



Ashley King Developments

Land off Backgate, Cowbit

Surface Water Drainage Assessment

131844-R1(0)-SW



INVESTORS
IN PEOPLE

RSK

SEPTEMBER 2014



RSK GENERAL NOTES

Project No.: 131844-R1(0)-SW

Site Name: Land off Backgate, Cowbit

Report Title: Surface Water Drainage Assessment

Client: Ashley King Developments

Date: September 2014

Office: Hemel Hempstead

Status: Draft

Author	<u>S Reed</u>	Technical reviewer	<u>S Marks</u>
Signature		Signature	
Date:	<u>5 September 2014</u>	Date:	<u>5 September 2014</u>

Project manager	<u>M Cheeseman</u>
Signature	
Date:	<u>5 September 2014</u>

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Where field investigations have been carried out, these have been restricted to a level of detail required to achieve the stated objectives of the work.

This work has been undertaken in accordance with the quality management system of RSK LDE Ltd.

Ashley King Developments
Land off Backgate, Cowbit
Surface Water Drainage Assessment
131844-R1(0)-SW

1 SURFACE WATER DRAINAGE ASSESSMENT

1.1 Pre-development Situation

In terms of estimating the potential runoff from the site, the pro-rated IOH 124 method has been used to estimate the existing surface runoff from the site. These calculations are shown in Appendix A.

Table 1: IOH 124 Greenfield Runoff Calculations

Total Catchment Area (m ²)	Impermeable Area (m ²)	% Impermeable	Peak flow of return period (l/s)			
			Qbar	Q1	Q30	Q100
15,400	0	0	2.1	1.9	5.1	7.6

1.2 Limiting Discharge for Design

Karl Vines of the South Holland Internal Drainage Board (IDB) has confirmed via telephone call (31/07/14) that a discharge limit of 20l/s/impermeable ha would be appropriate for the site.

The proposed impermeable area for the site is approximately 6,680m² (0.67ha) and equates to a discharge limit for the site of 13.4l/s.

1.3 Post-Development Situation

Surface Water

The total impermeable area of the proposed site is estimated to be around 6,680m² (43% of the site). Due to the requirement to control surface water drainage, additional methods of surface water attenuation will be required to retain the surface volumes on site to meet EA, South Holland IDB, Code of Sustainable Drainage and planning policy guidance.

It is proposed that surface water from the site will be discharged to the existing Mill Dyke Drain that runs west to east along the northern boundary of the site. The Mill Dyke Drain runs in a 600mm dia. pipe in the vicinity of the site and “dog-legs” to the south around the northern property boundary in the northeast corner of the site. The proposed connection point for the site drainage is at the existing manhole in the northeast corner of the site.

The proposed drainage strategy for the site is attached as drawing **40-01 Proposed Surface Water Drainage Strategy**.

Storage for the 1 in 100 year plus climate change rainfall event has been provided using modular storage beneath communal hard-standing areas, and the discharge from the site will be restricted to 13.4l/s using a Hydrobrake.

The proposed attenuation includes 5 separate areas of modular storage with a total storage volume of 260m³.

Windes software has been used to model the proposed drainage for the site and the outputs of this model are attached as **Appendix B**. The model shows that there is no flooding for the 1 in 100 year plus climate change rainfall event.

As provided by South Holland IDB, the invert level of Mill Dyke Drain at the connection point is 0.5mAOD. The site is mostly level and as such, the proposed drainage has been designed at minimum grade. Where necessary, shallow pipes where less than 1.2m of cover is possible will require additional protection.

Lateral Drainage Connection from the South

There is an existing 300mm dia. lateral drainage connection from the property located immediately to the south of the site that is owned by Mr T. Tyrrell. This existing connection will need to be maintained and the proposal is to divert the line as shown on the proposed drainage strategy. Mr Tyrrell is yet to confirmed the location of the pipe and this will need to be confirmed on site prior to detailed design and construction.

FIGURES

Drawing 40-01 Proposed Surface Water Strategy

APPENDICES

Appendix A Existing and Proposed Runoff Calculations
Appendix B Windes Model Outputs

Abnormal or unusual residual risks associated with the design outcomes shown on this drawing are:-

RSK LDE LTD has followed its Design Risk Management process for Hazard Elimination and Risk reduction in developing the designs shown on this drawing.
Abnormal or unusual residual risks may be shown above where it is considered that such risk may not normally be expected by competent persons engaged on work of this nature or type.

Topographic survey as carried out by Ratcliff Land & Engineering Surveys Ltd August 2013

LEGEND

- Site Boundary
- Existing Surface Water Network (not all lateral connections and manholes shown)
- Proposed Surface Water Network
- Overland Flow Routes

P2	28.08.14	Final	SMR	SM	MC
P1	22.08.14	Draft	SMR	SM	MC
Rev.	Date	Amendment	Drawn	Chkd.	Appd.



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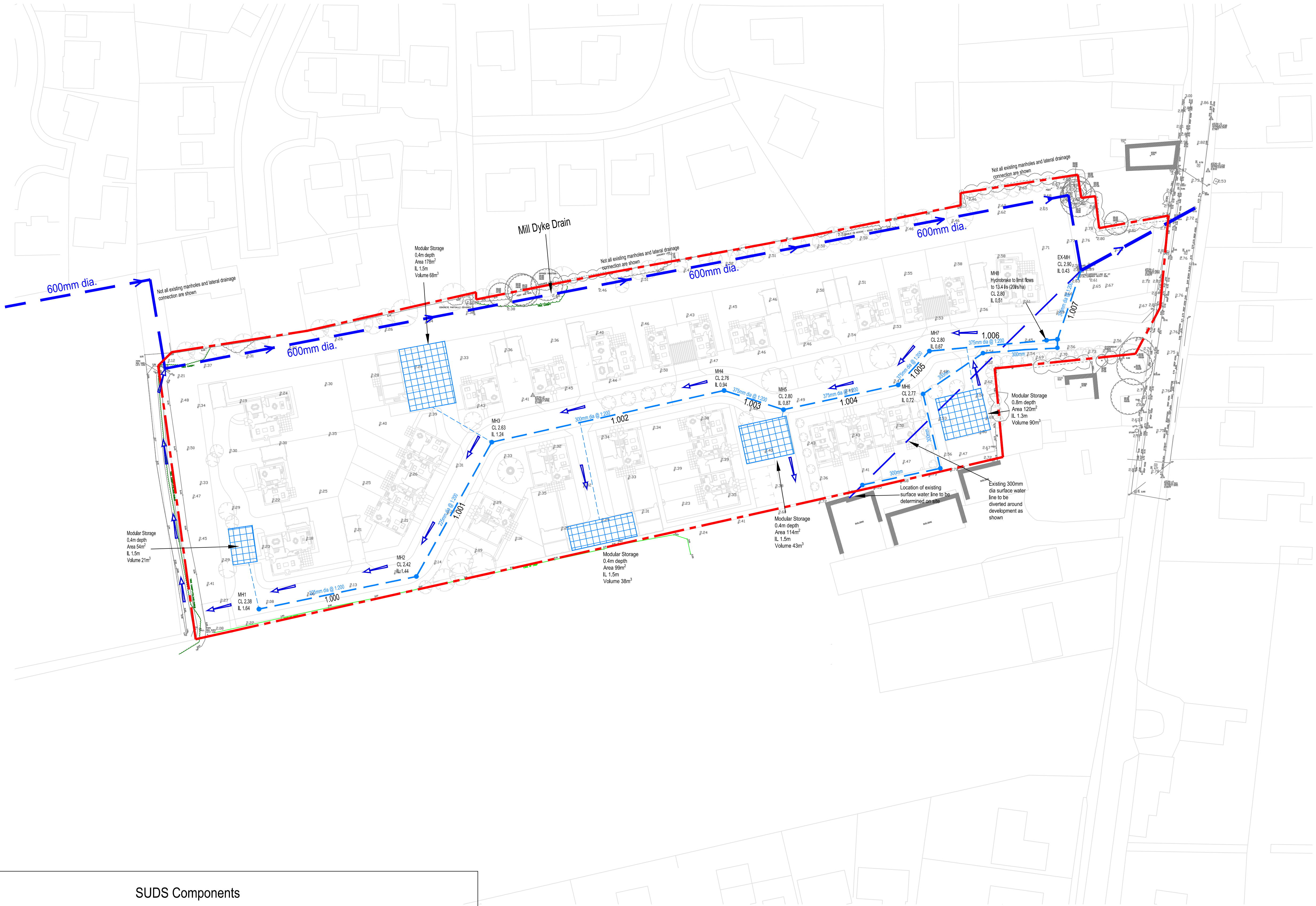
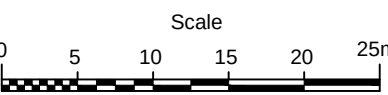
Ashley King Developments

Land off Backgate
Cowbit

Surface Water Drainage Strategy

Drawn SMR	Date 20/08/14	Checked SM	Date 22/08/14	Approved MC	Date 28/08/14
Scale 1:500	Orig Size A1	Dimensions m			

Project No. 131844	Drawing File
Drawing No. 40-01 SW Drainage Strategy	Rev. P2

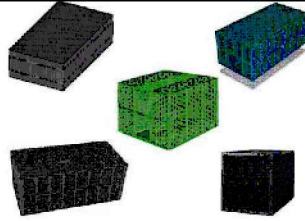


SUDS Components

1

Modular Storage

Modular plastic geocellular systems with a high void ratio that can be used to create a below ground infiltration (soakaway) or storage structure.



NOT FOR CONSTRUCTION

APPENDIX A

Existing and Proposed Runoff Calculations

Cowbit
FRA - Surface Water Strategy
Runoff

Job No. 131844
Name: Sam Reed
Date: 19/08/2014

Reference: The SUDS Manual 2007

	input
	output

1.0 Existing Area Summary

Total Area 1.54 ha
Impermeable Area 0.00 ha
 0%

1.1 IOH124 Greenfield Runoff Calcs - EXISTING

Carried out using WinDES source control

Grid Reference 527 318
SAAR 554 mm
Soil 0.3
Region Number 5
 (from WinDES)

	Peak flow	
Return Period	Total Site	
Qbar	2.1	l/s
1 in 1 year storm	1.9	l/s
1 in 30 year storm	5.1	l/s
1 in 100 year storm	7.6	l/s

1.2 Modified Rational Method - PROPOSED

$$Q = 2.78 C_v C_r i A$$

C_v = Volumetric Runoff Coefficient - a co-efficient that describes the proportion of rainfall appearing in the surface water drainage system, assumed
 C_r = Routing Coefficient - a routing co-efficient added to the Rational Method to represent runoff characteristics of a particular site or area in ;
 i = Rainfall Intensity (mm/h) based on a 1 hour rainfall event
 A = Area (ha)
 2.78 = Coefficient which accounts for the differences in units used for the inputs and the outputs of the equation (1000/360)

C_v 0.95
 C_r 1.3
 i (mm/hr) 13 Qbar
 7.5 1 in 1 year storm
 31.7 1 in 30 year storm
 46.5 1 in 100 year storm
Impermeable Area 0.668
 0.43

Rainfall data has been taken from the DDF calculator contained within the FEH CD ROM (CD3)

Return Period	Peak flow	
% Impervious	43%	
Qbar	29.8	l/s
1 in 1 year storm	17.2	l/s
1 in 30 year storm	72.7	l/s
1 in 100 year storm	106.6	l/s
1 in 100 year storm + CC	138.6	l/s

Cowbit
FRA - Surface Water Strategy
Proposed Development and Required Storage

Job No. 131844
Name: Sam Reed
Date: 19/08/2014

Reference: The SUDS Manual 2007

	input
	output

2.0 Proposed Development

2.1 Area Summary

Impermeable area	6,680	m ²	43%
Permeable areas	8,720	m ²	57%
Total Area	15,400	m²	100%

2.2 WinDes Quickstore

Carried out using WinDES source control

Region	England and Wales	
Grid Reference	527	318
M5-60	19	mm
Ratio	0.42	
Cv (summer)	0.75	
Cv (winter)	0.84	

	Total	
Impermeable area	0.668	ha

Maximum Allowable Discharge	13.4	l/s	South Holland IDB have specified a discharge rate of 20l/s/impermeable ha
-----------------------------	------	-----	---

(from WinDES)

	Restricted to 20 l/s/ha	
Return Period	Storage required, m³	
	min	max
1 in 100 year storm + 30% for climate change	245	349

Quick Storage Estimate

Micro Drainage

Variables

FSR Rainfall Cv (Summer)
 Return Period (years) Cv (Winter)
 Region Impervious Area (ha)
 Map M5-60 (mm) Maximum Allowable Discharge (l/s)
 Ratio R Infiltration Coefficient (m/hr)
 Safety Factor
 Climate Change (%)

Analyse OK Cancel Help

Enter Maximum Allowable Discharge between 0.0 and 999999.0

Quick Storage Estimate

Micro Drainage

Results

Global Variables require approximate storage of between 245 m³ and 349 m³.

These values are estimates only and should not be used for design purposes.

Analyse OK Cancel Help

Enter Maximum Allowable Discharge between 0.0 and 999999.0

RSK Ltd		Page 1																								
18 Frogmore Road Hemel Hempstead Hertfordshire																										
Date 28/08/2014 11:07 File Cowbit.srcx	Designed By SReed Checked By																									
Elstree Computing Ltd	Source Control W.12.5																									
<u>ICP SUDS Mean Annual Flood</u> Input <table> <tr> <td>Return Period (years)</td> <td>100</td> <td>Soil</td> <td>0.300</td> </tr> <tr> <td>Area (ha)</td> <td>1.540</td> <td>Urban</td> <td>0.000</td> </tr> <tr> <td>SAAR (mm)</td> <td>554</td> <td>Region Number</td> <td>Region 5</td> </tr> </table> Results l/s <table> <tr> <td>QBAR Rural</td> <td>2.1</td> </tr> <tr> <td>QBAR Urban</td> <td>2.1</td> </tr> <tr> <td>Q100 years</td> <td>7.6</td> </tr> <tr> <td>Q1 year</td> <td>1.9</td> </tr> <tr> <td>Q30 years</td> <td>5.1</td> </tr> <tr> <td>Q100 years</td> <td>7.6</td> </tr> </table>			Return Period (years)	100	Soil	0.300	Area (ha)	1.540	Urban	0.000	SAAR (mm)	554	Region Number	Region 5	QBAR Rural	2.1	QBAR Urban	2.1	Q100 years	7.6	Q1 year	1.9	Q30 years	5.1	Q100 years	7.6
Return Period (years)	100	Soil	0.300																							
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Q30 years	5.1																									
Q100 years	7.6																									
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APPENDIX B

Windes Model Outputs

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Elstree Computing Ltd	Network W.12.5	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	100	Add Flow / Climate Change (%)	30
M5-60 (mm)	19.000	Minimum Backdrop Height (m)	0.200
Ratio R	0.402	Maximum Backdrop Height (m)	1.500
Maximum Rainfall (mm/hr)	50	Min Design Depth for Optimisation (m)	0.600
Foul Sewage (l/s/ha)	0.00	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	200

Designed with Level Inverts

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.326	4-8	0.325	8-12	0.016

Total Area Contributing (ha) = 0.667

Total Pipe Volume (m³) = 19.019

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
1.000	40.000	0.200	200.0	0.109	5.00	0.0	0.600	o	225
1.001	40.000	0.200	200.0	0.078	0.00	0.0	0.600	o	225
1.002	60.000	0.300	200.0	0.196	0.00	0.0	0.600	o	300
1.003	15.000	0.075	200.0	0.072	0.00	0.0	0.600	o	375
1.004	30.000	0.150	200.0	0.066	0.00	0.0	0.600	o	375
1.005	10.000	0.050	200.0	0.013	0.00	0.0	0.600	o	375

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ Area (ha)	Σ DWF (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.72	1.640	0.109	0.0	0.0	4.4	0.92	36.6	19.2
1.001	50.00	6.45	1.440	0.187	0.0	0.0	7.6	0.92	36.6	32.9
1.002	50.00	7.35	1.240	0.383	0.0	0.0	15.6	1.11	78.3	67.4
1.003	50.00	7.55	0.940	0.455	0.0	0.0	18.5	1.28	141.1	80.1
1.004	50.00	7.94	0.865	0.521	0.0	0.0	21.2	1.28	141.1	91.7
1.005	50.00	8.07	0.715	0.534	0.0	0.0	21.7	1.28	141.1	94.0

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
1.006	32.000	0.160	200.0	0.133	0.00	0.0	0.600	o	375
1.007	18.000	0.090	200.0	0.000	0.00	0.0	0.600	o	375

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ Area (ha)	Σ DWF (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.006	50.00	8.49	0.665	0.667	0.0	0.0	27.1	1.28	141.1	117.4
1.007	50.00	8.72	0.505	0.667	0.0	0.0	27.1	1.28	141.1	117.4

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Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
1	2.380	0.740	1050	1.000	1.640	225				
2	2.420	0.980	1050	1.001	1.440	225	1.000	1.440	225	
3	2.630	1.390	1050	1.002	1.240	300	1.001	1.240	225	
4	2.760	1.820	1350	1.003	0.940	375	1.002	0.940	300	
5	2.800	1.935	1350	1.004	0.865	375	1.003	0.865	375	
6	2.770	2.055	1350	1.005	0.715	375	1.004	0.715	375	
7	2.800	2.135	1350	1.006	0.665	375	1.005	0.665	375	
8	2.800	2.295	1350	1.007	0.505	375	1.006	0.505	375	
outfall	2.890	2.475	0		OUTFALL		1.007	0.415	375	

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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 DIAM., L*W (mm)
1.000	o	225	1	2.380	1.640	0.515	1050
1.001	o	225	2	2.420	1.440	0.755	1050
1.002	o	300	3	2.630	1.240	1.090	1050
1.003	o	375	4	2.760	0.940	1.445	1350
1.004	o	375	5	2.800	0.865	1.560	1350
1.005	o	375	6	2.770	0.715	1.680	1350
1.006	o	375	7	2.800	0.665	1.760	1350
1.007	o	375	8	2.800	0.505	1.920	1350

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
1.000	40.000	200.0	2	2.420	1.440	0.755	1050
1.001	40.000	200.0	3	2.630	1.240	1.165	1050
1.002	60.000	200.0	4	2.760	0.940	1.520	1350
1.003	15.000	200.0	5	2.800	0.865	1.560	1350
1.004	30.000	200.0	6	2.770	0.715	1.680	1350
1.005	10.000	200.0	7	2.800	0.665	1.760	1350
1.006	32.000	200.0	8	2.800	0.505	1.920	1350
1.007	18.000	200.0	outfall	2.890	0.415	2.100	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)
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1.007	outfall	2.890	0.415	0.430	0	0
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Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Foul Sewage per hectare (l/s)	0.000
PIMP (% impervious)	100	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Run Time (mins)	60
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1
Number of Input Hydrographs	0	Number of Storage Structures	4
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0		

Synthetic Rainfall Details

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Simulation Criteria for Storm

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)	19.000	Storm Duration (mins)	30
Ratio R	0.402		

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Online Controls for Storm

Hydro-Brake® Manhole: 8, DS/PN: 1.007, Volume (m³): 6.7

Design Head (m) 2.000 Diameter (mm) 125
Design Flow (l/s) 13.4 Invert Level (m) 0.505
Hydro-Brake® Type Md5 SW Only

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	10.3	3.000	16.3	7.000	24.9
0.200	6.7	1.400	11.1	3.500	17.6	7.500	25.8
0.300	6.9	1.600	11.9	4.000	18.8	8.000	26.6
0.400	6.8	1.800	12.6	4.500	19.9	8.500	27.4
0.500	7.1	2.000	13.3	5.000	21.0	9.000	28.2
0.600	7.5	2.200	13.9	5.500	22.1	9.500	29.0
0.800	8.4	2.400	14.6	6.000	23.0		
1.000	9.4	2.600	15.2	6.500	24.0		

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Storage Structures for Storm

Cellular Storage Manhole: 1, DS/PN: 1.000

Invert Level (m)	1.500	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 ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	54.0	0.0	0.401	0.1	0.0
0.400	54.0	0.0			

Cellular Storage Manhole: 3, DS/PN: 1.002

Invert Level (m)	1.500	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 ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	277.2	0.0	0.401	0.1	0.0
0.400	277.2	0.0			

Cellular Storage Manhole: 5, DS/PN: 1.004

Invert Level (m)	1.500	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 ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	114.0	0.0	0.401	0.1	0.0
0.400	114.0	0.0			

Cellular Storage Manhole: 7, DS/PN: 1.006

Invert Level (m)	1.300	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 ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	120.0	0.0	0.801	0.1	0.0
0.800	120.0	0.0			

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Date 28.08.14 File Cowbit 28.08.14.mdx	Designed By SR Checked By																												
Elstree Computing Ltd	Network W.12.5																												
Manhole Headloss for Storm <table><thead><tr><th>PN</th><th>US/MH Name</th><th>US/MH Headloss</th></tr></thead><tbody><tr><td>1.000</td><td>1</td><td>0.500</td></tr><tr><td>1.001</td><td>2</td><td>0.500</td></tr><tr><td>1.002</td><td>3</td><td>0.500</td></tr><tr><td>1.003</td><td>4</td><td>0.500</td></tr><tr><td>1.004</td><td>5</td><td>0.500</td></tr><tr><td>1.005</td><td>6</td><td>0.500</td></tr><tr><td>1.006</td><td>7</td><td>0.500</td></tr><tr><td>1.007</td><td>8</td><td>0.500</td></tr></tbody></table>			PN	US/MH Name	US/MH Headloss	1.000	1	0.500	1.001	2	0.500	1.002	3	0.500	1.003	4	0.500	1.004	5	0.500	1.005	6	0.500	1.006	7	0.500	1.007	8	0.500
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