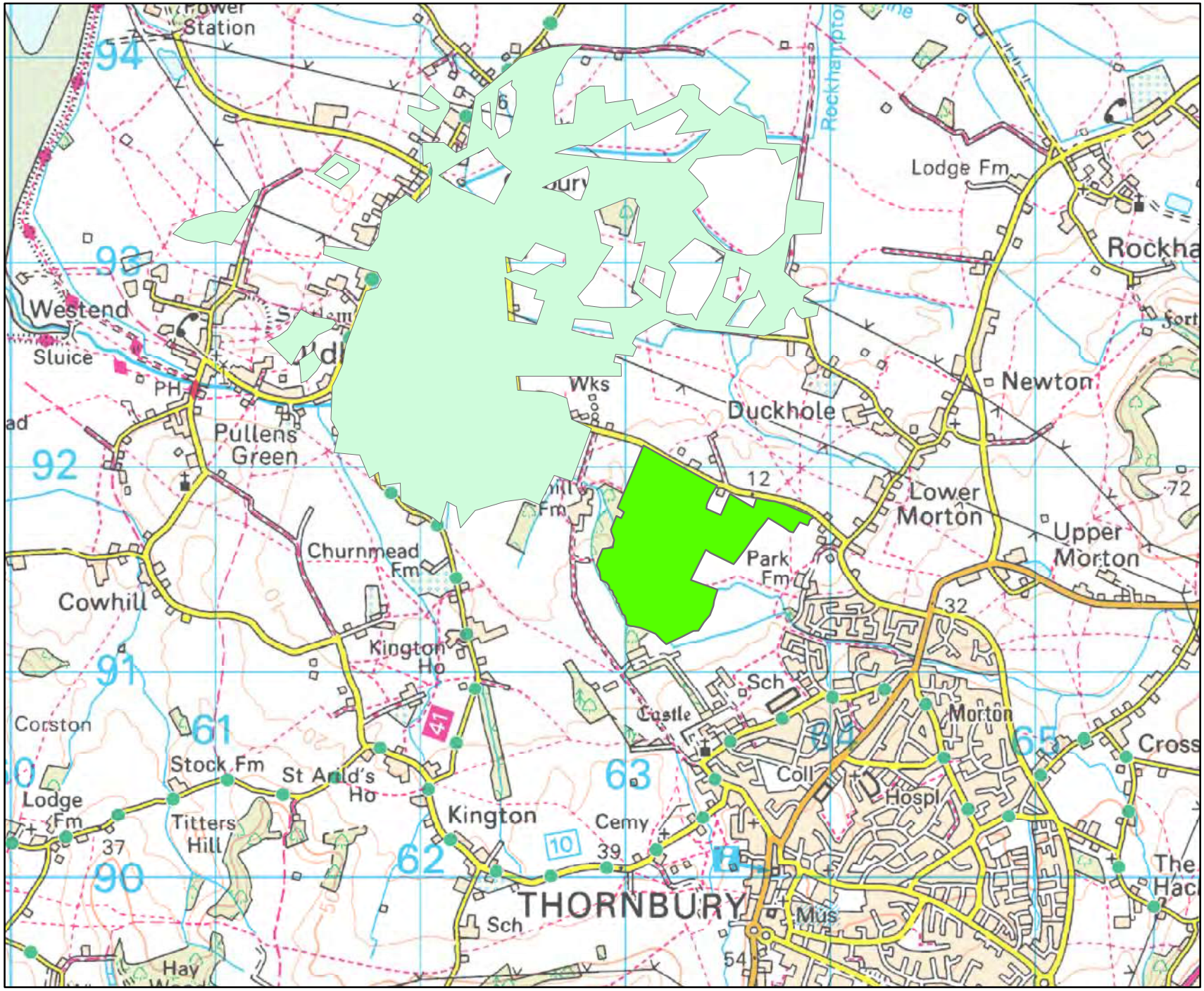
Historic flood events centred on ST 63392 91620 - created 06/12/2017 [Ref: 67533-WX]



Environment Agency

Scale at A4: **1:26,000**

N

Meters

0 205 410 820 1,230

Legend

Main River

67533_WX_site_boundary

START_DATE

01/07/1968

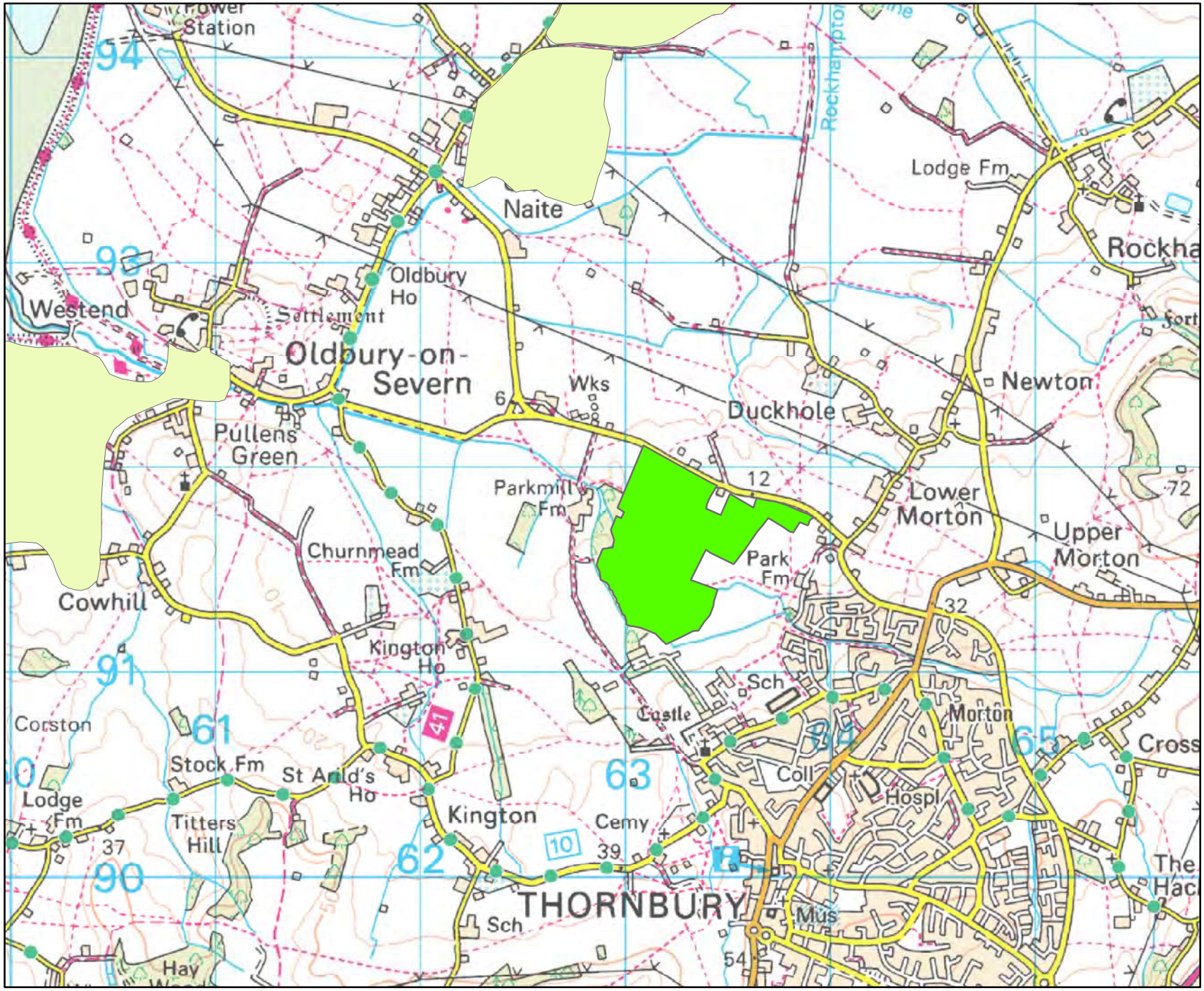
Historic Flood Events

Please see the attached sheet for more information on the individual flood events, such as: dates, source and cause of flooding.

These events and outlines are taken from our Historic Flood Records. We cannot guarantee that it is an exhaustative list of all past flood events in this location.

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 events centred on ST 63392 91620 - created 06/12/2017 [Ref: 67533-WX]



Environment Agency

Scale at A4: **1:26,000**

N

Meters

0 205 410 820 1,230

Legend

Main River

67533_WX_site_boundary

START_DATE

01/12/1981

Historic Flood Events

Please see the attached sheet for more information on the individual flood events, such as: dates, source and cause of flooding.

These events and outlines are taken from our Historic Flood Records. We cannot guarantee that it is an exhaustative list of all past flood events in this location.

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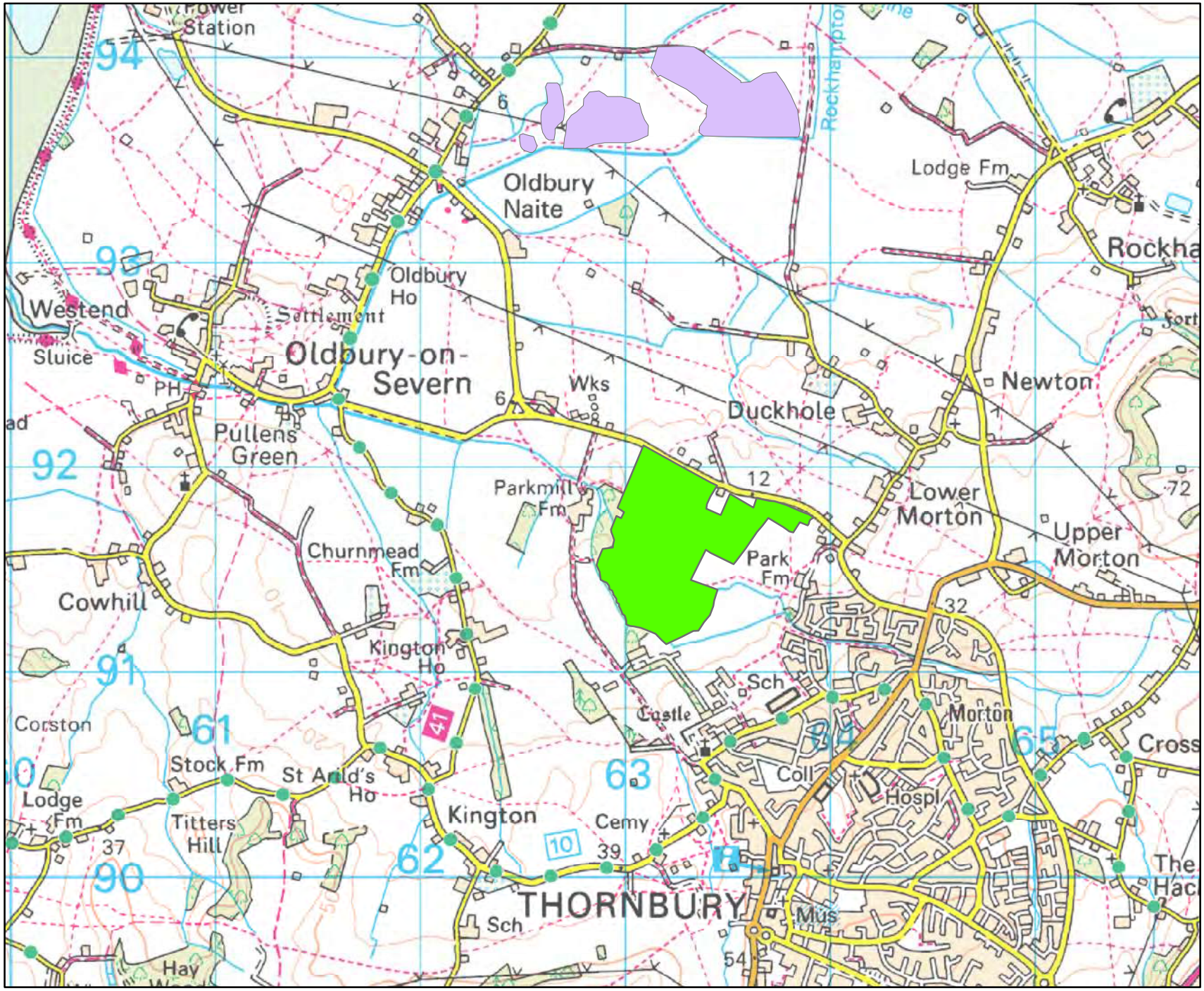
Historic flood events centred on ST 63392 91620 - created 06/12/2017 [Ref: 67533-WX]



Environment Agency

Scale at A4: **1:26,000**

N

0 205 410 820 1,230 Meters

Legend

- Main River
- 67533_WX_site_boundary

START_DATE

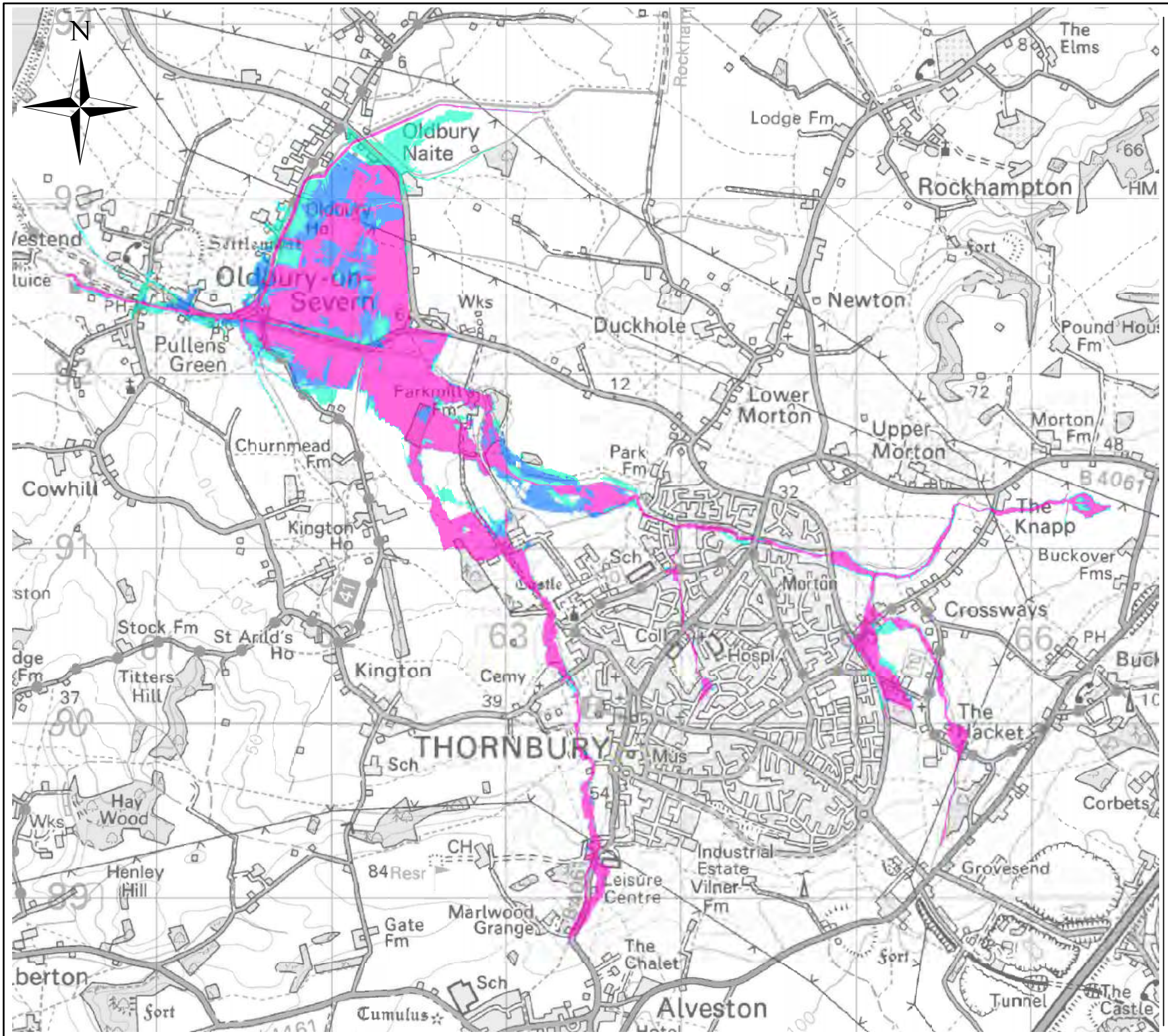
- 29/10/2000
- 25/11/2012
- 23/12/2013

Historic Flood Events

Please see the attached sheet for more information on the individual flood events, such as: dates, source and cause of flooding.

These events and outlines are taken from our Historic Flood Records. We cannot guarantee that it is an exhaustative list of all past flood events in this location.

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



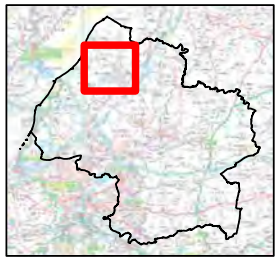
NOTES

AEP = Annual Exceedance Probability. The probability of a flood of a particular magnitude, or greater, occuring in any given year.

5% AEP = 1 in 20yr flood event
1% AEP = 1 in 100 yr flood event
0.1% AEP = 1 in 1000yr flood event

Generally, the Flood Zone Classification is based around the return periods. Anything less than a 5% AEP is considered Floodzone 3b, between 5% AEP and 1% AEP is Floodzone 3a. Floodzone 2 is considered to be between 1% AEP and 0.1% AEP. Anything greater than 0.1% is Floodzone 1.

KEY PLAN



LEGEND

- Flood Zone 3b
- Flood Zone 3a
- Flood Zone 2

0 160 320 640 960 1,280
Metres

Elevations above Ordnance Datum

REV	DATE	REMARKS
A	30/08/2011	Draft
B	10/11/2011	Final
C		
D		

South Gloucestershire Council

JBA consulting

STUDY REACHES

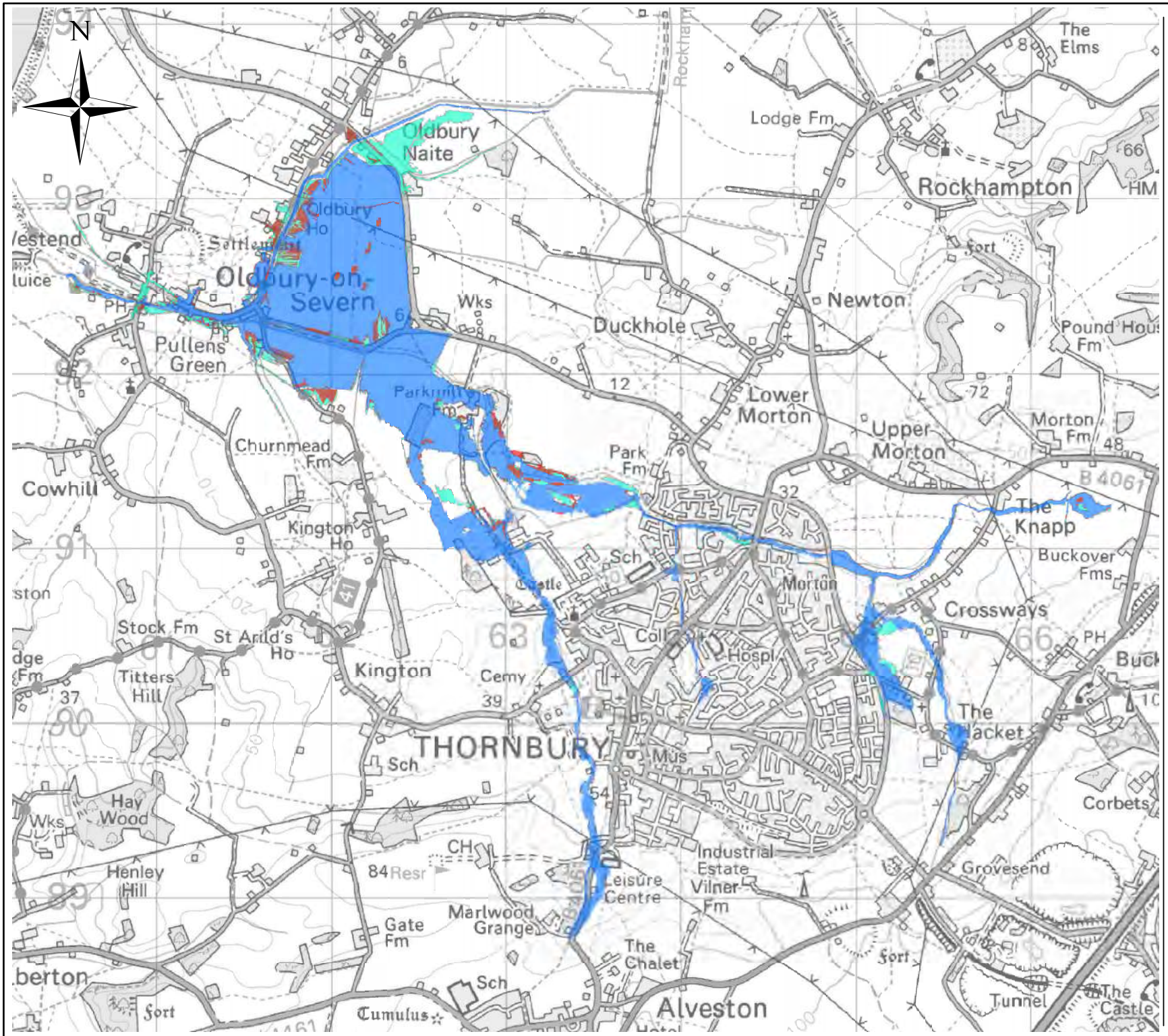
Flood Zone Maps

OS Map Sheet: Pickedmoor Brook

DATE OF ISSUE: Nov 2011 **REV NO:** 2 **REV DATE:**

DRAWING NO:

FZ/ Pickedmoor Brook



NOTES

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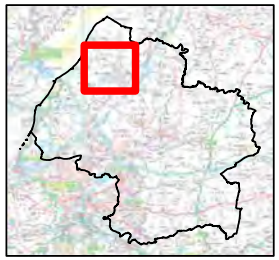
KEY PLAN



LEGEND

- Flood Zone 3a
- Flood Zone 3a Climate Change
- Flood Zone 2

0 170 340 680 1,020 1,360
Metres

Elevations above Ordnance Datum

REV	DATE	REMARKS
A	30/08/2011	Draft
B	10/11/2011	Final
C		
D		

South Gloucestershire Council

JBA consulting

STUDY REACHES

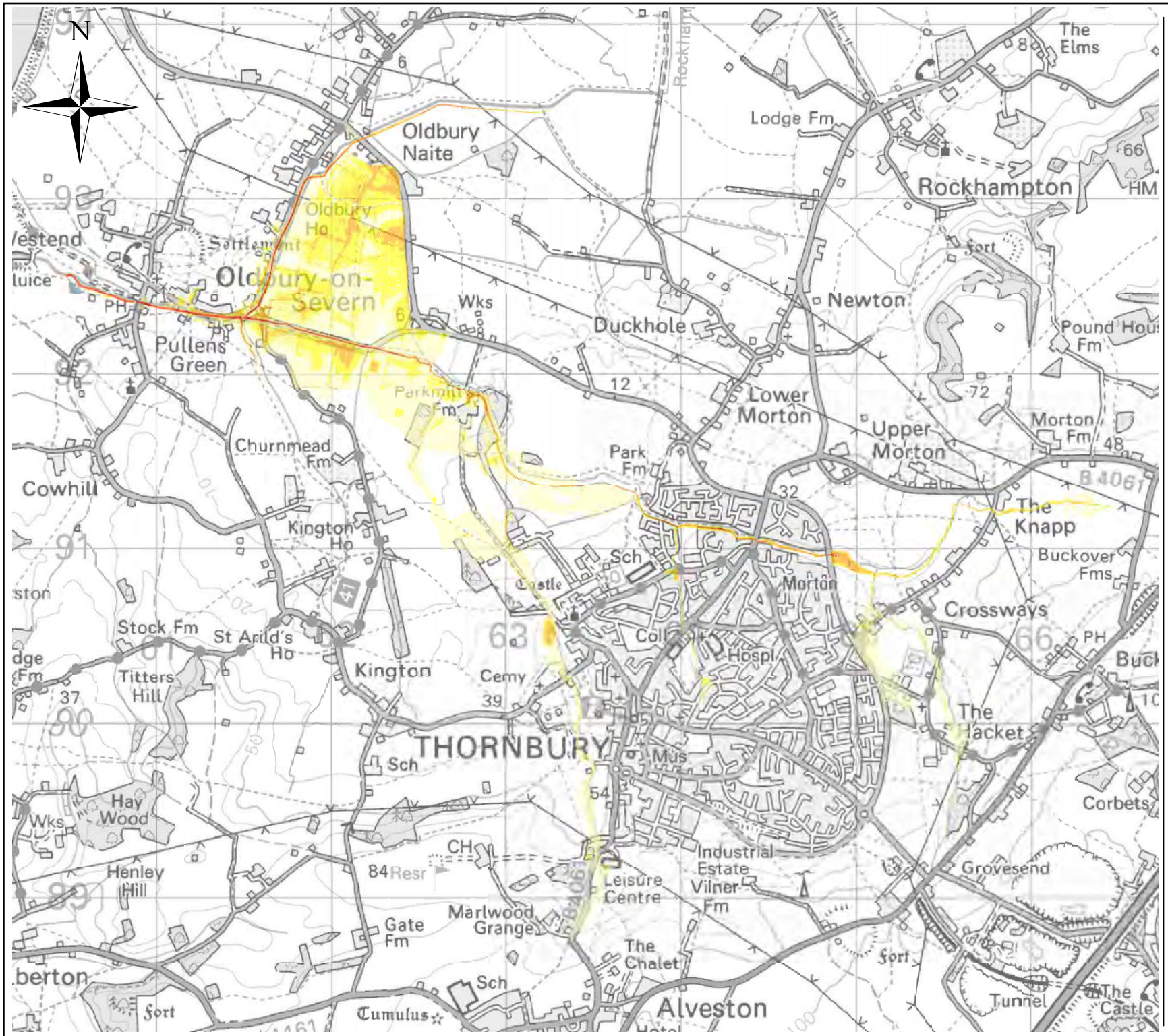
Flood Zone Maps (Climate Change)

OS Map Sheet: Pickedmoor Brook

DATE OF ISSUE: Nov 2011 **REV NO:** 2 **REV DATE:**

DRAWING NO:

FZCC/ Pickedmoor Brook

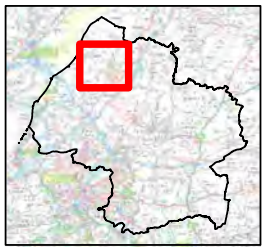


NOTES

AEP = Annual Exceedance Probability. The probability of a flood of a particular magnitude, or greater, occuring in any given year.

5% AEP = 1 in 20yr flood event
1% AEP = 1 in 100 yr flood event
1% AEP + CC= 1 in 100 yr flood event plus Climate Change
0.1% AEP = 1 in 1000yr flood event

KEY PLAN



LEGEND

1%+ CC AEP

- Very low hazard - Caution
- Danger for some
- Danger for most
- Danger for all

0 175 350 700 1,050 1,400 Metres

Elevations above Ordnance Datum

REV	DATE	REMARKS
A	30/08/2011	Draft
B	10/11/2011	Final
C		
D		

South Gloucestershire Council

JBA consulting

STUDY REACHES

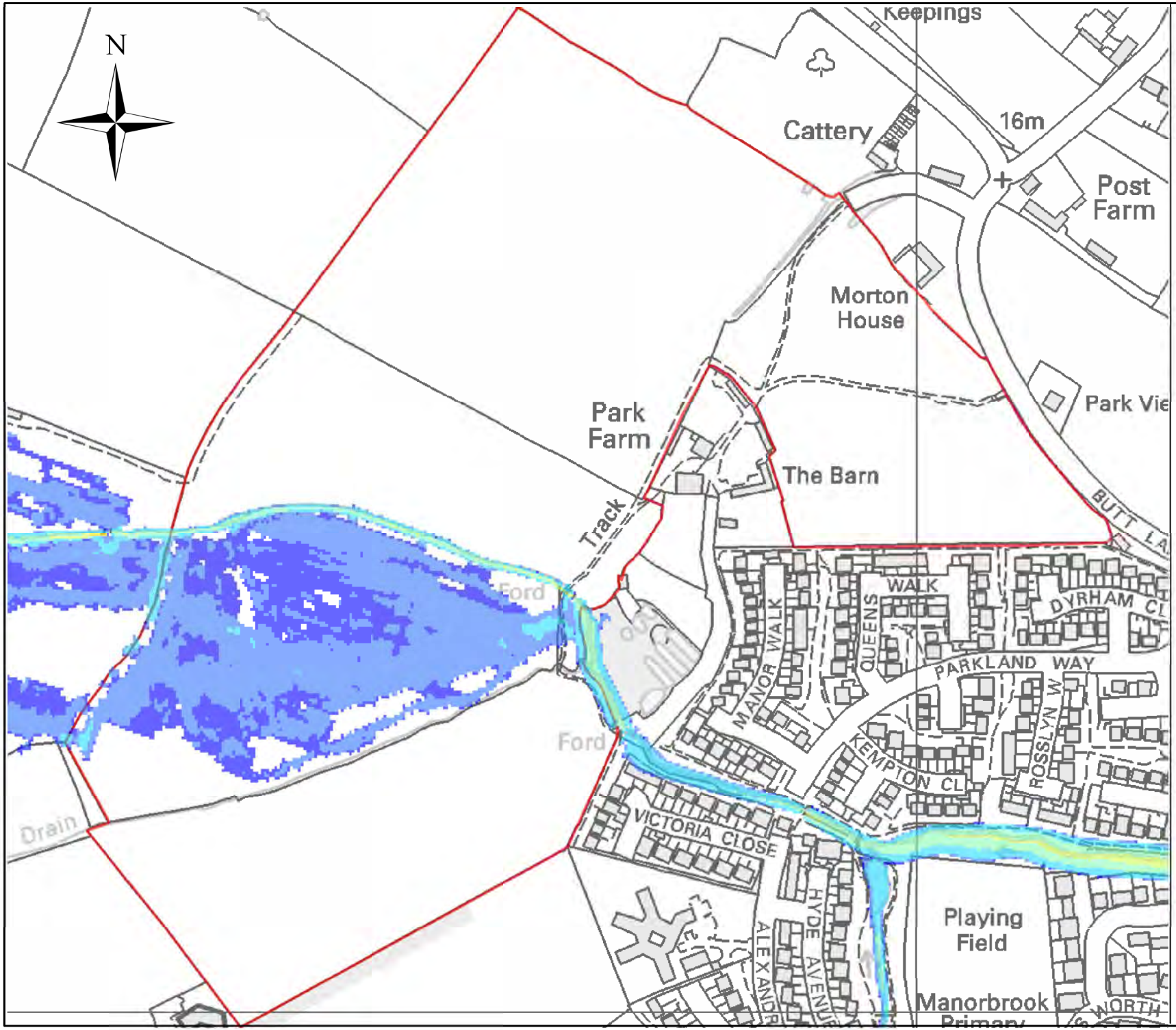
Hazard

OS Map Sheet: Pickedmoor Brook

DATE OF ISSUE: Nov 2011 **REV NO:** 2 **REV DATE:**

DRAWING NO:

Hazard/ Pickedmoor Brook



NOTES

AEP = Annual Exceedance Probability. The probability of a flood of a particular magnitude, or greater, occuring in any given year.
1% AEP = 1 in 100 yr flood event

KEY PLAN

Legend

1% AEP Depth

(m)

- 0.00 - 0.01
- 0.01 - 0.1
- 0.1 - 0.5
- 0.5 - 1
- 1.00- 1.5
- 1.5 - 2.0
- 2.01 - 2.5
- 2.50 - 4.7

0 20 40 80 120 160 Metres

Elevations above Ordnance Datum

REV	DATE	REMARKS
A	August 2011	Draft
B	Nov 2011	Final
C		
D		

South Gloucestershire Council

STUDY REACHES

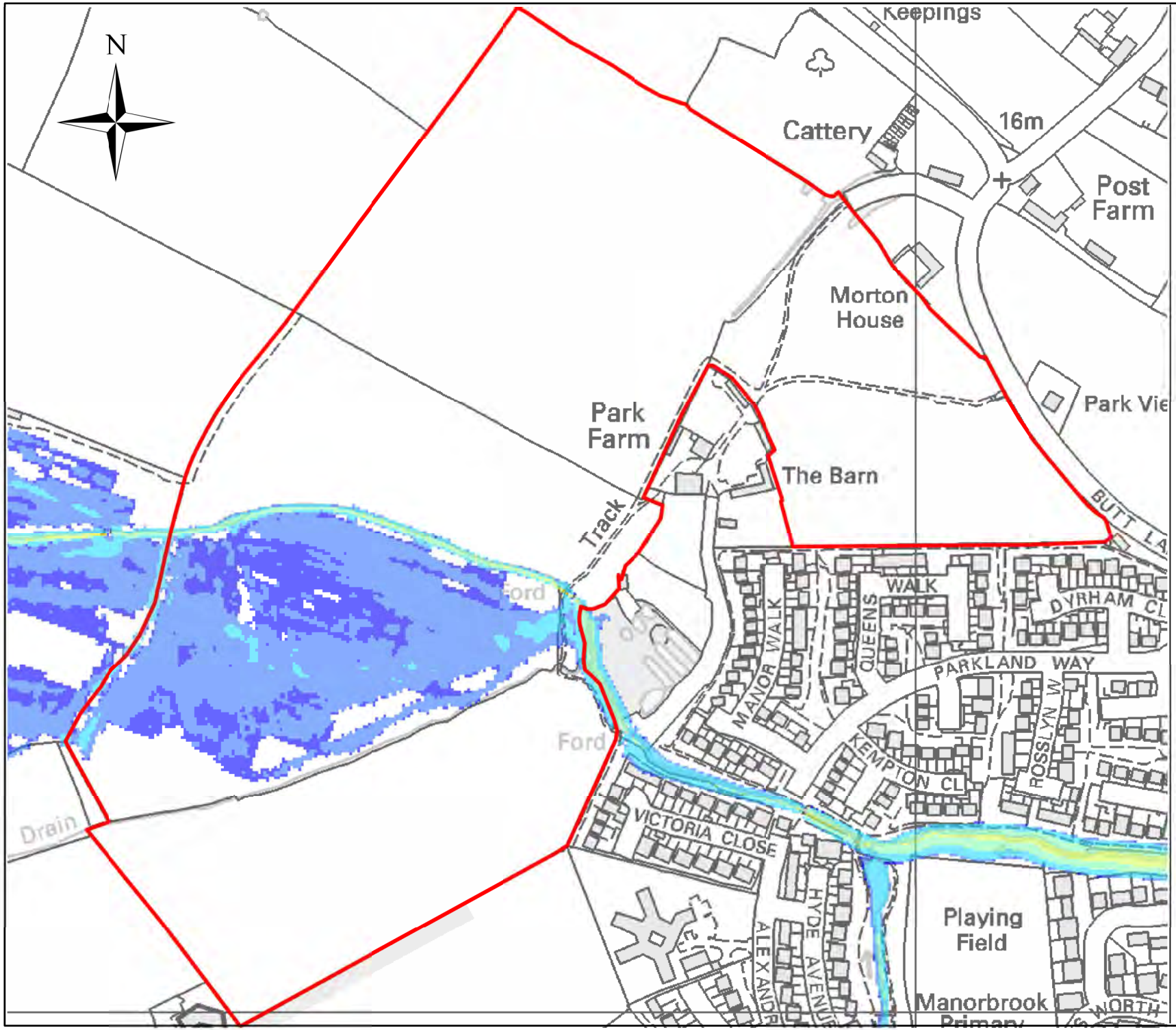
Depth 1% AEP

OS Map Sheet: Housing Opportunity (Thornbury)

DATE OF ISSUE: August 2011 **REV NO:** **REV DATE:**

DRAWING NO:

Depth1%AEP/ Housing Opportunity (Thornbury)



NOTES

AEP = Annual Exceedance Probability. The probability of a flood of a particular magnitude, or greater, occuring in any given year.
1% CC AEP = 1 in 100 yr plus Climate Change

Legend

1% +CC AEP Depth (m)

- 0.00 - 0.01
- 0.01 - 0.1
- 0.1 - 0.5
- 0.5 - 1
- 1.00- 1.5
- 1.5 - 2.0
- 2.01 - 2.5
- 2.50 - 4.7

0 20 40 80 120 160 Metres

Elevations above Ordnance Datum

REV	DATE	REMARKS
A	August 2011	Draft
B	Nov 2011	Final
C		
D		

South Gloucestershire Council

STUDY REACHES

Depth 1% AEP plus Climate Change

OS Map Sheet: Housing Opportunity (Thornbury)

DATE OF ISSUE: August 2011 **REV NO:** **REV DATE:**

DRAWING NO:

Depth1%AEPCC/ **Housing Opportunity (Thornbury)**

The Ditches within the red lines are known to be essential for highway and land drainage

The Ditches within the orange lines are unknown if they carry land drainage from the POS on Park Farm Sites. Note the ditch to the south west of Redcliffe House could be taking land drainage from the field not in your site.

Land West of Park Farm
Thornbury

Appendix C Surface Water Drainage

1. SK01 Rev B Indicative Drainage Strategy
2. FEH statistical method spreadsheet
3. MicroDrainage model output (1 in 100 +40% event)
4. MicroDrainage simulation graphs (6-12 hour, 1 in 100 year plus climate change events

Key:

- Indicative Attenuation Basins
- Flood Zone 2
- Flood Zone 3
- Proposed Connection to Existing Ditch
- Existing Ditch

Mark	Revision	Date	Drawn	Chkd	Appd
C	MASTERPLAN UPDATED	11.12.19	LD	-	-
B	MASTERPLAN UPDATED	06.11.18	KT		
A	MASTERPLAN UPDATED	24.08.18	DBM	LD	LD

SCALING NOTE: Do not scale from this drawing. If in doubt, ask.

UTILITIES NOTE: The position of any existing public or private sewers, utility services, plant or apparatus shown on this drawing is believed to be correct, but no warranty to this is expressed or implied. Other such plant or apparatus may also be present but not shown. The Contractor is therefore advised to undertake his own investigation where the presence of any existing sewers, services, plant or apparatus may affect his operations.

Drawing Issue Status

For Information

West of Park Farm, Thornbury

Indicative Drainage Strategy

Client

Barwood Development Securities

Date of 1st Issue	Designed	Drawn
11.06.18	AJB	GN
A3 Scale	Checked	Approved
	AJB	PS

Drawing Number	Revision
39209/4001/SK01	C

peterbrett

Offices throughout the UK and Europe

www.peterbrett.com

TAUNTON
Tel: 01823 445150

File Location: \\pba.int\tnt\projects\39209 west of park farm, thornbury\4001_hydro task_ta-hyd\cad\dwgs\sk01_ c_drainage strategy drawing.dwg

FEH Greenfield Runoff
Per Hectare

Project Title	WEST OF PARK FARM, THORNBURY	
Project No	39209	4001

Methodology as set out in SuDS Manual 24.3.2 — SUDS Manual Chapter 24

1 Retrieve FEH Catchment Information

Export catchment data from FEH CDROM as .xml file and save in FEH data export

Catchment Descriptors	**BFIHOST**	0.620	*see note 1*
	SAAR	779.0	*see note 1*
	FARL	1.0	*see note 2*

2 Derive QBAR (mean annual flood)

Define area	**Site Area**	12.2	ha	
	Applied Area	50.0	ha	*see note 3*
FEH Index Flood	**QMED (Q_2)**	31.1	l/s	*see note 4*
Calculate QBAR by dividing QMED by 2yr growth factor	**QBAR**	35.3	l/s	*see note 5*

3 Select appropriate growth factors

FSR Hydrological Region		8	*(refer to FSR Hydrological Region tab)*
100yr Growth Curve Factor	GQ_{100}	2.42	
30yr Growth Curve Factor	GQ_{30}	1.98	
10yr Growth Curve Factor	GQ_{10}	1.84	
2yr Growth Curve Factor	GQ_2	0.88	
1yr Growth Curve Factor	GQ_1	0.78	

4 Derive Flood Frequency

Greenfield Runoff per 1ha

100yr Peak Runoff Rate	Q_{100}	85.4	l/s	Q_{100}	7.0	l/s/ha
30yr Peak Runoff Rate	Q_{30}	69.9	l/s	Q_{30}	5.7	l/s/ha
10yr Growth Curve Factor	Q_{10}	64.9	l/s	Q_{10}	5.3	l/s/ha
QBAR Peak Runoff Rate	QBAR	35.3	l/s	Q_{BAR}	2.9	l/s/ha
2yr Peak Runoff Rate	Q_2	31.1	l/s	Q_2	2.5	l/s/ha
1yr Peak Runoff Rate	Q_1	27.5	l/s	Q_1	2.3	l/s/ha

Location of FEH Data (as Hyperlink) — Thornbury CDs

DOCUMENT ISSUE RECORD

Rev	Comments	Prepared	Date	Checked	Date
-	ORIGINAL CALCULATION	LD	17.11.17	AJB	20.11.17

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	0.292	0.292	2.9	255.9	O K
30 min Summer	0.379	0.379	2.9	338.7	O K
60 min Summer	0.467	0.467	2.9	426.5	O K
120 min Summer	0.545	0.545	2.9	506.8	O K
180 min Summer	0.597	0.597	2.9	562.2	O K
240 min Summer	0.636	0.636	2.9	604.3	O K
360 min Summer	0.691	0.691	2.9	665.2	O K
480 min Summer	0.728	0.728	2.9	706.8	Flood Risk
600 min Summer	0.753	0.753	2.9	735.5	Flood Risk
720 min Summer	0.770	0.770	2.9	755.7	Flood Risk
960 min Summer	0.790	0.790	2.9	778.3	Flood Risk
1440 min Summer	0.797	0.797	2.9	786.4	Flood Risk
2160 min Summer	0.772	0.772	2.9	757.5	Flood Risk
2880 min Summer	0.744	0.744	2.9	725.4	Flood Risk
4320 min Summer	0.700	0.700	2.9	675.4	O K
5760 min Summer	0.667	0.667	2.9	639.1	O K
7200 min Summer	0.649	0.649	2.9	618.7	O K
8640 min Summer	0.638	0.638	2.9	606.4	O K
10080 min Summer	0.633	0.633	2.9	600.8	O K
15 min Winter	0.325	0.325	2.9	286.8	O K
30 min Winter	0.420	0.420	2.9	379.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	137.577	0.0	215.2	19
30 min Summer	91.363	0.0	243.0	34
60 min Summer	57.895	0.0	408.1	64
120 min Summer	34.785	0.0	463.1	124
180 min Summer	25.972	0.0	462.0	184
240 min Summer	21.138	0.0	453.2	244
360 min Summer	15.802	0.0	439.8	364
480 min Summer	12.818	0.0	431.7	482
600 min Summer	10.860	0.0	426.6	602
720 min Summer	9.459	0.0	423.3	722
960 min Summer	7.560	0.0	419.8	962
1440 min Summer	5.451	0.0	417.3	1440
2160 min Summer	3.878	0.0	862.4	2096
2880 min Summer	3.044	0.0	831.9	2416
4320 min Summer	2.179	0.0	765.7	3156
5760 min Summer	1.736	0.0	1242.2	3976
7200 min Summer	1.480	0.0	1321.1	4832
8640 min Summer	1.314	0.0	1398.5	5696
10080 min Summer	1.198	0.0	1436.7	6552
15 min Winter	137.577	0.0	231.6	19
30 min Winter	91.363	0.0	244.6	34

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	0.518	0.518	2.9	478.5	O K
120 min Winter	0.604	0.604	2.9	569.4	O K
180 min Winter	0.661	0.661	2.9	631.8	O K
240 min Winter	0.704	0.704	2.9	679.5	Flood Risk
360 min Winter	0.765	0.765	2.9	749.2	Flood Risk
480 min Winter	0.806	0.806	2.9	797.3	Flood Risk
600 min Winter	0.835	0.835	2.9	831.2	Flood Risk
720 min Winter	0.855	0.855	2.9	855.4	Flood Risk
960 min Winter	0.879	0.879	2.9	884.1	Flood Risk
1440 min Winter	0.892	0.892	2.9	900.1	Flood Risk
2160 min Winter	0.874	0.874	2.9	877.6	Flood Risk
2880 min Winter	0.843	0.843	2.9	841.2	Flood Risk
4320 min Winter	0.789	0.789	2.9	777.2	Flood Risk
5760 min Winter	0.746	0.746	2.9	727.7	Flood Risk
7200 min Winter	0.717	0.717	2.9	694.6	Flood Risk
8640 min Winter	0.695	0.695	2.9	670.4	O K
10080 min Winter	0.680	0.680	2.9	653.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	57.895	0.0	447.0	64
120 min Winter	34.785	0.0	463.7	122
180 min Winter	25.972	0.0	452.5	182
240 min Winter	21.138	0.0	444.0	240
360 min Winter	15.802	0.0	434.9	358
480 min Winter	12.818	0.0	431.6	476
600 min Winter	10.860	0.0	431.7	594
720 min Winter	9.459	0.0	434.2	712
960 min Winter	7.560	0.0	439.0	944
1440 min Winter	5.451	0.0	437.6	1400
2160 min Winter	3.878	0.0	870.9	2072
2880 min Winter	3.044	0.0	845.8	2684
4320 min Winter	2.179	0.0	799.4	3332
5760 min Winter	1.736	0.0	1390.0	4272
7200 min Winter	1.480	0.0	1475.5	5192
8640 min Winter	1.314	0.0	1541.4	6144
10080 min Winter	1.198	0.0	1494.0	7064

Model Details

Storage is Online Cover Level (m) 1.000

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	815.0	1.100	1321.1

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0082-2900-0900-2900
Design Head (m)	0.900
Design Flow (l/s)	2.9
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	82
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	2.9
Flush-Flo™	0.265	2.9
Kick-Flo®	0.564	2.3
Mean Flow over Head Range	-	2.5

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	2.4	1.200	3.3	3.000	5.1	7.000	7.5
0.200	2.8	1.400	3.6	3.500	5.4	7.500	7.8
0.300	2.9	1.600	3.8	4.000	5.8	8.000	8.0
0.400	2.8	1.800	4.0	4.500	6.1	8.500	8.3
0.500	2.6	2.000	4.2	5.000	6.4	9.000	8.5
0.600	2.4	2.200	4.4	5.500	6.7	9.500	8.7
0.800	2.7	2.400	4.6	6.000	7.0		
1.000	3.0	2.600	4.7	6.500	7.3		

Model Details

Storage is Online Cover Level (m) 1.000

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	815.0	1.100	1321.1

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0082-2900-0900-2900
Design Head (m)	0.900
Design Flow (l/s)	2.9
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	82
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	2.9
Flush-Flo™	0.265	2.9
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Mean Flow over Head Range	-	2.5

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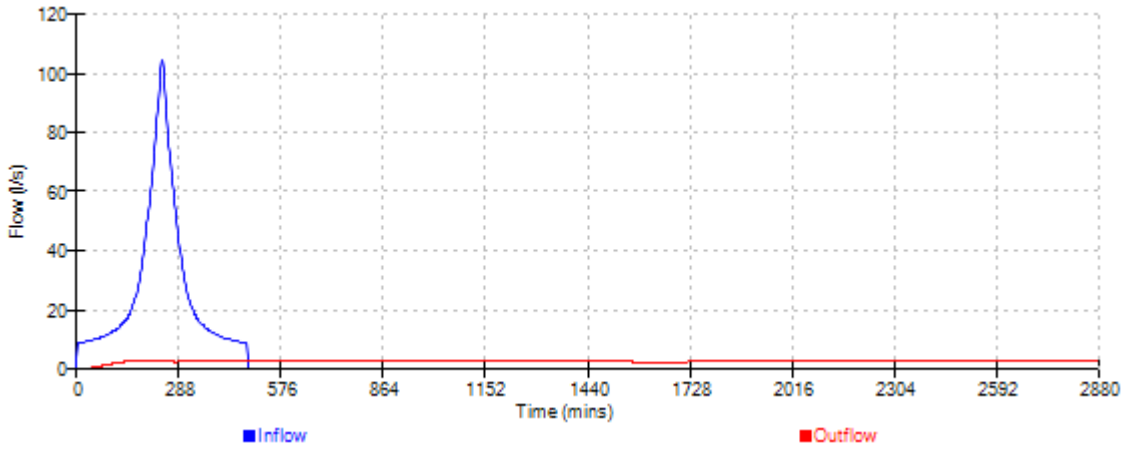
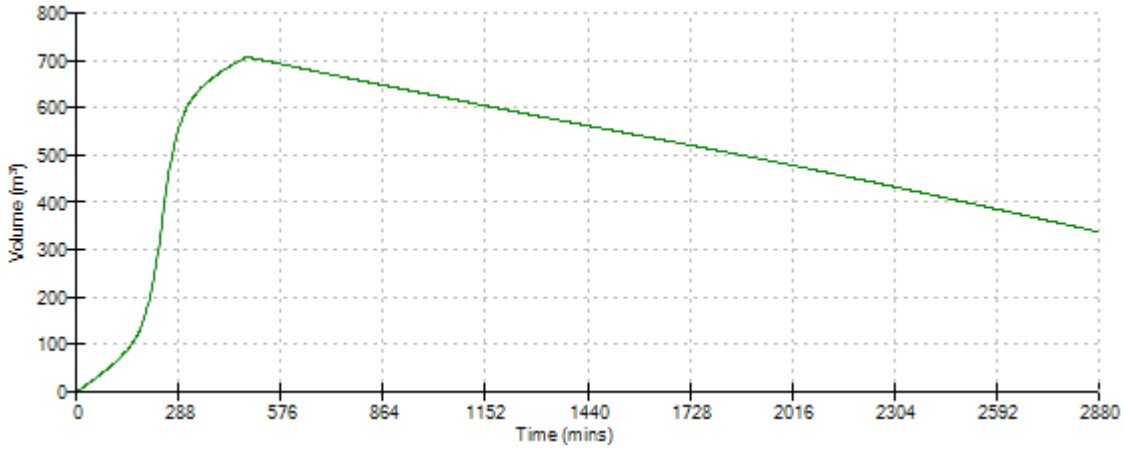
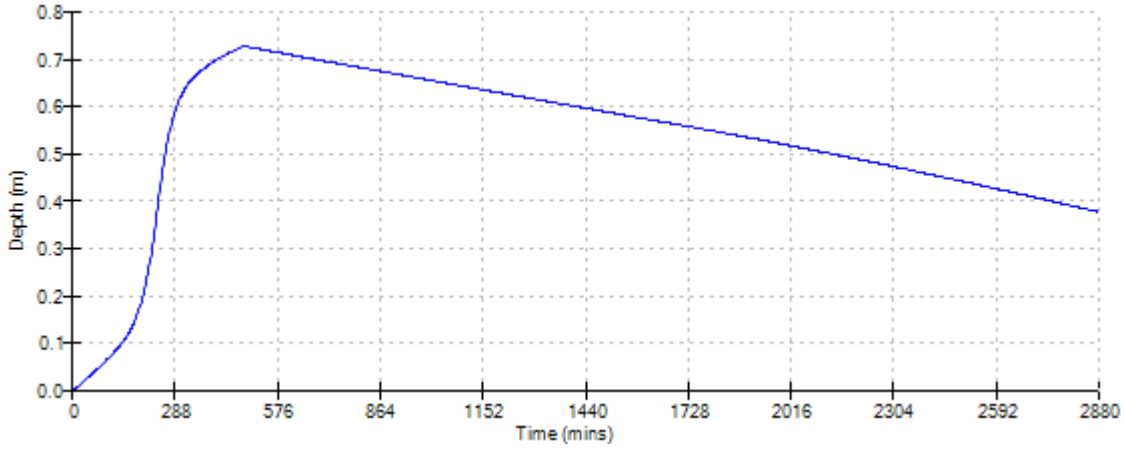
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.4	1.200	3.3	3.000	5.1	7.000	7.5
0.200	2.8	1.400	3.6	3.500	5.4	7.500	7.8
0.300	2.9	1.600	3.8	4.000	5.8	8.000	8.0
0.400	2.8	1.800	4.0	4.500	6.1	8.500	8.3
0.500	2.6	2.000	4.2	5.000	6.4	9.000	8.5
0.600	2.4	2.200	4.4	5.500	6.7	9.500	8.7
0.800	2.7	2.400	4.6	6.000	7.0		
1.000	3.0	2.600	4.7	6.500	7.3		

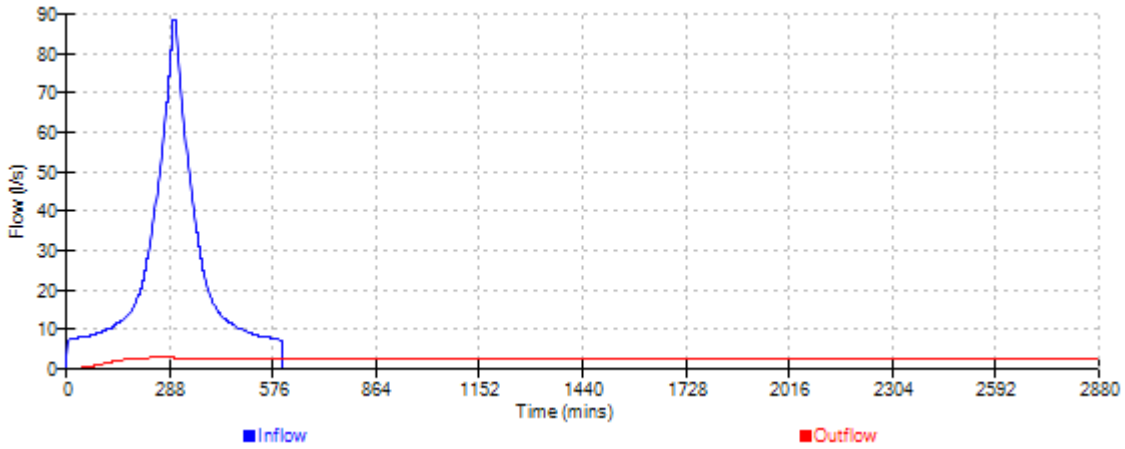
Event: 480 min Summer

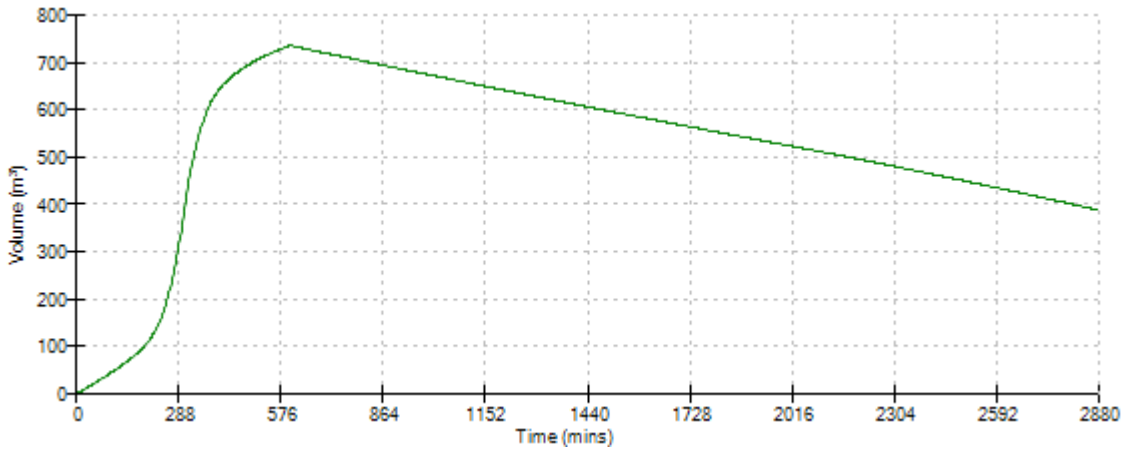


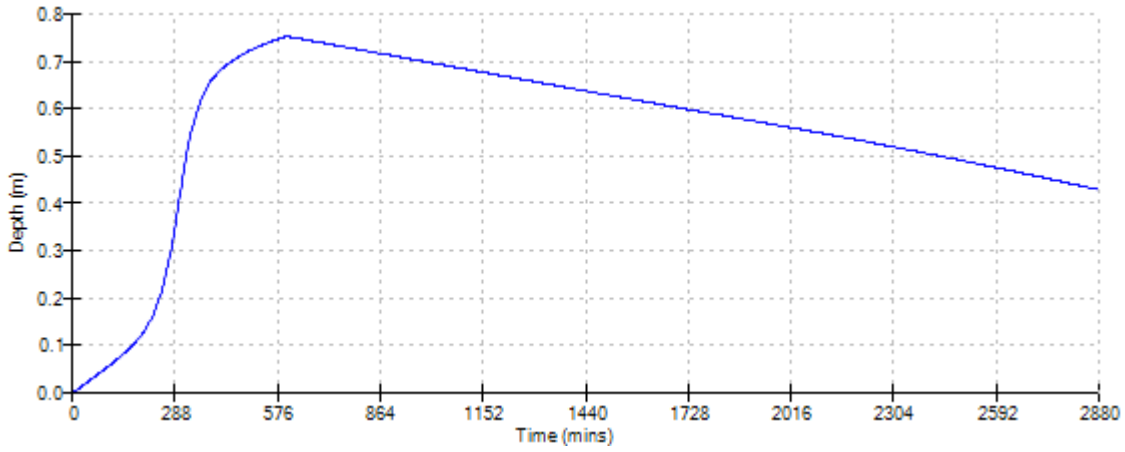




Event: 600 min Summer







Event: 720 min Summer