Our Ref: 16185

16 June 2025

Dealt with by: Daniel McLeish

Tesla Engineering Ltd, Water Lane, Storrington West Sussex RH20 3EA
Drainage Consultation Response Note
Planning Application DC/25/0371

This note has been prepared by Evans & Langford in response to consultation comments received from WSCC Flood Risk Management dated 30th May 2025.

This note provides further response to the outstanding points raised by WSCC Flood Risk Management. Set out below are the comments received, with the Evans & Langford response below.

WSCC Flood Risk Management Comment:

1) The CV value should be 1 (rather than summer/winter values) – The Applicant contends this is not achievable on site. The use of a Cv value of 1 is considered best practice under latest guidance, where the calculations are only based on the impermeable areas contributing to the drainage system. It is noted that the applicant can currently only reach Cv value of 0.91, therefore we have concerns that the system does not have enough capacity to adequately drain the site and that flood risk will increase elsewhere.
2) Please update to FEH 2022, as opposed to FEH 2013 which has been superseded. –The Applicant has provided suitable evidence to support that this was utilised and this point is addressed.
3) The MADD factor should be adjusted to 0. – The Applicant has stated that they can amend their calculations and should resubmit accordingly for review.
4) Please include the 1:30 plus climate change scenario in your calculations. – The Applicant has stated that they can amend their calculations and should resubmit accordingly for review.

Evans & Langford Response:

1) As noted in our Flood Risk Assessment and previous consultation response the existing surface water drainage system for Unit 12 (DC/23/0997) was designed to accommodate the possible future extension of Unit 12A as covered in this scheme.

Continued

That being said, we have revised the scheme to include a Cv value of 1 for both summer and winter profiles. This has required the additional construction of 6 further permeable parking spaces to provide sufficient storage volume for the drainage system. These porous spaces have previously been identified as future construction as site usage and demand necessitates.

We do maintain that this part of the site benefits from large planted buffers both around and through the site, and therefore a Cv value of 1.0 is overly conservative in this instance. Obviously the drainage system will benefit further through additional storage if the porous carpark is extended in future.

The revised calculations are appended to this Response Note.

2) Noted.

3) In the appended calculations the MADD factor has been adjusted to 0.

4) The 1:30 plus climate change scenario has been included in the appended calculations.

Revised Drainage Calculations
Cv = 1.0
MADD = 0.0
1:30 plus climate change scenario

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 509616 115413 TQ 09616 15413
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	0.156	4-8	0.061

Total Area Contributing (ha) = 0.217

Total Pipe Volume (m³) = 5.454

Network Design Table for Storm

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	13.710	0.250	54.8	0.051	5.00	0.0	0.600	o	225	Pipe/Conduit	
S1.001	16.130	0.540	29.9	0.038	0.00	0.0	0.600	o	225	Pipe/Conduit	
S2.000	9.670	0.100	96.7	0.039	5.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	5.13	38.750	0.051	0.0	0.0	0.0	1.77	70.4	9.2
S1.001	50.00	5.24	38.500	0.089	0.0	0.0	0.0	2.40	95.5	16.1
S2.000	50.00	5.12	38.060	0.039	0.0	0.0	0.0	1.33	52.9	7.0

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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
S1.002	2.990	0.030	99.7	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S3.000	20.540	0.485	42.4	0.000	5.00	1.9	0.600	o	225	Pipe/Conduit	
S4.000	3.820	0.075	50.9	0.042	5.00	0.0	0.600	o	150	Pipe/Conduit	
S3.001	48.780	0.450	108.4	0.013	0.00	0.0	0.600	o	225	Pipe/Conduit	
S3.002	12.980	0.215	60.4	0.034	0.00	0.0	0.600	o	225	Pipe/Conduit	
S3.003	2.990	0.110	27.2	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.003	6.575	0.030	219.2	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.004	10.689	0.070	152.7	0.000	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)
S1.002	50.00	5.28	37.960	0.128	0.0	0.0	0.0	1.31	52.1	23.1
S3.000	50.00	5.17	39.335	0.000	1.9	0.0	0.0	2.02	80.2	1.9
S4.000	50.00	5.05	39.000	0.042	0.0	0.0	0.0	1.41	25.0	7.6
S3.001	50.00	5.82	38.850	0.055	1.9	0.0	0.0	1.26	49.9	11.8
S3.002	50.00	5.95	38.400	0.089	1.9	0.0	0.0	1.69	67.0	18.0
S3.003	50.00	5.97	38.185	0.089	1.9	0.0	0.0	2.52	100.2	18.0
S1.003	50.00	6.13	37.550	0.217	1.9	0.0	0.0	0.67	11.9«	41.1
S1.004	50.00	6.35	37.520	0.217	1.9	0.0	0.0	0.81	14.3«	41.1

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Online Controls for Storm

Hydro-Brake® Optimum Manhole: S4, DS/PN: S1.004, Volume (m³): 1.8

Unit Reference	MD-SHE-0121-6300-0800-6300
Design Head (m)	0.800
Design Flow (l/s)	6.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	121
Invert Level (m)	37.520
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.800	6.3	Kick-Flo®	0.547	5.3
Flush-Flo™	0.245	6.3	Mean Flow over Head Range	-	5.4

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.3	1.200	7.6	3.000	11.7	7.000	17.6
0.200	6.3	1.400	8.2	3.500	12.6	7.500	18.2
0.300	6.3	1.600	8.7	4.000	13.5	8.000	18.7
0.400	6.1	1.800	9.2	4.500	14.2	8.500	19.3
0.500	5.7	2.000	9.7	5.000	15.0	9.000	19.8
0.600	5.5	2.200	10.1	5.500	15.7	9.500	20.4
0.800	6.3	2.400	10.6	6.000	16.3		
1.000	7.0	2.600	11.0	6.500	17.0		

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Storage Structures for Storm

Cellular Storage Manhole: S3, DS/PN: S1.003

Invert Level (m) 37.550 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)
0.000	330.0	330.0	0.751	0.0	384.5
0.750	330.0	384.5			

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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 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 509616 115413 TQ 09616 15413
Data Type	Point
Cv (Summer)	1.000
Cv (Winter)	1.000

Margin for Flood Risk Warning (mm) 300.0 DVD Status ON
Analysis Timestep Fine Inertia Status ON
DTS Status ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720
Return Period(s) (years)	2, 5, 10, 30, 100
Climate Change (%)	0, 0, 0, 40, 45

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)
S1.000	S1	15 Summer	2	+0%	100/15 Summer				38.815	-0.160
S1.001	S1	15 Summer	2	+0%	30/15 Summer				38.571	-0.154
S2.000	S2	15 Summer	2	+0%	30/15 Summer				38.141	-0.144
S1.002	S1	15 Summer	2	+0%	5/15 Summer				38.126	-0.059
S3.000	S2	15 Summer	2	+0%					39.359	-0.201
S4.000	S4	15 Summer	2	+0%	30/15 Summer				39.078	-0.072
S3.001	S4	15 Summer	2	+0%	100/15 Summer				38.931	-0.144
S3.002	S5	15 Summer	2	+0%	30/15 Summer				38.490	-0.135
S3.003	S2	15 Summer	2	+0%	30/15 Summer				38.286	-0.124
S1.003	S3	480 Summer	2	+0%	5/180 Summer				37.693	-0.007
S1.004	S4	360 Summer	2	+0%	2/180 Summer				37.701	0.031

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.000	0.18			11.1	OK	
S1.001	S1	0.000	0.21			18.0	OK	
S2.000	S2	0.000	0.19			8.4	OK	
S1.002	S1	0.000	0.88			26.4	OK	
S3.000	S2	0.000	0.03			1.9	OK	
S4.000	S4	0.000	0.53			9.1	OK	
S3.001	S4	0.000	0.28			13.2	OK	
S3.002	S5	0.000	0.33			19.3	OK	
S3.003	S2	0.000	0.41			19.3	OK	

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

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.003	S3	0.000	0.52		232	5.3	OK	
S1.004	S4	0.000	0.46			5.9	SURCHARGED	

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5 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 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 509616 115413 TQ 09616 15413
Data Type	Point
Cv (Summer)	1.000
Cv (Winter)	1.000

Margin for Flood Risk Warning (mm) 300.0 DVD Status ON
Analysis Timestep Fine Inertia Status ON
DTS Status ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720
Return Period(s) (years)	2, 5, 10, 30, 100
Climate Change (%)	0, 0, 0, 40, 45

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)
S1.000	S1	15 Summer	5	+0%	100/15 Summer				38.825	-0.150
S1.001	S1	15 Summer	5	+0%	30/15 Summer				38.583	-0.142
S2.000	S2	15 Summer	5	+0%	30/15 Summer				38.228	-0.057
S1.002	S1	15 Summer	5	+0%	5/15 Summer				38.212	0.027
S3.000	S2	15 Summer	5	+0%					39.359	-0.201
S4.000	S4	15 Summer	5	+0%	30/15 Summer				39.095	-0.055
S3.001	S4	15 Summer	5	+0%	100/15 Summer				38.944	-0.131
S3.002	S5	15 Summer	5	+0%	30/15 Summer				38.505	-0.120
S3.003	S2	15 Summer	5	+0%	30/15 Summer				38.303	-0.107
S1.003	S3	480 Summer	5	+0%	5/180 Summer				37.721	0.021
S1.004	S4	480 Summer	5	+0%	2/180 Summer				37.769	0.099

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.000	0.24			15.0	OK	
S1.001	S1	0.000	0.29			24.3	OK	
S2.000	S2	0.000	0.26			11.3	OK	
S1.002	S1	0.000	1.20			35.8	SURCHARGED	
S3.000	S2	0.000	0.03			1.9	OK	
S4.000	S4	0.000	0.72			12.3	OK	
S3.001	S4	0.000	0.36			17.2	OK	
S3.002	S5	0.000	0.44			25.3	OK	
S3.003	S2	0.000	0.54			25.3	OK	

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

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.003	S3	0.000	0.55		240	5.6	SURCHARGED	
S1.004	S4	0.000	0.43			5.6	SURCHARGED	

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10 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 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 509616 115413 TQ 09616 15413
Data Type	Point
Cv (Summer)	1.000
Cv (Winter)	1.000

Margin for Flood Risk Warning (mm) 300.0 DVD Status ON
Analysis Timestep Fine Inertia Status ON
DTS Status ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720
Return Period(s) (years)	2, 5, 10, 30, 100
Climate Change (%)	0, 0, 0, 40, 45

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)
S1.000	S1	15 Summer	10	+0%	100/15 Summer				38.835	-0.140
S1.001	S1	15 Summer	10	+0%	30/15 Summer				38.599	-0.126
S2.000	S2	15 Summer	10	+0%	30/15 Summer				38.285	0.000
S1.002	S1	15 Summer	10	+0%	5/15 Summer				38.265	0.080
S3.000	S2	15 Summer	10	+0%					39.359	-0.201
S4.000	S4	15 Summer	10	+0%	30/15 Summer				39.111	-0.039
S3.001	S4	15 Summer	10	+0%	100/15 Summer				38.959	-0.116
S3.002	S5	15 Summer	10	+0%	30/15 Summer				38.529	-0.096
S3.003	S2	15 Summer	10	+0%	30/15 Summer				38.333	-0.077
S1.003	S3	480 Summer	10	+0%	5/180 Summer				37.750	0.050
S1.004	S4	480 Summer	10	+0%	2/180 Summer				37.818	0.148

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.000	0.30			18.6	OK	
S1.001	S1	0.000	0.40			34.0	OK	
S2.000	S2	0.000	0.33			14.3	OK	
S1.002	S1	0.000	1.59			47.5	SURCHARGED	
S3.000	S2	0.000	0.03			1.9	OK	
S4.000	S4	0.000	0.89			15.3	OK	
S3.001	S4	0.000	0.46			21.9	OK	
S3.002	S5	0.000	0.60			34.6	OK	
S3.003	S2	0.000	0.75			34.9	OK	

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

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.003	S3	0.000	0.64		248	6.5	SURCHARGED	
S1.004	S4	0.000	0.46			5.9	SURCHARGED	

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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 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 509616 115413 TQ 09616 15413
Data Type	Point
Cv (Summer)	1.000
Cv (Winter)	1.000

Margin for Flood Risk Warning (mm) 300.0 DVD Status ON
Analysis Timestep Fine Inertia Status ON
DTS Status ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720
Return Period(s) (years)	2, 5, 10, 30, 100
Climate Change (%)	0, 0, 0, 40, 45

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)
S1.000	S1	15 Summer	30	+40%	100/15 Summer				38.870	-0.105
S1.001	S1	15 Summer	30	+40%	30/15 Summer				38.782	0.057
S2.000	S2	15 Summer	30	+40%	30/15 Summer				38.587	0.302
S1.002	S1	15 Summer	30	+40%	5/15 Summer				38.505	0.320
S3.000	S2	15 Summer	30	+40%					39.359	-0.201
S4.000	S4	15 Summer	30	+40%	30/15 Summer				39.270	0.120
S3.001	S4	15 Summer	30	+40%	100/15 Summer				39.007	-0.068
S3.002	S5	15 Summer	30	+40%	30/15 Summer				38.685	0.060
S3.003	S2	15 Summer	30	+40%	30/15 Summer				38.463	0.053
S1.003	S3	480 Summer	30	+40%	5/180 Summer				37.924	0.224
S1.004	S4	480 Summer	30	+40%	2/180 Summer				38.127	0.457

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.000	0.55			33.8	OK	
S1.001	S1	0.000	0.70			58.9	SURCHARGED	
S2.000	S2	0.000	0.57			25.1	SURCHARGED	
S1.002	S1	0.000	2.83			84.5	SURCHARGED	
S3.000	S2	0.000	0.03			1.9	OK	
S4.000	S4	0.000	1.61			27.6	SURCHARGED	
S3.001	S4	0.000	0.80			38.2	OK	
S3.002	S5	0.000	1.01			58.5	SURCHARGED	
S3.003	S2	0.000	1.24			58.1	SURCHARGED	

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

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.003	S3	0.000	0.76		368	7.6	SURCHARGED	
S1.004	S4	0.000	0.46			5.9	SURCHARGED	

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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 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 509616 115413 TQ 09616 15413
Data Type	Point
Cv (Summer)	1.000
Cv (Winter)	1.000

Margin for Flood Risk Warning (mm) 300.0 DVD Status ON
Analysis Timestep Fine Inertia Status ON
DTS Status ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720
Return Period(s) (years)	2, 5, 10, 30, 100
Climate Change (%)	0, 0, 0, 40, 45

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)
S1.000	S1	15 Summer	100	+45%	100/15 Summer				39.319	0.344
S1.001	S1	15 Summer	100	+45%	30/15 Summer				39.181	0.456
S2.000	S2	15 Summer	100	+45%	30/15 Summer				38.834	0.549
S1.002	S1	15 Summer	100	+45%	5/15 Summer				38.728	0.543
S3.000	S2	15 Summer	100	+45%					39.359	-0.201
S4.000	S4	15 Summer	100	+45%	30/15 Summer				39.566	0.416
S3.001	S4	15 Summer	100	+45%	100/15 Summer				39.263	0.188
S3.002	S5	15 Summer	100	+45%	30/15 Summer				38.857	0.232
S3.003	S2	15 Summer	100	+45%	30/15 Summer				38.537	0.127
S1.003	S3	480 Summer	100	+45%	5/180 Summer				38.044	0.344
S1.004	S4	480 Winter	100	+45%	2/180 Summer				38.267	0.597

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.000	0.71			43.3	SURCHARGED	
S1.001	S1	0.000	0.89			75.1	SURCHARGED	
S2.000	S2	0.000	0.74			32.6	SURCHARGED	
S1.002	S1	0.000	3.59			107.4	SURCHARGED	
S3.000	S2	0.000	0.03			1.9	OK	
S4.000	S4	0.000	2.00			34.3	SURCHARGED	
S3.001	S4	0.000	0.94			45.0	SURCHARGED	
S3.002	S5	0.000	1.20			69.6	SURCHARGED	

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

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S3.003	S2	0.000	1.49			69.6	SURCHARGED	
S1.003	S3	0.000	0.75		440	7.6	SURCHARGED	
S1.004	S4	0.000	0.47			6.0	SURCHARGED	

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Summary of Results for 100 year Return Period (+45%)

Half Drain Time : 469 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	39.966	0.146	0.0	1.8	1.8	46.4	O K
30 min Summer	39.999	0.179	0.0	1.9	1.9	64.5	O K
60 min Summer	40.032	0.212	0.0	1.9	1.9	82.8	Flood Risk
120 min Summer	40.052	0.232	0.0	1.9	1.9	93.9	Flood Risk
180 min Summer	40.062	0.242	0.0	1.9	1.9	99.4	Flood Risk
240 min Summer	40.068	0.248	0.0	1.9	1.9	102.2	Flood Risk
360 min Summer	40.071	0.251	0.0	1.9	1.9	104.0	Flood Risk
480 min Summer	40.069	0.249	0.0	1.9	1.9	103.0	Flood Risk
600 min Summer	40.066	0.246	0.0	1.9	1.9	101.4	Flood Risk
720 min Summer	40.063	0.243	0.0	1.9	1.9	99.5	Flood Risk
960 min Summer	40.056	0.236	0.0	1.9	1.9	95.9	Flood Risk
1440 min Summer	40.044	0.224	0.0	1.9	1.9	89.5	Flood Risk
2160 min Summer	40.027	0.207	0.0	1.9	1.9	80.0	Flood Risk
15 min Winter	39.966	0.146	0.0	1.8	1.8	46.4	O K
30 min Winter	39.999	0.179	0.0	1.9	1.9	64.6	O K
60 min Winter	40.032	0.212	0.0	1.9	1.9	82.9	Flood Risk
120 min Winter	40.053	0.233	0.0	1.9	1.9	94.2	Flood Risk
180 min Winter	40.063	0.243	0.0	1.9	1.9	99.7	Flood Risk
240 min Winter	40.069	0.249	0.0	1.9	1.9	102.7	Flood Risk
360 min Winter	40.072	0.252	0.0	1.9	1.9	104.8	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	152.479	0.0	48.0	26
30 min Summer	102.109	0.0	67.3	41
60 min Summer	65.075	0.0	88.2	70
120 min Summer	38.071	0.0	104.7	128
180 min Summer	27.849	0.0	115.6	188
240 min Summer	22.327	0.0	123.9	246
360 min Summer	16.378	0.0	136.9	364
480 min Summer	13.152	0.0	146.8	444
600 min Summer	11.098	0.0	155.1	502
720 min Summer	9.664	0.0	162.1	564
960 min Summer	7.775	0.0	173.9	692
1440 min Summer	5.732	0.0	191.8	970
2160 min Summer	4.234	0.0	211.5	1372
15 min Winter	152.479	0.0	48.0	26
30 min Winter	102.109	0.0	67.3	40
60 min Winter	65.075	0.0	88.2	70
120 min Winter	38.071	0.0	104.7	126
180 min Winter	27.849	0.0	115.6	184
240 min Winter	22.327	0.0	123.9	242
360 min Winter	16.378	0.0	136.8	354

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Summary of Results for 100 year Return Period (+45%)

	Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
480	min Winter	40.071	0.251	0.0	1.9	1.9	104.1	Flood Risk
600	min Winter	40.067	0.247	0.0	1.9	1.9	101.8	Flood Risk
720	min Winter	40.063	0.243	0.0	1.9	1.9	99.5	Flood Risk
960	min Winter	40.054	0.234	0.0	1.9	1.9	94.9	Flood Risk
1440	min Winter	40.036	0.216	0.0	1.9	1.9	85.0	Flood Risk
2160	min Winter	40.008	0.188	0.0	1.9	1.9	69.8	Flood Risk

	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
480	min Winter	13.152	0.0	146.8	460
600	min Winter	11.098	0.0	155.1	554
720	min Winter	9.664	0.0	162.0	578
960	min Winter	7.775	0.0	173.8	730
1440	min Winter	5.732	0.0	191.7	1034
2160	min Winter	4.234	0.0	211.1	1476

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 509616 115413 TQ 09616 15413
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	1.000
Cv (Winter)	1.000
Shortest Storm (mins)	15
Longest Storm (mins)	2160
Climate Change %	+45

Time Area Diagram

Total Area (ha) 0.150

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.000	4	8	0.075	8	12	0.075

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Model Details

Storage is Online Cover Level (m) 40.300

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	30.0
Membrane Percolation (mm/hr)	1000	Length (m)	60.8
Max Percolation (l/s)	506.7	Slope (1:X)	500.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	39.820	Membrane Depth (m)	0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0070-2000-0785-2000
Design Head (m)	0.785
Design Flow (l/s)	2.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	70
Invert Level (m)	39.335
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.785	2.0
Flush-Flo™	0.238	2.0
Kick-Flo®	0.502	1.6
Mean Flow over Head Range	-	1.8

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.8	1.200	2.4	3.000	3.7	7.000	5.5
0.200	2.0	1.400	2.6	3.500	4.0	7.500	5.7
0.300	2.0	1.600	2.8	4.000	4.2	8.000	5.9
0.400	1.9	1.800	2.9	4.500	4.5	8.500	6.0
0.500	1.6	2.000	3.1	5.000	4.7	9.000	6.2
0.600	1.8	2.200	3.2	5.500	4.9	9.500	6.4
0.800	2.0	2.400	3.3	6.000	5.1		
1.000	2.2	2.600	3.5	6.500	5.3		

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