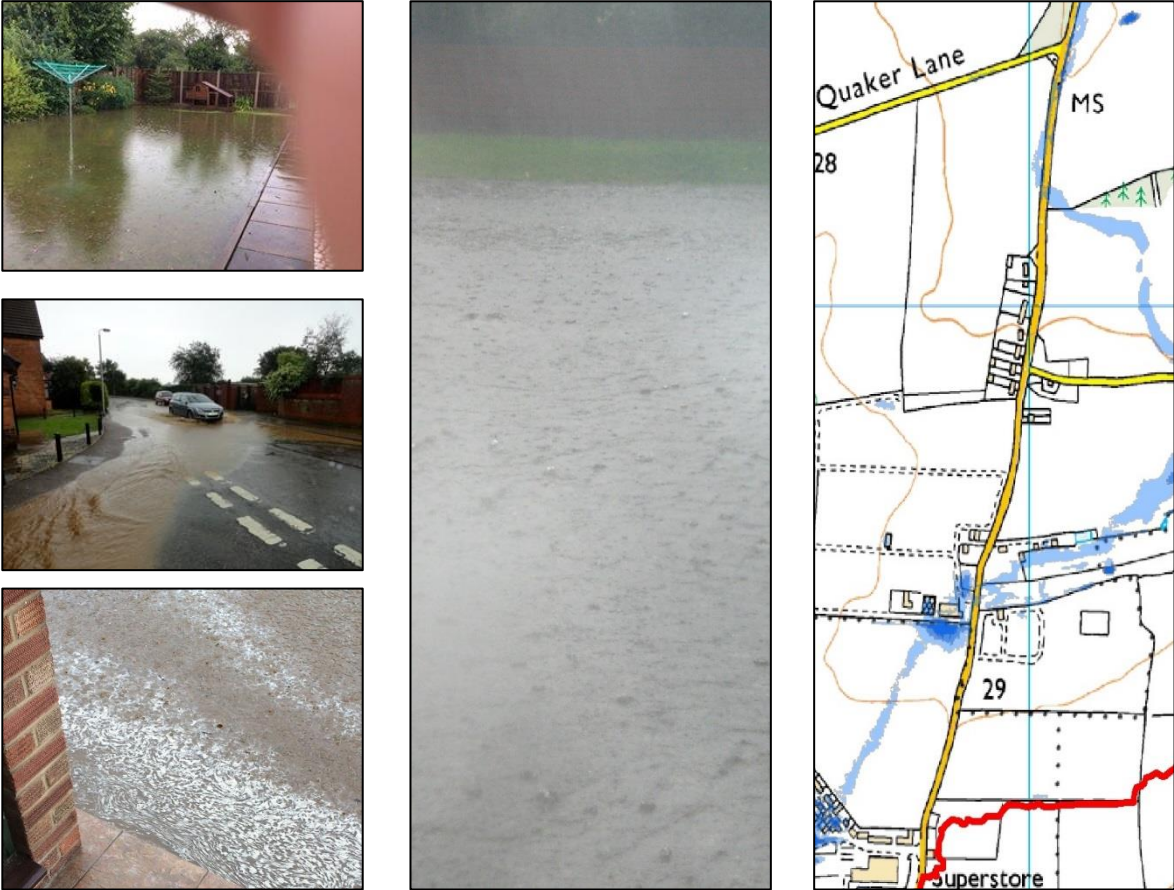


Flood Investigation Report

Flooding in Spixworth in June-July 2014 and June 2017



Report Reference: FIR014

Final report, version 7, prepared by Mark Ogden – Flood and Water Manager 20 November 2017

Executive Summary

(a) Flooding incidents

The flooding in Spixworth occurred on Douglas Road, Chestnut Avenue, Lilian Road, Buxton Road and Arthurton Road. Rainfall events led to the internal flooding of 9 properties on the date's bullet pointed below. 3 properties suffered internal flooding on more than 1 event.

- 27 June 2014 – 3 properties
- 20 July 2014 – 7 properties
- 27 June 2017 – 2 properties

(b) Flooding causes

- The rainfall experienced on the 20 July 2014 was exceptional in nature (it was recorded as a 1 in 121 year event).
- The foul sewer network on Lilian Road is subject to regular surcharging that follows most rainfall experienced in Spixworth. This surcharging suggests a relationship to there being a number of mis-connections of surface water drainage into the foul network.
- A large number of the properties impacted are situated on an overland flow path and/or are below the level of the nearest highway.

(c) Key recommendations

Our conclusion is;

- Norfolk County Council should lead on identifying funding for Property Level Protection
- 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.
- Anglian Water and partner organisations should work with property owners to identify and remove inappropriate connections to the foul network

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 Spixworth in June and July 2014 and June 2017 as:

- multiple residential 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:

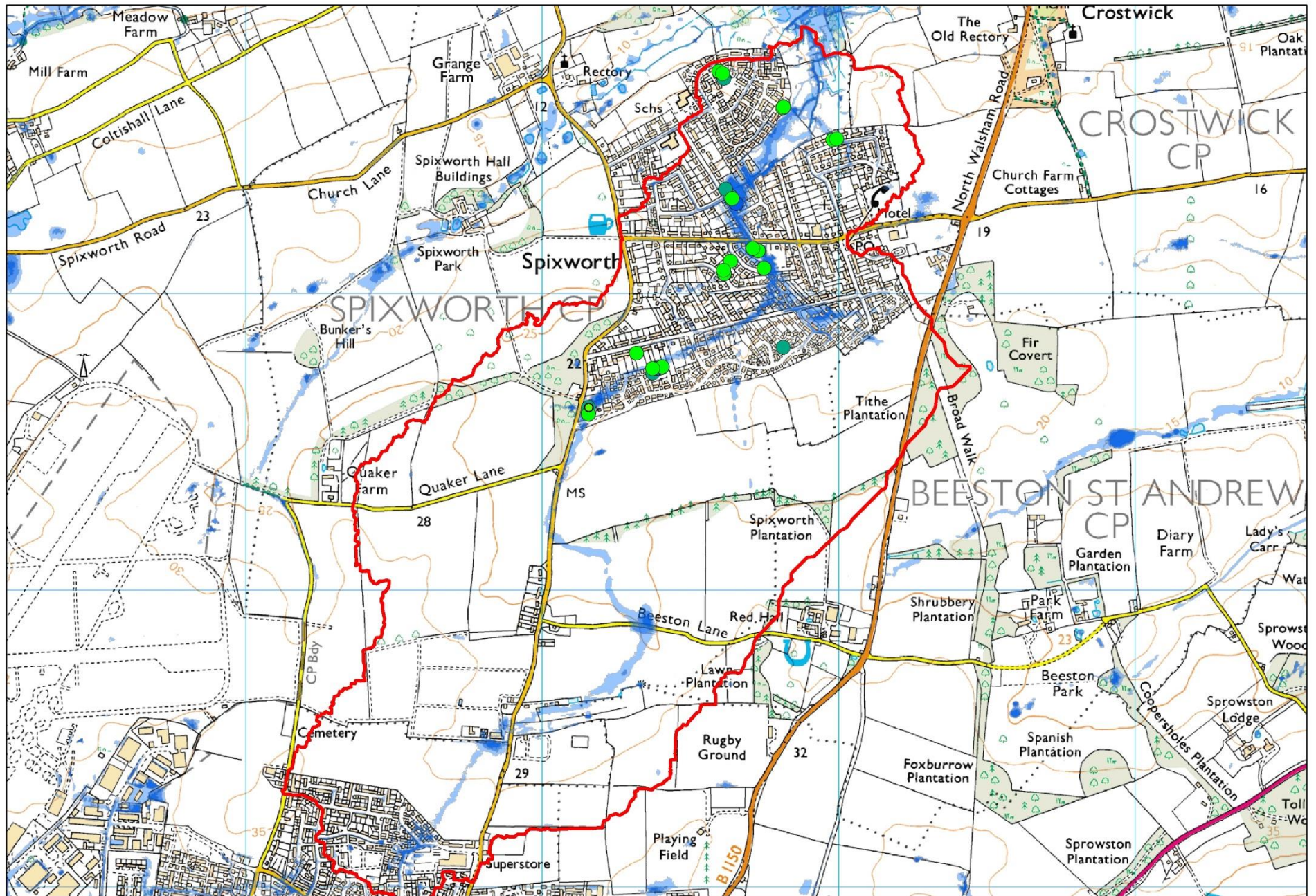
- provide a transparent and consistent review of recent flooding.
- identify those organisations and individuals who have responsibility to manage the causes of the flooding.
- identify what their response has been or will be to the flooding.
- make recommendations as to how the flood risk could be mitigated 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.

Flooding and flood risk within the Spixworth catchment



Flooding and flood risk within Spixworth Catchment

What are catchments?

To aid the investigation process and, for ease of presentation, the incidents of flooding 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.

Description of catchment

Spixworth village is primarily located at the northern outlet of a small catchment that receives surface water flows that emanates from the fringes of Old Catton, Norwich. This catchment includes a number of other smaller surface water flow paths from rural high ground that all converge on Spixworth Village and an outlet to a minor watercourse that connects to Spixworth Beck and the wider watercourse network, (see map included on preceding page).

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 event and the 1 in 100 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 event:	1	55	0
[b] No. of properties subject to surface water flood risk at 1 in 100 event:	1	116	1
[c] No. of properties subject to flood risk from rivers and the sea at 1 in 30 event:	0	0	0
[d] No. of properties subject to flood risk from rivers and the sea at 1 in 100 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 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 event:	0	0	0

Flood incidents within this catchment

Within this catchment 31 reports of external and internal flooding have been received. Out of these 31 reports 12 incidents of internal flooding have been confirmed and assessed as part of this investigation. These incidents are detailed in the table below.

Date of Incident	Incident as reported	What was the response to the flood incident
27/06/2017	On the 27/06/2017 - 1 property was internally flooded on Lilian Road , Spixworth. This incident was reported by a resident via an online flood report form on the 29 June 2017, (FWF/17/5/4898)	<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. • Anglian Water Services Ltd visited to investigate a pollution issue linked to the flooding incident after the incident. • Anglian Water Services Ltd assessed the capacity of their drainage system after the incident.
	On the 27/06/2017 - 1 property was internally flooded on Arthurton Road , Spixworth. This incident was reported by Norfolk County Council (Highways) via an electronic report on the 5 July 2017, (FWF/17/5/4930)	<ul style="list-style-type: none"> • Norfolk County Council (Highways) carried out maintenance work to the highway drainage system after the incident.
20/07/2014	On the 20/07/2014 - 2 properties were internally flooded on Douglas Road , Spixworth. These incidents were reported by: <ul style="list-style-type: none"> • Norfolk County Council (Highways) via email correspondence on the 6 August 2014, (FWF/14/5/0888) • Norfolk County Council (Highways) via email correspondence on the 22 July 2014, (FWF/14/5/1277) 	<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) cleaned and jetted 9 gullies. They checked and jetted connecting catchpits and jetted to the soakaways. They cleaned 2 soakaways. All pipework was seen to be clear and running.
	On the 20/07/2014 - 3 properties were internally flooded on Chestnut Avenue , Spixworth. These incidents were reported by: <ul style="list-style-type: none"> • Broadland District Council via email correspondence on the 23 July 2014, (FWF/14/5/0745) • a resident via personal communication on the 23 June 2017, (FWF/14/5/4855) • a resident via personal communication on the 23 June 2017, (FWF/14/5/4854) 	<ul style="list-style-type: none"> • Norfolk County Council (Highways) carried out maintenance work to the highway drainage system after the incident. • Norfolk County Council (Highways) undertook works to raise the level of the kerb on the road after the incident. • A resident carried out measures to minimise the impact of flooding after the incident.
	On the 20/07/2014 - 1 property was internally flooded on Lilian Road , Spixworth. This incident was reported by a member of the public via email	<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.

	correspondence on the 21 July 2014, (FWF/14/5/0690)	
	On the 20/07/2014 - 1 property was internally flooded on Buxton Road , Spixworth. This incident was reported by Anglian Water Services Ltd via an electronic report on the 4 April 2017, (FWF/14/5/1396)	<ul style="list-style-type: none"> • Anglian Water Services Ltd visited affected residents to offer advice and to gather information after the incident. • Norfolk County Council (Highways) carried out measures to minimise the impact of flooding after the incident.
27/06/2014	<p>On the 27/06/2014 - 3 properties were internally flooded on Douglas Road, Spixworth. These incidents were reported by:</p> <ul style="list-style-type: none"> • Broadland District Council via email correspondence on the 30 June 2014, (FWF/14/5/0705) • Norfolk County Council (Highways) via email correspondence on the 22 July 2014, (FWF/14/5/0819) • Broadland District Council via email correspondence on the 27 June 2014, (FWF/14/5/0890) 	<ul style="list-style-type: none"> • Norfolk County Council (Lead Local Flood Authority) worked together as part of a multi-agency group to co-ordinate their response to the flooding after the incident. • 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.

1 of the incidents (4%) of internal flooding in this catchment is within 2.5 km of a rain gauge. The rainfall events recorded by gauges for this catchment are;

27 June 2014 – 16.6 mm rainfall was recorded as falling in 2 hours 0 minutes at the Norwich Airport rainfall monitoring station. This intensity of rainfall for the total duration equates to a 2 year rainfall event.

20 July 2014 – 45.8 mm rainfall was recorded as falling in 1 hours 0 minutes at the Norwich Airport rainfall monitoring station. This intensity of rainfall for the total duration equates to a 121 year rainfall event.

27 June 2017 – No properties that were internally flooded in this event were within the 2.5 km radius of the nearest rain gauge.

Historic flooding incidents within the catchment

The following table lists historic flooding incidents within the catchment that we have been made aware of:

Date of incident	Impact	Rainfall intensity
Summer 1981	Internal flooding reported of homes on Lillian Road	Not known

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.

Following flooding to people, property and infrastructure;

- 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.
 - Determine the integrity and/or capacity of their assets where they have contributed to the flooding of properties to understand the systems role in accommodating normal rainfall events as well as mitigating flooding.
 - Review their current maintenance regimes to determine if the current frequency of maintenance is appropriate.
- Property owners of affected properties should seek their own legal advice.
- NCC should
 - Incorporate all relevant information of actual flooding into the review of the Norfolk Preliminary Flood Risk Assessment (“PFRA”).
 - Review and monitor the delivery of recommendations within this and other relevant flood investigation reports.
 - Lead on the development of partnership funding bids to assess and develop possible mitigation options for the management of flood risk within Spixworth and its catchment.

Flooding experienced at / on	Causes of flooding	Who has responsibilities to manage the cause(s) of the flood?
Lilian Road, Spixworth, 27/06/2017 Douglas Road, Spixworth, 20/07/2014 Lilian Road, Spixworth, 20/07/2014 Buxton Road, Spixworth, 20/07/2014 Douglas Road, Spixworth, 27/06/2014	Run-off from rainfall was concentrated along overland flowpaths on which the affected properties are positioned. The rainfall recorded on the 20 July 2014 would be classed as significant and beyond the capacity of existing drainage provision.	Property owners for all locations Upstream Landowners for Douglas Road
Lilian Road, Spixworth, 27/06/2017 Douglas Road, Spixworth, 20/07/2014 Lilian Road, Spixworth, 20/07/2014 Buxton Road, Spixworth, 20/07/2014 Douglas Road, Spixworth, 27/06/2014	Surface run-off flowed from the highway via dropped kerbs and due to the camber of the road onto the accesses of the properties, which contributed to the flooding of the affected properties.	Property owners Highways Authority
Arthurton Road, Spixworth, 27/06/2017	The surface water drainage system was partially obstructed by debris or silt. This reduced the efficiency of the incorrectly connected private drainage system from the property causing it to surcharge inside the property.	Property owner
Chestnut Avenue, Spixworth, 20/07/2014 Lilian Road, Spixworth, 20/07/2014	Run-off from rainfall was directed towards the surface water drainage network. These flows overwhelmed the drainage system. This directed flood water towards the affected properties. This was partly due to poorly infiltrating drainage systems within Chestnut Avenue as well as more generally due to the significance of the rainfall event experienced on the 20 July 2014 at both locations.	Anglian Water, property owners and other relevant Risk Management Authorities
Chestnut Avenue, Spixworth, 20/07/2014	Significant rainfall was directed into the upstream surface water system draining green space causing it to surcharge elsewhere. This surcharging contributed to the flooding at the affected properties.	Upstream Landowners

Flooding experienced at / on	Recommendation	Who has responsibility to follow up the recommendation?	Timescale
Lilian Road, Spixworth, 27/06/2017 Douglas Road, Spixworth, 20/07/2014 Lilian Road, Spixworth, 20/07/2014 Buxton Road, Spixworth, 20/07/2014 Douglas Road, Spixworth, 27/06/2014	Norfolk County Council as Lead Local Flood Authority will lead on identifying funding for property level protection measures for the affected properties. Property owners could also carry out their own measures where funding is not forthcoming.	NCC LLFA Property Owners	12 months
Lilian Road, Spixworth, 27/06/2017 Douglas Road, Spixworth, 20/07/2014 Lilian Road, Spixworth, 20/07/2014 Buxton Road, Spixworth, 20/07/2014 Douglas Road, Spixworth, 27/06/2014	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. Also, Norfolk County Council has permissive powers to prevent surface water run-off from flowing onto the highway from adjoining land, and will consider their use as appropriate	NCC Highways Property owners	12 months
Douglas Road, Spixworth, All events	Landowners should ensure that land management practices reduce the impact of agricultural run-off on residential areas and highway.	Upstream landowners	12 months
Arthurton Road, Spixworth, 27/06/2017	The property owner should remove the inappropriate connections to the surface water system and ensure they are connected to the foul network.	Property owner	12 months
Lilian Road, Spixworth, 27/06/2017 Lilian Road, Spixworth, 20/07/2014	Anglian Water should work with partner organisations to identify the potential for reducing the amount of surface water entering their drainage systems from mis-connections and other sources. Potential mitigation options should be communicated to residents and partner organisations. Anglian Water should also assess the need for the installation of non-return valves for at-risk properties and clearly communicate their findings to affected residents.	Anglian Water	12 months
Chestnut Avenue, Spixworth, 20/07/2014	Anglian Water should work with the private property owners to identify methods of removing excess surface water from the foul sewer to alternative points of discharge. This could include a range of mechanisms both within the existing drainage system as well as private property. It should be noted that it was reported by residents that they believe their infiltration devices installed to manage surface water as part of the original development have never functioned properly.	Anglian Water Property owners	12 months

Chestnut Avenue – Flooding experienced 20 July 2014

Causes - Surface water drainage system poorly infiltrating and capacity exceeded due to runoff from green space above properties during significant rainfall event.

Recommendations - Anglian Water to reduce surface water in their foul network and identify alternative points of discharge for surface water.

Lilian Road – Internal flooding experienced on 27 June 2017 and 20 July 2014.

Causes – Properties on surface water flow path, lower than the surrounding topography and highway, surcharging of foul network due to surface water ingress.

Recommendations - Norfolk County Council to identify property level protection and identify flood routing opportunities. Anglian Water to reduce surface water in their foul network and assess need for non-return valves.

Orchard Road – External flooding experienced on 23-24 June 2016

Godfrey Road – External flooding experienced on 27 May 2014



Networks

Anglian Water only have foul networks serving Spixworth. Surface water drainage is therefore either via the Norfolk County Council highway drainage network or by private soakaways. The principle outfall for the highways system drains to a nearby watercourse. The full extent of this system is unknown.

It should be noted that it is unclear the extent to which private surface water drainage systems exist however the majority of these are understood to be draining to soakaways or boreholes. It is also unclear the efficiency of these systems.

Recommendation - Norfolk County Council should determine the integrity and/or capacity of this asset and if the current frequency of maintenance is appropriate.



Sydney Road – External flooding experienced on 20 July 2014 and 9 August 2017

Croswick Lane – External flooding experienced on 23-24 June 2016

St Peters Way - External flooding occurring on 20 July 2014 and 23-24 June 2016

Map 1: Spixworth flooding June-July 2014 and June 2017

Buxton Road – Internal flooding experienced on 20 July 2014. External flooding experienced on 27 June 2017.

Causes - Properties on surface water flow path and lower than the surrounding topography and highway.

Recommendations - Norfolk County Council to identify property level protection and identify flood routing opportunities.



Douglas Road – Internal flooding experienced on 27 June 2014 and 20 July 2014.

Causes - Properties on surface water flow path and lower than the surrounding topography and highway.

Recommendations - Norfolk County Council to identify property level protection and identify flood routing opportunities.



Arthurton Road – Internal flooding experienced on 27 June 2017.

Causes - The surface water drainage system was partially obstructed and private property drainage was incorrectly connected causing it to surcharge inside the property.

Recommendations - The property owner should remove the inappropriate connections to the surface water system

Map 2: Spixworth flooding June-July 2014 and June 2017

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.

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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.