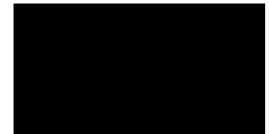




The Civil Engineering Practice
11 Tungsten Building
George Street
Fishergate
Sussex
BN41 1RA



Flood Risk Assessment

Proposed development at

**The Lillies Caravan Park
Yapton Road, Barnham, West Sussex**

On behalf of

Mr Roy Hartrick

February 2010

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1 Non Technical Summary

- 1.1 This Flood Risk Assessment has been undertaken in accordance with Planning Policy Statement 25 (PPS25) in support of an Outline Planning Application at The Lillies Caravan Park, Yapton Road, Barnham, West Sussex on behalf of Mr Roy Hartrick.
- 1.2 The proposals comprise 36 two, three and four bedroom houses together with a new access road, a maximum of 102 car parking spaces, a public open space and a play area.
- 1.3 Planning Policy Statement 25 (PPS25) 'Development and Flood Risk' requires that the Sequential Test be applied initially to a development application which indicates a possibility of flooding and is followed by the Exception Test if necessary.
- 1.4 The Environment Agency has been consulted in respect of historic flooding in the vicinity of the site and has confirmed that they hold no records of any flood events affecting the site.
- 1.5 The site is located within Flood Zone 1 with less than a one in a thousand chance of flooding in any year.
- 1.6 The proposed residential use is classified by PPS25 as more vulnerable and is deemed acceptable in Flood Zones 1 and 2. An Exception Test is not required.

2 Existing Site

2.1 Site Location

- 2.1.1 The development site is located on the south side of the B2233 Yapton Road, Barnham, West Sussex at postcode PO22 0AY, Ordnance Survey grid reference SU963040.
- 2.1.2 The site is bounded on its north side by the B2233 Yapton Road and all other sides by horticultural nurseries.
- 2.1.3 A copy of the site location plan is located in Appendix 1 at the rear of this report.

2.2 Site Description

- 2.2.1 The site is approximately 1.2ha in area and has levels of approximately 8.5m AOD at its northern boundary and 7.5m AOD at its southern boundary creating a gradient of approximately 1:175 across the site.
- 2.2.2 The site currently accommodates The Lillies Nursery & Caravan Site which incorporates an access road and hardstanding making a total of approximately 1,800m² of impermeable area, approximately 15% of the total site area.
- 2.2.3 Vehicular and pedestrian access to the site is available from the B2233 Yapton Road via a simple bellmouth junction.
- 2.2.4 A copy of the existing site layout plan is located in Appendix 2 at the rear of this report.

2.3 Drainage

- 2.3.1 The site is in an area where surface water is drained via soakaways. It is assumed that the existing hardstanding on the site is drained to soakaways but the location and details of these is currently unknown.
- 2.3.2 The geology in the vicinity is known to be London Clay overlain by gravels and the area has extensive sand deposits. A soakage rate of between 1×10^{-6} and 1×10^{-4} m/s is likely.
- 2.3.3 Foul drainage from the site is discharged to the 225mm diameter public foul sewer located at a depth of approximately 1.85m within the site at its northern boundary.

- 2.3.4 In addition to the existing foul sewer a public foul rising main crosses the site in an east west direction approximately 60m from its southern boundary.
- 2.3.5 A copy of Southern Water's sewer records for the area is located in Appendix 3 at the rear of this report.

3 Flood History and Flooding Potential

3.1 Flood History

3.1.1 The Environment Agency has been consulted in respect of historic flooding in the vicinity of the site and has confirmed that they hold no records of any flood events affecting the site but are aware of nearby flooding in Yapton Road in 1987 although have no specific details.

3.1.2 Arun District Council's Strategic Flood Risk Assessment confirms that there have been many recorded incidents of historic surface water flooding in Barnham and that the area is known to suffer from surface water flooding. The closest incidence of historic flooding was a localised event that occurred on Yapton Road at the junction with Hill Lane approximately 110m to the east of the site and was classified as surface water flooding.

3.1.3 There is no record of flooding affecting the site.

3.1.4 A copy of correspondence with the Environment Agency is located in Appendix 4 at the rear of this report.

3.2 Flood Defences

3.2.1 There are no flood defences in the vicinity of the site.

3.3 Flood Zone

3.3.1 Arun District Council's Strategic Flood Risk Assessment dated February 2008 identifies the development site within Flood Zone 1 with less than a one in a thousand chance of flooding in any given year.

3.3.2 The Environment Agency has confirmed that the site is located within Flood Zone 1.

3.4 Flooding Potential

3.4.1 The site is not at risk of tidal flooding and is not at risk of fluvial flooding from anything less than a 1:1000 year fluvial year flood event. Safe dry access would be available throughout the duration of a 1:100 year fluvial flood event.

3.4.2 Arun District Council's Strategic Flood Risk Assessment confirms that Barnham is within an area with a medium to high potential for groundwater flooding however the document confirms that there have

been no recorded incidents of flooding attributed to groundwater in the area.

- 3.4.3 A copy of the Environment Agency's on line flood map and the relevant Strategic Flood Risk Assessment maps are located in Appendix 5 at the rear of this Assessment.

4 Proposed Development

4.1 Description

- 4.1.1 The proposals comprise 36 two, three and four bedroom houses together with a new access road, a maximum of 102 car parking spaces, a public open space and a play area.
- 4.1.2 The entire impermeable area of the redeveloped site will be approximately 4,300m² making up approximately 36% of the total site area.
- 4.1.3 Vehicular access to the site will be via a new junction replacing the existing access onto the B2233 Yapton Road and pedestrian access will be available at this location and via a new pedestrian link to the site immediately west of the development.
- 4.1.4 A copy of the proposed site layout plan is located in Appendix 6 at the rear of this report.

4.2 Drainage Strategy

- 4.2.1 Surface water from the site will be discharged to shallow soakaways located above the water table in accordance with current guidance and standards.
- 4.2.2 In order to provide additional protection to the site for intense storms and provide a benefit to the wider area it is proposed that the site will drain to soakaways designed to half empty within 24 hours on a 1:10 year pluvial event and sized with sufficient storage to accommodate the volume of a 1:100 year event.
- 4.2.3 A preliminary drainage design based on an assumed soil permeability of 1x10⁻⁶m/s has been undertaken.
- 4.2.4 The dwellings would require a total of eleven 2.4m ring soakaways approximately 2m in depth and the hardstanding of the shared surface access would require a further 14 such soakaways.
- 4.2.5 In accordance with BRE 365 it has been assumed that only two of the excavation walls will provide soakage and the base has been ignored giving a soakage area of approximately 8m² per soakaway, a total of approximately 200m².

- 4.2.7 The storage volume required to accommodate flows on a 1:100 year return period pluvial event has been calculated by modelling a simple two pipe system restricted to 1l/s, the resultant worst case flood volume is approximately 190m³.
- 4.2.8 This volume plus an additional 30% to account for predicted climate change would need to be stored on site.
- 4.2.9 The suggested soakaway system has a total storage volume of approximately 135m³ leaving a shortfall of 55m³. This volume can readily be accommodated beneath the proposed shared 30% voided sub base with a depth of only 75mm across the full highway area or within a smaller area using a full depth voided sub base.
- 4.2.10 A drawing showing this possible surface water drainage scheme together with calculations is located in Appendix 7 at the rear of this Assessment
- 4.2.11 No increase in foul flows is anticipated and the existing drainage connection to the public foul sewer which is located within the site along its northern boundary will be maintained.
- 4.3 Safe Access
- 4.3.1 The site is located outside the predicted extent of a 1:100 year fluvial event and there is no need to elevate finished floor levels above the current on site levels.
- 4.3.2 Safe access to and from the site would remain available to pedestrians and vehicles throughout the duration of such an event.

5 The Sequential and Exception Tests

5.1 Introduction

- 5.1.1 The Sequential Approach is a risk based approach outlined within Planning Policy Statement 25 – Development and Flood Risk to be adopted at all levels of planning.

5.2 Application

- 5.2.1 Arun District Council's Local Development Framework documents do not yet incorporate the Site Allocations Development Plan Document.
- 5.2.2 However, given the location of the site in Flood Zone 1 it is clear that the site passes the Sequential Test.
- 5.2.3 PPS25 identifies the nature of the development proposals as more vulnerable and as appropriate in Flood Zones 1 and 2 without application of the Exception Test.

6 Conclusions

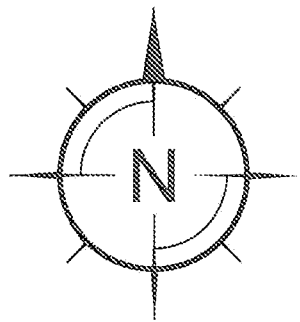
- 6.1 The Environment Agency holds no records of flooding in the area.
- 6.2 The site is located within Flood Zone 1 and is not at risk of tidal flooding. It is above the level of a 1:100 year return period fluvial flood event and not at risk of fluvial flooding in any less intense than a 1:1000 year flood event. The Sequential Test is therefore passed.
- 6.3 The Environment Agency's Modelled Flood Extent Map confirms that safe access will be available throughout the duration of a 1:100 return period fluvial event.
- 6.4 The new onsite surface water drainage system will be designed to accommodate the volume of water generated by a 1:100 year duration pluvial event incorporating an allowance for future climate change and will provide a benefit to the wider community.
- 6.5 Foul drainage will be discharged to the existing public foul sewer at the northern boundary of the site.
- 6.6 The residential use is defined in PPS25 as more vulnerable. The development is suitable at the proposed location and there is no requirement for the application of the Exception Test.

7 List of Appendices

- Appendix 1 Site Location Plan
- Appendix 2 Existing Site Layout Plan
- Appendix 3 Southern Water Sewer Records
- Appendix 4 Environment Agency Correspondence
- Appendix 5 Environment Agency and Arun District Council Strategic Flood Risk Assessment Maps
- Appendix 6 Proposed Site Layout Plan
- Appendix 7 Preliminary Surface Water Drainage Calculations and Potential Surface Water Drainage Scheme

Appendix 1
Site Location Plan

Appendix 2
Existing Site Layout Plan



TITLE	
Existing Site Layout Plan	
SCALE	DRG. No.
1:1000	2

Appendix 3
Southern Water Sewer Records

SEWER RECORDS PAGE 2 OF 2

Node	Cover	Invert	Size	Material	Shape
0203X	8.86	5.44	175	VC	CIRC
0701X	7.61	6.61	150	VC	CIRC
1201X	6.58	6.02	225	VC	CIRC
1204X			UNK	UNK	UNK
1701X	7.55	5.92	150	VC	CIRC
1702X	7.77	5.35	150	VC	CIRC
2101X	8.82	8.22	225	VC	CIRC
2102X	8.83	6.12	225	VC	CIRC
2701X	7.75	5.03	150	VC	CIRC
2702X	6.64	4.6	150	VC	CIRC
3001X	8.43	6.58	225	VC	CIRC
3101X	8.53	6.38	225	VC	CIRC
3701X	5.72	3.97	150	VC	CIRC
4001X	8.72	7.19	150	VC	CIRC
4002X	8.68	6.81	225	VC	CIRC
4003X	6.79	6.95	225	VC	CIRC
4701X	4.68	3.61	150	VC	CIRC
480PX	4.91	4.9	75	CI	CIRC
5001X	8.55	7.22	225	VC	CIRC
5002X	6.64		225	VC	CIRC
5901X	8.88	7.26	225	VC	CIRC
6801X	9.07	7.88	150	VC	CIRC
6802X	8.17	7.65	225	VC	CIRC
7001X	9.99	8.47	150	VC	CIRC
7902X	8.88	7.39	150	VC	CIRC
7903X	9.16	7.2	150	VC	CIRC
8101X	3.07	1.23	350	PVC	CIRC
8102X	2.5	0.84	375	CP	CIRC
8801X	5.6	4.14	175	VC	CIRC
9001X	6.5	4.77	175	VC	CIRC
9002X	6.23	4.49	175	VC	CIRC
9101X	6.31	5.04	175	VC	CIRC

[illegible]

Drawn by: goswama

Title: Lillies Caravan Park

Date: 01/02/2010



SHAPES (S)			
A	Archipel	Q	Rectangular
B	Barrel	R	Square
C	Cylinder	T	Trapezoidal
E	Egg	U	U Shape
H	Hexagon	Z	Other

MODE REFERENCING SYSTEM

1st digit: Numbered mode ending identifier

2nd digit: Numbered mode starting identifier

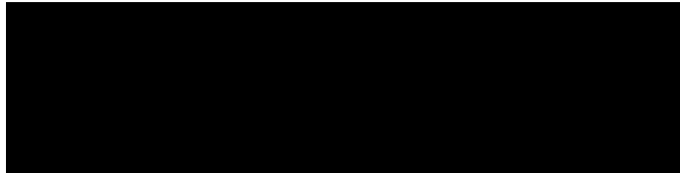
3rd digit: Number type identifier

4th digit: G = Forward channel
B = Backward mode
F = sequential mode

Appendix 4
Environment Agency Correspondence

Steve Doughty

From:
Sent:
To:
Cc:
Subject:



Hello Paul,

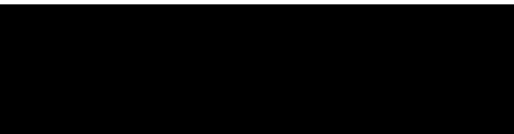
Further to our telephone conversation I can confirm that the site identified does not lie within any flood risk area, as identified on the Environment Agency's most recent Flood Maps.

The Agency has no record of flooding to this site, however we are aware of nearby flooding in Ypton Road in 1987 but have no specific details. Not all flooding events are reported to us and further information may be available from Arun District Council.

Kind regards

Aimee

Aimee Cox
Flood Risk Mapping and Data Management
Environment Agency
Colvedene Court
Wessex Way
Golden Common
Winchester
SO21 1WYF



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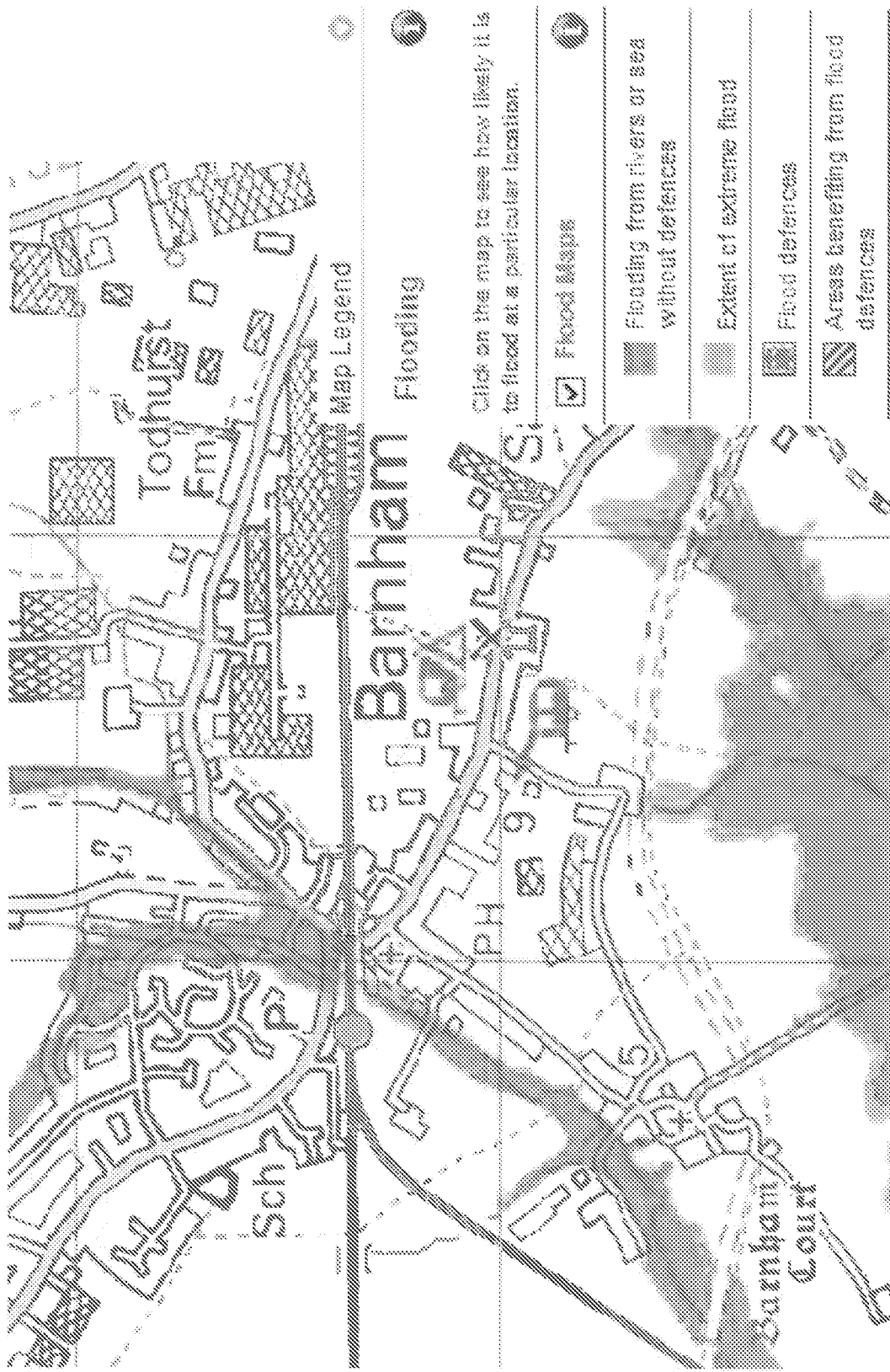
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Appendix 5

Environment Agency Flood Map and

Arun District Council SFRA Maps



Map Legend



Flood Maps

Click on the map to see how likely it is to flood at a particular location.



Flood Maps

Flooding from rivers or sea without defences

Extent of extreme flood

Flood defences

Areas benefiting from flood defences



Notes:

The Arun SFRA is a strategic assessment of flooding. Users of the SFRA should be aware of this when interpreting the information presented. The user is directed to the SFRA reports which outline the uncertainties associated with the studies. Particular attention is drawn to the following:

- Flood extent boundaries are not considered definitive. Land adjacent to these areas may also be at risk.
- Some flooding mechanisms have not been included in the assessment. The 'coastal risk area' is based on advice from LA Engineers and requires further assessment.

Arun District Council SFRA

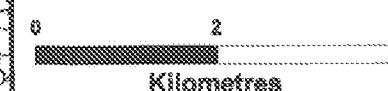
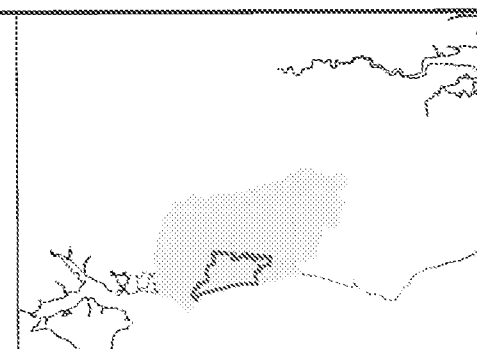
Map C2-T - Tidal Flood Zones with Climate Change



CAPITA SYMONDS

Legend

	Arun District Boundary		Coastal Risk Area
	Future Flood Zone 3b (2056)		Future Flood Zone 3a (2106)
	Future Flood Zone 3b (2106)		Future Flood Zone 2 (2056)
	Future Flood Zone 3a (2056)		Future Flood Zone 2 (2106)



Scale at A3: 1:80,000

Date: 31/01/2008

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Map_C2-T wor



Notes:

The Arun SFRA is a strategic assessment of flooding. Users of the SFRA should be aware of this when interpreting the information presented. The user is directed to the SFRA reports which outline the uncertainties associated with the studies. Particular attention is drawn to the following:

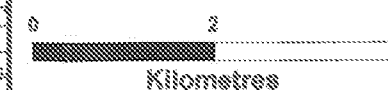
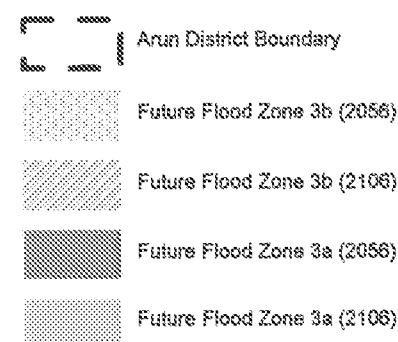
- Flood extent boundaries are not considered definitive. Land adjacent to these areas may also be at risk.
- Some flooding mechanisms have not been included in the assessment. The 'coastal risk area' is based on advice from LA Engineers and requires further assessment.

Arun District Council SFRA

Map C2-F - Climate Change Fluvial Flood Zones



CAPITA SYMONDS



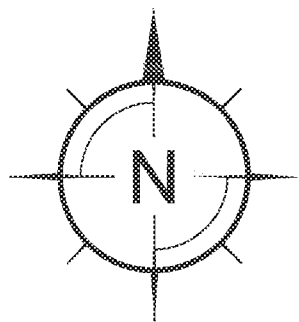
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Date: 31/01/2008

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Map_C2-F.wor

Appendix 6
Proposed Site Layout Plan



Proposed adjoining West Sussex County
Council Housing Site - 100 units.



Appendix 7

Preliminary Surface Water Drainage Calculations and Potential Surface Water Drainage Plan

Design of Perforated Concrete Ring Soakaways

Project Name:	21882
Project Number:	Lilles Caravan Park, Yapton Road, Barnham
Cover Level	50.00 m
Pipe Invert Level	49.00 m (lowest pipe)
Depth to Invert	1.00 m
Cover Grade	
Impermeable area	170 m ²
Gravel Surround Void Ratio	30 % (normally 30%)
Gravel Surround	150
Entry time	0 mins
Return Period	10 years (10years-BRE 365)
MS-60	20 mm
Ratio r1	0.35
Soil Characteristics	
Soil Infiltration Rate	10.00 x10 ⁻² m/s
Soil Description	

Calculations based on BRE Digest 365 - September 1991.
Effective cross section for soakaway taken as internal diameter
Required storage depth is the depth below the lowest incoming pipe invert level.
Note: Return Storm Period should be 10 years for BRE Digest 365.
Return Storm Period Assessments available are: 1, 2, 5, 10, 20, 25, 50, 100 years.
Ratio r1, in the range 0.12, 0.15, 0.18, 0.21, 0.24, 0.27, 0.30-0.45

Ring Size (m)	Approach Ring Wall Thickness (mm)	Excavation Size (m)	Required Storage Depth (m)	Run for worst case storm profile	Storage Provided Storage (m ³)	Time (hrs) (max24)	Total Depth of soakaway (m)	Design OK?
0.900	70	1.340	4.660	13.078	4.364	4.656	5.890	YES
1.050	80	1.510	3.890	11.718	4.573	5.420	4.880	YES
1.200	90	1.680	3.160	10.618	4.731	6.189	4.160	YES
1.350	95	1.840	2.630	9.678	4.873	6.993	3.630	YES
1.500	105	2.010	2.220	8.924	4.983	7.770	3.220	YES
1.600	115	2.330	1.660	7.736	5.233	9.396	2.660	YES
2.100	125	2.660	1.090	6.837	5.431	11.032	2.290	YES
2.400	140	2.980	1.050	6.258	5.695	12.539	2.050	YES
2.700	150	3.300	0.860	5.676	5.938	14.266	1.860	YES
3.000	165	3.630	0.720	5.227	5.983	15.998	1.720	YES

11 Tungsten Building
George Street
Fishersgate, BN41 1RA

Date

File Storage Estimate.SWS

Elstree Computing Ltd

Designed By

Checked By

Storm W.7.5 (c)1982-2001 Micro Drainage

STORM SEWER DESIGN by the Modified Rational MethodGlobal Variables

Location - England & Wales

Return Period (years)	100	Volumetric Runoff Coeff.	0.75
MS-60 (mm)	20	Infiltration	0
Ratio R	0.35	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Depth from Soffit to G.L. (m)	1.200
Foul Sewage (l/s/ha)	0.00	Min Vel. (m/s - Auto Design Only)	0.75
O'flow Setting (*Foul only)	0	Min Slope (1:X - Optimisation)	500

Designed with Level Soffits

Network Design Table

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
1.000	200.00	1.143	175.0	0.450	5.00	0	0.600	o	300
1.001	200.00	1.143	175.0	0.000	0.00	0	0.600	o	300

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E.Area (ha)	E.DWF (l/s)	Foul (l/s)	Infil. (l/s)	Vel (m/s)	CNF (l/s)	Flow (l/s)
1.000	50.0	7.8	1.000	0.450	0	0	0	1.19	84	61
1.001	50.0	10.6	5.957	0.450	0	0	0	1.19	84	61

11 Tungsten Building
George Street
Fishergate, BN41 1RA

Date
File 720 min 100 year.SIM
Elstree Computing Ltd

Designed By
Checked By
Simulation W.7.5 (c)1982-2001 Micro Drainage

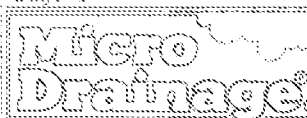


Summary of Results

Return Period (years) 100 Analysis Time Step (seconds) 120
Storm Duration (mins) 720 DVD Status OFF
Margin for Flood Risk warning (mm) 300 Inertia Status OFF

PN	Water Lev. (m)	Surcharged Depth (m)	Flooded Vol (m3)	Flow/ Capacity	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	8.267	0.967	0.000	0.26	0	21	FLD RISK
1.001	8.190	2.033	190.566	0.02	0	1	FLOOD

11 Tungsten Building
George Street
Fishergate, BN41 1AA



Date

Designed By

File 960 min 100 year.S1M

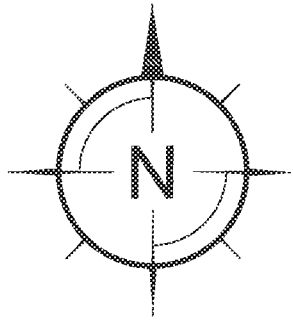
Checked By

Elstree Computing Ltd

Simulation v.7.5 (c)1992-2001 Micro Drainage

Summary of Results

Return Period (years)	100	Analysis Time Step (seconds)	160				
Storm Duration (mins)	960	OVD Status	OFF				
Margin for Flood Risk warning (mm)	300	Inertia Status	OFF				
PN	Water Lev. (m)	Surcharged Depth (m)	Flooded Vol (m3)	Flow/ Capacity	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	8.239	0.939	0.060	0.20	0	17	FLD RISK
1.001	8.192	2.035	192.301	0.02	0	1	FLOOD



Proposed adjoining West Sussex
County Council Housing Site -
100 units.

TITLE	
Potential Surface Water Drainage Plan	
SCALE	DWG NO.
1:1000	5

