NOTE TO FILE

JBA Project Code	2022s1587
Contract	Sherborne Restoration
Client	National Trust
Day, Date and Time	25/11/24
Author	Ellie Smith
Reviewer / Sign-off	Matthew Hemsworth
Subject	Detailed Design Flood Risk Analysis

1 Detailed Design Flood Risk Analysis

1.1 Purpose

The purpose of this technical note is to assess post-restoration flood risk along Sherborne Brook and the Broadwater Lakes from NGR SP 16386 15170 to NGR SP 16916 14883. The 2D hydraulic model was developed and was ran for the 2-year, 10-year, 100-year plus 30% climate change and 100-year plus 43% climate change (central and higher estimate for the 2080 epoch for the Cotswolds management catchment) to generate flood extents and maximum flood depths for analysis.

1.2 Pre-Restoration Conditions

Water levels within the Sherborne Brook and Broadwater Lakes are controlled by weir and sluice structures. As with any impounded system controlled by barriers, flow energy within the brook is artificially reduced upstream of the structures. Whilst this configuration acts to create a deeper body of water (the lake), in-channel hydraulics are also changed and consequently natural sediment supply and sediment dynamics are disrupted. This leads to un-natural sediment sinks (i.e. sediment accumulation) because the flow within the brook does not have sufficient energy to carry and transport sediment downstream. Overtime, vegetation has embedded itself within the deposited material and encroached from the channel margins, reducing the width of the Broadwater Lakes.

1.3 Post-Restoration Flood Risk Results (within the restoration works area)

The aim of the restoration along Sherborne Brook is to reduce the amount of silt that is transported and deposited downstream within the Broadwater Lakes. This can be done by encouraging greater overtopping onto the right bank floodplain, upstream of the footbridge at NGR SP 16578 15144, and slowing flow over the floodplain to increase the deposition of silt, reducing the amount that is entrained downstream into the Lakes. Therefore, the preferred restoration option consists of:

- Large woody material in the channel upstream of the footbridge to increase in-channel roughness and encourage greater overtopping onto the right bank floodplain.
- Scrapes on the right bank floodplain to help reduce flow velocities and store water, encouraging silt deposition.
- Localised right-bank lowering to enable more frequent overtopping during lower return periods.
- 50% channel narrowing at NGR SP 16578 15144 to reduce the flow area, slowing flows and causing water to back-up and overtop onto the right bank floodplain.
- Blockage of the drainage ditch at NGR SP 16531 15064 to allow water to dissipate onto the floodplain instead of being directed into the Sherborne Brook channel, to encourage flow attenuation and silt deposition.
- Lowering of the downstream, right bank floodplain (NGR SP 16601 15084) to encourage flow attenuation and silt deposition as a result of a reduction in flow velocities, before water rejoins the Broadwater Lakes.

1.3.1 2-year fluvial flood event

The flood extent and maximum depths for the detailed design 2-year fluvial flood event are shown in Figure 1-1. Flooding is seen to extend across a large area of the right bank floodplain. This can be attributed to the 50% narrowing of the river channel at NGR SP 16574 15150 and increased channel roughness (adding substantial amounts of woody material to the Sherborne Brook) which has encouraged water to back up and spill out onto the right bank floodplain. Flood depths are greater within excavated sections of the right bank floodplain, where scrapes and the lowered floodplain area is located as these features have increased the floodplain storage area. Maximum flood depths of 0.59m are found within the scrapes and maximum flood depths of 0.54m within the lowered downstream floodplain. Surrounding these design features, maximum flood depths are 0.2m. Flooding encroaches slightly onto the left bank floodplain with a maximum flood depth of 0.2m. Flooding does not extend near to the house on the left bank floodplain. Flood water is confined to the valley floor.

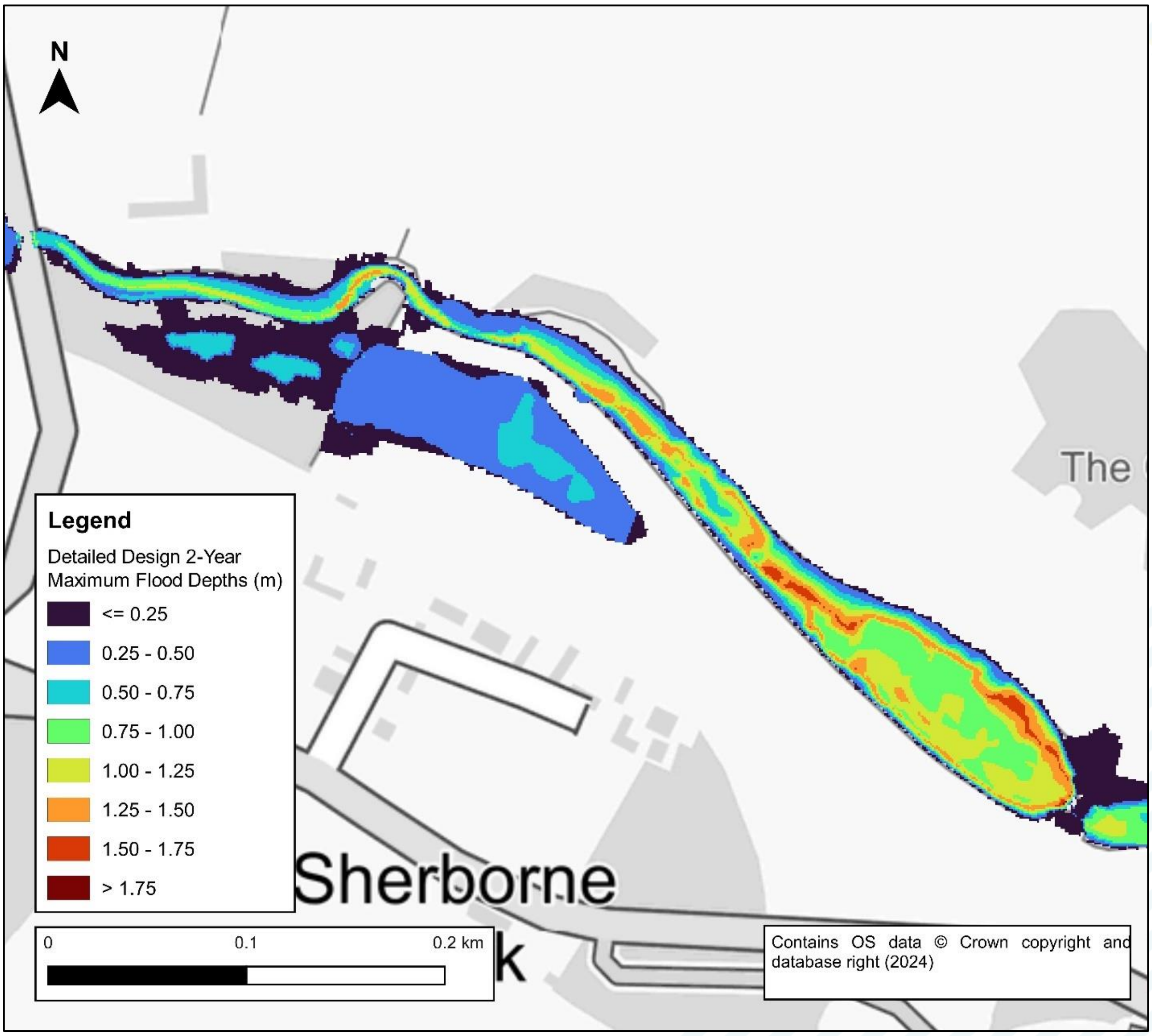

Figure 1-1: Detailed Design 2-Year Flood Depths and Extent

1.3.2 10-Year Fluvial Flood Event

The flood extent and maximum depths for the detailed design 10-year fluvial flood event are shown in Figure 1-2. Alike in the 2-year flood event, flooding is largely concentrated across the right bank floodplain. As a result of increased flows, more water has backed up behind the narrowed channel section, causing a greater quantity of water to spill out onto the right bank floodplain. Maximum flood depths are greater within the scrape features (0.77m) and lowered downstream area (0.7m). Surrounding these design features, maximum flood depths are 0.35m. Flooding encroaches slightly further onto the left bank floodplain with a maximum flood depth of 0.4m adjacent to the channel. Flooding does not extend near to the house on the left bank floodplain. Flood water is confined to the valley floor.

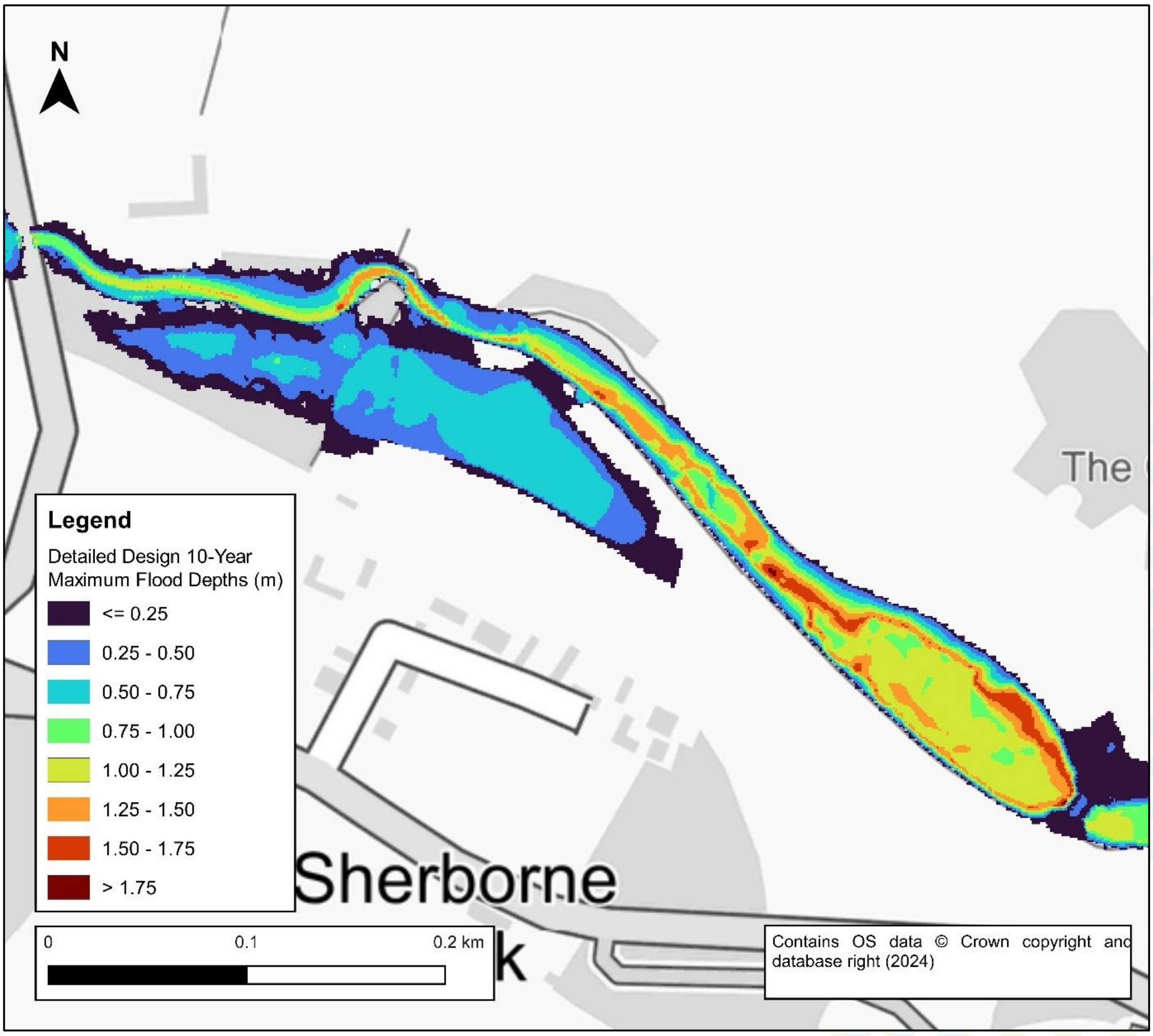

Figure 1-2: Detailed Design 10-Year Flood Depths and Extent

1.3.3 100-Year plus 30% Climate Change Fluvial Flood Event

The flood extent and maximum depths for the detailed design 100-year plus 30% climate change fluvial flood event are shown in Figure 1-3. Flooding is seen to extend across the whole of the right bank floodplain from the road bridge at NGR SP 16386 15170 to NGR SP 16715 15002 due to increased flows. Maximum flood depths are even greater within the scrape features (0.96m) and lowered downstream area (0.87m). Surrounding these design features, maximum flood depths are 0.6m. Flooding encroaches further onto the left bank floodplain with a maximum flood depth of 0.4m adjacent to the channel. Flooding does not reach the house on the left bank floodplain. Flood water is confined to the valley floor.

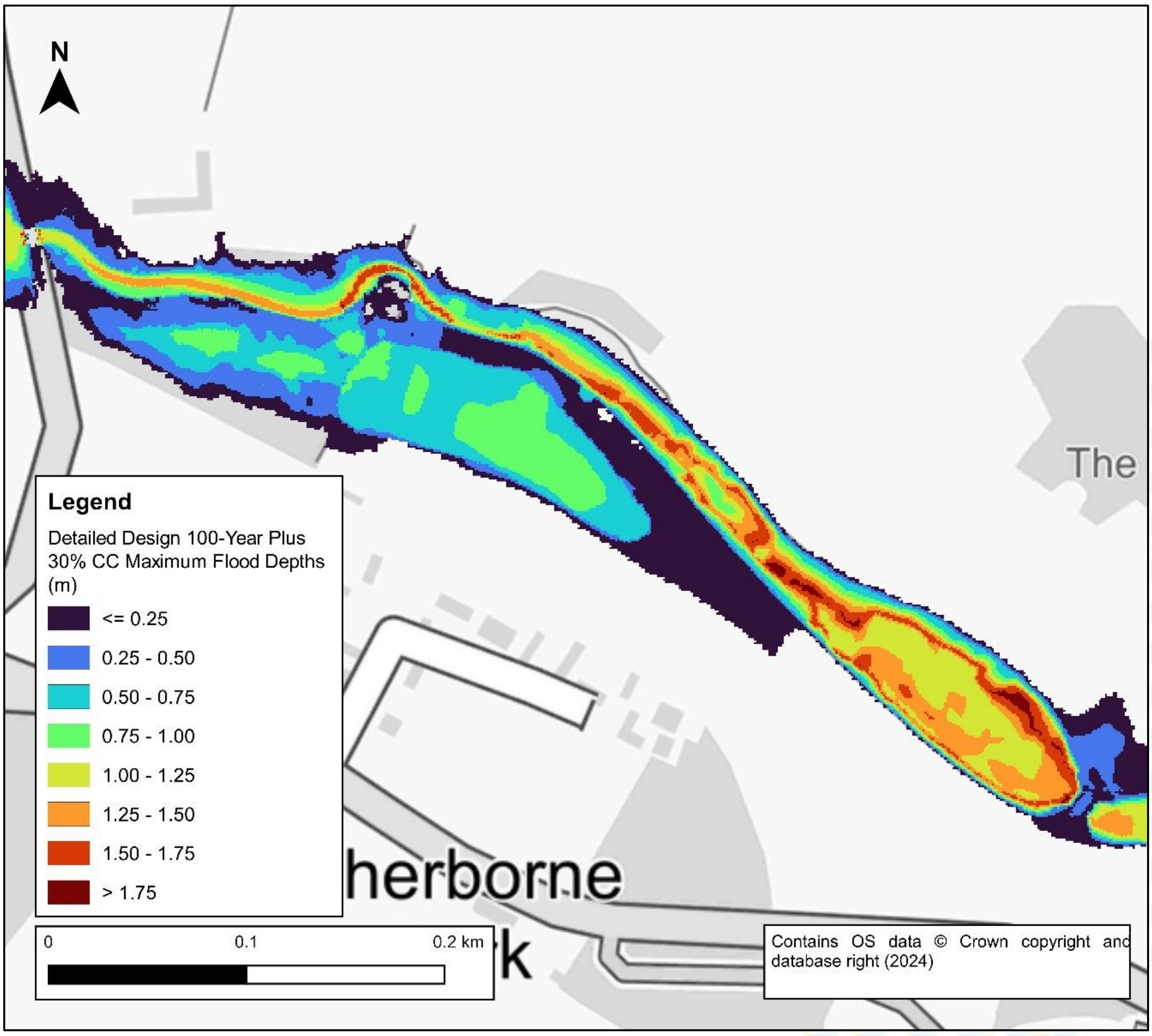

Figure 1-3: Detailed Design 100-Year plus 30% Climate Change Flood Depths and Extent

1.3.4 100-Year plus 43% Climate Change Fluvial Flood Event

The flood extent and maximum depths for the detailed design 100-year plus 43% climate change fluvial flood event are shown in Figure 1-4. Flooding is seen to extend across the whole of the right bank floodplain from the road bridge at NGR SP 16386 15170 to NGR SP 16715 15002 due to increased flows. Maximum flood depths are 1m within the scrape features and 0.88m lowered downstream area. Surrounding these design features, maximum flood depths are 0.6m. Flooding encroaches further onto the left bank floodplain with a maximum flood depth of 0.48m adjacent to the channel. Flooding does not reach the house on the left bank floodplain. Flood water is confined to the valley floor.

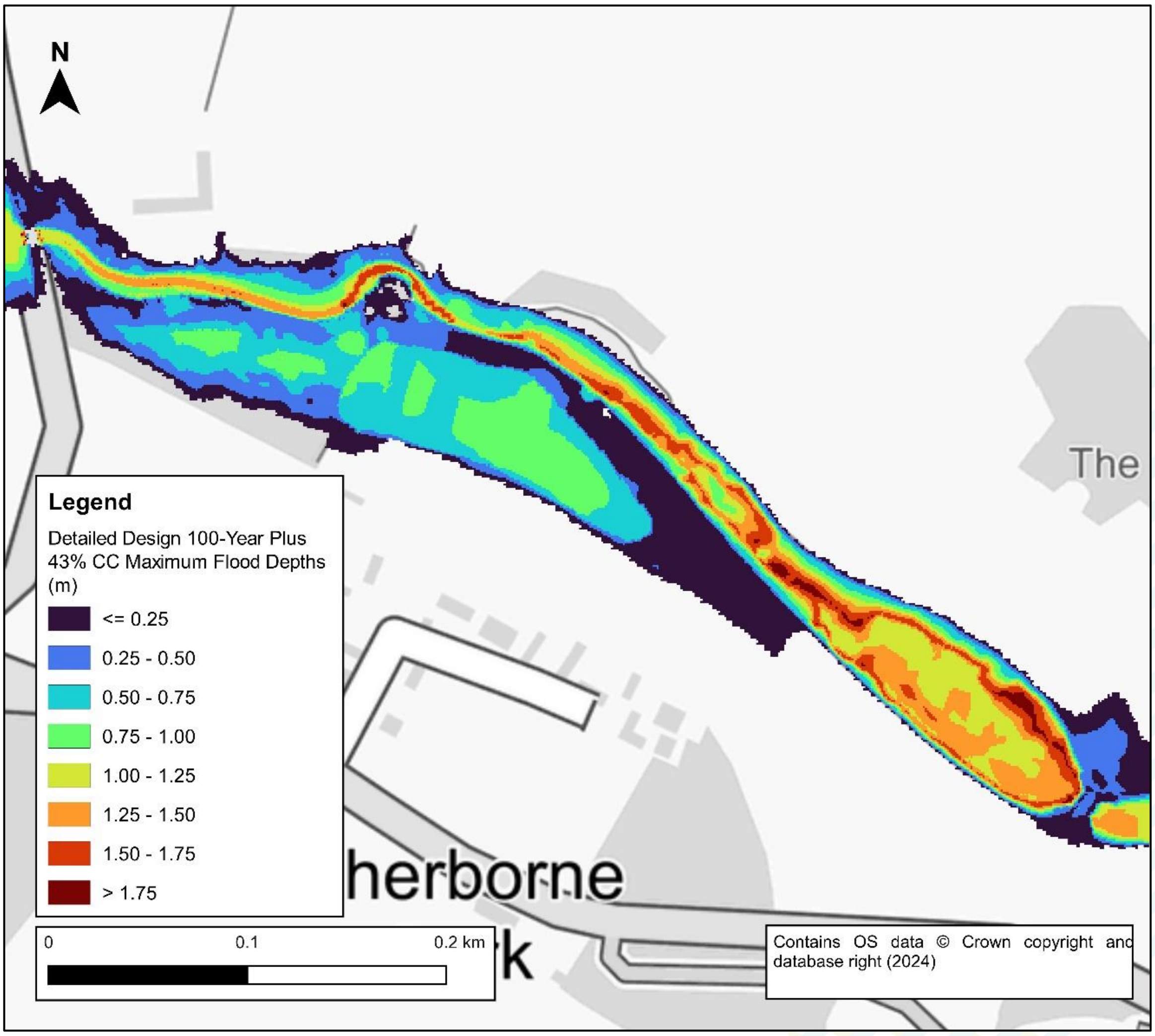

Figure 1-4: Detailed Design 100-Year plus 43% Climate Change Flood Depths and Extent

1.4 Post-Restoration Fluvial Flood Risk Results (outside of the restoration works area)

1.4.1 Upstream of restoration works

Throughout all modelled return periods, there is negligible change to flood extents and depths upstream of the road bridge at NGR SP 16385 15170 between baseline and restoration scenarios. Maximum flood depths are 0.4m on the right bank floodplain during a 2-year flood event. Maximum flood depths are 1.1m on the right-bank floodplain during a 100-year plus 43% climate change flood event. Water is confined to the valley floor.

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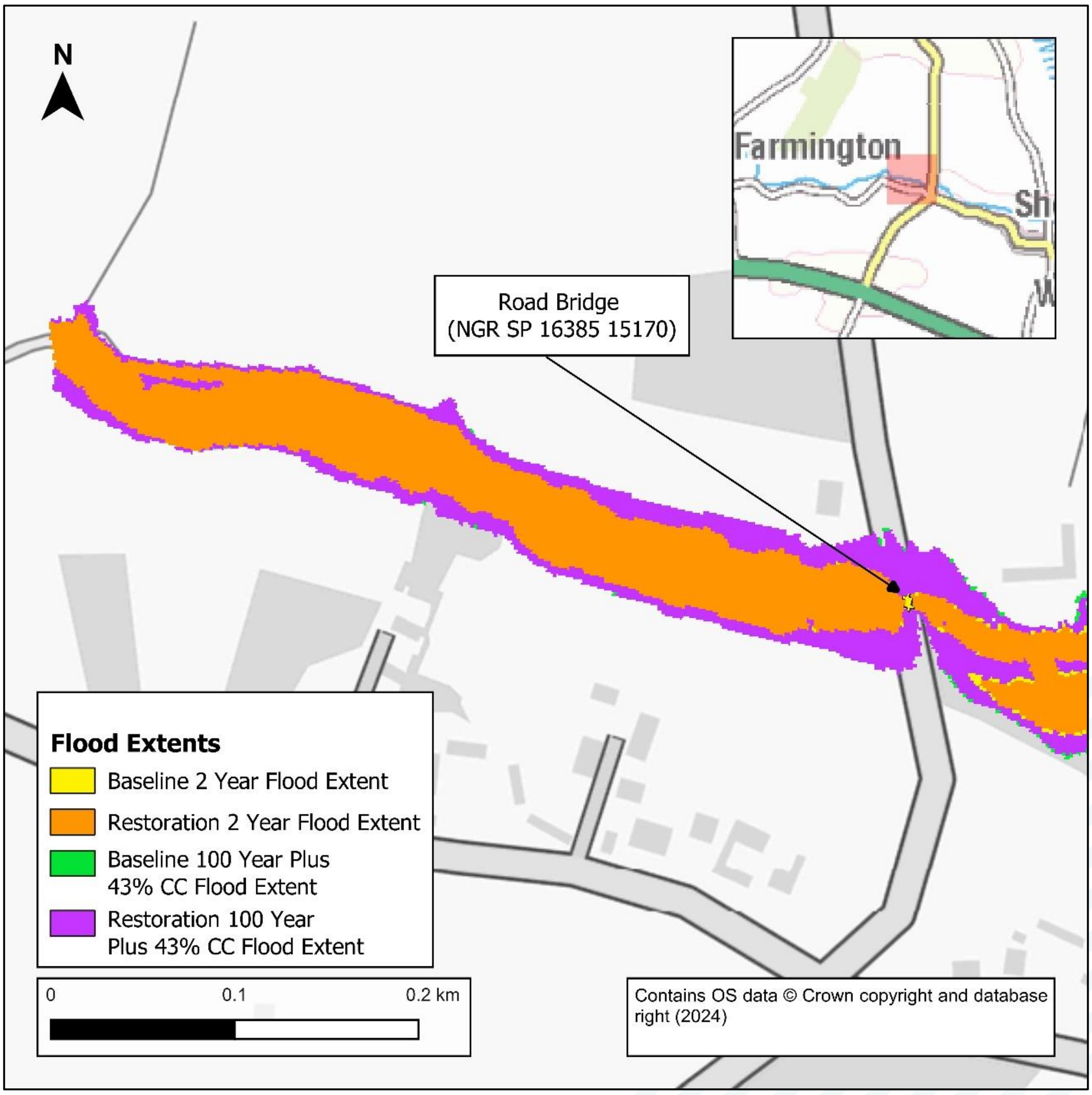

Figure 1-5: Baseline vs. Restoration Flood Extents for the 2 Year and 100 Year Plus 43% Climate Change Return Period Upstream of Road Bridge

1.4.2 Downstream of restoration works

Throughout all modelled return periods, there is negligible change to flood extents and depths downstream of the proposed restoration works area between baseline and restoration scenarios. Maximum flood depths are 0.12m on the right bank floodplain during a 2-year flood event. Maximum flood depths are 0.45m on the right-bank floodplain during a 100-year plus 43% climate change event. Water is confined to the valley floor.

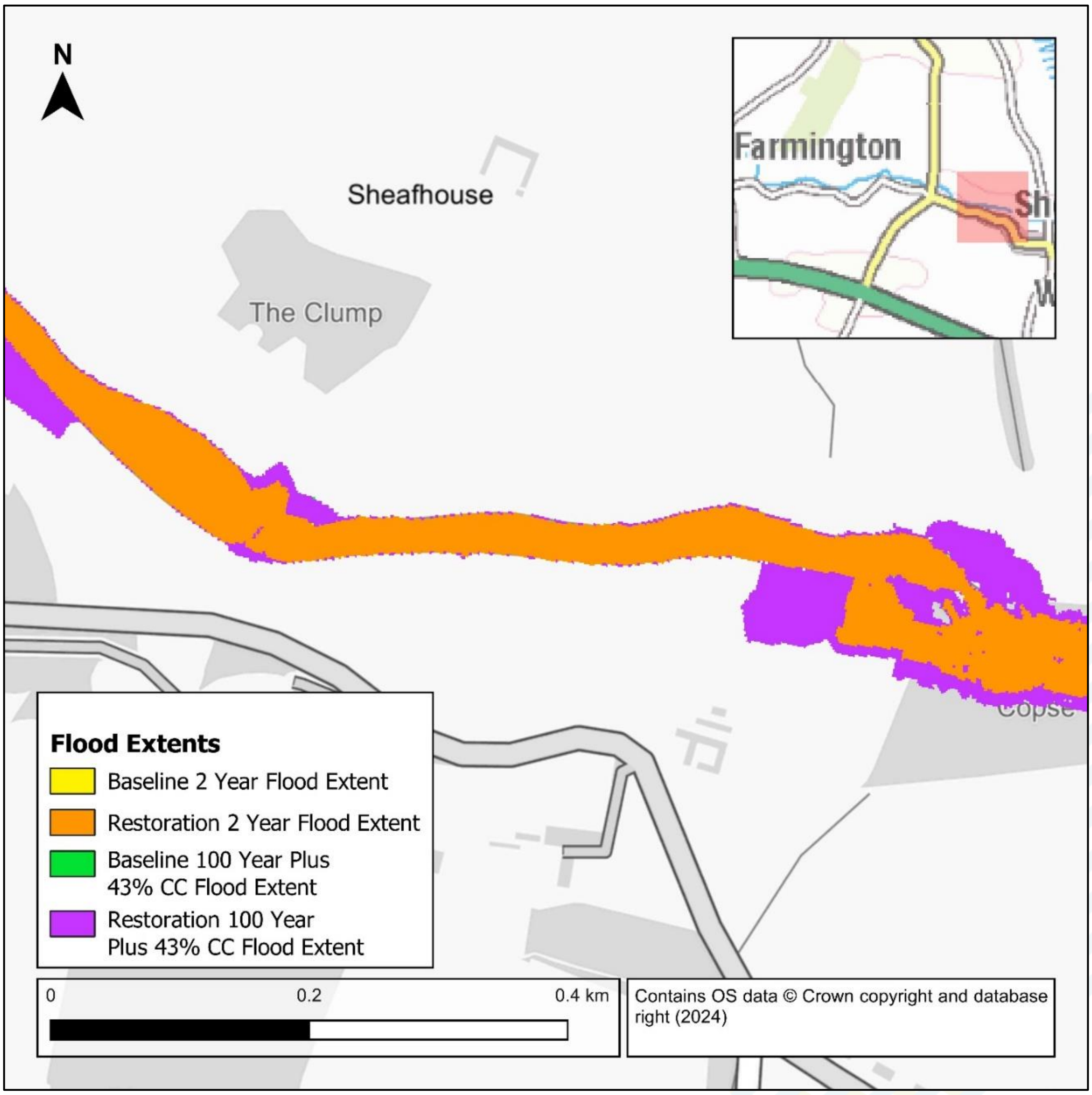

Figure 1-6: Baseline vs. Restoration Flood Extents for the 2 Year and 100 Year Plus 43% Climate Change Return Period Downstream