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Technical Note to Discharge Conditions

Project: AGP Huntingdon
Project No: P24 - 0131
Date: 12th May 2025
Issue: 1

Introduction

This technical note has been prepared by Simpon TWS on behalf of Whitbread PLC to provide further information required for the discharge of conditions relating to a proposed Premier Inn Extension at Huntingdon.

The outstanding conditions state the following:

Condition 9

"No layout of services, creating of hard surfaces or erection of a building shall commence until a detailed surface water drainage scheme for the site, based on the agreed 'Flood Risk Assessment and Drainage Strategy Report prepared by Simpson TWS Consulting Engineers, Reference P24-0131 Rev 5, dated 2nd July 2024 and received by the Local Planning Authority on 12th July 2024 has been submitted to and approved I writing by the Local Planning Authority. The scheme shall subsequently be implemented in full accordance with the approved details prior to first occupation."

A detailed surface water drainage scheme has been developed for the site based on the principles from the agreed Flood Risk Assessment and Drainage Strategy Report Rev 5. The detailed surface water drainage scheme can be seen on the Engineering Layout (Ref: P24-0131–100 C1 Engineering Layout) which is appended to this technical note. While the principle concepts established in the Flood Risk Assessment report remain, it has been necessary to make some minor changes to the surface water design due to the site constraints.

The main surface water principles are listed below together with the amendments:

- Roof runoff from the southern side of the existing hotel, two rainwater pipes from the western side of the hotel and the proposed extension will be drained via a proposed surface water drainage network which discharges to the existing surface water drainage network via a proposed Hydro-Brake flow control device. The Hydro-Brake flow control device restricts flows to a maximum rate of 4.9 l/s prior to entering the existing surface water drainage network. This is to ensure that the existing system will not be overwhelmed due to the proposed development. As there is an increase in the area which will be draining to the existing network, an attenuation tank is proposed in the access road in the west. Excess flows will be stored and attenuated for all storm events up to and including the 1 in 100 year event with a 40% allowance for climate change. The storage volume for a 1 in 100 year event with a 40% allowance for climate change is 38.9m³. MicroDrainage Simulation calculations for the proposed surface water network are appended to this technical note. Pipe numbers in the calculations correspond with those shown on the Engineering Layout drawing.

- The existing 150mm/225mm dia. surface water drainage network collecting runoff from the existing car park and access road will be diverted to accommodate the proposed attenuation tank and extension. The diverted surface water drainage network will reconnect to the existing network via a manhole on the east side of the proposed extension.

- Rainwater pipes along the western side of the proposed extension will be discharged via a rain garden. The proposed rain garden will provide treatment of runoff prior to discharging into the surface water drainage network via a perforated collector pipe in the sub-base.

- One of the rainwater pipes in the eastern side of the proposed extension will also discharge to a separate rain garden via a stone filled dished channel. The rain garden will provide treatment to the roof water runoff prior to discharging to the surface water drainage network.

- All other rainwater pipes from the proposed extension will be captured by a combination of rainwater gutters and downpipes that would discharge directly into a traditional network of gravity drained pipework.

- Surface water runoff from a flat section of the existing access to be retained will be drained via a channel drain and a road gully which will discharge to the proposed surface water drainage network. As there will be a decrease in the area discharging into this network no additional attenuation is proposed.

Condition 10

"No development, including preparatory works, shall commence until the details of measures indicating how additional surface water runoff from the site will be avoided during the construction works have been submitted to and approved in writing by the Local Planning Authority. The applicant may be required to provide collection, balancing and / or settlement system for these flows. The approved measures and systems shall be brought into operation before any works to create buildings or hard surfaces commence."

A Drainage Implementation, Management & Maintenance Plan has been prepared to address this condition and is appended to this technical note.

This note should be read in conjunction with the following appended documents:

- P24-0131-100 C1 Engineering Layout by Simpson TWS (March 2025)
- MicroDrainage Simulations Calculations (P24-0131 – Huntingdon PI – Proposed Hotel Network REV D) by Simpson TWS (March 2025)
- Drainage Implementation, Management & Maintenance Plan (P24-0131 Drainage Implementation, Management & Maintenance Plan – AGP Huntingdon – Issue 1) by Simpson TWS (March 2025)

Conclusion

It is concluded that the additional details provided with this technical note and appendix address outstanding comments and the conditions can be recommended for discharge.

Appendices

Engineering Layout (P24-0131 – 100 C1 Engineering Layout) by Simpson TWS (March 2025)

MicroDrainage Simulation Calculations (P24-0131 – Huntingdon PI – Proposed Hotel Network REV D) by Simpson TWS (March 2025)

Drainage Implementation, Management & Maintenance Plan (P24- 0131 – Issue 1) by Simpson TWS (March 2025)

DO NOT SCALE


Brewers Fayre
Premier Inn
EXISTING SURFACE WATER DRAINAGE TO BE DIVERTED AROUND PROPOSED ATTENUATION TANK IN ACCESS ROAD.
EXISTING FOUL DRAINAGE TO BE DIVERTED AROUND EXTENSION. MANHOLE OUTLET TO BE MADE 150mm DIA.
REFER TO AXIOM DRAWING 6214-WD-696 FOR EXTERNAL WALKWAY SETTING OUT LEVELS, RAMPS AND STEPS. HANDRAILS TO ARCHITECT's DETAILS AND SPECIFICATION.
EXISTING SVP TO BE RETAINED AND BOXED OUT AT GROUND FLOOR LEVEL FOR NEW LINEN ROOM.
EXISTING RWP AND CONNECTION TO BE ABANDONED.
INTERNAL RWP TO CONNECT DIRECTLY INTO SURFACE WATER PIPE PASSING BENEATH EXTENSION. RODDING ACCESS REQUIRED WITHIN PLANT ROOM.
EXISTING RWP CONNECTION TO BE DIVERTED AWAY FROM EXTENSION FOOTPRINT AND THROUGH NEW FLOW CONTROL MANHOLE
PROPOSED FOUL WATER DRAINAGE SERVING NEW ACCESSIBLE BEDROOMS TO REUSE EXISTING SVP CONNECTIONS WHERE POSSIBLE.
PROPOSED FOUL WATER CONNECTION ONTO EXISTING PRIVATE FOUL WATER DRAIN VIA THE CONSTRUCTION OF A NEW MANHOLE. CONNECTION WILL BE SUBJECT TO THE APPROVAL OF AN INDIRECT SEWER CONNECTION APPLICATION TO ANGLIAN WATER.
EXISTING SVP CONNECTIONS TO BE RETAINED AND BOXED OUT THROUGH GROUND FLOOR REDEVELOPMENT WORKS.
INDICATIVE LOCATIONS OF FLOOR GULLYS TO BE CONFIRMED BY ARCHITECT. GULLYS TO BE CONNECTED INTO EXISTING FOUL WATER CONNECTIONS BENEATH GROUND FLOOR.
2no PROPOSED ACCESSIBLE ROOMS
PROPOSED FLOW CONTROL CHAMBER TO LIMIT FLOWS TO A MAXIMUM RATE OF 4.9 l/s FOR ALL EVENTS UP TO AND INCLUDING A 1 IN 100 YEAR EVENT INCLUDING A 40% ALLOWANCE FOR CLIMATE CHANGE. ORIFICE DIA. = 75mm. OVERFLOW PIPE REQUIRED AT HIGH LEVEL AS FLOW CONTROL DEVICE TOO SMALL FOR A BY-PASS DOOR.
EXISTING RWP CONNECTION TO BE DIVERTED INTO PROPOSED DRAINAGE NETWORK
EXISTING SURFACE WATER NETWORK TO BE DIVERTED THROUGH NEW FLOW CONTROL CHAMBER.
EXISTING RWP TO BE RETAINED THROUGH CONCRETE SLAB.
ANY NEW DRAINAGE POINTS REQUIRED FOR THE BREAKFAST ROOM ARE TO BE SADDLED ONTO EXISTING SVP CONNECTIONS SERVING THE BEDROOMS ON THE UPPER FLOORS OF THE HOTEL.
EXISTING MANHOLE COVERS TO BE RETAINED AND LEVELS UPDATED TO SUIT NEW PATH AND SLAB.
PROPOSED BREAKFAST ROOM (64 COVERS)
PROPOSED SDS GEOLIGHT GEOCELLULAR ATTENUATION TANK TO STORE AND ATTENUATE SURFACE WATER RUNOFF FOR ALL STORM EVENTS UP TO AND INCLUDING A 1 IN 100 YEAR EVENT WITH A 40% ALLOWANCE FOR CLIMATE CHANGE.
TANK SECTION 1 = 24x2x0.375m
TANK SECTION 2 = 24x1x0.375m
TANK SECTION 3 = 6x4x0.375m
FILTER DRAIN 1 (2x300mm PIPES) = 4x1x0.375m
FILTER DRAIN 2 (1x300mm PIPES) = 24x1x0.375m
TOP OF TANK = 11.355mAOD
BASE OF TANK = 10.980mAOD
1 IN 100yr + 40% STORAGE VOL. = 38.9m³
NEW MANHOLE TO BE INSTALLED ON LINE OF EXISTING FOUL WATER DRAIN OUTSIDE FOOTPRINT OF EXTENSION. EXISTING MANHOLE TO BE ABANDONED. EXISTING AND PROPOSED SECTIONS OF PIPEWORK UNDER EXTENSION TO BE COORDINATED WITH PROPOSED FOUNDATIONS.
REINFORCED CONCRETE PROTECTION SLAB REQUIRED OVER PERFORATED PIPES IN FILTER DRAINS.
EXISTING GULLY TO BE REPLACED WITH A DRAINAGE CHANNEL WHEN ACCESS ROAD RE-LAID OVER TANK TO ADDRESS FLAT SECTION.
EXISTING 225mm DIA. SURFACE WATER PIPE TO BE DIVERTED BENEATH PROPOSED EXTENSION. REFER TO FOUNDATION LAYOUT FOR DETAILS OF WHERE IT CROSSES THE PROPOSED FOUNDATIONS.
EXTENT OF 45 DEGREE LOADING LINE OVER GEOCELLULAR ATTENUATION TANK. CONTRACTOR SHALL ENSURE CRANE OUTRIGGERS ARE NOT LOCATED TO THE NORTH OF THIS LINE TO AVOID DAMAGE TO ATTENUATION TANK.
NEW ROAD GULLY TO REPLACE EXISTING GULLY BENEATH FOOTPRINT OF EXTENSION. GULLY TO BE RECONNECTED INTO DIVERTED SURFACE WATER NETWORK.
PROPOSED RAIN GARDEN TO PROVIDE TREATMENT TO ROOF WATER RUNOFF FROM THE PROPOSED EXTENSION. PERFORATED PIPE TO RUN THROUGH SUB-BASE TO DISCHARGE WATER INTO EXISTING NETWORK.
RAIN GARDEN AREA = 24m²
FREEBOARD = 150mm
TOPSOIL DEPTH = 200mm MIN.
SUB-BASE DEPTH = 200mm
PROPOSED RAIN GARDEN TO FILTER RUNOFF FROM WESTERN ELEVATION RAINWATER PIPES AND DISTRIBUTE RUNOFF INTO SURFACE WATER NETWORK VIA PERFORATED COLLECTOR PIPE IN SUB-BASE
RAINWATER PIPES ALONG WESTERN ELEVATION TO DIVERT RAINWATER INTO THE TOP OF THE RAIN GARDEN.
PROPOSED RAIN GARDEN TO PROVIDE TREATMENT TO ROOF WATER RUNOFF FROM THE PROPOSED EXTENSION. PERFORATED PIPE TO RUN THROUGH SUB-BASE TO DISCHARGE WATER INTO EXISTING NETWORK.
RAIN GARDEN AREA = 8m²
FREEBOARD = 150mm
TOPSOIL DEPTH = 300mm
SUB-BASE DEPTH = 200mm
and Location of Pipes Taken from Previous Survey.
STONE FILLED DISHED CHANNEL TO DIVERT RAINWATER PIPE AREA TO RAIN GARDEN.
EXISTING GULLY TO BE REMOVED.
ACO MULTIDRAIN SHALLOW DRAINAGE CHANNEL
ACO MULTIDRAIN MD M100D 20.0 DRAINAGE CHANNEL
Escape Stair 2
Escape Stair 1
STEPS
RAMP
LINEN
Proposed Linen (intake)
EXISTING OFF SITE MANHOLE AND DRAINAGE NETWORK IDENTIFIED TO BE SURCHARGED. MANAGEMENT COMPANY FOR THE BRAMPTON HUT SERVICE AREA HAVE BEEN NOTIFIED AND ARE UNDERTAKING INVESTIGATIONS TO CONFIRM CAUSE AND RECTIFY ANY ISSUES IN THE DOWNSTREAM NETWORK.
Surface Water System Found in Poor Condition in Relation to Amount of Water Being Unable To Flow Due to Blockages. Pipe Sizes, Direction of Flow and Location of Pipes Taken from Previous Survey.
GPR Detections S32 Found in Pub Plant Room Other Side of Wall, Inline With Detections Assumed to be Water
No Detections Using EML/GPR. TFR
Tailor Gas Tanks. Recessible
Tarmac
Grass
Gravel
Vegetation
Slabs
Unmade
Bench
Planter
Dense Vegetation
Deciduous
Evergreen
Conifer
Hedge
Bush
Shrub
Tree
Lamp
Bollard
Sign
Manhole
Gully
Catchpit
Rodding Eye
Inspection Chamber
Soil Vent Pipe
Air Con
Fire Exit
Entrance Door
Ground Floor
Level Access
Steps
Ramp
Kerb
Edge
Fence
Wall
Building
Roof
Eaves
Ridge
Chimney
Skylight
Solar Panels
Plant Room
Lift Shaft
Stair Core
Escape Stair
Canopy
Porch
Bay Window
Dormer
Balcony
Parapet
Gutter
Downpipe
Soffit
Fascia
Cladding
Brick
Render
Glazing
Curtain Wall
Louvre
Vent
Flue
Aerial
Satellite Dish
CCTV
Security Gate
Barrier
Bollard
Tree Protection
Root Protection Area
Existing Drainage
Proposed Drainage
Foul Water
Surface Water
Rainwater Pipe
Soil Vent Pipe
Rodding Eye
Inspection Chamber
Manhole
Gully
Catchpit
Soakaway
Attenuation Tank
Rain Garden
Filter Drain
Perforated Pipe
Collector Pipe
Connection
Diversion
Abandoned
Existing
Proposed
Demolition
Retained
Boxed Out
Redevelopment
Ground Floor
First Floor
Second Floor
Roof
Section
Elevation
Plan
Detail
Reference
Grid
Axis
Dimension
Level
Datum
Survey
Topographical
Utility
Service
Gas
Water
Electric
Telecom
Fibre
Duct
Cable
Pipe
Chamber
Valve
Meter
Box
Cover
Frame
Lid
Grate
Channel
Drain
Sump
Pump
Tank
Vessel
Boiler
Heating
Cooling
Ventilation
Extract
Supply
Return
Flow
Pressure
Temperature
Control
Sensor
Alarm
Fire
Sprinkler
Hydrant
Hose
Reel
Extinguisher
Emergency
Lighting
Power
Socket
Switch
Distribution
Board
Meter
Cabinet
Kiosk
Substation
Transformer
Generator
Battery
Inverter
Charger
Solar
Photovoltaic
Wind
Turbine
Heat
Pump
Boiler
Radiator
Underfloor

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

Return Period (years)	2
FEH Rainfall Version	2013
Site Location	GB 519180 271850 TL 19180 71850
Data Type	Point
Maximum Rainfall (mm/hr)	50
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	1.000
PIMP (%)	100
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.200
Maximum Backdrop Height (m)	1.500
Min Design Depth for Optimisation (m)	1.200
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.075	4-8	0.019

Total Area Contributing (ha) = 0.094

Total Pipe Volume (m^3) = 4.079

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
1.000	16.208	0.445	36.4	0.011	5.00	0.0	0.600	o	150	Pipe/Conduit	
1.001	17.634	0.050	352.7	0.020	0.00	0.0	0.600	o	375	Pipe/Conduit	
2.000	2.754	0.020	137.7	0.007	5.00	0.0	0.600	o	150	Pipe/Conduit	
2.001	17.962	0.455	39.5	0.010	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.002	9.205	0.030	306.8	0.017	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)
1.000	50.00	5.16	11.640	0.011	0.0	0.0	0.0	1.67	29.6	2.0
1.001	50.00	5.47	10.970	0.031	0.0	0.0	0.0	0.96	105.9	5.6
2.000	50.00	5.05	11.620	0.007	0.0	0.0	0.0	0.85	15.1	1.3
2.001	50.00	5.24	11.600	0.017	0.0	0.0	0.0	1.61	28.4	3.1
1.002	50.00	5.62	10.920	0.065	0.0	0.0	0.0	1.03	113.7	11.7

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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
3.000	3.016	0.050	60.3	0.005	5.00	0.0	0.600	o	100	Pipe/Conduit	
3.001	1.000	0.140	7.1	0.007	0.00	0.0	0.600	o	100	Pipe/Conduit	
1.003	16.298	0.150	108.7	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.004	8.057	0.075	107.4	0.017	0.00	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)
3.000	50.00	5.05	11.080	0.005	0.0	0.0	0.0	0.99	7.8	0.9
3.001	50.00	5.06	11.030	0.012	0.0	0.0	0.0	2.91	22.9	2.2
1.003	50.00	5.90	10.890	0.077	0.0	0.0	0.0	0.96	17.0	13.9
1.004	50.00	6.04	10.740	0.094	0.0	0.0	0.0	0.97	17.1	17.0

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Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
S1	12.180	0.540	Open Manhole	1200	1.000	11.640	150				
S3	12.100	1.130	Open Manhole	1350	1.001	10.970	375	1.000	11.195	150	
S4	12.230	0.610	Open Manhole	1200	2.000	11.620	150				
S5	12.200	0.600	Open Manhole	1200	2.001	11.600	150	2.000	11.600	150	
S6	12.200	1.280	Open Manhole	1350	1.002	10.920	375	1.001	10.920	375	
								2.001	11.145	150	
S7	12.050	0.970	Open Manhole	1200	3.000	11.080	100				
S8	12.100	1.070	Open Manhole	1200	3.001	11.030	100	3.000	11.030	100	
S9 FC	12.200	1.310	Open Manhole	1350	1.003	10.890	150	1.002	10.890	375	
								3.001	10.890	100	
Node	12.200	1.460	Open Manhole	1200	1.004	10.740	150	1.003	10.740	150	
	12.200	1.535	Open Manhole	0		OUTFALL		1.004	10.665	150	

No coordinates have been specified, layout information cannot be produced.

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	150	S1	12.180	11.640	0.390	Open Manhole	1200
1.001	o	375	S3	12.100	10.970	0.755	Open Manhole	1350
2.000	o	150	S4	12.230	11.620	0.460	Open Manhole	1200
2.001	o	150	S5	12.200	11.600	0.450	Open Manhole	1200
1.002	o	375	S6	12.200	10.920	0.905	Open Manhole	1350
3.000	o	100	S7	12.050	11.080	0.870	Open Manhole	1200
3.001	o	100	S8	12.100	11.030	0.970	Open Manhole	1200
1.003	o	150	S9 FC	12.200	10.890	1.160	Open Manhole	1350
1.004	o	150	Node	12.200	10.740	1.310	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	16.208	36.4	S3	12.100	11.195	0.755	Open Manhole	1350
1.001	17.634	352.7	S6	12.200	10.920	0.905	Open Manhole	1350
2.000	2.754	137.7	S5	12.200	11.600	0.450	Open Manhole	1200
2.001	17.962	39.5	S6	12.200	11.145	0.905	Open Manhole	1350
1.002	9.205	306.8	S9 FC	12.200	10.890	0.935	Open Manhole	1350
3.000	3.016	60.3	S8	12.100	11.030	0.970	Open Manhole	1200
3.001	1.000	7.1	S9 FC	12.200	10.890	1.210	Open Manhole	1350
1.003	16.298	108.7	Node	12.200	10.740	1.310	Open Manhole	1200
1.004	8.057	107.4		12.200	10.665	1.385	Open Manhole	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)
1.004		12.200	10.665	0.000	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	1.000	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	0.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

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 2 Number of Real Time Controls 0

Synthetic Rainfall Details

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Synthetic Rainfall Details

Rainfall Model	FEH	Summer Storms	Yes
Return Period (years)	2	Winter Storms	No
FEH Rainfall Version	2013	Cv (Summer)	1.000
Site Location	GB 519180 271850 TL 19180 71850	Cv (Winter)	0.840
Data Type	Point	Storm Duration (mins)	30

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Online Controls for Storm

Hydro-Brake® Optimum Manhole: S9 FC, DS/PN: 1.003, Volume (m³): 2.7

Unit Reference	MD-SCU-0075-4900-0680-4900
Design Head (m)	0.680
Design Flow (l/s)	4.9
Flush-Flo™	Calculated
Objective	Linear discharge profile
Application	Surface
Sump Available	Yes
Diameter (mm)	75
Invert Level (m)	10.890
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.680	4.9	Kick-Flo®	0.113	2.2
Flush-Flo™	0.101	2.2	Mean Flow over Head Range	-	3.3

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.2	0.800	5.3	2.000	8.1	4.000	11.3	7.000	14.8
0.200	2.8	1.000	5.9	2.200	8.5	4.500	12.0	7.500	15.3
0.300	3.4	1.200	6.4	2.400	8.9	5.000	12.6	8.000	15.8
0.400	3.8	1.400	6.9	2.600	9.2	5.500	13.2	8.500	16.3
0.500	4.2	1.600	7.3	3.000	9.9	6.000	13.7	9.000	16.7
0.600	4.6	1.800	7.7	3.500	10.6	6.500	14.3	9.500	17.2

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Storage Structures for Storm

Complex Manhole: S3, DS/PN: 1.001

Filter Drain

Infiltration Coefficient Base (m/hr)	0.00000	Pipe Diameter (m)	0.300
Infiltration Coefficient Side (m/hr)	0.00000	Pipe Depth above Invert (m)	0.000
Safety Factor	2.0	Number of Pipes	2
Porosity	0.30	Slope (1:X)	0.0
Invert Level (m)	10.980	Cap Volume Depth (m)	0.375
Trench Width (m)	1.0	Cap Infiltration Depth (m)	0.000
Trench Length (m)	4.0		

Cellular Storage

Invert Level (m)	10.980	Safety Factor	2.0
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)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	96.0	0.0	0.375	96.0	0.0	0.376	0.0	0.0

Filter Drain

Infiltration Coefficient Base (m/hr)	0.00000	Pipe Diameter (m)	0.300
Infiltration Coefficient Side (m/hr)	0.00000	Pipe Depth above Invert (m)	0.000
Safety Factor	2.0	Number of Pipes	1
Porosity	0.30	Slope (1:X)	0.0
Invert Level (m)	10.980	Cap Volume Depth (m)	0.375
Trench Width (m)	1.0	Cap Infiltration Depth (m)	0.000
Trench Length (m)	24.0		

Filter Drain

Infiltration Coefficient Base (m/hr)	0.00000	Pipe Diameter (m)	0.150
Infiltration Coefficient Side (m/hr)	0.00000	Pipe Depth above Invert (m)	0.000
Safety Factor	2.0	Number of Pipes	1
Porosity	0.30	Slope (1:X)	28.6
Invert Level (m)	11.370	Cap Volume Depth (m)	0.200
Trench Width (m)	1.3	Cap Infiltration Depth (m)	0.000
Trench Length (m)	17.2		

Filter Drain Manhole: S6, DS/PN: 1.002

Infiltration Coefficient Base (m/hr)	0.00000	Pipe Diameter (m)	0.150
Infiltration Coefficient Side (m/hr)	0.00000	Pipe Depth above Invert (m)	0.000
Safety Factor	2.0	Number of Pipes	1
Porosity	0.30	Slope (1:X)	0.0
Invert Level (m)	11.450	Cap Volume Depth (m)	0.200
Trench Width (m)	1.1	Cap Infiltration Depth (m)	0.000
Trench Length (m)	7.2		

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Summary Wizard of 360 minute 2 year Summer I+0% 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	0.000
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 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH	Data Type	Point
FEH Rainfall Version	2013	Cv (Summer)	1.000
Site Location	GB 519180 271850 TL 19180 71850	Cv (Winter)	1.000

Margin for Flood Risk Warning (mm)	150.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
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, 5760, 7200, 8640, 10080
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 0, 0

PN	US/MH Name	Event	US/CL (m)	Surcharged Depth (m)	Flooded Volume (m³)	Maximum Vol (m³)	Discharge Vol (m³)	Pipe Flow (l/s)	Status
1.000	S1	360 minute 2 year Summer I+0%	12.180	-0.135	0.000	0.011	3.095	0.6	OK
1.001	S3	360 minute 2 year Summer I+0%	12.100	-0.335	0.000	3.119	8.724	1.2	OK
2.000	S4	360 minute 2 year Summer I+0%	12.230	-0.132	0.000	0.014	1.970	0.4	OK
2.001	S5	360 minute 2 year Summer I+0%	12.200	-0.132	0.000	0.016	4.784	0.9	OK
1.002	S6	360 minute 2 year Summer I+0%	12.200	-0.291	0.000	0.275	18.291	1.9	OK
3.000	S7	360 minute 2 year Summer I+0%	12.050	-0.087	0.000	0.009	1.407	0.3	OK
3.001	S8	360 minute 2 year Summer I+0%	12.100	-0.084	0.000	0.013	3.377	0.6	OK
1.003	S9 FC	360 minute 2 year Summer I+0%	12.200	-0.037	0.000	0.276	21.669	2.2	OK
1.004	Node	360 minute 2 year Summer I+0%	12.200	-0.104	0.000	0.068	26.452	3.0	OK

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Summary Wizard of 360 minute 30 year Summer I+0% 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	0.000
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 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH	Data Type	Point
FEH Rainfall Version	2013	Cv (Summer)	1.000
Site Location	GB 519180 271850 TL 19180 71850	Cv (Winter)	1.000

Margin for Flood Risk Warning (mm)	150.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
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, 5760, 7200, 8640, 10080
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 0, 0

PN	US/MH Name	Event	US/CL (m)	Surcharged Depth (m)	Flooded Volume (m³)	Maximum Vol (m³)	Discharge Vol (m³)	Pipe Flow (l/s)	Status
1.000	S1	360 minute 30 year Summer I+0%	12.180	-0.130	0.000	0.017	6.843	1.2	OK
1.001	S3	360 minute 30 year Summer I+0%	12.100	-0.228	0.000	14.499	19.318	2.8	OK
2.000	S4	360 minute 30 year Summer I+0%	12.230	-0.123	0.000	0.024	4.354	0.8	OK
2.001	S5	360 minute 30 year Summer I+0%	12.200	-0.124	0.000	0.028	10.572	1.9	OK
1.002	S6	360 minute 30 year Summer I+0%	12.200	-0.178	0.000	0.978	40.453	3.1	OK
3.000	S7	360 minute 30 year Summer I+0%	12.050	-0.062	0.000	0.038	3.111	0.6	OK
3.001	S8	360 minute 30 year Summer I+0%	12.100	-0.013	0.000	0.103	7.466	1.3	OK
1.003	S9 FC	360 minute 30 year Summer I+0%	12.200	0.076	0.000	0.739	47.817	2.9	SURCHARGED
1.004	Node	360 minute 30 year Summer I+0%	12.200	-0.093	0.000	0.088	58.391	4.6	OK

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Summary Wizard of 360 minute 100 year Summer I+0% 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	0.000
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 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH	Data Type	Point
FEH Rainfall Version	2013	Cv (Summer)	1.000
Site Location	GB 519180 271850 TL 19180 71850	Cv (Winter)	1.000

Margin for Flood Risk Warning (mm)	150.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
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, 5760, 7200, 8640, 10080
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 0, 0

PN	US/MH Name	Event	US/CL (m)	Surcharged Depth (m)	Flooded Volume (m³)	Maximum Vol (m³)	Discharge Vol (m³)	Pipe Flow (l/s)	Status
1.000	S1	360 minute 100 year Summer I+0%	12.180	-0.126	0.000	0.022	9.374	1.7	OK
1.001	S3	360 minute 100 year Summer I+0%	12.100	-0.143	0.000	23.659	26.540	3.7	OK
2.000	S4	360 minute 100 year Summer I+0%	12.230	-0.118	0.000	0.030	5.965	1.1	OK
2.001	S5	360 minute 100 year Summer I+0%	12.200	-0.119	0.000	0.034	14.483	2.6	OK
1.002	S6	360 minute 100 year Summer I+0%	12.200	-0.093	0.000	1.608	55.450	3.1	OK
3.000	S7	360 minute 100 year Summer I+0%	12.050	0.023	0.000	0.133	4.264	0.7	SURCHARGED
3.001	S8	360 minute 100 year Summer I+0%	12.100	0.072	0.000	0.202	10.227	1.7	SURCHARGED
1.003	S9 FC	360 minute 100 year Summer I+0%	12.200	0.161	0.000	1.098	65.810	3.4	SURCHARGED
1.004	Node	360 minute 100 year Summer I+0%	12.200	-0.086	0.000	0.099	80.298	5.6	OK

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Summary Wizard of 360 minute 2 year Winter I+0% 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	0.000
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 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH	Data Type	Point
FEH Rainfall Version	2013	Cv (Summer)	1.000
Site Location	GB 519180 271850 TL 19180 71850	Cv (Winter)	1.000

Margin for Flood Risk Warning (mm)	150.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
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, 5760, 7200, 8640, 10080
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 0, 0

PN	US/MH Name	Event	US/CL (m)	Surcharged Depth (m)	Flooded Volume (m³)	Maximum Vol (m³)	Discharge Vol (m³)	Pipe Flow (l/s)	Status
1.000	S1	360 minute 2 year Winter I+0%	12.180	-0.141	0.000	0.005	3.095	0.4	OK
1.001	S3	360 minute 2 year Winter I+0%	12.100	-0.347	0.000	1.826	8.720	0.8	OK
2.000	S4	360 minute 2 year Winter I+0%	12.230	-0.135	0.000	0.011	1.970	0.2	OK
2.001	S5	360 minute 2 year Winter I+0%	12.200	-0.135	0.000	0.013	4.783	0.6	OK
1.002	S6	360 minute 2 year Winter I+0%	12.200	-0.314	0.000	0.195	18.290	1.7	OK
3.000	S7	360 minute 2 year Winter I+0%	12.050	-0.089	0.000	0.007	1.407	0.2	OK
3.001	S8	360 minute 2 year Winter I+0%	12.100	-0.088	0.000	0.009	3.376	0.4	OK
1.003	S9 FC	360 minute 2 year Winter I+0%	12.200	-0.062	0.000	0.201	21.661	2.1	OK
1.004	Node	360 minute 2 year Winter I+0%	12.200	-0.108	0.000	0.062	26.444	2.6	OK

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Summary Wizard of 360 minute 30 year Winter I+0% 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	0.000
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 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH	Data Type	Point
FEH Rainfall Version	2013	Cv (Summer)	1.000
Site Location	GB 519180 271850 TL 19180 71850	Cv (Winter)	1.000

Margin for Flood Risk Warning (mm)	150.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
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, 5760, 7200, 8640, 10080
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 0, 0

PN	US/MH Name	Event	US/CL (m)	Surcharged Depth (m)	Flooded Volume (m³)	Maximum Vol (m³)	Discharge Vol (m³)	Pipe Flow (l/s)	Status
1.000	S1	360 minute 30 year Winter I+0%	12.180	-0.133	0.000	0.013	6.842	0.8	OK
1.001	S3	360 minute 30 year Winter I+0%	12.100	-0.245	0.000	12.695	19.372	2.8	OK
2.000	S4	360 minute 30 year Winter I+0%	12.230	-0.129	0.000	0.018	4.354	0.5	OK
2.001	S5	360 minute 30 year Winter I+0%	12.200	-0.129	0.000	0.020	10.572	1.2	OK
1.002	S6	360 minute 30 year Winter I+0%	12.200	-0.194	0.000	0.866	40.490	3.0	OK
3.000	S7	360 minute 30 year Winter I+0%	12.050	-0.079	0.000	0.019	3.110	0.4	OK
3.001	S8	360 minute 30 year Winter I+0%	12.100	-0.029	0.000	0.083	7.462	0.9	OK
1.003	S9 FC	360 minute 30 year Winter I+0%	12.200	0.060	0.000	0.671	48.016	2.8	SURCHARGED
1.004	Node	360 minute 30 year Winter I+0%	12.200	-0.098	0.000	0.078	58.587	3.8	OK

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Summary Wizard of 360 minute 100 year Winter I+0% 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	0.000
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 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH	Data Type	Point
FEH Rainfall Version	2013	Cv (Summer)	1.000
Site Location	GB 519180 271850 TL 19180 71850	Cv (Winter)	1.000

Margin for Flood Risk Warning (mm)	150.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
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, 5760, 7200, 8640, 10080
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 0, 0

PN	US/MH Name	Event	US/CL (m)	Surcharged Depth (m)	Flooded Volume (m³)	Maximum Vol (m³)	Discharge Vol (m³)	Pipe Flow (l/s)	Status
1.000	S1	360 minute 100 year Winter I+0%	12.180	-0.131	0.000	0.016	9.374	1.1	OK
1.001	S3	360 minute 100 year Winter I+0%	12.100	-0.161	0.000	21.761	26.477	3.2	OK
2.000	S4	360 minute 100 year Winter I+0%	12.230	-0.125	0.000	0.022	5.965	0.7	OK
2.001	S5	360 minute 100 year Winter I+0%	12.200	-0.125	0.000	0.025	14.482	1.7	OK
1.002	S6	360 minute 100 year Winter I+0%	12.200	-0.110	0.000	1.479	55.397	3.1	OK
3.000	S7	360 minute 100 year Winter I+0%	12.050	0.005	0.000	0.114	4.263	0.5	SURCHARGED
3.001	S8	360 minute 100 year Winter I+0%	12.100	0.055	0.000	0.183	10.219	1.1	SURCHARGED
1.003	S9 FC	360 minute 100 year Winter I+0%	12.200	0.144	0.000	1.031	65.648	3.3	SURCHARGED
1.004	Node	360 minute 100 year Winter I+0%	12.200	-0.093	0.000	0.088	80.131	4.6	OK

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

Return Period (years)	2
FEH Rainfall Version	2013
Site Location	GB 519180 271850 TL 19180 71850
Data Type	Point
Maximum Rainfall (mm/hr)	50
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	1.000
PIMP (%)	100
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.200
Maximum Backdrop Height (m)	1.500
Min Design Depth for Optimisation (m)	1.200
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.075	4-8	0.019

Total Area Contributing (ha) = 0.094

Total Pipe Volume (m³) = 4.079

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
1.000	16.208	0.445	36.4	0.011	5.00	0.0	0.600	o	150	Pipe/Conduit	
1.001	17.634	0.050	352.7	0.020	0.00	0.0	0.600	o	375	Pipe/Conduit	
2.000	2.754	0.020	137.7	0.007	5.00	0.0	0.600	o	150	Pipe/Conduit	
2.001	17.962	0.455	39.5	0.010	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.002	9.205	0.030	306.8	0.017	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)
1.000	50.00	5.16	11.640	0.011	0.0	0.0	0.0	1.67	29.6	2.0
1.001	50.00	5.47	10.970	0.031	0.0	0.0	0.0	0.96	105.9	5.6
2.000	50.00	5.05	11.620	0.007	0.0	0.0	0.0	0.85	15.1	1.3
2.001	50.00	5.24	11.600	0.017	0.0	0.0	0.0	1.61	28.4	3.1
1.002	50.00	5.62	10.920	0.065	0.0	0.0	0.0	1.03	113.7	11.7

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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
3.000	3.016	0.050	60.3	0.005	5.00	0.0	0.600	o	100	Pipe/Conduit	
3.001	1.000	0.140	7.1	0.007	0.00	0.0	0.600	o	100	Pipe/Conduit	
1.003	16.298	0.150	108.7	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.004	8.057	0.075	107.4	0.017	0.00	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)
3.000	50.00	5.05	11.080	0.005	0.0	0.0	0.0	0.99	7.8	0.9
3.001	50.00	5.06	11.030	0.012	0.0	0.0	0.0	2.91	22.9	2.2
1.003	50.00	5.90	10.890	0.077	0.0	0.0	0.0	0.96	17.0	13.9
1.004	50.00	6.04	10.740	0.094	0.0	0.0	0.0	0.97	17.1	17.0

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Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
S1	12.180	0.540	Open Manhole	1200	1.000	11.640	150				
S3	12.100	1.130	Open Manhole	1350	1.001	10.970	375	1.000	11.195	150	
S4	12.230	0.610	Open Manhole	1200	2.000	11.620	150				
S5	12.200	0.600	Open Manhole	1200	2.001	11.600	150	2.000	11.600	150	
S6	12.200	1.280	Open Manhole	1350	1.002	10.920	375	1.001	10.920	375	
								2.001	11.145	150	
S7	12.050	0.970	Open Manhole	1200	3.000	11.080	100				
S8	12.100	1.070	Open Manhole	1200	3.001	11.030	100	3.000	11.030	100	
S9 FC	12.200	1.310	Open Manhole	1350	1.003	10.890	150	1.002	10.890	375	
								3.001	10.890	100	
Node	12.200	1.460	Open Manhole	1200	1.004	10.740	150	1.003	10.740	150	
	12.200	1.535	Open Manhole	0		OUTFALL		1.004	10.665	150	

No coordinates have been specified, layout information cannot be produced.

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	150	S1	12.180	11.640	0.390	Open Manhole	1200
1.001	o	375	S3	12.100	10.970	0.755	Open Manhole	1350
2.000	o	150	S4	12.230	11.620	0.460	Open Manhole	1200
2.001	o	150	S5	12.200	11.600	0.450	Open Manhole	1200
1.002	o	375	S6	12.200	10.920	0.905	Open Manhole	1350
3.000	o	100	S7	12.050	11.080	0.870	Open Manhole	1200
3.001	o	100	S8	12.100	11.030	0.970	Open Manhole	1200
1.003	o	150	S9 FC	12.200	10.890	1.160	Open Manhole	1350
1.004	o	150	Node	12.200	10.740	1.310	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	16.208	36.4	S3	12.100	11.195	0.755	Open Manhole	1350
1.001	17.634	352.7	S6	12.200	10.920	0.905	Open Manhole	1350
2.000	2.754	137.7	S5	12.200	11.600	0.450	Open Manhole	1200
2.001	17.962	39.5	S6	12.200	11.145	0.905	Open Manhole	1350
1.002	9.205	306.8	S9 FC	12.200	10.890	0.935	Open Manhole	1350
3.000	3.016	60.3	S8	12.100	11.030	0.970	Open Manhole	1200
3.001	1.000	7.1	S9 FC	12.200	10.890	1.210	Open Manhole	1350
1.003	16.298	108.7	Node	12.200	10.740	1.310	Open Manhole	1200
1.004	8.057	107.4		12.200	10.665	1.385	Open Manhole	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)
1.004		12.200	10.665	0.000	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	1.000	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	0.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

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 2 Number of Real Time Controls 0

Synthetic Rainfall Details

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Synthetic Rainfall Details

Rainfall Model	FEH	Summer Storms	Yes
Return Period (years)	2	Winter Storms	No
FEH Rainfall Version	2013	Cv (Summer)	1.000
Site Location	GB 519180 271850 TL 19180 71850	Cv (Winter)	0.840
Data Type	Point	Storm Duration (mins)	30

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Online Controls for Storm

Hydro-Brake® Optimum Manhole: S9 FC, DS/PN: 1.003, Volume (m³): 2.7

Unit Reference	MD-SCU-0075-4900-0680-4900
Design Head (m)	0.680
Design Flow (l/s)	4.9
Flush-Flo™	Calculated
Objective	Linear discharge profile
Application	Surface
Sump Available	Yes
Diameter (mm)	75
Invert Level (m)	10.890
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.680	4.9	Kick-Flo®	0.113	2.2
Flush-Flo™	0.101	2.2	Mean Flow over Head Range	-	3.3

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.2	0.800	5.3	2.000	8.1	4.000	11.3	7.000	14.8
0.200	2.8	1.000	5.9	2.200	8.5	4.500	12.0	7.500	15.3
0.300	3.4	1.200	6.4	2.400	8.9	5.000	12.6	8.000	15.8
0.400	3.8	1.400	6.9	2.600	9.2	5.500	13.2	8.500	16.3
0.500	4.2	1.600	7.3	3.000	9.9	6.000	13.7	9.000	16.7
0.600	4.6	1.800	7.7	3.500	10.6	6.500	14.3	9.500	17.2

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Storage Structures for Storm

Complex Manhole: S3, DS/PN: 1.001

Filter Drain

Infiltration Coefficient Base (m/hr)	0.00000	Pipe Diameter (m)	0.300
Infiltration Coefficient Side (m/hr)	0.00000	Pipe Depth above Invert (m)	0.000
Safety Factor	2.0	Number of Pipes	2
Porosity	0.30	Slope (1:X)	0.0
Invert Level (m)	10.980	Cap Volume Depth (m)	0.375
Trench Width (m)	1.0	Cap Infiltration Depth (m)	0.000
Trench Length (m)	4.0		

Cellular Storage

Invert Level (m)	10.980	Safety Factor	2.0
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)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	96.0	0.0	0.375	96.0	0.0	0.376	0.0	0.0

Filter Drain

Infiltration Coefficient Base (m/hr)	0.00000	Pipe Diameter (m)	0.300
Infiltration Coefficient Side (m/hr)	0.00000	Pipe Depth above Invert (m)	0.000
Safety Factor	2.0	Number of Pipes	1
Porosity	0.30	Slope (1:X)	0.0
Invert Level (m)	10.980	Cap Volume Depth (m)	0.375
Trench Width (m)	1.0	Cap Infiltration Depth (m)	0.000
Trench Length (m)	24.0		

Filter Drain

Infiltration Coefficient Base (m/hr)	0.00000	Pipe Diameter (m)	0.150
Infiltration Coefficient Side (m/hr)	0.00000	Pipe Depth above Invert (m)	0.000
Safety Factor	2.0	Number of Pipes	1
Porosity	0.30	Slope (1:X)	28.6
Invert Level (m)	11.370	Cap Volume Depth (m)	0.200
Trench Width (m)	1.3	Cap Infiltration Depth (m)	0.000
Trench Length (m)	17.2		

Filter Drain Manhole: S6, DS/PN: 1.002

Infiltration Coefficient Base (m/hr)	0.00000	Pipe Diameter (m)	0.150
Infiltration Coefficient Side (m/hr)	0.00000	Pipe Depth above Invert (m)	0.000
Safety Factor	2.0	Number of Pipes	1
Porosity	0.30	Slope (1:X)	0.0
Invert Level (m)	11.450	Cap Volume Depth (m)	0.200
Trench Width (m)	1.1	Cap Infiltration Depth (m)	0.000
Trench Length (m)	7.2		

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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	0.000
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 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH	Data Type	Point
FEH Rainfall Version	2013	Cv (Summer)	1.000
Site Location	GB 519180 271850 TL 19180 71850	Cv (Winter)	1.000

Margin for Flood Risk Warning (mm)	150.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
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, 5760, 7200, 8640, 10080
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
1.000	S1	15 Summer	2	+0%					11.670	-0.120	0.000
1.001	S3	120 Summer	2	+0%					11.029	-0.316	0.000
2.000	S4	15 Summer	2	+0%					11.658	-0.112	0.000
2.001	S5	15 Summer	2	+0%					11.636	-0.114	0.000
1.002	S6	15 Summer	2	+0%	100/15 Summer				11.085	-0.210	0.000
3.000	S7	15 Summer	2	+0%	30/15 Summer				11.108	-0.072	0.000
3.001	S8	15 Summer	2	+0%	30/15 Summer				11.088	-0.042	0.000
1.003	S9 FC	15 Summer	2	+0%	2/15 Summer				11.085	0.045	0.000
1.004	Node	15 Summer	2	+0%	100/15 Summer				10.805	-0.085	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S1	0.09		2.4	OK	
1.001	S3	0.02		1.5	OK	
2.000	S4	0.14		1.5	OK	
2.001	S5	0.13		3.4	OK	
1.002	S6	0.03		2.6	OK	
3.000	S7	0.17		1.1	OK	
3.001	S8	0.21		2.2	OK	
1.003	S9 FC	0.17		2.8	SURCHARGED	
1.004	Node	0.38		5.7	OK	

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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	0.000
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 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH	Data Type	Point
FEH Rainfall Version	2013	Cv (Summer)	1.000
Site Location	GB 519180 271850 TL 19180 71850	Cv (Winter)	1.000

Margin for Flood Risk Warning (mm)	150.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
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, 5760, 7200, 8640, 10080
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
1.000	S1	15 Summer	30	+0%					11.688	-0.102	0.000
1.001	S3	120 Summer	30	+0%					11.153	-0.192	0.000
2.000	S4	15 Summer	30	+0%					11.683	-0.087	0.000
2.001	S5	15 Summer	30	+0%					11.665	-0.085	0.000
1.002	S6	15 Summer	30	+0%	100/15 Summer				11.248	-0.047	0.000
3.000	S7	15 Summer	30	+0%	30/15 Summer				11.300	0.120	0.000
3.001	S8	15 Summer	30	+0%	30/15 Summer				11.291	0.161	0.000
1.003	S9 FC	15 Summer	30	+0%	2/15 Summer				11.249	0.209	0.000
1.004	Node	15 Summer	30	+0%	100/15 Summer				10.856	-0.034	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S1	0.23		6.2	OK	
1.001	S3	0.04		3.4	OK	
2.000	S4	0.36		3.9	OK	
2.001	S5	0.39		10.2	OK	
1.002	S6	0.04		3.5	OK	
3.000	S7	0.42		2.6	SURCHARGED	
3.001	S8	0.53		5.5	SURCHARGED	
1.003	S9 FC	0.23		3.6	SURCHARGED	
1.004	Node	0.95		14.1	OK	

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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	0.000
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 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH	Data Type	Point
FEH Rainfall Version	2013	Cv (Summer)	1.000
Site Location	GB 519180 271850 TL 19180 71850	Cv (Winter)	1.000

Margin for Flood Risk Warning (mm)	150.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
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, 5760, 7200, 8640, 10080
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
1.000	S1	15 Summer	100	+0%					11.696	-0.094	0.000
1.001	S3	120 Summer	100	+0%					11.237	-0.108	0.000
2.000	S4	15 Summer	100	+0%					11.694	-0.076	0.000
2.001	S5	15 Summer	100	+0%					11.677	-0.073	0.000
1.002	S6	15 Summer	100	+0%	100/15 Summer				11.351	0.056	0.000
3.000	S7	15 Summer	100	+0%	30/15 Summer				11.446	0.266	0.000
3.001	S8	15 Summer	100	+0%	30/15 Summer				11.420	0.290	0.000
1.003	S9 FC	15 Winter	100	+0%	2/15 Summer				11.355	0.315	0.000
1.004	Node	15 Summer	100	+0%	100/15 Summer				10.919	0.029	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S1	0.30		8.3	OK	
1.001	S3	0.04		3.8	OK	
2.000	S4	0.49		5.2	OK	
2.001	S5	0.51		13.7	OK	
1.002	S6	0.04		3.5	SURCHARGED	
3.000	S7	0.65		4.0	SURCHARGED	
3.001	S8	0.76		7.9	SURCHARGED	
1.003	S9 FC	0.25		4.0	SURCHARGED	
1.004	Node	1.17		17.5	SURCHARGED	

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

Return Period (years)	2
FEH Rainfall Version	2013
Site Location	GB 519180 271850 TL 19180 71850
Data Type	Point
Maximum Rainfall (mm/hr)	50
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	1.000
PIMP (%)	100
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.200
Maximum Backdrop Height (m)	1.500
Min Design Depth for Optimisation (m)	1.200
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.075	4-8	0.019

Total Area Contributing (ha) = 0.094

Total Pipe Volume (m³) = 4.079

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
1.000	16.208	0.445	36.4	0.011	5.00	0.0	0.600	o	150	Pipe/Conduit	
1.001	17.634	0.050	352.7	0.020	0.00	0.0	0.600	o	375	Pipe/Conduit	
2.000	2.754	0.020	137.7	0.007	5.00	0.0	0.600	o	150	Pipe/Conduit	
2.001	17.962	0.455	39.5	0.010	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.002	9.205	0.030	306.8	0.017	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)
1.000	50.00	5.16	11.640	0.011	0.0	0.0	0.0	1.67	29.6	2.0
1.001	50.00	5.47	10.970	0.031	0.0	0.0	0.0	0.96	105.9	5.6
2.000	50.00	5.05	11.620	0.007	0.0	0.0	0.0	0.85	15.1	1.3
2.001	50.00	5.24	11.600	0.017	0.0	0.0	0.0	1.61	28.4	3.1
1.002	50.00	5.62	10.920	0.065	0.0	0.0	0.0	1.03	113.7	11.7

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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
3.000	3.016	0.050	60.3	0.005	5.00	0.0	0.600	o	100	Pipe/Conduit	
3.001	1.000	0.140	7.1	0.007	0.00	0.0	0.600	o	100	Pipe/Conduit	
1.003	16.298	0.150	108.7	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.004	8.057	0.075	107.4	0.017	0.00	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)
3.000	50.00	5.05	11.080	0.005	0.0	0.0	0.0	0.99	7.8	0.9
3.001	50.00	5.06	11.030	0.012	0.0	0.0	0.0	2.91	22.9	2.2
1.003	50.00	5.90	10.890	0.077	0.0	0.0	0.0	0.96	17.0	13.9
1.004	50.00	6.04	10.740	0.094	0.0	0.0	0.0	0.97	17.1	17.0

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Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
S1	12.180	0.540	Open Manhole	1200	1.000	11.640	150				
S3	12.100	1.130	Open Manhole	1350	1.001	10.970	375	1.000	11.195	150	
S4	12.230	0.610	Open Manhole	1200	2.000	11.620	150				
S5	12.200	0.600	Open Manhole	1200	2.001	11.600	150	2.000	11.600	150	
S6	12.200	1.280	Open Manhole	1350	1.002	10.920	375	1.001	10.920	375	
								2.001	11.145	150	
S7	12.050	0.970	Open Manhole	1200	3.000	11.080	100				
S8	12.100	1.070	Open Manhole	1200	3.001	11.030	100	3.000	11.030	100	
S9 FC	12.200	1.310	Open Manhole	1350	1.003	10.890	150	1.002	10.890	375	
								3.001	10.890	100	
Node	12.200	1.460	Open Manhole	1200	1.004	10.740	150	1.003	10.740	150	
	12.200	1.535	Open Manhole	0		OUTFALL		1.004	10.665	150	

No coordinates have been specified, layout information cannot be produced.

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	150	S1	12.180	11.640	0.390	Open Manhole	1200
1.001	o	375	S3	12.100	10.970	0.755	Open Manhole	1350
2.000	o	150	S4	12.230	11.620	0.460	Open Manhole	1200
2.001	o	150	S5	12.200	11.600	0.450	Open Manhole	1200
1.002	o	375	S6	12.200	10.920	0.905	Open Manhole	1350
3.000	o	100	S7	12.050	11.080	0.870	Open Manhole	1200
3.001	o	100	S8	12.100	11.030	0.970	Open Manhole	1200
1.003	o	150	S9 FC	12.200	10.890	1.160	Open Manhole	1350
1.004	o	150	Node	12.200	10.740	1.310	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	16.208	36.4	S3	12.100	11.195	0.755	Open Manhole	1350
1.001	17.634	352.7	S6	12.200	10.920	0.905	Open Manhole	1350
2.000	2.754	137.7	S5	12.200	11.600	0.450	Open Manhole	1200
2.001	17.962	39.5	S6	12.200	11.145	0.905	Open Manhole	1350
1.002	9.205	306.8	S9 FC	12.200	10.890	0.935	Open Manhole	1350
3.000	3.016	60.3	S8	12.100	11.030	0.970	Open Manhole	1200
3.001	1.000	7.1	S9 FC	12.200	10.890	1.210	Open Manhole	1350
1.003	16.298	108.7	Node	12.200	10.740	1.310	Open Manhole	1200
1.004	8.057	107.4		12.200	10.665	1.385	Open Manhole	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)
1.004		12.200	10.665	0.000	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	1.000	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	0.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

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 2 Number of Real Time Controls 0

Synthetic Rainfall Details

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Synthetic Rainfall Details

Rainfall Model	FEH	Summer Storms	Yes
Return Period (years)	2	Winter Storms	No
FEH Rainfall Version	2013	Cv (Summer)	1.000
Site Location	GB 519180 271850 TL 19180 71850	Cv (Winter)	0.840
Data Type	Point	Storm Duration (mins)	30

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Online Controls for Storm

Hydro-Brake® Optimum Manhole: S9 FC, DS/PN: 1.003, Volume (m³): 2.7

Unit Reference	MD-SCU-0075-4900-0680-4900
Design Head (m)	0.680
Design Flow (l/s)	4.9
Flush-Flo™	Calculated
Objective	Linear discharge profile
Application	Surface
Sump Available	Yes
Diameter (mm)	75
Invert Level (m)	10.890
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.680	4.9	Kick-Flo®	0.113	2.2
Flush-Flo™	0.101	2.2	Mean Flow over Head Range	-	3.3

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.2	0.800	5.3	2.000	8.1	4.000	11.3	7.000	14.8
0.200	2.8	1.000	5.9	2.200	8.5	4.500	12.0	7.500	15.3
0.300	3.4	1.200	6.4	2.400	8.9	5.000	12.6	8.000	15.8
0.400	3.8	1.400	6.9	2.600	9.2	5.500	13.2	8.500	16.3
0.500	4.2	1.600	7.3	3.000	9.9	6.000	13.7	9.000	16.7
0.600	4.6	1.800	7.7	3.500	10.6	6.500	14.3	9.500	17.2

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Storage Structures for Storm

Complex Manhole: S3, DS/PN: 1.001

Filter Drain

Infiltration Coefficient Base (m/hr)	0.00000	Pipe Diameter (m)	0.300
Infiltration Coefficient Side (m/hr)	0.00000	Pipe Depth above Invert (m)	0.000
Safety Factor	2.0	Number of Pipes	2
Porosity	0.30	Slope (1:X)	0.0
Invert Level (m)	10.980	Cap Volume Depth (m)	0.375
Trench Width (m)	1.0	Cap Infiltration Depth (m)	0.000
Trench Length (m)	4.0		

Cellular Storage

Invert Level (m)	10.980	Safety Factor	2.0
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)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	96.0	0.0	0.375	96.0	0.0	0.376	0.0	0.0

Filter Drain

Infiltration Coefficient Base (m/hr)	0.00000	Pipe Diameter (m)	0.300
Infiltration Coefficient Side (m/hr)	0.00000	Pipe Depth above Invert (m)	0.000
Safety Factor	2.0	Number of Pipes	1
Porosity	0.30	Slope (1:X)	0.0
Invert Level (m)	10.980	Cap Volume Depth (m)	0.375
Trench Width (m)	1.0	Cap Infiltration Depth (m)	0.000
Trench Length (m)	24.0		

Filter Drain

Infiltration Coefficient Base (m/hr)	0.00000	Pipe Diameter (m)	0.150
Infiltration Coefficient Side (m/hr)	0.00000	Pipe Depth above Invert (m)	0.000
Safety Factor	2.0	Number of Pipes	1
Porosity	0.30	Slope (1:X)	28.6
Invert Level (m)	11.370	Cap Volume Depth (m)	0.200
Trench Width (m)	1.3	Cap Infiltration Depth (m)	0.000
Trench Length (m)	17.2		

Filter Drain Manhole: S6, DS/PN: 1.002

Infiltration Coefficient Base (m/hr)	0.00000	Pipe Diameter (m)	0.150
Infiltration Coefficient Side (m/hr)	0.00000	Pipe Depth above Invert (m)	0.000
Safety Factor	2.0	Number of Pipes	1
Porosity	0.30	Slope (1:X)	0.0
Invert Level (m)	11.450	Cap Volume Depth (m)	0.200
Trench Width (m)	1.1	Cap Infiltration Depth (m)	0.000
Trench Length (m)	7.2		

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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	0.000
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 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model		FEH	Data Type Point
FEH Rainfall Version		2013	Cv (Summer) 1.000
Site Location	GB 519180 271850 TL 19180 71850		Cv (Winter) 1.000

Margin for Flood Risk Warning (mm)	150.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
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, 5760, 7200, 8640, 10080
Return Period(s) (years)	30
Climate Change (%)	35

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
1.000	S1	15 Summer	30	+35%					11.697	-0.093	0.000
1.001	S3	120 Winter	30	+35%					11.236	-0.109	0.000
2.000	S4	15 Summer	30	+35%					11.695	-0.075	0.000
2.001	S5	15 Summer	30	+35%					11.677	-0.073	0.000
1.002	S6	15 Summer	30	+35%	30/15 Summer				11.362	0.067	0.000
3.000	S7	15 Summer	30	+35%	30/15 Summer				11.448	0.268	0.000
3.001	S8	15 Summer	30	+35%	30/15 Summer				11.423	0.293	0.000
1.003	S9 FC	15 Summer	30	+35%	30/15 Summer				11.365	0.325	0.000
1.004	Node	15 Summer	30	+35%	30/15 Summer				10.922	0.032	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S1	0.31		8.4	OK	
1.001	S3	0.04		3.8	OK	
2.000	S4	0.49		5.3	OK	
2.001	S5	0.52		13.8	OK	
1.002	S6	0.04		3.5	SURCHARGED	
3.000	S7	0.66		4.1	SURCHARGED	
3.001	S8	0.78		8.1	SURCHARGED	
1.003	S9 FC	0.25		4.0	SURCHARGED	
1.004	Node	1.19		17.7	SURCHARGED	

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

Return Period (years)	2
FEH Rainfall Version	2013
Site Location	GB 519180 271850 TL 19180 71850
Data Type	Point
Maximum Rainfall (mm/hr)	50
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	1.000
PIMP (%)	100
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.200
Maximum Backdrop Height (m)	1.500
Min Design Depth for Optimisation (m)	1.200
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.075	4-8	0.019

Total Area Contributing (ha) = 0.094

Total Pipe Volume (m³) = 4.079

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
1.000	16.208	0.445	36.4	0.011	5.00	0.0	0.600	o	150	Pipe/Conduit	
1.001	17.634	0.050	352.7	0.020	0.00	0.0	0.600	o	375	Pipe/Conduit	
2.000	2.754	0.020	137.7	0.007	5.00	0.0	0.600	o	150	Pipe/Conduit	
2.001	17.962	0.455	39.5	0.010	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.002	9.205	0.030	306.8	0.017	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)
1.000	50.00	5.16	11.640	0.011	0.0	0.0	0.0	1.67	29.6	2.0
1.001	50.00	5.47	10.970	0.031	0.0	0.0	0.0	0.96	105.9	5.6
2.000	50.00	5.05	11.620	0.007	0.0	0.0	0.0	0.85	15.1	1.3
2.001	50.00	5.24	11.600	0.017	0.0	0.0	0.0	1.61	28.4	3.1
1.002	50.00	5.62	10.920	0.065	0.0	0.0	0.0	1.03	113.7	11.7

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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
3.000	3.016	0.050	60.3	0.005	5.00	0.0	0.600	o	100	Pipe/Conduit	
3.001	1.000	0.140	7.1	0.007	0.00	0.0	0.600	o	100	Pipe/Conduit	
1.003	16.298	0.150	108.7	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.004	8.057	0.075	107.4	0.017	0.00	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)
3.000	50.00	5.05	11.080	0.005	0.0	0.0	0.0	0.99	7.8	0.9
3.001	50.00	5.06	11.030	0.012	0.0	0.0	0.0	2.91	22.9	2.2
1.003	50.00	5.90	10.890	0.077	0.0	0.0	0.0	0.96	17.0	13.9
1.004	50.00	6.04	10.740	0.094	0.0	0.0	0.0	0.97	17.1	17.0

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Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
S1	12.180	0.540	Open Manhole	1200	1.000	11.640	150				
S3	12.100	1.130	Open Manhole	1350	1.001	10.970	375	1.000	11.195	150	
S4	12.230	0.610	Open Manhole	1200	2.000	11.620	150				
S5	12.200	0.600	Open Manhole	1200	2.001	11.600	150	2.000	11.600	150	
S6	12.200	1.280	Open Manhole	1350	1.002	10.920	375	1.001	10.920	375	
								2.001	11.145	150	
S7	12.050	0.970	Open Manhole	1200	3.000	11.080	100				
S8	12.100	1.070	Open Manhole	1200	3.001	11.030	100	3.000	11.030	100	
S9 FC	12.200	1.310	Open Manhole	1350	1.003	10.890	150	1.002	10.890	375	
								3.001	10.890	100	
Node	12.200	1.460	Open Manhole	1200	1.004	10.740	150	1.003	10.740	150	
	12.200	1.535	Open Manhole	0		OUTFALL		1.004	10.665	150	

No coordinates have been specified, layout information cannot be produced.

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	150	S1	12.180	11.640	0.390	Open Manhole	1200
1.001	o	375	S3	12.100	10.970	0.755	Open Manhole	1350
2.000	o	150	S4	12.230	11.620	0.460	Open Manhole	1200
2.001	o	150	S5	12.200	11.600	0.450	Open Manhole	1200
1.002	o	375	S6	12.200	10.920	0.905	Open Manhole	1350
3.000	o	100	S7	12.050	11.080	0.870	Open Manhole	1200
3.001	o	100	S8	12.100	11.030	0.970	Open Manhole	1200
1.003	o	150	S9 FC	12.200	10.890	1.160	Open Manhole	1350
1.004	o	150	Node	12.200	10.740	1.310	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	16.208	36.4	S3	12.100	11.195	0.755	Open Manhole	1350
1.001	17.634	352.7	S6	12.200	10.920	0.905	Open Manhole	1350
2.000	2.754	137.7	S5	12.200	11.600	0.450	Open Manhole	1200
2.001	17.962	39.5	S6	12.200	11.145	0.905	Open Manhole	1350
1.002	9.205	306.8	S9 FC	12.200	10.890	0.935	Open Manhole	1350
3.000	3.016	60.3	S8	12.100	11.030	0.970	Open Manhole	1200
3.001	1.000	7.1	S9 FC	12.200	10.890	1.210	Open Manhole	1350
1.003	16.298	108.7	Node	12.200	10.740	1.310	Open Manhole	1200
1.004	8.057	107.4		12.200	10.665	1.385	Open Manhole	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)
1.004		12.200	10.665	0.000	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	1.000	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	0.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

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 2 Number of Real Time Controls 0

Synthetic Rainfall Details

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Synthetic Rainfall Details

Rainfall Model	FEH	Summer Storms	Yes
Return Period (years)	2	Winter Storms	No
FEH Rainfall Version	2013	Cv (Summer)	1.000
Site Location	GB 519180 271850 TL 19180 71850	Cv (Winter)	0.840
Data Type	Point	Storm Duration (mins)	30

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Online Controls for Storm

Hydro-Brake® Optimum Manhole: S9 FC, DS/PN: 1.003, Volume (m³): 2.7

Unit Reference	MD-SCU-0075-4900-0680-4900
Design Head (m)	0.680
Design Flow (l/s)	4.9
Flush-Flo™	Calculated
Objective	Linear discharge profile
Application	Surface
Sump Available	Yes
Diameter (mm)	75
Invert Level (m)	10.890
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.680	4.9	Kick-Flo®	0.113	2.2
Flush-Flo™	0.101	2.2	Mean Flow over Head Range	-	3.3

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.2	0.800	5.3	2.000	8.1	4.000	11.3	7.000	14.8
0.200	2.8	1.000	5.9	2.200	8.5	4.500	12.0	7.500	15.3
0.300	3.4	1.200	6.4	2.400	8.9	5.000	12.6	8.000	15.8
0.400	3.8	1.400	6.9	2.600	9.2	5.500	13.2	8.500	16.3
0.500	4.2	1.600	7.3	3.000	9.9	6.000	13.7	9.000	16.7
0.600	4.6	1.800	7.7	3.500	10.6	6.500	14.3	9.500	17.2

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Storage Structures for Storm

Complex Manhole: S3, DS/PN: 1.001

Filter Drain

Infiltration Coefficient Base (m/hr)	0.00000	Pipe Diameter (m)	0.300
Infiltration Coefficient Side (m/hr)	0.00000	Pipe Depth above Invert (m)	0.000
Safety Factor	2.0	Number of Pipes	2
Porosity	0.30	Slope (1:X)	0.0
Invert Level (m)	10.980	Cap Volume Depth (m)	0.375
Trench Width (m)	1.0	Cap Infiltration Depth (m)	0.000
Trench Length (m)	4.0		

Cellular Storage

Invert Level (m)	10.980	Safety Factor	2.0
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)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	96.0	0.0	0.375	96.0	0.0	0.376	0.0	0.0

Filter Drain

Infiltration Coefficient Base (m/hr)	0.00000	Pipe Diameter (m)	0.300
Infiltration Coefficient Side (m/hr)	0.00000	Pipe Depth above Invert (m)	0.000
Safety Factor	2.0	Number of Pipes	1
Porosity	0.30	Slope (1:X)	0.0
Invert Level (m)	10.980	Cap Volume Depth (m)	0.375
Trench Width (m)	1.0	Cap Infiltration Depth (m)	0.000
Trench Length (m)	24.0		

Filter Drain

Infiltration Coefficient Base (m/hr)	0.00000	Pipe Diameter (m)	0.150
Infiltration Coefficient Side (m/hr)	0.00000	Pipe Depth above Invert (m)	0.000
Safety Factor	2.0	Number of Pipes	1
Porosity	0.30	Slope (1:X)	28.6
Invert Level (m)	11.370	Cap Volume Depth (m)	0.200
Trench Width (m)	1.3	Cap Infiltration Depth (m)	0.000
Trench Length (m)	17.2		

Filter Drain Manhole: S6, DS/PN: 1.002

Infiltration Coefficient Base (m/hr)	0.00000	Pipe Diameter (m)	0.150
Infiltration Coefficient Side (m/hr)	0.00000	Pipe Depth above Invert (m)	0.000
Safety Factor	2.0	Number of Pipes	1
Porosity	0.30	Slope (1:X)	0.0
Invert Level (m)	11.450	Cap Volume Depth (m)	0.200
Trench Width (m)	1.1	Cap Infiltration Depth (m)	0.000
Trench Length (m)	7.2		

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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	0.000
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 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model		FEH	Data Type Point
FEH Rainfall Version		2013	Cv (Summer) 1.000
Site Location	GB 519180 271850 TL 19180 71850		Cv (Winter) 1.000

Margin for Flood Risk Warning (mm)	150.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
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, 5760, 7200, 8640, 10080
Return Period(s) (years)	30
Climate Change (%)	35

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
1.000	S1	15 Summer	30	+35%					11.697	-0.093	0.000
1.001	S3	120 Winter	30	+35%					11.236	-0.109	0.000
2.000	S4	15 Summer	30	+35%					11.695	-0.075	0.000
2.001	S5	15 Summer	30	+35%					11.677	-0.073	0.000
1.002	S6	15 Summer	30	+35%	30/15 Summer				11.362	0.067	0.000
3.000	S7	15 Summer	30	+35%	30/15 Summer				11.448	0.268	0.000
3.001	S8	15 Summer	30	+35%	30/15 Summer				11.423	0.293	0.000
1.003	S9 FC	15 Summer	30	+35%	30/15 Summer				11.365	0.325	0.000
1.004	Node	15 Summer	30	+35%	30/15 Summer				10.922	0.032	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S1	0.31		8.4	OK	
1.001	S3	0.04		3.8	OK	
2.000	S4	0.49		5.3	OK	
2.001	S5	0.52		13.8	OK	
1.002	S6	0.04		3.5	SURCHARGED	
3.000	S7	0.66		4.1	SURCHARGED	
3.001	S8	0.78		8.1	SURCHARGED	
1.003	S9 FC	0.25		4.0	SURCHARGED	
1.004	Node	1.19		17.7	SURCHARGED	

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Summary Wizard of 360 minute 100 year Summer I+40% 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	0.000
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 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH	Data Type	Point
FEH Rainfall Version	2013	Cv (Summer)	1.000
Site Location	GB 519180 271850 TL 19180 71850	Cv (Winter)	1.000

Margin for Flood Risk Warning (mm)	150.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
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, 5760, 7200, 8640, 10080
Return Period(s) (years)	100
Climate Change (%)	40

PN	US/MH Name	Event	US/CL (m)	Surcharged Depth (m)	Flooded Volume (m³)	Maximum Vol (m³)	Discharge Vol (m³)	Pipe Flow (l/s)	Status
1.000	S1	360 minute 100 year Summer I+40%	12.180	-0.120	0.000	0.028	13.117	2.4	OK
1.001	S3	360 minute 100 year Summer I+40%	12.100	-0.002	0.000	38.351	36.991	4.1	OK
2.000	S4	360 minute 100 year Summer I+40%	12.230	-0.113	0.000	0.036	8.347	1.5	OK
2.001	S5	360 minute 100 year Summer I+40%	12.200	-0.113	0.000	0.041	20.266	3.7	OK
1.002	S6	360 minute 100 year Summer I+40%	12.200	0.051	0.000	2.449	77.475	3.9	SURCHARGED
3.000	S7	360 minute 100 year Summer I+40%	12.050	0.162	0.000	0.291	5.970	1.0	SURCHARGED
3.001	S8	360 minute 100 year Summer I+40%	12.100	0.213	0.000	0.363	14.316	2.3	SURCHARGED
1.003	S9 FC	360 minute 100 year Summer I+40%	12.200	0.302	0.000	1.499	91.730	4.0	SURCHARGED
1.004	Node	360 minute 100 year Summer I+40%	12.200	-0.077	0.000	0.114	112.009	7.1	OK

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Summary Wizard of 360 minute 100 year Winter I+40% 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	0.000
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 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH	Data Type	Point
FEH Rainfall Version	2013	Cv (Summer)	1.000
Site Location	GB 519180 271850 TL 19180 71850	Cv (Winter)	1.000

Margin for Flood Risk Warning (mm)	150.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
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, 5760, 7200, 8640, 10080
Return Period(s) (years)	100
Climate Change (%)	40

PN	US/MH Name	Event	US/CL (m)	Surcharged Depth (m)	Flooded Volume (m³)	Maximum Vol (m³)	Discharge Vol (m³)	Pipe Flow (l/s)	Status
1.000	S1	360 minute 100 year Winter I+40%	12.180	-0.127	0.000	0.020	13.117	1.5	OK
1.001	S3	360 minute 100 year Winter I+40%	12.100	-0.019	0.000	36.585	36.831	3.9	OK
2.000	S4	360 minute 100 year Winter I+40%	12.230	-0.120	0.000	0.029	8.347	1.0	OK
2.001	S5	360 minute 100 year Winter I+40%	12.200	-0.120	0.000	0.033	20.267	2.4	OK
1.002	S6	360 minute 100 year Winter I+40%	12.200	0.030	0.000	2.398	77.296	4.1	SURCHARGED
3.000	S7	360 minute 100 year Winter I+40%	12.050	0.147	0.000	0.274	5.957	0.6	SURCHARGED
3.001	S8	360 minute 100 year Winter I+40%	12.100	0.195	0.000	0.342	14.291	1.5	SURCHARGED
1.003	S9 FC	360 minute 100 year Winter I+40%	12.200	0.293	0.000	1.483	91.626	4.0	SURCHARGED
1.004	Node	360 minute 100 year Winter I+40%	12.200	-0.085	0.000	0.100	111.902	5.8	OK

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

Return Period (years)	2
FEH Rainfall Version	2013
Site Location	GB 519180 271850 TL 19180 71850
Data Type	Point
Maximum Rainfall (mm/hr)	50
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	1.000
PIMP (%)	100
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.200
Maximum Backdrop Height (m)	1.500
Min Design Depth for Optimisation (m)	1.200
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.075	4-8	0.019

Total Area Contributing (ha) = 0.094

Total Pipe Volume (m³) = 4.079

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
1.000	16.208	0.445	36.4	0.011	5.00	0.0	0.600	o	150	Pipe/Conduit	
1.001	17.634	0.050	352.7	0.020	0.00	0.0	0.600	o	375	Pipe/Conduit	
2.000	2.754	0.020	137.7	0.007	5.00	0.0	0.600	o	150	Pipe/Conduit	
2.001	17.962	0.455	39.5	0.010	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.002	9.205	0.030	306.8	0.017	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)
1.000	50.00	5.16	11.640	0.011	0.0	0.0	0.0	1.67	29.6	2.0
1.001	50.00	5.47	10.970	0.031	0.0	0.0	0.0	0.96	105.9	5.6
2.000	50.00	5.05	11.620	0.007	0.0	0.0	0.0	0.85	15.1	1.3
2.001	50.00	5.24	11.600	0.017	0.0	0.0	0.0	1.61	28.4	3.1
1.002	50.00	5.62	10.920	0.065	0.0	0.0	0.0	1.03	113.7	11.7

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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
3.000	3.016	0.050	60.3	0.005	5.00	0.0	0.600	o	100	Pipe/Conduit	
3.001	1.000	0.140	7.1	0.007	0.00	0.0	0.600	o	100	Pipe/Conduit	
1.003	16.298	0.150	108.7	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.004	8.057	0.075	107.4	0.017	0.00	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)
3.000	50.00	5.05	11.080	0.005	0.0	0.0	0.0	0.99	7.8	0.9
3.001	50.00	5.06	11.030	0.012	0.0	0.0	0.0	2.91	22.9	2.2
1.003	50.00	5.90	10.890	0.077	0.0	0.0	0.0	0.96	17.0	13.9
1.004	50.00	6.04	10.740	0.094	0.0	0.0	0.0	0.97	17.1	17.0

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Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
S1	12.180	0.540	Open Manhole	1200	1.000	11.640	150				
S3	12.100	1.130	Open Manhole	1350	1.001	10.970	375	1.000	11.195	150	
S4	12.230	0.610	Open Manhole	1200	2.000	11.620	150				
S5	12.200	0.600	Open Manhole	1200	2.001	11.600	150	2.000	11.600	150	
S6	12.200	1.280	Open Manhole	1350	1.002	10.920	375	1.001	10.920	375	
								2.001	11.145	150	
S7	12.050	0.970	Open Manhole	1200	3.000	11.080	100				
S8	12.100	1.070	Open Manhole	1200	3.001	11.030	100	3.000	11.030	100	
S9 FC	12.200	1.310	Open Manhole	1350	1.003	10.890	150	1.002	10.890	375	
								3.001	10.890	100	
Node	12.200	1.460	Open Manhole	1200	1.004	10.740	150	1.003	10.740	150	
	12.200	1.535	Open Manhole	0		OUTFALL		1.004	10.665	150	

No coordinates have been specified, layout information cannot be produced.

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	150	S1	12.180	11.640	0.390	Open Manhole	1200
1.001	o	375	S3	12.100	10.970	0.755	Open Manhole	1350
2.000	o	150	S4	12.230	11.620	0.460	Open Manhole	1200
2.001	o	150	S5	12.200	11.600	0.450	Open Manhole	1200
1.002	o	375	S6	12.200	10.920	0.905	Open Manhole	1350
3.000	o	100	S7	12.050	11.080	0.870	Open Manhole	1200
3.001	o	100	S8	12.100	11.030	0.970	Open Manhole	1200
1.003	o	150	S9 FC	12.200	10.890	1.160	Open Manhole	1350
1.004	o	150	Node	12.200	10.740	1.310	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	16.208	36.4	S3	12.100	11.195	0.755	Open Manhole	1350
1.001	17.634	352.7	S6	12.200	10.920	0.905	Open Manhole	1350
2.000	2.754	137.7	S5	12.200	11.600	0.450	Open Manhole	1200
2.001	17.962	39.5	S6	12.200	11.145	0.905	Open Manhole	1350
1.002	9.205	306.8	S9 FC	12.200	10.890	0.935	Open Manhole	1350
3.000	3.016	60.3	S8	12.100	11.030	0.970	Open Manhole	1200
3.001	1.000	7.1	S9 FC	12.200	10.890	1.210	Open Manhole	1350
1.003	16.298	108.7	Node	12.200	10.740	1.310	Open Manhole	1200
1.004	8.057	107.4		12.200	10.665	1.385	Open Manhole	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)
1.004		12.200	10.665	0.000	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	1.000	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	0.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

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 2 Number of Real Time Controls 0

Synthetic Rainfall Details

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Synthetic Rainfall Details

Rainfall Model	FEH	Summer Storms	Yes
Return Period (years)	2	Winter Storms	No
FEH Rainfall Version	2013	Cv (Summer)	1.000
Site Location	GB 519180 271850 TL 19180 71850	Cv (Winter)	0.840
Data Type	Point	Storm Duration (mins)	30

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Online Controls for Storm

Hydro-Brake® Optimum Manhole: S9 FC, DS/PN: 1.003, Volume (m³): 2.7

Unit Reference	MD-SCU-0075-4900-0680-4900
Design Head (m)	0.680
Design Flow (l/s)	4.9
Flush-Flo™	Calculated
Objective	Linear discharge profile
Application	Surface
Sump Available	Yes
Diameter (mm)	75
Invert Level (m)	10.890
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.680	4.9	Kick-Flo®	0.113	2.2
Flush-Flo™	0.101	2.2	Mean Flow over Head Range	-	3.3

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.2	0.800	5.3	2.000	8.1	4.000	11.3	7.000	14.8
0.200	2.8	1.000	5.9	2.200	8.5	4.500	12.0	7.500	15.3
0.300	3.4	1.200	6.4	2.400	8.9	5.000	12.6	8.000	15.8
0.400	3.8	1.400	6.9	2.600	9.2	5.500	13.2	8.500	16.3
0.500	4.2	1.600	7.3	3.000	9.9	6.000	13.7	9.000	16.7
0.600	4.6	1.800	7.7	3.500	10.6	6.500	14.3	9.500	17.2

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Storage Structures for Storm

Complex Manhole: S3, DS/PN: 1.001

Filter Drain

Infiltration Coefficient Base (m/hr)	0.00000	Pipe Diameter (m)	0.300
Infiltration Coefficient Side (m/hr)	0.00000	Pipe Depth above Invert (m)	0.000
Safety Factor	2.0	Number of Pipes	2
Porosity	0.30	Slope (1:X)	0.0
Invert Level (m)	10.980	Cap Volume Depth (m)	0.375
Trench Width (m)	1.0	Cap Infiltration Depth (m)	0.000
Trench Length (m)	4.0		

Cellular Storage

Invert Level (m)	10.980	Safety Factor	2.0
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)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	96.0	0.0	0.375	96.0	0.0	0.376	0.0	0.0

Filter Drain

Infiltration Coefficient Base (m/hr)	0.00000	Pipe Diameter (m)	0.300
Infiltration Coefficient Side (m/hr)	0.00000	Pipe Depth above Invert (m)	0.000
Safety Factor	2.0	Number of Pipes	1
Porosity	0.30	Slope (1:X)	0.0
Invert Level (m)	10.980	Cap Volume Depth (m)	0.375
Trench Width (m)	1.0	Cap Infiltration Depth (m)	0.000
Trench Length (m)	24.0		

Filter Drain

Infiltration Coefficient Base (m/hr)	0.00000	Pipe Diameter (m)	0.150
Infiltration Coefficient Side (m/hr)	0.00000	Pipe Depth above Invert (m)	0.000
Safety Factor	2.0	Number of Pipes	1
Porosity	0.30	Slope (1:X)	28.6
Invert Level (m)	11.370	Cap Volume Depth (m)	0.200
Trench Width (m)	1.3	Cap Infiltration Depth (m)	0.000
Trench Length (m)	17.2		

Filter Drain Manhole: S6, DS/PN: 1.002

Infiltration Coefficient Base (m/hr)	0.00000	Pipe Diameter (m)	0.150
Infiltration Coefficient Side (m/hr)	0.00000	Pipe Depth above Invert (m)	0.000
Safety Factor	2.0	Number of Pipes	1
Porosity	0.30	Slope (1:X)	0.0
Invert Level (m)	11.450	Cap Volume Depth (m)	0.200
Trench Width (m)	1.1	Cap Infiltration Depth (m)	0.000
Trench Length (m)	7.2		

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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	0.000
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 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH	Data Type	Point
FEH Rainfall Version	2013	Cv (Summer)	1.000
Site Location	GB 519180 271850 TL 19180 71850	Cv (Winter)	1.000

Margin for Flood Risk Warning (mm)	150.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
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, 5760, 7200, 8640, 10080
Return Period(s) (years)	100
Climate Change (%)	40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
1.000	S1	15 Summer	100	+40%					11.708	-0.082	0.000
1.001	S3	120 Winter	100	+40%	100/60 Summer				11.586	0.241	0.000
2.000	S4	15 Summer	100	+40%					11.712	-0.058	0.000
2.001	S5	15 Summer	100	+40%					11.695	-0.055	0.000
1.002	S6	120 Winter	100	+40%	100/15 Summer				11.583	0.288	0.000
3.000	S7	120 Winter	100	+40%	100/15 Summer				11.585	0.405	0.000
3.001	S8	120 Winter	100	+40%	100/15 Summer				11.583	0.453	0.000
1.003	S9 FC	120 Winter	100	+40%	100/15 Summer				11.581	0.541	0.000
1.004	Node	15 Summer	100	+40%	100/15 Summer				11.003	0.113	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S1	0.42		11.6	OK	
1.001	S3	0.05		4.5	SURCHARGED	
2.000	S4	0.68		7.3	OK	
2.001	S5	0.72		19.1	OK	
1.002	S6	0.07		5.4	SURCHARGED	
3.000	S7	0.22		1.4	SURCHARGED	
3.001	S8	0.33		3.4	SURCHARGED	
1.003	S9 FC	0.31		4.9	SURCHARGED	
1.004	Node	1.60		23.8	SURCHARGED	

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DRAINAGE IMPLEMENTATION, MANAGEMENT & MAINTENANCE PLAN

HUNTINGDON PREMIER INN A1
BRAMPTON
HUNTINGDON
PE28 4NQ

PREPARED FOR:

Premier Inn

JOB NO:	P24-0131
DATE:	24th March 2025
ISSUE NO:	1

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DOCUMENT HISTORY

Issue	Description	Date
1	First issue.	24.03.25

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1. INTRODUCTION

1.1 This report has been prepared by Simpson TWS on behalf of Premier Inn Hotels Ltd to provide details of the operation and maintenance requirements for the drainage proposals for the development.

1.2 Premier Inn Hotels Ltd have an established management team who are responsible for the management / maintenance of their commercial properties throughout the UK. The management team would ensure that the hotel's drainage system is operated and maintained in accordance with this plan.

1.3 On occupation of the development, this maintenance and management plan should be incorporated into the development's "Operation and Maintenance Manual" with the as-built drainage system operated and maintained in accordance with the requirements set out in the following section of this report to prevent a reduction in the performance of the drainage system over the lifetime of the development.

1.4 Premier Inn Hotels Ltd.'s appointed management company should ensure that the maintenance contractor tasked with carrying out any maintenance works provides a risk assessment and method statement that adopts best practice health and safety policies for maintenance personnel throughout the duration of any maintenance works. Measures may include:

- Ensure the use of safe systems of work and procedures are followed.
- Certificated operatives only to be used for all confined space entry.
- Ensure appropriate PPE is worn at all times including the use of safety goggles, ear defenders and other relevant equipment when using high pressure jetting.
- Do not work in weather conditions where flooding or surging is likely.
- Erect barriers where appropriate and provide adequate lighting.
- No operations to be carried out by operatives working alone.
- Time maintenance to not conflict with other on-site activities.
- Method statement to be prepared and approved prior to entry into confined space.

2. DRAINAGE IMPLEMENTATION PLAN

2.1 This Implementation Plan sets out measures to be implemented during construction of the surface water drainage system for the scheme to ensure the site and areas downstream are protected from runoff during construction of the development. It is recommended that the plan is incorporated into the Contractor's Construction Health and Safety Plan with the development carried out in accordance with the measures proposed.

2.2 The surface water drainage network and associated outfalls will be constructed at an early stage of the development`s programme as part of the earthworks phase. During construction, this will assist in managing runoff and help settle out the high volumes of sediments created during construction.

2.3 It is not always possible to ensure that new impermeable areas are immediately connected to the drainage system. Therefore, the following additional measures will be implemented to ensure construction runoff is appropriately managed:

- Protective coverings would be used to help prevent runoff stripping material stockpiles.
- Plant and wheel washing would take place in a designated location. The area would be tanked and not allowed to discharge into the drainage system or infiltrate into the ground. Effluent should be treated as contaminated waste and disposed off site by a licensed waste management operator.
- Surfaces used as access roads and storage areas during construction should be swept regularly to prevent accumulation of dust and mud.
- Should groundwater be encountered in excavations, such water would not be discharged to the drainage system until the amount of suspended solids has been reduced through the controlled use of skips or tanks, which will act as stilling basins.
- To prevent contamination associated with the use of oils and hydrocarbons during construction, the Contractor would ensure that the following precautionary measures are employed during construction:
    - Regular maintenance of machinery and plant.
    - Use of drip trays.
    - Regular checking of machinery and plant for oil leaks.
    - Use of correct storage facilities.
    - Regular checks for signs of wear and tear on tanks.
    - Specific procedures are followed when refuelling.
    - Use of a designated area for refuelling.
    - Emergency spill kit to be located near refuelling area.
    - Regular emptying of bunds.
    - Tanks should be located in secure areas to stop vandalism.

2.4 The above measures would help to ensure that untreated construction runoff would not be discharged to the surface water drainage system.

2.5 During construction, all components of the drainage system should be constructed in accordance with relevant drawings, specifications, and manufacture's guidelines. Further to this Building Control should visit the site on a regular basis to inspect completed works and ensure that the drainage system is installed correctly.

2.6 Upon completion, all underground pipework would be jet cleaned and CCTV surveyed, areas of porous surfacing would be swept and cleaned. The Contractor would be responsible for rectifying any significant defects identified at this stage and for a period of approximately 12 months thereafter. At the end of this period a further inspection will be carried out by the Contract Administrator and on completion of any outstanding remedial works, the drainage system would be handed over.

3. DRAINAGE MANAGEMENT & MAINTENANCE PLAN

3.1 This Drainage Management & Maintenance Plan provides details of the plan proposed for maintenance and management of the drainage scheme associated with the proposed development.

3.2 On occupation of the development, it is recommended that each element of the as-built drainage system is maintained in accordance with the regime set out in the tables below.

Table 1: Below Ground Drainage System – Operation and Maintenance Requirements

Maintenance schedule	Required action	Frequency
Regular maintenance	Remove all litter and debris from external hard landscaped areas and adjacent landscaping, which may pose a risk to the performance of the system.	Monthly.
	Remove build-up of sediment / silt in catch-pits and dispose of oils / petrol residues using safe standard practices.	As required.
	Stabilise and mow adjacent landscaped areas and remove weeds.	
Remedial actions	Repair or rehabilitate inlet and outlets to ensure they are in good condition and operating as designed.	
	Remediate any landscaping, which has raised to within 50mm of the level of adjacent hard landscaping.	
Monitoring	Check of all inlets / outlets for blockages or evidence of physical damage with any necessary remedial action or clearance carried out if required.	On a monthly basis for the first 3 months of operation, thereafter every 6 months & following severe rainfall events.
	Inspect all surfaces for ponding, or silt accumulation. Record areas where water is ponding for more than 48 hours and carry out any remedial work deemed necessary.	After severe storms.

Table 2: Proposed Geocellular Storage Tank - Operation and Maintenance Requirements

Maintenance schedule	**Required action**	**Frequency**
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for first 3 months of operation, then every 6 months.
	Debris removal from catchment surface (where may cause risks to performance).	Monthly.
	Where rainfall infiltrates into blocks from above, check surface of filter for blockage by silt, algae or other matter. Remove and replace surface infiltration medium as necessary.	Monthly / after severe storms.
	Remove sediment from pre-treatment structures.	Annually, or as required.
Remedial actions	Repair/rehabilitation of inlets, outlet, overflows and vents.	As required.
Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed.	Annually and after large storms.

Table 3: Proposed Flow Control Device - Operation and Maintenance Requirements

Maintenance schedule	**Required action**	**Frequency**
Regular maintenance	Cleaning off the flow control device of any debris/ sediment.	As required.
Remedial actions	Flow control device repairs.	As required.
	Repair of erosion damage, or damage to chamber.	
Monitoring	Inspection of the chamber for debris and sediment build up.	Monthly for first 3 months, thereafter, every 6 months and following severe storm events.

Table 4: Rain Gardens - Operation and Maintenance Requirements

Maintenance schedule	Required action	Frequency
Regular maintenance	Remove litter and surface debris and weeds	Quarterly
	Replace any plants, to maintain planting density	As required
	Remove sediment, litter and debris build-up from inlets or from forebays	Quarterly to biannually
Occasional maintenance	Infill any holes or scour in the filter medium, improve erosion protection if required	As required
	Repair minor accumulations of silt by raking away surface mulch, scarifying surface of medium and replacing mulch	As required
Remedial Actions	Remove and replace filter and vegetation above	As required but likely to be > 20 years
Monitoring	Inspect infiltration surface for silting and ponding time, record de-watering time of the facility	Quarterly
	Check operation of underdrains by inspection of flows after rain	Annually
	Assess plants for disease infection, poor growth, invasive species etc and replace as necessary	Quarterly
	Inspect inlets and outlets for blockage	Quarterly

Table 5: Existing Petrol Interceptor - Operation and Maintenance Requirements

Maintenance schedule	Required action	Frequency
Regular maintenance	Cleaning of interceptor, inlets, and outlets of retained pollutants & silt.	Every 3, 6 or 12 months depending on site conditions (or following poor performance).
Remedial actions	Repair of erosion damage, or damage to tank.	As required.
	Interceptor repairs.	
Monitoring	Inspection of the tank for pollutants and silt.	Every 3, 6 or 12 months depending on site conditions (or following poor performance).
	Inspection of inlets and outlets	
	Inspection of areas receiving overflow, for evidence of erosion.	

Table 6: Gravel Filter Drains - Operation and Maintenance Requirements

Maintenance schedule	Required action	Frequency
Regular maintenance	Liter and debris removal from trench surface, access chambers and pre-treatment devices.	Monthly (or as required)
	Removal and washing of exposed stones on the trench surface.	Annually or when silt is evident on the surface.
	Trimming of any roots that may be causing blockages.	Annually (semi-annual the first year)
	Remove weeds on the trench surface	Monthly (at start, then as required)
Occasional maintenance	Removal of sediment from pre-treatment devices.	Annually
	Remove tree roots or trees that grow close to the trench.	As required
Remedial Actions	Inspect inlets, outlets and inspection points for blockages, clogging, standing water and structural damage.	Annually
	Clear perforated pipework of blockages.	As required
	Rehabilitate infiltration or filtration surfaces.	
	Excavate trench walls to expose clean soils if infiltration performance reduces to unacceptable levels.	
	Replace geotextiles and clean and replace filter media, if clogging occurs.	
Monitoring	Inspect pre-treatment systems, inlets, trench surfaces and perforated pipework for silt accumulation. Establish appropriate silt removal frequencies.	Annually