STATION ROAD, RATBY

FLOOD RISK ASSESSMENT

APPENDIX 9

Modelled and Historic flood information,
provided by the Environment Agency

William O'Leary
Hannah Reed
Telford House
Fulbourn
Cambridge
CB21 5HB

Our Ref: CS 30391/EC/JR - Interim

Date: 16th July 2010

Dear Sir

Provision of Product 4 for FRA/FCA/SFRA – Station Road, Ratby

Thank you for your request of 22/06/2010 to use Environment Agency data, Product 4, in the development of the FRA/FCA/SFRA – Station Road, Ratby. The information is attached.

If you have requested this information to help inform a development proposal, then you should note the detail in the attached advisory text on the use of Environment Agency Information for Flood Risk Assessments / Flood Consequence Assessments.

Supporting Information

Our records do not show any formal raised flood defences relevant for the site.Rothley brook is classified as main river therefore we maintain and inspect it. We are cannot be specific about the standard of protection that the capacity the watercourse offers. The watercourse nearest to the site on the west is not classified as main river, we do not have powers to maintain and improve it.

Please note that we are still awaiting confirmation as to whether any SFRA have been undertaken for the site locality when we receive confirmation we will send out a final report.

This information is provided subject to the enclosed notice, which you should read.

Yours faithfully

STEVEN TUPPER
Team Leader - External Relations

For further information please contact External Relations on 0115 846 3696
Fax:- 0115 982 8319
Direct e-mail **midseast@environment-agency.gov.uk**

Enc. Detailed FRA/FCA Map
Standard Notice (Commercial)

William O'Leary
Hannah Reed
Telford House
Fulbourn
Cambridge
CB21 5HB

Our Ref: CS 30391/EC/JR - final

Date: 28th July 2010

Dear Sir

Provision of Product 4 for FRA/FCA/SFRA – Station Road, Ratby

The lower part of the site is within Flood Zone 3, which is the high risk zone and is defined for mapping purposes by the Agency's Flood Zones. Flood Zone 3 refers to land where the indicative annual probability of flooding is 1 in 100 years or less from river sources (i.e. it has a 1% or greater chance of flooding in any given year). Part of the site next to the River may be categorised as functional floodplain.

A copy of the Hinckley & Bosworth SFRA for the area is currently available online upon the Council's website.

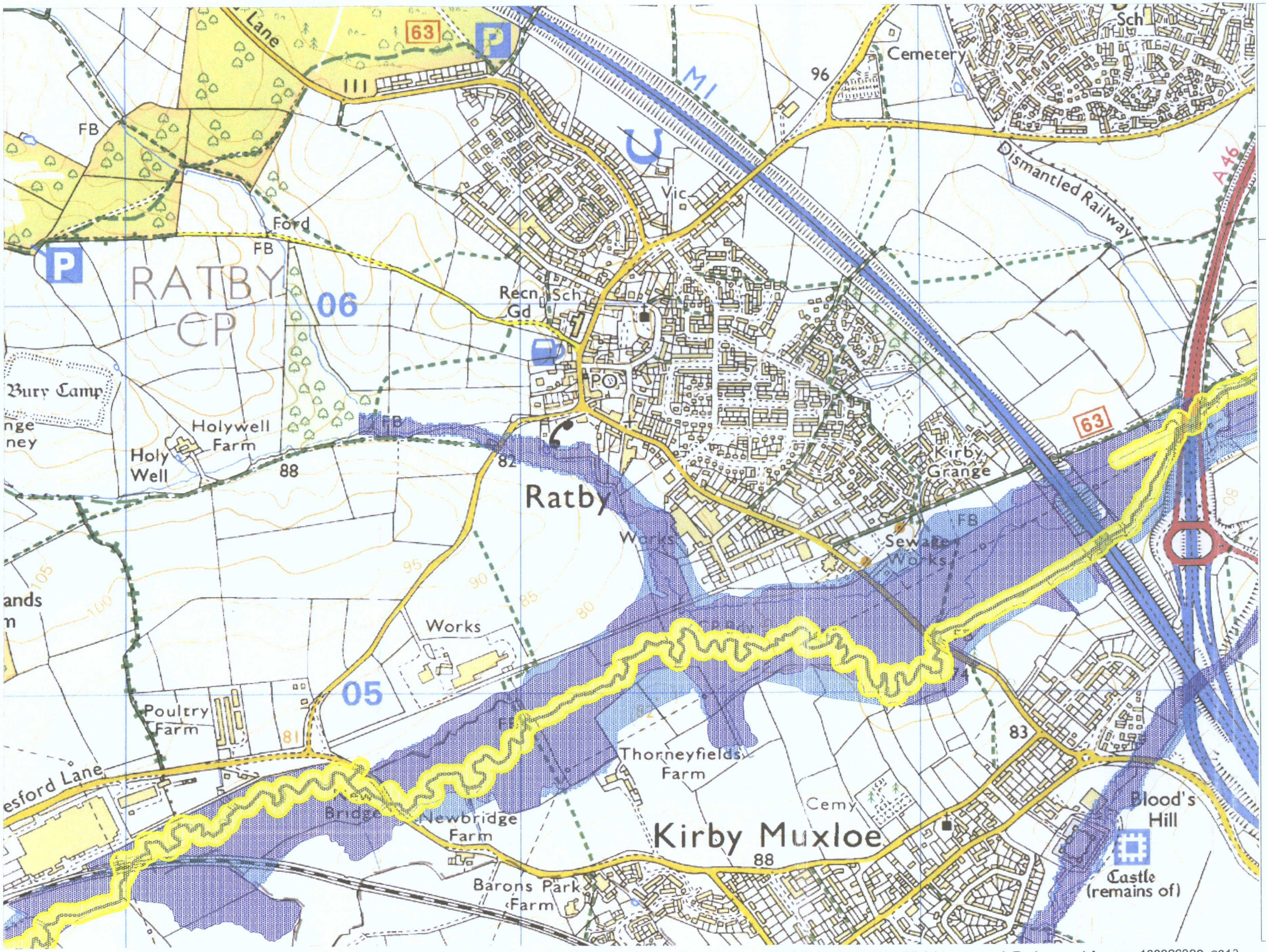
Yours faithfully

STEVEN TUPPER
Team Leader - External Relations

For further information please contact External Relations on 0115 846 3696
Fax:- 0115 982 8319
Direct e-mail **midseast@environment-agency.gov.uk**

Enc. Detailed FRA/FCA Map
Standard Notice (Commercial)

Detailed FRA/FCA Map centred on Ratby, Leicester - created 07 July 2010 Ref: [CS30391]



Environment Agency

Scale 1:10,000

N
W E
S

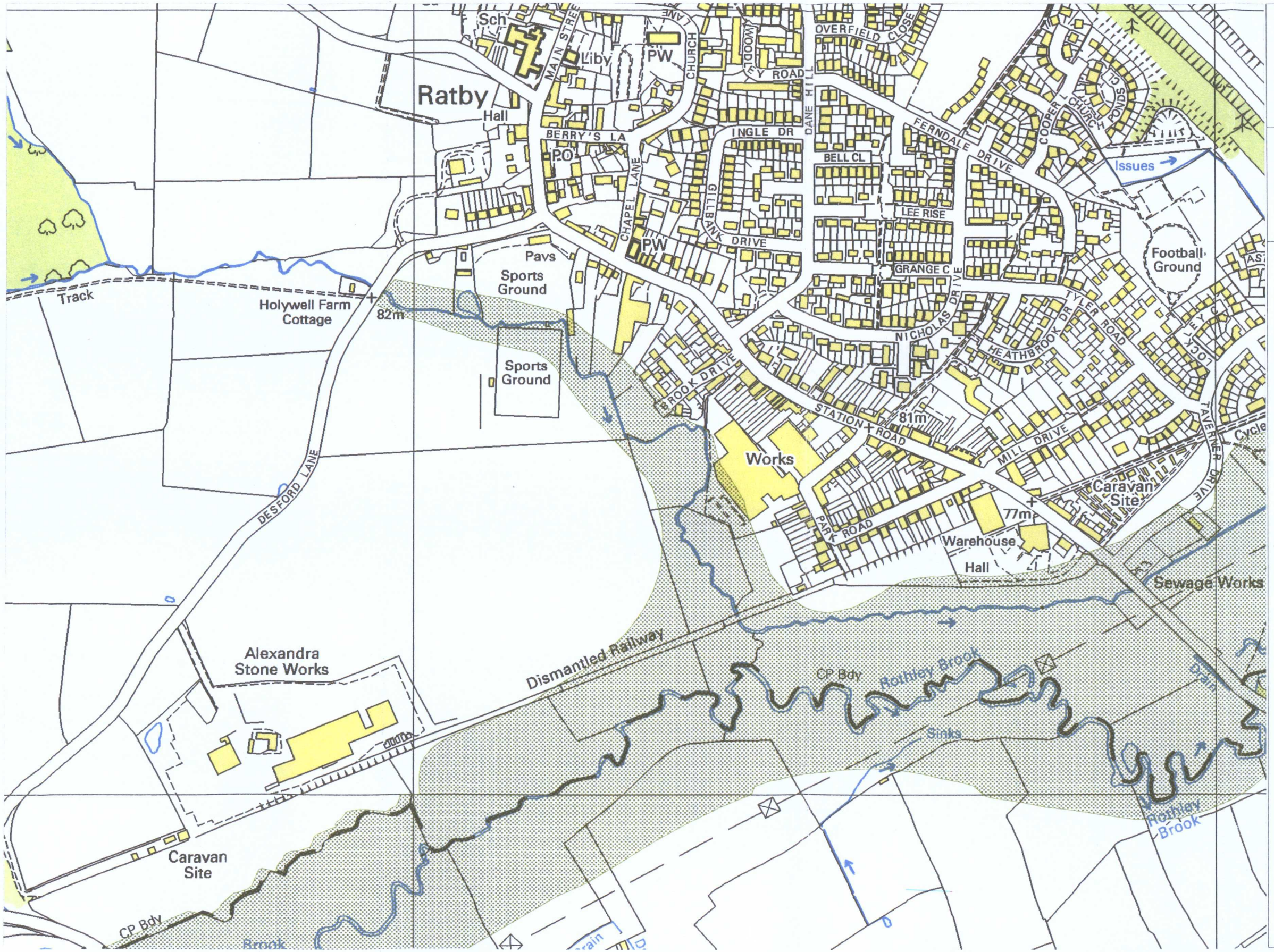
Legend

- 1% (1 in 100 year) floodplain
- 0.1% (1 in 1000 year) floodplain
- Main River
- Bank Top ePlanning Tool

© Environment Agency copyright and / or database rights 2010. All rights reserved. © Crown Copyright and database right. All rights reserved. Environment Agency, 100026380, 2010.

Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 08708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

Historic Flood Outlines Map centred on Ratby, Leicester - created 07 July 2010 Ref: [CS30391]



Environment Agency

Scale 1:5000

N W E S

Legend

1977 historic flood exent outline

© Environment Agency copyright and / or database rights 2010. All rights reserved. © Crown Copyright and database right. All rights reserved. Environment Agency, 100026380, 2010.

Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 08708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

CS30391

The following information, including the modelled extents mapping, has been produced including the effect of any local defences.

Node point reference	Location	20% (1 in 5 year) modelled level (mAOD)	10% (1 in 10 year) modelled level (mAOD)	4% (1 in 25 year) modelled level (mAOD)
R204	SK 51310 05130	76.53	76.56	76.60
R200	SK 51520 05130	75.82	75.84	75.87
R197	SK 51680 05150	75.17	75.19	75.22

Source: River Soar Flood Plain Mapping, Halcrow, February 1996

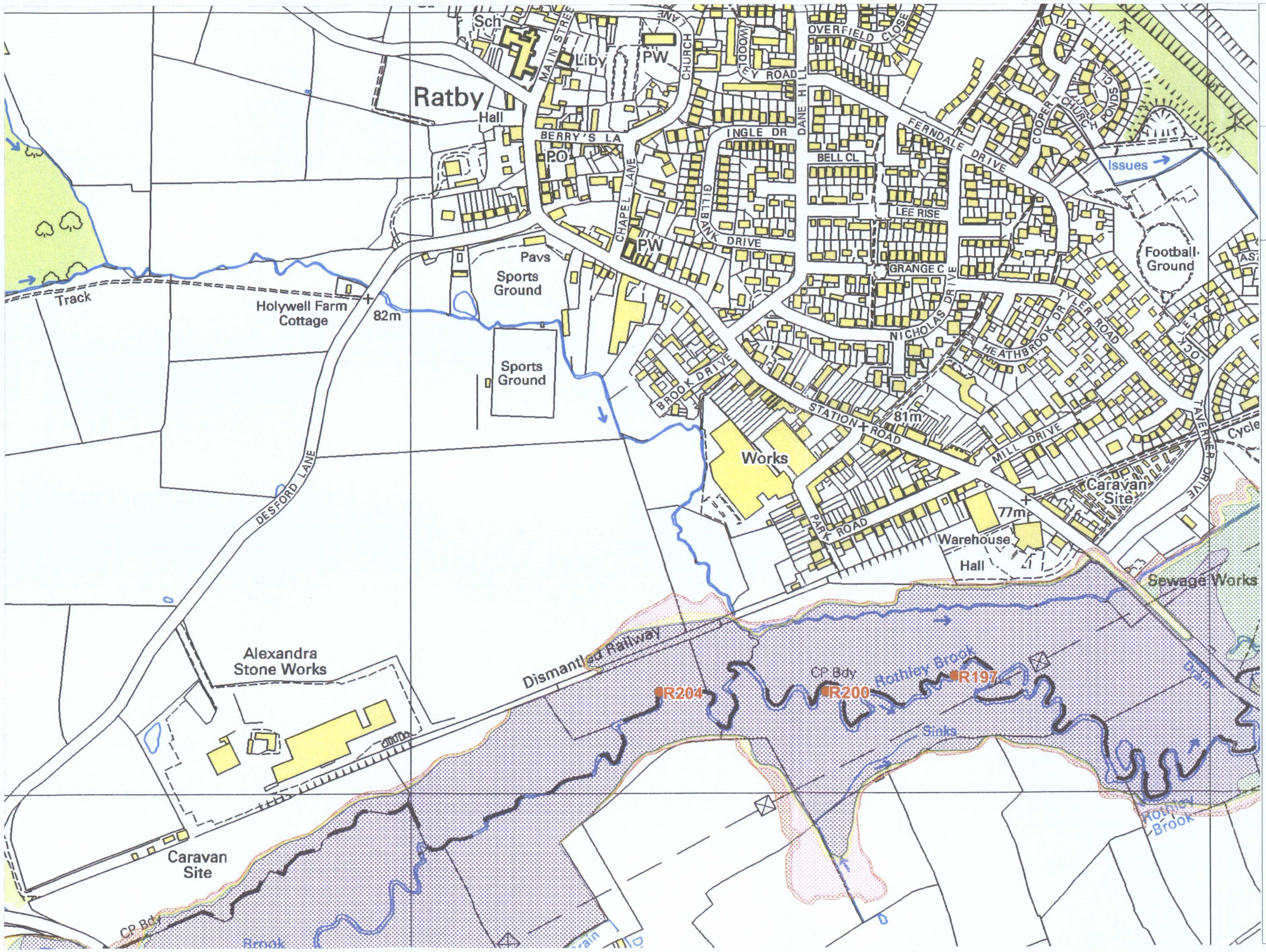
Node point reference	Location	2% (1 in 50 year) modelled level (mAOD)	1% (1 in 100 year) modelled level (mAOD)	0.67% (1 in 150 year) modelled level (mAOD)
R204	SK 51310 05130	76.63	76.66	76.67
R200	SK 51520 05130	75.90	75.92	75.93
R197	SK 51680 05150	75.25	75.27	75.29

Source: River Soar Flood Plain Mapping, Halcrow, February 1996

Historic Information

Map Reference	Flood Event Code	Name	Start Date	End Date	Source of Flooding	Cause of Flooding
1977	03412FEG1977029	19770101	1977	1977	Main river	channel capacity exceeded (no raised defences)

Modelled Flood Extents Map centred on Ratby, Leicester - created 07 July 2010 Ref: [CS30391]



Environment Agency

Scale 1:5000

N W E S

Legend

- 1 in 5 year modelled extent
- 1 in 10 year modelled extent
- 1 in 25 year modelled extent
- 1 in 50 year modelled extent
- 1 in 100 year modelled extent
- Modelled node point and reference
  Source: River Soar Flood Plain Mapping, Halcrow, February 1996

© Environment Agency copyright and / or database rights 2010. All rights reserved. © Crown Copyright and database right. All rights reserved. Environment Agency, 100026380, 2010.

Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 08708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

STATION ROAD, RATBY

FLOOD RISK ASSESSMENT

APPENDIX 10

Proposed development plans,
provided by Corporate Architecture Ltd



NO DIMENSIONS TO BE SCALED FROM THIS DRAWING, ALL DIMENSIONS TO BE CHECKED ON SITE. ANY DISCREPANCIES WITH THE DRAWINGS TO BE REPORTED AND CLARIFIED PRIOR TO COMMENCING WORKS ON SITE, IF IN DOUBT - ASK. THIS DRAWING IS COPYRIGHT.

N

0 5 10 15 20 25

Scale (m)

REV REF	REVISION DESCRIPTION	DATE	BY
-	-	-	-

mjm		

CLIENT
Mr P Cresswell
Two Spinneys
28 Stoughton Lane
Leicestershire
LE2 2FH

TITLE
Proposed Development on
Land West of The Pinfold
and south of Station Road
Ratby, Leicester
LE6 0JN

PROPOSED EXTERNAL WORKS

DATE: FEB 2010
SCALE: 1:200
DRAWING NO: 2986.PC.09.004
ISSUE NO: -

CORPORATE ARCHITECTURE Ltd

CORPORATE ARCHITECTURE LIMITED
CHARTERED ARCHITECTS
25 Leicester Road Ratby Leicester LE6 4GR
Tel: 01 16 278 9257 Fax: 01 16 2789259

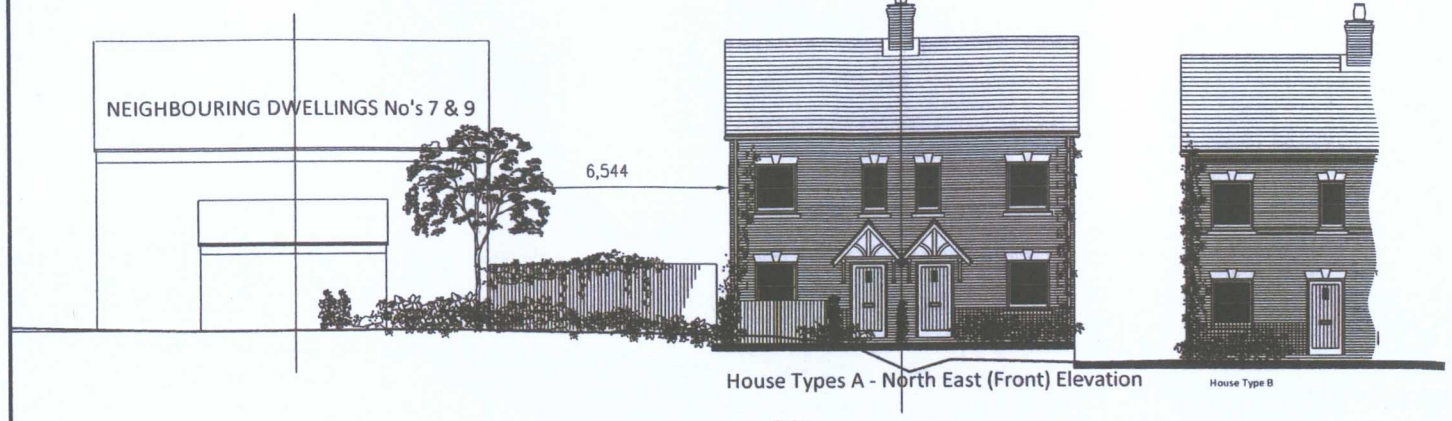
NO DIMENSIONS TO BE SCALED FROM THIS DRAWING. ALL DIMENSIONS TO BE CHECKED ON SITE. ANY DISCREPANCIES WITH THE DRAWINGS TO BE REPORTED AND CLARIFIED PRIOR TO COMMENCING WORKS ON SITE, IF IN DOUBT - ASK. THIS DRAWING IS COPYRIGHT.

THIS DRAWING HAS BEEN CREATED IN AUTOCAD - IF IN DOUBT ASK

DEFINED SCALE SET @ A1 ONLY

PDF created with pdfFactory Pro trial version www.pdffactory.com

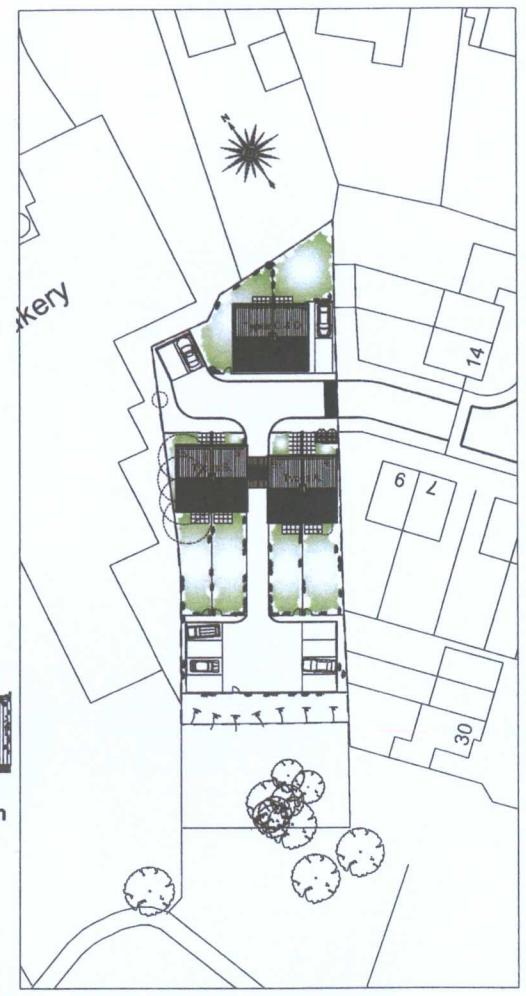
NO DIMENSIONS TO BE SCALED FROM THIS DRAWING, ALL DIMENSIONS TO BE CHECKED ON SITE. ANY DISCREPANCIES WITH THE DRAWINGS TO BE REPORTED AND CLARIFIED PRIOR TO COMMENCING WORKS ON SITE, IF IN DOUBT - ASK. THIS DRAWING IS COPYRIGHT.



House Types A - North East (Front) Elevation



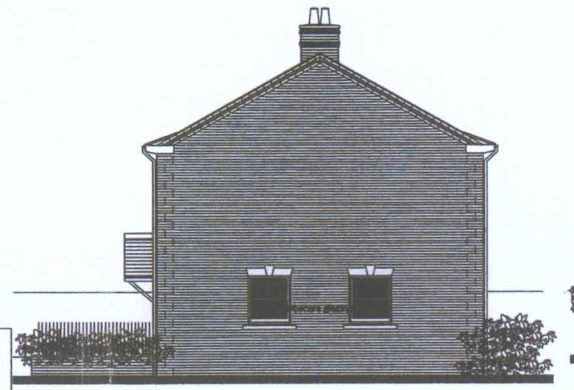
House Types A - South West (Rear) Elevation



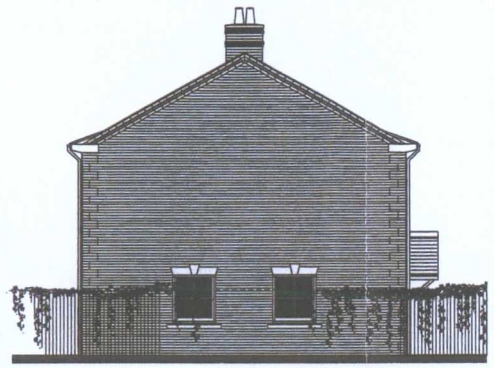
SITE BLOCK PLAN scale 1:500



House Types A- Ground Floor Plan



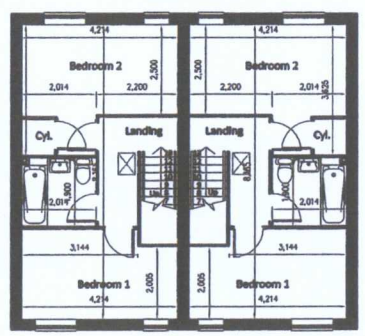
House Types A - North West (Side) Elevation



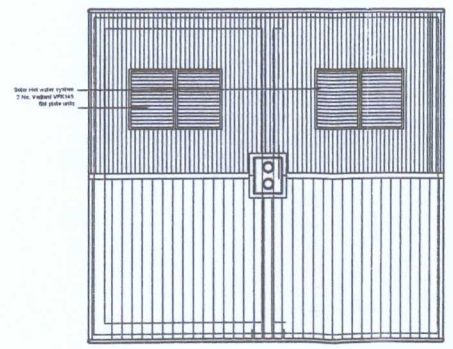
House Types A - South East (Side) Elevation

0 2 4 6 8 10

Scale (m)



House Types A - First Floor Plan



House Types A - Roof Plan

REV REF	REVISION DESCRIPTION	DATE	BY
-	-	-	-

CLIENT
Paul Cresswell &
Red Cherry Enterprises Ltd
Two Spinneys
28 Stoughton Lane
Leicestershire LE2 2FH

DATE: MAY 2010
SCALE: 1:100
DRAWING NO: 2986.PC.09.005
ISSUE NO:

TITLE
Proposed Development on
Land West of The Pinfold
and south of Station Road
Ratby, Leicester
LE6 0JN

PROPOSED HOUSE TYPE A

CORPORATE ARCHITECTURE LIMITED
CHARTERED ARCHITECTS
35 Leicester Road Ratby Leicester LE6 0GL
Tel 0116 2391357 Fax 0116 2390239

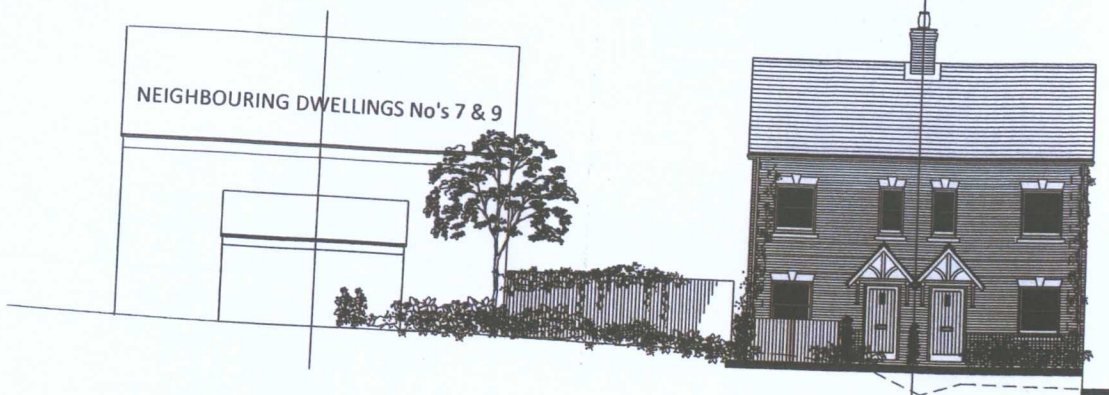
NO DIMENSIONS TO BE SCALED FROM THIS DRAWING. ALL DIMENSIONS TO BE CHECKED ON SITE. ANY DISCREPANCIES WITH THE DRAWING TO BE REPORTED AND CLARIFIED PRIOR TO COMMENCING WORKS ON SITE. IF IN DOUBT - ASK. THIS INFORMATION IS COPYRIGHT.

THIS DRAWING HAS BEEN CREATED IN A3 SCALE - IF IN DOUBT ASK

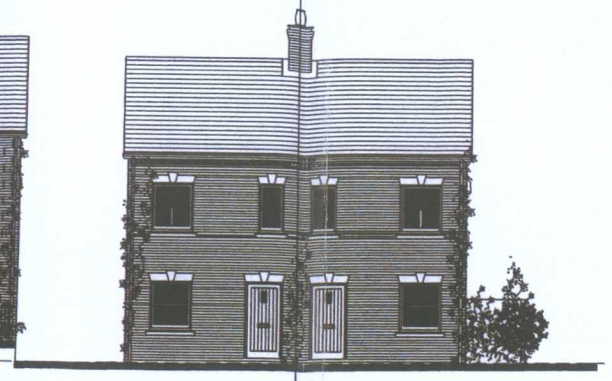
DEFINED SCALE SET @ A1 ONLY

PDF created with pdfFactory Pro trial version www.pdffactory.com

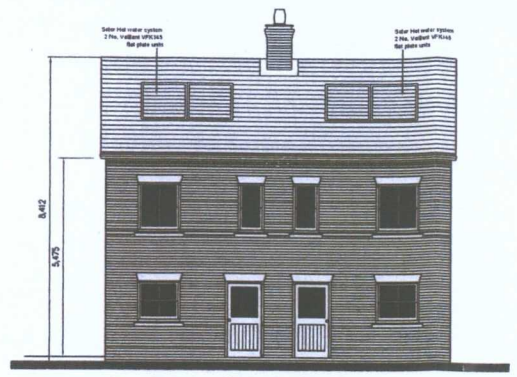
NO DIMENSIONS TO BE SCALED FROM THIS DRAWING, ALL DIMENSIONS TO BE CHECKED ON SITE. ANY DISCREPANCIES WITH THE DRAWINGS TO BE REPORTED AND CLARIFIED PRIOR TO COMMENCING WORKS ON SITE, IF IN DOUBT - ASK. THIS DRAWING IS COPYRIGHT.



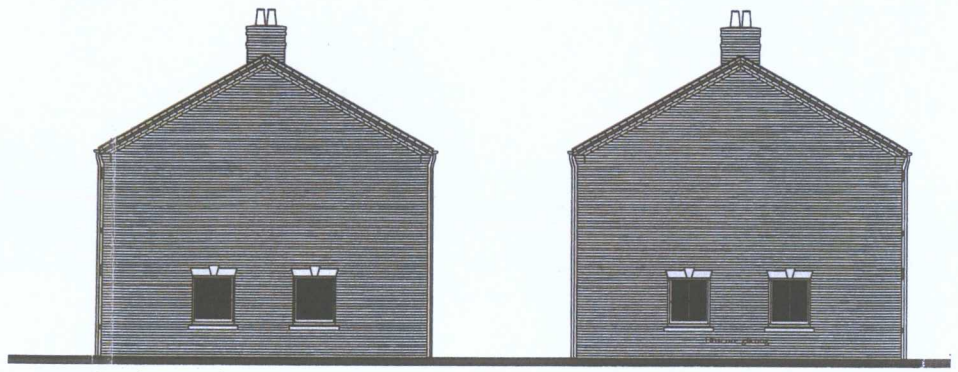
House Types A



House Types B - North East (Front) Elevation

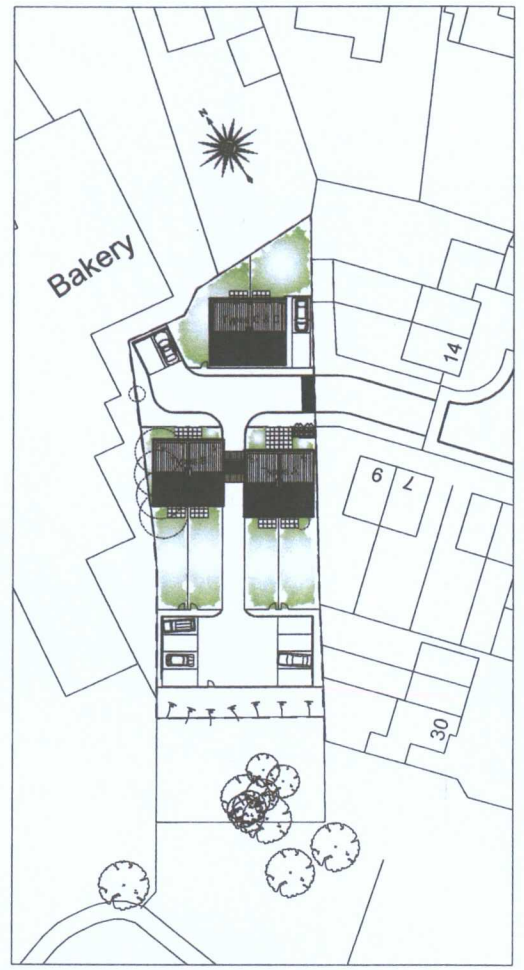


South West (Rear) Elevation



North West Elevation

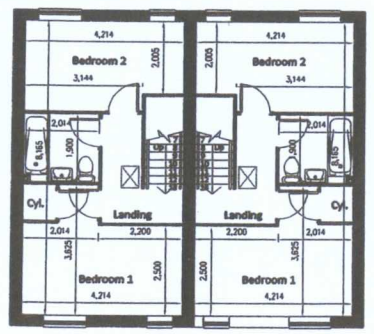
South East Elevation



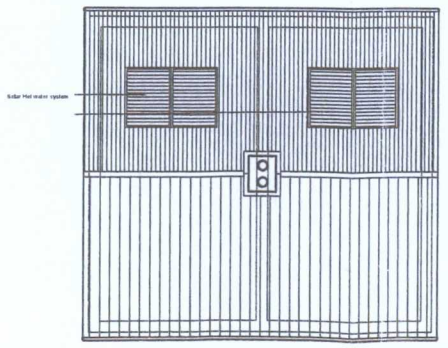
SITE BLOCK PLAN scale 1:500



House Types B - Ground Floor Plan



House Types B - First Floor Plan



House Types B - Roof Plan

REV REF	REVISION DESCRIPTION	DATE	BY
-	-	-	-

CLIENT
Paul Cresswell &
Red Cherry Enterprises Ltd
Two Spinneys
28 Stoughton Lane
Leicestershire LE2 2FH

TITLE
Proposed Development on
Land West of The Pinfold
and south of Station Road
Ratby, Leicester
LE6 0JN

PROPOSED HOUSE TYPE B

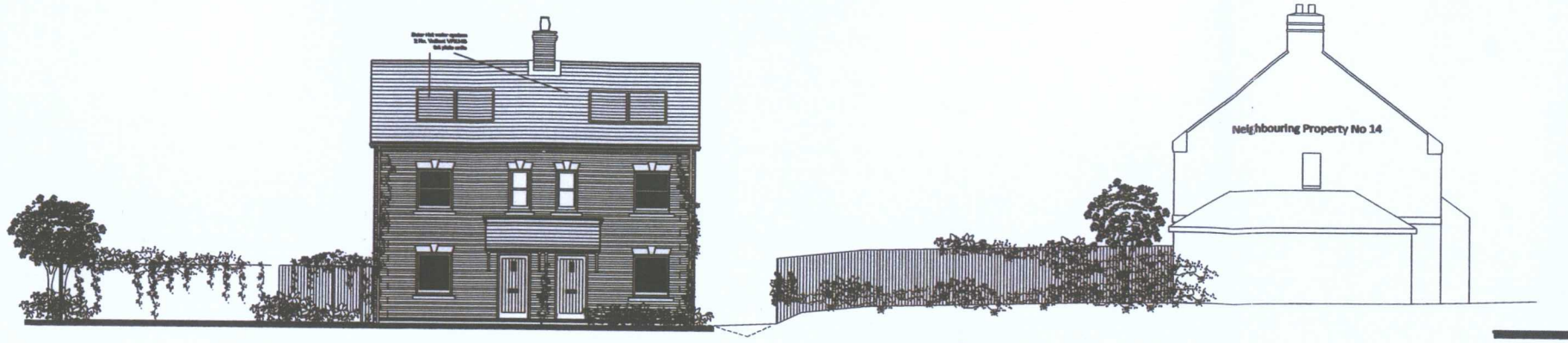
DATE: MAY 2010
SCALE: 1:100
DRAWING NO: 2986 PC 09 006
ISSUE NO: -

CORPORATE ARCHITECTURE LTD

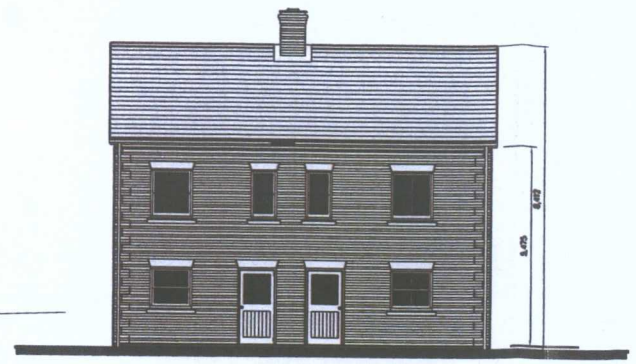
CORPORATE ARCHITECTURE LIMITED
CHARTERED ARCHITECTS
35 Lancaster Road Oadby Leicester LE2 4GE
tel 0116 2709357 fax 0116 2709359

THIS DRAWING HAS BEEN CREATED IN ACCORDANCE WITH OUR STANDARD CONDITIONS OF ENGAGEMENT AND IS COPYRIGHT.
NO DIMENSIONS TO BE SCALED FROM THIS DRAWING. ALL DIMENSIONS TO BE CHECKED ON SITE. ANY DISCREPANCIES WITH THE DRAWING TO BE REPORTED AND CLARIFIED PRIOR TO COMMENCING WORKS ON SITE. IF IN DOUBT - ASK. THIS INFORMATION IS COPYRIGHT.
DO NOT SCALE FROM THIS DRAWING, ALL DIMENSIONS TO BE CHECKED ON SITE. ANY DISCREPANCIES WITH THE DRAWING TO BE REPORTED AND CLARIFIED PRIOR TO COMMENCING WORKS ON SITE. IF IN DOUBT - ASK. THIS INFORMATION IS COPYRIGHT.
DO NOT SCALE FROM THIS DRAWING

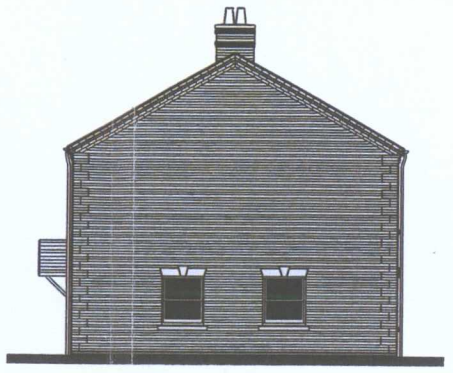
PDF created with pdfFactory Pro trial version www.pdffactory.com



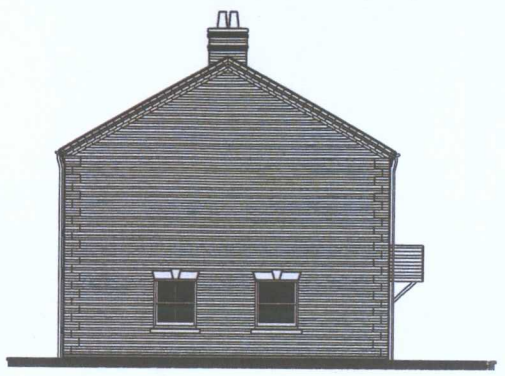
House Types C & D - South West (Front) Elevation



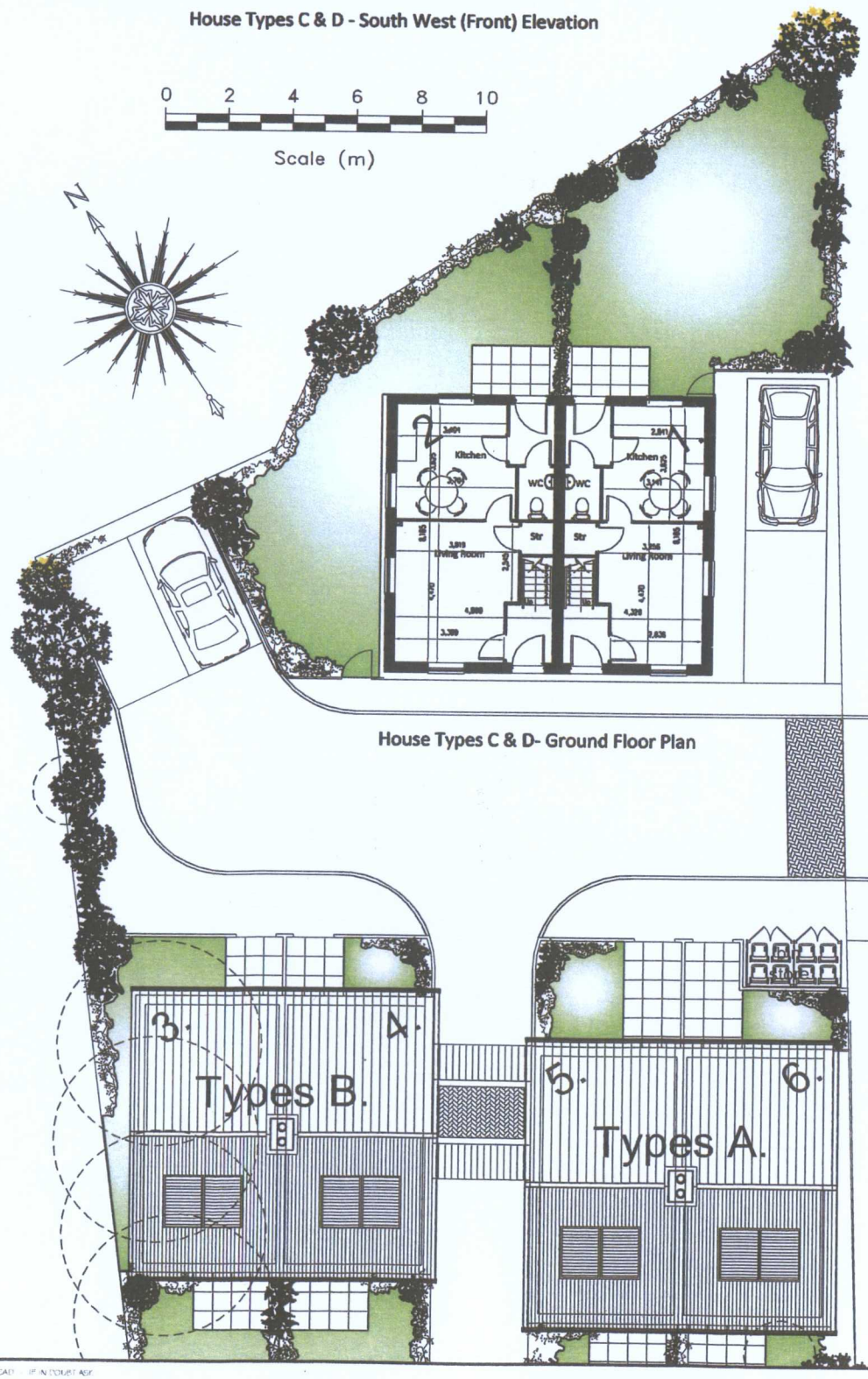
House Types C & D - North East (Rear) Elevation



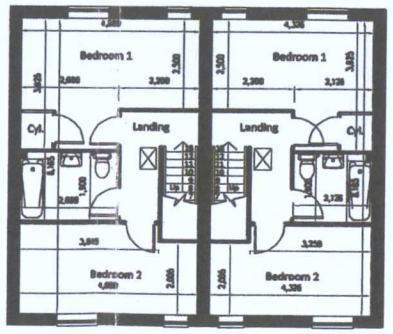
House Type D- South East Elevation



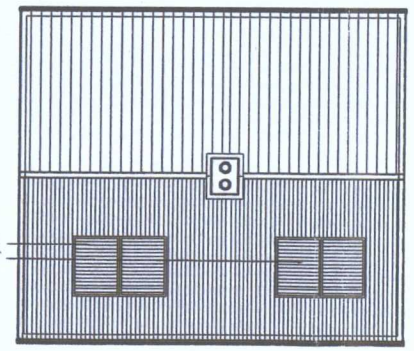
House Type C- North West Elevation



House Types C & D- Ground Floor Plan

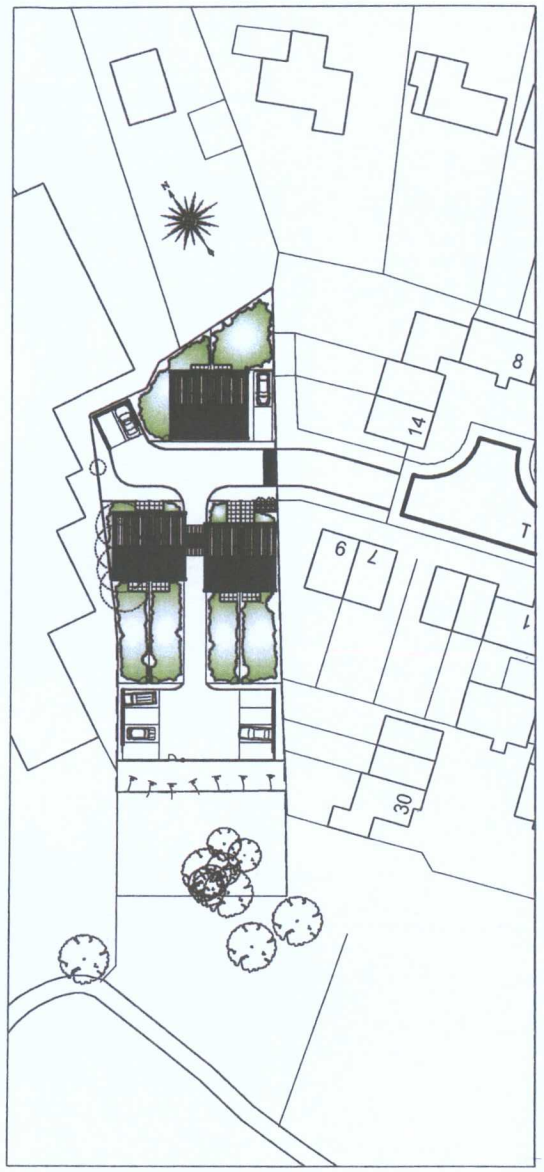


House Types C & D- First Floor Plan



House Types C & D - Roof Plan

NO DIMENSIONS TO BE SCALED FROM THIS DRAWING, ALL DIMENSIONS TO BE CHECKED ON SITE. ANY DISCREPANCIES WITH THE DRAWINGS TO BE REPORTED AND CLARIFIED PRIOR TO COMMENCING WORKS ON SITE, IF IN DOUBT - ASK. THIS DRAWING IS COPYRIGHT.



SITE BLOCK PLAN scale 1:500

REV REF	REVISION DESCRIPTION	DATE	BY
-	-	-	-

Created by: NICK

Checked by:

Date checked:

CLIENT
Paul Cresswell &
Red Cherry Enterprises Ltd
Two Spinneys
28 Stoughton Lane
Leicestershire LE2 2FH

TITLE
Proposed Development on
Land West of The Pinfold
and south of Station Road
Ratby, Leicester
LE6 0JN

PROPOSED HOUSE TYPES C & D

DATE: MAY 2010

SCALE: 1:100

DRAWING NO: 2986 PC 09 007

ISSUE NO: -

CORPORATE ARCHITECTURE LIMITED
CHARTERED ARCHITECTS
35 Lancaster Road Shirley Lancaster LE5 4GL
Tel: 0116 278 5257 Fax: 0116 2789259

NO DIMENSIONS TO BE SCALED FROM THIS DRAWING. ALL DIMENSIONS TO BE CHECKED ON SITE. ANY DISCREPANCIES WITH THE DRAWING TO BE REPORTED AND CLARIFIED PRIOR TO COMMENCING WORKS ON SITE, IF IN DOUBT - ASK. THIS INFORMATION IS COPYRIGHT.

THIS DRAWING HAS BEEN CREATED IN AUTOCAD - IF IN DOUBT ASK

DEFINED SCALE SET @ A1 ONLY

PDF created with pdfFactory Pro trial version www.pdffactory.com

STATION ROAD, RATBY

FLOOD RISK ASSESSMENT

APPENDIX 11

Runoff Calculations

Hannah, Reed and Associates

Calculation

Job no:	210120	Sheet no:	1
Date:	06/08/10	Calculation by:	AJB
File:	Greenfield Ratby	Checked by:	

Flood Studies Report - Unit Hydrograph Method of Flood Estimation
Sites < 0.5 Km2 will be calculated to a min catchmnet of 0.5 Km2

Step 1

Define catchment area from 1;25000 map	**A**	=	0.001	km2
Catchment area for use in calculation	**A**	=	0.50	km2

Step 2

Ave. annual rainfall from fig II.3.1, or from MetOffice localised data.	**SAAR**	=	676	mm

Step 3

Soil index fractions taken from fig I.4.18	Very High	**S1**	=	0
	High	**S2**	=	0
	Moderate	**S3**	=	0
	Low	**S4**	=	1
	Very Low	**S5**	=	0
		Soil	=	0.45

Step 4

QBAR rural calculated using Equation 7.1, IOH Report 124	**QBAR**	=	0.21	cu

*QBAR = 0.00108*AREA^0.89*SAAR^1.17*SOIL^2.17*

Step 5

Peak flows for 50ha area	**100yr storm**	=	0.54	cu
calculated by applying regional	**30yr storm**	=	0.41	cu
growth factors to QBAR	**2yr storm**	=	0.19	cu

(NOTE: amend hydrometric area on attached RGF worksheet tab)

Step 6

Peak flows expressed in l/s/ha	**100yr Peak**	=	10.84	l/s/ha
(see attached calculation sheet)	**30yr storm**	=	8.16	l/s/ha
	2yr storm	=	3.75	l/s/ha
	QBAR	=	4.22	l/s/ha

Step 7

Allowable outflow for site	**100yr Peak**	=	1.52	l/s
catchment area	**30yr storm**	=	1.14	l.s
	2yr storm	=	0.53	l/s
	QBAR	=	0.59	l/s

Hannah, Reed and Associates

Calculation

Job no:	210120	Sheet no:	2
Date:	06/08/10	Calculation by:	AJB
File:	Ratby FRA	Checked by:	

Flood Studies Report - Regional Growth Factors

Regional Data

Select Hydrometric Area
28

Located within Region:
Severn-Trent Region

Known Flow Data

Flood Return Period
QBAR
(do not amend for IOH124 calculation)
Peak Flow for QBAR Event
0.21 *cumecs based on catchment area of 50 ha

Regional Growth Factors Applied

Flood Event	Growth Factor	Peak Flow
QBAR	1.00	0.21 *
1 in 2 years	0.89	0.19 *
1 in 5 years	1.23	0.26 *
1 in 10 years	1.49	0.31 *
1 in 25 years	1.87	0.39 *
1 in 30 years	1.94	0.41 *
1 in 50 years	2.20	0.46 *
1 in 100 years	2.57	0.54 *
1 in 200 years	2.98	0.63 *

Natural Rates of Run-off

Flood Event	Allowable Discharge
QBAR	4.22 l/s/ha
1 in 2 years	3.75 l/s/ha
1 in 5 years	5.19 l/s/ha
1 in 10 years	6.28 l/s/ha
1 in 25 years	7.89 l/s/ha
1 in 30 years	8.16 l/s/ha
1 in 50 years	9.28 l/s/ha
1 in 100 years	10.84 l/s/ha
1 in 200 years	12.57 l/s/ha

Qbar Urban Calculation **Ratby Leicestershire**

Existing Site

CIND	32.84
NC	0.75776

Equation 7.2 on page 37 of Report 124
Equation 7.3 on page 38 of Report 124

SOIL = 0.4 from greenfield 124 method based on FSR, CWI = 96.0 based on FEH catchment descriptors
SAAR = 676mm from FSR method

QBAR(urban)/QBAR (rural)	1

Equation 7.4 on page 38 of Report 124

(Part A	1
(Part B	1

Stage 1 of Equation 7.4)
Stage 2 of Equation 7.4)

Existing URBAN	0.00
QBAR (urban) existing	**0.21**

total site 100% permeable

QBAR(rural) = 0.21 from greenfield 124 method

Proposed Site

CIND	32.84
NC	0.75776

Equation 7.2 on page 37 of Report 124
Equation 7.3 on page 38 of Report 124

SOIL = 0.4 from greenfield 124 method based on FSR, CWI = 96.0 based on FEH catchment descriptors
SAAR = 676mm from FSR method

QBAR(urban)/QBAR (rural)	1.664107

Equation 7.4 on page 38 of Report 124

(Part A	1.5056603
(Part B	1.1052339

Stage 1 of Equation 7.4)
Stage 2 of Equation 7.4)

Proposed URBAN as % of total	0.31
QBAR (urban) proposed	**0.349462**

31% impermeable (545m imp on 1737m total site area)
Value used in Qbar box on proposed IOH calc Sheet

QBAR(rural) = 0.21 from greenfield 124 method

Hannah, Reed and Associates

Calculation

Job no:	210120	Sheet no:	1
Date:	06/08/10	Calculation by:	AJB
File:	Proposed Ratby	Checked by:	

Flood Studies Report - Unit Hydrograph Method of Flood Estimation
Sites < 0.5 Km2 will be calculated to a min catchmnet of 0.5 Km2

Step 1

Define catchment area from 1;25000 map	**A**	=	0.001	km2
Catchment area for use in calculation	**A**	=	0.50	km2

Step 2

Ave. annual rainfall from fig II.3.1, or from MetOffice localised data.	**SAAR**	=	676	mm

Step 3

Soil index fractions taken from fig I.4.18	Very High	**S1**	=	0
	High	**S2**	=	0
	Moderate	**S3**	=	0
	Low	**S4**	=	1
	Very Low	**S5**	=	0
		Soil	=	0.45

Step 4

QBAR rural calculated using Equation 7.1, IOH Report 124	**QBAR**	=	0.35	cu

*QBAR = 0.00108*AREA^0.89*SAAR^1.17*SOIL^2.17*

Step 5

Peak flows for 50ha area	**100yr storm**	=	0.90	cu
calculated by applying regional	**30yr storm**	=	0.68	cu
growth factors to QBAR	**2yr storm**	=	0.31	cu

(NOTE: amend hydrometric area on attached RGF worksheet tab)

Step 6

Peak flows expressed in l/s/ha	**100yr Peak**	=	17.96	l/s/ha
(see attached calculation sheet)	**30yr storm**	=	13.53	l/s/ha
	2yr storm	=	6.22	l/s/ha
	QBAR	=	6.99	l/s/ha

Step 7

Allowable outflow for site	**100yr Peak**	=	2.51	l/s
catchment area	**30yr storm**	=	1.89	l.s
	2yr storm	=	0.87	l/s
	QBAR	=	0.98	l/s

Hannah, Reed and Associates

Calculation

Job no:	210120	Sheet no:	2
Date:	06/08/10	Calculation by:	AJB
File:	Ratby FRA	Checked by:	

Flood Studies Report - Regional Growth Factors

Regional Data

Select Hydrometric Area
28

Located within Region:
Severn-Trent Region

Known Flow Data

Flood Return Period
QBAR
(do not amend for IOH124 calculation)
Peak Flow for QBAR Event
0.35 *cumecs based on catchment area of 50 ha

Regional Growth Factors Applied

Flood Event	Growth Factor	Peak Flow
QBAR	1.00	0.35 *
1 in 2 years	0.89	0.31 *
1 in 5 years	1.23	0.43 *
1 in 10 years	1.49	0.52 *
1 in 25 years	1.87	0.65 *
1 in 30 years	1.94	0.68 *
1 in 50 years	2.20	0.77 *
1 in 100 years	2.57	0.90 *
1 in 200 years	2.98	1.04 *

Natural Rates of Run-off

Flood Event	Allowable Discharge
QBAR	6.99 l/s/ha
1 in 2 years	6.22 l/s/ha
1 in 5 years	8.60 l/s/ha
1 in 10 years	10.41 l/s/ha
1 in 25 years	13.07 l/s/ha
1 in 30 years	13.53 l/s/ha
1 in 50 years	15.37 l/s/ha
1 in 100 years	17.96 l/s/ha
1 in 200 years	20.82 l/s/ha

STATION ROAD, RATBY

FLOOD RISK ASSESSMENT

APPENDIX 12

Proposed Impermeable Areas Plan



Proposed Impermeable Area

Rev	Description	Dr	Ch	Date

Client: Corporate Architecture Ltd

Project: Flood Risk Assessment
Station Road, Ratby

Title: Appendix 12
Impermeable Area Plan

Hannah · Reed
Telford House, Fulbourn, Cambridge. CB21 5HB
Telephone: 01223 882000
Fax: 01223 881888
e-mail: cambridge@hannahreed.co.uk

Sheet Size	A3
Scale	1:250,000
Drawn	AJB
Checked	
Approved	
Drawing Number	C210120/101
Rev	P1

©This drawing is the copyright of Hannah Reed & Associates Limited and shall not be reproduced without permission

LAST PLOT DATE: 11/8/2010 11:12 AM

CAD FILENAME: \\Camserv3\project folders\2010 Projects\C-210120-Station Rd, Ratby - FRA\DRAWINGS\Area Calc version.dwg

STATION ROAD, RATBY

FLOOD RISK ASSESSMENT

APPENDIX 13

Preliminary Storage Calculations

Hannah·Reed

Job no:	C-210120	Sheet no:	FEH 2
Calculation by:	AJB	Revision:	P1
Checked by:	O	Date:	09-Aug-10

Preliminary Estimate of Storage

Flood Estimation Handbook: Volume 2 Rainfall Frequency Estimation

Return Period	100		
Climate Change	30		% increase due to climate change
Gross Area	0.05	ha	
Impermeable factor	100	%	Enter 100 if no 'rural contribution'
Impermeable area	0.05	ha	Note: entry will overwrite formulae
Time of conc.	0.00	mins	time of entry + time of flow
Allowable outflow	10.8	l/s/ha	Also used for non-imperm run-off
Outlet factor	0.70		Vortex control=0.7,Orifice=0.58
Site outflow	0.41	l/s	Outflow reduced by outlet factor
Other losses	Optional	l/s	i.e abstractions, soakage etc.
Dilapidation	10.00	%	Percentage increase for siltation

Time (hrs)	Rain mm	Inflow m^3 urban	Inflow m^3 rural	Outflow m^3 allow	Outflow m^3 other	Storage m^3	Storage +dilap
0.5	44.9	24	0	1	0	24	26
1.0	54.0	29	0	1	0	28	31
2.0	64.6	35	0	3	0	32	35
3.0	71.6	39	0	4	0	35	38
4.0	76.9	42	0	6	0	36	40
6.0	85.1	46	0	9	0	37	41
8.0	91.4	50	0	12	0	38	42
10.0	96.5	53	0	15	0	38	41
12.0	100.9	55	0	18	0	37	41
16.0	108.0	59	0	24	0	35	39
20.0	113.9	62	0	30	0	32	36
24.0	118.9	65	0	36	0	29	32
36.0	130.8	71	0	54	0	18	19
48.0	139.9	76	0	71	0	5	5
72.0	147.7	81	0	107	0	0	0
96.0	153.5	84	0	143	0	0	0
144.0	162.1	88	0	214	0	0	0
192.0	168.4	92	0	286	0	0	0
240.0	173.5	95	0	357	0	0	0

Storage Required	42	m^3	Including 10% dilapidation allowance

STATION ROAD, RATBY

FLOOD RISK ASSESSMENT

APPENDIX 14

Glossary of Terms
PPS25 Development and Flood Risk: The Sequential Test
FCDPAG Indicative Standards of Protection

GLOSSARY OF TERMS AND ABBREVIATIONS

Attenuation	Slowing down the rate of flow to prevent flooding and erosion, with a consequent increase in the duration of the flow.
Balancing pond	A pond designed to attenuate flows by storing runoff during peak periods and releasing the water after the flood peak has passed. The pond always contains water. Storage periods may not be long enough to improve water quality.
Catchment	A river catchment is the whole area which drains either naturally or with artificial assistance to a river. It includes the drainage channels, tributaries, floodplains and washlands associated with a river and an estuary where one is present.
Climate Change	Flood risk may increase due to environmental changes, and one of the key uncertainties in assessing flood risk at present is the extent to which climate is changing and may change in the future. Annex B of PPS25 advocates a precautionary approach to deal with the uncertainties of how climate change may affect sea levels, river flows and flood risk. Current best practice recommends allowing for a 10% increase in peak rainfall intensity and a 20% increase in peak river flow to 2055. Recommended allowances for net sea level rise in the East of England are 4mm/yr to 2025 and then 8.5mm/yr onwards to 2055.
Critical ordinary watercourse	Ordinary watercourses which the Environment Agency and other operating authorities agree are critical because they have the potential to put large numbers of people and property at risk from flooding.
Design flood level	The flood level to which defences or mitigation measures are designed. This is typically the 1% (1 in 100 year) flood level. More extensive flooding and higher levels due to more extreme conditions than the design event or as a result of obstructions of the watercourse may occur at any time.
Development	In accordance with the definitions given in Section 55 of the Town and Country Planning Act 1990, with certain exceptions development means the carrying out of building, engineering, mining or other operations, in on over or under land or the making of any material change in use of any buildings or other land.
Drainage (land drainage)	The Water Resources Act 1991 (as amended by the Environment Act 1995) defines drainage as including: a) defence against water, including sea water; b) irrigation other than spray irrigation; c) warping; and d) the carrying on, for any purpose, of any other practice which involves management of the level of water in a watercourse.
Exception Test	If, following application of the Sequential Test (see below), it is not possible for proposed development to be located in zones of lower probability of flooding, the Exception Test can be applied as detailed in Annex D of PPS25. For the Exception Test to be passed the Flood Risk Assessment must demonstrate the proposed development provides wider sustainability benefits to the community that outweigh the estimated flood risk.

Flood defence	Flood defence means the drainage of land (as defined above), and the provision of flood warning systems.
Flood Estimation Handbook (FEH)	The primary national guide to flood probability estimation in the UK, developed by CEH Wallingford. The use of the FEH ensures national consistency in estimating the probability of flooding, although users must be aware of the need to exercise good judgment and recognise the uncertainty inherent in flood estimation. Prediction of flood flows is not an exact science and therefore the results of estimation cannot be guaranteed and the user makes use of them at his own risk.
Flood return period/risk	The risk of flooding to floodplain areas and property is often described in terms of a return period. Statistical return periods relate to the long term average time interval between events of a particular magnitude. The 1 in 100 year return period flood has a one percent chance of occurring in any one year, i.e. the odds of it happening are one hundred to one. It does not mean that flooding of this magnitude will only occur once every 100 years.
Flood Zone Maps	These were produced by the Environment Agency after the 1998 and 2000 floods to improve public awareness of flood risk and updated in 2004 alongside the release of the new FRA guidance. The floodplain envelopes indicate where flooding from rivers, streams, watercourses or the sea is possible or has occurred, but ignore the presence of all flood defences such as embankments, pumping stations and walls, although the locations of flood defence structures are indicated. The maps therefore only give a general indication of potential areas at risk of flooding, generally based on either 1% probability assessments or historic flood levels. (www.environment-agency.gov.uk/subjects/flood/?lang=_e)
Flooding	Inundation by river or sea water whether caused by inadequate or slow drainage, or by breaches or overtopping of banks or defences.
Floodplain	All land adjacent to a watercourse over which water flows in times of flood.
Greenfield	Land which has not been developed.
Greenfield rate of runoff	Rate of water flow which would occur over the ground surface of undeveloped land to the drainage system.
Hydrology	The study of water resources
Main River	Watercourses shown as such on the statutory main river maps held by the Department for Environment, Food and Rural Affairs. Main rivers are maintained by the Environment Agency and are generally larger arterial watercourses.
Ordinary Watercourses	Any watercourse that does not form part of Main River. Internal Drainage Boards maintain certain designated common watercourses within Internal Drainage Districts. Local Authorities maintain certain 'awarded' common watercourses and highway ditches outside Internal Drainage Districts. Generally, other common watercourses are the responsibility of riparian owners.
PAGN/FCDPAG	The DEFRA Flood and Coastal Defence Project Appraisal Guidance (FCDPAG) documents provide advice on best practice for the appraisal of flood and coastal defence projects. A brief

	summary of these documents and the applicable standards (tables 6.1 & 6.2) are appended to this glossary.
PPS25	Planning Policy Statement 25: Development and Flood Risk is a document published by Communities and Local Government in December 2006. PPS25 explains how flood risk should be considered at all stages of the planning and development process in order to reduce future damage to property and loss of life.
Riparian	Relating to, or situated on the banks of a river or watercourse.
Runoff	Water flow over the ground surface to the drainage system. This occurs if the ground is impermeable or if permeable ground is saturated.
Sequential test	Annex D of PPS25 advocates that planners use a sequential test when considering land allocations for development to avoid flood risk where possible. Details of this test are summarised in the PPS25 Table 1, appended to this glossary.
Soakaway	A subsurface structure into which surface water is conveyed, designed to promote infiltration.
Source Control	The control of runoff at or near its source.
Storage Compensation	Due to the cumulative impacts of developments on the extent and function of the floodplain, the EA may require compensation storage to be provided at a site where a loss of storage in the floodplain occurs, irrespective of the negligible impacts of individual developments. In other words, an area of ground above the floodplain level must be found that can be excavated to compensate for the floodplain storage volume lost by developing the building area. In addition, the EA may insist that compensation is provided on a 'level-for-level' basis, i.e. providing compensation areas at the same level as where storage has been lost, so that there is a minimal impact on the flood patterns in the area.
SuDS	Sustainable Drainage Systems: A strategy, supported by a range of techniques, for dealing with surface water drainage that seeks to promote sustainable and environmentally beneficial or least damaging solutions. Developing a 'greenfield' site can significantly alter the way rainfall runs off the site. Impermeable areas such as tarmac mean that rainwater cannot infiltrate into the ground, and is instead channelled directly into rivers via drains and sewers. Flood risk may therefore be increased by the rapid flow of surface water run-off from developed areas into the watercourse. SuDS were developed initially with urban drainage in mind but the approach has broad application over all development drainage. SuDS techniques include Source Control.
Swale	A grass-lined channel designed to drain water from a site as well as controlling the flow and quality of the surface water.
Watercourse	Any natural or artificial channel which conveys surface water.
Wetland	A pond that has a high proportion of emergent vegetation in relation to open water that provides a variety of habitats.

PPS25 DEVELOPMENT AND FLOOD RISK: THE SEQUENTIAL TEST

PPS25 advocates that planners use a sequential test when considering land allocations for development to avoid flood risk where possible. The risk of flooding to the site should be assessed and the land should be classified into the appropriate flood zone as described in below (Table D.1 of PPS25). In areas at risk of river or sea flooding, preference should be given to locating new development in Flood Zone 1. If there is no reasonably available site in Flood Zone 1, the flood risk vulnerability of the proposed development (Table D.2 of PPS25) can be taken into account in locating development in Flood Zones 2 and then Flood Zone 3 through applying the Exception Test if required. Within each Flood Zone new development should be directed to sites at the lowest probability of flooding from all sources.

Table D.1: Flood Zones

(NB: Flood Zones refer to the probability of river and sea flooding, ignoring the presence of defences)

Flood Zones	
Zone 1: Low Probability Annual probability of flooding: River, tidal & coastal <0.1%	*Appropriate uses*: All uses of land are appropriate in this zone. *FRA requirements*: For development proposals on sites comprising one hectare or above the vulnerability to flooding from other sources as well as from river and sea flooding, and the potential to increase flood risk elsewhere through the addition of hard surfaces and the effect of the new development on surface water run-off, should be incorporated in a FRA. This need only be brief unless the factors above or other local considerations require particular attention. See Annex E for minimum requirements. *Policy aims:* In this zone, developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area and beyond through the layout and form of the development, and the appropriate application of sustainable drainage techniques.
Zone 2: Medium Probability Annual probability of flooding: River 0.1 – 1.0% Tidal & coastal 0.1 – 0.5%	*Appropriate uses*: The water-compatible, less vulnerable and more vulnerable uses of land and essential infrastructure in Table D.2 are appropriate in this zone. *FRA requirements*: All development proposals in this zone should be accompanied by a FRA. See Annex E for minimum requirements. *Policy aims*: In this zone, developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area through the layout and form of the development, and the appropriate application of sustainable drainage techniques.

Flood Zones (continued)	
Zone 3a: High Probability Annual probability of flooding, with defences where they exist: River 1.0% or greater Tidal & coastal 0.5% or greater	*Appropriate uses*: The water-compatible and less vulnerable uses of land in Table D.2 are appropriate in this zone. The highly vulnerable uses in Table D.2 should not be permitted in this zone. The more vulnerable and essential infrastructure uses in Table D.2 should only be permitted in this zone if the Exception Test is passed. Essential infrastructure permitted in this zone should be designed and constructed to remain operational and safe for users in times of flood. *FRA requirements*: All development proposals in this zone should be accompanied by a FRA. See Annex E for minimum requirements. *Policy aims*: In this zone, developers and local authorities should seek opportunities to: (i) reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage techniques; (ii) relocate existing development to land in zones with a lower probability of flooding; (iii) create space for flooding to occur by restoring functional floodplain and flood flow pathways and by identifying, allocating and safeguarding open space for flood storage.
Zone 3b: The Functional Floodplain Annual probability of flooding: River 5% or greater Or, is designed to flood in an extreme (0.1%) flood, or at another probability to be agreed between the Local Planning Authority and Environment Agency, including water conveyance routes.	*Appropriate uses*: Only the water-compatible uses and the essential infrastructure listed in Table D.2 that has to be there should be permitted in this zone. It should be designed and constructed to: - remain operational and safe for users in times of flood; - result in no net loss of floodplain storage - not impede water flows; and - not increase flood risk elsewhere. Essential infrastructure in this zone should pass the Exception Test. *FRA requirements*: All development proposals in this zone should be accompanied by a FRA. See Annex E for minimum requirements. *Policy aims*: In this zone, developers and local authorities should seek opportunities to: (i) reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage techniques; and (ii) relocate existing development to land in zones with a lower probability of flooding.

Table D.2: Flood Risk Vulnerability Classification

Essential Infrastructure	• Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk, and strategic utility infrastructure, including electricity generating power stations and grid and primary substations.
Highly Vulnerable	• Police stations, Ambulance stations and Fire stations and Command Centres and telecommunications installations required to be operational during flooding. • Emergency dispersal points. • Basement dwellings. • Caravans, mobile homes and park homes intended for permanent residential use. • Installations requiring hazardous substances consent.
More Vulnerable	• Hospitals. • Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels. • Buildings used for: dwelling houses; student halls of residence; drinking establishments; nightclubs; and hotels. • Non-residential uses for health services, nurseries and educational establishments. • Landfill and sites used for waste management facilities for hazardous waste. • Sites used for holiday or short-let caravans and camping, **subject to a specific warning and evacuation plan.**
Less Vulnerable	• Buildings used for: shops, financial, professional and other services; restaurants and cafes; hot food takeaways; offices; general industry; storage and distribution; non-residential institutions not included in 'more vulnerable'; and assembly and leisure. • Land and buildings used for agriculture and forestry. • Waste treatment (except landfill and hazardous waste facilities). • Minerals working and processing (except for sand and gravel working). • Water treatment plants. • Sewage treatment plants (if adequate pollution control measures are in place).
Water-compatible Development	• Flood control infrastructure. • Water transmission infrastructure and pumping stations. • Sewage transmission infrastructure and pumping stations. • Sand and gravel workings. • Docks, marinas and wharves. • Navigation facilities. • MOD defence installations. • Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location. • Water-based recreation (excluding sleeping accommodation).

	• Lifeguard and coastguard stations. • Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms. • Essential ancillary sleeping or residential accommodation for staff required by uses in this category, **subject to a specific warning and evacuation plan**.

Notes:

1) This classification is based partly on DEFRA/Environment Agency research on Flood Risks to People (FD2321/TR2) and also on the need of some uses to keep functioning during flooding.

2) Buildings that combine a mixture of uses should be placed into the higher of the relevant classes of flood risk sensitivity. Developments that allow uses to be distributed over the site may fall within several classes of flood risk sensitivity.

3) The impact of a flood on the particular uses identified within this flood risk vulnerability classification will vary within each vulnerability class. Therefore, the flood risk management infrastructure and other risk mitigation measures needed to ensure the development is safe may differ between uses within a particular vulnerability classification.

FCDPAG INDICATIVE STANDARDS OF PROTECTION

The DEFRA Flood and Coastal Defence Project Appraisal Guidance (FCDPAG) documents provide advice on best practice for the appraisal of flood and coastal defence projects. Volume 3: Economic Appraisal gives indicative standards for flood and coastal defence in England and Wales. The tables below are provided "as an aid to authorities to help in establishing the range of options to be considered, though they should not constrain the need to consider a full range of alternatives. They do not represent any entitlement to protection or minimum level to be achieved". Please refer to the FCDPAG documents at http://www.defra.gov.uk/environ/fcd/pubs/pagn/default.htm for further information.

Table 6.1 Indicative standards of protection

Land use band	*Indicative standards of protection*			
	Fluvial		**Coastal**	
	Return period (years)	**Annual probability of failure**	**Return period (years)**	**Annual probability of failure**
A	50-200	0.005-0.02	100-300	0.003-0.01
B	25-100	0.01-0.04	50-200	0.005-0.02
C	5-50	0.02-0.20	10-100	0.01-0.10
D	1.25-10	0.10-0.80	2.5-20	0.05-0.40
E	<2.5	>0.40	<5	>0.20

The standards shown in Table 6.1 are determined by land use bands, as defined in Table 6.2 below.

Table 6.2 Description of Land Use Bands

Land use band	*Indicative range of housing units (or equivalent) per km of coastline or single river bank*	*Description*
A	>=50	Typically intensively developed urban areas at risk from flooding and/or erosion
B	>=25 to <50	Typically less intensive urban areas with some high-grade agricultural land and/or environmental assets of international importance requiring protection.
C	>=5 to <25	Typically large areas of high-grade agricultural land and/or environmental assets of national significance requiring protection with some properties also at risk, including caravans and temporary structures.
D	>=1.25 to <5	Typically mixed agricultural land with occasional, often agriculturally related, properties at risk. Agricultural land may be prone to flooding, water logging or coastal erosion. May also apply to environmental assets of local significance.
E	>0 to <1.25	Typically low-grade agricultural land, often grass, at risk from flooding, impeded land drainage or coastal erosion, with isolated agricultural or seasonally occupied properties at risk, or environmental assets at little risk from frequent inundation.