River Witham, North Witham

Flooding 6th January 2025 – Evidence Based Review

Date: 9th May 2025

Version No.5

Contents

Introduction

This review has been undertaken following a rainfall event on the 5th and 6th of January 2025 resulting in residential property and garden flooding in North Witham and flooding to agricultural land and roads within the Upper Witham area on the 6th of January 2025. It has been undertaken by staff in the Witham Partnerships and Strategic Overview (PSO) team at the Environment Agency (EA) and is based on available and relevant information at the time.

Figures (graphs, photos, tables) considered pertinent to the text have been included within the main report. Figures considered useful but which provide additional evidence to support understanding have been included in Appendix 1.

For feedback or any further information, please contact psolincs@environment-agency.gov.uk.

Purpose and what will happen next

The purpose of this investigation is:

- To understand the causes and mechanisms of flooding. It has been initiated by the Environment Agency because we believe flooding from a designated main river occurred resulting in properties being flooded internally.
- To provide the direction for any further work the Environment Agency will undertake following flooding (see Next Steps section).
- To share with Lincolnshire County Council to support any Section 19 investigation undertaken and with communities who were impacted by flooding. It is a public document and will be shared on request.

Section 1: The Upper Witham upstream of Grantham and North Witham

North Witham is a small village located within the South Kesteven District of Lincolnshire. The village is located along the upper course of the River Witham, approximately 9 miles (14 km) south from the nearest major town of Grantham. Its approximate central National Grid Reference is SK 92667 21867. It has an estimated population of 143 in around 72 households. North Witham sits at a relatively high elevation at around 100m above sea level, being in the higher ground of the River Witham catchment. Land levels around the Witham valley at this point peak at around 140-150m above sea level.

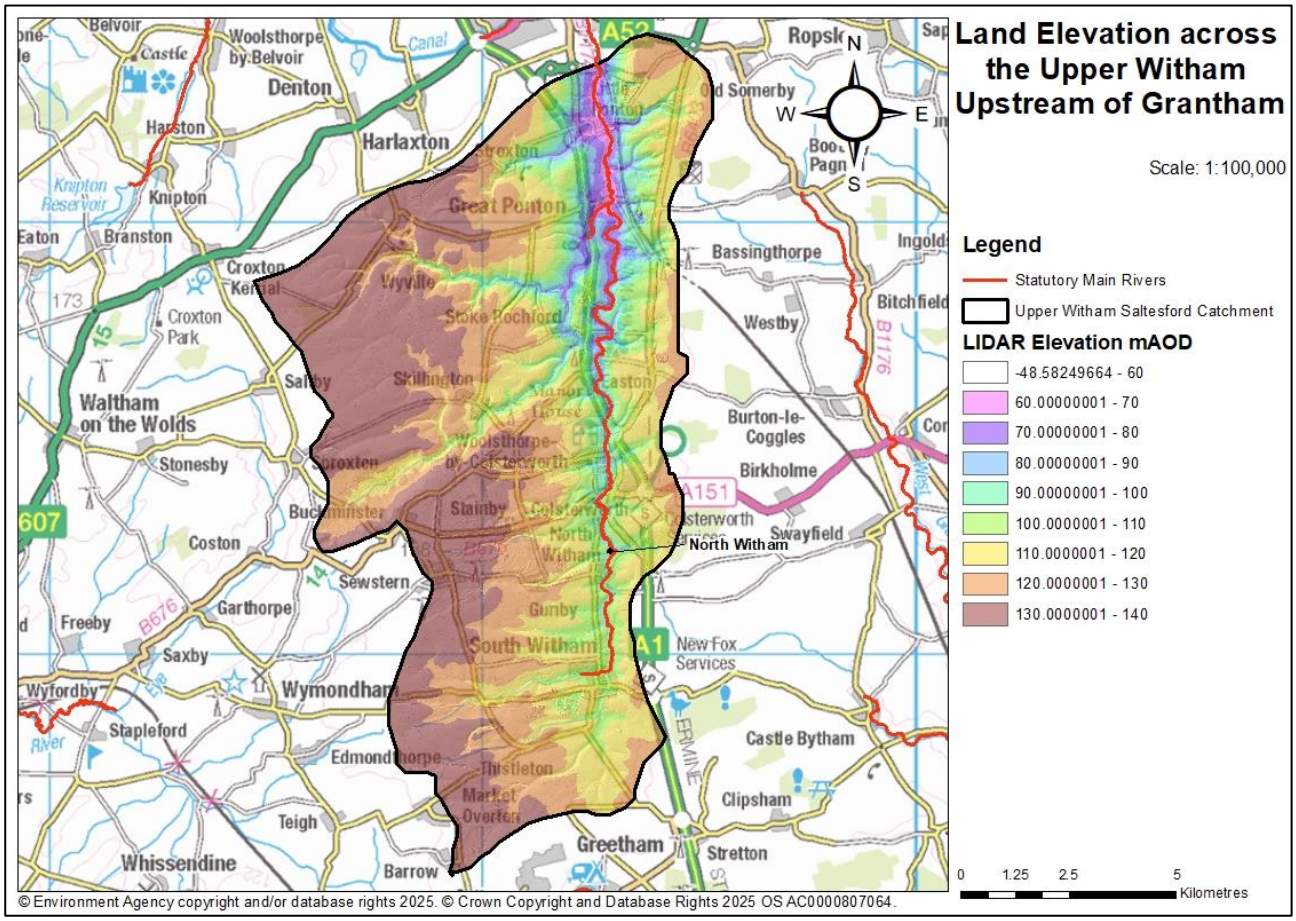

Figure 1: Topography of the Upper Witham Upstream of Grantham.

Section 2: Summary of prevailing weather and catchment conditions

United Kingdom

The period from late December 2024 to early January 2025 brought some very wet and windy weather, with significant cold spells and snowfalls across upland areas in the north. Several long-running rainfall gauging stations in eastern England recorded their wettest January day on record on the 5th January. The very wet weather was accompanied by some strong winds and near freezing temperatures and rain fell on extremely saturated and frozen ground. The heavy rain between the 4th to 6th January led to significant flooding problems. Worst hit areas included parts of Leicestershire and Lincolnshire with major incidents being declared by the Lincolnshire Resilience Forum. Map (Source: Met Office. Crown copyright, 2025).

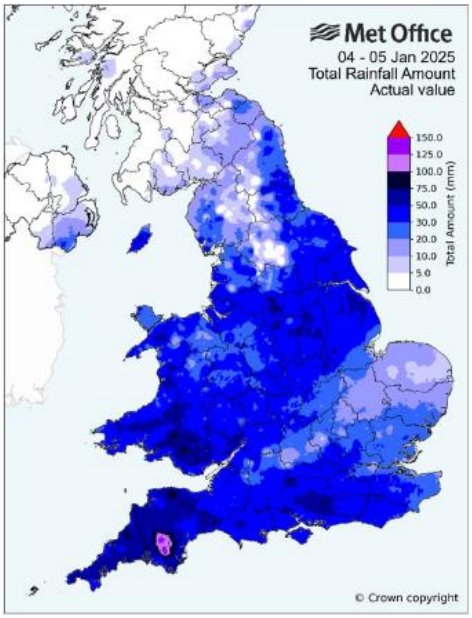

Figure 02: National Rainfall 4th to 5th January 2025

Rainfall in Lincolnshire

The heavy rain and snowfall on 5th and 6th January led to significant flooding problems in Lincolnshire. In Edenham, near Bourne, 50 children were taken to safety after their school was cut off by floodwater. 30 to 50mm of rain fell very widely across the country but it was especially wet across parts of Lincolnshire with over 50mm in some locations and the whole-month's average rainfall falling in just two days. On the 5th, several weather stations recorded their wettest January day on record including Cranwell, (30.8mm, 111 years) and Coningsby (33.2mm, 60 years).

Catchment Conditions

The ground conditions across the catchment were already saturated. The soil had the capacity to absorb less than 5mm of rainfall (known as the soil moisture deficit). The actual amount of water the soil can absorb is also dependant on other factors such as soil type, evaporation rates and rainfall intensity. Temperatures overnight on the 5th and 6th January were around 0°C and snow had fallen on the higher ground, meaning the surface of the ground was frozen and, in some places, covered with a layer of snow. Vegetation cover in January is significantly reduced, with no leaves on trees. These factors resulted in rainfall running overland and straight into watercourses rather than infiltrating into the ground and reaching watercourses at a slower rate. This caused rapidly rising river levels and flooding.

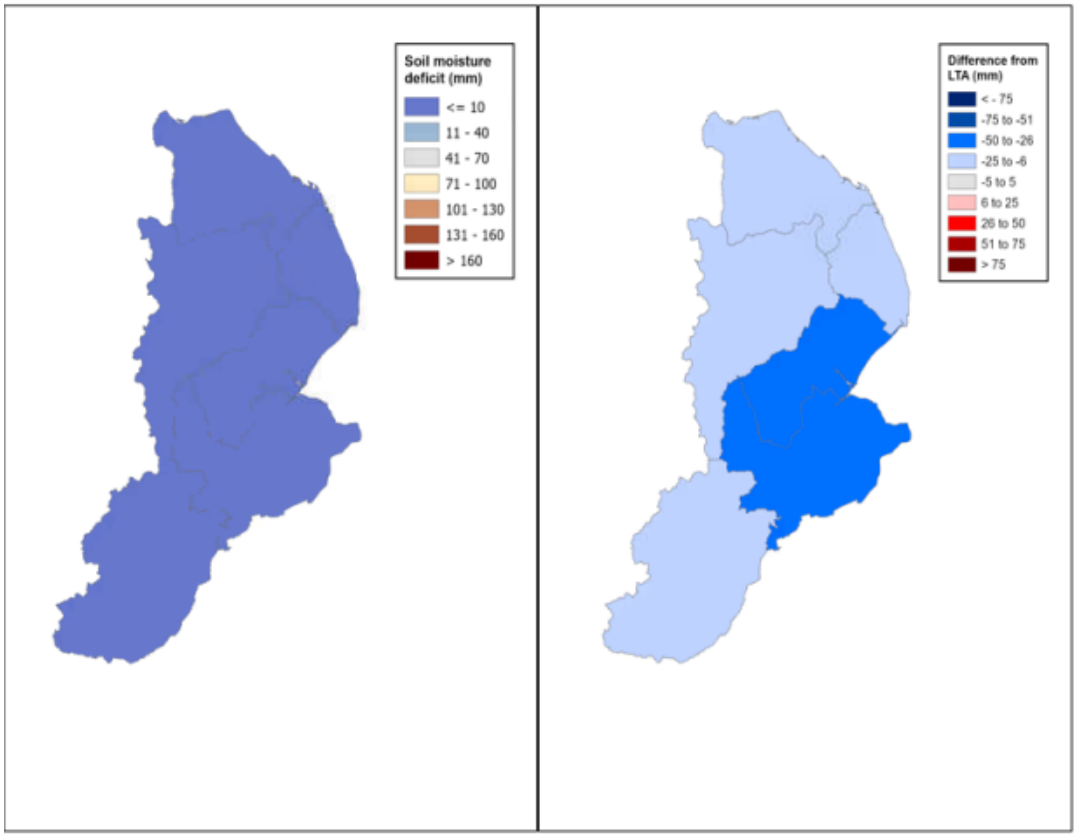

Figure 3: Lincolnshire Soil Moisture Deficit during December 2024

Section 3: What happened and impacts

Rainfall in River Witham Saltesford Upper Catchment

The South Witham rainfall gauge received 47.6mm between 05:30hrs on 05/01/2025 and 11:45hrs on 06/01/2025 totalling 30.25 hours. Peak rainfall was between 22:45hrs on the 05/01/2025 and 05:30hrs on 06/01/2025 inclusive (Figure 4).

Met Office Radar data suggests 30-50mm of rain for the 4th to the 5th January. The South Witham Gauging Station recorded only 4.2mm for the 01/01/2025 and 0.4mm for the 04/01/25 so rainfall preceding the event was not heavy. The ground was frozen with snow deposits visible in some photos.

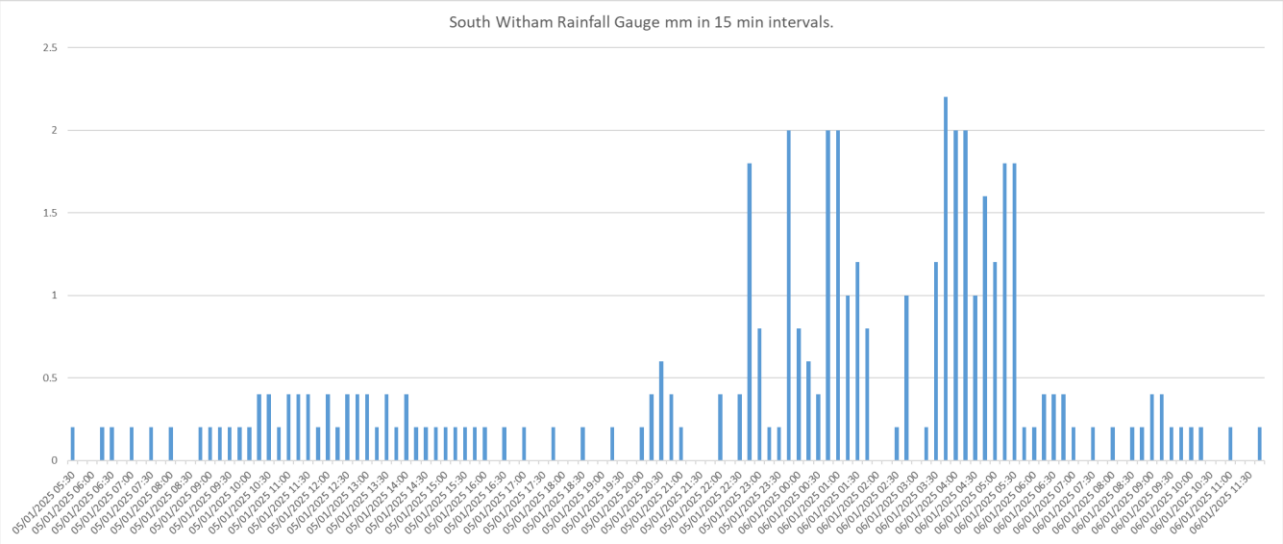

Figure 4: Rainfall at South Witham Rainfall Gauge in 15 minute intervals from 05:30 on 05/01/2025 to 11:45 on 06/01/2025

River Witham and flooding

The River Witham in this area is an open channel, in a largely unaltered state. The river banks are primarily natural high ground, with a small area on the roadside being embankments and floodwalls. The river is the lowest point, with the land gradually inclining upwards forming a valley. A flood defence scheme (the North Witham Flood Alleviation Scheme) has previously been implemented in this area to protect three properties (River Cottage, Riverside Cottages and Pheasant Cottage) on “Bull Lane” (referred to as Water Lane on current maps). Properties were previously at risk from events with a 20% probability of occurring in any year. Works were undertaken in August to October 2003. The works comprised of a concrete cut-off trench combined with concrete/brick flood walls or clay embankments. These defences were constructed to a minimum level of 96.3mAOD above sea level. Pumps to remove groundwater from the property side of the floodwall of Pheasent cottage and River Cottage were also installed.

The River Witham responded to Rainfall between 05:30hrs on the 05/01 and 11:45hrs on the 06/01 resulting in the highest river level recorded since 2000, peaking at 95.79m above sea level between 05:30hrs and 09:45hrs inclusive on the 6th January. It is believed

that river levels were higher than this as the gauging station appears to have drowned out (Figure 5). On 06/01/25 the river level increased sharply from 95.427m above sea level at 04:45hrs to 95.76m above sea level at 05:00hrs, an increase of 0.333m. This was shortly before the apparent drowning out of the gauge at 05:30hrs.

Compared to previous events; other than being the highest levels on record, the river response was not unusual. The River Witham typically responds by rising rapidly following rainfall and then falling equally rapidly unless further rain inputs cause another peak. The January 2025 event is most similar to the January 2024 event, other than the January 2024 event had two peaks in rainfall and as such two peaks in river levels, while the January 2025 event only had one peak in rainfall and river level.

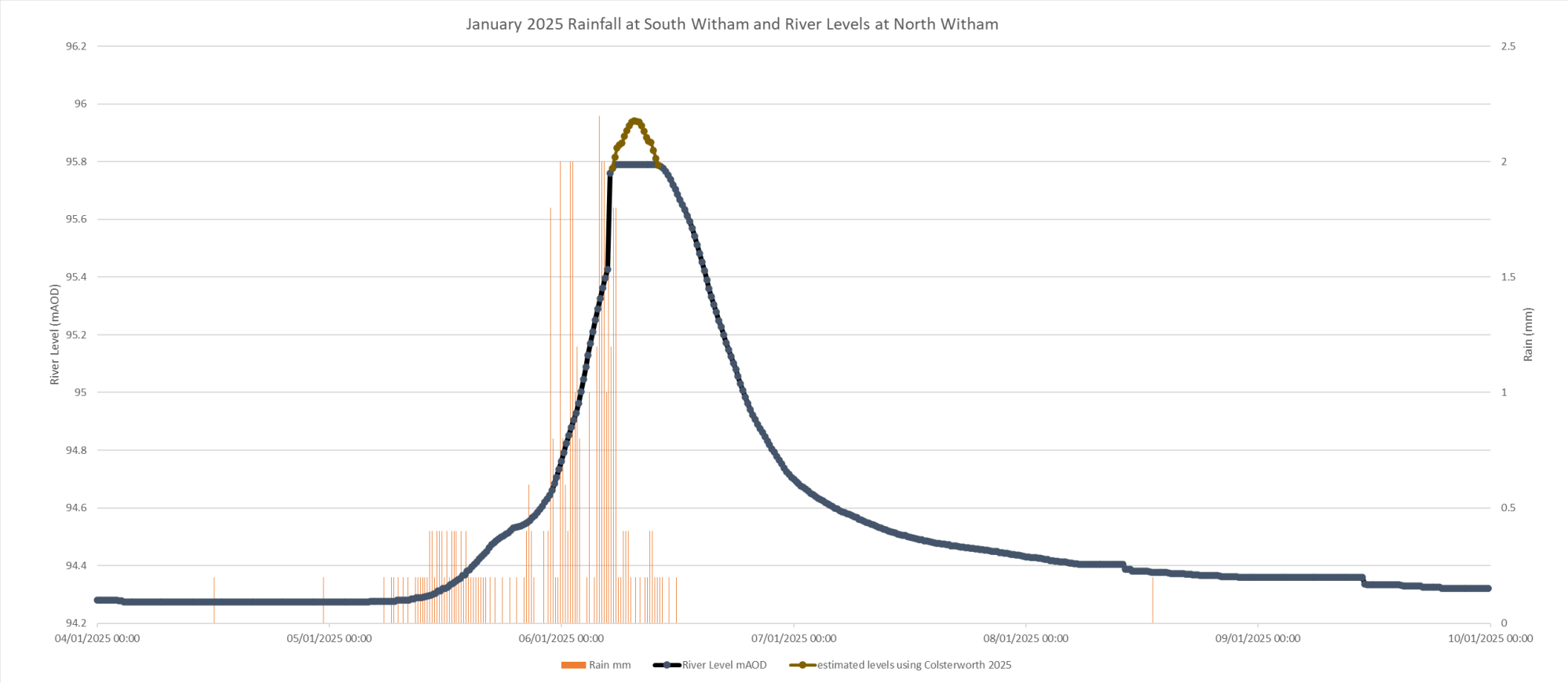

Figure 5: River Levels and rainfall at North Witham Gauging Station from 04/01/2025 to 10/01/2025. The brown line is the estimated level extrapolated using the change in levels at the next gauging station downstream, Colsterworth, for the same rainfall event.

Flooding Impacts

Water Lane (also called Bull Lane on some maps) flooded to at least 95.79m above sea level, with the true level being difficult to determine as the gauging station was drowned out. The estimated flood level is at least 95.86m above sea level, as photo evidence from the public shows the edge of the flood extent (although after peak flows) to land that is roughly this height. The land level was taken from LIDAR for the area the photo was taken.

The road flooded up to approximately the outside of the property called Riverside Forge downstream (figure 7) and to where the road crosses the Witham upstream. The flood level on the road was to the height of the fence running between the road and the river. Photo evidence from the public shows this, however photos were likely taken after peak water levels.

Fields on the right and left of the river; close to the houses, flooded (figures 6 and 8). Fields upstream before the river passes under Water Lane flooded (figure 8). Fields further upstream before a bend in the river flooded (figure 9).

Levels did not exceed the height of the embankment in the garden of the property known as River Cottage. This embankment has a crest height of about 96.2-96.3m above sea level. This measurement is taken from the LIDAR. The resident of River Cottage provided photo evidence of the flooding. This property was flooded externally, with detached garages and gardens affected. The resident reported two cars being flooded on the driveway. They also reported water backing up through pipes in the garden, it is believed these are part of the Anglian Water network. Resident reported they have a pump installed that actively pumped the water back out of the garden and that they would likely have experienced internal flooding if not for the pump.

The resident of the property known as Riverside Forge provided photos of the flooding in their garden, around the back of their detached garage, and outside the front of their detached garage. Land levels taken from LIDAR are about 95.8m above sea level. Some photos appear to have been taken after the peak flows.

The property called Pheasant Cottage was reported to have flooded internally by neighbours, however as of yet the resident has not confirmed this (dated 11/03/2025). The extent and depths of internal flooding is unknown.

Figure 6: Flooding of Water Lane on the left of the river and a field on the right of the river. Provided by the public.

Figure 7: Flooding on Water Lane, downstream extent. Provided by Public.

Figure 8: Flooding of fields on right side of the Witham (background) and left side of the Witham (foreground). Provided by the public.

Figure 9: Field off Water Lane where the river passes under the road. Provided by the public.

Figure 10: Field upstream of Water Lane. Provided by the public.

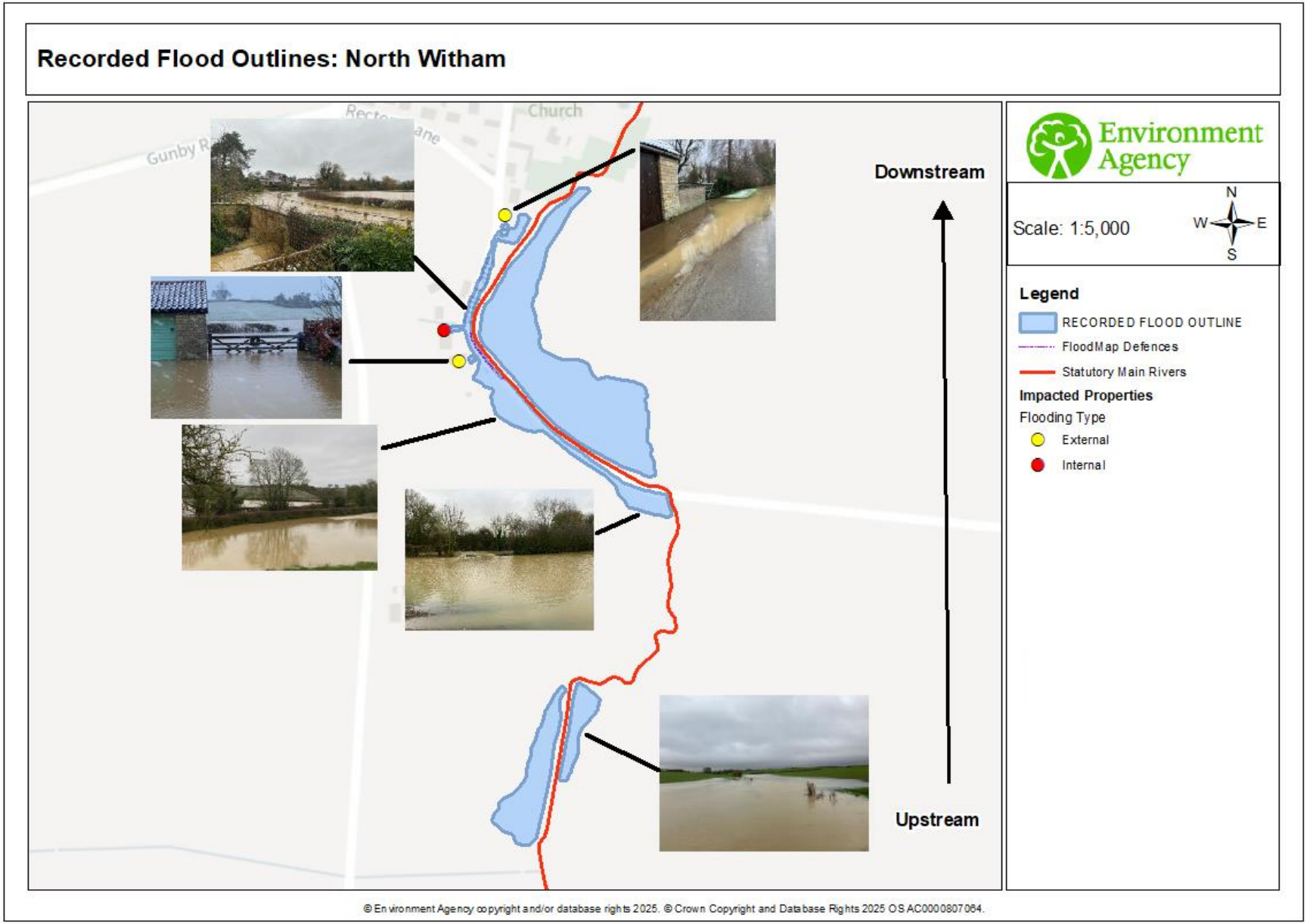

Figure 11: Flooded properties and land, North Witham.

Flood Warnings

North Witham is covered by the “River Witham in North Witham” Flood Warning Area (code 053FWFPUWI02) and the “Witham in South Kesteven” Flood Alert Area (code 053WAF108WSK).

The Flood Warning was issued on 06th January at 04:26 and removed at 11:22 on the 07th January 2025. It has not been possible to determine how much in advance of the flooding to Pheasant Cottage, the warning was received.

Section 4: Potential Causes of Flooding Review

Review Scope

We have reviewed the following potential causes of flooding to understand the part they may have had in why the flooding occurred:

- Rainfall, preceding catchment conditions and river response
- Alteration of the flood defences to remove steps and install a demountable defence.

Rainfall 5th to 6th January 2025, preceding catchment conditions and historic context

Table 1	
Date	Daily Rainfall (mm)
09/08/2004	63.8
11/06/2019	50.4
20/10/2023	46.6
15/10/2002	45.8
18/07/2001	44.8
06/06/2008	43.4
04/10/2004	42.8
23/07/2013	42.2
03/04/2000	41
20/07/2007	38.8

For context, it is useful to review the historic rainfall records for the past 24 years from 1st January 2000. For the period between 1991 and 2020 the average rainfall for this area is 52mm in January and 60mm in December – data from Met office Monthly Precipitation Observations 12km grids.

The rainfall for this event was spread over two days, neither of which are in the top 10 daily rainfall events since 2000 (table 1), with 06/01/2025 being the 29th highest rainfall recorded at 29.6mm and the 05/01/2025 being the 115th highest. While not being in the top 10, this makes rainfall totals on the 5th and 6th greater than 98.74% and 99.68% of all daily rainfall total since 2000 respectively. It must be noted that total rainfall for this event (47.6mm) is close to the monthly average for January for this area (52mm) and was received in 30.25h. The rainfall in this event was greater than the total January rainfall for some previous years. The rainfall for January 2025 was above average at 53.2mm as of the 21/01/2025, however as with other measures was not the highest on record, see Figure 12

Table 2		
Rain in 48h (mm)	Date Begin	Date End
86.2	09/08/2004	10/08/2004
71.6	10/06/2019	11/06/2019
68.4	17/07/2001	18/07/2001
66.6	11/06/2019	12/06/2019
63.8	08/08/2004	09/08/2004
61.4	06/07/2001	07/07/2001
54.8	14/10/2002	15/10/2002
53	19/10/2023	20/10/2023
48	02/04/2000	03/04/2000
48	15/10/2002	16/10/2002
47.8	20/11/2016	21/11/2016
47.6	**05/01/2025**	**06/01/2025**

For rainfall over a 48h period the event from the 05/01/25 to 06/01/25 was the 12th highest recorded rainfall. See Table 2.

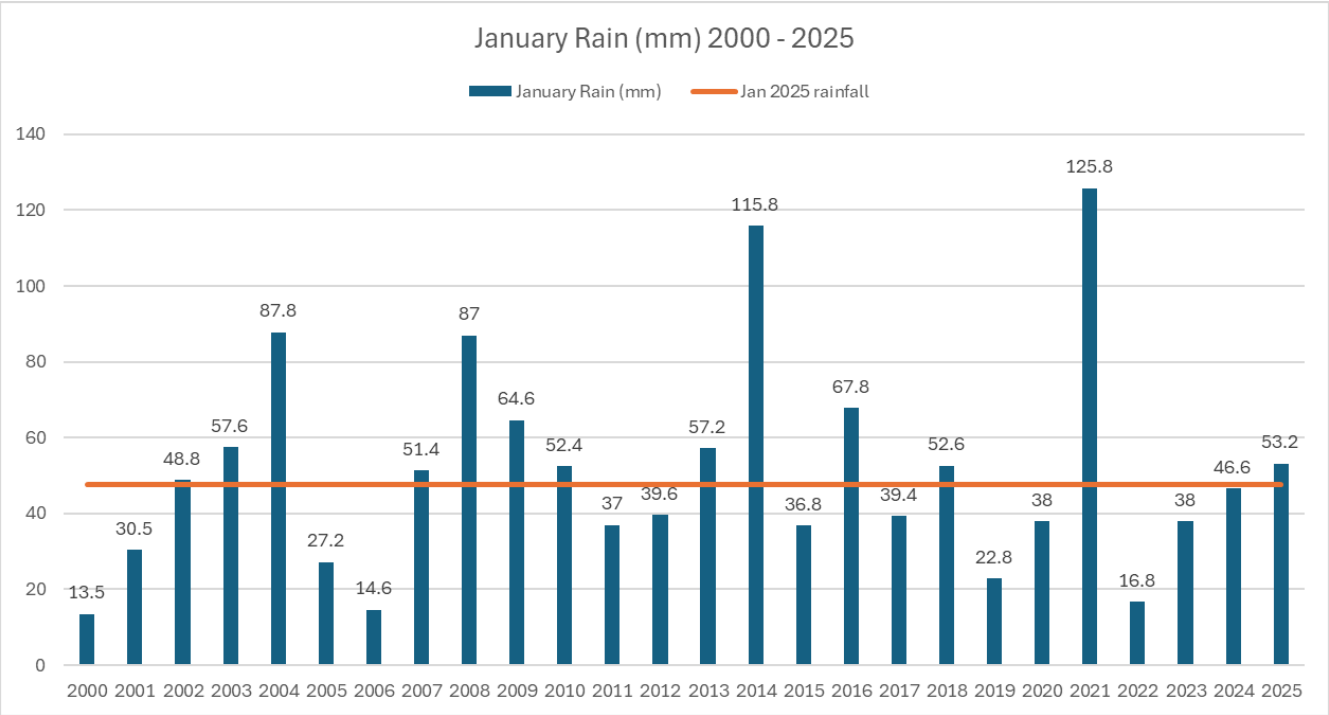

Figure 12: South Witham Rainfall Gauge January monthly rainfall totals 2000 to 2025. The orange line indicates the rainfall for the Jan 2025 event. The rainfall total for Jan 2025 is only up until 21/01/2025 rather than the full month.

North Witham River Level Gauge		
Date	River Level (m above sea level)	Total Event Rainfall South Witham Rainfall Gauge(mm)
06/01/2025	**95.79**	**48**
19/07/2021	95.765	70.2
01/01/2024	95.679	35.8
21/11/2016	95.602	47.8
03/04/2000	95.307	48
14/06/2019	95.066	107.8
24/12/2020	94.712	40.8
16/01/2021	94.708	41
21/07/2007	94.685	51
23/07/2013	94.493	42.2
24/08/2015	94.467	38.6
10/08/2004	94.304	86.2
21/10/2023	94.213	62.5
06/06/2008	94.114	43.4
16/10/2002	94.02	48

Table 3 shows peak river levels during events in descending order, compared to the rainfall during that event. The table makes it clear that rainfall alone does not explain the record river levels observed in this event as previous events with greater rainfall, such as June 2019 in which 107.8mm of rain fell, however river levels remained lower than other events with less rainfall, for example the January 2025 event. The levels at the North Witham gauging station were the highest on record, with relatively high rainfall falling directly onto saturated, frozen ground being the primary factors being the primary factors contributing to this. The lack of interception by trees and other vegetation may have also contributed to these levels.

These accounts demonstrate how important other environmental factors are in resulting river responses and flooding following rainfall, in this case time of year and the capacity of the soil and vegetation to, intercept, absorb and hold on to water.

Table 3: Peak River Levels compared to rainfall totals

River Witham response

The River Witham response to the rainfall of the 5th and 6th January 2025 resulted in flooding not previously evidenced and the highest river levels recorded at the North Witham gauging station. The station drowned out at 95.79m above sea level. Colsterworth gauging station is downstream of North Witham and was used to estimate the levels at North Witham using the relative changes in water level recorded during the peak. From this estimation levels may have reached 95.94m above sea level, which if correct, would be an event with a 1:1000 (0.1%) probability of occurring in any one year.

See Appendix 1 for graphs of previous flooding events.

To understand the magnitude of the flood event, analysis of the Upper Witham Grantham model 2015 has been undertaken to estimate the Annual Exceedance Probability (AEP) of flooding (the chance of the flood event occurring in any one year).

The modelled in channel node (UWE19553) closest to the gauging station has the level of a 1% probability event as 95.588m above sea level, 0.5% as 95.658m above sea level and 0.1% as 95.921m above sea level. This recorded level in this event was 95.79m above sea level, however the gauge was drowned out, so the estimated level is up to 95.94m above sea level. As such it is likely this was more than a 0.5% probability event and possibly a 0.1% probability event, however because the gauge drowned out it is impossible to say for sure. The defences built as part of the flood alleviation scheme to protect River Cottage, Riverside Cottages and Pheasant Cottage did not overtop, however they have been altered and water is likely to have passed through this gap in the defence.

Reference	X	Y	L2	L5	L10	L20	L25	L30	L50	L75	L100	L100_CC20	L200	L200_CC20	L1000	L1000_CC20
UWE19553	492739	321645	95.214	95.406	95.452	95.5	95.516	95.525	95.555	95.574	95.588	95.654	95.65846	95.72658	95.921	96.082
UWE19593	492724	321607	95.283	95.466	95.506	95.55	95.564	95.573	95.601	95.619	95.632	95.695	95.69917	95.76514	95.955	96.116
UWE19687	492779	321529	95.394	95.552	95.583	95.62	95.632	95.64	95.665	95.68	95.693	95.749	95.75343	95.81522	95.997	96.154

Table 4: modelled scenarios from the Upper Witham Grantham model 2015.

Alteration of the flood defences

The defences installed as part of the North Witham Flood Alleviation Scheme in 2003 included walls and embankments to a level of 96.3m above sea level. These works were constructed on behalf of the Environment Agency but became the responsibility of the householders following completion of construction. These defences prevented the internal flooding of properties River Cottage and Riverside Cottages. Pheasant Cottage flooded internally however the defences for Pheasant Cottage appear to have been altered, with the removal of the “as built” access steps in the wall (as indicated in drawing number NJD 31128/02D- see appendix 1). The steps have been replaced by a demountable defence, which has a lower crest height that the flood wall. Considering no other properties flooded internally, it is reasonable to assert that a possible failure in this demountable defence, the possibility that it was overtopped or the possibility that the defence was not in place at the time of flooding is the cause of the internal flooding of Pheasant Cottage.

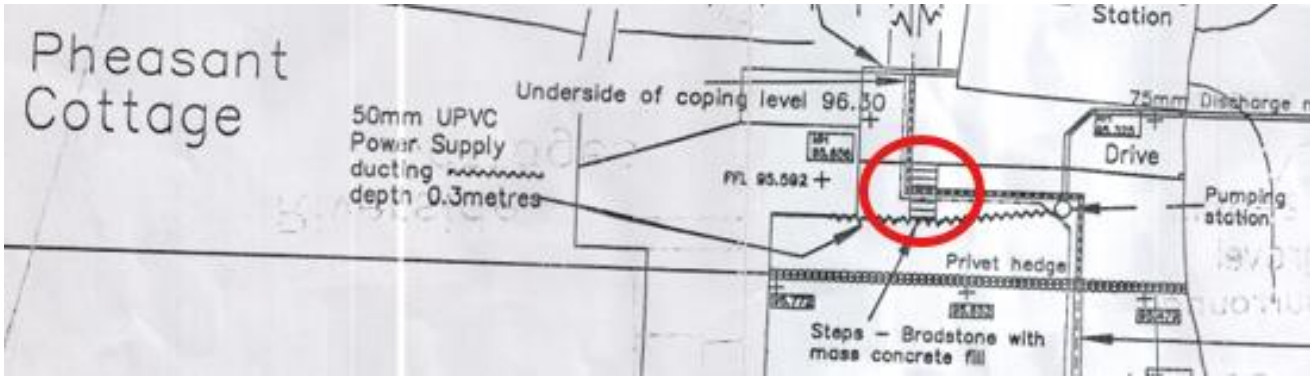

Figure 13: Excerpt from as built drawings showing steps detail at Pheasant Cottage

Figure 14: The demountable defence outside Pheasant Cottage that has replaced the steps as built in the original design. Provided by Environment Agency.

Section 5: Review Conclusions and next steps

Conclusions

In summary, the effects of Rainfall 05/01/2025-06/01/2025 and the preceding catchment conditions of a low soil moisture deficit, frozen ground and reduced rainfall interception by vegetation:

- led to approximately 47.6mm of rainfall within 30.25 hours causing the River Witham to exceed its channel capacity resulting in overtopping and flooding of, gardens, outbuildings, farmland and the suspected flooding of a residential property.
- caused an extreme exceedance flood event with at least a 1:200 (0.5%) chance of occurring in any one year. It is possible, however unconfirmed that the flood event was one with a 1:1000 (0.1%) chance of occurring in any one year.

Internal flooding of the property called Pheasant Cottage was caused by the removal of the steps that were part of the “as built” defences. The steps were replaced with a demountable defence. The demountable defence is lower than the wall and it is unknown if it is watertight. It is unknown if the defence was in place at the time of flooding.

While the river level in this event is the highest on record, previous events have seen similar river levels, particularly July 2001 with a peak level of 95.765m above sea level, which is 0.025m below the record on this event. The true peak river level in this event is undoubtedly higher than the record due to the station drowning out, being estimated to be at least 95.86m above sea level. It is reasonable to assert that this event represents the highest levels on record and that it was an extreme event, however similar events could occur in the future.

Issues for further investigation and action

The North Witham river level gauge drowns out at 95.79m above sea level, the possibility of raising the gauge to prevent it drowning out in future should be considered.

Next Steps

We have set out below several proposed steps the Environment Agency intend to action in 2025/26 (indicative timescale).

Short term [up to 3 months]

- None

Medium Term [3 to 6 months]

- Attempt to contact the homeowner of Pheasant Cottage regarding restoring the flood defences to as built condition.

Longer Term [6 months +]

- Investigate the possibility of upgrading the gauge to continue reading during high flow events.

Main Rivers rights and responsibilities

You can find out more information about the rights and responsibilities of owning a river bank here: Your watercourse: rights and roles | Engage Environment Agency

How resilient are you?

Are you prepared for future floods?

Although defences reduce the likelihood of flooding, the risk can never be removed entirely. To begin to be more resilient take some practical steps to help reduce the impact of flooding to your home or business.

To find out if you are at risk, how to prepare, and check what flood warnings are available to sign up for (free) visit Flooding - GOV.UK or call Floodline on 0345 988 1188.

The Environment Agency intend to provide improved coverage of fluvial (river) flood warnings in this area this year, so please check back after the summer to see if you can register for additional warnings. Sign up for flood warnings - GOV.UK

You can find out how to put together Flood Plans for your home, business or community here www.gov.uk/prepare-for-flooding Call Floodline on 0345 988 1188 for a hard copy. You can also check with your parish, ward or borough council to see if they have or are developing a Community Emergency Plan.

There is guidance on measures that can be taken to improve homes and businesses resilience to flooding on this website https://thefloodhub.co.uk/pfr/. There is also further information on Flood Products to help reduce the impact of flooding on your home e.g. flood doors, airbrick covers, at www.bluepages.org.uk.

Appendix 1

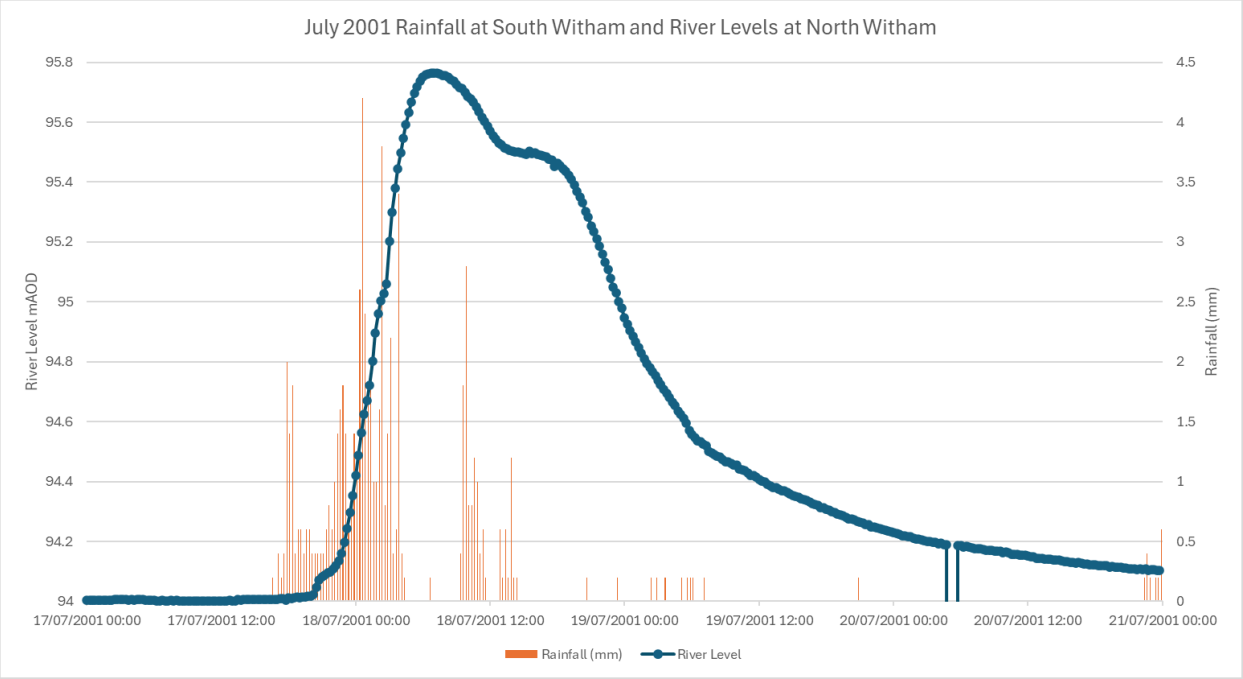

Figure 15: River Levels at North Witham and Rainfall at South Witham Gauges between 17/07/2001 and 21/07/2001.

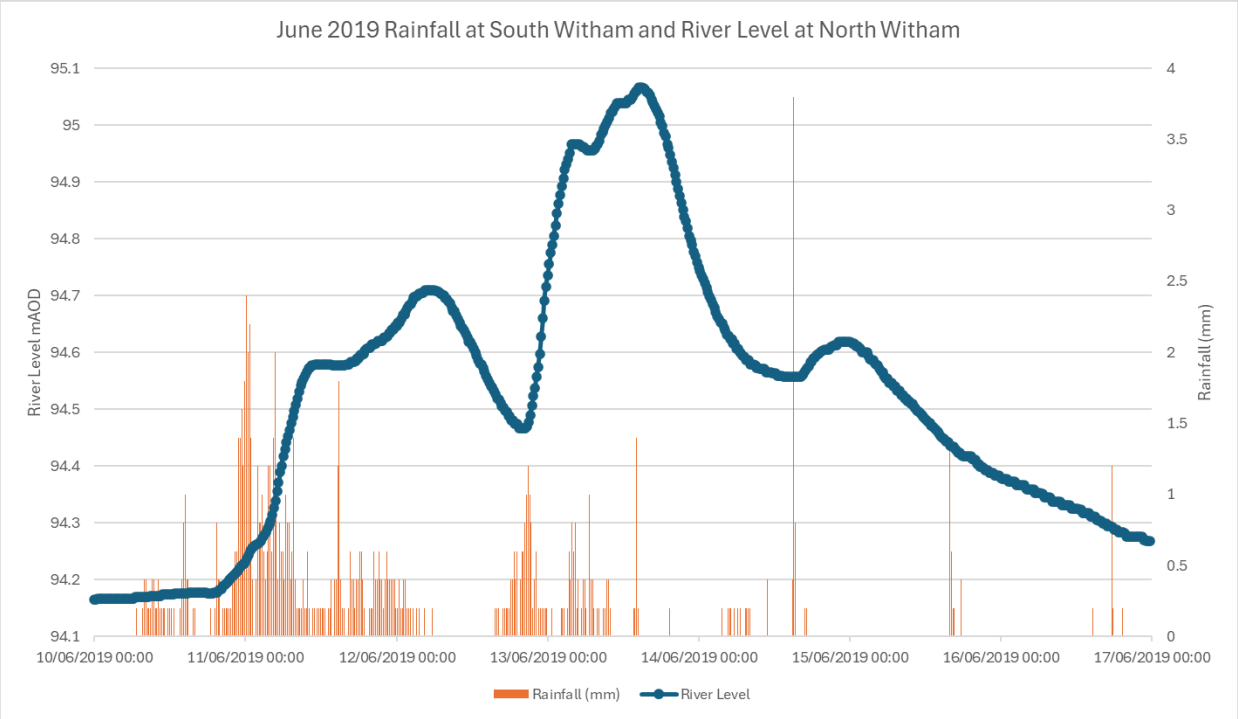

Figure 16: River Levels at North Witham and Rainfall at South Witham Gauges between 10/06/2019 and 17/06/2019.

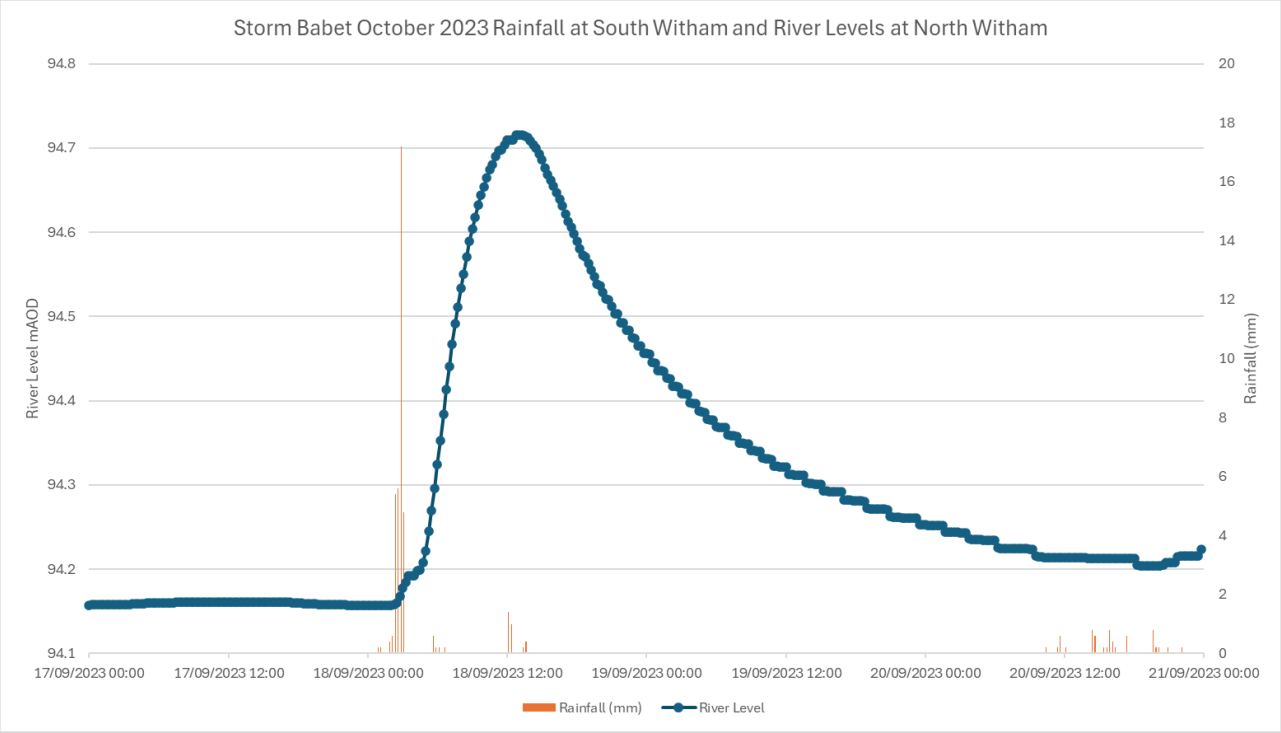

Figure 17: River Levels at North Witham and Rainfall at South Witham Gauges between 17/09/2023 and 21/09/2023.

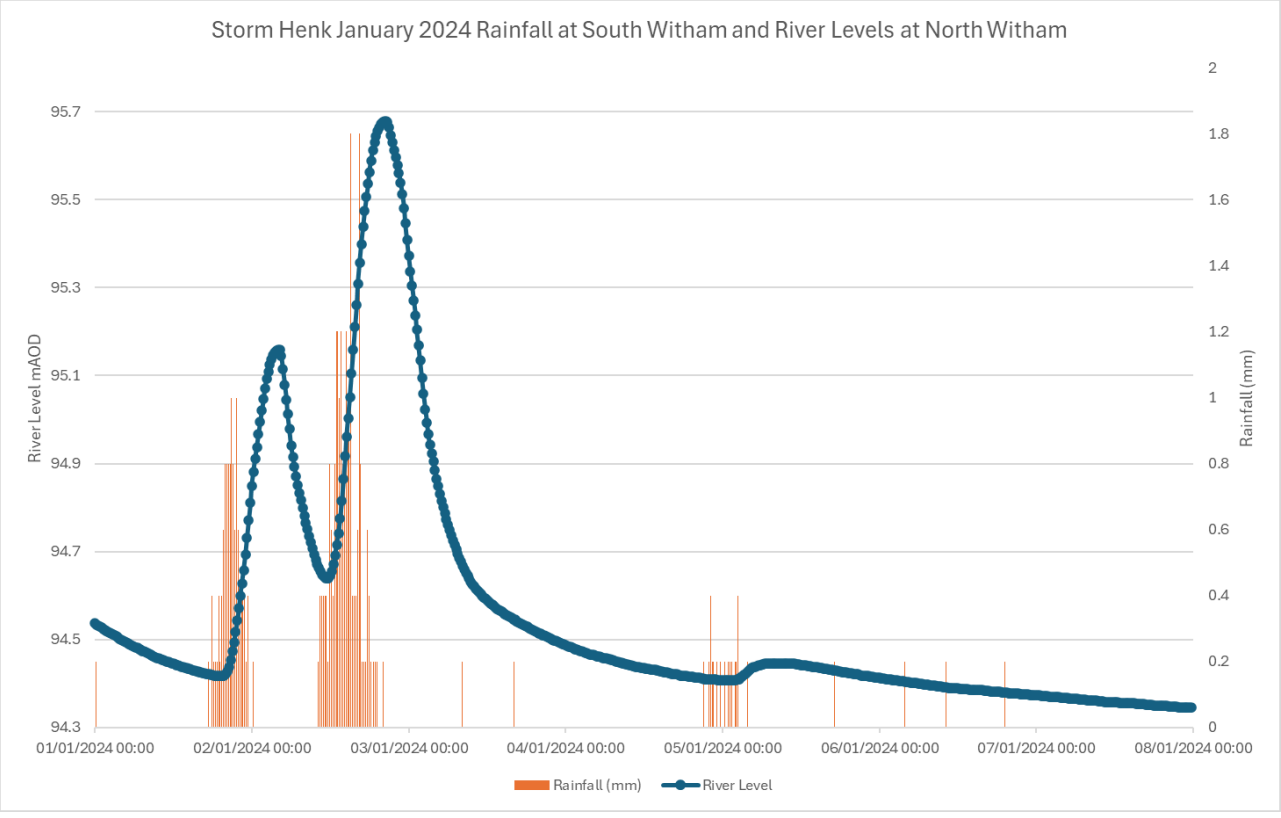

Figure 18: River Levels at North Witham and Rainfall at South Witham Gauges between 01/01/2024 and 08/01/2024.

Figure 19: Drawing NJD 31128/02D, indicating flood defence locations, including the steps at Pheasant Cottage, that were subsequently removed.