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Project	Project No.	Sheet No.
Catalyst Bicester, Wendlebury Rd, Bicester. for Albion Land.	S1358	D1
	Drawing No.	Rev. 3
Section: Surface Water Drainage Design	By: JG	Date: Nov. 2022
	Checked: WB	Date: Nov. 2022

Calculations

PROPOSED DEVELOPMENT

CATALYST BICESTER

WENDLEBURY ROAD, BICESTER

FOR ALBION LAND

SURFACE WATER DRAINAGE DESIGN

1.0 INTRODUCTION

The following calculations are prepared to justify the principles for design of below-ground surface water drainage systems for the above development. The development plot has an area of 18.4 ha and exhibits a gentle gradient from west to east. With the exception of a chicken farm in the southwestern corner, the site is presently undeveloped and comprises of open fields used as arable land. The proposed scheme is to develop the site with new roads, buildings and external yard hardstanding areas for B1(c), B2, and B8 use classes, and a Leisure Club.

Following permission granted on outline applications 19/01740/HYBRID and 19/01746/OUT in September 2020 and reserved matters applications approved for Phases 1, 2 and 3, this document provides full hydraulic calculation package for all phases of the development at Catalyst in support of discharge of conditions relating to SW Drainage. This document is in compliance with the approved BJH FRA (Issue 3) and attached Appendices respectfully.

The site presently drains naturally in an easterly direction towards Langford Brook which forms the eastern site boundary. Ground levels within the site boundary shall be adjusted by local raising levels in the northern sector to create a plateau for building development, with associated lowering of levels within the western and southern sectors to provide flood compensation. Details of the flood compensation scheme are appended to the BJH site-specific flood risk assessment.

The surface water drainage strategy for the developed site is to maintain the existing outfall arrangements and limit flows to existing greenfield values by utilising substantial retention swales and below-ground sub-grade attenuation storage, incorporating flow control devices to the drainage network. The design for the site drainage shall include an allowance for climate change.

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	Checked: WB	Date: Nov. 2022

Calculations

2.0 GROUND CONDITIONS

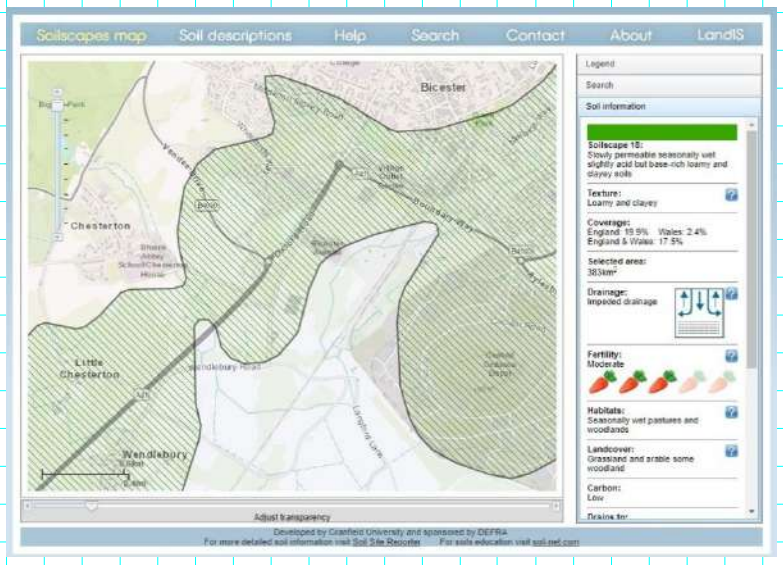
The published BGS geology map indicates Alluvium across the majority of the site. The Alluvium is absent in the northwest and the southwest of the site, where River Terrace deposits are shown. Solid geology of the Kellaway's Formation is anticipated below, comprising interbedded sandstone and siltstone of the Kellaway's Sand Member, underlain by mudstone interbedded with siltstone and sandstone of the Kellaway's Clay Member. Kellaway's Sand is shown to be absent in the north of the site. The Kellaway's Formation is anticipated to be underlain by limestone of the Cornbrash Formation.

A series of 18 trial pits have been excavated by Applied Geology on behalf of Albion Land Ltd. Topsoil and subsoil was encountered at surface across the site and was underlain by Superficial Deposits comprising Alluvium and River Terrace Deposits, which in turn was underlain by the Kellaways Formation, predominantly comprising clay, with initial horizons of sand in the southeast of the site. This is broadly consistent with the published geological records. Groundwater was recorded as seepages in all trial pits, with the exception of TP12 (no River Terrace Deposits present) within the River Terrace Deposits at depths of between 0.5m and 1.3m bgl.

3.0 DESIGN

3.1 Greenfield Runoff Estimate

Greenfield runoff estimation is undertaken using the UK SuDS Tools Website using the Institute of Hydrology Report 124 methodology. Based upon soils information for the development site obtained from the Cranfield Soil and AgriFood Institute Soilscapes Viewer and the ground conditions established during the trial pitting exercise undertaken by Applied Geology, the SOIL is conservatively considered to be type 3 for the purpose of greenfield runoff estimation. The default value of SOIL type 1 (sandy highly permeable material), allocated by the UK SuDS Tools Website for the subject site, is considered inappropriate and is therefore edited within the input data.



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Section Surface Water Drainage Design	By JG	Date Nov. 2022
	Checked WB	Date Nov. 2022

Calculations

Greenfield runoff is calculated using the Institute of Hydrology Report 124 methodology; the appended calculation sheet confirms the 1:1 greenfield runoff rate = **20.43 litres/sec**

3.2 Quick Storage Estimate

For the purpose of initial sizing of flood storage requirements it shall be assumed that the outflow from the whole site shall be restricted to 20.4 l/sec for all rainfall events up to and including the 1 in 100 year event inclusive of an allowance of 40% for climate change in accordance with government guidance.

Drainage design is undertaken using the Source Control module of MicroDrainage Windes software. The surface water drainage shall be split into two catchments; Units 10-13 shall drain into Swale 1, and Units 1-9 + David Lloyd shall drain into Swale 2. Both swales shall discharge to existing field ditches which in turn outfall to Langford Brook to the east. The total permissible outflow rates are apportioned at 8 l/sec from Swale 1, and 12 l/sec from Swale 2. Input data and results of Quick Storage Estimates are presented on the following sheets no's 1 and 20. For 1 in 100 year +40% storm events (using FEH 2013 design rainfall) the software predicts storage volumes between 1850 m^3 and 2531 m^3 will be required for Swale 1, and between 5867 m^3 and 7516 m^3 will be required for Swale 2.

3.3 Drainage Layouts

The attached BJH drawings S1358-DD01C, DD02C & DD03C illustrate the hard surfaced drained site areas, pipe design references and lengths, and the layout of principal below-ground drainage runs respectively. The Leisure Centre plot has dedicated surface water attenuation provisions by virtue of private below-ground storage and a hydro brake flow control to restrict flows to 60 l/sec at the outfall manhole connecting to the shared system constructed through the industrial plot. This information is input to the Windes software and modelled in the Simulation module.

3.4 Units 1-9 + David Lloyd – Simulation Results

In order to establish the critical storm event a simple model is created within the Source Control module of Windes using a Swale fitted with an Hydrobrake flow control device to restrict outflows to 12 l/sec. Swale 2 dimensions are shown on the attached BJH drawing S1358-DD04C.

MicroDrainage pages 2-14 include complete details of the network i.e., pipe details, manhole details, outfall details, simulation details, online controls, storage provisions and a volume summary. The total volume in the system from attenuation basin 1, porous paving, pipes, and manholes is 7098 m^3. The following critical results have been presented for all storms assessed from 15 mins to 4320 mins (3 Days). All storms have been run for the 2-year, 30-year, and 100-year+40% return periods.

In line with Local and National Guidance, no flooding to any drainage element should occur up to the 30-year return period for all storm events. In addition, no flooding should occur to any buildings on site in the 100-year +40% return period for all storm events.

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Project	Project No.	Sheet No.
Catalyst Bicester, Wendlebury Rd, Bicester. for Albion Land.	S1358	D4
	Drawing No.	Rev. 3
Section: Surface Water Drainage Design	By: JG	Date: Nov. 2022
	Checked: WB	Date: Nov. 2022

Calculations

3.4.1 Simulation 2yr Winter & Summer Storms

MicroDrainage pages 15-16 indicates the critical storm simulation and results are for the critical return period winter design storm. The water level in Swale 2 is 63.129m (depth of 229mm); discharge to outfall is 12 l/sec. The maximum volume of water in the system is 1388m^3. None of the pipes in the system are significantly surcharged and no flooding is predicted.

None of the pipes in the system are significantly surcharged and **No flooding is predicted**.

3.4.2 Simulation 30yr Winter & Summer Storms

MicroDrainage pages 17-18 indicates the critical storm simulation and results are for the critical return period winter design storm. The water level in Swale 2 is 63.379m (depth of 479mm); discharge to outfall is 12 l/sec. The maximum volume of water in the system is 3057 m^3. Some of the pipes in the system are surcharged and no flooding is predicted.

None of the pipes in the system are significantly surcharged and **No flooding is predicted**.

3.5.3 Simulation 100yr+40% Winter & Summer Storms

MicroDrainage page 19-20 indicates the critical storm simulation and results are for the critical return period winter design storm. The water level in Swale 2 is 63.763m (depth of 863mm); discharge to outfall is 12 l/sec. The maximum volume of water in the system is 5907 m^3. Some of the pipes in the system are surcharged and no flooding is predicted.

None of the pipes in the system are significantly surcharged and **No flooding is predicted**.

3.5 Units 10-13 – Swale 1

In order to establish the critical storm event a simple model is created within the Source Control module of Windes using a Swale fitted with an Hydrobrake flow control device to restrict outflows to 8 l/sec. Swale 1 dimensions are shown on the attached BJH drawing 1358-DD04C.

MicroDrainage pages 21-26 include complete details of the network i.e., pipe details, manhole details, outfall details, simulation details, online controls, storage provisions and a volume summary. The total volume in the system from attenuation basin 2, porous paving, pipes, and manholes is 2173 m^3. The following critical results have been presented for all storms assessed from 15 mins to 4320 mins (3 Days). All storms have been run for the 2-year, 30-year, and 100-year+40% return periods.

In line with Local and National Guidance, no flooding to any drainage element should occur up to the 30-year return period for all storm events. In addition, no flooding should occur to any buildings on site in the 100-year +40% return period for all storm events.

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Project	Project No.	Sheet No.
Catalyst Bicester, Wendlebury Rd, Bicester. for Albion Land.	S1358	D5
	Drawing No.	Rev. 3
Section: Surface Water Drainage Design	By: JG	Date: Nov. 2022
	Checked: WB	Date: Nov. 2022

Calculations

3.4.1 Simulation 2yr Winter & Summer Storms

MicroDrainage pages 27-28 indicate the critical storm simulation and results are for the critical return period winter design storm. The water level in Swale 1 is 63.671m (depth of 571mm); discharge to outfall is 8 l/sec. The maximum volume of water in the system is 382 m^3. None of the pipes in the system are surcharged and no flooding is predicted.

None of the pipes in the system are significantly surcharged and **No flooding is predicted**.

3.4.2 Simulation 30yr Winter & Summer Storms

MicroDrainage pages 29-30 indicate the critical storm simulation and results are for the critical return period winter design storm. The water level in Swale 1 is 64.144m (depth of 1044mm); discharge to outfall is 8 l/sec. The maximum volume of water in the system is 885 m^3. Some of the pipes in the system are surcharged and no flooding is predicted.

None of the pipes in the system are significantly surcharged and **No flooding is predicted**.

3.4.3 Simulation 100yr+40% Winter & Summer Storms

MicroDrainage pages 31-32 indicate the critical storm simulation and results are for the critical return period winter design storm. The water level in Swale 1 is 64.632m (depth of 1532mm); discharge to outfall is 8 l/sec. The maximum volume of water in the system is 1718 m^3. Some of the pipes in the system are surcharged and no flooding is predicted.

None of the pipes in the system are significantly surcharged and **No flooding is predicted**.

4.0 EXCEEDANCE EVENTS

Site levels will arranged to ensure that overland flow routes are created to encourage any build-up of surface water to flow in an easterly direction towards lower laying parklands, wetlands and eventual discharge back into the Langford Brook.

Similarly, the bunding to the Swale will be constructed to ensure that there is facility for overspill to occur in an easterly direction away from the development land. Bunding will also be at least 300mm freeboard above the maximum predicted water level to provide extra exceedance volume. In addition predicted river flood levels in the 1 in 100 year + 35% event will be 64.11m so the swales bunds will keep flood water out of the swales and keep surface water in.

Exceedance flow routes have been detailed on S1358-DD05A.

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Project	Project No.	Sheet No.
Catalyst Bicester, Wendlebury Rd, Bicester. for Albion Land.	S1358	D6
	Drawing No.	Rev. 3
Section Surface Water Drainage Design	By JG	Date Nov. 2022
	Checked WB	Date Nov. 2022

Calculations

5.0 WATER QUALITY

A simple quality assessment has been carried out below to the CIRIA SUDS Manual method below:

Industrial Roofs

0.3 / 0.2 / 0.05 - Industrial Roofs (Low Hazard)

0.5 / 0.5 / 0.6 - All roof drains to pass through Detention Basins before discharge.

All mitigation indices > pollution indices therefore OK.

Combined Delivery Yards & Car Parking

0.8 / 0.8 / 0.9 - Delivery Yards & Car Parking – (High Hazard)

0.8 / 0.6 / 0.9* - All yards & car parks to pass through petrol interceptor before discharge.
0.5 / 0.5 / 0.6** - In addition, all yards & car parks to pass through Detention Basins before discharge.

1.0 / 0.85 / 1.0 - Total mitigation indices (Maximum achievable score = 1.0)

*Indices from SPEL Handbook attached for stormceptor system.
**For secondary treatment indices are reduced by 50%.

All mitigation indices > pollution indices therefore OK.

Dedicated Car Parking

0.7 / 0.6 / 0.7 - General non-residential parking – (Medium Hazard)

0.7 / 0.6 / 0.7* - All yards & car parks to pass through permeable paving before discharge.
0.5 / 0.5 / 0.6** - All Car Parks to pass through Detention Basins before discharge.

0.95 / 0.85 / 1.0 - Total mitigation indices (Maximum achievable score = 1.0)

General Estate Roads

0.5 / 0.4 / 0.4 - General Access Roads & Footpaths – (Medium/Low Hazard)

0.5 / 0.5 / 0.6 - All Roads to pass through Detention Basins before discharge.

All mitigation indices > pollution indices therefore OK.

Overall 100% compliance to treat runoff adequately is achieved with the SuDS features provided.

APPENDIX A

GREENFIELD RUNOFF ESTIMATE

HR Wallingford
Working with water

Greenfield runoff estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	peter brooks
Site name:	Promised Land Farm
Site location:	Bicester

This is an estimation of the greenfield runoff rate limits that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 rev. E (2012) and the SuDS Manual, C753 (Ciria, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site coordinates

Latitude:	51.88559° N
Longitude:	1.16552° W

Reference:	6484523
Date:	2018-10-25T08:25:55

Methodology	IH124

Site characteristics

Total site area (ha)	9.7

Methodology

Qbar estimation method	Calculate from SPR and SAAR
SPR estimation method	Calculate from SOIL type

	Default	Edited
SOIL type	1	3
HOST class	---	---
SPR/SPRHOST	0.1	0.37

Hydrological characteristics

	Default	Edited
SAAR (mm)	617	617
Hydrological region	6	6
Growth curve factor: 1 year	0.85	0.85
Growth curve factor: 30 year	2.3	2.3
Growth curve factor: 100 year	3.19	3.19

Notes:

(1) Is Q_{BAR} < 2.0 l/s/ha?

Normally limiting discharge rates which are less than 2.0 l/s/ha are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consents are usually set at 5.0l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set in which case blockage work must be addressed by using appropriate drainage elements

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite may be a requirement for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Qbar (l/s)	1.41	24.04
1 in 1 year (l/s)	1.19	20.43
1 in 30 years (l/s)	3.23	55.29
1 in 100 years (l/s)	4.48	76.69

APPENDIX B

BAILEY JOHNSON HAYES DRAWINGS

S1358-DD01C – Drained Areas

S1358-DD02C – SW Drainage Design Refs

S1358-DD03C – Proposed SW Drainage

S1358-DD04C – Proposed Swales

S1358-DD05A – Exceedance Flow Routes

A0

DRAINAGE NOTES

1. This drawing is to be read in conjunction with all relevant Architects and Bailey Johnson Hayes drawings and specifications.
2. Do not scale. Work only to figured dimensions.
3. All dimensions and condition of existing drainage to have invert levels confirmed on site prior to commencement of work.
4. Proposed Site and Finishes Plan from Cornish Architects:- Drawing Ref: 22011 - TP - 001 - E
   Topographical Survey by MK Surveys Limited: Drawing Ref: 25646 (Rev 1) - Topographical Survey
5. All works to Adopted Sewers to be carried out in accordance with the requirements of Sewers for Adoption in the Sewerage Sector Guidance v2.2 (2022) and the Adopting authority requirements.
6. All private drainage is to be constructed in accordance with the Building Regulations as current at construction.
7. Drains to be 'Hepworth Supersleeve' or similar approved Laid in Class S Bedding to BS 882 1983: Table 4, or to BS 8301 1985: Appendix D. 450mm Diameter Drains and above are to be Hepworth Concrete Pipes Class H or similar approved drains within the site may be different main accordance with Sewerage Sector Guidance v2.2 (2022).
8. All trenches within trafficked areas to be backfilled with 75mm down graded stone fill, placed and compacted in 150mm layers. All pipes in Roadways / Parking, less than 900mm deep to pipe crown to be encased in concrete and flexible joints provided at 3000mm centres.
9. All drains to have Class S granular bed and surround, except where:
   a) Cover beneath roads or hardstanding is less than 900mm to Pipe Crown or,
   b) Cover beneath landscaping is less than 600mm in which case Class Z bed/surround is required.
10. All Manholes greater than 1m to soffit to be constructed in Precast Concrete Rings to BS 5911: Part 1. Rings to be bedded in sealant strips unless otherwise noted in Manhole Schedule.
11. Manholes in footpaths or landscaped areas to be backfilled with 40mm down graded stone fill, compacted in layers not exceeding 150mm thick. All manholes beneath roads and parking areas to be cased in minimum 150mm concrete surround.
12. All connections to rain water pipes to be provided with Rodding access.
13. All road gullies to be Hepworth Road Gullies, Ref 214 RGR4 with 150mm diameter outlets or similar approved. Gullies to be encased in minimum 150mm concrete.
14. Drains under buildings and within 300mm of the underside of floor slab to be encased in 150mm concrete. Casing to incorporate flexible fibre board joints at spacing's as recommended by the pipe manufacturer. Drains under buildings
15. Architect is to provide final rain water pipe positions for construction.
16. All Pipes to enter manhole with Soffits Level unless otherwise stated. See manhole details drawings for further clarity of connections.

LEGEND

- INDICATES SURFACE WATER MANHOLES
- INDICATES SURFACE WATER PIPE RUNS
- INDICATES INDICATIVE DAVID LLOYD DRAINS
- INDICATES LINEAR DRAINAGE CHANNELS
- INDICATES ROAD GULLIES
- INDICATES SUBGRADE STONE TANK
- INDICATES ATTENUATION BASINS

ALL PIPES CONNECTED DIRECTY INTO GULLIES TO BE 150MM DIAMETER (COLOURED MAGENTA ON PLAN)

SCALE

10m 5m 0 10m 20m 30m

Scale 1:500 @A0

ADDITIONAL NOTES

NOTE: DAVID LLOYD SW DRAINAGE DESIGNED AND CONSTRUCTED BY OTHERS. RESTRICTED TO 60 L/S INTO CATALYST BICESTER SW SCHEME

NOTE: DRAINAGE IS A MIXTURE OF INVERT & SOFFIT MANHOLE DESIGN. SEE BJH MANHOLE DETAILS FOR SPECIFIC PIPE INLET/OUTLET LEVELS

NOTE: ALL RWP PIPE POSITIONS TO BE AGREED WITH THE ARCHITECT

CALCULATIONS

Rev	Date	Revision Description
C	15.11.22	Revised to latest masterplan layout
B	15.03.22	Updated to latest layout
A	01.07.19	Redrawn

Revision Schedule

Project Title
Catalyst Bicester
Wendlebury Road, Bicester

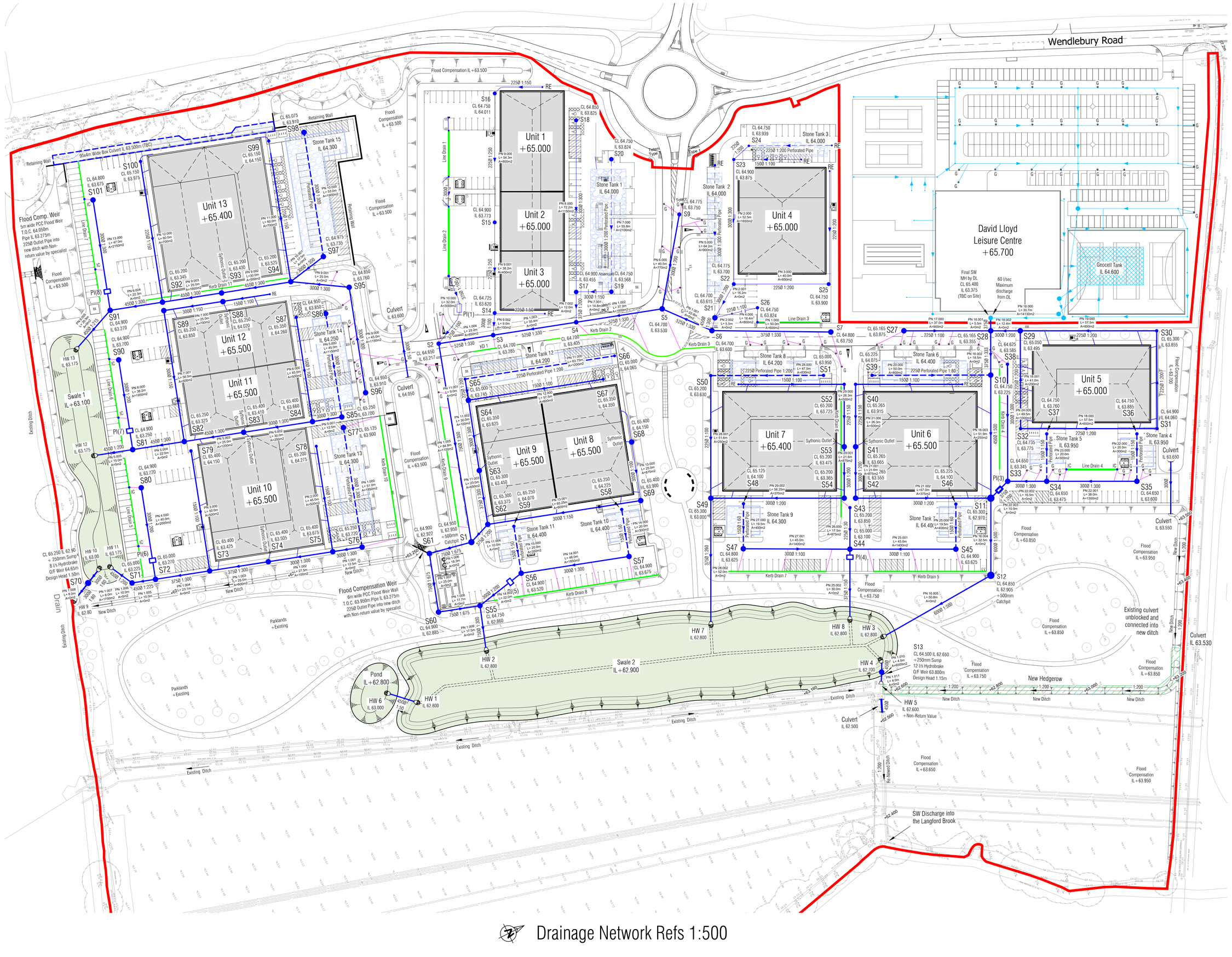
Client
ALBION LAND

Drawing Title
DRAINAGE CALCULATIONS
SW Drained Areas

BAILEY JOHNSON HAYES
Consulting Engineers
ST.ALBANS: Suite 4, Phoenix House, 63 Campfield Rd, ST.ALBANS, Herts AL1 5FL
MANCHESTER: Grange House, John Dalton Street, MANCHESTER, M2 6FW

Scale	1:500 @A0
Date	01.07.19
Drawn	JNG
Drawing Number	S1358-DD01 C

SW Drained Areas 1:500



Drainage Network Refs 1:500

A0

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B	15.03.22	Updated to latest layout
A	01.07.19	Redrawn

Revision Schedule

Project Title: Catalyst Bicester
Wendlebury Road, Bicester

Client: ALBION LAND

Drawing Title: DRAINAGE CALCULATIONS
Drainage Network Refs

BAILEY JOHNSON HAYES
Consulting Engineers
ST.ALBANS: Suite 4, Phoenix House, 63 Campfield Rd, ST.ALBANS, Herts AL1 5FL
MANCHESTER: Grange House, John Dalton Street, MANCHESTER, M2 6FW

Scale	1:500 @A1
Date	01.07.19
Drawn	JNG
Drawing Number	S1358-DD02 C

A0

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   b) Cover beneath landscaping is less than 600mm in which case Class Z bed/surround is required.
10. All Manholes greater than 1m to soffit to be constructed in Precast Concrete Rings to BS 5911: Part 1. Rings to be bedded in sealant strips unless otherwise noted in Manhole Schedule.
11. Manholes in footpaths or landscaped areas to be backfilled with 40mm down graded stone fill, compacted in layers not exceeding 150mm thick. All manholes beneath roads and parking areas to be cased in minimum 150mm concrete surround.
12. All connections to rain water pipes to be provided with Rodding access.
13. All road gullies to be Hepworth Road Gullies, Ref 214 RGR4 with 150mm diameter outlets or similar approved. Gullies to be encased in minimum 150mm concrete.
14. Drains under buildings and within 300mm of the underside of floor slab to be encased in 150mm concrete. Casing to incorporate flexible fibre board joints at spacing's as recommended by the pipe manufacturer. Drains under buildings
15. Architect is to provide final rain water pipe positions for construction.
16. All Pipes to enter manhole with Soffits Level unless otherwise stated. See manhole details drawings for further clarity of connections.

LEGEND

- INDICATES SURFACE WATER MANHOLES
- INDICATES SURFACE WATER PIPE RUNS
- INDICATES INDICATIVE DAVID LLOYD DRAINS
- INDICATES LINEAR DRAINAGE CHANNELS
- INDICATES ROAD GULLIES
- INDICATES SUBGRADE STONE TANK
- INDICATES ATTENUATION BASINS

ALL PIPES CONNECTED DIRECTY INTO GULLIES TO BE 150MM DIAMETER (COLOURED MAGENTA ON PLAN)

SCALE

10m 5m 0 10m 20m 30m

Scale 1:500 @A0

ADDITIONAL NOTES

NOTE: DAVID LLOYD SW DRAINAGE DESIGNED AND CONSTRUCTED BY OTHERS. RESTRICTED TO 60 L/S INTO CATALYST BICESTER SW SCHEME

NOTE: DRAINAGE IS A MIXTURE OF INVERT & SOFFIT MANHOLE DESIGN. SEE BJH MANHOLE DETAILS FOR SPECIFIC PIPE INLET/OUTLET LEVELS

NOTE: ALL RWP PIPE POSITIONS TO BE AGREED WITH THE ARCHITECT

CALCULATIONS

Rev	Date	Revision Description
C	15.11.22	Revised to latest masterplan layout
B	15.03.22	Updated to latest layout
A	01.07.19	Redrawn

Revision Schedule

Project Title: Catalyst Bicester
Wendlebury Road, Bicester

Client: ALBION LAND

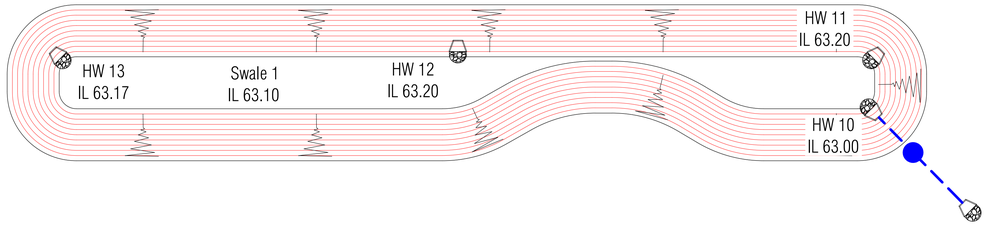
Drawing Title: DRAINAGE CALCULATIONS
SW Drainage Layout

BAILEY JOHNSON HAYES
Consulting Engineers
ST.ALBANS: Suite 4, Phoenix House, 63 Campfield Rd, ST.ALBANS, Herts AL1 5FL
MANCHESTER: Grange House, John Dalton Street, MANCHESTER, M2 6FW

Scale	1:500 @A0
Date	01.07.19
Drawn	JNG
Drawing Number	S1358-DD03 C

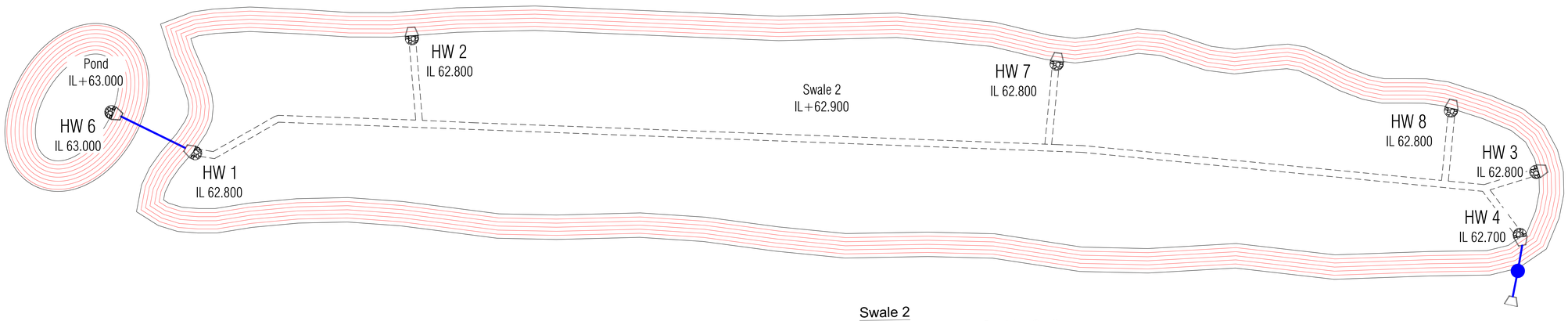
SW Drainage Layout 1:500

A0



Swale 1

D = 0m	A = 441m2	V=0m3
D = 0.2m	A = 561m2	V=124m3
D = 0.4m	A = 683m2	V=124m3
D = 0.6m	A = 809m2	V=274m3
D = 0.8m	A = 936m2	V=449m3
D = 1.0m	A = 1065m2	V=650m3
D = 1.2m	A = 1198m2	V=880m3
D = 1.4m	A = 1332m2	V=1135m3
D = 1.6m	A = 1468m2	V=1420m3
D = 1.8m	A = 1607m2	V=1734m3
D = 2.0m	A = 1747m2	V=2188m3



Swale 2

D = 0m	A = 5073m2	V = 0m3
D = 0.2m	A = 5340m2	V = 1041m3
D = 0.4m	A = 5611m2	V = 2137m3
D = 0.6m	A = 5883m2	V = 3287m3
D = 0.8m	A = 6158m2	V = 4492m3
D = 1.0m	A = 6435m2	V = 5754m3
D = 1.2m	A = 6715m2	V = 7073m3

Swale Areas 1:250

CALCULATIONS

Rev	Date	Revision Description
C	15.11.22	Revised to latest masterplan layout
B	01.03.20	Volumes added to swale details
A	01.07.19	Redrawn

Revision Schedule

Project Title
Catalyst Bicester
Wendlebury Road, Bicester

Client
ALBION LAND

Drawing Title
DRAINAGE CALCULATIONS
Swale Areas

BAILEY JOHNSON HAYES
Consulting Engineers
ST.ALBANS: Suite 4, Phoenix House, 63 Campfield Rd, ST.ALBANS, Herts AL1 5FL
MANCHESTER: Grange House, John Dalton Street, MANCHESTER, M2 6FW

Scale	1:500 @A0
Date	01.07.19
Drawn	JNG

Drawing Number
S1358-DD04 C

A0

DRAINAGE NOTES

1. This drawing is to be read in conjunction with all relevant Architects and Bailey Johnson Hayes drawings and specifications.
2. Do not scale. Work only to figured dimensions.
3. All dimensions and condition of existing drainage to have invert levels confirmed on site prior to commencement of work.
4. Proposed Site and Finishes Plan from Cornish Architects:- Drawing Ref: 22011 - TP - 001 - E
   Topographical Survey by MK Surveys Limited:
   Drawing Ref: 25646 (Rev 1) - Topographical Survey
5. All works to Adopted Sewers to be carried out in accordance with the requirements of Sewers for Adoption in the Sewerage Sector Guidance v2.2 (2022) and the Adopting authority requirements.
6. All private drainage is to be constructed in accordance with the Building Regulations as current at construction.
7. Drains to be 'Hepworth Supersleeve' or similar approved Laid in Class S Bedding to BS 882 1983: Table 4, or to BS 8301 1985: Appendix D. 450mm Diameter Drains and above are to be Hepworth Concrete Pipes Class H or similar approved drains within the site may be different main accordance with Sewerage Sector Guidance v2.2 (2022).
8. All trenches within trafficked areas to be backfilled with 75mm down graded stone fill, placed and compacted in 150mm layers. All pipes in Roadways / Parking, less than 900mm deep to pipe crown to be encased in concrete and flexible joints provided at 3000mm centres.
9. All drains to have Class S granular bed and surround, except where:
   a) Cover beneath roads or hardstanding is less than 900mm to Pipe Crown or,
   b) Cover beneath landscaping is less than 600mm in which case Class Z bed/surround is required.
10. All Manholes greater than 1m to soffit to be constructed in Precast Concrete Rings to BS 5911: Part 1. Rings to be bedded in sealant strips unless otherwise noted in Manhole Schedule.
11. Manholes in footpaths or landscaped areas to be backfilled with 40mm down graded stone fill, compacted in layers not exceeding 150mm thick. All manholes beneath roads and parking areas to be cased in minimum 150mm concrete surround.
12. All connections to rain water pipes to be provided with Rodding access.
13. All road gullies to be Hepworth Road Gullies, Ref 214 RGR4 with 150mm diameter outlets or similar approved. Gullies to be encased in minimum 150mm concrete.
14. Drains under buildings and within 300mm of the underside of floor slab to be encased in 150mm concrete. Casing to incorporate flexible fibre board joints at spacing's as recommended by the pipe manufacturer. Drains under buildings
15. Architect is to provide final rain water pipe positions for construction.
16. All Pipes to enter manhole with Soffits Level unless otherwise stated. See manhole details drawings for further clarity of connections.

LEGEND

- INDICATES SURFACE WATER MANHOLES
- INDICATES SURFACE WATER PIPE RUNS
- INDICATES INDICATIVE DAVID LLOYD DRAINS
- INDICATES LINEAR DRAINAGE CHANNELS
- INDICATES ROAD GULLIES
- INDICATES SUBGRADE STONE TANK
- INDICATES ATTENUATION BASINS

ALL PIPES CONNECTED DIRECTY INTO GULLIES TO BE 150MM DIAMETER (COLOURED MAGENTA ON PLAN)

SCALE

10m 5m 0 10m 20m 30m

Scale 1:500 @A0

ADDITIONAL NOTES

NOTE: DAVID LLOYD SW DRAINAGE DESIGNED AND CONSTRUCTED BY OTHERS. RESTRICTED TO 60 L/S INTO CATALYST BICESTER SW SCHEME

NOTE: DRAINAGE IS A MIXTURE OF INVERT & SOFFIT MANHOLE DESIGN. SEE BJH MANHOLE DETAILS FOR SPECIFIC PIPE INLET/OUTLET LEVELS

NOTE: ALL RWP PIPE POSITIONS TO BE AGREED WITH THE ARCHITECT

CALCULATIONS

Rev	Date	Revision Description
A	15.11.22	Revised to latest masterplan layout

Revision Schedule

Project Title
Catalyst Bicester
Wendlebury Road, Bicester

Client
ALBION LAND

Drawing Title
DRAINAGE CALCULATIONS
Exceedance Flood Routes

BAILEY JOHNSON HAYES
Consulting Engineers
ST.ALBANS: Suite 4, Phoenix House, 63 Campfield Rd, ST.ALBANS, Herts AL1 5FL
MANCHESTER: Grange House, John Dalton Street, MANCHESTER, M2 6FW

Scale	1:500 @A0
Date	01.07.19
Drawn	JNG

Drawing Number
S1358-DD05 A

Exceedance Flood Routes 1:500

APPENDIX C

MICRODRAINAGE CALCULATIONS

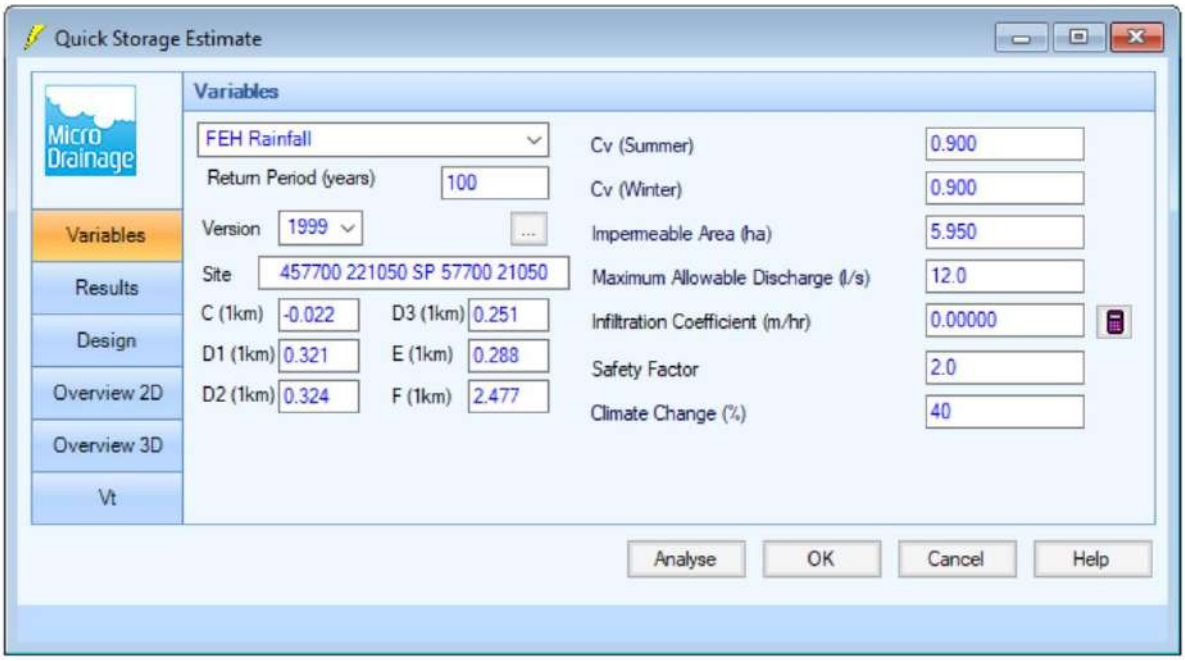
Page 1 – Units 1-9 Quick Storage Estimate

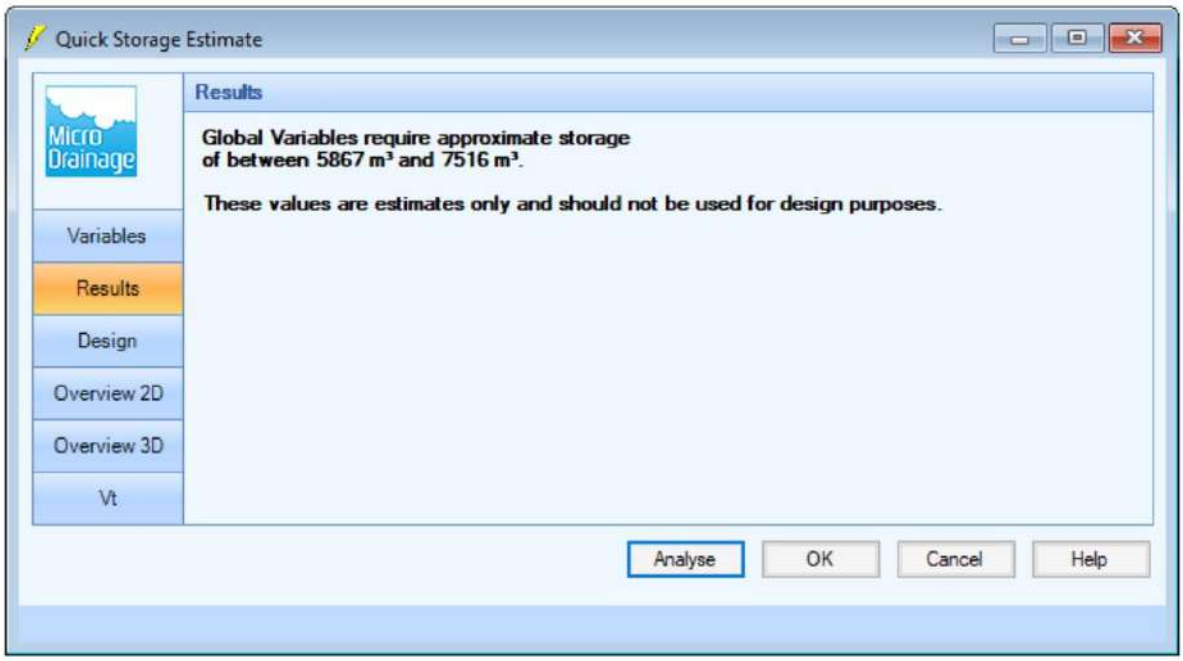
Pages 2-19 – Units 1-9 MircoDrainage Results

Page 20 – Units 10-13 Quick Storage Estimate

Pages 21-32 – Units 10-13 MircoDrainage Results

100 Year + 40% Climate Change Event





STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Storm

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	50.000	0.150	333.3	0.060	15.00	0.0	0.600	o	375	Pipe/Conduit	
2.000	52.500	0.175	300.0	0.165	15.00	0.0	0.600	o	300	Pipe/Conduit	
3.000	40.000	0.200	200.0	0.085	15.00	0.0	0.600	o	225	Pipe/Conduit	
2.001	16.200	0.085	190.6	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
4.000	18.400	0.209	88.0	0.080	15.00	0.0	0.600	o	225	Pipe/Conduit	
5.000	64.200	0.214	300.0	0.090	15.00	0.0	0.600	o	300	Pipe/Conduit	
2.002	5.500	0.015	366.7	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.001	22.800	0.070	325.7	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	
6.000	40.500	0.220	184.1	0.077	15.00	0.0	0.600	o	300	Pipe/Conduit	
1.002	37.000	0.125	296.0	0.160	0.00	0.0	0.600	o	525	Pipe/Conduit	
7.000	55.800	0.256	218.0	0.210	15.00	0.0	0.600	o	300	Pipe/Conduit	
7.001	14.800	0.113	131.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	82.79	15.84	63.750	0.060	0.0	0.0	0.0	0.99	109.0	16.1
2.000	82.40	15.97	63.875	0.165	0.0	0.0	0.0	0.90	63.8	44.2
3.000	83.18	15.72	63.900	0.085	0.0	0.0	0.0	0.92	36.6	23.0
2.001	81.66	16.21	63.625	0.250	0.0	0.0	0.0	1.14	80.3	66.3
4.000	84.84	15.22	63.824	0.080	0.0	0.0	0.0	1.39	55.4	22.1
5.000	81.72	16.19	63.829	0.090	0.0	0.0	0.0	0.90	63.8	23.9
2.002	81.39	16.29	63.615	0.420	0.0	0.0	0.0	1.06	167.9	111.1
1.001	80.47	16.60	63.530	0.480	0.0	0.0	0.0	1.24	267.5	125.5
6.000	83.63	15.58	63.750	0.077	0.0	0.0	0.0	1.16	81.7	20.9
1.002	79.09	17.08	63.405	0.717	0.0	0.0	0.0	1.30	280.7	184.3
7.000	82.69	15.88	63.824	0.210	0.0	0.0	0.0	1.06	75.0	56.4
7.001	82.12	16.06	63.568	0.210	0.0	0.0	0.0	1.37	97.0	56.4

STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
8.000	72.200	0.295	244.7	0.115	15.00	0.0	0.600	o	300	Pipe/Conduit	
7.002	12.000	0.050	240.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.003	35.400	0.120	295.0	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	
9.000	54.300	0.238	228.2	0.080	15.00	0.0	0.600	o	225	Pipe/Conduit	
9.001	38.200	0.153	249.7	0.045	0.00	0.0	0.600	o	225	Pipe/Conduit	
9.002	9.000	0.110	81.8	0.010	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.004	23.200	0.068	341.2	0.085	0.00	0.0	0.600	o	525	Pipe/Conduit	
10.000	32.000	0.320	100.0	0.300	15.00	0.0	0.600	o	375	Pipe/Conduit	
1.005	84.800	0.267	317.6	0.110	0.00	0.0	0.600	o	750	Pipe/Conduit	
11.000	63.750	0.320	199.2	0.120	15.00	0.0	0.600	o	225	Pipe/Conduit	
11.001	9.000	0.045	200.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
12.000	57.500	0.575	100.0	0.060	15.00	0.0	0.600	o	150	Pipe/Conduit	
11.002	30.000	0.100	300.0	0.010	0.00	0.0	0.600	o	300	Pipe/Conduit	
11.003	23.000	0.075	306.7	0.065	0.00	0.0	0.600	o	375	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
8.000	81.67	16.20	63.825	0.115	0.0	0.0	0.0	1.00	70.7	30.5
7.002	81.15	16.37	63.405	0.325	0.0	0.0	0.0	1.17	128.7	85.7
1.003	77.82	17.53	63.405	1.042	0.0	0.0	0.0	1.30	281.2	263.5
9.000	82.14	16.05	64.011	0.080	0.0	0.0	0.0	0.86	34.3	21.4
9.001	79.82	16.82	63.773	0.125	0.0	0.0	0.0	0.82	32.7	32.4
9.002	79.52	16.93	63.620	0.135	0.0	0.0	0.0	1.45	57.5	34.9
1.004	76.96	17.85	63.217	1.262	0.0	0.0	0.0	1.21	261.3«	315.6
10.000	84.59	15.29	63.912	0.300	0.0	0.0	0.0	1.81	200.1	82.5
1.005	74.64	18.76	63.217	1.672	0.0	0.0	0.0	1.56	691.3	405.6
11.000	81.83	16.15	64.065	0.120	0.0	0.0	0.0	0.92	36.7	31.9
11.001	81.33	16.31	63.745	0.120	0.0	0.0	0.0	0.92	36.6	31.9
12.000	82.45	15.95	64.350	0.060	0.0	0.0	0.0	1.00	17.8	16.1
11.002	79.69	16.87	63.625	0.190	0.0	0.0	0.0	0.90	63.8	49.2
11.003	78.63	17.24	63.450	0.255	0.0	0.0	0.0	1.03	113.7	65.2

STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
13.000	25.000	0.250	100.0	0.088	15.00	0.0	0.600	o	300	Pipe/Conduit	
13.001	65.250	0.450	145.0	0.060	0.00	0.0	0.600	o	300	Pipe/Conduit	
11.004	10.000	0.050	200.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.006	18.300	0.028	653.6	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
1.007	25.000	0.037	675.7	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
1.008	17.700	0.025	708.0	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
14.000	20.000	0.400	50.0	0.030	15.00	0.0	0.600	o	150	Pipe/Conduit	
14.001	46.000	0.155	296.8	0.185	0.00	0.0	0.600	o	300	Pipe/Conduit	
15.000	20.000	0.400	50.0	0.035	15.00	0.0	0.600	o	150	Pipe/Conduit	
14.002	22.000	0.110	200.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.009	17.500	0.060	291.7	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
16.000	30.700	0.205	149.8	1.413	15.00	0.0	0.600	o	300	Pipe/Conduit	
16.001	5.500	0.020	275.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
17.000	37.000	0.370	100.0	0.090	15.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
13.000	84.69	15.27	64.150	0.088	0.0	0.0	0.0	1.57	111.1	24.2
13.001	81.99	16.10	63.900	0.148	0.0	0.0	0.0	1.30	92.1	39.4
11.004	78.26	17.37	63.375	0.403	0.0	0.0	0.0	1.28	141.1	102.5
1.006	73.95	19.04	62.950	2.075	0.0	0.0	0.0	1.09	480.3«	498.7
1.007	73.02	19.43	62.922	2.075	0.0	0.0	0.0	1.07	472.3«	498.7
1.008	72.37	19.71	62.885	2.075	0.0	0.0	0.0	1.04	461.2«	498.7
14.000	84.79	15.23	64.225	0.030	0.0	0.0	0.0	1.43	25.2	8.3
14.001	82.06	16.08	63.675	0.215	0.0	0.0	0.0	0.91	64.1	57.3
15.000	84.79	15.23	64.070	0.035	0.0	0.0	0.0	1.43	25.2	9.6
14.002	81.04	16.41	63.520	0.250	0.0	0.0	0.0	1.11	78.3	65.8
1.009	71.96	19.89	62.860	2.325	0.0	0.0	0.0	1.63	721.6	543.7
16.000	84.24	15.40	63.580	1.413	0.0	0.0	0.0	1.28	90.7«	386.8
16.001	83.96	15.48	63.375	1.413	0.0	0.0	0.0	1.09	120.1«	386.8
17.000	84.00	15.47	63.875	0.090	0.0	0.0	0.0	1.31	52.0	24.6

STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
18.000	57.500	0.285	201.8	0.065	15.00	0.0	0.600	o	225	Pipe/Conduit	
18.001	41.000	0.205	200.0	0.020	0.00	0.0	0.600	o	225	Pipe/Conduit	
19.000	57.500	0.285	201.8	0.085	15.00	0.0	0.600	o	225	Pipe/Conduit	
18.002	12.400	0.065	190.8	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
16.002	18.500	0.055	336.4	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
20.000	50.000	0.625	80.0	0.080	15.00	0.0	0.600	o	225	Pipe/Conduit	
16.003	51.900	0.105	494.3	0.025	0.00	0.0	0.600	o	450	Pipe/Conduit	
21.000	26.300	0.175	150.3	0.050	15.00	0.0	0.600	o	225	Pipe/Conduit	
21.001	21.600	0.110	196.4	0.088	0.00	0.0	0.600	o	300	Pipe/Conduit	
21.002	57.000	0.285	200.0	0.037	0.00	0.0	0.600	o	300	Pipe/Conduit	
22.000	20.000	0.135	148.1	0.030	15.00	0.0	0.600	o	150	Pipe/Conduit	
22.001	38.000	0.125	304.0	0.130	0.00	0.0	0.600	o	300	Pipe/Conduit	
23.000	20.000	0.135	148.1	0.030	15.00	0.0	0.600	o	150	Pipe/Conduit	
22.002	16.500	0.055	300.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
18.000	82.16	16.05	64.060	0.065	0.0	0.0	0.0	0.92	36.5	17.4
18.001	79.92	16.79	63.775	0.085	0.0	0.0	0.0	0.92	36.6	22.1
19.000	82.16	16.05	63.855	0.085	0.0	0.0	0.0	0.92	36.5	22.7
18.002	79.40	16.97	63.495	0.170	0.0	0.0	0.0	1.13	80.2	43.9
16.002	78.51	17.28	63.355	1.673	0.0	0.0	0.0	0.98	108.5«	426.9
20.000	83.68	15.57	64.075	0.080	0.0	0.0	0.0	1.46	58.2	21.8
16.003	75.95	18.24	63.225	1.778	0.0	0.0	0.0	0.91	144.4«	438.9
21.000	84.20	15.41	63.915	0.050	0.0	0.0	0.0	1.06	42.3	13.7
21.001	83.14	15.73	63.665	0.138	0.0	0.0	0.0	1.12	79.1	37.3
21.002	80.50	16.59	63.555	0.175	0.0	0.0	0.0	1.11	78.3	45.8
22.000	84.22	15.40	63.885	0.030	0.0	0.0	0.0	0.82	14.6	8.2
22.001	81.95	16.11	63.600	0.160	0.0	0.0	0.0	0.90	63.4	42.6
23.000	84.22	15.40	63.760	0.030	0.0	0.0	0.0	0.82	14.6	8.2
22.002	81.02	16.42	63.475	0.190	0.0	0.0	0.0	0.90	63.8	50.0

STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
24.000	49.500	0.165	300.0	0.100	15.00	0.0	0.600	o	300	Pipe/Conduit	
22.003	10.000	0.050	200.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
16.004	32.500	0.065	500.0	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
16.005	50.800	0.105	483.8	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
25.000	19.500	0.325	60.0	0.040	15.00	0.0	0.600	o	150	Pipe/Conduit	
25.001	45.000	0.450	100.0	0.140	0.00	0.0	0.600	o	300	Pipe/Conduit	
26.000	17.500	0.600	29.2	0.088	15.00	0.0	0.600	o	225	Pipe/Conduit	
27.000	19.500	0.325	60.0	0.040	15.00	0.0	0.600	o	150	Pipe/Conduit	
27.001	45.000	0.450	100.0	0.140	0.00	0.0	0.600	o	300	Pipe/Conduit	
25.002	30.000	0.200	150.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
28.000	47.500	0.320	148.4	0.083	15.00	0.0	0.600	o	225	Pipe/Conduit	
28.001	51.600	0.480	107.5	0.025	0.00	0.0	0.600	o	225	Pipe/Conduit	
29.000	26.300	0.175	150.3	0.050	15.00	0.0	0.600	o	225	Pipe/Conduit	
29.001	21.600	0.110	196.4	0.088	0.00	0.0	0.600	o	300	Pipe/Conduit	
29.002	56.250	0.290	194.0	0.038	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
24.000	82.57	15.91	63.585	0.100	0.0	0.0	0.0	0.90	63.8	26.8
22.003	80.63	16.55	63.345	0.290	0.0	0.0	0.0	1.28	141.1	76.0
16.004	74.69	18.74	62.970	2.243	0.0	0.0	0.0	1.08	306.0«	544.4
16.005	72.84	19.51	62.905	2.243	0.0	0.0	0.0	1.10	311.1«	544.4
25.000	84.74	15.25	64.100	0.040	0.0	0.0	0.0	1.30	23.0	11.0
25.001	83.17	15.73	63.625	0.180	0.0	0.0	0.0	1.57	111.1	48.7
26.000	85.18	15.12	63.850	0.088	0.0	0.0	0.0	2.43	96.7	24.4
27.000	84.74	15.25	64.100	0.040	0.0	0.0	0.0	1.30	23.0	11.0
27.001	83.17	15.73	63.625	0.180	0.0	0.0	0.0	1.57	111.1	48.7
25.002	82.10	16.07	63.100	0.448	0.0	0.0	0.0	1.48	163.1	119.5
28.000	83.13	15.74	63.950	0.083	0.0	0.0	0.0	1.07	42.6	22.4
28.001	81.01	16.42	63.630	0.108	0.0	0.0	0.0	1.26	50.1	28.4
29.000	84.20	15.41	63.725	0.050	0.0	0.0	0.0	1.06	42.3	13.7
29.001	83.14	15.73	63.475	0.138	0.0	0.0	0.0	1.12	79.1	37.3
29.002	80.57	16.57	63.365	0.176	0.0	0.0	0.0	1.13	79.5	46.1

STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
28.002	52.000	0.200	260.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.010	4.000	0.050	80.0	0.650	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.011	4.000	0.050	80.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
28.002	78.35	17.34	63.000	0.284	0.0	0.0	0.0	1.12	123.6	72.3
1.010	71.87	19.92	62.700	5.950	0.0	0.0	0.0	1.76	124.4«	1389.8
1.011	71.79	19.96	62.650	5.950	0.0	0.0	0.0	1.76	124.4«	1389.8

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.011	DITCH	64.500	62.600	0.000	1000	0

Online Controls for Storm

Hydro-Brake® Optimum Manhole: DLS1, DS/PN: 16.001, Volume (m³): 5.0

Unit Reference	MD-SHE-0306-6000-2000-6000
Design Head (m)	2.000
Design Flow (l/s)	60.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	306
Invert Level (m)	63.375
Minimum Outlet Pipe Diameter (mm)	375
Suggested Manhole Diameter (mm)	Site Specific Design (Contact Hydro International)

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	60.0	Kick-Flo®	1.354	49.7
Flush-Flo™	0.621	60.0	Mean Flow over Head Range	-	51.4

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	9.3	1.200	54.8	3.000	73.0	7.000	110.2
0.200	31.4	1.400	50.5	3.500	78.6	7.500	113.9
0.300	53.8	1.600	53.8	4.000	83.9	8.000	117.6
0.400	58.0	1.800	57.0	4.500	88.8	8.500	121.1
0.500	59.5	2.000	60.0	5.000	93.5	9.000	124.5
0.600	60.0	2.200	62.8	5.500	97.9	9.500	127.9
0.800	59.4	2.400	65.5	6.000	102.2		
1.000	57.8	2.600	68.1	6.500	106.3		

Complex Manhole: S13, DS/PN: 1.011, Volume (m³): 2.3

Hydro-Brake® Optimum

Unit Reference	MD-SHE-0156-1200-1150-1200
Design Head (m)	1.150
Design Flow (l/s)	12.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	156
Invert Level (m)	62.650
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.150	12.0	Kick-Flo®	0.763	9.9
Flush-Flo™	0.345	12.0	Mean Flow over Head Range	-	10.3

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake

Hydro-Brake® Optimum

Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.6	1.200	12.2	3.000	18.9	7.000	28.4
0.200	11.4	1.400	13.2	3.500	20.4	7.500	29.4
0.300	11.9	1.600	14.0	4.000	21.7	8.000	30.3
0.400	11.9	1.800	14.8	4.500	23.0	8.500	31.2
0.500	11.7	2.000	15.6	5.000	24.2	9.000	32.1
0.600	11.4	2.200	16.3	5.500	25.3	9.500	32.9
0.800	10.1	2.400	17.0	6.000	26.4		
1.000	11.2	2.600	17.7	6.500	27.4		

Weir

Discharge Coef 0.544 Width (m) 1.800 Invert Level (m) 63.800

Storage Structures for Storm

Porous Car Park Manhole: S23, DS/PN: 2.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	6.0
Membrane Percolation (mm/hr)	1000	Length (m)	30.0
Max Percolation (l/s)	50.0	Slope (1:X)	0.0
Safety Factor	1.5	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	64.000	Cap Volume Depth (m)	0.400

Porous Car Park Manhole: RE, DS/PN: 5.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	6.0
Membrane Percolation (mm/hr)	1000	Length (m)	50.0
Max Percolation (l/s)	83.3	Slope (1:X)	0.0
Safety Factor	1.5	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	64.000	Cap Volume Depth (m)	0.400

Porous Car Park Manhole: S20, DS/PN: 7.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	15.0
Membrane Percolation (mm/hr)	1000	Length (m)	50.0
Max Percolation (l/s)	208.3	Slope (1:X)	0.0
Safety Factor	1.5	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	64.000	Cap Volume Depth (m)	0.400

Porous Car Park Manhole: S66, DS/PN: 11.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	8.0
Membrane Percolation (mm/hr)	1000	Length (m)	60.0
Max Percolation (l/s)	133.3	Slope (1:X)	0.0
Safety Factor	1.5	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	64.200	Cap Volume Depth (m)	0.400

Porous Car Park Manhole: S58, DS/PN: 14.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	14.0
Membrane Percolation (mm/hr)	1000	Length (m)	12.0
Max Percolation (l/s)	46.7	Slope (1:X)	0.0
Safety Factor	1.5	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	64.400	Cap Volume Depth (m)	0.400

Porous Car Park Manhole: S59, DS/PN: 15.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	14.0
Membrane Percolation (mm/hr)	1000	Length (m)	12.0
Max Percolation (l/s)	46.7	Slope (1:X)	0.0
Safety Factor	1.5	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	64.400	Cap Volume Depth (m)	0.400

Cellular Storage Manhole: DLS2, DS/PN: 16.000

Invert Level (m) 64.000 Safety Factor 1.5
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	600.0	0.0	1.001	0.0	0.0
1.000	600.0	0.0			

Porous Car Park Manhole: S39, DS/PN: 20.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	8.0
Membrane Percolation (mm/hr)	1000	Length (m)	35.0
Max Percolation (l/s)	77.8	Slope (1:X)	0.0
Safety Factor	1.5	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	64.400	Cap Volume Depth (m)	0.400

Porous Car Park Manhole: S36, DS/PN: 22.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	12.0
Membrane Percolation (mm/hr)	1000	Length (m)	12.0
Max Percolation (l/s)	40.0	Slope (1:X)	0.0
Safety Factor	1.5	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	63.950	Cap Volume Depth (m)	0.400

Porous Car Park Manhole: S37, DS/PN: 23.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	14.0
Membrane Percolation (mm/hr)	1000	Length (m)	10.0
Max Percolation (l/s)	38.9	Slope (1:X)	0.0
Safety Factor	1.5	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	63.950	Cap Volume Depth (m)	0.400

Porous Car Park Manhole: S46, DS/PN: 25.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	14.0
Membrane Percolation (mm/hr)	1000	Length (m)	12.0
Max Percolation (l/s)	46.7	Slope (1:X)	0.0
Safety Factor	1.5	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	64.400	Cap Volume Depth (m)	0.400

Porous Car Park Manhole: S48, DS/PN: 27.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	14.0
Membrane Percolation (mm/hr)	1000	Length (m)	12.0
Max Percolation (l/s)	46.7	Slope (1:X)	0.0
Safety Factor	1.5	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	64.300	Cap Volume Depth (m)	0.400

Porous Car Park Manhole: S51, DS/PN: 28.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	8.0
Membrane Percolation (mm/hr)	1000	Length (m)	35.0
Max Percolation (l/s)	77.8	Slope (1:X)	0.0
Safety Factor	1.5	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	64.200	Cap Volume Depth (m)	0.400

Tank or Pond Manhole: SWALE, DS/PN: 1.010

Invert Level (m) 62.900

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	5073.0	0.400	5611.0	0.800	6158.0	1.001	0.0
0.200	5340.0	0.600	5883.0	1.000	6435.0		

Volume Summary (Static)

Length Calculations based on Centre-Centre

Pipe Number	USMH Name	Manhole Volume (m³)	Pipe Volume (m³)	Storage Structure Volume (m³)	Total Volume (m³)
1.000	S7	1.503	5.522	0.000	7.025
2.000	S23	1.159	3.711	21.600	26.470
3.000	S25	0.961	1.590	0.000	2.552
2.001	S22	1.216	1.145	0.000	2.361
4.000	S26	1.047	0.732	0.000	1.779
5.000	RE	2.173	4.538	36.000	42.711
2.002	S21	1.553	0.875	0.000	2.428
1.001	S6	2.068	4.936	0.000	7.003
6.000	S9	1.159	2.863	0.000	4.022
1.002	S5	2.288	8.010	0.000	10.298
7.000	S20	1.047	3.944	90.000	94.992
7.001	S19	1.337	1.046	0.000	2.383
8.000	S18	1.159	5.104	0.000	6.263
7.002	S17	1.854	1.325	0.000	3.179
1.003	S4	2.288	7.663	0.000	9.952
9.000	S16	0.836	2.159	0.000	2.995
9.001	S15	1.275	1.519	0.000	2.793
9.002	S14	1.250	0.358	0.000	1.608
1.004	S3	2.621	5.022	0.000	7.643
10.000	IC	1.056	3.534	0.000	4.591
1.005	S2	3.647	37.463	0.000	41.110
11.000	S66	1.057	2.535	57.600	61.192
11.001	S65	1.419	0.358	0.000	1.777
12.000	S67	1.131	1.016	0.000	2.147
11.002	S64	1.894	2.121	0.000	4.015
11.003	S63	2.648	2.540	0.000	5.188
13.000	S68	1.414	1.767	0.000	3.181
13.001	S69	1.696	4.612	0.000	6.309
11.004	S62	2.755	1.104	0.000	3.860
1.006	S1	5.089	8.085	0.000	13.174
1.007	S61	5.033	11.045	0.000	16.078
1.008	S60	5.128	7.820	0.000	12.947
14.000	S58	1.159	0.353	20.160	21.673
14.001	S57	1.385	3.252	0.000	4.637
15.000	S59	1.335	0.353	20.160	21.848
14.002	S56	1.561	1.555	0.000	3.116
1.009	S55	4.809	7.731	0.000	12.541
16.000	DLS2	2.058	2.170	570.190	574.418
16.001	DLS1	2.899	0.607	0.000	3.506
17.000	S27	1.459	1.471	0.000	2.930
18.000	S31	0.950	2.286	0.000	3.236
18.001	S32	1.086	1.630	0.000	2.716
19.000	S30	1.634	2.286	0.000	3.921
18.002	S29	1.759	0.877	0.000	2.635
16.002	S28	2.591	2.043	0.000	4.634
20.000	S39	1.301	1.988	33.600	36.889
16.003	S10	2.183	8.254	0.000	10.437
21.000	S40	1.527	1.046	0.000	2.573
21.001	S41	1.810	1.527	0.000	3.336
21.002	S42	1.934	4.029	0.000	5.963
22.000	S36	0.978	0.353	17.280	18.612
22.001	S35	1.188	2.686	0.000	3.874
23.000	S37	1.120	0.353	16.800	18.273
22.002	S34	1.329	1.166	0.000	2.495

Volume Summary (Static)

Pipe Number	USMH Name	Manhole Volume (m³)	Pipe Volume (m³)	Storage Structure Volume (m³)	Total Volume (m³)
24.000	S38	1.176	3.499	0.000	4.675
22.003	S33	1.868	1.104	0.000	2.972
16.004	S11	4.117	9.189	0.000	13.307
16.005	S12	3.437	14.363	0.000	17.800
25.000	S46	1.272	0.345	20.160	21.777
25.001	S45	1.442	3.181	0.000	4.623
26.000	S43	1.527	0.696	0.000	2.223
27.000	S48	1.159	0.345	20.160	21.664
27.001	S47	1.329	3.181	0.000	4.510
25.002	S44	2.720	3.313	0.000	6.033
28.000	S51	1.188	1.889	33.600	36.676
28.001	S50	1.776	2.052	0.000	3.827
29.000	S52	1.668	1.046	0.000	2.714
29.001	S53	1.951	1.527	0.000	3.478
29.002	S54	2.075	3.976	0.000	6.051
28.002	S49	3.292	5.743	0.000	9.035
1.010	SWALE	4.580	0.283	5750.806	5755.669
1.011	S13	2.092	0.283	0.000	2.375
Total		139.486	250.095	6708.116	7097.696

2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 2 Number of Storage Structures 14 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 457460 221065 SP 57460 21065
Data Type	Point
Cv (Summer)	0.900
Cv (Winter)	0.900

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Flooded Volume (m³)	Maximum Vol (m³)	Pipe Flow (l/s)	Status
1.000	S7	30 minute 2 year Summer I+0%	64.800	63.806	0.000	0.074	5.6	OK
2.000	S23	30 minute 2 year Summer I+0%	64.900	63.977	0.000	0.110	15.3	OK
3.000	S25	30 minute 2 year Summer I+0%	64.750	63.972	0.000	0.076	7.9	OK
2.001	S22	30 minute 2 year Summer I+0%	64.700	63.827	0.000	0.867	23.0	OK
4.000	S26	30 minute 2 year Summer I+0%	64.750	63.882	0.000	0.060	7.4	OK
5.000	RE	30 minute 2 year Summer I+0%	65.750	63.902	0.000	0.078	8.3	OK
2.002	S21	30 minute 2 year Summer I+0%	64.700	63.796	0.000	2.419	38.5	OK
1.001	S6	30 minute 2 year Summer I+0%	64.700	63.717	0.000	0.883	44.0	OK
6.000	S9	30 minute 2 year Summer I+0%	64.775	63.812	0.000	0.064	7.1	OK
1.002	S5	30 minute 2 year Summer I+0%	64.700	63.675	0.000	2.062	59.4	OK
7.000	S20	30 minute 2 year Summer I+0%	64.750	63.930	0.000	0.115	19.5	OK
7.001	S19	30 minute 2 year Summer I+0%	64.750	63.685	0.000	0.395	19.3	OK
8.000	S18	30 minute 2 year Summer I+0%	64.850	63.904	0.000	0.084	10.6	OK
7.002	S17	30 minute 2 year Summer I+0%	64.700	63.658	0.000	1.223	29.7	OK
1.003	S4	30 minute 2 year Summer I+0%	64.700	63.634	0.000	5.664	87.2	OK
9.000	S16	30 minute 2 year Summer I+0%	64.750	64.083	0.000	0.076	7.4	OK
9.001	S15	30 minute 2 year Summer I+0%	64.900	63.873	0.000	0.261	12.5	OK
9.002	S14	30 minute 2 year Summer I+0%	64.725	63.703	0.000	0.224	13.7	OK
1.004	S3	30 minute 2 year Summer I+0%	64.700	63.543	0.000	3.052	101.7	OK
10.000	IC	30 minute 2 year Summer I+0%	64.650	64.011	0.000	0.134	27.9	OK
1.005	S2	30 minute 2 year Summer I+0%	64.650	63.509	0.000	3.671	133.7	OK
11.000	S66	30 minute 2 year Summer I+0%	65.000	64.151	0.000	0.092	11.1	OK
11.001	S65	30 minute 2 year Summer I+0%	65.000	63.840	0.000	0.227	11.1	OK

2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Flooded Volume (m³)	Maximum Vol (m³)	Pipe Flow (l/s)	Status
12.000	S67	30 minute 2 year Summer I+0%	65.350	64.408	0.000	0.060	5.6	OK
11.002	S64	30 minute 2 year Summer I+0%	65.300	63.737	0.000	0.135	17.3	OK
11.003	S63	30 minute 2 year Summer I+0%	65.300	63.587	0.000	0.324	23.3	OK
13.000	S68	30 minute 2 year Summer I+0%	65.400	64.207	0.000	0.059	8.2	OK
13.001	S69	15 minute 2 year Summer I+0%	65.400	63.987	0.000	0.159	15.6	OK
11.004	S62	30 minute 2 year Summer I+0%	65.300	63.532	0.000	0.971	38.0	OK
1.006	S1	30 minute 2 year Summer I+0%	64.950	63.434	0.000	17.930	157.1	OK
1.007	S61	30 minute 2 year Summer I+0%	64.900	63.391	0.000	4.998	156.1	OK
1.008	S60	30 minute 2 year Summer I+0%	64.900	63.348	0.000	6.420	155.7	OK
14.000	S58	15 minute 2 year Winter I+0%	65.250	64.259	0.000	0.033	2.7	OK
14.001	S57	15 minute 2 year Summer I+0%	64.900	63.824	0.000	0.165	28.2	OK
15.000	S59	30 minute 2 year Summer I+0%	65.250	64.107	0.000	0.036	3.3	OK
14.002	S56	30 minute 2 year Summer I+0%	64.900	63.658	0.000	0.720	29.7	OK
1.009	S55	30 minute 2 year Summer I+0%	64.750	63.161	0.000	2.495	167.0	OK
16.000	DLS2	30 minute 2 year Summer I+0%	65.400	64.094	0.000	54.193	57.1	SURCHARGED
16.001	DLS1	30 minute 2 year Summer I+0%	65.400	63.995	0.000	2.960	57.1	SURCHARGED
17.000	S27	30 minute 2 year Summer I+0%	65.165	63.937	0.000	0.064	8.4	OK
18.000	S31	30 minute 2 year Summer I+0%	64.900	64.122	0.000	0.065	6.0	OK
18.001	S32	30 minute 2 year Summer I+0%	64.735	63.848	0.000	0.175	8.0	OK
19.000	S30	30 minute 2 year Summer I+0%	65.300	63.927	0.000	0.076	7.9	OK
18.002	S29	30 minute 2 year Summer I+0%	65.050	63.639	0.000	0.351	15.6	OK
16.002	S28	30 minute 2 year Summer I+0%	65.165	63.627	0.000	1.225	78.9	OK
20.000	S39	30 minute 2 year Summer I+0%	65.225	64.129	0.000	0.056	7.4	OK
16.003	S10	30 minute 2 year Summer I+0%	64.750	63.495	0.000	1.130	87.8	OK
21.000	S40	30 minute 2 year Summer I+0%	65.265	63.966	0.000	0.052	4.6	OK
21.001	S41	15 minute 2 year Summer I+0%	65.265	63.768	0.000	0.114	17.4	OK
21.002	S42	15 minute 2 year Summer I+0%	65.265	63.670	0.000	0.336	23.1	OK
22.000	S36	30 minute 2 year Summer I+0%	64.750	63.931	0.000	0.046	2.8	OK
22.001	S35	15 minute 2 year Summer I+0%	64.650	63.723	0.000	0.136	20.0	OK
23.000	S37	30 minute 2 year Summer I+0%	64.750	63.806	0.000	0.046	2.8	OK
22.002	S34	30 minute 2 year Summer I+0%	64.650	63.608	0.000	0.659	22.0	OK
24.000	S38	30 minute 2 year Summer I+0%	64.625	63.663	0.000	0.083	9.3	OK
22.003	S33	30 minute 2 year Summer I+0%	64.650	63.484	0.000	0.451	30.9	OK
16.004	S11	30 minute 2 year Summer I+0%	65.300	63.296	0.000	2.374	135.0	OK
16.005	S12	30 minute 2 year Summer I+0%	64.850	63.203	0.000	3.673	134.0	OK
25.000	S46	30 minute 2 year Summer I+0%	65.225	64.142	0.000	0.041	3.7	OK
25.001	S45	30 minute 2 year Summer I+0%	64.900	63.722	0.000	0.104	23.1	OK
26.000	S43	30 minute 2 year Summer I+0%	65.200	63.896	0.000	0.047	8.2	OK
27.000	S48	30 minute 2 year Summer I+0%	65.125	64.142	0.000	0.041	3.7	OK
27.001	S47	30 minute 2 year Summer I+0%	64.800	63.722	0.000	0.104	23.1	OK
25.002	S44	30 minute 2 year Summer I+0%	65.000	63.258	0.000	0.374	53.6	OK
28.000	S51	30 minute 2 year Summer I+0%	65.000	64.016	0.000	0.069	7.7	OK
28.001	S50	30 minute 2 year Summer I+0%	65.200	63.701	0.000	0.143	10.4	OK
29.000	S52	30 minute 2 year Summer I+0%	65.200	63.776	0.000	0.052	4.6	OK
29.001	S53	15 minute 2 year Summer I+0%	65.200	63.578	0.000	0.114	17.4	OK
29.002	S54	15 minute 2 year Summer I+0%	65.200	63.479	0.000	0.333	22.6	OK
28.002	S49	30 minute 2 year Summer I+0%	65.300	63.134	0.000	0.272	31.2	OK
1.010	SWALE	480 minute 2 year Winter I+0%	64.500	63.129	0.000	1211.275	18.5	SURCHARGED
1.011	S13	360 minute 2 year Summer I+0%	64.500	63.222	0.000	0.818	11.9	SURCHARGED

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 2 Number of Storage Structures 14 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 457460 221065 SP 57460 21065
Data Type	Point
Cv (Summer)	0.900
Cv (Winter)	0.900

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Flooded Volume (m³)	Maximum Vol (m³)	Pipe Flow (l/s)	Status
1.000	S7	30 minute 30 year Summer I+0%	64.800	64.087	0.000	0.475	12.7	OK
2.000	S23	30 minute 30 year Summer I+0%	64.900	64.218	0.000	12.173	29.5	SURCHARGED
3.000	S25	30 minute 30 year Summer I+0%	64.750	64.218	0.000	0.354	17.9	SURCHARGED
2.001	S22	30 minute 30 year Summer I+0%	64.700	64.168	0.000	5.749	39.1	SURCHARGED
4.000	S26	60 minute 30 year Summer I+0%	64.750	64.103	0.000	0.310	16.4	SURCHARGED
5.000	RE	30 minute 30 year Summer I+0%	65.750	64.092	0.000	8.578	37.5	OK
2.002	S21	30 minute 30 year Summer I+0%	64.700	64.066	0.000	6.779	82.9	SURCHARGED
1.001	S6	30 minute 30 year Winter I+0%	64.700	64.055	0.000	6.661	107.3	OK
6.000	S9	30 minute 30 year Summer I+0%	64.775	64.050	0.000	0.334	16.4	OK
1.002	S5	30 minute 30 year Summer I+0%	64.700	64.030	0.000	8.327	112.3	SURCHARGED
7.000	S20	30 minute 30 year Summer I+0%	64.750	64.078	0.000	17.765	42.5	OK
7.001	S19	30 minute 30 year Summer I+0%	64.750	64.046	0.000	4.220	39.3	SURCHARGED
8.000	S18	30 minute 30 year Summer I+0%	64.850	64.099	0.000	0.305	23.9	OK
7.002	S17	30 minute 30 year Summer I+0%	64.700	64.033	0.000	6.617	45.7	SURCHARGED
1.003	S4	30 minute 30 year Summer I+0%	64.700	63.946	0.000	9.998	147.4	SURCHARGED
9.000	S16	30 minute 30 year Summer I+0%	64.750	64.128	0.000	0.127	17.6	OK
9.001	S15	15 minute 30 year Summer I+0%	64.900	63.979	0.000	1.014	30.7	OK
9.002	S14	30 minute 30 year Winter I+0%	64.725	63.894	0.000	1.510	29.3	SURCHARGED
1.004	S3	30 minute 30 year Summer I+0%	64.700	63.839	0.000	8.358	169.1	SURCHARGED
10.000	IC	30 minute 30 year Summer I+0%	64.650	64.070	0.000	0.219	66.2	OK
1.005	S2	30 minute 30 year Winter I+0%	64.650	63.799	0.000	6.839	239.7	OK
11.000	S66	30 minute 30 year Summer I+0%	65.000	64.205	0.000	0.872	25.0	OK
11.001	S65	30 minute 30 year Summer I+0%	65.000	64.026	0.000	1.583	25.3	SURCHARGED

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Flooded Volume (m³)	Maximum Vol (m³)	Pipe Flow (l/s)	Status
12.000	S67	30 minute 30 year Summer I+0%	65.350	64.448	0.000	0.106	13.2	OK
11.002	S64	30 minute 30 year Summer I+0%	65.300	63.961	0.000	0.855	38.3	SURCHARGED
11.003	S63	30 minute 30 year Summer I+0%	65.300	63.881	0.000	2.549	55.3	SURCHARGED
13.000	S68	30 minute 30 year Summer I+0%	65.400	64.240	0.000	0.096	19.4	OK
13.001	S69	15 minute 30 year Summer I+0%	65.400	64.053	0.000	0.410	42.6	OK
11.004	S62	30 minute 30 year Summer I+0%	65.300	63.795	0.000	4.851	93.3	SURCHARGED
1.006	S1	30 minute 30 year Summer I+0%	64.950	63.703	0.000	34.244	281.5	SURCHARGED
1.007	S61	30 minute 30 year Summer I+0%	64.900	63.672	0.000	8.660	273.2	OK
1.008	S60	30 minute 30 year Winter I+0%	64.900	63.635	0.000	11.407	275.6	OK
14.000	S58	30 minute 30 year Summer I+0%	65.250	64.279	0.000	0.055	6.6	OK
14.001	S57	15 minute 30 year Summer I+0%	64.900	64.188	0.000	0.810	85.8	SURCHARGED
15.000	S59	30 minute 30 year Summer I+0%	65.250	64.129	0.000	0.061	7.7	OK
14.002	S56	15 minute 30 year Summer I+0%	64.900	63.882	0.000	3.350	89.5	SURCHARGED
1.009	S55	720 minute 30 year Winter I+0%	64.750	63.380	0.000	5.595	70.5	OK
16.000	DLS2	60 minute 30 year Summer I+0%	65.400	64.407	0.000	232.817	59.9	SURCHARGED
16.001	DLS1	60 minute 30 year Summer I+0%	65.400	64.300	0.000	3.397	59.9	SURCHARGED
17.000	S27	30 minute 30 year Summer I+0%	65.165	63.974	0.000	0.107	19.8	OK
18.000	S31	30 minute 30 year Summer I+0%	64.900	64.160	0.000	0.107	14.3	OK
18.001	S32	30 minute 30 year Summer I+0%	64.735	63.896	0.000	0.364	19.1	OK
19.000	S30	30 minute 30 year Summer I+0%	65.300	63.972	0.000	0.127	18.7	OK
18.002	S29	30 minute 30 year Summer I+0%	65.050	63.828	0.000	2.496	36.0	SURCHARGED
16.002	S28	30 minute 30 year Winter I+0%	65.165	63.742	0.000	2.169	112.2	SURCHARGED
20.000	S39	30 minute 30 year Summer I+0%	65.225	64.162	0.000	0.092	17.6	OK
16.003	S10	30 minute 30 year Winter I+0%	64.750	63.589	0.000	1.951	131.4	OK
21.000	S40	30 minute 30 year Summer I+0%	65.265	63.996	0.000	0.086	11.0	OK
21.001	S41	15 minute 30 year Summer I+0%	65.265	63.860	0.000	0.372	51.3	OK
21.002	S42	15 minute 30 year Summer I+0%	65.265	63.784	0.000	1.078	66.5	OK
22.000	S36	30 minute 30 year Summer I+0%	64.750	63.956	0.000	0.349	6.3	OK
22.001	S35	15 minute 30 year Summer I+0%	64.650	63.929	0.000	0.584	62.6	SURCHARGED
23.000	S37	30 minute 30 year Summer I+0%	64.750	63.833	0.000	0.077	6.6	OK
22.002	S34	15 minute 30 year Summer I+0%	64.650	63.789	0.000	2.757	63.3	SURCHARGED
24.000	S38	30 minute 30 year Summer I+0%	64.625	63.710	0.000	0.136	22.0	OK
22.003	S33	15 minute 30 year Summer I+0%	64.650	63.594	0.000	1.778	78.5	OK
16.004	S11	240 minute 30 year Winter I+0%	65.300	63.468	0.000	7.428	120.1	OK
16.005	S12	360 minute 30 year Summer I+0%	64.850	63.411	0.000	7.768	123.3	OK
25.000	S46	30 minute 30 year Summer I+0%	65.225	64.167	0.000	0.070	8.8	OK
25.001	S45	15 minute 30 year Summer I+0%	64.900	63.817	0.000	0.217	73.6	OK
26.000	S43	30 minute 30 year Summer I+0%	65.200	63.922	0.000	0.076	19.4	OK
27.000	S48	30 minute 30 year Summer I+0%	65.125	64.167	0.000	0.070	8.8	OK
27.001	S47	15 minute 30 year Summer I+0%	64.800	63.817	0.000	0.217	73.5	OK
25.002	S44	15 minute 30 year Summer I+0%	65.000	63.488	0.000	2.873	151.9	SURCHARGED
28.000	S51	30 minute 30 year Summer I+0%	65.000	64.055	0.000	0.114	18.3	OK
28.001	S50	30 minute 30 year Summer I+0%	65.200	63.748	0.000	0.282	25.0	OK
29.000	S52	30 minute 30 year Summer I+0%	65.200	63.806	0.000	0.086	11.0	OK
29.001	S53	15 minute 30 year Summer I+0%	65.200	63.670	0.000	0.372	51.3	OK
29.002	S54	15 minute 30 year Summer I+0%	65.200	63.593	0.000	1.070	65.9	OK
28.002	S49	720 minute 30 year Winter I+0%	65.300	63.379	0.000	3.022	8.7	SURCHARGED
1.010	SWALE	720 minute 30 year Winter I+0%	64.500	63.379	0.000	2611.876	20.2	SURCHARGED
1.011	S13	240 minute 30 year Winter I+0%	64.500	63.498	0.000	1.131	11.9	SURCHARGED

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 2 Number of Storage Structures 14 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 457460 221065 SP 57460 21065
Data Type	Point
Cv (Summer)	0.900
Cv (Winter)	0.900

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

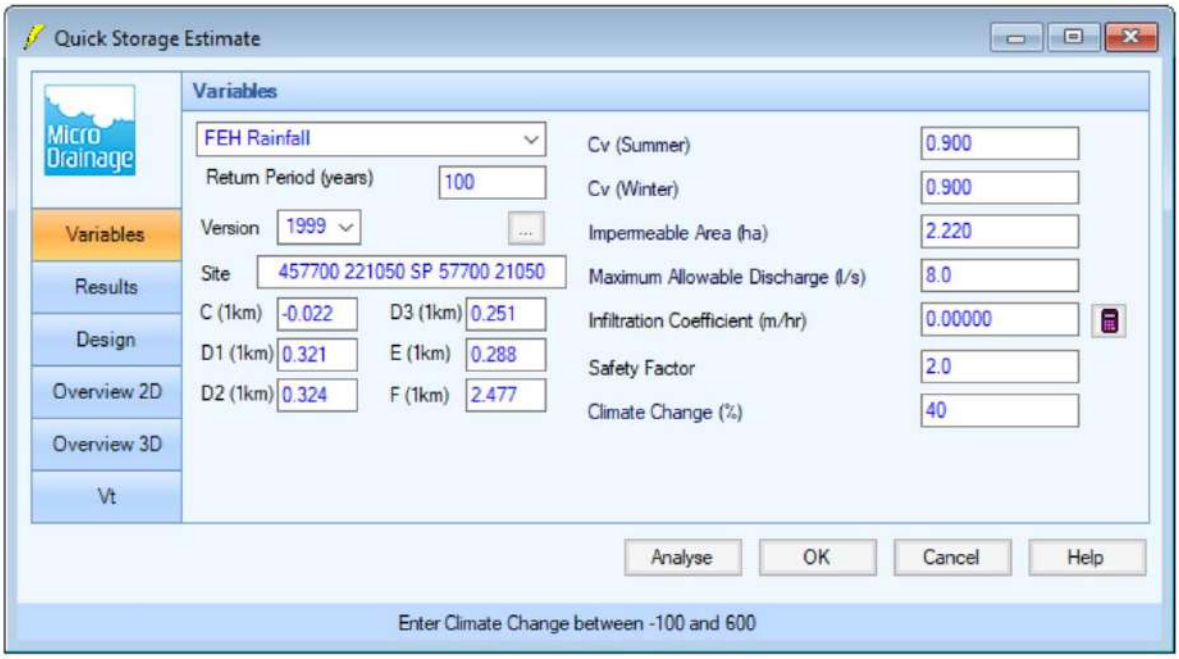
Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 0, 40

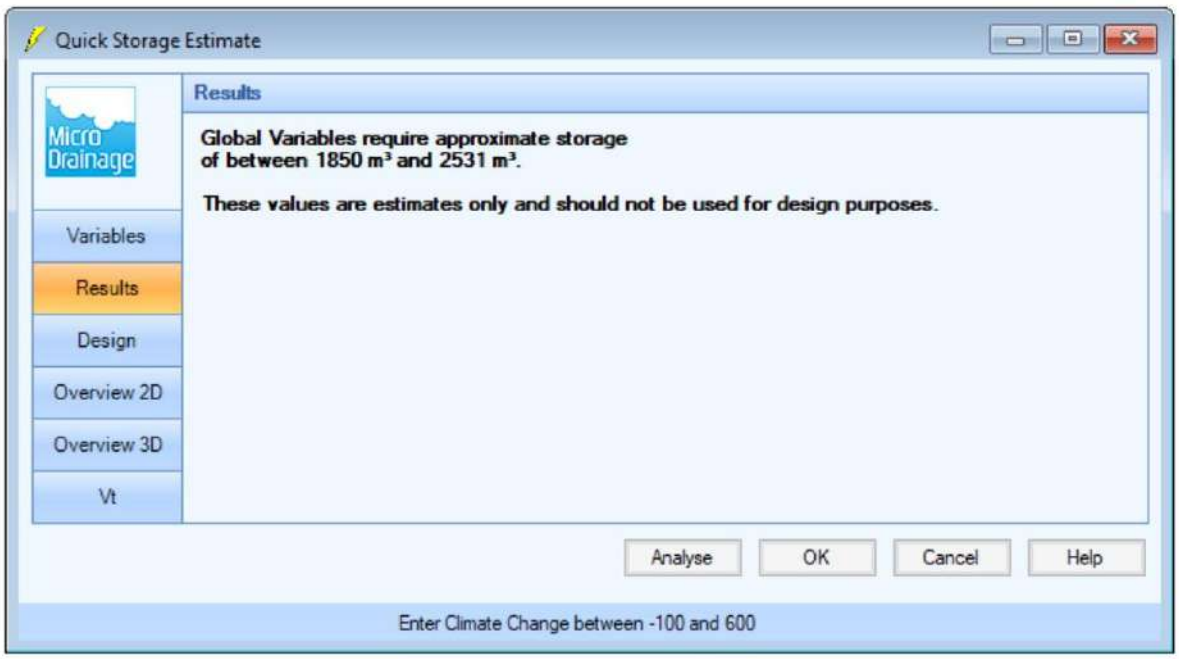
PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Flooded Volume (m³)	Maximum Vol (m³)	Pipe Flow (l/s)	Status
1.000	S7	30 minute 100 year Summer I+40%	64.800	64.340	0.000	0.838	23.6	SURCHARGED
2.000	S23	30 minute 100 year Summer I+40%	64.900	64.678	0.000	22.503	61.9	FLOOD RISK
3.000	S25	30 minute 100 year Summer I+40%	64.750	64.660	0.000	0.854	32.5	FLOOD RISK
2.001	S22	30 minute 100 year Summer I+40%	64.700	64.497	0.000	6.150	94.0	FLOOD RISK
4.000	S26	30 minute 100 year Winter I+40%	64.750	64.438	0.000	0.688	31.8	SURCHARGED
5.000	RE	30 minute 100 year Summer I+40%	65.750	64.376	0.000	34.408	51.7	SURCHARGED
2.002	S21	30 minute 100 year Summer I+40%	64.700	64.346	0.000	7.331	123.2	SURCHARGED
1.001	S6	30 minute 100 year Summer I+40%	64.700	64.323	0.000	7.406	144.3	SURCHARGED
6.000	S9	30 minute 100 year Summer I+40%	64.775	64.375	0.000	0.701	30.5	SURCHARGED
1.002	S5	30 minute 100 year Summer I+40%	64.700	64.283	0.000	8.922	187.1	SURCHARGED
7.000	S20	30 minute 100 year Summer I+40%	64.750	64.305	0.000	69.206	44.2	SURCHARGED
7.001	S19	30 minute 100 year Summer I+40%	64.750	64.269	0.000	4.647	45.2	SURCHARGED
8.000	S18	30 minute 100 year Summer I+40%	64.850	64.374	0.000	0.615	45.1	SURCHARGED
7.002	S17	30 minute 100 year Summer I+40%	64.700	64.263	0.000	7.190	53.2	SURCHARGED
1.003	S4	30 minute 100 year Summer I+40%	64.700	64.176	0.000	10.428	228.5	SURCHARGED
9.000	S16	30 minute 100 year Summer I+40%	64.750	64.688	0.000	0.760	33.0	FLOOD RISK
9.001	S15	30 minute 100 year Summer I+40%	64.900	64.500	0.000	2.928	43.5	SURCHARGED
9.002	S14	30 minute 100 year Summer I+40%	64.725	64.192	0.000	2.113	47.6	SURCHARGED
1.004	S3	30 minute 100 year Summer I+40%	64.700	64.080	0.000	9.158	272.8	SURCHARGED
10.000	IC	30 minute 100 year Summer I+40%	64.650	64.139	0.000	0.317	119.8	OK
1.005	S2	30 minute 100 year Summer I+40%	64.650	63.999	0.000	8.974	416.0	SURCHARGED
11.000	S66	30 minute 100 year Summer I+40%	65.000	64.319	0.000	17.384	30.8	SURCHARGED

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Flooded Volume (m³)	Maximum Vol (m³)	Pipe Flow (l/s)	Status
11.001	S65	30 minute 100 year Summer I+40%	65.000	64.178	0.000	2.722	32.3	SURCHARGED
12.000	S67	30 minute 100 year Summer I+40%	65.350	65.094	0.000	0.836	23.3	FLOOD RISK
11.002	S64	30 minute 100 year Summer I+40%	65.300	64.140	0.000	1.379	50.4	SURCHARGED
11.003	S63	30 minute 100 year Summer I+40%	65.300	64.065	0.000	2.904	75.6	SURCHARGED
13.000	S68	30 minute 100 year Summer I+40%	65.400	64.273	0.000	0.133	35.1	OK
13.001	S69	30 minute 100 year Summer I+40%	65.400	64.171	0.000	1.103	69.4	OK
11.004	S62	30 minute 100 year Summer I+40%	65.300	63.982	0.000	6.976	135.7	SURCHARGED
1.006	S1	30 minute 100 year Summer I+40%	64.950	63.891	0.000	39.564	526.8	SURCHARGED
1.007	S61	30 minute 100 year Summer I+40%	64.900	63.824	0.000	9.566	521.4	SURCHARGED
1.008	S60	960 minute 100 year Winter I+40%	64.900	63.764	0.000	12.418	83.2	SURCHARGED
14.000	S58	15 minute 100 year Summer I+40%	65.250	64.514	0.000	6.061	26.3	SURCHARGED
14.001	S57	15 minute 100 year Summer I+40%	64.900	64.882	0.000	1.692	127.0	FLOOD RISK
15.000	S59	15 minute 100 year Summer I+40%	65.250	64.233	0.000	0.178	14.9	SURCHARGED
14.002	S56	15 minute 100 year Summer I+40%	64.900	64.126	0.000	4.152	135.6	SURCHARGED
1.009	S55	960 minute 100 year Winter I+40%	64.750	63.764	0.000	10.707	93.3	SURCHARGED
16.000	DLS2	60 minute 100 year Winter I+40%	65.400	64.964	0.000	550.909	66.8	SURCHARGED
16.001	DLS1	120 minute 100 year Summer I+40%	65.400	65.180	0.000	4.656	59.9	FLOOD RISK
17.000	S27	30 minute 100 year Summer I+40%	65.165	64.217	0.000	0.381	35.6	SURCHARGED
18.000	S31	30 minute 100 year Summer I+40%	64.900	64.391	0.000	0.369	25.4	SURCHARGED
18.001	S32	30 minute 100 year Summer I+40%	64.735	64.241	0.000	2.688	28.2	SURCHARGED
19.000	S30	30 minute 100 year Summer I+40%	65.300	64.372	0.000	0.579	33.4	SURCHARGED
18.002	S29	30 minute 100 year Summer I+40%	65.050	64.110	0.000	4.511	61.7	SURCHARGED
16.002	S28	30 minute 100 year Summer I+40%	65.165	64.022	0.000	3.545	156.6	SURCHARGED
20.000	S39	30 minute 100 year Summer I+40%	65.225	64.197	0.000	0.132	31.9	OK
16.003	S10	30 minute 100 year Summer I+40%	64.750	63.869	0.000	3.744	190.0	SURCHARGED
21.000	S40	15 minute 100 year Summer I+40%	65.265	64.390	0.000	0.531	22.8	SURCHARGED
21.001	S41	15 minute 100 year Summer I+40%	65.265	64.361	0.000	1.779	81.1	SURCHARGED
21.002	S42	15 minute 100 year Summer I+40%	65.265	64.200	0.000	2.166	103.6	SURCHARGED
22.000	S36	30 minute 100 year Summer I+40%	64.750	64.064	0.000	5.117	14.6	SURCHARGED
22.001	S35	15 minute 100 year Summer I+40%	64.650	64.240	0.000	1.051	93.1	SURCHARGED
23.000	S37	30 minute 100 year Summer I+40%	64.750	63.958	0.000	0.571	13.5	SURCHARGED
22.002	S34	15 minute 100 year Summer I+40%	64.650	63.925	0.000	3.429	100.3	SURCHARGED
24.000	S38	30 minute 100 year Summer I+40%	64.625	63.845	0.000	0.288	40.2	OK
22.003	S33	30 minute 100 year Summer I+40%	64.650	63.772	0.000	4.634	118.8	SURCHARGED
16.004	S11	960 minute 100 year Winter I+40%	65.300	63.767	0.000	14.140	86.8	SURCHARGED
16.005	S12	960 minute 100 year Winter I+40%	64.850	63.765	0.000	10.275	85.8	SURCHARGED
25.000	S46	15 minute 100 year Summer I+40%	65.225	64.414	0.000	1.080	24.9	SURCHARGED
25.001	S45	15 minute 100 year Summer I+40%	64.900	64.420	0.000	1.217	114.0	SURCHARGED
26.000	S43	30 minute 100 year Summer I+40%	65.200	63.950	0.000	0.107	35.1	OK
27.000	S48	15 minute 100 year Summer I+40%	65.125	64.332	0.000	1.876	23.8	SURCHARGED
27.001	S47	15 minute 100 year Summer I+40%	64.800	64.380	0.000	1.172	113.0	SURCHARGED
25.002	S44	15 minute 100 year Summer I+40%	65.000	63.858	0.000	7.647	247.5	SURCHARGED
28.000	S51	30 minute 100 year Summer I+40%	65.000	64.105	0.000	0.169	33.1	OK
28.001	S50	30 minute 100 year Summer I+40%	65.200	63.820	0.000	0.657	44.5	OK
29.000	S52	15 minute 100 year Summer I+40%	65.200	64.204	0.000	0.536	23.1	SURCHARGED
29.001	S53	15 minute 100 year Summer I+40%	65.200	64.175	0.000	1.784	81.1	SURCHARGED
29.002	S54	15 minute 100 year Summer I+40%	65.200	64.013	0.000	2.169	104.3	SURCHARGED
28.002	S49	960 minute 100 year Winter I+40%	65.300	63.763	0.000	6.876	12.1	SURCHARGED
1.010	SWALE	960 minute 100 year Winter I+40%	64.500	63.763	0.000	4911.999	17.6	SURCHARGED
1.011	S13	600 minute 100 year Summer I+40%	64.500	63.812	0.000	1.486	11.9	SURCHARGED

100 Year + 40% Climate Change Event





STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Storm

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	51.000	0.180	283.3	0.185	15.00	0.0	0.600	o	300	Pipe/Conduit	
1.001	12.500	0.045	277.8	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
2.000	45.000	0.450	100.0	0.050	15.00	0.0	0.600	o	150	Pipe/Conduit	
1.002	27.500	0.095	289.5	0.010	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.003	25.000	0.080	312.5	0.060	0.00	0.0	0.600	o	375	Pipe/Conduit	
3.000	50.000	0.500	100.0	0.050	15.00	0.0	0.600	o	150	Pipe/Conduit	
1.004	23.100	0.080	288.8	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
4.000	40.000	0.200	200.0	0.200	15.00	0.0	0.600	o	300	Pipe/Conduit	
1.005	10.000	0.045	222.2	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.006	10.000	0.050	200.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
5.000	45.000	0.150	300.0	0.115	15.00	0.0	0.600	o	300	Pipe/Conduit	
5.001	12.500	0.040	312.5	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
6.000	45.000	0.450	100.0	0.050	15.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	82.57	15.91	63.900	0.185	0.0	0.0	0.0	0.93	65.7	49.6
1.001	81.87	16.14	63.720	0.185	0.0	0.0	0.0	0.94	66.3	49.6
2.000	83.10	15.75	64.275	0.050	0.0	0.0	0.0	1.00	17.8	13.5
1.002	80.37	16.64	63.675	0.245	0.0	0.0	0.0	0.92	65.0	64.0
1.003	79.18	17.04	63.505	0.305	0.0	0.0	0.0	1.02	112.6	78.5
3.000	82.84	15.83	64.150	0.050	0.0	0.0	0.0	1.00	17.8	13.5
1.004	78.16	17.41	63.425	0.355	0.0	0.0	0.0	1.06	117.2	90.2
4.000	83.57	15.60	63.720	0.200	0.0	0.0	0.0	1.11	78.3	54.3
1.005	77.83	17.53	63.270	0.555	0.0	0.0	0.0	1.36	216.3	140.4
1.006	77.51	17.65	63.225	0.555	0.0	0.0	0.0	1.43	228.1	140.4
5.000	82.83	15.83	63.850	0.115	0.0	0.0	0.0	0.90	63.8	31.0
5.001	82.09	16.07	63.700	0.115	0.0	0.0	0.0	0.88	62.5	31.0
6.000	83.10	15.75	64.260	0.050	0.0	0.0	0.0	1.00	17.8	13.5

STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
5.002	30.000	0.100	300.0	0.020	0.00	0.0	0.600	o	300	Pipe/Conduit	
5.003	25.000	0.085	294.1	0.120	0.00	0.0	0.600	o	450	Pipe/Conduit	
7.000	25.000	0.170	147.1	0.070	15.00	0.0	0.600	o	300	Pipe/Conduit	
7.001	56.000	0.375	149.3	0.050	0.00	0.0	0.600	o	300	Pipe/Conduit	
5.004	22.000	0.075	293.3	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
8.000	40.000	0.200	200.0	0.195	15.00	0.0	0.600	o	300	Pipe/Conduit	
5.005	15.000	0.075	200.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
9.000	45.000	0.150	300.0	0.115	15.00	0.0	0.600	o	300	Pipe/Conduit	
9.001	25.000	0.085	294.1	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
10.000	53.000	0.175	302.9	0.190	15.00	0.0	0.600	o	300	Pipe/Conduit	
10.001	17.500	0.060	291.7	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
11.000	60.000	0.400	150.0	0.070	15.00	0.0	0.600	o	225	Pipe/Conduit	
9.002	30.000	0.095	315.8	0.050	0.00	0.0	0.600	o	450	Pipe/Conduit	
9.003	25.000	0.085	294.1	0.160	0.00	0.0	0.600	o	450	Pipe/Conduit	
12.000	60.000	0.400	150.0	0.070	15.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
5.002	80.41	16.62	63.660	0.185	0.0	0.0	0.0	0.90	63.8	48.3
5.003	79.38	16.97	63.410	0.305	0.0	0.0	0.0	1.18	187.7	78.7
7.000	84.50	15.32	64.020	0.070	0.0	0.0	0.0	1.29	91.5	19.2
7.001	82.15	16.05	63.850	0.120	0.0	0.0	0.0	1.28	90.8	32.0
5.004	78.51	17.28	63.325	0.425	0.0	0.0	0.0	1.18	188.0	108.4
8.000	83.57	15.60	63.700	0.195	0.0	0.0	0.0	1.11	78.3	53.0
5.005	78.02	17.46	63.250	0.620	0.0	0.0	0.0	1.43	228.1	157.2
9.000	82.83	15.83	63.910	0.115	0.0	0.0	0.0	0.90	63.8	31.0
9.001	81.41	16.29	63.760	0.115	0.0	0.0	0.0	0.91	64.4	31.0
10.000	82.35	15.98	63.910	0.190	0.0	0.0	0.0	0.90	63.5	50.9
10.001	81.37	16.30	63.735	0.190	0.0	0.0	0.0	0.92	64.7	50.9
11.000	82.49	15.94	64.150	0.070	0.0	0.0	0.0	1.07	42.4	18.8
9.002	80.06	16.74	63.525	0.425	0.0	0.0	0.0	1.14	181.1	110.6
9.003	79.04	17.09	63.430	0.585	0.0	0.0	0.0	1.18	187.7	150.3
12.000	82.49	15.94	63.970	0.070	0.0	0.0	0.0	1.07	42.4	18.8

STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
9.004	22.300	0.075	297.3	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
13.000	47.000	0.150	313.3	0.215	15.00	0.0	0.600	o	300	Pipe/Conduit	
9.005	20.500	0.095	215.8	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.007	6.000	0.100	60.0	0.175	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.008	8.000	0.100	80.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
9.004	78.15	17.41	63.345	0.655	0.0	0.0	0.0	1.17	186.7	166.4
13.000	82.66	15.89	63.675	0.215	0.0	0.0	0.0	0.88	62.4	57.8
9.005	77.48	17.66	63.270	0.870	0.0	0.0	0.0	1.38	219.5	219.1
1.007	77.35	17.71	63.000	2.220	0.0	0.0	0.0	2.03	143.7«	558.0
1.008	77.14	17.78	62.900	2.220	0.0	0.0	0.0	1.76	124.4«	558.0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.008	Ditch	65.000	62.800	0.000	900	0

Online Controls for Storm

Complex Manhole: S70, DS/PN: 1.008, Volume (m³): 3.0

Hydro-Brake® Optimum

Unit Reference	MD-SHE-0121-8000-1730-8000
Design Head (m)	1.730
Design Flow (l/s)	8.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	121
Invert Level (m)	62.900
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.730	8.0	Kick-Flo®	1.053	6.3
Flush-Flo™	0.512	8.0	Mean Flow over Head Range	-	7.0

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.3	1.200	6.7	3.000	10.4	7.000	15.5
0.200	6.9	1.400	7.2	3.500	11.1	7.500	16.0
0.300	7.6	1.600	7.7	4.000	11.9	8.000	16.5
0.400	7.9	1.800	8.1	4.500	12.6	8.500	17.0
0.500	8.0	2.000	8.6	5.000	13.2	9.000	17.5
0.600	8.0	2.200	8.9	5.500	13.8	9.500	18.0
0.800	7.6	2.400	9.3	6.000	14.4		
1.000	6.8	2.600	9.7	6.500	15.0		

Weir

Discharge Coef 0.544 Width (m) 1.800 Invert Level (m) 64.650

Storage Structures for Storm

Porous Car Park Manhole: S77, DS/PN: 1.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	12.0
Membrane Percolation (mm/hr)	1000	Length (m)	43.0
Max Percolation (l/s)	143.3	Slope (1:X)	0.0
Safety Factor	1.5	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	64.300	Cap Volume Depth (m)	0.400

Porous Car Park Manhole: S86, DS/PN: 5.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	12.0
Membrane Percolation (mm/hr)	1000	Length (m)	38.0
Max Percolation (l/s)	126.7	Slope (1:X)	0.0
Safety Factor	1.5	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	64.250	Cap Volume Depth (m)	0.400

Porous Car Park Manhole: S98, DS/PN: 10.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	15.0
Membrane Percolation (mm/hr)	1000	Length (m)	56.0
Max Percolation (l/s)	233.3	Slope (1:X)	0.0
Safety Factor	1.5	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	64.300	Cap Volume Depth (m)	0.400

Tank or Pond Manhole: SWALE, DS/PN: 1.007

Invert Level (m) 63.100

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	441.0	0.600	809.0	1.200	1198.0	1.800	1607.0
0.200	561.0	0.800	936.0	1.400	1332.0	1.801	0.0
0.400	683.0	1.000	1065.0	1.600	1468.0		

Volume Summary (Static)

Length Calculations based on Centre-Centre

Pipe Number	USMH Name	Manhole Volume (m³)	Pipe Volume (m³)	Storage Structure Volume (m³)	Total Volume (m³)
1.000	S77	1.357	3.605	61.920	66.882
1.001	S76	1.730	0.884	0.000	2.614
2.000	S78	1.046	0.795	0.000	1.841
1.002	S75	1.951	1.944	0.000	3.895
1.003	S74	2.712	2.761	0.000	5.474
3.000	S79	1.414	0.884	0.000	2.297
1.004	S73	2.827	2.551	0.000	5.378
4.000	S80	1.335	2.827	0.000	4.162
1.005	S72	2.476	1.590	0.000	4.067
1.006	S71	2.541	1.590	0.000	4.131
5.000	S86	1.244	3.181	54.720	59.145
5.001	S85	1.753	0.884	0.000	2.637
6.000	S87	1.233	0.795	0.000	2.028
5.002	S84	1.968	2.121	0.000	4.088
5.003	S83	2.848	3.976	0.000	6.825
7.000	S88	1.391	1.767	0.000	3.158
7.001	S89	1.583	3.958	0.000	5.542
5.004	S82	2.755	3.499	0.000	6.254
8.000	S90	1.357	2.827	0.000	4.185
5.005	S81	2.362	2.386	0.000	4.747
9.000	S96	1.176	3.181	0.000	4.357
9.001	S95	1.233	1.767	0.000	3.000
10.000	S98	1.318	3.746	100.800	105.864
10.001	S97	1.402	1.237	0.000	2.639
11.000	S99	1.131	2.386	0.000	3.517
9.002	S94	2.398	4.771	0.000	7.169
9.003	S93	2.534	3.976	0.000	6.510
12.000	S100	1.335	2.386	0.000	3.720
9.004	S92	2.655	3.547	0.000	6.202
13.000	S101	1.272	3.322	0.000	4.595
9.005	S91	2.333	3.260	0.000	5.594
1.007	SWALE	3.006	0.424	1814.361	1817.791
1.008	S70	2.658	0.565	0.000	3.223
Total		62.334	79.395	2031.801	2173.530

2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 4 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 457460 221065 SP 57460 21065
Data Type	Point
Cv (Summer)	0.900
Cv (Winter)	0.900

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Flooded Volume (m³)	Maximum Vol (m³)	Pipe Flow (l/s)	Status
1.000	S77	30 minute 2 year Summer I+0%	65.100	64.007	0.000	0.116	17.1	OK
1.001	S76	30 minute 2 year Summer I+0%	65.250	63.840	0.000	0.511	17.1	OK
2.000	S78	30 minute 2 year Summer I+0%	65.200	64.328	0.000	0.054	4.6	OK
1.002	S75	30 minute 2 year Summer I+0%	65.400	63.803	0.000	0.360	22.3	OK
1.003	S74	360 minute 2 year Winter I+0%	65.400	63.677	0.000	0.506	8.8	OK
3.000	S79	30 minute 2 year Summer I+0%	65.400	64.203	0.000	0.054	4.6	OK
1.004	S73	360 minute 2 year Winter I+0%	65.400	63.677	0.000	1.832	10.1	OK
4.000	S80	30 minute 2 year Summer I+0%	64.900	63.822	0.000	0.110	18.6	OK
1.005	S72	360 minute 2 year Winter I+0%	65.000	63.676	0.000	2.969	15.5	OK
1.006	S71	360 minute 2 year Winter I+0%	65.000	63.675	0.000	1.889	15.1	OK
5.000	S86	30 minute 2 year Summer I+0%	64.950	63.935	0.000	0.090	10.7	OK
5.001	S85	30 minute 2 year Summer I+0%	65.250	63.801	0.000	0.348	10.7	OK
6.000	S87	30 minute 2 year Summer I+0%	65.350	64.313	0.000	0.054	4.6	OK
5.002	S84	30 minute 2 year Summer I+0%	65.400	63.770	0.000	0.281	16.9	OK
5.003	S83	360 minute 2 year Winter I+0%	65.400	63.673	0.000	0.735	8.7	OK
7.000	S88	30 minute 2 year Summer I+0%	65.250	64.076	0.000	0.058	6.5	OK
7.001	S89	15 minute 2 year Summer I+0%	65.250	63.928	0.000	0.171	13.1	OK
5.004	S82	360 minute 2 year Winter I+0%	65.250	63.672	0.000	3.735	11.8	OK
8.000	S90	30 minute 2 year Summer I+0%	64.900	63.801	0.000	0.109	18.1	OK
5.005	S81	360 minute 2 year Winter I+0%	64.900	63.672	0.000	4.039	16.7	OK
9.000	S96	30 minute 2 year Summer I+0%	64.950	63.995	0.000	0.090	10.7	OK
9.001	S95	30 minute 2 year Summer I+0%	64.850	63.847	0.000	0.296	10.7	OK
10.000	S98	30 minute 2 year Summer I+0%	65.075	64.021	0.000	0.120	17.6	OK

2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Flooded Volume (m^3)	Maximum Vol (m^3)	Pipe Flow (l/s)	Status
10.001	S97	30 minute 2 year Summer I+0%	64.975	63.850	0.000	0.486	17.6	OK
11.000	S99	30 minute 2 year Summer I+0%	65.150	64.210	0.000	0.062	6.5	OK
9.002	S94	30 minute 2 year Summer I+0%	65.200	63.688	0.000	0.277	38.3	OK
9.003	S93	360 minute 2 year Winter I+0%	65.200	63.675	0.000	2.209	16.7	OK
12.000	S100	30 minute 2 year Summer I+0%	65.150	64.030	0.000	0.062	6.5	OK
9.004	S92	360 minute 2 year Winter I+0%	65.200	63.674	0.000	3.021	18.4	OK
13.000	S101	30 minute 2 year Summer I+0%	64.800	63.796	0.000	0.131	20.0	OK
9.005	S91	360 minute 2 year Winter I+0%	64.900	63.673	0.000	3.976	24.0	OK
1.007	SWALE	360 minute 2 year Winter I+0%	65.100	63.671	0.000	357.056	9.0	SURCHARGED
1.008	S70	360 minute 2 year Winter I+0%	65.250	63.691	0.000	1.223	8.0	SURCHARGED

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 4 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 457460 221065 SP 57460 21065
Data Type	Point
Cv (Summer)	0.900
Cv (Winter)	0.900

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Flooded Volume (m³)	Maximum Vol (m³)	Pipe Flow (l/s)	Status
1.000	S77	60 minute 30 year Summer I+0%	65.100	64.228	0.000	0.366	38.2	SURCHARGED
1.001	S76	120 minute 30 year Summer I+0%	65.250	64.184	0.000	3.982	28.1	SURCHARGED
2.000	S78	30 minute 30 year Summer I+0%	65.200	64.362	0.000	0.093	11.0	OK
1.002	S75	120 minute 30 year Summer I+0%	65.400	64.170	0.000	1.809	36.8	SURCHARGED
1.003	S74	480 minute 30 year Winter I+0%	65.400	64.146	0.000	2.765	13.2	SURCHARGED
3.000	S79	30 minute 30 year Summer I+0%	65.400	64.237	0.000	0.093	11.0	OK
1.004	S73	480 minute 30 year Winter I+0%	65.400	64.145	0.000	4.350	15.4	SURCHARGED
4.000	S80	480 minute 30 year Winter I+0%	64.900	64.146	0.000	0.476	8.8	SURCHARGED
1.005	S72	480 minute 30 year Winter I+0%	65.000	64.145	0.000	6.384	24.1	SURCHARGED
1.006	S71	480 minute 30 year Winter I+0%	65.000	64.144	0.000	2.684	23.8	SURCHARGED
5.000	S86	480 minute 30 year Winter I+0%	64.950	64.148	0.000	0.331	5.0	OK
5.001	S85	480 minute 30 year Winter I+0%	65.250	64.147	0.000	3.569	5.0	SURCHARGED
6.000	S87	30 minute 30 year Summer I+0%	65.350	64.347	0.000	0.093	11.0	OK
5.002	S84	480 minute 30 year Winter I+0%	65.400	64.146	0.000	1.783	8.0	SURCHARGED
5.003	S83	480 minute 30 year Winter I+0%	65.400	64.145	0.000	3.076	13.0	SURCHARGED
7.000	S88	480 minute 30 year Winter I+0%	65.250	64.145	0.000	0.136	3.1	OK
7.001	S89	480 minute 30 year Winter I+0%	65.250	64.145	0.000	1.523	5.3	OK
5.004	S82	480 minute 30 year Winter I+0%	65.250	64.145	0.000	8.792	18.2	SURCHARGED
8.000	S90	480 minute 30 year Winter I+0%	64.900	64.145	0.000	0.498	8.5	SURCHARGED
5.005	S81	480 minute 30 year Winter I+0%	64.900	64.144	0.000	7.294	26.2	SURCHARGED
9.000	S96	180 minute 30 year Winter I+0%	64.950	64.164	0.000	0.282	10.8	OK
9.001	S95	180 minute 30 year Winter I+0%	64.850	64.156	0.000	3.438	10.2	SURCHARGED
10.000	S98	180 minute 30 year Winter I+0%	65.075	64.178	0.000	0.298	17.8	OK

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Flooded Volume (m³)	Maximum Vol (m³)	Pipe Flow (l/s)	Status
10.001	S97	180 minute 30 year Winter I+0%	64.975	64.159	0.000	4.033	17.4	SURCHARGED
11.000	S99	30 minute 30 year Summer I+0%	65.150	64.246	0.000	0.102	15.4	OK
9.002	S94	180 minute 30 year Winter I+0%	65.200	64.150	0.000	5.349	35.6	SURCHARGED
9.003	S93	480 minute 30 year Winter I+0%	65.200	64.147	0.000	5.575	24.8	SURCHARGED
12.000	S100	480 minute 30 year Winter I+0%	65.150	64.147	0.000	0.194	3.1	OK
9.004	S92	480 minute 30 year Winter I+0%	65.200	64.146	0.000	7.207	27.0	SURCHARGED
13.000	S101	480 minute 30 year Winter I+0%	64.800	64.146	0.000	0.527	9.0	SURCHARGED
9.005	S91	480 minute 30 year Winter I+0%	64.900	64.145	0.000	7.809	34.7	SURCHARGED
1.007	SWALE	480 minute 30 year Winter I+0%	65.100	64.144	0.000	802.704	10.7	SURCHARGED
1.008	S70	480 minute 30 year Winter I+0%	65.250	64.160	0.000	1.754	8.0	SURCHARGED

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 4 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 457460 221065 SP 57460 21065
Data Type	Point
Cv (Summer)	0.900
Cv (Winter)	0.900

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Flooded Volume (m³)	Maximum Vol (m³)	Pipe Flow (l/s)	Status
1.000	S77	600 minute 100 year Winter I+40%	65.100	64.639	0.000	53.280	10.5	SURCHARGED
1.001	S76	600 minute 100 year Winter I+40%	65.250	64.637	0.000	4.552	10.3	SURCHARGED
2.000	S78	30 minute 100 year Summer I+40%	65.200	64.787	0.000	0.573	18.7	SURCHARGED
1.002	S75	600 minute 100 year Winter I+40%	65.400	64.637	0.000	2.655	13.6	SURCHARGED
1.003	S74	600 minute 100 year Winter I+40%	65.400	64.635	0.000	3.464	17.2	SURCHARGED
3.000	S79	60 minute 100 year Summer I+40%	65.400	64.679	0.000	0.592	17.4	SURCHARGED
1.004	S73	600 minute 100 year Winter I+40%	65.400	64.634	0.000	5.197	19.9	SURCHARGED
4.000	S80	600 minute 100 year Winter I+40%	64.900	64.635	0.000	1.029	12.6	FLOOD RISK
1.005	S72	600 minute 100 year Winter I+40%	65.000	64.633	0.000	7.084	32.0	SURCHARGED
1.006	S71	600 minute 100 year Winter I+40%	65.000	64.633	0.000	3.384	31.9	SURCHARGED
5.000	S86	600 minute 100 year Winter I+40%	64.950	64.636	0.000	53.632	7.0	SURCHARGED
5.001	S85	600 minute 100 year Winter I+40%	65.250	64.636	0.000	4.149	6.8	SURCHARGED
6.000	S87	30 minute 100 year Summer I+40%	65.350	64.715	0.000	0.509	19.1	SURCHARGED
5.002	S84	600 minute 100 year Winter I+40%	65.400	64.635	0.000	2.670	11.0	SURCHARGED
5.003	S83	600 minute 100 year Winter I+40%	65.400	64.634	0.000	3.776	18.3	SURCHARGED
7.000	S88	600 minute 100 year Winter I+40%	65.250	64.635	0.000	0.690	4.3	SURCHARGED
7.001	S89	600 minute 100 year Winter I+40%	65.250	64.634	0.000	2.564	7.1	SURCHARGED
5.004	S82	600 minute 100 year Winter I+40%	65.250	64.634	0.000	9.496	25.0	SURCHARGED
8.000	S90	600 minute 100 year Winter I+40%	64.900	64.634	0.000	1.051	12.0	FLOOD RISK
5.005	S81	600 minute 100 year Winter I+40%	64.900	64.633	0.000	7.994	36.7	FLOOD RISK
9.000	S96	600 minute 100 year Winter I+40%	64.950	64.639	0.000	0.818	7.2	SURCHARGED
9.001	S95	600 minute 100 year Winter I+40%	64.850	64.637	0.000	4.083	7.2	FLOOD RISK

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Flooded Volume (m³)	Maximum Vol (m³)	Pipe Flow (l/s)	Status
10.000	S98	600 minute 100 year Winter I+40%	65.075	64.638	0.000	85.983	10.3	SURCHARGED
10.001	S97	600 minute 100 year Winter I+40%	64.975	64.637	0.000	4.676	10.0	SURCHARGED
11.000	S99	600 minute 100 year Winter I+40%	65.150	64.638	0.000	0.547	4.4	SURCHARGED
9.002	S94	600 minute 100 year Winter I+40%	65.200	64.637	0.000	6.743	21.6	SURCHARGED
9.003	S93	600 minute 100 year Winter I+40%	65.200	64.636	0.000	6.275	30.0	SURCHARGED
12.000	S100	600 minute 100 year Winter I+40%	65.150	64.636	0.000	0.748	4.3	SURCHARGED
9.004	S92	600 minute 100 year Winter I+40%	65.200	64.635	0.000	7.935	33.7	SURCHARGED
13.000	S101	600 minute 100 year Winter I+40%	64.800	64.635	0.000	1.080	13.1	FLOOD RISK
9.005	S91	600 minute 100 year Winter I+40%	64.900	64.633	0.000	8.509	46.0	FLOOD RISK
1.007	SWALE	600 minute 100 year Winter I+40%	65.100	64.632	0.000	1417.317	13.1	SURCHARGED
1.008	S70	600 minute 100 year Winter I+40%	65.250	64.648	0.000	2.306	8.0	SURCHARGED