Scott White and Hookins

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[redacted]

Drainage and Flood Risk Assessment Report

Palmer Road Sports Hub

Date: 15/11/2024
Project No. 304433
Report Reference: 304433-SWH-ZZ-ZZ-C-RP-0001
Revision: P01

Structural Engineering
Civil Engineering
CDM Consultants
Sustainability and BREEAM
Traffic and Transport
Flood Risk Assessments
Highway Engineering
Event Engineering

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Issue and Amendment Record:

Revision	Comment/Amendment	Prepared	Reviewed	Approved	Date
P01	Planning Issue	TK	IL	IL	20/11/24

Contents

1.0 Introduction

1.1 Scott White & Hookins have been instructed by Mace on behalf of Arun District Council to undertake a drainage strategy and flood risk assessment of the proposed redevelopment of the existing Angmering Sports & Social Club, West Sussex. This drainage report and flood risk assessment has been produced as a supporting document for a planning application and takes the form of a desk top study.

1.2 The site comprises of public open space used for recreational use. The proposed development comprises the demolition of an existing car park, sports & social club building and hard standing area use for basketball. A location plan is provided in Appendix A. Proposed site plans are provided in Appendix B.

1.3 On the basis of the proposed development is used for recreational purposes the scheme is classed as 'Less Vulnerable' under table 2 of the NPPF. One this basis development is considered appropriate in all flood zones apart from FZ3b. This site meets the sequential test criteria, and an exception test is not required.

	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
FZ1				X	
FZ2		ETR			
FZ3a	ETR		ETR		
FZ3b	ETR				

Green – Development appropriate
Red – Development not permitted
ETR – Exception test required to allow development

1.4 This report considers the flood risk to the proposed development and the impact that the development will have in relation flooding of adjacent areas and watercourses. It also considers any limits relating to flooding that are likely to be imposed to allow the development to be undertaken and recommends Sustainable Urban Drainage systems (SUDS) to control surface water runoff.

1.5 This report takes into account the requirements of the NPPF and local policies and is based on information received from the Environment Agency, Arun District Council and Southern Water.

1.6 Local planning policy is contained within the adopted Arun Local Plan 2011 – 2031. Relevant polices are W DM2 Flood Risk and Policy W DM3 Sustainable Drainage Systems. See Appendix .

2.0 Existing Site Conditions

2.1 The site is accessed via Decoy Drive, Angmering, Littlehampton, BN16 4DN, centred on grid reference TQ 06597 05122 and is approximately 4.1 ha in size. A location plan is given in **Appendix A.**

2.2 The site currently comprises a public open space for recreational use. There is a gravel car park, social club and hard standing multi-use court centrally within the site. The rest of the site comprises of a large, grassed area used for football. The site is flanked by an existing housing estate to the south and east, a new housing development to the north and open farmland to the west. An aerial view of the site is below as figure 1.

Figure 1 – Aerial view

2.3 A topographical survey was undertaken by Stuart Baker Land Surveyor in April 2024. The site falls from a high point at the northeast corner at 16.05m AOD to a low point in the southwest corner at 11.70m AOD over approximately 315m with a gradient of 1 in 72. See **Appendix C.**

2.4 An underground services survey was undertaken by Encompass Surveys in May 2024 (ENC/300524/3368U1). See **Appendix D.**

2.5 The survey indicates that the existing sports & social club is connected to foul drainage and the existing car park area is picked up by some gullies, these drain into the ditch which runs to the west of the site.

2.6 Existing sewer records have been supplied by Arun District Council which suggest the presence of surface water sewers in Arundel Road to the east and an existing foul sewer to the south in Decoy Road. See **Appendix D.**

2.7 The existing site is flanked to the south and west by open watercourses which run across the open farmland.

2.8 The British Geological Survey records for the site indicate that the site is likely to be underlain by Superficial head deposits comprising clay, silt, sand and gravel on top of London Clay Formation bedrock. See **Appendix E.**

2.9 The site is underlain by a principal bedrock aquifer and is not located within a Source Protection Zone

2.10 An extensive assessment of infiltration characteristics of the ground was undertaken by RSK in June 2024. This assessment included infiltration testing to BRE365 standards, 7 trial holes were dug as per the dimensions listed in the table below across the site. Due to the file size the full report will be issued as a separate document.

Trial pit	Trial Pit Dimensions (m) (L x W x D)	Geological unit	Length of test (mins)	Depth drained to (mbgl)	Test result (m/s)
SA01	1.18 x 0.50 x 1.25	Head Deposits (cohesive)	180	0.37	Insufficient infiltration
SA02	1.80 x 0.50 x 1.30	Head Deposits (cohesive)	219	0.39	Insufficient infiltration
SA03	2.00 x 0.50 x 1.30	Head Deposits (cohesive)	180	0.54	Insufficient infiltration
SA04	1.80 x 0.50 x 1.10	Head Deposits (granular)	234	0.92	1.19×10^{-3}
SA05	1.80 x 0.50 x 1.20	Head Deposits (granular)	180	0.98	1.80×10^{-4}
			98	0.63	Insufficient infiltration
SA06	1.60 x 0.50 x 1.30	Head Deposits (cohesive)	180	0.45	Insufficient infiltration
SA07	1.20 x 0.50 x 1.10	Head Deposits (cohesive)	180	0.44	Insufficient infiltration
Notes: Minor pit collapses noted within SA01 and SA07, details included within Soakaway Certificates, insufficient infiltration to calculate a rate within cohesive portions.					

2.11 Ground water monitoring was also undertaken during these site investigations and was encountered in three locations at depths between 1.2m and 3.6m below ground level.

2.12 Due to the timing of this project, the site investigations were undertaken during the summer months, so that Arun District Council can gain a full understanding of the potential for infiltration across the site, further winter ground water monitoring and infiltration testing will be undertaken and results provided at the earliest opportunity.

2.13 On the basis of the ground conditions encountered on site, the majority of trial pits had insufficient infiltration although this typically occurred within the shallow soils. At this

stage we have conservatively assumed that infiltration is not possible on site and developed a drainage strategy on this basis. However, it is likely that due to the existing nature of the site the proposed grassed pitches can continue to drain as existing with some assistance from perimeter drainage to discharge into the local watercourse network. This will be further confirmed following the additional testing currently underway.

3.0 Potential Flood Risk Affecting the site

3.1 Flood zone

3.1.1 The Flood map for planning indicates that the site is wholly located in Flood Zone 1. See extract of flood maps in **Appendix G.**

3.1.2 The flood zones are defined in table 1 of the Planning Practice Guidance (PPG) section as follows:

- Flood Zone 1 'Low Probability' – Land at less than 1 in 1000 (0.1%) annual probability of river flooding;
- Flood Zone 2 'Medium Probability' – Land between 1 in 100 (1%) and 1 in 1000 (0.1%) annual probability of river flooding, or between 1 in 200 (0.5%) and 1 in 1000 (0.1%) annual probability of river flooding;
- Flood Zone 3 'High Probability' – Land at 1 in 100 (1%) or greater annual probability of river flooding, or 1 in 200 (0.5%) or greater annual probability of river flooding.

3.2 Fluvial Flooding (overtopping of watercourses)

3.2.1 The nearest main river managed by the EA is the River Arun approximately 5.8km west of the site and is strongly tidal influenced due to its proximity to the sea. It is therefore considered that the risk of fluvial flooding alone is negligible.

3.3 Surface Water Flooding

3.3.1 The site has a gentle 1 in 72 gradients from the northeast to southwest. The EA surface water flood map shows the site at very low risk of surface water flooding. Given the permeable nature of the existing football pitches, whilst there is a gradient across the site, this would typically naturally drain away.

3.4 Ground Water Flooding

3.4.1 Summer ground water monitoring carried out by RSK revealed that ground water levels are between 1.2m and 3.6m deep across the site within the London Clay bedrock layer.

3.4.2 The Arun District Council Strategic Flood Risk Assessment (SFRA) undertaken by JBA Consulting in 2016 mapping shows all the 1km^2 grid which covers the site to be 50-75% susceptible to groundwater flooding. See SFRA extract in **Appendix H.**

3.4.3 During winter months there is a potential risk of groundwater flooding occurring across the site. However, having reviewed the topographical levels and gradients is likely that any groundwater which reaches the surface will naturally flow towards the existing ditches which flank the development site to the west.

3.5 **Reservoir Flooding**

3.5.1 EA flood maps indicate the site is not at risk of flooding in the event of a breach from reservoirs.

3.6 **Sewer Flooding**

3.6.1 Sewer maps provided by Arun District Council indicate there are foul and surface water sewers within the vicinity of the site. These sewers do not cross the site and are located in surrounding roads which fall away from the development site so there is not a risk of flooding in the event of a blockage or a heavy storm event.

3.7 **Historical Flooding**

3.7.1 The SFRA holds no flood records for the site. See map in **Appendix H**.

3.8 Our assessment of the above flood risk indicate there is a low risk of flooding across the site. However, although summer groundwater levels are relatively low a further assessment will be provided once winter groundwater levels have been identified.

4.0 Outline drainage proposals

4.1 Surface Water

4.1.1 Based on the drainage hierarchy stated in paragraph 2.3 of **Appendix L**, the preferred method of disposal of surface water from the site should be via infiltration directly into the ground. However, due to the poor infiltration rates experienced during the summer site investigation it is not practicable to undertake this method.

4.1.2 The next form of discharge on the hierarchy is to dispose of surface water into a local watercourse. As noted above, there are ditches which serve the south and western edges of the site which flow into surrounding ditches and ponds in the local area. Due to levels across the site, it is practicable to dispose of surface water run-off from the proposed car park, pavilion and sports pitches in this manner. Connection into the ditches will be subject to an ordinary watercourse application which is separate from the planning process.

4.1.3 The next form of discharge on the hierarchy is to dispose of surface water into a local surface water sewer. As noted above there is an existing surface water sewer in Arundel Road to the east of the site. Due to levels in this location of the site, it is proposed that the access road off Arundel Road which serves the site will make a connection here subject to a Section 106 application with Southern Water.

4.1.4 For this site SuDs drainage should be introduced where practicable. Although the geological information for the site indicates that the soil is made up of clay and silt layers the open nature of the proposals provides sufficient space for the use of open graded stone sub-bases in the parking area with open swales / ditches. The new grass pitches have also been designed to incorporate the use of filter drains and perforated pipes.

4.1.5 On the basis of the above the following drainage options are considered to be appropriate for this site:

Device	Description
Rain Gardens	Elements of landscaping designed to accommodate small areas of discharge close to source.
Permeable surfaces	Storm water is allowed to infiltrate through the surface into a storage layer, from which it can either infiltrate into permeable soils or discharge to sewers.

Rainwater harvesting	Reduces the annual average rate of runoff from the site by reusing water for non-potable uses e.g. toilet flushing.
Filter drains & perforated pipes	Trenches filled with granular materials (which are designed to take flows from adjacent impermeable areas) that convey runoff while allowing infiltration.
Filter Strips	Wide gently sloping areas of grass or dense vegetation that slow surface water flows and remove pollutants from run-off from adjacent hardstanding areas.
Attenuation Underground	Oversized pipes or geo-cellular tanks designed to store water below ground level.
Proprietary Treatment Systems	Petrol interceptors, silt traps and similar devices used as part of an overall SUDS scheme to provide pollution control prior to discharge.

4.1.6 It is proposed that the new access road off Arundel Road to the west of the site is drained via a network of gullies and pipes attenuated through a 5m x 40m x 0.4m deep cellular tank and discharges into an existing surface water sewer in Arundel Road via a flow control device designed for a 1 in 100 year plus 45% climate change to limit the discharge to the positively drained Qbar rate of 0.3l/s for this catchment.

4.1.7 It is proposed that the new car park, pavilion, MUGA and grassed pitch all drain into the existing ditch to the south of the site via a flow control hydro brake designed for a 1 in 100 year plus 45% climate change to be discharged at the positively drained area Qbar rate of 2.2l/s for this catchment. The drainage network in this area is split for the car park to drain via porous paving and open graded stone sub-base into perforated pipes under the car park aisle. Surface water collected at the north of the site runs into attenuation created by an open graded stone sub-base in the lower overspill area. This is combined with surface water run-off from new pavilion roof which is collected via down pipes and surrounding hard standing area and the MUGA and grassed pitch. The depth of the sub-base in the north of the site is 300mm and in the southern overspill area ranges between 625mm and 825mm. To aide with surcharged attenuation in a 1 in 100 year plus 45% climate change storm event an additional 10m x 30m x 0.4m deep cellular crate is required which will be located between the car park and the MUGA under the play area.

4.1.8 The proposed drainage for the 3G pitch and dual grass pitches to the west of the pavilion has been designed by Surfacing Solutions, they have provided a separate feasibility report which provides details for this area. We have included the drainage in these areas for coordination purposes.

4.1.9 Existing and design surface water drainage calculations are in **Appendix I.**

4.1.10 The proposed drainage strategy layout is in **Appendix J.**

4.1.11 Protection of groundwater from pollution is covered in Chapter 26 of CIRIA SuDS

Manual C753. Due to the limited extent of the surface water catchment from the development i.e., rainwater from roofs and non-residential parking areas, we can utilise the "simple qualitative method" described in this chapter (cl. 26.7.1) where we may select **"SuDS with a total pollution mitigation index that equals or exceeds the pollution hazard index",** Table 26.2 & 26.4 CIRIA refers.

Pollution Hazard (Indices method)				
Area	Pollution Hazard	TSS	Metals	Hydro-carbons
Residential Roofs	Low	0.3	0.2-0.8	0.05
Low traffic roads and parking	Low	0.5	0.4	0.4

Note – Please see CIRIA SUDS manual for full descriptions.

Pollution Mitigation (Indices method)			
Area - Main Car Park			
Component	TSS	Metals	Hydro-carbons
Permeable Paving	0.7	0.6	0.7

Note – Please see CIRIA SUDS manual for full descriptions.

4.1.12 The proposed SuDs features as shown in the above table offer sufficient pollution mitigation and are considered acceptable. Rainwater from roofs is considered to have a very low pollution risk (Table 26.2 CIRIA) for sites within FZ1. Catchpits and silt traps on gullies are to be provided before any attenuation cellular units to prevent silt and debris build up and causing blockages.

4.1.13 To ensure drainage elements function correctly, maintenance of drainage should be covered by a suitable management company and subject to a regular maintenance regime. Maintenance of SuDs to be in accordance with CIRIA SuDs manual C753 where specific intervals are advised with the document as per element type. A summary of these is in **Appendix K**.

4.2 **Foul Sewers**

4.2.1 The indicative foul sewer strategy comprises of a gravity fed network which discharge from the ground floor of the proposed pavilion building into an existing chamber which served the original club house as shown on the drainage strategy plan in **Appendix J.**

4.2.2 The indicative gravity fed system is to be designed in accordance with the guidance document: British Water Flows and Loads. The following table provides the required loadings.

Table of Loadings for Sewage Treatment Systems			
Per person / activity / day (unless otherwise specified)	FLOW	BOD	Ammonia as N
AMENITY SITES (Grams)	(Litres)	(Grams)	
Local community sports club, e.g. squash, rugby & football	40	25	6

Proposed foul sewer calculations are based on the standard local community sports club flow rates indicated in the above table for the average number of occupants.

Total Occupancy = 120 people

120people x 40 litres per day = 4,800 litres per day (4.8m3)

4800 / 24 hours = **200 litres per hour**
200 / 60 minutes = **3.33 litres per Minute**
3.33 / 60 seconds = **0.055 litres per second**

5.0 Summary and Recommendations

5.1 This Flood Risk Assessment (FRA) has been prepared by Scott White & Hookins to support a planning application for the redevelopment of the Angmering Sports & Social Club and its facilities.

5.2 This FRA concludes that:

- The site is wholly within Flood Zone 1.
- Groundwater levels across the site have been taken at the highest of 1.2m below ground level.
- The site has been assessed to be at low risk from all sources of flooding such as from sewers, overland flow and failure of reservoirs.

5.3 The drainage strategy seeks to return the rainfall run-off generated by the development via gullies, permeable paving, filter drains, cellular storage and open swales into the existing surrounding watercourse and sewer networks via suitably designed flow controls for the positively drained area to the existing Qbar flow rates calculated for a 1 in 100 year storm event plus 45% climate change.

5.4 In conclusion, the future occupants and users of the proposed development will be safe from flooding and there will be no detrimental impact on third parties. The proposal complies with the National Planning Policy (NPPF) and local planning policy with respect to flood risk and is an appropriate development at this location.

5.5 In the event of an excessive storm event which overwhelms the surface water network with a surface water flood exceedance event, overground surface water run-off shall follow the existing natural topography of the site and discharge into the existing ditches which flank the western part of the site and will not put the new building at risk of flooding.

6.0 Appendices

A. Site Location Plan
B. Proposed Site Plans
C. Existing Topographic Survey
D. Underground Services Survey
E. Existing Sewer Record Drawings
F. British Geological Survey Records
G. Flood Map Extracts
H. SFRA Flood Map Extracts
I. Design Drainage Calculations
J. Proposed Drainage Layout Drawings
K. SW Drainage Maintenance Schedule
L. Local Drainage Planning Policy applicable to the development

Appendix A

Site Location Plan

ARUN DISTRICT COUNCIL A2222-LPL

No.	Note
1	All dimensions to be verified on site by GENERAL CONTRACTOR prior to any work, setting out or shop drawings being prepared.
2	Drawings not to be scaled. Work to figured dimensions only.
3	© copyright SAUNDERS BOSTON LIMITED. All rights reserved. This drawing remains the property of SAUNDERS BOSTON LIMITED at all times and may not be reproduced or copied in whole or in part without their prior written consent.
4	This drawing and related specifications are for use only in the stated location.
5	This drawing is to be read in conjunction with all other Consultants drawings and specifications.
6	Drainage has not been surveyed and any/all pipe locations and below ground drainage runs are indicative.
7	It is assumed that all works will be carried out by a competent contractor who will be working, where appropriate, to an approved method statement.

Scale 1:1250

0 12.5 25 37.5 62.5m

Location Plan

1 : 1250

No.	Revision	Date	Chk	Auth
P04	Planning Issue	18.11.24	MC	MP
P03	Draft Planning Issue	04.11.24	MC	MP
P02	Stage 3 Issue	18.10.24	MC	MP
P01	First Issue	16.10.24	MC	MP

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STAGE 3

SBA Project Code	Drawn	Date
2072	MC	14/10/23
	Checked MP	

Client: Arun District Council

Job: Angmering Sports Hub

Drawing: Location Plan

Scale	Revision
1 : 1250 @A1	**P04**

project originator zone level type role number

2072-SBA -XX -S1 -DR -A -5001

Appendix B

Proposed Site Plan

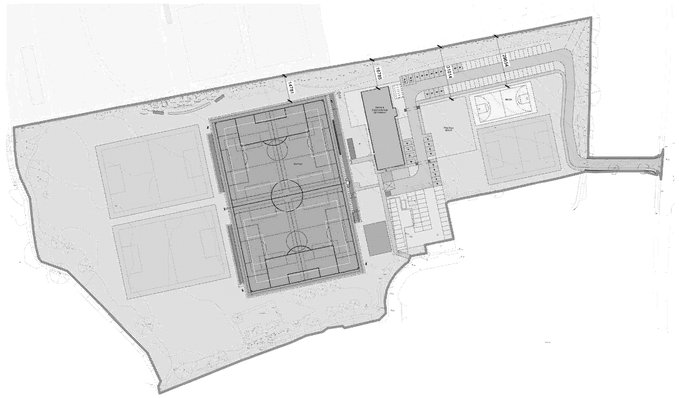
No.	Note
1	All dimensions to be verified on site by GENERAL CONTRACTOR prior to any work, setting out or shop drawings being prepared.
2	Drawings not to be scaled. Work to figured dimensions only.
3	
4	This drawing and related specifications are for use only in the stated location.
5	This drawing is to be read in conjunction with all other Consultants drawings and specifications.
6	Drainage has not been surveyed and any/all pipe locations and below ground drainage runs are indicative.
7	It is assumed that all works will be carried out by a competent contractor who will be working, where appropriate, to an approved method statement.

MEP information:
For latest MEP design see DWG: (E1901) 24020-ION-XX-XX-DR-E-1901_P1 - Prop Site Ext Ltg (bound)
Received: 18/10/2024

Site planting layout indicative, refer to landscape architects details and specification

- Sports & Community Hub
- Play Area
- MUGA
- Resin bonded
- 3G Pitch
- 3G Pitch Spectator Areas
- Cycle Parking
- Tarmac
- Grasscrete
- Bin Store
- ASHP Equipment
- Storage Container
- Feeder Pillar
- Cricket Nets
- Cricket Shelters
- Outdoor Gym
- Tactile paving & drop curbs
- Retaining walls (Indicative)
- Banked Viewing Areas
- Emergency Vehicle Parking
- DDA parking space
- DDA & EV parking space
- EV charging parking space
- Existing Planting (indicative)
- Potential proposed planting (indicative tbc)
- Trees removed
- Trees pruning

Sports pitches approved under A/122/19/OUT
Cricket Nets (not to be included as part of the scheme)
Potential future site access
Grasscrete parking bays
Root protection zone
Potential future 5m access route
Cycle Parking (42 spaces)
Resin bonded path and patio
Tarmac access route to transport & drainage consultants details
114 Parking Spaces (6 Accessible & 25 EV)
Trees pruning for pitch access refer to Arboriculturist's information
To pitches
Main Entrance
MUGA
Retain tree / hedge line
Tactile paving & drop curbs
Trees / hedge line removed for cricket pitch boundary
Cricket shelters
Play Area 600m²
Planting and positions indicative. Refer to landscape architects details and specification
5m access route
Overhead cables across access
Refer to transport consultants drawings and details for access
7v7 Mini Soccer Grass Pitch 55 x 37m
3G Pitch 106m x 70m. Refer to SSL for 3G pitch details and specification
Storage Container
Sports & Community Hub GIFA 654m²
To 3G pitch
5v5 Mini Soccer Grass Pitch 37 x 27m
Site access
Boot cleaners
Delivery
ASHP Equipment
Retaining walls by specialist
Proposed pedestrian route
Public right of way
Bin Store
Spectator Area
Storage Area
Public right of way
7v7 Mini Soccer Grass Pitch 55 x 37m
Outdoor Gym 235m²
Outline of Existing Pavilion to be demolished
Pitch maintenance access to landscape architects details
Existing vehicular access route to be blocked after construction but with continued and extended pedestrian and cyclist access
Floodlights by SSL
Public right of way



Site Boundary Distance Key

Site Plan
1 : 500

Scale 1:500
0 5 10 15 25m

No.	Revision	Date	Chk	Auth
P19	Planning Issue	18.11.24	MC	MP
P18	Draft Planning Issue	04.11.24	MC	MP
P17	Container relocated after client confirmation on 01/11/2024 and updates to Arboricultural information	01.11.24	MC	MP
P16	Drainage overlay removed after client request	24.10.24	MC	MP
P15	Stage 3 Issue	18.10.24	MC	MP
P14	Updates following clients feedback & Sub station omitted	07.10.24	MC	MP
P13	Updates following clients feedback	01.10.24	MC	MP
P12	Larger size 3G pitch outline added & external finishes around Sports Hub updated	12/09/24	MC	MP
P11	Updates to layout following comments from client team	09/09/24	MC	MP
P10	Updates following public consultation comments intergration	22/08/24	MC	MP
P09	Updates following comments from PM	12/07/24	MC	MP
P08	Stage 2 Issue	05/07/24	MC	MP

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STAGE 3

SBA Project Code: 2072
Drawn: MC
Checked: MP
Date: 02/05/2024

Client: Arun District Council

Job: Angmering Sports Hub

Drawing: Site Plan

Scale: As indicated @A0

Revision: P19

project originator zone level type role number
2072-SBA -XX -S1 -DR -A -5002

Appendix C

Existing Topographical Survey

Appendix D

Underground Utilities Plan

DO NOT SCALE FROM THIS DRAWING - CHECK ALL DIMENSIONS ON SITE

THIS DRAWING IS INDICATIVE ONLY. THEREFORE, FURNISHING CONTRACTORS MUST CHECK ALL INFORMATION SHOWN FOR ACCURACY, PRIOR TO ANALYSING, DRAWING FROM ANY INCONSISTENCIES WITH

ANY INACCURACIES WITH THIS DRAWING MUST BE REPORTED TO ION CONSULTING ENGINEERS AT THE EARLIEST OPPORTUNITY

0 1 2 3 4 5 6 7 8 9 10m

BACKGROUND INFORMATION

ION XREF DRG No.		AutoCAD Dwg Rev (2024-09-19)	
RECEIVED FROM	DRAWING NUMBER	REV	DATE REC'D
Stuart Dolley	2315		2024.09.06

NOTES

NOTES

1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH THE ION CONSULTING ENGINEERS SPECIFICATION FOR THE MECHANICAL & ELECTRICAL SERVICES INSTALLATION.

LEGEND

- UKPN HV CABLES.
- UKPN LV CABLES.
- UKPN LV POLE.
- OPENREACH DUCTS.
- OPENREACH SPLIT COUPLING.
- OPENREACH CHANGE OF STATE.
- OPENREACH BOX.
- OPENREACH POLE.
- OPENREACH PCP.
- OPENREACH FUTURE PCP.
- OPENREACH KIOSK.
- DRAIN.
- GAS MAINS.
- SEWER MAINS.
- DRAINAGE MANHOLE.
- WATER MAINS.
- WATER MANHOLE.

REV	DATE	DESCRIPTION	DRN	CHK
P1	18.10.2024	RIBA STAGE 3 - PRELIMINARY ISSUE	AH	RD

CLIENT: ARUN DISTRICT COUNCIL

PROJECT: PALMER ROAD SPORTS HUB

TITLE: EXISTING EXTERNAL SITE UTILITIES SERVICES LAYOUT

STATUS: **PRELIMINARY** | SCALE: 1:250

Building Services Consulting Engineers
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SIZE: A0

DWG No: 24020-ION-XX-XX-DR-ME-0901 | REV: P1

Appendix E

Existing Sewer Records Plan

Scale: 1:1250 | Date: 21/05/24 | Wastewater Plan A2
Map Centre: 506558,105085 | Our Ref: 1474708 - 2 | Powered by digdat

Foul Gravity Sewer
Combined Gravity Sewer
Culverted Water Course or Treated Effluent
Surface Water Gravity Sewer
Rising Main, Vacuum or Syphon
Combined Outfall
Surface Water Outfall
Foul Outfall
Surface Water Inlet
Combined Pumping Station
Surface Water Pumping Station
Foul Pumping Station
Water Treatment Works
Section 104 Area
Building Over Agreement Area
Foul Manhole
Combined Manhole
Surface Water Manhole
Side Entry Manhole, Decarcation Chamber, Dummy Manhole or Surface Water Soakaway

amanda.white@apogeeutilityconsultants.co.uk
427290

WATER for LIFE
from Southern Water

WARNING: BAC pipes are constructed of Bonded Asbestos Cement.

WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement.

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
5703	F	0.00	0.00	
5801	F	11.31	10.02	
5802	F	11.17	9.90	
5803	F	11.38	9.63	
5901	F	12.22	11.22	
5902	F	12.82	0.00	
5903	F	11.77	10.68	
6001	F	13.84	12.27	
6002	F	0.00	0.00	
6003	F	0.00	0.00	
6004	F	0.00	0.00	
6005	F	0.00	0.00	
6006	F	0.00	0.00	
6007	F	0.00	0.00	
6701	F	11.43	10.23	
6801	F	11.76	10.49	
6802	F	11.72	10.33	
6803	F	12.47	0.00	
6805	F	0.00	0.00	
6901	F	13.21	0.00	
6902	F	0.00	0.00	
6903	F	0.00	0.00	
7001	F	13.14	11.49	
7002	F	13.15	11.90	
7003	F	13.62	12.26	
7004	F	0.00	0.00	
7006	F	13.45	12.10	
7101	F	14.00	12.85	
7103	F	13.95	12.60	
7201	F	15.01	13.66	
7302	F	18.10	16.75	
7801	F	12.11	10.21	
7802	F	13.31	11.35	
7803	F	0.00	0.00	
7804	F	0.00	0.00	
7805	F	0.00	0.00	
7806	F	0.00	0.00	
7807	F	0.00	0.00	
7901	F	12.71	11.11	
7902	F	14.23	11.67	
7903	F	14.22	12.42	
7904	F	14.35	12.95	
8801	F	13.64	11.58	
8802	F	14.10	12.00	

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

Appendix F

British Geological Maps

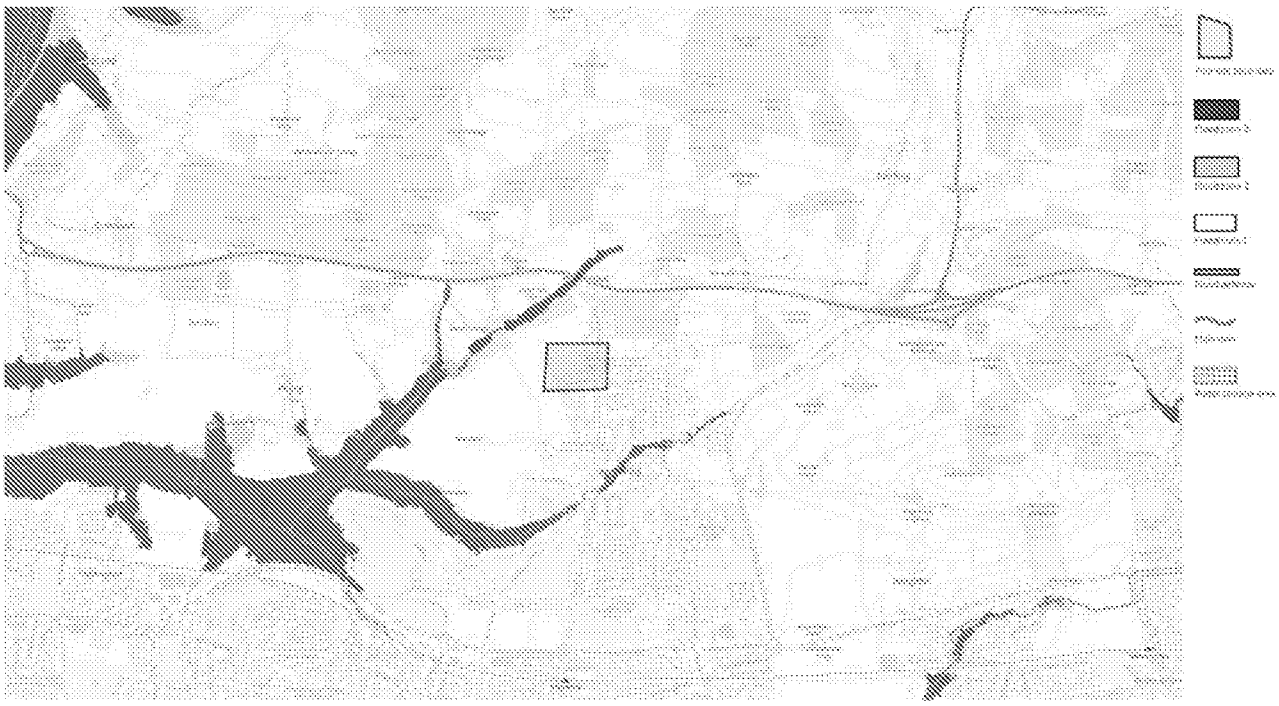
Superficial Layers – Head Deposits (Clay, Sand, Silt and Gravel)

Bedrock Layers – London Clay Formation

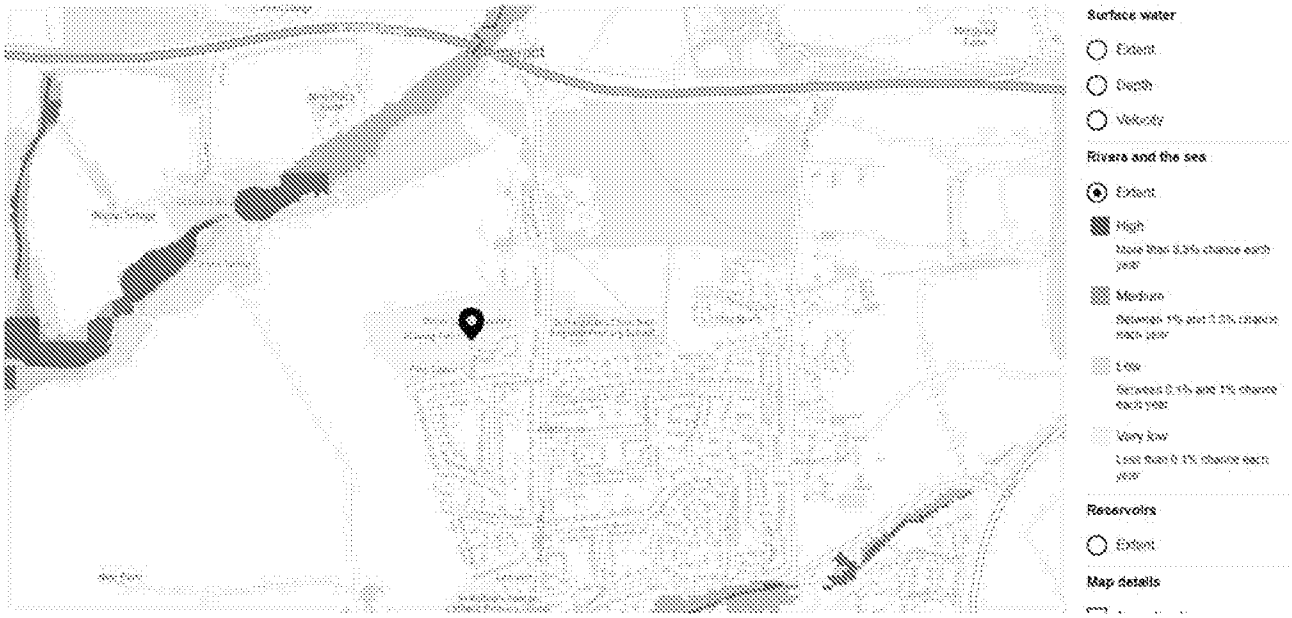
Appendix G

Flood Extract Maps

Flood Zone



River Flooding



Low Probability (Flood Zone 1) means that each year this area has a chance of flooding of less than 0.1%. This takes into account the effect of any flood defences in the area. These defences reduce but do not completely stop the chance of flooding as they can be overtopped, or fail.

Medium Probability (Flood Zone 2) means that each year this area has a chance of flooding of between 0.1% and 1%. This takes into account the effect of any flood defences in the area. These defences reduce but do not completely stop the chance of flooding as they can be overtopped, or fail.

High Probability (Flood Zone 3) means that each year this area has a chance of flooding of greater than 1%. This takes into account the effect of any flood defences in the area. These defences reduce but do not completely stop the chance of flooding as they can be overtopped, or fail.

Surface Water Flooding

Very low risk means that each year this area has a chance of flooding of less than 0.1%. Flooding from surface water is difficult to predict as rainfall location and volume are difficult to forecast. In addition, local features can greatly affect the chance and severity of flooding.

Low risk means that each year this area has a chance of flooding of between 0.1% and 1%. Flooding from surface water is difficult to predict as rainfall location and volume are difficult to forecast. In addition, local features can greatly affect the chance and severity of flooding.

Medium risk means that each year this area has a chance of flooding of between 1% and 3.3%. Flooding from surface water is difficult to predict as rainfall location and volume are difficult to forecast. In addition, local features can greatly affect the chance and severity of flooding.

High risk means that each year this area has a chance of flooding of greater than 3.3%. Flooding from surface water is difficult to predict as rainfall location and volume are difficult to forecast. In addition, local features can greatly affect the chance and severity of flooding.

Appendix H

SFRA Flood Map Extract Maps

N

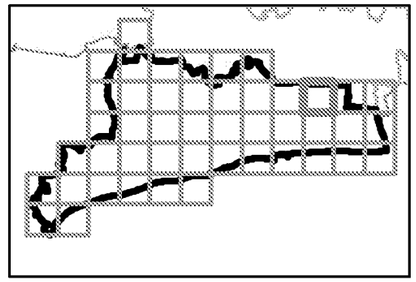
Notes

The Areas Susceptible to Groundwater Flooding (ASTGWF) is a strategic scale map showing groundwater flood areas on a 1km square grid. The data was produced to annotate Indicative Flood Risk Areas for Preliminary Flood Risk Assessment (PFRA) studies and allow the Lead Local Flood Authorities (LLFAs) to determine whether there may be a risk of flooding from groundwater.

This data shows the proportion of each 1km grid square where geological and hydrogeological condition show that groundwater might emerge. It does not show the likelihood of groundwater flooding occurring. It does not take account of the chance of flooding from groundwater rebound. This dataset covers a large area of land, and only isolated locations within the overall susceptible area are actually likely to suffer the consequences of groundwater flooding.

The ASTGWF data should be used only in combination with other information, for example local data or historic data. It should not be used as sole evidence for any specific flood risk management, land use planning or other decisions at any scale. However, the data can help to identify areas for assessment at a local scale where finer resolution datasets exist.

Key Plan



Legend

Arun District SFRA boundary

< 25%

>= 25% <50%

>= 50% <75%

>= 75%

0 0.125 0.25 0.5 km

REF	Date	Comments
A	June 2018	-
B		
C		

ARUN DISTRICT COUNCIL

LEVEL 1 SFRA: APPENDIX F
AREAS SUSCEPTIBLE TO GROUNDWATER

Sheet No: 37 of 46 Index Number: AGW_37

JBA

ARUN DISTRICT COUNCIL

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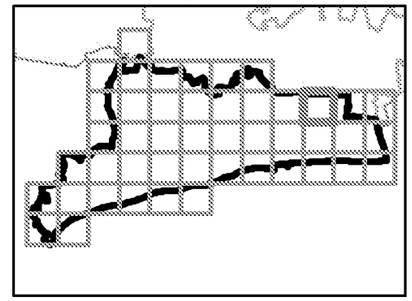
Notes

The Historic Flooding Map shows the recorded incidents and flood outlines provided by Arun District Council, West Sussex County Council, Southern Water and Environment Agency. Historical flood extent was obtained from the Environment Agency.

Flooding incidents provided have been categorised based upon the details provided in the records. Unknown flood points could not be determined from the information provided, and therefore could be from a number of sources.

Please note that not all historical records may be shown on this map, and that it is therefore advised you contact Arun District Council for updated information post 2015.

Key Plan



Legend

- Arun District SFRA boundary
- Historic flood outline
- Source of flooding
  - Fluvial
  - Coastal
  - Tidal
  - Surface Water
  - Pasture
  - Unknown

0 0.125 0.25 0.5 km

REF	Date	Comments
A	June 2015	-
B		
C		

ARUN DISTRICT COUNCIL

LEVEL 1 SFRA: APPENDIX H HISTORIC FLOODING RECORDS

Sheet No: 37 of 48 Index Number: ADC_37

ARUN DISTRICT COUNCIL

Appendix I

Existing and Proposed Drainage Calculations

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.400
Area (ha)	0.077	Urban	0.000
SAAR (mm)	750	Region Number	Region 7

Results l/s

QBAR Rural	0.3
QBAR Urban	0.3
Q100 years	0.9
Q1 year	0.2
Q30 years	0.6
Q100 years	0.9

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.400
Area (ha)	0.507	Urban	0.000
SAAR (mm)	750	Region Number	Region 7

Results l/s

QBAR Rural	1.9
QBAR Urban	1.9
Q100 years	6.0
Q1 year	1.6
Q30 years	4.2
Q100 years	6.0

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.400
Area (ha)	0.782	Urban	0.000
SAAR (mm)	719	Region Number	Region 7

Results l/s

QBAR Rural	2.7
QBAR Urban	2.7
Q100 years	8.8
Q1 year	2.3
Q30 years	6.2
Q100 years	8.8

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.400
Area (ha)	0.674	Urban	0.000
SAAR (mm)	750	Region Number	Region 7

Results l/s

QBAR Rural	2.5
QBAR Urban	2.5
Q100 years	7.9
Q1 year	2.1
Q30 years	5.6
Q100 years	7.9

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	100	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	1.000	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	Cover Level (m)	Node Type	Easting (m)	Northing (m)	Depth (m)
Depth/Area 1	0.077	14.200	Junction	506431.620	105065.527	1.100

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Additional Storage (m³/ha)	0.0
Summer CV	1.000	Skip Steady State	x	Check Discharge Rate(s)	x
Winter CV	1.000	Drain Down Time (mins)	1440	Check Discharge Volume	x

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
100	45	0	0

Node Depth/Area 1 Online Orifice Control

Flap Valve	x	Design Depth (m)	0.500	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Flow (l/s)	0.3		
Invert Level (m)	11.000	Diameter (m)	0.014		

Node Depth/Area 1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	3.0	Invert Level (m)	13.100
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	576

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	200.0	0.0	0.400	200.0	0.0	0.401	0.0	0.0

Other (defaults)

Entry Loss (manhole)	0.250	Entry Loss (junction)	0.000	Apply Recommended Losses	x
Exit Loss (manhole)	0.250	Exit Loss (junction)	0.000	Flood Risk (m)	0.300

Approval Settings

Node Size	✓	Minimum Full Bore Velocity (m/s)	
Node Losses	✓	Maximum Full Bore Velocity (m/s)	3.000
Link Size	✓	Proportional Velocity	✓
Minimum Diameter (mm)	150	Return Period (years)	
Link Length	✓	Minimum Proportional Velocity (m/s)	0.750
Maximum Length (m)	100.000	Maximum Proportional Velocity (m/s)	3.000
Coordinates	✓	Surcharged Depth	✓
Accuracy (m)	1.000	Return Period (years)	
Crossings	✓	Maximum Surcharged Depth (m)	0.100
Cover Depth	✓	Flooding	✓
Minimum Cover Depth (m)		Return Period (years)	30
Maximum Cover Depth (m)	3.000	Time to Half Empty	x
Backdrops	✓	Discharge Rates	✓
Minimum Backdrop Height (m)		Discharge Volume	✓
Maximum Backdrop Height (m)	1.500	100 year 360 minute (m^3)	
Full Bore Velocity	✓		

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year +45% CC 15 minute summer	541.474	153.218
100 year +45% CC 15 minute winter	379.982	153.218
100 year +45% CC 30 minute summer	361.949	102.419
100 year +45% CC 30 minute winter	254.000	102.419
100 year +45% CC 60 minute summer	246.536	65.152
100 year +45% CC 60 minute winter	163.793	65.152
100 year +45% CC 120 minute summer	146.861	38.811
100 year +45% CC 120 minute winter	97.571	38.811
100 year +45% CC 180 minute summer	110.449	28.422
100 year +45% CC 180 minute winter	71.795	28.422
100 year +45% CC 240 minute summer	85.878	22.695
100 year +45% CC 240 minute winter	57.055	22.695
100 year +45% CC 360 minute summer	63.826	16.425
100 year +45% CC 360 minute winter	41.489	16.425
100 year +45% CC 480 minute summer	49.190	12.999
100 year +45% CC 480 minute winter	32.681	12.999
100 year +45% CC 600 minute summer	39.565	10.822
100 year +45% CC 600 minute winter	27.033	10.822
100 year +45% CC 720 minute summer	34.726	9.307
100 year +45% CC 720 minute winter	23.338	9.307
100 year +45% CC 960 minute summer	27.812	7.323
100 year +45% CC 960 minute winter	18.423	7.323
100 year +45% CC 1440 minute summer	19.514	5.230
100 year +45% CC 1440 minute winter	13.114	5.230
100 year +45% CC 2160 minute summer	13.563	3.748
100 year +45% CC 2160 minute winter	9.345	3.748
100 year +45% CC 2880 minute summer	11.095	2.974
100 year +45% CC 2880 minute winter	7.457	2.974
100 year +45% CC 4320 minute summer	8.303	2.171
100 year +45% CC 4320 minute winter	5.468	2.171
100 year +45% CC 5760 minute summer	6.852	1.754
100 year +45% CC 5760 minute winter	4.435	1.754
100 year +45% CC 7200 minute summer	5.882	1.500

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year +45% CC 7200 minute winter	3.796	1.500
100 year +45% CC 8640 minute summer	5.208	1.328
100 year +45% CC 8640 minute winter	3.361	1.328
100 year +45% CC 10080 minute summer	4.720	1.204
100 year +45% CC 10080 minute winter	3.046	1.204

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 77.51%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute winter	Depth/Area 1	352	13.406	0.306	8.9	61.3385	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
360 minute winter	Depth/Area 1	Orifice	0.6	65.6

Results for 100 year +45% CC 15 minute summer. 1455 minute analysis at 1 minute timestep. Mass balance: 99.50%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	Depth/Area 1	20	13.232	0.132	68.1	26.5557	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
15 minute summer	Depth/Area 1	Orifice	0.6	29.3

Results for 100 year +45% CC 15 minute winter, 1455 minute analysis at 1 minute timestep. Mass balance: 77.51%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	Depth/Area 1	20	13.266	0.166	63.8	33.3669	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
15 minute winter	Depth/Area 1	Orifice	0.6	36.1

Results for 100 year +45% CC 30 minute summer. 1470 minute analysis at 1 minute timestep. Mass balance: 99.91%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute summer	Depth/Area 1	35	13.280	0.180	62.3	36.1008	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
30 minute summer	Depth/Area 1	Orifice	0.6	39.3

Results for 100 year +45% CC 30 minute winter. 1470 minute analysis at 1 minute timestep. Mass balance: 99.73%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m^3)	Flood (m^3)	Status
30 minute winter	Depth/Area 1	34	13.281	0.181	50.4	36.3028	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m^3)
30 minute winter	Depth/Area 1	Orifice	0.6	39.5

Results for 100 year +45% CC 60 minute summer. 1500 minute analysis at 1 minute timestep. Mass balance: 96.36%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m^3)	Flood (m^3)	Status
60 minute summer	Depth/Area 1	64	13.338	0.238	47.3	47.6870	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m^3)
60 minute summer	Depth/Area 1	Orifice	0.6	52.0

Results for 100 year +45% CC 60 minute winter. 1500 minute analysis at 1 minute timestep. Mass balance: 99.81%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m^3)	Flood (m^3)	Status
60 minute winter	Depth/Area 1	63	13.330	0.230	34.2	46.0322	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m^3)
60 minute winter	Depth/Area 1	Orifice	0.6	50.3

Results for 100 year +45% CC 120 minute summer. 1560 minute analysis at 2 minute timestep. Mass balance: 97.88%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m^3)	Flood (m^3)	Status
120 minute summer	Depth/Area 1	124	13.370	0.270	30.0	54.1272	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m^3)
120 minute summer	Depth/Area 1	Orifice	0.6	56.9

Results for 100 year +45% CC 120 minute winter. 1560 minute analysis at 2 minute timestep. Mass balance: 96.61%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	Depth/Area 1	122	13.367	0.267	20.7	53.5442	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
120 minute winter	Depth/Area 1	Orifice	0.6	56.8

Results for 100 year +45% CC 180 minute summer. 1620 minute analysis at 4 minute timestep. Mass balance: 96.84%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m^3)	Flood (m^3)	Status
180 minute summer	Depth/Area 1	184	13.384	0.284	22.0	56.9762	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m^3)
180 minute summer	Depth/Area 1	Orifice	0.6	59.1

Results for 100 year +45% CC 180 minute winter. 1620 minute analysis at 4 minute timestep. Mass balance: 96.80%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
180 minute winter	Depth/Area 1	184	13.385	0.285	15.1	57.1762	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
180 minute winter	Depth/Area 1	Orifice	0.6	59.1

Results for 100 year +45% CC 240 minute summer. 1680 minute analysis at 4 minute timestep. Mass balance: 97.10%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m^3)	Flood (m^3)	Status
240 minute summer	Depth/Area 1	244	13.395	0.295	18.4	59.1613	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m^3)
240 minute summer	Depth/Area 1	Orifice	0.6	61.4

Results for 100 year +45% CC 240 minute winter. 1680 minute analysis at 4 minute timestep. Mass balance: 97.02%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
240 minute winter	Depth/Area 1	240	13.397	0.297	12.2	59.5521	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
240 minute winter	Depth/Area 1	Orifice	0.6	61.3

Results for 100 year +45% CC 360 minute summer. 1800 minute analysis at 8 minute timestep. Mass balance: 97.25%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m^3)	Flood (m^3)	Status
360 minute summer	Depth/Area 1	360	13.404	0.304	13.7	60.9104	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m^3)
360 minute summer	Depth/Area 1	Orifice	0.6	65.6

Results for 100 year +45% CC 360 minute winter. 1800 minute analysis at 8 minute timestep. Mass balance: 97.24%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute winter	Depth/Area 1	352	13.406	0.306	8.9	61.3385	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
360 minute winter	Depth/Area 1	Orifice	0.6	65.6

Results for 100 year +45% CC 480 minute summer. 1920 minute analysis at 8 minute timestep. Mass balance: 97.43%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
480 minute summer	Depth/Area 1	480	13.403	0.303	10.5	60.7117	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
480 minute summer	Depth/Area 1	Orifice	0.6	69.8

Results for 100 year +45% CC 480 minute winter. 1920 minute analysis at 8 minute timestep. Mass balance: 97.37%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
480 minute winter	Depth/Area 1	472	13.406	0.306	7.0	61.3295	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
480 minute winter	Depth/Area 1	Orifice	0.6	69.7

Results for 100 year +45% CC 600 minute summer. 2040 minute analysis at 15 minute timestep. Mass balance: 97.51%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m^3)	Flood (m^3)	Status
600 minute summer	Depth/Area 1	600	13.400	0.300	8.5	60.0904	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m^3)
600 minute summer	Depth/Area 1	Orifice	0.6	73.7

Results for 100 year +45% CC 600 minute winter. 2040 minute analysis at 15 minute timestep. Mass balance: 97.54%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
600 minute winter	Depth/Area 1	585	13.402	0.302	5.8	60.4969	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
600 minute winter	Depth/Area 1	Orifice	0.6	73.6

Results for 100 year +45% CC 720 minute summer. 2160 minute analysis at 15 minute timestep. Mass balance: 97.56%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m^3)	Flood (m^3)	Status
720 minute summer	Depth/Area 1	720	13.392	0.292	7.4	58.4756	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m^3)
720 minute summer	Depth/Area 1	Orifice	0.6	77.8

Results for 100 year +45% CC 720 minute winter. 2160 minute analysis at 15 minute timestep. Mass balance: 97.58%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
720 minute winter	Depth/Area 1	690	13.398	0.298	5.0	59.7634	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
720 minute winter	Depth/Area 1	Orifice	0.6	77.7

Results for 100 year +45% CC 960 minute summer. 2400 minute analysis at 15 minute timestep. Mass balance: 97.67%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m^3)	Flood (m^3)	Status
960 minute summer	Depth/Area 1	825	13.377	0.277	5.9	55.4899	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m^3)
960 minute summer	Depth/Area 1	Orifice	0.6	85.5

Results for 100 year +45% CC 960 minute winter. 2400 minute analysis at 15 minute timestep. Mass balance: 97.67%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
960 minute winter	Depth/Area 1	900	13.379	0.279	3.9	55.9888	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
960 minute winter	Depth/Area 1	Orifice	0.6	85.5

Results for 100 year +45% CC 1440 minute summer. 2880 minute analysis at 30 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute summer	Depth/Area 1	1080	13.353	0.253	4.2	50.7465	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
1440 minute summer	Depth/Area 1	Orifice	0.6	96.4

Results for 100 year +45% CC 1440 minute winter. 2880 minute analysis at 30 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m^3)	Flood (m^3)	Status
1440 minute winter	Depth/Area 1	1140	13.351	0.251	2.8	50.2535	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m^3)
1440 minute winter	Depth/Area 1	Orifice	0.6	96.7

Results for 100 year +45% CC 2160 minute summer. 3600 minute analysis at 60 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
2160 minute summer	Depth/Area 1	1500	13.326	0.226	2.9	45.3230	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
2160 minute summer	Depth/Area 1	Orifice	0.6	102.9

Results for 100 year +45% CC 2160 minute winter. 3600 minute analysis at 60 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m^3)	Flood (m^3)	Status
2160 minute winter	Depth/Area 1	1620	13.322	0.222	2.0	44.5114	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m^3)
2160 minute winter	Depth/Area 1	Orifice	0.6	106.3

Results for 100 year +45% CC 2880 minute summer. 4320 minute analysis at 60 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
2880 minute summer	Depth/Area 1	1920	13.305	0.205	2.4	41.0308	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
2880 minute summer	Depth/Area 1	Orifice	0.6	108.9

Results for 100 year +45% CC 2880 minute winter. 4320 minute analysis at 60 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m^3)	Flood (m^3)	Status
2880 minute winter	Depth/Area 1	2040	13.280	0.180	1.6	36.0093	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m^3)
2880 minute winter	Depth/Area 1	Orifice	0.6	109.9

Results for 100 year +45% CC 4320 minute summer. 5760 minute analysis at 60 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
4320 minute summer	Depth/Area 1	2700	13.266	0.166	1.8	33.2655	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
4320 minute summer	Depth/Area 1	Orifice	0.6	121.3

Results for 100 year +45% CC 4320 minute winter. 5760 minute analysis at 60 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m^3)	Flood (m^3)	Status
4320 minute winter	Depth/Area 1	2820	13.231	0.131	1.2	26.3315	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m^3)
4320 minute winter	Depth/Area 1	Orifice	0.6	120.3

Results for 100 year +45% CC 5760 minute summer. 7200 minute analysis at 60 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
5760 minute summer	Depth/Area 1	3480	13.238	0.138	1.5	27.6282	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
5760 minute summer	Depth/Area 1	Orifice	0.6	127.1

Results for 100 year +45% CC 5760 minute winter. 7200 minute analysis at 60 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m^3)	Flood (m^3)	Status
5760 minute winter	Depth/Area 1	3600	13.186	0.086	0.9	17.2465	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m^3)
5760 minute winter	Depth/Area 1	Orifice	0.6	131.7

Results for 100 year +45% CC 7200 minute summer. 8640 minute analysis at 60 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
7200 minute summer	Depth/Area 1	4200	13.214	0.114	1.3	22.8273	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
7200 minute summer	Depth/Area 1	Orifice	0.6	135.0

Results for 100 year +45% CC 7200 minute winter. 8640 minute analysis at 60 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m^3)	Flood (m^3)	Status
7200 minute winter	Depth/Area 1	4380	13.155	0.055	0.8	11.0128	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m^3)
7200 minute winter	Depth/Area 1	Orifice	0.6	134.6

Results for 100 year +45% CC 8640 minute summer. 10080 minute analysis at 60 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
8640 minute summer	Depth/Area 1	4920	13.193	0.093	1.1	18.7081	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
8640 minute summer	Depth/Area 1	Orifice	0.6	145.1

Results for 100 year +45% CC 8640 minute winter. 10080 minute analysis at 60 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m^3)	Flood (m^3)	Status
8640 minute winter	Depth/Area 1	5100	13.127	0.027	0.7	5.4680	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m^3)
8640 minute winter	Depth/Area 1	Orifice	0.6	144.0

Results for 100 year +45% CC 10080 minute summer. 11520 minute analysis at 60 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
10080 minute summer	Depth/Area 1	5640	13.179	0.079	1.0	15.8997	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
10080 minute summer	Depth/Area 1	Orifice	0.6	154.4

Results for 100 year +45% CC 10080 minute winter. 11520 minute analysis at 60 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
10080 minute winter	Depth/Area 1	5760	13.106	0.006	0.7	1.2302	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
10080 minute winter	Depth/Area 1	Orifice	0.6	152.6

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	100	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	1.000	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	50.0		

Adoptable Manhole Type

Max Width (mm)	Diameter (mm)	Max Width (mm)	Diameter (mm)
374	1200	749	1500
499	1350	900	1800

>900 Link+900 mm

Max Depth (m)	Diameter (mm)	Max Depth (m)	Diameter (mm)
1.500	1050	99.999	1200

Circular Link Type

Shape	Circular	Auto Increment (mm)	75
Barrels	1	Follow Ground	x

Available Diameters (mm)

100 | 150

Nodes

	Name	Area (ha)	T of E (mins)	Cover Level (m)	Node Type	Easting (m)	Northing (m)	Depth (m)
✓	Depth/Area 1	0.507	5.00	13.600	Junction	506431.620	105065.527	0.880
✓	Depth/Area 2	0.000	5.00	14.000	Junction	506430.417	105066.145	1.000

Links

ame	US Node	DS Node	Length (m)	ks (mm) / n	Velocity Equation	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	Link Type	T of C (mins)	F (m
000	Depth/Area 2	Depth/Area 1	1.352	0.600	Colebrook-White	13.000	12.720	0.280	4.8	100	Circular	5.01	

JS pth m)	DS Depth (m)	Minimum Depth (m)	Maximum Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)	Notes
900	0.780	0.780	0.900	0.000	0.0	0	0.000	Velocity is more than 3 m/s | Upstream Depth is less than the specif

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	1.352	4.8	100	Circular	14.000	13.000	0.000	13.600	12.720	0.780

Link	US Node	Node Type	DS Node	Node Type
1.000	Depth/Area 2	Junction	Depth/Area 1	Junction

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Node Type	Connections	Link	IL (m)	Dia (mm)	Link Type
Depth/Area 1	506431.620	105065.527	13.600	0.880	Junction	1	1.000	12.720	100	Circular
Depth/Area 2	506430.417	105066.145	14.000	1.000	Junction	0	1.000	13.000	100	Circular

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Additional Storage (m³/ha)	0.0
Summer CV	1.000	Skip Steady State	x	Check Discharge Rate(s)	x
Winter CV	1.000	Drain Down Time (mins)	1440	Check Discharge Volume	x

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
100	45	0	0

Node Depth/Area 1 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	12.450	Product Number	CTL-SHE-0065-1900-1000-1900
Design Depth (m)	1.000	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	1.9	Min Node Diameter (mm)	1200

Node Depth/Area 1 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	12.720	Slope (1:X)	9000.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Depth (m)	0.880
Safety Factor	2.0	Width (m)	44.600	Inf Depth (m)	0.675
Porosity	0.30	Length (m)	44.600		

Node Depth/Area 2 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	13.000
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	1425

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	300.0	0.0	0.400	300.0	0.0	0.401	0.0	0.0

Other (defaults)

Entry Loss (manhole)	0.250	Entry Loss (junction)	0.000	Apply Recommended Losses	x
Exit Loss (manhole)	0.250	Exit Loss (junction)	0.000	Flood Risk (m)	0.300

Approval Settings

Node Size	✓	Minimum Full Bore Velocity (m/s)	
Node Losses	✓	Maximum Full Bore Velocity (m/s)	3.000
Link Size	✓	Proportional Velocity	✓
Minimum Diameter (mm)	150	Return Period (years)	
Link Length	✓	Minimum Proportional Velocity (m/s)	0.750
Maximum Length (m)	100.000	Maximum Proportional Velocity (m/s)	3.000
Coordinates	✓	Surcharged Depth	✓
Accuracy (m)	1.000	Return Period (years)	
Crossings	✓	Maximum Surcharged Depth (m)	0.100
Cover Depth	✓	Flooding	✓
Minimum Cover Depth (m)		Return Period (years)	30
Maximum Cover Depth (m)	3.000	Time to Half Empty	x
Backdrops	✓	Discharge Rates	✓
Minimum Backdrop Height (m)		Discharge Volume	✓
Maximum Backdrop Height (m)	1.500	100 year 360 minute (m³)	
Full Bore Velocity	✓		

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year +45% CC 15 minute summer	541.474	153.218
100 year +45% CC 15 minute winter	379.982	153.218
100 year +45% CC 30 minute summer	361.949	102.419
100 year +45% CC 30 minute winter	254.000	102.419
100 year +45% CC 60 minute summer	246.536	65.152
100 year +45% CC 60 minute winter	163.793	65.152
100 year +45% CC 120 minute summer	146.861	38.811
100 year +45% CC 120 minute winter	97.571	38.811
100 year +45% CC 180 minute summer	110.449	28.422
100 year +45% CC 180 minute winter	71.795	28.422
100 year +45% CC 240 minute summer	85.878	22.695
100 year +45% CC 240 minute winter	57.055	22.695
100 year +45% CC 360 minute summer	63.826	16.425
100 year +45% CC 360 minute winter	41.489	16.425
100 year +45% CC 480 minute summer	49.190	12.999
100 year +45% CC 480 minute winter	32.681	12.999
100 year +45% CC 600 minute summer	39.565	10.822
100 year +45% CC 600 minute winter	27.033	10.822
100 year +45% CC 720 minute summer	34.726	9.307
100 year +45% CC 720 minute winter	23.338	9.307
100 year +45% CC 960 minute summer	27.812	7.323
100 year +45% CC 960 minute winter	18.423	7.323
100 year +45% CC 1440 minute summer	19.514	5.230
100 year +45% CC 1440 minute winter	13.114	5.230

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year +45% CC 2160 minute summer	13.563	3.748
100 year +45% CC 2160 minute winter	9.345	3.748
100 year +45% CC 2880 minute summer	11.095	2.974
100 year +45% CC 2880 minute winter	7.457	2.974
100 year +45% CC 4320 minute summer	8.303	2.171
100 year +45% CC 4320 minute winter	5.468	2.171
100 year +45% CC 5760 minute summer	6.852	1.754
100 year +45% CC 5760 minute winter	4.435	1.754
100 year +45% CC 7200 minute summer	5.882	1.500
100 year +45% CC 7200 minute winter	3.796	1.500
100 year +45% CC 8640 minute summer	5.208	1.328
100 year +45% CC 8640 minute winter	3.361	1.328
100 year +45% CC 10080 minute summer	4.720	1.204
100 year +45% CC 10080 minute winter	3.046	1.204

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 91.87%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
960 minute winter	Depth/Area 1	945	13.365	0.645	25.9	383.6429	0.0000	OK
960 minute winter	Depth/Area 2	945	13.365	0.365	9.3	109.6183	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
960 minute winter	Depth/Area 1	Hydro-Brake®		1.8				250.8
960 minute winter	Depth/Area 2	1.000	Depth/Area 1	-9.3	-1.374	-0.333	0.0106	

Results for 100 year +45% CC 15 minute summer. 1455 minute analysis at 1 minute timestep. Mass balance: 99.83%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	Depth/Area 1	19	13.041	0.321	448.1	189.9157	0.0000	OK
15 minute summer	Depth/Area 2	59	13.025	0.025	6.2	7.5125	0.0000	OK

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	Depth/Area 1	Hydro-Brake®		1.8				149.7
15 minute summer	Depth/Area 2	1.000	Depth/Area 1	-6.2	-1.340	-0.222	0.0063	

Results for 100 year +45% CC 15 minute winter. 1455 minute analysis at 1 minute timestep. Mass balance: 91.87%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	Depth/Area 1	19	13.066	0.346	420.4	205.1696	0.0000	OK
15 minute winter	Depth/Area 2	62	13.043	0.043	8.3	12.8680	0.0000	OK

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	Depth/Area 1	Hydro-Brake®		1.8				146.3
15 minute winter	Depth/Area 2	1.000	Depth/Area 1	-8.3	-1.714	-0.297	0.0075	

Results for 100 year +45% CC 30 minute summer. 1470 minute analysis at 1 minute timestep. Mass balance: 97.38%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute summer	Depth/Area 1	33	13.145	0.425	410.8	252.4138	0.0000	OK
30 minute summer	Depth/Area 2	73	13.104	0.104	15.2	31.3156	0.0000	SURCHARGED

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute summer	Depth/Area 1	Hydro-Brake®		1.8				139.4
30 minute summer	Depth/Area 2	1.000	Depth/Area 1	-15.2	-2.535	-0.547	0.0106	

Results for 100 year +45% CC 30 minute winter. 1470 minute analysis at 1 minute timestep. Mass balance: 99.91%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	Depth/Area 1	33	13.137	0.417	331.9	247.1324	0.0000	OK
30 minute winter	Depth/Area 2	73	13.097	0.097	14.3	29.0477	0.0000	OK

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute winter	Depth/Area 1	Hydro-Brake®		1.8				140.1
30 minute winter	Depth/Area 2	1.000	Depth/Area 1	-14.3	-2.465	-0.515	0.0105	

Results for 100 year +45% CC 60 minute summer. 1500 minute analysis at 1 minute timestep. Mass balance: 99.92%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute summer	Depth/Area 1	62	13.215	0.495	311.5	293.7200	0.0000	OK
60 minute summer	Depth/Area 2	104	13.172	0.172	20.7	51.5052	0.0000	SURCHARGED

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
60 minute summer	Depth/Area 1	Hydro-Brake®		1.8				141.8
60 minute summer	Depth/Area 2	1.000	Depth/Area 1	-20.7	-2.972	-0.744	0.0106	

Results for 100 year +45% CC 60 minute winter. 1500 minute analysis at 1 minute timestep. Mass balance: 99.17%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute winter	Depth/Area 1	60	13.222	0.502	225.1	298.2634	0.0000	OK
60 minute winter	Depth/Area 2	105	13.175	0.175	21.3	52.5399	0.0000	SURCHARGED

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
60 minute winter	Depth/Area 1	Hydro-Brake®		1.8				142.0
60 minute winter	Depth/Area 2	1.000	Depth/Area 1	-21.3	-3.037	-0.767	0.0106	

Results for 100 year +45% CC 120 minute summer. 1560 minute analysis at 2 minute timestep. Mass balance: 99.91%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute summer	Depth/Area 1	122	13.258	0.538	197.7	319.8535	0.0000	OK
120 minute summer	Depth/Area 2	152	13.236	0.236	22.5	70.8371	0.0000	SURCHARGED

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
120 minute summer	Depth/Area 1	Hydro-Brake®		1.8				153.3
120 minute summer	Depth/Area 2	1.000	Depth/Area 1	-22.5	-3.155	-0.810	0.0106	

Results for 100 year +45% CC 120 minute winter. 1560 minute analysis at 2 minute timestep. Mass balance: 99.52%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	Depth/Area 1	118	13.266	0.546	136.2	324.3570	0.0000	OK
120 minute winter	Depth/Area 2	152	13.239	0.239	22.4	71.6925	0.0000	SURCHARGED

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
120 minute winter	Depth/Area 1	Hydro-Brake®		1.8				153.5
120 minute winter	Depth/Area 2	1.000	Depth/Area 1	-22.4	-3.066	-0.806	0.0106	

Results for 100 year +45% CC 180 minute summer. 1620 minute analysis at 4 minute timestep. Mass balance: 99.23%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
180 minute summer	Depth/Area 1	184	13.284	0.564	145.0	334.8532	0.0000	OK
180 minute summer	Depth/Area 2	200	13.277	0.277	22.7	83.1855	0.0000	SURCHARGED

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
180 minute summer	Depth/Area 1	Hydro-Brake®		1.8				162.7
180 minute summer	Depth/Area 2	1.000	Depth/Area 1	-22.7	-3.116	-0.817	0.0106	

Results for 100 year +45% CC 180 minute winter. 1620 minute analysis at 4 minute timestep. Mass balance: 99.93%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
180 minute winter	Depth/Area 1	176	13.283	0.563	99.7	334.5318	0.0000	OK
180 minute winter	Depth/Area 2	200	13.274	0.274	21.2	82.2219	0.0000	SURCHARGED

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
180 minute winter	Depth/Area 1	Hydro-Brake®		1.8				162.3
180 minute winter	Depth/Area 2	1.000	Depth/Area 1	-21.2	-2.853	-0.761	0.0106	

Results for 100 year +45% CC 240 minute summer. 1680 minute analysis at 4 minute timestep. Mass balance: 99.23%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
240 minute summer	Depth/Area 1	244	13.304	0.584	120.9	346.9876	0.0000	OK
240 minute summer	Depth/Area 2	252	13.303	0.303	22.2	90.8285	0.0000	SURCHARGED

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
240 minute summer	Depth/Area 1	Hydro-Brake®		1.8				171.1
240 minute summer	Depth/Area 2	1.000	Depth/Area 1	-22.2	-3.003	-0.798	0.0106	

Results for 100 year +45% CC 240 minute winter. 1680 minute analysis at 4 minute timestep. Mass balance: 99.91%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
240 minute winter	Depth/Area 1	240	13.302	0.582	80.4	345.7812	0.0000	OK
240 minute winter	Depth/Area 2	248	13.301	0.301	19.7	90.1703	0.0000	SURCHARGED

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
240 minute winter	Depth/Area 1	Hydro-Brake®		1.8				170.7
240 minute winter	Depth/Area 2	1.000	Depth/Area 1	-19.7	-2.642	-0.706	0.0106	

Results for 100 year +45% CC 360 minute summer. 1800 minute analysis at 8 minute timestep. Mass balance: 99.17%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute summer	Depth/Area 1	368	13.332	0.612	89.9	363.8912	0.0000	OK
360 minute summer	Depth/Area 2	368	13.333	0.333	20.0	99.7537	0.0000	SURCHARGED

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
360 minute summer	Depth/Area 1	Hydro-Brake®		1.8				185.7
360 minute summer	Depth/Area 2	1.000	Depth/Area 1	-20.0	-2.705	-0.720	0.0106	

Results for 100 year +45% CC 360 minute winter. 1800 minute analysis at 8 minute timestep. Mass balance: 99.95%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute winter	Depth/Area 1	360	13.330	0.610	58.4	362.3340	0.0000	OK
360 minute winter	Depth/Area 2	360	13.330	0.330	16.8	98.8887	0.0000	SURCHARGED

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
360 minute winter	Depth/Area 1	Hydro-Brake®		1.8				185.2
360 minute winter	Depth/Area 2	1.000	Depth/Area 1	-16.8	-2.268	-0.604	0.0106	

Results for 100 year +45% CC 480 minute summer. 1920 minute analysis at 8 minute timestep. Mass balance: 99.70%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
480 minute summer	Depth/Area 1	488	13.346	0.626	69.3	372.2830	0.0000	OK
480 minute summer	Depth/Area 2	488	13.347	0.347	17.7	103.9726	0.0000	SURCHARGED

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
480 minute summer	Depth/Area 1	Hydro-Brake®		1.8				199.7
480 minute summer	Depth/Area 2	1.000	Depth/Area 1	-17.7	-2.471	-0.636	0.0106	

Results for 100 year +45% CC 480 minute winter. 1920 minute analysis at 8 minute timestep. Mass balance: 99.94%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
480 minute winter	Depth/Area 1	480	13.347	0.627	46.0	372.5937	0.0000	OK
480 minute winter	Depth/Area 2	480	13.347	0.347	14.7	104.0753	0.0000	SURCHARGED

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
480 minute winter	Depth/Area 1	Hydro-Brake®		1.8				199.4
480 minute winter	Depth/Area 2	1.000	Depth/Area 1	-14.7	-1.981	-0.527	0.0106	

Results for 100 year +45% CC 600 minute summer. 2040 minute analysis at 15 minute timestep. Mass balance: 99.96%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
600 minute summer	Depth/Area 1	615	13.354	0.634	55.7	376.6426	0.0000	OK
600 minute summer	Depth/Area 2	615	13.354	0.354	15.3	106.1336	0.0000	SURCHARGED

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
600 minute summer	Depth/Area 1	Hydro-Brake®		1.8				212.1
600 minute summer	Depth/Area 2	1.000	Depth/Area 1	-15.3	-2.218	-0.548	0.0106	

Results for 100 year +45% CC 600 minute winter. 2040 minute analysis at 15 minute timestep. Mass balance: 99.95%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
600 minute winter	Depth/Area 1	600	13.356	0.636	38.1	378.2675	0.0000	OK
600 minute winter	Depth/Area 2	600	13.356	0.356	12.9	106.9198	0.0000	SURCHARGED

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
600 minute winter	Depth/Area 1	Hydro-Brake®		1.8				211.8
600 minute winter	Depth/Area 2	1.000	Depth/Area 1	-12.9	-1.753	-0.463	0.0106	

Results for 100 year +45% CC 720 minute summer. 2160 minute analysis at 15 minute timestep. Mass balance: 99.95%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
720 minute summer	Depth/Area 1	735	13.359	0.638	48.9	379.5292	0.0000	OK
720 minute summer	Depth/Area 2	735	13.359	0.359	14.6	107.5867	0.0000	SURCHARGED

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
720 minute summer	Depth/Area 1	Hydro-Brake®		1.8				225.4
720 minute summer	Depth/Area 2	1.000	Depth/Area 1	-14.6	-2.058	-0.526	0.0106	

Results for 100 year +45% CC 720 minute winter. 2160 minute analysis at 15 minute timestep. Mass balance: 99.94%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
720 minute winter	Depth/Area 1	720	13.362	0.642	32.9	381.4715	0.0000	OK
720 minute winter	Depth/Area 2	720	13.362	0.362	11.5	108.5347	0.0000	SURCHARGED

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
720 minute winter	Depth/Area 1	Hydro-Brake®		1.8				225.1
720 minute winter	Depth/Area 2	1.000	Depth/Area 1	-11.5	-1.608	-0.414	0.0106	

Results for 100 year +45% CC 960 minute summer. 2400 minute analysis at 15 minute timestep. Mass balance: 99.95%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
960 minute summer	Depth/Area 1	960	13.361	0.641	39.2	381.1213	0.0000	OK
960 minute summer	Depth/Area 2	960	13.361	0.361	13.0	108.3197	0.0000	SURCHARGED

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
960 minute summer	Depth/Area 1	Hydro-Brake®		1.8				251.4
960 minute summer	Depth/Area 2	1.000	Depth/Area 1	-13.0	-1.753	-0.467	0.0106	

Results for 100 year +45% CC 960 minute winter. 2400 minute analysis at 15 minute timestep. Mass balance: 99.95%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
960 minute winter	Depth/Area 1	945	13.365	0.645	25.9	383.6429	0.0000	OK
960 minute winter	Depth/Area 2	945	13.365	0.365	9.3	109.6183	0.0000	SURCHARGED

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
960 minute winter	Depth/Area 1	Hydro-Brake®		1.8				250.8
960 minute winter	Depth/Area 2	1.000	Depth/Area 1	-9.3	-1.374	-0.333	0.0106	

Results for 100 year +45% CC 1440 minute summer. 2880 minute analysis at 30 minute timestep. Mass balance: 99.96%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute summer	Depth/Area 1	1440	13.352	0.632	27.5	375.7333	0.0000	OK
1440 minute summer	Depth/Area 2	1440	13.352	0.352	8.5	105.6358	0.0000	SURCHARGED

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
1440 minute summer	Depth/Area 1	Hydro-Brake®		1.8				299.8
1440 minute summer	Depth/Area 2	1.000	Depth/Area 1	-8.5	-1.416	-0.305	0.0106	

Results for 100 year +45% CC 1440 minute winter. 2880 minute analysis at 30 minute timestep. Mass balance: 99.95%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute winter	Depth/Area 1	1410	13.359	0.639	18.5	379.7888	0.0000	OK
1440 minute winter	Depth/Area 2	1410	13.359	0.359	6.4	107.6799	0.0000	SURCHARGED

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
1440 minute winter	Depth/Area 1	Hydro-Brake®		1.8				298.8
1440 minute winter	Depth/Area 2	1.000	Depth/Area 1	-6.4	-1.181	-0.230	0.0106	

Results for 100 year +45% CC 2160 minute summer. 3600 minute analysis at 60 minute timestep. Mass balance: 99.95%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
2160 minute summer	Depth/Area 1	2100	13.322	0.602	19.1	357.5289	0.0000	OK
2160 minute summer	Depth/Area 2	2100	13.322	0.322	6.5	96.4885	0.0000	SURCHARGED

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
2160 minute summer	Depth/Area 1	Hydro-Brake®		1.8				368.8
2160 minute summer	Depth/Area 2	1.000	Depth/Area 1	-6.5	-1.204	-0.233	0.0106	

Results for 100 year +45% CC 2160 minute winter. 3600 minute analysis at 60 minute timestep. Mass balance: 99.95%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
2160 minute winter	Depth/Area 1	2100	13.334	0.614	13.2	364.6620	0.0000	OK
2160 minute winter	Depth/Area 2	2100	13.334	0.334	4.9	100.0752	0.0000	SURCHARGED

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
2160 minute winter	Depth/Area 1	Hydro-Brake®		1.8				367.4
2160 minute winter	Depth/Area 2	1.000	Depth/Area 1	-4.9	-0.625	-0.175	0.0106	

Results for 100 year +45% CC 2880 minute summer. 4320 minute analysis at 60 minute timestep. Mass balance: 99.96%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
2880 minute summer	Depth/Area 1	2400	13.299	0.579	15.6	343.8375	0.0000	OK
2880 minute summer	Depth/Area 2	2400	13.299	0.299	5.6	89.6055	0.0000	SURCHARGED

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
2880 minute summer	Depth/Area 1	Hydro-Brake®		1.8				434.5
2880 minute summer	Depth/Area 2	1.000	Depth/Area 1	-5.6	-1.177	-0.203	0.0106	

Results for 100 year +45% CC 2880 minute winter. 4320 minute analysis at 60 minute timestep. Mass balance: 99.96%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
2880 minute winter	Depth/Area 1	2640	13.304	0.584	10.5	346.8631	0.0000	OK
2880 minute winter	Depth/Area 2	2640	13.304	0.304	6.1	91.1266	0.0000	SURCHARGED

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
2880 minute winter	Depth/Area 1	Hydro-Brake®		1.8				436.1
2880 minute winter	Depth/Area 2	1.000	Depth/Area 1	-6.1	-1.087	-0.218	0.0106	

Results for 100 year +45% CC 4320 minute summer. 5760 minute analysis at 60 minute timestep. Mass balance: 99.96%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
4320 minute summer	Depth/Area 1	3180	13.271	0.551	11.7	327.5718	0.0000	OK
4320 minute summer	Depth/Area 2	3180	13.271	0.271	3.5	81.4284	0.0000	SURCHARGED

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
4320 minute summer	Depth/Area 1	Hydro-Brake®		1.8				551.1
4320 minute summer	Depth/Area 2	1.000	Depth/Area 1	-3.5	-0.473	-0.125	0.0106	

Results for 100 year +45% CC 4320 minute winter. 5760 minute analysis at 60 minute timestep. Mass balance: 99.96%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
4320 minute winter	Depth/Area 1	3360	13.269	0.549	7.7	326.3336	0.0000	OK
4320 minute winter	Depth/Area 2	3360	13.269	0.269	2.5	80.8059	0.0000	SURCHARGED

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
4320 minute winter	Depth/Area 1	Hydro-Brake®		1.8				554.0
4320 minute winter	Depth/Area 2	1.000	Depth/Area 1	-2.5	-0.406	-0.092	0.0106	

Results for 100 year +45% CC 5760 minute summer. 7200 minute analysis at 60 minute timestep. Mass balance: 99.97%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
5760 minute summer	Depth/Area 1	4020	13.255	0.535	9.7	317.9727	0.0000	OK
5760 minute summer	Depth/Area 2	4020	13.255	0.255	3.4	76.6027	0.0000	SURCHARGED

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
5760 minute summer	Depth/Area 1	Hydro-Brake®		1.8				655.6
5760 minute summer	Depth/Area 2	1.000	Depth/Area 1	5.1	0.756	0.182	0.0106	

Results for 100 year +45% CC 5760 minute winter. 7200 minute analysis at 60 minute timestep. Mass balance: 99.97%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
5760 minute winter	Depth/Area 1	4260	13.241	0.521	6.2	309.2792	0.0000	OK
5760 minute winter	Depth/Area 2	4260	13.241	0.241	1.9	72.2323	0.0000	SURCHARGED

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
5760 minute winter	Depth/Area 1	Hydro-Brake®		1.8				661.6
5760 minute winter	Depth/Area 2	1.000	Depth/Area 1	4.7	0.724	0.168	0.0106	

Results for 100 year +45% CC 7200 minute summer. 8640 minute analysis at 60 minute timestep. Mass balance: 99.97%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
7200 minute summer	Depth/Area 1	4860	13.243	0.523	8.3	310.5935	0.0000	OK
7200 minute summer	Depth/Area 2	4860	13.243	0.243	2.9	72.8929	0.0000	SURCHARGED

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
7200 minute summer	Depth/Area 1	Hydro-Brake®		1.8				759.1
7200 minute summer	Depth/Area 2	1.000	Depth/Area 1	4.8	0.688	0.172	0.0106	

Results for 100 year +45% CC 7200 minute winter. 8640 minute analysis at 60 minute timestep. Mass balance: 99.97%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
7200 minute winter	Depth/Area 1	5220	13.220	0.500	5.3	296.7968	0.0000	OK
7200 minute winter	Depth/Area 2	5220	13.220	0.220	2.3	65.9568	0.0000	SURCHARGED

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
7200 minute winter	Depth/Area 1	Hydro-Brake®		1.8				769.9
7200 minute winter	Depth/Area 2	1.000	Depth/Area 1	4.0	0.696	0.144	0.0106	

Results for 100 year +45% CC 8640 minute summer. 10080 minute analysis at 60 minute timestep. Mass balance: 99.97%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
8640 minute summer	Depth/Area 1	5700	13.234	0.514	7.3	305.0351	0.0000	OK
8640 minute summer	Depth/Area 2	5700	13.234	0.234	2.4	70.0986	0.0000	SURCHARGED

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
8640 minute summer	Depth/Area 1	Hydro-Brake®		1.8				863.3
8640 minute summer	Depth/Area 2	1.000	Depth/Area 1	4.0	0.666	0.143	0.0106	

Results for 100 year +45% CC 8640 minute winter. 10080 minute analysis at 60 minute timestep. Mass balance: 99.97%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
8640 minute winter	Depth/Area 1	6120	13.197	0.477	5.0	283.2638	0.0000	OK
8640 minute winter	Depth/Area 2	6120	13.197	0.197	1.9	59.1538	0.0000	SURCHARGED

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
8640 minute winter	Depth/Area 1	Hydro-Brake®		1.8				878.3
8640 minute winter	Depth/Area 2	1.000	Depth/Area 1	5.0	0.745	0.181	0.0106	

Results for 100 year +45% CC 10080 minute summer. 11520 minute analysis at 60 minute timestep. Mass balance: 99.97%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
10080 minute summer	Depth/Area 1	6540	13.226	0.506	6.6	300.3446	0.0000	OK
10080 minute summer	Depth/Area 2	6540	13.226	0.226	2.0	67.7406	0.0000	SURCHARGED

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
10080 minute summer	Depth/Area 1	Hydro-Brake®		1.8				966.6
10080 minute summer	Depth/Area 2	1.000	Depth/Area 1	5.1	0.746	0.182	0.0106	

Results for 100 year +45% CC 10080 minute winter. 11520 minute analysis at 60 minute timestep. Mass balance: 99.97%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
10080 minute winter	Depth/Area 1	6960	13.180	0.460	5.7	273.2032	0.0000	OK
10080 minute winter	Depth/Area 2	6960	13.180	0.180	1.8	54.0959	0.0000	SURCHARGED

Link Event	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
10080 minute winter	Depth/Area 1	Hydro-Brake®		1.8				989.7
10080 minute winter	Depth/Area 2	1.000	Depth/Area 1	5.2	0.746	0.185	0.0106	

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	100	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	1.000	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	Cover Level (m)	Node Type	Easting (m)	Northing (m)	Depth (m)
Depth/Area 1	0.782	12.620	Junction	506518.601	105073.673	0.450

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Additional Storage (m³/ha)	0.0
Summer CV	1.000	Skip Steady State	x	Check Discharge Rate(s)	x
Winter CV	1.000	Drain Down Time (mins)	1440	Check Discharge Volume	x

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
100	45	0	0

Node Depth/Area 1 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	12.130	Product Number	CTL-SHE-0087-2700-0400-2700
Design Depth (m)	0.400	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	2.7	Min Node Diameter (mm)	1200

Node Depth/Area 1 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	12.170	Slope (1:X)	9000.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Depth (m)	0.450
Safety Factor	5.0	Width (m)	76.000	Inf Depth (m)	0.350
Porosity	0.30	Length (m)	110.000		

Other (defaults)

Entry Loss (manhole)	0.250	Entry Loss (junction)	0.000	Apply Recommended Losses	x
Exit Loss (manhole)	0.250	Exit Loss (junction)	0.000	Flood Risk (m)	0.300

Approval Settings

Node Size	✓	Minimum Full Bore Velocity (m/s)	
Node Losses	✓	Maximum Full Bore Velocity (m/s)	3.000
Link Size	✓	Proportional Velocity	✓
Minimum Diameter (mm)	150	Return Period (years)	
Link Length	✓	Minimum Proportional Velocity (m/s)	0.750
Maximum Length (m)	100.000	Maximum Proportional Velocity (m/s)	3.000
Coordinates	✓	Surcharged Depth	✓
Accuracy (m)	1.000	Return Period (years)	
Crossings	✓	Maximum Surcharged Depth (m)	0.100
Cover Depth	✓	Flooding	✓
Minimum Cover Depth (m)		Return Period (years)	30
Maximum Cover Depth (m)	3.000	Time to Half Empty	x
Backdrops	✓	Discharge Rates	✓
Minimum Backdrop Height (m)		Discharge Volume	✓
Maximum Backdrop Height (m)	1.500	100 year 360 minute (m^3)	
Full Bore Velocity	✓		

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year +45% CC 15 minute summer	541.474	153.218
100 year +45% CC 15 minute winter	379.982	153.218
100 year +45% CC 30 minute summer	361.949	102.419
100 year +45% CC 30 minute winter	254.000	102.419
100 year +45% CC 60 minute summer	246.536	65.152
100 year +45% CC 60 minute winter	163.793	65.152
100 year +45% CC 120 minute summer	146.861	38.811
100 year +45% CC 120 minute winter	97.571	38.811
100 year +45% CC 180 minute summer	110.449	28.422
100 year +45% CC 180 minute winter	71.795	28.422
100 year +45% CC 240 minute summer	85.878	22.695
100 year +45% CC 240 minute winter	57.055	22.695
100 year +45% CC 360 minute summer	63.826	16.425
100 year +45% CC 360 minute winter	41.489	16.425
100 year +45% CC 480 minute summer	49.190	12.999
100 year +45% CC 480 minute winter	32.681	12.999
100 year +45% CC 600 minute summer	39.565	10.822
100 year +45% CC 600 minute winter	27.033	10.822
100 year +45% CC 720 minute summer	34.726	9.307
100 year +45% CC 720 minute winter	23.338	9.307
100 year +45% CC 960 minute summer	27.812	7.323
100 year +45% CC 960 minute winter	18.423	7.323
100 year +45% CC 1440 minute summer	19.514	5.230
100 year +45% CC 1440 minute winter	13.114	5.230
100 year +45% CC 2160 minute summer	13.563	3.748
100 year +45% CC 2160 minute winter	9.345	3.748
100 year +45% CC 2880 minute summer	11.095	2.974
100 year +45% CC 2880 minute winter	7.457	2.974
100 year +45% CC 4320 minute summer	8.303	2.171
100 year +45% CC 4320 minute winter	5.468	2.171
100 year +45% CC 5760 minute summer	6.852	1.754
100 year +45% CC 5760 minute winter	4.435	1.754
100 year +45% CC 7200 minute summer	5.882	1.500

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year +45% CC 7200 minute winter	3.796	1.500
100 year +45% CC 8640 minute summer	5.208	1.328
100 year +45% CC 8640 minute winter	3.361	1.328
100 year +45% CC 10080 minute summer	4.720	1.204
100 year +45% CC 10080 minute winter	3.046	1.204

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 94.16%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute winter	Depth/Area 1	1410	12.495	0.325	28.5	791.7185	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
1440 minute winter	Depth/Area 1	Hydro-Brake®	2.7	402.3

Results for 100 year +45% CC 15 minute summer. 1455 minute analysis at 1 minute timestep. Mass balance: 99.96%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	Depth/Area 1	20	12.296	0.126	691.0	296.3936	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
15 minute summer	Depth/Area 1	Hydro-Brake®	2.7	224.8

Results for 100 year +45% CC 15 minute winter. 1455 minute analysis at 1 minute timestep. Mass balance: 99.98%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	Depth/Area 1	20	12.296	0.126	648.4	296.6143	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
15 minute winter	Depth/Area 1	Hydro-Brake®	2.7	224.8

Results for 100 year +45% CC 30 minute summer. 1470 minute analysis at 1 minute timestep. Mass balance: 94.16%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute summer	Depth/Area 1	35	12.346	0.176	633.7	418.8207	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
30 minute summer	Depth/Area 1	Hydro-Brake®	2.7	235.1

Results for 100 year +45% CC 30 minute winter. 1470 minute analysis at 1 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	Depth/Area 1	35	12.336	0.166	511.9	395.9164	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
30 minute winter	Depth/Area 1	Hydro-Brake®	2.7	235.5

Results for 100 year +45% CC 60 minute summer. 1500 minute analysis at 1 minute timestep. Mass balance: 96.37%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute summer	Depth/Area 1	65	12.386	0.216	480.4	519.0122	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
60 minute summer	Depth/Area 1	Hydro-Brake®	2.7	234.7

Results for 100 year +45% CC 60 minute winter. 1500 minute analysis at 1 minute timestep. Mass balance: 99.99%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute winter	Depth/Area 1	64	12.379	0.209	347.1	501.1139	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
60 minute winter	Depth/Area 1	Hydro-Brake®	2.7	235.3

Results for 100 year +45% CC 120 minute summer. 1560 minute analysis at 2 minute timestep. Mass balance: 97.53%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m^3)	Flood (m^3)	Status
120 minute summer	Depth/Area 1	126	12.420	0.250	304.9	604.8303	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m^3)
120 minute summer	Depth/Area 1	Hydro-Brake®	2.7	235.9

Results for 100 year +45% CC 120 minute winter. 1560 minute analysis at 2 minute timestep. Mass balance: 99.99%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	Depth/Area 1	124	12.415	0.245	210.0	590.8422	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
120 minute winter	Depth/Area 1	Hydro-Brake®	2.7	236.9

Results for 100 year +45% CC 180 minute summer. 1620 minute analysis at 4 minute timestep. Mass balance: 94.90%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m^3)	Flood (m^3)	Status
180 minute summer	Depth/Area 1	188	12.448	0.278	223.5	673.8976	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m^3)
180 minute summer	Depth/Area 1	Hydro-Brake®	2.7	238.1

Results for 100 year +45% CC 180 minute winter. 1620 minute analysis at 4 minute timestep. Mass balance: 99.99%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
180 minute winter	Depth/Area 1	184	12.436	0.266	153.8	642.4108	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
180 minute winter	Depth/Area 1	Hydro-Brake®	2.7	239.1

Results for 100 year +45% CC 240 minute summer. 1680 minute analysis at 4 minute timestep. Mass balance: 97.17%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m^3)	Flood (m^3)	Status
240 minute summer	Depth/Area 1	248	12.457	0.287	186.5	695.6777	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m^3)
240 minute summer	Depth/Area 1	Hydro-Brake®	2.7	244.6

Results for 100 year +45% CC 240 minute winter. 1680 minute analysis at 4 minute timestep. Mass balance: 99.99%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
240 minute winter	Depth/Area 1	244	12.450	0.280	123.9	677.9781	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
240 minute winter	Depth/Area 1	Hydro-Brake®	2.7	244.3

Results for 100 year +45% CC 360 minute summer. 1800 minute analysis at 8 minute timestep. Mass balance: 95.40%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m^3)	Flood (m^3)	Status
360 minute summer	Depth/Area 1	368	12.479	0.309	138.6	751.9197	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m^3)
360 minute summer	Depth/Area 1	Hydro-Brake®	2.7	261.3

Results for 100 year +45% CC 360 minute winter. 1800 minute analysis at 8 minute timestep. Mass balance: 99.99%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute winter	Depth/Area 1	360	12.468	0.298	90.1	722.2303	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
360 minute winter	Depth/Area 1	Hydro-Brake®	2.7	258.4

Results for 100 year +45% CC 480 minute summer. 1920 minute analysis at 8 minute timestep. Mass balance: 98.40%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m^3)	Flood (m^3)	Status
480 minute summer	Depth/Area 1	488	12.482	0.312	106.9	758.2554	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m^3)
480 minute summer	Depth/Area 1	Hydro-Brake®	2.7	276.0

Results for 100 year +45% CC 480 minute winter. 1920 minute analysis at 8 minute timestep. Mass balance: 99.99%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
480 minute winter	Depth/Area 1	480	12.478	0.308	71.0	749.1694	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
480 minute winter	Depth/Area 1	Hydro-Brake®	2.7	274.6

Results for 100 year +45% CC 600 minute summer. 2040 minute analysis at 15 minute timestep. Mass balance: 98.44%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m^3)	Flood (m^3)	Status
600 minute summer	Depth/Area 1	615	12.488	0.318	85.9	773.1544	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m^3)
600 minute summer	Depth/Area 1	Hydro-Brake®	2.7	291.9

Results for 100 year +45% CC 600 minute winter. 2040 minute analysis at 15 minute timestep. Mass balance: 99.99%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
600 minute winter	Depth/Area 1	600	12.485	0.315	58.7	765.1487	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
600 minute winter	Depth/Area 1	Hydro-Brake®	2.7	290.2

Results for 100 year +45% CC 720 minute summer. 2160 minute analysis at 15 minute timestep. Mass balance: 99.99%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m^3)	Flood (m^3)	Status
720 minute summer	Depth/Area 1	735	12.488	0.318	75.4	773.5920	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m^3)
720 minute summer	Depth/Area 1	Hydro-Brake®	2.7	306.1

Results for 100 year +45% CC 720 minute winter. 2160 minute analysis at 15 minute timestep. Mass balance: 99.99%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
720 minute winter	Depth/Area 1	720	12.489	0.319	50.7	776.8367	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
720 minute winter	Depth/Area 1	Hydro-Brake®	2.7	306.9

Results for 100 year +45% CC 960 minute summer. 2400 minute analysis at 15 minute timestep. Mass balance: 99.99%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m^3)	Flood (m^3)	Status
960 minute summer	Depth/Area 1	960	12.493	0.323	60.4	785.2823	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m^3)
960 minute summer	Depth/Area 1	Hydro-Brake®	2.7	339.0

Results for 100 year +45% CC 960 minute winter. 2400 minute analysis at 15 minute timestep. Mass balance: 99.99%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
960 minute winter	Depth/Area 1	945	12.494	0.324	40.0	788.6546	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
960 minute winter	Depth/Area 1	Hydro-Brake®	2.7	339.9

Results for 100 year +45% CC 1440 minute summer. 2880 minute analysis at 30 minute timestep. Mass balance: 99.83%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute summer	Depth/Area 1	1440	12.494	0.324	42.4	787.3374	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
1440 minute summer	Depth/Area 1	Hydro-Brake®	2.7	401.2

Results for 100 year +45% CC 1440 minute winter. 2880 minute analysis at 30 minute timestep. Mass balance: 99.99%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute winter	Depth/Area 1	1410	12.495	0.325	28.5	791.7185	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
1440 minute winter	Depth/Area 1	Hydro-Brake®	2.7	402.3

Results for 100 year +45% CC 2160 minute summer. 3600 minute analysis at 60 minute timestep. Mass balance: 99.92%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
2160 minute summer	Depth/Area 1	2160	12.486	0.316	29.5	767.7642	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
2160 minute summer	Depth/Area 1	Hydro-Brake®	2.7	488.7

Results for 100 year +45% CC 2160 minute winter. 3600 minute analysis at 60 minute timestep. Mass balance: 99.99%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
2160 minute winter	Depth/Area 1	2100	12.488	0.318	20.3	772.4098	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
2160 minute winter	Depth/Area 1	Hydro-Brake®	2.7	491.5

Results for 100 year +45% CC 2880 minute summer. 4320 minute analysis at 60 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
2880 minute summer	Depth/Area 1	2520	12.477	0.307	24.1	745.5909	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
2880 minute summer	Depth/Area 1	Hydro-Brake®	2.7	578.0

Results for 100 year +45% CC 2880 minute winter. 4320 minute analysis at 60 minute timestep. Mass balance: 99.99%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
2880 minute winter	Depth/Area 1	2700	12.479	0.309	16.2	750.1552	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
2880 minute winter	Depth/Area 1	Hydro-Brake®	2.7	582.9

Results for 100 year +45% CC 4320 minute summer. 5760 minute analysis at 60 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
4320 minute summer	Depth/Area 1	3300	12.464	0.294	18.0	714.2106	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
4320 minute summer	Depth/Area 1	Hydro-Brake®	2.7	750.8

Results for 100 year +45% CC 4320 minute winter. 5760 minute analysis at 60 minute timestep. Mass balance: 99.99%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
4320 minute winter	Depth/Area 1	3420	12.461	0.291	11.9	706.8361	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
4320 minute winter	Depth/Area 1	Hydro-Brake®	2.7	760.7

Results for 100 year +45% CC 5760 minute summer. 7200 minute analysis at 60 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
5760 minute summer	Depth/Area 1	4080	12.455	0.285	14.9	691.8586	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
5760 minute summer	Depth/Area 1	Hydro-Brake®	2.7	916.2

Results for 100 year +45% CC 5760 minute winter. 7200 minute analysis at 60 minute timestep. Mass balance: 99.99%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
5760 minute winter	Depth/Area 1	4320	12.448	0.278	9.6	673.0364	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
5760 minute winter	Depth/Area 1	Hydro-Brake®	2.7	933.2

Results for 100 year +45% CC 7200 minute summer. 8640 minute analysis at 60 minute timestep. Mass balance: 99.99%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
7200 minute summer	Depth/Area 1	4920	12.449	0.279	12.8	675.9040	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
7200 minute summer	Depth/Area 1	Hydro-Brake®	2.7	1081.8

Results for 100 year +45% CC 7200 minute winter. 8640 minute analysis at 60 minute timestep. Mass balance: 99.99%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
7200 minute winter	Depth/Area 1	5280	12.435	0.265	8.2	641.1834	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
7200 minute winter	Depth/Area 1	Hydro-Brake®	2.7	1107.3

Results for 100 year +45% CC 8640 minute summer. 10080 minute analysis at 60 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
8640 minute summer	Depth/Area 1	5760	12.445	0.275	11.3	664.8644	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
8640 minute summer	Depth/Area 1	Hydro-Brake®	2.7	1246.5

Results for 100 year +45% CC 8640 minute winter. 10080 minute analysis at 60 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
8640 minute winter	Depth/Area 1	6180	12.424	0.254	7.3	613.0902	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
8640 minute winter	Depth/Area 1	Hydro-Brake®	2.7	1285.9

Results for 100 year +45% CC 10080 minute summer. 11520 minute analysis at 60 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m^3)	Flood (m^3)	Status
10080 minute summer	Depth/Area 1	6600	12.442	0.272	10.3	657.7197	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m^3)
10080 minute summer	Depth/Area 1	Hydro-Brake®	2.7	1409.8

Results for 100 year +45% CC 10080 minute winter. 11520 minute analysis at 60 minute timestep. Mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m^3)	Flood (m^3)	Status
10080 minute winter	Depth/Area 1	7080	12.413	0.243	6.6	586.4758	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m^3)
10080 minute winter	Depth/Area 1	Hydro-Brake®	2.7	1464.5

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	100	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	1.000	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	Cover Level (m)	Node Type	Easting (m)	Northing (m)	Depth (m)
Depth/Area 1	0.723	11.870	Junction	506431.620	105065.527	0.770

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Additional Storage (m³/ha)	0.0
Summer CV	1.000	Skip Steady State	x	Check Discharge Rate(s)	x
Winter CV	1.000	Drain Down Time (mins)	1440	Check Discharge Volume	x

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
100	45	0	0

Node Depth/Area 1 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	11.000	Product Number	CTL-SHE-0077-2500-0900-2500
Design Depth (m)	0.900	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	2.5	Min Node Diameter (mm)	1200

Node Depth/Area 1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	3.0	Invert Level (m)	11.100
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	775.0	0.0	0.700	1435.0	0.0

Other (defaults)

Entry Loss (manhole)	0.250	Entry Loss (junction)	0.000	Apply Recommended Losses	x
Exit Loss (manhole)	0.250	Exit Loss (junction)	0.000	Flood Risk (m)	0.300

Approval Settings

Node Size	✓	Minimum Full Bore Velocity (m/s)	
Node Losses	✓	Maximum Full Bore Velocity (m/s)	3.000
Link Size	✓	Proportional Velocity	✓
Minimum Diameter (mm)	150	Return Period (years)	
Link Length	✓	Minimum Proportional Velocity (m/s)	0.750
Maximum Length (m)	100.000	Maximum Proportional Velocity (m/s)	3.000
Coordinates	✓	Surcharged Depth	✓
Accuracy (m)	1.000	Return Period (years)	
Crossings	✓	Maximum Surcharged Depth (m)	0.100
Cover Depth	✓	Flooding	✓
Minimum Cover Depth (m)		Return Period (years)	30
Maximum Cover Depth (m)	3.000	Time to Half Empty	x
Backdrops	✓	Discharge Rates	✓
Minimum Backdrop Height (m)		Discharge Volume	✓
Maximum Backdrop Height (m)	1.500	100 year 360 minute (m^3)	
Full Bore Velocity	✓		

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year +45% CC 15 minute summer	541.474	153.218
100 year +45% CC 15 minute winter	379.982	153.218
100 year +45% CC 30 minute summer	361.949	102.419
100 year +45% CC 30 minute winter	254.000	102.419
100 year +45% CC 60 minute summer	246.536	65.152
100 year +45% CC 60 minute winter	163.793	65.152
100 year +45% CC 120 minute summer	146.861	38.811
100 year +45% CC 120 minute winter	97.571	38.811
100 year +45% CC 180 minute summer	110.449	28.422
100 year +45% CC 180 minute winter	71.795	28.422
100 year +45% CC 240 minute summer	85.878	22.695
100 year +45% CC 240 minute winter	57.055	22.695
100 year +45% CC 360 minute summer	63.826	16.425
100 year +45% CC 360 minute winter	41.489	16.425
100 year +45% CC 480 minute summer	49.190	12.999
100 year +45% CC 480 minute winter	32.681	12.999
100 year +45% CC 600 minute summer	39.565	10.822
100 year +45% CC 600 minute winter	27.033	10.822
100 year +45% CC 720 minute summer	34.726	9.307
100 year +45% CC 720 minute winter	23.338	9.307
100 year +45% CC 960 minute summer	27.812	7.323
100 year +45% CC 960 minute winter	18.423	7.323
100 year +45% CC 1440 minute summer	19.514	5.230
100 year +45% CC 1440 minute winter	13.114	5.230
100 year +45% CC 2160 minute summer	13.563	3.748
100 year +45% CC 2160 minute winter	9.345	3.748
100 year +45% CC 2880 minute summer	11.095	2.974
100 year +45% CC 2880 minute winter	7.457	2.974
100 year +45% CC 4320 minute summer	8.303	2.171
100 year +45% CC 4320 minute winter	5.468	2.171
100 year +45% CC 5760 minute summer	6.852	1.754
100 year +45% CC 5760 minute winter	4.435	1.754
100 year +45% CC 7200 minute summer	5.882	1.500

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year +45% CC 7200 minute winter	3.796	1.500
100 year +45% CC 8640 minute summer	5.208	1.328
100 year +45% CC 8640 minute winter	3.361	1.328
100 year +45% CC 10080 minute summer	4.720	1.204
100 year +45% CC 10080 minute winter	3.046	1.204

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 93.39%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
960 minute winter	Depth/Area 1	945	11.759	0.659	37.0	716.4642	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
960 minute winter	Depth/Area 1	Hydro-Brake®	2.5	320.7

Results for 100 year +45% CC 15 minute summer. 1455 minute analysis at 1 minute timestep. Mass balance: 94.23%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	Depth/Area 1	20	11.413	0.313	639.0	289.5789	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
15 minute summer	Depth/Area 1	Hydro-Brake®	2.5	215.9

Results for 100 year +45% CC 15 minute winter. 1455 minute analysis at 1 minute timestep. Mass balance: 93.39%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	Depth/Area 1	20	11.416	0.316	599.5	292.0688	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
15 minute winter	Depth/Area 1	Hydro-Brake®	2.5	215.8

Results for 100 year +45% CC 30 minute summer. 1470 minute analysis at 1 minute timestep. Mass balance: 99.97%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute summer	Depth/Area 1	35	11.482	0.382	585.8	365.0120	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
30 minute summer	Depth/Area 1	Hydro-Brake®	2.5	214.3

Results for 100 year +45% CC 30 minute winter. 1470 minute analysis at 1 minute timestep. Mass balance: 97.10%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	Depth/Area 1	35	11.491	0.391	473.2	376.0393	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
30 minute winter	Depth/Area 1	Hydro-Brake®	2.5	213.4

Results for 100 year +45% CC 60 minute summer. 1500 minute analysis at 1 minute timestep. Mass balance: 98.33%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute summer	Depth/Area 1	65	11.571	0.471	444.2	469.9870	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
60 minute summer	Depth/Area 1	Hydro-Brake®	2.5	204.2

Results for 100 year +45% CC 60 minute winter. 1500 minute analysis at 1 minute timestep. Mass balance: 99.99%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute winter	Depth/Area 1	64	11.565	0.465	321.0	462.4446	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
60 minute winter	Depth/Area 1	Hydro-Brake®	2.5	205.7

Results for 100 year +45% CC 120 minute summer. 1560 minute analysis at 2 minute timestep. Mass balance: 99.98%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m^3)	Flood (m^3)	Status
120 minute summer	Depth/Area 1	126	11.630	0.530	281.9	543.9219	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m^3)
120 minute summer	Depth/Area 1	Hydro-Brake®	2.5	201.2

Results for 100 year +45% CC 120 minute winter. 1560 minute analysis at 2 minute timestep. Mass balance: 99.96%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	Depth/Area 1	124	11.631	0.531	194.2	544.7871	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
120 minute winter	Depth/Area 1	Hydro-Brake®	2.5	201.2

Results for 100 year +45% CC 180 minute summer. 1620 minute analysis at 4 minute timestep. Mass balance: 99.95%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
180 minute summer	Depth/Area 1	188	11.667	0.567	206.6	590.7372	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
180 minute summer	Depth/Area 1	Hydro-Brake®	2.5	206.5

Results for 100 year +45% CC 180 minute winter. 1620 minute analysis at 4 minute timestep. Mass balance: 99.98%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
180 minute winter	Depth/Area 1	184	11.667	0.567	142.2	591.6030	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
180 minute winter	Depth/Area 1	Hydro-Brake®	2.5	206.5

Results for 100 year +45% CC 240 minute summer. 1680 minute analysis at 4 minute timestep. Mass balance: 99.03%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m^3)	Flood (m^3)	Status
240 minute summer	Depth/Area 1	248	11.695	0.595	172.5	628.5964	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m^3)
240 minute summer	Depth/Area 1	Hydro-Brake®	2.5	215.6

Results for 100 year +45% CC 240 minute winter. 1680 minute analysis at 4 minute timestep. Mass balance: 99.98%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
240 minute winter	Depth/Area 1	244	11.691	0.591	114.6	623.3615	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
240 minute winter	Depth/Area 1	Hydro-Brake®	2.5	215.2

Results for 100 year +45% CC 360 minute summer. 1800 minute analysis at 8 minute timestep. Mass balance: 99.05%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute summer	Depth/Area 1	368	11.724	0.624	128.2	667.2731	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
360 minute summer	Depth/Area 1	Hydro-Brake®	2.5	234.8

Results for 100 year +45% CC 360 minute winter. 1800 minute analysis at 8 minute timestep. Mass balance: 99.99%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute winter	Depth/Area 1	360	11.720	0.620	83.3	662.7587	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
360 minute winter	Depth/Area 1	Hydro-Brake®	2.5	234.1

Results for 100 year +45% CC 480 minute summer. 1920 minute analysis at 8 minute timestep. Mass balance: 99.86%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
480 minute summer	Depth/Area 1	488	11.737	0.637	98.8	684.8178	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
480 minute summer	Depth/Area 1	Hydro-Brake®	2.5	253.0

Results for 100 year +45% CC 480 minute winter. 1920 minute analysis at 8 minute timestep. Mass balance: 99.99%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
480 minute winter	Depth/Area 1	480	11.738	0.638	65.6	686.0698	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
480 minute winter	Depth/Area 1	Hydro-Brake®	2.5	252.9

Results for 100 year +45% CC 600 minute summer. 2040 minute analysis at 15 minute timestep. Mass balance: 99.98%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m^3)	Flood (m^3)	Status
600 minute summer	Depth/Area 1	615	11.745	0.645	79.5	696.8066	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m^3)
600 minute summer	Depth/Area 1	Hydro-Brake®	2.5	269.4

Results for 100 year +45% CC 600 minute winter. 2040 minute analysis at 15 minute timestep. Mass balance: 99.99%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
600 minute winter	Depth/Area 1	600	11.748	0.648	54.3	699.9391	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
600 minute winter	Depth/Area 1	Hydro-Brake®	2.5	269.5

Results for 100 year +45% CC 720 minute summer. 2160 minute analysis at 15 minute timestep. Mass balance: 99.33%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m^3)	Flood (m^3)	Status
720 minute summer	Depth/Area 1	735	11.756	0.656	69.7	710.9811	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m^3)
720 minute summer	Depth/Area 1	Hydro-Brake®	2.5	287.7

Results for 100 year +45% CC 720 minute winter. 2160 minute analysis at 15 minute timestep. Mass balance: 99.99%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
720 minute winter	Depth/Area 1	720	11.754	0.654	46.9	708.9498	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
720 minute winter	Depth/Area 1	Hydro-Brake®	2.5	287.0

Results for 100 year +45% CC 960 minute summer. 2400 minute analysis at 15 minute timestep. Mass balance: 99.61%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
960 minute summer	Depth/Area 1	975	11.759	0.659	55.9	715.3439	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
960 minute summer	Depth/Area 1	Hydro-Brake®	2.5	321.3

Results for 100 year +45% CC 960 minute winter. 2400 minute analysis at 15 minute timestep. Mass balance: 99.98%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
960 minute winter	Depth/Area 1	945	11.759	0.659	37.0	716.4642	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
960 minute winter	Depth/Area 1	Hydro-Brake®	2.5	320.7

Results for 100 year +45% CC 1440 minute summer. 2880 minute analysis at 30 minute timestep. Mass balance: 99.98%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute summer	Depth/Area 1	1440	11.753	0.653	39.2	707.5273	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
1440 minute summer	Depth/Area 1	Hydro-Brake®	2.5	383.1

Results for 100 year +45% CC 1440 minute winter. 2880 minute analysis at 30 minute timestep. Mass balance: 99.98%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute winter	Depth/Area 1	1410	11.757	0.657	26.3	713.3044	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
1440 minute winter	Depth/Area 1	Hydro-Brake®	2.5	383.3

Results for 100 year +45% CC 2160 minute summer. 3600 minute analysis at 60 minute timestep. Mass balance: 99.99%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
2160 minute summer	Depth/Area 1	2160	11.734	0.634	27.2	680.6541	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
2160 minute summer	Depth/Area 1	Hydro-Brake®	2.5	471.2

Results for 100 year +45% CC 2160 minute winter. 3600 minute analysis at 60 minute timestep. Mass balance: 99.98%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
2160 minute winter	Depth/Area 1	2100	11.740	0.640	18.8	690.0165	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
2160 minute winter	Depth/Area 1	Hydro-Brake®	2.5	472.4

Results for 100 year +45% CC 2880 minute summer. 4320 minute analysis at 60 minute timestep. Mass balance: 99.99%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
2880 minute summer	Depth/Area 1	2640	11.711	0.611	22.3	650.0395	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
2880 minute summer	Depth/Area 1	Hydro-Brake®	2.5	560.7

Results for 100 year +45% CC 2880 minute winter. 4320 minute analysis at 60 minute timestep. Mass balance: 99.99%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
2880 minute winter	Depth/Area 1	2700	11.719	0.619	15.0	660.1503	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
2880 minute winter	Depth/Area 1	Hydro-Brake®	2.5	561.9

Results for 100 year +45% CC 4320 minute summer. 5760 minute analysis at 60 minute timestep. Mass balance: 99.99%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
4320 minute summer	Depth/Area 1	3360	11.684	0.584	16.7	613.2810	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
4320 minute summer	Depth/Area 1	Hydro-Brake®	2.5	721.4

Results for 100 year +45% CC 4320 minute winter. 5760 minute analysis at 60 minute timestep. Mass balance: 99.99%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
4320 minute winter	Depth/Area 1	3420	11.681	0.581	11.0	609.2269	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
4320 minute winter	Depth/Area 1	Hydro-Brake®	2.5	729.0

Results for 100 year +45% CC 5760 minute summer. 7200 minute analysis at 60 minute timestep. Mass balance: 99.99%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
5760 minute summer	Depth/Area 1	4140	11.666	0.566	13.8	590.3235	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
5760 minute summer	Depth/Area 1	Hydro-Brake®	2.5	872.0

Results for 100 year +45% CC 5760 minute winter. 7200 minute analysis at 60 minute timestep. Mass balance: 99.99%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
5760 minute winter	Depth/Area 1	4380	11.655	0.555	8.9	575.0869	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
5760 minute winter	Depth/Area 1	Hydro-Brake®	2.5	886.7

Results for 100 year +45% CC 7200 minute summer. 8640 minute analysis at 60 minute timestep. Mass balance: 99.99%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
7200 minute summer	Depth/Area 1	4980	11.656	0.556	11.8	576.6184	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
7200 minute summer	Depth/Area 1	Hydro-Brake®	2.5	1018.6

Results for 100 year +45% CC 7200 minute winter. 8640 minute analysis at 60 minute timestep. Mass balance: 99.99%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
7200 minute winter	Depth/Area 1	5340	11.636	0.536	7.6	550.6691	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
7200 minute winter	Depth/Area 1	Hydro-Brake®	2.5	1040.8

Results for 100 year +45% CC 8640 minute summer. 10080 minute analysis at 60 minute timestep. Mass balance: 99.99%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
8640 minute summer	Depth/Area 1	5820	11.649	0.549	10.5	567.8792	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
8640 minute summer	Depth/Area 1	Hydro-Brake®	2.5	1165.6

Results for 100 year +45% CC 8640 minute winter. 10080 minute analysis at 60 minute timestep. Mass balance: 99.99%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
8640 minute winter	Depth/Area 1	6240	11.612	0.512	6.7	520.6024	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
8640 minute winter	Depth/Area 1	Hydro-Brake®	2.5	1198.3

Results for 100 year +45% CC 10080 minute summer. 11520 minute analysis at 60 minute timestep. Mass balance: 99.99%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
10080 minute summer	Depth/Area 1	6660	11.642	0.542	9.5	559.4030	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
10080 minute summer	Depth/Area 1	Hydro-Brake®	2.5	1314.2

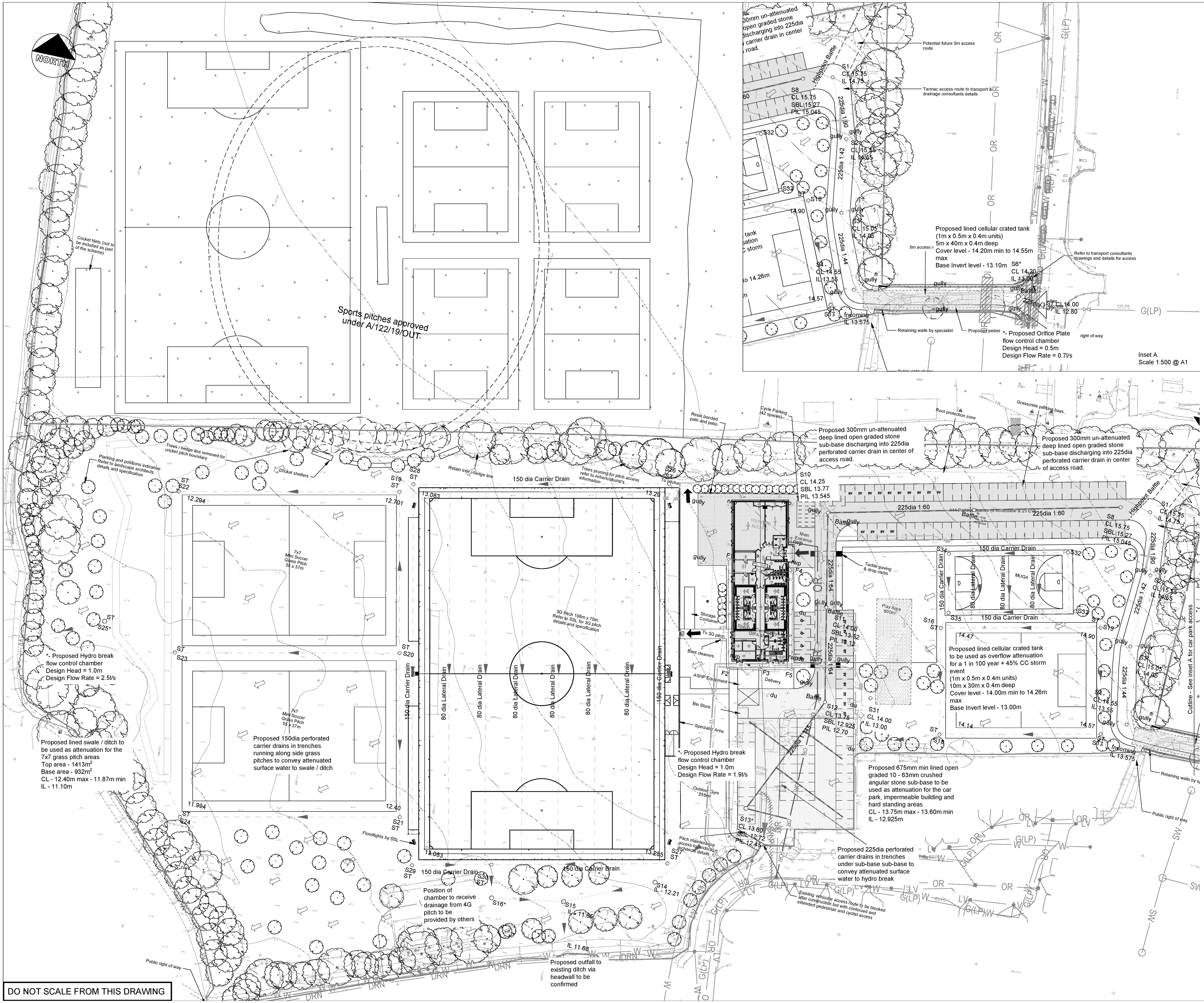
Results for 100 year +45% CC 10080 minute winter. 11520 minute analysis at 60 minute timestep. Mass balance: 99.99%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
10080 minute winter	Depth/Area 1	7140	11.597	0.497	6.1	501.5142	0.0000	OK

Link Event	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
10080 minute winter	Depth/Area 1	Hydro-Brake®	2.5	1359.3

Appendix J

Proposed Drainage Layout and Details



Notes

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- The Contractor shall be responsible and liable for ensuring the stability of the works, adjoining structures and services at all stages of construction. Any temporary works shall be designed, installed and maintained by the Contractor.
- Existing below ground services and obstructions shall be located and identified prior to start of the work on site.
- Care shall be exercised when excavations are close to existing structures to ensure they do not experience any loss of support. Temporary and permanent works for excavations shall be designed to resist the additional lateral earth pressures arising from any permanent and variable actions applied ground level or resulting from existing structures, in addition to those generated by the soil itself, without significant deformation.
- Refer to the Architect's/Fire Consultant's drawings and specification for the overall fire strategy and protection requirements of the building and structure.
- Refer to the Engineer's "NBS" Specification of Works for detailed specification.
- Notwithstanding the content of these notes, all construction shall meet the requirements of Building Regulation Approved Document Part A and H.
- If in doubt, ask!

LEGEND

- Area of impermeable roof area for pavilion and storage unit.
- Area of Un-attenuated lined 300mm open graded 10 - 63mm crushed angular stone sub-base to discharge rainwater from porous grasscrete parking spaces and impermeable tarmac access road into 225dia perforated pipes to be conveyed to over-spill car park area.
- Area of attenuated lined 675mm min / 825mm max open graded 10 - 63mm crushed angular stone sub-base under over-spill car park area to discharge rainwater from porous grasscrete parking area and tarmac access roads into 225dia perforated pipes to be conveyed to existing watercourse via hydro break control.
- Lined trench filled with sand and granular material surrounding a perforated pipe.
- Cellular attenuation tanks located under car park access road and to the east of the main carpark area.
- Gully
- du — Distribution Unit
- Baffle
- Proposed surface water pipe
- 900 dia type E Proposed surface water chamber
- Proposed foul sewer pipe
- 600 dia type E Proposed foul sewer chamber
- Proposed Surface Water Exceedance Flow

HAZARDS LEADING TO UNUSUAL OR SIGNIFICANT RISKS DURING THE CONSTRUCTION PROCESS ARE IDENTIFIED ON THIS DRAWING AS:

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RISKS/HAZARDS SPECIFIC TO THIS DRAWING:

PRELIMINARY - NOT FOR CONSTRUCTION

Rev.	Amendment	Drn.	Chkd.	Appd.	Date
P05	Preliminary - stage 3 for planning	TK	TK	IL	20.11.24
P04	Preliminary - stage 3 for initial costing	TK	TK	IL	25.10.24
P03	Preliminary - Draft stage 3	TK	TK	IL	18.10.24
P02	Preliminary - Updated following design review	TK	TK	IL	16.07.24
P01	Preliminary	TK	TK	IL	08.07.24

Project

Palmer Road, Sports Hub

Drawing

Drainage Strategy Layout

Client

Arun District Council

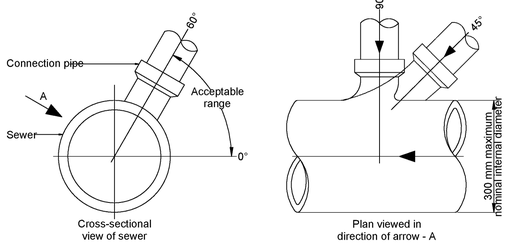
Scott White and Hookins
Structural Engineering | Civil Engineering | Sustainability and BREEAM | CDM Consultancy
Harman House, Andover Road, Winchester, Hampshire SO23 7BS
T: +44 (0)1962 844855 W: www.swh.co.uk E: info@swh.co.uk

Scale at A1 - 1:500

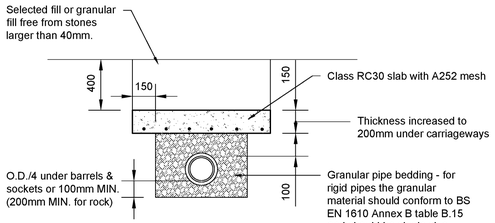
304433-SWH-XX-XX-DR-C-5000 P05

Project | Originator | Zone | Level | Type | Role | Number | Rev.

CP004-01_FM_ST_008_D

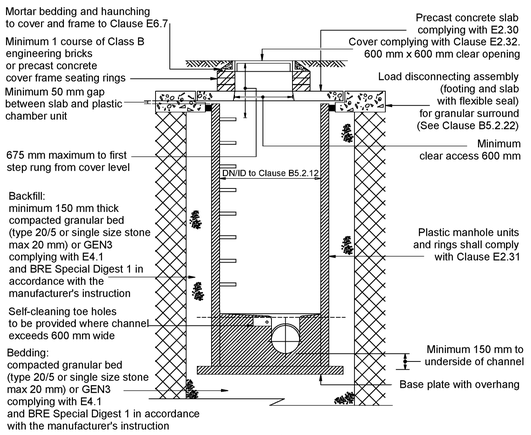


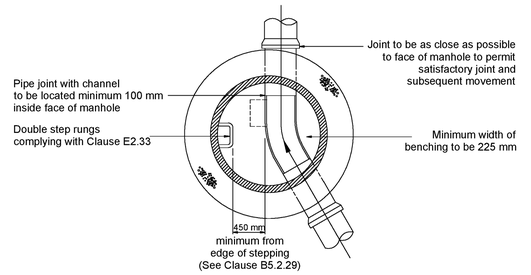
CONNECTION TO SEWER



(1:10)

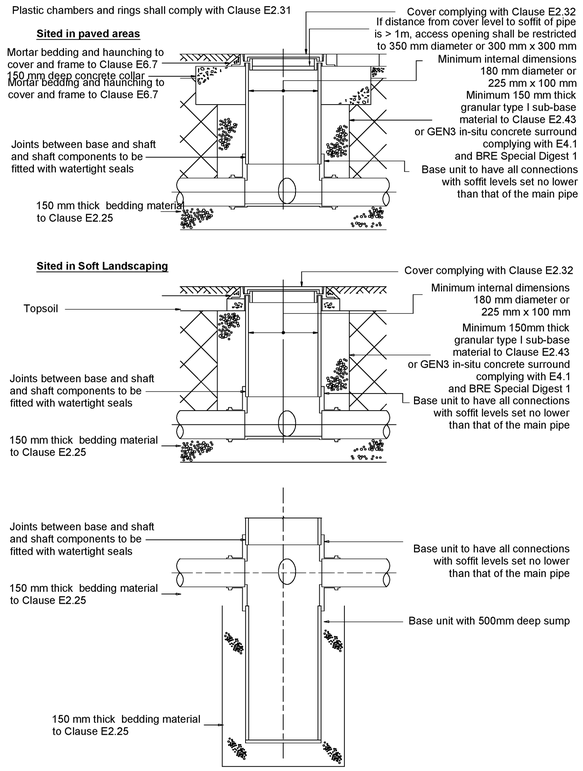
BED C
PIPE PROTECTION DETAIL





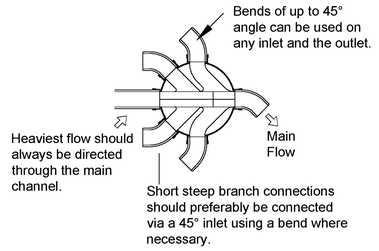
TYPICAL ACCESS CHAMBER DETAIL - TYPE B

Depth from cover level to soffit of pipe 1.5 m to 3 m
Flexible material construction



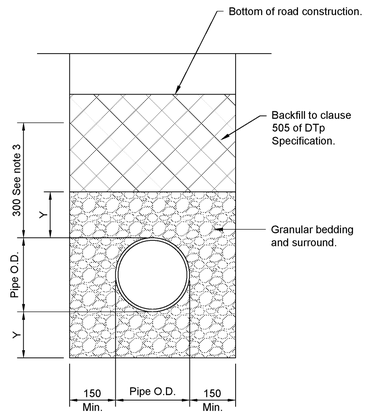
TYPICAL INSPECTION CHAMBER DETAIL - TYPE E

Depth from cover level to soffit of pipe up to 2 m
Flexible material construction



(Plan)
(475mmØ MH)
(Depth to invert less than 1.20m below ground level)

PLASTIC INSPECTION CHAMBER IN HARD LANDSCAPED AREAS



CLASS S BEDDING

GRANULAR BED AND SURROUND
(COVER TO SOFFIT GREATER THAN 1200mm)

(BEDDING FACTOR = 2.2)

PIPE DIAMETER	CLASS OF BEDDING	IMPORTED GRANULAR MATERIAL (NOTE 1)
100	F S B	10mm nominal size
Over 100 to 150	F S B	10 or 14mm nom. single size or 14 to 5mm graded
Over 150 to 500	F S B	10,14,20mm nom. single size or 14 to 5mm graded or 20 to 5mm graded
Over 500 (note 2)	F S B	10,14,20mm nom. single size crushed rock or 14 to 5mm graded or 20 to 5mm graded or 40 to 5mm graded

NOTES:

1. Imported granular materials to include aggregates and air cooled blast furnace slag to BSEN 12620:2002 and sintered pulverized fuel ash to BSEN 13055-1:2002.
2. Angular materials should be chosen to ensure sufficient support is provided to heavier pipes
3. Class S bedding shall be used with all flexible pipes.

GRANULAR BEDDING & SIDEFILL MATERIALS FOR RIGID AND FLEXIBLE PIPES

PIPE DIAMETER	Y minimum		MAXIMUM TRENCH WIDTH	L
	Y1 min.	Y2 min.		
100	100	200	700	18
150	100	200	750	18
200	100	200	800	18
225	100	200	825	18
300	100	200	925	18

NOTES:

1. Dimension Y1 shall be used unless Y2 is specified or is directed by the Engineer.
2. Dimension Y2 shall be used in place of Y1 where the excavation is in rock or in mixed soils containing rock beds, boulders, large flints or other irregular hard spots.
3. Dimension Y2 shall be increased by 40mm for each additional 1.0m of cover in excess of 0.5m.
4. Dimension L is the width of the compressible filler required at joints in concrete protection to pipes.

DIMENSIONS FOR PIPE BEDDING

DO NOT SCALE FROM THIS DRAWING

Notes

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- Refer to the Architect's/Fire Consultant's drawings and specifications for the overall fire strategy and protection requirements of the building and structure.

DRAINAGE

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- Drainage works to be constructed in accordance with BS EN 752 and Approved Document H
- Drainage works to be constructed in accordance with Water Authorities Association Specification 'Sewers for Adoption' 7th Edition.
- Prior to undertaking any construction the invert level of the outfall connection must be confirmed.
- All soft spots and unacceptable material encountered in drainage excavations is to be removed and replaced with granular material to the requirements of the building control officer.
- Pipes to be installed to manufacturers recommendations.
- Pipes under buildings to be laid to a fall of 1:40 minimum unless noted otherwise. Elsewhere pipes are to be laid at minimum fall of 1:80 for foul and 1:100 for surface water unless noted otherwise.
- Plastic plain wall pipes to be PVC-U to BS EN 1401-1, class min SN4, with flexible joints, Kitemark certified. Structured wall plastic pipes to be to WIS 04-35-01, Kitemark certified. *NOTE: Use SN8 if sewer is to be adopted.*
- Clay pipes to be vitrified clay to BS EN 295-1, with flexible joints, Kitemark certified. Crushing strength of clayware pipes above 150mm dia to be class 120.
- Concrete pipes to be precast concrete to BS 5911-1 and BS EN 1916, with flexible joints. Crushing strength of concrete pipes above 150mm dia to be class 120 (Class M)
- Bedding of pipes to be in accordance with approved document H1.
- Rocker pipes with flexible joints are to be provided at a distance of 150mm and 750mm from the face of construction to manholes, where pipes pass above, below or through ground beams or foundations; at gully connections and soil stack ends.
- Manhole access covers are to be located at the outgoing side of manholes.
- Cover levels are to be fixed on site to suit finished levels. Covers and frames to BS EN124, Grade D400 to be used in areas subject to heavy vehicular loading, Grade C250 in areas subject to light vehicular loading and Grade B125 to be used elsewhere.

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RISKS/HAZARDS SPECIFIC TO THIS DRAWING:

- Existing buried or overhead services
- Existing tree routes

FOR TENDER - NOT FOR CONSTRUCTION

Rev.	Amendment	Dm.	Chkd	Appd.	Date
P01	Preliminary	TK	TK	TK	11.09.23

Project

Palmer Road, Sports Hub

Drawing

Drainage Construction Details
Sheet 1 of 3

Client

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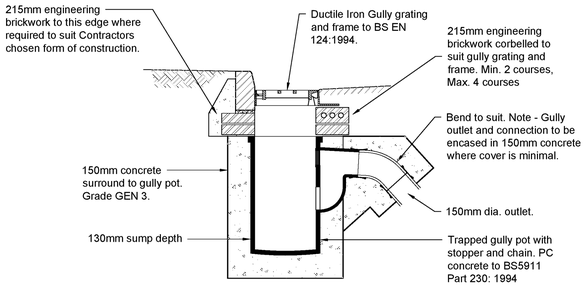
Scale at A1 - 1:10

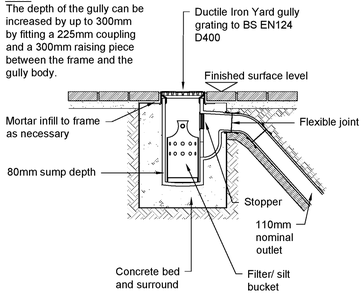
304433-SWH-XX-XX-DR-C-5100-P01

Project | Originator | Zone | Level | Type | Role | Number | Rev.

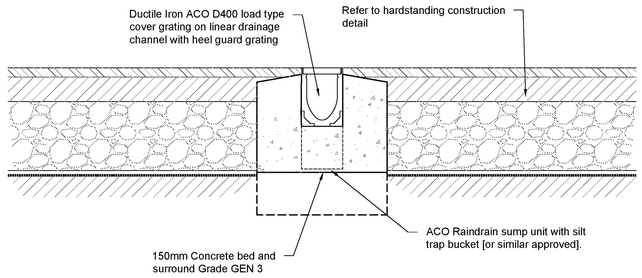
CP004-01_FM_ST_008_D



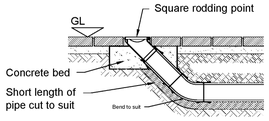
ROAD GULLY



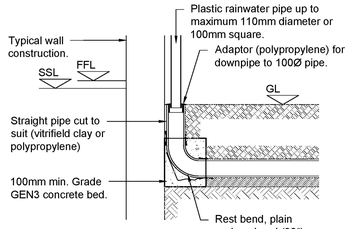
YARD / INTERNAL GULLY CONNECTION DETAIL



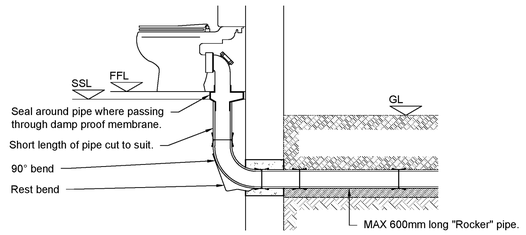
ACO CHANNEL DETAIL



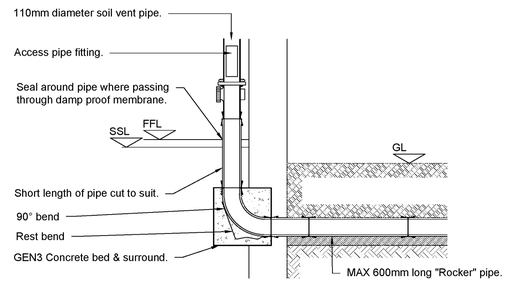
RODDING EYE



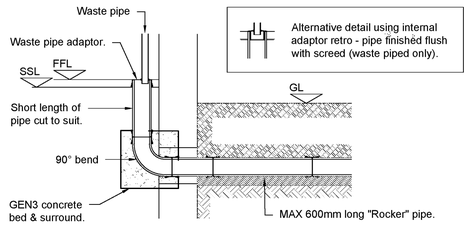
EXTERNAL RAINWATER PIPE CONNECTION



INTERNAL WC PIPE CONNECTION



INTERNAL SOIL & VENT PIPE CONNECTION



INTERNAL WASTE PIPE CONNECTION

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- Existing tree routes

PRELIMINARY - NOT FOR CONSTRUCTION

Rev.	Amendment	Dm.	Chkd.	Appd.	Date
P01	Preliminary - for initial costing	TK	TK	TK	25.10.24

Project

Palmer Road, Sports Hub

Drawing

Drainage Construction Details
Sheet 2 of 3

Client

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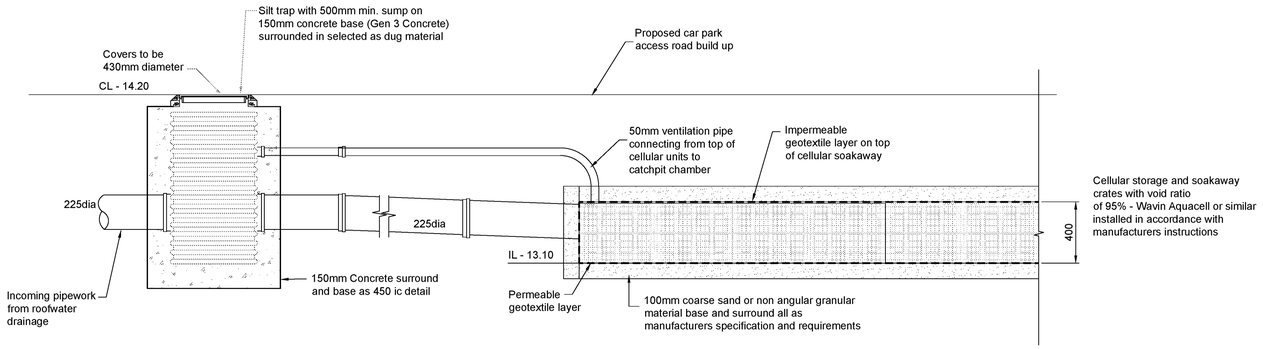
Scale at A1 - 1:10

304433-SWH-XX-XX-DR-C-5110-P01

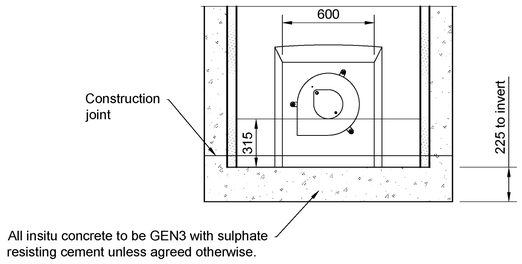
Project | Originator | Zone | Level | Type | Role | Number | Rev.

DO NOT SCALE FROM THIS DRAWING

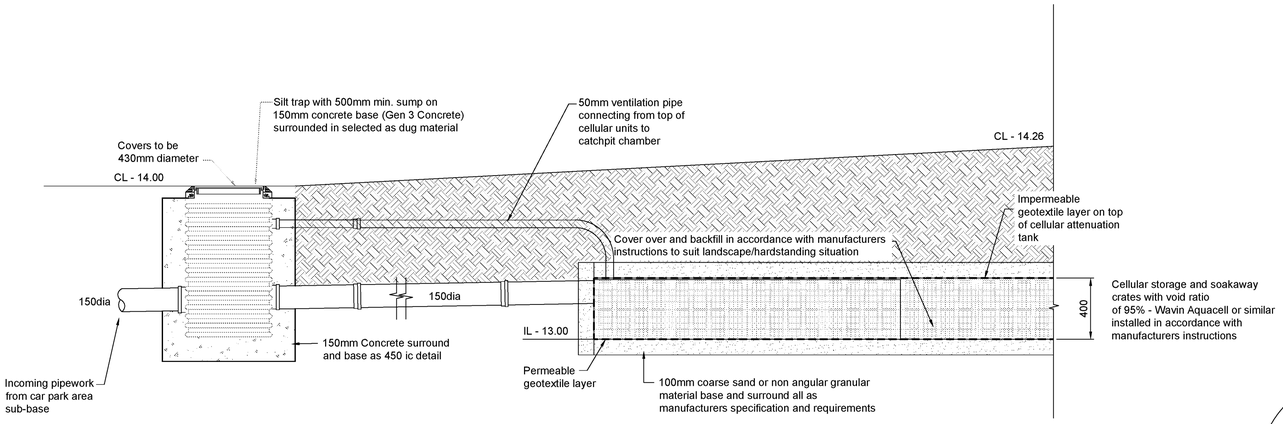


Proposed attenuation tank within car park access road

(TO SPECIALIST DESIGN - WAVIN AQUACELL OR SIMILAR APPROVED)

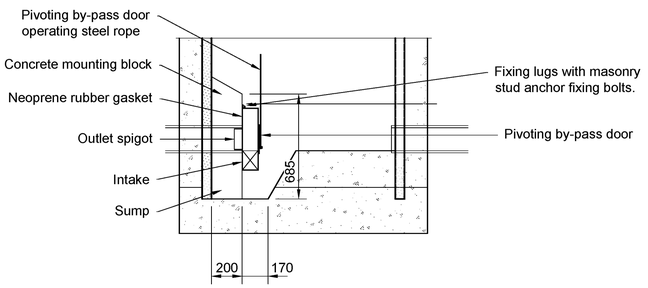


SECTION B-B

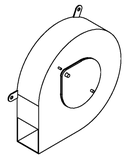


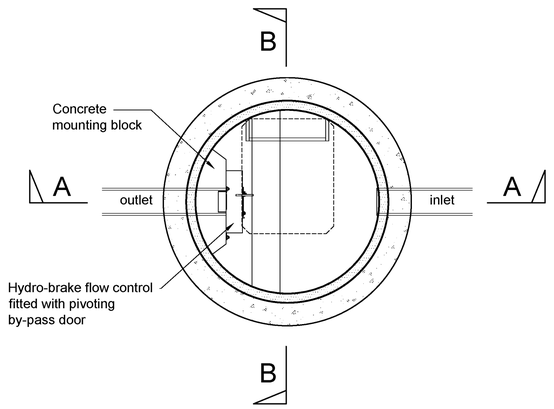
Proposed attenuation tank within landscaped area acting as overflow storage for carpark area

(TO SPECIALIST DESIGN - WAVIN AQUACELL OR SIMILAR APPROVED)



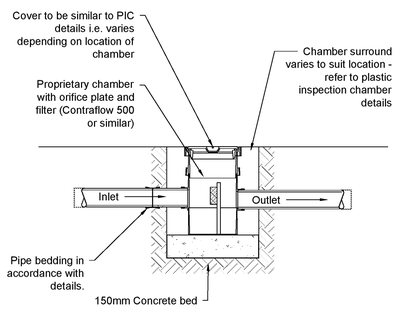
SECTION A-A





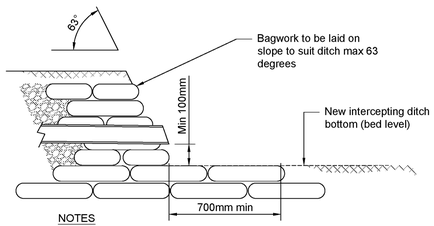
TYPICAL HYDROBRAKE DETAILS

(Manhole details as type B)



PLASTIC ORIFICE CHAMBER

(1:20)



NOTES

1. Dimensions are in millimeters unless otherwise stated
2. Bag sizes nominally 500x300x120
3. Bags to be hessian and filled with ST4 concrete
4. 12mm dia, mild steel dowel bars to be driven diagonally and vertically through bags to secure the courses, bars cut to suit location and are to pass through not less than 4 bags. min length 450mm
5. All ST mix concrete to be specification for Highway Works, clause 2602
6. Standard size of headwall, is 1 meters long by 0.9 meters high. Adjust to suit ditch.

BAGWORK HEADWALL

(1:20)

Notes

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- All drawings issued in CAD/Revit format are provided solely as a supplement to the information shown on the equivalent PDF drawing only.
- The contractor shall verify all site dimensions and existing details, setting out dimensions and levels with the Architect. Engineer to be informed of any discrepancies before proceeding with work.
- Existing details are assumed and are to be confirmed on site with any discrepancies recorded and reported to the Engineer so that any adjustments required to the scheme can be considered.
- The contractor is responsible and liable for ensuring the stability of the works, adjoining structures and services at all stages of construction. Any temporary works are to be designed and detailed by the contractor.
- All existing services are to be located prior to commencement of the work on site. Unless shown we have no knowledge of any underground obstructions or services. These are to be determined prior to the commencement of the works on site.
- Refer to the Architect's/Fire Consultant's drawings and specifications for the overall fire strategy and protection requirements of the building and structure.

DRAINAGE

- Any information given on this drawing regarding existing services is believed to be correct. The contractor must check this information and determine the nature and location of other existing services from the various statutory authorities before commencing excavation works.
- Drainage works to be constructed in accordance with BS EN 752 and Approved Document H
- Drainage works to be constructed in accordance with Water Authorities Association Specification 'Sewers for Adoption' 7th Edition.
- Prior to undertaking any construction the invert level of the outfall connection must be confirmed.
- All soft spots and unacceptable material encountered in drainage excavations is to be removed and replaced with granular material to the requirements of the building control officer.
- Pipes to be installed to manufacturers recommendations.
- Pipes under buildings to be laid to a fall of 1:40 minimum unless noted otherwise. Elsewhere pipes are to be laid at minimum fall of 1:80 for foul and 1:100 for surface water unless noted otherwise.
- Plastic plain wall pipes to be PVC-U to BS EN 1401-1, class min SN4, with flexible joints, Kitemark certified. Structured wall plastic pipes to be to WIS 04-35-01, Kitemark certified. *NOTE: Use SN8 if sewer is to be adopted.*
- Clay pipes to be vitrified clay to BS EN 295-1, with flexible joints, Kitemark certified. Crushing strength of clayware pipes above 150mm dia to be class 120.
- Concrete pipes to be precast concrete to BS 5911-1 and BS EN 1916, with flexible joints. Crushing strength of concrete pipes above 150mm dia to be class 120 (Class M)
- Bedding of pipes to be in accordance with approved document H1.
- Rocker pipes with flexible joints are to be provided at a distance of 150mm and 750mm from the face of construction to manholes, where pipes pass above, below or through ground beams or foundations; at gully connections and soil stack ends.
- Manhole access covers are to be located at the outgoing side of manholes.
- Cover levels are to be fixed on site to suit finished levels. Covers and frames to BS EN124, Grade D400 to be used in areas subject to heavy vehicular loading, Grade C250 in areas subject to light vehicular loading and Grade B125 to be used elsewhere.

HAZARDS LEADING TO UNUSUAL OR SIGNIFICANT RISKS DURING THE CONSTRUCTION PROCESS ARE IDENTIFIED ON THIS DRAWING AS:

NOTE: THE LIST BELOW IDENTIFIES CERTAIN RISKS WHICH ARE DEEMED TO BE UNUSUAL, ABNORMAL OR UNEXPECTED TO A COMPETENT CONTRACTOR CARRYING OUT WORK OF THIS NATURE BUT DOES NOT COVER ALL POSSIBLE SITUATIONS WHICH MAY BE ENCOUNTERED DURING THE CONSTRUCTION PROCESS. IT IS THEREFORE THE MAIN CONTRACTOR'S RESPONSIBILITY TO IDENTIFY ANY FURTHER RISKS/HAZARDS AND TAKE APPROPRIATE ACTION.

RISKS/HAZARDS SPECIFIC TO THIS DRAWING:

- Existing buried or overhead services
- Existing tree routes

PRELIMINARY - NOT FOR CONSTRUCTION

P01	Preliminary	TK	TK	TK	19.11.24
Rev.	Amendment	Dm.	Chkd.	Appd.	Date

Project

Palmer Road, Sports Hub

Drawing

Drainage Construction Details
Sheet 3 of 3

Client

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Scale at A1 - 1:20

304433-SWH-XX-XX-DR-C-5120-P01

Project | Originator | Zone | Level | Type | Role | Number | Rev.

CP004-01_FM_ST_008_D

DO NOT SCALE FROM THIS DRAWING

Appendix K

SW Drainage Maintenance Schedule

This schedule sets out the inspection and maintenance requirements for long term management of the development's surface water drainage system. This work is to be undertaken by the Client.

All those responsible for maintenance should take appropriate health, safety and welfare precautions for all activities including lone working, if relevant, and risk assessments should always be undertaken. The site's infrastructure Health and Safety File should be consulted before carrying out any works either inside or outside of the development's boundary and information regarding the location of existing utilities passed on to operatives.

The requirements of the Health and Safety at Work Act 1974 and The Construction (Design and Management) Regulations 2015 should be adhered to and any residual risks identified in the Health and Safety File should be managed and information passed on to maintenance operatives through task specific risk assessments.

There are three types of maintenance activities associated with surface water drainage systems.

The SuDS Manual, CIRIA C753, defines these as:

- Regular Maintenance – *'basic tasks undertaken on a frequent and predictable schedule' including vegetation management, litter and debris removal, and inspections.'*
- Occasional Maintenance – *'tasks that are likely to be required periodically, but on a much less frequent and predictable basis than the routine tasks (sediment removal is an example.'*
- Remedial Maintenance – *'intermittent tasks that may be required to rectify faults associated with the system, although the likelihood of faults can be minimised by good design. Where remedial work is found to be necessary, it is likely to be due to site-specific characteristics or unforeseen events, and as such timings are difficult to predict.'*

SuDS Components Operation and Maintenance Activities

Operation and Maintenance activity	SuDS component (Components shown thus ~~Wetland~~ are not relevant to the project for which this schedule has been compiled.)												
	Pond	~~Wetland~~	Detention basin	Infiltration basin	Soakaway	Infiltration Trench	Filter Drain	Modular Storage	Pervious Pavement	Swale/bioretention/trees	Filter Strip	Green Roofs	Proprietary Treatment Systems
Regular maintenance													
Inspection	■	■	■	■	■	■	■	■	■	■	■	■	■
Litter and debris removal	■	■	■	■	□	■	■	□	■	■	■		□
Grass cutting	■	■	■	■	□	■	■	□	□	■	■		
Weed and invasive plant control	□	□	□	□		□	□		□		□	■	
Shrub management (including pruning)	□	□	□	□					□	□	□		
Shoreline vegetation management	■	■	□										
Aquatic vegetation management	■	■	□										
Occasional maintenance													
Sediment management[1]	■	■	■	■	■	■	■	■	■	■	■		■
Vegetation replacement	□	□	□	□						□	□	■	
Vacuum sweeping and brushing									■				
Remedial maintenance													
Structure rehabilitation /repair	□	□	□	□	□	□	□	□	□	□	□	□	
Infiltration surface reconditioning				□	□	□	□		□	□	□		

■ Will be required □ May be required

[1] Sediment should be collected and managed in pre-treatment systems, upstream of the main device.

Piped Network / Chambers

Piped Network/Chambers Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Inspect and identify any features that are not operating correctly. If required take remedial action	Monthly for three months, then six monthly
	Debris removal from catchment surface / gratings (where may cause risks to performance)	Monthly (and after large storms)
	Remove sediment from trapped sumps, manholes and catchpits.	Annually or as required
Remedial Maintenance	Repair / rehabilitation of gratings, inlets and outlets	As required
Monitoring	Inspect / check all gratings, trapped sumps, manholes and catchpits to ensure that they are in good condition and operating as designed	Annually and after large storm events
Structure Rehabilitation / Repair	Regular Maintenance and Monitoring to identify if repair and / or replacement of features or pipework is required.	As required

Permeable Pavements

Permeable Pavement Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Brushing and vacuuming (standard cosmetic sweep over the whole surface). Care should be taken in adjusting vacuuming equipment to avoid removal of jointing material if present. Any lost material should be replaced.	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturers' recommendations – pay particular attention to areas where water runs from adjacent impermeable areas as this area is most likely to collect the most sediment
Occasional Maintenance	Stabilise and mow contributing and adjacent areas.	As required.
	Removal of weed or management using glyphosate applied directly to the weeds by an applicator rather than spraying.	As required – once per year on less frequently used pavements
	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50mm of the level of the paving.	As required

Remedial Maintenance	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structured performance or a hazard to users, and replace lost jointing material.	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 year or as required (if infiltration and filtration performance is reduced due to significant clogging)
Monitoring	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and / or weed growth - If required, take remedial action.	Three-monthly, forty-eight hours after large rainfall events in the first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually
The SuDS Manual Table 20.15: Operation and maintenance requirements for pervious pavements		

Filter Strip

Filter Strip Maintenance Schedule	Required Action	Frequency
Regular Maintenance	Litter and debris removal	
	Grass cutting – to retain grass height within specified design range	Monthly (during growing season), or as required
	Manage other vegetation and remove nuisance plants	Monthly (at start, then as required)
Occasional maintenance	Check for poor vegetation growth due to lack of sunlight or dropping of leaf litter, and cut back adjacent vegetation where possible	Annually
	Re-seed areas of poor vegetation growth. Alter plant types to better suit conditions, if required	Annually, or if bare soil is exposed over 10% or more of the filter strip area
Remedial actions	Repair erosion or other damage by re-turfing or reseeding	As required.
	Re-level uneven surfaces and reinstate design levels	As required.
	Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of the soil surface	As required.
	Remove build up of sediment on upstream gravel trench, flow spreader or at top of filter strip	As required.
	Remove and dispose of oils or petrol residues using safe standard practices	As required.
Monitoring	Inspect filter strip surface to identify evidence of erosion, compaction, ponding, sedimentation and contamination (e.g.	Half yearly

	oils)	
	Check flow spreader and filter strip surface for even gradients	Half yearly
	Inspect gravel diaphragm trench upstream of filter strip for clogging	Half yearly
	Inspect silt accumulation rates and establish appropriate removal frequencies	Half yearly
The SuDS Manual Table 15.1: Operation and maintenance requirements for filter strips.		

Appendix L

Local Drainage Planning Policy Applicable to the Development

National Guidance

2.1 The frequency and severity of river flooding is perceived to have increased in recent years and in an attempt to mitigate the flood risk the Government published Planning Policy Statement Note 25: Development and Flood Risk (PPS25) in December 2006. PPS25 detailed the importance of the effective management and reduction of flood risk in the land use planning process and attempted to address the issue of climate change. This has since been superseded by the National Planning Policy Framework and the supporting technical guidance.

2.2 Traditionally surface water runoff from developments has been conveyed by pipe systems to the nearest watercourse or sewer. This tends to increase the rate and volume of the run off often leading to flooding downstream of the new development. Latest policy promotes the use of sustainable urban drainage systems (SuDS) whereby the control of run off is to be as close to source as possible. This can be achieved by utilising techniques which mimic the natural drainage processes, the use of direct infiltration for example. The Environment Agency will, in general, seek to restrict the allowable discharge from a new development to that previously expected from the undeveloped land.

2.3 The requirements of the revised Building Regulations which came into force on1st April 2002 are that adequate provision should be made for dealing with rainwater from the roofs of buildings and certain paved areas providing access to the buildings. Run off from such drainage systems are to be discharged to one of the following systems listed in order of priority:-

- A soakaway or other infiltration system
- A watercourse
- A sewer or drain

2.4 The revised Building Regulations were drafted to reinforce the requirements for SuDS wherever possible.

2.5 The Requirements of a Flood Risk Assessment:

2.5.1 A Flood Risk Assessment is required in order to ascertain whether a development will exacerbate the risk of flooding elsewhere in the catchment or is at risk of flooding itself.

2.5.2 A site specific FRA is required for: -

- Proposals of 1 Hectare or greater situated in Flood Zone 1
- New development (including minor development and change of use) located in areas of Flood Zone 1 that have critical drainage problems

- New development (including minor development and change of use) located in areas of Flood Zones 2 & 3.

Local Policies

2.6 Arun District Council Local Plan 2011-2031 outlines the different requirements of new developments. The requirements of the Local Plan relating to flood risk states:

2.6.3 Policy W DM2: Flood risk

Development in areas at risk from flooding, identified on the latest Environment Agency flood risk maps and the Council's Strategic Flood Risk Assessment (SFRA), will only be permitted where all of the following criteria have been satisfied:

a. The sequential test in accordance with the National Planning Policy Guidance has been met.
b. A site specific Flood Risk Assessment demonstrates that the development will be safe, including access and egress, without increasing flood risk elsewhere and reduce flood risk overall.
c. The sustainability benefits to the wider community are clearly identified.
d. The scheme identifies adaptation and mitigation measures.
e. Appropriate flood warning and evacuation plans are in place; and
f. New site drainage systems are designed to take account of events which exceed the normal design standard i.e. consideration of flood flow routing and utilising temporary storage areas.

The reports prepared as part of the criteria above must take into account contingency allowances, taking climate change into account as set out in Flood Risk Assessments: climate change allowances section of the NPPG.

In locations where strategic flood defence or resilient and resistant construction measures are necessary within the site itself, proposals will be required to demonstrate how measures have been incorporated as an intrinsic part of the scheme in a manner which is compatible with the latest Strategic Flood Risk Assessment.

All development proposals must take account of relevant Surface Water Management Plans, Catchment Flood Management Plans and related Flood Defence Plans and strategies such as the Lower Tidal River Arun Strategy. The council may require financial contributions from development on sites where measures to address flood risk or to improve the environmental quality of watercourses have been identified by these Plans and Strategies.

2.6.5 The requirements of the Local Plan relating to drainage states:

Policy W DM3: Sustainable Urban Drainage Systems

To increase the levels of water capture and storage and improve water quality, all

development must identify opportunities to incorporate a range of Sustainable Urban Drainage Systems (SUDS), appropriate to the size of development, at an early stage of the design process.

Proposals for both major and minor development proposals must incorporate SUDS within the private areas of the development in order to provide source control features to the overall SUDS design. These features include:

- Green roofs
- Permeable driveways and parking
- Soakaways
- Water harvesting and storage features including water butts.

Proposals for major development must also integrate SUDS within public open spaces and roads, reflecting discussion with the appropriate bodies. SUDS must therefore be integrated into the overall design of a development and must:

a. Contribute positively to the appearance of the area, integrating access to allow maintenance of existing watercourses and the system.
b. Effectively manage water (including its quality)
c. Accommodate and enhance biodiversity by making connections to existing Green Infrastructure assets and
d. Provide amenity for local residents (ensuring a safe environment)
e. Retain the existing drainage network of the site and the wider area,
f. Be maintained in perpetuity, supported through a Maintenance and Management Plan/Regime, including its financing, agreed with the Local Planning Authority.

In order to ensure that SUDS discharge water from the development at the same or lesser rate, as prior to construction, developers must:

f. Follow the hierarchy of preference for different types of surface water drainage disposal systems as set out in Approved Document H of the Building Regulations and the SUDS manual produced by CIRIA.
g. Undertake up to six months groundwater monitoring within the winter period.
h. Undertake winter percolation testing in accordance with BRE365.
i. The proposed drainage system must be designed to ensure that there is no flooding on a 1 in 30 year storm event.
j. The design must also take account of the 1 in 100 year storm event plus 30% allowance for climate change, on stored volumes, to ensure that there is no flooding of properties or the public highway or inundation of the foul sewerage system. Any excess flows must be contained within the site boundary, and within designated storage areas.