



# Norfolk County Council

## Investigation Report into the flooding in Cromer in 2016-2017

Report Reference: FIR027

Draft Report prepared by Mark Ogden and Bethany Green on 04 December 2017



<b>Contents</b> .....	2
Executive Summary .....	3
Map of Catchments.....	5
Justification of Flood Investigation.....	6
Flooding and flood risk in the <b>Cromer East</b> catchment.....	8
Flooding and flood risk in the <b>Cromer West</b> catchment .....	15
Flooding and flood risk in the <b>St Peter and St Paul’s</b> catchment .....	19
Disclaimer.....	25
Appendix A – Key definitions and responsibilities.....	26

**Maps**

Map 1	Map of catchments	5
Map 2	Map of Cromer East catchment	7
Map 3	Map of Cromer East - Flood and drainage detail	13
Map 4	Map of Cromer West and St Peter and Paul’s catchment	14
Map 5	Map of Cromer West – Flood and Drainage detail	18
Map 7	Map of St Peter and St Paul’s Flood and Drainage detail	22

## **Executive Summary**

### **(a) Flooding incidents and causes**

Between 1<sup>st</sup> January 2016 and 31<sup>st</sup> December 2017 17 reports of flooding were generated for Cromer. This led to the identification of five properties that had suffered internal flooding. In addition to these there were also two more unconfirmed instances of internal flooding reported to the LLFA. The properties affected were concentrated within the overall catchment<sup>1</sup> of North Norfolk. 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 17 properties affected in each sub-catchment is set out below:

- Cromer West catchment: 1 internal, 2 external
- Cromer East catchment: 3 internal, 10 external
- St Peter and St Pauls catchment: 1 internal

The flooding that occurred in Brownhill; Cromwell Road; Bond Street; Station Road; Church Street, and Overstrand Road, Cromer was caused by Drainage system overloaded; Surcharging of the drainage system; Entry of flood water into property; Drainage system or outfall blockage, unmaintained or obstructed; Surface water washed off public highway by vehicles; Surface run-off from roads and Increased run-off. This led to the internal flooding of 5 properties.

There are no historic flood events recorded by the LLFA in these catchments.

### **(b) Flooding causes**

These three catchments cover both urban and rural land and therefore have quite different run-off characteristics, for example St Peter and St Pauls is very small and completely urbanised whereas Cromer West has a far greater scope and is predominantly rural. As the flooding in Cromer was spread out over a period of two years and dispersed across wider Cromer there are a variety of causes that pertain to each separate case. These are explored in more detail in each section however some of the key trends have been summarised below.

- The surface water drainage system was partially obstructed by debris or silt. This reduced the efficiency of the upstream drainage system contributing to flooding at the affected properties.
- Run-off from significant rainfall was directed towards the surface water drainage network. These flows could not be accommodated as the system was already overloaded. This directed flood water towards the affected 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

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<sup>1</sup> 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 water management organisations. 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.

### **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 large 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.

**All 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 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. 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.
- Work with property owners to assess the road structure to identify if it could be amended to route flood water away from the 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.

**North Norfolk District Council** should assess if there is a need to use their permissive powers to maintain the watercourse under the Land Drainage Act 1991 in relation to Cromwell Road.

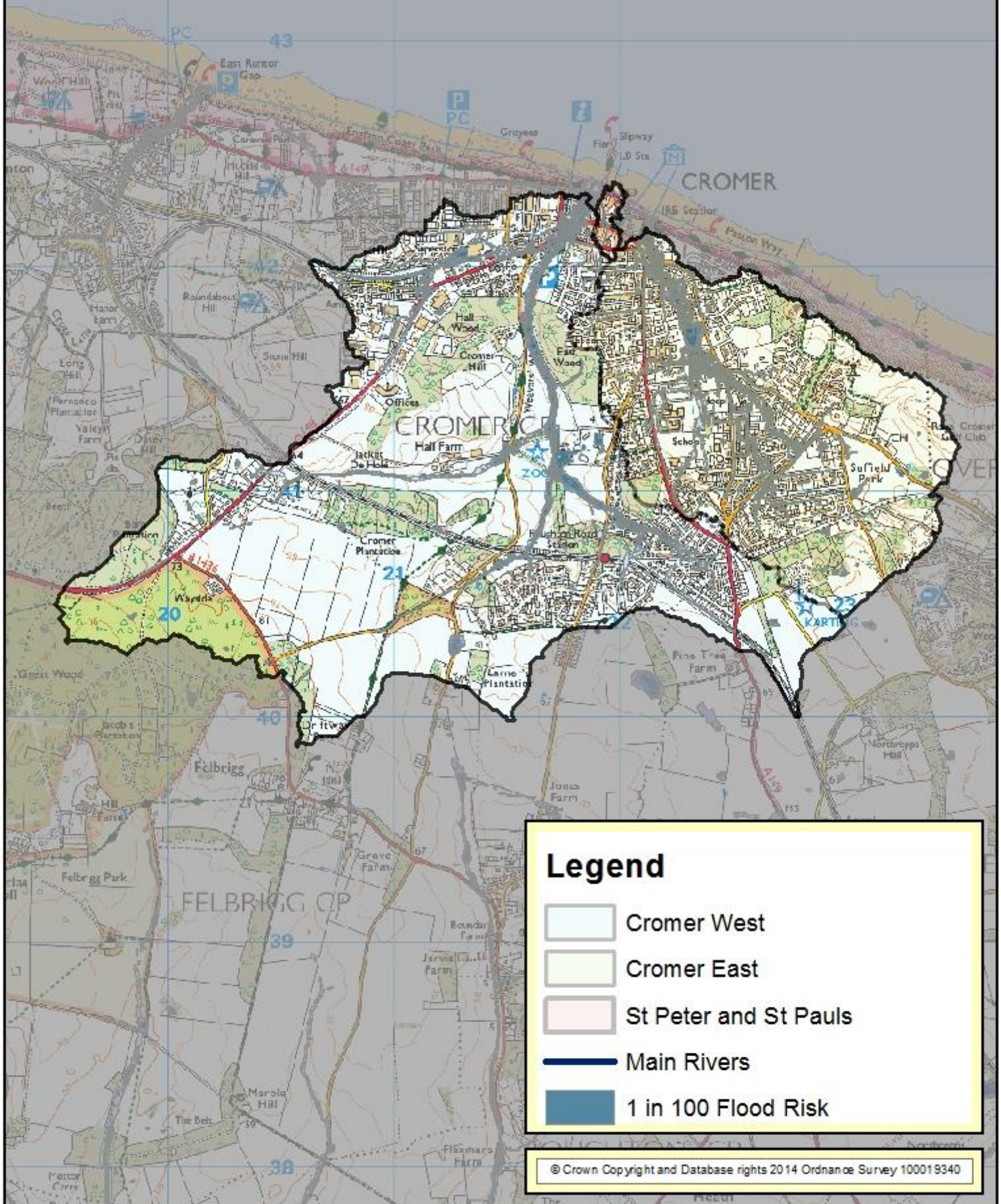


Location:

Cromer – All catchments

Drawing:

Map 1



### Legend

-  Cromer West
-  Cromer East
-  St Peter and St Pauls
-  Main Rivers
-  1 in 100 Flood Risk

## **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 Cromer in 2016-2017 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.



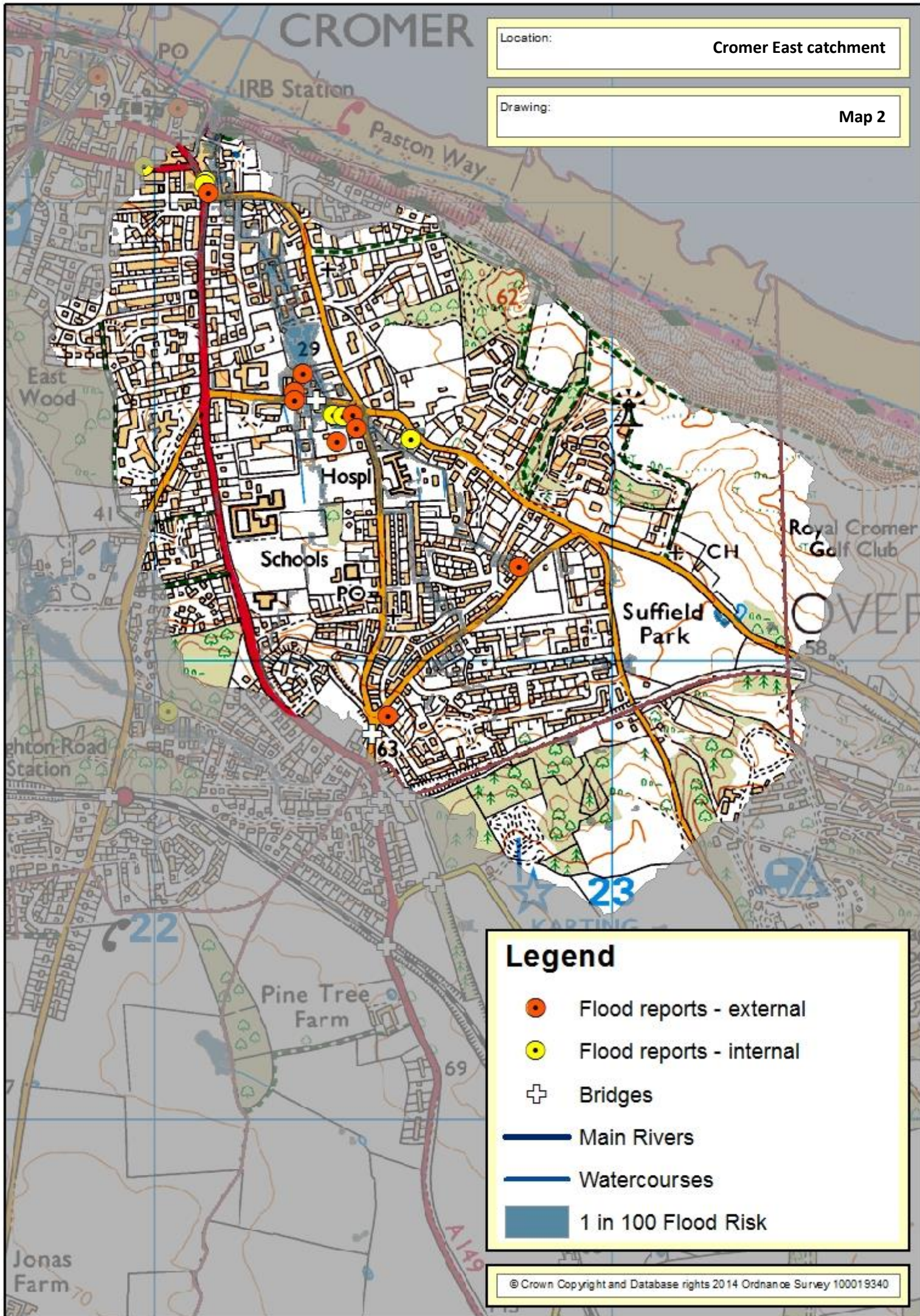
# CROMER

Location:





Cromer East catchment

Drawing:

Map 2



## Legend

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



## Flooding and Flood Risk in the Cromer East catchment

### Description of catchment

Land cover is largely urban interspersed with green spaces and rural areas. Water flows from South East to the outfall at the North West to the gangway next to the coast. The majority of flood reports were located along this central flow line which coincides with the more densely populated areas.

### 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.

<b>Flood Risk Data Source</b>	<b>Critical Services</b>	<b>Residential</b>	<b>Non-residential</b>
[a] No. of properties subject to surface water flood risk at 1 in 30 year event:	0	166	9
[b] No. of properties subject to surface water flood risk at 1 in 100 year event:	1	272	93
[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 3 incidents of internal flooding have been assessed as part of this investigation. These incidents are detailed in the table below.

<b>Incident as reported</b>	<b>What was the response to the flood incident</b>
On the 23/06/2016 - 1 property was internally flooded on <b>Cromwell Road</b> , Cromer. This incident was reported by Norfolk County Council (Highways) via email correspondence on the 20 September 2016, (FWF/16/1/3558)	<ul style="list-style-type: none"> <li>The Fire and Rescue Service responded and pumped out during the incident.</li> </ul>
On the 08/08/2017 - 1 property was internally flooded on <b>Church Street</b> , Cromer. This incident was reported by Norfolk County Council (Lead Local Flood Authority) via email correspondence on the 11 August 2017, (FWF/17/1/5163)	<ul style="list-style-type: none"> <li>Norfolk County Council (Lead Local Flood Authority) visited affected residents to offer advice and to gather information after the incident.</li> </ul>
On the 08/08/2017 - 1 property was internally flooded on <b>Overstrand Road</b> , Cromer. This incident was reported by a resident via a flood	<ul style="list-style-type: none"> <li>Anglian Water Services Ltd visited affected residents to offer advice and to gather information after the incident.</li> </ul>



questionnaire on the 2 November 2017,  
(FWF/17/1/5540)

- The Fire and Rescue Service visited affected residents to offer advice and to gather information after the incident.
- North Norfolk 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.

4 of the incidents (100%) of internal flooding in this catchment are within 2.5km of a rain gauge. The rainfall events recorded for this catchment is measured by The Environment Agency Essex, Norfolk and Suffolk Area rainfall station (Name: CROMER STW RG (TELEM)) and is a tipping bucket automatic (ARG) rain-gauge. The data collected by the LLFA covers only the month of September, 2017. This is due to the fact that the data for June, 2016 is considered 'Incomplete' or 'Suspect' by the Environment Agency as the TBR was over recording check gauge by 601.7% and therefore officers suspect that check gauge has been tampered with.

Rainfall data was requested from the Environment Agency for the period from 01/08/2017 to 30/08/2017. During this period 94.52% data collection appears to have been achieved. Over this period it can be seen that 1 rainfall event that recorded a peak of over 4.5mm occurred on the afternoon of the 8<sup>th</sup> August. The average rainfall recorded was 0.66 mm over any given 15 min interval. This is calculated as a 1 in 2 year event. This relatively frequent rainfall event suggests that the volume of water alone was not necessarily to blame for the flooding problems caused. However, it is important to note here that the gauge was reported to be under-recording by 3.1% and some of the data was reported as 'Incomplete'. Therefore we must treat this data with caution when trying to draw conclusions.

## 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;

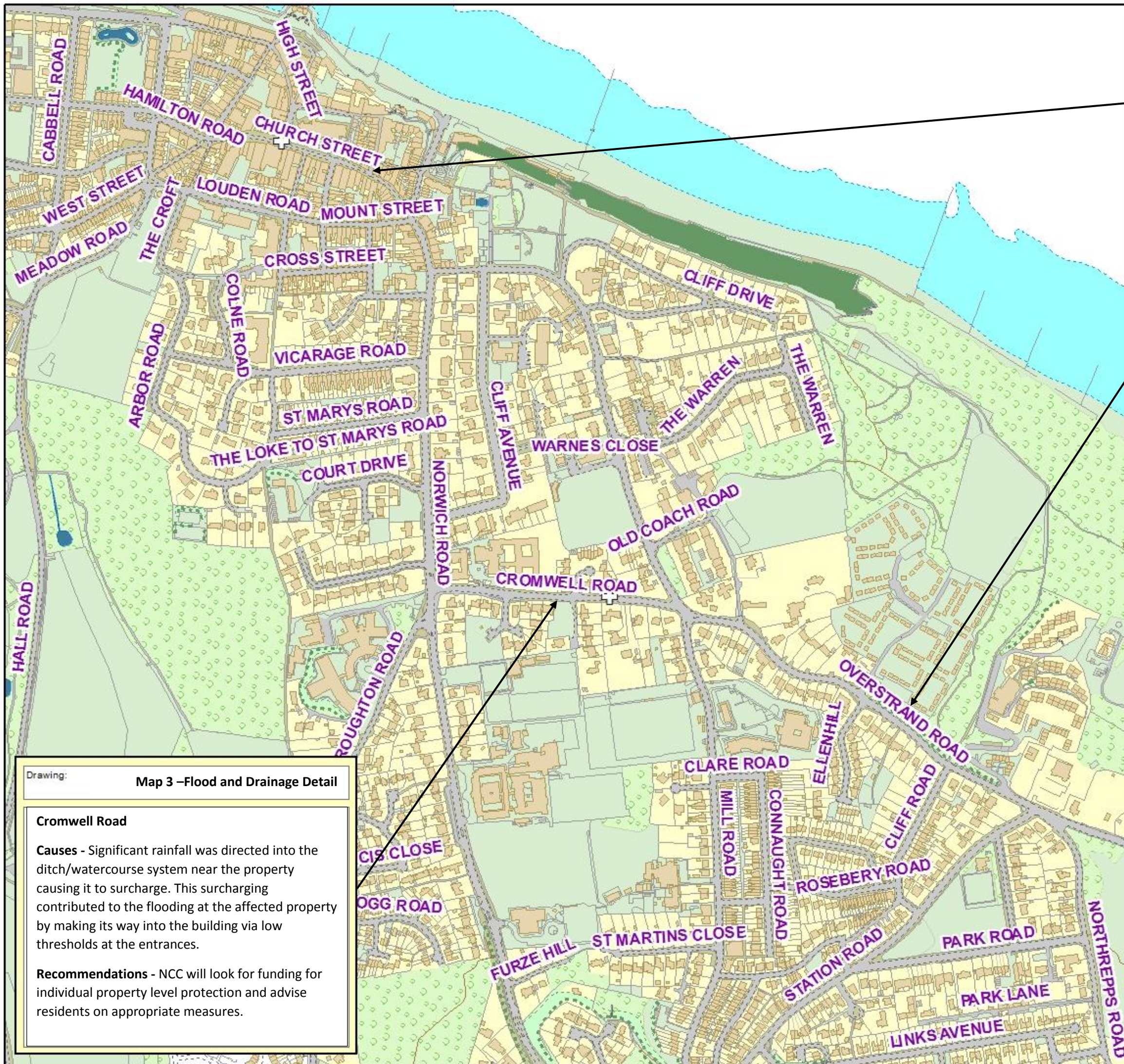
- Risk Management Authorities should
  - communicate with affected residents where their assets have given rise to the flooding of properties.
  - review the appropriateness of their response to flooding.
  - Determine the integrity and/or capacity of their assets where they have contributed to the flooding of properties to understand the systems role in accommodating normal rainfall events as well as mitigating flooding.
- 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.

Flooding experienced at / on	Causes of flooding	Who has responsibilities to manage the cause(s) of the flood?
Church Street, Cromer, 08/08/2017	Surface run-off flowed from the highway due to the camber of the road onto the access of the properties, which contributed to the flooding of the affected properties.	Property owners, Norfolk County Council
Church Street, Cromer, 08/08/2017 Overstrand Road, Cromer, 08/08/2017 Cromwell Road, Cromer, 23/06/2016	The surface water drainage system was partially obstructed by debris or silt. This reduced the efficiency of the upstream drainage system contributing to flooding at the affected properties.	Norfolk County Council North Norfolk District Council
	The flood water entered the properties through low thresholds at entrances.	Property owners
Church Street, Cromer, 08/08/2017 Overstrand Road, Cromer, 08/08/2017	Run-off from significant rainfall was directed towards the surface water drainage network. These flows could not be accommodated as the system was already overloaded. This directed flood water towards the affected properties.	Norfolk County Council North Norfolk District Council Anglian Water
Cromwell Road, Cromer, 23/06/2016	Significant rainfall was directed into the ditch/watercourse system causing it to surcharge. This surcharging contributed to the flooding at the affected property.	Norfolk County Council North Norfolk District Council



Flooding experienced at / on	Recommendation	Who has responsibility to follow up the recommendation?	Timescale
Church Street, Cromer, 08/08/2017 Overstrand Road, Cromer, 08/08/2017 Cromwell Road, Cromer, 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.	Norfolk County Council, Property Owners	12 months
	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.	Norfolk County Council Anglian Water North Norfolk District Council Property Owners	12 months
Church Street, Cromer, 08/08/2017 Cromwell Road, Cromer, 23/06/2016	Norfolk County Council Highways will consider opportunities to route flood water on the highway away from affected properties to alternative points of discharge, or other solutions as practicable, if flood risk is not increased elsewhere in the catchment.	Norfolk County Council	12 months
	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.	Anglian Water	12 months
Overstrand Road, Cromer, 08/08/2017	The Lead Local Flood Authority will investigate with third parties the potential for retro-fitting permeable areas and other methods of small scale sustainable drainage systems	Norfolk County Council Property Owners	12 months





Location: **Cromer East catchment**

**Church Street Causes** - Surface run-off flowed from the highway due to the camber of the road onto the access of the properties. The already overloaded system could not cope and therefore directed more water along the highway and into properties at low thresholds.

**Recommendations** - 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.

**Overstrand Road**

**Causes** - The surface water drainage system was partially obstructed by debris or silt. This meant that the ditch/watercourse system could not cope with the amount of rainfall causing it to overflow and flood into nearby properties.

**Recommendations** - NCC will look for funding for individual property level protection and advise residents on appropriate measures. Meanwhile, property owners should protect their buildings where funding is not forthcoming.







Drawing: **Map 3 - Flood and Drainage Detail**

**Cromwell Road**

**Causes** - Significant rainfall was directed into the ditch/watercourse system near the property causing it to surcharge. This surcharging contributed to the flooding at the affected property by making its way into the building via low thresholds at the entrances.

**Recommendations** - NCC will look for funding for individual property level protection and advise residents on appropriate measures.

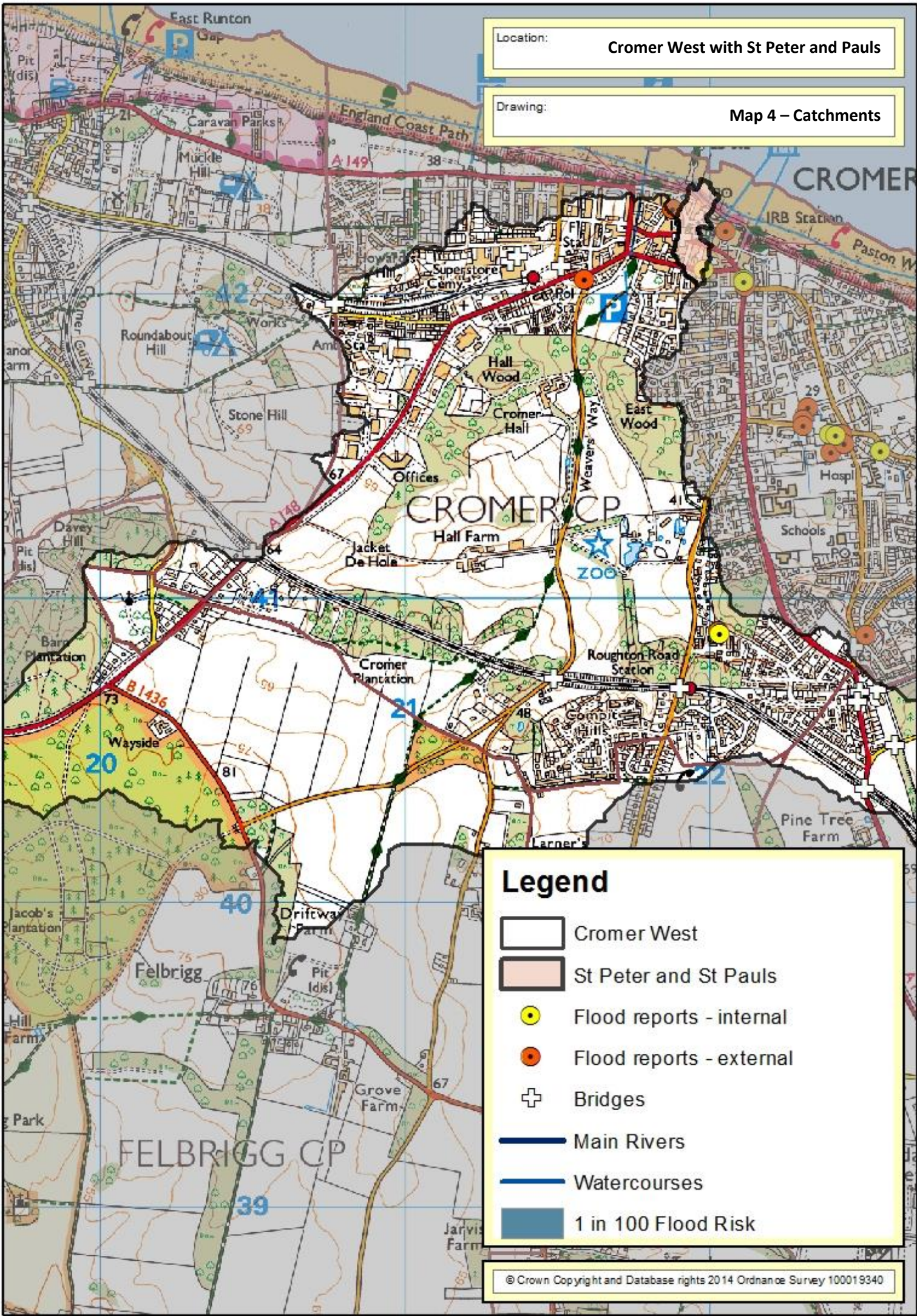
**Legend**

-  Bridges
-  Watercourses
-  Main Rivers
-  Water bodies



Location: **Cromer West with St Peter and Pauls**

Drawing: **Map 4 – Catchments**





## Flooding and Flood Risk in the Cromer West catchment

### Description of catchment

A fairly large rural catchment with greater urban concentration towards Cromer town to the north. Water flows towards the north and outfalls at the coast near New Street. Flood reports tend to aggregate towards the town centre and more built up areas. The combined system is pumped to Water Treatment Works at Sandy Lane.

### Flood Risk within the catchment

The flood risk from local sources (ordinary watercourses and surface run-off) and strategic sources (fluvial above 3 square km 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.

<b>Flood Risk Data Source</b>	<b>Critical Services</b>	<b>Residential</b>	<b>Non-residential</b>
[a] No. of properties subject to surface water flood risk at 1 in 30 year event:	1	182	58
[b] No. of properties subject to surface water flood risk at 1 in 100 year event:	1	268	93
[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 1 incidents of internal flooding have been assessed as part of this investigation. These incidents are detailed in the table below.

<b>Date of Incident</b>	<b>Incident as reported</b>	<b>What was the response to the flood incident</b>
23/06/2016	On the 23/06/2016 - 1 property was internally flooded on Brownhill, Cromer. This incident was reported by North Norfolk District Council via email correspondence on the 13 July 2016, (FWF/16/1/3816)	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.

### 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 (100%) of internal flooding in this catchment are within 2.5km of a rain gauge. However, the data for this date is considered 'Incomplete' or 'Suspect' by the Environment Agency due to the fact that the TBR was over recording check gauge by 601.7% and therefore officers suspect that check gauge has been tampered with.

#### 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.

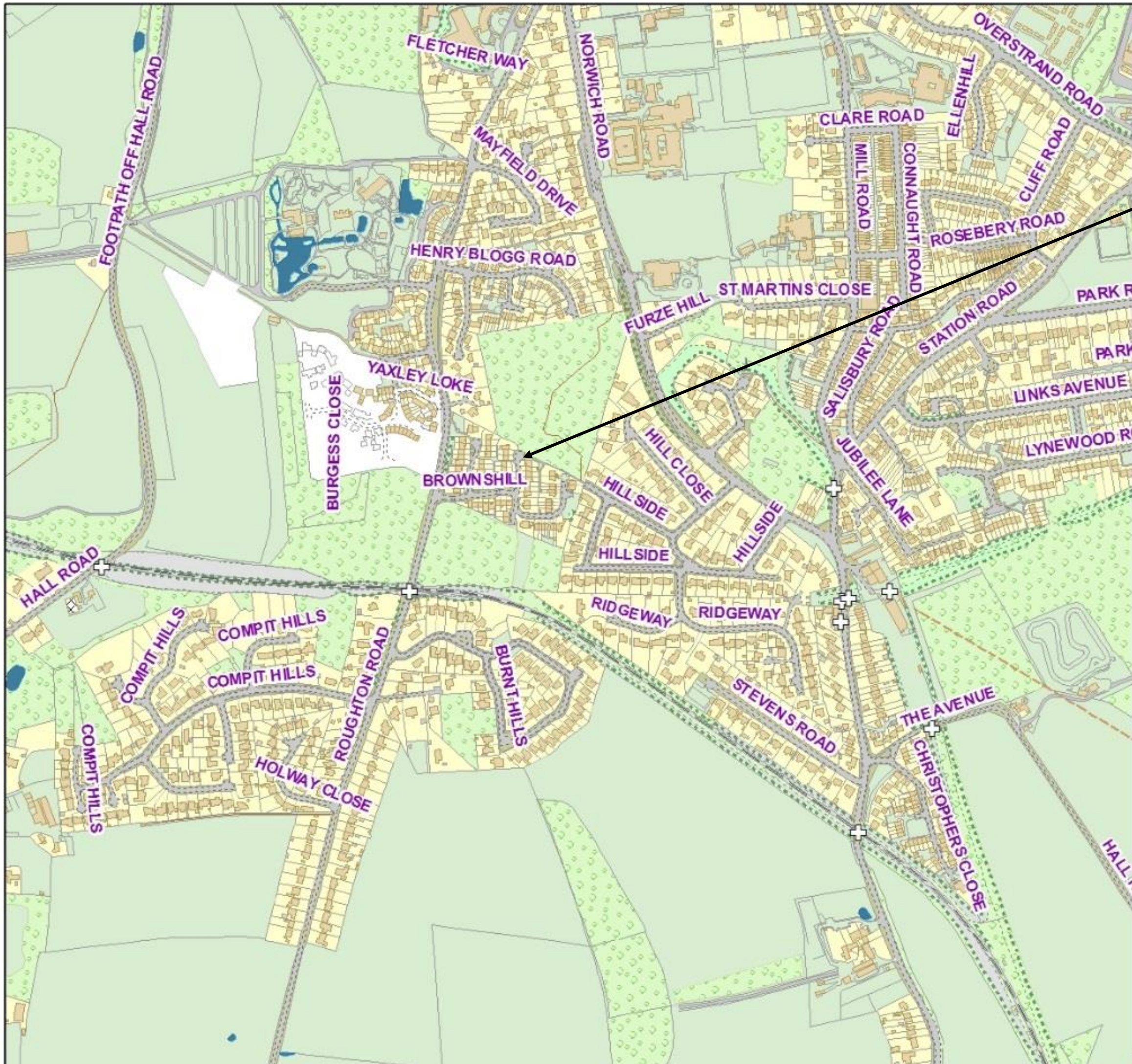
Following flooding to people, property and infrastructure;

- 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.
- 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.

Flooding experienced at / on	Causes of flooding	Who has responsibilities to manage the cause(s) of the flood?
Brownshill, Cromer, 23/06/2016	Run-off from significant rainfall was directed towards combined drainage network. These flows could not be accommodated as the system was already overloaded. This directed flood water towards the affected properties. This was due to the infiltration of surface water into existing drainage networks.	Norfolk County Council Anglian Water
	Significant rainfall was directed into the foul system causing it to surcharge elsewhere. This surcharging contributed to the flooding at the affected properties.	Norfolk County Council Anglian Water
	The flood water entered the property through the toilets and sinks.	Norfolk County Council Anglian Water

Flooding experienced at / on	Recommendation	Who has responsibility to follow up the recommendation?	Timescale
Brownshill, Cromer, 23/06/2016	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, including retro-fitting permeable areas and other methods of small scale sustainable drainage systems	Anglian Water Norfolk County Council Property Owners	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.	Norfolk County Council Anglian Water Property Owners	12 months





Location: Cromer West catchment

Drawing: Map 5 – Flood and Drainage detail

**Brownshill**

**Causes** - Significant rainfall was directed into the foul system causing it to surcharge elsewhere. This surcharging contributed to the flooding at the affected properties.

**Recommendations** - 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.

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



**Legend**

- ⊕ Bridges
- Watercourses
- Main Rivers
- Water bodies

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## Flooding and Flood Risk in the St Peter and St Paul's catchment

### Description of catchment

A small urban catchment in the centre of Cromer. Water outfalls to the north towards the coast. Combined system pumped to Water Treatment Works at Sandy Lane.

### Flood Risk within the catchment

The flood risk from local sources (ordinary watercourses and surface run-off) and strategic sources (fluvial above 3 square km 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.

<b>Flood Risk Data Source</b>	<b>Critical Services</b>	<b>Residential</b>	<b>Non-residential</b>
[a] No. of properties subject to surface water flood risk at 1 in 30 year event:	0	0	0
[b] No. of properties subject to surface water flood risk at 1 in 100 year event:	0	0	3
[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 1 incidents of internal flooding have been assessed as part of this investigation. These incidents are detailed in the table below.

<b>Date of Incident</b>	<b>Incident as reported</b>	<b>What was the response to the flood incident</b>
21/12/2015	On the 21/12/2015 - 1 property was internally flooded on Bond Street, Cromer. This incident was reported by a resident via a flood questionnaire on the 28 <sup>th</sup> January 2016, (FWF/16/1/2338)	Anglian Water Services Ltd 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 (100%) of internal flooding in this catchment are within 2.5km of a rain gauge. The rainfall events recorded for this catchment is measured by The Environment Agency Essex, Norfolk and Suffolk Area rainfall station (Name: CROMER STW RG (TELEM)) and is a tipping bucket automatic (ARG) rain-gauge. The data collected by the LLFA covers only the month of September, 2017. This is due to the fact that the data for June, 2016 is considered 'Incomplete' or 'Suspect' by the Environment Agency as the TBR was over recording check gauge by 601.7% and therefore officers suspect that check gauge has been tampered with.

Rainfall data was requested from the Environment Agency for the period from 01/08/2017 to 30/08/2017. During this period 94.52% data collection appears to have been achieved. Over this period it can be seen that 1 rainfall event that recorded a peak of over 4.5mm occurred on the afternoon of the 8<sup>th</sup> August. The average rainfall recorded was 0.66 mm over any given 15 min interval. This is calculated as a 1 in 2 year event. This relatively frequent rainfall event suggests that the volume of water alone was not necessarily to blame for the flooding problems caused. However, it is important to note here that the gauge was reported to be under-recording by 3.1% and some of the data was reported as 'Incomplete'. Therefore we must treat this data with caution when trying to draw conclusions.

#### 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.

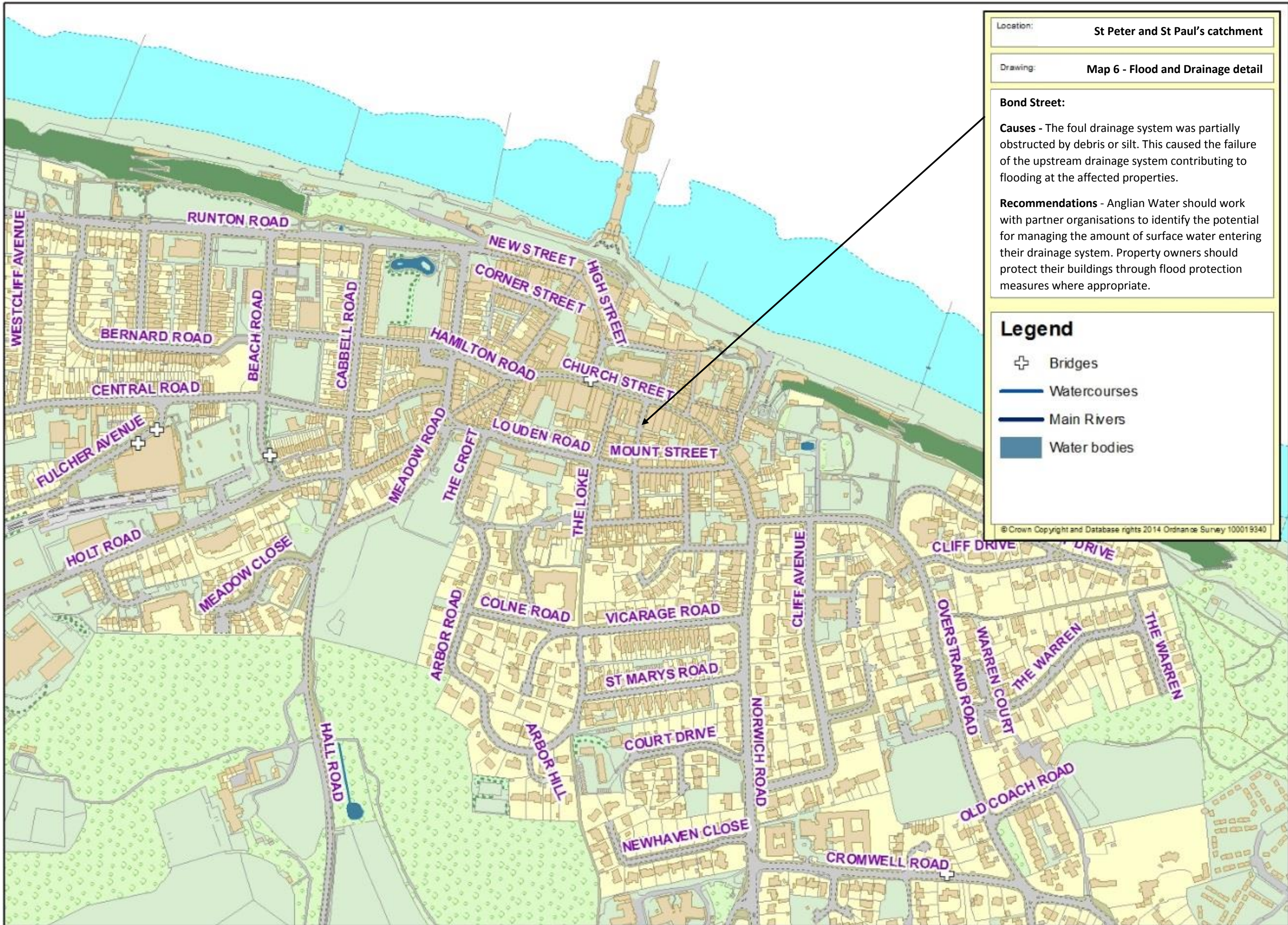
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  - Determine the integrity and/or capacity of their assets where they have contributed to the flooding of properties to understand the systems role in accommodating normal rainfall events as well as mitigating flooding.
- Property owners of affected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

Flooding experienced at / on	Causes of flooding	Who has responsibilities to manage the cause(s) of the flood?
Bond Street, Cromer, 21/12/2015	The combined drainage system was partially obstructed by debris or silt. This caused the failure of the upstream drainage system contributing to flooding at the affected properties.	Norfolk County Council Anglian Water
	Significant rainfall was directed into the surface water system causing it to surcharge elsewhere. This surcharging contributed to the flooding at the affected property.	Norfolk County Council Anglian Water
	The flood water entered the property through low thresholds at entrances.	Norfolk County Council Property Owners

Flooding experienced at / on	Recommendation	Who has responsibility to follow up the recommendation?	Timescale
Bond Street, Cromer, 21/12/2015	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, including retro-fitting permeable areas and other methods of small scale sustainable drainage systems	Anglian Water Norfolk County Council Property Owners	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.	Norfolk County Council Property Owners	12 months





Location: St Peter and St Paul's catchment

Drawing: Map 6 - Flood and Drainage detail

**Bond Street:**

**Causes** - The foul drainage system was partially obstructed by debris or silt. This caused the failure of the upstream drainage system contributing to flooding at the affected properties.

**Recommendations** - Anglian Water should work with partner organisations to identify the potential for managing the amount of surface water entering their drainage system. Property owners should protect their buildings through flood protection measures where appropriate.

**Legend**

- ⊕ Bridges
- Watercourses
- Main Rivers
- Water bodies

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## **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.

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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.