Summary of the 2023 modelling report - Hoxne

In April 2022 the Environment Agency commissioned a hydraulic modelling study for the mill sluices at Wainford, Wortwell and Hoxne on the River Waveney.

Previous modelling undertaken in 2012 focused on removing the main sluices at these locations because at the time, this was seen as the scenario that could have the greatest impact on flood risk to people and property. However, this study did not focus specifically on the mill sluices that we are proposing to withdraw maintenance responsibility for and the flood risk to people and property if these assets were left closed during a flood event.

This document provides a summary of the findings from the latest modelling study which focuses on the impact of the Hoxne Sluice being closed during a range of flood events. Please note that the maps that have been included here are those found in the modelling report and are designed to illustrate the outputs from the events where the greatest changes in flood extent and flood depth were observed during the modelling runs. Where the changes were negligible, a written summary of the outputs has been provided here.

The structures at Hoxne Mill

The two structures at Hoxne Mill are:

- The mill sluice located around 70m upstream of the mill buildings at TM1888777839 and shown in Photograph 5 on the Citizen Space web page. This is the structure that we are proposing to withdraw our maintenance responsibility for and transfer ownership to a third-party riparian owner.
- A weir located around 700m upstream of the mill buildings at TM1844478094. This structure defines the split in flow between the mill race and main channel.

Modelling Approach

- A Baseline Scenario was run for the 50%, 20%, 5% and 1% Annual Exceedance Probability (AEP) events. The mill sluice gates were modelled as open to provide a comparison with the second scenario below.
- A simulation was then run for the 50%, 20%, 5% and 1% AEP events but with the sluice gates closed for the duration of the storm event (30 hours). This is referred to as Scenario 1 below.
- A 50% AEP event is a flood event with a 50% chance of occurring in any given year. A 1% AEP event has a 1% chance of occurring in any given year etc.

NB. The mill sluice at Hoxne is referred to as the Hoxne Guillotine Gate in the maps provided in this summary document.

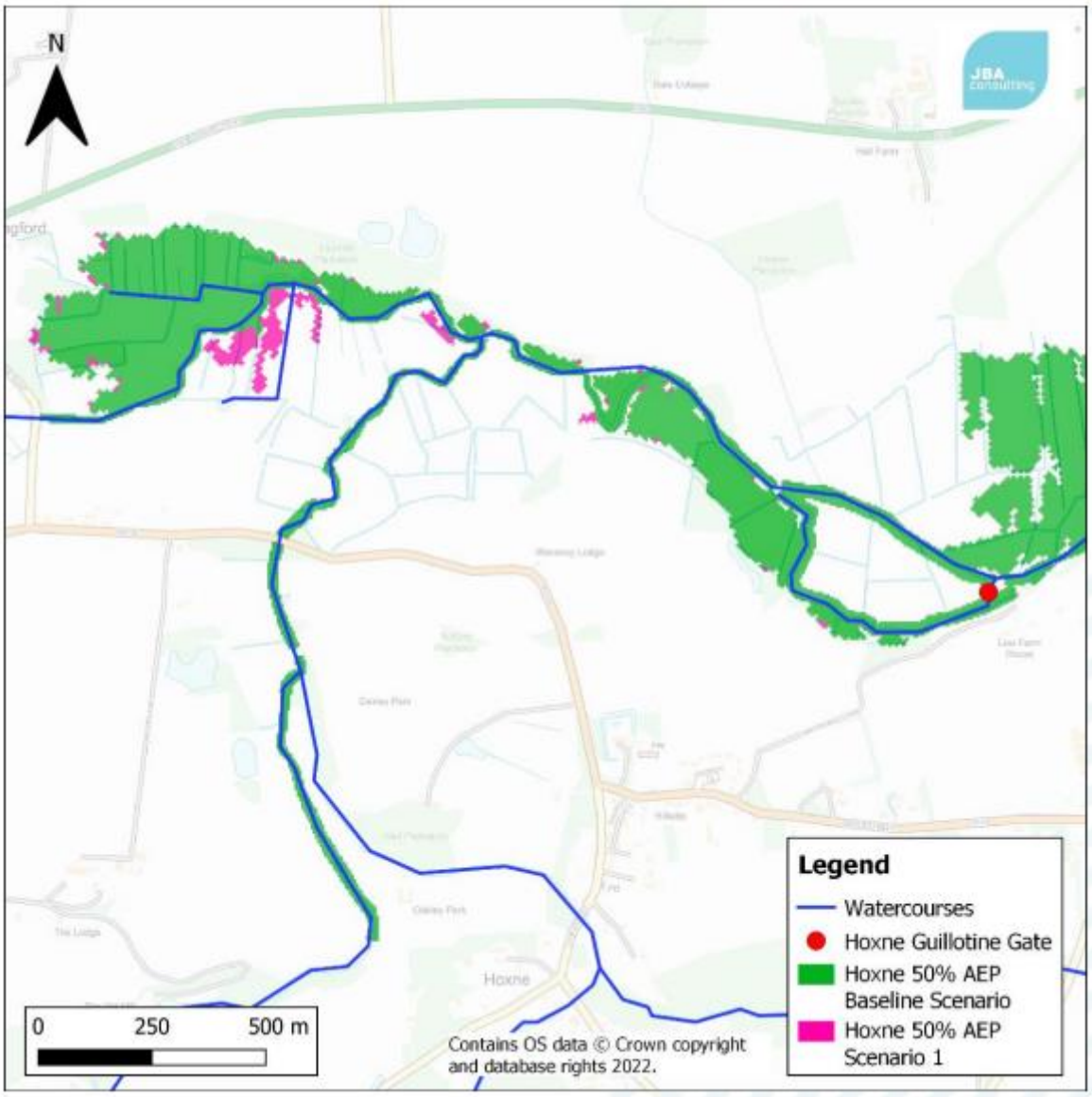
Summary of outputs

a) Flood extent

For all modelled AEP events, there is a slight increase in flood extent with the mill sluice gates closed (Scenario 1) in comparison with the Baseline Scenario. This increase is confined to the floodplain upstream of the mill sluice.

This increase is greatest for the 50% AEP event and is shown in pink in Map 1 below. This is predominately in the rural areas in the upper reaches of the modelled area/south of Farmhill Plantation at National Grid Reference TM1730678411.

Map 1: Flood extent comparison at Hoxne for the 50% AEP event



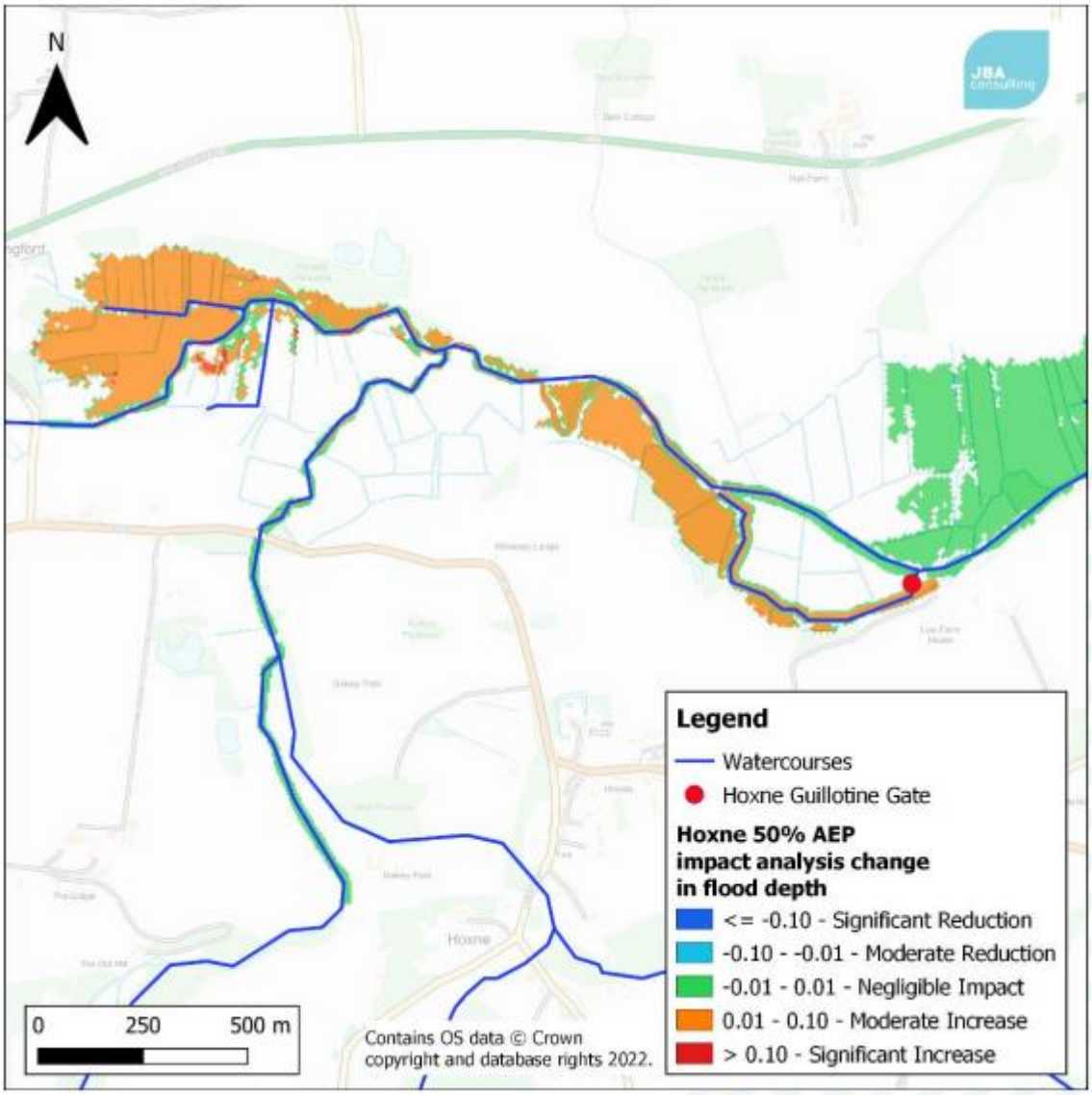
There is only a minor increase in flood extent in the 5% AEP event and during the 1% AEP event the increase is described as insignificant in the report. Increases in flood extent are located up to 2.6km upstream of the structure during the 50% AEP event, 1.67km upstream during the 5% AEP event and 1.18km during the 1% AEP event.

b) Maximum flood depth

For all AEP events, there is an increase in maximum flood depth upstream of the mill sluice and a negligible change downstream with the sluice gates closed (Scenario 1).

Map 2 shows the changes in maximum flood depth for Scenario 1 when compared to the Baseline Scenario for the 50% AEP event. Downstream of the mill sluice there is a negligible change in flood depths (<±0.01m) as a result of closing the sluice gates. Upstream of the mill sluice, maximum flood depth in most locations increases by up to 0.03m. Where there is an increase in flood extent south of Farmhill Plantation (National Grid Reference TM1730678411), flood depth increases are greater than 0.1m (shown in red on the map) because this is newly flooded land.

Map 2 – Change in flood depth at Hoxne for the 50% AEP event



During the 20% and 5% AEP events, there is an increase in maximum flood depth of approximately 0.01m directly upstream of the mill sluice which reaches 500m and 250m upstream of the structure respectively. The remainder of the flooded area has a negligible change in peak flood depth.

There is very limited change in maximum flood depth during the 1% AEP event and this is confined to approximately 150m upstream of the structure. The remainder of the floodplain during this event has a negligible change in flood depth.

c) In-channel peak water levels

A comparison of in-channel peak water levels at Hoxne for all modelled AEPs can be found in Table 1 below.

There is an increase in in-channel water levels upstream of the mill sluice during all modelled AEP events, which reaches a maximum of 2km upstream of the structure during the 50% AEP event. There is no change in peak water level downstream of the mill sluice. The change in in-channel water level decreases with larger flood events.

Table 1 - In-channel peak water levels at Hoxne

Scenario 1	50% AEP	20% AEP	5% AEP	1% AEP
Baseline Water Level (mAOD)	20.49	20.62	20.70	20.81
Scenario 1 Water Level (mAOD)	20.61	20.71	20.78	20.87
Difference (m)	**+0.12**	**+0.09**	**+0.08**	**+0.06**

d) Flooded properties

Table 2 below shows that whilst there is a change in flood extent, flood depth, and in-channel water levels as a result of the sluice gates being closed (Scenario 1), there is no increase in number of properties flooded.

Table 2 - Additional flooded properties at risk at Hoxne

Scenario 1		50% AEP	20% AEP	5% AEP	1% AEP
Baseline property count		14	15	24	45
Scenario 1	Count	14	15	24	45
	Difference	**0**	**0**	**0**	**0**

Summary of findings

- Scenario 1 simulated the impact of closing the mill sluice gates at Hoxne. The gates were modelled as open during the Baseline Scenario.
- With the sluice gates closed, the modelled flood extents are shown to increase slightly at some locations upstream of the structure for all modelled AEP events. This is predominately in the rural areas in the upper reaches of the modelled area/south of Farmhill Plantation at National Grid Reference TM1730678411.
- The greatest change in maximum flood depth was noted during the 50% AEP event, with changes of up to 0.1m to the south of Farmhill Plantation which correlates to newly flooded land. Changes elsewhere are up to a maximum of 0.03m for this return period. With increasing return periods, the changes are less pronounced.
- With regards to in-channel water levels, there is a maximum increase of 0.12m located upstream of the mill sluice during the 50% AEP event. This increase extends upstream approximately 2km from the sluice, although the increase in water level lessens with distance from the structure. The change in in-channel water level decreases with larger flood events.
- The flood extent and depth, and peak in-channel water levels all increase upstream of the sluice during Scenario 1 because the closure of the gates reduces the conveyance of water through the structure and so water backs up upstream of the asset.
- Despite the slight changes in flood extent, depth and peak in-channel water levels, no additional properties are flooded when the sluice gates are closed.