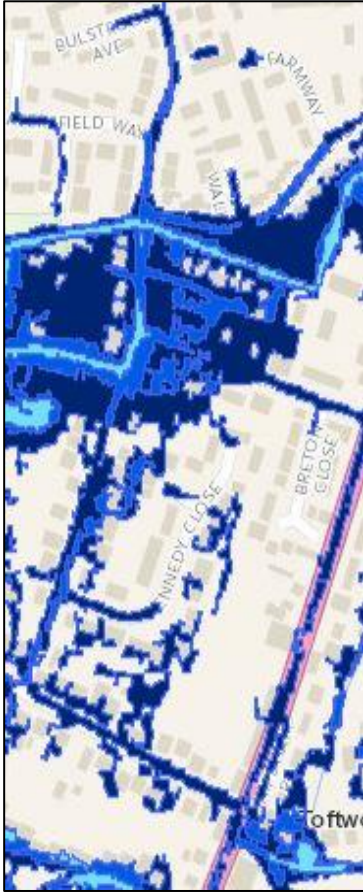


Flood Investigation Report

Flooding in Dereham on 23 June 2016



Report Reference: FIR017
Draft Report, Version 3, prepared by Mark Ogden on 2 October 2017



Norfolk County Council

Contents

.....	2
Executive Summary.....	3
Map of catchments.....	6
Justification for Flood Investigation.....	7
Flooding and flood risk within the Upper Dereham Stream catchment.....	9
Flooding and flood risk within the Lower Dereham Stream catchment.....	22
Flooding and flood risk within the Fen Road Watercourse catchment	29
Flooding and flood risk within the Upper River Tud catchment	34
Disclaimer.....	40
Appendix A - Key definitions and responsibilities.....	41

Maps

Map 1	Map of catchments	5
Map 2	Map of Upper Dereham Stream catchment	7
Map 3	Map of Upper Dereham Stream, to A47 culvert, Flood and drainage details	19
Map 4	Map of Upper Dereham Stream, north A47 culvert, Flood and drainage details	20
Map 5	Map of Lower Dereham Stream catchment	21
Map 6	Map of Lower Dereham Stream catchment, Flood and drainage details	29
Map 7	Map of Fen Road Watercourse catchment	30
Map 8	Map of Fen Road Watercourse catchment, Flood and drainage details	36
Map 9	Map of Upper River Tud catchment	37
Map 10	Map of Upper River Tud catchment, Flood and drainage details	44

Executive Summary

(a) Flooding incidents and causes

On the afternoon of the 22nd June the Environment Agency held Flood Advisory Service (FAS) teleconferences with partners to inform them of the risk of surface water flooding based on the flood guidance statement. The purpose of this was to provide information to partners on the forecast and potential impacts.

Flooding in Dereham occurred on 23 June 2016. The rainfall event on this date generated 141 reports of flooding that led to the identification of 48 properties that had suffered internal flooding. The properties affected were concentrated within the overall catchment¹ of Dereham Stream which is a tributary of Wendling Beck and the River Wensum. For ease of presentation we have set out the report based on the sub-catchments within which the incidents were located. A summary of the 48 properties affected in each sub-catchment are set out below;

- Upper Dereham Stream catchment – 36 properties
- Lower Dereham Stream catchment – 5 properties
- Fen Road Watercourse catchment – 2 properties
- Upper River Tud catchment – 5 properties

The incidents of internal flooding in Dereham and its environs occurred in the following parishes and at the approximate locations listed below;

- **Dereham Parish:**
Boyd Avenue, Chapel Lane, Hillcrest Avenue, Larners Road, Lilac Close, Lineside, Norwich Road, Orchid Avenue, Pine Grove, Sharon Close, Shipdham Road, South Green Gardens, South Green, Southend, Stone Road, Westfield Road, Willow Grove, Yaxham Road
- **Scarning Parish:**
Fen Road, Washbridge
- **Shipdham Parish:**
Herne Lane, Shipdham Road
- **Yaxham Parish:**
St. Peter's Close

14 residents whose properties flooded in June 2016 stated that they had previously experienced flooding. 2 residents referred to a flood event on 7 July 2015 which caused internal flooding. 1 resident also referred to events in May 2014 and August 2012 that caused internal flooding. Internal flooding was reported by 1 resident in 18 June 2009, June 2005, 8 June 2003, August 2000, 3 July 1999 and 23 July 1996. 1 resident also reported the August 2000 event but did not state what the impact was. 1 resident stated internal flooding happening regularly but did not state when. 1 resident and 1 media report referred to a flood event on 6 July 2012 but these reports did not state what the impact was. 8 residents reported flooding having occurred previously but did not state when or what the impact was.

¹ What are catchments? - To aid the investigation process and, for ease of presentation, the incidents of flooding within this report have been grouped within this document based on hydrological catchments. The purpose of viewing flooding incidents based on catchments reflects the reality that flooding does not respect the administrative boundaries of Risk Management Authorities. Hydrological catchments catch water and discharge it at locations known as outlets. Individual hydrological catchment boundaries are usually formed by ridges of surrounding higher ground, which separate the lower lying areas at a line known as a watershed.

(b) Flooding causes

The flooding that occurred in Dereham in 2016 was concentrated in the Upper Dereham Stream catchment but was also spread over 3 other separate catchments. It is evident that certain causes of flooding were only apparent in certain locations. This is particularly true when considering the different run-off characteristics between highly urbanised catchments such as the Upper Dereham Stream and those of predominantly rural catchments such as Fen Road. More detail on the causes that occurred at the individual catchment level can be found in each section of this report however some of the key trends identified in the flooding of 2016 have been summarised on below;

- The rainfall experienced on 23 June 2016 was recorded at the East Dereham STW monitoring station as being a 1 in 32 year event². However, it is likely that localised areas of the catchment saw a much greater rainfall event as a number of the properties that were internally flooded only correlated between the 1 in 100 year and the 1 in 1000 year flood extent mapping. This judgement is supported by the extensive evidence of flooding submitted to the LLFA.
- A large number of the properties impacted are situated on overland flow paths and/or are below the level of the nearest highway.
- The flooding in several locations was exacerbated by the loss of drainage features within the catchment (such as ditches) and the amendments of principal drains and watercourses and their connections through culverting, infilling and lack of maintenance which caused a loss of integrity and capacity of the drainage network.
- The capacity of surface water drainage including land drains, highway drainage and private property drainage was exceeded due to the significant levels of rainfall that fell during the event.
- The capacity of the foul network was also exceeded due to the ingress of surface water into the foul network. This caused the foul network to surcharge in a number of locations during the event with several residents reporting foul water entering their property.
- Features such as kerbs, walls, garden fences and alleyways had the effect of containing or channelling flood water near to properties.
- Flood water entered properties through the unprotected structure of the building. This included via features such as low thresholds at entrances, unprotected air bricks and services conduits.

(c) Key recommendations

The recommendations set out in the report have been summarised below. Specific recommendations for each individual catchment are set out within the report. Please note a number of these recommendations have already been followed up by the respective organisations identified. Progress against these recommendations will be assessed as part of an addendum to this report to be undertaken a year from the date of publication of this report.

Risk Management Authorities should;

- Communicate with affected residents where their assets have given rise to the flooding of properties.
- Review the appropriateness of their response to flooding.

² Recent rainfall - This report seeks to draw on rainfall data to ascertain the intensity of the rainfall events experienced across the catchments that led to the flooding. This analysis is useful in assessing (in broad terms) if the design capacity of drainage systems within the affected areas was exceeded. Norfolk County Council has sought to use data from rain gauges where incidents of flooding are located within a 2.5 km radius of the instrumentation. This distance meets the requirements of British Standards and aims to capture localised rainfall patterns across each catchment. Where there is no available data within this radius this will be stated.

- Determine the integrity and/or capacity of their assets and their maintenance where they have contributed to the flooding of properties to understand the systems role in accommodating rainfall events as well as mitigating flooding.

Property owners of affected properties should;

- Confirm the integrity, capacity and appropriateness of their property drainage
- Determine if works are needed to remove the risk posed by structures that form obstructions to flows.
- Determine if it is appropriate for them to protect their buildings through flood protection measures.
- Seek their own legal advice if they are concerned about the responsibilities and liabilities of themselves and/or others.
- **All property owners** should remove any inappropriate surface water connections to the foul sewer system and direct flows to alternative points of discharge where it doesn't increase flood risk.

Norfolk County Council should;

- Work with partner organisations to identify funding for flood mitigation. This would include assessing the potential to install property level protection measures, reduce run-off and increase the attenuation of flood water to reduce the impacts of flooding.
- Work with property owners to consider opportunities to route flood water on the highway away from affected properties to alternative points of discharge, or other solutions as practicable.
- Seek to remind riparian owners of their responsibility to undertake appropriate levels of maintenance to sustain the efficiency of the drainage systems.
- Communicate with local residents to advise them of the appropriate measures they could take to protect their property without prejudicing the rights and responsibilities of adjoining property holders
- Determine if works are needed to remove the risk posed by structures that form obstructions to watercourse flows and communicate with affected parties and riparian owners
- Review and monitor the delivery of recommendations within this and other relevant flood investigation reports.

Anglian Water should;

- Work with partner organisations to identify the potential for managing the amount of surface water entering their drainage system in flood events.

Norfolk Rivers Internal Drainage Board should;

- Determine if works are needed to increase volumetric capacity and/or remove the risk posed by structures that form obstructions to watercourse flows.

Breckland District Council should;

- Review their approach to the use of their permissive powers to maintain watercourses under the Land Drainage Act 1991.

Highways England should;

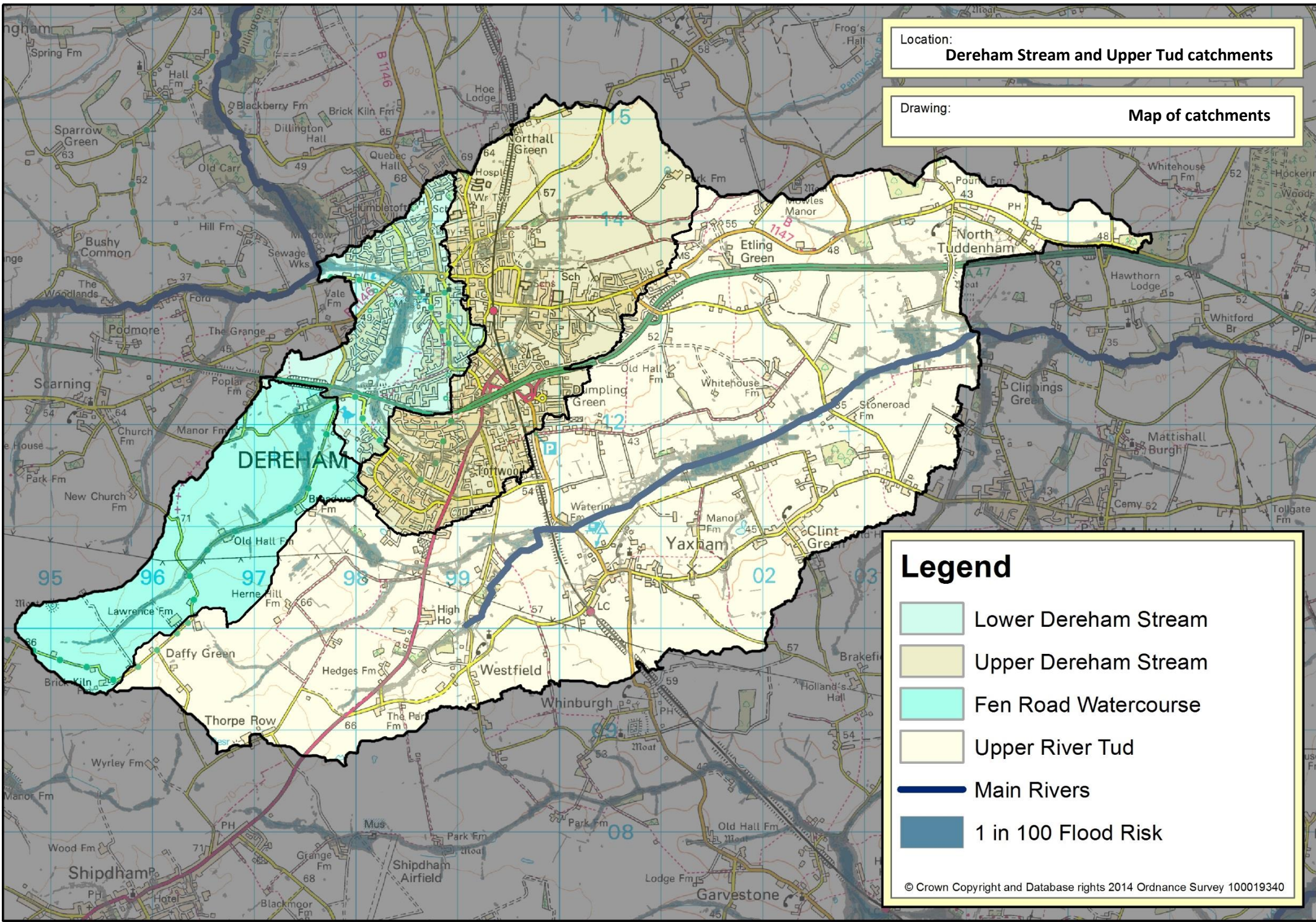
- Work with partner organisations to identify the potential for managing the amount of surface water entering their drainage system in flood events.

The Environment Agency should;

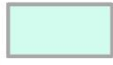

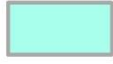



- Determine if works are needed to increase volumetric capacity and/or remove the risk posed by structures that form obstructions to Main River flows.

Location:
Dereham Stream and Upper Tud catchments

Drawing:
Map of catchments



Legend

-  Lower Dereham Stream
-  Upper Dereham Stream
-  Fen Road Watercourse
-  Upper River Tud
-  Main Rivers
-  1 in 100 Flood Risk

© Crown Copyright and Database rights 2014 Ordnance Survey 100019340

Justification for Flood Investigation

The purpose of this report relates to Section 19 of the Flood and Water Management Act 2010. This legislation sets out that the County Council, in its role as Lead Local Flood Authority for Norfolk, should investigate the role and response of organisations to significant flooding incidents. Significant flooding is deemed to be those incidents that impact upon people, property and infrastructure.

The Norfolk Local Flood Risk Management Strategy Policy UC2 (Flood Investigation) sets out the thresholds the Lead Local Flood Authority will apply to its formal flood investigation role. This states an investigation will be undertaken where it is determined that;

- (a) There is ambiguity surrounding the source or responsibility for a flood incident, and/or;
- (b) There is cause to investigate the flood incident, due to either its impact, or consequence

In judging the impact or consequence of a flood event Norfolk County Council uses the criteria set out below;

- Any risk to loss of life or serious injury.
- One or more residential or business property flooded internally.
- One or more critical services/installations and vulnerable person's properties flooded internally; and/or rendered inoperable or their functions severely compromised due to the access to the premises being impassable; and/or resulting in a loss of service impacting on the local community.
- Any section of a national category 3 road or above made impassable due to flooding; and/or flooding to priority 1 and 2 gritting routes.
- Flooding adversely impacting a rail link by making it impassable.

It was deemed necessary to complete a formal Investigation Report into the flooding in Dereham in 23-25 June 2016 as:

- multiple residential properties were internally flooded.
- multiple commercial properties were internally flooded.

This impact met Norfolk County Council's threshold for triggering the undertaking of a formal flood investigation.

The flood investigation report aims to:

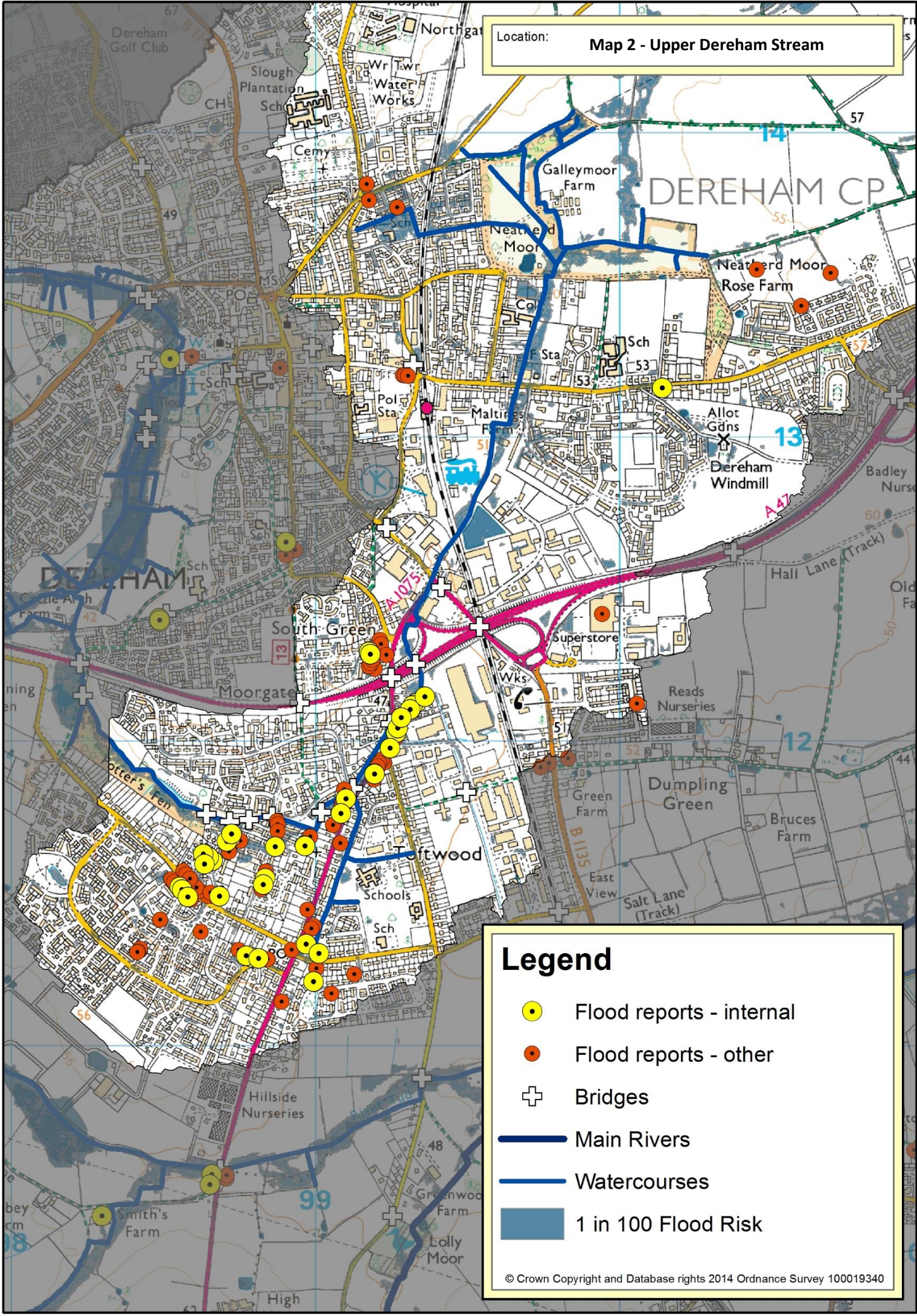
- provide a transparent and consistent review of recent flooding.
- identify those organisations and individuals who have responsibility to manage the causes of the flooding.
- identify what their response has been or will be to the flooding.
- make recommendations as to how the flood risk could be mitigated or reduced.
- provide new evidence of the level of risk faced by communities in Norfolk that can be used in current funding bids in support of flood mitigation schemes.

Mitigation measures include property level protection: reinstating lost drainage features: reviewing or increasing maintenance regimes and increasing the capacity of the drainage network.

The flood investigation report cannot:

- Resolve the flooding issues or provide designed solutions.
- Force authorities to undertake any of the recommended actions.

Location: **Map 2 - Upper Dereham Stream**



Legend

- Flood reports - internal
- Flood reports - other
- Bridges
- Main Rivers
- Watercourses
- 1 in 100 Flood Risk

© Crown Copyright and Database rights 2014 Ordnance Survey 100019340

Flooding and flood risk within the Upper Dereham Stream catchment

Description of catchment

This catchment originates in the largely rural area north of Dereham. The stream, with numerous tributaries, passes through the urban area east and then south of the Town Centre before outfalling into Scarning Fen. The concentration of flooding occurred in the sub-urban areas south of the A47.

Flood Risk within the catchment

The flood risk from local sources (ordinary watercourses and surface run-off) and strategic sources (Main Rivers and the sea) of flooding within this catchment has been assessed. The number of properties at risk are set out in the table below for two different risk bandings, the 1 in 30 year event and the 1 in 100 year event. This assessment does not take into account flood risk from groundwater or reservoir failure.

Flood Risk Data Source	Critical Services	Residential	Non-residential
[a] No. of properties subject to surface water flood risk at 1 in 30 year event:	4	127	15
[b] No. of properties subject to surface water flood risk at 1 in 100 year event:	6	339	39
[c] No. of properties subject to flood risk from rivers and the sea at 1 in 30 year event:	0	0	0
[d] No. of properties subject to flood risk from rivers and the sea at 1 in 100 year event:	0	0	0
[e] No. of properties only subject to both flood risk from surface water and rivers and the sea (combined risk) at 1 in 30 year event:	0	0	0
[f] No. of properties only subject to both flood risk from surface water and rivers and the sea (combined risk) at 1 in 100 year event:	0	0	0

Flood incidents within this catchment

Within this catchment 110 reports of external and internal flooding have been received. Out of these 110 reports 36 incidents of internal flooding have been confirmed and assessed as part of this investigation. These incidents are detailed in the table below.

Incident as reported	What was the response to the flood incident
<p>On the 23/06/2016 - 1 property was internally flooded on Orchid Avenue, Dereham. This incident was reported by the Fire and Rescue Service via an electronic report on the 10 July 2016, (FWF/16/3/3395)</p>	<ul style="list-style-type: none"> • The Fire and Rescue Service responded and pumped out during the incident. • Anglian Water Services Ltd visited to investigate and undertake works following a pollution issue linked to the flooding incident after the event
<p>On the 23/06/2016 - 3 properties were internally flooded on Lilac Close, Dereham. These incidents were reported by:</p> <ul style="list-style-type: none"> • the Fire and Rescue Service via an electronic report on the 10 July 2016, (FWF/16/3/3414) • a resident via email correspondence on the 28 June 2016, (FWF/16/3/2870) • a resident via personal communication on the 23 January 2017, (FWF/16/3/4145) 	<ul style="list-style-type: none"> • The Fire and Rescue Service visited affected residents to offer advice and to gather information during the incident. • Norfolk County Council (Lead Local Flood Authority) visited affected residents to offer advice and to gather information after the incident.
<p>On the 23/06/2016 - 2 properties were internally flooded on Pine Grove, Dereham. These incidents were reported by:</p> <ul style="list-style-type: none"> • a resident via a telephone call on the 29 September 2016, (FWF/16/3/3580) • a resident via a telephone call on the 29 September 2016, (FWF/16/3/3581) 	<ul style="list-style-type: none"> • Norfolk County Council (Lead Local Flood Authority) visited affected residents to offer advice and to gather information after the incident. • A resident carried out measures to minimise the impact of flooding during the incident. • Anglian Water Services Ltd visited affected residents to offer advice and to gather information after the incident. • The Fire and Rescue Service visited affected residents to offer advice and to gather information during the incident.
<p>On the 23/06/2016 - 1 property was internally flooded on Boyd Avenue, Dereham. This incident was reported by a resident via a telephone call on the 12 October 2016, (FWF/16/3/3577)</p>	<ul style="list-style-type: none"> • Anglian Water Services Ltd visited affected residents to offer advice and to gather information after the incident.
<p>On the 23/06/2016 - 4 properties were internally flooded on Stone Road, Dereham. These incidents were reported by:</p> <ul style="list-style-type: none"> • a resident via email correspondence on the 22 November 2016, (FWF/16/3/3749) • residents via personal communication on the 23 January 2017, (FWF/16/3/4152), (FWF/16/3/4153), (FWF/16/3/4157) 	<ul style="list-style-type: none"> • Norfolk County Council (Lead Local Flood Authority) visited affected residents to offer advice and to gather information after the incident. • Norfolk County Council (Highways) visited affected residents to offer advice and to gather information after the incident. • The Fire and Rescue Service visited affected residents to offer advice and to gather information during the incident.

<p>On the 23/06/2016 - 1 property was internally flooded on Willow Grove, Dereham. This incident was reported by a resident via an online flood report form on the 12 July 2016, (FWF/16/3/3045)</p>	<ul style="list-style-type: none"> • Norfolk County Council (Lead Local Flood Authority) visited affected residents to offer advice and to gather information after the incident.
<p>On the 23/06/2016 - 7 properties were internally flooded on South Green, Dereham. These incidents were reported by:</p> <ul style="list-style-type: none"> • the Fire and Rescue Service via an electronic report on the 10 July 2016, (FWF/16/3/3286) • a resident via an online flood report form on the 24 November 2016, (FWF/16/3/3792) • a resident via a telephone call on the 5 January 2017, (FWF/16/3/4121) • residents via personal communication on the 23 January 2017, (FWF/16/3/4128), (FWF/16/3/4129) • a resident via email correspondence on the 28 June 2016, (FWF/16/3/2876) • a resident via an online flood report form on the 30 June 2016, (FWF/16/3/2957) 	<ul style="list-style-type: none"> • The Fire and Rescue Service visited affected residents to offer advice and to gather information during the incident. • Norfolk County Council (Lead Local Flood Authority) visited affected residents to offer advice and to gather information after the incident. • Anglian Water Services Ltd visited affected residents to offer advice and to gather information after the incident. • The Fire and Rescue Service responded and pumped out during the incident. • Anglian Water Services Ltd visited to investigate a pollution issue linked to the flooding incident after the incident. • A resident carried out measures to minimise the impact of flooding during the incident.
<p>On the 23/06/2016 - 4 properties were internally flooded on Shipdham Road, Dereham. These incidents were reported by:</p> <ul style="list-style-type: none"> • the Fire and Rescue Service via an electronic report on the 10 July 2016, (FWF/16/3/3317) • the media via an article on the 27 January 2017, (FWF/16/3/4200) • a resident via personal communication on the 23 January 2017, (FWF/16/3/4132) • a resident via personal communication on the 25 January 2017, (FWF/16/3/4169) 	<ul style="list-style-type: none"> • The Fire and Rescue Service visited affected residents to offer advice and to gather information during the incident. • Norfolk County Council (Lead Local Flood Authority) visited affected residents to offer advice and to gather information after the incident. • Norfolk County Council (Highways) visited affected residents to offer advice and to gather information after the incident.
<p>On the 23/06/2016 - 3 properties were internally flooded on Larners Road, Dereham. These incidents were reported by:</p> <ul style="list-style-type: none"> • a resident via an online flood report form on the 12 December 2016, (FWF/16/3/3984) • a resident via an online flood report form on the 5 July 2016, (FWF/16/3/2949) • a resident via personal communication on the 23 January 2017, (FWF/16/3/4141) 	<ul style="list-style-type: none"> • Norfolk County Council (Lead Local Flood Authority) visited affected residents to offer advice and to gather information after the incident.
<p>On the 23/06/2016 - 2 properties were internally flooded on Hillcrest Avenue, Dereham. These incidents were reported by:</p> <ul style="list-style-type: none"> • a resident via personal communication on the 23 January 2017, (FWF/16/3/4209) 	<ul style="list-style-type: none"> • Norfolk County Council (Lead Local Flood Authority) visited affected residents to offer advice and to gather information after the incident.

<ul style="list-style-type: none"> • a resident via personal communication on the 25 January 2017, (FWF/16/3/4166) 	
<p>On the 23/06/2016 - 1 property was internally flooded on Westfield Road, Dereham. This incident was reported by a resident via personal communication on the 23 January 2017, (FWF/16/3/4137)</p>	<ul style="list-style-type: none"> • Norfolk County Council (Lead Local Flood Authority) visited affected residents to offer advice and to gather information after the incident.
<p>On the 23/06/2016 - 1 property was internally flooded on Sharon Close, Dereham. This incident was reported by a resident via an online flood report form on the 15 July 2016, (FWF/16/3/4165)</p>	<ul style="list-style-type: none"> • Norfolk County Council (Lead Local Flood Authority) visited affected residents to offer advice and to gather information after the incident.
<p>On the 23/06/2016 - 3 properties were internally flooded on South Green Gardens, Dereham. These incidents were reported by:</p> <ul style="list-style-type: none"> • a resident via an online flood report form on the 27 June 2016, (FWF/16/3/2880) • a resident via an online flood report form on the 27 June 2016, (FWF/16/3/2881) • a resident via an online flood report form on the 28 June 2016, (FWF/16/3/2878) 	<ul style="list-style-type: none"> • Residents carried out measures to minimise the impact of flooding during the incident. • Norfolk County Council (Lead Local Flood Authority) visited affected residents to offer advice and to gather information after the incident.
<p>On the 23/06/2016 - 1 property was internally flooded on Norwich Road, Dereham. This incident was reported by a resident via email correspondence on the 31 May 2017, (FWF/16/3/4715)</p>	<ul style="list-style-type: none"> • No authority visited the affected property however Norfolk County Council (Lead Local Flood Authority) contacted resident to offer advice and to gather information after the incident.
<p>On the 23/06/2016 - 2 properties were internally flooded on Chapel Lane, Dereham. These incidents were reported by:</p> <ul style="list-style-type: none"> • a resident via personal communication on the 23 January 2017, (FWF/16/3/4140) • a member of the public via personal communication on the 23 January 2017, (FWF/16/3/5454) 	<ul style="list-style-type: none"> • Norfolk County Council (Lead Local Flood Authority) visited affected residents to offer advice and to gather information after the incident.

Recent rainfall within the catchment

This report seeks to draw on rainfall data to ascertain the intensity of the rainfall events experienced in the catchment that led to the flooding. This analysis is useful in assessing (in broad terms) if the design capacity of drainage systems within the affected areas was exceeded.

Norfolk County Council has sought to use data from rain gauges where incidents of flooding are located within a 2.5 km radius of the instrumentation. This distance meets the requirements of British Standards and aims to capture localised rainfall patterns. Where there is no available data within this radius this will be stated.

18 of the incidents (50%) of internal flooding in this catchment are within 2.5km of a rain gauge. The rainfall events recorded by gauges for this catchment are;

23 June 2016 - 45mm rainfall was recorded as falling in 3 hours 30 minutes at the East Dereham STW rainfall monitoring station. This intensity of rainfall for the total duration equates to a 32 year rainfall event.

Historic flooding incidents within the catchment

The following table lists flooding incidents within the catchment that have been recorded:

Date of incident	Impact	Rainfall intensity
6 July 2012	One resident in Pine Grove, Dereham reported surface water and foul water flooding occurring on this date. The media also stated that flooding occurred on this date on Larners Road, Boyd Avenue, Orchid Avenue, South Green Gardens, Dereham Hospital and the Tesco store. No impact was stated.	Unknown
18 June 2009	One resident in Hillcrest Avenue, Dereham reported surface water flooding occurring on this date causing internal flooding	Unknown
June 2005	One resident in Hillcrest Avenue, Dereham reported surface water flooding occurring on this date causing internal flooding	Unknown
8 June 2003	One resident in Hillcrest Avenue, Dereham reported surface water flooding occurring on this date causing internal flooding	Unknown
August 2000	Two residents in Hillcrest Avenue, Dereham reported surface water flooding occurring on this date. One resident reported it caused internal flooding	Unknown
3 July 1999	One resident in Hillcrest Avenue, Dereham reported surface water flooding occurring on this date causing internal flooding	Unknown
23 July 1996	One resident in Hillcrest Avenue, Dereham reported surface water flooding occurring on this date causing internal flooding	Unknown
Unknown	8 residents reported flooding experienced previously. They were Stone Road (2x), Larners Road (1x), Sharon Close (1x), South Green Gardens (1x), South Green (3x). No dates or impact were given. One resident on South Green stated some properties had been flooded 5 or 6 times internally but did not state when.	Unknown

Causes of flooding within the catchment and recommendations

The findings of the investigation are detailed on the following pages. The first table details the causes that led to flooding within the catchment as well as when and where they were experienced. It also sets out which Risk Management Authorities have responsibility to help manage the causes of the flooding. The second table sets out recommendations to mitigate the causes and impacts of the flooding experienced within this catchment.

Flooding experienced at / on	Causes of flooding	Who has responsibilities to manage the cause(s) of the flood?
Boyd Avenue, Dereham, 23/06/2016 Chapel Lane, Dereham, 23/06/2016 Hillcrest Avenue, Dereham, 23/06/2016 Larners Road, Dereham, 23/06/2016 Lilac Close, Dereham, 23/06/2016 Norwich Road, Dereham, 23/06/2016 Orchid Avenue, Dereham, 23/06/2016 Pine Grove, Dereham, 23/06/2016 Sharon Close, Dereham, 23/06/2016 Shipdham Road, Dereham, 23/06/2016 South Green Gardens, Dereham, 23/06/2016 Stone Road, Dereham, 23/06/2016 Willow Grove, Dereham, 23/06/2016	<p>Run-off from significant rainfall was concentrated along overland flowpaths on which the affected properties are positioned. Due to the nature of the topography of South Dereham a large area of urban run-off is directed North towards the Dereham Stream. This run-off is concentrated through the urban environment to meet flows channelled within and exceeding Dereham Stream that are heading to the South and South West. These flows converge at the northern end of Shipdham Road and can only be conveyed away from properties when capacity in Dereham Stream is available.</p>	Property Owners
Shipdham Road, Dereham, 23/06/2016 South Green, Dereham, 23/06/2016 Westfield Road, Dereham, 23/06/2016	<p>Run-off from significant rainfall was directed towards the historic ditch network and receiving watercourse (Dereham Stream). The amendments of principal drains and watercourses through canalising, straightening and culverting caused a loss of integrity and capacity. Therefore the flows entering the ditches and watercourse as run-off or positive discharge could not be accommodated by the receiving watercourse. This caused water to exceed the channel capacity and overtop its banks. These flood flows then made their way into the affected properties. Between the A47 and South Green flood water backed up behind culverts and found its way onto the road at a low entrance way. It is also noted that there is a large concentration of significant outfalls from positive drainage systems located South of the A47 and North of Middlemarch Road. Properties have also been built in areas prone to natural flooding e.g. the functional flood plain of Dereham Stream.</p>	Breckland District Council, Norfolk County Council, Riparian Owners, Property Owners, Land Owners, Anglian Water

<p>Shipdham Road, Dereham, 23/06/2016 South Green, Dereham, 23/06/2016</p>	<p>Run-off from significant rainfall was obstructed by man-made constructions (e.g. walls, fencing, embankments) which directed flood water towards the affected properties and roads.</p>	<p>Property owners</p>
<p>Hillcrest Avenue, Dereham, 23/06/2016 Larners Road, Dereham, 23/06/2016 Lilac Close, Dereham, 23/06/2016 Orchid Avenue, Dereham, 23/06/2016 Sharon Close, Dereham, 23/06/2016 Shipdham Road, Dereham, 23/06/2016 South Green Gardens, Dereham, 23/06/2016 South Green, Dereham, 23/06/2016 Stone Road, Dereham, 23/06/2016 Westfield Road, Dereham, 23/06/2016</p>	<p>Surface run-off from significant rainfall that had made its way onto private tracks, roads and the highway flowed along the road network and onto the accesses of affected properties that were situated lower than these features.</p>	<p>Property owners, Land owners, Norfolk County Council</p>
<p>Hillcrest Avenue, Dereham, 23/06/2016 Lilac Close, Dereham, 23/06/2016 Norwich Road, Dereham, 23/06/2016 Orchid Avenue, Dereham, 23/06/2016 Pine Grove, Dereham, 23/06/2016 Sharon Close, Dereham, 23/06/2016 South Green Gardens, Dereham, 23/06/2016 Stone Road, Dereham, 23/06/2016</p>	<p>Significant rainfall was directed into the surface water and foul drainage networks. This caused the network to surcharge. Flows that exceeded the system's capacity contributed to the flooding.</p>	<p>Anglian Water, Norfolk County Council</p>
<p>Boyd Avenue, Dereham, 23/06/2016 Lilac Close, Dereham, 23/06/2016 Orchid Avenue, Dereham, 23/06/2016 Pine Grove, Dereham, 23/06/2016 Shipdham Road, Dereham, 23/06/2016 South Green Gardens, Dereham, 23/06/2016 South Green, Dereham, 23/06/2016 Westfield Road, Dereham, 23/06/2016</p>	<p>Run-off from significant rainfall was directed towards the surface water and foul drainage network. These flows could not be accommodated as the system was already overloaded. This directed flood water towards the affected properties and along roads.</p>	<p>Anglian Water, Norfolk County Council</p>

All locations, Dereham, 23/06/2016	The flood water entered many of the properties through the unprotected structure of the building. This included via features such as low thresholds at entrances, unprotected air bricks and services conduits.	Property owners
Chapel Lane, Dereham, 23/06/2016 Hillcrest Avenue, Dereham, 23/06/2016 Larners Road, Dereham, 23/06/2016 Lilac Close, Dereham, 23/06/2016 Orchid Avenue, Dereham, 23/06/2016 Pine Grove, Dereham, 23/06/2016 School Lane, Dereham, 23/06/2016 Sharon Close, Dereham, 23/06/2016 Shipdham Road, Dereham, 23/06/2016 South Green, Dereham, 23/06/2016 Stone Road, Dereham, 23/06/2016 Willow Grove, Dereham, 23/06/2016	The loss of drainage features within the catchment (such as ditches) and the amendments of principal drains and their connections through culverting, infilling and lack of maintenance caused a loss of integrity and capacity of the drainage network. This caused water to leave the drainage network at inappropriate locations. It should be noted that some of these historic features were of significant capacity.	Riparian owners, Land owners, Norfolk County Council, Breckland District Council

Flooding experienced at / on	Recommendation	Who has responsibility to follow up the recommendation?	Timescale
All locations, Dereham, 23/06/2016	Norfolk County Council will work with partner organisations to identify funding for flood mitigation. This would include assessing the potential to install property level protection measures, reduce run-off and increase the attenuation of flood water to reduce the impacts of flooding. Property owners could also carry out their own measures where funding is not forthcoming or residents are unwilling to wait for measures to be approved through national funding schemes.	Property owners, Land owners, Riparian owners, Anglian Water, Norfolk County Council, Highways England	12 months
Hillcrest Avenue, Dereham, 23/06/2016 Larners Road, Dereham, 23/06/2016 Lilac Close, Dereham, 23/06/2016 Orchid Avenue, Dereham, 23/06/2016 Pine Grove, Dereham, 23/06/2016 School Lane, Dereham, 23/06/2016 Sharon Close, Dereham, 23/06/2016 Shipdham Road, Dereham, 23/06/2016 South Green Gardens, Dereham, 23/06/2016 South Green, Dereham, 23/06/2016 Stone Road, Dereham, 23/06/2016 Westfield Road, Dereham, 23/06/2016 Chapel Lane, Dereham, 23/06/2016 Willow Grove, Dereham, 23/06/2016	Norfolk County Council will determine if works are needed to remove the risk posed by structures that form obstructions to watercourse flows and communicate with affected parties and riparian owners. Norfolk County Council would seek to remind riparian owners of their responsibility to undertake appropriate levels of maintenance to sustain the efficiency of the drainage systems.	Norfolk County Council, Norfolk Rivers Internal Drainage Board, Highways England	12 months
Chapel Lane, Dereham, 23/06/2016 Hillcrest Avenue, Dereham, 23/06/2016 Larners Road, Dereham, 23/06/2016 Lilac Close, Dereham, 23/06/2016 Orchid Avenue, Dereham, 23/06/2016 Sharon Close, Dereham, 23/06/2016	Norfolk County Council will consider opportunities to route flood water on the highway away from affected properties to alternative points of discharge, or other solutions as practicable.	Norfolk County Council	12 months

Shipdham Road, Dereham, 23/06/2016 South Green Gardens, Dereham, 23/06/2016 South Green, Dereham, 23/06/2016 Stone Road, Dereham, 23/06/2016 Westfield Road, Dereham, 23/06/2016			
All locations, Dereham, 23/06/2016	Anglian Water should work with partner organisations to identify the potential for managing the amount or rate of surface water entering their drainage system in flood events. Anglian Water should also identify the impact of water levels in Dereham Stream on their surface water outfalls and the level of constraint this has on their network.	Anglian Water	12 months
All locations, Dereham, 23/06/2016	Norfolk County Council will investigate with third parties the potential for retro-fitting permeable areas and other methods of small scale sustainable drainage systems.	Norfolk County Council	12 months
All locations, Dereham, 23/06/2016	Relevant Risk Management Authorities and property owners should confirm, where possible, the nature of onsite drainage and the existence of any connections to a wider drainage network. This work should seek to confirm the efficiency of property drainage and where the drainage network conveys flows to.	Property and asset owners	12 months
All locations, Dereham, 23/06/2016	Determine the integrity and/or capacity of their assets and review their maintenance regimes where they have contributed to the flooding of properties to understand the systems role in accommodating rainfall events as well as mitigating flooding.	Drainage asset owners	12 months

Map 4: Flood and drainage details



South Green Gardens – Internal and external flooding experienced on 23 June 2016

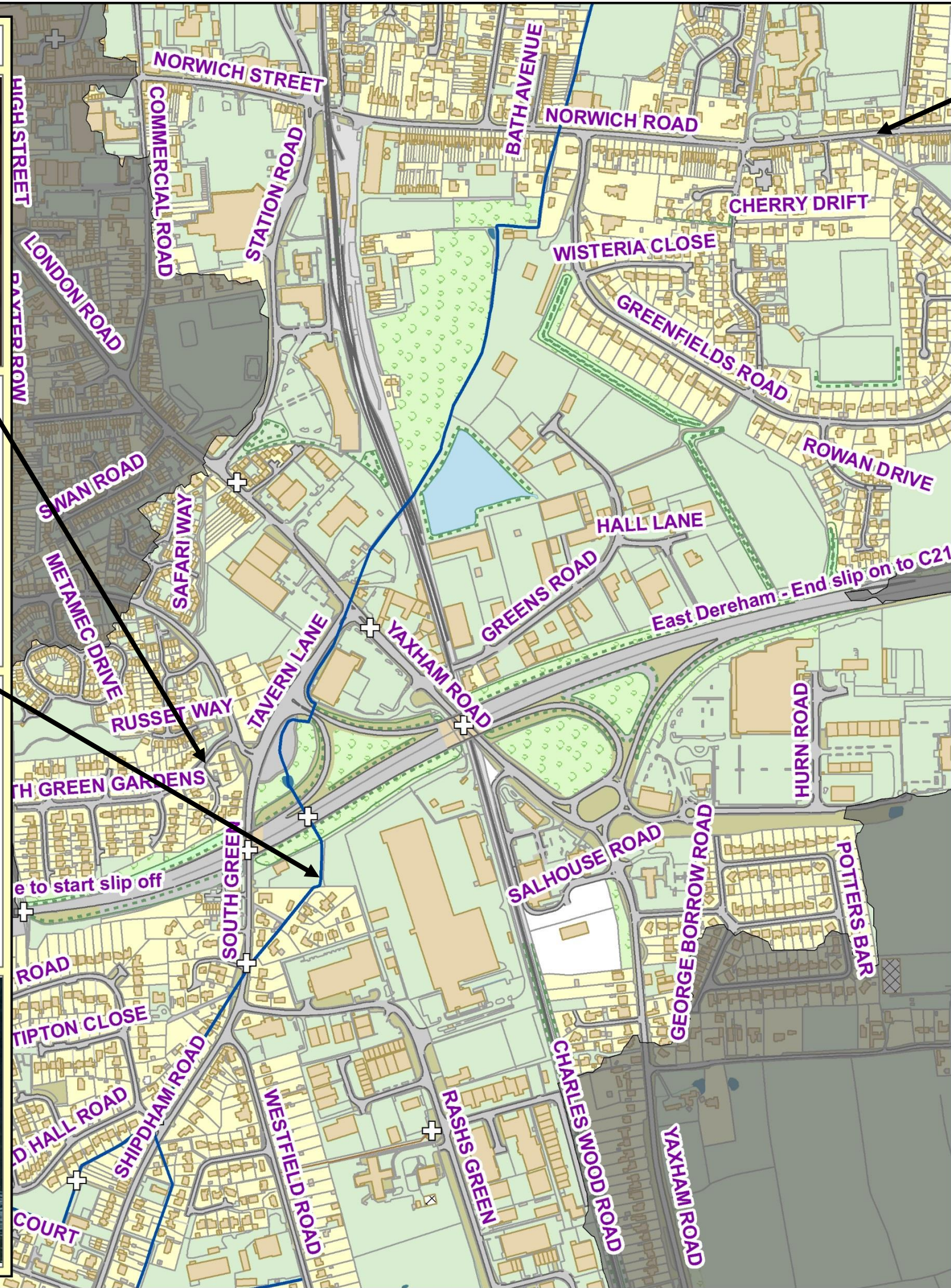
Causes – Significant rainfall was directed into the surface water and foul drainage networks. This caused the network to surcharge. Flows that exceeded the system’s capacity contributed to the flooding.

Recommendations – Norfolk County Council and relevant RMAs to explore funding for flood mitigation, attenuation and flood routing. Property owners should protect their buildings through flood protection measures where appropriate.

South Green and Shipdham Road – Internal and external flooding experienced on 23 June 2016

Causes – Flows entering the ditches and watercourse could not be accommodated. This caused water to exceed the channel capacity and overtop its banks. These flood flows then made their way into the affected properties and egressed onto the road.

Recommendations – Norfolk County Council will determine if works are needed to remove the risk posed by structures that form obstructions to watercourse flows and communicate with affected parties and riparian owners.



Location: **Upper Dereham Stream, above A47 culvert**

Norwich Road – Internal and external flooding experienced on 23 June 2016

Causes – Surface run-off from significant rainfall that had made its way onto roads and the highway flowed along the road network and onto the accesses of affected properties that were situated lower than these features.

Recommendations – Norfolk County Council could assess whether opportunities exist to route flood water on the highway away from the affected properties to alternative points of discharge.

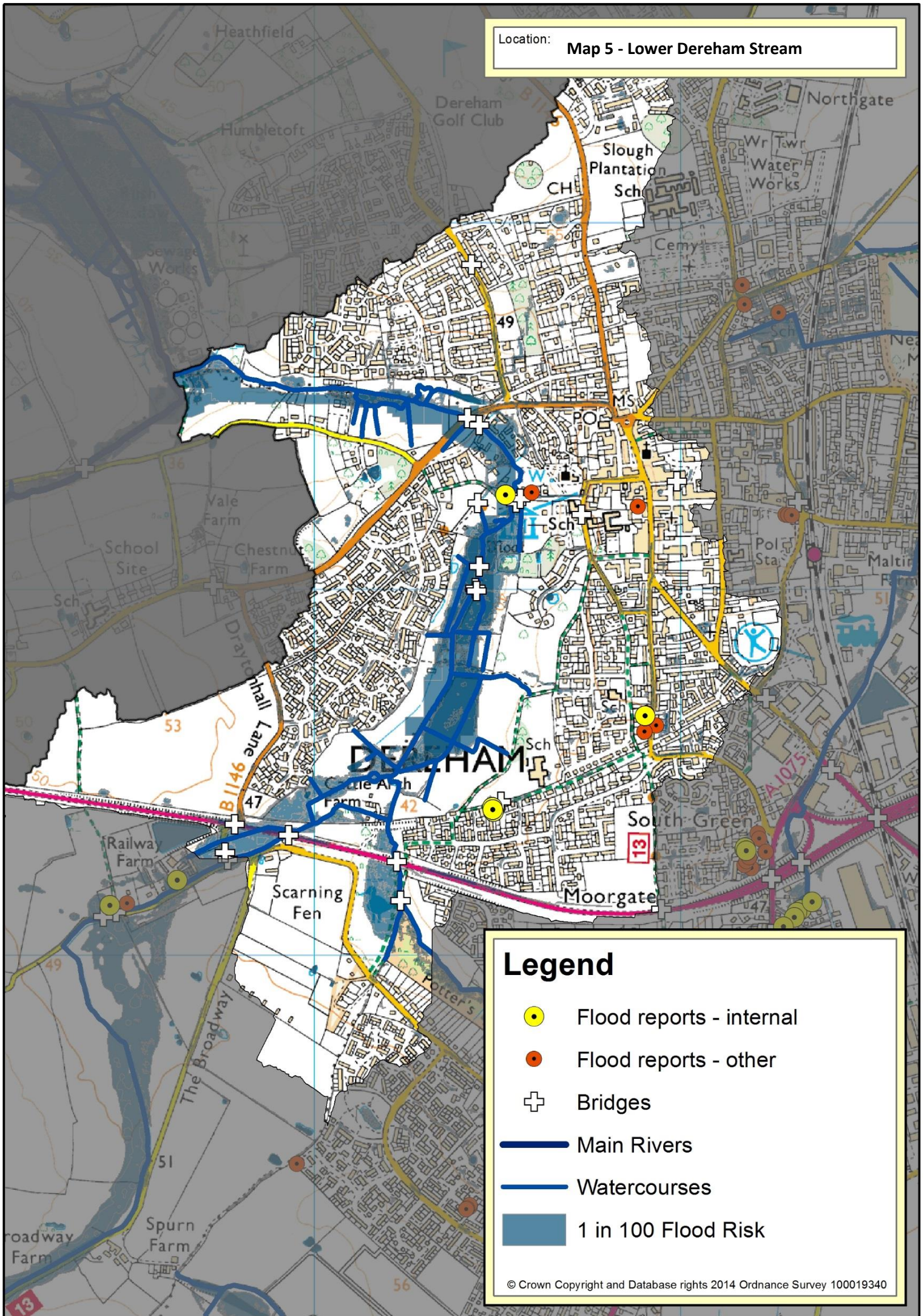
External Flooding – 72 reports of external or unconfirmed internal flooding occurring on 23 June 2016 were also received within this catchment. These reports came from Old Hall Road, Orchid Avenue, Rashes Green, Shipdham Road, Boyd Avenue, Hillcrest Avenue, Epsom Gardens, Lilac Close, Woodfield, Larners Road, The Crescent, Swanton Grove, St Francis Court, Acacia Avenue, Diana Close, School Lane, Stone Road, Cemetery Road, Sharon Close, Norwich Street, Yarrow Road, Etling Green, Kings Road, South Green, Larners Drift, Shillings Lane, South Green Gardens, Kingston Road and Chapel Lane.



Legend

- ⊕ Bridges
- Watercourses
- Main Rivers
- Water bodies

Location: **Map 5 - Lower Dereham Stream**



Legend

- Flood reports - internal
- Flood reports - other
- ⊕ Bridges
- Main Rivers
- Watercourses
- 1 in 100 Flood Risk

Flooding and flood risk within the Lower Dereham Stream catchment

Description of catchment

This catchment contains a lowland fen area, largely surrounded by the urban development of Dereham to the north and east and Scarning to the west. The stream outfalls into Wending Beck.

Flood Risk within the catchment

The flood risk from local sources (ordinary watercourses and surface run-off) and strategic sources (Main Rivers and the sea) of flooding within this catchment has been assessed. The number of properties at risk are set out in the table below for two different risk bandings, the 1 in 30 year event and the 1 in 100 year event. This assessment does not take into account flood risk from groundwater or reservoir failure.

Flood Risk Data Source	Critical Services	Residential	Non-residential
[a] No. of properties subject to surface water flood risk at 1 in 30 year event:	0	53	6
[b] No. of properties subject to surface water flood risk at 1 in 100 year event:	0	153	67
[c] No. of properties subject to flood risk from rivers and the sea at 1 in 30 year event:	0	4	0
[d] No. of properties subject to flood risk from rivers and the sea at 1 in 100 year event:	0	45	0
[e] No. of properties only subject to both flood risk from surface water and rivers and the sea (combined risk) at 1 in 30 year event:	0	0	0
[f] No. of properties only subject to both flood risk from surface water and rivers and the sea (combined risk) at 1 in 100 year event:	0	20	3

Flood incidents within this catchment

Within this catchment 10 reports of external and internal flooding have been received. Out of these 10 reports 5 incidents of internal flooding have been confirmed and assessed as part of this investigation. These incidents are detailed in the table below.

Incident as reported	What was the response to the flood incident
<p>On the 23/06/2016 - 3 properties were internally flooded on Lineside, Dereham. These incidents were reported by:</p> <ul style="list-style-type: none">• a resident via email correspondence on the 27 July 2016, (FWF/16/3/3090)• a resident via email correspondence on the 27 July 2016, (FWF/16/3/3114)• a resident via email correspondence on the 27 July 2016, (FWF/16/3/3115)	<ul style="list-style-type: none">• Norfolk County Council (Lead Local Flood Authority) visited affected residents to offer advice and to gather information after the incident.• Norfolk County Council (Highways) visited affected residents to offer advice and to gather information after the incident.
<p>On the 23/06/2016 - 1 property was internally flooded on Southend, Dereham. This incident was reported by a resident via an online flood report form on the 29 June 2016, (FWF/16/3/2817)</p>	<ul style="list-style-type: none">• No authority visited the affected property however Norfolk County Council (Lead Local Flood Authority) contacted resident to offer advice and to gather information after the incident.
<p>On the 23/06/2016 - 1 property was internally flooded on Washbridge, Scarning. This incident was reported by the Fire and Rescue Service via an electronic report on the 10 July 2016, (FWF/16/3/3323)</p>	<ul style="list-style-type: none">• The Fire and Rescue Service visited affected residents to offer advice and to gather information during the incident.• Breckland District Council visited affected residents to offer advice and to gather information after the incident.

Recent rainfall within the catchment

This report seeks to draw on rainfall data to ascertain the intensity of the rainfall events experienced in the catchment that led to the flooding. This analysis is useful in assessing (in broad terms) if the design capacity of drainage systems within the affected areas was exceeded.

Norfolk County Council has sought to use data from rain gauges where incidents of flooding are located within a 2.5 km radius of the instrumentation. This distance meets the requirements of British Standards and aims to capture localised rainfall patterns. Where there is no available data within this radius this will be stated.

5 of the incidents (100%) of internal flooding in this catchment are within 2.5km of a rain gauge. The rainfall events recorded by gauges for this catchment are;

23 June 2016 - 45mm rainfall was recorded as falling in 3 hours 30 minutes at the East Dereham STW rainfall monitoring station. This intensity of rainfall for the total duration equates to a 32 year rainfall event.

Historic flooding incidents within the catchment

The following table lists flooding incidents within the catchment that have been recorded:

Date of incident	Impact	Rainfall intensity
17 July 2015	Two residents reported suffering internal flooding on this date.	Unknown
May 2014	One resident reported suffering internal flooding on this date.	Unknown
August 2012	One resident reported suffering internal flooding on this date.	Unknown

Causes of flooding within the catchment and recommendations

The findings of the investigation are detailed on the following pages. The first table details the causes that led to flooding within the catchment as well as when and where they were experienced. It also sets out which Risk Management Authorities have responsibility to help manage the causes of the flooding. The second table sets out recommendations to mitigate the causes and impacts of the flooding experienced within this catchment.

Flooding experienced at / on	Causes of flooding	Who has responsibilities to manage the cause(s) of the flood?
<p>Lineside, Dereham, 23/06/2016 Southend, Dereham, 23/06/2016</p>	<p>Run-off from significant rainfall was concentrated along overland flowpaths on which the affected properties are positioned or adjacent to.</p>	<p>Property owners</p>
<p>Lineside, Dereham, 23/06/2016 Southend, Dereham, 23/06/2016</p>	<p>Surface run-off from significant rainfall that had made its way onto the highway flowed onto the accesses of affected properties that were situated lower than these features.</p>	<p>Norfolk County Council, Property owners</p>
<p>Lineside, Dereham, 23/06/2016</p>	<p>The surface water drainage system outfall was obstructed by debris. This caused the failure of the upstream drainage system contributing to flooding at the affected properties.</p>	<p>Anglian Water, Norfolk County Council</p>
<p>Washbridge, Scarning, 23/06/2016</p>	<p>Run-off from significant rainfall was directed into Dereham Stream. These flows could not be contained within the watercourse channel. Flooding from the watercourse flowed into the affected property. Properties have also been built in areas prone to natural flooding e.g. the functional flood plain of Dereham Stream.</p>	<p>Riparian owners, Internal Drainage Board</p>
<p>Lineside, Dereham, 23/06/2016</p>	<p>Significant rainfall was directed into the surface water and foul drainage networks. This caused the network to surcharge. Flows that exceeded the system's capacity contributed to the flooding.</p>	<p>Anglian Water, Norfolk County Council</p>
<p>Lineside, Dereham, 23/06/2016 Southend, Dereham, 23/06/2016 Washbridge, Scarning, 23/06/2016</p>	<p>The flood water entered many of the properties through the unprotected structure of the building. This included via features such as low thresholds at entrances, unprotected air bricks and services conduits (including ventilation systems).</p>	<p>Property owners</p>

Flooding experienced at / on	Recommendation	Who has responsibility to follow up the recommendation?	Timescale
Lineside, Dereham, 23/06/2016 Southend, Dereham, 23/06/2016 Washbridge, Scarning, 23/06/2016	Norfolk County Council will work with partner organisations to identify funding for flood mitigation. This would include assessing the potential to install property level protection measures, reduce run-off and increase the attenuation of flood water to reduce the impacts of flooding. Property owners could also carry out their own measures where funding is not forthcoming or residents are unwilling to wait for measures to be approved through national funding schemes.	Property owners, Land owners, Riparian owners, Anglian Water, Norfolk County Council	12 months
Lineside, Dereham, 23/06/2016	Norfolk County Council will consider opportunities to route flood water on the highway away from affected properties to alternative points of discharge, or other solutions as practicable.	Norfolk County Council	12 months
Lineside, Dereham, 23/06/2016	Norfolk County Council and Anglian Water should review the level of maintenance required to sustain the design efficiency of their drainage systems that serves the flooding location in line with the risk identified.	Norfolk County Council, Anglian Water	12 months
Washbridge, Scarning, 23/06/2016	The Internal Drainage Board should determine if works are needed to remove the risk posed by structures that form obstructions to watercourse flows and communicate with affected parties and riparian owners.	Norfolk Rivers Internal Drainage Board	12 months
Lineside, Dereham, 23/06/2016 Southend, Dereham, 23/06/2016 Washbridge, Scarning, 23/06/2016	Property owners should protect their buildings through flood protection measures where appropriate. Norfolk County Council will communicate with local residents to advise them of the appropriate measures they could take to protect their property without prejudicing the rights and responsibilities of adjoining property holders.	Property owners	12 months

Map 6: Flood and drainage details

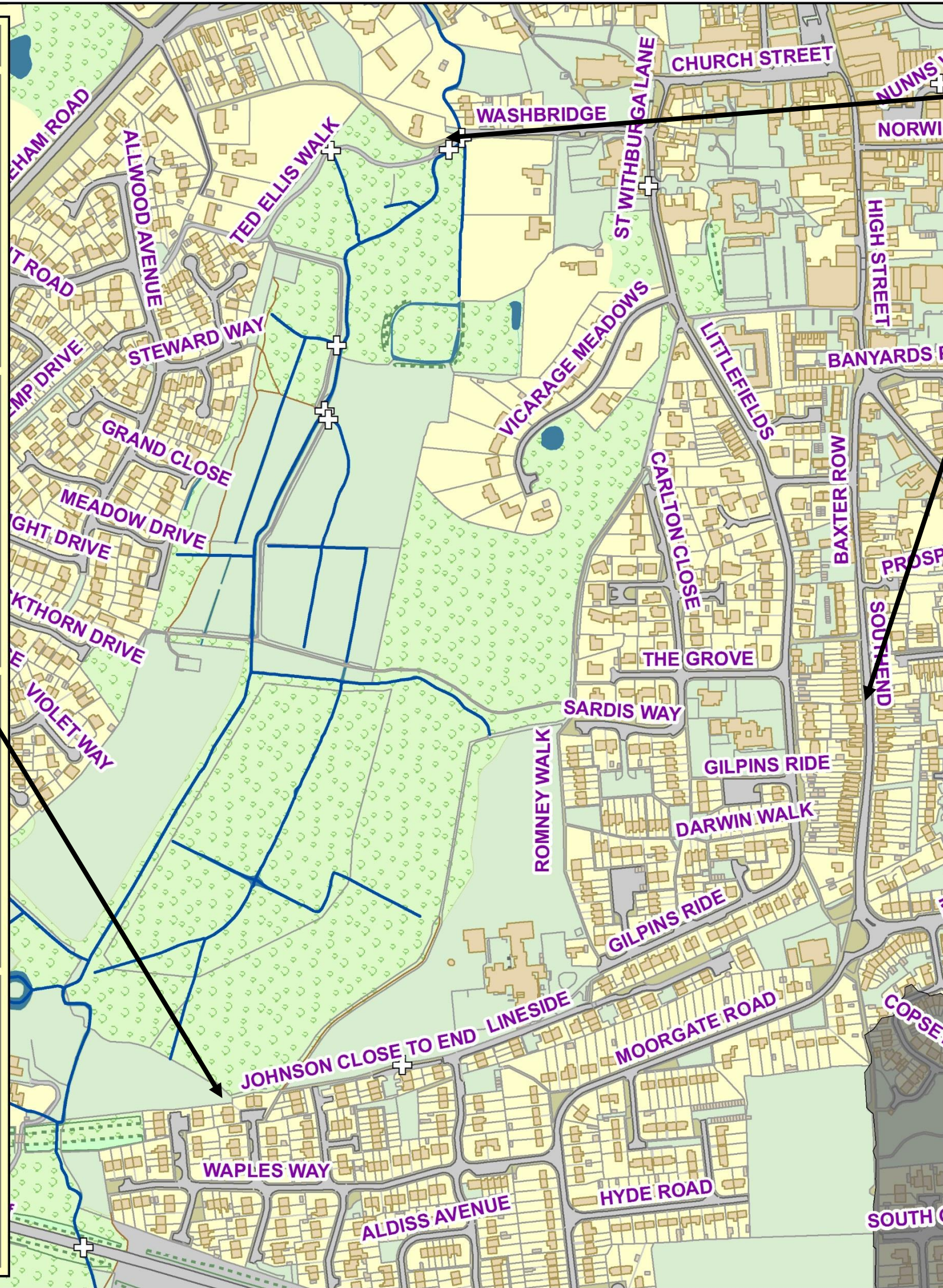


External flooding – 5 reports of external or unconfirmed internal flooding occurring on 23 June 2016 were also received within this catchment. These reports came from Washbridge, High Street and Southend.

Lineside – Internal and external flooding experienced on 23 June 2016

Causes – Surface run-off from significant rainfall that had made its way onto the highway flowed onto the accesses of affected properties that were situated lower than these features.

Recommendations – Norfolk County Council will consider opportunities to route flood water on the highway away from affected properties to alternative points of discharge, or other solutions as practicable.



Location: **Lower Dereham Stream**

Washbridge – Internal flooding experienced on 23 June 2016

Causes – Run-off from significant rainfall was directed into Dereham Stream. These flows could not be contained within the watercourse channel and flooded the affected property. Properties have been built in areas prone to natural flooding e.g. the functional flood plain of Dereham Stream.

Recommendations – The Internal Drainage Board should determine if works are needed to remove the risk posed by structures that form obstructions to watercourse flows and communicate with affected parties and riparian owners.

Southend – Internal and external flooding experienced on 23 June 2016

Causes – The flood water entered many of the properties through the unprotected structure of the building. This included via features such as low thresholds at entrances, unprotected air bricks and services conduits (including ventilation systems).

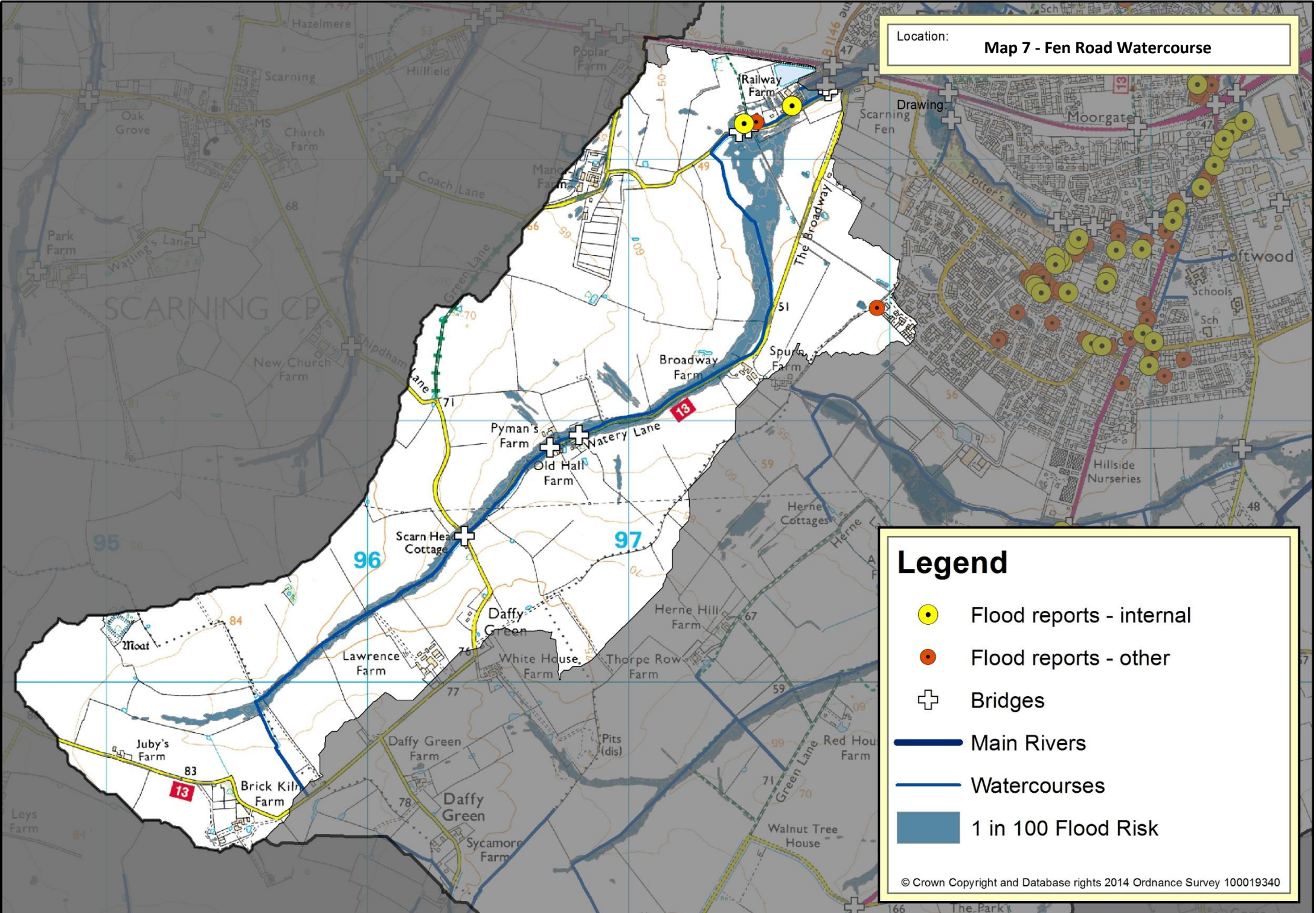
Recommendations – Property owners should protect their buildings through flood protection measures where appropriate.



Legend

- ⊕ Bridges
- Watercourses
- Main Rivers
- Water bodies

Location: **Map 7 - Fen Road Watercourse**



Legend

- Flood reports - internal
- Flood reports - other
- Bridges
- Main Rivers
- Watercourses
- 1 in 100 Flood Risk

© Crown Copyright and Database rights 2014 Ordnance Survey 100019340

Flooding and flood risk within the Fen Road Watercourse catchment

Description of catchment

This largely rural catchment runs south-west to north-east and outfalls into the Dereham Stream at Scarning Fen. The flooding to property occurred in the north-east corner of the catchment.

Flood Risk within the catchment

The flood risk from local sources (ordinary watercourses and surface run-off) and strategic sources (Main Rivers and the sea) of flooding within this catchment has been assessed. The number of properties at risk are set out in the table below for two different risk bandings, the 1 in 30 year event and the 1 in 100 year event. This assessment does not take into account flood risk from groundwater or reservoir failure.

Flood Risk Data Source	Critical Services	Residential	Non-residential
[a] No. of properties subject to surface water flood risk at 1 in 30 year event:	0	6	7
[b] No. of properties subject to surface water flood risk at 1 in 100 year event:	0	8	12
[c] No. of properties subject to flood risk from rivers and the sea at 1 in 30 year event:	0	0	0
[d] No. of properties subject to flood risk from rivers and the sea at 1 in 100 year event:	0	0	0
[e] No. of properties only subject to both flood risk from surface water and rivers and the sea (combined risk) at 1 in 30 year event:	0	0	0
[f] No. of properties only subject to both flood risk from surface water and rivers and the sea (combined risk) at 1 in 100 year event:	0	0	0

Flood incidents within this catchment

Within this catchment 4 reports of external and internal flooding have been received. Out of these 4 reports 2 incidents of internal flooding have been confirmed and assessed as part of this investigation. These incidents are detailed in the table below.

Incident as reported	What was the response to the flood incident
<p>On the 23/06/2016 - 2 properties were internally flooded on Fen Road, Scarning. These incidents were reported by:</p> <ul style="list-style-type: none"> • the Fire and Rescue Service via an electronic report on the 10 July 2016, (FWF/16/3/3320) • Norfolk County Council (Highways) via an electronic report on the 19 July 2016, (FWF/16/3/3980) 	<ul style="list-style-type: none"> • The Fire and Rescue Service visited affected residents to offer advice and to gather information during the incident. • Norfolk County Council (Lead Local Flood Authority) visited affected residents to offer advice and to gather information after the incident. • A resident carried out measures to minimise the impact of flooding during the incident.

Recent rainfall within the catchment

This report seeks to draw on rainfall data to ascertain the intensity of the rainfall events experienced in the catchment that led to the flooding. This analysis is useful in assessing (in broad terms) if the design capacity of drainage systems within the affected areas was exceeded.

Norfolk County Council has sought to use data from rain gauges where incidents of flooding are located within a 2.5 km radius of the instrumentation. This distance meets the requirements of British Standards and aims to capture localised rainfall patterns. Where there is no available data within this radius this will be stated.

2 of the incidents (100%) of internal flooding in this catchment are within 2.5km of a rain gauge. The rainfall events recorded by gauges for this catchment are;

23 June 2016 - 45mm rainfall was recorded as falling in 3 hours 30 minutes at the East Dereham STW rainfall monitoring station. This intensity of rainfall for the total duration equates to a 32 year rainfall event.

Historic flooding incidents within the catchment

No information on historic flooding incidents within the catchment has been forthcoming during the course of this investigation.

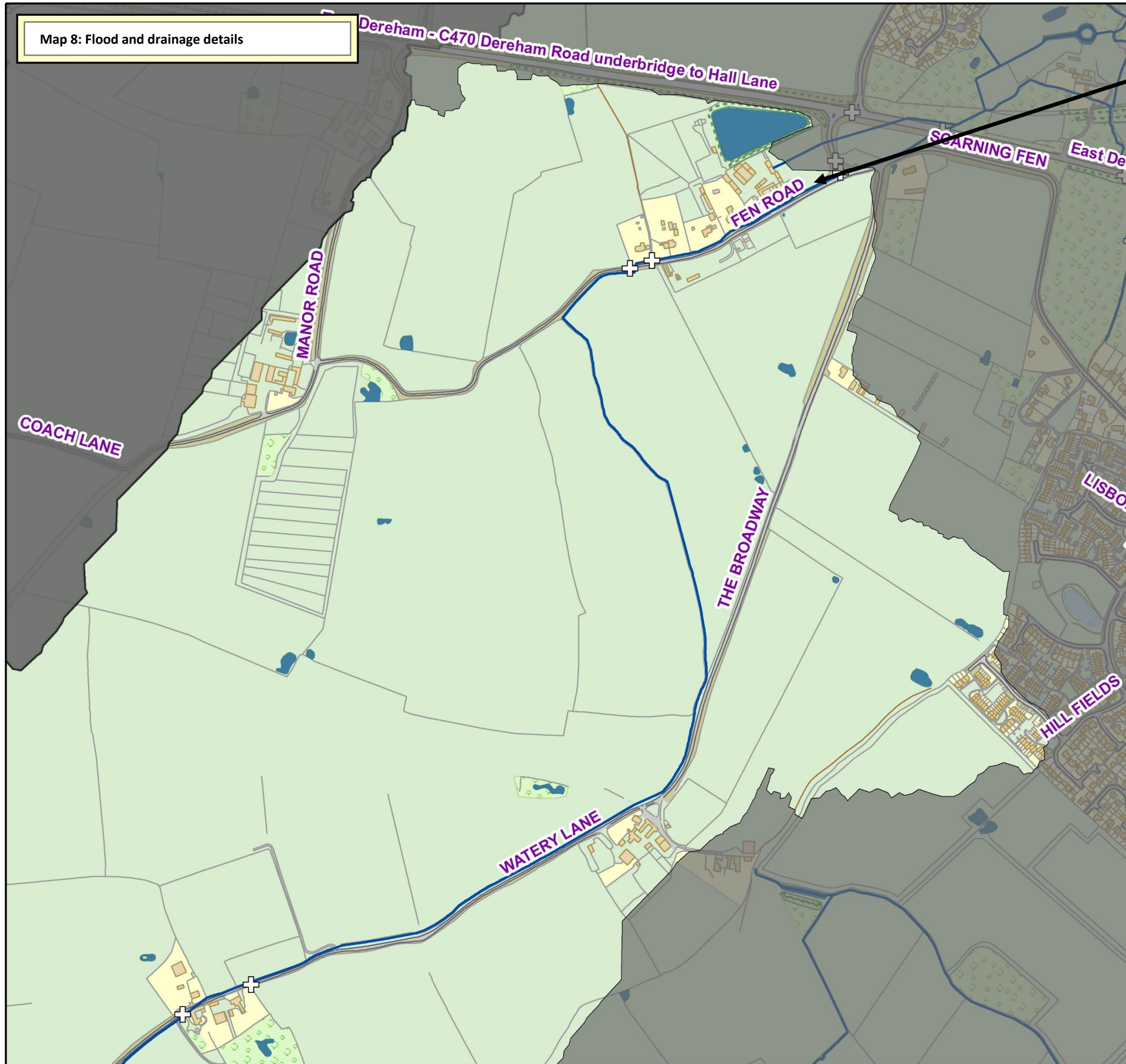
Causes of flooding within the catchment and recommendations

The findings of the investigation are detailed on the following pages. The first table details the causes that led to flooding within the catchment as well as when and where they were experienced. It also sets out which Risk Management Authorities have responsibility to help manage the causes of the flooding. The second table sets out recommendations to mitigate the causes and impacts of the flooding experienced within this catchment.

Flooding experienced at / on	Causes of flooding	Who has responsibilities to manage the cause(s) of the flood?
Fen Road, Scarning, 23/06/2016	Run-off from significant rainfall across the catchment was directed along flow paths towards the surface water drainage network and the watercourse. These flows could not be accommodated by the receiving watercourse which caused flood water to flow into the affected properties.	Property owners, Land owners, Riparian owners, Anglian Water, Norfolk County Council
	Surface run-off flowed from the highway and private roads towards the watercourse which contributed to the flooding of the affected properties.	Land owners Property owners Highways Authority
	The flood water entered many of the properties through the unprotected structure of the building. This included via features such as low thresholds at entrances, unprotected air bricks and services conduits.	Property owners

Flooding experienced at / on	Recommendation	Who has responsibility to follow up the recommendation?	Timescale
Fen Road, Scarning, 23/06/2016	Norfolk County Council will determine if works are needed to increase volumetric capacity, remove the risk posed by structures that form obstructions to watercourse flows and communicate with affected parties and riparian owners. Norfolk County Council would seek to remind riparian owners of their responsibility to undertake appropriate levels of maintenance to sustain the efficiency of the drainage system.	Norfolk County Council	12 months
	Property owners should protect their buildings through flood protection measures where appropriate. Norfolk County Council will communicate with local residents to advise them of the appropriate measures they could take to protect their property without prejudicing the rights and responsibilities of adjoining property holders.	Property owners	12 months

Map 8: Flood and drainage details



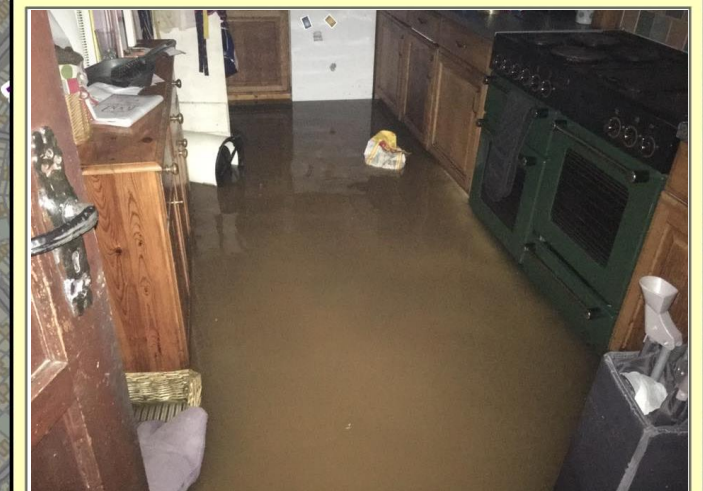
Location: **Fen Road Watercourse**

Fen Road – Internal and external flooding experienced on 23 June 2016

Causes – Run-off from significant rainfall across the catchment was directed along flow paths towards the drainage network and watercourse. These flows could not be accommodated by the receiving watercourse. This caused flood water to enter properties through the unprotected structure of the building.

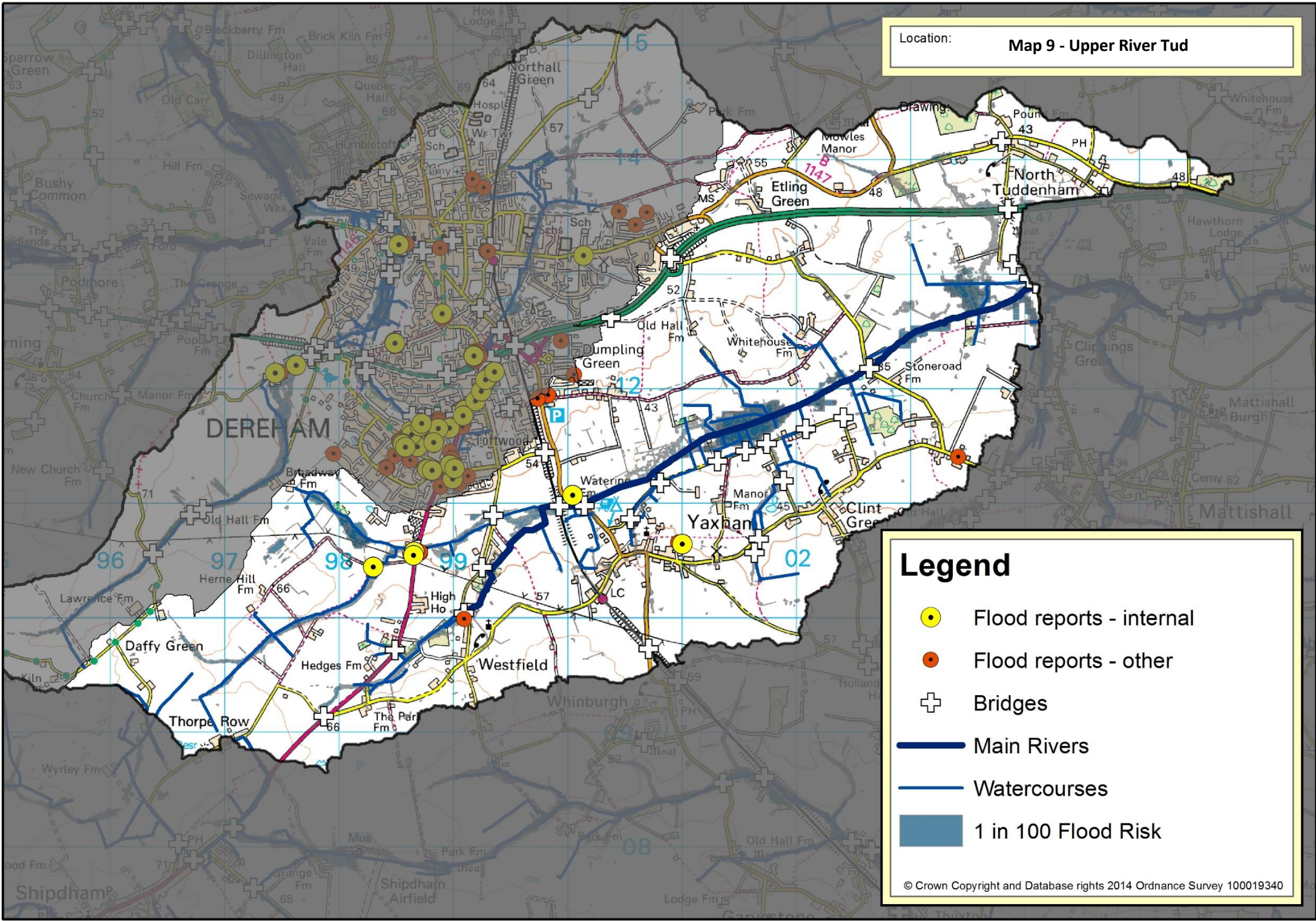
Recommendations – Norfolk County Council will determine the influence on the watercourse of channel capacity, structures and maintenance. Property owners should protect their buildings through flood protection measures where appropriate.

External flooding – 2 reports of external or unconfirmed internal flooding occurring on 23 June 2016 were also received within this catchment. These reports came from Fen Road and Strasbourg Way.



Legend

- ⊕ Bridges
- Watercourses
- Main Rivers
- Water bodies



Legend

- Flood reports - internal
- Flood reports - other
- Bridges
- Main Rivers
- Watercourses
- 1 in 100 Flood Risk

© Crown Copyright and Database rights 2014 Ordnance Survey 100019340

Flooding and flood risk within the Upper River Tud catchment

Description of catchment

This rural catchment runs west to east and forms the headwater of the River Tud, which in turn outfalls to the River Wensum at Hellesdon Mill near Norwich. The flooding in this catchment occurred south of Dereham.

Flood Risk within the catchment

The flood risk from local sources (ordinary watercourses and surface run-off) and strategic sources (Main Rivers and the sea) of flooding within this catchment has been assessed. The number of properties at risk are set out in the table below for two different risk bandings, the 1 in 30 year event and the 1 in 100 year event. This assessment does not take into account flood risk from groundwater or reservoir failure.

Flood Risk Data Source	Critical Services	Residential	Non-residential
[a] No. of properties subject to surface water flood risk at 1 in 30 year event:	0	20	1
[b] No. of properties subject to surface water flood risk at 1 in 100 year event:	1	43	6
[c] No. of properties subject to flood risk from rivers and the sea at 1 in 30 year event:	0	0	0
[d] No. of properties subject to flood risk from rivers and the sea at 1 in 100 year event:	0	1	0
[e] No. of properties only subject to both flood risk from surface water and rivers and the sea (combined risk) at 1 in 30 year event:	0	0	0
[f] No. of properties only subject to both flood risk from surface water and rivers and the sea (combined risk) at 1 in 100 year event:	0	0	0

Flood incidents within this catchment

Within this catchment 17 reports of external and internal flooding have been received. Out of these 17 reports 5 incidents of internal flooding have been confirmed and assessed as part of this investigation. These incidents are detailed in the table below.

Incident as reported	What was the response to the flood incident
On the 23/06/2016 - 1 property was internally flooded on Yaxham Road , Dereham. This incident was reported by the Fire and Rescue Service via an electronic report on the 5 October 2016, (FWF/16/3/3533)	<ul style="list-style-type: none">• The Fire and Rescue Service carried out measures to minimise the impact of flooding during the incident.
On the 23/06/2016 - 2 properties were internally flooded on Shipdham Road , Shipdham. These incidents were reported by: <ul style="list-style-type: none">• a resident via email correspondence on the 12 April 2017, (FWF/16/3/4172)• a resident via a flood questionnaire received on the 22 February 2017, (FWF/16/3/4357)	<ul style="list-style-type: none">• Norfolk County Council (Lead Local Flood Authority) visited affected residents to offer advice and to gather information after the incident.
On the 23/06/2016 - 1 property was internally flooded on Herne Lane , Shipdham. This incident was reported by a resident via social media on the 28 June 2016, (FWF/16/3/2917)	<ul style="list-style-type: none">• Norfolk County Council (Lead Local Flood Authority) visited affected residents to offer advice and to gather information after the incident.
On the 23/06/2016 - 1 property was internally flooded on St. Peter's Close , Yaxham. This incident was reported by Breckland District Council via email correspondence on the 18 July 2016, (FWF/16/3/3860)	<ul style="list-style-type: none">• Breckland District Council provided sandbags to minimise the impact of flooding during the incident.• Police officers from Norfolk Constabulary attended during the event.

Recent rainfall within the catchment

This report seeks to draw on rainfall data to ascertain the intensity of the rainfall events experienced in the catchment that led to the flooding. This analysis is useful in assessing (in broad terms) if the design capacity of drainage systems within the affected areas was exceeded.

Norfolk County Council has sought to use data from rain gauges where incidents of flooding are located within a 2.5 km radius of the instrumentation. This distance meets the requirements of British Standards and aims to capture localised rainfall patterns. Where there is no available data within this radius this will be stated.

There were no rain gauges within 2.5km of the incidents of flooding within this catchment.

Historic flooding incidents within the catchment

No information on historic flooding incidents within the catchment has been forthcoming during the course of this investigation.

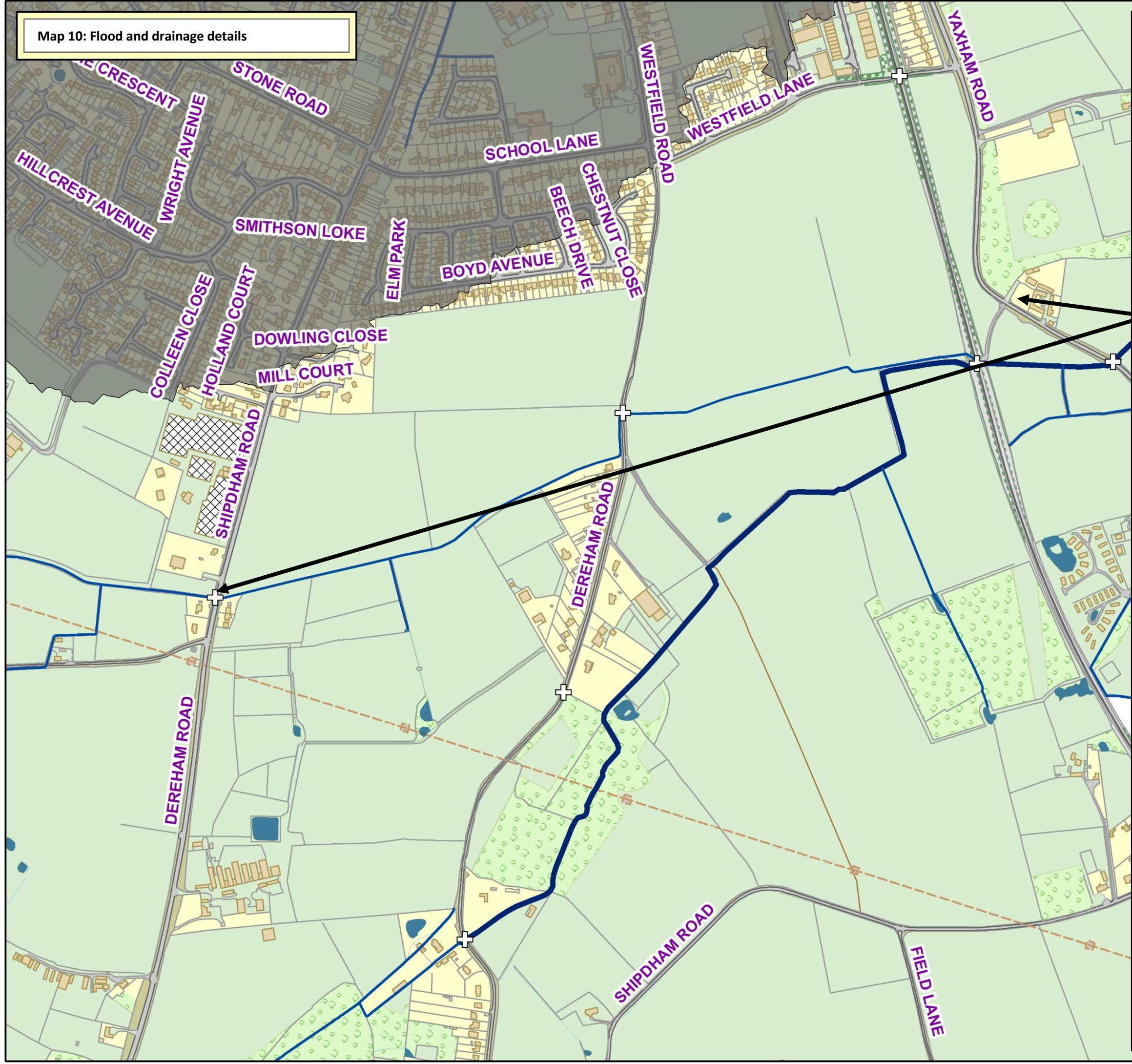
Causes of flooding within the catchment and recommendations

The findings of the investigation are detailed on the following pages. The first table details the causes that led to flooding within the catchment as well as when and where they were experienced. It also sets out which Risk Management Authorities have responsibility to help manage the causes of the flooding. The second table sets out recommendations to mitigate the causes and impacts of the flooding experienced within this catchment.

Flooding experienced at / on	Causes of flooding	Who has responsibilities to manage the cause(s) of the flood?
<p>Yaxham Road, Dereham, 23/06/2016 Shipdham Road, Shipdham, 23/06/2016 Herne Lane, Shipdham, 23/06/2016</p>	<p>Run-off from significant rainfall across the catchment was directed along flow paths towards the surface water drainage network and the watercourse. These flows could not be accommodated by the receiving watercourse which caused flood water to flow into the affected properties.</p>	<p>Property owners, Land owners, Riparian owners, Norfolk County Council, Environment Agency, Internal Drainage Board</p>
<p>Yaxham Road, Dereham, 23/06/2016 St. Peter's Close, Yaxham, 23/06/2016</p>	<p>Surface run-off flowed from the highway onto the access of the properties which contributed to the flooding of the affected properties.</p>	<p>Property owners, Norfolk County Council</p>
<p>Yaxham Road, Dereham, 23/06/2016 Shipdham Road, Shipdham, 23/06/2016 Herne Lane, Shipdham, 23/06/2016 St. Peter's Close, Yaxham, 23/06/2016</p>	<p>Run-off from significant rainfall was directed towards the surface water and foul drainage network. These flows could not be accommodated by the capacity of the system and caused it to surcharge. This caused flood water to be directed towards the affected properties. Please note on a number of locations the foul network is private not public.</p>	<p>Property owners, Anglian Water, Norfolk County Council</p>
<p>Yaxham Road, Dereham, 23/06/2016 Shipdham Road, Shipdham, 23/06/2016 Herne Lane, Shipdham, 23/06/2016 St. Peter's Close, Yaxham, 23/06/2016</p>	<p>The flood water entered many of the properties through the unprotected structure of the building. This included via features such as low thresholds at entrances, unprotected air bricks and services conduits.</p>	<p>Property owners</p>

Flooding experienced at / on	Recommendation	Who has responsibility to follow up the recommendation?	Timescale
Yaxham Road, Dereham, 23/06/2016 Shipdham Road, Shipdham, 23/06/2016 Herne Lane, Shipdham, 23/06/2016	Norfolk County Council, Norfolk Rivers Internal Drainage Board and the Environment Agency will determine if works are needed to increase volumetric capacity and/or remove the risk posed by structures that form obstructions to Main River flows. Norfolk County Council would seek to remind riparian owners of their responsibility to undertake appropriate levels of maintenance to sustain the efficiency of the drainage system.	Norfolk County Council, Norfolk Rivers Internal Drainage Board, Environment Agency	12 months
Yaxham Road, Dereham, 23/06/2016 Shipdham Road, Shipdham, 23/06/2016 Herne Lane, Shipdham, 23/06/2016 St. Peter's Close, Yaxham, 23/06/2016	Property owners should protect their buildings through flood protection measures where appropriate. Norfolk County Council will communicate with local residents to advise them of the appropriate measures they could take to protect their property without prejudicing the rights and responsibilities of adjoining property holders.	Property owners	12 months
Yaxham Road, Dereham, 23/06/2016 St. Peter's Close, Yaxham, 23/06/2016	Norfolk County Council will consider opportunities to route flood water on the highway away from affected properties to alternative points of discharge, or other solutions as practicable.	Norfolk County Council	12 months
St. Peter's Close, Yaxham, 23/06/2016	Anglian Water should work with partner organisations to identify the potential for managing the amount or rate of surface water entering their drainage system in flood events to reduce the likelihood of surcharging.	Anglian Water	12 months

Map 10: Flood and drainage details



Location: Upper River Tud



Shipdham Road and Yaxham Road – Internal flooding experienced on 23 June 2016

Causes – Run-off from significant rainfall entered surface water drainage and watercourse. These flows exceeded the capacity of the watercourse flooding properties. The flood water entered many of the properties through the unprotected structure of the building at **all locations** in this catchment.

Recommendations – Norfolk County Council will determine the influence on the watercourse of channel capacity, structures and maintenance. Property owners should protect their buildings through flood protection measures where appropriate.



Legend

- ⊕ Bridges
- Watercourses
- Main Rivers
- Water bodies

© Crown Copyright and Database rights 2014 Ordnance Survey 100019340

Disclaimer

Although every effort has been taken to ensure the accuracy of the information contained within the pages of the report, we cannot guarantee that the contents will always be current, accurate or complete.

This report has been prepared as part of Norfolk County Council's responsibilities under the Flood and Water Management Act 2010. It is intended to provide context and information to support the delivery of the local flood risk management strategy and should not be used for any other purpose.

The findings of the report are based on a subjective assessment of the information available by those undertaking the investigation and therefore may not include all relevant information. As such it should not be considered as a definitive assessment of all factors that may have triggered or contributed to the flood event.

The opinions, conclusions and any recommendations in this Report are based on assumptions made by Norfolk County Council when preparing this report, including, but not limited to those key assumptions noted in the Report, including reliance on information provided by third parties.

Norfolk County Council expressly disclaims responsibility for any error in, or omission from, this report arising from or in connection with any of the assumptions being incorrect.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the time of preparation and Norfolk County Council expressly disclaims responsibility for any error in, or omission from this report arising from or in connection with those opinions, conclusions and any recommendations.

The implications for producing Flood Investigation Reports and any consequences of blight have been considered. The process of gaining insurance for a property and/or purchasing/selling a property and any flooding issues identified are considered a separate and legally binding process placed upon property owners and this is independent of and does not relate to the County Council highlighting flooding to properties at a street level.

Norfolk County Council forbids the reproduction of this report or its contents by any third party without prior agreement.

Appendix A - Key definitions and responsibilities

What is flooding?

Section 1 of the Flood and Water Management Act 2010 states that: "Flood" includes any case where land not normally covered by water becomes covered by water. In addition, this section adds the caveat: "But "flood" does not include – (a) a flood from any part of the sewerage system, unless wholly or partly caused by an increase in the volume of rainwater (including snow and other precipitation) entering or otherwise affecting the system, or (b) a flood caused by a burst water main (within the meaning given by Section 219 of the Water Industry Act 1991)."

What is internal and external flooding?

For the purposes of this report, properties that have internally flooded are those where it is considered that water has entered the fabric of the building;

- Basements and below ground level floors are included.
- Garages are included if in the fabric of the building. Garages adjacent or separate from the main building are not included.
- Occupied caravans are included but not tents.

External flooding included those properties where water has entered gardens or surrounding areas which restricts access, affects the highway or where flooding has disrupted essential services to the property such as sewerage. For businesses this includes those where the flood waters are directly preventing them trading as usual.

What is Local Flood Risk?

Local Flood Risk is defined by the Flood and Water Management Act 2010 as being flood risk from surface runoff, groundwater and ordinary watercourses.

- 'Surface runoff' means rainwater (including snow and other precipitation) which is on the surface of the ground (whether or not it is moving) and, has not entered a watercourse, drainage system or public sewer.
- 'Groundwater' means all water which is below the surface of the ground and in direct contact with the ground or subsoil.
- 'Ordinary Watercourse' means a watercourse that does not form part of a main river and includes a reference to a lake, pond or other area of water which flows into an ordinary watercourse.

Roles and Responsibilities of Risk Management Authorities

Below is a short summary of those groups and Risk Management Authorities ("RMAs") that have a role in managing flooding within Norfolk. The listing of responsibilities includes those duties or powers that directly relate to managing the flood incidents or consequence. All RMAs have a duty to cooperate with other RMAs.

1. Norfolk County Council (as Lead Local Flood Authority)

- Duty to investigate significant flooding from any source.
- Duty to maintain a register of structures or features which affect flood risk from all sources.
- Power to undertake works to manage flood risk from surface run-off and groundwater.
- Powers to regulate activities on ordinary watercourses outside of Internal Drainage Board areas.
- Duties as a Category 1 Responder for Emergency Planning and the Fire & Rescue Service.

2. District Councils

- Powers to undertake works on ordinary watercourses outside of IDB areas.
- The Local Planning Authority for their District area and determine the appropriateness of developments and their exposure and effect on flood risk.
- Duties as a Category 1 Responder for Emergency Planning.

3. Internal Drainage Boards (“IDBs”)

- A duty to act in a manner consistent with the national and local strategies and guidance when exercising FCERM functions.
- Duty to act in a manner consistent with Local Flood Risk Management Strategies when exercising other functions that may affect flood risk.
- Powers to regulate activities on ordinary watercourses within IDB areas.
- Exercise a general power of supervision over all matters relating to the drainage of land within their district.
- Powers to undertake works on ordinary watercourses within IDB areas.

4. Highway Authorities (Norfolk County Council / Highways England)

- Powers to undertake works to manage water on the highway and to move water off the highway.
- Enforcement powers to unauthorised alterations, obstructions and interferences with highway drainage.
- Have responsibilities for culverts vested in the highway. Currently NCC discharges its responsibilities associated with bridges and culverts (whether as owner or highway authority) through the inspection of condition (undertaken by the Bridges team) and through maintenance activity (delivered on a as needs basis by the relevant Highways area team).

5. Water Companies

- Undertake cost beneficial capital schemes to alleviate or eliminate flooding where the flood event is associated with a failure of their assets.
- Duty to provide, improve, maintain and operate systems of public sewers and works for the purpose of effectually draining an area.
- Are responsible for flooding from their foul, combined and surface water sewers, and from burst water mains.
- Maintain ‘At Risk Registers’ for Ofwat that record properties that have flooded from public foul, combined and surface water sewers and that are at risk of flooding again.
- Water companies respond to reports from the public of flooding associated with their assets and determine an appropriate response in line with their standards or customer service.
- Duties as a Category 2 Responder for Emergency Planning.

6. Riparian Owners

- Duty of care towards neighbours upstream and downstream, avoiding any action likely to cause flooding.
- Entitled to protect their properties from flooding.
- May be required to maintain the condition of their watercourse to ensure that the proper flow of water is unimpeded.