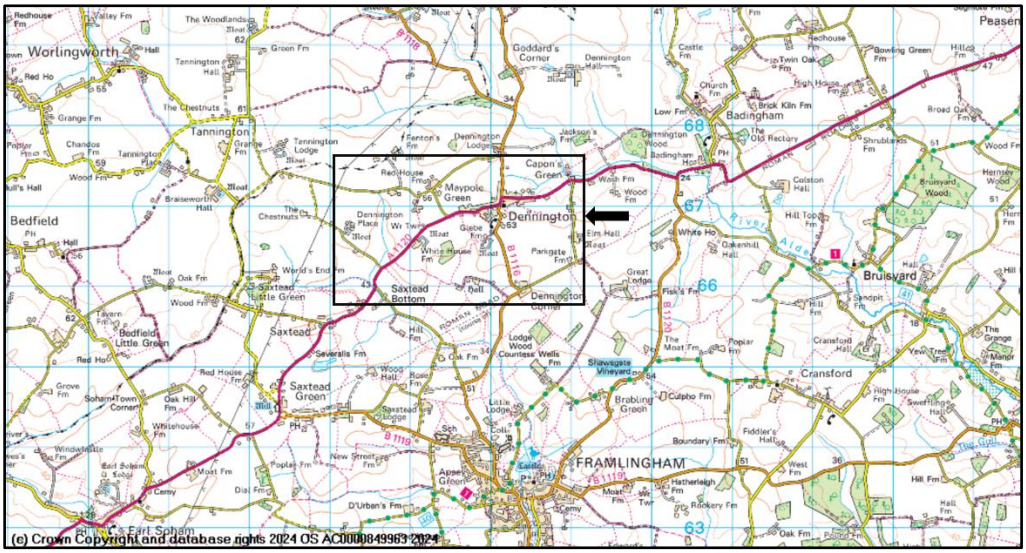
Section 19 Flood and Water Management Act 2010

Dennington Flood Investigation

Storm Babet 2023



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Executive Summary

Storm Babet caused significant disruption to communities across Suffolk between 18th - 21st October 2023. The community of Dennington was significantly impacted, with approximately twelve properties suffering internal flooding as well as disruption to infrastructure and services. Suffolk County Council, as Lead Local Flood Authority, have therefore undertaken a Section 19 Flood Investigation. The resulting report will:

- highlight the probable causes of flooding
- identify options to reduce future flood risk and increase property resilience
- make recommendations for actions by relevant responsible organisations, landowners or homeowners.

Dennington is located in an area at significant risk of both fluvial and pluvial flooding and the nature of the surrounding topography and geology contributes to the susceptibility of the community to flooding. Areas of Dennington are low-lying, surrounded by a relatively shallow rural catchment. The local geology and soils are susceptible to high run off, making a high number of properties in the village vulnerable to flooding due to intense rainfall events.

Storm Babet delivered significant rainfall to the catchment, following an extended period of above average rainfall. Impacts within Dennington were widespread and for the purposes of this report, the affected areas have been categorised into four zones. The description of the flood events detailed in the report have been compiled using data submitted to Suffolk County Council, as well as information from Risk Management Authorities (e.g. Suffolk County Council Highways and Anglian Water) and the community.

A comprehensive summary for each zone is provided within the report, outlining the context of the event and the impact. Key findings are that Dennington was severely impacted by flooding due to the intensity and duration of rainfall which overwhelmed the natural flow routes and the capacity of watercourses and drainage infrastructure. This situation was compounded when overland flow paths converged and saw the resultant internal flooding of property.

Short, medium and longer term recommendations have been published and each have a potential role to improve resilience and reduce the risk of flooding to Dennington. For short term measures, key highlights include the implementation of a community flood plan and maximising Property Flood Resilience (PFR) grants. For medium to longer term recommendations, there is emphasis on the management of water from rural land though new natural flood management features, to reduce flood risk within the catchment.

Justification for Investigation

Suffolk County Council, Lead Local Flood Authority (LLFA) has determined that in accordance with our criteria, it is considered necessary and appropriate to carry out an investigation into this flood event.

This is in accordance with Section 19 (1) of the Flood and Water Management Act 2010, and in accordance with Section 19 (2) of the Flood and Water Management Act 2010, to publish the results and notify the relevant risk management authorities (RMAs).

Section 19 Local authorities: investigations

(1) On becoming aware of a flood in its area, a lead local flood authority must, to the extent that it considers it necessary or appropriate, investigate—

> *(a) which risk management authorities have relevant flood risk management functions, and*
>
> *(b) whether each of those risk management authorities has exercised, or is proposing to exercise, those functions in response to the flood.*

(2) Where an authority carries out an investigation under subsection (1) it must—

> *(a) publish the results of its investigation, and*
>
> *(b) notify any relevant risk management authorities*

Criteria for an investigation (as per Appendix D of the Suffolk Flood Risk Management Strategy):	
There was a risk to life because of flooding?	
Internal flooding of one property (domestic or business) has been experienced on more than one occasion?	
Internal flooding of five properties has been experienced during one single flood incident	✓
Where a major transport route was closed for more than 10 hours because of flooding	
Critical infrastructure was affected by flooding	
There is ambiguity surrounding the source or responsibility of a flood incident	

Understanding the flood context

1. What happened during Storm Babet

A succession of weather fronts between the 11th and 13th of October 2023 brought significant rainfall to the region. Readings indicate that between 30mm and 50mm of rain fell across Suffolk compared with an average of just less than 65mm across the whole month of October according to Meteorological Office weather data (Met Office, 1991- 2020). This significant rainfall in a short space of time resulted in saturated land and rivers reaching their capacity. Shortly after this, Storm Babet followed on the 18th to 21st of October 2023. The storm brought between 50 mm and 80 mm of rain to much of central and northern East Anglia, with some Suffolk weather stations recording the wettest October day on record.

The Environment Agency River level gauging stations indicated many flows close to or exceeding their highest on record, and the weather remained wetter than average for the rest of the month. October 2023 was the joint wettest on record in the east of England since 1871. During Storm Babet, Suffolk saw the heaviest rainfall across East Anglia causing significant flooding of roads and properties. The river systems rose rapidly across whole catchments due to the existing conditions, which was unusual as storms will often impact a small area and result in a steady progression of flood water downstream. A major incident was declared by Suffolk Resilience Forum (SRF) in the afternoon of the 20th of October due to significant impacts on communities and disruption to the road and rail networks.

The following maps illustrate the extent to which the rainfall in the months preceding Storm Babet exceeded the average monthly rainfall for July to October in recent years in Suffolk.

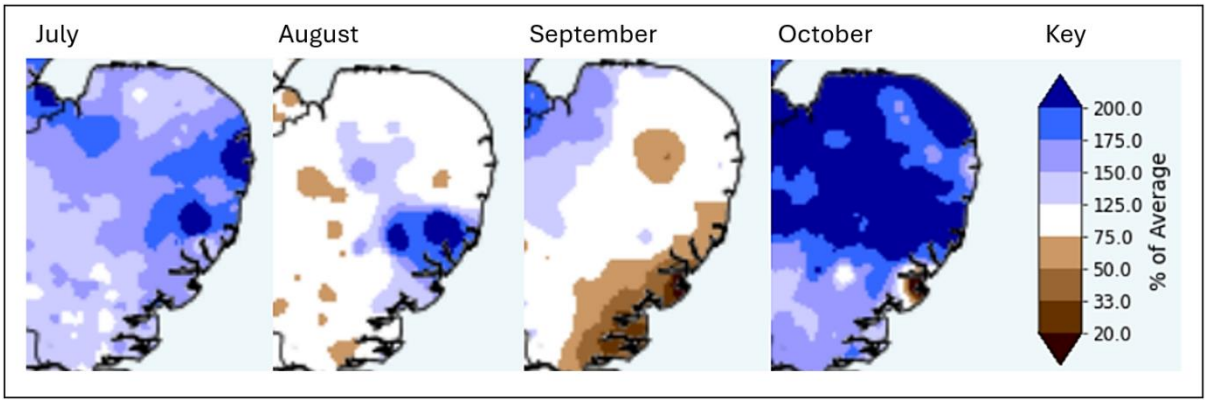

Fig. 1. Average monthly rainfall (July – October 2023) as a percentage of the historic average monthly rainfall

The following report acknowledges that October 2023 and particularly Storm Babet, was an extreme event and will assess the probable causes and impacts. The report will recommend measures to reduce the risk of flooding within the location, in line with best practice, ranging from large to small scale interventions and be targeted at a range of stakeholders. It should be noted that Storm Babet was a significant event,

with a low probability of recurrence. The recommendations will provide advice about reducing flood risk. However, they should not be relied upon as a guaranteed failsafe to mitigate against all future flooding.

2. Location of flooding

The village of Dennington is located in the district of East Suffolk District Council, approximately two miles north of the town of Framlingham (Fig. 2). The A1120 runs through Dennington village.

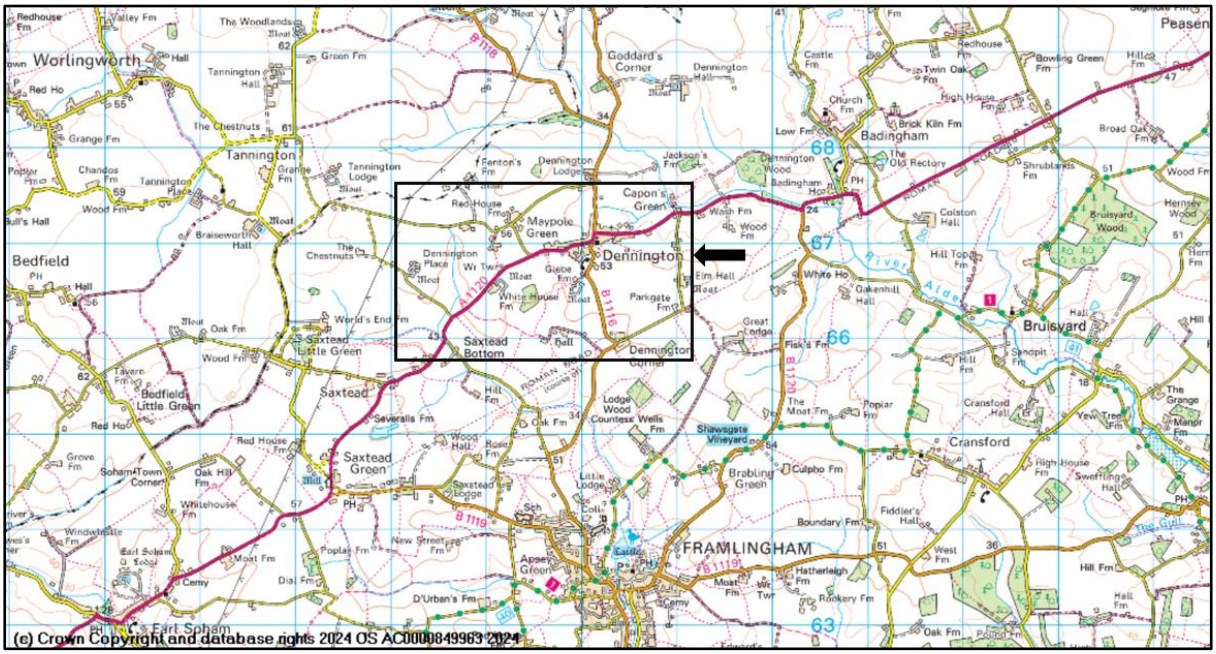

Fig. 2. Investigation area map

Fig. 3 shows the most significant watercourses in and around Dennington. Two tributaries of the River Alde converge 1.2 km north of Dennington village and become a statutory main river, flowing southeast towards Capon's Green, where the river then flows east along the north side of the A1120. To the west of Dennington, tributaries converge near Saxtead Bottom to form the River Ore which flows southeast, becoming a main river where it flows under Durrant Bridge on the B1116.

The Environment Agency has permissive powers to carry out maintenance, improvement or construction work on statutory main rivers to manage flood risk. Lead Local Flood Authorities (LLFAs) and Internal Drainage Boards (IDBs) manage the flood risk from ordinary watercourses but responsibility for maintaining watercourses rests with the Riparian Landowner, defined as those who have a river, stream or ditch which runs next to or through their land or property.

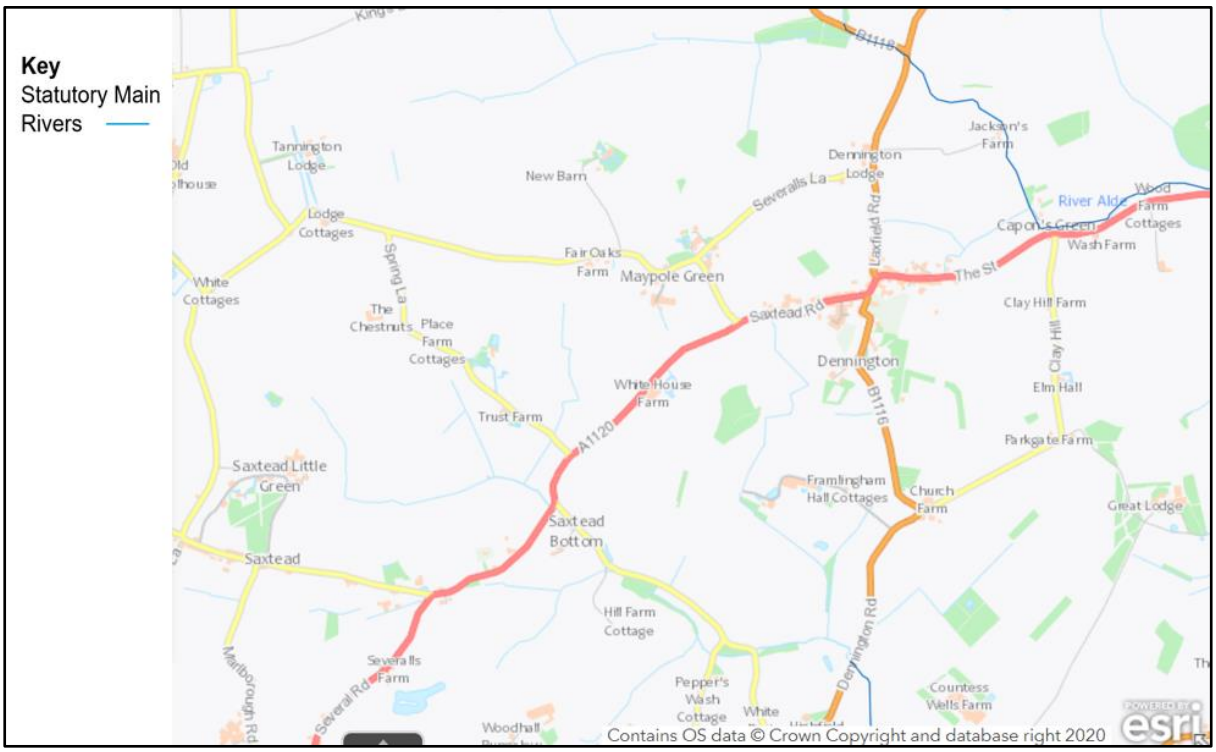

Fig. 3. Location of statutory main rivers and significant ordinary watercourses

On the 20th October 2023, Storm Babet resulted in significant rainfall across Suffolk on already saturated ground due to above average rainfall in the preceding weeks. Dennington was significantly impacted with approximately twelve properties reporting internal flooding. Flood water was described as coming from several sources including surface water runoff from surrounding fields (pluvial), the overtopping of local watercourses (fluvial), groundwater and overwhelmed drainage systems. Within this report, the term 'flood water' may be used to describe all types of flooding.

For the purposes of this investigation the various areas affected by flooding have been separated into four distinct zones:

1. Capon's Green
2. The Street
3. Clay Hill
4. Spring Lane

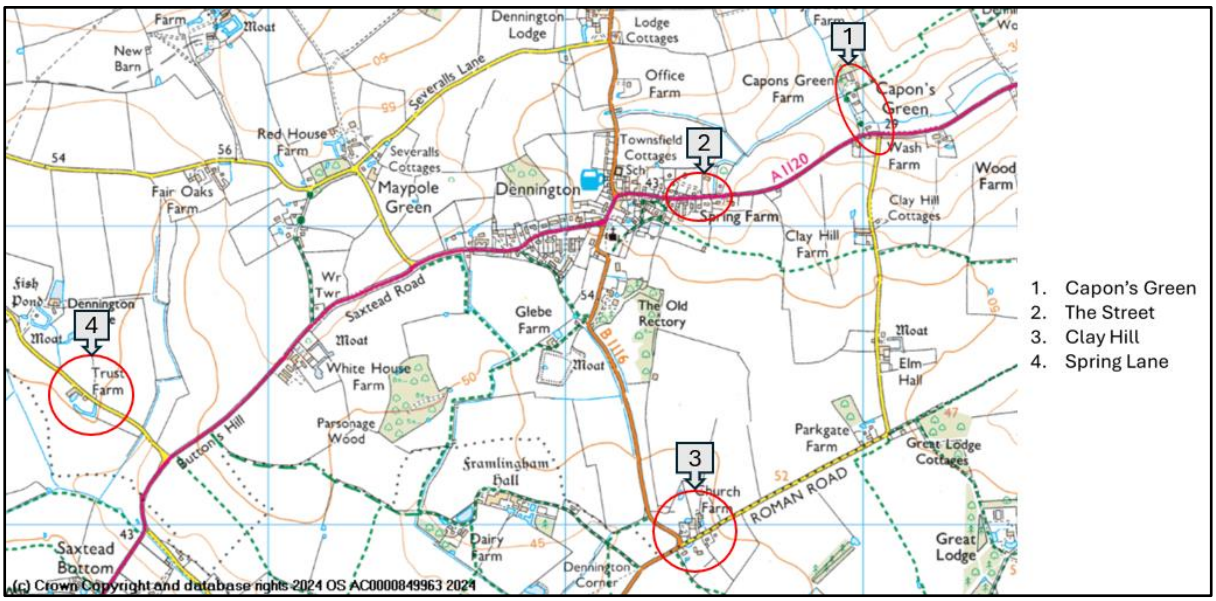

Fig. 4. Distinct flood zones for investigation

3. Records of any historical flooding

A review of Suffolk County Council's Highways reporting tool, local and social media reports indicate previous episodes of internal flooding on The Street at a single property in 2022. This was due to damage to a surface water pipe which had been blocked by the installation of a new foul pipe on private property. The surface water pipe also transported highway surface water from The Street via a gully and the blockage caused the gully to surcharge, flooding property. The pipework was repaired by January 2023 and there have been no subsequent reports of flooding.

4. The Environment Agency hold a historical flood record for the area of Dennington. Between 11th – 15th October 1993, two properties are reported to have flooded in the Wash Lane area and flooding of property has been recorded in Capon's Green."Predicted Flood Risk

The parish of Dennington is at significant risk of pluvial (surface water) flooding (Fig. 5). Clay Hill (east of the junction with the B1116) is the area at greatest risk of surface water flooding of all the areas impacted in Dennington. On the north side of Clay Hill, all affected property is at high risk of surface water flooding. On the south side of Clay Hill, affected property is not identified directly as at risk of surface water flooding although it is adjacent to a high risk area of surface water flooding. In Capon's Green affected property is at low or no risk of surface water flooding. Affected property on the south side of The Street is adjacent to a low surface water flood risk area. Affected property in Spring Lane is not directly predicted to be at flood risk but is adjacent to a localised area of high surface water flood risk.

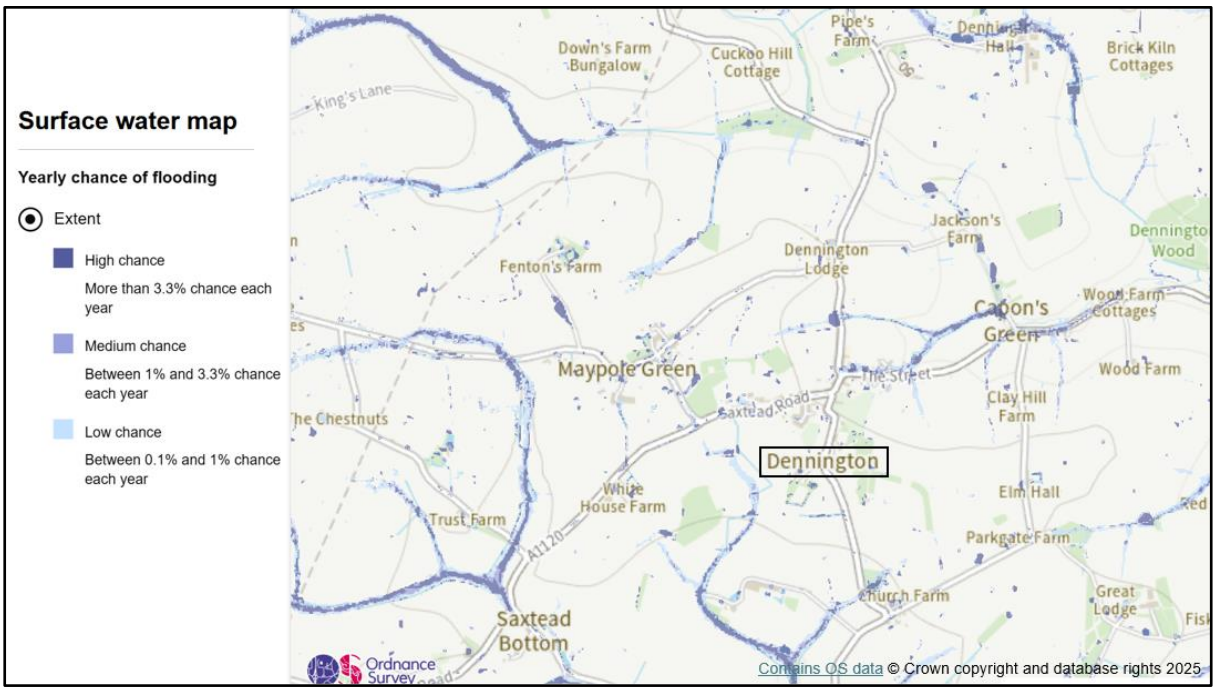

Fig. 5. Predicted pluvial flood risk (surface water)

Affected property at risk of fluvial (river) flooding in Dennington parish was located solely at Capon's Green and is associated with the River Alde (Fig. 6). Properties that were impacted in this area were either at low risk or adjacent to areas of low and medium risk of fluvial flooding.

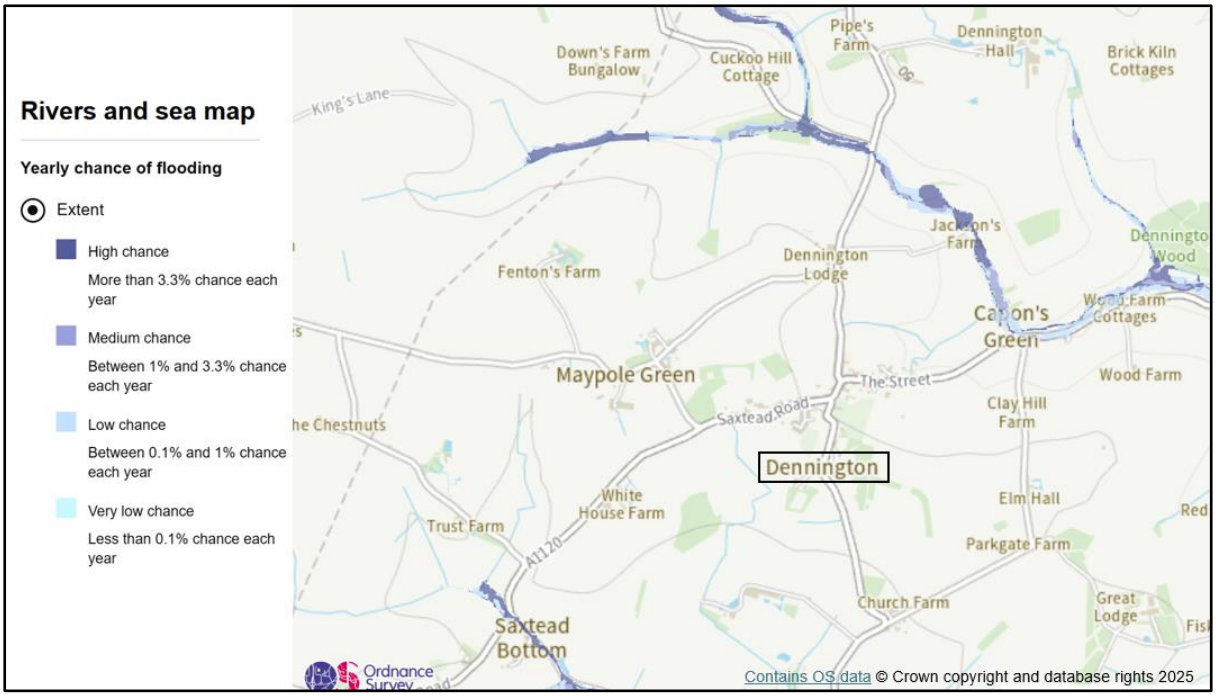

Fig. 6. Predicted fluvial flood risk (from rivers)

5. Catchment characteristics

The parish of Dennington includes part of the River Ore and the River Alde catchments (Fig. 7). The River Ore catchment (map A on Figure 7) drains surface water from the west and south of the parish south towards Framlingham. The River Alde catchment (map B on Figure 7) drains surface water from the north and east of the parish to Capon's Green and then further eastwards towards Bruisyard.

In the "River Alde to Farnham" gauging station catchment, the groundwater contours are reported to show only token relationship to the surface topography. The "River Ore to Beversham" gauging station catchment is reported to have a groundwater influenced regime and the groundwater catchment here exceeds the topographic catchment.

The parish is situated in a rural area with farmland used predominantly for arable agriculture. Significant areas of the parish are relatively flat and low lying, meaning that surface water accumulates in these areas and is not rapidly dispersed. High groundwater levels in some areas compounds this effect and overwhelmed infrastructure and watercourses may be observed during these intense rainfall events.

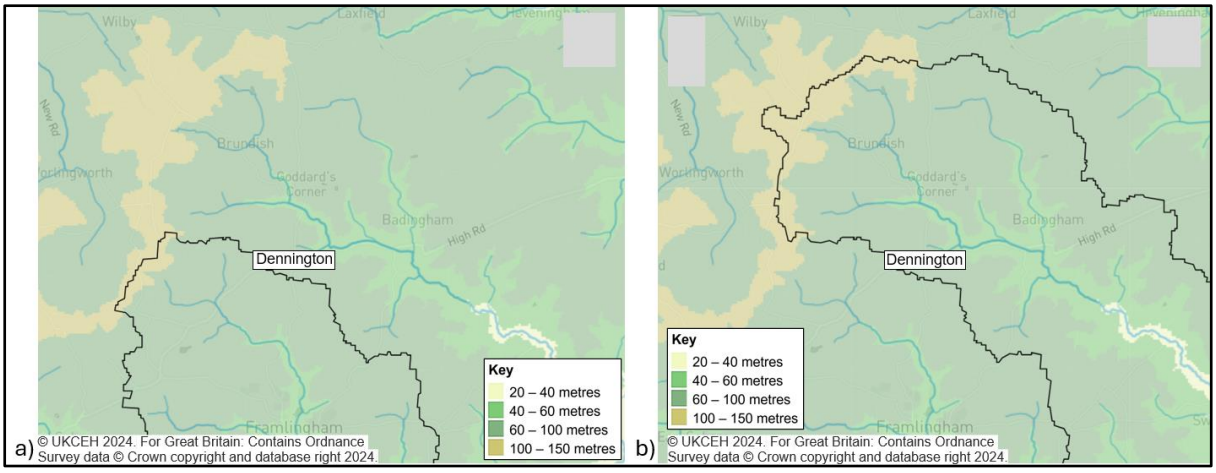

Fig. 7. Elevation maps showing a) Ore at Beversham gauging station catchment boundary and b) Alde at Farnham gauging station catchment boundary (National River Flow Archive)

The soils surrounding Dennington are loamy and clayey with impeded drainage or are only slowly permeable meaning that surface water runoff is greater, particularly during intense rainfall (Fig. 8). However, the saturated nature of the soils leading up to the event would also have prevented some infiltration.

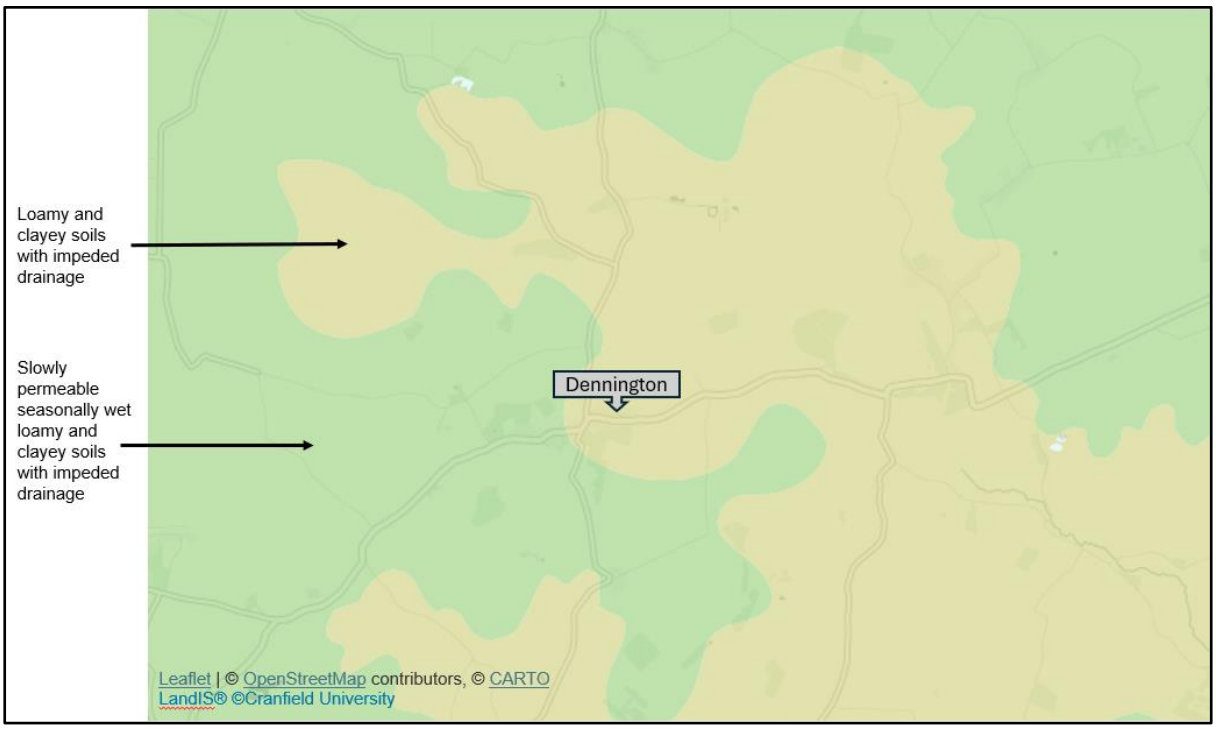

Fig. 8. Soil map of catchment area (LandIS Soilscapes)

Fig. 9 shows that much of the superficial geology surrounding Dennington is made up of 'Lowestoft Formation – Diamicton' which is described by the British Geological Survey as a diverse mixture of clay, sand, gravel, and boulders varying widely in size and shape. This is sometimes known as boulder clay. This generally has a low permeability meaning water will tend to flow off it before it can infiltrate, which also reflects the reports collected during Storm Babet.

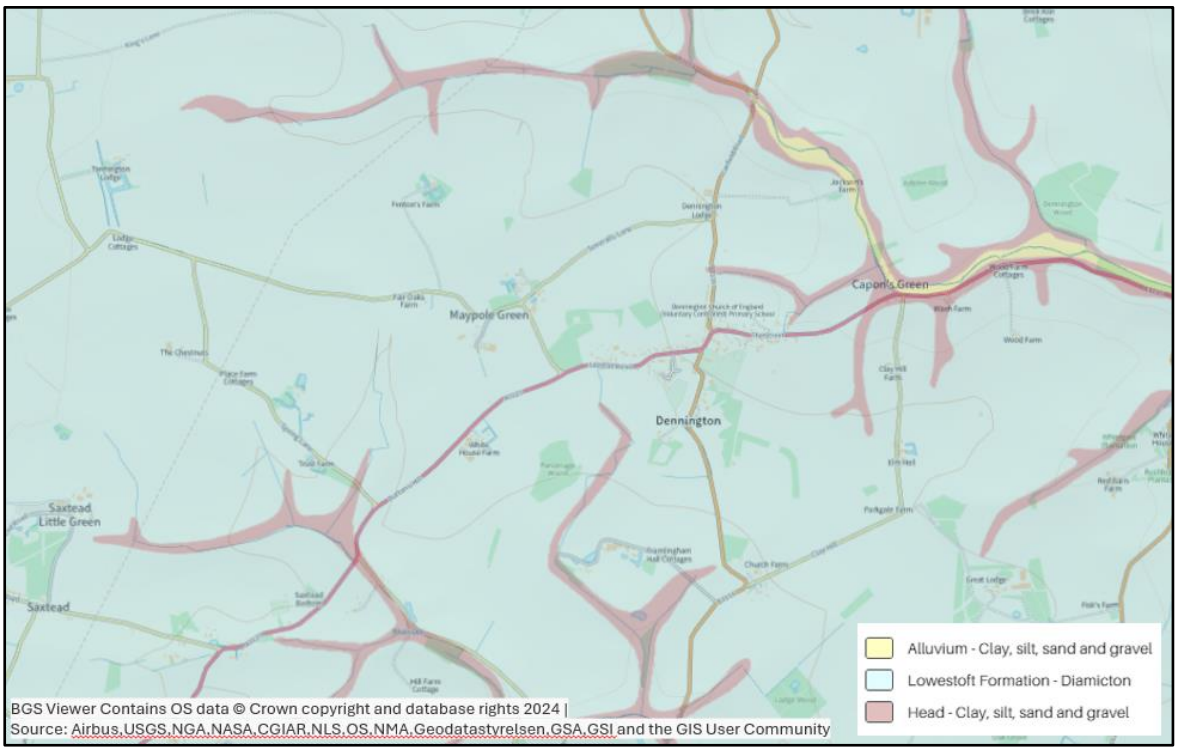

Fig. 9. Superficial geology (British Geological Society)

The bedrock in Dennington and the surrounding area consists of Lewes Nodular chalk formation and Crag Group - sand which are generally relatively permeable (Fig. 10).

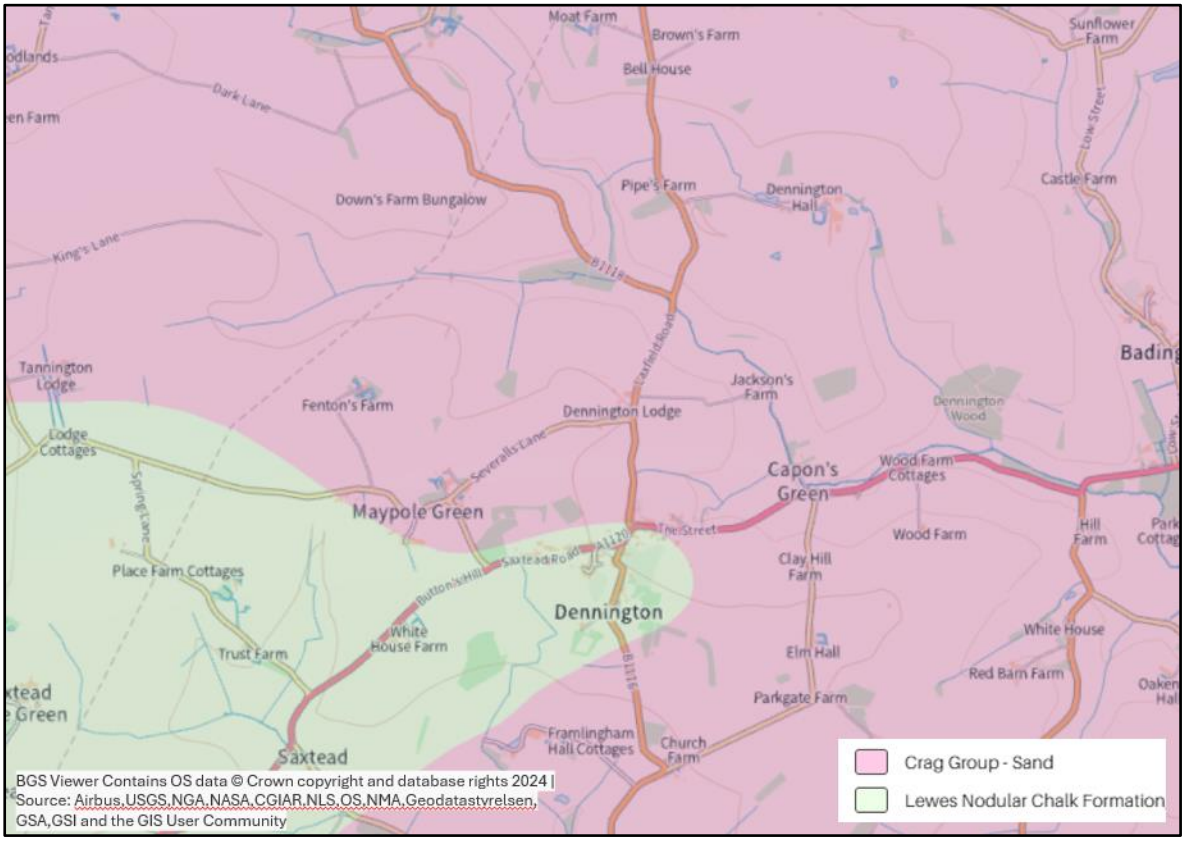

Fig. 10. Bedrock geology (British Geological Society)

However, during short term intense rainfall events, soil composition and superficial geology become more influential in affecting the volume of surface water runoff. Combined with the presence of significant low lying relatively flat areas, this makes Dennington susceptible to extreme rainfall events. Saturated ground and high rainfall, like that of Storm Babet, will further emphasise the vulnerability of the parish and localised flooding could be experienced.

Flooding Sources, Pathways & Receptors

Storm Babet was an extreme event which came at a time when Suffolk had experienced a significant amount of rainfall in the preceding weeks.

The description of the flood events described below will discuss the probable sources of flooding, the observed flow paths through the community and the receptors which have been affected. The term 'floodwater' may be used to describe both fluvial (water from a watercourse), pluvial (surface water run-off) and groundwater flooding. This section has been prepared using reports submitted to Suffolk County Council via the online Highways Reporting Tool, community information and site visits.

Data from surrounding Environment Agency rain gauges indicates that a significant volume of rain was experienced during Storm Babet. The nearest rainfall gauge to Dennington is in Stradbroke (approx. 5km northwest of Dennington). At the Stradbroke rainfall gauge 50.15mm of rain was recorded over a period of 18hrs between 19 Oct 21:30 and 20 Oct 15:15. 26.55mm (more than half) of rainfall was received over 4hrs on the morning of 20 October.

Sub-daily recordings of groundwater levels at the nearest groundwater monitoring station at Brookside, west of Framlingham near Earl Soham, rose from their lowest 2023 values at 20:00 on the 11th October to their highest 2023 values at 18:00 on the 20th October, rising by over 1m.

Groundwater levels [mAOD] recorded at Strawberry Hill, Framlingham in the last year of measurements (25/09/2014 - 30/9/2015) ranged between 27.01 and 27.4mAOD.

The Environment Agency issue two types of warning when flooding is possible from a main river. These are:

1. Flood Alert – Flooding is possible. Be prepared. - usually issued between 2 and 12 hours before flooding.

2. Flood Warning - Flooding is expected. Immediate action required – usually issued 30 minutes to 2 hours before flooding.

Dennington is not covered by the Environment Agency Flood Warning Service and there are no flood warnings or alerts available.

Detailed descriptions of each investigation area can be found below.

1. Capon’s Green

The easternmost area where property was affected by internal flooding was Wash Lane in Capon’s Green. The predicted flood risk within this location for affected property ranges from no to low risk from pluvial flooding (Figure 11) and no to high risk for fluvial flooding (Figure 12).

Figure 11 Predicted surface water (pluvial) flood risk at Capon's Green

Figure 12 Predicted flood risk from rivers (fluvial) at Capon's Green

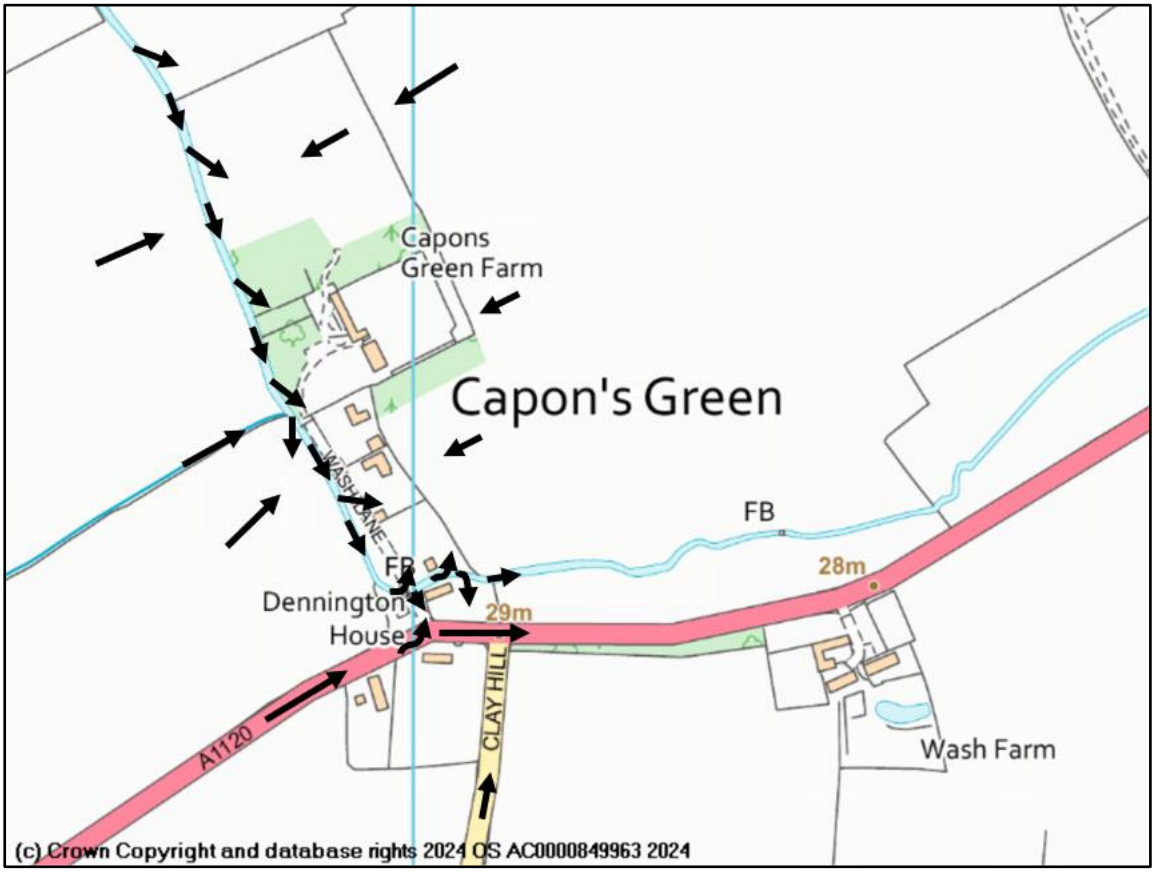

Figure 13 Approximate flood water flow paths at Capon's Green

During Storm Babet, the River Alde, which runs through Capons Green, was reported as overtopping, contributing to floodwater in and adjacent to Wash Lane. In addition to this, customer reports also describe surface flood water flowing from fields and highway drainage being overwhelmed. Surface water flowed east down the A1120 towards the junction with Wash Lane. Some of this surface water then flowed down Wash Lane, further adding to flood water. Highway gullies on the north side of the A1120 west of and adjacent to Wash Lane were reported to be non-operational. Flooding of property on Wash Lane reached internal levels of approximately 45cm.

In summary:

- The River Alde overtopped its banks, contributing to floodwater in Wash Lane.
- Surface water flowed from the fields west, east and north of Wash Lane, contributing to the River Alde flow adjacent to Wash Lane.
- Highway drainage on the A1120 was overwhelmed.

Recommended actions:

- Residents to install Property Flood Resilience (PFR) via grant funded scheme.
- Suffolk Highways to investigate the functioning of gullies on the north side of the A1120, west of Wash Lane.
- Explore potential natural flood management measures (eg. leaky dams, attenuation ponds and flood plain reconnection) to “slow the flow” and attenuate water north and west of Capon’s Green in the upper catchment of the River Alde and on the surface water flow paths.

2. The Street

The primary flood risk within this location is pluvial (surface water) flooding. Surface water was reported as flowing off fields to the rear of property on the south side of the street, causing internal flooding to a level of approximately 25cm. Affected property on the south side of The Street is adjacent to a low risk surface water flow path, flowing north. Flood water was also reported as coming from under floorboards.

A private drainage system adjacent to affected property which transports surface water to the highways surface water drainage system was reported as blocked and backing up. This has been repaired on private land and it is believed that there is a blockage/collapse in the highways drainage system causing flooding to continue to occur. An Anglian Water pumping station in the vicinity was reported to be functioning correctly during Storm Babet.

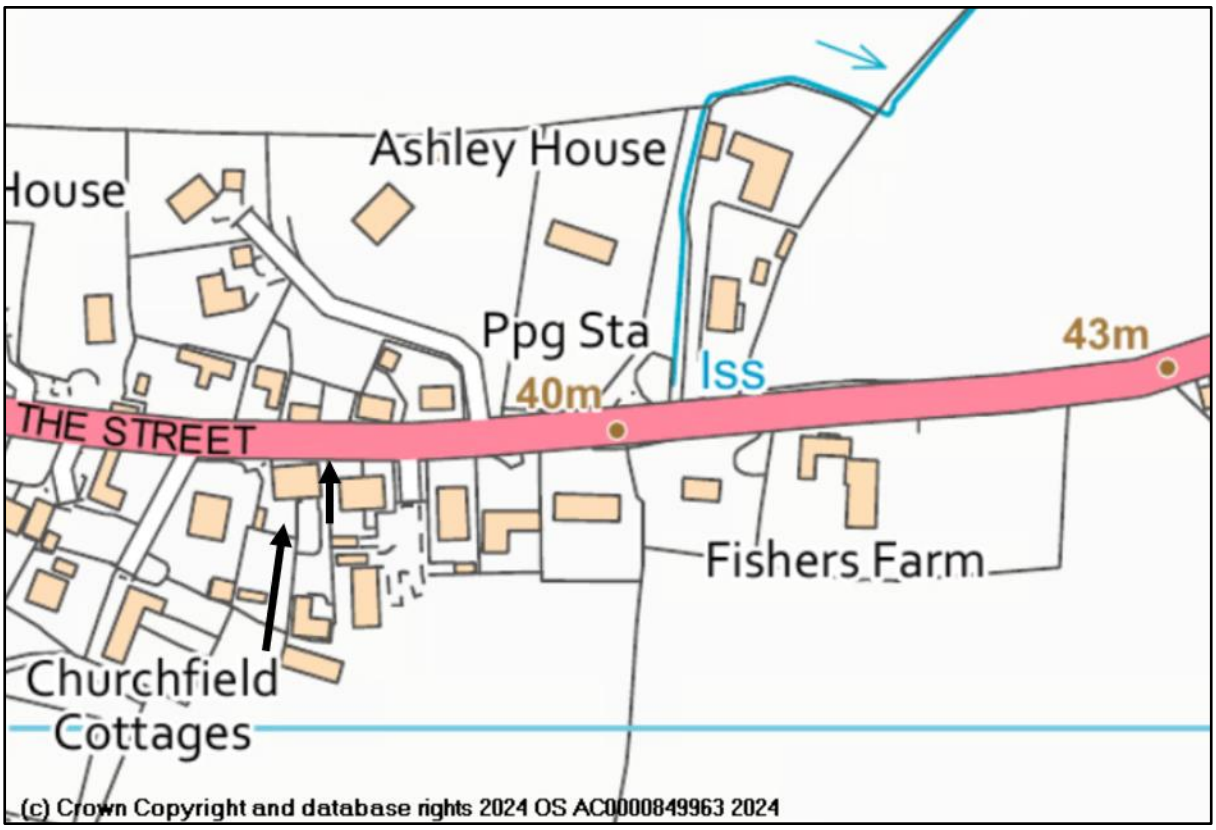

Fig. 14. Approximate flood water flow paths in The Street

In summary:

- Property on the south side of The Street was flooded from the rear by surface water runoff from fields.
- Flood water was also reported as coming from under floorboards.
- Highways surface water drainage connecting with private drainage systems is reported as being blocked or having collapsed.

Recommended actions:

- Residents to install Property Flood Resilience (PFR) via grant funded scheme.
- Suffolk Highways to investigate the reported blocked/collapsed drainage system within the area of the flooding extent.

3. Clay Hill

The primary flood risk within this location is pluvial (surface water) flooding. To the east of the junction between Clay Hill and the B1116, on the north side of Clay Hill, affected property is at localised medium and high risk of surface water flooding. Surface water was reported as flowing off fields and flooding property on the north side of Clay Hill. Drainage ditches were reported as being overwhelmed, including along Clay Hill where ditches were also described as being damaged. Driveways which were at a lower level than the highway facilitated surface water runoff from the

highway. Internal property flood levels in property on the north side of Clay Hill reached approximately 15 cm.

On the south side of Clay Hill, affected property is adjacent to a high risk area of surface water flooding. Internal flooding of property was attributed primarily to groundwater flooding and secondarily to flood water from overwhelmed ditches. Internal property flood water levels were reported to have reached approximately 5cm.

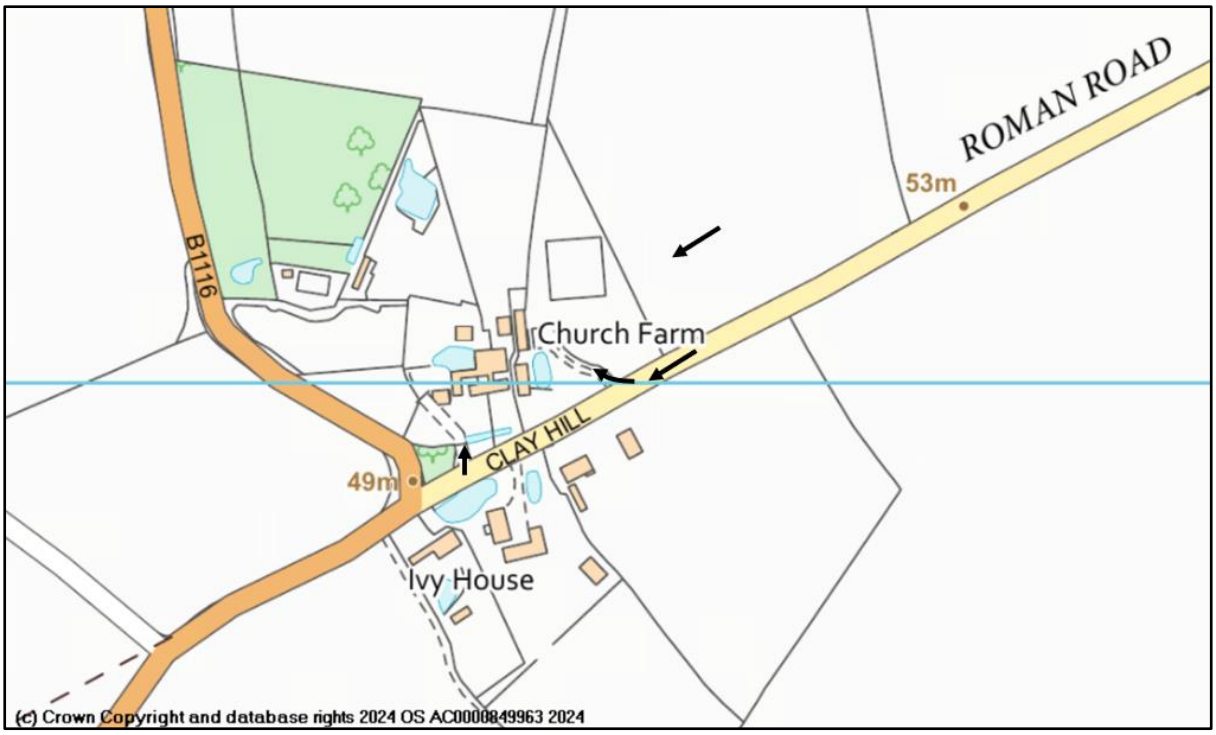

Fig. 15 Approximate flood water flow paths in Clay Hill

In summary:

- Affected property on the north side of Clay Hill was flooded from surface water flowing off fields and flood water from overwhelmed drainage ditches.
- Low level driveways facilitated surface water runoff from Clay Hill.
- Affected property south of Clay Hill was flooded primarily from groundwater and secondarily from floodwater from overwhelmed ditches.

Recommended actions:

- Residents to install Property Flood Resilience (PFR) via grant funded scheme.
- Landowners to carry out watercourse / culvert maintenance to reduce flood risk as necessary in accordance with their riparian responsibilities.

4. Spring Lane

Affected property in Spring Lane is adjacent to a localised area of high surface water flood risk. Reports describe floodwater not being able to drain into ditches from the

highway due to blocked grips on both sides of Spring Lane. Driveways which were at a lower level than the highway facilitated surface water runoff from the highway. In extreme rainfall conditions, drainage capacity in the field ditch above affected property on the south side of Spring Lane is restricted due to the only outlet from the ditch appearing to be a small drainage pipe through the adjacent field. The length and capacity of this pipe is unknown.

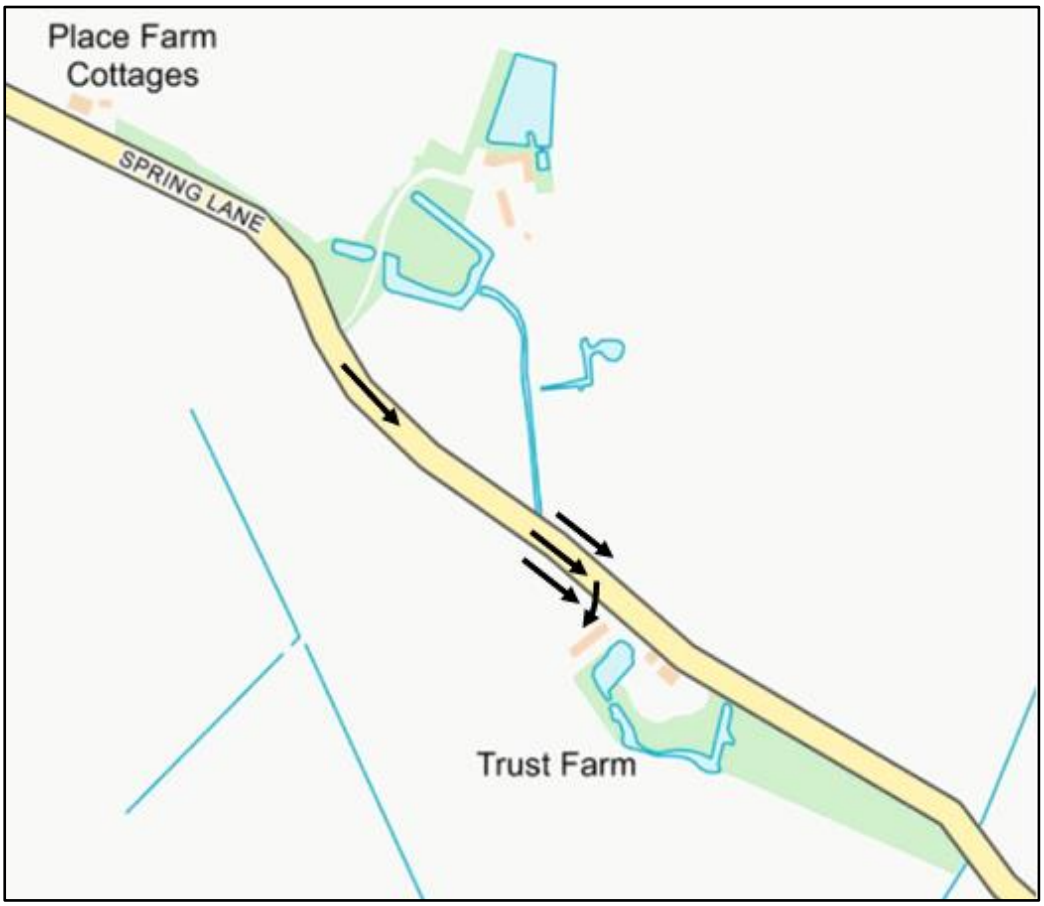

Figure 16 Approximate flood water flow paths in Spring Lane

In summary:

- Blocked grips on Spring Lane restricted highway drainage.
- Drainage capacity from the ditch on the west side of Spring Lane is restricted due to the size of the piped ditch outlet.

Recommendations:

- Suffolk Highways to undertake the re-cutting of grips on Spring Lane.
- Landowner to investigate drainage capacity of pipe on south side of Spring Lane, in particular its size and ability to convey flows.
- Landowners north and south of Spring Lane to carry out watercourse/culvert maintenance to reduce flood risk as necessary in accordance with their riparian responsibilities.

Risk Management Authorities, Non-Risk Management Authorities and flood risk functions

Risk Management Authority	Relevant Flood Risk Function(s)
Suffolk County Council	Lead Local Flood Authority, Highways Authority & Asset Owner
Environment Agency	Lead organisation for providing flood risk management under its permissive powers and warning of flooding from main rivers
East Suffolk District Council	Local Planning Authority & Asset Owner
Anglian Water	Asset Owner
Non-Risk Management Authority	**Relevant Flood Risk Function(s)**
Private Landowners	Riparian Responsibilities and management of water from land or/ watercourses
Private Homeowners	Improving flood resilience to property and some riparian responsibilities if adjacent to watercourses.
Parish Council	Manage flood risk at a community level, prepare and produce flood action plans and maintain watercourses where present on land they own.

Action(s) completed to date:

The following section acknowledges actions that RMA's and Non-RMAs have implemented or are currently in progress since Storm Babet and prior to publishing of this report.

Action	Responsible Party	Progress
Offer of £5k Property Flood Resilience (PFR) grant funded scheme to eligible properties that flooded during Storms Babet	Suffolk County Council Lead Local Flood Authority (LLFA)	Ongoing
Ensure riparian landowner responsibilities are understood with regard to watercourse management	SCC LLFA	SCC published "Flood Smart Living" web guide and handbook designed to increase flood resilience for residents, landowners and communities, December 2024

LLFA Recommended Action(s):

The following section provides a range of flood mitigation measures that could be implemented to reduce the risk of flooding in Dennington. They have been derived from data and evidence collated as part of the report and have been included having been considered realistic in their implementation. The implementation of actions falls to the responsible party. Progress on the action will be monitored by Suffolk County Council but it should be acknowledged that the council has limited powers to enforce the implementation of recommended actions.

Action	Responsible Party	Timescale for response	Latest Progress Update for Actions
Short Term Actions (e.g. standard maintenance activity and initial investigation of options that can be undertaken with limited need for forward planning)			
Establish a Community Emergency Plan that includes plans to manage future flood events –Liaison with Suffolk Joint Emergency Planning Unit	Dennington Parish Council	6 months	
Maximise the uptake of the £5k PFR Grant - initial application must be made before the end of April 2025	Residents / SCC LLFA	2 months	Ongoing
Suffolk Highways to investigate the functioning of gullies on the north side of the A1120, west of Wash Lane.	SCC Highways	6 months	Suffolk Highways plans to cleanse jet and investigate the highways gullies, pipes and any outfalls into watercourses (third party or highways) that may be buried.
Suffolk Highways to investigate the reported blocked/collapsed drainage system within the area of the flooding extent.	SCC Highways	6 months	Suffolk Highways plan to carry out jetting and investigations.
Suffolk Highways to undertake the re-cutting of grips on Spring Lane.	SCC Highways	6 months	Recutting grips on Spring Lane will be investigated.

Medium Term Actions (e.g. longer planning timescales and potential need to source funding but potential for greater impact)			
Investigate drainage capacity of pipe on south side of Spring Lane.	SCC LLFA and Landowner	12-24 months	Suffolk Highways plan to carry out jetting and investigations
Explore potential natural flood management measures (eg. leaky dams and attenuation ponds) to “slow the flow” and attenuate water in the upper catchment on surface water flow paths and ditches north and west of Capon’s Green.	Landowners, supported by relevant authority, resource dependant (SCC LLFA, EA)	12 - 24 months	
Long Term actions (significantly longer timescale and budget required with potentially greater positive impact)			
Deliver any capital interventions that are economically, technically and environmentally feasible and acceptable to improve the flood resilience.	Landowners, supported by relevant authority, resource dependant (SCC LLFA, EA)	TBC	

Approval

This report will be reviewed and updated every 6 months until actions are marked as complete.

Reviewer	Date of Review

Disclaimer

This report has been prepared and published as part of Suffolk County Council's responsibilities under Section 19 of 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 while all reasonable efforts have been made to gather and verify such information 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. Should there be additional information available to develop the report, please email to floodinvestigations@suffolk.gov.uk.

The opinions, conclusions and recommendations in this Report are based on assumptions made by Suffolk 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.

Suffolk 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.

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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 Suffolk County Council highlighting flooding to properties at a street level. Property owners and prospective purchasers or occupiers of property are advised to seek and rely on their own surveys and reports regarding any specific risk to any identified area of land.

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