

## DRAINAGE NETWORK DESIGN FOR VULCAN CLOSE WHITSTABLE


<b>Project Number</b>	<b>6341</b>
<b>Document Reference</b>	6341-D009
<b>Revision</b>	P1
<b>Prepared by</b>	DO
<b>Date prepared</b>	August 17
<b>Client</b>	JENNERS
<b>Instructed by</b>	JENNERS

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## Revisions

Rev:	Description:	Date:	Rev by:	Chk by:
<b>P1</b>	Drainage Network Design	02/08/2017	DO	DO
		Add date		
		Add date		
		Add date		

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Date 02.08.2017 File 6341-NETWORK.MDX	Designed by D.O Checked by DO	
Micro Drainage		Network 2016.1

Existing Network Details for Existing

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
E1.000	21.552	0.143	150.7	0.014	5.00	0.0	0.600	o	150	Pipe/Conduit
E1.001	10.761	0.148	72.7	0.008	0.00	0.0	0.600	o	150	Pipe/Conduit
E2.000	13.450	0.075	179.3	0.012	5.00	0.0	0.600	o	150	Pipe/Conduit
E1.002	3.032	0.005	606.4	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit
E1.003	6.305	0.028	225.2	0.003	0.00	0.0	0.600	o	225	Pipe/Conduit
E3.000	20.522	0.250	82.1	0.021	5.00	0.0	0.600	o	150	Pipe/Conduit
E3.001	8.037	0.113	71.1	0.002	0.00	0.0	0.600	o	150	Pipe/Conduit
E4.000	2.144	0.028	76.6	0.002	5.00	0.0	0.600	o	150	Pipe/Conduit
E1.004	2.638	0.017	155.2	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit

Network Results Table


PN	US/IL (m)	$\Sigma$ I.Area (ha)	$\Sigma$ Base Flow (l/s)	Vel (m/s)	Cap (l/s)
E1.000	13.410	0.014	0.0	0.82	14.4
E1.001	13.268	0.022	0.0	1.18	20.9
E2.000	13.195	0.012	0.0	0.75	13.2
E1.002	13.120	0.034	0.0	0.40	7.1
E1.003	13.115	0.037	0.0	0.87	34.5
E3.000	13.450	0.021	0.0	1.11	19.6
E3.001	13.200	0.023	0.0	1.19	21.1
E4.000	13.115	0.002	0.0	1.15	20.3
E1.004	13.087	0.062	0.0	0.80	14.2

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Manhole Schedules for Existing

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
ERE1	13.810	0.400	Open Manhole	450	E1.000	13.410	150				
ESW1	13.805	0.538	Open Manhole	450	E1.001	13.268	150	E1.000	13.267	150	
ESW2	13.700	0.505	Open Manhole	450	E2.000	13.195	150				
ETANK	13.870	0.750	Open Manhole	1200	E1.002	13.120	150	E1.001	13.120	150	
								E2.000	13.120	150	
ESW3	13.885	0.770	Open Manhole	600	E1.003	13.115	225	E1.002	13.115	150	
ERE2	14.275	0.825	Open Manhole	450	E3.000	13.450	150				
ESW4	14.300	1.100	Open Manhole	450	E3.001	13.200	150	E3.000	13.200	150	
ESW6	14.090	0.975	Open Manhole	450	E4.000	13.115	150				
ESW5	14.090	1.003	Open Manhole	1200	E1.004	13.087	150	E1.003	13.087	225	
								E3.001	13.087	150	
								E4.000	13.087	150	
ESWM	14.420	1.350	Open Manhole	0		OUTFALL		E1.004	13.070	150	

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PIPELINE SCHEDULES for Existing

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., (mm)	L*W
E1.000	o	150	ERE1	13.810	13.410	0.250	Open Manhole		450
E1.001	o	150	ESW1	13.805	13.268	0.387	Open Manhole		450
E2.000	o	150	ESW2	13.700	13.195	0.355	Open Manhole		450
E1.002	o	150	ETANK	13.870	13.120	0.600	Open Manhole		1200
E1.003	o	225	ESW3	13.885	13.115	0.545	Open Manhole		600
E3.000	o	150	ERE2	14.275	13.450	0.675	Open Manhole		450
E3.001	o	150	ESW4	14.300	13.200	0.950	Open Manhole		450
E4.000	o	150	ESW6	14.090	13.115	0.825	Open Manhole		450
E1.004	o	150	ESW5	14.090	13.087	0.853	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., (mm)	L*W
E1.000	21.552	150.7	ESW1	13.805	13.267	0.388	Open Manhole		450
E1.001	10.761	72.7	ETANK	13.870	13.120	0.600	Open Manhole		1200
E2.000	13.450	179.3	ETANK	13.870	13.120	0.600	Open Manhole		1200
E1.002	3.032	606.4	ESW3	13.885	13.115	0.620	Open Manhole		600
E1.003	6.305	225.2	ESW5	14.090	13.087	0.778	Open Manhole		1200
E3.000	20.522	82.1	ESW4	14.300	13.200	0.950	Open Manhole		450
E3.001	8.037	71.1	ESW5	14.090	13.087	0.853	Open Manhole		1200
E4.000	2.144	76.6	ESW5	14.090	13.087	0.853	Open Manhole		1200
E1.004	2.638	155.2	ESWM	14.420	13.070	1.200	Open Manhole		0

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Area Summary for Existing

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.014	0.014	0.014
1.001	-	-	100	0.008	0.008	0.008
2.000	-	-	100	0.012	0.012	0.012
1.002	-	-	100	0.000	0.000	0.000
1.003	-	-	100	0.003	0.003	0.003
3.000	-	-	100	0.021	0.021	0.021
3.001	-	-	100	0.002	0.002	0.002
4.000	-	-	100	0.002	0.002	0.002
1.004	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.062	0.062	0.062

Free Flowing Outfall Details for Existing


Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
E1.004	ESWM	14.420	13.070	0.000	0	0

Simulation Criteria for Existing

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m <sup>3</sup> /ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	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 Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.800	Storm Duration (mins)	30
Ratio R	0.400		

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Online Controls for Existing


Hydro-Brake Optimum® Manhole: ESW5, DS/PN: E1.004, Volume (m³): 1.5

Unit Reference	MD-SHE-0115-5000-0280-5000
Design Head (m)	0.280
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	115
Invert Level (m)	13.087
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.280	5.0
Flush-Flo™	0.158	5.0
Kick-Flo®	0.240	4.7
Mean Flow over Head Range	-	3.7

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.0	1.200	9.9	3.000	15.2	7.000	23.3
0.200	4.9	1.400	10.6	3.500	16.4	7.500	24.1
0.300	5.2	1.600	11.3	4.000	17.6	8.000	24.9
0.400	5.9	1.800	12.0	4.500	18.6	8.500	25.7
0.500	6.5	2.000	12.6	5.000	19.7	9.000	26.4
0.600	7.1	2.200	13.2	5.500	20.6	9.500	27.2
0.800	8.2	2.400	13.7	6.000	21.5		
1.000	9.1	2.600	14.3	6.500	22.4		

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Storage Structures for Existing

Cellular Storage Manhole: ETANK, DS/PN: E1.002

Invert Level (m) 13.120 Safety Factor 2.0  
 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95  
 Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )
0.000	66.0	44.0	0.400	0.0	53.0
0.300	66.0	53.0			



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

Simulation Criteria

Areal Reduction Factor 1.000      Additional Flow - % of Total Flow 0.000  
Hot Start (mins) 0      MADD Factor \* 10m<sup>3</sup>/ha Storage 2.000  
Hot Start Level (mm) 0      Inlet Coefficient 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 Storage Structures 1  
Number of Online Controls 1      Number of Time/Area Diagrams 0  
Number of Offline Controls 0      Number of Real Time Controls 0

Synthetic Rainfall Details


Rainfall Model      FSR      Ratio R 0.400  
Region England and Wales Cv (Summer) 0.750  
M5-60 (mm)      19.800 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0      DVD Status OFF  
Analysis Timestep      Fine Inertia Status OFF  
DTS 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) 1, 30, 100  
Climate Change (%) 0, 0, 30


PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
E1.000	ERE1	15 Winter	1	+0%					13.448
E1.001	ESW1	15 Winter	1	+0%					13.307
E2.000	ESW2	15 Winter	1	+0%					13.232
E1.002	ETANK	60 Winter	1	+0%	100/15 Summer				13.160
E1.003	ESW3	15 Winter	1	+0%					13.173
E3.000	ERE2	15 Winter	1	+0%					13.490
E3.001	ESW4	15 Winter	1	+0%	100/15 Summer				13.242
E4.000	ESW6	15 Winter	1	+0%	30/15 Summer				13.174
E1.004	ESW5	15 Winter	1	+0%	30/15 Summer				13.173

PN	US/MH Name	Surcharged Flooded			Pipe		Level Exceeded
		Depth (m)	Volume (m <sup>3</sup> )	Flow / Cap. (l/s)	Flow (l/s)	Status	
E1.000	ERE1	-0.112	0.000	0.14	1.9	OK	
E1.001	ESW1	-0.111	0.000	0.15	2.8	OK	
E2.000	ESW2	-0.113	0.000	0.14	1.6	OK	
E1.002	ETANK	-0.110	0.000	0.11	1.1	OK	

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

PN	US/MH Name	Surcharged		Flooded		Pipe		Level Exceeded
		Depth (m)	Volume (m <sup>3</sup> )	Flow / Cap.	Overflow (l/s)	Flow (l/s)	Status	
E1.003	ESW3	-0.167	0.000	0.03		0.9	OK	
E3.000	ERE2	-0.110	0.000	0.15		2.9	OK	
E3.001	ESW4	-0.108	0.000	0.17		3.1	OK	
E4.000	ESW6	-0.091	0.000	0.02		0.3	OK	
E1.004	ESW5	-0.064	0.000	0.30		3.3	OK	

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

Simulation Criteria

Areal Reduction Factor 1.000      Additional Flow - % of Total Flow 0.000  
Hot Start (mins) 0      MADD Factor \* 10m<sup>3</sup>/ha Storage 2.000  
Hot Start Level (mm) 0      Inlet Coefficient 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 Storage Structures 1  
Number of Online Controls 1      Number of Time/Area Diagrams 0  
Number of Offline Controls 0      Number of Real Time Controls 0

Synthetic Rainfall Details


Rainfall Model      FSR      Ratio R 0.400  
Region England and Wales Cv (Summer) 0.750  
M5-60 (mm)      19.800 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0      DVD Status OFF  
Analysis Timestep      Fine Inertia Status OFF  
DTS 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)      1, 30, 100  
Climate Change (%)      0, 0, 30


PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
E1.000	ERE1	15 Winter	30	+0%					13.471
E1.001	ESW1	15 Winter	30	+0%					13.335
E2.000	ESW2	15 Winter	30	+0%					13.255
E1.002	ETANK	60 Winter	30	+0%	100/15 Summer				13.226
E1.003	ESW3	15 Winter	30	+0%					13.278
E3.000	ERE2	15 Winter	30	+0%					13.515
E3.001	ESW4	15 Winter	30	+0%	100/15 Summer				13.332
E4.000	ESW6	15 Winter	30	+0%	30/15 Summer				13.311
E1.004	ESW5	15 Winter	30	+0%	30/15 Summer				13.310

PN	US/MH Name	Surcharged Flooded			Pipe		Status	Level Exceeded
		Depth (m)	Volume (m <sup>3</sup> )	Flow / Cap. (l/s)	Flow (l/s)			
E1.000	ERE1	-0.089	0.000	0.34	4.6	OK		
E1.001	ESW1	-0.083	0.000	0.40	7.4	OK		
E2.000	ESW2	-0.090	0.000	0.33	4.0	OK		
E1.002	ETANK	-0.044	0.000	0.33	3.5	OK		

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

PN	US/MH Name	Surcharged		Flooded		Pipe Flow (l/s)	Status	Level Exceeded
		Depth (m)	Volume (m <sup>3</sup> )	Flow / Cap.	Overflow (l/s)			
E1.003	ESW3	-0.062	0.000	0.15		3.8	OK	
E3.000	ERE2	-0.085	0.000	0.38		7.0	OK	
E3.001	ESW4	-0.018	0.000	0.39		7.2	OK	
E4.000	ESW6	0.046	0.000	0.05		0.6	SURCHARGED	
E1.004	ESW5	0.073	0.000	0.45		4.9	SURCHARGED	

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

Simulation Criteria

Areal Reduction Factor 1.000      Additional Flow - % of Total Flow 0.000  
Hot Start (mins) 0      MADD Factor \* 10m<sup>3</sup>/ha Storage 2.000  
Hot Start Level (mm) 0      Inlet Coefficient 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 Storage Structures 1  
Number of Online Controls 1      Number of Time/Area Diagrams 0  
Number of Offline Controls 0      Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model      FSR      Ratio R 0.400  
Region England and Wales Cv (Summer) 0.750  
M5-60 (mm)      19.800 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0      DVD Status OFF  
Analysis Timestep      Fine Inertia Status OFF  
DTS 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) 1, 30, 100  
Climate Change (%) 0, 0, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
E1.000	ERE1	15 Winter	100	+30%					13.493
E1.001	ESW1	15 Winter	100	+30%					13.360
E2.000	ESW2	60 Winter	100	+30%					13.344
E1.002	ETANK	60 Winter	100	+30%	100/15 Summer				13.340
E1.003	ESW3	120 Winter	100	+30%					13.338
E3.000	ERE2	15 Winter	100	+30%					13.539
E3.001	ESW4	15 Winter	100	+30%	100/15 Summer				13.406
E4.000	ESW6	15 Summer	100	+30%	30/15 Summer				13.348
E1.004	ESW5	15 Summer	100	+30%	30/15 Summer				13.347

PN	US/MH Name	Surcharged Flooded			Pipe		Status	Level Exceeded
		Depth (m)	Volume (m <sup>3</sup> )	Flow / Cap. (l/s)	Flow (l/s)			
E1.000	ERE1	-0.067	0.000	0.57	7.8	OK		
E1.001	ESW1	-0.058	0.000	0.67	12.5	OK		
E2.000	ESW2	-0.001	0.000	0.29	3.5	OK		
E1.002	ETANK	0.070	0.000	0.45	4.8	SURCHARGED		

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

PN	US/MH Name	Surcharged Flooded			Pipe		Status	Level Exceeded
		Depth (m)	Volume (m <sup>3</sup> )	Flow / Overflow Cap. (l/s)	Flow (l/s)			
E1.003	ESW3	-0.002	0.000	0.16	4.3		OK	
E3.000	ERE2	-0.061	0.000	0.64	11.8		OK	
E3.001	ESW4	0.056	0.000	0.71	13.0	SURCHARGED		
E4.000	ESW6	0.083	0.000	0.10	1.1	SURCHARGED		
E1.004	ESW5	0.110	0.000	0.44	4.8	SURCHARGED		

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Existing Network Details for Existing

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
E1.000	21.552	0.143	150.7	0.014	5.00	0.0	0.600	o	150	Pipe/Conduit
E1.001	10.761	0.148	72.7	0.008	0.00	0.0	0.600	o	150	Pipe/Conduit
E2.000	13.450	0.075	179.3	0.012	5.00	0.0	0.600	o	150	Pipe/Conduit
E1.002	3.032	0.005	606.4	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit
E1.003	6.305	0.028	225.2	0.003	0.00	0.0	0.600	o	225	Pipe/Conduit
E3.000	20.522	0.250	82.1	0.021	5.00	0.0	0.600	o	150	Pipe/Conduit
E3.001	8.037	0.113	71.1	0.002	0.00	0.0	0.600	o	150	Pipe/Conduit
E4.000	2.144	0.028	76.6	0.002	5.00	0.0	0.600	o	150	Pipe/Conduit
E1.004	2.638	0.017	155.2	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit

Network Results Table

PN	US/IL (m)	$\Sigma$ I.Area (ha)	$\Sigma$ Base Flow (l/s)	Vel (m/s)	Cap (l/s)
E1.000	13.410	0.014	0.0	0.82	14.4
E1.001	13.268	0.022	0.0	1.18	20.9
E2.000	13.195	0.012	0.0	0.75	13.2
E1.002	13.120	0.034	0.0	0.40	7.1
E1.003	13.115	0.037	0.0	0.87	34.5
E3.000	13.450	0.021	0.0	1.11	19.6
E3.001	13.200	0.023	0.0	1.19	21.1
E4.000	13.115	0.002	0.0	1.15	20.3
E1.004	13.087	0.062	0.0	0.80	14.2


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Manhole Schedules for Existing

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
ERE1	13.810	0.400	Open Manhole	450	E1.000	13.410	150				
ESW1	13.805	0.538	Open Manhole	450	E1.001	13.268	150	E1.000	13.267	150	
ESW2	13.700	0.505	Open Manhole	450	E2.000	13.195	150				
ETANK	13.870	0.750	Open Manhole	1200	E1.002	13.120	150	E1.001	13.120	150	
								E2.000	13.120	150	
ESW3	13.885	0.770	Open Manhole	600	E1.003	13.115	225	E1.002	13.115	150	
ERE2	14.275	0.825	Open Manhole	450	E3.000	13.450	150				
ESW4	14.300	1.100	Open Manhole	450	E3.001	13.200	150	E3.000	13.200	150	
ESW6	14.090	0.975	Open Manhole	450	E4.000	13.115	150				
ESW5	14.090	1.003	Open Manhole	1200	E1.004	13.087	150	E1.003	13.087	225	
								E3.001	13.087	150	
								E4.000	13.087	150	
ESWM	14.420	1.350	Open Manhole	0		OUTFALL		E1.004	13.070	150	



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PIPELINE SCHEDULES for Existing

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., (mm)	L*W
E1.000	o	150	ERE1	13.810	13.410	0.250	Open Manhole		450
E1.001	o	150	ESW1	13.805	13.268	0.387	Open Manhole		450
E2.000	o	150	ESW2	13.700	13.195	0.355	Open Manhole		450
E1.002	o	150	ETANK	13.870	13.120	0.600	Open Manhole		1200
E1.003	o	225	ESW3	13.885	13.115	0.545	Open Manhole		600
E3.000	o	150	ERE2	14.275	13.450	0.675	Open Manhole		450
E3.001	o	150	ESW4	14.300	13.200	0.950	Open Manhole		450
E4.000	o	150	ESW6	14.090	13.115	0.825	Open Manhole		450
E1.004	o	150	ESW5	14.090	13.087	0.853	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., (mm)	L*W
E1.000	21.552	150.7	ESW1	13.805	13.267	0.388	Open Manhole		450
E1.001	10.761	72.7	ETANK	13.870	13.120	0.600	Open Manhole		1200
E2.000	13.450	179.3	ETANK	13.870	13.120	0.600	Open Manhole		1200
E1.002	3.032	606.4	ESW3	13.885	13.115	0.620	Open Manhole		600
E1.003	6.305	225.2	ESW5	14.090	13.087	0.778	Open Manhole		1200
E3.000	20.522	82.1	ESW4	14.300	13.200	0.950	Open Manhole		450
E3.001	8.037	71.1	ESW5	14.090	13.087	0.853	Open Manhole		1200
E4.000	2.144	76.6	ESW5	14.090	13.087	0.853	Open Manhole		1200
E1.004	2.638	155.2	ESWM	14.420	13.070	1.200	Open Manhole		0

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Area Summary for Existing

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.014	0.014	0.014
1.001	-	-	100	0.008	0.008	0.008
2.000	-	-	100	0.012	0.012	0.012
1.002	-	-	100	0.000	0.000	0.000
1.003	-	-	100	0.003	0.003	0.003
3.000	-	-	100	0.021	0.021	0.021
3.001	-	-	100	0.002	0.002	0.002
4.000	-	-	100	0.002	0.002	0.002
1.004	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.062	0.062	0.062

Free Flowing Outfall Details for Existing


Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
E1.004	ESWM	14.420	13.070	0.000	0	0

Simulation Criteria for Existing

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m <sup>3</sup> /ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	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 Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.800	Storm Duration (mins)	30
Ratio R	0.400		

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Online Controls for Existing


Hydro-Brake Optimum® Manhole: ESW5, DS/PN: E1.004, Volume (m³): 1.5

Unit Reference	MD-SHE-0115-5000-0280-5000
Design Head (m)	0.280
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	115
Invert Level (m)	13.087
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.280	5.0
Flush-Flo™	0.158	5.0
Kick-Flo®	0.240	4.7
Mean Flow over Head Range	-	3.7

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.0	1.200	9.9	3.000	15.2	7.000	23.3
0.200	4.9	1.400	10.6	3.500	16.4	7.500	24.1
0.300	5.2	1.600	11.3	4.000	17.6	8.000	24.9
0.400	5.9	1.800	12.0	4.500	18.6	8.500	25.7
0.500	6.5	2.000	12.6	5.000	19.7	9.000	26.4
0.600	7.1	2.200	13.2	5.500	20.6	9.500	27.2
0.800	8.2	2.400	13.7	6.000	21.5		
1.000	9.1	2.600	14.3	6.500	22.4		


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Storage Structures for Existing

Cellular Storage Manhole: ETANK, DS/PN: E1.002

Invert Level (m) 13.120 Safety Factor 2.0  
 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95  
 Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )
0.000	66.0	44.0	0.400	0.0	53.0
0.300	66.0	53.0			

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

Simulation Criteria

Areal Reduction Factor 1.000      Additional Flow - % of Total Flow 0.000  
Hot Start (mins) 0      MADD Factor \* 10m<sup>3</sup>/ha Storage 2.000  
Hot Start Level (mm) 0      Inlet Coefficient 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 Storage Structures 1  
Number of Online Controls 1      Number of Time/Area Diagrams 0  
Number of Offline Controls 0      Number of Real Time Controls 0

Synthetic Rainfall Details


Rainfall Model      FSR      Ratio R 0.400  
Region England and Wales Cv (Summer) 0.750  
M5-60 (mm)      19.800 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0      DVD Status OFF  
Analysis Timestep      Fine Inertia Status OFF  
DTS 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) 1, 30, 100  
Climate Change (%) 0, 0, 40


US/MH PN	Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
E1.000	ERE1	15 Winter	1	+0%					13.448
E1.001	ESW1	15 Winter	1	+0%					13.307
E2.000	ESW2	15 Winter	1	+0%	100/30 Winter				13.232
E1.002	ETANK	60 Winter	1	+0%	100/15 Summer				13.160
E1.003	ESW3	15 Winter	1	+0%	100/30 Winter				13.173
E3.000	ERE2	15 Winter	1	+0%					13.490
E3.001	ESW4	15 Winter	1	+0%	100/15 Summer				13.242
E4.000	ESW6	15 Winter	1	+0%	30/15 Summer				13.174
E1.004	ESW5	15 Winter	1	+0%	30/15 Summer				13.173

PN	US/MH Name	Depth (m)	Surcharged		Flooded		Pipe		Level Exceeded
			Volume (m <sup>3</sup> )	Flow / Cap.	Flow / (l/s)	Flow (l/s)	Status		
E1.000	ERE1	-0.112	0.000	0.14		1.9	OK		
E1.001	ESW1	-0.111	0.000	0.15		2.8	OK		
E2.000	ESW2	-0.113	0.000	0.14		1.6	OK		
E1.002	ETANK	-0.110	0.000	0.11		1.1	OK		

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1)  
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PN	US/MH Name	Surcharged		Flooded		Pipe		Level Exceeded
		Depth (m)	Volume (m <sup>3</sup> )	Flow / Cap.	Overflow (l/s)	Flow (l/s)	Status	
E1.003	ESW3	-0.167	0.000	0.03		0.9	OK	
E3.000	ERE2	-0.110	0.000	0.15		2.9	OK	
E3.001	ESW4	-0.108	0.000	0.17		3.1	OK	
E4.000	ESW6	-0.091	0.000	0.02		0.3	OK	
E1.004	ESW5	-0.064	0.000	0.30		3.3	OK	

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

Simulation Criteria

Areal Reduction Factor 1.000      Additional Flow - % of Total Flow 0.000  
Hot Start (mins) 0      MADD Factor \* 10m<sup>3</sup>/ha Storage 2.000  
Hot Start Level (mm) 0      Inlet Coefficient 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 Storage Structures 1  
Number of Online Controls 1      Number of Time/Area Diagrams 0  
Number of Offline Controls 0      Number of Real Time Controls 0

Synthetic Rainfall Details


Rainfall Model      FSR      Ratio R 0.400  
Region England and Wales Cv (Summer) 0.750  
M5-60 (mm)      19.800 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0      DVD Status OFF  
Analysis Timestep      Fine Inertia Status OFF  
DTS 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)      1, 30, 100  
Climate Change (%)      0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
E1.000	ERE1	15 Winter	30	+0%					13.471
E1.001	ESW1	15 Winter	30	+0%					13.335
E2.000	ESW2	15 Winter	30	+0%	100/30 Winter				13.255
E1.002	ETANK	60 Winter	30	+0%	100/15 Summer				13.226
E1.003	ESW3	15 Winter	30	+0%	100/30 Winter				13.278
E3.000	ERE2	15 Winter	30	+0%					13.515
E3.001	ESW4	15 Winter	30	+0%	100/15 Summer				13.332
E4.000	ESW6	15 Winter	30	+0%	30/15 Summer				13.311
E1.004	ESW5	15 Winter	30	+0%	30/15 Summer				13.310


PN	US/MH Name	Surcharged Flooded			Pipe		Status	Level Exceeded
		Depth (m)	Volume (m <sup>3</sup> )	Flow / Cap. (l/s)	Flow (l/s)			
E1.000	ERE1	-0.089	0.000	0.34	4.6	OK		
E1.001	ESW1	-0.083	0.000	0.40	7.4	OK		
E2.000	ESW2	-0.090	0.000	0.33	4.0	OK		
E1.002	ETANK	-0.044	0.000	0.33	3.5	OK		

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

PN	US/MH Name	Surcharged		Flooded		Pipe Flow (l/s)	Status	Level Exceeded
		Depth (m)	Volume (m <sup>3</sup> )	Flow / Cap.	Overflow (l/s)			
E1.003	ESW3	-0.062	0.000	0.15		3.8	OK	
E3.000	ERE2	-0.085	0.000	0.38		7.0	OK	
E3.001	ESW4	-0.018	0.000	0.39		7.2	OK	
E4.000	ESW6	0.046	0.000	0.05		0.6	SURCHARGED	
E1.004	ESW5	0.073	0.000	0.45		4.9	SURCHARGED	



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

Simulation Criteria

Areal Reduction Factor 1.000      Additional Flow - % of Total Flow 0.000  
Hot Start (mins) 0      MADD Factor \* 10m<sup>3</sup>/ha Storage 2.000  
Hot Start Level (mm) 0      Inlet Coefficient 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 Storage Structures 1  
Number of Online Controls 1      Number of Time/Area Diagrams 0  
Number of Offline Controls 0      Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model      FSR      Ratio R 0.400  
Region England and Wales Cv (Summer) 0.750  
M5-60 (mm)      19.800 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0      DVD Status OFF  
Analysis Timestep      Fine Inertia Status OFF  
DTS 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)      1, 30, 100  
Climate Change (%)      0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
E1.000	ERE1	15 Winter	100	+40%					13.497
E1.001	ESW1	60 Winter	100	+40%					13.370
E2.000	ESW2	60 Winter	100	+40%	100/30 Winter				13.367
E1.002	ETANK	60 Winter	100	+40%	100/15 Summer				13.363
E1.003	ESW3	60 Winter	100	+40%	100/30 Winter				13.361
E3.000	ERE2	15 Winter	100	+40%					13.544
E3.001	ESW4	15 Winter	100	+40%	100/15 Summer				13.420
E4.000	ESW6	60 Winter	100	+40%	30/15 Summer				13.358
E1.004	ESW5	60 Winter	100	+40%	30/15 Summer				13.358

PN	US/MH Name	Surcharged Flooded			Pipe		Status	Level Exceeded
		Depth (m)	Volume (m <sup>3</sup> )	Flow / Cap. (l/s)	Flow (l/s)			
E1.000	ERE1	-0.063	0.000	0.62	8.4	OK		
E1.001	ESW1	-0.048	0.000	0.37	6.9	OK		
E2.000	ESW2	0.022	0.000	0.31	3.7	SURCHARGED		
E1.002	ETANK	0.093	0.000	0.44	4.6	SURCHARGED		

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

PN	US/MH Name	Surcharged		Flooded		Pipe Flow (l/s)	Status	Level Exceeded
		Depth (m)	Volume (m <sup>3</sup> )	Flow / Cap.	Overflow (l/s)			
E1.003	ESW3	0.021	0.000	0.18		4.7	SURCHARGED	
E3.000	ERE2	-0.056	0.000	0.69		12.7	OK	
E3.001	ESW4	0.070	0.000	0.77		14.0	SURCHARGED	
E4.000	ESW6	0.093	0.000	0.06		0.6	SURCHARGED	
E1.004	ESW5	0.121	0.000	0.45		4.9	SURCHARGED	

