



Norfolk County Council

Investigation Report into the flooding in Norwich Urban Area: 2016 to 2018

Report Reference: FIR030

Report prepared by Mark Ogden on 19 February 2019



Executive Summary

(a) Flooding incidents and causes

This report covers the incidents of flooding that occurred in the Norwich urban area from June 2016 to June 2018.

On **23/06/2016**, 8 properties reported internal flooding on Avenue Road (FWF/16/4/2821) Chapel Field North (FWF/16/4/3752), Church Lane Eaton (FWF/16/4/2962), Low Road Hellesdon (FWF/16/5/5905), Mile End Road Norwich (FWF/16/4/4665), Unthank Road (FWF/16/4/2844) and Whiffler Road (FWF/16/4/3584) and 1 priority road was unpassable due to surface water pooling on North Park Avenue (FWF/16/4/2866).

On this date widespread flooding occurred across the County, generating nearly 500 reports of flooding, 216 of which justified formal investigation by Norfolk County Council.

On **16/06/2016**, 1 property on Davidson Close Thorpe St Andrew (FWF/16/5/4054) reported internal flooding.

In **2017**, 3 properties reported internal flooding on Low Road Hellesdon (FWF/17/5/5955) on 12/08/2017, and Whiting Road Norwich (FWF/17/4/5977), Ipswich Road Norwich (FWF/17/4/4954) on 06/07/2017.

On **02/06/2018**, 3 properties reported internal flooding on Holt Road Hellesdon (FWF/18/5/6633), Reephams Road Hellesdon (FWF/18/5/6701) and Middletons Lane Hellesdon (FWF/18/5/6630).

On this date intense localised downpours occurred in numerous locations in the County, generating nearly 70 reports of flooding, 29 of which justified formal investigation by Norfolk County Council.

Specific causes for each individual catchment on these dates are set out within the report.

(b) 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.
- 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 resilience 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 resilience 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
- 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.

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.

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 Norwich Urban Area from 2016 to 2018 as:

- multiple residential properties were internally flooded.
- multiple commercial properties were internally flooded.
- one critical services installation was affected by flooding.

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 resilience: 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.

Norwich Catchments

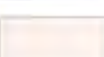
Legend

 Verified Flood Reports

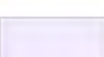
 Other flooding

 Eaton

 Eaton Park


 Hellesdon

 Nelson Town Close CDC

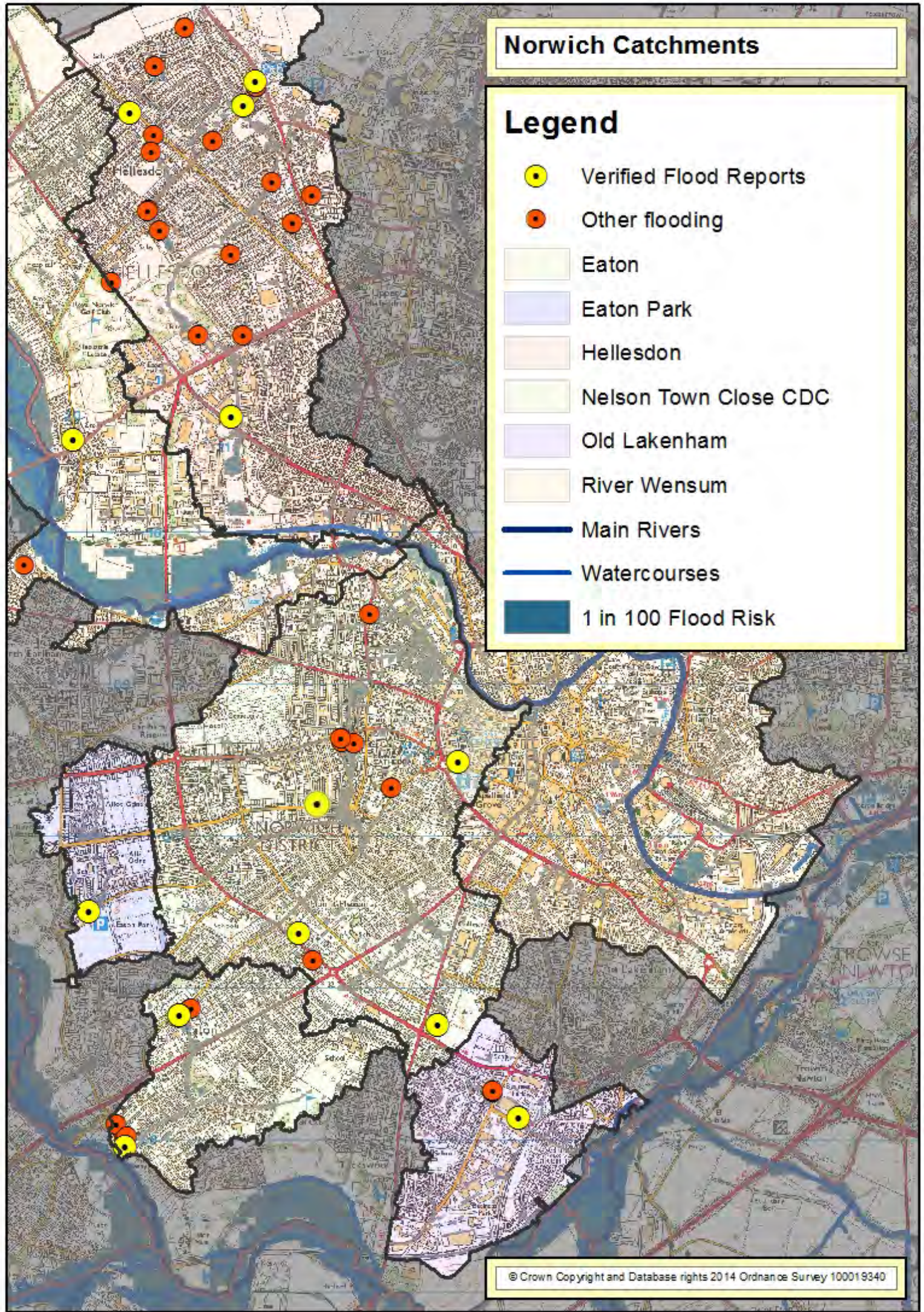
 Old Lakenham

 River Wensum

 Main Rivers

 Watercourses

 1 in 100 Flood Risk



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 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.

Nelson and Town Close Critical Drainage Catchment

Description of catchment

This area has been identified as a Critical Drainage Catchment by the Lead Local Flood Authority due to the concentration of surface water flood risk highlighted in the Norwich Urban Area Surface Water Management Plan and subsequent detailed flood risk studies. Several overland flowpaths converge and flow south to north through dense urban areas before spreading out across flatter land north of the Dereham Road adjacent to the River Wensum. The area is served by surface water sewers which outfall to the River Wensum and also foul and combined sewers which are pumped to the Water Recycling Centre at Whitlingham for treatment.

Flood Risk within the catchment

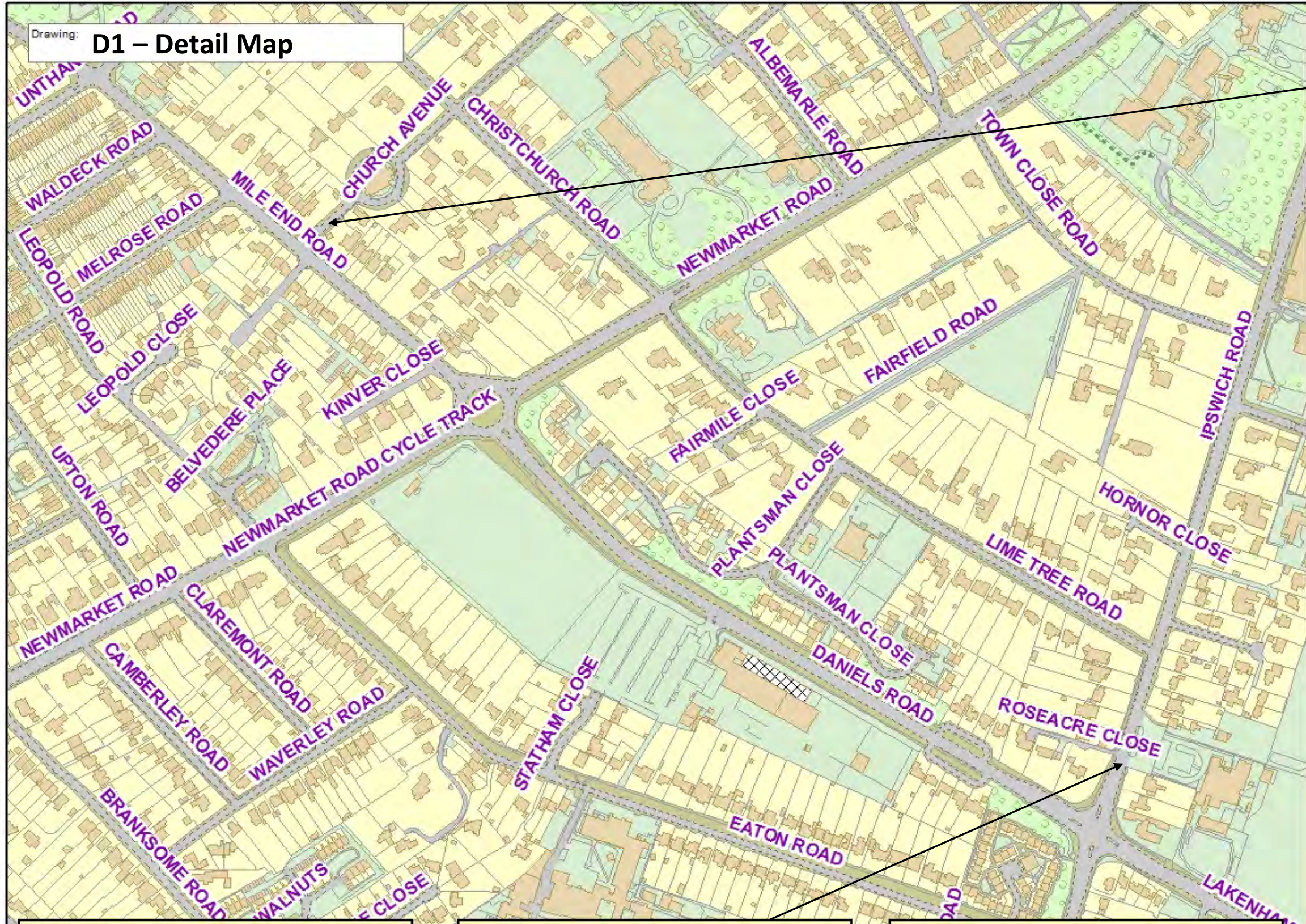
The flood risk from local sources (ordinary watercourses and surface run-off) and strategic sources (fluvial above 3 square km and the sea) of flooding within this catchment has been assessed. The number of properties at risk are set out in the table below for two different risk bandings, the 1 in 30 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:	15	721	232
[b] No. of properties subject to surface water flood risk at 1 in 100 event:	24	1686	378
[c] No. of properties subject to flood risk from rivers and the sea at 1 in 30 event:	1	0	1
[d] No. of properties subject to flood risk from rivers and the sea at 1 in 100 event:	1	1	3
[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	1	2

Flood incidents within this catchment

Within this catchment 4 incidents of internal flooding have been assessed as part of this investigation. These are on Park Lane, Earlham Road and Mile End Road on 23/06/2016, West Parade on 29/09/2016, Grosvenor Road on 22/07/2017, Old Palace Road on 01/01/2018 and Earlham Road on 02/06/2018. These incidents are described below. 7 reports of external or unconfirmed incidents of flooding have also been recorded in this catchment in this timescale.

Drawing: **D1 – Detail Map**



Location: **Nelson Town Close CDC**

Mile End Road

1 property was flooded internally on 23/06/2016. This incident was reported by Norwich City Council.

Causes – Surface run-off from 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.

Anglian Water Services Ltd assessed the capacity of their drainage system after the incident.

Mile End Road

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 resilience measures where appropriate.

Recommendations – 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.



Ipswich Road

1 property was internally flooded on Ipswich Road 06/07/2017. This incident was reported by the media via an article on 07/07/2017.

Causes - The affected property had structural issues that did not cope with heavy rainfall, e.g. (failure of roof / guttering etc). Run-off from significant rainfall pooled at a low point within the catchment affecting property.





Ipswich Road

The property owner carried out measures to minimise the impact of flooding during the incident.

Property owners should protect their buildings through flood resilience measures where appropriate. NCC will advise them of the appropriate measures they could take to protect their property without prejudicing the rights and responsibilities of adjoining property holders.

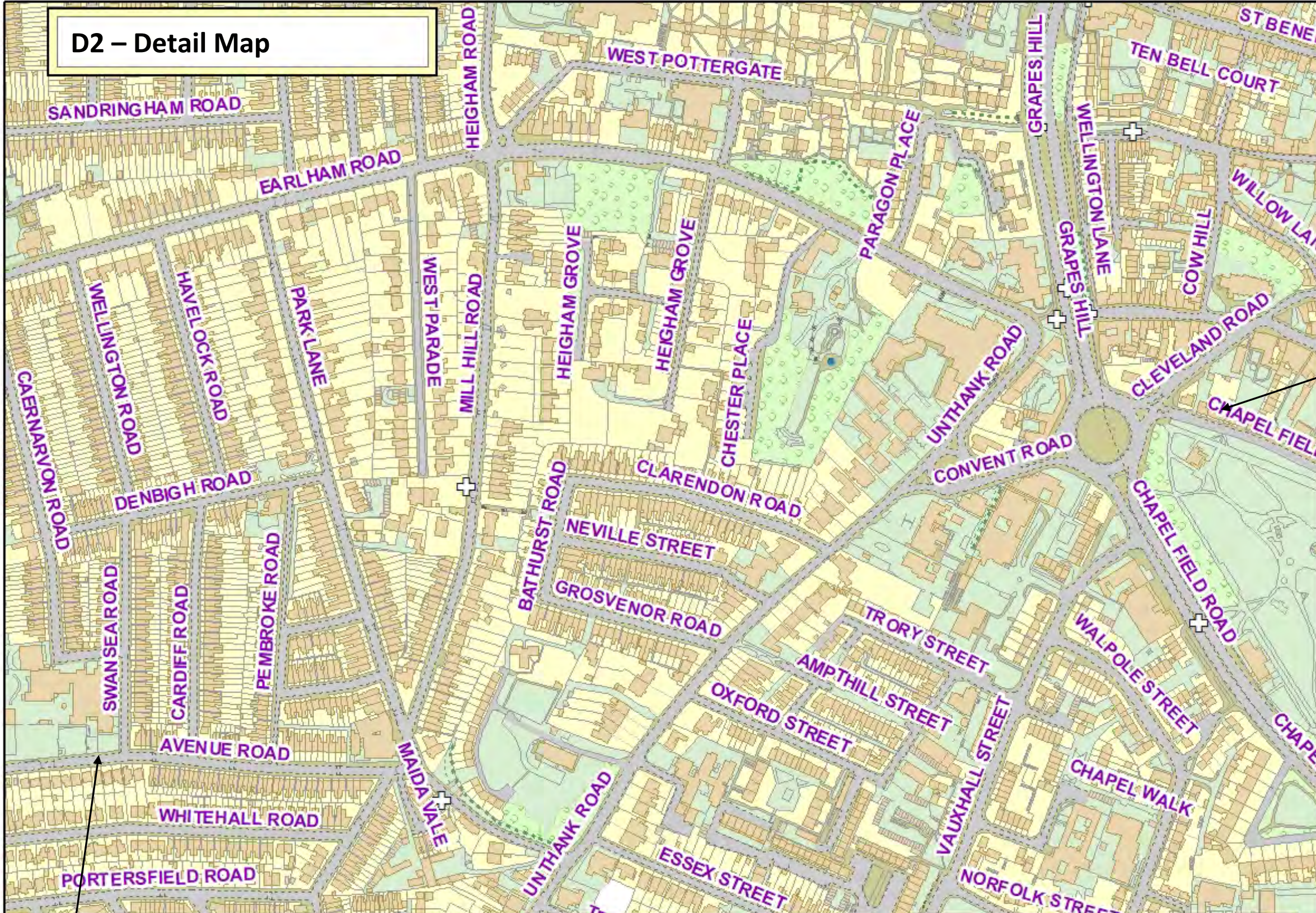


Legend

-  Bridges
-  Watercourses
-  Main Rivers
-  Water bodies

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D2 – Detail Map



Nelson Town Close CDC

Chapelfield North

1 property was flooded internally on 23/06/2016 and was reported via an online form.

Causes – significant rainfall was directed into the combined sewer system causing it to surcharge elsewhere. This surcharging contributed to the flooding at the affected property.

Chapelfield North

Recommendations – 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.

Property owners should protect their buildings through flood resilience measures where appropriate. NCC will advise them of the appropriate measures they could take to protect their property without prejudicing the rights and responsibilities of adjoining property holders.

Chapelfield North

Flooding at this location has also been recorded for 20/07/2014, 20/08/2015 and 18/09/2015. All in times of heavy rain.

Since receiving the flood report NCC has been made aware of 4 further incidents of flooding in December 2018.

Foul water entered the property through the sewer system.

Avenue Road

1 property was flooded internally on 23/06/2016 and was reported via a media report.

Causes – significant rainfall was directed into the surface water sewer system causing it to surcharge elsewhere. This surcharging contributed to the flooding at the affected property.

The affected property had structural issues that did not cope with heavy rainfall, e.g. (failure of roof / guttering etc).





Avenue Road

Recommendations – 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.

Property owners should protect their buildings through flood resilience measures where appropriate. NCC will advise them of the appropriate measures they could take to protect their property without prejudicing the rights and responsibilities of adjoining property holders.



Legend

-  Bridges
-  Watercourses
-  Main Rivers
-  Water bodies

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 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 - 32mm rainfall was recorded as falling in 2 hours 0 minutes at the Norwich Heigham rainfall monitoring station. This intensity of rainfall for the total duration equates to a 1:16 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
2008	Several areas including Gladstone Road and Unthank Road	Unknown

Flooding and flood risk within the Hellesdon catchment

Description of catchment

This catchment covers the North West of the city and its outlying urban settlements within the Broadland District Council area. It is bounded by high ground within the urban environment to the East. It extends outside the urban area from the high ground in the North and West and falls towards the River Wensum to the South. As such there are a number of overland flow paths associated with the topography which aggregate as they fall towards the river and its associated watercourses. In addition, there are numerous outfalls of surface water management systems into this network.

The flooding incidents reported within this catchment relate to overland flow paths emanating in North Hellesdon that converge to flow South in the direction of Drayton Road. These are ultimately directed into local ditches that drain into the River Wensum.

The flood risk within this catchment is approximately 171 properties (non-residential and residential) in the 1 in 30 predicted rainfall event. There are approximately 434 properties (non-residential and residential) in the 1 in 100 rainfall event.

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 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:	0	135	36
[b] No. of properties subject to surface water flood risk at 1 in 100 event:	1	350	83
[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

Flood incidents within this catchment

Within this catchment 8 incidents of internal flooding have been assessed as part of this investigation. These incidents are described below. 19 reports of external or unconfirmed incidents of flooding have also been recorded in this catchment in this timescale. These are on Hellesdon Close Reepham Road, High Road Hellesdon, Middletons Lane, City View Road, Hawthorne Avenue, Gowing Close and Drayton High Road on 23-24/06/2016, Sadler Road on 13/01/2017, Wood View Road on 25/04/2017, Middletons Lane on 09/08/2017 Prince Andrews Road on 02/01/2018 and Holt Road Hellesdon on 02/06/2018.

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 (12.5%) 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 - 32mm rainfall was recorded as falling in 2 hours 0 minutes at the Norwich Heigham rainfall monitoring station. This intensity of rainfall for the total duration equates to a 1 in 16 rainfall event.

Historic flooding incidents within the catchment

6 properties flooded internally on 27/05/2014 with two of these properties experiencing repeat internal flooding on later rainfall events in the same year. The details of this flooding can be found in the Investigation Report into the flooding within the Norwich Urban Area during the summer of 2014 at: <https://www.norfolk.gov.uk/rubbish-recycling-and-planning/flood-and-water-management/flood-investigations>

1 property on Holt Road, Hellesdon also reported external flooding on 14/7/2014 (FWF14/5/6734) and 23/06/2016 (FWF/16/5/6597).

Flooding and flood risk within the River Wensum catchment

Description of catchment

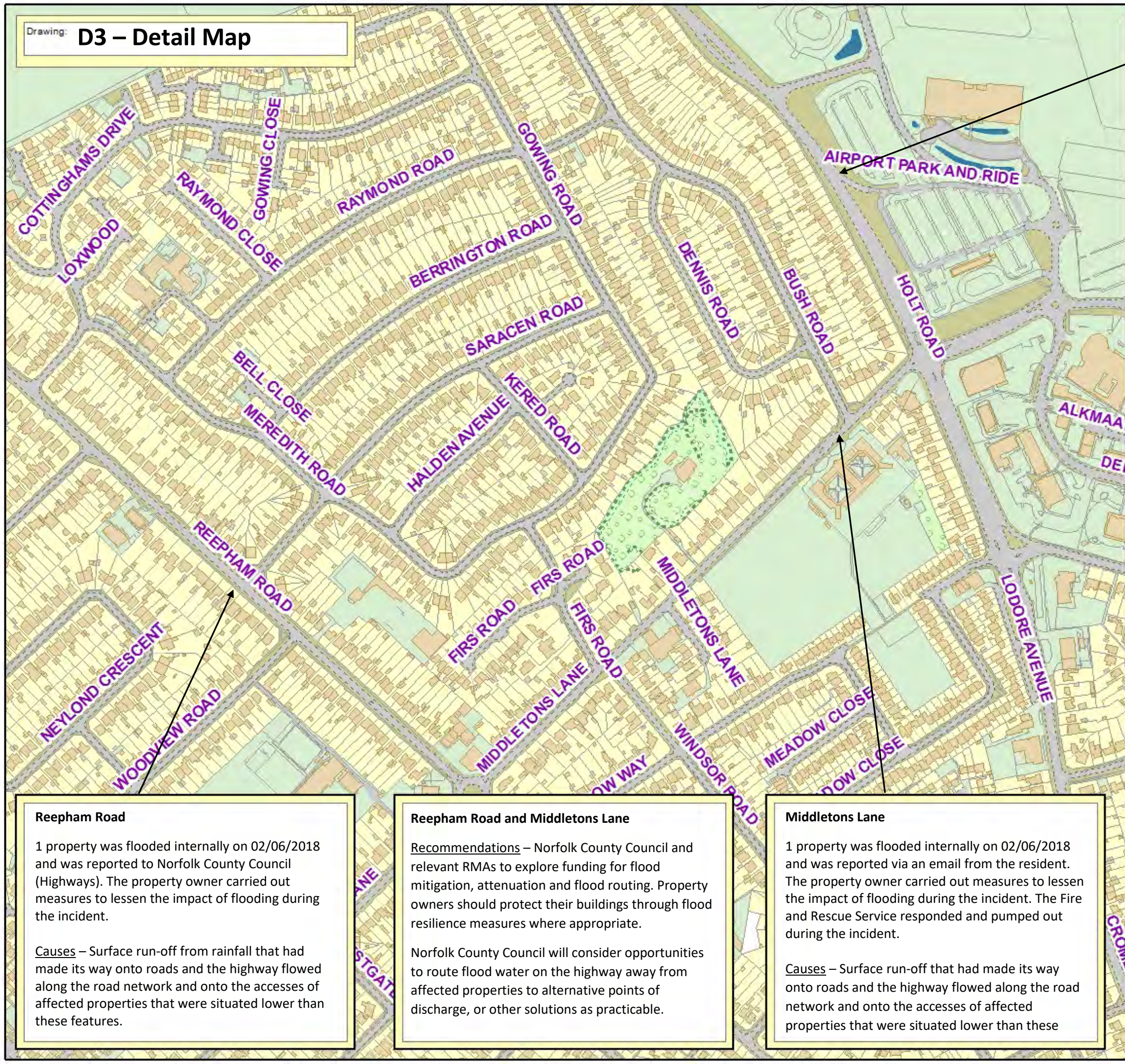
This area forms part of the much larger River Wensum catchment which rises west of Fakenham, flows through Norwich and joins the River Yare near Whitlingham. Short surface water flowpaths run east to west through a mix of urban settlement and open spaces.

Flood incidents within this catchment

Within this catchment 2 incidents of internal flooding on Low Road, Hellesdon have been assessed as part of this investigation. This incident is described below. 2 reports of external or unconfirmed incidents of flooding have also been recorded in this catchment in this timescale. These were on Hellesdon Close Norwich and Wensum Valley Close, both on 23/06/2016

Historic flooding incidents within the catchment

1 property flooded internally on 27/05/2014. The details of this flooding can be found in the Investigation Report into the flooding within the Norwich Urban Area during the summer of 2014 at: <https://www.norfolk.gov.uk/rubbish-recycling-and-planning/flood-and-water-management/flood-investigations>



Holt Road

1 property was flooded internally on 02/06/2018 and was reported to Norfolk County Council (Highways).

The property owner carried out measures to lessen the impact of flooding during the incident. The Fire and Rescue Service visited affected residents to offer advice and to gather information during the incident. Norfolk County Council (Highways) assessed the capacity of their drainage system after the incident.

Holt Road

Causes – Surface run-off from 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. Significant rainfall was directed into the sewer system causing it to surcharge elsewhere. This surcharging contributed to the flooding at the affected property.

Previous flood reports have been received for 23/06/2016 and 14/07/2014 in this location.

Holt Road

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 resilience measures where appropriate.

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.

Reepham Road

1 property was flooded internally on 02/06/2018 and was reported to Norfolk County Council (Highways). The property owner carried out measures to lessen the impact of flooding during the incident.

Causes – Surface run-off from 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.

Reepham Road and Middletons Lane

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 resilience measures where appropriate.





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.

Middletons Lane

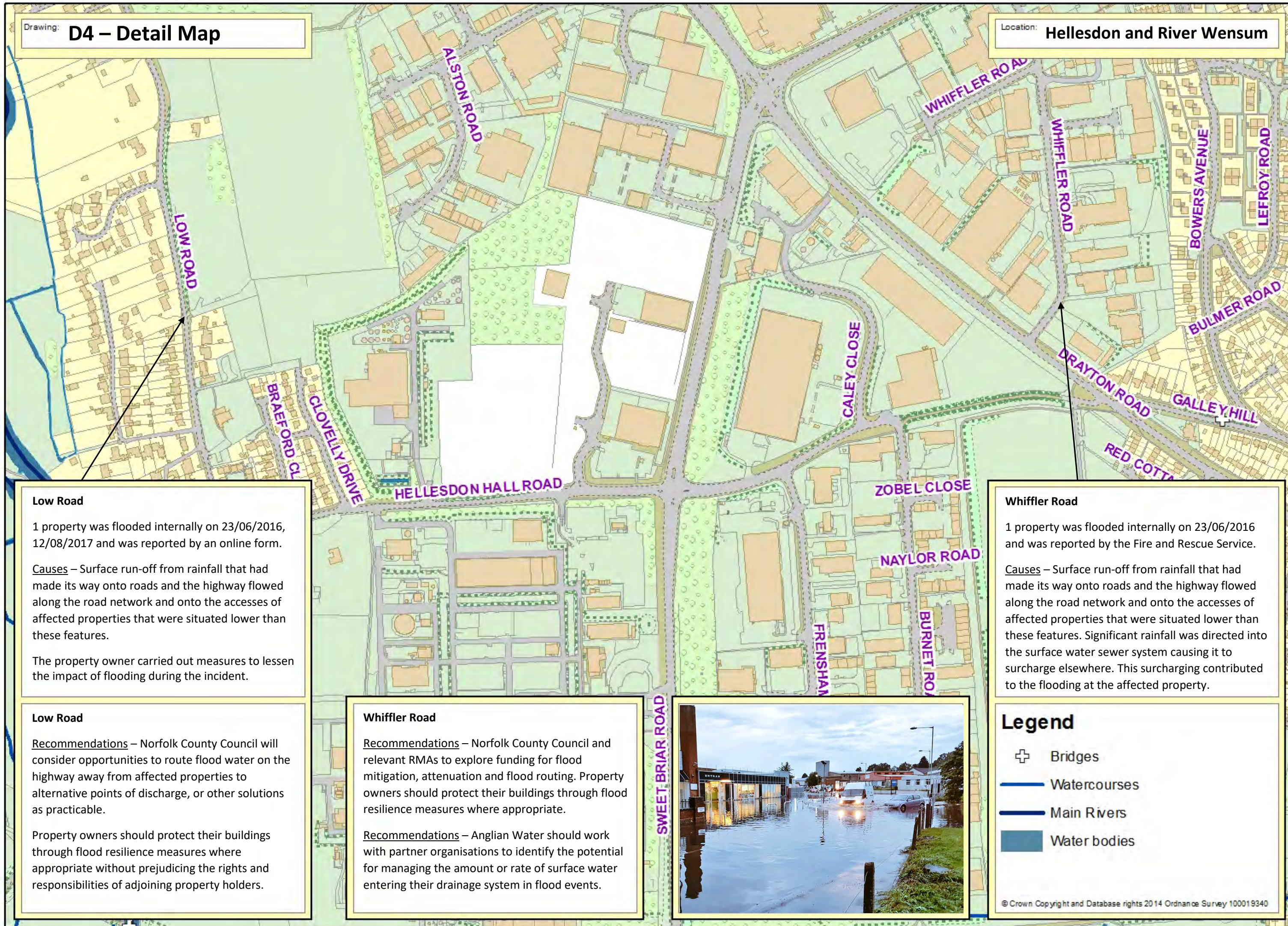
1 property was flooded internally on 02/06/2018 and was reported via an email from the resident. The property owner carried out measures to lessen the impact of flooding during the incident. The Fire and Rescue Service responded and pumped out during the incident.

Causes – Surface run-off 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

Legend

-  Bridges
-  Watercourses
-  Main Rivers
-  Water bodies

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Low Road

1 property was flooded internally on 23/06/2016, 12/08/2017 and was reported by an online form.

Causes – Surface run-off from 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.

The property owner carried out measures to lessen the impact of flooding during the incident.

Low Road

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.

Property owners should protect their buildings through flood resilience measures where appropriate without prejudicing the rights and responsibilities of adjoining property holders.

Whiffler Road

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 resilience measures where appropriate.

Recommendations – 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.

Whiffler Road

1 property was flooded internally on 23/06/2016 and was reported by the Fire and Rescue Service.

Causes – Surface run-off from 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. Significant rainfall was directed into the surface water sewer system causing it to surcharge elsewhere. This surcharging contributed to the flooding at the affected property.

Legend

- ⊕ Bridges
- Watercourses
- Main Rivers
- Water bodies



Flooding and flood risk within the Eaton catchment

Description of catchment

This largely sub-urban catchment runs from the north-east to the south-west. Both surface water sewer and overland flowpaths outfall into the River Yare south-west of Church Lane. The flood reports and flood risk associated with the overland flowpaths are distributed across the catchment.

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 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	20	1
[b] No. of properties subject to surface water flood risk at 1 in 100 event:	1	102	2
[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 2 incidents of internal flooding have been assessed as part of this investigation. These incidents are described below. 7 reports of external or unconfirmed incidents of flooding have also been recorded in this catchment in this timescale. These are on Church Lane on 23/06/2016 and 06/07/2017, Havant Close on 23/06/2016 and Unthank Road on 23/06/2016.

Recent rainfall within the catchment

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

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
24/08/2010	Church Lane - Reports of manhole covers lifted by water. Church hall car park also flooded	Unknown
12/08/2008	Flooding in Havant Close and Church lane	Unknown
20/07/1988	Flooding of property on Church Lane	Unknown

Drawing: **D5 – Detail Map**

Unthank Road

1 property was flooded internally on 23/06/2016 and was reported via email correspondence.

The flood water entered the property through [low thresholds at entrances.

A resident carried out measures to minimise the impact of flooding during the incident.

Anglian Water Services Ltd assessed the capacity of their drainage system after the incident.



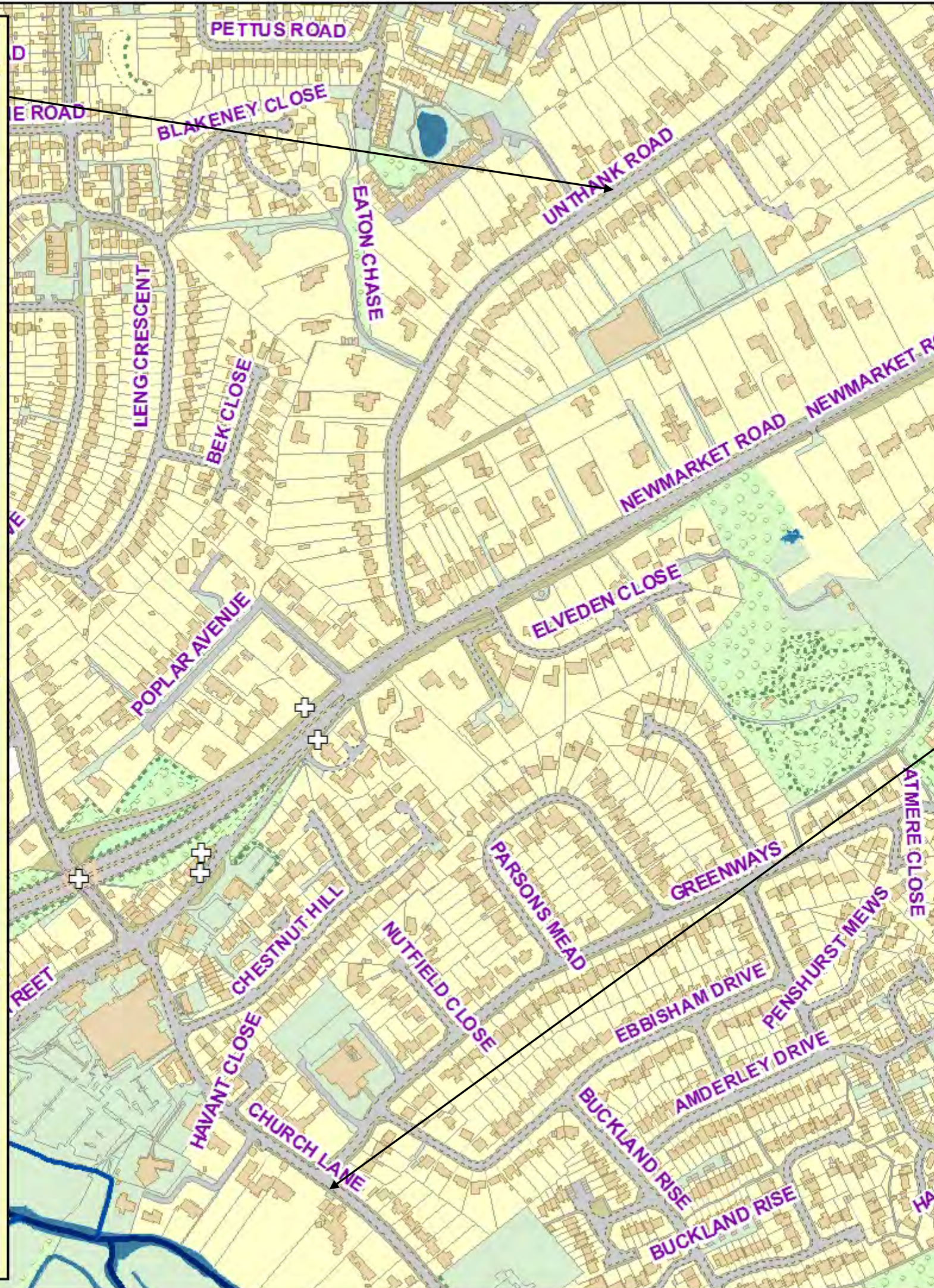
Unthank Road

Causes – Surface run-off from 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. Significant rainfall was directed into the surface water sewer system causing it to surcharge elsewhere. This surcharging contributed to the flooding at the affected property.

Unthank Road and Church Lane

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 resilience measures where appropriate.

Recommendations – 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.



Location: **Eaton Catchment**

Church Lane

1 property was flooded internally on 23/06/2016 and was reported by a resident via email correspondence.





A resident carried out measures to minimise the impact of flooding during the incident. Anglian Water Services Ltd, Norwich City Council and Norfolk County Council visited affected residents to offer advice and to gather information after the incident.



Church Lane

Causes – Surface run-off from 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. Significant rainfall was directed into the surface water sewer system causing it to surcharge elsewhere. This surcharging contributed to the flooding at the affected property.

Legend

-  Bridges
-  Watercourses
-  Main Rivers
-  Water bodies

Flooding and flood risk within the Old Lakenham catchment

Description of catchment

This collection of small catchments comprises of mix of industrial units and residential areas. Numerous overland flowpaths and surface water sewer networks fall south and south-east, outfalling into the River Yare

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 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:	0	23	8
[b] No. of properties subject to surface water flood risk at 1 in 100 event:	2	78	21
[c] No. of properties subject to flood risk from rivers and the sea at 1 in 30 event:	0	1	0
[d] No. of properties subject to flood risk from rivers and the sea at 1 in 100 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 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

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.

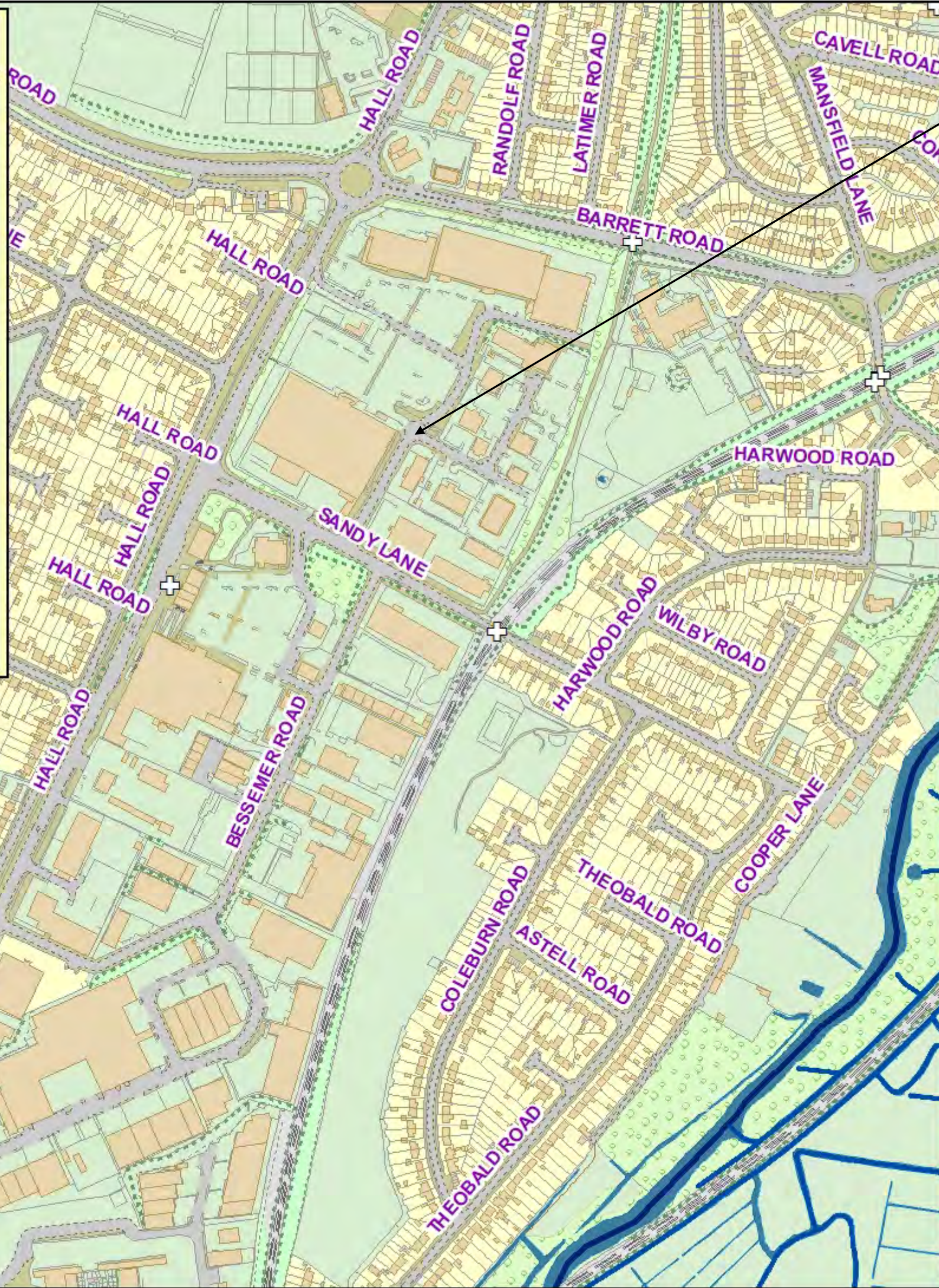
Norfolk County Council has sought to use data from rain gauges where incidents of flooding are located within a 2.5 km radius of the instrumentation. This distance meets the requirements of British Standards and aims to capture localised rainfall patterns. Where there is no available data within this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

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

Flood incidents within this catchment

Within this catchment 1 incident of internal flooding has been assessed as part of this investigation. These incidents are detailed below. 2 reports of external or unconfirmed incidents of flooding have also been recorded in this catchment in this timescale. These are on Hall Road on 06/07/2017.

D6 – Detail Map



Lakenham Catchment

Whiting Road

1 property was flooded internally on 06/07/2017 and was reported by the property owner via an electronic report. The property owner also reported flooding at this location on 31/05/2016

The flood water entered the property through low thresholds at entrances.

The property owner carried out measures to minimise the impact of flooding during the incident.

Whiting Road

Causes – Surface run-off from rainfall from large impermeable areas and flows 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.




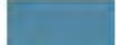
Recommendations – Norfolk County Council could investigate with third parties the potential for retro-fitting permeable areas and other methods of small scale sustainable drainage systems

Whiting Road

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.

Property owners should protect their buildings through flood resilience measures where appropriate without prejudicing the rights and responsibilities of adjoining property holders.

Legend

-  Bridges
-  Watercourses
-  Main Rivers
-  Water bodies

Flooding and flood risk within the Eaton Park catchment

Description of catchment

This catchment, which comprises of housing, allotments and parkland, runs mainly north to south. Both surface water sewers and overland flowpaths outfall into watercourses that connect to the River Yare south of the UEA campus.

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 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:	0	29	2
[b] No. of properties subject to surface water flood risk at 1 in 100 event:	0	64	6
[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

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.

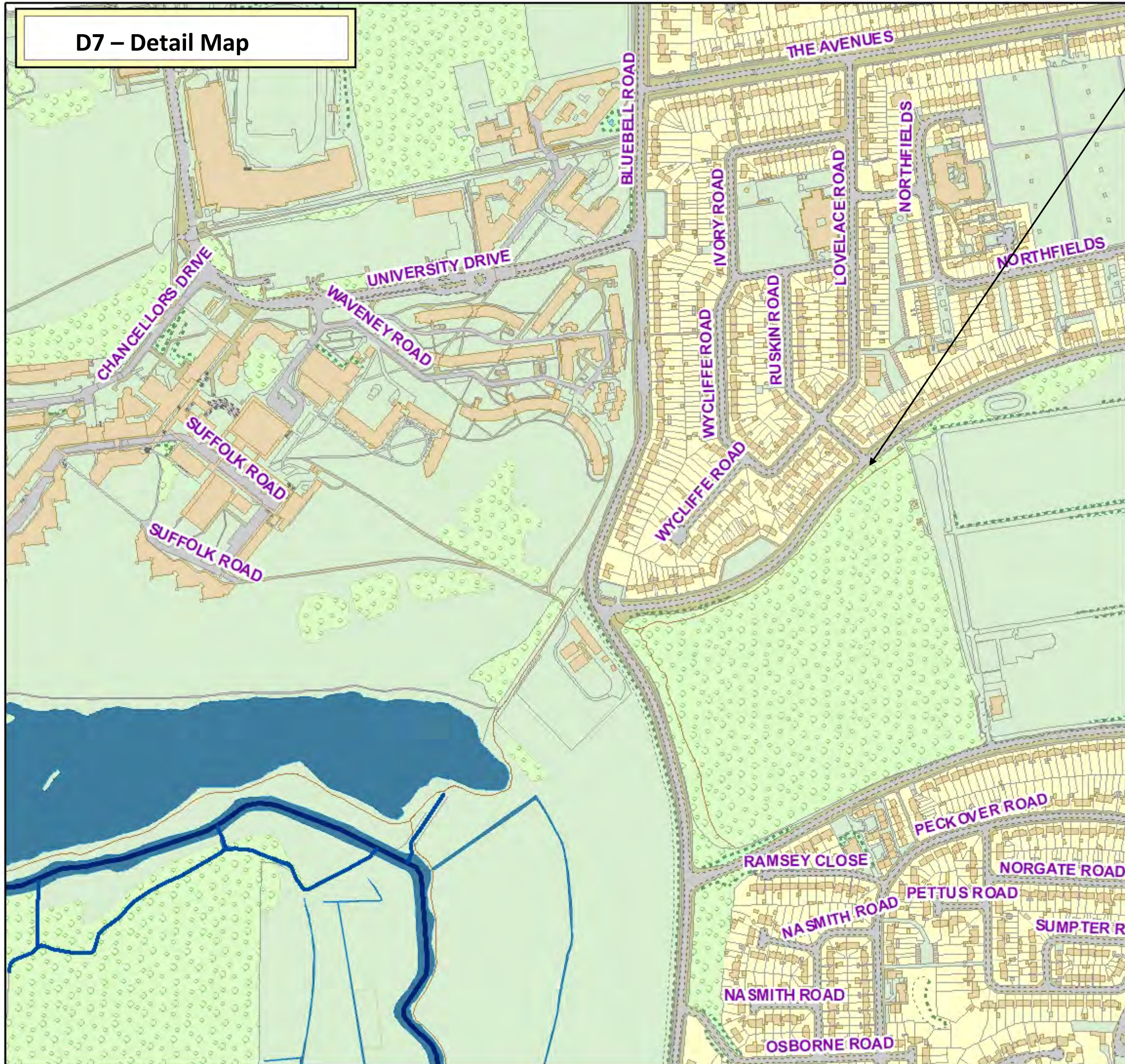
1 of the incidents (100%) of flooding in this catchment are within 2.5km of a rain gauge. The rainfall event recorded by gauges for this catchment is;

23 June 2016 - 32mm rainfall was recorded as falling in 2 hours 0 minutes at the Norwich Heigham rainfall monitoring station. This intensity of rainfall for the total duration equates to a 1:16 rainfall event.

Flood incidents within this catchment

Within this catchment 1 incident of flooding that blocked a primary road has been assessed as part of this investigation. This incident is detailed below.

D7 – Detail Map



Eaton Park Catchment

North Park Avenue

Flooded was reported at this location on 23/06/2016 by a resident via email correspondence.

Causes – run-off from significant rainfall was concentrated along overland flowpaths and pooled at a low point within the catchment.

Causes – significant rainfall was directed into the surface water sewer system causing it to surcharge elsewhere.







North Park Avenue

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.

Recommendations – 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.

Legend

-  Bridges
-  Watercourses
-  Main Rivers
-  Water bodies

Flooding and flood risk within the Thorpe St Andrew catchment

Description of catchment

This catchment covers an area in the East of the city and its outlying urban settlements. A small part of this area is within the Norwich City Council area whilst the majority of the area is within the Broadland District Council area. It is bounded by high ground within the urban environment to the West and North. It extends outside the urban area from the high ground in the East. All catchments in this area fall towards the River Yare to the South. As such there are a number of overland flow paths associated with this topography which aggregate as they fall towards the river and its associated watercourses. In addition, there are numerous outfalls of surface water management systems into this network.

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 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:	2	90	8
[b] No. of properties subject to surface water flood risk at 1 in 100 event:	6	278	40
[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

Recent rainfall within the catchment

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

Flood incidents within this catchment

Within this catchment 1 incident of internal flooding has been assessed as part of this investigation.

Historic flooding incidents within the catchment

2 properties flooded internally on 27/05/2014 with both of these properties experiencing repeat internal flooding on later rainfall events in the same year. The details of this flooding can be found in the Investigation Report into the flooding within the Norwich Urban Area during the summer of 2014 at: <https://www.norfolk.gov.uk/rubbish-recycling-and-planning/flood-and-water-management/flood-investigations>


Thorpe St Andrew Catchment


Legend

 Verified Flood Reports

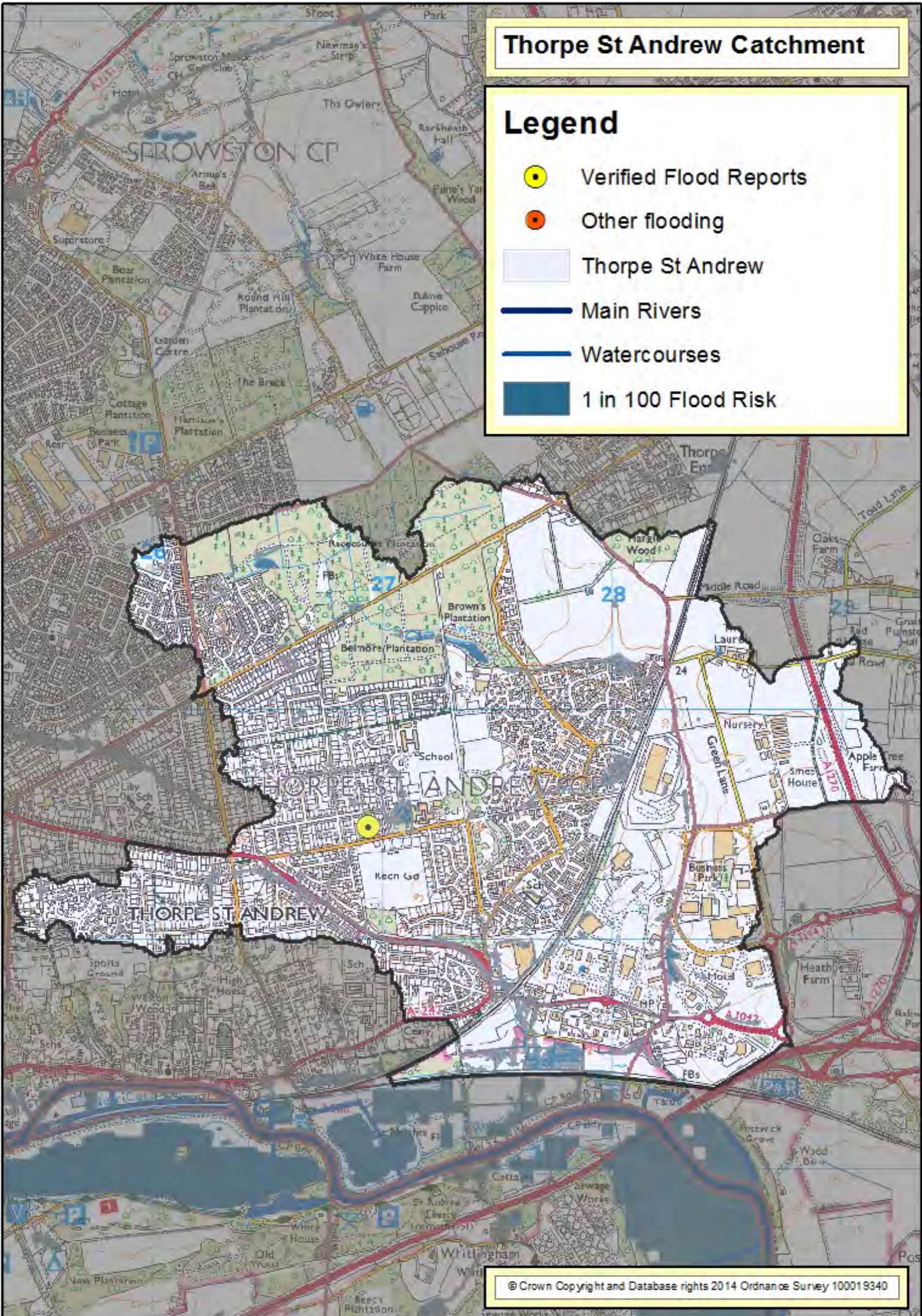
 Other flooding

 Thorpe St Andrew

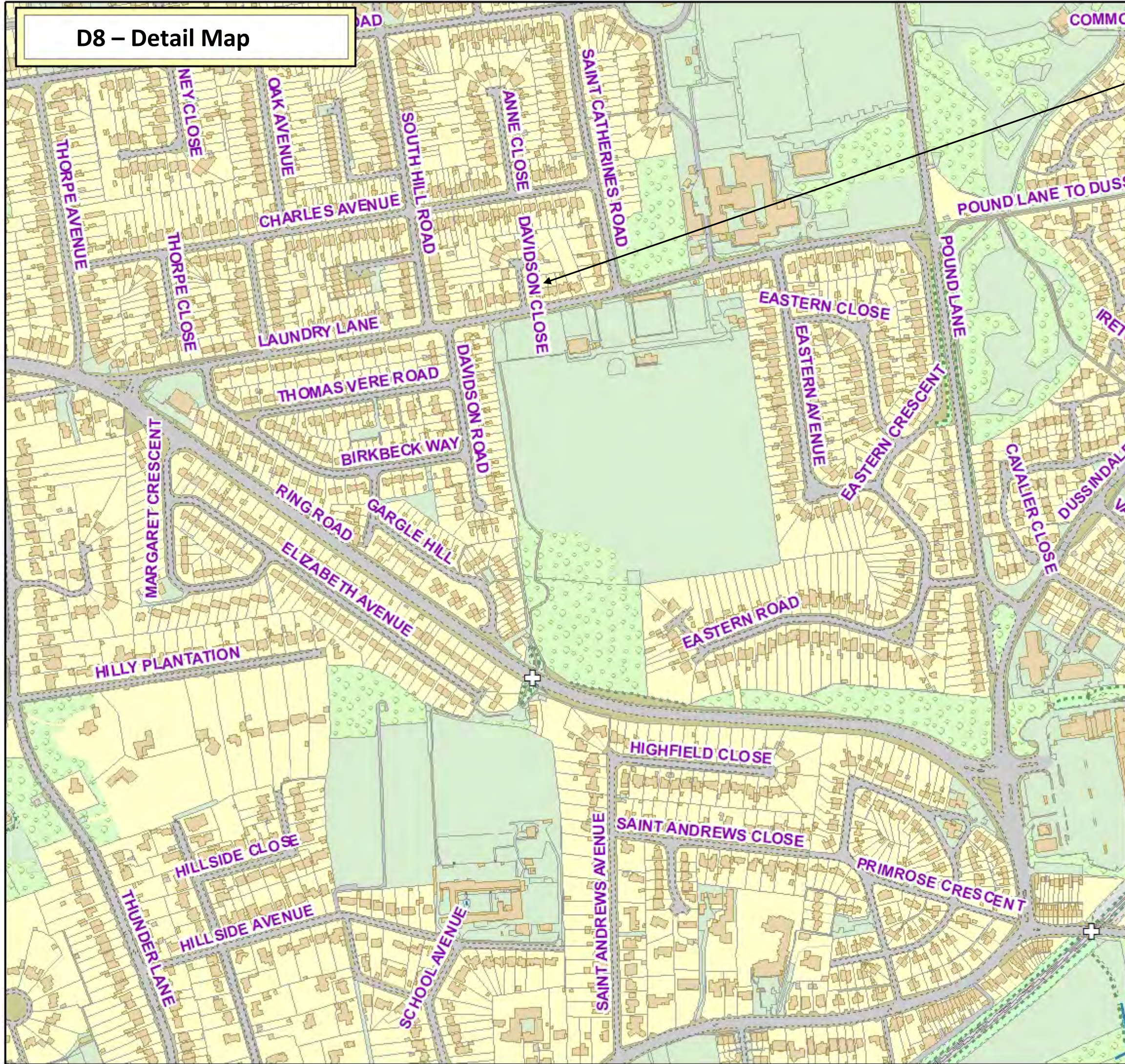
 Main Rivers

 Watercourses

 1 in 100 Flood Risk



D8 – Detail Map



Thorpe St. Andrew Catchment

Davidson Close

1 property was flooded internally on 16/6/2016 and was reported by the property owner via an electronic report. Flooding was also reported at this location on 20/7/2014.

The flood water entered the property through low thresholds at entrances.

Norfolk County Council (Highways) assessed the capacity of their drainage system after the incident







Davidson Close

Causes – run-off from significant rainfall was concentrated along overland flowpaths and pooled at a low point within the catchment.

Recommendations – Norfolk County Council should identify the potential for managing the amount or rate of surface water entering their drainage system in flood events. Property owners should protect their buildings through flood resilience measures where appropriate.

Legend

-  Bridges
-  Watercourses
-  Main Rivers
-  Water bodies

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.

Investigation Report into the flooding in Norwich Urban Area: 2016 to 2018 – Addendum

Update on actions taken since flood events

A number of projects have subsequently been initiated by Risk Management Authorities in response to the Flood Investigation Report.

Nelson and Town Close Critical Drainage Catchment:

- Norfolk County Council have successfully secured EU funding, in partnership with Anglian Water for developing a project called 'CATCH' which involves the instalment of a large number of small scale water storage features which delay the amount of water entering the drainage system in heavy rainfall. The water is infiltrated at a slower rate back into the catchment preventing the overloading of the drainage system.
- Norwich City Council has undertaken gully improvement works at Mile End Road
- Norwich City Council has implemented an improved maintenance regime for the Avenues

Hellesdon and Wensum Catchments:

- Norfolk County Council has implemented an improved maintenance regime for Holt Road and Low Road
- Norfolk County Council and Norwich City Council a structural maintenance scheme for Whiffler Road

Eaton Catchment:

- Norwich City Council has undertaken gully cleansing and roadside threshold work on Unthank Road
- Property owners have undertaken a range of different measures such as air brick covers and flood prevention gates with the help of Norfolk County Council.

Lakenham Catchment:

- Norwich City Council are investigating a structural maintenance scheme for Whiting Road

Thorpe St. Andrew Catchment:

- Norfolk County Council has installed a positive drainage system in Davidson Close to replace the existing soakaway