MHA PSP4 MKCC Section 19 Flood Investigation Report

Section 19 Flood Investigation Report: 21st - 29th September 2024 Flood Event

Project number: 60740209

August 2025

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Quality information

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Revision History

Revision	Revision date	Details	Authorized	Name	Position
D01	01/07/2025	S19 Flood Investigation Report	Y	Becky Browne	Project Manager
D02	11/08/2025	S19 Flood Investigation Report	Y	Becky Browne	Project Manager

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Abbreviations

Acronym	Definition
ACDPs	Areas with Critical Drainage Problems
AEP	Annual Exceedance Probability
DDF	Depth Duration Frequency
DEFRA	Department for Environment, Food and Rural Affairs
EA	Environment Agency
FEH	Flood Estimation Handbook
FMfP	Flood Map for Planning
FWMA	Flood and Water Management Act
IDB	Internal Drainage Board
LiDAR	Light Detection and Ranging
LLFA	Lead Local Flood Authority
m AOD	Meters above Ordnance Datum
MKCC	Milton Keynes City Council
NSWWS	National Severe Weather Warning Service
PFR	Property Flood Resilience
RMAs	Risk Management Authorities
RoFSW	Risk of Flooding from Surface Water
SFRA	Strategic Flood Risk Assessment
SMD	Soil Moisture Deficit
SuDS	Sustainable Drainage Systems
SWMP	Surface Water Management Plan

Glossary of Terms

Term	Description
Annual Exceedance Probability (AEP)	The probability that an event of a particular magnitude (in this context rainfall or river flow event) will be exceeded in any one year. For example, an event with a 0.5% AEP equates to a 1 in 200 year return period probability event.
Catchment	The land (and its area) which drains (normally naturally) to a given point on a river, drainage system or other body of water.
Critical Drainage Catchment	A discrete geographic area (usually a hydrological catchment) where multiple or interlinked sources of flood risk cause flooding during a severe rainfall event thereby affecting people, property or local infrastructure.
Climate Change	Climate change refers to a large-scale, long-term shift in the planet's weather patterns and average temperatures. Climate Change can be as a result of natural global variations; recent accelerated climate change is attributed to anthropogenic action.
Culvert	A channel or pipe that carries water below the level of the ground.
DG5 Register	A held register by the Water Utility Company which details properties who have experienced sewer flooding due to hydraulic overload.
Flood Defence	Flood defence infrastructure, such as flood walls and embankments, intended to protect an area against flooding to a specified Standard of Protection.
Flood Hotspot	These are locations where concentrations of flooding incidents have occurred which meet the threshold as set out in the Flood Investigation Protocol.
Flood Risk	The level of flood risk is the product of the frequency or likelihood of the flood events and their consequences (such as loss, damage, harm, distress, and disruption).
Flood Risk Management	The activity of understanding the probability and consequences of flooding and seeking to modify these factors to manage flood risk to people, property and the environment in line with agreed policy objectives.

Term	Description
Flood Warning	If a flood warning is issued in an area, it means flooding is expected and will cause disruption.
Flood Zone 1 (Low probability)	Land where flooding from rivers and the sea is very unlikely. There is less than a 0.1 per cent (1 in 1000) chance of flooding occurring each year.
Flood Zone 2 (Medium probability)	Land which has between a one in 100 and one in 1000 annual probability (chance) of river flooding (1% -0.1%); or between a one in 200 and 1 in 1000 annual probability (chance) of sea flooding (0.5%-0.1%).
Flood Zone 3a (High probability)	Land which has a greater than one in 100 annual probability (chance) of river flooding (>1%); or greater than one in 200 annual probability (chance) of sea flooding (>0.5%).
Greenfield	Previously undeveloped sites for commercial development or exploitation.
Lead Local Flood Authority	As defined by the FWMA, LLFAs are county councils and unitary authorities. They lead in managing local flood risks (i.e., risks of flooding from surface water, ground water and ordinary (smaller) watercourses). This includes ensuring co-operation between the Risk Management Authorities in their area.
Main River	A watercourse designated on a statutory map of Main Rivers, maintained by Defra, on which the Environment Agency has permissive powers carry out flood defence works, maintenance and operational activities for Main Rivers only however they have no formal obligation to do so.
National Planning Policy Framework	Framework which aims to simplify and accentuate accessibility on current policy in planning of development of an area, particularly for local planning authorities and decision makers.
Ordinary Watercourse	All rivers, streams, ditches, drains, cuts, dykes, sluices, sewers (other than public sewers) and passages through which water flows which do not form part of a Main River. Local authorities and, where relevant Internal Drainage Boards, have similar permissive powers on Ordinary Watercourses as the Environment Agency has on Main Rivers.
Overtopping	The process of water rising over the top of a barrier intended to contain it (e.g., sea defence).
Reservoir	A large, raised structure, raised lake or other area capable of storing at least 10,000 cubic metres of water above natural ground level, created artificially, or enlarged. This is defined by the Reservoirs Act, 1975.
Return Period	The long-term average period between events of a given magnitude which have the same annual exceedance probability of occurring.
Risk	Risk is a factor of the probability or likelihood of an event occurring multiplied by consequence: Risk = Probability x Consequence. It is also referred to in this report in a more general sense.
Runoff	The flow of water from an area caused by rainfall.
Soil Moisture Deficit	The difference between the actual amount of water available in the soil and the amount of water the soil can potentially hold.
Standard of Protection	The design event or standard to which a building, asset or area is protected against flooding, generally expressed as an annual exceedance probability.
Strategic Flood Risk Assessment	An area-wide study, undertaken by one or more local authorities, to assess the risks that all sources of flooding poses to a Borough or District, both now and in the future. It incorporates the impacts of further land changes and climate change in the development of an area and if these factors impact the risk of flooding.
Surface Water Flooding	In this context, surface water flooding describes flooding from sewers, drains, groundwater, and runoff from land, small water courses and ditches that occurs as a result of heavy rainfall.
Sustainable Drainage Systems	A sequence of management practices and control structures, often referred to as SuDS, designed to collect and drain water in a manner which mimics natural drainage processes and are considered more sustainable than some conventional techniques.

Executive Summary

As the Lead Local Flood Authority, Milton Keynes City Council (MKCC) has a responsibility to record and investigate flood incidents, in accordance with Section 19 of the Flood and Water Management Act (2010). The Section 19 Flood Investigation has been prepared for the flood event of 21st – 29th September 2024. A review of reported flood incidents was undertaken by MKCC which determined that six hotspots met the threshold for a flood investigation to be undertaken, as a result of the September 2024 flood event. The six hotspots include Bletchley, Bradwell, Emberton, Lavendon, Newport Pagnell and Stony Stratford.

Consultation has been undertaken with the relevant local authorities, agencies and local residents to determine the causes of the 21st – 29th September 2024 flooding. As part of the data collection exercise, site visits of each area were undertaken to assess potential flood mechanisms and to obtain information from residents and stakeholders affected by the flood events. This has informed the understanding of flood mechanisms for the 21st – 29th September 2024 flood event and is supported by anecdotal evidence from online sources.

Eight days of exceptionally high rainfall led to the flood event in Milton Keynes from 21st-29th September 2024. A Met Office report of the September 2024 rainfall noted that Buckinghamshire recorded more than three times (300%) their average September rainfall. Through analysis of the recorded rainfall data, a high-level rainfall pattern can be determined. There were two distinct periods of rainfall over this period, the first over 21st – 23rd and the second from 26th – 27th which then fell onto already saturated ground. Estimates suggest that the rainfall event was so intense that the ground became saturated very quickly causing high levels of surface water and fluvial flooding as well as surcharging of sewers in some areas.

Flood Hotspots

Records indicate that 24 properties were affected in Bletchley during the September 2024 flood event. Analysis of rainfall data recorded across Bletchley, estimates that the rainfall event had a >0.1% AEP. Although rainfall was recorded throughout the storm event, maximum rainfall depths were recorded on the 27th September. The primary sources of flooding in Bletchley were localised surface water runoff, primarily caused by impermeable surfaces affecting properties situated at lower elevations. Additionally, sewer surcharging contributed to flooding in certain areas.

Records indicate that 8 properties were affected in Bradwell during the September 2024 flood event. Analysis of rainfall data recorded across Bradwell, estimates that the rainfall event had a >0.1% AEP. Although rainfall was recorded throughout the storm event, maximum rainfall depths were recorded on the 23rd and 27th September, indicating two distinct periods of rainfall. The primary sources of flooding in Bradwell were localised surface water runoff, primarily caused by impermeable surfaces and sloped topography towards impacted properties.

Records indicate that 11 properties were affected in Emberton during the September 2024 flood event. Analysis of rainfall data recorded across Emberton, estimates that the rainfall event had a 1.3% - 1% AEP. Although rainfall was recorded throughout the storm event, maximum rainfall depths were recorded on the 22nd September. The primary sources of flooding in Emberton were surface water runoff, which was mainly caused by impermeable surfaces and the overwhelming of the drainage network. This led to the failure of a pumping station and resulted in sewer surcharging. Fluvial flooding from unnamed watercourses in Petsoe End also caused significant impacts in the area.

Records indicate that 44 properties were affected in Lavendon during the September 2024 flood event. Analysis of rainfall data recorded across Lavendon, estimates that the rainfall event had a >0.1% AEP. Although rainfall was recorded throughout the storm event, maximum rainfall depths were recorded on the 22nd September. The primary sources of flooding in Lavendon were surface water runoff, which exceeded the capacity of the drainage network and caused many roads to act as informal drainage channels. The extent of surface water flooding was exacerbated by the recent harvest, which likely reduced infiltration in surrounding rural areas and increased run off. High levels of surface water flooding likely contributed to the extent of fluvial flooding of the unnamed ordinary watercourse in Lavendon, indicating that the flood mechanisms were interconnected. Additionally, sewer surcharging led to flooding in certain areas.

Records indicate that 15 properties were affected in Newport Pagnell during the September 2024 flood event. . Analysis of rainfall data recorded across Newport Pagnell, estimates that the rainfall event had a 10% – 20% AEP suggesting the rainfall was less intense compared to other hotspots. Although rainfall was recorded throughout the

storm event, maximum rainfall depths were recorded on the 27th September. High river flows were recorded at the River Great Ouse and record water levels were logged at the River Ouzel and both Main Rivers flow through Newport Pagnell. The primary sources of flooding in Newport Pagnell were due to a combination of fluvial and surface water flooding. High water levels in the River Great Ouse prevent the River Ouzel from discharging into it, leading elevated river levels and fluvial flooding. Furthermore, elevated river levels prevented the discharge of surface water from many areas leading to surcharging of surface water systems.

Records indicate that 15 properties were affected in Stony Stratford during the September 2024 flood event. Analysis of rainfall data recorded across Stony Stratford, estimates that the rainfall event had a >0.1% AEP. Although rainfall was recorded throughout the storm event, maximum rainfall depths were recorded on the 21st September. The primary sources of flooding in Stony Stratford were fluvial flooding from the River Great Ouse and surface water run off due to large impermeable surfaces and low thresholds at impacted properties. Additionally, sewer surcharging led to flooding at properties and certain areas experienced groundwater flooding.

Flood Investigation Outcomes

All of the Risk Management Authorities (RMA) and Emergency Services within Milton Keynes played a part in the incident response to the September 2024 flood event. All agencies and authorities were proactive in their response to the incident.

The review of the flood incident response and impacts of flooding have been used to identify potential areas for improvement, including the following:

- Communications and Flood Planning;
- Improving Community Resilience to Repeat Events;
- Understanding of Integrated Flooding Mechanisms; and
- Implementation of Sustainable Drainage Systems (SuDS).

Further assessment of the incident response and lessons learnt are outlined in **Section 6** of this report.

Through the investigation of flood mechanisms and impacts of the September 2024 flood events, several recommendations for improvement have been identified. The recommendations in **Section 7** detail the lead RMA, the associated timescale and whether it is statutory and non-statutory.

1. Introduction

1.1 Background

Section 19 of the Flood and Water Management Act (FWMA) published in 2010, places a duty on Lead Local Flood Authorities (LLFA), such as Milton Keynes City Council (MKCC), to investigate flood incidents from surface water, groundwater and Ordinary Watercourses, where it is considered 'necessary and appropriate'. Strategic policies should seek to manage flood risk from all sources and be informed by the Strategic Flood Risk Assessment (SFRA).

These policies, such as those outlined within a Local Plan, should also consider advice from the Environment Agency and other relevant flood management authorities.

The FWMA (Section 3(19)) describes the role of Local Authority Investigations, noting:

"1. On becoming aware of a flood in its area, a LLFA must, to the extent that it considers necessary or appropriate, investigate-

a) which Risk Management Authorities (RMAs) have relevant flood risk management functions, and,

b) whether each of those RMAs 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 RMAs."

The FWMA (Section 6(13)) states RMAs within England to be:

a) the Environment Agency (EA);

b) a LLFA (such as MKCC);

c) a district council for an area for which there is no unitary authority;

d) an internal drainage board;

e) a water company (such as Anglian Water (AW)); and

f) a highway authority.

1.2 Criteria for Investigating Flood Incidents

As the LLFA, MKCC has a statutory duty to investigate flooding under Section 19 of the FWMA in instances to the extent that it considers necessary or appropriate. The MKCC Flood Investigations Protocol[1] states a flood event is 'necessary or appropriate' if it meets one or more the following criteria:

1. *'Flooding has affected critical infrastructure for a period in excess of three hours from the onset of flooding;*
2. *Internal flooding of a building has been experienced on more than one occasion in the last five years;*
3. *Internal flooding of five buildings in close proximity has been experienced during one single flood incident.'*

The September 2024 flood event meets point 2 and 3 of criteria, therefore MKCC has a statutory duty to investigate the flood event in certain locations. As per the Flood Investigation Protocol[1] reported flood incidents are reviewed to determine if the incident meets the threshold for formal investigation. Therefore, a review of reported flood incidents was undertaken by MKCC which determined that six hotspots met the threshold for a flood investigation to be undertaken, as a result of the September 2024 flood event. The incidents reported fluvial, surface water, groundwater and sewer flooding, which affected local highways and properties in several areas of the borough. Following the MKCC Flood Investigation Protocol, it was deemed necessary to complete a Flood Investigation Report. The six hotspots are further discussed in **Section 2**.

[1] Milton Keynes (2025) Flood Investigation Protocol. Available: Flood investigation protocol | Milton Keynes City Council

Investigations include liaison with relevant stakeholders, private organisations and residents, to produce a report of the flood events. The report collates all useful information together, to provide a description of the possible cause. The report also aims to identify the relevant RMAs or individuals with flood risk management responsibilities and determine whether they have responded or intend to respond to the flood incident. It also highlights the potential long-term solutions and suggests recommendations for flood risk management action. It is the responsibility of the Investigating Officer to resolve the flooding; however, they will investigate the cause and notify any relevant authority. The reports will be published on the MKCC website once finalised.

1.3 Risk Management Authority Duties and Responsibilities

The legal framework for management of flood risk and events lies with several agencies. The key responsibilities of each agency are outlined in the section below. The MKCC Local Flood Risk Management Strategy (LFRMS) identifies the RMAs as MKCC, the EA, AW, Bedford Group of Drainage Boards for the area.

1.3.1 Milton Keynes City Council

As the LLFA, MKCC have a strategic role in the co-ordination and management of flood risk from surface water, groundwater and Ordinary Watercourses that are not within the Bedford Group IDB district. Under Section 19 of the FWMA (2010), MKCC as the LLFA are required to investigate flood incidents when certain thresholds are met as set out in MKCC Flood Investigation Protocol.

The FWMA states the LLFA have powers to designate structures and features that have a significant effect on flood risk in their area and designate assets if appropriate. Once designated, the owner must seek consent from the authority to alter, remove or replace the asset or feature (FWMA Schedule 1)[2]. MKCC is responsible for ensuring that a Land Drainage Consent is obtained for any works to Ordinary Watercourses that could impact water flow or storage outside Internal Drainage Board districts. This function is carried out on the Council's behalf by the Bedford Group of Internal Drainage Boards, who manage the consent process. MKCC also act as a statutory consultee on planning applications that involve surface water drainage considerations.

MKCC are also the Highway Authority for the Milton Keynes, with a duty to maintain adopted highways within the administrative region under Section 41 of the Highways Act 1980[3]. This includes ensuring all adopted highways are drained of surface water and where necessary maintain road drainage networks, such as gullies.

MKCC Emergency Planning team are a Category 1 Responder under the Civil Contingencies Act 2004[4], therefore have a duty to develop emergency plans and assess local risks, to improve the emergency response. The LLFA act as a technical expert to advise, where requested, during a flood event. Information relating to civil protection matters must be made available to warn and advise the public in the event of an emergency.

1.3.2 Environment Agency

The EA provide a strategic overview for all sources of flooding through supervising and working with other organisations. The EA hold a strategic role and responsibility to manage and investigate flooding from Main Rivers, reservoirs and the sea and provide and operate flood warning systems. Under the Civil Contingencies Act 2004, the EA is a Category 1 Responder.

Under the Water Resources Act (1991)[5], the EA undertakes maintenance, improvement, or construction work on Main Rivers to manage flood risk. Any works in, over, or under a Main River, within a floodplain, or in proximity to a flood defence structure is regulated by the EA and governed through Flood Risk Activity Environmental Permits, as required under the Environmental Permitting (England and Wales) Regulations. Flood risk from Ordinary Watercourses and surface water is not under the jurisdiction of the EA and instead, is the statutory responsibility of the LLFA. The EA are therefore responsible for managing the designated Main Rivers in Milton Keynes which are the River Great Ouse, River Ouzel, Water Eaton Brook and River Tove[6].

1.3.3 Anglian Water

AW is responsible for the supply and effective drainage of water in the Milton Keynes area, including all main public sewers including surface water, foul and/or combined sewer systems. Under the Water Industry Act (1991)[7], AW

[2] GOV.UK (2010) Flood and Water Management Act Schedule 1. Available: Flood and Water Management Act 2010
[3] GOV.UK, Highways Act 1980. Available: Highways Act 1980
[4] GOV.UK, Civil Contingencies 2004. Available: https://www.legislation.gov.uk/ukpga/2004/36/pdfs/ukpga_20040036_en.pdf
[5] GOV.UK, Water Resources Act 1991. Available: Water Resources Act 1991
[6] Environment Agency (2025) Statutory Main River Map. Available: Statutory Main River Map
[7] GOV.UK, Water Industry Act 1991. Available: Water Industry Act 1991

must maintain and operate systems of public sewers, undertake capacity improvements to mitigate flood risk from sewer sources and must respond to flood incidents which involve their assets.

It is important to note AW does not have responsibility for highway or land drainage, until it reaches the sewer network, and does not have statutory responsibility for drainage within the property boundary and serving one property. However, AW are generally responsible for shared sewer pipes within property boundaries if the homes were built before 2011. If homes were built after 2011, AW are responsible for shared sewer pipes if responsibility has been transferred to AW by the housing developer[8].

AW is designated as a Category 2 Responder under the Civil Contingencies Act 2004. In this role, it supports emergency planning and response by cooperating with lead responders and providing relevant information and expertise, particularly in relation to water and wastewater infrastructure.

Sewerage systems are not designed to accommodate flows resulting from exceptionally severe weather events. Larger, more intense storms would therefore be expected to result in surcharge of the sewer network.

1.3.4 Bedford Group of Drainage Boards

The Bedford Group of Drainage Boards comprises three IDBs which are situated in the upper reaches of the Great Ouse River catchment, including Milton Keynes. The Bedford Group IDB manages a total of 1,147 km of watercourses within its Drainage District, serving an area of 37,709 hectares. Under the Land Drainage Act 1991 (as amended by the Act 1994) the Bedford Group IDB oversee all land drainage matters within their districts. The Bedford Group IDB have powers to undertake works to improve and manage any watercourse or drainage systems within their District and regulate activities in and alongside these systems or, under an agreement with the EA, to Main Rivers. The Bedford Group IDB issue Land Drainage Consents for works affecting water flow or storage in ordinary watercourses within their districts. They also set byelaws to protect a 9-metre buffer zone along watercourses for maintenance and inspection access.

1.4 Other Stakeholder Duties and Responsibilities

1.4.1 Riparian Owners

Riparian owners are those who own land which adjoins a watercourse. Riparian owners have a duty to manage their section of the watercourse in a way that does not increase flood risk or cause environmental harm. They must allow water to flow naturally through their land without obstruction, pollution, or diversion. This includes the removal of blockages that could impede flow, obstruct navigation, or contribute to flooding on neighbouring land.

In addition, riparian owners are responsible for maintaining any structures on their stretch of the watercourse, ensuring they remain free from obstructions. Before undertaking any works in or around a watercourse, owners must identify and obtain the necessary permissions. This may include applying to the EA for a Flood Risk Activity Environmental Permit for works on Main Rivers or flood defences or securing Land Drainage Consent from MKCC or the Bedford Group of Internal Drainage Boards for works affecting Ordinary Watercourses. These responsibilities apply equally to both residential and commercial landowners.

1.4.2 The Parks Trust

The Parks Trust is an independent charity set up in 1992, responsible for managing and maintaining over 6,000 acres of parks and green spaces in Milton Keynes. The Parks Trust maintains and enhances parks, woodlands for se by the public. They focus on regular upkeep, improving biodiversity, and promoting sustainable practices to ensure the long-term health of green spaces. In relation to flood risk, the Parks Trust manages the land around the balancing lakes and preserves natural floodplains to reduce flood risk in Milton Keynes. The Parks Trust have adopted numerous Sustainable Drainage Systems (SuDS) features, which have been taken over from developers, to manage surface runoff and prevent flooding.

1.4.3 Buckinghamshire Fire and Rescue Service

Buckinghamshire Fire and Rescue Service, as a Category 1 Responder under the Civil Contingencies Act 2004, must develop emergency plans and assess local risks to inform their emergency planning.

[8] Anglian Water (2025) Sewer Pipe Responsibility. Available: Sewer pipe responsibility

1.4.4 Canal & River Trust

The Canal & River Trust is a charity responsible for managing over 2,000 miles of navigable canals and rivers across England and Wales.

The Canal & River Trust manages water levels in canals to mitigate flood risks. They accept surface water runoff from developments and use canals to intercept drainage, hold up flows, and move water away from flood-prone areas. The Grand Union Canal flows through Milton Keynes.

1.4.5 Local Residents and Businesses

Residents who are aware they are at risk of flooding should take action to protect their property from flooding and erosion, ensuring that any measures do not increase flood risk to others. They are also responsible for allowing water to flow naturally through their land and for obtaining all necessary permissions before carrying out any work in or around the watercourse. Residents should report flooding incidents or potential problems (such as blocked drains) to the LLFA or appropriate organisation, if known.

1.4.6 Flood Action Groups

Of the six hotspots, Stony Stratford and Newport Pagnell have established flood groups. This includes Stony Stratford FLAG and Stony Stratford Flood Resilience Working Group and the Newport Pagnell Flood Group. A flood group within Lavendon is currently within the Draft Plan phase.

The flood groups are a voluntary group of local residents, who meet on a regular basis, to work on behalf of the wider community to help to try and reduce the impact of future flood events. Their focus includes emergency planning, flood resilience, warning and informing whilst providing a unified voice for the community to communicate ideas and queries to others. Flood groups do not have predefined roles and responsibilities; these are determined individually by each group.

2. Flood Hotspots

Six flood hotspots were determined by MKCC on the basis of flood reports from Milton Keynes as a result of the significant flooding in September 2024. The six hotspots are shown in **Figure 1-1** including Bletchley, Bradwell, Emberton, Lavendon, Newport Pagnell and Stony Stratford.

Flood reports from individual homes and businesses were considered as well as the flood mechanisms and impacts occurring on roads within the hotspots. The six hotspots were determined to meet the threshold for formal investigation, as per the Flood Investigation Protocol. It should be noted that other areas may have been impacted outside of these hotspots, due to the widespread nature of the rainfall event, however these areas did not meet the threshold for formal investigation.

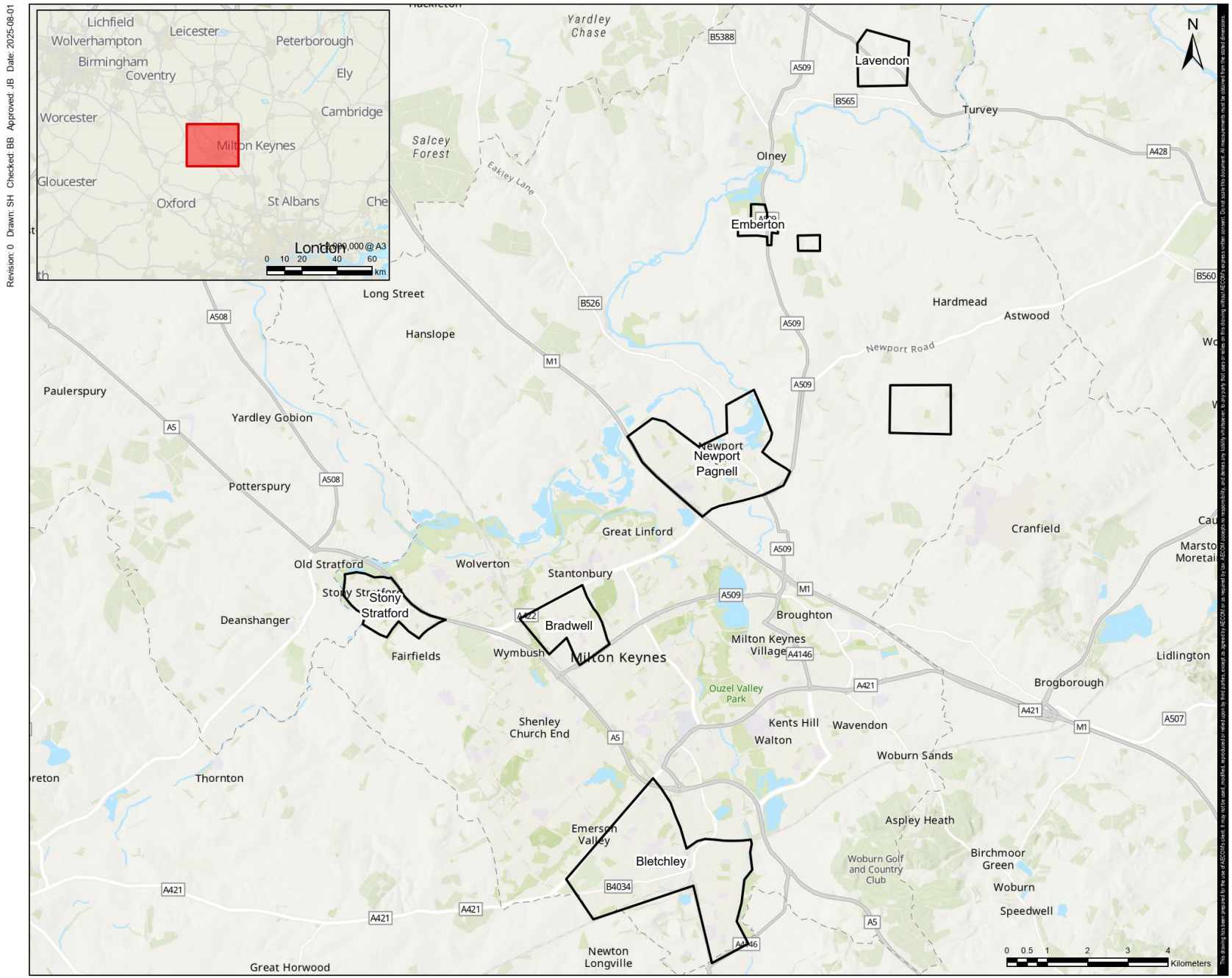


Figure 1-1: Milton Keynes Study Area and Hotspots

2.1.1 Bletchley

2.1.1.1 Overview

The Bletchley hotspot is split into three areas. Bletchley is located in the south of Milton Keynes and is divided for administrative purposes into two civil parishes, Bletchley and Fenny Stratford and West Bletchley. Bletchley is considered to be a large urban area with a mix of residential and commercial centres. Major Milton Keynes grid roads serve the town including Watling Street (an old Roman road now the A5), B4034, A421 and the A4146. The town is also served by Bletchley Railway station which connects the West Coast Main Line and the Bletchley-Bedford Marston Vale Line. Bletchley is serviced by separate foul and surface sewer networks as shown on the AW sewer mapping in **Appendix A**. The urban area is bordered by greenspace to the east and south, featuring designated recreation areas such as Blue Lagoon Lake and Nature Reserve in the south, and Waterhall Park to the east.

The Main River Ouzel flows along the eastern boundary of Bletchley, in a northerly direction. There are various unnamed Ordinary Watercourses within Bletchley which are regulated by Bedford Group IDB. The unnamed Ordinary Watercourses are primarily located within the greenspace surrounding the urban areas of Bletchley. The small tributaries of the River Ouzel, located to the east of Bletchley, are maintained by various riparian owners. One unnamed watercourse flows south-west through the urban area of Bletchley. The Grand Union Canal also flows along the eastern boundary of Bletchley, parallel to the Great River Ouzel, and is owned and maintained by the Canal and River Trust.

Bletchley is not located within an Area with Critical Drainage Problems (ACDP). However, West Bletchley has been identified in MKCC Surface Water Management Plan (SWMP)[9] as a Critical Drainage Catchment (CDC20), noted as an area where flood risk is considered to be most severe in Milton Keynes.

Figure 1-3 and **Figure 1-4** show the bedrock and superficial geology of the six hotspots. The geology of the Bletchley hotspot features a superficial layer primarily composed of the Oadby Member, a diamicton sedimentary deposit formed during the Quaternary period. Beneath this, the bedrock consists of the Oxford Clay Formation, a mudstone sedimentary bedrock that dates to the Jurassic period. The areas in the proximity of the River Ouzel have resulted in a covering of alluvium and river terrace deposits. Most of the land within the study area is defined as Soilscape 8- “Slightly acid loamy and clayey soils with impeded drainage” and Soilscape 9- ‘Lime-rich loamy and clayey soils with impeded drainage’[10]. As the area is also urbanised, a large proportion of Bletchley is covered by impermeable surfaces.

As the Bletchley hotspot is split into three areas, the hotspot has differing topographies as shown in **Figure 1-2**. West Bletchley is located at a higher topography than the east, with a gradual slope from west to east. The two areas in the east border the Main River Ouzel and therefore are located at a lower elevation. LiDAR mapping indicates a high point of approximately 116 m AOD and a low point of 63 m AOD within the hotspot. Further detail of the localised topography is set out in **Section 5**.

2.1.1.2 Flood History

Bletchley has experienced several notable flood events in recent years. Two Section 19 Reports have previously been published for Bletchley as a result of significant flooding in January 2021[11] and June 2021[12]. In the January 2021 event, it was determined that the flooding was the result of a combination of river and surface water flooding due to the intense rainfall in the River Ouzel catchment over an already saturated catchment. The likely cause of flooding in the June 2021 event was due to an intense rainfall event that subsequently led to the overwhelming of surface water systems. The EA Recorded Flood Outlines shows historical flooding along the River Ouzel, located west of Bletchley. However, there are no EA Recorded Flood Outlines within the Bletchley hotspot.

2.1.2 Bradwell

2.1.2.1 Overview

Bradwell is a small village located north-west of central Milton Keynes. Bradwell features a mix of urban residential areas and significant greenspace. The village has many Scheduled Monuments and listed buildings as well as a disused railway station. The V6 Grafton Street bounds Bradwell to the east and connects the village to the rest of

[9] AECOM (2016) Surface Water Management Plan. Available: https://www.milton-keynes.gov.uk/sites/default/files/2022-02/MK%20Surface%20Water%20Management%20Plan%20Report%20MKFLO001.pdf
[10] Cranfield University (2025) Soilscapes Viewer. Available: LandIS - Land Information System - Soilscapes soil types viewer
[11] WSP (2022) Flood Risk Investigation: Bletchley Section 19 Report. Available: Bletchley_Waterhall Park_S19_2020_Final.pdf
[12] Milton Keynes Council (2022) Flood Investigation Report: Bletchley and Fenny Stratford, and West Bletchley. Available: Bletchley_Waterhall Park_S19_2020_Final.pdf

Milton Keynes. Bradwell is serviced by separate foul and surface sewer networks as shown on the AW sewer mapping in **Appendix A**.

There are no EA Main Rivers present within Bradwell. An unnamed Ordinary Watercourse flows through the greenspace east of the village which is regulated by the Bedford Group IDB and maintained by the riparian owner.

Bradwell is not located in an ACDP. However, Bradwell has been identified in MKCC SWMP as a Critical Drainage Catchment (CDC19), noted as an area where flood risk is considered at most severe in Milton Keynes.

Figure 1-3 and **Figure 1-4** show the bedrock and superficial geology of the six hotspots. The geology of the area features a superficial layer primarily composed of the Oadby Member, a diamicton sedimentary deposit formed during the Quaternary period. Beneath this, the bedrock formation varies across the area consisting of primarily sandstone, siltstone and mudstone of the Peterborough Member and Kellaways Formation and a localised area of limestone in the north-west of Bradwell. Similarly, the soil scape is also varied with the area being characterised as Soilscape 18- 'Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils' in the south-east, Soilscape 20- 'Loamy and clayey floodplain soils with naturally high groundwater' in the north-east and Soilscape 9- 'Lime-rich loamy and clayey soils with impeded drainage' in the central region. Impermeable surfaces also cover Bradwell due to the residential developments.

The topography of Bradwell, as shown in **Figure 1-2**, generally slopes from north-east to south-west, towards the unnamed Ordinary Watercourse. LiDAR mapping indicates a high point of approximately 96 m AOD and a low point of 68 m AOD within the hotspot. Further detail of the localised topography is set out in **Section 5**.

2.1.2.2 Flood History

Bradwell has a relatively minor history of flooding. The EA Recorded Flood Outlines show no historical flooding in Bradwell. Surface water flood risk in Bradwell generally follows the paths of roads, watercourses, and other infrastructure.[13] No Section 19 Investigations have previously been undertaken in the area.

2.1.3 Emberton

2.1.3.1 Overview

Emberton is a village located 11 km north-west of central Milton Keynes, near the borders of Northamptonshire and Bedfordshire. The village is considered to be semi-rural comprising of a small residential area surrounded by greenspace. The A509 runs through Emberton and connects the village to the rest of Milton Keynes. AW sewer mapping showed no asset data within Petsoe End however data was not available for the main village of the Emberton hotspot.

There are no EA Main Rivers present within Emberton. One unnamed watercourse is shown on mapping to flow parallel to the A509 north of the village. Four waterbodies are located north of Emberton within Emberton Country Park. Although not located within Emberton village, the River Great Ouse also flows along border of the park to the north in close proximity to Emberton.

Emberton is not located in an ACDP and has not been identified in MKCC SWMP as a Critical Drainage Catchment.

Figure 1-3 and **Figure 1-4** show the bedrock and superficial geology of the six hotspots. The geology of the area features a superficial layer at the north end of the village comprised of sand and gravel with the Oadby Member, a diamicton sedimentary deposit at the south end of the village. No information is available regarding the superficial geology of the central are of Emberton. Beneath this, the bedrock formation is comprised of argillaceous rocks with subordinate sandstone and limestone in the north and limestone formation in the south. The soil scape within Emberton is described as Soilscape 8- "Slightly acid loamy and clayey soils with impeded drainage" and Soilscape 9- 'Lime-rich loamy and clayey soils with impeded drainage'. Although Emberton is semi-rural, impermeable surfaces partially cover the village due to the residential areas.

The topography of Emberton generally slopes from south to north, towards the River Great Ouse. LiDAR mapping shows a high point of approximately 70 mAOD and a low point of 50 mAOD within the hotspot area. Further detail of the localised topography is set out in **Section 5**.

2.1.3.2 Flood History

Emberton has a history of flooding primarily due to its proximity to the Main River Great Ouse. The EA Recorded Flood Outlines show historical flooding from the Main River to the north and west of Emberton however no historical

[13]JBA Consulting (2024) Strategic Flood Risk Assessment Appendix M. Available: https://www.milton-keynes.gov.uk/sites/default/files/2024-07/Appendix%20M-%20Flood_Risk_Summary.pdf

flood outlines are located within the hotspot. No Section 19 Investigations have previously been undertaken in the area.

2.1.4 Lavendon

2.1.4.1 Overview

Lavendon is a village located 14 km north-east of central Milton Keynes. The village is considered to be semi-rural comprising of a small residential area surrounded by greenspace. The A428 runs through Lavendon connecting the village to Bedford and the A509 borders Lavendon connecting the village to the rest of Milton Keynes. Lavendon is serviced by separate foul and surface sewer networks however, only foul sewers are located under the main roads through the town as shown on the AW sewer mapping in **Appendix A**.

There are no EA Main Rivers present within Lavendon. An unnamed Ordinary Watercourse flows through Lavendon as a tributary of River Great Ouse. A second unnamed Ordinary Watercourse flows through the Lavendon from the north-east where it is then culverted under Castle Road. A third Ordinary Watercourse is located parallel to Castle Road to the north. The unnamed Ordinary Watercourses are regulated by MKCC and maintained by riparian owners.

Lavendon is not located in an ACDP. However, Lavendon has been identified in MKCC SWMP as a Critical Drainage Catchment (CDC2), noted as an area where flood risk is considered to be most severe in Milton Keynes.

Figure 1-3 and **Figure 1-4** show the bedrock and superficial geology of the six hotspots. The geology of the area features a small superficial deposit of alluvium and clay, silt, sand and gravel underneath the Ordinary Watercourses. No information is available regarding the superficial geology of the majority of Lavendon. Beneath this, the bedrock formation is comprised of limestone deposits and mudstone formations. The soil scape within Lavendon is described as Soilscape 5- 'Freely draining lime-rich loamy soils'. Although Lavendon is semi-rural, impermeable surfaces partially cover the village due to the residential areas.

The topography of Lavendon, as shown in **Figure 1-2**, generally slopes from north to south, featuring a higher rural catchment area. Low elevation points follow the natural river channels. LiDAR mapping shows a high point of approximately 90 mAOD and a low point of 50 mAOD within the hotspot area. Further detail of the localised topography is set out in **Section 5**.

2.1.4.2 Flood History

Lavendon has experienced historical flooding due to 'channel capacity exceedance' from an Unnamed Ordinary Watercourse as detailed in the EA Recorded Flood Outlines. A Section 19 report has been published for Lavendon as a result of significant flooding in December 2020[14]. It was determined that flooding was caused by heavy rainfall over a relatively short period of time falling onto a near saturated or saturated catchment. The capacity of the Ordinary Watercourse was exceeded due to undersized culverts.

2.1.5 Newport Pagnell

2.1.5.1 Overview

Newport Pagnell is a town located 5.5 km north-east of central Milton Keynes. The town is considered to be highly urbanised with a mix of residential and commercial centres. The town is served by the M1 via the A509 and A422 which connects it with central Milton Keynes in the south and other notable towns in the north. Newport Pagnell is serviced by separate foul and surface sewer networks as shown on the AW sewer mapping in **Appendix A**. Newport Pagnell is bordered to the north and east by greenspace comprised predominantly of farmland.

The EA Main River Great Ouse flows around the northern boundary of Newport Pagnell with the Chichely Brook joining as a tributary to the east. The Main River Ouzel flows through the east of the town and confluences with along the Tongwell Brook which flows along southern boundary of Newport Pagnell. An unnamed Ordinary Watercourse, which is a tributary of the River Great Ouse, is located in the north of Newport Pagnell and flows along the boundary of Bury Field. A raised embankment at Kickles Bank serves as a flood defence, protecting the area around Lakes Lane. The two Ordinary Watercourses are regulated by the Bedford Group IDB and maintained by riparian owners. Multiple lakes are located the north-east and north-west of the town.

Newport Pagnell is not located in an ACDP. However, Newport Pagnell has been identified in MKCC SWMP as a Critical Drainage Catchment (CDC8), noted as an area where flood risk is considered to be most severe in Milton Keynes.

[14] David Smiths Associates (2021) Flood Investigation Report Lavendon. Available: 21_42983_01_FIR_Lavendon_Rev01-Anonymised.pdf

Figure 1-3 and **Figure 1-4** show the bedrock and superficial geology of the six hotspots. The geology of the area features superficial deposits of clay, silt, sand and gravel however no information is available regarding the superficial geology of the central area of Newport Pagnell. Alluvium deposits are found in the superficial geology of the areas underneath the Main Rivers. Beneath this, the bedrock formation in centre of Newport Pagnell is comprised of mudstone and the outer areas comprised of sandstone, siltstone and mud. Limestone is present in the bedrock below the Main Rivers. The soil scape within Emberton is described as Soilscape 8- "Slightly acid loamy and clayey soils with impeded drainage" and Soilscape 20- "Loamy and clayey floodplain soils with naturally high groundwater". As the area is also urbanised, a large proportion of Newport Pagnell is covered by impermeable surfaces.

The topography of Newport Pagnell, as shown in **Figure 1-2**, is varied over the hotspot, with areas of higher elevation in the east and west of the hotspot. LiDAR mapping shows a high point of approximately 70 mAOD and a low point of 55 mAOD within the hotspot area. Further detail of the localised topography is set out in **Section 5**.

2.1.5.2 Flood History

Newport Pagnell has experienced historical flooding from the Main River Great Ouse and River Ouzel as detailed in the EA Recorded Flood Outlines. Two S19 Flood Investigation reports have previously been published for Newport Pagnell as a result of significant flooding in May 2018[15] and December 2020[16]. In the May 2018 event, it was determined that the flooding was a result of the capacity of the drainage systems being exceeded during a heavy rainfall event resulting in overland flow to low topography areas. The likely cause of flooding during the December 2020 event was the result of a combination of river, surface water and groundwater flooding due to intense rainfall on an already saturated catchment.

2.1.6 Stony Stratford

2.1.6.1 Overview

Stony Stratford is a town located in the north-west corner of the Milton Keynes urban area. The town is considered to be urban with both residential and urban centres. Stony Stratford is no longer on any national routes however these can be accessed at the roundabout located 1 mile north of the town and local roads link Stony Stratford to nearby towns. Stony Stratford is serviced by separate foul and surface sewer networks as shown on the AW sewer mapping in **Appendix A**. A small section of combined sewer connects a small number of properties on Vicarage Walk. Stony Stratford is bordered to the north and west by greenspace, featuring Stony Stratford Nature Reserve in the north and farmland to the west.

The EA Main River Great Ouse flows around the northern and western boundary of Stony Stratford. There is a small unnamed Ordinary Watercourse which flows adjacent to Queen Eleanor Street. A small tributary of the River Great Ouse is located west of Stony Stratford which is regulated by the Bedford Group IDB and maintained by riparian owners. Various waterbodies are located north of Stony Stratford within Stony Stratford Nature Reserve.

Stony Stratford is not located in an ACDP. However, Stony Stratford has been identified in MKCC SWMP as a Critical Drainage Catchment (CDC15), noted as an area where flood risk is considered to be most severe in Milton Keynes.

Figure 1-3 and **Figure 1-4** show the bedrock and superficial geology of the six hotspots. The geology of the area features superficial deposits of sand and gravel river terrace deposits in the north and a mix of glaciofluvial deposits and Oadby Member, a diamicton sedimentary deposit in the south of the area. Beneath this, the bedrock varies locally consisting of Lias Group interbedded siltstone and mudstone in the north. The central area is comprised of limestone formations and a sandstone, siltstone and mudstone formation with Oxford Clay formation in the south. The soil scape within Stony Stratford is described as Soilscape 9- "Lime-rich loamy and clayey soils with impeded drainage" and Soilscape 20- "Loamy and clayey floodplain soils with naturally high groundwater". As the area is also urbanised, a large proportion of Stony Stratford is covered by impermeable surfaces.

The topography of Stony Stratford, as shown in **Figure 1-2**, generally slopes from south-east to north-west, towards the River Great Ouse. LiDAR mapping indicates a high point of approximately 90 m AOD and a low point of 64 m AOD within the hotspot. Further detail of the localised topography is set out in **Section 5**.

2.1.6.2 Flood History

Stony Stratford has experienced historical flooding from the Main River Great Ouse as detailed in the EA Recorded Flood Outlines. A S19 Flood Investigation report has previously been published for Stony Stratford as a result of

[15] AECOM (2019) Flood Investigation Report: Newport Pagnell. Available: https://www.milton-keynes.gov.uk/sites/default/files/2022-08/Newport%20Pagnell%20Flood%20Investigation%20Report_final.pdf
[16] WSP (2022) Flood Risk Investigation: Newport Pagnell Section 19 Report. Available: https://www.milton-keynes.gov.uk/sites/default/files/2023-12/Newport%20Pagnell%20-%20December%202020%20Section%2019%20Report.pdf

significant flooding in December 2020[17]. The likely cause of flooding in the December 2020 event was due to an intense rainfall event onto a saturated catchment that subsequently led to the overwhelming of rivers and surface and sewer network systems.

[17] WSP (2021) Flood Risk Investigation: Stony Stratford Section 19 Report. Available: https://www.milton-keynes.gov.uk/sites/default/files/2022-08/0.%20Stony%20Stratford%20S19_Final.pdf

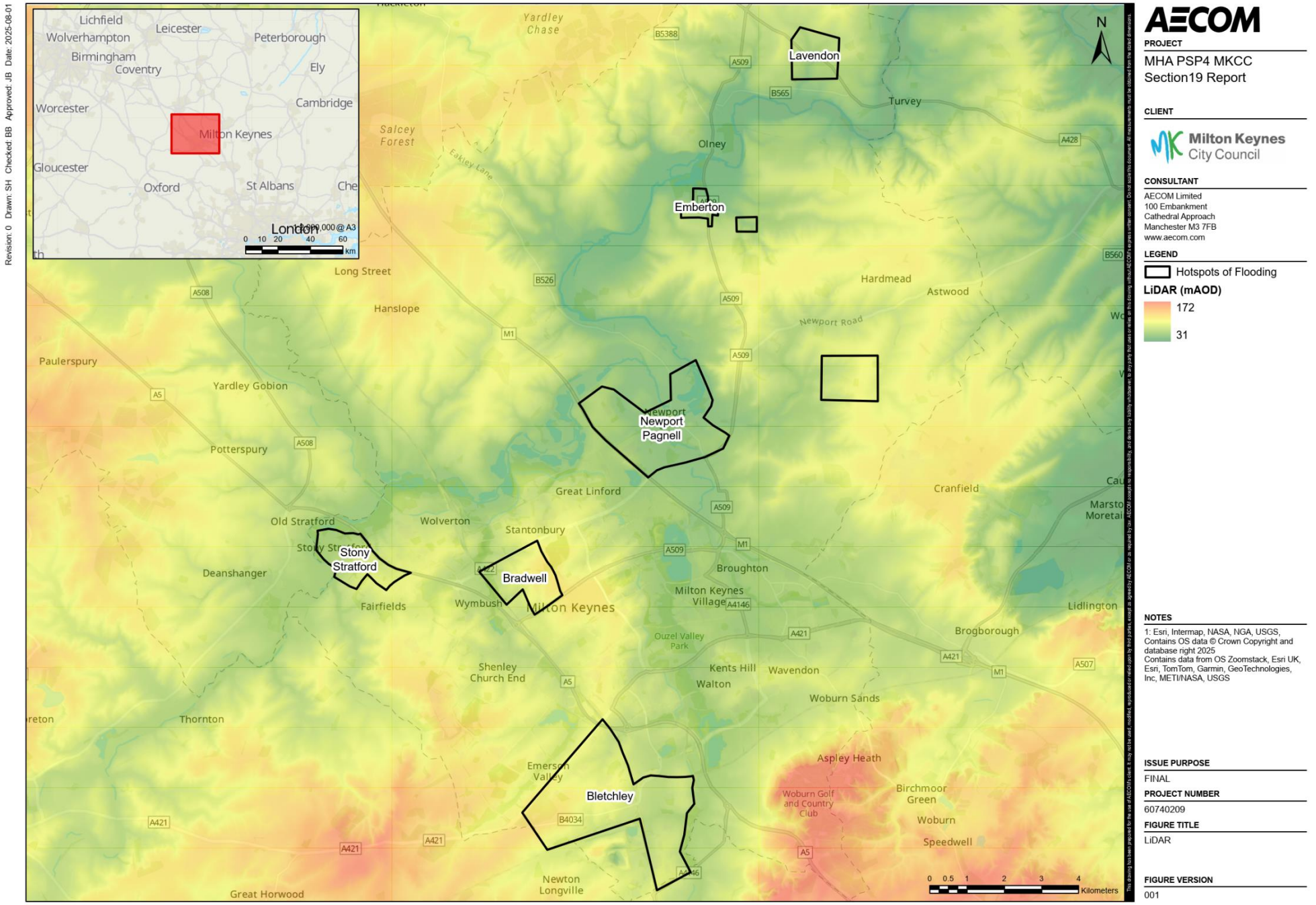
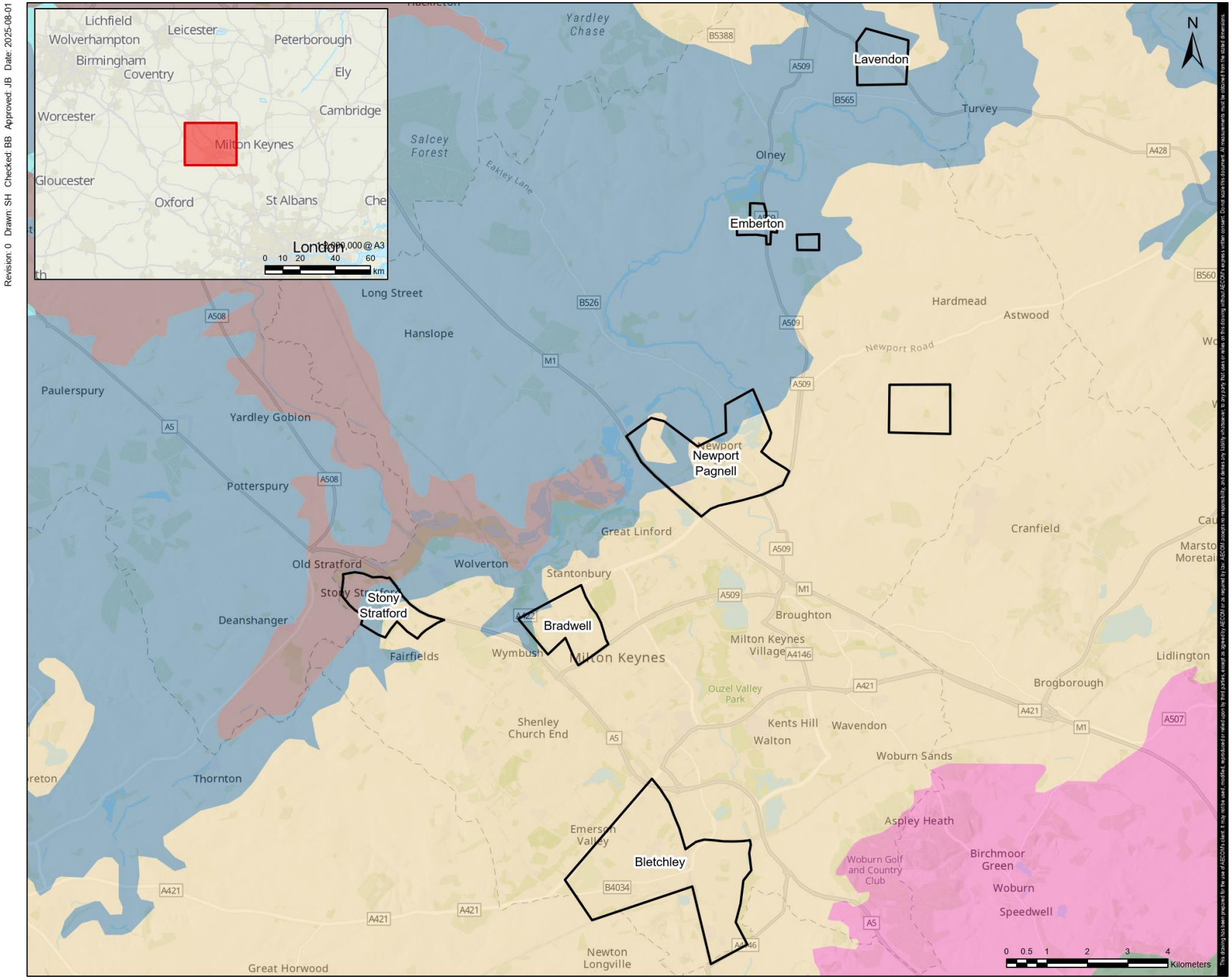


Figure 1-2: Topography of Milton Keynes



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LEGEND
- Hotspots of Flooding

Bedrock Geology
- CHALK
- LIMESTONE AND CALCAREOUS SANDSTONE
- LIMESTONE AND MUDSTONE, INTERBEDDED
- LIMESTONE, SANDSTONE, SILTSTONE AND MUDSTONE
- MUDSTONE, SANDSTONE AND LIMESTONE
- MUDSTONE, SILTSTONE AND SANDSTONE
- MUDSTONE, SILTSTONE, LIMESTONE AND SANDSTONE
- SANDSTONE AND MUDSTONE
- SANDSTONE, LIMESTONE AND ARGILLACEOUS ROCKS

NOTES
1: Esri, Intermap, NASA, NGA, USGS, Contains OS data © Crown Copyright and database right 2025
Contains data from OS Zoomstack, Esri UK, Esri, TomTom, Garmin, GeoTechnologies, Inc, METI/NASA, USGS

ISSUE PURPOSE
FINAL

PROJECT NUMBER
60740209

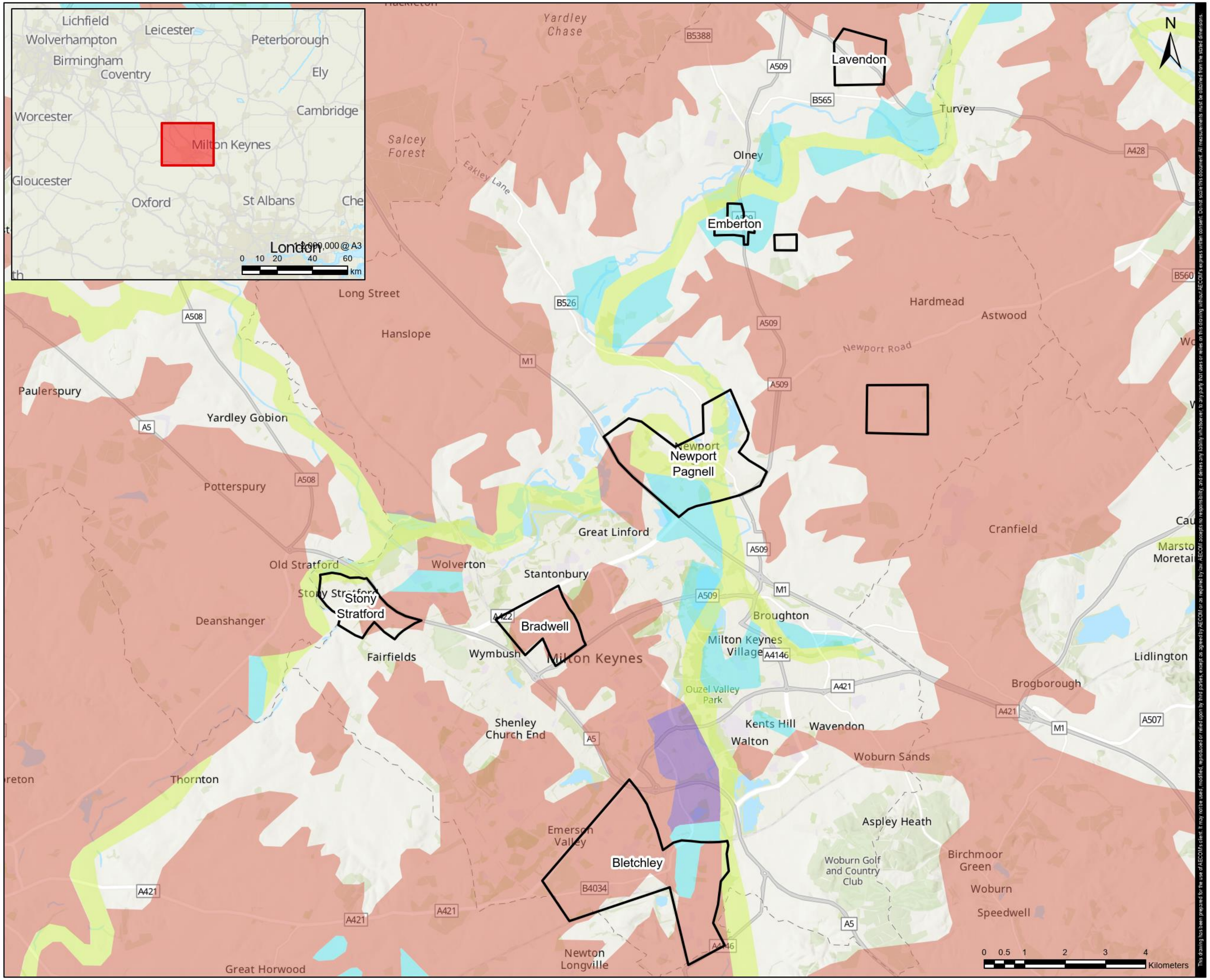
FIGURE TITLE
Bedrock Geology

FIGURE VERSION
001

Revision: 0 Drawn: SH Checked: BB Approved: JB Date: 2025-08-01

Figure 1-3: Bedrock Geology of Milton Keynes

Revision: 0 Drawn: SH Checked: BB Approved: JB Date: 2025-08-01



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Section19 Report

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LEGEND

Hotspots of Flooding

Superficial Geology

- CLAY
- CLAY, SILT AND SAND
- DIAMICTON
- SAND AND GRAVEL
- UNKNOWN LITHOLOGY

NOTES

1: Esri, Intermap, NASA, NGA, USGS, Contains OS data © Crown Copyright and database right 2025
Contains data from OS Zoomstack, Esri UK, Esri, TomTom, Garmin, GeoTechnologies, Inc, METI/NASA, USGS

ISSUE PURPOSE

FINAL

PROJECT NUMBER

60740209

FIGURE TITLE

Superficial Geology

FIGURE VERSION

001

Figure 1-4: Superficial Geology of Milton Keynes

3. Data Collection

3.1 Data Register

The data used in this investigation was collected by MKCC from various sources. **Table 3-1** shows the data received, the original data source and the data type.

Table 3-1: Data Register

Data Received	Data Source	Data Type
Report a Flood Form records of flooded properties	MKCC	Excel
Flood Tracker	MKCC	Excel
Email Records of Flood Event	MKCC	PDF
Images and Videos of Flood Event	MKCC	png
Asset Data	MKCC	Shapefile, CSV
S19 Flood Reports	MKCC Open Data	PDF
Sewer and Surface Water Networks	Anglian Water	PDF
DG5 Register	Anglian Water	Excel
Radar Rainfall Data	Met Office	Excel
Rain Gauge Rainfall Data	Environment Agency	Excel
EA River Gauge Station data	Environment Agency Open Data	Online
LiDAR	DEFRA	Shapefile
Bedrock and Superficial Geology	BGS	Shapefile

3.2 Data Review

The data was collected by MKCC and provided to AECOM to undertake the flood investigation. The data collected was used to identify which areas, within the six hotspots, experienced flooding on 21st to 29th September 2024. All data has been reviewed against the hotspots identified, to focus the report and ensure all relevant information is captured.

A gap analysis of the data provided by MKCC was also undertaken. Various forms of flooding records and data were provided by MKCC as shown in **Table 3-1**. Flood outlines were not received from MKCC. However, sufficient data was available to undertake the flood investigation and produce the S19 report.

3.3 Site Visit

A site visit was conducted on the 13th and 14th of March 2025 to gather observations from the six hotspots. Using the flood records collected by MKCC, the areas affected during the flood event within these hotspots were identified. These impacted areas were mapped and used to inform and guide the site visit. This visit helped verify flood sources, mechanisms, and impacts, and undertake visual inspections of the affected areas. The site visit also confirmed the accuracy of data received from MKCC. Observations and findings from site visit are included in **Section 5** which contribute to understanding the cause of the September 2024 flood event.

3.4 Key Statistics

The flood record data provided by MKCC details the number of properties flooded in each hotspot and the type of flooding which occurred (internal property flooding, external flooding or unconfirmed). This is based on flood records received by MKCC by 3rd April 2025. It is important to note that the data used is from the MKCC Flood Records and therefore only includes properties where residents have reported flooding. Furthermore, the incidence of flooding is frequently underreported, as residents may be reluctant to disclose such events due to concerns about potential increases in insurance premiums or negative impacts on property values.

A breakdown of the key statistics is presented in **Table 3-2**, for the six hotspots only. It should be noted that due to the variety of sources considered and the quality of data, it has not been possible in all instances to verify the type of flooding recorded.

Table 3-2: Reports of Flooded Properties

Hotspot	Type of Flooding	No. Properties Flooded
Bletchley	Internal & External Flooding	20
	External Flood Only	4
	Unconfirmed	0
Total Reports of Property Flooding in Bletchley		**24**
Bradwell	Internal Flooding	6
	External Flood Only	2
	Unconfirmed	0
Total Reports of Property Flooding in Bradwell		**8**
Emberton	Internal Flooding	5
	External Flood Only	6
	Unconfirmed	0
Total Reports of Property Flooding in Emberton		**11**
Lavendon	Internal Flooding	34
	External Flood Only	10
	Unconfirmed	0
Total Reports of Property Flooding in Lavendon		**44**
Newport Pagnell	Internal Flooding	15
	External Flood Only	1
	Unconfirmed	0
Total Reports of Property Flooding in Newport Pagnell		**16**
Stony Stratford	Internal & External Flooding	10
	External Flood Only	4

Unconfirmed	1
Total Reports of Property Flooding in Stony Stratford	**15**

4. Meteorological Conditions

4.1 Overview

On 21st September to 29th September 2024, intense rainfall was experienced across Milton Keynes and Buckinghamshire. There were reports of widespread surface water flooding affecting properties and priority roads and various incidents of foul sewer surcharges. Though surface water flooding characterised the event, it also combined with Ordinary Watercourse and Main River flooding in Lavendon and Newport Pagnell.

According to the EA Monthly Water Situation Report[18] for September 2024, south-east England rainfall was classed as exceptionally high. A Met Office report[19] of the September 2024 rainfall noted that Buckinghamshire recorded more than three times (300%) their average September rainfall.

Analysis of DEFRA Rain Gauge Data[20] and Met Office Radar Data (provided by MKCC) of the rainfall from 21st-29th September was undertaken. Using a six-day rolling average duration, maximum rainfall results indicate magnitudes exceeding the 1 in 1000-year return period across parts of Milton Keynes. The methods used to estimate the return periods from the datasets are set out in **Section 4.3**.

Estimating rainfall and flood probabilities involves considerable uncertainty, primarily due to uncertainties in measurement and frequency analysis. No measurement is perfect, and uncertainties can arise due to spatial variability and temporal resolution. Frequency analysis of extreme natural events is uncertain because the exact frequency distribution of these extremes is unknown. Estimations are typically based on relatively short data records and involve assumptions.

4.2 Antecedent Conditions

The EA Monthly Water Situation Report notes that the three-month cumulative totals were classed as normal or higher in all catchments with more than two-thirds of the catchments classed as above normal or higher. In the south-east of England, the monthly rainfall in the preceding months was varied (**Figure 4-1)**. Below average rainfall was recorded in August and June, and above average rainfall was recorded in July as shown in **Figure 4-2**.

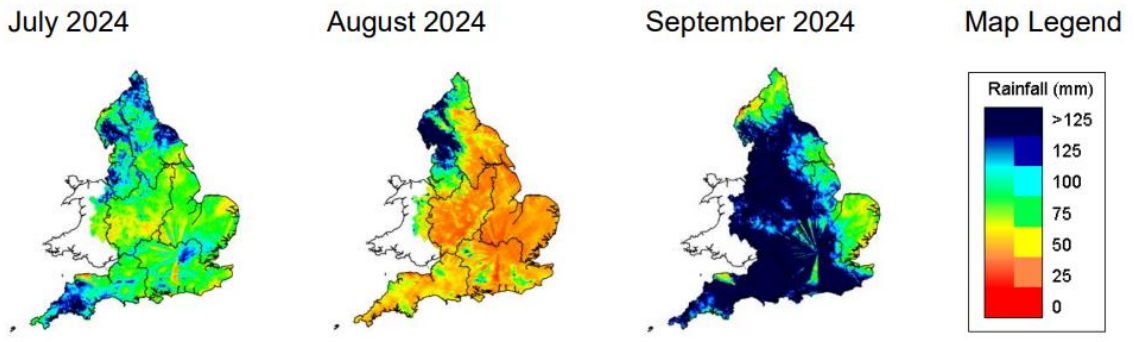


Figure 4-1: Monthly rainfall across England and Wales for the past 11 months. UKPP radar data[18]

[18] Environment Agency (2025) Water situation: September 2024 summary. Available: Water situation : September 2024 summary - GOV.UK
[19] Met Office (Oct 2024) Record-breaking rainfall for some this September. Available: Record-breaking rainfall for some this September - Met Office
[20] DEFRA (2025) Hydrology Data Explorer. Available: Hydrology Data Explorer - Explore

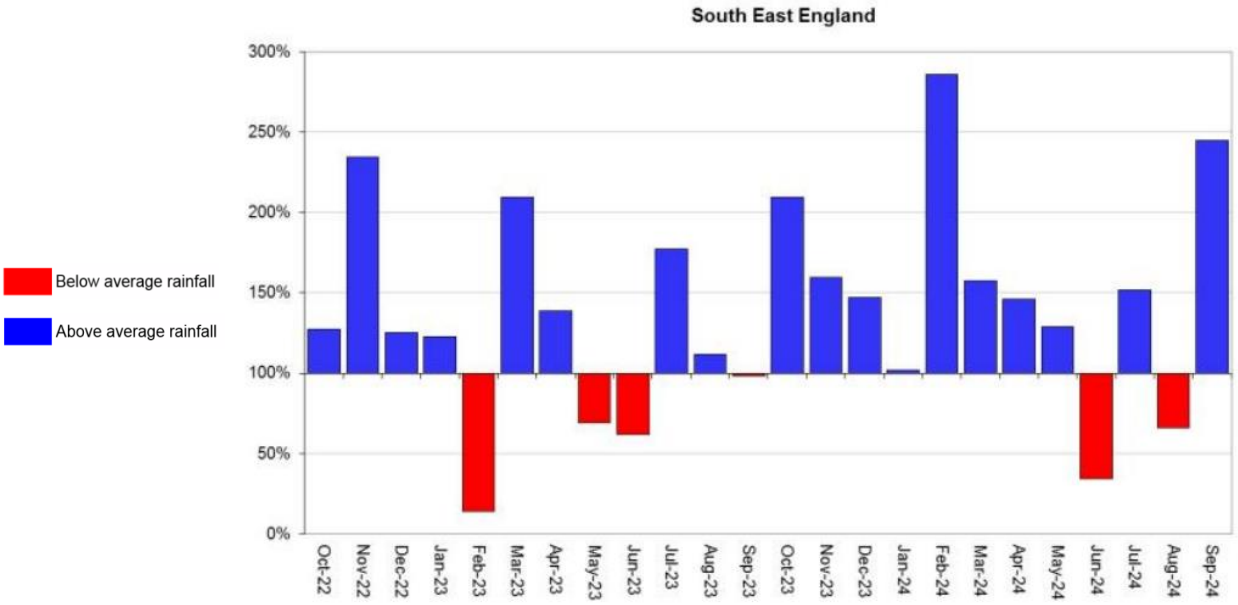


Figure 4-2: Monthly rainfall totals for the past 24 months as a percentage of the 1961 to 1990 long term average for South East England[18]

Figure 4-3 shows the Soil Moisture Deficits (SMDs) for south-east England. By the end of September, in the south-east of England, SMD values had decreased sharply (the ground had become saturated) due to above average rainfall, and soils were wetter than the long-term average. SMDs in the preceding months were higher than the LTA indicating that the ground was dry.

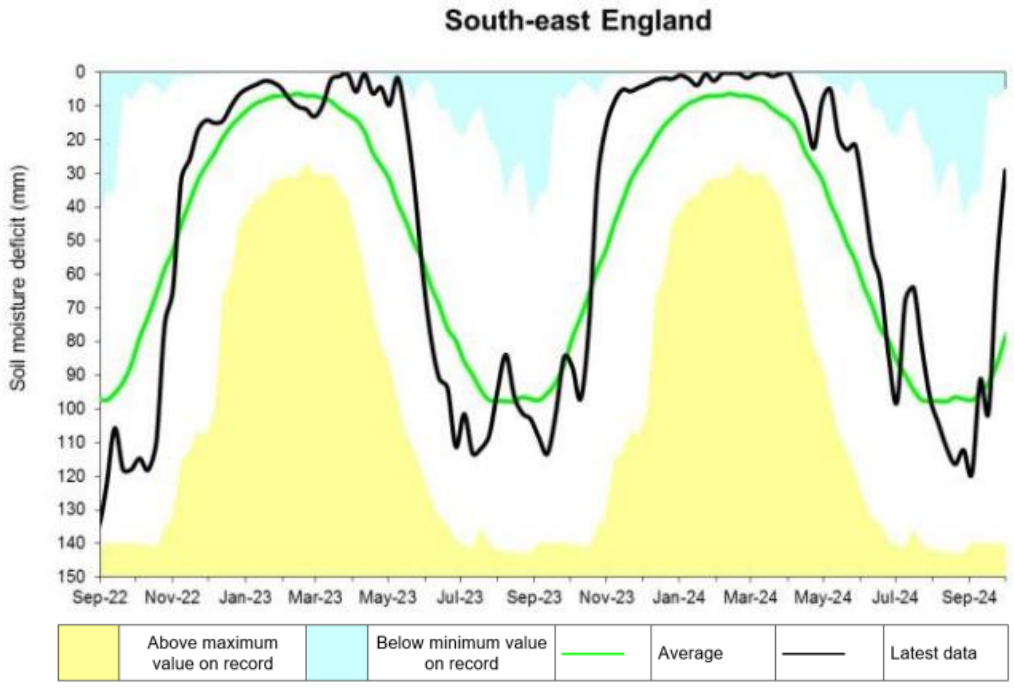


Figure 4-3: Latest soil moisture deficits for south-east England compared to maximum, minimum and 1961 to 1990 long term average.[18]

There is a lack of suitable groundwater data near Milton Keynes to enable a direct analysis of the groundwater state during this event. The nearest groundwater sites are Ashley Green and Redlands Hall which are 30 km south

and 40 km east, respectively. However, as noted by the EA, Redlands Hall data is collected through manually dipping at different times during the month and so may not be fully representative of month end levels. **Figure 4-4** shows notably high groundwater levels at the end of August at both indicator sites, prior to the flood event. At the end of September, groundwater levels were exceptionally high at Ashley Green and above normal at Redlands Hall.

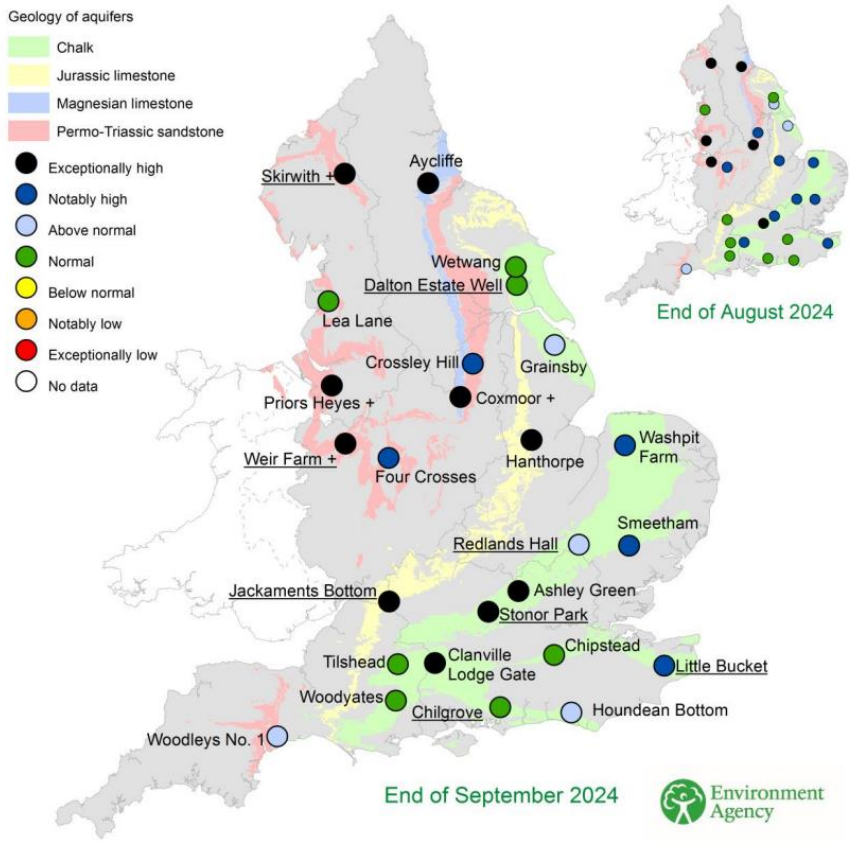


Figure 4-4: Groundwater levels for indicator sites at the end of August 2024 and September 2024, classed relative to an analysis of respective historic August and September levels.[18]

4.3 Recorded Rainfall

4.3.1 Event Overview

The EA Water Situation Report illustrates that September was a wet month for the south-east of England, with exceptionally high monthly rainfall. A rainfall event analysis for the September flood event was undertaken to estimate the return period of the flood event in Milton Keynes. The analysis utilised publicly available DEFRA Rain Gauge Data and Met Office Radar Data provided by MKCC.

Rainfall accumulations during the flood event were calculated for a range of durations between (and inclusive of) 1 hour to 144 hours. The accumulations were calculated on a 'sliding duration' basis. The rainfall accumulation totals were compared from the rain gauge and rainfall radar data to determine the most appropriate duration to analyse. The 144-hour (6-day) duration was selected, as the maximum rainfall accumulations were recorded over this period at all rain gauge and radar locations.

Through analysis of the recorded rainfall data, a high-level rainfall pattern can be determined. **Figure 4-8** shows the locations of the rain gauges and radar points. The rainfall event covered a period of 9 days: 21st – 29th September. There were two distinct periods of rainfall over this period, the first over 21st – 23rd and the second from 26th – 27th. Rain gauges and radar locations in the north recorded maximum rainfall accumulations during the first period of rainfall, as shown in **Figure 4-5** for Lavendon. A smaller peak was also recorded at rain gauges and radar locations in south during the first period of rainfall. However, maximum rainfall accumulations were recorded during the second period from 26th – 27th, as shown in **Figure 4-6** for Bletchley (2). The second period of rainfall then fell onto saturated ground, therefore increasing the rate of surface water run off. Recorded rainfall plots over the 9-day period for each rain gauge and radar location are included in **Appendix B**.

Figure 4-5: Lavendon - Recorded Rainfall Radar Depth Plot

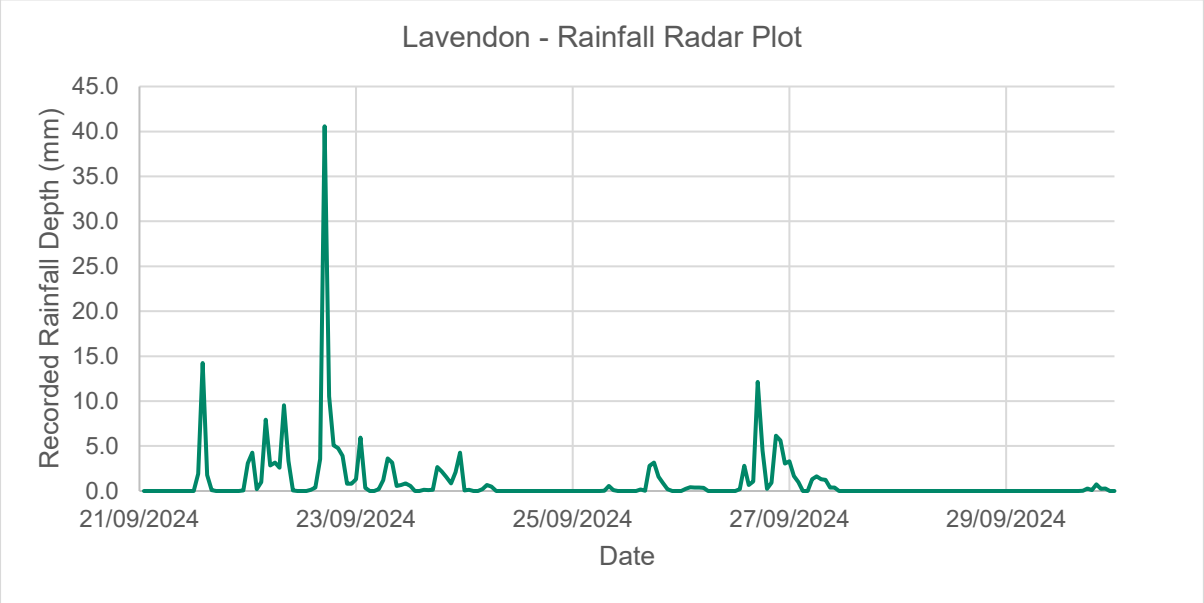
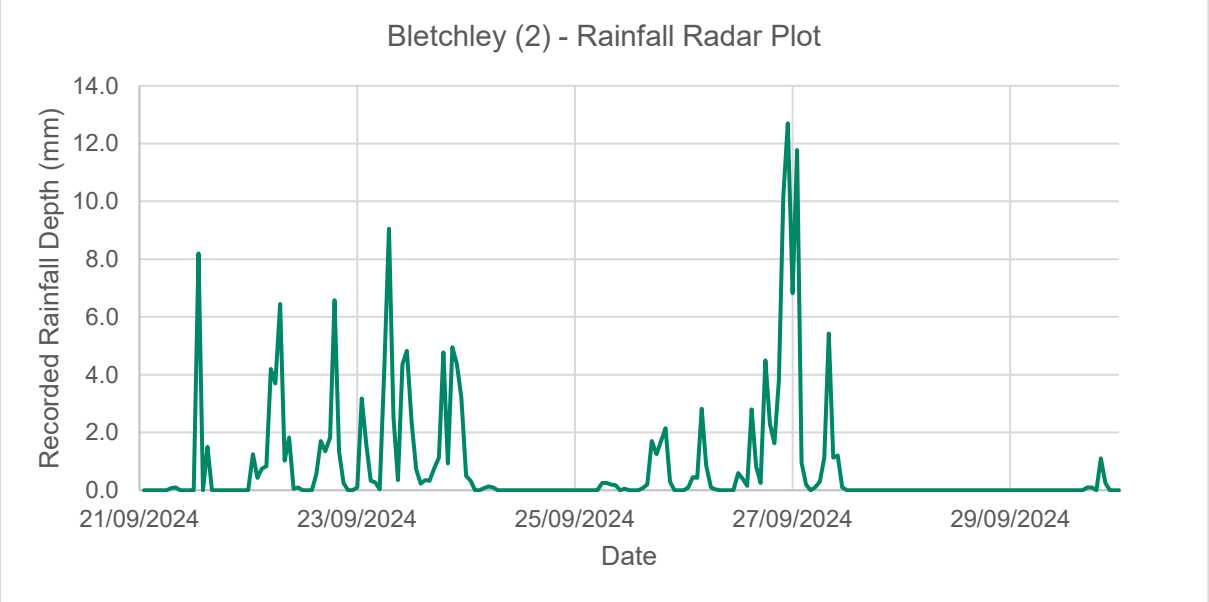


Figure 4-6: Bletchley (2) – Recorded Rainfall Radar Depth Plot



4.3.2 Rain Gauge Data

There are five EA tipping bucket rain gauges near Milton Keynes with available data, as presented in **Figure 4-8**. The Toddington rain gauge was also initially analysed, however the data showed considerably less rainfall when compared to nearby gauges and the data was also marked as suspect. Therefore, Toddington rain gauge was excluded from the rest of the analysis.

The five rain gauges are shown in **Figure 4-8** and are located at:

- Quinton (15 minute) (National Grid Reference (NGR) SP7752054740)
- Towcester (15 minute) (NGR SP7168748776)
- Brackley (15 minute) (NGR SP6011536084)
- Drayton Parslow (15 minute) (NGR SP8481628710)
- Birchmoor (15 minute) (NGR SP9436834716)

As illustrated in **Table 4-1**, the largest observed 144-hour (6-day) total (cumulative 15 min rainfall data) of 187 mm was recorded at Birchmoor rain gauge. Although other rain gauges recorded lower maximum depths, all recorded depths were significantly high. The results indicate intense rainfall across Milton Keynes during the flood event.

Table 4-1: Rain Gauge Data

Rain Gauge	Maximum Rainfall Depth (mm)	Data Quality Flag
Quinton	166	Unchecked
Towcester	161	Checked
Brackley	155	Checked
Birchmoor	187	Checked
Drayton Parslow	147	Checked

4.3.3 Rainfall Radar Data

Rainfall radar data was provided by MKCC in 1km^2 areas for each of the six hotspots. As the Bletchley hotspot covers a wider area, a 1km^2 and 2km^2 area of radar rainfall data was provided. Whilst rainfall radar should not be considered as a direct substitute for ground-based observations, it is necessary to adopt a combined approach where the rain gauge coverage may only be partially representative of the area rainfall over the study catchment.

Table 4-2 shows the largest observed 144-hour (6-day) total (cumulative 60 min rainfall data) was 222 mm and was recorded in Lavendon. Maximum rainfall depths were high across all hotspots, most notably in Lavendon, Bradwell and Bletchley. Although maximum rainfall depths were lower at Emberton, Newport Pagnell and Stony Stratford compared to other hotspots and rain gauge data, all recorded depths were notably high.

Table 4-2: Rainfall Radar Data

Radar Data Location (NGR)	Maximum Rainfall Depth (mm)
Lavendon (491717, 253655)	222
Emberton (48926, 4249260)	112
Newport Pagnell (487792, 244068)	80
Stony Stratford (479165, 240249)	121
Bradwell (48417, 7239766)	183
Bletchley 1 (485978, 233310)	175
Bletchley 2 (488069, 231820)	182

Radar data often indicates lower rainfall amounts compared to rain gauge data due to variations in radar coverage, which can impact data quality. Milton Keynes, as illustrated in **Figure 4-7**, falls within an area of low-quality radar coverage. This highlights the necessity of integrating both radar and rain gauge data to achieve a more accurate representation of the rainfall event.

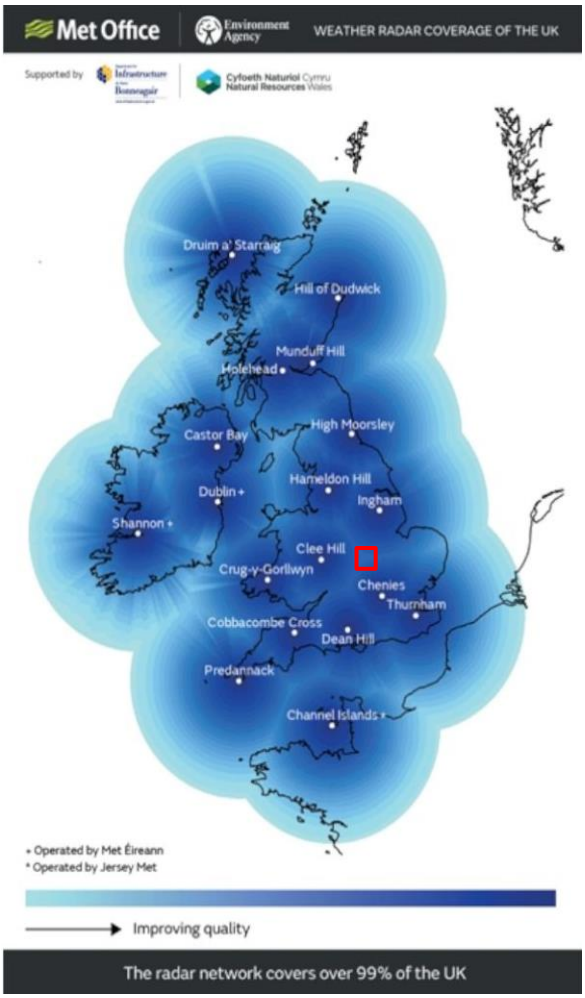


Figure 4-7: Weather Radar Coverage of the UK[21]

4.3.4 Event Rarity

The estimated rainfall totals presented in **Section 4.3.2** and **Section 4.3.3** were used to estimate event rarity for the flood event using the Depth-Duration-Frequency (DDF) rainfall model. DDF curves describe rainfall depth as a function of duration for given return periods at specified locations within the UK and can be reproduced using the Flood Estimation Handbook (FEH) Website[22].

Return periods are expressed as Annual Exceedance Probability (AEP). AEP is a statistical measure used to describe the likelihood of a given event, such as flooding, occurring in any given year and is often expressed as a percentage.

Table 4-3 presents the return periods estimated using the FEH Website for the maximum rainfall depths recorded at the five rain gauges and seven radar rainfall locations over a 144 hours (6 day) period. **Table 4-3** highlights the intense nature of the rainfall event due the low return periods across Milton Keynes. **Figure 4-8** illustrates the locations of the rain gauges and radar rainfall locations along with their associated return period estimates. This further highlights the high intensity and prolonged duration of the rainfall event. However, return periods are notably higher in Newport Pagnell suggesting the spatially variable nature of the rainfall.

While the probability of the rainfall event is considered low, the potential impact of such events can be severe, often leading to significant flooding and damage. However, DDF models have greater uncertainty for higher magnitude rainfall events due to limitations with the data as higher magnitude events are rarer, leading to fewer data points for accurate statistical analysis.

[21] Met Office (2025) Weather Radar Network Renewal. Available: Weather radar network renewal - Met Office
[22] UK Centre for Ecology and Hydrology (2025) Flood Estimation Handbook Web Service. Available: Map - FEH Web Service

Table 4-3: Maximum Rainfall Depths and associated Return Period Estimates at Rain Gauges and Radar data locations

Rain Gauge	Maximum Rainfall Depth	Estimated Return Period
Quinton	166	>0.1% AEP
Towcester	161	>0.1% AEP
Brackley	155	0.2 – 0.1% AEP
Birchmoor	187	>0.1% AEP
Drayton Parslow	147	0.2 – 0.1% AEP
Radar Data Location	**Maximum Rainfall Depth**	**Return Period**
Lavendon (491717, 253655)	222	>0.1% AEP
Emberton (48926, 4249260)	112	1.3% - 1% AEP
Newport Pagnell (487792, 244068)	80	20% - 10% AEP
Stony Stratford (479165, 240249)	121	0.5% - 0.2% AEP
Bradwell (48417, 7239766)	183	>0.1% AEP
Bletchley 1 (485978, 233310)	175	>0.1% AEP
Bletchley 2 (488069, 231820)	182	>0.1% AEP

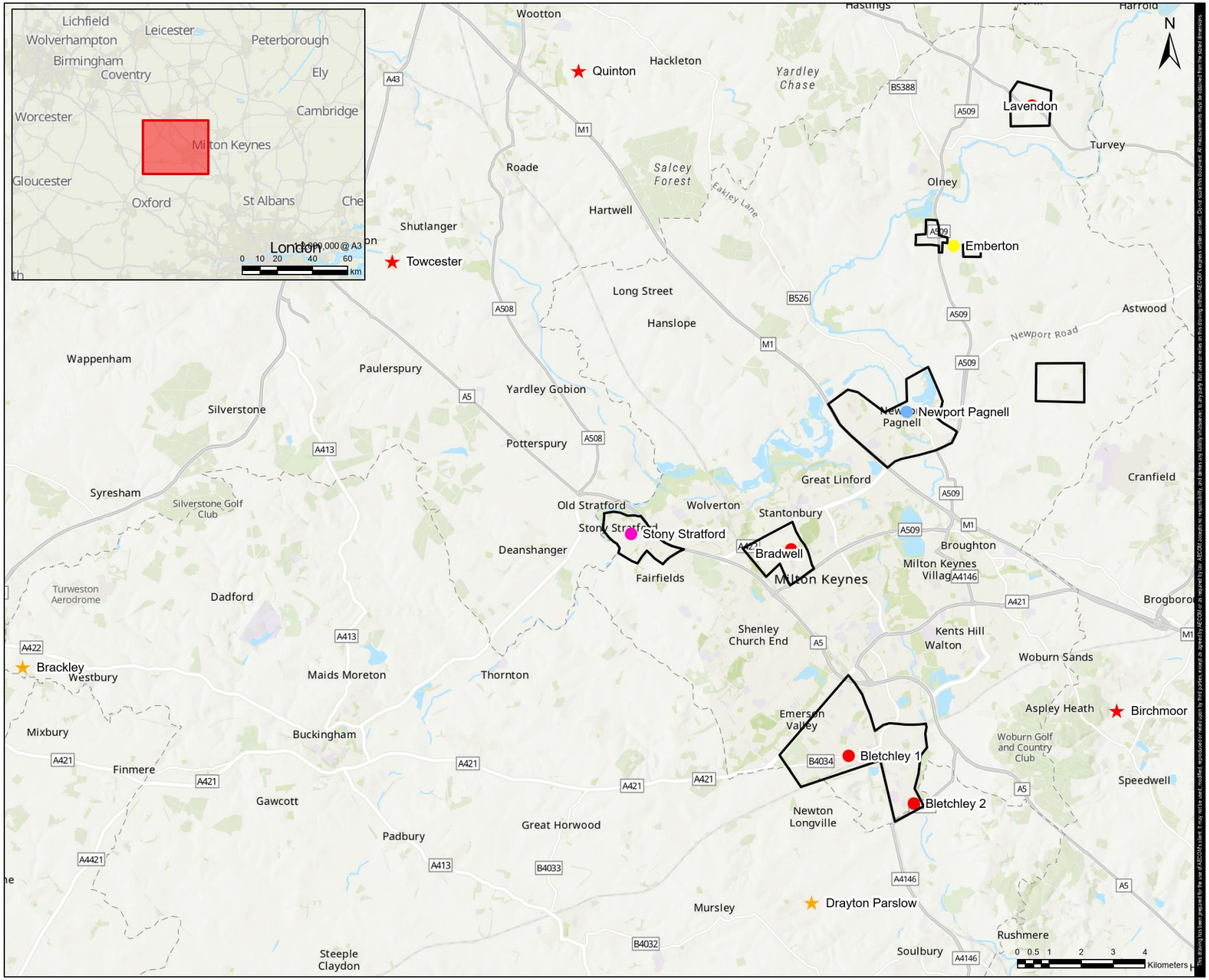


Figure 4-8: Rain Gauge and Radar Data Locations with associated Return Periods (AEP) over 144 hour (6 -day) duration

4.4 River Flows

As noted in **Section 2**, two EA Main Rivers flow through the study area: River Great Ouse and River Ouzel. Both Main Rivers flow through the Newport Pagnell hotspot and the River Great Ouse borders the Stony Stratford hotspot. The EA Water Situation Report noted the River Great Ouse recorded their highest monthly mean flow for September since 1979. It should be noted that during the flood event, the Passenham gauge on the River Great Ouse was not operational and the Brackley gauge, located upstream and typically used as a substitute, became inundated with floodwater resulting in inaccurate readings. Therefore, there is no reliable data to accurately represent the river levels at the River Great Ouse near Milton Keynes during the event. The River Ouzel reached the highest level ever recorded at the River Ouzel level at Milton Keynes monitoring point. A record level of 2.36 m was recorded on the 28th September at the 'River Ouzel at Milton Keynes' measuring station[23]. It is noted that property flooding is possible above 1.4 m in nearby areas. As such, river levels and flows were high during the flood event in Milton Keynes.

4.5 Summary

Eight days of exceptionally high rainfall led to the flood event in Milton Keynes from 21st-29th September 2024. Investigation of antecedent conditions found that the ground was relatively dry in the months preceding the rainfall event due to months of below average rainfall and high SMD data. As such, it is likely that antecedent conditions did not contribute to surface water flooding during the flood event.

However, groundwater levels were notably high the month before the rainfall event and exceptionally high after. This suggests that antecedent conditions contributed to groundwater flooding during the September 2024 flood event.

The return period analysis discussed above was determined using FEH methods and showed returns periods greater than 0.1% AEP at seven out of twelve locations analysed. All return periods were notably low except at Newport Pagnell. Estimates suggests that the rainfall event was so intense that the ground became saturated very quickly causing high levels of surface water and fluvial flooding.

Furthermore, river flows were the highest since 1979 at the River Great Ouse and the highest recorded water levels were logged at the River Ouzel monitoring station within Milton Keynes. This further evidence's the intense nature and prolonged duration of the rainfall event which likely led to fluvial flooding in Milton Keynes, most notably at Newport Pagnell and Stony Stratford.

[23] OGL (2025) River Ouzel level at Milton Keynes. Available: River Ouzel level at Milton Keynes - GOV.UK

5. Flood Mechanisms and Impacts

This section explores the flood sources, mechanisms, and impacts at each of the six hotspots as a result of the flood event on 29th September 2024. This information has been derived from the data received from MKCC (**Section 3.1**). The flood mechanisms and impacts have been verified through site observations obtained during the site visit held on 13th and 14th March 2025 (**Section 3.3**). The findings have also been corroborated against online EA mapping including the Flood Map for Planning (FMfP) and Risk of Flooding from Surface Water (RoFSW) map. An overview of each flood hotspot is provided in **Section 2**. The findings from this section have formed the basis for recommendations, which are presented in **Section 8**.

5.1 Bletchley

5.1.1.1 Flood Impacts

Records indicate 24 properties were affected in Bletchley by the flood event in September 2024. 20 of these properties reported internal flooding and 4 external only as shown in **Table 5-1**. **Figure 5-1** shows the reported flooding incidents within the Bletchley hotspot.

Table 5-1: Bletchley – Reports of Flooding

Bletchley	Type of Flooding	No. Properties Flooded
	Internal Flooding	20
	External Flood Only	4
	Unconfirmed	0
Total Reports of Property Flooding in Bletchley		**24**

- The areas of interest affected include: Severn Way, St Georges Road, Buckingham Road, Turing Gate, Sheelin Grove, Nevis Grove, Simpson Road, Windermere Drive, Trent Road and Knowles Nursery School.
- Anecdotal evidence from flood records provided by residents to MKCC noted external flooding at properties along Severn Way, Turing Gate, Trent Road and Knowles Nursery School. Flood records noted localised external flooding as a result of balcony flooding at Trent Road; therefore site observations were not undertaken at this location.
- Anecdotal evidence from flood records provided by residents to MKCC noted internal flooding at St Georges Road and Windermere Drive. Internal flooding within the basement of a property along Buckingham Road was also reported.
- Anecdotal evidence from flood records provided by residents to MKCC noted internal flooding at a significant number of properties along Sheelin Grove and Nevis Grove. During the flood event on the 23rd September, the fire service was called to internal flooding incidents at Nevis Grove where hydrosacks were used to assist in redirecting flood water[24].

[24] MK Citizen (2024) Bucks Fire and Rescue urges people to avoid travelling as amber warning for rain in place across Milton Keynes. Available: https://www.miltonkeynes.co.uk/news/people/bucks-fire-and-rescue-urges-people-to-avoid-travelling-as-amber-warning-for-rain-in-place-across-milton-keynes-4794008

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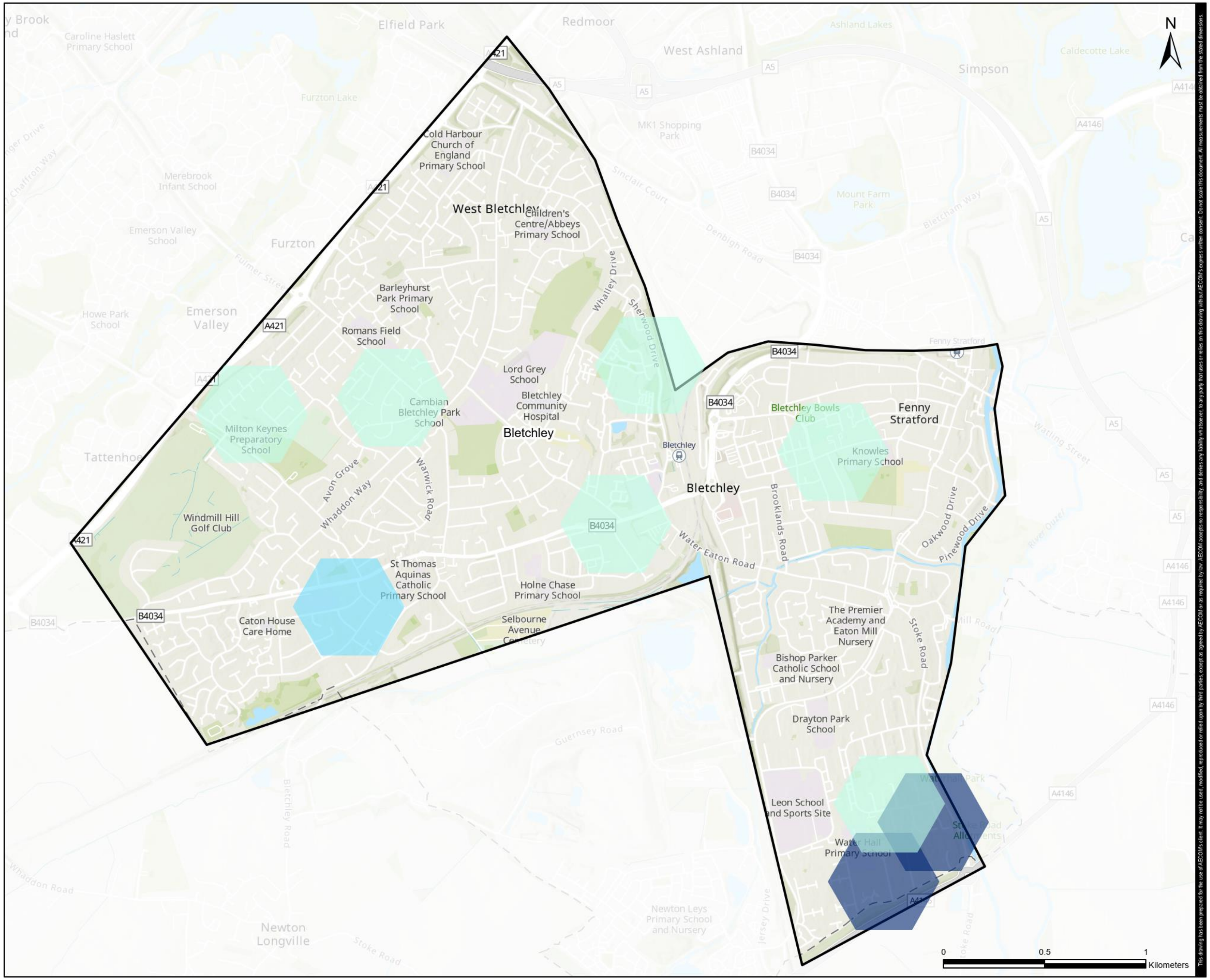

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LEGEND

Bletchley

Count of Flooding Incidents

- 1
- 2
- 3 - 4
- 5 - 6
- > 7

NOTES

1: Esri Community Maps Contributors, Esri UK, Esri, TomTom, Garmin, GeoTechnologies, Inc, METI/NASA, USGS, Esri, Intermap, NASA, NGA, USGS

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FIGURE TITLE

Bletchley Flooding Incidents

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Figure 5-1: Bletchley Flooding Incidents

5.1.1.2 Site Observations

Severn Way

As presented in **Photograph 1**, a depression in the road surface along Tattenhoe Lane at the junction of Sunningdale Way causes water to pond in this area next to the kerb, and as a result has led to cracks in the road surface. A gentle slope in topography of Tattenhoe Lane in both directions and Sunningdale Way coveys flows to the area of lowest elevation. During intense rainfall events, flows overtop the kerb and are channelled down the adjacent footpath towards the greenspace (**Photograph 2**). Site observations found a large area of raised ground in the greenspace which limits storage capacity in the area. As such, surface water is channelled down the side of the raised area towards impacted properties on Severn Way. Gullies were identified along Tattenhoe Lane, suggesting the capacity was exceeded or became blocked during the flood event.

Photograph 1

Photograph 2

St Georges Road

Site observations found that St George Road sloped towards the impacted property in both directions, resulting in the area of lowest elevation outside the property. The road provides a large impermeable surface for flows to be conveyed towards the impacted properties. A gully was identified outside the impacted properties, suggesting this exceeded capacity or became blocked during the flood event.

Buckingham Road

Site observations found that the impacted properties along Buckingham Road (**Photograph 3**) have a ground floor and basement located below road level, which increases the risk of flooding in the event of overspill onto the footpath. A sewer manhole located on the footpath outside the impacted properties was also identified during the site visit.

Photograph 3

Turing Gate

There is a slight elevation in the road surface on Turing Gate as it leads onto Colossus Way, caused by a small speed bump. It is likely that flows from Colossus Way are conveyed down Turing Gate at an increased rate due to the speed bump. Gullies were identified along Turing Gate, suggesting they exceeded capacity or became blocked during the flood event.

Sheelin Grove

Comparison of site visit observations and aerial imagery reveals a change in land use behind properties along Sheelin Grove. Previously greenfield land, the area was under construction for new properties at the time of the site visit, as shown in **Photograph 4**. This change likely increased impermeable surfaces, leading to surface water run off towards the back of impacted properties.

Photograph 4

Nevis Grove

Site observations noted that behind the affected properties along Nevis Road lies a greenspace characterised by a steep slope (**Photograph 5**). A small footpath, lacking drainage, separates the greenspace from the properties. It is likely that surface water flows are conveyed down the slope towards the properties, causing surface water ingress during intense rainfall events.

Photograph 5

Windermere Drive

Site visit observations found no obvious surface water flow path at the front of the properties due to a raised driveway and kerb. However, a sloped greenspace was identified behind the impacted properties, separated by a

small footpath. No gullies were identified in this area; therefore, it is likely that flows were conveyed towards the impacted properties and were unable to drain away.

Knowles Nursery School

The car park outside Knowles Nursery School consists of a large, flat, impermeable surface. While the entrance slopes toward the road where a gully is located, a surrounding boundary wall likely restricts outflow, resulting in surface water ponding within the car park.

5.1.1.3 Flood Sources and Mechanisms

Figure 5-2 illustrates the impacted areas and flow paths within the Bletchley hotspot. Following a review of the data and site walkover it is concluded that the flooding within the Bletchley hotspot was a result of the following:

- Analysis of rainfall data recorded across Bletchley, estimates that the rainfall event had a >0.1% AEP. This analysis highlights the intensity and rarity of the rainfall event.

- Anecdotal evidence provided by residents noted external flooding at properties along Severn Way from flooding of greenspace which backs onto the impacted properties. A depression in road surface at the junction of Tattenhoe Lane and Sunningdale Way allows surface water to accumulate due to the absence of gullies. During intense rainfall events, surface water likely overtops the kerb, onto the footpath and towards the area of greenspace. A large area of raised ground in the greenspace limits storage capacity in the area and likely channels flows down the side and towards the impacted properties. The EA RoFSW map shows an extensive surface water pathway from Sunningdale Way towards the impacted property along Severn Way, therefore corroborating the sources and mechanisms found from flood records and site observations.

- The impacted property along St Georges Road is located at the area of lowest elevation due to the sloped topography of the road from both directions. The EA RoFSW map shows surface water ponding at the location of the impacted property during all mapped AEP events.

- Site observations identified a sewer manhole outside of the impacted properties along Buckingham Road. AW records noted internal flooding at this location during the flood event due to capacity of a foul sewer. Impacted properties have a ground floor and basement located below road level, allowing flows to be conveyed from the footpath towards the area of lowest elevation at the impacted properties.

- The speed bump within the road design at Turing Gate, likely exacerbated flows down the road leading to external flooding. The EA RoFSW map shows surface water flood extents along Turing Gate and Collosus Way, between a 0.1% and 1% AEP.

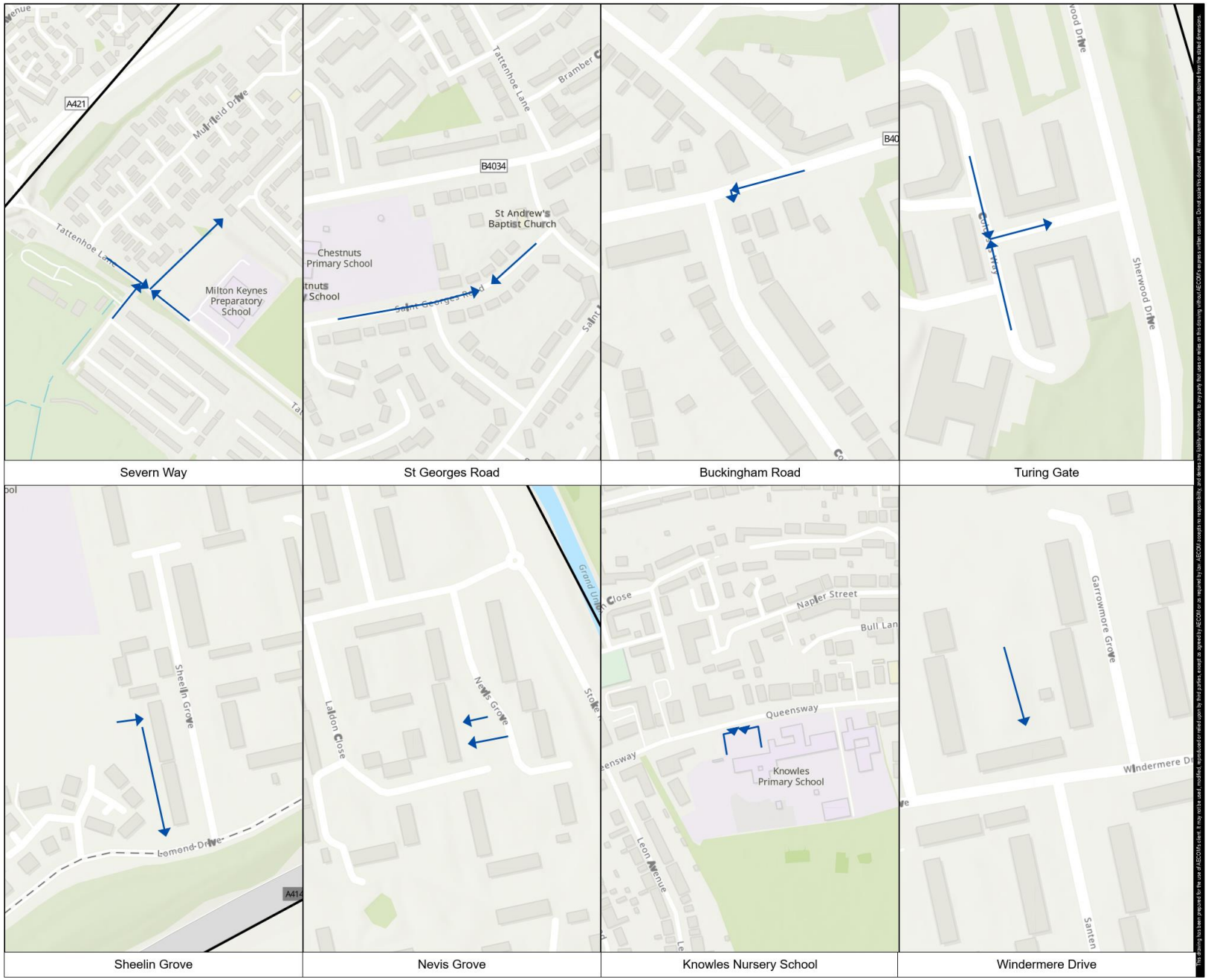
- The change in land use from greenfield to a construction area increased impermeable surface, resulting in surface water runoff towards the back of the affected properties along Sheelin Grove. The EA RoFSW map shows areas of surface water ponding at the impacted properties, suggesting localised topographic depressions.

- Impacted properties at Nevis Grove and Windermere Drive are characterised by sloped greenspaces which back onto the properties. The intense nature of the rainfall event, combined with the absence of gullies in the dividing footpath, likely caused internal flooding at these properties due to surface water flows. The EA RoFSW map corresponds with the findings at Nevis Grove however there is an absence of mapped surface water extents along Windermere Drive. This may suggest localised flooding issues that will not be captured by national mapping.

- Site observations identified numerous gullies near the impacted properties at St Georges Road and Turing Gate. However, rainfall analysis estimates that the rainfall event was a >0.1% AEP event across Bletchley. As such, this suggests that the AEP of the event was greater than the design standard for drainage systems and the capacity of the gullies was likely exceeded.

- The extensive impermeable surface of the Knowles Nursery car park, combined with the intensity of the rainfall event, led to external flooding, which was further exacerbated by boundary walls restricting water outflow.

- Anecdotal evidence from flood records noted balcony flooding at a property along Trent Road, suggesting localised external flooding issues.



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LEGEND

- Bletchley
- Surface Water Pathway
- Fluvial Pathway

NOTES

1: Esri Community Maps Contributors, Esri UK, Esri, TomTom, Garmin, GeoTechnologies, Inc, METI/NASA, USGS, Sources: Esri, Maxar, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap, and the GIS user community

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60740209

FIGURE TITLE

Bletchley Flow Paths

FIGURE VERSION

001

Figure 5-2: Bletchley Flow Paths

5.2 Bradwell

5.2.1.1 Flood Impacts

Records indicate 8 properties were affected in Bradwell by the flood event in September 2024. 6 of these properties reported internal flooding and 2 external only as shown in **Table 5-2**. **Figure 5-3** shows the reported flooding incidents within the Bradwell hotspot.

Table 5-2: Bradwell – Reports of Flooding

Bradwell	Type of Flooding	No. Properties Flooded
	Internal Flooding	6
	External Flood Only	2
	Unconfirmed	0
Total Reports of Property Flooding in Bradwell		**8**

- The areas of interest affected include: Abbey Road, Ramsay Close, Langcliffe Drive, Arncliffe Drive Bradwell Common Local Centre
- Anecdotal evidence from flood records provided by residents to MKCC noted external flooding at properties on Abbey Road and Langcliffe Drive.
- Anecdotal evidence from flood records provided by residents to MKCC noted internal flooding at properties along Ramsay Close, Arncliffe Drive and Bradwell Common Local Centre. Residents noted that the properties at Ramsay Close had not experienced flooding before.

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LEGEND
Bradwell
Count of Flooding Incidents
1
2
3 - 4
5 - 6
> 7

NOTES
1: Esri Community Maps Contributors, Esri UK, Esri, TomTom, Garmin, GeoTechnologies, Inc, METI/NASA, USGS, Esri, Intermap, NASA, NGA, USGS

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PROJECT NUMBER
60740209

FIGURE TITLE
Bradwell Flooding Incidents

FIGURE VERSION
001

Figure 5-3: Bradwell Flooding Incidents

5.2.1.2 Site Observations

Abbey Road

Properties along Abbey Road are located at an area of low elevation with steep sloped driveway towards the front of the properties (**Photograph 6**). Site observations found that there were no gullies in Abbey Road outside of the impacted properties. Therefore, surface water likely runs off the road and down the sloped driveways leading to external flooding.

Photograph 6

Ramsay Close

Ramsay Close is characterised by a slope which declines south-east, with run off likely from Quinton Drive. However, site observations found that there were no obvious flow paths towards the impacted properties on Ramsay Close suggesting localised flooding.

Arncliffe Drive

Tree roots within drains caused blockages during the flood event leading to localised drainage issues and internal flooding along Arncliffe Drive.

Langcliffe Drive

Langcliffe Drive has extensive impermeable surfaces due to the presence of large driveways and parking areas. The absence of raised kerbs allows vehicle access and parking but also contributes to surface water accumulation on the road and around property exteriors.

Bradwell Common Local Centre

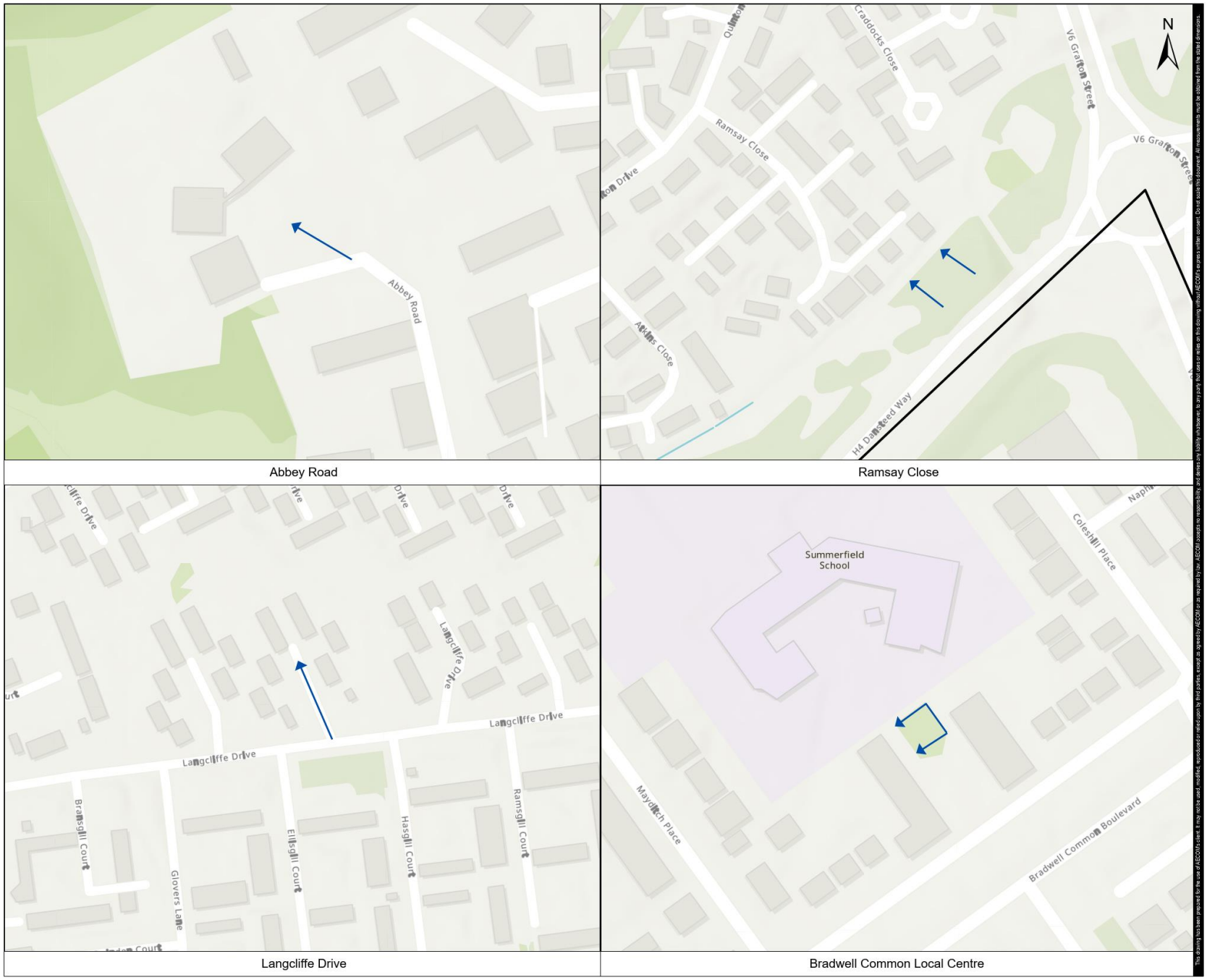
The area surrounding the Common Lane Local Centre includes a courtyard and playground constructed with impermeable materials. A gentle slope in topography likely directs surface water toward the Local Centre during heavy rainfall, despite the presence of drainage gullies.

5.2.1.3 Flood Sources and Mechanisms

Figure 5-4 illustrates the impacted areas and flow paths within the Bradwell hotspot. Following a review of the data and site walkover it is concluded that the flooding within the Bradwell hotspot was a result of the following:

- Analysis of rainfall data recorded across Bradwell, estimates that the rainfall event had > 0.1% AEP. This analysis highlights the intensity and rarity of the rainfall event.
- The steep sloped driveways along Abbey Road and absence of road gullies likely enabled the flow of surface water from the road towards the impacted properties.

- The EA RoFSW Map does not show any surface water extents at the impacted properties along Abbey Road, Langcliffe Drive and Arncliffe Drive suggesting highly localised flooding issues that will not be captured by national mapping. Flood records note that the problem of tree roots with drains along Arncliffe Drive had been resolved.
- Although site observations found no obvious flow paths towards the impacted properties along Ramsay Close, the EA RoFSW Map shows a large area of surface water flooding in the greenspace behind the impacted properties.
- The EA RoFSW map indicates significant surface water flooding in the area outside Bradwell Common Local Centre. This is likely due to the high proportion of impermeable surfaces and the sloping topography directing runoff toward the centre, leading to internal flooding during the event. Although gullies are present, they may have become blocked or overwhelmed during the flood event due to limited capacity.
- Data provided by MKCC indicates that reported incidents were isolated and did not occur within a specific area. It is likely that the impacted properties were located at lower elevations leading to water ingress.



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LEGEND
- Bradwell
- Surface Water Pathway
- Fluvial Pathway

NOTES
1: Esri Community Maps Contributors, Esri UK, Esri, TomTom, Garmin, GeoTechnologies, Inc, METI/NASA, USGS, Sources: Esri, Maxar, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap, and the GIS user community

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PROJECT NUMBER
60740209

FIGURE TITLE
Bradwell Flow Paths

FIGURE VERSION
001

Figure 5-4: Bradwell Flow Paths

5.3 Emberton

5.3.1.1 Flood Impacts

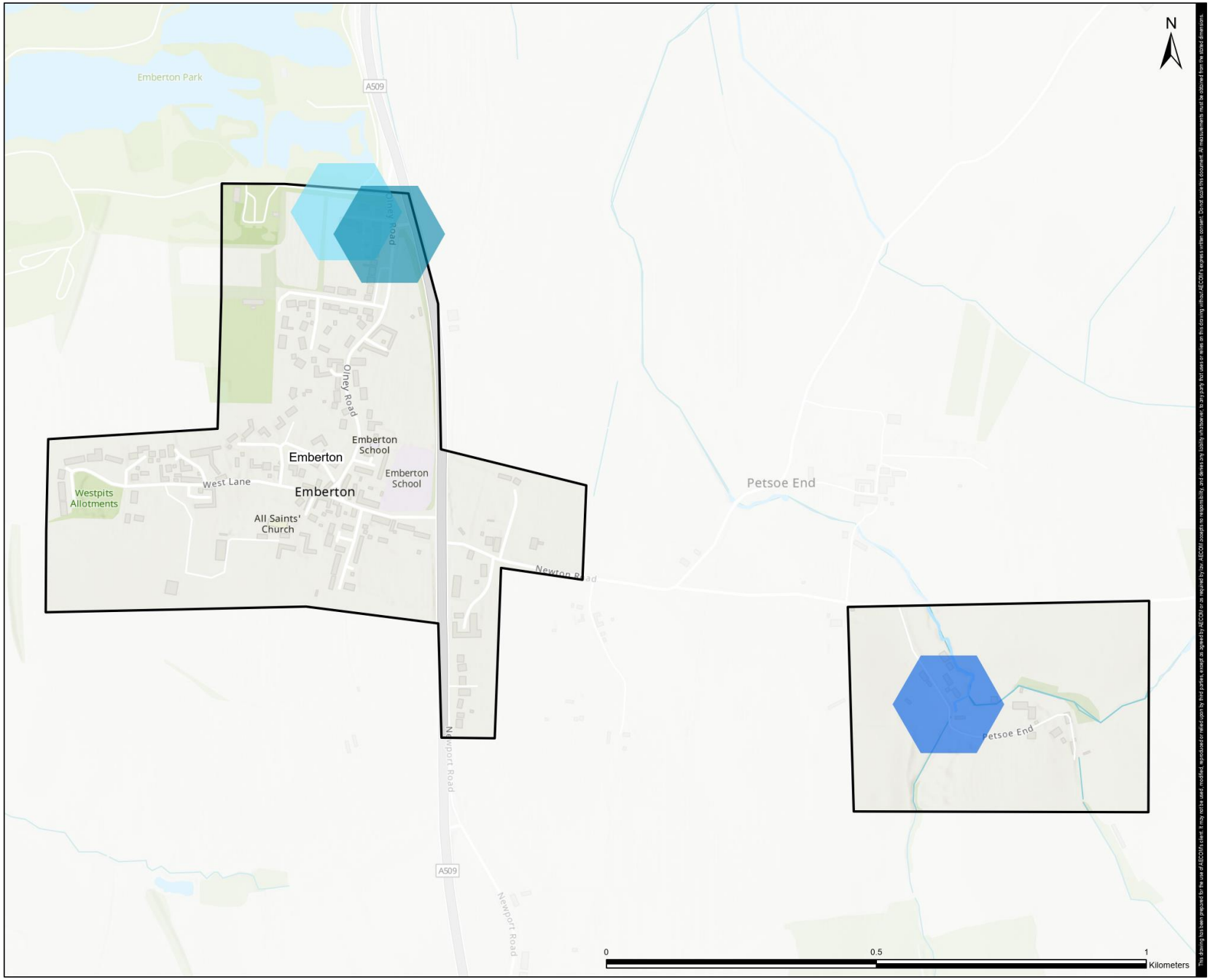
Records indicate 11 properties were affected in Emberton by the flood event in September 2024. None of these properties reported internal flooding and 6 external only as shown in **Table 5-3**. **Figure 5-5** shows the reported flooding incidents within the Emberton hotspot.

Table 5-3: Emberton – Reports of Flooding

Emberton	Type of Flooding	No. Properties Flooded
	Internal Flooding	5
	External Flood Only	6
	Unconfirmed	0
Total Reports of Property Flooding in Emberton		**11**

- The areas of interest affected include: Olney Road, Harvey Drive and properties within Petsoe End.
- Anecdotal evidence from flood records provided by residents to MKCC noted external flooding at the front of properties along Olney Road.
- Anecdotal evidence from flood records provided by residents to MKCC noted external flooding outside properties along Harvey Drive from a manhole, due to the nearby pumping station becoming overwhelmed during the flood event. Information from AW corresponds with anecdotal evidence, noting that tankers were on site to assist.
- Anecdotal evidence from flood records provided by residents to MKCC noted internal flooding at properties within Petsoe End, with multiple properties evacuated due to water ingress. On 22nd September Buckinghamshire Fire & Rescue attended an internal flooding incident at Petsoe End and used a lightweight portable pump to reduce the water level inside a property. Three people were also rescued from flood water at Petsoe End by firefighters using a wide area flooding kit and rescue sled[25].

[25] Buckinghamshire Fire and Rescue Service (2024) Flood Related Incidents. Available: Flooding related incidents - Buckinghamshire Fire & Rescue Service



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LEGEND

Emberton

Count of Flooding Incidents

- 1
- 2
- 3 - 4
- 5 - 6
- > 7

NOTES

1: Esri Community Maps Contributors, Esri UK, Esri, TomTom, Garmin, GeoTechnologies, Inc, METI/NASA, USGS, Sources: Esri, Maxar, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap, and the GIS user community

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PROJECT NUMBER

60740209

FIGURE TITLE

Emberton Flooding Incidents

FIGURE VERSION

001

Figure 5-5: Emberton Flooding Incidents

5.3.1.2 Site Observations

Olney Road

Photograph 7 shows that Olney Road is characterised by a gentle slope, which declines to the north towards Harvey Drive. At the northern end of Olney Road, a ditch is located opposite the impacted properties. However, it was noted that the ditch looked as if it had recently been de-vegetated and cleared. This suggests that this ditch may have been overgrown and highly vegetated leading to excess floodwater on the road causing external flooding at properties along Olney Road. During the site visit it was highlighted that Olney Road is busy with traffic. As such, bow waves are likely to have contributed to the external flooding at the impacted properties.

Photograph 7

Harvey Drive

As shown in **Photograph 8**, an AW Pumping Station is located in close proximity to properties along Harvey Drive. A large manhole is also located outside the impacted property. It is likely that stormwater from Emberton overwhelms the pumping station causing the manhole to discharge outside the properties.

Photograph 8

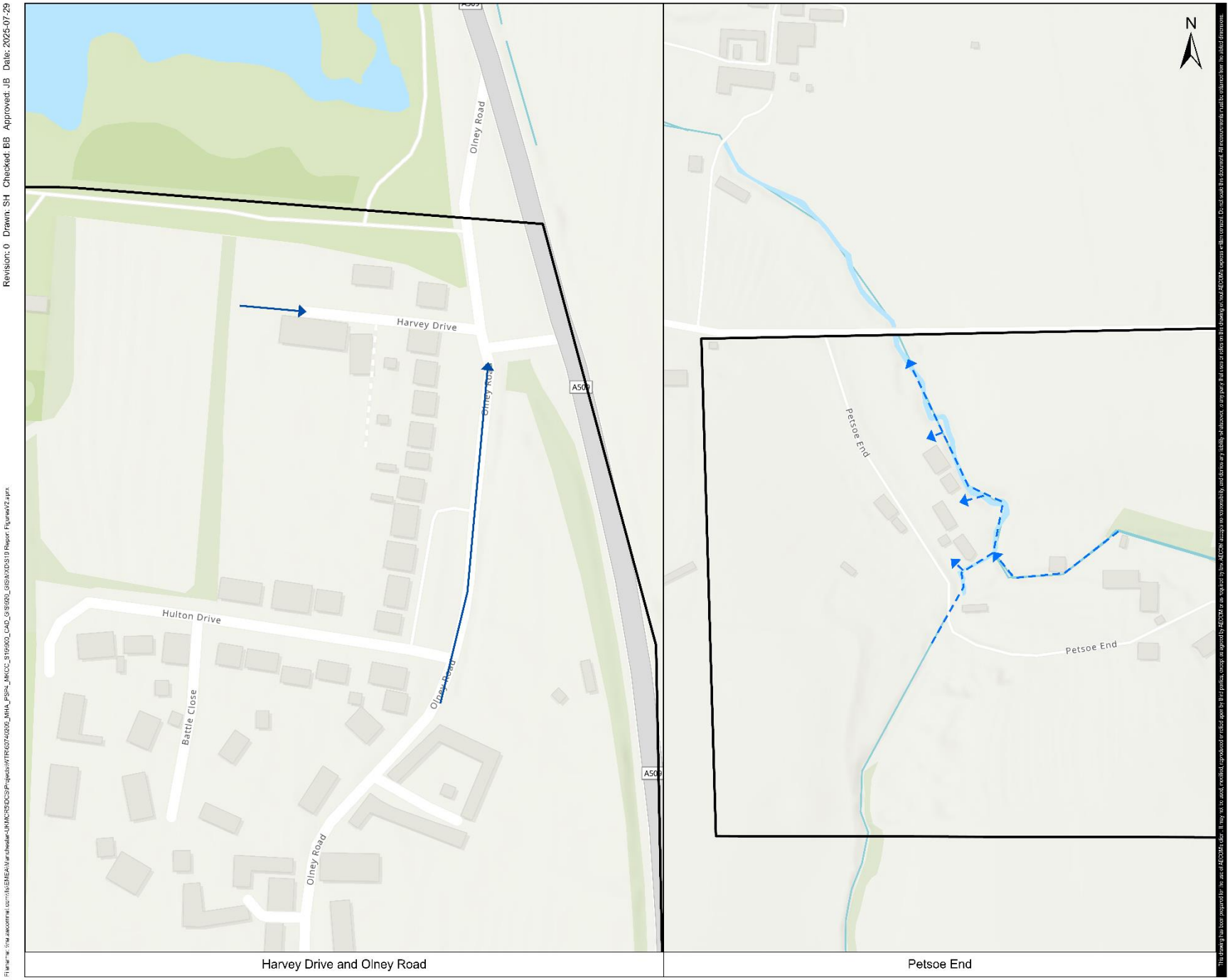
Petsoe End

Flooded properties within Petsoe End are located in close proximity to the confluence of two unnamed Ordinary Watercourses. A smaller Ordinary Watercourse drains the adjacent greenspace and is culverted beneath a road. It then flows through the garden of an affected properties, where it joins a larger Ordinary Watercourse. This larger watercourse runs behind impacted properties and eventually discharges into the River Great Ouse upstream. During the rainfall event, it is likely that the capacity of these watercourses was exceeded, resulting in out of bank flows and internal flooding at several properties within Petsoe End.

5.3.1.3 Flood Sources and Mechanisms

Figure 5-6 illustrates the impacted areas and flow paths within the Bradwell hotspot. Following a review of the data and site walkover it is concluded that the flooding within the Emberton hotspot was a result of the following:

- Analysis of rainfall radar data highlights the intensity of the rainfall, as estimates indicate that the rainfall event at Emberton was a 1.3% – 1% AEP event.
- Site observations found that Olney Road slopes from south to north which would convey flood water along the impermeable road. At the northern end, a recently cleared ditch is located on the opposite side of the road from the impacted properties. It is likely that this ditch may have been overgrown and highly vegetated leading to excess floodwater on the road causing external flooding at properties along Olney Road. Furthermore, bow waves likely contribute to external flooding at the impacted properties. The EA RoFSW map shows surface water extents along the length of Olney Road during all mapped AEP events. Information provided by AW noted that the foul system was also overwhelmed, due to surface water being incorrectly connected to the foul network from some properties, as well as a blockage in a private manhole.
- Anecdotal evidence from residents reported external flooding due to manhole surcharge along Harvey Drive. Site observations confirmed the existence of an AW pumping station located at the end of Harvey Drive. It is likely that the pumping station was overwhelmed by the high volume of surface water resulting from intense rainfall in Emberton, leading to surcharges and preventing foul discharge from properties. AW noted that tankers were on site to assist.
- Internal flooding at properties in Petsoe End is likely the result of fluvial flooding from unnamed Ordinary Watercourses that flow through the area. Anecdotal evidence highlights the severity of the flooding, as flood records note properties were evacuated and online sources note that Buckinghamshire Fire and Rescue service were called to the incidents to reduce internal flood levels and assist with evacuation. According to the EA FMfP, the impacted properties are located adjacent to Flood Zones 2 and 3 associated with an unnamed Ordinary Watercourse.



Revision: 0 Drawn: SH Checked: BB Approved: JB Date: 2025-07-29

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PROJECT
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LEGEND
- Emberton
- Surface Water Pathway
- Fluvial Pathway

NOTES
1: Esri Community Maps Contributors, Esri UK, Esri, TomTom, Garmin, GeoTechnologies, Inc, METI/NASA, USGS, Sources: Esri, Maxar, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap, and the GIS user community

ISSUE PURPOSE
DRAFT

PROJECT NUMBER
60740209

FIGURE TITLE
Emberton Flow Paths

FIGURE VERSION
001

Figure 5-6: Emberton Flow Paths

5.4 Lavendon

5.4.1.1 Flood Impacts

Records indicate 44 properties were affected in Lavendon by the flood event in September 2024. 34 of these properties reported internal flooding and 10 external only as shown in **Table 5-4**. **Figure 5-7** shows the reported flooding incidents within the Lavendon hotspot.

Table 5-4: Lavendon – Reports of Flooding

Lavendon	Type of Flooding	No. Properties Flooded
	Internal Flooding	34
	External Flood Only	10
	Unconfirmed	0
Total Reports of Property Flooding in Lavendon		**44**

- The areas of interest affected include: New Row, Rectory Farm, Harrold Road, Northampton Road, The Glebe, Castle Road, Olney Road, Jacks Close, Lavendon Baptist Church, Joiners Way and Tinick Crescent.
- Anecdotal evidence from flood records provided by residents to MKCC noted internal flooding at properties at New Row and Rectory Farm from adjacent fields. As such, residents excavated an informal trench behind the properties along New Row during the flood event to try to divert the water.
- Anecdotal evidence from flood records provided by residents to MKCC noted internal flooding at properties along Harrold Road.
- Anecdotal evidence from flood records provided by residents to MKCC noted internal flooding at properties along Northampton Road, from surface water runoff, despite the implementation of sandbags.
- As presented in **Photograph 9**, The Glebe was flooded. The two informal storage areas, one shown in **Photograph 10** located either side of The Glebe and the two culverts underneath The Glebe exceeded maximum capacity.
- As presented in **Photograph 11**, Castle Road was flooded. Anecdotal evidence provided by residents suggested groundwater flooding at impacted properties in the north section of Castle Road. Anecdotal evidence from flood records provided by residents to MKCC noted internal ground floor flooding at properties along the south section Castle Road due to water ingress from the back of the houses through the gardens. It was reported that flood water flowed through and around the properties to converge with floodwater on Castle Road. The high level of disruption is clear from photographic evidence of the significant depth and extent of flooding.
- **Photograph 12** shows flooding in the centre of Lavendon where Northampton Road meets Olney Road. Anecdotal evidence from flood records provided by residents to MKCC noted internal flooding at properties along Olney Road despite the use of sandbags. Sewer backups were also reported leading to further internal flooding. During the flood event on the 22nd September 2024, the fire service attended a flooding incident which affected multiple properties at Olney Road. A flooding kit was used, and road closures were put in place highlighting the high level of disruption.
- Anecdotal evidence from flood records provided by residents to MKCC noted external flooding at a property along Jacks Close, with water up to the threshold of the front door and flowing through the back garden of the property. AW was called to the property during the event.
- Anecdotal evidence from flood records provided by residents to MKCC noted internal flooding at Lavendon Baptist Church due to surcharging of the foul sewer system inside the property. As such, site observations were not undertaken at this location.
- Anecdotal evidence from flood records provided by residents to MKCC noted external flooding at properties along Joiners Way and Tinick Crescent.

Photograph 9

Source: Facebook Group

Photograph 10

Source: Facebook Group

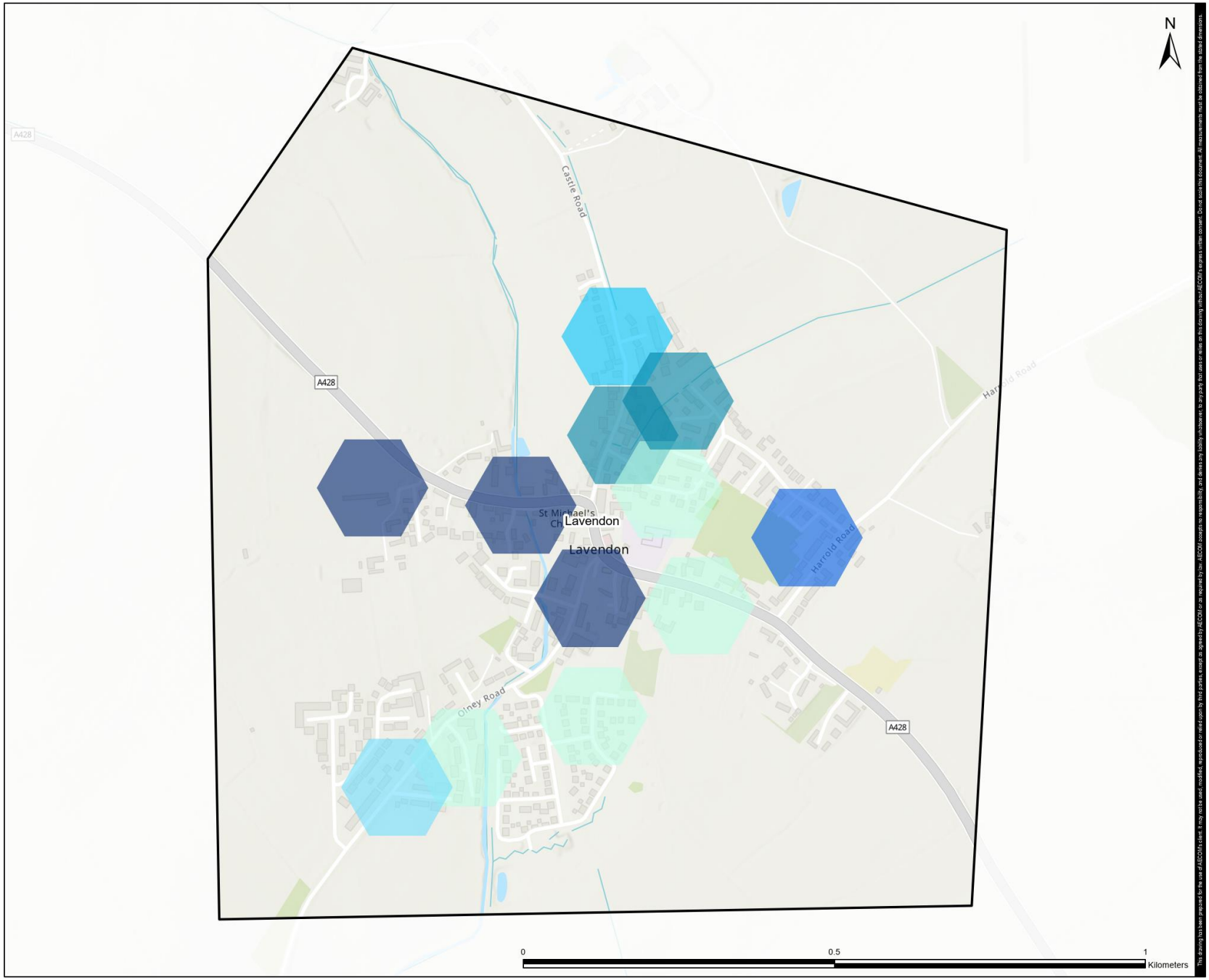
Photograph 11

Source: MKCC

Photograph 12

Source: BBC News [Online], News Article Published 22nd September 2024[26]

[26] BBC News (2024) Major roads closed after heavy rain hits towns. Available: Watford, Bedford and Milton Keynes roads closed after heavy rain - BBC News



Revision: 0 Drawn: SH Checked: BB Approved: JB Date: 2025-07-31

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LEGEND
Lavendon
Count of Flooding Incidents
1
2
3 - 4
5 - 6
> 7

NOTES
1: Esri Community Maps Contributors, Esri UK, Esri, TomTom, Garmin, GeoTechnologies, Inc, METI/NASA, USGS, Sources: Esri, Maxar, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap, and the GIS user community

ISSUE PURPOSE
FINAL

PROJECT NUMBER
60740209

FIGURE TITLE
Lavendon Flooding Incidents

FIGURE VERSION
001

Figure 5-7: Lavendon Flooding Incidents

5.4.1.2 Site Observations

New Row and Rectory Farm

Greenspace borders impacted properties at New Row and Rectory Farm. **Photograph 13** shows a decline in topography towards New Row with a natural depression behind the properties. It is likely that water seeped through the walls, at the back of the properties, due to the notable age of the buildings and relative structural stability. It was evident that residents had excavated a ditch behind the properties in an attempt to divert the water. At the time of the site visit, sandbags at the back of the properties were still in place. Similarly, the topography of the adjacent greenspace declines towards Rectory Farm, likely channelling surface water flows towards the property.

Photograph 13

Harrold Road

Lavendon Park is located behind impacted properties along Harrold Road. Site visit observations noted that the topography at Lavendon Park slopes towards the rear of the properties. Surface water is likely conveyed down this slope towards Harrold Road. Site observations also noted the presence of an overgrown ditch which bounds the greenspace at the junction of Harrold Road and The Glebe. This may have contributed to flooding along Harrold Road.

Northampton Road

Northampton Road is characterised by a slope which declines southeast. The road is relatively wide due to on street parking. The high levels of impermeable surfaces increase the rate and volume of surface water conveyed downslope towards the centre of Lavendon. Northampton Road slopes towards the impacted properties (**Photograph 14**) and flows are likely to be conveyed to the area of lowest elevation. Although there is a small kerb outside the properties, the property thresholds are at kerb height which increases the risk of water ingress in the event of surface water on the footpath. Site visit observations noted that there are numerous drains along Northampton Road which suggests that these may have been blocked or exceeded capacity during the flood event.

Photograph 14

The Glebe

Site observations confirmed that two flood storage basins are located either side of The Glebe connected to a small unnamed Ordinary Watercourse. Two large square culverts (**Photograph 15**) allow water to follow under The Glebe into the second basin where the water is then culverted through a small pipe (**Photograph 16**) back into the unnamed Ordinary Watercourse. The water likely overspilled the two basins onto the road and into the gardens of adjacent properties due to a constriction in flow through the small pipe into the Unnamed Ordinary Watercourse. The gardens of the impacted properties also have a low threshold.

Photograph 15

Photograph 16

Castle Road

Castle Road is characterised by a steep slope, which declines south towards the centre of Lavendon. Significant flooding was reported along Castle Road, which likely conveyed water towards other impacted areas within Lavendon. Site visit observations noted that impacted properties in the northern section of Castle Road are unlikely to be affected by surface water due the slope in topography away from the properties, suggesting localised flooding. However, blocked or infilled culverts were noted within the ditch along the eastern side of Castle Road adjacent to greenspace. This blockage may lead to overspill onto the impermeable road surface therefore increasing the amount of surface water flowing down Castle Road.

An unnamed Ordinary Watercourse flows behind properties located in the south section of Castle Road (**Photograph 17**). The size of the channel alongside the intensity of the rainfall event likely led to flooding of the Ordinary Watercourse. The channel had been eroded (**Photograph 18**) and fencing and decking had been damaged during the flood event. As such, it is likely that the channel capacity was exceeded, and water flowed through the back gardens into adjacent properties.

Photograph 17

Photograph 18

Olney Road

Olney Road meets at a midpoint on Northampton Road; this allows for the confluence of flows and contributes to the volume of surface water conveyed downslope towards Olney Road. As shown in **Photograph 19**, the kerb has

been dropped at the top of Olney Road to allow for pedestrian access. The kerb then raises significantly in front of low threshold properties to prevent overtopping of flow from the road. However, it is likely that water is conveyed behind the raised kerb, due to the dropped kerb at the top of Olney Road, which then becomes trapped and flows into adjacent properties with low thresholds. Site observations found that there is a drain behind the raised kerb however this is small and was partially blocked. As such, the water likely ponds at the front of the properties during a flood event causing seepage and surface water ingress. The road slopes towards impacted properties at the south of Olney Road, down a small side street.

Photograph 19

Jacks Close

An area of greenspace adjacent to Jacks Close declines towards impacted properties, likely directing flows along Jacks Close. Gullies were identified along Jacks Close suggesting these became blocked or exceeded capacity during the rainfall event.

Joiners Way and Tinick Crescent

Both Joiners Way and Tinick Crescent are characterised by relatively long and impermeable roads, likely causing external flooding at impacted properties. Gullies were identified along Joiners Way and Tinick Crescent suggesting these became blocked or exceeded capacity during the rainfall event.

5.4.1.3 Flood Sources and Mechanisms

Figure 5-8 illustrates the impacted areas and flow paths within the Lavendon hotspot. Following a review of the data and site walkover it is concluded that the flooding within the Lavendon hotspot was a result of the following:

- Analysis of rainfall data recorded across Lavendon, estimates that the rainfall event had a > 0.1% AEP. This analysis highlights the intensity and rarity of the rainfall event.
- The upstream catchment is predominantly rural, and MKCC representatives noted that rural areas had undergone a recent harvest. Therefore, without crops, this reduces the rate of infiltration and increases surface water runoff.
- Anecdotal evidence from residents noted internal flooding at the back of properties along New Row from the adjacent greenspace despite residents excavating an informal trench in an attempt to divert flood water. Site visit observations confirmed this and found a decline in topography towards the impacted properties. The EA RoFSW shows surface water extents at the back of properties along New Row during a 0.1% AEP event, suggesting a localised depression in topography corresponding with site observations.
- Anecdotal evidence from residents noted internal flooding at Rectory Farm from adjacent greenspace. Site observations confirmed a decline in topography towards Rectory Farm, likely conveying flows towards the impacted properties. Flood records noted that drains were kept clear during the flood event suggesting that the system was overwhelmed due to the intensity of the rainfall exceeding its design capacity.

- Anecdotal evidence from residents noted flooding at the back of properties along Harrold Road from the adjacent green space at Lavendon Park. Site observations of Lavendon Park confirmed the likelihood of a flow pathway behind the gardens, due to a decline in topography towards Harrold Road and a small depression behind the impacted properties. An overgrown ditch was also found in the greenspace at the junction of Harrold Road and The Glebe, contributing to flooding of Harrold Road. The EA RoFSW supports these findings as surface water extents are shown during the 0.1% AEP event, behind impacted properties adjacent to Lavendon Park.
- Despite the permeable surfaces of the greenspaces at New Row and Lavendon Park properties were still impacted, highlighting the intense nature of the rainfall event. Antecedent conditions did not contribute to surface water flooding within Milton Keynes, as the ground had been relatively dry over the preceding months.
- Site observations found that a section of Northampton Road slopes towards impacted properties due to on street parking. It is likely that flows from Northampton Road will be conveyed towards the low topography area. Thresholds at these properties were at kerb height, increasing the likelihood of surface water ingress. The EA RoFSW shows surface water extents along Northampton Road and at impacted properties, supporting the findings from flood records and site observations.
- Anecdotal evidence from residents and photographic evidence from MKCC indicates that the informal flood storage basins at The Glebe exceeded capacity and led to flooding of adjacent properties. Site observations found that an unnamed Ordinary Watercourse flows parallel to the impacted properties. Therefore, it is likely that once the storage areas reached capacity, water would likely flow into the adjacent properties. Furthermore, site observations found that the outlet culvert is relatively small in comparison to the flood storage basins, resulting in a constriction in flow and likely overspill of the basins during a flood event.
- Anecdotal evidence from residents noted internal flooding of properties located at the south end of Castle Road. Photographic evidence from MKCC shows out of bank flow from an unnamed Ordinary Watercourse located behind the properties, with flood water conveying through properties and onto Castle Road. Site observations found that the unnamed Ordinary Watercourse banks were eroded, and fencing had been washed away during the flood event. The channel was highly vegetated, and its limited size, combined with the intensity of the rainfall, did not provide sufficient capacity to accommodate floodwater. As such, it is likely that flows exceeded the channel capacity and flowed through adjacent properties to the area of lowest elevation on Castle Road. This corresponds with the findings of the Lavendon S19 Flood Investigation 2020[14].
- Several roads decline towards Olney Road, including Castle Road, Northampton Road and High Street resulting in large volumes of water flowing down Olney Road. Site observations found that a dropped kerb at the top of Olney Road likely diverts flows along the pavement towards low threshold properties. The water likely becomes trapped due to a raised kerb. Furthermore, only one small gully was located on this section of footpath, outside of the impacted properties, resulting in slow drainage of flood water and ponding in this area.
- Castle Road conveys flows towards Olney Road, with both roads acting as an informal drainage route. These findings correspond with EA RoFSW Map, as surface water is shown to flow from the unnamed Ordinary Watercourse, onto Castle Road and flow towards Olney Road during all AEP events.
- Review of the data highlights that surface water flows were conveyed along roads from the upper catchment. Numerous gullies were identified during the site visit. Rainfall analysis estimates that the rainfall event was a >0.1% AEP event across Lavendon. Due to rarity of the rainfall event, this suggests that the AEP of the event was greater than the design standard for drainage systems and the capacity of the gullies was likely exceeded. It was also noted by MKCC that the gullies in Lavendon were last cleaned in May 2023.
- Site observations confirmed an area of greenspace adjacent to Jacks Close which declines towards the impacted properties likely conveying flows. Anecdotal evidence noted that AW attended the property during the flood event, suggesting issues with the local sewer network which may have contributed to the extent of flooding.
- Anecdotal evidence noted internal flooding at Lavendon Baptist Church due to surcharging of the foul sewer system inside the property.

- Joiners Way and Tinick Crescent feature long, impermeable roads that likely led to to external flooding at impacted properties. The presence of gullies along both roads suggests they either became blocked or were overwhelmed during the rainfall event.

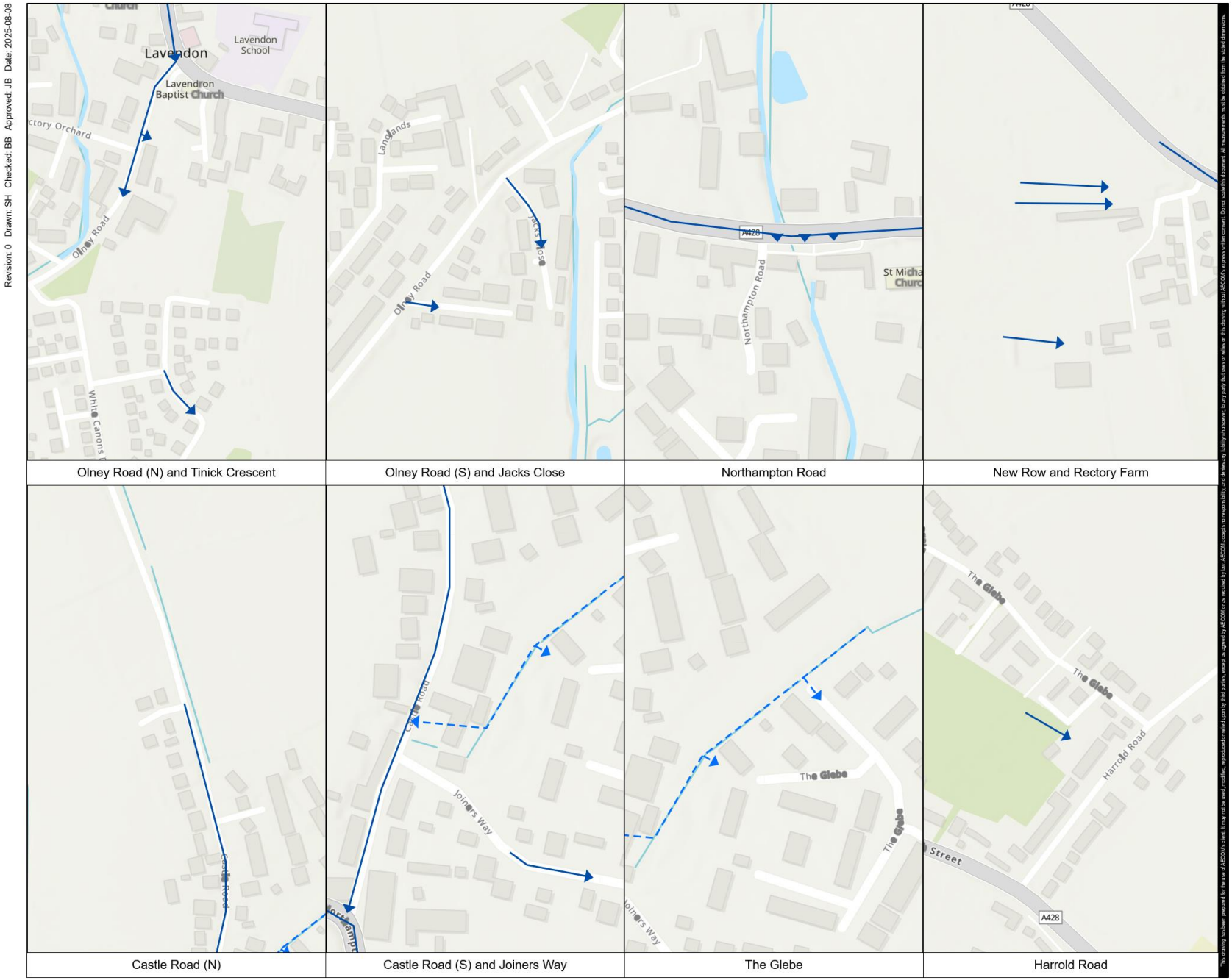


Figure 5-8: Lavendon Flow Paths

5.5 Newport Pagnell

5.5.1.1 Flood Impacts

Records indicate 15 properties were affected in Newport Pagnell by the flood event in September 2024. 10 of these properties reported internal flooding, 4 external only and 1 unconfirmed as shown in **Table 5-5**. **Figure 5-9** shows the reported flooding incidents within the Newport Pagnell hotspot.

Table 5-5: Newport Pagnell – Reports of Flooding

Newport Pagnell	Type of Flooding	No. Properties Flooded
	Internal Flooding	10
	External Flood Only	4
	Unconfirmed	1
Total Reports of Property Flooding in Newport Pagnell		**15**

- The areas affected include: High Street, Tickford Street, Priory Street, Woad Farm and Gog Lane.
- Anecdotal evidence from flood records provided by residents to MKCC indicated internal flooding at a property on High Street due to overtopping of the Great River Ouse during the flood event.
- Anecdotal evidence from flood records provided by residents to MKCC indicated external flooding at properties along Tickford Street (**Photograph 20**). **Photograph 21** shows out of bank flow of the River Ouzel from Tickford Bridge and subsequent flooding of the adjacent greenspace.
- As shown in **Photograph 22 and Photograph 23**, Priory Street was significantly flooded. Anecdotal evidence from flood records provided by residents to MKCC noted internal flooding at multiple properties along Priory Street despite the use of sandbags. A reported incident to MKCC suggests the water level reached approximately 300 mm within the entrance to a private property. As shown in **Photograph 24,** a water rescue sled was used to rescue residents from two properties on Priory Street. Due to the significant level of flooding, Priory Street was closed[27].
- Anecdotal evidence from flood records provided by residents to MKCC indicated internal flooding at Woad Farm due to bow waves caused by traffic along Sherington Road.
- Anecdotal evidence from flood records provided by residents to MKCC indicated internal flooding at properties along Gog Lane.

Photograph 20

Source: YouTube - Talk Shows Central by DRM, News Video Published 24th October 2024[28]

[27] BBC News (2024) Flooding across the East of England. Available: https://www.bbc.co.uk/news/live/c20md54evvmt
[28] Talk Shows Central by DRM (2024) 'Terrible' Flooding Engulfs Newport Pagnell After Heavy Rainfall

Photograph 21

Source: Yahoo!News [Online], News Article Published 24th September 2024[29]

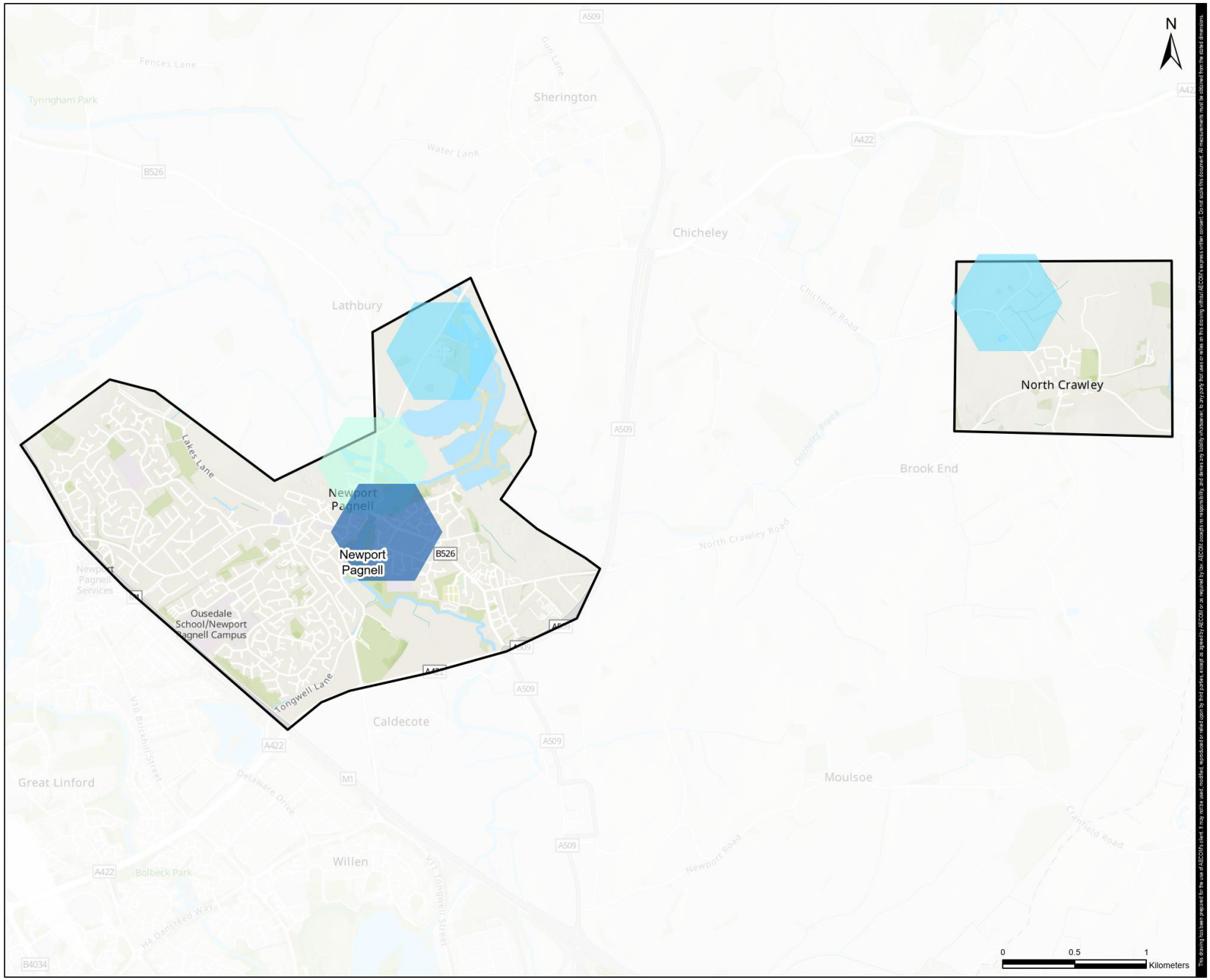
Photograph 22

Source: MK Citizen [Online], News Article Published 24th September 2024

Photograph 23

Source: Facebook Group

[29] Yahoo!News (2024) Parts of small English tow underwater as river burst its banks. Available: Parts of small English town underwater as river bursts its banks



Revision: 0 Drawn: SH Checked: BB Approved: JB Date: 2025-07-31

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LEGEND

Newport Pagnell

Count of Flooding Incidents

1
2
3 - 4
5 - 6
> 7

NOTES

1: Esri, Intermap, NASA, NGA, USGS, Esri UK, Esri, TomTom, Garmin, GeoTechnologies, Inc, METI/NASA, USGS

ISSUE PURPOSE

FINAL

PROJECT NUMBER

60740209

FIGURE TITLE

Newport Pagnell Flooding Incidents

FIGURE VERSION

001

Figure 5-9: Newport Pagnell Flooding Incidents

5.5.1.2 Site Observations

High Street

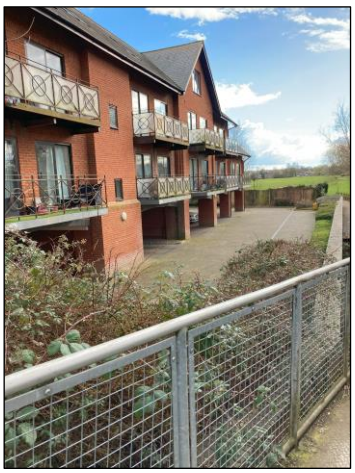
The impacted property is located immediately adjacent to the River Great Ouse. Site observations noted significant erosion of the nearby embankment. As such, it is likely that out of bank flow led to internal flooding through external doors and seepage through walls of the property.

Tickford Street

Tickford Street is relatively wide due to on street parking, providing a large area of impermeable surface (**Photograph 24**). The road gradually slopes away from Tickford Bridge, likely channelling water down Tickford Street. Site observations found that Tickford Street is a busy road, with bow waves from passing vehicles potentially contributing to external flooding at properties along the road, as evidenced in **Photograph 21**. During the site visit, it was also noted that various gullies were located along Tickford Street which were clear.

Photograph 24

Reports also noted external flooding at impacted properties near Tickford Street. Site observations found that the building is situated at a lower elevation, at river level, compared to Tickford Street, and is adjacent to the Main River Ouzel. Despite the presence of a boundary wall (**Photograph 25**), it is likely that the river was overtopped during the flood event and floodwater seeped through and/or overtopped the wall. This was evidenced by damaged vegetation and the eroded embankment along the riverside, which was littered with washed up debris (**Photograph 26)**. All residential properties in this location are elevated above river level, as the building is constructed on stilts and the area underneath is used as a car park (**Photograph 25**). The large impermeable area reduces capacity for infiltration and likely led to ponding of flood water behind the boundary wall.



Photograph 25

Photograph 26

Priory Street

Flooding on Priory Street occurred due to elevated water levels in the River Great Ouse, which prevented the discharge of surface water into the river. As a result, the capacity of the surrounding land to drain effectively was reduced, leading to the surface water system becoming overwhelmed and surcharging. Additionally, surface water accumulated behind fluvial defences, further contributing to the flooding. As shown in **Photograph 27**, the kerb heights along Priory Street are high, suggesting that floodwater exceeded this height, leading to surface water ingress. At the time of the site visit, sandbags were still in place at the front of properties. Numerous gullies were identified during the visit suggesting the capacity was exceeded or became blocked during the flood event.

Photograph 27

Woad Farm

The impacted property is located at the intersection of Sherington Road and Northampton Road which are both long, fast-moving, and impermeable routes causing bow waves which likely exacerbated the extent of flooding at Woad Farm. Site observations also noted that Woad Farm is located in close proximity to the River Great Ouse.

Gog Lane

No gullies were identified along Gog Lane, however a small ditch runs parallel to the road bordering the greenspace opposite the impacted properties. Furthermore, small unnamed ordinary watercourses drain the greenspace which is then culverted under Gog Lane. It is likely that these small ditches and ordinary watercourses, which act as drainage systems, became overwhelmed leading to out of banks flows and internal flooding of properties.

5.5.1.3 Flood Sources and Mechanisms

Figure 5-10 illustrates the impacted areas and flow paths within the Newport Pagnell hotspot. Following a review of the data and site walkover it is concluded that the flooding within the Newport Pagnell hotspot was a result of the following:

- Analysis of recorded radar rainfall data indicated that the rainfall was less intense at Newport Pagnell compared to other hotspots, as analysis estimated 20% - 10% AEP compared to >0.1% AEP at surrounding hotspots and rain gauges. However, high river flows were recorded at the River Great Ouse and record water levels were logged at the River Ouzel. Both Main Rivers flow through Newport Pagnell, suggesting fluvial flooding characterised the flood event at this hotspot.

- Fluvial flooding likely caused internal flooding at a property along High Street, situated at river level adjacent to the River Great Ouse. Site observations noted the eroded embankment of the Main River next to the property, and anecdotal evidence indicated that existing Property Flood Resilience (PFR) measures were ineffective. This highlights the severity of fluvial flooding during the flood event. The EA FMfP shows extensive fluvial flooding this area, with the impacted property situated within Flood Zone 2 and 3.

- The slope and width of Tickford Street creates a key surface water pathway. These finding correspond with the extensive surface water flooding shown on the EA RoFSW map, during the 0.1% AEP event. Tickford Street is a high traffic road therefore bow waves likely contributed to external flooding.

- **Photograph 22** was taken from Tickford Bridge and shows the extent of fluvial flooding due to the overtopping of the River Ouzel. High water levels in the River Great Ouse prevented the River Ouzel from discharging, resulting in elevated river levels and backwater flooding. Furthermore, the confluence of the Ouzel with Tongwell Brook led to high river level at Tickford Bridge which is downstream of the confluence. Alongside anecdotal evidence from residents, it is likely that the floodwater seeped through the boundary wall which borders the raised properties near Tickford Street. The large impermeable car park likely caused ponding of fluvial floodwater in this area, leading to a rupture of the sewer system at the properties, as noted by residents. The EA FMfP shows fluvial flood extents up to the boundary wall, under a defended scenario, corresponding with site observations.

- Anecdotal evidence from residents and photographic evidence from MKCC highlights the severity of the internal and external flooding along Priory Street. Elevated water levels in the River Great Ouse, prevented the discharge of surface water from Priory Street into the river. As a result, the surface water system became overwhelmed and surcharged preventing drainage of surface water along Prioery Street. The RoFSW map also shows Priory Street at risk of surface water flooding during all AEP events, confirming the findings that surface water contributed to the severity of flooding at this location.

- Numerous gullies were identified during the site visit along Tickford Street and Priory Street. However, the intensity of rainfall and high levels of the River Ouzel caused surcharging of drains and surface water flooding to the low ground sections at Priory Street. It is understood to be caused by the incapacity of the surface water drainage system to discharge into the River Ouzel.

- The EA FMfP shows extensive fluvial flooding in this area, with the impacted property situated within Flood Zone 2 and 3. Anecdotal evidence from residents noted that bow waves likely exacerbated flooding at the properties due to being located at the intersection of two main roads.

- Multiple unnamed Ordinary Watercourses and ditches drain the greenspace located near the impacted properties on Gog Lane. Due to the intense nature of the flood event, it is likely that these became overwhelmed leading to out of bank flow and internal flooding. The EA RoFSW map shows surface water flow paths from the Ordinary Watercourses toward the impacted properties during all AEP events, confirming the findings that surface water contributed to the flooding at this location.

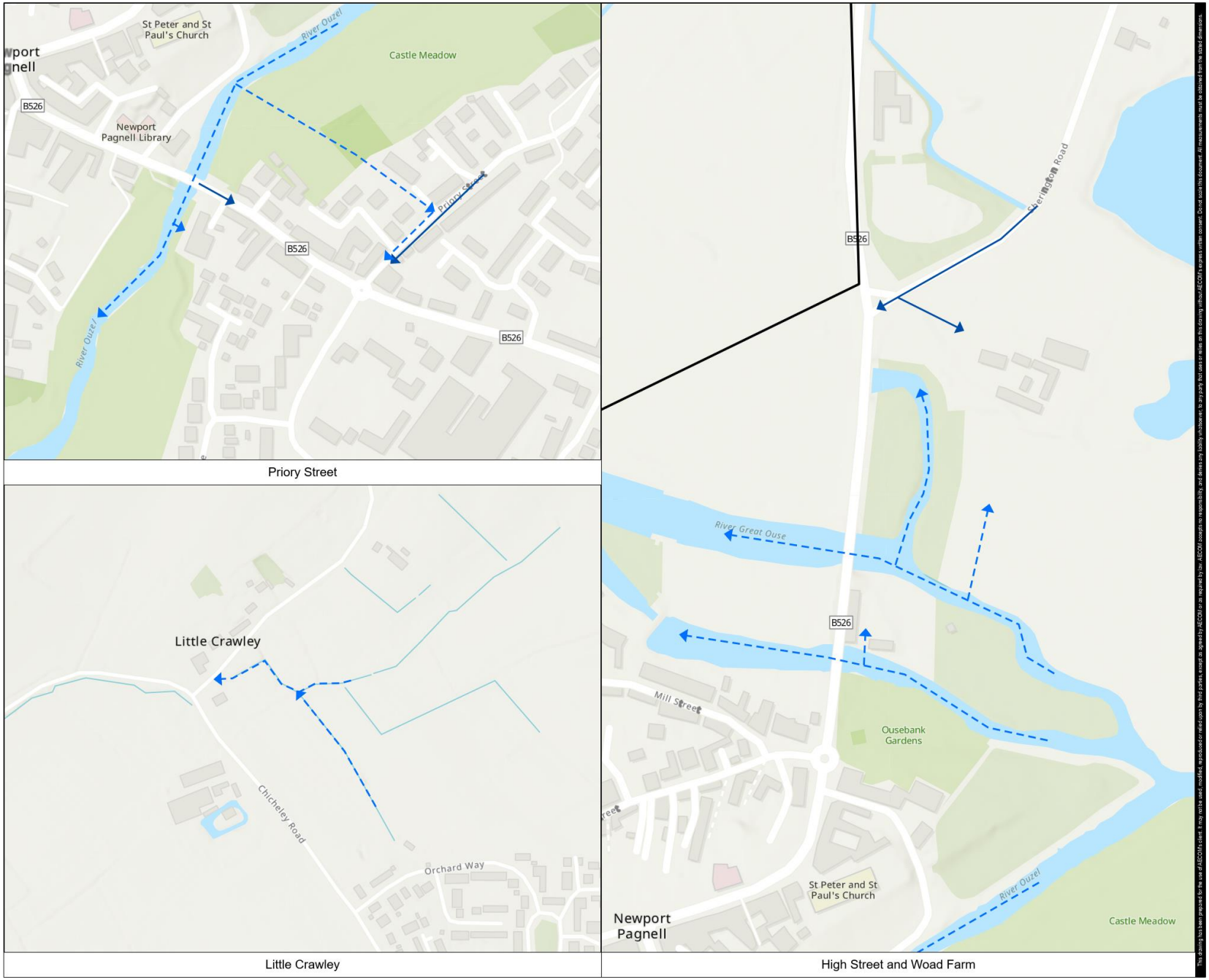


Figure 5-10: Newport Pagnell Flow Paths

5.6 Stony Stratford

5.6.1.1 Flood Impacts

Records indicate 15 properties were affected in Stony Stratford by the flood event in September 2024. 10 of these properties reported internal flooding, 4 external only and 1 unconfirmed as shown in **Table 5-6**. **Figure 5-11** shows the reported flooding incidents within the Stony Stratford hotspot.

Table 5-6: Stony Stratford – Reports of Flooding

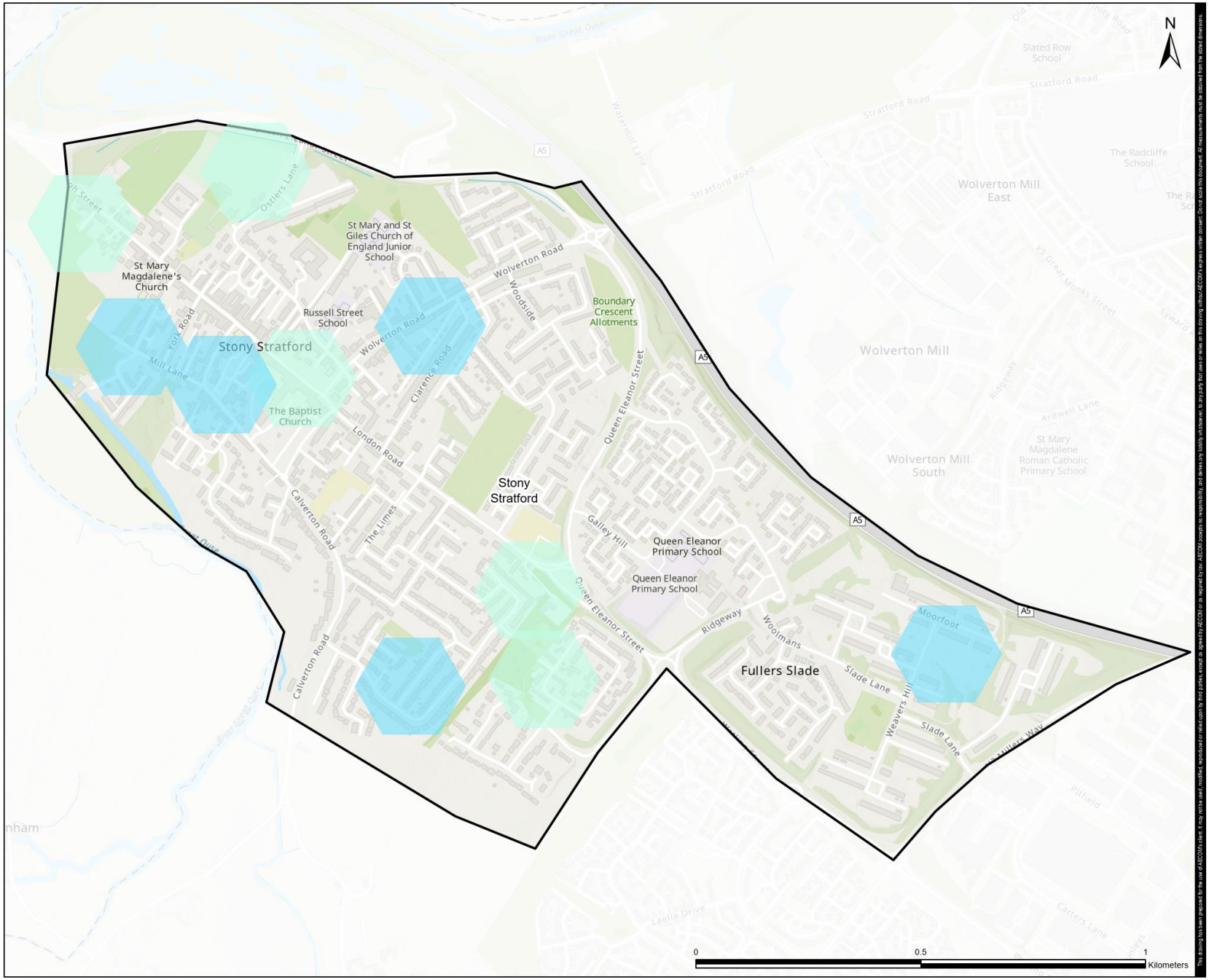
Stony Stratford	Type of Flooding	No. Properties Flooded
	Internal Flooding	10
	External Flood Only	4
	Unconfirmed	1
Total Reports of Property Flooding in Stony Stratford		**15**

- The areas affected include: Latimer Road, Milford Avenue, Goran Avenue, Clarence Road, Willow Lane, Prospect Road, Wolverton Road, High Street, Market Square, Temperance Terrace, Stony Stratford Cricket and Football Club, Woolmans and Shearmans.
- Anecdotal evidence from flood records provided by residents to MKCC indicated external flooding at properties along Latimer Road and both internal and external flooding along Goran Avenue.
- Anecdotal evidence from flood records provided by residents to MKCC noted internal flooding at a property along Milford Avenue due to flood water entering the property from the back.
- Anecdotal evidence from flood records provided by residents to MKCC noted internal flooding in the basement of a property along Clarence Road. A resident reported 8 inches of flood water.
- Anecdotal evidence from flood records provided by residents to MKCC noted internal flooding at a property along Willow Lane due to water overflowing from a watercourse or river.
- Anecdotal evidence from flood records provided by residents to MKCC noted external flooding at a property along Prospect Road, with gardens flooded up to the threshold of the property.
- Anecdotal evidence from flood records provided by residents to MKCC noted external flooding at a property along Wolverton Road.
- Anecdotal evidence from flood records provided by residents noted internal flooding at a commercial property along High Street. It was noted that flooding occurred along the length of High Street.
- Anecdotal evidence from flood records provided by residents to MKCC noted external flooding at a commercial property within Market Square and a commercial property also reported internal flooding in this area. Records noted that the car park within Market Square became inundated with flood water.
- As shown in **Photograph 28**, the Stony Stratford Cricket and Football Club was flooded as well as the adjacent playing fields. Anecdotal evidence from flood records provided by residents to MKCC noted flood depths of approximately 150 mm internally despite the use of sandbags.
- Anecdotal evidence from flood records provided by residents to MKCC noted internal flooding at properties along Temperance Terrace due to the overtopping of the River Great Ouse.
- Anecdotal evidence from flood records noted internal localised flooding issues at impacted properties due to blocked gutters and pre-existing issues such as leaks. As such, site observations were not undertaken at this location.

Photograph 28

Source: BBC News [Online], News Article Published 23rd September 2024[30]

[30] BBC News (2024) Flooding Across the East of England [Online] Available: Live updates: Flooding across Bedfordshire and the East of England - BBC News



AECOM

PROJECT

MHA PSP4 MKCC
Section19 Report

CLIENT

Milton Keynes City Council

CONSULTANT

AECOM Limited
100 Embankment
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LEGEND

Stony Stratford

Count of Flooding Incidents

- 1
- 2
- 3 - 4
- 5 - 6
- > 7

NOTES

1: Esri Community Maps Contributors, Esri UK, Esri, TomTom, Garmin, GeoTechnologies, Inc, METI/NASA, USGS, Esri, Intermap, NASA, NGA, USGS

ISSUE PURPOSE

FINAL

PROJECT NUMBER

60740209

FIGURE TITLE

Stony Stratford Flooding Incidents

FIGURE VERSION

001

Revision: 0 Drawn: SH Checked: BB Approved: JB Date: 2025-07-31

Figure 5-11: Stony Stratford Flooding Incidents

5.6.1.2 Site Observations

Latimer Road

Site observations found no obvious flow paths towards the impacted properties suggesting localised foul or surface water blockages.

Milford Avenue

A small, unnamed road is located behind the impacted properties along Milford Avenue, which connects London Road to Buttons Pre-School. The unnamed road is characterised by a slope from both ends which results in a low point behind the impacted properties, as shown in **Photograph 29**. Surface water is likely to flow from London Road and the pre-school car park to area of lowest elevation. During the site visit, no gullies were identified along the unnamed road which likely led to ponding, and subsequent overtopping of the kerb during periods of high rainfall. A manhole was identified on the unnamed road.

Photograph 29

Goran Avenue

Impacted properties on Goran Avenue have driveways that slope towards the buildings, while properties on the opposite side of the street have driveways that slope away from the buildings. It is likely that surface water flows towards the properties at a lower elevation leading to internal flooding. **Photograph 30** shows properties situated at a lower elevation than the road surface. Site observations noted that numerous properties had paved driveways, likely exacerbating surface water run off due to the increase in impermeable surfaces. The kerb height along Goran Avenue varies, allowing surface water to be transferred onto the pavement and towards impacted properties where the kerb is low. Furthermore, impacted properties also had low thresholds with entryways at the same height as the road. Numerous gullies were identified along Goran Avenue suggesting that these may have been blocked or exceeded capacity during the flood event.

Photograph 30

Clarence Road

Site observations found no obvious flow paths towards the impacted properties due to raised kerbs and boundary walls outside the properties. However, it was noted that many properties along Clarence Road had basements below ground level.

Wolverton Road

Wolverton Road is highly impermeable due to the absence of front gardens, which likely limits infiltration. Additionally, the kerb height is minimal, likely allowing surface water to transfer onto the footpath resulting in external flooding at properties.

High Street

Stony Stratford High Street is one of the longest and widest roads in the hotspot, due to on street parking on both sides and wide footpaths (**Photograph 31**). The topography of High Street is relatively flat, and the total impermeable area likely reduces capacity of infiltration, increasing the volume and rate of ponding. Due to being a commercial high street, property thresholds are the same level as the footpath for access. Numerous gullies were identified, however high water levels in the River Great Ouse prevented surface water discharge into the river. Furthermore, due to the age and design of buildings along High Street, surface water run-off from the properties flow directly onto the High Street and exacerbates flooding in the area.

Photograph 31

Market Square

Market Square is characterised by a large impermeable area which is used as a car park. The car park gently slopes towards the impacted properties, which have low thresholds at kerb height. The kerb is only slightly raised; therefore, surface water is likely to transfer to the footpath and into impacted properties. A small number of gullies were identified during the site visit.

Temperance Terrace

The River Great Ouse borders an area of greenspace known as Tombs Meadow, which is adjacent to Temperance Terrace. Onsite MKCC representatives noted that during flood events, Tombs Meadow serves as a floodplain, with water flowing through the bridge arches into the greenspace on the opposite side (**Photograph 32**). The EA FMfP shows that Temperance Terrace is located within Flood Zone 2 and 3, therefore it is likely that internal flooding was caused by fluvial sources.

Photograph 32

Willow Lane

Willow Lane are located in close proximity to the River Great Ouse. It has been observed that several properties along the Willow Lane have low threshold levels, suggesting that they may be vulnerable to internal flooding during fluvial flood events.

Prospect Road

Properties along Prospect Road back onto Tombs Meadow which serves as a floodplain for the River Great Ouse during flood events.

Stony Stratford Cricket and Football Club

At the time of the site visit, a large ditch was being maintained outside the Cricket and Football Club (**Photograph 33**). It was noted that during the flood event, the ditch was too shallow to store or divert surface water from Ostlers Lane and away from the clubhouses. Site observations found that Magdalen Close gently slopes towards Ostlers Lane, which borders the Cricket and Football Club. It is likely that surface water flows are channelled down Magdalen Close and along Ostlers Lane towards the impacted property via the sloped entries to the car park (**Photograph 34**).

Photograph 33

Photograph 34

5.6.1.3 Flood Sources and Mechanisms

Figure 5-12 illustrates the impacted areas and flow paths within the Stony Stratford hotspot. Following a review of the data and site walkover it is concluded that the flooding within the Stony Stratford hotspot was a result of the following:

- Analysis of rainfall data recorded across Stony Stratford, estimates that the rainfall event had a less than 0.1% AEP. This analysis highlights the intensity and rarity of the rainfall event.
- Site observations found no obvious flow paths towards impacted properties along Latimer and Milford Avenue. However, AW incident records noted internal flooding at properties on Latimer and Milford Avenue due to foul sewer surcharges during the flood event suggesting these became blocked or exceeded capacity.
- Large volumes of surface water were conveyed towards impacted properties on Goran Avenue due to sloped driveways which channelled water to the area of lowest elevation. An increase in impermeable surface throughout the estate, through paving of driveways likely exacerbated flows. Dropped kerbs outside impacted properties and low thresholds likely led to surface water ingress from the road. The EA RoFSW shows surface water extents at impacted properties during a 0.1% AEP event.
- Residents reported basement flooding at properties along Clarence Road. However, site observations did not reveal any clear flow paths, indicating that groundwater flooding might be the cause. The Groundwater Vulnerability Map[31] shows that these properties are located in a medium-high groundwater vulnerability area.
- Due to the absence of front gardens along Wolverton Road, the street is highly impermeable. Kerb heights are also low along the road, allowing the transfer of surface water onto the footpath result in external flooding at properties. The EA RoFSW map doesn't show flooding in this location, suggesting localised drainage issues within the road.
- The flat, large impermeable area of High Street likely caused surface water to pond along the road. Since property thresholds are at footpath height, the transfer of surface water onto the footpath likely led to internal flooding at these properties. High water levels in the River Great Ouse prevented surface water discharge into the river leading to surcharging along High Street. Furthermore, due to the age and design of buildings along High Street, surface water run-off from the properties flows directly onto the High Street and exacerbates flooding in the area. The EA RoFSW map shows extensive surface water flooding along High Street.
- Market Square is also characterised by a large impermeable surface with a gentle slope towards the impacted properties. However, there is an absence of mapped surface water extents at Market Square. This may suggest localised flooding issues that will not be captured by national mapping.
- Fluvial flooding likely caused internal flooding at properties along Temperance Terrace, Prospect Road and Willow Lane. During the flood event, the River Great Ouse experienced high flow levels, resulting in the flooding of Tombs Meadow. Temperance Terrace is situated in an open area of greenspace adjacent to Tombs Meadow, therefore it is probable that the fluvial flooding impacted these properties. The EA FMfP shows extensive fluvial flooding this area, as the impacted properties at Temperance Terrace, Prospect Road and Willow Lane are located within Flood Zone 2 and 3. Residents at Temperance Terrace observed that the September 2024 flood event had a lesser impact compared to previous floods, due to the clearance works carried out by the Environment Agency within the River Great Ouse. Several properties along Temperance Terrace are equipped with property-level resilience measures; however, their effectiveness relies upon residents actively deploying them during flood events.
- Anecdotal and photographic evidence highlights the severity of flooding at Stony Stratford Cricket and Football Club. The EA FMfP shows that the Stony Stratford Cricket and Football Club is located within Flood Zone 2 and 3 from the River Great Ouse. Additionally, the gentle slope of Magdalen Lane and Ostlers Lane likely contributed surface water flows towards the clubhouse and playing fields. During the site visit, a ditch was being maintained between Ostlers Lane and the impacted site, indicating insufficient storage capacity and surface water drainage during the flood event. Despite the permeable surfaces of the playing fields, **Photograph 28** reveals the depth and extent of flooding, highlighting the intense nature of the rainfall event and extent of fluvial flooding. Antecedent conditions did not contribute to surface water

[31] DEFRA (205) MAGIC Map – Groundwater Vulnerability Map (England). Available: Magic Map Application

flooding within Milton Keynes, as the ground had been relatively dry over the preceding months. Furthermore, the EA RoFSW map shows extensive surface water flooding at the playing fields during a 0.1% AEP event, corresponding with flood records and photographic evidence.

- Numerous gullies were identified during the site visit within Stony Stratford. Rainfall analysis estimates that the rainfall event was a >0.1% AEP event across Stony Stratford. Due to rarity of the rainfall event, this suggests that the AEP of the event was greater than the design standard for drainage systems and the capacity of the gullies was likely exceeded.
- Anecdotal evidence from flood records noted localised flooding issues at impacted properties at Woolmans and Shearmans due to blocked gutters and pre-existing issues such as leaks which were exacerbated due to the intense rainfall event.

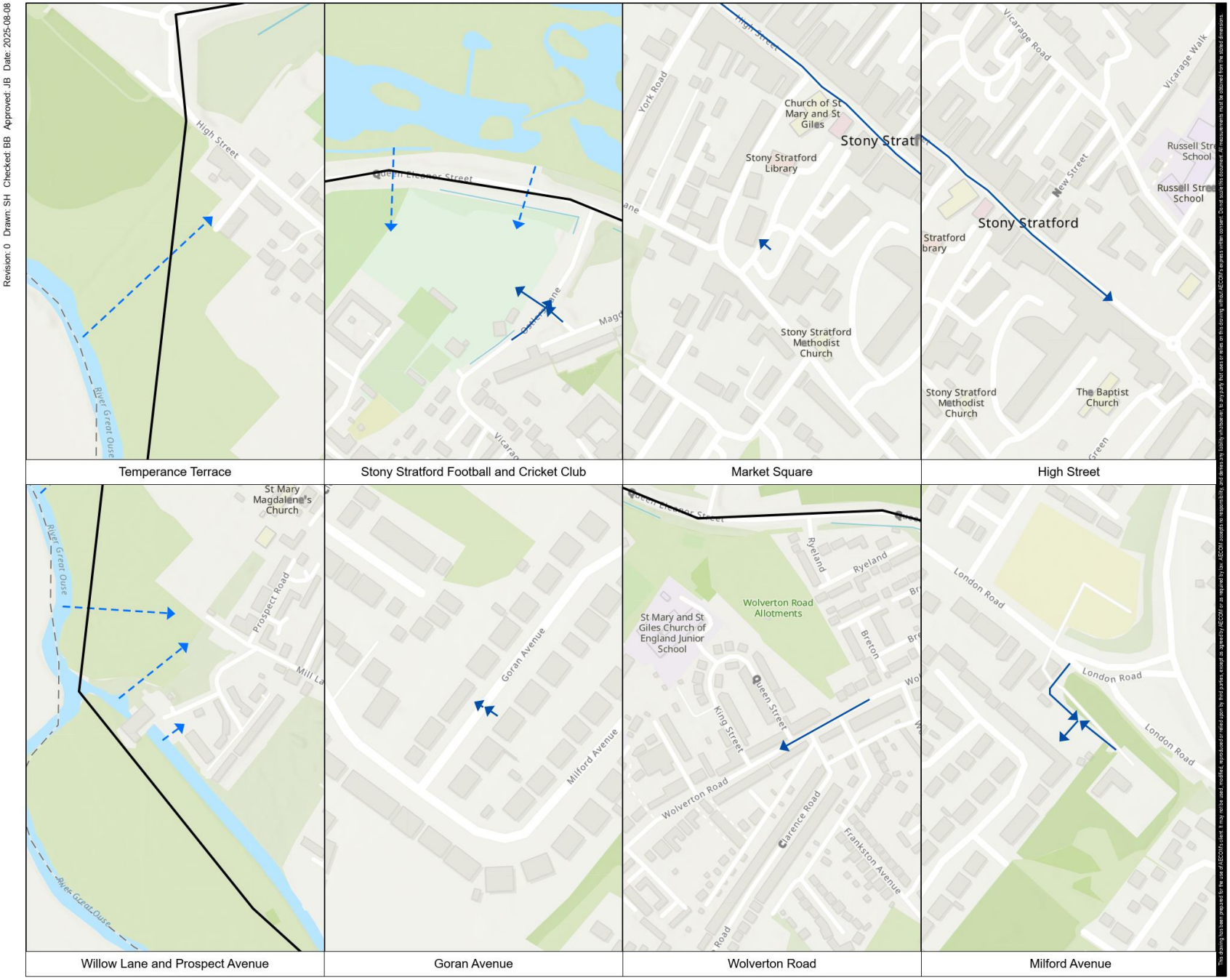

Figure 5-12: Stony Stratford Flow Paths

6. Flood Investigation Outcomes

6.1 Flood Incident Response – Core Themes

6.1.1 Rainfall Event

As discussed in **Section 4**, from the 21st September to the 29th September 2024 intense rainfall was experienced across Milton Keynes. Analysis of recorded rainfall data found that estimated return periods were greater than 0.1% AEP at three of the five rain gauge locations and four of the seven radar locations. Results of the analysis highlights the high intensity and prolonged duration of the rainfall event across Milton Keynes.

High magnitude events are highly unpredictable and intense, often exceeding the capacity of existing infrastructure, leading to increased surface water flooding. Furthermore, the extended period of intense rainfall likely led to overtopping of existing flood defence infrastructure and may have caused any existing flood prevention measures to be rendered ineffective.

Most of the flooding resulted from surface water or a combination of surface water and fluvial flooding. As such, there was little lead time between the first signs of flooding effect on property. This impacted the capacity for RMAs and emergency responders to effectively mobilise resources, contact the relevant authorities and identify areas at greatest risk.

As discussed in **Section 4**, there were two distinct periods of rainfall which characterised this event, the first over 21st – 23rd and the second from 26th – 27th. Hotspots in the north recorded maximum rainfall during the first period, whilst hotspots in the south recorded maximum rainfall during the second period however a smaller peak was also recorded during the first period. The two periods of rainfall of rainfall occurred in short succession, impacting the six hotspots and other areas across the entirety of Milton Keynes. This meant that there was little opportunity to investigate reasons for the flooding, nor time to review all areas and properties affected.

6.1.2 Warnings

Analysis of recorded rainfall in the preceding months found that antecedent conditions did not contribute to the flood event in September 2024. As such, it is likely that the onset of rainfall was unexpected due to relatively dry preceding months.

The historic record of warnings issued by the Met Office[32] indicate a National Severe Weather Warning Service (NSWWS) of thunderstorm was released on the 19th September and a NSWWS of rain was released on the 20th, 21st, 22nd, 25th and 26th September for the south-east of England. Therefore, extensive rainfall warnings were issued throughout the duration of the event.

However, the large impermeable surface area of each hotspot creates a flashy response to rainfall, meaning the onset of a flood event occurs quickly and can be difficult to predict on a local scale. Furthermore, MKCC representatives noted that the recent harvest left rural areas without crops, reducing infiltration and increasing surface water runoff. Although warnings were issued throughout the event, the intensity and prolonged rainfall is challenging to defend against.

6.1.3 Exchange of Information

Exchange of information during a flood event can be challenging due to rapidly changing conditions, co-ordination issues between multiple organisations and public confusion due to various sources of information.

Given the limited lead time that preceded the flood event and subsequent high-magnitude event, RMAs involved were initially unaware of the scale and severity of the flood event. However, the LLFA acted as a technical advisor, providing key information to Category 1 responders. Coordination during the event was effective, and the Emergency Planning team facilitated a post-event session to capture lessons learned.

As a Category 1 responder, the Emergency Planning department is available via a helpline during flood events to provide response and advice. The Emergency Planning team can coordinate with the Highways team to close roads that may pose a risk and post these on the Milton Keynes website and social media channels. Whilst various roads are monitored by CCTV and can be reviewed during the event to facilitate quick road closures, in most cases,

[32] Met Office (2025) National Meteorological Library and Archive. Available: Met Office - Search Results

a team member is dispatched to assess the flooding and determine if a road needs to be closed. This process can cause delays and exacerbate flooding through bow waves. The Emergency Planning team also work together with the Highways team to distribute sandbags in accordance with the Highways and Transportation Service Sandbag Policy[33]

6.1.4 Resource Availability

MKCC had limited resources available with which to support residents on site, during the flood event. This was in part due to the scale of the event, which affected various areas across the Milton Keynes. MKCC mobilised resources to aide in the event, including facilitating road closures, providing sandbags and mobilising officers on site. However, resource availability remained stretched due to the scale of the flooding. Only two of the six hotspots, Stony Stratford and Newport Pagnell, have flood groups which hold flood kits that can be distributed to the worst affected areas during the flood event.

6.1.5 Positive Observations

There were several actions and interactions between stakeholders, which improved the response to the flood event and helped to mitigate the impact. The positive observations are as follows:

- MKCC was proactive. The team sought to engage multiple stakeholders, including RMAs and the general public, in order to collate information and better understand the event and its impacts;
- All enquiries and reports to MKCC were directed to the FWMT to provide a single water and flood interface for residents and local groups;
- RMAs have been proactive in undertaking post-event investigations;
- Buckinghamshire Fire and Rescue received large numbers of calls as a result of the heavy rain, and attended various incidents within the hotspots including Lavendon, Newport Pagnell, Bletchley and Bradwell;
- During the flood event Newport Pagnell Flood Group liaised with MKCC Emergency Planning and Highways teams to provide on the ground information and facilitate delivery and distribution of sandbags;
- MKCC posted road closure notices on their website and social media channels to inform local residents;
- The Stony Stratford Flood Group provided support to residents who had given consent as a result of the September 2024 flood event;
- Prior to the September 2024 flooding in Stony Stratford, the EA and the Bedford Group IDBs had undertaken clearance works in the River Great Ouse. Residents of Temperance Terrace noted the flood impacts were reduced in September 2024 compared to previous flood events, suggesting a positive impact as a result of the clearance works;
- Clearance of ditches along Olney Road in Emberton and at Stony Stratford Cricket and Football Club which is likely to increase flood water storage for future flood events;
- Residents have proactively reported flood impacts on their properties, enabling MKCC to conduct a Section 19 Investigation.

6.2 Lessons Learnt

Following a review of the information supplied by the RMA's, relevant stakeholders and data collected from the site walkover, the following strategic areas have been identified as potential areas for improvement:

- Communications and Planning;
- Improving Community Resilience to Repeat Events; and
- Understanding of Integrated Flooding Mechanisms.

[33] Milton Keynes City Council (2025) Highways and Transportation Service: Sandbags. Available: Sandbag policy (1).docx

6.2.1 Communication and Flood Planning

Following the September 2024 flood event, the RMAs and relevant authorities identified the importance of clearly defined channels of communications during and after the flood event. Strengthening partnerships with other key players is a priority to effectively plan, protect and respond to flooding.

All RMAs should review procedures and processes for data collection during and after a flood event. Reports of flood should capture data in a manner which can be shared rapidly amongst the relevant stakeholders and easily documented in a clear and simple way.

Emergency planning for flood events is essential to protect lives, property, health, and the overall well-being of communities. Review of the existing Local Flood Risk Management Strategy (LFRMS) will help to address the increasing risk of flooding that is likely to impact Milton Keynes. MKCC are part of the Thames Valley Local Resilience Forum[34] which is a multi-agency partnership which respond to incidents within the Thames Valley. Creation of a Multi-Agency Flood Plan will allow for a cohesive, multi-agency approach to managing flood risk and will help to address the complex nature of flooding within the area and improve the response to any future events.

6.2.2 Community Resilience

Community resilience is key to the preparedness of a flood event, in addition to the mitigation of damage caused by potential flood events. Through awareness, the local community can introduce measures to protect their property and possessions.

Although the benefit of these measures are typically limited to a single property, if the level of awareness is high across a community, it is expected that several households will implement flood risk measures; this increases the overall capacity of a community to protect property within the wider area, with potential to reduce impact and disruption following a flood event.

Furthermore, an awareness of the relevant authorities will enable communication prior to, during and after a flood event. Regular contact between the local community and relevant authority allows for the identification of issues which may exacerbate the impact of a flood. Contact with the most appropriate authority will also enable authorities to respond effectively.

Local authorities, such as MKCC, should continue to initiate discussions within the community to drive awareness and direct individuals to the relevant contacts; this will allow for members of the community to communicate issues to the most appropriate authority or organisation prior to, during and after a flood event. It is also important for future planning and prevention purposes to continue to encourage residents to report both flooding risks, such as blocked gullies and overgrown vegetation, and to report the flood event.

Of the six hotspots, currently Newport Pagnell and Stony Stratford have established flood groups with Lavendon flood group in the draft stage. MKCC should encourage the creation of more local flood groups and provide support through connecting flood groups and help securing flood kits. Consistent engagement within the local community increases the level of resilience and helps to drive adaptability to flood events over a longer period of time. Their local knowledge needed to be taken on board and resources allocated accordingly.

6.2.3 Understanding Integral Flood Mechanisms

Assessment of the flood mechanisms within each hotspot indicate a combination of surface water, sewer surcharge and fluvial flooding. The mechanisms are closely linked and can contribute to the severity and frequency of damage. Insufficient drainage capacity can prevent surface water flowing into the network, resulting in ponding and larger flow pathways on the road surface, whilst greater volumes of surface water entering the combined network can result in surcharge of sewer drainage assets. The combination of surface water and fluvial flooding can significantly increase flood depths and flow rates, leading to the rapid exceedance of drainage system capacities.

It is important to understand the interactions between different flood mechanisms, to determine the most effective solution; a solution which addresses multiple flood mechanism will typically provide longer term benefit and significantly reduce the impact of a flood, compared to a solution which addresses a single cause.

[34] Thames Valey LRF (2025) Thames Valley Local Resilience Forum. Available: About Thames Valley Local Resilience Forum

6.2.4 Sustainable Drainage Systems

Sustainable Drainage Systems (SuDS) solutions should be implemented, as part of a long-term approach to flood risk alleviation. Solutions should seek to relieve pressure on the drainage network and target areas where surface water flooding is known to occur.

In the case of the September 2024 flood events, SuDS solutions were likely to have had only localised benefit. This is due to the large scale of AEP event, which exceeded drainage capacity and the capacity of Ordinary Watercourses and Main Rivers within the hotspots. However, localised surface water flooding issues were found in every hotspot. Furthermore, there is an increasing amount of hardstanding surfaces at properties and a reduction in private gardens and greenspaces, which reduces the natural amount of infiltration of rainfall and contributed to localised flooding during the September 2024 event. Solutions developed should account for the scale and placement of SuDS, in order to increase the potential benefits.

Schedule 3 of The Flood and Water Management Act 2010 would mandate the use of SuDS on new developments and create a new local SuDS Approval Body (SAB), which aims to focus on the implementation, management and adoption of SuDS. As of June 2025, no decision has been made as to whether the SAB function or Schedule 3 will be enacted. However, it would be beneficial to review roles, resources, and technical skills in preparation for the potential enactment.

7. Risk Management Authority Response

This section provides a summary of the response from each of the RMA's which operate within MKCC administrative region and presents suggestions for further management of flood risk.

7.1 Milton Keynes City Council as LLFA

As the LLFA, MKCC have conducted this Section 19 Flood Investigation Report in response to the flood incidents from the 21st to 29th September 2024. The report has been compiled through collaboration with relevant RMAs and stakeholders and is to be published in the public domain. MKCC will coordinate with RMAs for further work and any future investigations, whilst working collaboratively with local communities to address flood issues. The Emergency Planning Team within MKCC help to coordinate between key council services like Housing and Highways with the emergency services and local communities.

7.2 Milton Keynes City Council as Highways Authority

MKCC as the Highways Authority is responsible for maintenance of highways within Milton Keynes. MKCC is moving to a risk-based approach for gully cleansing, the frequency of cleansing is to be determined by the client using a risk-based approach or as determined in the Code of Practice for Highways Drainage Maintenance. During the flood event, Milton Keynes also posted road closures to notify the public and reduce the effect of bow waves. MKCC provide online resources to report a blocked gully or damaged drain cover and aim to maintain the gullies so they can effectively remove road surface water. Even when a gully is clean and well maintained it will only cope with a certain volume of water at one time, a sudden and heavy downpour can still cause flooding especially if the road is in a low-lying area.

MKCC as the Highways Authority is also responsible for temporarily closing roads or footways that are impassable. Highways team with service provider, Ringway will monitor the water levels on the roads and footways. MKCC post updates about closed roads on their social media channels during the flood event.

The Highways team keep a small stock of sandbags for emergencies at the Bleak Hall depot but these will only be distributed if a highways officer has confirmed that there is a very severe risk to the public in line with the Sandbag Policy.

7.3 Environment Agency

The EA takes a strategic overview of all sources of flooding and coastal erosion and manage flood risk from Main Rivers, reservoirs and the sea. Prior to the September 2024 flooding in Stony Stratford, the EA had undertaken clearance works in the River Great Ouse. Residents of Temperance Terrace noted the flood impacts were reduced in September 2024 compared to previous flood events, suggesting a positive impact as a result of the clearance works.

The EA issue flood alerts and flood warnings through monitoring of rain and river gauges. Flood warnings inform communities about the risk of flooding, allowing people to take necessary precautions. Flood warnings and alerts can be received through email or text, ensuring that people can stay informed and take necessary actions quickly, regardless of their location or access to other forms of communication. The EA also meet with flood groups within Milton Keynes to discuss how to make the community as resilient as possible.

7.4 Anglian Water

AW is responsible for managing and responding to sewer flooding incidents. This includes addressing blockages, overflows, and ensuring the sewer network operates effectively. AW records all reports of flooding from sewers, ensuring that affected properties receive appropriate attention and mitigation measures. During severe weather, storms and widespread flooding, reports are prioritised based on risk and emergency areas.

7.5 The Bedford Group of Drainage Boards

The Bedford Group IDBs have powers to undertake works to improve and manage any watercourse or drainage systems within their District and regulate activities in and alongside these systems or, under an agreement with the EA, to Main Rivers. During the September 2024 flood event, the Bedford Group IDBs helped with response efforts by working alongside local agencies to mitigate the impact.

The Bedford Group IDBs provided guidance on water management, directing floodwater to arterial networks and ensure safe discharged locations to reduce the environmental impact. The Bedford Group IDBs efficiently removed over 80 million litres of floodwater using 25 tankers and high-volume pumps within their District[35]. Their understanding of local drainage systems helped protect infrastructure and prevent further flood risk in surrounding areas. The Bedford Group IDBs undertake a rolling programme of asset inspections which are assessed for their overall condition and helps to identify watercourses which most require maintenance[36].

[35] The Beford Group of Drainage Boards (2025) Newsletter 2025. Available: https://www.idbs.org.uk/wp-content/uploads/2025/05/newsletter-2025-digital-compressed.pdf
[36] The Bedford Group of Drainage Boards (2025) Maintenance Programme. Available: Maintenance Programme - The Bedford Group of Drainage Boards

8. Next Steps

As LLFA, MKCC are responsible for the coordination of flood risk management strategies and actions within the region. It is suggested that the recommendations listed within this Section 19 Report are incorporated into an Action Plan, to be produced by the relevant RMAs. This Action Plan should be monitored and discussed at future operational flood group meetings.

Following a review of this Section 19 Report and liaison with RMAs, should flood risk be considered unacceptable at a hotspot, MKCC should investigate potential capital schemes which could provide flood alleviation.

8.1 Recommendations

Through the investigation of flood mechanisms and impacts of the September 2024 flood events, several recommendations for improvement have been identified; this is presented in **Table 8-1**.

Recommendations have been categorised as statutory or non-statutory. Statutory recommendations are a legal requirement and must be implemented as part of the Section 19 Flood Investigation. It is important to identify the statutory recommendations, to ensure appropriate action is taken. Non- statutory recommendations are not required under law yet are considered to be of benefit to the management of flood risk within the area. Given the widespread nature of the flood event, the recommendations may not be applicable to every hotspot. However, they should be considered where relevant and appropriate.

Table 8-1: Recommendations

Recommendation	Detail	Lead	Timescale	Statutory or Non - Statutory
MKCC is to publish the findings of the Section 19 Flood Investigation Report.	The published report will aid the development of flood mitigation strategies and provide vital information for RMAs.	MKCC - LLFA	Short term	Statutory
Review and update the 2016 Milton Keynes Local Flood Risk Management Strategy. Under Section 9 of the Flood and Water Management Act 2010.	The LLFA have a duty to develop, maintain, apply and monitor a strategy for local flood risk management and a responsibility to update every 6 years.	MKCC - LLFA	Medium term	Statutory
Communication with local communities should be proactive and seek to improve awareness for flood events.	Discussions should emphasise the importance of preparing for a flood event before an incident occurs. Residents should be frequently directed to the useful contacts and be encouraged to report potential issues at the earliest possible opportunity. This may involve frequently publishing contact information and links to flood forms on social media platforms and reminding residents during town hall events. Teams within MKCC such as Emergency Planning, Communications and Highways should collaborate with the LLFA to enhance communication with the local communities.	MKCC - LLFA	Short term	Non - Statutory
Explore opportunities to streamline the flood reporting process by developing a simplified flood report form.	This could include the creation of separate forms for internal and external flooding incidents, making it easier to determine whether the threshold for a Section 19 investigation has been met. Such improvements would reduce the time required for post-event data processing and improve the efficiency of identifying triggers for a Section 19 investigation. Teams within MKCC such as Customer Services, Highways, Housing and Emergency Planning should work with the LLFA to streamline the flood reporting process.	MKCC – LLFA	Medium Term	Non - Statutory
Investigate emerging technologies which offers the opportunity to capture flood information and photographic evidence from the public in a quick and efficient way.	Investigation of emerging technologies by the MKCC Communications team could include mobile apps and web-based tools would help improve the recording and reporting of flooding information across the Milton Keynes borough. Investigation of emerging technologies by the MKCC Highways team could include installing CCTV on flood-prone roads to enable quick closures and re-openings during flood events. This allows for real-	MKCC – Communications Team, Highways Team, LLFA	Medium term	Non - Statutory

	time monitoring and a fast response, preventing exacerbated flooding caused by bow waves. Additionally, highways officers can be more effectively utilised elsewhere, as they won't need to conduct on-site investigations to close the roads. Investigation of the use of drones post-flood event by the LLFA and MKCC Highways team, to monitor receding floodwaters and facilitate the rapid reopening of roads.			
Development of an Outline Business Case informed by the findings of the Lavendon Feasibility Study.	The development of an Outline Business Case (OBC) is dependent of MKCC obtaining the required funding to undertake the OBC.	MKCC - LLFA	Long term	Non - Statutory
It is recommended that the importance of clear gullies and drains is communicated to residents, to increase awareness and promote local action.	MKCC have moved to a risk-based approach for gully cleaning to prevent build-up of leaves and debris. If residents take an active role in monitoring and reporting the gully condition, this could improve the effectiveness of drainage within the area.	MKCC - Highways & Local Residents	Short term	Non - Statutory
It is recommended that public consultation forms part of any scheme development exercise.	Members of the local community have expressed concern about the flood event and there is a desire for changes to be made, in order to reduce or mitigate the impact of any future event. As such, engaging residents will likely increase buy-in to flood alleviation proposals. Subject to the source of flooding, the EA and/ or LLFA should aim to engage residents throughout schemes development	MKCC/ Environment Agency & Local Residents	Long term	Non - Statutory
The local community should consider Property Flood Resilience (PFR) measures, to reduce the potential impact of a flood event.	Local residents who are identified as being at risk of flooding are encouraged to implement PFR measures. This could include resistance measures such as flood doors, airbrick covers etc, or resilience measures such as raising electrical sockets, installing sump pumps etc. They should continually familiarise themselves with the key contact information and report events via the appropriate channels, to help mitigate risk.	Local Residents	Medium term	Non - Statutory
MKCC should work with Anglian Water and the Environment Agency to progress the Balancing Lakes Study to develop an integrated	To gain a better understanding of the fluvial interaction of the River Great Ouse and River Ouzel and the impact on the sewer network capacity within Newport Pagnell.	MKCC – LLFA	Long term	Non - Statutory

catchment model of the River Great Ouse and River Ouzel.				
Ongoing communication and partnership working with Anglian Water and RMAs to develop holistic solutions and identify opportunities for project works to reduce flood risk by retrofitting SuDS.	Work with Anglian Water to develop partnership projects for SuDS retrofits and holistic solutions, which are suitable for surface water flooding and does not have a negative impact on the sewer system. SuDS help to intercept and store surface water and can reduce pressure on the public surface water sewer network. Localised surface water flooding issues are present within all hotspots. Key areas include Bletchley and Bradwell where the hotspot is characterised by surface water flooding.	MKCC - LLFA & Anglian Water	Long term	Non - Statutory
Anglian Water should review the capacity of the sewer system in areas affected by the flooding, to ascertain whether there is any scope to invest and prioritise construction at these locations.	Drainage capacity issues were identified across all hotspots. Key areas include Emberton, Stony Stratford, Newport Pagnell and Lavendon.	Anglian Water	Long term	Non - Statutory
The Environment Agency should look to improve telemetry services.	Various gauges were not operational or provided inaccurate readings during the flood event near Milton Keynes (e.g Passenham and Brackley). Improving these systems would support more accurate post-event analysis and flood investigation.	Environment Agency	Medium Term	Non - Statutory
The Environment Agency should identify whether targeted maintenance of the River Great Ouse at Tombs Meadow can be incorporated as part of the wider maintenance programme.	Previous maintenance likely mitigated the impacts of flooding at Temperance Terrace during the September 2024 flood event. The Parks Trust had also undertaken vegetation clearance within Tombs Meadow as part of their work caring for green spaces in Milton Keynes.	Environment Agency	Medium term	Non – Statutory Permissive Powers
Clearing channels and ditches of vegetation to improve flow and reduce sediment accumulation, maintaining the channel's capacity to handle larger volumes of water during flood events.	Channel clearance helps prevent out-of-bank flows and minimises the risk of flooding roads and adjacent areas. Ditches observed during the site visit that may benefit from clearance are: • Lavendon – Ordinary Watercourse which flows from The Glebe to Castle Road • Lavendon – Blocked ditch at the north end of Castle Road, adjacent to greenspace	Riparian Owners	Medium term	Non - Statutory

- Lavendon – Overgrown ditch within the greenspace at the junction of Harrold Road and The Glebe
- Bletchley – Ordinary Watercourse that flows adjacent to Simpson Road
- Stony Stratford – Ditch outside the Stony Stratford Football and Cricket Club (Clearance started)
- Emberton – Ditch across from impacted properties along Olney Road (Clearance started)

9. Useful Contacts

Flooding from Public Sewer or Burst Water Main

ANGLIAN WATER

- Report Sewer Flooding - **03457 145 145**
- https://www.anglianwater.co.uk/contact-us/

Flooding from the Public Highway or Drains

MILTON KEYNES CITY COUNCIL

- Report a Flooding Emergency - **01908 252353 (out of hours 01908 226699)**
- Report a Flood Form (to be used after an incident has occurred) - Report a Flood
- Report an issue with a blocked gully - https://www.milton-keynes.gov.uk/highways/road-gullies-and-flooding/gullies-and-flooding-highway

Flooding from a Main River

ENVIRONMENT AGENCY

- General Enquiries - **03708 506 506 (Mon-Fri, 8am – 6pm)**
- Incident Hotline - **0800 80 70 60 (24hour service)**
- Flood Line - **0345 988 1188 (24 hour service)**
- General Enquiries Email - **enquiries@environment–agency.gov.uk**

Useful Web Resources

The following web links contain useful information about being prepared, understanding flood risk and reporting drainage issues to MKCC Council.

Flood help and advice:
https://www.milton-keynes.gov.uk/flood-and-water-management/flood-help-and-advice

What to do in a flood emergency:
https://www.milton-keynes.gov.uk/highways/road-gullies-and-flooding/flooding

Understanding Flood Risk and Flood Warnings

Check current flood warnings and river levels:
https://www.gov.uk/check-if-youre-at-risk-of-flooding

Sign up for flood warnings:
https://www.gov.uk/sign-up-for-flood-warnings

Appendix A

Appendix B