15/00314/AOP – South West Milton Keynes

TO	Vikki Keeble, Buckinghamshire Council Sustainable Drainage Team	**FROM**	WSP
DATE	**01 October 2020**	**CONFIDENTIALITY**	**Public**
SUBJECT	**SURFACE WATER DRAINAGE RESPONSE TO BUCKINGHAMSHIRE COUNCIL COMMENTS**		

WSP has been appointed by the South West Milton Keynes (SWMK) Consortium to prepare a Technical Note in response Buckingham Councils Drainage Teams comments received on 21st July 2020 with respect to the proposed mixed-use sustainable urban extension at South West Milton Keynes (planning ref 15/00314/AOP).

Context

A site-specific flood risk assessment (FRA) was submitted to support the outline planning application for the proposed development at South West Milton Keynes (70069442 FRA 001 Rv8).

A response was received from Buckinghamshire Council Drainage Team whereby they requested further information to the proposals on surface water drainage grounds. The following key comments were noted in their correspondence dated 21st July 2020:

1. There are two extensive areas of surface water flood risk, one located at the junction of A421 Buckingham Road and Whaddon Road and the other near the footpath by the railway line. These areas also have an associated hazard rating of significant, meaning that this area is dangerous for most people; flood zone with deep fast flowing water. The LLFA would strongly advise that a sequential approach is taken to locating development. The Development Framework Parameters Plan (drawing no. CSA/2955/114) indicates that the junction of A421 Buckingham Road and Whaddon Road will not be the main point of access; instead this will be located on the B4034 Buckingham Road via a new junction, therefore avoiding the area of significant hazard associated with surface water flooding.
2. The FRA (4.5.4) states that no development will occur in the area of surface water ponding adjacent to the railway line, however overland flow routes that convey surface water in this direction will be managed either through blue-green corridors or the highway. I would encourage the former option to be explored as a priority as this can link the development parcels to the wider public open space network and enhance the local environment and amenity. The design of the surface water drainage network and wider blue-green infrastructure should be considered from the outset and ensure that no dwellings, educational facilities or commercial buildings are located in areas shown to be at risk of surface water flooding. If proposals do show development located in areas at risk of surface water flooding, the applicant may be required to undertake surface water modelling to demonstrate that the mitigation measures are suitably robust to future occupants and users are not at risk of surface water flooding.
3. The FRA (4.5.6 – 4.5.8) touches upon the ordinary watercourses which are present within the site and I am pleased that the development proposals are seeking to incorporate the watercourses into a blue-green corridor. There are some indicative proposals in relation to the eastern ordinary watercourse, I would encourage that the applicant seeks to engage with the Lead Local Flood

Authority to discuss proposals such as re-alignments prior to the submission of any reserved matters applications as any works to the ordinary watercourse may have implications on site layout.

4. The Infiltration SuDS Map provided by the British Geological Survey 2016, indicates that the water table in this area is variable and can range from greater than 5m below the surface to less than 3m below the surface. The FRA (4.6.4) details that on-site investigations have taken place during the winter of 2017; groundwater was recorded at depths of 2.m to 6.54m below ground level. This information should be used to inform the design of any sustainable drainage feature to ensure that there is a sufficient freeboard of 1m between any device and the water table to limit the potential capacity issues in times of high groundwater levels.

5. Indicative Surface Water Drainage Strategy (drawing no. 1442-D-003 Rev. P12) shows that the site will drain to two catchments, north and south, following the local topography. Prior to discharging to watercourses, surface water runoff will, in places, be conveyed by swales and then to strategic basins across the site. The FRA (Table 6) stipulates that a variety of SuDS will be investigated at detailed design stage such as (but not limited to) green roofs, pervious paving and filter strips. The FRA does not include all of the SuDS components as listed in the CIRIA SuDS Manual and so at detailed design these should form part of any assessment. It should also be noted that SuDS can play a crucial role in integrated the urban environment with the natural environment and will be key in ensuring that blue-green corridors feature across the development site at both a strategic and parcel scale. As part of any planning application on this site, I would expect to see a range of above ground sustainable drainage features. The final drainage scheme for each parcel should be supported by a water quality assessment as per the guidance in the CIRIA SuDS Manual.

6. The surface water drainage strategy should also include details of greenfield runoff rates, with should be calculated using FEH methods. The FRA (5.2.9-5.212) presents evidence as to why this approach is inappropriate, namely the total developable area being under 50ha. However, within the referenced guidance document (SCOP030219), FEH statistical method is promoted due to the approach being simple and relatively easy to use, similar to that of IH124 but with the advantage that it is a more accurate greenfield runoff estimation method. In addition, this document notes that IH124 should also not be used for catchments less than 50ha in size. Therefore, the evidence suggests that it is more appropriate to use the FEH statistical method due to higher levels of accuracy. The FRA should be amended on this basis.

7. Storage calculations should demonstrate that for the 1 in 30 year event the system does not flood and any flooding occurring between the 1 in 30 year and 1 in 100 year plus 40% allowance for climate change is safely contained in the site based on the amended discharge rates. Details of the existing and proposed discharge volumes should be shown for critical storm events and durations as detailed above along with the adopted approach to mitigate any increases in discharge volumes.

8. If any flooding occurs for the 1 in 100 year plus 40% climate change event, details of where this flooding will occur and the volume of the flooding must be provided. For rainfall events over the 1 in 100 plus 40% climate change allowance event, a drawing showing the direction of exceedance flows must be provided.

9. The FRA includes a 10% allowance for urban creep to take account of any future increases in impermeable areas within the site.

10. An indicative maintenance schedule for the surface water drainage system has been provided at outline planning stage. At detailed design, the applicant should provide details of access, easements and further information on the maintenance tasks which are required, the persons responsible for undertaking maintenance and frequency by which these will be undertaken.
11. Under the terms of the Land Drainage Act 1991 and the Floods and Water Management Act 2010, the prior consent of the Lead Local Flood Authority is required for any proposed works or structures in the watercourse. After planning permission has been granted by the LPA, the applicant must apply for Land Drainage Consent from the LLFA, information and the application form can be found on our website. Please be aware that this process can take up to two months.

The following Technical note aims to address the key comments raised by Buckinghamshire Council Drainage Team.

Comment 1 – Consideration of Existing Surface Water Flow Routes

"There are two extensive areas of surface water flood risk, one located at the junction of A421 Buckingham Road and Whaddon Road and the other near the footpath by the railway line. These areas also have an associated hazard rating of significant, meaning that this area is dangerous for most people; flood zone with deep fast flowing water. The LLFA would strongly advise that a sequential approach is taken to locating development. The Development Framework Parameters Plan (drawing no. CSA/2955/114) indicates that the junction of A421 Buckingham Road and Whaddon Road will not be the main point of access; instead this will be located on the B4034 Buckingham Road via a new junction, therefore avoiding the area of significant hazard associated with surface water flooding".

As noted within the comment, a Sequential Approach has been taken to the location of the new junction access to the site, as such avoiding areas identified to be at high surface water risk on the Long-Term Flood Risk Map (Surface Water). With regard to the footpath by the railway line, no development has been proposed within the vicinity of the surface water ponding identified on the Long-Term Flood Risk Map (Surface Water) at this location and consideration will be given, at the next stage of design, to internal parcel layouts to account for the surface water flow routes identified in this area.

Comment 2 – Consideration of Existing Surface Water Flow Routes

"The FRA (4.5.4) states that no development will occur in the area of surface water ponding adjacent to the railway line, however overland flow routes that convey surface water in this direction will be managed either through blue-green corridors or the highway. I would encourage the former option to be explored as a priority as this can link the development parcels to the wider public open space network and enhance the local environment and amenity. The design of the surface water drainage network and wider blue-green infrastructure should be considered from the outset and ensure that no dwellings, educational facilities or commercial buildings are located in areas shown to be at risk of surface water flooding. If proposals do show development located in areas at risk of surface water flooding, the applicant may be required to undertake surface water modelling to demonstrate that the mitigation measures are suitably robust to future occupants and users are not at risk of surface water flooding. "

As per Comment 1, no development has been proposed within the vicinity of areas identified to be at high surface water risk on the Long-Term Flood Risk Map (Surface Water) at this location and consideration will be given, at the next stage of design, to internal parcel layouts to account for the surface water flow routes identified in this area.

Comment 3 – Consideration of Existing Watercourses

"The FRA (4.5.6 – 4.5.8) touches upon the ordinary watercourses which are present within the site and I am pleased that the development proposals are seeking to incorporate the watercourses into a blue-green corridor. There are some indicative proposals in relation to the eastern ordinary watercourse, I would encourage that the applicant seeks to engage with the Lead Local Flood Authority to discuss proposals such as re-alignments prior to the submission of any reserved matters applications as any works to the ordinary watercourse may have implications on site layout".

As noted within paragraphs 4.5.6-4.5.8 of the submitted FRA (ref. 70069442 FRA 001 Rv8), it is currently proposed to integrate, enhance and reprofile the eastern small, unnamed, ordinary watercourse within the development, as far as reasonably practicable. This will be further developed at the next stage of design with active engagement with the Lead Local Flood Authority (LLFA) prior to submission of details pertinent to this.

Comment 4 - Groundwater

"The Infiltration SuDS Map provided by the British Geological Survey 2016, indicates that the water table in this area is variable and can range from greater than 5m below the surface to less than 3m below the surface. The FRA (4.6.4) details that on-site investigations have taken place during the winter of 2017; groundwater was recorded at depths of 2.m to 6.54m below ground level. This information should be used to inform the design of any sustainable drainage feature to ensure that there is a sufficient freeboard of 1m between any device and the water table to limit the potential capacity issues in times of high groundwater levels".

The proposed attenuation basins on site have been proposed to be 1m deep. Site investigations, as noted within the submitted FRA (ref. 70069442 FRA 001 Rv8), identified groundwater at depths of 2m or greater and as such, sufficient freeboard of 1m between identified groundwater levels and attenuation features has been provided at this stage. Should further Site Investigation be undertaken which identifies shallower groundwater levels on site, basins in these locations would be suitably lined to prevent groundwater ingress.

Comment 5 – SuDS Requirements

"Indicative Surface Water Drainage Strategy (drawing no. 1442-D-003 Rev. P12) shows that the site will drain to two catchments, north and south, following the local topography. Prior to discharging to watercourses, surface water runoff will, in places, be conveyed by swales and then to strategic basins across the site. The FRA (Table 6) stipulates that a variety of SuDS will be investigated at detailed design stage such as (but not limited to) green roofs, pervious paving and filter strips. The FRA does not include all of the SuDS components as listed in the CIRIA SuDS Manual and so at detailed design these should form part of any assessment. It should also be noted that SuDS can play a crucial role in integrated the urban environment with the natural environment and will be key in ensuring that blue-green corridors feature across the development site at both a strategic and parcel scale. As part of any planning application on this site, I would expect to see a range of above ground sustainable drainage features. The final drainage scheme for each parcel should be supported by a water quality assessment as per the guidance in the CIRIA SuDS Manual".

Table 6 of the submitted FRA (ref 70069442 FRA 001 Rv8) provides details of a range of SuDS which may be utilised across the proposed development site. Given the outline level nature of these proposals, further SuDS, as identified in CIRIA C753 'The SuDS Manual,' may be further considered at the next stage of design.

Comment 6 – Greenfield Runoff Rates

"The surface water drainage strategy should also include details of greenfield runoff rates, with should be calculated using FEH methods. The FRA (5.2.9-5.212) presents evidence as to why this approach is inappropriate, namely the total developable area being under 50ha. However, within the referenced guidance document (SCOP030219), FEH statistical method is promoted due to the approach being simple and relatively easy to use, similar to that of IH124 but with the advantage that it is a more accurate greenfield runoff estimation method. In addition, this document notes that IH124 should also not be used for catchments less than 50ha in size. Therefore, the evidence suggests that it is more appropriate to use the FEH statistical method due to higher levels of accuracy. The FRA should be amended on this basis".

IoH124 methodology of calculating greenfield runoff rates from the site is widely accepted across the industry. The IoH124 rate is calculated for catchments of between 50ha and 2,500ha in size and interpolated in a linear fashion to calculate the proposed QBar rates for the site. As such, it is an appropriate method to calculate greenfield runoff from the proposed development site.

Given this, as the use of the FEH statistical method to calculate greenfield discharge rates is noted within the Drainage Teams response as the preferred method to calculate greenfield runoff updated the surface water drainage calculations, based on the revised runoff rates, have been provided.

FEH catchment descriptors, purchased for the site, were utilised within Microdrainage Source Control to calculate the QMED discharge rate which is shown in Table 1.

Table 1 - Greenfield Run-Off Rates (Using FEH QMed)

Greenfield Run-Off	499ha (l/s)	1ha (l/s)
QMed	1087.8.7	2.72

This identifies that the QMed runoff rate is 0.4l/s/ha lower than the Qbar runoff rate calculated using the IoH124 methodology as identified within the submitted FRA.

Given this, the greenfield runoff rates for each catchment identified in drainage drawing 1442-D-003 have been recalculated utilising the QMed discharge rate, as identified within Table 2.

Table 2 – QMed Run Off Assessment

Catchment	Developed Area (ha)	Impermeable Area (ha)	QMed (l/s)
A	3.20	2.08	9.7
B	7.40	4.44	20.1
C	1.90	1.14	5.2
D	2.11	1.27	5.8
E	2.40	1.32	6.6
F	1.90	1.14	5.2
G	1.40	0.84	3.8
H	1.20	0.96	3.3
I	2.00	1.20	5.4
J	1.20	0.96	3.3
K	1.30	1.04	3.5
L	8.60	5.16	23.4
M	4.90	2.94	13.3
N	1.80	1.08	4.9
O	3.00	1.65	8.2
P	2.00	1.20	5.4
Q	4.50	2.70	12.2
R	4.20	2.52	11.4
S	2.40	1.44	6.5
T	9.10	5.20	24.7
Total	**66.51**	**40.28**	**180.9**

Assessments have thereafter been completed to determine the characteristics of the SuDS features required. The Micro Drainage 'Source Control' module has been utilised to provide routing calculations for the 1 in 100 year plus 40% climate change event to identify the size and nature of storage required. This ensures the peak outflows are in line with those identified alongside the nature of SuDS proposed on site in Table 2, whilst the drainage strategy is shown on 1442-D-003, appended to this Technical Note and Micro Drainage summary calculations are also provided appended to this Technical Note.

Table 3 – Site Attenuation Requirements in the 1 in 100 Year + 40% Climate Change Event

Catchment	Proposed QMed Discharge Rate (l/s)	Storage Volume Required (m^3)	SuDS Controls
A	9.7	1,570.00	Attenuation Basin & Swale
B	20.1	3,330.00	Attenuation Basin & Swale
C	5.2	840.00	Attenuation Basin & Swale
D	5.8	950.00	Attenuation Basin & Swale
E	6.6	970.00	Attenuation Basin& Swale
F	5.2	850.00	Attenuation Basin & Swale
G	3.8	630.00	Attenuation Basin & Swale
H	3.3	740.00	Attenuation Basin & Swale
I	5.4	890.00	Attenuation Basin & Swale
J	3.3	740.00	Attenuation Basin
K	3.5	800.00	Attenuation Basin
L	23.4	3,880.00	Attenuation Basin
M	13.3	2,200.00	Attenuation Basin & Swale
N	4.9	800.00	Attenuation Basin & Swale
O	8.2	1,210.00	Attenuation Basin & Swale
P	5.4	900.00	Attenuation Basin & Swale
Q	12.2	1,430.00	Attenuation Basin & Swale
R	11.4	1,880.00	Attenuation Basin & Swale
S	6.5	1,080.00	Attenuation Basin
T	24.7	3,620.00	Attenuation Basin & Swale
Total	**180.9**	**29,310.00**	

The revised calculations and the surface water drainage strategy drawing demonstrate that there is sufficient space available on site to accommodate the volume of surface water required up to the 1 in 100 year plus climate change event without exacerbating flood risk elsewhere. Further to this, detailed design will incorporate proposed pipe work which will also provide some storage of surface water volume.

Comment 7 – Revised Calculations

"Storage calculations should demonstrate that for the 1 in 30 year event the system does not flood and any flooding occurring between the 1 in 30 year and 1 in 100 year plus 40% allowance for climate change is safely contained in the site based on the amended discharge rates. Details of the existing and proposed discharge volumes should be shown for critical storm events and durations as detailed above along with the adopted approach to mitigate any increases in discharge volumes".

Revised calculations demonstrating surface water on site is limited to the QMed greenfield discharge rate as calculated utilising the FEH Statistical Method are available appended to this Technical Note and demonstrate that attenuation basins have been adequately sized so there is no flooding in the 1 in 100 year plus 40% climate change event.

Comment 8 – Revised Calculations & Consideration of Exceedance

"If any flooding occurs for the 1 in 100 year plus 40% climate change event, details of where this flooding will occur and the volume of the flooding must be provided. For rainfall events over the 1 in 100 plus 40% climate change allowance event, a drawing showing the direction of exceedance flows must be provided".

Revised calculations demonstrating surface water on site is limited to the QMed greenfield discharge rate as calculated utilising the FEH Statistical Method are available appended to this Technical Note and demonstrate that attenuation basins have been adequately sized so there is no flooding in the 1 in 100 year plus 40% climate change event.

Given the proposed areas of the attenuation remain the same and the Development Parameters Plan remains the same, the Surface Water Exceedance Plan which was provided as part of the submitted FRA (ref 70069442 FRA 001 Rv8) has been re-attached to this Technical Note.

Comment 9 – Urban Creep

"*The FRA includes a 10% allowance for urban creep to take account of any future increases in impermeable areas within the site".*

Revised calculations have been provided which demonstrate the impact of urban creep with the revised greenfield discharge rate calculated utilising the FEH statistical method greenfield discharge rate. These demonstrate that the proposed SuDS system has sufficient capacity to accommodate a 10% increase in impermeable area during the 1 in 100 year return period plus 40% for climate change event without overflow.

Comment 10 – SuDS Maintenance

"An indicative maintenance schedule for the surface water drainage system has been provided at outline planning stage. At detailed design, the applicant should provide details of access, easements and further information on the maintenance tasks which are required, the persons responsible for undertaking maintenance and frequency by which these will be undertaken".

The proposed maintenance regimes for the SuDS features should be in accordance with The SuDS Manual (CIRIA C753) and other best practice guidelines and in accordance with manufacturer's recommendations.

This will ensure the design performance, structural integrity and where applicable- appearance of each feature is maintained throughout its lifetime.

The details of the party responsible for maintenance of each feature will be confirmed prior to occupation of the proposed development.

Comment 11 – Land Drainage Consents

"Under the terms of the Land Drainage Act 1991 and the Floods and Water Management Act 2010, the prior consent of the Lead Local Flood Authority is required for any proposed works or structures in the watercourse. After planning permission has been granted by the LPA, the applicant must apply for Land Drainage Consent from the LLFA, information and the application form can be found on our website. Please be aware that this process can take up to two months".

Any required land drainage consents will be sought prior to construction on site. This process will be undertaken separately to the planning process.

Conclusions

This Technical note aims to provide a response to the comments raised by Buckinghamshire Council Drainage Team on the 21st July 2020 with respect to the proposed development at South West Milton Keynes (ref. 15/00314/AOPO and demonstrate that the proposed development may be considered appropriate in terms of surface water drainage and associated flood risk.

The key comments raised by Buckinghamshire Council Drainage Team have been summarised in the table below, with a summary response aiming to address these comments

Buckinghamshire Council Drainage Team Comment	**Response**
Consideration of Existing Surface Water Flow Routes	A Sequential Approach has been taken to the location of the new junction access to the site, as such avoiding areas identified to be at high surface water risk. With regard to the footpath by the railway line, no development has been proposed within the vicinity of the surface water ponding identified on the Long-Term Flood Risk Map (Surface Water) at this location. Further consideration will be given at the next stage of design to internal parcel layouts to account for the surface water flow routes identified in this area.
Consideration of Existing Ordinary Watercourses	As noted within paragraphs 4.5.6-4.5.8 of the submitted FRA, it is currently proposed to integrate, enhance and reprofile the eastern small, unnamed, ordinary watercourse within the development, as far as reasonably practicable. Further consideration will be given at the next stage of design to internal parcel layouts to account for the surface water flow routes identified in this area.

Buckinghamshire Council Drainage Team Comment	Response
Groundwater	The proposed attenuation basins on site have been proposed to be 1m deep. Site investigations as noted within the submitted FRA identified groundwater at depths of 2m or greater and as such, sufficient freeboard of 1m between identified groundwater levels and attenuation features has been provided. Should further Site Investigation be undertaken which identifies shallower groundwater levels on site, basins in these locations would be suitably lined to prevent groundwater ingress. This would be further detailed at the next design stage.
Submitted Requirements	Table 6 of the submitted FRA provides details of a range of SuDS which could be utilised across the proposed development site Given the outline level nature of these proposals, further SuDS, as identified in CIRIA C753 'The SuDS Manual,' may be further considered at the next stage of design.
Greenfield Run-Off Rates	The FEH statistical method to calculate greenfield discharge rates is noted within the Drainage Teams response as the preferred method to calculate greenfield runoff and therefore, we have updated the surface water drainage calculations based on the revised runoff rates. Revised calculations and a revised Surface Water Drainage Plan is available appended to this Technical Note.
Revised Calculations	Revised calculations demonstrating surface water on site is limited to the QMed greenfield discharge rate as calculated utilising the FEH Statistical Method are available appended to this Technical Note and demonstrate that attenuation basins have been adequately sized so there is no flooding in the 1 in 100 year plus 40% climate change event.
Consideration of Exceedance	Given the proposed areas of the attenuation remain the same and the Development Parameters Plan remains the same, the Surface Water Exceedance Plan which was provided as part of the submitted FRA has been re-attached to this Technical Note.

Buckinghamshire Council Drainage Team Comment	Response
Urban Creep	Revised calculations have been provided which demonstrate the impact of urban creep with the revised greenfield discharge rate calculated utilising the FEH statistical method greenfield discharge rate. These demonstrate that the proposed SuDS system has sufficient capacity to accommodate a 10% increase in impermeable area during the 1 in 100 year return period plus 40% for climate change event without overflow.
SuDS Maintenance	The proposed maintenance regimes for the devices should be in accordance with The SuDS Manual (CIRIA C753) and other best practice guidelines and in accordance with manufacturer's recommendations. This will ensure the design performance, structural integrity and where applicable- appearance of each feature is maintained throughout its lifetime. The details of the party responsible for maintenance of each feature will be confirmed prior to occupation of the proposed development. Until such times as this may be determined.
Land Drainage Consents	Any required land drainage consents will be sought prior to construction on site. This process will be undertaken separately to the planning process.

Appendix A

DRAWINGS

DO NOT SCALE

NOTES

1. ALL LEVELS ARE IN METRES ABOVE ORDNANCE DATUM.
2. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE STATED.
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6. ILLUSTRATIVE DRAINAGE STRATEGY BASED ON:
   - 6.1. TOPOGRAPHICAL SURVEY PRODUCED BY HALLAM LAND MANAGEMENT DATED SEPTEMBER 2009.
   - 6.2 DEVELOPMENT FRAMEWORK PARAMETERS PLAN REV L, CSA ENVIRONMENTAL DATED 02.09.2020.
7. SURFACE WATER CALCULATIONS UNDERTAKEN USING MICRODRAINANGE SOURCE CONTROL AND ARE SUBJECT TO REFINEMENT AT DETAILED DESIGN.
8. ASSUMPTIONS USED TO DESIGN INDICATIVE SURFACE WATER DRAINAGE STRATEGY:
   - 8.1. BASINS SIZED TO ACCOMMODATE 1 IN 100 YEAR EVENT PLUS 40% CLIMATE CHANGE IN ACCORDANCE WITH ENVIRONMENT AGENCY GUIDANCE 2016.
   - 8.2. BASINS DESIGNED 1m DEEP WITH 1 IN 4 SIDE SLOPES.
   - 8.3. DISCHARGE RATE LIMITED TO QMED FOR ALL EVENTS UP TO THE 1 IN 100 YEAR PLUS 40% CLIMATE CHANGE EVENT.
   - 8.4. IMPERMEABLE AREA ASSUMED 60% FOR RESIDENTIAL PARCELS, 80% EMPLOYMENT PARCELS, 55% FOR SCHOOLS.
   - 8.5. A SENSITIVITY TEST FOR 10% DEVELOPMENT CREEP HAS BEEN UNDERTAKEN AND APPLIED TO BASIN SIZES.
   - 8.6. NO CONSIDERATION HAS BEEN GIVEN TO EARTHWORKS AT THIS STAGE.

KEY

- SITE BOUNDARY
- EXISTING WATERCOURSE
- PROPOSED DRAINAGE CATCHMENT BOUNDARY (PROPOSED OUTFALL NORTH SITE)
- PROPOSED DRAINAGE CATCHMENT BOUNDARY (PROPOSED OUTFALL SOUTH SITE)
- PROPOSED SURFACE WATER ATTENUATION
- PROPOSED CONVEYANCE SWALE
- PROPOSED SURFACE WATER SEWER
- SURFACE WATER FLOW ROUTE
- OIL — EXISTING OIL PIPELINE (6m OFFSET REQUIRED)
- EXISTING WATERCOURSE TO BE ENHANCED, RE-PROFILED AND / OR INTEGRATED INTO DEVELOPMENT AS FAR AS REASONABLY PRACTICABLE.

DRAINAGE CATCHMENT DETAILS

CATCHMENT	CONTRIBUTING AREA [ha]	STORAGE VOLUME [m³] REQUIRED FOR THE 1 IN 100 YEAR + CLIMATE CHANGE EVENT	PROPOSED DISCHARGE RATE (QBAR) [L/S]
A	2.08	1,570	9.7
B	4.44	3,330	20.1
C	1.14	840	5.2
D	1.27	950	5.8
E	1.44	970	6.6
F	1.14	850	5.2
G	0.84	630	3.8
H	0.96	740	3.3
I	1.20	890	5.4
J	0.96	740	3.3
K	1.04	800	3.5
L	5.16	3,880	23.4
M	2.94	2,200	13.3
N	1.08	800	4.9
O	1.65	1,120	8.2
P	1.20	900	5.4
Q	2.70	1,430	12.2
R	2.52	1,880	11.4
S	1.44	1,080	6.5
T	5.20	3,620	24.7
TOTAL	40.3	29,310	180.9

REV	DATE	BY	DESCRIPTION	CHK	APP
P19	03/09/2020	PS	UPDATED MASTERPLAN	AC	AC
P18	02/09/2020	PS	UPDATED BASED ON ACCESS & LLFA COMMENTS	AC	AC
P17	22/05/2020	PS	UPDATED MASTERPLAN	CSP	AC
P16	12/05/2020	PS	UPDATED MASTERPLAN	AC	AC
P15	01/05/2020	PS	UPDATED MASTERPLAN	AC	AC
P14	27/04/2020	PS	BASINS MOVED BASED ON UPDATED TREE CONSTRAINTS PLAN	AC	AC
P13	22/04/2020	PS	UPDATED MASTERPLAN	AC	AC
P12	19/03/2020	JG	BASINS ADJUSTED TO ACCOUNT FOR 10% DEVELOPMENT CREEP.	AC	AN
P11	10/03/2020	JG	ALL BASINS REFINED TO ENSURE 1:4 SIDE SLOPES WHILST MINIMISING BASIN SIZES WITH 4M EARTHWORKS BUFFER INSTALLED.	AC	AN
P01	23/10/2018	PS	FIRST ISSUE	AC	SW

DRAWING STATUS: S2 - FOR INFORMATION

wsp

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T+ 44 (0) 121 352 4700, F+ 44 (0) 121 352 4701
wsp.com

CLIENT: SOUTH WEST MILTON KEYNES CONSORTIUM

ARCHITECT: CSA ENVIRONMENTAL

SITE/PROJECT: SOUTH WEST MILTON KEYNES

TITLE: INDICATIVE SURFACE WATER DRAINAGE STRATEGY

SCALE @ A1:	CHECKED:	APPROVED:
1:3000	AC	AN

PROJECT NO:	DESIGNED:	DRAWN:	DATE:
70051442	JG	JG	September 20

DRAWING No: 1442-D-003 REV: P19

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NOTES

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5. REPRODUCED FROM THE ORDNANCE SURVEY MAP WITH PERMISSION OF THE CONTROLLER OF HER MAJESTY'S STATIONARY OFFICE. LICENSE NO. 100048755. CROWN COPYRIGHT RESERVED.
6. ILLUSTRATIVE DRAINAGE STRATEGY BASED ON:
   - 6.1. TOPOGRAPHICAL SURVEY PRODUCED BY HALLAM LAND MANAGEMENT DATED SEPTEMBER 2009.
   - 6.2 DEVELOPMENT FRAMEWORK PLAN REVISION L BY CSA ENVIRONMENTAL DATED 02.09.2020
7. SURFACE WATER CALCULATIONS UNDERTAKEN USING MICRODRAINANGE SOURCE CONTROL AND ARE SUBJECT TO REFINEMENT AT DETAILED DESIGN.
8. ASSUMPTIONS USED TO DESIGN INDICATIVE SURFACE WATER DRAINAGE STRATEGY:
   - 8.1. BASINS SIZED TO ACCOMMODATE 1 IN 100 YEAR EVENT PLUS 40% CLIMATE CHANGE IN ACCORDANCE WITH ENVIRONMENT AGENCY GUIDANCE 2016.
   - 8.2. BASINS DESIGNED 1m DEEP WITH 1 IN 4 SIDE SLOPES AND INCLUDE A 300mm FREEBOARD ALLOWANCE.
   - 8.3. DISCHARGE RATE LIMITED TO QMED FOR ALL EVENTS UP TO THE 1 IN 100 YEAR PLUS 40% CLIMATE CHANGE EVENT.
   - 8.4. IMPERMEABLE AREA ASSUMED 60% FOR RESIDENTIAL PARCELS, 80% EMPLOYMENT PARCELS, 55% FOR SCHOOLS.
   - 8.5. A SENSITIVITY TEST FOR 10% DEVELOPMENT CREEP HAS BEEN UNDERTAKEN.
   - 8.6. NO CONSIDERATION HAS BEEN GIVEN TO EARTHWORKS AT THIS STAGE.

KEY

- SITE BOUNDARY
- EXISTING WATERCOURSE
- PROPOSED DRAINAGE CATCHMENT BOUNDARY (PROPOSED OUTFALL NORTH SITE)
- PROPOSED DRAINAGE CATCHMENT BOUNDARY (PROPOSED OUTFALL SOUTH SITE)
- PROPOSED SURFACE WATER ATTENUATION
- PROPOSED CONVEYANCE SWALE
- PROPOSED SURFACE WATER SEWER
- SURFACE WATER EXCEEDANCE FLOW ROUTE
- OIL — EXISTING OIL PIPELINE (6m OFFSET REQUIRED)

REV	DATE	BY	DESCRIPTION	CHK	APP
P10	03/09/2020	PS	UPDATED MASTERPLAN	AC	AC
P09	01/05/2020	PS	UPDATED MASTERPLAN	AC	AC
P08	29/04/2020	PS	UPDATED MASTERPLAN	AC	AC
P01	23/10/2018	PS	FIRST ISSUE	AC	SW

DRAWING STATUS: S2 - FOR INFORMATION

wsp
The Mailbox - Level 2, 100 Wharfside Street, Birmingham, B1 1RT, UK
T+ 44 (0) 121 352 4700, F+ 44 (0) 121 352 4701
wsp.com

CLIENT: SOUTH WEST MILTON KEYNES CONSORTIUM

ARCHITECT: CSA ENVIRONMENTAL

SITE/PROJECT: SOUTH WEST MILTON KEYNES

TITLE: INDICATIVE SURFACE WATER EXCEEDANCE FLOW ROUTE PLAN

SCALE @ A1:	CHECKED:		APPROVED:
1:3000	AC		AN
PROJECT NO: 70051442	DESIGNED: JG	DRAWN: JG	DATE: May 20

DRAWING No: 1442-D-004_P08 REV: P10

Appendix B

CALCULATIONS

Appendix B.1

GREENFIELD RUN-OFF

FEH Mean Annual Flood

Input

QMED Method	2008	URBEXT (1990)	0.2011
Site Location GB 415450 296500 SP 15450 96500		SPRHOST	37.410
Area (ha)	399.000	BFIHOST	0.388
SAAR (mm)	682	FARL	1.000

Results

QMED Rural (l/s) 1087.8 QMED Urban (l/s) 1402.9

Appendix B.2

1 IN 100 YEAR + 40% CLIMATE CHANGE

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	103.687	0.287	8.7	584.3	O K
30 min Summer	103.763	0.363	8.7	752.1	O K
60 min Summer	103.836	0.436	8.7	919.1	O K
120 min Summer	103.915	0.515	8.7	1108.5	O K
180 min Summer	103.958	0.558	8.7	1212.5	O K
240 min Summer	103.984	0.584	8.7	1277.4	O K
360 min Summer	104.011	0.611	8.7	1346.1	O K
480 min Summer	104.022	0.622	8.7	1374.0	O K
600 min Summer	104.025	0.625	8.7	1382.0	O K
720 min Summer	104.024	0.624	8.7	1378.6	O K
960 min Summer	104.013	0.613	8.7	1352.1	O K
1440 min Summer	103.981	0.581	8.7	1270.9	O K
2160 min Summer	103.937	0.537	8.7	1161.3	O K
2880 min Summer	103.901	0.501	8.7	1074.2	O K
4320 min Summer	103.843	0.443	8.7	936.2	O K
5760 min Summer	103.795	0.395	8.7	825.3	O K
7200 min Summer	103.756	0.356	8.7	735.7	O K
8640 min Summer	103.722	0.322	8.7	660.7	O K
10080 min Summer	103.694	0.294	8.7	598.4	O K
15 min Winter	103.720	0.320	8.7	655.1	O K
30 min Winter	103.803	0.403	8.7	843.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	151.654	0.0	498.5	23
30 min Summer	97.974	0.0	630.1	38
60 min Summer	60.354	0.0	887.6	68
120 min Summer	36.913	0.0	1079.1	126
180 min Summer	27.268	0.0	1184.0	186
240 min Summer	21.821	0.0	1248.3	246
360 min Summer	15.737	0.0	1314.5	366
480 min Summer	12.370	0.0	1336.3	484
600 min Summer	10.223	0.0	1334.5	604
720 min Summer	8.729	0.0	1320.2	722
960 min Summer	6.777	0.0	1284.8	962
1440 min Summer	4.731	0.0	1211.8	1314
2160 min Summer	3.309	0.0	1815.3	1620
2880 min Summer	2.578	0.0	1879.8	1984
4320 min Summer	1.834	0.0	1979.2	2768
5760 min Summer	1.454	0.0	2162.7	3568
7200 min Summer	1.225	0.0	2274.6	4320
8640 min Summer	1.071	0.0	2381.6	5096
10080 min Summer	0.961	0.0	2480.5	5760
15 min Winter	151.654	0.0	556.1	23
30 min Winter	97.974	0.0	685.0	37

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	103.883	0.483	8.7	1031.7	O K
120 min Winter	103.971	0.571	8.7	1246.5	O K
180 min Winter	104.018	0.618	8.7	1364.6	O K
240 min Winter	104.047	0.647	8.7	1438.2	O K
360 min Winter	104.078	0.678	8.7	1518.0	O K
480 min Winter	104.091	0.691	8.7	1552.4	O K
600 min Winter	104.096	0.696	8.7	1564.7	O K
720 min Winter	104.096	0.696	8.7	1564.3	O K
960 min Winter	104.087	0.687	8.7	1541.8	O K
1440 min Winter	104.057	0.657	8.7	1463.2	O K
2160 min Winter	104.006	0.606	8.7	1333.3	O K
2880 min Winter	103.962	0.562	8.7	1223.5	O K
4320 min Winter	103.876	0.476	8.7	1015.5	O K
5760 min Winter	103.803	0.403	8.7	844.6	O K
7200 min Winter	103.742	0.342	8.7	704.6	O K
8640 min Winter	103.690	0.290	8.7	589.9	O K
10080 min Winter	103.648	0.248	8.7	498.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	60.354	0.0	992.4	66
120 min Winter	36.913	0.0	1196.4	126
180 min Winter	27.268	0.0	1297.6	184
240 min Winter	21.821	0.0	1348.5	242
360 min Winter	15.737	0.0	1369.9	360
480 min Winter	12.370	0.0	1354.2	476
600 min Winter	10.223	0.0	1337.1	592
720 min Winter	8.729	0.0	1320.2	708
960 min Winter	6.777	0.0	1286.9	934
1440 min Winter	4.731	0.0	1221.8	1372
2160 min Winter	3.309	0.0	2027.2	1736
2880 min Winter	2.578	0.0	2095.2	2192
4320 min Winter	1.834	0.0	2195.4	3028
5760 min Winter	1.454	0.0	2423.3	3856
7200 min Winter	1.225	0.0	2549.6	4608
8640 min Winter	1.071	0.0	2670.7	5352
10080 min Winter	0.961	0.0	2784.1	6048

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 483669 232428 SP 83669 32428
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 2.080

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	1.050	4	8	1.030

Model Details

Storage is Online Cover Level (m) 104.400

Tank or Pond Structure

Invert Level (m) 103.400

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1890.0	1.000	2990.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0140-8700-0800-8700
Design Head (m)	0.800
Design Flow (l/s)	8.7
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	140
Invert Level (m)	103.400
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)	0.800	8.7	Kick-Flo®	0.562	7.4
Flush-Flo™	0.254	8.7	Mean Flow over Head Range	-	7.4

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.0	1.200	10.5	3.000	16.3	7.000	24.4
0.200	8.6	1.400	11.3	3.500	17.5	7.500	25.2
0.300	8.7	1.600	12.1	4.000	18.7	8.000	26.0
0.400	8.4	1.800	12.8	4.500	19.7	8.500	26.7
0.500	8.0	2.000	13.4	5.000	20.8	9.000	27.5
0.600	7.6	2.200	14.0	5.500	21.7	9.500	28.3
0.800	8.7	2.400	14.6	6.000	22.7		
1.000	9.7	2.600	15.2	6.500	23.6		

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	103.287	0.287	20.1	1247.6	O K
30 min Summer	103.364	0.364	20.1	1605.1	O K
60 min Summer	103.440	0.440	20.1	1961.0	O K
120 min Summer	103.523	0.523	20.1	2364.2	O K
180 min Summer	103.568	0.568	20.1	2584.1	O K
240 min Summer	103.596	0.596	20.1	2721.1	O K
360 min Summer	103.625	0.625	20.1	2867.7	O K
480 min Summer	103.637	0.637	20.1	2926.5	O K
600 min Summer	103.640	0.640	20.1	2942.2	O K
720 min Summer	103.638	0.638	20.1	2933.2	O K
960 min Summer	103.626	0.626	20.1	2872.0	O K
1440 min Summer	103.591	0.591	20.1	2695.6	O K
2160 min Summer	103.549	0.549	20.1	2487.4	O K
2880 min Summer	103.514	0.514	20.1	2316.3	O K
4320 min Summer	103.455	0.455	20.1	2032.5	O K
5760 min Summer	103.406	0.406	20.1	1799.8	O K
7200 min Summer	103.366	0.366	20.1	1612.1	O K
8640 min Summer	103.333	0.333	20.1	1458.4	O K
10080 min Summer	103.305	0.305	20.1	1332.9	O K
15 min Winter	103.320	0.320	20.1	1398.5	O K
30 min Winter	103.406	0.406	20.1	1800.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	151.654	0.0	983.2	23
30 min Summer	97.974	0.0	1274.7	37
60 min Summer	60.354	0.0	1833.8	68
120 min Summer	36.913	0.0	2241.2	126
180 min Summer	27.268	0.0	2470.2	186
240 min Summer	21.821	0.0	2618.1	246
360 min Summer	15.737	0.0	2790.8	364
480 min Summer	12.370	0.0	2881.1	484
600 min Summer	10.223	0.0	2929.2	604
720 min Summer	8.729	0.0	2950.5	722
960 min Summer	6.777	0.0	2939.5	960
1440 min Summer	4.731	0.0	2806.6	1216
2160 min Summer	3.309	0.0	3826.4	1540
2880 min Summer	2.578	0.0	3958.8	1936
4320 min Summer	1.834	0.0	4161.8	2728
5760 min Summer	1.454	0.0	4591.8	3512
7200 min Summer	1.225	0.0	4825.4	4256
8640 min Summer	1.071	0.0	5045.6	5008
10080 min Summer	0.961	0.0	5242.2	5744
15 min Winter	151.654	0.0	1107.7	23
30 min Winter	97.974	0.0	1413.2	37

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	103.490	0.490	20.1	2201.3	O K
120 min Winter	103.583	0.583	20.1	2657.3	O K
180 min Winter	103.633	0.633	20.1	2909.0	O K
240 min Winter	103.664	0.664	20.1	3065.5	O K
360 min Winter	103.697	0.697	20.1	3233.5	O K
480 min Winter	103.711	0.711	20.1	3304.5	Flood Risk
600 min Winter	103.715	0.715	20.1	3328.3	Flood Risk
720 min Winter	103.715	0.715	20.1	3325.0	Flood Risk
960 min Winter	103.705	0.705	20.1	3272.2	Flood Risk
1440 min Winter	103.670	0.670	20.1	3096.5	O K
2160 min Winter	103.617	0.617	20.1	2829.5	O K
2880 min Winter	103.568	0.568	20.1	2585.0	O K
4320 min Winter	103.481	0.481	20.1	2156.7	O K
5760 min Winter	103.406	0.406	20.1	1799.9	O K
7200 min Winter	103.344	0.344	20.1	1512.6	O K
8640 min Winter	103.295	0.295	20.1	1287.0	O K
10080 min Winter	103.257	0.257	19.9	1113.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	60.354	0.0	2056.3	66
120 min Winter	36.913	0.0	2498.7	124
180 min Winter	27.268	0.0	2736.6	184
240 min Winter	21.821	0.0	2883.0	242
360 min Winter	15.737	0.0	3036.4	358
480 min Winter	12.370	0.0	3093.8	476
600 min Winter	10.223	0.0	3100.8	590
720 min Winter	8.729	0.0	3078.2	706
960 min Winter	6.777	0.0	2997.6	930
1440 min Winter	4.731	0.0	2823.7	1358
2160 min Winter	3.309	0.0	4277.7	1692
2880 min Winter	2.578	0.0	4424.1	2132
4320 min Winter	1.834	0.0	4640.0	2980
5760 min Winter	1.454	0.0	5148.2	3752
7200 min Winter	1.225	0.0	5412.3	4472
8640 min Winter	1.071	0.0	5662.2	5192
10080 min Winter	0.961	0.0	5889.6	5856

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 483669 232428 SP 83669 32428
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 4.440

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	2.220	4	8	2.220

Model Details

Storage is Online Cover Level (m) 104.000

Tank or Pond Structure

Invert Level (m) 103.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	4160.0	1.000	5590.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0201-2010-0800-2010
Design Head (m)	0.800
Design Flow (l/s)	20.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	201
Invert Level (m)	103.000
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.800	20.1	Kick-Flo®	0.608	17.6
Flush-Flo™	0.319	20.1	Mean Flow over Head Range	-	16.5

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.9	1.200	24.4	3.000	37.9	7.000	57.1
0.200	19.1	1.400	26.2	3.500	40.8	7.500	59.0
0.300	20.1	1.600	28.0	4.000	43.5	8.000	60.9
0.400	19.9	1.800	29.6	4.500	46.1	8.500	62.4
0.500	19.3	2.000	31.1	5.000	48.5	9.000	64.2
0.600	17.9	2.200	32.6	5.500	50.8	9.500	66.0
0.800	20.1	2.400	34.0	6.000	53.0		
1.000	22.3	2.600	35.3	6.500	55.0		

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	111.290	0.290	5.2	319.7	O K
30 min Summer	111.366	0.366	5.2	411.4	O K
60 min Summer	111.438	0.438	5.2	502.2	O K
120 min Summer	111.517	0.517	5.2	604.7	O K
180 min Summer	111.558	0.558	5.2	660.5	O K
240 min Summer	111.583	0.583	5.2	694.4	O K
360 min Summer	111.608	0.608	5.2	728.8	O K
480 min Summer	111.617	0.617	5.2	741.1	O K
600 min Summer	111.618	0.618	5.2	742.6	O K
720 min Summer	111.615	0.615	5.2	738.0	O K
960 min Summer	111.601	0.601	5.2	718.2	O K
1440 min Summer	111.564	0.564	5.2	667.8	O K
2160 min Summer	111.515	0.515	5.2	602.0	O K
2880 min Summer	111.474	0.474	5.2	548.7	O K
4320 min Summer	111.410	0.410	5.2	466.3	O K
5760 min Summer	111.358	0.358	5.2	401.6	O K
7200 min Summer	111.315	0.315	5.2	349.9	O K
8640 min Summer	111.280	0.280	5.2	307.7	O K
10080 min Summer	111.250	0.250	5.2	273.3	O K
15 min Winter	111.322	0.322	5.2	358.5	O K
30 min Winter	111.406	0.406	5.2	461.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	151.654	0.0	289.9	23
30 min Summer	97.974	0.0	367.9	37
60 min Summer	60.354	0.0	497.9	68
120 min Summer	36.913	0.0	606.9	126
180 min Summer	27.268	0.0	668.6	186
240 min Summer	21.821	0.0	708.6	246
360 min Summer	15.737	0.0	755.1	364
480 min Summer	12.370	0.0	777.4	484
600 min Summer	10.223	0.0	786.2	604
720 min Summer	8.729	0.0	785.9	722
960 min Summer	6.777	0.0	770.7	960
1440 min Summer	4.731	0.0	730.6	1244
2160 min Summer	3.309	0.0	1005.3	1576
2880 min Summer	2.578	0.0	1042.9	1956
4320 min Summer	1.834	0.0	1105.7	2728
5760 min Summer	1.454	0.0	1188.6	3512
7200 min Summer	1.225	0.0	1250.5	4256
8640 min Summer	1.071	0.0	1310.3	5008
10080 min Summer	0.961	0.0	1366.9	5744
15 min Winter	151.654	0.0	323.5	23
30 min Winter	97.974	0.0	402.2	37

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	111.486	0.486	5.2	564.0	O K
120 min Winter	111.573	0.573	5.2	680.4	O K
180 min Winter	111.619	0.619	5.2	743.5	O K
240 min Winter	111.647	0.647	5.2	782.3	O K
360 min Winter	111.675	0.675	5.2	823.0	O K
480 min Winter	111.686	0.686	5.2	839.0	O K
600 min Winter	111.689	0.689	5.2	842.9	O K
720 min Winter	111.687	0.687	5.2	840.0	O K
960 min Winter	111.675	0.675	5.2	822.5	O K
1440 min Winter	111.638	0.638	5.2	770.5	O K
2160 min Winter	111.582	0.582	5.2	693.0	O K
2880 min Winter	111.531	0.531	5.2	624.1	O K
4320 min Winter	111.435	0.435	5.2	497.9	O K
5760 min Winter	111.355	0.355	5.2	398.3	O K
7200 min Winter	111.290	0.290	5.2	319.2	O K
8640 min Winter	111.237	0.237	5.2	257.8	O K
10080 min Winter	111.197	0.197	5.2	211.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	60.354	0.0	557.1	66
120 min Winter	36.913	0.0	675.7	124
180 min Winter	27.268	0.0	739.8	184
240 min Winter	21.821	0.0	777.5	242
360 min Winter	15.737	0.0	808.3	360
480 min Winter	12.370	0.0	807.9	476
600 min Winter	10.223	0.0	799.8	590
720 min Winter	8.729	0.0	790.9	706
960 min Winter	6.777	0.0	772.4	932
1440 min Winter	4.731	0.0	735.1	1360
2160 min Winter	3.309	0.0	1124.6	1696
2880 min Winter	2.578	0.0	1165.9	2160
4320 min Winter	1.834	0.0	1234.7	2984
5760 min Winter	1.454	0.0	1331.7	3752
7200 min Winter	1.225	0.0	1401.3	4472
8640 min Winter	1.071	0.0	1468.7	5192
10080 min Winter	0.961	0.0	1533.2	5848

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 483669 232428 SP 83669 32428
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.140

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.570	4	8	0.570

Model Details

Storage is Online Cover Level (m) 112.000

Tank or Pond Structure

Invert Level (m) 111.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1020.0	1.000	1650.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0110-5200-0800-5200
Design Head (m)	0.800
Design Flow (l/s)	5.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	110
Invert Level (m)	111.000
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)	0.800	5.2	Kick-Flo®	0.537	4.3
Flush-Flo™	0.241	5.2	Mean Flow over Head Range	-	4.5

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.8	1.200	6.3	3.000	9.7	7.000	14.5
0.200	5.2	1.400	6.7	3.500	10.4	7.500	14.9
0.300	5.2	1.600	7.2	4.000	11.1	8.000	15.4
0.400	5.0	1.800	7.6	4.500	11.7	8.500	15.8
0.500	4.6	2.000	8.0	5.000	12.3	9.000	16.3
0.600	4.6	2.200	8.3	5.500	12.9	9.500	16.8
0.800	5.2	2.400	8.7	6.000	13.4		
1.000	5.8	2.600	9.0	6.500	14.0		

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	105.247	0.247	5.7	356.5	O K
30 min Summer	105.313	0.313	5.7	458.7	O K
60 min Summer	105.377	0.377	5.7	560.1	O K
120 min Summer	105.447	0.447	5.7	674.6	O K
180 min Summer	105.484	0.484	5.7	736.6	O K
240 min Summer	105.507	0.507	5.7	774.8	O K
360 min Summer	105.530	0.530	5.7	815.1	O K
480 min Summer	105.539	0.539	5.7	830.8	O K
600 min Summer	105.541	0.541	5.7	834.2	O K
720 min Summer	105.539	0.539	5.7	830.2	O K
960 min Summer	105.526	0.526	5.7	808.8	O K
1440 min Summer	105.493	0.493	5.7	751.2	O K
2160 min Summer	105.453	0.453	5.7	685.3	O K
2880 min Summer	105.421	0.421	5.7	631.9	O K
4320 min Summer	105.368	0.368	5.7	545.3	O K
5760 min Summer	105.324	0.324	5.7	476.0	O K
7200 min Summer	105.289	0.289	5.7	420.3	O K
8640 min Summer	105.259	0.259	5.7	375.0	O K
10080 min Summer	105.235	0.235	5.7	338.0	O K
15 min Winter	105.276	0.276	5.7	399.7	O K
30 min Winter	105.349	0.349	5.7	514.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	151.654	0.0	308.9	23
30 min Summer	97.974	0.0	393.4	37
60 min Summer	60.354	0.0	545.4	68
120 min Summer	36.913	0.0	665.0	126
180 min Summer	27.268	0.0	732.7	186
240 min Summer	21.821	0.0	776.4	246
360 min Summer	15.737	0.0	827.0	366
480 min Summer	12.370	0.0	851.6	484
600 min Summer	10.223	0.0	862.6	604
720 min Summer	8.729	0.0	865.1	722
960 min Summer	6.777	0.0	855.6	962
1440 min Summer	4.731	0.0	818.4	1214
2160 min Summer	3.309	0.0	1112.7	1544
2880 min Summer	2.578	0.0	1153.1	1936
4320 min Summer	1.834	0.0	1218.6	2728
5760 min Summer	1.454	0.0	1321.2	3512
7200 min Summer	1.225	0.0	1389.6	4256
8640 min Summer	1.071	0.0	1455.1	5016
10080 min Summer	0.961	0.0	1515.9	5744
15 min Winter	151.654	0.0	345.3	23
30 min Winter	97.974	0.0	431.5	37

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	105.419	0.419	5.7	628.8	O K
120 min Winter	105.497	0.497	5.7	758.5	O K
180 min Winter	105.539	0.539	5.7	830.0	O K
240 min Winter	105.564	0.564	5.7	874.7	O K
360 min Winter	105.592	0.592	5.7	922.5	O K
480 min Winter	105.603	0.603	5.7	942.4	O K
600 min Winter	105.606	0.606	5.7	948.8	O K
720 min Winter	105.606	0.606	5.7	947.3	O K
960 min Winter	105.596	0.596	5.7	931.1	O K
1440 min Winter	105.566	0.566	5.7	877.7	O K
2160 min Winter	105.512	0.512	5.7	784.9	O K
2880 min Winter	105.468	0.468	5.7	710.1	O K
4320 min Winter	105.391	0.391	5.7	581.9	O K
5760 min Winter	105.324	0.324	5.7	475.9	O K
7200 min Winter	105.270	0.270	5.7	391.1	O K
8640 min Winter	105.226	0.226	5.7	324.5	O K
10080 min Winter	105.192	0.192	5.6	273.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	60.354	0.0	610.5	66
120 min Winter	36.913	0.0	740.7	124
180 min Winter	27.268	0.0	810.3	184
240 min Winter	21.821	0.0	850.6	242
360 min Winter	15.737	0.0	884.8	360
480 min Winter	12.370	0.0	886.8	476
600 min Winter	10.223	0.0	877.2	592
720 min Winter	8.729	0.0	866.5	708
960 min Winter	6.777	0.0	844.9	934
1440 min Winter	4.731	0.0	803.3	1372
2160 min Winter	3.309	0.0	1244.4	1692
2880 min Winter	2.578	0.0	1289.1	2132
4320 min Winter	1.834	0.0	1359.2	2984
5760 min Winter	1.454	0.0	1480.6	3752
7200 min Winter	1.225	0.0	1557.6	4536
8640 min Winter	1.071	0.0	1631.6	5192
10080 min Winter	0.961	0.0	1701.2	5856

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 483669 232428 SP 83669 32428
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.270

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.635	4	8	0.635

Model Details

Storage is Online Cover Level (m) 106.000

Tank or Pond Structure

Invert Level (m) 105.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1360.0	1.000	2080.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0115-5700-0800-5700
Design Head (m)	0.800
Design Flow (l/s)	5.7
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	115
Invert Level (m)	105.000
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)	0.800	5.7	Kick-Flo®	0.543	4.8
Flush-Flo™	0.244	5.7	Mean Flow over Head Range	-	4.9

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)
0.100	4.0	1.200	6.9	3.000	10.6	7.000	15.9
0.200	5.7	1.400	7.4	3.500	11.4	7.500	16.4
0.300	5.7	1.600	7.9	4.000	12.2	8.000	16.9
0.400	5.5	1.800	8.3	4.500	12.9	8.500	17.4
0.500	5.1	2.000	8.8	5.000	13.5	9.000	17.9
0.600	5.0	2.200	9.2	5.500	14.1	9.500	18.4
0.800	5.7	2.400	9.5	6.000	14.8		
1.000	6.3	2.600	9.9	6.500	15.3		

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	111.294	0.294	6.5	369.9	O K
30 min Summer	111.371	0.371	6.5	475.8	O K
60 min Summer	111.446	0.446	6.5	580.5	O K
120 min Summer	111.527	0.527	6.5	698.3	O K
180 min Summer	111.570	0.570	6.5	762.0	O K
240 min Summer	111.595	0.595	6.5	800.2	O K
360 min Summer	111.620	0.620	6.5	838.1	O K
480 min Summer	111.628	0.628	6.5	850.3	O K
600 min Summer	111.628	0.628	6.5	850.1	O K
720 min Summer	111.623	0.623	6.5	842.8	O K
960 min Summer	111.606	0.606	6.5	816.3	O K
1440 min Summer	111.566	0.566	6.5	756.5	O K
2160 min Summer	111.513	0.513	6.5	678.4	O K
2880 min Summer	111.470	0.470	6.5	615.7	O K
4320 min Summer	111.401	0.401	6.5	517.1	O K
5760 min Summer	111.345	0.345	6.5	440.1	O K
7200 min Summer	111.300	0.300	6.5	379.0	O K
8640 min Summer	111.264	0.264	6.5	330.5	O K
10080 min Summer	111.235	0.235	6.5	291.9	O K
15 min Winter	111.327	0.327	6.5	414.8	O K
30 min Winter	111.413	0.413	6.5	533.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	151.654	0.0	335.7	23
30 min Summer	97.974	0.0	429.6	37
60 min Summer	60.354	0.0	576.2	68
120 min Summer	36.913	0.0	703.7	126
180 min Summer	27.268	0.0	776.8	186
240 min Summer	21.821	0.0	825.4	246
360 min Summer	15.737	0.0	885.1	364
480 min Summer	12.370	0.0	918.9	484
600 min Summer	10.223	0.0	939.0	602
720 min Summer	8.729	0.0	950.3	722
960 min Summer	6.777	0.0	953.4	960
1440 min Summer	4.731	0.0	912.5	1198
2160 min Summer	3.309	0.0	1164.3	1536
2880 min Summer	2.578	0.0	1208.0	1908
4320 min Summer	1.834	0.0	1282.2	2688
5760 min Summer	1.454	0.0	1375.9	3464
7200 min Summer	1.225	0.0	1447.4	4184
8640 min Summer	1.071	0.0	1516.4	4928
10080 min Summer	0.961	0.0	1581.5	5648
15 min Winter	151.654	0.0	375.6	23
30 min Winter	97.974	0.0	474.0	37

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	111.495	0.495	6.5	652.1	O K
120 min Winter	111.586	0.586	6.5	785.9	O K
180 min Winter	111.633	0.633	6.5	857.8	O K
240 min Winter	111.661	0.661	6.5	901.7	O K
360 min Winter	111.690	0.690	6.5	946.6	O K
480 min Winter	111.700	0.700	6.5	962.9	Flood Risk
600 min Winter	111.702	0.702	6.5	965.4	Flood Risk
720 min Winter	111.698	0.698	6.5	960.0	O K
960 min Winter	111.683	0.683	6.5	936.1	O K
1440 min Winter	111.640	0.640	6.5	869.5	O K
2160 min Winter	111.581	0.581	6.5	778.3	O K
2880 min Winter	111.522	0.522	6.5	691.0	O K
4320 min Winter	111.418	0.418	6.5	541.0	O K
5760 min Winter	111.333	0.333	6.5	423.2	O K
7200 min Winter	111.266	0.266	6.5	332.4	O K
8640 min Winter	111.214	0.214	6.5	265.0	O K
10080 min Winter	111.177	0.177	6.4	217.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	60.354	0.0	645.3	66
120 min Winter	36.913	0.0	785.2	124
180 min Winter	27.268	0.0	863.9	184
240 min Winter	21.821	0.0	914.4	242
360 min Winter	15.737	0.0	970.5	358
480 min Winter	12.370	0.0	993.8	474
600 min Winter	10.223	0.0	998.4	590
720 min Winter	8.729	0.0	991.9	704
960 min Winter	6.777	0.0	969.9	926
1440 min Winter	4.731	0.0	921.3	1344
2160 min Winter	3.309	0.0	1303.1	1668
2880 min Winter	2.578	0.0	1351.9	2108
4320 min Winter	1.834	0.0	1434.4	2940
5760 min Winter	1.454	0.0	1541.7	3688
7200 min Winter	1.225	0.0	1622.0	4400
8640 min Winter	1.071	0.0	1699.9	5096
10080 min Winter	0.961	0.0	1774.1	5744

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 483669 232428 SP 83669 32428
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.320

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.660	4	8	0.660

Model Details

Storage is Online Cover Level (m) 112.000

Tank or Pond Structure

Invert Level (m) 111.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1180.0	1.000	1770.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0122-6500-0800-6500
Design Head (m)	0.800
Design Flow (l/s)	6.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	122
Invert Level (m)	111.000
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)	0.800	6.5	Kick-Flo®	0.547	5.4
Flush-Flo™	0.246	6.5	Mean Flow over Head Range	-	5.6

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.4	1.200	7.9	3.000	12.1	7.000	18.1
0.200	6.4	1.400	8.4	3.500	13.0	7.500	18.8
0.300	6.4	1.600	9.0	4.000	13.9	8.000	19.3
0.400	6.3	1.800	9.5	4.500	14.7	8.500	19.9
0.500	5.9	2.000	10.0	5.000	15.4	9.000	20.5
0.600	5.7	2.200	10.4	5.500	16.2	9.500	21.0
0.800	6.5	2.400	10.9	6.000	16.8		
1.000	7.2	2.600	11.3	6.500	17.5		

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	110.264	0.264	5.2	319.8	O K
30 min Summer	110.335	0.335	5.2	411.5	O K
60 min Summer	110.403	0.403	5.2	502.4	O K
120 min Summer	110.479	0.479	5.2	604.9	O K
180 min Summer	110.519	0.519	5.2	660.6	O K
240 min Summer	110.543	0.543	5.2	695.1	O K
360 min Summer	110.568	0.568	5.2	730.8	O K
480 min Summer	110.578	0.578	5.2	744.0	O K
600 min Summer	110.579	0.579	5.2	746.4	O K
720 min Summer	110.577	0.577	5.2	742.5	O K
960 min Summer	110.564	0.564	5.2	723.8	O K
1440 min Summer	110.526	0.526	5.2	670.8	O K
2160 min Summer	110.480	0.480	5.2	606.5	O K
2880 min Summer	110.443	0.443	5.2	556.1	O K
4320 min Summer	110.384	0.384	5.2	475.8	O K
5760 min Summer	110.335	0.335	5.2	412.1	O K
7200 min Summer	110.296	0.296	5.2	361.2	O K
8640 min Summer	110.264	0.264	5.2	319.7	O K
10080 min Summer	110.237	0.237	5.2	286.0	O K
15 min Winter	110.294	0.294	5.2	358.6	O K
30 min Winter	110.373	0.373	5.2	461.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	151.654	0.0	283.9	23
30 min Summer	97.974	0.0	361.2	37
60 min Summer	60.354	0.0	494.0	68
120 min Summer	36.913	0.0	602.4	126
180 min Summer	27.268	0.0	663.8	186
240 min Summer	21.821	0.0	703.5	246
360 min Summer	15.737	0.0	749.4	366
480 min Summer	12.370	0.0	771.9	484
600 min Summer	10.223	0.0	781.7	604
720 min Summer	8.729	0.0	783.0	722
960 min Summer	6.777	0.0	770.5	962
1440 min Summer	4.731	0.0	736.2	1242
2160 min Summer	3.309	0.0	1002.3	1556
2880 min Summer	2.578	0.0	1039.3	1936
4320 min Summer	1.834	0.0	1100.5	2728
5760 min Summer	1.454	0.0	1187.4	3512
7200 min Summer	1.225	0.0	1249.0	4256
8640 min Summer	1.071	0.0	1308.3	5008
10080 min Summer	0.961	0.0	1363.9	5744
15 min Winter	151.654	0.0	317.1	23
30 min Winter	97.974	0.0	395.9	37

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	110.449	0.449	5.2	564.1	O K
120 min Winter	110.533	0.533	5.2	680.6	O K
180 min Winter	110.578	0.578	5.2	744.4	O K
240 min Winter	110.605	0.605	5.2	783.7	O K
360 min Winter	110.634	0.634	5.2	825.3	O K
480 min Winter	110.645	0.645	5.2	842.1	O K
600 min Winter	110.649	0.649	5.2	846.7	O K
720 min Winter	110.647	0.647	5.2	844.5	O K
960 min Winter	110.636	0.636	5.2	828.3	O K
1440 min Winter	110.602	0.602	5.2	778.2	O K
2160 min Winter	110.546	0.546	5.2	699.4	O K
2880 min Winter	110.495	0.495	5.2	627.3	O K
4320 min Winter	110.407	0.407	5.2	506.8	O K
5760 min Winter	110.333	0.333	5.2	409.3	O K
7200 min Winter	110.273	0.273	5.2	331.7	O K
8640 min Winter	110.226	0.226	5.2	271.6	O K
10080 min Winter	110.189	0.189	5.1	226.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	60.354	0.0	552.9	66
120 min Winter	36.913	0.0	670.9	124
180 min Winter	27.268	0.0	734.2	184
240 min Winter	21.821	0.0	771.7	242
360 min Winter	15.737	0.0	804.0	360
480 min Winter	12.370	0.0	806.2	476
600 min Winter	10.223	0.0	798.0	592
720 min Winter	8.729	0.0	788.7	706
960 min Winter	6.777	0.0	769.6	932
1440 min Winter	4.731	0.0	731.3	1368
2160 min Winter	3.309	0.0	1120.9	1712
2880 min Winter	2.578	0.0	1162.2	2136
4320 min Winter	1.834	0.0	1228.6	2980
5760 min Winter	1.454	0.0	1330.4	3752
7200 min Winter	1.225	0.0	1399.8	4472
8640 min Winter	1.071	0.0	1466.8	5192
10080 min Winter	0.961	0.0	1530.2	5856

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 483669 232428 SP 83669 32428
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.140

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.570	4	8	0.570

Model Details

Storage is Online Cover Level (m) 111.000

Tank or Pond Structure

Invert Level (m) 110.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1150.0	1.000	1655.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0110-5200-0800-5200
Design Head (m)	0.800
Design Flow (l/s)	5.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	110
Invert Level (m)	110.000
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)	0.800	5.2	Kick-Flo®	0.537	4.3
Flush-Flo™	0.241	5.2	Mean Flow over Head Range	-	4.5

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.8	1.200	6.3	3.000	9.7	7.000	14.5
0.200	5.2	1.400	6.7	3.500	10.4	7.500	14.9
0.300	5.2	1.600	7.2	4.000	11.1	8.000	15.4
0.400	5.0	1.800	7.6	4.500	11.7	8.500	15.8
0.500	4.6	2.000	8.0	5.000	12.3	9.000	16.3
0.600	4.6	2.200	8.3	5.500	12.9	9.500	16.8
0.800	5.2	2.400	8.7	6.000	13.4		
1.000	5.8	2.600	9.0	6.500	14.0		

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	115.250	0.250	3.8	235.7	O K
30 min Summer	115.314	0.314	3.8	303.2	O K
60 min Summer	115.375	0.375	3.8	370.1	O K
120 min Summer	115.441	0.441	3.8	445.4	O K
180 min Summer	115.475	0.475	3.8	486.1	O K
240 min Summer	115.496	0.496	3.8	511.1	O K
360 min Summer	115.517	0.517	3.8	537.1	O K
480 min Summer	115.525	0.525	3.8	546.9	O K
600 min Summer	115.527	0.527	3.8	548.6	O K
720 min Summer	115.524	0.524	3.8	545.4	O K
960 min Summer	115.511	0.511	3.8	530.0	O K
1440 min Summer	115.478	0.478	3.8	489.4	O K
2160 min Summer	115.439	0.439	3.8	443.3	O K
2880 min Summer	115.407	0.407	3.8	406.4	O K
4320 min Summer	115.355	0.355	3.8	347.6	O K
5760 min Summer	115.312	0.312	3.8	301.1	O K
7200 min Summer	115.277	0.277	3.8	264.1	O K
8640 min Summer	115.248	0.248	3.8	233.9	O K
10080 min Summer	115.224	0.224	3.8	209.4	O K
15 min Winter	115.277	0.277	3.8	264.2	O K
30 min Winter	115.348	0.348	3.8	340.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	151.654	0.0	212.1	23
30 min Summer	97.974	0.0	268.9	37
60 min Summer	60.354	0.0	366.2	68
120 min Summer	36.913	0.0	446.5	126
180 min Summer	27.268	0.0	492.1	186
240 min Summer	21.821	0.0	521.7	246
360 min Summer	15.737	0.0	555.9	366
480 min Summer	12.370	0.0	572.2	484
600 min Summer	10.223	0.0	578.8	604
720 min Summer	8.729	0.0	579.5	722
960 min Summer	6.777	0.0	572.0	962
1440 min Summer	4.731	0.0	550.0	1216
2160 min Summer	3.309	0.0	740.4	1540
2880 min Summer	2.578	0.0	767.9	1936
4320 min Summer	1.834	0.0	813.6	2728
5760 min Summer	1.454	0.0	875.6	3512
7200 min Summer	1.225	0.0	921.2	4256
8640 min Summer	1.071	0.0	965.2	5008
10080 min Summer	0.961	0.0	1006.7	5744
15 min Winter	151.654	0.0	236.6	23
30 min Winter	97.974	0.0	293.7	37

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	115.415	0.415	3.8	415.6	O K
120 min Winter	115.488	0.488	3.8	501.1	O K
180 min Winter	115.526	0.526	3.8	548.1	O K
240 min Winter	115.550	0.550	3.8	577.3	O K
360 min Winter	115.574	0.574	3.8	608.4	O K
480 min Winter	115.584	0.584	3.8	621.0	O K
600 min Winter	115.587	0.587	3.8	624.7	O K
720 min Winter	115.586	0.586	3.8	623.2	O K
960 min Winter	115.577	0.577	3.8	611.5	O K
1440 min Winter	115.547	0.547	3.8	574.3	O K
2160 min Winter	115.495	0.495	3.8	510.0	O K
2880 min Winter	115.452	0.452	3.8	458.4	O K
4320 min Winter	115.376	0.376	3.8	371.2	O K
5760 min Winter	115.311	0.311	3.8	300.3	O K
7200 min Winter	115.258	0.258	3.8	243.9	O K
8640 min Winter	115.215	0.215	3.8	200.1	O K
10080 min Winter	115.181	0.181	3.7	166.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	60.354	0.0	409.8	66
120 min Winter	36.913	0.0	497.4	124
180 min Winter	27.268	0.0	544.3	184
240 min Winter	21.821	0.0	571.2	242
360 min Winter	15.737	0.0	591.3	360
480 min Winter	12.370	0.0	589.5	476
600 min Winter	10.223	0.0	583.1	592
720 min Winter	8.729	0.0	576.3	708
960 min Winter	6.777	0.0	563.0	934
1440 min Winter	4.731	0.0	537.5	1372
2160 min Winter	3.309	0.0	828.3	1692
2880 min Winter	2.578	0.0	858.8	2132
4320 min Winter	1.834	0.0	908.2	2980
5760 min Winter	1.454	0.0	981.1	3752
7200 min Winter	1.225	0.0	1032.4	4536
8640 min Winter	1.071	0.0	1082.0	5192
10080 min Winter	0.961	0.0	1129.3	5856

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 483669 232428 SP 83669 32428
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.840

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.420	4	8	0.420

Model Details

Storage is Online Cover Level (m) 116.000

Tank or Pond Structure

Invert Level (m) 115.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	860.0	1.000	1630.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0095-3800-0800-3800
Design Head (m)	0.800
Design Flow (l/s)	3.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	95
Invert Level (m)	115.000
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)	0.800	3.8	Kick-Flo®	0.525	3.1
Flush-Flo™	0.239	3.8	Mean Flow over Head Range	-	3.3

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.1	1.200	4.6	3.000	7.0	7.000	10.5
0.200	3.8	1.400	4.9	3.500	7.6	7.500	10.9
0.300	3.8	1.600	5.2	4.000	8.0	8.000	11.2
0.400	3.6	1.800	5.5	4.500	8.5	8.500	11.5
0.500	3.3	2.000	5.8	5.000	8.9	9.000	11.8
0.600	3.3	2.200	6.1	5.500	9.4	9.500	12.2
0.800	3.8	2.400	6.3	6.000	9.8		
1.000	4.2	2.600	6.6	6.500	10.1		

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	110.265	0.265	3.3	270.1	O K
30 min Summer	110.335	0.335	3.3	347.9	O K
60 min Summer	110.402	0.402	3.3	425.6	O K
120 min Summer	110.475	0.475	3.3	514.2	O K
180 min Summer	110.515	0.515	3.3	563.6	O K
240 min Summer	110.539	0.539	3.3	595.0	O K
360 min Summer	110.566	0.566	3.3	629.7	O K
480 min Summer	110.579	0.579	3.3	645.4	O K
600 min Summer	110.584	0.584	3.3	652.0	O K
720 min Summer	110.585	0.585	3.3	653.2	O K
960 min Summer	110.579	0.579	3.3	646.5	O K
1440 min Summer	110.557	0.557	3.3	618.0	O K
2160 min Summer	110.519	0.519	3.3	569.5	O K
2880 min Summer	110.486	0.486	3.3	528.4	O K
4320 min Summer	110.438	0.438	3.3	468.8	O K
5760 min Summer	110.399	0.399	3.3	422.8	O K
7200 min Summer	110.368	0.368	3.3	385.6	O K
8640 min Summer	110.340	0.340	3.3	354.1	O K
10080 min Summer	110.317	0.317	3.3	327.4	O K
15 min Winter	110.295	0.295	3.3	302.8	O K
30 min Winter	110.371	0.371	3.3	390.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	151.654	0.0	230.0	23
30 min Summer	97.974	0.0	271.8	38
60 min Summer	60.354	0.0	410.9	68
120 min Summer	36.913	0.0	491.2	128
180 min Summer	27.268	0.0	522.3	186
240 min Summer	21.821	0.0	525.9	246
360 min Summer	15.737	0.0	516.2	366
480 min Summer	12.370	0.0	507.3	486
600 min Summer	10.223	0.0	499.6	604
720 min Summer	8.729	0.0	492.6	724
960 min Summer	6.777	0.0	479.8	962
1440 min Summer	4.731	0.0	456.0	1440
2160 min Summer	3.309	0.0	834.4	1824
2880 min Summer	2.578	0.0	860.8	2112
4320 min Summer	1.834	0.0	877.8	2892
5760 min Summer	1.454	0.0	999.6	3688
7200 min Summer	1.225	0.0	1051.9	4464
8640 min Summer	1.071	0.0	1102.3	5264
10080 min Summer	0.961	0.0	1149.5	6048
15 min Winter	151.654	0.0	251.6	23
30 min Winter	97.974	0.0	277.9	37

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	110.445	0.445	3.3	477.6	O K
120 min Winter	110.526	0.526	3.3	578.2	O K
180 min Winter	110.570	0.570	3.3	634.2	O K
240 min Winter	110.597	0.597	3.3	669.8	O K
360 min Winter	110.628	0.628	3.3	709.8	O K
480 min Winter	110.642	0.642	3.3	728.9	O K
600 min Winter	110.648	0.648	3.3	737.7	O K
720 min Winter	110.650	0.650	3.3	740.6	O K
960 min Winter	110.647	0.647	3.3	736.0	O K
1440 min Winter	110.628	0.628	3.3	710.3	O K
2160 min Winter	110.590	0.590	3.3	660.1	O K
2880 min Winter	110.553	0.553	3.3	612.2	O K
4320 min Winter	110.488	0.488	3.3	529.9	O K
5760 min Winter	110.429	0.429	3.3	457.8	O K
7200 min Winter	110.378	0.378	3.3	398.4	O K
8640 min Winter	110.335	0.335	3.3	347.9	O K
10080 min Winter	110.297	0.297	3.3	304.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	60.354	0.0	456.5	66
120 min Winter	36.913	0.0	525.4	126
180 min Winter	27.268	0.0	525.5	184
240 min Winter	21.821	0.0	518.3	242
360 min Winter	15.737	0.0	507.4	360
480 min Winter	12.370	0.0	499.6	478
600 min Winter	10.223	0.0	493.1	594
720 min Winter	8.729	0.0	487.4	712
960 min Winter	6.777	0.0	476.8	942
1440 min Winter	4.731	0.0	457.1	1390
2160 min Winter	3.309	0.0	921.9	2032
2880 min Winter	2.578	0.0	933.1	2308
4320 min Winter	1.834	0.0	900.4	3164
5760 min Winter	1.454	0.0	1119.7	4032
7200 min Winter	1.225	0.0	1178.3	4824
8640 min Winter	1.071	0.0	1235.3	5616
10080 min Winter	0.961	0.0	1289.4	6360

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 483669 232428 SP 83669 32428
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.960

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.480	4	8	0.480

Model Details

Storage is Online Cover Level (m) 111.000

Tank or Pond Structure

Invert Level (m) 110.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	940.0	1.000	1600.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0089-3300-0800-3300
Design Head (m)	0.800
Design Flow (l/s)	3.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	89
Invert Level (m)	110.000
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)	0.800	3.3	Kick-Flo®	0.519	2.7
Flush-Flo™	0.237	3.3	Mean Flow over Head Range	-	2.9

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)
0.100	2.8	1.200	4.0	3.000	6.1	7.000	9.1
0.200	3.3	1.400	4.3	3.500	6.6	7.500	9.4
0.300	3.3	1.600	4.5	4.000	7.0	8.000	9.7
0.400	3.2	1.800	4.8	4.500	7.4	8.500	10.0
0.500	2.8	2.000	5.0	5.000	7.8	9.000	10.3
0.600	2.9	2.200	5.3	5.500	8.1	9.500	10.5
0.800	3.3	2.400	5.5	6.000	8.5		
1.000	3.7	2.600	5.7	6.500	8.8		

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	110.263	0.263	5.4	336.8	O K
30 min Summer	110.332	0.332	5.4	433.3	O K
60 min Summer	110.399	0.399	5.4	529.1	O K
120 min Summer	110.473	0.473	5.4	637.2	O K
180 min Summer	110.511	0.511	5.4	695.9	O K
240 min Summer	110.535	0.535	5.4	732.3	O K
360 min Summer	110.560	0.560	5.4	770.4	O K
480 min Summer	110.569	0.569	5.4	784.9	O K
600 min Summer	110.571	0.571	5.4	787.8	O K
720 min Summer	110.568	0.568	5.4	784.1	O K
960 min Summer	110.556	0.556	5.4	765.2	O K
1440 min Summer	110.520	0.520	5.4	709.3	O K
2160 min Summer	110.476	0.476	5.4	643.1	O K
2880 min Summer	110.441	0.441	5.4	590.8	O K
4320 min Summer	110.385	0.385	5.4	507.6	O K
5760 min Summer	110.338	0.338	5.4	441.2	O K
7200 min Summer	110.300	0.300	5.4	388.0	O K
8640 min Summer	110.269	0.269	5.4	344.6	O K
10080 min Summer	110.243	0.243	5.4	309.2	O K
15 min Winter	110.293	0.293	5.4	377.6	O K
30 min Winter	110.370	0.370	5.4	486.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	151.654	0.0	297.4	23
30 min Summer	97.974	0.0	377.7	37
60 min Summer	60.354	0.0	519.1	68
120 min Summer	36.913	0.0	632.7	126
180 min Summer	27.268	0.0	696.9	186
240 min Summer	21.821	0.0	738.1	246
360 min Summer	15.737	0.0	784.9	366
480 min Summer	12.370	0.0	806.8	484
600 min Summer	10.223	0.0	815.0	604
720 min Summer	8.729	0.0	814.4	722
960 min Summer	6.777	0.0	799.1	962
1440 min Summer	4.731	0.0	764.8	1244
2160 min Summer	3.309	0.0	1054.3	1560
2880 min Summer	2.578	0.0	1093.0	1936
4320 min Summer	1.834	0.0	1156.5	2728
5760 min Summer	1.454	0.0	1249.7	3520
7200 min Summer	1.225	0.0	1314.5	4256
8640 min Summer	1.071	0.0	1376.9	5016
10080 min Summer	0.961	0.0	1435.2	5744
15 min Winter	151.654	0.0	332.1	23
30 min Winter	97.974	0.0	413.2	37

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	110.444	0.444	5.4	594.1	O K
120 min Winter	110.525	0.525	5.4	716.7	O K
180 min Winter	110.568	0.568	5.4	784.2	O K
240 min Winter	110.595	0.595	5.4	825.9	O K
360 min Winter	110.623	0.623	5.4	870.3	O K
480 min Winter	110.634	0.634	5.4	888.4	O K
600 min Winter	110.637	0.637	5.4	893.9	O K
720 min Winter	110.636	0.636	5.4	892.0	O K
960 min Winter	110.626	0.626	5.4	875.8	O K
1440 min Winter	110.594	0.594	5.4	824.5	O K
2160 min Winter	110.541	0.541	5.4	741.5	O K
2880 min Winter	110.492	0.492	5.4	667.2	O K
4320 min Winter	110.409	0.409	5.4	542.7	O K
5760 min Winter	110.338	0.338	5.4	441.0	O K
7200 min Winter	110.280	0.280	5.4	359.8	O K
8640 min Winter	110.233	0.233	5.4	295.9	O K
10080 min Winter	110.196	0.196	5.3	247.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	60.354	0.0	580.9	66
120 min Winter	36.913	0.0	704.3	124
180 min Winter	27.268	0.0	769.7	184
240 min Winter	21.821	0.0	807.4	242
360 min Winter	15.737	0.0	836.9	360
480 min Winter	12.370	0.0	835.4	476
600 min Winter	10.223	0.0	826.1	592
720 min Winter	8.729	0.0	816.3	706
960 min Winter	6.777	0.0	796.4	934
1440 min Winter	4.731	0.0	757.0	1370
2160 min Winter	3.309	0.0	1178.8	1728
2880 min Winter	2.578	0.0	1221.9	2136
4320 min Winter	1.834	0.0	1290.1	2984
5760 min Winter	1.454	0.0	1400.3	3752
7200 min Winter	1.225	0.0	1473.3	4536
8640 min Winter	1.071	0.0	1543.7	5192
10080 min Winter	0.961	0.0	1610.3	5856

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 483669 232428 SP 83669 32428
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.200

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.600	4	8	0.600

Model Details

Storage is Online Cover Level (m) 111.000

Tank or Pond Structure

Invert Level (m) 110.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1200.0	1.000	1880.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0112-5400-0800-5400
Design Head (m)	0.800
Design Flow (l/s)	5.4
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	112
Invert Level (m)	110.000
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)	0.800	5.4	Kick-Flo®	0.538	4.5
Flush-Flo™	0.242	5.4	Mean Flow over Head Range	-	4.6

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.9	1.200	6.5	3.000	10.0	7.000	15.0
0.200	5.3	1.400	7.0	3.500	10.8	7.500	15.5
0.300	5.3	1.600	7.5	4.000	11.5	8.000	16.0
0.400	5.2	1.800	7.9	4.500	12.2	8.500	16.5
0.500	4.8	2.000	8.3	5.000	12.8	9.000	16.9
0.600	4.7	2.200	8.7	5.500	13.4	9.500	17.4
0.800	5.4	2.400	9.0	6.000	14.0		
1.000	6.0	2.600	9.4	6.500	14.5		

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	113.151	0.251	3.3	270.2	O K
30 min Summer	113.218	0.318	3.3	347.9	O K
60 min Summer	113.283	0.383	3.3	425.7	O K
120 min Summer	113.355	0.455	3.3	514.3	O K
180 min Summer	113.393	0.493	3.3	563.6	O K
240 min Summer	113.418	0.518	3.3	595.1	O K
360 min Summer	113.445	0.545	3.3	630.2	O K
480 min Summer	113.457	0.557	3.3	646.3	O K
600 min Summer	113.462	0.562	3.3	653.2	O K
720 min Summer	113.464	0.564	3.3	654.8	O K
960 min Summer	113.459	0.559	3.3	648.5	O K
1440 min Summer	113.437	0.537	3.3	620.5	O K
2160 min Summer	113.398	0.498	3.3	569.3	O K
2880 min Summer	113.367	0.467	3.3	530.5	O K
4320 min Summer	113.321	0.421	3.3	472.6	O K
5760 min Summer	113.284	0.384	3.3	427.1	O K
7200 min Summer	113.254	0.354	3.3	390.3	O K
8640 min Summer	113.228	0.328	3.3	359.2	O K
10080 min Summer	113.205	0.305	3.3	332.7	O K
15 min Winter	113.179	0.279	3.3	302.9	O K
30 min Winter	113.254	0.354	3.3	390.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	151.654	0.0	226.8	23
30 min Summer	97.974	0.0	269.8	38
60 min Summer	60.354	0.0	408.4	68
120 min Summer	36.913	0.0	488.6	126
180 min Summer	27.268	0.0	521.8	186
240 min Summer	21.821	0.0	528.8	246
360 min Summer	15.737	0.0	519.4	366
480 min Summer	12.370	0.0	510.1	486
600 min Summer	10.223	0.0	502.0	604
720 min Summer	8.729	0.0	494.6	724
960 min Summer	6.777	0.0	481.3	962
1440 min Summer	4.731	0.0	457.1	1440
2160 min Summer	3.309	0.0	832.6	1792
2880 min Summer	2.578	0.0	858.3	2104
4320 min Summer	1.834	0.0	874.7	2860
5760 min Summer	1.454	0.0	998.8	3680
7200 min Summer	1.225	0.0	1051.0	4464
8640 min Summer	1.071	0.0	1101.1	5264
10080 min Summer	0.961	0.0	1147.8	6048
15 min Winter	151.654	0.0	248.5	23
30 min Winter	97.974	0.0	277.6	37

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	113.325	0.425	3.3	477.7	O K
120 min Winter	113.405	0.505	3.3	578.2	O K
180 min Winter	113.448	0.548	3.3	634.5	O K
240 min Winter	113.475	0.575	3.3	670.2	O K
360 min Winter	113.505	0.605	3.3	710.6	O K
480 min Winter	113.520	0.620	3.3	730.0	O K
600 min Winter	113.526	0.626	3.3	739.1	O K
720 min Winter	113.529	0.629	3.3	742.2	O K
960 min Winter	113.526	0.626	3.3	738.1	O K
1440 min Winter	113.507	0.607	3.3	713.3	O K
2160 min Winter	113.470	0.570	3.3	663.8	O K
2880 min Winter	113.433	0.533	3.3	615.2	O K
4320 min Winter	113.369	0.469	3.3	532.0	O K
5760 min Winter	113.312	0.412	3.3	461.7	O K
7200 min Winter	113.264	0.364	3.3	403.2	O K
8640 min Winter	113.223	0.323	3.3	353.2	O K
10080 min Winter	113.186	0.286	3.3	310.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	60.354	0.0	453.8	66
120 min Winter	36.913	0.0	525.5	126
180 min Winter	27.268	0.0	528.6	184
240 min Winter	21.821	0.0	521.1	242
360 min Winter	15.737	0.0	509.2	360
480 min Winter	12.370	0.0	500.6	478
600 min Winter	10.223	0.0	493.6	594
720 min Winter	8.729	0.0	487.4	712
960 min Winter	6.777	0.0	476.1	942
1440 min Winter	4.731	0.0	455.3	1390
2160 min Winter	3.309	0.0	918.5	2032
2880 min Winter	2.578	0.0	930.1	2312
4320 min Winter	1.834	0.0	903.8	3156
5760 min Winter	1.454	0.0	1118.9	3984
7200 min Winter	1.225	0.0	1177.3	4824
8640 min Winter	1.071	0.0	1234.1	5616
10080 min Winter	0.961	0.0	1287.6	6352

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 483669 232428 SP 83669 32428
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.960

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.480	4	8	0.480

Model Details

Storage is Online Cover Level (m) 113.900

Tank or Pond Structure

Invert Level (m) 112.900

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1010.0	1.000	1590.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0089-3300-0800-3300
Design Head (m)	0.800
Design Flow (l/s)	3.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	89
Invert Level (m)	112.900
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)	0.800	3.3	Kick-Flo®	0.519	2.7
Flush-Flo™	0.237	3.3	Mean Flow over Head Range	-	2.9

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)
0.100	2.8	1.200	4.0	3.000	6.1	7.000	9.1
0.200	3.3	1.400	4.3	3.500	6.6	7.500	9.4
0.300	3.3	1.600	4.5	4.000	7.0	8.000	9.7
0.400	3.2	1.800	4.8	4.500	7.4	8.500	10.0
0.500	2.8	2.000	5.0	5.000	7.8	9.000	10.3
0.600	2.9	2.200	5.3	5.500	8.1	9.500	10.5
0.800	3.3	2.400	5.5	6.000	8.5		
1.000	3.7	2.600	5.7	6.500	8.8		

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	113.285	0.285	3.5	292.7	O K
30 min Summer	113.361	0.361	3.5	377.0	O K
60 min Summer	113.435	0.435	3.5	461.3	O K
120 min Summer	113.516	0.516	3.5	557.8	O K
180 min Summer	113.560	0.560	3.5	611.4	O K
240 min Summer	113.588	0.588	3.5	645.1	O K
360 min Summer	113.618	0.618	3.5	682.4	O K
480 min Summer	113.631	0.631	3.5	699.3	O K
600 min Summer	113.637	0.637	3.5	706.3	O K
720 min Summer	113.638	0.638	3.5	707.6	O K
960 min Summer	113.632	0.632	3.5	700.2	O K
1440 min Summer	113.607	0.607	3.5	669.6	O K
2160 min Summer	113.568	0.568	3.5	620.1	O K
2880 min Summer	113.535	0.535	3.5	580.7	O K
4320 min Summer	113.480	0.480	3.5	514.1	O K
5760 min Summer	113.437	0.437	3.5	463.3	O K
7200 min Summer	113.402	0.402	3.5	422.7	O K
8640 min Summer	113.372	0.372	3.5	388.9	O K
10080 min Summer	113.346	0.346	3.5	359.9	O K
15 min Winter	113.318	0.318	3.5	328.1	O K
30 min Winter	113.402	0.402	3.5	422.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	151.654	0.0	249.5	23
30 min Summer	97.974	0.0	290.9	38
60 min Summer	60.354	0.0	445.4	68
120 min Summer	36.913	0.0	529.1	128
180 min Summer	27.268	0.0	554.5	186
240 min Summer	21.821	0.0	553.1	246
360 min Summer	15.737	0.0	543.2	366
480 min Summer	12.370	0.0	534.8	486
600 min Summer	10.223	0.0	527.3	604
720 min Summer	8.729	0.0	520.5	724
960 min Summer	6.777	0.0	507.8	962
1440 min Summer	4.731	0.0	483.2	1440
2160 min Summer	3.309	0.0	902.9	1816
2880 min Summer	2.578	0.0	927.1	2168
4320 min Summer	1.834	0.0	932.2	2904
5760 min Summer	1.454	0.0	1083.1	3688
7200 min Summer	1.225	0.0	1139.8	4472
8640 min Summer	1.071	0.0	1194.5	5272
10080 min Summer	0.961	0.0	1245.9	6048
15 min Winter	151.654	0.0	272.0	23
30 min Winter	97.974	0.0	294.6	37

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	113.483	0.483	3.5	517.7	O K
120 min Winter	113.573	0.573	3.5	626.8	O K
180 min Winter	113.621	0.621	3.5	687.3	O K
240 min Winter	113.652	0.652	3.5	725.7	O K
360 min Winter	113.686	0.686	3.5	769.0	O K
480 min Winter	113.701	0.701	3.5	789.6	Flood Risk
600 min Winter	113.709	0.709	3.5	799.1	Flood Risk
720 min Winter	113.711	0.711	3.5	802.2	Flood Risk
960 min Winter	113.707	0.707	3.5	797.2	Flood Risk
1440 min Winter	113.686	0.686	3.5	769.4	O K
2160 min Winter	113.644	0.644	3.5	715.5	O K
2880 min Winter	113.605	0.605	3.5	666.3	O K
4320 min Winter	113.540	0.540	3.5	586.5	O K
5760 min Winter	113.473	0.473	3.5	506.4	O K
7200 min Winter	113.417	0.417	3.5	440.4	O K
8640 min Winter	113.369	0.369	3.5	385.1	O K
10080 min Winter	113.326	0.326	3.5	337.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	60.354	0.0	493.9	66
120 min Winter	36.913	0.0	557.6	126
180 min Winter	27.268	0.0	553.4	184
240 min Winter	21.821	0.0	546.8	242
360 min Winter	15.737	0.0	537.5	360
480 min Winter	12.370	0.0	530.9	478
600 min Winter	10.223	0.0	525.2	594
720 min Winter	8.729	0.0	520.0	710
960 min Winter	6.777	0.0	510.0	942
1440 min Winter	4.731	0.0	491.2	1388
2160 min Winter	3.309	0.0	995.8	2016
2880 min Winter	2.578	0.0	1000.2	2284
4320 min Winter	1.834	0.0	931.6	3204
5760 min Winter	1.454	0.0	1213.2	4040
7200 min Winter	1.225	0.0	1276.7	4832
8640 min Winter	1.071	0.0	1338.5	5624
10080 min Winter	0.961	0.0	1397.4	6448

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 483669 232428 SP 83669 32428
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.040

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.520	4	8	0.520

Model Details

Storage is Online Cover Level (m) 114.000

Tank or Pond Structure

Invert Level (m) 113.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	960.0	1.000	1460.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0092-3500-0800-3500
Design Head (m)	0.800
Design Flow (l/s)	3.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	92
Invert Level (m)	113.000
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)	0.800	3.5	Kick-Flo®	0.521	2.9
Flush-Flo™	0.238	3.5	Mean Flow over Head Range	-	3.0

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.9	1.200	4.2	3.000	6.5	7.000	9.7
0.200	3.5	1.400	4.5	3.500	7.0	7.500	10.0
0.300	3.5	1.600	4.8	4.000	7.4	8.000	10.3
0.400	3.3	1.800	5.1	4.500	7.8	8.500	10.6
0.500	3.0	2.000	5.3	5.000	8.2	9.000	10.9
0.600	3.1	2.200	5.6	5.500	8.6	9.500	11.2
0.800	3.5	2.400	5.8	6.000	9.0		
1.000	3.9	2.600	6.0	6.500	9.3		

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	104.274	0.274	23.2	1450.6	O K
30 min Summer	104.349	0.349	23.4	1866.1	O K
60 min Summer	104.422	0.422	23.4	2280.0	O K
120 min Summer	104.503	0.503	23.4	2749.3	O K
180 min Summer	104.546	0.546	23.4	3005.3	O K
240 min Summer	104.573	0.573	23.4	3164.5	O K
360 min Summer	104.601	0.601	23.4	3335.5	O K
480 min Summer	104.613	0.613	23.4	3406.2	O K
600 min Summer	104.617	0.617	23.4	3426.8	O K
720 min Summer	104.615	0.615	23.4	3417.9	O K
960 min Summer	104.603	0.603	23.4	3345.6	O K
1440 min Summer	104.570	0.570	23.4	3148.7	O K
2160 min Summer	104.532	0.532	23.4	2923.2	O K
2880 min Summer	104.500	0.500	23.4	2734.5	O K
4320 min Summer	104.446	0.446	23.4	2417.9	O K
5760 min Summer	104.400	0.400	23.4	2156.1	O K
7200 min Summer	104.363	0.363	23.4	1944.2	O K
8640 min Summer	104.332	0.332	23.4	1770.4	O K
10080 min Summer	104.306	0.306	23.4	1628.3	O K
15 min Winter	104.306	0.306	23.4	1625.9	O K
30 min Winter	104.389	0.389	23.4	2093.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	151.654	0.0	1095.6	23
30 min Summer	97.974	0.0	1431.9	37
60 min Summer	60.354	0.0	2094.3	68
120 min Summer	36.913	0.0	2563.4	126
180 min Summer	27.268	0.0	2827.4	186
240 min Summer	21.821	0.0	2998.4	246
360 min Summer	15.737	0.0	3199.7	364
480 min Summer	12.370	0.0	3305.8	484
600 min Summer	10.223	0.0	3364.3	604
720 min Summer	8.729	0.0	3393.7	722
960 min Summer	6.777	0.0	3397.0	960
1440 min Summer	4.731	0.0	3269.4	1198
2160 min Summer	3.309	0.0	4414.4	1536
2880 min Summer	2.578	0.0	4563.7	1932
4320 min Summer	1.834	0.0	4786.8	2724
5760 min Summer	1.454	0.0	5321.1	3512
7200 min Summer	1.225	0.0	5589.9	4256
8640 min Summer	1.071	0.0	5841.3	5008
10080 min Summer	0.961	0.0	6062.7	5744
15 min Winter	151.654	0.0	1238.9	23
30 min Winter	97.974	0.0	1593.7	37

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	104.470	0.470	23.4	2559.2	O K
120 min Winter	104.560	0.560	23.4	3089.6	O K
180 min Winter	104.609	0.609	23.4	3382.5	O K
240 min Winter	104.640	0.640	23.4	3566.6	O K
360 min Winter	104.672	0.672	23.4	3765.6	O K
480 min Winter	104.686	0.686	23.4	3851.1	O K
600 min Winter	104.691	0.691	23.4	3881.4	O K
720 min Winter	104.691	0.691	23.4	3880.3	O K
960 min Winter	104.682	0.682	23.4	3823.6	O K
1440 min Winter	104.650	0.650	23.4	3626.6	O K
2160 min Winter	104.597	0.597	23.4	3311.4	O K
2880 min Winter	104.552	0.552	23.4	3040.2	O K
4320 min Winter	104.470	0.470	23.4	2561.4	O K
5760 min Winter	104.401	0.401	23.4	2159.7	O K
7200 min Winter	104.343	0.343	23.4	1835.5	O K
8640 min Winter	104.297	0.297	23.3	1580.0	O K
10080 min Winter	104.262	0.262	23.1	1383.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	60.354	0.0	2350.8	66
120 min Winter	36.913	0.0	2860.9	124
180 min Winter	27.268	0.0	3136.8	184
240 min Winter	21.821	0.0	3306.0	242
360 min Winter	15.737	0.0	3487.2	360
480 min Winter	12.370	0.0	3561.3	476
600 min Winter	10.223	0.0	3579.9	592
720 min Winter	8.729	0.0	3564.4	706
960 min Winter	6.777	0.0	3478.1	932
1440 min Winter	4.731	0.0	3272.0	1360
2160 min Winter	3.309	0.0	4936.7	1688
2880 min Winter	2.578	0.0	5101.3	2108
4320 min Winter	1.834	0.0	5337.2	2948
5760 min Winter	1.454	0.0	5967.3	3752
7200 min Winter	1.225	0.0	6271.5	4472
8640 min Winter	1.071	0.0	6557.6	5192
10080 min Winter	0.961	0.0	6814.1	5856

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 483669 232428 SP 83669 32428
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 5.160

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	2.580	4	8	2.580

Model Details

Storage is Online Cover Level (m) 105.000

Tank or Pond Structure

Invert Level (m) 104.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	5090.0	1.000	6670.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0215-2340-0800-2340
Design Head (m)	0.800
Design Flow (l/s)	23.4
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	215
Invert Level (m)	104.000
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.800	23.4	Kick-Flo®	0.615	20.6
Flush-Flo™	0.331	23.4	Mean Flow over Head Range	-	19.0

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	7.3	1.200	28.4	3.000	44.1	7.000	66.6
0.200	21.0	1.400	30.6	3.500	47.5	7.500	68.8
0.300	23.4	1.600	32.6	4.000	50.7	8.000	71.0
0.400	23.2	1.800	34.5	4.500	53.7	8.500	72.8
0.500	22.6	2.000	36.3	5.000	56.5	9.000	74.9
0.600	21.0	2.200	38.0	5.500	59.2	9.500	77.0
0.800	23.4	2.400	39.6	6.000	61.8		
1.000	26.0	2.600	41.2	6.500	64.2		

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	104.280	0.280	13.3	825.7	O K
30 min Summer	104.356	0.356	13.3	1062.4	O K
60 min Summer	104.431	0.431	13.3	1297.8	O K
120 min Summer	104.513	0.513	13.3	1564.2	O K
180 min Summer	104.557	0.557	13.3	1709.4	O K
240 min Summer	104.584	0.584	13.3	1799.8	O K
360 min Summer	104.613	0.613	13.3	1895.4	O K
480 min Summer	104.624	0.624	13.3	1932.9	O K
600 min Summer	104.626	0.626	13.3	1942.0	O K
720 min Summer	104.624	0.624	13.3	1935.0	O K
960 min Summer	104.612	0.612	13.3	1892.5	O K
1440 min Summer	104.576	0.576	13.3	1771.7	O K
2160 min Summer	104.531	0.531	13.3	1623.6	O K
2880 min Summer	104.494	0.494	13.3	1504.2	O K
4320 min Summer	104.434	0.434	13.3	1308.8	O K
5760 min Summer	104.384	0.384	13.3	1150.1	O K
7200 min Summer	104.343	0.343	13.3	1022.3	O K
8640 min Summer	104.310	0.310	13.3	917.6	O K
10080 min Summer	104.282	0.282	13.3	832.2	O K
15 min Winter	104.312	0.312	13.3	925.6	O K
30 min Winter	104.397	0.397	13.3	1191.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	151.654	0.0	679.9	23
30 min Summer	97.974	0.0	874.6	37
60 min Summer	60.354	0.0	1236.1	68
120 min Summer	36.913	0.0	1508.8	126
180 min Summer	27.268	0.0	1662.2	186
240 min Summer	21.821	0.0	1761.0	246
360 min Summer	15.737	0.0	1875.8	364
480 min Summer	12.370	0.0	1934.7	484
600 min Summer	10.223	0.0	1964.2	604
720 min Summer	8.729	0.0	1974.8	722
960 min Summer	6.777	0.0	1957.4	960
1440 min Summer	4.731	0.0	1857.7	1230
2160 min Summer	3.309	0.0	2552.7	1556
2880 min Summer	2.578	0.0	2643.2	1936
4320 min Summer	1.834	0.0	2785.6	2728
5760 min Summer	1.454	0.0	3049.0	3512
7200 min Summer	1.225	0.0	3205.3	4256
8640 min Summer	1.071	0.0	3353.6	5008
10080 min Summer	0.961	0.0	3488.3	5744
15 min Winter	151.654	0.0	763.3	23
30 min Winter	97.974	0.0	965.5	37

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	104.480	0.480	13.3	1456.9	O K
120 min Winter	104.572	0.572	13.3	1758.6	O K
180 min Winter	104.621	0.621	13.3	1924.6	O K
240 min Winter	104.652	0.652	13.3	2027.4	O K
360 min Winter	104.684	0.684	13.3	2137.5	O K
480 min Winter	104.697	0.697	13.3	2183.4	O K
600 min Winter	104.701	0.701	13.3	2198.0	Flood Risk
720 min Winter	104.700	0.700	13.3	2194.8	Flood Risk
960 min Winter	104.690	0.690	13.3	2157.8	O K
1440 min Winter	104.655	0.655	13.3	2037.8	O K
2160 min Winter	104.600	0.600	13.3	1854.1	O K
2880 min Winter	104.550	0.550	13.3	1685.6	O K
4320 min Winter	104.460	0.460	13.3	1391.5	O K
5760 min Winter	104.384	0.384	13.3	1148.2	O K
7200 min Winter	104.321	0.321	13.3	952.2	O K
8640 min Winter	104.271	0.271	13.3	798.5	O K
10080 min Winter	104.232	0.232	13.2	680.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	60.354	0.0	1384.9	66
120 min Winter	36.913	0.0	1680.8	124
180 min Winter	27.268	0.0	1839.4	184
240 min Winter	21.821	0.0	1935.9	242
360 min Winter	15.737	0.0	2032.3	360
480 min Winter	12.370	0.0	2060.7	476
600 min Winter	10.223	0.0	2054.5	590
720 min Winter	8.729	0.0	2031.2	706
960 min Winter	6.777	0.0	1977.6	932
1440 min Winter	4.731	0.0	1867.0	1358
2160 min Winter	3.309	0.0	2853.7	1692
2880 min Winter	2.578	0.0	2953.7	2136
4320 min Winter	1.834	0.0	3106.0	2984
5760 min Winter	1.454	0.0	3417.6	3752
7200 min Winter	1.225	0.0	3594.1	4536
8640 min Winter	1.071	0.0	3762.2	5192
10080 min Winter	0.961	0.0	3917.3	5856

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 483669 232428 SP 83669 32428
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 2.940

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	1.470	4	8	1.470

Model Details

Storage is Online Cover Level (m) 105.000

Tank or Pond Structure

Invert Level (m) 104.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	2830.0	1.000	3730.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0168-1330-0800-1330
Design Head (m)	0.800
Design Flow (l/s)	13.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	168
Invert Level (m)	104.000
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)	0.800	13.3	Kick-Flo®	0.584	11.5
Flush-Flo™	0.278	13.3	Mean Flow over Head Range	-	11.1

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.0	1.200	16.1	3.000	25.0	7.000	37.6
0.200	13.0	1.400	17.3	3.500	26.9	7.500	38.8
0.300	13.3	1.600	18.5	4.000	28.7	8.000	40.1
0.400	13.0	1.800	19.5	4.500	30.3	8.500	41.1
0.500	12.5	2.000	20.6	5.000	31.9	9.000	42.3
0.600	11.6	2.200	21.5	5.500	33.4	9.500	43.5
0.800	13.3	2.400	22.4	6.000	34.9		
1.000	14.8	2.600	23.3	6.500	36.2		

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	100.299	0.299	4.9	302.9	O K
30 min Summer	100.376	0.376	4.9	389.7	O K
60 min Summer	100.450	0.450	4.9	475.7	O K
120 min Summer	100.530	0.530	4.9	572.9	O K
180 min Summer	100.572	0.572	4.9	625.6	O K
240 min Summer	100.597	0.597	4.9	657.4	O K
360 min Summer	100.622	0.622	4.9	689.8	O K
480 min Summer	100.631	0.631	4.9	701.1	O K
600 min Summer	100.632	0.632	4.9	702.3	O K
720 min Summer	100.628	0.628	4.9	697.7	O K
960 min Summer	100.614	0.614	4.9	678.6	O K
1440 min Summer	100.576	0.576	4.9	630.6	O K
2160 min Summer	100.527	0.527	4.9	569.5	O K
2880 min Summer	100.485	0.485	4.9	517.9	O K
4320 min Summer	100.419	0.419	4.9	439.0	O K
5760 min Summer	100.366	0.366	4.9	377.5	O K
7200 min Summer	100.322	0.322	4.9	328.4	O K
8640 min Summer	100.286	0.286	4.9	288.2	O K
10080 min Summer	100.255	0.255	4.9	255.5	O K
15 min Winter	100.332	0.332	4.9	339.6	O K
30 min Winter	100.417	0.417	4.9	437.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	151.654	0.0	277.0	23
30 min Summer	97.974	0.0	351.0	37
60 min Summer	60.354	0.0	473.2	68
120 min Summer	36.913	0.0	576.7	126
180 min Summer	27.268	0.0	635.3	186
240 min Summer	21.821	0.0	673.3	246
360 min Summer	15.737	0.0	717.2	364
480 min Summer	12.370	0.0	737.7	484
600 min Summer	10.223	0.0	744.9	604
720 min Summer	8.729	0.0	743.3	722
960 min Summer	6.777	0.0	728.1	960
1440 min Summer	4.731	0.0	690.4	1242
2160 min Summer	3.309	0.0	953.5	1596
2880 min Summer	2.578	0.0	989.3	1960
4320 min Summer	1.834	0.0	1049.4	2728
5760 min Summer	1.454	0.0	1126.5	3512
7200 min Summer	1.225	0.0	1185.3	4256
8640 min Summer	1.071	0.0	1242.2	5008
10080 min Summer	0.961	0.0	1296.1	5744
15 min Winter	151.654	0.0	308.9	23
30 min Winter	97.974	0.0	383.0	37

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	100.499	0.499	4.9	534.3	O K
120 min Winter	100.587	0.587	4.9	644.5	O K
180 min Winter	100.633	0.633	4.9	704.1	O K
240 min Winter	100.661	0.661	4.9	740.7	O K
360 min Winter	100.690	0.690	4.9	779.1	O K
480 min Winter	100.701	0.701	4.9	794.0	Flood Risk
600 min Winter	100.704	0.704	4.9	797.5	Flood Risk
720 min Winter	100.701	0.701	4.9	794.6	Flood Risk
960 min Winter	100.689	0.689	4.9	777.7	O K
1440 min Winter	100.651	0.651	4.9	727.9	O K
2160 min Winter	100.595	0.595	4.9	654.6	O K
2880 min Winter	100.545	0.545	4.9	591.1	O K
4320 min Winter	100.445	0.445	4.9	469.9	O K
5760 min Winter	100.363	0.363	4.9	374.8	O K
7200 min Winter	100.296	0.296	4.9	299.6	O K
8640 min Winter	100.242	0.242	4.9	241.1	O K
10080 min Winter	100.200	0.200	4.9	197.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	60.354	0.0	529.5	66
120 min Winter	36.913	0.0	642.0	124
180 min Winter	27.268	0.0	702.8	184
240 min Winter	21.821	0.0	738.2	242
360 min Winter	15.737	0.0	765.1	358
480 min Winter	12.370	0.0	762.9	476
600 min Winter	10.223	0.0	755.3	590
720 min Winter	8.729	0.0	747.1	706
960 min Winter	6.777	0.0	730.1	932
1440 min Winter	4.731	0.0	695.6	1358
2160 min Winter	3.309	0.0	1066.8	1692
2880 min Winter	2.578	0.0	1105.8	2164
4320 min Winter	1.834	0.0	1171.8	2984
5760 min Winter	1.454	0.0	1262.1	3752
7200 min Winter	1.225	0.0	1328.2	4536
8640 min Winter	1.071	0.0	1392.2	5192
10080 min Winter	0.961	0.0	1453.7	5856

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 483669 232428 SP 83669 32428
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.080

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.540	4	8	0.540

Model Details

Storage is Online Cover Level (m) 101.000

Tank or Pond Structure

Invert Level (m) 100.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	930.0	1.000	1550.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0108-4900-0800-4900
Design Head (m)	0.800
Design Flow (l/s)	4.9
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	108
Invert Level (m)	100.000
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)	0.800	4.9	Kick-Flo®	0.537	4.1
Flush-Flo™	0.242	4.9	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)
0.100	3.7	1.200	5.9	3.000	9.1	7.000	13.6
0.200	4.9	1.400	6.4	3.500	9.8	7.500	14.1
0.300	4.9	1.600	6.8	4.000	10.4	8.000	14.5
0.400	4.7	1.800	7.2	4.500	11.0	8.500	14.9
0.500	4.4	2.000	7.5	5.000	11.6	9.000	15.4
0.600	4.3	2.200	7.9	5.500	12.1	9.500	15.8
0.800	4.9	2.400	8.2	6.000	12.6		
1.000	5.4	2.600	8.5	6.500	13.1		

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	102.302	0.302	8.2	462.4	O K
30 min Summer	102.381	0.381	8.2	594.8	O K
60 min Summer	102.457	0.457	8.2	725.6	O K
120 min Summer	102.539	0.539	8.2	872.9	O K
180 min Summer	102.583	0.583	8.2	952.4	O K
240 min Summer	102.608	0.608	8.2	1000.1	O K
360 min Summer	102.634	0.634	8.2	1047.3	O K
480 min Summer	102.642	0.642	8.2	1062.4	O K
600 min Summer	102.641	0.641	8.2	1061.9	O K
720 min Summer	102.636	0.636	8.2	1052.7	O K
960 min Summer	102.619	0.619	8.2	1019.2	O K
1440 min Summer	102.579	0.579	8.2	945.6	O K
2160 min Summer	102.526	0.526	8.2	849.6	O K
2880 min Summer	102.483	0.483	8.2	771.7	O K
4320 min Summer	102.412	0.412	8.2	648.6	O K
5760 min Summer	102.356	0.356	8.2	552.2	O K
7200 min Summer	102.310	0.310	8.2	475.7	O K
8640 min Summer	102.272	0.272	8.2	415.1	O K
10080 min Summer	102.243	0.243	8.2	367.0	O K
15 min Winter	102.335	0.335	8.2	518.5	O K
30 min Winter	102.423	0.423	8.2	667.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	151.654	0.0	416.2	23
30 min Summer	97.974	0.0	533.5	37
60 min Summer	60.354	0.0	718.0	68
120 min Summer	36.913	0.0	877.0	126
180 min Summer	27.268	0.0	968.3	186
240 min Summer	21.821	0.0	1029.1	246
360 min Summer	15.737	0.0	1104.1	364
480 min Summer	12.370	0.0	1147.0	484
600 min Summer	10.223	0.0	1173.2	602
720 min Summer	8.729	0.0	1188.8	722
960 min Summer	6.777	0.0	1196.9	960
1440 min Summer	4.731	0.0	1150.9	1186
2160 min Summer	3.309	0.0	1453.7	1520
2880 min Summer	2.578	0.0	1508.1	1908
4320 min Summer	1.834	0.0	1600.2	2684
5760 min Summer	1.454	0.0	1719.0	3464
7200 min Summer	1.225	0.0	1808.2	4184
8640 min Summer	1.071	0.0	1894.2	4928
10080 min Summer	0.961	0.0	1974.9	5640
15 min Winter	151.654	0.0	465.9	23
30 min Winter	97.974	0.0	589.6	37

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	102.507	0.507	8.2	815.0	O K
120 min Winter	102.599	0.599	8.2	982.3	O K
180 min Winter	102.647	0.647	8.2	1072.0	O K
240 min Winter	102.675	0.675	8.2	1126.7	O K
360 min Winter	102.704	0.704	8.2	1182.7	Flood Risk
480 min Winter	102.715	0.715	8.2	1202.8	Flood Risk
600 min Winter	102.716	0.716	8.2	1205.7	Flood Risk
720 min Winter	102.713	0.713	8.2	1198.8	Flood Risk
960 min Winter	102.697	0.697	8.2	1168.4	O K
1440 min Winter	102.653	0.653	8.2	1084.7	O K
2160 min Winter	102.593	0.593	8.2	972.2	O K
2880 min Winter	102.534	0.534	8.2	863.6	O K
4320 min Winter	102.428	0.428	8.2	676.3	O K
5760 min Winter	102.342	0.342	8.2	529.0	O K
7200 min Winter	102.273	0.273	8.2	415.7	O K
8640 min Winter	102.220	0.220	8.1	331.9	O K
10080 min Winter	102.183	0.183	8.0	273.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	60.354	0.0	804.2	66
120 min Winter	36.913	0.0	978.9	124
180 min Winter	27.268	0.0	1077.5	184
240 min Winter	21.821	0.0	1141.1	242
360 min Winter	15.737	0.0	1213.6	358
480 min Winter	12.370	0.0	1246.8	474
600 min Winter	10.223	0.0	1257.6	590
720 min Winter	8.729	0.0	1253.9	704
960 min Winter	6.777	0.0	1227.2	926
1440 min Winter	4.731	0.0	1164.7	1342
2160 min Winter	3.309	0.0	1627.1	1664
2880 min Winter	2.578	0.0	1687.8	2104
4320 min Winter	1.834	0.0	1790.3	2936
5760 min Winter	1.454	0.0	1926.3	3688
7200 min Winter	1.225	0.0	2026.6	4392
8640 min Winter	1.071	0.0	2123.5	5024
10080 min Winter	0.961	0.0	2215.7	5656

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 483669 232428 SP 83669 32428
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.650

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.825	4	8	0.825

Model Details

Storage is Online Cover Level (m) 103.000

Tank or Pond Structure

Invert Level (m) 102.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1430.0	1.000	2180.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0136-8200-0800-8200
Design Head (m)	0.800
Design Flow (l/s)	8.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	136
Invert Level (m)	102.000
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)	0.800	8.2	Kick-Flo®	0.559	6.9
Flush-Flo™	0.253	8.2	Mean Flow over Head Range	-	7.0

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.9	1.200	9.9	3.000	15.3	7.000	23.0
0.200	8.1	1.400	10.7	3.500	16.5	7.500	23.8
0.300	8.1	1.600	11.4	4.000	17.6	8.000	24.5
0.400	7.9	1.800	12.0	4.500	18.6	8.500	25.2
0.500	7.5	2.000	12.6	5.000	19.5	9.000	25.9
0.600	7.2	2.200	13.2	5.500	20.5	9.500	26.6
0.800	8.2	2.400	13.8	6.000	21.3		
1.000	9.1	2.600	14.3	6.500	22.2		

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	106.162	0.162	5.3	337.4	O K
30 min Summer	106.207	0.207	5.4	434.0	O K
60 min Summer	106.252	0.252	5.4	530.3	O K
120 min Summer	106.301	0.301	5.4	639.3	O K
180 min Summer	106.328	0.328	5.4	698.5	O K
240 min Summer	106.344	0.344	5.4	735.1	O K
360 min Summer	106.362	0.362	5.4	773.9	O K
480 min Summer	106.368	0.368	5.4	789.2	O K
600 min Summer	106.370	0.370	5.4	792.9	O K
720 min Summer	106.369	0.369	5.4	790.0	O K
960 min Summer	106.361	0.361	5.4	772.0	O K
1440 min Summer	106.342	0.342	5.4	728.6	O K
2160 min Summer	106.319	0.319	5.4	678.2	O K
2880 min Summer	106.300	0.300	5.4	635.2	O K
4320 min Summer	106.267	0.267	5.4	563.0	O K
5760 min Summer	106.239	0.239	5.4	503.4	O K
7200 min Summer	106.217	0.217	5.4	455.0	O K
8640 min Summer	106.199	0.199	5.4	415.4	O K
10080 min Summer	106.184	0.184	5.4	383.0	O K
15 min Winter	106.181	0.181	5.4	378.1	O K
30 min Winter	106.232	0.232	5.4	486.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	151.654	0.0	256.1	23
30 min Summer	97.974	0.0	333.5	37
60 min Summer	60.354	0.0	488.4	68
120 min Summer	36.913	0.0	597.6	126
180 min Summer	27.268	0.0	659.1	186
240 min Summer	21.821	0.0	699.0	246
360 min Summer	15.737	0.0	746.4	364
480 min Summer	12.370	0.0	771.8	484
600 min Summer	10.223	0.0	786.0	602
720 min Summer	8.729	0.0	793.4	722
960 min Summer	6.777	0.0	794.8	960
1440 min Summer	4.731	0.0	766.4	1172
2160 min Summer	3.309	0.0	1028.2	1532
2880 min Summer	2.578	0.0	1062.9	1932
4320 min Summer	1.834	0.0	1114.2	2724
5760 min Summer	1.454	0.0	1238.2	3512
7200 min Summer	1.225	0.0	1300.9	4256
8640 min Summer	1.071	0.0	1359.7	5016
10080 min Summer	0.961	0.0	1411.5	5744
15 min Winter	151.654	0.0	289.2	23
30 min Winter	97.974	0.0	370.5	37

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	106.281	0.281	5.4	595.2	O K
120 min Winter	106.337	0.337	5.4	718.2	O K
180 min Winter	106.367	0.367	5.4	785.8	O K
240 min Winter	106.386	0.386	5.4	828.0	O K
360 min Winter	106.406	0.406	5.4	873.9	O K
480 min Winter	106.415	0.415	5.4	893.7	O K
600 min Winter	106.418	0.418	5.4	900.6	O K
720 min Winter	106.417	0.417	5.4	900.0	O K
960 min Winter	106.411	0.411	5.4	885.7	O K
1440 min Winter	106.389	0.389	5.4	835.9	O K
2160 min Winter	106.358	0.358	5.4	765.4	O K
2880 min Winter	106.331	0.331	5.4	705.1	O K
4320 min Winter	106.282	0.282	5.4	597.2	O K
5760 min Winter	106.241	0.241	5.4	506.3	O K
7200 min Winter	106.207	0.207	5.4	432.7	O K
8640 min Winter	106.180	0.180	5.4	374.3	O K
10080 min Winter	106.158	0.158	5.3	328.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	60.354	0.0	548.1	66
120 min Winter	36.913	0.0	666.9	124
180 min Winter	27.268	0.0	731.8	184
240 min Winter	21.821	0.0	772.0	242
360 min Winter	15.737	0.0	815.3	358
480 min Winter	12.370	0.0	833.2	476
600 min Winter	10.223	0.0	838.4	592
720 min Winter	8.729	0.0	836.4	706
960 min Winter	6.777	0.0	820.5	932
1440 min Winter	4.731	0.0	778.2	1354
2160 min Winter	3.309	0.0	1150.5	1664
2880 min Winter	2.578	0.0	1188.4	2104
4320 min Winter	1.834	0.0	1241.9	2948
5760 min Winter	1.454	0.0	1388.5	3752
7200 min Winter	1.225	0.0	1459.4	4536
8640 min Winter	1.071	0.0	1526.2	5192
10080 min Winter	0.961	0.0	1586.3	5944

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 483669 232428 SP 83669 32428
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.200

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.600	4	8	0.600

Model Details

Storage is Online Cover Level (m) 107.000

Tank or Pond Structure

Invert Level (m) 106.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	2030.0	1.000	2670.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0114-5400-0700-5400
Design Head (m)	0.700
Design Flow (l/s)	5.4
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	114
Invert Level (m)	106.000
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)	0.700	5.4	Kick-Flo®	0.486	4.6
Flush-Flo™	0.216	5.4	Mean Flow over Head Range	-	4.6

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.0	1.200	6.9	3.000	10.7	7.000	16.0
0.200	5.4	1.400	7.5	3.500	11.5	7.500	16.5
0.300	5.3	1.600	7.9	4.000	12.2	8.000	17.1
0.400	5.1	1.800	8.4	4.500	13.0	8.500	17.6
0.500	4.6	2.000	8.8	5.000	13.6	9.000	18.1
0.600	5.0	2.200	9.2	5.500	14.3	9.500	18.6
0.800	5.7	2.400	9.6	6.000	14.9		
1.000	6.4	2.600	10.0	6.500	15.4		

Summary of Results for 100 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	94.137	0.137	9.3	542.7	O K
30 min Summer	94.175	0.175	11.9	696.0	O K
60 min Summer	94.213	0.213	12.1	847.6	O K
120 min Summer	94.254	0.254	12.2	1017.0	O K
180 min Summer	94.276	0.276	12.2	1106.3	O K
240 min Summer	94.289	0.289	12.2	1159.4	O K
360 min Summer	94.301	0.301	12.2	1210.1	O K
480 min Summer	94.304	0.304	12.2	1223.0	O K
600 min Summer	94.303	0.303	12.2	1217.3	O K
720 min Summer	94.299	0.299	12.2	1201.5	O K
960 min Summer	94.291	0.291	12.2	1169.2	O K
1440 min Summer	94.277	0.277	12.2	1111.5	O K
2160 min Summer	94.258	0.258	12.2	1034.2	O K
2880 min Summer	94.241	0.241	12.2	965.2	O K
4320 min Summer	94.213	0.213	12.1	850.1	O K
5760 min Summer	94.191	0.191	12.0	760.7	O K
7200 min Summer	94.175	0.175	11.9	695.8	O K
8640 min Summer	94.165	0.165	11.4	652.7	O K
10080 min Summer	94.157	0.157	10.9	620.4	O K
15 min Winter	94.153	0.153	10.6	607.6	O K
30 min Winter	94.196	0.196	12.0	780.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	108.324	0.0	358.3	23
30 min Summer	69.981	0.0	490.8	37
60 min Summer	43.110	0.0	745.4	66
120 min Summer	26.366	0.0	925.6	126
180 min Summer	19.477	0.0	1030.2	186
240 min Summer	15.586	0.0	1100.5	244
360 min Summer	11.241	0.0	1189.3	364
480 min Summer	8.836	0.0	1242.7	482
600 min Summer	7.302	0.0	1278.8	600
720 min Summer	6.235	0.0	1304.5	688
960 min Summer	4.841	0.0	1336.8	780
1440 min Summer	3.379	0.0	1363.0	1016
2160 min Summer	2.364	0.0	1626.1	1412
2880 min Summer	1.842	0.0	1681.4	1816
4320 min Summer	1.310	0.0	1758.8	2596
5760 min Summer	1.038	0.0	1968.6	3336
7200 min Summer	0.875	0.0	2065.0	4032
8640 min Summer	0.765	0.0	2153.3	4752
10080 min Summer	0.687	0.0	2227.9	5448
15 min Winter	108.324	0.0	413.1	22
30 min Winter	69.981	0.0	560.4	37

Summary of Results for 100 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	94.238	0.238	12.2	951.7	O K
120 min Winter	94.285	0.285	12.2	1143.7	O K
180 min Winter	94.310	0.310	12.2	1246.2	O K
240 min Winter	94.324	0.324	12.2	1308.0	O K
360 min Winter	94.339	0.339	12.2	1369.5	O K
480 min Winter	94.344	0.344	12.2	1389.0	O K
600 min Winter	94.344	0.344	12.2	1388.2	O K
720 min Winter	94.341	0.341	12.2	1375.8	O K
960 min Winter	94.330	0.330	12.2	1331.7	O K
1440 min Winter	94.309	0.309	12.2	1245.8	O K
2160 min Winter	94.282	0.282	12.2	1130.5	O K
2880 min Winter	94.256	0.256	12.2	1024.2	O K
4320 min Winter	94.213	0.213	12.1	849.1	O K
5760 min Winter	94.182	0.182	11.9	721.9	O K
7200 min Winter	94.163	0.163	11.3	646.0	O K
8640 min Winter	94.150	0.150	10.4	595.9	O K
10080 min Winter	94.141	0.141	9.7	558.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	43.110	0.0	843.4	66
120 min Winter	26.366	0.0	1043.6	124
180 min Winter	19.477	0.0	1159.1	182
240 min Winter	15.586	0.0	1236.5	240
360 min Winter	11.241	0.0	1333.3	356
480 min Winter	8.836	0.0	1391.0	472
600 min Winter	7.302	0.0	1429.4	584
720 min Winter	6.235	0.0	1456.3	694
960 min Winter	4.841	0.0	1488.8	900
1440 min Winter	3.379	0.0	1509.9	1102
2160 min Winter	2.364	0.0	1827.0	1544
2880 min Winter	1.842	0.0	1889.7	1964
4320 min Winter	1.310	0.0	1981.3	2764
5760 min Winter	1.038	0.0	2210.4	3464
7200 min Winter	0.875	0.0	2319.4	4176
8640 min Winter	0.765	0.0	2420.3	4920
10080 min Winter	0.687	0.0	2507.3	5640

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 483669 232428 SP 83669 32428
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+0

Time Area Diagram

Total Area (ha) 2.700

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	1.350	4	8	1.350

Model Details

Storage is Online Cover Level (m) 95.000

Tank or Pond Structure

Invert Level (m) 94.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	3900.0	1.000	4750.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0163-1220-0700-1220
Design Head (m)	0.700
Design Flow (l/s)	12.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	163
Invert Level (m)	94.000
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)	0.700	12.2	Kick-Flo®	0.521	10.6
Flush-Flo™	0.260	12.2	Mean Flow over Head Range	-	10.1

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.8	1.200	15.7	3.000	24.4	7.000	36.7
0.200	12.0	1.400	16.9	3.500	26.3	7.500	37.8
0.300	12.1	1.600	18.1	4.000	28.0	8.000	39.0
0.400	11.8	1.800	19.1	4.500	29.6	8.500	40.3
0.500	11.0	2.000	20.1	5.000	31.2	9.000	41.4
0.600	11.3	2.200	21.0	5.500	32.7	9.500	42.6
0.800	13.0	2.400	21.9	6.000	34.1		
1.000	14.4	2.600	22.8	6.500	35.4		

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	97.280	0.280	11.4	707.6	O K
30 min Summer	97.357	0.357	11.4	910.4	O K
60 min Summer	97.431	0.431	11.4	1112.1	O K
120 min Summer	97.513	0.513	11.4	1340.1	O K
180 min Summer	97.557	0.557	11.4	1464.4	O K
240 min Summer	97.584	0.584	11.4	1541.8	O K
360 min Summer	97.613	0.613	11.4	1622.9	O K
480 min Summer	97.624	0.624	11.4	1654.3	O K
600 min Summer	97.626	0.626	11.4	1661.5	O K
720 min Summer	97.624	0.624	11.4	1654.8	O K
960 min Summer	97.611	0.611	11.4	1617.4	O K
1440 min Summer	97.574	0.574	11.4	1513.1	O K
2160 min Summer	97.528	0.528	11.4	1382.1	O K
2880 min Summer	97.491	0.491	11.4	1277.5	O K
4320 min Summer	97.429	0.429	11.4	1107.6	O K
5760 min Summer	97.379	0.379	11.4	970.3	O K
7200 min Summer	97.338	0.338	11.4	859.7	O K
8640 min Summer	97.304	0.304	11.4	769.2	O K
10080 min Summer	97.276	0.276	11.4	695.4	O K
15 min Winter	97.313	0.313	11.4	793.3	O K
30 min Winter	97.398	0.398	11.4	1021.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	151.654	0.0	593.0	23
30 min Summer	97.974	0.0	760.6	37
60 min Summer	60.354	0.0	1067.1	68
120 min Summer	36.913	0.0	1302.0	126
180 min Summer	27.268	0.0	1434.2	186
240 min Summer	21.821	0.0	1519.2	246
360 min Summer	15.737	0.0	1618.2	364
480 min Summer	12.370	0.0	1668.5	484
600 min Summer	10.223	0.0	1693.0	604
720 min Summer	8.729	0.0	1700.7	722
960 min Summer	6.777	0.0	1682.2	960
1440 min Summer	4.731	0.0	1593.2	1242
2160 min Summer	3.309	0.0	2194.6	1556
2880 min Summer	2.578	0.0	2273.1	1936
4320 min Summer	1.834	0.0	2398.1	2728
5760 min Summer	1.454	0.0	2616.2	3512
7200 min Summer	1.225	0.0	2750.7	4256
8640 min Summer	1.071	0.0	2878.8	5008
10080 min Summer	0.961	0.0	2995.9	5744
15 min Winter	151.654	0.0	664.8	23
30 min Winter	97.974	0.0	838.1	37

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	97.480	0.480	11.4	1248.5	O K
120 min Winter	97.572	0.572	11.4	1506.9	O K
180 min Winter	97.622	0.622	11.4	1648.9	O K
240 min Winter	97.652	0.652	11.4	1736.6	O K
360 min Winter	97.684	0.684	11.4	1830.3	O K
480 min Winter	97.697	0.697	11.4	1869.0	O K
600 min Winter	97.701	0.701	11.4	1881.0	Flood Risk
720 min Winter	97.700	0.700	11.4	1877.7	O K
960 min Winter	97.689	0.689	11.4	1845.0	O K
1440 min Winter	97.653	0.653	11.4	1740.4	O K
2160 min Winter	97.598	0.598	11.4	1580.8	O K
2880 min Winter	97.547	0.547	11.4	1434.2	O K
4320 min Winter	97.455	0.455	11.4	1178.5	O K
5760 min Winter	97.378	0.378	11.4	968.0	O K
7200 min Winter	97.315	0.315	11.4	798.6	O K
8640 min Winter	97.264	0.264	11.4	665.6	O K
10080 min Winter	97.225	0.225	11.3	564.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	60.354	0.0	1195.1	66
120 min Winter	36.913	0.0	1450.0	124
180 min Winter	27.268	0.0	1586.7	184
240 min Winter	21.821	0.0	1669.5	242
360 min Winter	15.737	0.0	1750.3	360
480 min Winter	12.370	0.0	1771.1	476
600 min Winter	10.223	0.0	1762.1	590
720 min Winter	8.729	0.0	1741.1	706
960 min Winter	6.777	0.0	1695.9	932
1440 min Winter	4.731	0.0	1603.2	1358
2160 min Winter	3.309	0.0	2453.5	1692
2880 min Winter	2.578	0.0	2540.3	2136
4320 min Winter	1.834	0.0	2674.3	2984
5760 min Winter	1.454	0.0	2932.2	3752
7200 min Winter	1.225	0.0	3084.0	4536
8640 min Winter	1.071	0.0	3229.0	5192
10080 min Winter	0.961	0.0	3363.7	5856

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 483669 232428 SP 83669 32428
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 2.520

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	1.260	4	8	1.260

Model Details

Storage is Online Cover Level (m) 98.000

Tank or Pond Structure

Invert Level (m) 97.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	2420.0	1.000	3200.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0158-1140-0800-1140
Design Head (m)	0.800
Design Flow (l/s)	11.4
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	158
Invert Level (m)	97.000
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)	0.800	11.4	Kick-Flo®	0.577	9.8
Flush-Flo™	0.270	11.4	Mean Flow over Head Range	-	9.6

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.7	1.200	13.8	3.000	21.4	7.000	32.1
0.200	11.2	1.400	14.9	3.500	23.0	7.500	33.2
0.300	11.4	1.600	15.8	4.000	24.5	8.000	34.3
0.400	11.1	1.800	16.7	4.500	26.0	8.500	35.2
0.500	10.7	2.000	17.6	5.000	27.3	9.000	36.2
0.600	10.0	2.200	18.4	5.500	28.6	9.500	37.2
0.800	11.4	2.400	19.2	6.000	29.8		
1.000	12.7	2.600	19.9	6.500	31.0		

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	95.235	0.235	6.5	404.3	O K
30 min Summer	95.298	0.298	6.5	520.2	O K
60 min Summer	95.360	0.360	6.5	635.4	O K
120 min Summer	95.428	0.428	6.5	765.4	O K
180 min Summer	95.465	0.465	6.5	835.8	O K
240 min Summer	95.487	0.487	6.5	879.2	O K
360 min Summer	95.510	0.510	6.5	924.9	O K
480 min Summer	95.519	0.519	6.5	942.6	O K
600 min Summer	95.521	0.521	6.5	946.3	O K
720 min Summer	95.519	0.519	6.5	941.8	O K
960 min Summer	95.506	0.506	6.5	917.9	O K
1440 min Summer	95.475	0.475	6.5	856.3	O K
2160 min Summer	95.439	0.439	6.5	785.4	O K
2880 min Summer	95.408	0.408	6.5	726.9	O K
4320 min Summer	95.358	0.358	6.5	630.9	O K
5760 min Summer	95.316	0.316	6.5	553.4	O K
7200 min Summer	95.282	0.282	6.5	491.1	O K
8640 min Summer	95.254	0.254	6.5	440.3	O K
10080 min Summer	95.232	0.232	6.5	398.9	O K
15 min Winter	95.262	0.262	6.5	453.3	O K
30 min Winter	95.332	0.332	6.5	583.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	151.654	0.0	341.1	23
30 min Summer	97.974	0.0	436.4	37
60 min Summer	60.354	0.0	611.8	68
120 min Summer	36.913	0.0	746.4	126
180 min Summer	27.268	0.0	822.5	186
240 min Summer	21.821	0.0	871.9	246
360 min Summer	15.737	0.0	929.6	364
480 min Summer	12.370	0.0	959.1	484
600 min Summer	10.223	0.0	973.8	604
720 min Summer	8.729	0.0	979.4	722
960 min Summer	6.777	0.0	973.1	960
1440 min Summer	4.731	0.0	929.7	1200
2160 min Summer	3.309	0.0	1256.1	1540
2880 min Summer	2.578	0.0	1301.1	1932
4320 min Summer	1.834	0.0	1372.8	2728
5760 min Summer	1.454	0.0	1495.8	3512
7200 min Summer	1.225	0.0	1572.8	4256
8640 min Summer	1.071	0.0	1646.3	5016
10080 min Summer	0.961	0.0	1713.7	5744
15 min Winter	151.654	0.0	382.0	23
30 min Winter	97.974	0.0	480.2	37

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	95.401	0.401	6.5	713.3	O K
120 min Winter	95.477	0.477	6.5	860.4	O K
180 min Winter	95.518	0.518	6.5	941.3	O K
240 min Winter	95.544	0.544	6.5	992.1	O K
360 min Winter	95.571	0.571	6.5	1047.3	O K
480 min Winter	95.583	0.583	6.5	1070.5	O K
600 min Winter	95.586	0.586	6.5	1078.3	O K
720 min Winter	95.586	0.586	6.5	1077.2	O K
960 min Winter	95.577	0.577	6.5	1059.6	O K
1440 min Winter	95.547	0.547	6.5	998.0	O K
2160 min Winter	95.495	0.495	6.5	895.2	O K
2880 min Winter	95.453	0.453	6.5	813.7	O K
4320 min Winter	95.379	0.379	6.5	671.7	O K
5760 min Winter	95.316	0.316	6.5	553.5	O K
7200 min Winter	95.265	0.265	6.5	458.7	O K
8640 min Winter	95.223	0.223	6.5	384.2	O K
10080 min Winter	95.191	0.191	6.4	326.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	60.354	0.0	685.1	66
120 min Winter	36.913	0.0	831.7	124
180 min Winter	27.268	0.0	910.8	184
240 min Winter	21.821	0.0	957.8	242
360 min Winter	15.737	0.0	1000.4	360
480 min Winter	12.370	0.0	1008.1	476
600 min Winter	10.223	0.0	1000.1	592
720 min Winter	8.729	0.0	987.8	708
960 min Winter	6.777	0.0	963.0	934
1440 min Winter	4.731	0.0	917.6	1372
2160 min Winter	3.309	0.0	1405.0	1684
2880 min Winter	2.578	0.0	1454.6	2112
4320 min Winter	1.834	0.0	1530.9	2980
5760 min Winter	1.454	0.0	1676.4	3752
7200 min Winter	1.225	0.0	1763.3	4536
8640 min Winter	1.071	0.0	1846.4	5192
10080 min Winter	0.961	0.0	1923.9	5856

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 483669 232428 SP 83669 32428
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.440

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.720	4	8	0.720

Model Details

Storage is Online Cover Level (m) 96.000

Tank or Pond Structure

Invert Level (m) 95.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1650.0	1.000	2330.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0122-6500-0800-6500
Design Head (m)	0.800
Design Flow (l/s)	6.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	122
Invert Level (m)	95.000
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)	0.800	6.5	Kick-Flo®	0.547	5.4
Flush-Flo™	0.246	6.5	Mean Flow over Head Range	-	5.6

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.4	1.200	7.9	3.000	12.1	7.000	18.1
0.200	6.4	1.400	8.4	3.500	13.0	7.500	18.8
0.300	6.4	1.600	9.0	4.000	13.9	8.000	19.3
0.400	6.3	1.800	9.5	4.500	14.7	8.500	19.9
0.500	5.9	2.000	10.0	5.000	15.4	9.000	20.5
0.600	5.7	2.200	10.4	5.500	16.2	9.500	21.0
0.800	6.5	2.400	10.9	6.000	16.8		
1.000	7.2	2.600	11.3	6.500	17.5		

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	96.261	0.261	24.7	1446.1	O K
30 min Summer	96.333	0.333	24.7	1856.8	O K
60 min Summer	96.403	0.403	24.7	2258.3	O K
120 min Summer	96.478	0.478	24.7	2695.7	O K
180 min Summer	96.516	0.516	25.0	2918.6	O K
240 min Summer	96.538	0.538	25.3	3043.6	O K
360 min Summer	96.555	0.555	25.6	3144.4	O K
480 min Summer	96.555	0.555	25.6	3145.1	O K
600 min Summer	96.547	0.547	25.5	3097.1	O K
720 min Summer	96.534	0.534	25.3	3021.5	O K
960 min Summer	96.500	0.500	24.8	2824.7	O K
1440 min Summer	96.448	0.448	24.7	2517.3	O K
2160 min Summer	96.396	0.396	24.7	2214.9	O K
2880 min Summer	96.355	0.355	24.7	1980.8	O K
4320 min Summer	96.285	0.285	24.7	1580.4	O K
5760 min Summer	96.227	0.227	24.7	1252.7	O K
7200 min Summer	96.180	0.180	24.7	989.5	O K
8640 min Summer	96.141	0.141	24.7	775.8	O K
10080 min Summer	96.110	0.110	24.7	604.5	O K
15 min Winter	96.292	0.292	24.7	1623.8	O K
30 min Winter	96.373	0.373	24.7	2087.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	151.654	0.0	1475.6	23
30 min Summer	97.974	0.0	1907.9	37
60 min Summer	60.354	0.0	2350.5	68
120 min Summer	36.913	0.0	2877.4	126
180 min Summer	27.268	0.0	3186.4	186
240 min Summer	21.821	0.0	3402.2	246
360 min Summer	15.737	0.0	3678.4	364
480 min Summer	12.370	0.0	3855.7	484
600 min Summer	10.223	0.0	3982.8	602
720 min Summer	8.729	0.0	4081.2	722
960 min Summer	6.777	0.0	4131.3	934
1440 min Summer	4.731	0.0	4011.9	1142
2160 min Summer	3.309	0.0	4642.2	1520
2880 min Summer	2.578	0.0	4822.8	1936
4320 min Summer	1.834	0.0	5146.6	2728
5760 min Summer	1.454	0.0	5440.5	3512
7200 min Summer	1.225	0.0	5731.7	4248
8640 min Summer	1.071	0.0	6011.9	4936
10080 min Summer	0.961	0.0	6292.7	5648
15 min Winter	151.654	0.0	1654.0	23
30 min Winter	97.974	0.0	2043.9	37

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	96.452	0.452	24.7	2541.2	O K
120 min Winter	96.538	0.538	25.3	3043.6	O K
180 min Winter	96.582	0.582	26.0	3305.2	O K
240 min Winter	96.607	0.607	26.3	3456.8	O K
360 min Winter	96.630	0.630	26.6	3593.2	O K
480 min Winter	96.634	0.634	26.7	3617.6	O K
600 min Winter	96.629	0.629	26.6	3588.7	O K
720 min Winter	96.620	0.620	26.5	3529.5	O K
960 min Winter	96.592	0.592	26.1	3362.4	O K
1440 min Winter	96.526	0.526	25.2	2973.5	O K
2160 min Winter	96.460	0.460	24.7	2589.2	O K
2880 min Winter	96.405	0.405	24.7	2268.5	O K
4320 min Winter	96.304	0.304	24.7	1690.0	O K
5760 min Winter	96.213	0.213	24.7	1177.7	O K
7200 min Winter	96.142	0.142	24.7	780.6	O K
8640 min Winter	96.087	0.087	24.7	473.1	O K
10080 min Winter	96.045	0.045	24.7	245.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	60.354	0.0	2632.7	66
120 min Winter	36.913	0.0	3220.9	124
180 min Winter	27.268	0.0	3571.2	182
240 min Winter	21.821	0.0	3811.2	242
360 min Winter	15.737	0.0	4120.4	358
480 min Winter	12.370	0.0	4181.0	474
600 min Winter	10.223	0.0	4176.4	588
720 min Winter	8.729	0.0	4168.2	702
960 min Winter	6.777	0.0	4143.6	922
1440 min Winter	4.731	0.0	4072.5	1310
2160 min Winter	3.309	0.0	5200.4	1640
2880 min Winter	2.578	0.0	5405.0	2104
4320 min Winter	1.834	0.0	5762.9	2984
5760 min Winter	1.454	0.0	6090.6	3744
7200 min Winter	1.225	0.0	6413.2	4464
8640 min Winter	1.071	0.0	6733.2	5104
10080 min Winter	0.961	0.0	7051.7	5752

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 483669 232428 SP 83669 32428
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 5.200

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	2.600	4	8	2.600

Model Details

Storage is Online Cover Level (m) 97.000

Tank or Pond Structure

Invert Level (m) 96.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	5430.0	1.000	6310.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0220-2480-0800-2480
Design Head (m)	0.800
Design Flow (l/s)	24.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	220
Invert Level (m)	95.700
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.800	24.8	Kick-Flo®	0.619	21.9
Flush-Flo™	0.340	24.7	Mean Flow over Head Range	-	20.0

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	7.4	1.200	30.1	3.000	46.8	7.000	70.5
0.200	21.7	1.400	32.4	3.500	50.4	7.500	73.0
0.300	24.7	1.600	34.5	4.000	53.7	8.000	75.3
0.400	24.6	1.800	36.5	4.500	56.9	8.500	77.1
0.500	23.9	2.000	38.4	5.000	59.9	9.000	79.4
0.600	22.4	2.200	40.3	5.500	62.7	9.500	81.6
0.800	24.8	2.400	42.0	6.000	65.4		
1.000	27.6	2.600	43.6	6.500	68.0		

Appendix B.3

DEVELOPMENT CREEP

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	103.716	0.316	8.7	646.7	O K
30 min Summer	103.798	0.398	8.7	832.7	O K
60 min Summer	103.878	0.478	8.7	1018.5	O K
120 min Summer	103.965	0.565	8.7	1230.3	O K
180 min Summer	104.011	0.611	8.7	1346.9	O K
240 min Summer	104.040	0.640	8.7	1419.4	O K
360 min Summer	104.070	0.670	8.7	1497.6	O K
480 min Summer	104.083	0.683	8.7	1530.9	O K
600 min Summer	104.087	0.687	8.7	1542.3	O K
720 min Summer	104.087	0.687	8.7	1541.1	O K
960 min Summer	104.077	0.677	8.7	1517.1	O K
1440 min Summer	104.046	0.646	8.7	1435.8	O K
2160 min Summer	104.004	0.604	8.7	1329.2	O K
2880 min Summer	103.969	0.569	8.7	1241.2	O K
4320 min Summer	103.907	0.507	8.7	1088.7	O K
5760 min Summer	103.857	0.457	8.7	970.5	O K
7200 min Summer	103.816	0.416	8.7	874.7	O K
8640 min Summer	103.781	0.381	8.7	794.1	O K
10080 min Summer	103.751	0.351	8.7	725.5	O K
15 min Winter	103.751	0.351	8.7	725.1	O K
30 min Winter	103.842	0.442	8.7	934.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	151.654	0.0	549.4	23
30 min Summer	97.974	0.0	679.2	38
60 min Summer	60.354	0.0	980.1	68
120 min Summer	36.913	0.0	1183.0	126
180 min Summer	27.268	0.0	1285.1	186
240 min Summer	21.821	0.0	1338.5	246
360 min Summer	15.737	0.0	1366.2	366
480 min Summer	12.370	0.0	1351.9	484
600 min Summer	10.223	0.0	1334.3	604
720 min Summer	8.729	0.0	1316.7	724
960 min Summer	6.777	0.0	1281.5	962
1440 min Summer	4.731	0.0	1211.5	1370
2160 min Summer	3.309	0.0	2001.2	1692
2880 min Summer	2.578	0.0	2066.9	2076
4320 min Summer	1.834	0.0	2157.5	2848
5760 min Summer	1.454	0.0	2392.0	3632
7200 min Summer	1.225	0.0	2516.5	4400
8640 min Summer	1.071	0.0	2635.6	5184
10080 min Summer	0.961	0.0	2745.9	5944
15 min Winter	151.654	0.0	608.9	23
30 min Winter	97.974	0.0	720.2	37

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	103.929	0.529	8.7	1143.1	O K
120 min Winter	104.025	0.625	8.7	1382.3	O K
180 min Winter	104.076	0.676	8.7	1513.9	O K
240 min Winter	104.108	0.708	8.7	1596.6	Flood Risk
360 min Winter	104.142	0.742	8.7	1687.8	Flood Risk
480 min Winter	104.157	0.757	8.7	1728.7	Flood Risk
600 min Winter	104.163	0.763	8.7	1745.3	Flood Risk
720 min Winter	104.164	0.764	8.7	1747.7	Flood Risk
960 min Winter	104.157	0.757	8.7	1728.4	Flood Risk
1440 min Winter	104.129	0.729	8.7	1652.0	Flood Risk
2160 min Winter	104.078	0.678	8.7	1517.6	O K
2880 min Winter	104.037	0.637	8.7	1411.9	O K
4320 min Winter	103.958	0.558	8.7	1214.0	O K
5760 min Winter	103.880	0.480	8.7	1025.1	O K
7200 min Winter	103.816	0.416	8.7	872.4	O K
8640 min Winter	103.759	0.359	8.7	744.1	O K
10080 min Winter	103.711	0.311	8.7	637.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	60.354	0.0	1092.8	66
120 min Winter	36.913	0.0	1297.9	126
180 min Winter	27.268	0.0	1374.7	184
240 min Winter	21.821	0.0	1385.5	242
360 min Winter	15.737	0.0	1368.9	360
480 min Winter	12.370	0.0	1352.8	476
600 min Winter	10.223	0.0	1337.6	594
720 min Winter	8.729	0.0	1322.9	708
960 min Winter	6.777	0.0	1293.8	936
1440 min Winter	4.731	0.0	1235.3	1374
2160 min Winter	3.309	0.0	2230.9	1780
2880 min Winter	2.578	0.0	2294.0	2216
4320 min Winter	1.834	0.0	2318.1	3120
5760 min Winter	1.454	0.0	2679.9	3928
7200 min Winter	1.225	0.0	2820.1	4752
8640 min Winter	1.071	0.0	2955.0	5456
10080 min Winter	0.961	0.0	3081.5	6248

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 483669 232428 SP 83669 32428
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 2.300

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	1.150	4	8	1.150

Model Details

Storage is Online Cover Level (m) 104.400

Tank or Pond Structure

Invert Level (m) 103.400

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1890.0	1.000	2990.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0140-8700-0800-8700
Design Head (m)	0.800
Design Flow (l/s)	8.7
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	140
Invert Level (m)	103.400
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)	0.800	8.7	Kick-Flo®	0.562	7.4
Flush-Flo™	0.254	8.7	Mean Flow over Head Range	-	7.4

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.0	1.200	10.5	3.000	16.3	7.000	24.4
0.200	8.6	1.400	11.3	3.500	17.5	7.500	25.2
0.300	8.7	1.600	12.1	4.000	18.7	8.000	26.0
0.400	8.4	1.800	12.8	4.500	19.7	8.500	26.7
0.500	8.0	2.000	13.4	5.000	20.8	9.000	27.5
0.600	7.6	2.200	14.0	5.500	21.7	9.500	28.3
0.800	8.7	2.400	14.6	6.000	22.7		
1.000	9.7	2.600	15.2	6.500	23.6		

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	103.314	0.314	20.1	1372.2	O K
30 min Summer	103.399	0.399	20.1	1766.1	O K
60 min Summer	103.481	0.481	20.1	2159.4	O K
120 min Summer	103.573	0.573	20.1	2607.0	O K
180 min Summer	103.622	0.622	20.1	2854.1	O K
240 min Summer	103.653	0.653	20.1	3007.9	O K
360 min Summer	103.685	0.685	20.1	3172.5	O K
480 min Summer	103.699	0.699	20.1	3241.5	O K
600 min Summer	103.703	0.703	20.1	3263.7	Flood Risk
720 min Summer	103.702	0.702	20.1	3259.0	Flood Risk
960 min Summer	103.691	0.691	20.1	3203.4	O K
1440 min Summer	103.658	0.658	20.1	3032.5	O K
2160 min Summer	103.616	0.616	20.1	2820.3	O K
2880 min Summer	103.578	0.578	20.1	2631.1	O K
4320 min Summer	103.515	0.515	20.1	2325.0	O K
5760 min Summer	103.464	0.464	20.1	2075.8	O K
7200 min Summer	103.421	0.421	20.1	1872.6	O K
8640 min Summer	103.385	0.385	20.1	1702.7	O K
10080 min Summer	103.355	0.355	20.1	1561.2	O K
15 min Winter	103.350	0.350	20.1	1538.2	O K
30 min Winter	103.444	0.444	20.1	1981.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	151.654	0.0	1086.4	23
30 min Summer	97.974	0.0	1390.1	38
60 min Summer	60.354	0.0	2017.8	68
120 min Summer	36.913	0.0	2454.5	126
180 min Summer	27.268	0.0	2691.3	186
240 min Summer	21.821	0.0	2838.1	246
360 min Summer	15.737	0.0	2995.7	366
480 min Summer	12.370	0.0	3059.4	484
600 min Summer	10.223	0.0	3073.4	604
720 min Summer	8.729	0.0	3056.3	722
960 min Summer	6.777	0.0	2975.1	962
1440 min Summer	4.731	0.0	2788.3	1260
2160 min Summer	3.309	0.0	4196.3	1624
2880 min Summer	2.578	0.0	4337.7	1992
4320 min Summer	1.834	0.0	4539.4	2772
5760 min Summer	1.454	0.0	5050.3	3568
7200 min Summer	1.225	0.0	5308.8	4328
8640 min Summer	1.071	0.0	5552.5	5096
10080 min Summer	0.961	0.0	5771.2	5848
15 min Winter	151.654	0.0	1218.3	23
30 min Winter	97.974	0.0	1524.5	37

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	103.536	0.536	20.1	2423.6	O K
120 min Winter	103.637	0.637	20.1	2929.8	O K
180 min Winter	103.692	0.692	20.1	3208.0	O K
240 min Winter	103.726	0.726	20.1	3382.1	Flood Risk
360 min Winter	103.762	0.762	20.1	3572.3	Flood Risk
480 min Winter	103.778	0.778	20.1	3655.9	Flood Risk
600 min Winter	103.784	0.784	20.1	3687.6	Flood Risk
720 min Winter	103.785	0.785	20.1	3689.5	Flood Risk
960 min Winter	103.776	0.776	20.1	3642.3	Flood Risk
1440 min Winter	103.743	0.743	20.1	3469.6	Flood Risk
2160 min Winter	103.690	0.690	20.1	3195.7	O K
2880 min Winter	103.645	0.645	20.1	2969.7	O K
4320 min Winter	103.556	0.556	20.1	2522.1	O K
5760 min Winter	103.476	0.476	20.1	2134.4	O K
7200 min Winter	103.409	0.409	20.1	1816.1	O K
8640 min Winter	103.354	0.354	20.1	1554.9	O K
10080 min Winter	103.308	0.308	20.1	1345.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	60.354	0.0	2257.9	66
120 min Winter	36.913	0.0	2721.4	126
180 min Winter	27.268	0.0	2956.6	184
240 min Winter	21.821	0.0	3086.3	242
360 min Winter	15.737	0.0	3181.8	360
480 min Winter	12.370	0.0	3172.8	476
600 min Winter	10.223	0.0	3136.3	592
720 min Winter	8.729	0.0	3097.0	706
960 min Winter	6.777	0.0	3014.8	934
1440 min Winter	4.731	0.0	2846.4	1368
2160 min Winter	3.309	0.0	4687.7	1712
2880 min Winter	2.578	0.0	4829.9	2164
4320 min Winter	1.834	0.0	5017.4	3032
5760 min Winter	1.454	0.0	5660.6	3856
7200 min Winter	1.225	0.0	5953.2	4616
8640 min Winter	1.071	0.0	6230.2	5360
10080 min Winter	0.961	0.0	6482.8	6048

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 483669 232428 SP 83669 32428
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 4.880

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	2.440	4	8	2.440

Model Details

Storage is Online Cover Level (m) 104.000

Tank or Pond Structure

Invert Level (m) 103.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	4160.0	1.000	5590.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0201-2010-0800-2010
Design Head (m)	0.800
Design Flow (l/s)	20.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	201
Invert Level (m)	103.000
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.800	20.1	Kick-Flo®	0.608	17.6
Flush-Flo™	0.319	20.1	Mean Flow over Head Range	-	16.5

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.9	1.200	24.4	3.000	37.9	7.000	57.1
0.200	19.1	1.400	26.2	3.500	40.8	7.500	59.0
0.300	20.1	1.600	28.0	4.000	43.5	8.000	60.9
0.400	19.9	1.800	29.6	4.500	46.1	8.500	62.4
0.500	19.3	2.000	31.1	5.000	48.5	9.000	64.2
0.600	17.9	2.200	32.6	5.500	50.8	9.500	66.0
0.800	20.1	2.400	34.0	6.000	53.0		
1.000	22.3	2.600	35.3	6.500	55.0		

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	111.316	0.316	5.2	351.0	O K
30 min Summer	111.398	0.398	5.2	451.7	O K
60 min Summer	111.477	0.477	5.2	551.9	O K
120 min Summer	111.562	0.562	5.2	665.7	O K
180 min Summer	111.607	0.607	5.2	727.3	O K
240 min Summer	111.634	0.634	5.2	765.0	O K
360 min Summer	111.662	0.662	5.2	804.1	O K
480 min Summer	111.673	0.673	5.2	819.1	O K
600 min Summer	111.675	0.675	5.2	822.2	O K
720 min Summer	111.672	0.672	5.2	818.6	O K
960 min Summer	111.659	0.659	5.2	799.9	O K
1440 min Summer	111.622	0.622	5.2	748.1	O K
2160 min Summer	111.576	0.576	5.2	684.7	O K
2880 min Summer	111.537	0.537	5.2	631.0	O K
4320 min Summer	111.467	0.467	5.2	540.0	O K
5760 min Summer	111.413	0.413	5.2	470.7	O K
7200 min Summer	111.369	0.369	5.2	415.3	O K
8640 min Summer	111.331	0.331	5.2	369.2	O K
10080 min Summer	111.299	0.299	5.2	330.6	O K
15 min Winter	111.351	0.351	5.2	393.5	O K
30 min Winter	111.442	0.442	5.2	506.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	151.654	0.0	317.0	23
30 min Summer	97.974	0.0	396.1	38
60 min Summer	60.354	0.0	545.6	68
120 min Summer	36.913	0.0	662.5	126
180 min Summer	27.268	0.0	726.4	186
240 min Summer	21.821	0.0	765.2	246
360 min Summer	15.737	0.0	801.0	366
480 min Summer	12.370	0.0	805.8	484
600 min Summer	10.223	0.0	798.5	604
720 min Summer	8.729	0.0	789.5	722
960 min Summer	6.777	0.0	770.3	962
1440 min Summer	4.731	0.0	729.9	1284
2160 min Summer	3.309	0.0	1101.0	1640
2880 min Summer	2.578	0.0	1141.1	2024
4320 min Summer	1.834	0.0	1206.9	2772
5760 min Summer	1.454	0.0	1303.6	3576
7200 min Summer	1.225	0.0	1371.7	4328
8640 min Summer	1.071	0.0	1437.5	5096
10080 min Summer	0.961	0.0	1499.8	5840
15 min Winter	151.654	0.0	352.3	23
30 min Winter	97.974	0.0	424.2	37

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	111.528	0.528	5.2	619.8	O K
120 min Winter	111.622	0.622	5.2	748.1	O K
180 min Winter	111.672	0.672	5.2	818.0	O K
240 min Winter	111.702	0.702	5.2	861.4	Flood Risk
360 min Winter	111.734	0.734	5.2	907.7	Flood Risk
480 min Winter	111.747	0.747	5.2	926.9	Flood Risk
600 min Winter	111.751	0.751	5.2	932.8	Flood Risk
720 min Winter	111.750	0.750	5.2	931.3	Flood Risk
960 min Winter	111.739	0.739	5.2	915.2	Flood Risk
1440 min Winter	111.704	0.704	5.2	863.9	Flood Risk
2160 min Winter	111.648	0.648	5.2	783.9	O K
2880 min Winter	111.601	0.601	5.2	718.9	O K
4320 min Winter	111.508	0.508	5.2	593.2	O K
5760 min Winter	111.423	0.423	5.2	483.4	O K
7200 min Winter	111.353	0.353	5.2	396.3	O K
8640 min Winter	111.295	0.295	5.2	325.4	O K
10080 min Winter	111.247	0.247	5.2	269.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	60.354	0.0	609.5	66
120 min Winter	36.913	0.0	733.9	126
180 min Winter	27.268	0.0	793.7	184
240 min Winter	21.821	0.0	817.7	242
360 min Winter	15.737	0.0	817.2	360
480 min Winter	12.370	0.0	808.9	476
600 min Winter	10.223	0.0	800.4	592
720 min Winter	8.729	0.0	791.8	706
960 min Winter	6.777	0.0	774.8	934
1440 min Winter	4.731	0.0	740.5	1370
2160 min Winter	3.309	0.0	1231.0	1716
2880 min Winter	2.578	0.0	1273.7	2168
4320 min Winter	1.834	0.0	1337.6	3072
5760 min Winter	1.454	0.0	1460.4	3864
7200 min Winter	1.225	0.0	1537.0	4616
8640 min Winter	1.071	0.0	1611.2	5360
10080 min Winter	0.961	0.0	1682.2	6048

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 483669 232428 SP 83669 32428
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.250

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.625	4	8	0.625

Model Details

Storage is Online Cover Level (m) 112.000

Tank or Pond Structure

Invert Level (m) 111.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1020.0	1.000	1650.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0110-5200-0800-5200
Design Head (m)	0.800
Design Flow (l/s)	5.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	110
Invert Level (m)	111.000
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)	0.800	5.2	Kick-Flo®	0.537	4.3
Flush-Flo™	0.241	5.2	Mean Flow over Head Range	-	4.5

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.8	1.200	6.3	3.000	9.7	7.000	14.5
0.200	5.2	1.400	6.7	3.500	10.4	7.500	14.9
0.300	5.2	1.600	7.2	4.000	11.1	8.000	15.4
0.400	5.0	1.800	7.6	4.500	11.7	8.500	15.8
0.500	4.6	2.000	8.0	5.000	12.3	9.000	16.3
0.600	4.6	2.200	8.3	5.500	12.9	9.500	16.8
0.800	5.2	2.400	8.7	6.000	13.4		
1.000	5.8	2.600	9.0	6.500	14.0		

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	105.271	0.271	5.7	393.3	O K
30 min Summer	105.344	0.344	5.7	506.3	O K
60 min Summer	105.413	0.413	5.7	618.8	O K
120 min Summer	105.490	0.490	5.7	746.3	O K
180 min Summer	105.531	0.531	5.7	816.3	O K
240 min Summer	105.556	0.556	5.7	860.3	O K
360 min Summer	105.583	0.583	5.7	907.2	O K
480 min Summer	105.594	0.594	5.7	926.5	O K
600 min Summer	105.597	0.597	5.7	932.4	O K
720 min Summer	105.596	0.596	5.7	930.7	O K
960 min Summer	105.587	0.587	5.7	913.8	O K
1440 min Summer	105.556	0.556	5.7	859.3	O K
2160 min Summer	105.511	0.511	5.7	782.3	O K
2880 min Summer	105.476	0.476	5.7	723.4	O K
4320 min Summer	105.421	0.421	5.7	631.0	O K
5760 min Summer	105.375	0.375	5.7	557.3	O K
7200 min Summer	105.338	0.338	5.7	497.6	O K
8640 min Summer	105.307	0.307	5.7	447.8	O K
10080 min Summer	105.280	0.280	5.7	406.2	O K
15 min Winter	105.302	0.302	5.7	441.0	O K
30 min Winter	105.382	0.382	5.7	567.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	151.654	0.0	340.1	23
30 min Summer	97.974	0.0	426.4	38
60 min Summer	60.354	0.0	601.0	68
120 min Summer	36.913	0.0	729.7	126
180 min Summer	27.268	0.0	799.5	186
240 min Summer	21.821	0.0	840.7	246
360 min Summer	15.737	0.0	878.1	366
480 min Summer	12.370	0.0	883.7	484
600 min Summer	10.223	0.0	875.4	604
720 min Summer	8.729	0.0	864.2	724
960 min Summer	6.777	0.0	841.5	962
1440 min Summer	4.731	0.0	796.2	1368
2160 min Summer	3.309	0.0	1224.6	1628
2880 min Summer	2.578	0.0	1268.3	1992
4320 min Summer	1.834	0.0	1334.8	2772
5760 min Summer	1.454	0.0	1457.0	3576
7200 min Summer	1.225	0.0	1532.7	4328
8640 min Summer	1.071	0.0	1605.3	5096
10080 min Summer	0.961	0.0	1672.8	5848
15 min Winter	151.654	0.0	378.3	23
30 min Winter	97.974	0.0	459.7	37

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	105.459	0.459	5.7	694.6	O K
120 min Winter	105.544	0.544	5.7	839.3	O K
180 min Winter	105.590	0.590	5.7	919.2	O K
240 min Winter	105.618	0.618	5.7	969.0	O K
360 min Winter	105.648	0.648	5.7	1023.4	O K
480 min Winter	105.661	0.661	5.7	1047.2	O K
600 min Winter	105.666	0.666	5.7	1056.1	O K
720 min Winter	105.666	0.666	5.7	1056.4	O K
960 min Winter	105.659	0.659	5.7	1042.4	O K
1440 min Winter	105.630	0.630	5.7	991.4	O K
2160 min Winter	105.580	0.580	5.7	902.8	O K
2880 min Winter	105.537	0.537	5.7	827.4	O K
4320 min Winter	105.456	0.456	5.7	688.8	O K
5760 min Winter	105.387	0.387	5.7	575.2	O K
7200 min Winter	105.328	0.328	5.7	481.8	O K
8640 min Winter	105.279	0.279	5.7	405.1	O K
10080 min Winter	105.239	0.239	5.7	343.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	60.354	0.0	671.5	66
120 min Winter	36.913	0.0	807.6	126
180 min Winter	27.268	0.0	870.7	184
240 min Winter	21.821	0.0	896.0	242
360 min Winter	15.737	0.0	894.2	360
480 min Winter	12.370	0.0	882.4	476
600 min Winter	10.223	0.0	870.9	594
720 min Winter	8.729	0.0	859.9	708
960 min Winter	6.777	0.0	838.8	936
1440 min Winter	4.731	0.0	798.1	1374
2160 min Winter	3.309	0.0	1366.8	1776
2880 min Winter	2.578	0.0	1412.6	2196
4320 min Winter	1.834	0.0	1476.8	3032
5760 min Winter	1.454	0.0	1632.4	3864
7200 min Winter	1.225	0.0	1717.8	4616
8640 min Winter	1.071	0.0	1799.8	5360
10080 min Winter	0.961	0.0	1877.1	6056

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 483669 232428 SP 83669 32428
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.400

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.700	4	8	0.700

Model Details

Storage is Online Cover Level (m) 106.000

Tank or Pond Structure

Invert Level (m) 105.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1360.0	1.000	2080.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0115-5700-0800-5700
Design Head (m)	0.800
Design Flow (l/s)	5.7
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	115
Invert Level (m)	105.000
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)	0.800	5.7	Kick-Flo®	0.543	4.8
Flush-Flo™	0.244	5.7	Mean Flow over Head Range	-	4.9

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)
0.100	4.0	1.200	6.9	3.000	10.6	7.000	15.9
0.200	5.7	1.400	7.4	3.500	11.4	7.500	16.4
0.300	5.7	1.600	7.9	4.000	12.2	8.000	16.9
0.400	5.5	1.800	8.3	4.500	12.9	8.500	17.4
0.500	5.1	2.000	8.8	5.000	13.5	9.000	17.9
0.600	5.0	2.200	9.2	5.500	14.1	9.500	18.4
0.800	5.7	2.400	9.5	6.000	14.8		
1.000	6.3	2.600	9.9	6.500	15.3		

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	111.321	0.321	6.5	406.8	O K
30 min Summer	111.405	0.405	6.5	523.4	O K
60 min Summer	111.487	0.487	6.5	639.2	O K
120 min Summer	111.575	0.575	6.5	770.4	O K
180 min Summer	111.622	0.622	6.5	840.7	O K
240 min Summer	111.649	0.649	6.5	883.3	O K
360 min Summer	111.677	0.677	6.5	926.7	O K
480 min Summer	111.687	0.687	6.5	941.9	O K
600 min Summer	111.688	0.688	6.5	943.4	O K
720 min Summer	111.684	0.684	6.5	937.3	O K
960 min Summer	111.668	0.668	6.5	911.8	O K
1440 min Summer	111.627	0.627	6.5	849.7	O K
2160 min Summer	111.578	0.578	6.5	774.9	O K
2880 min Summer	111.534	0.534	6.5	708.8	O K
4320 min Summer	111.460	0.460	6.5	601.0	O K
5760 min Summer	111.402	0.402	6.5	518.4	O K
7200 min Summer	111.354	0.354	6.5	452.0	O K
8640 min Summer	111.314	0.314	6.5	397.8	O K
10080 min Summer	111.281	0.281	6.5	353.2	O K
15 min Winter	111.357	0.357	6.5	456.1	O K
30 min Winter	111.451	0.451	6.5	587.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	151.654	0.0	368.5	23
30 min Summer	97.974	0.0	466.5	37
60 min Summer	60.354	0.0	633.0	68
120 min Summer	36.913	0.0	770.7	126
180 min Summer	27.268	0.0	848.6	186
240 min Summer	21.821	0.0	898.9	246
360 min Summer	15.737	0.0	956.5	364
480 min Summer	12.370	0.0	982.7	484
600 min Summer	10.223	0.0	991.1	604
720 min Summer	8.729	0.0	987.9	722
960 min Summer	6.777	0.0	965.9	960
1440 min Summer	4.731	0.0	913.7	1228
2160 min Summer	3.309	0.0	1277.9	1596
2880 min Summer	2.578	0.0	1325.4	1984
4320 min Summer	1.834	0.0	1405.0	2764
5760 min Summer	1.454	0.0	1511.8	3520
7200 min Summer	1.225	0.0	1590.6	4256
8640 min Summer	1.071	0.0	1666.7	5016
10080 min Summer	0.961	0.0	1738.6	5744
15 min Winter	151.654	0.0	411.0	23
30 min Winter	97.974	0.0	508.2	37

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	111.540	0.540	6.5	718.0	O K
120 min Winter	111.638	0.638	6.5	865.8	O K
180 min Winter	111.689	0.689	6.5	945.7	O K
240 min Winter	111.720	0.720	6.5	994.8	Flood Risk
360 min Winter	111.752	0.752	6.5	1046.3	Flood Risk
480 min Winter	111.765	0.765	6.5	1066.2	Flood Risk
600 min Winter	111.768	0.768	6.5	1071.0	Flood Risk
720 min Winter	111.765	0.765	6.5	1067.1	Flood Risk
960 min Winter	111.751	0.751	6.5	1044.5	Flood Risk
1440 min Winter	111.710	0.710	6.5	978.3	Flood Risk
2160 min Winter	111.650	0.650	6.5	884.3	O K
2880 min Winter	111.598	0.598	6.5	804.4	O K
4320 min Winter	111.492	0.492	6.5	647.1	O K
5760 min Winter	111.402	0.402	6.5	517.9	O K
7200 min Winter	111.328	0.328	6.5	415.7	O K
8640 min Winter	111.267	0.267	6.5	334.9	O K
10080 min Winter	111.221	0.221	6.5	273.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	60.354	0.0	708.0	66
120 min Winter	36.913	0.0	857.7	124
180 min Winter	27.268	0.0	938.2	184
240 min Winter	21.821	0.0	984.9	242
360 min Winter	15.737	0.0	1020.3	358
480 min Winter	12.370	0.0	1017.4	476
600 min Winter	10.223	0.0	1007.7	590
720 min Winter	8.729	0.0	997.0	706
960 min Winter	6.777	0.0	974.5	930
1440 min Winter	4.731	0.0	928.1	1356
2160 min Winter	3.309	0.0	1430.1	1688
2880 min Winter	2.578	0.0	1481.4	2140
4320 min Winter	1.834	0.0	1567.0	2992
5760 min Winter	1.454	0.0	1693.8	3800
7200 min Winter	1.225	0.0	1782.4	4536
8640 min Winter	1.071	0.0	1868.2	5192
10080 min Winter	0.961	0.0	1950.2	5856

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 483669 232428 SP 83669 32428
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.450

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.725	4	8	0.725

Model Details

Storage is Online Cover Level (m) 112.000

Tank or Pond Structure

Invert Level (m) 111.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1180.0	1.000	1770.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0122-6500-0800-6500
Design Head (m)	0.800
Design Flow (l/s)	6.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	122
Invert Level (m)	111.000
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)	0.800	6.5	Kick-Flo®	0.547	5.4
Flush-Flo™	0.246	6.5	Mean Flow over Head Range	-	5.6

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.4	1.200	7.9	3.000	12.1	7.000	18.1
0.200	6.4	1.400	8.4	3.500	13.0	7.500	18.8
0.300	6.4	1.600	9.0	4.000	13.9	8.000	19.3
0.400	6.3	1.800	9.5	4.500	14.7	8.500	19.9
0.500	5.9	2.000	10.0	5.000	15.4	9.000	20.5
0.600	5.7	2.200	10.4	5.500	16.2	9.500	21.0
0.800	6.5	2.400	10.9	6.000	16.8		
1.000	7.2	2.600	11.3	6.500	17.5		

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	110.288	0.288	5.2	351.0	O K
30 min Summer	110.366	0.366	5.2	451.8	O K
60 min Summer	110.440	0.440	5.2	552.0	O K
120 min Summer	110.523	0.523	5.2	665.8	O K
180 min Summer	110.567	0.567	5.2	728.2	O K
240 min Summer	110.593	0.593	5.2	766.5	O K
360 min Summer	110.621	0.621	5.2	806.8	O K
480 min Summer	110.632	0.632	5.2	822.7	O K
600 min Summer	110.635	0.635	5.2	826.7	O K
720 min Summer	110.633	0.633	5.2	824.0	O K
960 min Summer	110.621	0.621	5.2	806.8	O K
1440 min Summer	110.587	0.587	5.2	756.5	O K
2160 min Summer	110.541	0.541	5.2	692.1	O K
2880 min Summer	110.500	0.500	5.2	635.0	O K
4320 min Summer	110.438	0.438	5.2	548.4	O K
5760 min Summer	110.387	0.387	5.2	480.6	O K
7200 min Summer	110.346	0.346	5.2	426.1	O K
8640 min Summer	110.311	0.311	5.2	380.6	O K
10080 min Summer	110.282	0.282	5.2	342.8	O K
15 min Winter	110.321	0.321	5.2	393.6	O K
30 min Winter	110.407	0.407	5.2	506.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	151.654	0.0	310.7	23
30 min Summer	97.974	0.0	389.6	38
60 min Summer	60.354	0.0	541.4	68
120 min Summer	36.913	0.0	657.7	126
180 min Summer	27.268	0.0	720.9	186
240 min Summer	21.821	0.0	759.3	246
360 min Summer	15.737	0.0	795.8	366
480 min Summer	12.370	0.0	802.7	484
600 min Summer	10.223	0.0	796.3	604
720 min Summer	8.729	0.0	787.0	722
960 min Summer	6.777	0.0	766.9	962
1440 min Summer	4.731	0.0	725.2	1314
2160 min Summer	3.309	0.0	1097.4	1664
2880 min Summer	2.578	0.0	1137.5	1992
4320 min Summer	1.834	0.0	1200.9	2772
5760 min Summer	1.454	0.0	1302.3	3568
7200 min Summer	1.225	0.0	1370.1	4328
8640 min Summer	1.071	0.0	1435.4	5096
10080 min Summer	0.961	0.0	1496.7	5840
15 min Winter	151.654	0.0	345.6	23
30 min Winter	97.974	0.0	419.8	37

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	110.490	0.490	5.2	619.8	O K
120 min Winter	110.581	0.581	5.2	748.7	O K
180 min Winter	110.630	0.630	5.2	819.1	O K
240 min Winter	110.660	0.660	5.2	862.9	O K
360 min Winter	110.692	0.692	5.2	910.2	O K
480 min Winter	110.705	0.705	5.2	930.2	Flood Risk
600 min Winter	110.709	0.709	5.2	936.9	Flood Risk
720 min Winter	110.709	0.709	5.2	936.1	Flood Risk
960 min Winter	110.699	0.699	5.2	921.4	O K
1440 min Winter	110.666	0.666	5.2	872.4	O K
2160 min Winter	110.612	0.612	5.2	792.8	O K
2880 min Winter	110.566	0.566	5.2	727.5	O K
4320 min Winter	110.474	0.474	5.2	598.6	O K
5760 min Winter	110.397	0.397	5.2	493.1	O K
7200 min Winter	110.332	0.332	5.2	407.9	O K
8640 min Winter	110.278	0.278	5.2	338.3	O K
10080 min Winter	110.235	0.235	5.2	283.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	60.354	0.0	605.1	66
120 min Winter	36.913	0.0	728.4	126
180 min Winter	27.268	0.0	787.8	184
240 min Winter	21.821	0.0	813.4	242
360 min Winter	15.737	0.0	815.0	360
480 min Winter	12.370	0.0	805.8	476
600 min Winter	10.223	0.0	796.3	592
720 min Winter	8.729	0.0	787.0	708
960 min Winter	6.777	0.0	768.6	934
1440 min Winter	4.731	0.0	732.3	1372
2160 min Winter	3.309	0.0	1226.4	1732
2880 min Winter	2.578	0.0	1268.1	2192
4320 min Winter	1.834	0.0	1331.8	3032
5760 min Winter	1.454	0.0	1459.0	3856
7200 min Winter	1.225	0.0	1535.4	4616
8640 min Winter	1.071	0.0	1609.1	5360
10080 min Winter	0.961	0.0	1679.1	6048

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 483669 232428 SP 83669 32428
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.250

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.625	4	8	0.625

Model Details

Storage is Online Cover Level (m) 111.000

Tank or Pond Structure

Invert Level (m) 110.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1150.0	1.000	1655.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0110-5200-0800-5200
Design Head (m)	0.800
Design Flow (l/s)	5.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	110
Invert Level (m)	110.000
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)	0.800	5.2	Kick-Flo®	0.537	4.3
Flush-Flo™	0.241	5.2	Mean Flow over Head Range	-	4.5

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.8	1.200	6.3	3.000	9.7	7.000	14.5
0.200	5.2	1.400	6.7	3.500	10.4	7.500	14.9
0.300	5.2	1.600	7.2	4.000	11.1	8.000	15.4
0.400	5.0	1.800	7.6	4.500	11.7	8.500	15.8
0.500	4.6	2.000	8.0	5.000	12.3	9.000	16.3
0.600	4.6	2.200	8.3	5.500	12.9	9.500	16.8
0.800	5.2	2.400	8.7	6.000	13.4		
1.000	5.8	2.600	9.0	6.500	14.0		

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	115.272	0.272	3.8	258.3	O K
30 min Summer	115.341	0.341	3.8	332.5	O K
60 min Summer	115.407	0.407	3.8	406.2	O K
120 min Summer	115.478	0.478	3.8	489.5	O K
180 min Summer	115.516	0.516	3.8	535.2	O K
240 min Summer	115.539	0.539	3.8	563.7	O K
360 min Summer	115.563	0.563	3.8	593.8	O K
480 min Summer	115.572	0.572	3.8	605.8	O K
600 min Summer	115.575	0.575	3.8	609.1	O K
720 min Summer	115.573	0.573	3.8	607.2	O K
960 min Summer	115.564	0.564	3.8	594.9	O K
1440 min Summer	115.533	0.533	3.8	556.6	O K
2160 min Summer	115.489	0.489	3.8	502.9	O K
2880 min Summer	115.455	0.455	3.8	462.5	O K
4320 min Summer	115.401	0.401	3.8	400.0	O K
5760 min Summer	115.357	0.357	3.8	350.7	O K
7200 min Summer	115.321	0.321	3.8	311.1	O K
8640 min Summer	115.290	0.290	3.8	278.1	O K
10080 min Summer	115.264	0.264	3.8	250.6	O K
15 min Winter	115.301	0.301	3.8	289.7	O K
30 min Winter	115.377	0.377	3.8	373.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	151.654	0.0	231.7	23
30 min Summer	97.974	0.0	289.0	38
60 min Summer	60.354	0.0	400.8	68
120 min Summer	36.913	0.0	487.1	126
180 min Summer	27.268	0.0	534.1	186
240 min Summer	21.821	0.0	562.1	246
360 min Summer	15.737	0.0	586.6	366
480 min Summer	12.370	0.0	588.7	484
600 min Summer	10.223	0.0	582.8	604
720 min Summer	8.729	0.0	576.0	724
960 min Summer	6.777	0.0	562.0	962
1440 min Summer	4.731	0.0	534.5	1370
2160 min Summer	3.309	0.0	810.1	1624
2880 min Summer	2.578	0.0	839.7	1988
4320 min Summer	1.834	0.0	887.1	2768
5760 min Summer	1.454	0.0	959.3	3568
7200 min Summer	1.225	0.0	1009.4	4328
8640 min Summer	1.071	0.0	1057.7	5096
10080 min Summer	0.961	0.0	1103.4	5848
15 min Winter	151.654	0.0	257.3	23
30 min Winter	97.974	0.0	309.7	37

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	115.450	0.450	3.8	456.0	O K
120 min Winter	115.528	0.528	3.8	550.8	O K
180 min Winter	115.570	0.570	3.8	603.0	O K
240 min Winter	115.595	0.595	3.8	635.4	O K
360 min Winter	115.622	0.622	3.8	670.5	O K
480 min Winter	115.634	0.634	3.8	685.6	O K
600 min Winter	115.638	0.638	3.8	690.9	O K
720 min Winter	115.638	0.638	3.8	690.5	O K
960 min Winter	115.630	0.630	3.8	680.2	O K
1440 min Winter	115.603	0.603	3.8	644.7	O K
2160 min Winter	115.555	0.555	3.8	583.4	O K
2880 min Winter	115.512	0.512	3.8	530.5	O K
4320 min Winter	115.433	0.433	3.8	436.9	O K
5760 min Winter	115.367	0.367	3.8	360.8	O K
7200 min Winter	115.310	0.310	3.8	299.0	O K
8640 min Winter	115.262	0.262	3.8	248.8	O K
10080 min Winter	115.223	0.223	3.8	208.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	60.354	0.0	447.9	66
120 min Winter	36.913	0.0	539.4	126
180 min Winter	27.268	0.0	581.7	184
240 min Winter	21.821	0.0	596.7	242
360 min Winter	15.737	0.0	593.0	360
480 min Winter	12.370	0.0	585.2	476
600 min Winter	10.223	0.0	577.8	594
720 min Winter	8.729	0.0	570.9	708
960 min Winter	6.777	0.0	557.7	936
1440 min Winter	4.731	0.0	532.6	1374
2160 min Winter	3.309	0.0	904.8	1780
2880 min Winter	2.578	0.0	936.7	2192
4320 min Winter	1.834	0.0	984.3	3028
5760 min Winter	1.454	0.0	1074.7	3856
7200 min Winter	1.225	0.0	1131.0	4616
8640 min Winter	1.071	0.0	1185.5	5360
10080 min Winter	0.961	0.0	1237.6	6048

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 483669 232428 SP 83669 32428
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.920

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.460	4	8	0.460

Model Details

Storage is Online Cover Level (m) 116.000

Tank or Pond Structure

Invert Level (m) 115.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	860.0	1.000	1630.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0095-3800-0800-3800
Design Head (m)	0.800
Design Flow (l/s)	3.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	95
Invert Level (m)	115.000
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)	0.800	3.8	Kick-Flo®	0.525	3.1
Flush-Flo™	0.239	3.8	Mean Flow over Head Range	-	3.3

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.1	1.200	4.6	3.000	7.0	7.000	10.5
0.200	3.8	1.400	4.9	3.500	7.6	7.500	10.9
0.300	3.8	1.600	5.2	4.000	8.0	8.000	11.2
0.400	3.6	1.800	5.5	4.500	8.5	8.500	11.5
0.500	3.3	2.000	5.8	5.000	8.9	9.000	11.8
0.600	3.3	2.200	6.1	5.500	9.4	9.500	12.2
0.800	3.8	2.400	6.3	6.000	9.8		
1.000	4.2	2.600	6.6	6.500	10.1		

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	110.291	0.291	3.3	298.5	O K
30 min Summer	110.367	0.367	3.3	384.6	O K
60 min Summer	110.439	0.439	3.3	470.8	O K
120 min Summer	110.520	0.520	3.3	569.8	O K
180 min Summer	110.563	0.563	3.3	624.9	O K
240 min Summer	110.590	0.590	3.3	659.9	O K
360 min Summer	110.619	0.619	3.3	699.1	O K
480 min Summer	110.633	0.633	3.3	717.5	O K
600 min Summer	110.639	0.639	3.3	725.8	O K
720 min Summer	110.641	0.641	3.3	728.3	O K
960 min Summer	110.637	0.637	3.3	723.0	O K
1440 min Summer	110.617	0.617	3.3	695.9	O K
2160 min Summer	110.580	0.580	3.3	647.5	O K
2880 min Summer	110.551	0.551	3.3	609.1	O K
4320 min Summer	110.501	0.501	3.3	546.0	O K
5760 min Summer	110.460	0.460	3.3	495.6	O K
7200 min Summer	110.427	0.427	3.3	456.2	O K
8640 min Summer	110.399	0.399	3.3	423.1	O K
10080 min Summer	110.376	0.376	3.3	395.0	O K
15 min Winter	110.323	0.323	3.3	334.6	O K
30 min Winter	110.406	0.406	3.3	431.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	151.654	0.0	249.0	23
30 min Summer	97.974	0.0	277.6	38
60 min Summer	60.354	0.0	450.7	68
120 min Summer	36.913	0.0	522.6	128
180 min Summer	27.268	0.0	526.0	186
240 min Summer	21.821	0.0	519.0	246
360 min Summer	15.737	0.0	507.9	366
480 min Summer	12.370	0.0	499.8	486
600 min Summer	10.223	0.0	493.1	604
720 min Summer	8.729	0.0	487.1	724
960 min Summer	6.777	0.0	475.9	964
1440 min Summer	4.731	0.0	454.7	1440
2160 min Summer	3.309	0.0	910.3	1876
2880 min Summer	2.578	0.0	921.4	2248
4320 min Summer	1.834	0.0	877.2	2984
5760 min Summer	1.454	0.0	1103.7	3752
7200 min Summer	1.225	0.0	1161.3	4544
8640 min Summer	1.071	0.0	1217.3	5360
10080 min Summer	0.961	0.0	1269.9	6144
15 min Winter	151.654	0.0	267.4	23
30 min Winter	97.974	0.0	278.3	37

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	110.486	0.486	3.3	528.3	O K
120 min Winter	110.575	0.575	3.3	640.1	O K
180 min Winter	110.622	0.622	3.3	702.3	O K
240 min Winter	110.652	0.652	3.3	742.1	O K
360 min Winter	110.685	0.685	3.3	787.6	O K
480 min Winter	110.701	0.701	3.3	809.8	Flood Risk
600 min Winter	110.709	0.709	3.3	820.8	Flood Risk
720 min Winter	110.712	0.712	3.3	825.2	Flood Risk
960 min Winter	110.710	0.710	3.3	822.5	Flood Risk
1440 min Winter	110.693	0.693	3.3	798.5	O K
2160 min Winter	110.657	0.657	3.3	749.2	O K
2880 min Winter	110.620	0.620	3.3	699.7	O K
4320 min Winter	110.563	0.563	3.3	625.4	O K
5760 min Winter	110.507	0.507	3.3	553.7	O K
7200 min Winter	110.453	0.453	3.3	487.6	O K
8640 min Winter	110.407	0.407	3.3	432.5	O K
10080 min Winter	110.367	0.367	3.3	385.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	60.354	0.0	496.1	66
120 min Winter	36.913	0.0	527.7	126
180 min Winter	27.268	0.0	517.8	184
240 min Winter	21.821	0.0	510.8	244
360 min Winter	15.737	0.0	502.2	360
480 min Winter	12.370	0.0	496.5	478
600 min Winter	10.223	0.0	491.8	596
720 min Winter	8.729	0.0	487.6	712
960 min Winter	6.777	0.0	479.7	942
1440 min Winter	4.731	0.0	465.5	1398
2160 min Winter	3.309	0.0	978.1	2036
2880 min Winter	2.578	0.0	950.8	2344
4320 min Winter	1.834	0.0	876.0	3244
5760 min Winter	1.454	0.0	1236.0	4152
7200 min Winter	1.225	0.0	1300.5	4968
8640 min Winter	1.071	0.0	1363.3	5784
10080 min Winter	0.961	0.0	1423.6	6552

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 483669 232428 SP 83669 32428
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.060

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.530	4	8	0.530

Model Details

Storage is Online Cover Level (m) 111.000

Tank or Pond Structure

Invert Level (m) 110.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	940.0	1.000	1600.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0089-3300-0800-3300
Design Head (m)	0.800
Design Flow (l/s)	3.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	89
Invert Level (m)	110.000
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)	0.800	3.3	Kick-Flo®	0.519	2.7
Flush-Flo™	0.237	3.3	Mean Flow over Head Range	-	2.9

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)
0.100	2.8	1.200	4.0	3.000	6.1	7.000	9.1
0.200	3.3	1.400	4.3	3.500	6.6	7.500	9.4
0.300	3.3	1.600	4.5	4.000	7.0	8.000	9.7
0.400	3.2	1.800	4.8	4.500	7.4	8.500	10.0
0.500	2.8	2.000	5.0	5.000	7.8	9.000	10.3
0.600	2.9	2.200	5.3	5.500	8.1	9.500	10.5
0.800	3.3	2.400	5.5	6.000	8.5		
1.000	3.7	2.600	5.7	6.500	8.8		

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	110.288	0.288	5.4	370.8	O K
30 min Summer	110.363	0.363	5.4	477.3	O K
60 min Summer	110.436	0.436	5.4	583.2	O K
120 min Summer	110.516	0.516	5.4	703.5	O K
180 min Summer	110.559	0.559	5.4	769.7	O K
240 min Summer	110.585	0.585	5.4	810.5	O K
360 min Summer	110.612	0.612	5.4	853.7	O K
480 min Summer	110.623	0.623	5.4	871.1	O K
600 min Summer	110.626	0.626	5.4	875.9	O K
720 min Summer	110.625	0.625	5.4	873.5	O K
960 min Summer	110.614	0.614	5.4	856.5	O K
1440 min Summer	110.581	0.581	5.4	804.5	O K
2160 min Summer	110.538	0.538	5.4	736.3	O K
2880 min Summer	110.499	0.499	5.4	677.0	O K
4320 min Summer	110.439	0.439	5.4	587.1	O K
5760 min Summer	110.391	0.391	5.4	516.7	O K
7200 min Summer	110.351	0.351	5.4	459.7	O K
8640 min Summer	110.318	0.318	5.4	412.3	O K
10080 min Summer	110.289	0.289	5.4	372.6	O K
15 min Winter	110.320	0.320	5.4	415.7	O K
30 min Winter	110.404	0.404	5.4	535.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	151.654	0.0	326.4	23
30 min Summer	97.974	0.0	407.8	38
60 min Summer	60.354	0.0	570.6	68
120 min Summer	36.913	0.0	692.7	126
180 min Summer	27.268	0.0	758.1	186
240 min Summer	21.821	0.0	796.9	246
360 min Summer	15.737	0.0	830.7	366
480 min Summer	12.370	0.0	833.4	484
600 min Summer	10.223	0.0	824.6	604
720 min Summer	8.729	0.0	814.5	722
960 min Summer	6.777	0.0	793.5	962
1440 min Summer	4.731	0.0	750.8	1340
2160 min Summer	3.309	0.0	1157.7	1668
2880 min Summer	2.578	0.0	1199.6	2016
4320 min Summer	1.834	0.0	1264.6	2772
5760 min Summer	1.454	0.0	1375.0	3576
7200 min Summer	1.225	0.0	1446.6	4328
8640 min Summer	1.071	0.0	1515.5	5104
10080 min Summer	0.961	0.0	1580.1	5848
15 min Winter	151.654	0.0	362.7	23
30 min Winter	97.974	0.0	437.7	37

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	110.484	0.484	5.4	654.8	O K
120 min Winter	110.573	0.573	5.4	791.2	O K
180 min Winter	110.620	0.620	5.4	865.9	O K
240 min Winter	110.649	0.649	5.4	912.5	O K
360 min Winter	110.680	0.680	5.4	963.0	O K
480 min Winter	110.693	0.693	5.4	984.7	O K
600 min Winter	110.697	0.697	5.4	992.4	O K
720 min Winter	110.697	0.697	5.4	992.2	O K
960 min Winter	110.689	0.689	5.4	977.8	O K
1440 min Winter	110.658	0.658	5.4	927.9	O K
2160 min Winter	110.606	0.606	5.4	844.5	O K
2880 min Winter	110.563	0.563	5.4	776.5	O K
4320 min Winter	110.477	0.477	5.4	643.2	O K
5760 min Winter	110.403	0.403	5.4	533.7	O K
7200 min Winter	110.340	0.340	5.4	444.3	O K
8640 min Winter	110.288	0.288	5.4	371.0	O K
10080 min Winter	110.245	0.245	5.4	312.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	60.354	0.0	637.5	66
120 min Winter	36.913	0.0	765.9	126
180 min Winter	27.268	0.0	825.0	184
240 min Winter	21.821	0.0	846.9	242
360 min Winter	15.737	0.0	843.3	360
480 min Winter	12.370	0.0	833.1	476
600 min Winter	10.223	0.0	823.2	592
720 min Winter	8.729	0.0	813.5	708
960 min Winter	6.777	0.0	794.7	934
1440 min Winter	4.731	0.0	757.6	1372
2160 min Winter	3.309	0.0	1293.2	1752
2880 min Winter	2.578	0.0	1336.2	2196
4320 min Winter	1.834	0.0	1398.8	3068
5760 min Winter	1.454	0.0	1540.5	3864
7200 min Winter	1.225	0.0	1621.2	4616
8640 min Winter	1.071	0.0	1699.0	5360
10080 min Winter	0.961	0.0	1772.8	6056

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 483669 232428 SP 83669 32428
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.320

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.660	4	8	0.660

Model Details

Storage is Online Cover Level (m) 111.000

Tank or Pond Structure

Invert Level (m) 110.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1200.0	1.000	1880.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0112-5400-0800-5400
Design Head (m)	0.800
Design Flow (l/s)	5.4
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	112
Invert Level (m)	110.000
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)	0.800	5.4	Kick-Flo®	0.538	4.5
Flush-Flo™	0.242	5.4	Mean Flow over Head Range	-	4.6

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.9	1.200	6.5	3.000	10.0	7.000	15.0
0.200	5.3	1.400	7.0	3.500	10.8	7.500	15.5
0.300	5.3	1.600	7.5	4.000	11.5	8.000	16.0
0.400	5.2	1.800	7.9	4.500	12.2	8.500	16.5
0.500	4.8	2.000	8.3	5.000	12.8	9.000	16.9
0.600	4.7	2.200	8.7	5.500	13.4	9.500	17.4
0.800	5.4	2.400	9.0	6.000	14.0		
1.000	6.0	2.600	9.4	6.500	14.5		

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	113.176	0.276	3.3	298.6	O K
30 min Summer	113.249	0.349	3.3	384.6	O K
60 min Summer	113.320	0.420	3.3	470.9	O K
120 min Summer	113.398	0.498	3.3	569.7	O K
180 min Summer	113.441	0.541	3.3	625.1	O K
240 min Summer	113.468	0.568	3.3	660.4	O K
360 min Summer	113.497	0.597	3.3	700.0	O K
480 min Summer	113.511	0.611	3.3	718.7	O K
600 min Summer	113.518	0.618	3.3	727.4	O K
720 min Summer	113.520	0.620	3.3	730.2	O K
960 min Summer	113.516	0.616	3.3	725.5	O K
1440 min Summer	113.497	0.597	3.3	699.5	O K
2160 min Summer	113.461	0.561	3.3	651.5	O K
2880 min Summer	113.432	0.532	3.3	612.8	O K
4320 min Summer	113.381	0.481	3.3	548.1	O K
5760 min Summer	113.342	0.442	3.3	499.1	O K
7200 min Summer	113.311	0.411	3.3	460.4	O K
8640 min Summer	113.285	0.385	3.3	427.6	O K
10080 min Summer	113.262	0.362	3.3	399.8	O K
15 min Winter	113.207	0.307	3.3	334.7	O K
30 min Winter	113.288	0.388	3.3	431.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	151.654	0.0	245.9	23
30 min Summer	97.974	0.0	277.1	38
60 min Summer	60.354	0.0	448.0	68
120 min Summer	36.913	0.0	522.0	128
180 min Summer	27.268	0.0	529.2	186
240 min Summer	21.821	0.0	521.9	246
360 min Summer	15.737	0.0	509.8	366
480 min Summer	12.370	0.0	500.9	486
600 min Summer	10.223	0.0	493.6	604
720 min Summer	8.729	0.0	487.0	724
960 min Summer	6.777	0.0	475.0	964
1440 min Summer	4.731	0.0	452.6	1442
2160 min Summer	3.309	0.0	906.8	1884
2880 min Summer	2.578	0.0	917.9	2256
4320 min Summer	1.834	0.0	882.3	2948
5760 min Summer	1.454	0.0	1102.9	3744
7200 min Summer	1.225	0.0	1160.3	4544
8640 min Summer	1.071	0.0	1216.0	5352
10080 min Summer	0.961	0.0	1268.1	6144
15 min Winter	151.654	0.0	264.9	23
30 min Winter	97.974	0.0	278.8	37

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	113.366	0.466	3.3	528.3	O K
120 min Winter	113.453	0.553	3.3	640.3	O K
180 min Winter	113.500	0.600	3.3	702.7	O K
240 min Winter	113.529	0.629	3.3	742.7	O K
360 min Winter	113.563	0.663	3.3	788.4	O K
480 min Winter	113.579	0.679	3.3	811.0	O K
600 min Winter	113.587	0.687	3.3	822.2	O K
720 min Winter	113.590	0.690	3.3	826.9	O K
960 min Winter	113.589	0.689	3.3	824.7	O K
1440 min Winter	113.572	0.672	3.3	801.7	O K
2160 min Winter	113.537	0.637	3.3	753.5	O K
2880 min Winter	113.501	0.601	3.3	704.1	O K
4320 min Winter	113.444	0.544	3.3	629.3	O K
5760 min Winter	113.386	0.486	3.3	554.7	O K
7200 min Winter	113.336	0.436	3.3	490.9	O K
8640 min Winter	113.292	0.392	3.3	436.9	O K
10080 min Winter	113.254	0.354	3.3	390.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	60.354	0.0	493.6	66
120 min Winter	36.913	0.0	530.8	126
180 min Winter	27.268	0.0	520.1	184
240 min Winter	21.821	0.0	512.2	244
360 min Winter	15.737	0.0	502.3	360
480 min Winter	12.370	0.0	495.7	478
600 min Winter	10.223	0.0	490.3	596
720 min Winter	8.729	0.0	485.5	712
960 min Winter	6.777	0.0	476.5	944
1440 min Winter	4.731	0.0	460.3	1398
2160 min Winter	3.309	0.0	973.9	2040
2880 min Winter	2.578	0.0	947.3	2368
4320 min Winter	1.834	0.0	873.9	3248
5760 min Winter	1.454	0.0	1235.1	4144
7200 min Winter	1.225	0.0	1299.4	4968
8640 min Winter	1.071	0.0	1361.9	5784
10080 min Winter	0.961	0.0	1421.6	6552

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 483669 232428 SP 83669 32428
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.060

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.530	4	8	0.530

Model Details

Storage is Online Cover Level (m) 113.900

Tank or Pond Structure

Invert Level (m) 112.900

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1010.0	1.000	1590.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0089-3300-0800-3300
Design Head (m)	0.800
Design Flow (l/s)	3.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	89
Invert Level (m)	112.900
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)	0.800	3.3	Kick-Flo®	0.519	2.7
Flush-Flo™	0.237	3.3	Mean Flow over Head Range	-	2.9

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)
0.100	2.8	1.200	4.0	3.000	6.1	7.000	9.1
0.200	3.3	1.400	4.3	3.500	6.6	7.500	9.4
0.300	3.3	1.600	4.5	4.000	7.0	8.000	9.7
0.400	3.2	1.800	4.8	4.500	7.4	8.500	10.0
0.500	2.8	2.000	5.0	5.000	7.8	9.000	10.3
0.600	2.9	2.200	5.3	5.500	8.1	9.500	10.5
0.800	3.3	2.400	5.5	6.000	8.5		
1.000	3.7	2.600	5.7	6.500	8.8		

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	113.311	0.311	3.5	321.1	O K
30 min Summer	113.394	0.394	3.5	413.7	O K
60 min Summer	113.473	0.473	3.5	506.5	O K
120 min Summer	113.562	0.562	3.5	613.1	O K
180 min Summer	113.609	0.609	3.5	672.1	O K
240 min Summer	113.639	0.639	3.5	709.5	O K
360 min Summer	113.672	0.672	3.5	751.4	O K
480 min Summer	113.687	0.687	3.5	771.0	O K
600 min Summer	113.694	0.694	3.5	779.7	O K
720 min Summer	113.696	0.696	3.5	782.2	O K
960 min Summer	113.691	0.691	3.5	776.2	O K
1440 min Summer	113.668	0.668	3.5	746.5	O K
2160 min Summer	113.628	0.628	3.5	695.0	O K
2880 min Summer	113.596	0.596	3.5	655.0	O K
4320 min Summer	113.546	0.546	3.5	593.5	O K
5760 min Summer	113.501	0.501	3.5	539.8	O K
7200 min Summer	113.464	0.464	3.5	495.8	O K
8640 min Summer	113.434	0.434	3.5	459.7	O K
10080 min Summer	113.407	0.407	3.5	429.2	O K
15 min Winter	113.346	0.346	3.5	359.9	O K
30 min Winter	113.437	0.437	3.5	463.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	151.654	0.0	268.0	23
30 min Summer	97.974	0.0	294.4	38
60 min Summer	60.354	0.0	484.6	68
120 min Summer	36.913	0.0	554.6	128
180 min Summer	27.268	0.0	554.3	186
240 min Summer	21.821	0.0	547.8	246
360 min Summer	15.737	0.0	538.1	366
480 min Summer	12.370	0.0	531.0	486
600 min Summer	10.223	0.0	524.9	604
720 min Summer	8.729	0.0	519.3	724
960 min Summer	6.777	0.0	508.6	962
1440 min Summer	4.731	0.0	487.8	1440
2160 min Summer	3.309	0.0	978.2	1860
2880 min Summer	2.578	0.0	986.3	2220
4320 min Summer	1.834	0.0	911.9	3024
5760 min Summer	1.454	0.0	1187.1	3808
7200 min Summer	1.225	0.0	1249.1	4608
8640 min Summer	1.071	0.0	1309.4	5360
10080 min Summer	0.961	0.0	1366.3	6152
15 min Winter	151.654	0.0	286.4	23
30 min Winter	97.974	0.0	293.7	37

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	113.525	0.525	3.5	568.4	O K
120 min Winter	113.622	0.622	3.5	688.4	O K
180 min Winter	113.675	0.675	3.5	755.2	O K
240 min Winter	113.708	0.708	3.5	797.9	Flood Risk
360 min Winter	113.745	0.745	3.5	846.6	Flood Risk
480 min Winter	113.763	0.763	3.5	870.3	Flood Risk
600 min Winter	113.772	0.772	3.5	881.9	Flood Risk
720 min Winter	113.775	0.775	3.5	886.4	Flood Risk
960 min Winter	113.772	0.772	3.5	883.2	Flood Risk
1440 min Winter	113.753	0.753	3.5	857.0	Flood Risk
2160 min Winter	113.712	0.712	3.5	803.5	Flood Risk
2880 min Winter	113.672	0.672	3.5	751.9	O K
4320 min Winter	113.611	0.611	3.5	674.5	O K
5760 min Winter	113.555	0.555	3.5	605.2	O K
7200 min Winter	113.498	0.498	3.5	535.6	O K
8640 min Winter	113.445	0.445	3.5	473.3	O K
10080 min Winter	113.400	0.400	3.5	421.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	60.354	0.0	531.1	66
120 min Winter	36.913	0.0	556.5	126
180 min Winter	27.268	0.0	548.0	184
240 min Winter	21.821	0.0	542.5	244
360 min Winter	15.737	0.0	536.3	360
480 min Winter	12.370	0.0	532.2	478
600 min Winter	10.223	0.0	528.6	594
720 min Winter	8.729	0.0	525.3	712
960 min Winter	6.777	0.0	518.9	942
1440 min Winter	4.731	0.0	507.4	1396
2160 min Winter	3.309	0.0	1047.9	2036
2880 min Winter	2.578	0.0	1015.7	2332
4320 min Winter	1.834	0.0	933.7	3244
5760 min Winter	1.454	0.0	1329.3	4152
7200 min Winter	1.225	0.0	1398.7	5040
8640 min Winter	1.071	0.0	1466.2	5800
10080 min Winter	0.961	0.0	1531.3	6560

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 483669 232428 SP 83669 32428
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.140

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.570	4	8	0.570

Model Details

Storage is Online Cover Level (m) 114.000

Tank or Pond Structure

Invert Level (m) 113.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	960.0	1.000	1460.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0092-3500-0800-3500
Design Head (m)	0.800
Design Flow (l/s)	3.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	92
Invert Level (m)	113.000
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)	0.800	3.5	Kick-Flo®	0.521	2.9
Flush-Flo™	0.238	3.5	Mean Flow over Head Range	-	3.0

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.9	1.200	4.2	3.000	6.5	7.000	9.7
0.200	3.5	1.400	4.5	3.500	7.0	7.500	10.0
0.300	3.5	1.600	4.8	4.000	7.4	8.000	10.3
0.400	3.3	1.800	5.1	4.500	7.8	8.500	10.6
0.500	3.0	2.000	5.3	5.000	8.2	9.000	10.9
0.600	3.1	2.200	5.6	5.500	8.6	9.500	11.2
0.800	3.5	2.400	5.8	6.000	9.0		
1.000	3.9	2.600	6.0	6.500	9.3		

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	104.301	0.301	23.4	1597.8	O K
30 min Summer	104.382	0.382	23.4	2056.3	O K
60 min Summer	104.462	0.462	23.4	2514.5	O K
120 min Summer	104.551	0.551	23.4	3035.9	O K
180 min Summer	104.599	0.599	23.4	3323.6	O K
240 min Summer	104.629	0.629	23.4	3504.9	O K
360 min Summer	104.662	0.662	23.4	3701.0	O K
480 min Summer	104.675	0.675	23.4	3785.1	O K
600 min Summer	104.680	0.680	23.4	3814.4	O K
720 min Summer	104.680	0.680	23.4	3812.1	O K
960 min Summer	104.670	0.670	23.4	3753.1	O K
1440 min Summer	104.639	0.639	23.4	3560.7	O K
2160 min Summer	104.597	0.597	23.4	3310.0	O K
2880 min Summer	104.562	0.562	23.4	3102.4	O K
4320 min Summer	104.505	0.505	23.4	2762.2	O K
5760 min Summer	104.457	0.457	23.4	2480.8	O K
7200 min Summer	104.417	0.417	23.4	2250.8	O K
8640 min Summer	104.383	0.383	23.4	2057.6	O K
10080 min Summer	104.354	0.354	23.4	1896.6	O K
15 min Winter	104.335	0.335	23.4	1790.9	O K
30 min Winter	104.426	0.426	23.4	2306.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	151.654	0.0	1216.3	23
30 min Summer	97.974	0.0	1568.8	38
60 min Summer	60.354	0.0	2309.9	68
120 min Summer	36.913	0.0	2813.8	126
180 min Summer	27.268	0.0	3088.5	186
240 min Summer	21.821	0.0	3258.1	246
360 min Summer	15.737	0.0	3442.2	366
480 min Summer	12.370	0.0	3521.0	484
600 min Summer	10.223	0.0	3544.9	604
720 min Summer	8.729	0.0	3534.0	722
960 min Summer	6.777	0.0	3449.8	962
1440 min Summer	4.731	0.0	3228.0	1286
2160 min Summer	3.309	0.0	4849.4	1620
2880 min Summer	2.578	0.0	5008.4	1988
4320 min Summer	1.834	0.0	5227.5	2768
5760 min Summer	1.454	0.0	5862.4	3568
7200 min Summer	1.225	0.0	6160.5	4328
8640 min Summer	1.071	0.0	6439.7	5096
10080 min Summer	0.961	0.0	6686.7	5848
15 min Winter	151.654	0.0	1368.7	23
30 min Winter	97.974	0.0	1728.8	37

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	104.515	0.515	23.4	2821.9	O K
120 min Winter	104.614	0.614	23.4	3411.6	O K
180 min Winter	104.668	0.668	23.4	3737.9	O K
240 min Winter	104.701	0.701	23.4	3942.3	Flood Risk
360 min Winter	104.737	0.737	23.4	4167.0	Flood Risk
480 min Winter	104.753	0.753	23.4	4267.5	Flood Risk
600 min Winter	104.760	0.760	23.4	4307.4	Flood Risk
720 min Winter	104.760	0.760	23.4	4312.6	Flood Risk
960 min Winter	104.753	0.753	23.4	4263.0	Flood Risk
1440 min Winter	104.722	0.722	23.4	4071.3	Flood Risk
2160 min Winter	104.671	0.671	23.4	3758.4	O K
2880 min Winter	104.629	0.629	23.4	3499.0	O K
4320 min Winter	104.543	0.543	23.4	2987.7	O K
5760 min Winter	104.469	0.469	23.4	2550.8	O K
7200 min Winter	104.406	0.406	23.4	2190.1	O K
8640 min Winter	104.354	0.354	23.4	1893.4	O K
10080 min Winter	104.311	0.311	23.4	1654.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	60.354	0.0	2587.0	66
120 min Winter	36.913	0.0	3123.5	126
180 min Winter	27.268	0.0	3395.6	184
240 min Winter	21.821	0.0	3548.8	242
360 min Winter	15.737	0.0	3674.0	360
480 min Winter	12.370	0.0	3680.0	476
600 min Winter	10.223	0.0	3639.0	592
720 min Winter	8.729	0.0	3591.4	706
960 min Winter	6.777	0.0	3491.6	934
1440 min Winter	4.731	0.0	3287.1	1370
2160 min Winter	3.309	0.0	5413.7	1716
2880 min Winter	2.578	0.0	5573.5	2168
4320 min Winter	1.834	0.0	5780.1	3028
5760 min Winter	1.454	0.0	6572.2	3856
7200 min Winter	1.225	0.0	6910.0	4616
8640 min Winter	1.071	0.0	7227.9	5360
10080 min Winter	0.961	0.0	7514.1	6048

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 483669 232428 SP 83669 32428
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 5.680

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	2.840	4	8	2.840

Model Details

Storage is Online Cover Level (m) 105.000

Tank or Pond Structure

Invert Level (m) 104.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	5090.0	1.000	6670.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0215-2340-0800-2340
Design Head (m)	0.800
Design Flow (l/s)	23.4
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	215
Invert Level (m)	104.000
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.800	23.4	Kick-Flo®	0.615	20.6
Flush-Flo™	0.331	23.4	Mean Flow over Head Range	-	19.0

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	7.3	1.200	28.4	3.000	44.1	7.000	66.6
0.200	21.0	1.400	30.6	3.500	47.5	7.500	68.8
0.300	23.4	1.600	32.6	4.000	50.7	8.000	71.0
0.400	23.2	1.800	34.5	4.500	53.7	8.500	72.8
0.500	22.6	2.000	36.3	5.000	56.5	9.000	74.9
0.600	21.0	2.200	38.0	5.500	59.2	9.500	77.0
0.800	23.4	2.400	39.6	6.000	61.8		
1.000	26.0	2.600	41.2	6.500	64.2		

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	104.307	0.307	13.3	907.9	O K
30 min Summer	104.390	0.390	13.3	1168.6	O K
60 min Summer	104.471	0.471	13.3	1428.7	O K
120 min Summer	104.561	0.561	13.3	1724.4	O K
180 min Summer	104.610	0.610	13.3	1887.4	O K
240 min Summer	104.640	0.640	13.3	1988.2	O K
360 min Summer	104.672	0.672	13.3	2095.6	O K
480 min Summer	104.684	0.684	13.3	2139.8	O K
600 min Summer	104.688	0.688	13.3	2153.2	O K
720 min Summer	104.687	0.687	13.3	2148.9	O K
960 min Summer	104.676	0.676	13.3	2109.8	O K
1440 min Summer	104.641	0.641	13.3	1991.8	O K
2160 min Summer	104.597	0.597	13.3	1844.5	O K
2880 min Summer	104.558	0.558	13.3	1712.9	O K
4320 min Summer	104.494	0.494	13.3	1501.7	O K
5760 min Summer	104.441	0.441	13.3	1332.5	O K
7200 min Summer	104.398	0.398	13.3	1195.0	O K
8640 min Summer	104.362	0.362	13.3	1079.9	O K
10080 min Summer	104.331	0.331	13.3	983.9	O K
15 min Winter	104.342	0.342	13.3	1017.8	O K
30 min Winter	104.435	0.435	13.3	1310.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	151.654	0.0	748.7	23
30 min Summer	97.974	0.0	950.2	38
60 min Summer	60.354	0.0	1358.5	68
120 min Summer	36.913	0.0	1650.7	126
180 min Summer	27.268	0.0	1808.7	186
240 min Summer	21.821	0.0	1906.0	246
360 min Summer	15.737	0.0	2006.9	366
480 min Summer	12.370	0.0	2041.8	484
600 min Summer	10.223	0.0	2041.7	604
720 min Summer	8.729	0.0	2021.6	722
960 min Summer	6.777	0.0	1965.2	962
1440 min Summer	4.731	0.0	1845.9	1284
2160 min Summer	3.309	0.0	2798.6	1628
2880 min Summer	2.578	0.0	2895.5	1996
4320 min Summer	1.834	0.0	3038.7	2772
5760 min Summer	1.454	0.0	3351.5	3576
7200 min Summer	1.225	0.0	3524.2	4328
8640 min Summer	1.071	0.0	3688.2	5096
10080 min Summer	0.961	0.0	3837.7	5848
15 min Winter	151.654	0.0	836.7	23
30 min Winter	97.974	0.0	1035.9	37

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	104.525	0.525	13.3	1603.5	O K
120 min Winter	104.625	0.625	13.3	1938.0	O K
180 min Winter	104.679	0.679	13.3	2121.5	O K
240 min Winter	104.712	0.712	13.3	2236.1	Flood Risk
360 min Winter	104.748	0.748	13.3	2360.7	Flood Risk
480 min Winter	104.764	0.764	13.3	2414.9	Flood Risk
600 min Winter	104.769	0.769	13.3	2434.8	Flood Risk
720 min Winter	104.769	0.769	13.3	2435.1	Flood Risk
960 min Winter	104.760	0.760	13.3	2401.8	Flood Risk
1440 min Winter	104.726	0.726	13.3	2283.8	Flood Risk
2160 min Winter	104.671	0.671	13.3	2095.5	O K
2880 min Winter	104.626	0.626	13.3	1940.8	O K
4320 min Winter	104.534	0.534	13.3	1634.1	O K
5760 min Winter	104.453	0.453	13.3	1370.6	O K
7200 min Winter	104.386	0.386	13.3	1154.9	O K
8640 min Winter	104.329	0.329	13.3	977.4	O K
10080 min Winter	104.283	0.283	13.3	834.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	60.354	0.0	1519.0	66
120 min Winter	36.913	0.0	1828.4	126
180 min Winter	27.268	0.0	1982.9	184
240 min Winter	21.821	0.0	2063.2	242
360 min Winter	15.737	0.0	2107.0	360
480 min Winter	12.370	0.0	2088.2	476
600 min Winter	10.223	0.0	2063.5	592
720 min Winter	8.729	0.0	2037.9	706
960 min Winter	6.777	0.0	1985.9	934
1440 min Winter	4.731	0.0	1881.0	1370
2160 min Winter	3.309	0.0	3126.5	1716
2880 min Winter	2.578	0.0	3224.7	2168
4320 min Winter	1.834	0.0	3359.0	3032
5760 min Winter	1.454	0.0	3755.8	3864
7200 min Winter	1.225	0.0	3951.0	4616
8640 min Winter	1.071	0.0	4136.9	5360
10080 min Winter	0.961	0.0	4309.0	6048

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 483669 232428 SP 83669 32428
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 3.230

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	1.615	4	8	1.615

Model Details

Storage is Online Cover Level (m) 105.000

Tank or Pond Structure

Invert Level (m) 104.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	2830.0	1.000	3730.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0168-1330-0800-1330
Design Head (m)	0.800
Design Flow (l/s)	13.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	168
Invert Level (m)	104.000
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)	0.800	13.3	Kick-Flo®	0.584	11.5
Flush-Flo™	0.278	13.3	Mean Flow over Head Range	-	11.1

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.0	1.200	16.1	3.000	25.0	7.000	37.6
0.200	13.0	1.400	17.3	3.500	26.9	7.500	38.8
0.300	13.3	1.600	18.5	4.000	28.7	8.000	40.1
0.400	13.0	1.800	19.5	4.500	30.3	8.500	41.1
0.500	12.5	2.000	20.6	5.000	31.9	9.000	42.3
0.600	11.6	2.200	21.5	5.500	33.4	9.500	43.5
0.800	13.3	2.400	22.4	6.000	34.9		
1.000	14.8	2.600	23.3	6.500	36.2		

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	100.327	0.327	4.9	334.1	O K
30 min Summer	100.411	0.411	4.9	430.0	O K
60 min Summer	100.491	0.491	4.9	525.4	O K
120 min Summer	100.579	0.579	4.9	633.7	O K
180 min Summer	100.624	0.624	4.9	692.1	O K
240 min Summer	100.651	0.651	4.9	727.9	O K
360 min Summer	100.679	0.679	4.9	764.9	O K
480 min Summer	100.690	0.690	4.9	779.0	O K
600 min Summer	100.692	0.692	4.9	781.8	O K
720 min Summer	100.689	0.689	4.9	778.2	O K
960 min Summer	100.676	0.676	4.9	760.1	O K
1440 min Summer	100.638	0.638	4.9	710.4	O K
2160 min Summer	100.591	0.591	4.9	650.0	O K
2880 min Summer	100.552	0.552	4.9	600.4	O K
4320 min Summer	100.482	0.482	4.9	513.5	O K
5760 min Summer	100.426	0.426	4.9	447.2	O K
7200 min Summer	100.380	0.380	4.9	394.3	O K
8640 min Summer	100.342	0.342	4.9	350.3	O K
10080 min Summer	100.309	0.309	4.9	313.5	O K
15 min Winter	100.363	0.363	4.9	374.6	O K
30 min Winter	100.456	0.456	4.9	482.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	151.654	0.0	304.2	23
30 min Summer	97.974	0.0	378.7	38
60 min Summer	60.354	0.0	521.0	68
120 min Summer	36.913	0.0	632.3	126
180 min Summer	27.268	0.0	693.1	186
240 min Summer	21.821	0.0	729.4	246
360 min Summer	15.737	0.0	760.5	366
480 min Summer	12.370	0.0	761.7	484
600 min Summer	10.223	0.0	754.4	604
720 min Summer	8.729	0.0	746.1	722
960 min Summer	6.777	0.0	728.4	962
1440 min Summer	4.731	0.0	691.3	1284
2160 min Summer	3.309	0.0	1049.5	1640
2880 min Summer	2.578	0.0	1087.6	2024
4320 min Summer	1.834	0.0	1150.6	2808
5760 min Summer	1.454	0.0	1241.5	3576
7200 min Summer	1.225	0.0	1306.5	4328
8640 min Summer	1.071	0.0	1369.3	5096
10080 min Summer	0.961	0.0	1429.1	5848
15 min Winter	151.654	0.0	337.7	23
30 min Winter	97.974	0.0	402.9	37

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	100.544	0.544	4.9	590.2	O K
120 min Winter	100.639	0.639	4.9	712.1	O K
180 min Winter	100.690	0.690	4.9	778.5	O K
240 min Winter	100.720	0.720	4.9	819.7	Flood Risk
360 min Winter	100.752	0.752	4.9	863.7	Flood Risk
480 min Winter	100.765	0.765	4.9	881.8	Flood Risk
600 min Winter	100.769	0.769	4.9	887.4	Flood Risk
720 min Winter	100.768	0.768	4.9	885.8	Flood Risk
960 min Winter	100.757	0.757	4.9	870.3	Flood Risk
1440 min Winter	100.721	0.721	4.9	821.1	Flood Risk
2160 min Winter	100.664	0.664	4.9	744.9	O K
2880 min Winter	100.617	0.617	4.9	683.5	O K
4320 min Winter	100.526	0.526	4.9	567.6	O K
5760 min Winter	100.438	0.438	4.9	461.0	O K
7200 min Winter	100.366	0.366	4.9	377.5	O K
8640 min Winter	100.305	0.305	4.9	309.7	O K
10080 min Winter	100.255	0.255	4.9	255.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	60.354	0.0	581.9	66
120 min Winter	36.913	0.0	700.2	124
180 min Winter	27.268	0.0	755.5	184
240 min Winter	21.821	0.0	774.8	242
360 min Winter	15.737	0.0	771.8	360
480 min Winter	12.370	0.0	764.3	476
600 min Winter	10.223	0.0	756.7	592
720 min Winter	8.729	0.0	749.0	706
960 min Winter	6.777	0.0	733.7	934
1440 min Winter	4.731	0.0	702.5	1370
2160 min Winter	3.309	0.0	1173.5	1716
2880 min Winter	2.578	0.0	1214.3	2168
4320 min Winter	1.834	0.0	1272.3	3076
5760 min Winter	1.454	0.0	1390.8	3864
7200 min Winter	1.225	0.0	1463.9	4616
8640 min Winter	1.071	0.0	1534.7	5360
10080 min Winter	0.961	0.0	1602.7	6048

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 483669 232428 SP 83669 32428
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.190

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.600	4	8	0.590

Model Details

Storage is Online Cover Level (m) 101.000

Tank or Pond Structure

Invert Level (m) 100.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	930.0	1.000	1550.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0108-4900-0800-4900
Design Head (m)	0.800
Design Flow (l/s)	4.9
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	108
Invert Level (m)	100.000
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)	0.800	4.9	Kick-Flo®	0.537	4.1
Flush-Flo™	0.242	4.9	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)
0.100	3.7	1.200	5.9	3.000	9.1	7.000	13.6
0.200	4.9	1.400	6.4	3.500	9.8	7.500	14.1
0.300	4.9	1.600	6.8	4.000	10.4	8.000	14.5
0.400	4.7	1.800	7.2	4.500	11.0	8.500	14.9
0.500	4.4	2.000	7.5	5.000	11.6	9.000	15.4
0.600	4.3	2.200	7.9	5.500	12.1	9.500	15.8
0.800	4.9	2.400	8.2	6.000	12.6		
1.000	5.4	2.600	8.5	6.500	13.1		

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	102.331	0.331	8.2	510.6	O K
30 min Summer	102.417	0.417	8.2	657.0	O K
60 min Summer	102.500	0.500	8.2	802.4	O K
120 min Summer	102.591	0.591	8.2	967.1	O K
180 min Summer	102.638	0.638	8.2	1055.3	O K
240 min Summer	102.666	0.666	8.2	1108.7	O K
360 min Summer	102.694	0.694	8.2	1163.0	O K
480 min Summer	102.704	0.704	8.2	1182.0	Flood Risk
600 min Summer	102.705	0.705	8.2	1183.8	Flood Risk
720 min Summer	102.701	0.701	8.2	1176.0	Flood Risk
960 min Summer	102.684	0.684	8.2	1143.7	O K
1440 min Summer	102.644	0.644	8.2	1066.8	O K
2160 min Summer	102.595	0.595	8.2	974.4	O K
2880 min Summer	102.550	0.550	8.2	893.1	O K
4320 min Summer	102.475	0.475	8.2	757.9	O K
5760 min Summer	102.416	0.416	8.2	654.1	O K
7200 min Summer	102.367	0.367	8.2	570.7	O K
8640 min Summer	102.326	0.326	8.2	502.6	O K
10080 min Summer	102.292	0.292	8.2	446.6	O K
15 min Winter	102.368	0.368	8.2	572.6	O K
30 min Winter	102.463	0.463	8.2	737.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	151.654	0.0	459.0	23
30 min Summer	97.974	0.0	582.1	37
60 min Summer	60.354	0.0	792.0	68
120 min Summer	36.913	0.0	964.6	126
180 min Summer	27.268	0.0	1062.2	186
240 min Summer	21.821	0.0	1125.6	246
360 min Summer	15.737	0.0	1199.1	364
480 min Summer	12.370	0.0	1234.4	484
600 min Summer	10.223	0.0	1248.2	604
720 min Summer	8.729	0.0	1247.4	722
960 min Summer	6.777	0.0	1221.7	960
1440 min Summer	4.731	0.0	1154.7	1216
2160 min Summer	3.309	0.0	1602.2	1580
2880 min Summer	2.578	0.0	1661.4	1968
4320 min Summer	1.834	0.0	1760.4	2732
5760 min Summer	1.454	0.0	1896.8	3520
7200 min Summer	1.225	0.0	1995.5	4256
8640 min Summer	1.071	0.0	2090.7	5016
10080 min Summer	0.961	0.0	2180.3	5744
15 min Winter	151.654	0.0	512.1	23
30 min Winter	97.974	0.0	635.5	37

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	102.555	0.555	8.2	901.3	O K
120 min Winter	102.654	0.654	8.2	1086.6	O K
180 min Winter	102.706	0.706	8.2	1186.9	Flood Risk
240 min Winter	102.738	0.738	8.2	1248.5	Flood Risk
360 min Winter	102.770	0.770	8.2	1312.9	Flood Risk
480 min Winter	102.783	0.783	8.2	1337.8	Flood Risk
600 min Winter	102.786	0.786	8.2	1343.6	Flood Risk
720 min Winter	102.783	0.783	8.2	1338.5	Flood Risk
960 min Winter	102.769	0.769	8.2	1309.9	Flood Risk
1440 min Winter	102.727	0.727	8.2	1226.4	Flood Risk
2160 min Winter	102.667	0.667	8.2	1110.0	O K
2880 min Winter	102.614	0.614	8.2	1010.2	O K
4320 min Winter	102.507	0.507	8.2	814.4	O K
5760 min Winter	102.414	0.414	8.2	652.1	O K
7200 min Winter	102.339	0.339	8.2	523.7	O K
8640 min Winter	102.277	0.277	8.2	422.3	O K
10080 min Winter	102.229	0.229	8.2	345.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	60.354	0.0	886.0	66
120 min Winter	36.913	0.0	1073.8	124
180 min Winter	27.268	0.0	1175.5	184
240 min Winter	21.821	0.0	1235.9	242
360 min Winter	15.737	0.0	1287.3	358
480 min Winter	12.370	0.0	1289.3	476
600 min Winter	10.223	0.0	1277.3	590
720 min Winter	8.729	0.0	1263.8	704
960 min Winter	6.777	0.0	1235.0	928
1440 min Winter	4.731	0.0	1175.1	1354
2160 min Winter	3.309	0.0	1793.0	1672
2880 min Winter	2.578	0.0	1857.1	2136
4320 min Winter	1.834	0.0	1963.5	2988
5760 min Winter	1.454	0.0	2125.2	3800
7200 min Winter	1.225	0.0	2236.3	4536
8640 min Winter	1.071	0.0	2343.6	5192
10080 min Winter	0.961	0.0	2445.9	5856

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 483669 232428 SP 83669 32428
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.820

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.910	4	8	0.910

Model Details

Storage is Online Cover Level (m) 103.000

Tank or Pond Structure

Invert Level (m) 102.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1430.0	1.000	2180.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0136-8200-0800-8200
Design Head (m)	0.800
Design Flow (l/s)	8.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	136
Invert Level (m)	102.000
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)	0.800	8.2	Kick-Flo®	0.559	6.9
Flush-Flo™	0.253	8.2	Mean Flow over Head Range	-	7.0

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.9	1.200	9.9	3.000	15.3	7.000	23.0
0.200	8.1	1.400	10.7	3.500	16.5	7.500	23.8
0.300	8.1	1.600	11.4	4.000	17.6	8.000	24.5
0.400	7.9	1.800	12.0	4.500	18.6	8.500	25.2
0.500	7.5	2.000	12.6	5.000	19.5	9.000	25.9
0.600	7.2	2.200	13.2	5.500	20.5	9.500	26.6
0.800	8.2	2.400	13.8	6.000	21.3		
1.000	9.1	2.600	14.3	6.500	22.2		

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	106.178	0.178	5.4	371.4	O K
30 min Summer	106.228	0.228	5.4	477.9	O K
60 min Summer	106.276	0.276	5.4	584.3	O K
120 min Summer	106.331	0.331	5.4	705.2	O K
180 min Summer	106.361	0.361	5.4	771.5	O K
240 min Summer	106.379	0.379	5.4	812.9	O K
360 min Summer	106.399	0.399	5.4	857.8	O K
480 min Summer	106.407	0.407	5.4	876.9	O K
600 min Summer	106.410	0.410	5.4	883.4	O K
720 min Summer	106.410	0.410	5.4	882.3	O K
960 min Summer	106.403	0.403	5.4	867.0	O K
1440 min Summer	106.382	0.382	5.4	819.6	O K
2160 min Summer	106.357	0.357	5.4	763.8	O K
2880 min Summer	106.337	0.337	5.4	718.0	O K
4320 min Summer	106.302	0.302	5.4	641.3	O K
5760 min Summer	106.273	0.273	5.4	577.4	O K
7200 min Summer	106.250	0.250	5.4	525.3	O K
8640 min Summer	106.229	0.229	5.4	481.5	O K
10080 min Summer	106.212	0.212	5.4	445.0	O K
15 min Winter	106.199	0.199	5.4	416.2	O K
30 min Winter	106.254	0.254	5.4	536.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	151.654	0.0	283.7	23
30 min Summer	97.974	0.0	364.6	38
60 min Summer	60.354	0.0	538.2	68
120 min Summer	36.913	0.0	655.5	126
180 min Summer	27.268	0.0	719.9	186
240 min Summer	21.821	0.0	760.2	246
360 min Summer	15.737	0.0	804.4	366
480 min Summer	12.370	0.0	823.7	484
600 min Summer	10.223	0.0	830.4	604
720 min Summer	8.729	0.0	829.5	722
960 min Summer	6.777	0.0	814.9	962
1440 min Summer	4.731	0.0	769.5	1242
2160 min Summer	3.309	0.0	1129.5	1580
2880 min Summer	2.578	0.0	1166.3	1964
4320 min Summer	1.834	0.0	1216.2	2768
5760 min Summer	1.454	0.0	1363.2	3568
7200 min Summer	1.225	0.0	1432.6	4328
8640 min Summer	1.071	0.0	1497.8	5096
10080 min Summer	0.961	0.0	1555.6	5848
15 min Winter	151.654	0.0	318.8	23
30 min Winter	97.974	0.0	400.9	37

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	106.309	0.309	5.4	655.7	O K
120 min Winter	106.370	0.370	5.4	792.2	O K
180 min Winter	106.403	0.403	5.4	867.7	O K
240 min Winter	106.424	0.424	5.4	915.4	O K
360 min Winter	106.447	0.447	5.4	968.6	O K
480 min Winter	106.458	0.458	5.4	992.9	O K
600 min Winter	106.462	0.462	5.4	1003.2	O K
720 min Winter	106.463	0.463	5.4	1005.1	O K
960 min Winter	106.458	0.458	5.4	994.0	O K
1440 min Winter	106.438	0.438	5.4	947.2	O K
2160 min Winter	106.403	0.403	5.4	867.9	O K
2880 min Winter	106.376	0.376	5.4	805.2	O K
4320 min Winter	106.325	0.325	5.4	692.7	O K
5760 min Winter	106.281	0.281	5.4	595.0	O K
7200 min Winter	106.244	0.244	5.4	513.7	O K
8640 min Winter	106.213	0.213	5.4	446.7	O K
10080 min Winter	106.188	0.188	5.4	392.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	60.354	0.0	602.7	66
120 min Winter	36.913	0.0	728.3	124
180 min Winter	27.268	0.0	792.8	184
240 min Winter	21.821	0.0	828.7	242
360 min Winter	15.737	0.0	856.5	360
480 min Winter	12.370	0.0	856.5	476
600 min Winter	10.223	0.0	846.3	594
720 min Winter	8.729	0.0	834.9	708
960 min Winter	6.777	0.0	813.0	936
1440 min Winter	4.731	0.0	771.9	1372
2160 min Winter	3.309	0.0	1261.3	1712
2880 min Winter	2.578	0.0	1300.2	2140
4320 min Winter	1.834	0.0	1345.4	3028
5760 min Winter	1.454	0.0	1528.1	3856
7200 min Winter	1.225	0.0	1606.7	4616
8640 min Winter	1.071	0.0	1680.9	5360
10080 min Winter	0.961	0.0	1747.9	6056

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 483669 232428 SP 83669 32428
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.320

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.660	4	8	0.660

Model Details

Storage is Online Cover Level (m) 107.000

Tank or Pond Structure

Invert Level (m) 106.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	2030.0	1.000	2670.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0114-5400-0700-5400
Design Head (m)	0.700
Design Flow (l/s)	5.4
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	114
Invert Level (m)	106.000
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)	0.700	5.4	Kick-Flo®	0.486	4.6
Flush-Flo™	0.216	5.4	Mean Flow over Head Range	-	4.6

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.0	1.200	6.9	3.000	10.7	7.000	16.0
0.200	5.4	1.400	7.5	3.500	11.5	7.500	16.5
0.300	5.3	1.600	7.9	4.000	12.2	8.000	17.1
0.400	5.1	1.800	8.4	4.500	13.0	8.500	17.6
0.500	4.6	2.000	8.8	5.000	13.6	9.000	18.1
0.600	5.0	2.200	9.2	5.500	14.3	9.500	18.6
0.800	5.7	2.400	9.6	6.000	14.9		
1.000	6.4	2.600	10.0	6.500	15.4		

Summary of Results for 100 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	94.152	0.152	10.5	602.8	O K
30 min Summer	94.194	0.194	12.0	773.8	O K
60 min Summer	94.236	0.236	12.2	943.5	O K
120 min Summer	94.282	0.282	12.2	1134.1	O K
180 min Summer	94.307	0.307	12.2	1235.8	O K
240 min Summer	94.322	0.322	12.2	1297.1	O K
360 min Summer	94.336	0.336	12.2	1358.3	O K
480 min Summer	94.341	0.341	12.2	1377.4	O K
600 min Summer	94.341	0.341	12.2	1375.9	O K
720 min Summer	94.337	0.337	12.2	1362.2	O K
960 min Summer	94.328	0.328	12.2	1323.3	O K
1440 min Summer	94.312	0.312	12.2	1257.0	O K
2160 min Summer	94.292	0.292	12.2	1171.9	O K
2880 min Summer	94.273	0.273	12.2	1096.1	O K
4320 min Summer	94.242	0.242	12.2	967.7	O K
5760 min Summer	94.217	0.217	12.1	864.8	O K
7200 min Summer	94.197	0.197	12.0	785.6	O K
8640 min Summer	94.182	0.182	11.9	724.3	O K
10080 min Summer	94.171	0.171	11.8	679.7	O K
15 min Winter	94.170	0.170	11.8	675.0	O K
30 min Winter	94.218	0.218	12.1	867.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	108.324	0.0	409.0	23
30 min Summer	69.981	0.0	555.3	37
60 min Summer	43.110	0.0	836.2	66
120 min Summer	26.366	0.0	1034.8	126
180 min Summer	19.477	0.0	1149.5	186
240 min Summer	15.586	0.0	1226.2	244
360 min Summer	11.241	0.0	1322.2	364
480 min Summer	8.836	0.0	1379.3	482
600 min Summer	7.302	0.0	1417.2	602
720 min Summer	6.235	0.0	1443.6	720
960 min Summer	4.841	0.0	1475.0	826
1440 min Summer	3.379	0.0	1493.4	1054
2160 min Summer	2.364	0.0	1811.1	1448
2880 min Summer	1.842	0.0	1872.6	1848
4320 min Summer	1.310	0.0	1961.3	2636
5760 min Summer	1.038	0.0	2192.1	3392
7200 min Summer	0.875	0.0	2300.1	4104
8640 min Summer	0.765	0.0	2399.5	4832
10080 min Summer	0.687	0.0	2484.1	5456
15 min Winter	108.324	0.0	470.1	22
30 min Winter	69.981	0.0	630.4	37

Summary of Results for 100 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	94.264	0.264	12.2	1059.3	O K
120 min Winter	94.316	0.316	12.2	1275.0	O K
180 min Winter	94.344	0.344	12.2	1391.4	O K
240 min Winter	94.361	0.361	12.2	1462.4	O K
360 min Winter	94.379	0.379	12.2	1535.7	O K
480 min Winter	94.385	0.385	12.2	1562.3	O K
600 min Winter	94.386	0.386	12.2	1566.0	O K
720 min Winter	94.384	0.384	12.2	1556.7	O K
960 min Winter	94.374	0.374	12.2	1515.6	O K
1440 min Winter	94.350	0.350	12.2	1416.7	O K
2160 min Winter	94.321	0.321	12.2	1294.1	O K
2880 min Winter	94.293	0.293	12.2	1178.8	O K
4320 min Winter	94.246	0.246	12.2	982.4	O K
5760 min Winter	94.208	0.208	12.1	829.8	O K
7200 min Winter	94.181	0.181	11.9	719.9	O K
8640 min Winter	94.165	0.165	11.4	653.2	O K
10080 min Winter	94.154	0.154	10.6	609.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	43.110	0.0	944.3	66
120 min Winter	26.366	0.0	1164.2	124
180 min Winter	19.477	0.0	1290.0	182
240 min Winter	15.586	0.0	1373.5	240
360 min Winter	11.241	0.0	1476.6	358
480 min Winter	8.836	0.0	1536.5	472
600 min Winter	7.302	0.0	1575.1	586
720 min Winter	6.235	0.0	1600.9	698
960 min Winter	4.841	0.0	1628.7	914
1440 min Winter	3.379	0.0	1631.7	1138
2160 min Winter	2.364	0.0	2033.0	1580
2880 min Winter	1.842	0.0	2102.1	2016
4320 min Winter	1.310	0.0	2205.7	2812
5760 min Winter	1.038	0.0	2460.7	3568
7200 min Winter	0.875	0.0	2583.0	4248
8640 min Winter	0.765	0.0	2696.4	4928
10080 min Winter	0.687	0.0	2795.0	5648

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 483669 232428 SP 83669 32428
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+0

Time Area Diagram

Total Area (ha) 3.000

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	1.500	4	8	1.500

Model Details

Storage is Online Cover Level (m) 95.000

Tank or Pond Structure

Invert Level (m) 94.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	3900.0	1.000	4750.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0163-1220-0700-1220
Design Head (m)	0.700
Design Flow (l/s)	12.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	163
Invert Level (m)	94.000
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)	0.700	12.2	Kick-Flo®	0.521	10.6
Flush-Flo™	0.260	12.2	Mean Flow over Head Range	-	10.1

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.8	1.200	15.7	3.000	24.4	7.000	36.7
0.200	12.0	1.400	16.9	3.500	26.3	7.500	37.8
0.300	12.1	1.600	18.1	4.000	28.0	8.000	39.0
0.400	11.8	1.800	19.1	4.500	29.6	8.500	40.3
0.500	11.0	2.000	20.1	5.000	31.2	9.000	41.4
0.600	11.3	2.200	21.0	5.500	32.7	9.500	42.6
0.800	13.0	2.400	21.9	6.000	34.1		
1.000	14.4	2.600	22.8	6.500	35.4		

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	97.307	0.307	11.4	778.4	O K
30 min Summer	97.391	0.391	11.4	1002.0	O K
60 min Summer	97.472	0.472	11.4	1224.9	O K
120 min Summer	97.562	0.562	11.4	1478.3	O K
180 min Summer	97.611	0.611	11.4	1617.7	O K
240 min Summer	97.641	0.641	11.4	1703.8	O K
360 min Summer	97.672	0.672	11.4	1795.1	O K
480 min Summer	97.685	0.685	11.4	1832.3	O K
600 min Summer	97.688	0.688	11.4	1843.2	O K
720 min Summer	97.687	0.687	11.4	1838.9	O K
960 min Summer	97.675	0.675	11.4	1804.2	O K
1440 min Summer	97.640	0.640	11.4	1701.1	O K
2160 min Summer	97.595	0.595	11.4	1572.6	O K
2880 min Summer	97.555	0.555	11.4	1458.0	O K
4320 min Summer	97.490	0.490	11.4	1273.8	O K
5760 min Summer	97.437	0.437	11.4	1127.4	O K
7200 min Summer	97.393	0.393	11.4	1008.8	O K
8640 min Summer	97.356	0.356	11.4	909.4	O K
10080 min Summer	97.325	0.325	11.4	826.5	O K
15 min Winter	97.343	0.343	11.4	872.7	O K
30 min Winter	97.435	0.435	11.4	1123.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	151.654	0.0	652.6	23
30 min Summer	97.974	0.0	825.5	38
60 min Summer	60.354	0.0	1173.1	68
120 min Summer	36.913	0.0	1424.9	126
180 min Summer	27.268	0.0	1561.0	186
240 min Summer	21.821	0.0	1644.6	246
360 min Summer	15.737	0.0	1729.9	366
480 min Summer	12.370	0.0	1756.9	484
600 min Summer	10.223	0.0	1753.4	604
720 min Summer	8.729	0.0	1733.6	722
960 min Summer	6.777	0.0	1686.1	962
1440 min Summer	4.731	0.0	1586.0	1284
2160 min Summer	3.309	0.0	2407.4	1640
2880 min Summer	2.578	0.0	2491.6	1996
4320 min Summer	1.834	0.0	2618.0	2772
5760 min Summer	1.454	0.0	2877.1	3576
7200 min Summer	1.225	0.0	3025.7	4328
8640 min Summer	1.071	0.0	3167.3	5096
10080 min Summer	0.961	0.0	3297.3	5848
15 min Winter	151.654	0.0	728.4	23
30 min Winter	97.974	0.0	897.4	37

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	97.526	0.526	11.4	1374.9	O K
120 min Winter	97.626	0.626	11.4	1661.5	O K
180 min Winter	97.680	0.680	11.4	1818.5	O K
240 min Winter	97.713	0.713	11.4	1916.4	Flood Risk
360 min Winter	97.749	0.749	11.4	2022.8	Flood Risk
480 min Winter	97.764	0.764	11.4	2068.7	Flood Risk
600 min Winter	97.769	0.769	11.4	2085.2	Flood Risk
720 min Winter	97.769	0.769	11.4	2084.8	Flood Risk
960 min Winter	97.760	0.760	11.4	2055.3	Flood Risk
1440 min Winter	97.725	0.725	11.4	1952.4	Flood Risk
2160 min Winter	97.670	0.670	11.4	1788.6	O K
2880 min Winter	97.623	0.623	11.4	1654.2	O K
4320 min Winter	97.530	0.530	11.4	1388.3	O K
5760 min Winter	97.449	0.449	11.4	1160.1	O K
7200 min Winter	97.380	0.380	11.4	973.7	O K
8640 min Winter	97.323	0.323	11.4	820.4	O K
10080 min Winter	97.277	0.277	11.4	697.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	60.354	0.0	1311.3	66
120 min Winter	36.913	0.0	1577.9	126
180 min Winter	27.268	0.0	1710.1	184
240 min Winter	21.821	0.0	1776.8	242
360 min Winter	15.737	0.0	1806.7	360
480 min Winter	12.370	0.0	1788.7	476
600 min Winter	10.223	0.0	1767.9	592
720 min Winter	8.729	0.0	1746.5	706
960 min Winter	6.777	0.0	1703.1	934
1440 min Winter	4.731	0.0	1615.7	1370
2160 min Winter	3.309	0.0	2689.7	1716
2880 min Winter	2.578	0.0	2775.6	2168
4320 min Winter	1.834	0.0	2894.3	3064
5760 min Winter	1.454	0.0	3223.9	3864
7200 min Winter	1.225	0.0	3391.8	4616
8640 min Winter	1.071	0.0	3552.2	5360
10080 min Winter	0.961	0.0	3701.5	6048

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 483669 232428 SP 83669 32428
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 2.770

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	1.385	4	8	1.385

Model Details

Storage is Online Cover Level (m) 98.000

Tank or Pond Structure

Invert Level (m) 97.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	2420.0	1.000	3200.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0158-1140-0800-1140
Design Head (m)	0.800
Design Flow (l/s)	11.4
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	158
Invert Level (m)	97.000
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)	0.800	11.4	Kick-Flo®	0.577	9.8
Flush-Flo™	0.270	11.4	Mean Flow over Head Range	-	9.6

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.7	1.200	13.8	3.000	21.4	7.000	32.1
0.200	11.2	1.400	14.9	3.500	23.0	7.500	33.2
0.300	11.4	1.600	15.8	4.000	24.5	8.000	34.3
0.400	11.1	1.800	16.7	4.500	26.0	8.500	35.2
0.500	10.7	2.000	17.6	5.000	27.3	9.000	36.2
0.600	10.0	2.200	18.4	5.500	28.6	9.500	37.2
0.800	11.4	2.400	19.2	6.000	29.8		
1.000	12.7	2.600	19.9	6.500	31.0		

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	95.257	0.257	6.5	444.0	O K
30 min Summer	95.326	0.326	6.5	571.5	O K
60 min Summer	95.393	0.393	6.5	698.5	O K
120 min Summer	95.468	0.468	6.5	842.5	O K
180 min Summer	95.508	0.508	6.5	921.4	O K
240 min Summer	95.533	0.533	6.5	970.8	O K
360 min Summer	95.560	0.560	6.5	1024.6	O K
480 min Summer	95.571	0.571	6.5	1047.2	O K
600 min Summer	95.575	0.575	6.5	1054.5	O K
720 min Summer	95.574	0.574	6.5	1053.0	O K
960 min Summer	95.565	0.565	6.5	1034.5	O K
1440 min Summer	95.532	0.532	6.5	969.6	O K
2160 min Summer	95.491	0.491	6.5	887.8	O K
2880 min Summer	95.459	0.459	6.5	824.4	O K
4320 min Summer	95.406	0.406	6.5	722.7	O K
5760 min Summer	95.363	0.363	6.5	640.5	O K
7200 min Summer	95.327	0.327	6.5	573.8	O K
8640 min Summer	95.297	0.297	6.5	518.1	O K
10080 min Summer	95.272	0.272	6.5	471.8	O K
15 min Winter	95.286	0.286	6.5	497.8	O K
30 min Winter	95.363	0.363	6.5	641.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	151.654	0.0	374.4	23
30 min Summer	97.974	0.0	472.4	38
60 min Summer	60.354	0.0	671.3	68
120 min Summer	36.913	0.0	815.7	126
180 min Summer	27.268	0.0	894.7	186
240 min Summer	21.821	0.0	942.7	246
360 min Summer	15.737	0.0	989.4	366
480 min Summer	12.370	0.0	1001.9	484
600 min Summer	10.223	0.0	997.5	604
720 min Summer	8.729	0.0	985.5	724
960 min Summer	6.777	0.0	959.6	962
1440 min Summer	4.731	0.0	913.1	1318
2160 min Summer	3.309	0.0	1376.3	1604
2880 min Summer	2.578	0.0	1424.5	1988
4320 min Summer	1.834	0.0	1496.9	2768
5760 min Summer	1.454	0.0	1641.9	3568
7200 min Summer	1.225	0.0	1726.9	4328
8640 min Summer	1.071	0.0	1807.9	5096
10080 min Summer	0.961	0.0	1882.5	5848
15 min Winter	151.654	0.0	417.4	23
30 min Winter	97.974	0.0	512.7	37

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	95.438	0.438	6.5	784.0	O K
120 min Winter	95.521	0.521	6.5	947.1	O K
180 min Winter	95.566	0.566	6.5	1037.7	O K
240 min Winter	95.594	0.594	6.5	1094.4	O K
360 min Winter	95.625	0.625	6.5	1156.5	O K
480 min Winter	95.638	0.638	6.5	1183.9	O K
600 min Winter	95.643	0.643	6.5	1194.4	O K
720 min Winter	95.643	0.643	6.5	1195.4	O K
960 min Winter	95.636	0.636	6.5	1180.4	O K
1440 min Winter	95.609	0.609	6.5	1124.1	O K
2160 min Winter	95.560	0.560	6.5	1024.1	O K
2880 min Winter	95.516	0.516	6.5	936.2	O K
4320 min Winter	95.439	0.439	6.5	785.6	O K
5760 min Winter	95.373	0.373	6.5	659.4	O K
7200 min Winter	95.317	0.317	6.5	555.4	O K
8640 min Winter	95.271	0.271	6.5	470.0	O K
10080 min Winter	95.233	0.233	6.5	401.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	60.354	0.0	750.4	66
120 min Winter	36.913	0.0	904.2	126
180 min Winter	27.268	0.0	978.0	184
240 min Winter	21.821	0.0	1012.0	242
360 min Winter	15.737	0.0	1019.5	360
480 min Winter	12.370	0.0	1005.9	476
600 min Winter	10.223	0.0	992.2	594
720 min Winter	8.729	0.0	978.9	708
960 min Winter	6.777	0.0	953.6	936
1440 min Winter	4.731	0.0	905.1	1374
2160 min Winter	3.309	0.0	1535.6	1792
2880 min Winter	2.578	0.0	1587.7	2168
4320 min Winter	1.834	0.0	1657.2	3028
5760 min Winter	1.454	0.0	1839.8	3856
7200 min Winter	1.225	0.0	1935.7	4616
8640 min Winter	1.071	0.0	2027.4	5360
10080 min Winter	0.961	0.0	2113.1	6056

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 483669 232428 SP 83669 32428
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.580

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.790	4	8	0.790

Model Details

Storage is Online Cover Level (m) 96.000

Tank or Pond Structure

Invert Level (m) 95.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1650.0	1.000	2330.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0122-6500-0800-6500
Design Head (m)	0.800
Design Flow (l/s)	6.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	122
Invert Level (m)	95.000
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)	0.800	6.5	Kick-Flo®	0.547	5.4
Flush-Flo™	0.246	6.5	Mean Flow over Head Range	-	5.6

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.4	1.200	7.9	3.000	12.1	7.000	18.1
0.200	6.4	1.400	8.4	3.500	13.0	7.500	18.8
0.300	6.4	1.600	9.0	4.000	13.9	8.000	19.3
0.400	6.3	1.800	9.5	4.500	14.7	8.500	19.9
0.500	5.9	2.000	10.0	5.000	15.4	9.000	20.5
0.600	5.7	2.200	10.4	5.500	16.2	9.500	21.0
0.800	6.5	2.400	10.9	6.000	16.8		
1.000	7.2	2.600	11.3	6.500	17.5		

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	96.287	0.287	24.7	1594.2	O K
30 min Summer	96.367	0.367	24.7	2047.7	O K
60 min Summer	96.444	0.444	24.7	2492.9	O K
120 min Summer	96.527	0.527	25.2	2981.3	O K
180 min Summer	96.570	0.570	25.8	3234.0	O K
240 min Summer	96.594	0.594	26.1	3378.9	O K
360 min Summer	96.615	0.615	26.4	3504.5	O K
480 min Summer	96.618	0.618	26.5	3519.9	O K
600 min Summer	96.612	0.612	26.4	3481.4	O K
720 min Summer	96.600	0.600	26.2	3412.5	O K
960 min Summer	96.568	0.568	25.8	3221.9	O K
1440 min Summer	96.509	0.509	24.9	2876.6	O K
2160 min Summer	96.453	0.453	24.7	2550.0	O K
2880 min Summer	96.412	0.412	24.7	2309.3	O K
4320 min Summer	96.345	0.345	24.7	1926.1	O K
5760 min Summer	96.285	0.285	24.7	1583.9	O K
7200 min Summer	96.235	0.235	24.7	1298.9	O K
8640 min Summer	96.193	0.193	24.7	1063.3	O K
10080 min Summer	96.158	0.158	24.7	870.0	O K
15 min Winter	96.321	0.321	24.7	1789.8	O K
30 min Winter	96.410	0.410	24.7	2301.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	151.654	0.0	1624.1	23
30 min Summer	97.974	0.0	2047.4	38
60 min Summer	60.354	0.0	2586.5	68
120 min Summer	36.913	0.0	3162.4	126
180 min Summer	27.268	0.0	3506.8	186
240 min Summer	21.821	0.0	3740.7	246
360 min Summer	15.737	0.0	4048.0	364
480 min Summer	12.370	0.0	4185.0	484
600 min Summer	10.223	0.0	4183.5	602
720 min Summer	8.729	0.0	4179.0	722
960 min Summer	6.777	0.0	4164.4	960
1440 min Summer	4.731	0.0	4074.2	1172
2160 min Summer	3.309	0.0	5106.9	1544
2880 min Summer	2.578	0.0	5309.2	1960
4320 min Summer	1.834	0.0	5661.6	2772
5760 min Summer	1.454	0.0	5985.9	3576
7200 min Summer	1.225	0.0	6301.2	4320
8640 min Summer	1.071	0.0	6611.5	5024
10080 min Summer	0.961	0.0	6924.9	5752
15 min Winter	151.654	0.0	1819.1	23
30 min Winter	97.974	0.0	2029.3	37

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	96.497	0.497	24.7	2803.7	O K
120 min Winter	96.592	0.592	26.1	3363.4	O K
180 min Winter	96.641	0.641	26.8	3658.6	O K
240 min Winter	96.670	0.670	27.2	3832.5	O K
360 min Winter	96.697	0.697	27.5	3996.9	O K
480 min Winter	96.704	0.704	27.6	4037.9	Flood Risk
600 min Winter	96.701	0.701	27.6	4019.4	Flood Risk
720 min Winter	96.693	0.693	27.5	3967.6	O K
960 min Winter	96.666	0.666	27.1	3808.3	O K
1440 min Winter	96.601	0.601	26.2	3419.6	O K
2160 min Winter	96.529	0.529	25.2	2990.0	O K
2880 min Winter	96.473	0.473	24.7	2664.9	O K
4320 min Winter	96.377	0.377	24.7	2110.4	O K
5760 min Winter	96.287	0.287	24.7	1591.1	O K
7200 min Winter	96.208	0.208	24.7	1145.6	O K
8640 min Winter	96.144	0.144	24.7	791.0	O K
10080 min Winter	96.093	0.093	24.7	511.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	60.354	0.0	2897.0	66
120 min Winter	36.913	0.0	3543.9	124
180 min Winter	27.268	0.0	3926.3	184
240 min Winter	21.821	0.0	4192.0	242
360 min Winter	15.737	0.0	4223.1	358
480 min Winter	12.370	0.0	4230.4	474
600 min Winter	10.223	0.0	4230.6	590
720 min Winter	8.729	0.0	4226.0	702
960 min Winter	6.777	0.0	4207.2	926
1440 min Winter	4.731	0.0	4147.0	1332
2160 min Winter	3.309	0.0	5718.8	1652
2880 min Winter	2.578	0.0	5946.3	2108
4320 min Winter	1.834	0.0	6341.5	3028
5760 min Winter	1.454	0.0	6708.1	3864
7200 min Winter	1.225	0.0	7061.9	4608
8640 min Winter	1.071	0.0	7407.7	5280
10080 min Winter	0.961	0.0	7754.5	5952

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 483669 232428 SP 83669 32428
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 5.720

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	2.860	4	8	2.860

Model Details

Storage is Online Cover Level (m) 97.000

Tank or Pond Structure

Invert Level (m) 96.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	5430.0	1.000	6310.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0220-2480-0800-2480
Design Head (m)	0.800
Design Flow (l/s)	24.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	220
Invert Level (m)	95.700
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.800	24.8	Kick-Flo®	0.619	21.9
Flush-Flo™	0.340	24.7	Mean Flow over Head Range	-	20.0

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	7.4	1.200	30.1	3.000	46.8	7.000	70.5
0.200	21.7	1.400	32.4	3.500	50.4	7.500	73.0
0.300	24.7	1.600	34.5	4.000	53.7	8.000	75.3
0.400	24.6	1.800	36.5	4.500	56.9	8.500	77.1
0.500	23.9	2.000	38.4	5.000	59.9	9.000	79.4
0.600	22.4	2.200	40.3	5.500	62.7	9.500	81.6
0.800	24.8	2.400	42.0	6.000	65.4		
1.000	27.6	2.600	43.6	6.500	68.0		

Appendix C

CORRESPONDENCE

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Highways and Technical Services
Service Director: Rob Smith
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Buckinghamshire Council
The Gateway
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21st July 2020

Dear Claire,

Planning ref:	**15/00314/AOP**
Location:	**Land South Of The A421 West Of Far Bletchley North Of The East West Rail Link And East Of Whaddon Road Newton Longville**
Proposal:	**Outline planning application with all matters reserved except for access for a mixed-use sustainable urban extension on land to the south west of Milton Keynes to provide up to 1,855 mixed tenure dwellings; an employment area (B1); a neighbourhood centre including retail (A1/A2/A3/A4/A5), community (D1/D2) and residential (C3) uses; a primary and a secondary school; a grid road reserve; multi-functional green space; a sustainable drainage system; and associated access, drainage and public transport infrastructure.**

Buckinghamshire Council as the Lead Local Flood Authority (LLFA) has reviewed the information provided in the following documents:

- Flood Risk Assessment and Surface Water Drainage Strategy (ref. FRA001, May 2020, WSP)

The LLFA requests that further information is provided in relation to the greenfield runoff rates prior to the determination of the above proposals.

Surface water flood risk

The Flood Map for Surface Water (FMfSW) provided by the Environment Agency shows that the site lies in an area of very low to high risk of surface water flooding. An online version of this mapping data is available to view through the Environment Agency's Long term flood risk information mapping. The areas of high risk are associated with existing watercourses within the site boundary and along the existing railway line to the south of the site. These areas of surface water flood risk extend into medium to low risk events.

There are two extensive areas of surface water flood risk, one located at the junction of A421 Buckingham Road and Whaddon Road and the other near the footpath by the railway line. These areas also have an associated hazard rating of significant, meaning that this area is dangerous for most people; flood zone with deep fast flowing water.

The LLFA would strongly advise that a sequential approach is taken to locating development. The Development Framework Parameters Plan (drawing no. CSA/2955/114) indicates that the junction of A421 Buckingham Road and Whaddon Road will not be the main point of access; instead this will be located on the B4034 Buckingham Road via a new junction, therefore avoiding the area of significant hazard associated with surface water flooding.

The FRA (4.5.4) states that no development will occur in the area of surface water ponding adjacent to the railway line, however overland flow routes that convey surface water in this direction will be managed either through blue-green corridors or the highway. I would encourage the former option to be explored as a priority as this can link the development parcels to the wider public open space network and enhance the local environment and amenity. The design of the surface water drainage network and wider blue-green infrastructure should be considered from the outset and ensure that no dwellings, educational facilities or commercial buildings are located in areas shown to be at risk of surface water flooding. If proposals do show development located in areas at risk of surface water flooding, the applicant may be required to undertake surface water modelling to demonstrate that the mitigation measures are suitably robust to future occupants and users are not at risk of surface water flooding.

The FRA (4.5.6 – 4.5.8) touches upon the ordinary watercourses which are present within the site and I am pleased that the development proposals are seeking to incorporate the watercourses into a blue-green corridor. There are some indicative proposals in relation to the eastern ordinary watercourse, I would encourage that the applicant seeks to engage with the Lead Local Flood Authority to discuss proposals such as re-alignments prior to the submission of any reserved matters applications as any works to the ordinary watercourse may have implications on site layout.

Groundwater

The Infiltration SuDS Map provided by the British Geological Survey 2016, indicates that the water table in this area is variable and can range from greater than 5m below the surface to less than 3m below the surface. The FRA (4.6.4) details that on-site investigations have taken place during the winter of 2017; groundwater was recorded at depths of 2.m to 6.54m below ground level. This information should be used to inform the design of any sustainable drainage feature to ensure that there is a sufficient freeboard of 1m between any device and the water table to limit the potential capacity issues in times of high groundwater levels.

Overview of surface water drainage proposals

Indicative Surface Water Drainage Strategy (drawing no. 1442-D-003 Rev. P12) shows that the site will drain to two catchments, north and south, following the local topography. Prior to discharging to watercourses, surface water runoff will, in places, be conveyed by swales and then to strategic basins across the site. The FRA (Table 6) stipulates that a variety of SuDS will be investigated at detailed design stage such as (but not limited to) green roofs, pervious paving and filter strips. The FRA does not include all of the SuDS components as listed in the CIRIA SuDS Manual and so at detailed design these should form part of any assessment. It should also be noted that SuDS can play a crucial role in integrated the urban environment with the natural environment and will be key in ensuring that blue-green corridors feature across the development site at both a strategic and parcel scale. As part of any planning application on this site, I would expect to see a range of above ground sustainable drainage features. The final drainage scheme for each parcel should be supported by a water quality assessment as per the guidance in the CIRIA SuDS Manual.

The surface water drainage strategy should also include details of greenfield runoff rates, with should be calculated using FEH methods. The FRA (5.2.9-5.212) presents evidence as to why this approach is inappropriate, namely the total developable area being under 50ha. However, within the referenced guidance document (SCOP030219), FEH statistical method is promoted due to the approach being simple and relatively easy to use, similar to that of IH124 but with the advantage that it is a more accurate greenfield runoff estimation method. In addition, this document notes that IH124 should

also not be used for catchments less than 50ha in size. Therefore, the evidence suggests that it is more appropriate to use the FEH statistical method due to higher levels of accuracy. The FRA should be amended on this basis.

Storage calculations should demonstrate that for the 1 in 30 year event the system does not flood and any flooding occurring between the 1 in 30 year and 1 in 100 year plus 40% allowance for climate change is safely contained in the site based on the amended discharge rates. Details of the existing and proposed discharge volumes should be shown for critical storm events and durations as detailed above along with the adopted approach to mitigate any increases in discharge volumes.

If any flooding occurs for the 1 in 100 year plus 40% climate change event, details of where this flooding will occur and the volume of the flooding must be provided. For rainfall events over the 1 in 100 plus 40% climate change allowance event, a drawing showing the direction of exceedance flows must be provided.

The FRA includes a 10% allowance for urban creep to take account of any future increases in impermeable areas within the site.

An indicative maintenance schedule for the surface water drainage system has been provided at outline planning stage. At detailed design, the applicant should provide details of access, easements and further information on the maintenance tasks which are required, the persons responsible for undertaking maintenance and frequency by which these will be undertaken.

We request that the applicant visit our website, where our requirements are clearly stated. Useful documents include our Developer Pack. Our website also contains our Local Flood Risk Management Strategy (LFRMS) and Preliminary Flood Risk Assessment (PFRA) which are strategically important documents that should be reviewed.

Connecting to an ordinary watercourse
Under the terms of the Land Drainage Act 1991 and the Floods and Water Management Act 2010, the prior consent of the Lead Local Flood Authority is required for any proposed works or structures in the watercourse. After planning permission has been granted by the LPA, the applicant must apply for Land Drainage Consent from the LLFA, information and the application form can be found on our website. Please be aware that this process can take up to two months.

Yours sincerely,

Vikki Keeble
Sustainable Drainage Team Leader
Email: suds@buckinghamshire.gov.uk

BUCKINGHAMSHIRE & RIVER OUZEL INTERNAL DRAINAGE BOARD

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21 July 2020

Buckinghamshire Council
The Gateway
Gatehouse Road
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BY E-MAIL ONLY

For the attention of Mrs Claire Bayley

Dear Sir/Madam

Application No:	**15/00314/AOP**
Location:	**Land South Of The A421 West Of Far Bletchley North Of The East West Rail Link And East Of Whaddon Road Newton Longville**
Proposal:	**Outline planning application with all matters reserved except for access for a mixed-use sustainable urban extension on land to the south west of Milton Keynes to provide up to 1,855 mixed tenure dwellings; an employment area (B1); a neighbourhood centre including retail (A1/A2/A3/A4/A5), community (D1/D2) and residential (C3) uses; a primary and a secondary school; a grid road reserve; multi-functional green space; a sustainable drainage system; and associated access, drainage and public transport infrastructure.**
Grid Reference:	**483218, 232564**

The Board's advice is that when determining the surface water discharge rate, the greenfield run-off rate should only be applied to the contributing impermeable area (Ha) not the whole site. However as this is not within the Board's area, the LLFA will determine whether the proposals are acceptable.

Please direct any reply to Trevor Skelding at the Board's offices.

Yours faithfully

Trevor Skelding
Principal Engineer
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