Calderdale Flood Partners

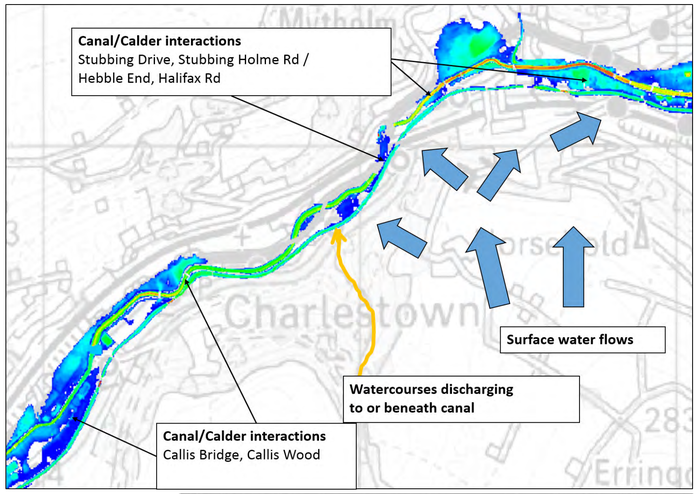
Options Assessment - Canal Flooding

Parts of Hebden Bridge are known to be at risk of flooding from the Rochdale Canal.

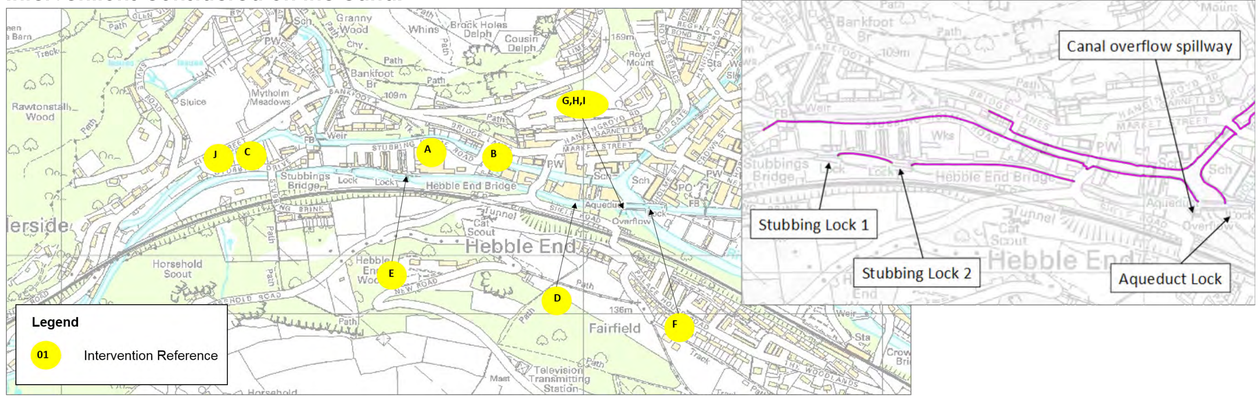
Canal flooding is driven by the following mechanisms as shown below:

1. Surface water overland flows coming down the valley sides and running into the canal along its length,
2. Small watercourses discharging directly into the canal,
3. Small watercourses that normally flow beneath the canal overflowing into the canal, potentially due to pipe block age or exceedance,
4. River water spilling out of the River Calder channel and entering the canal upstream of and within Hebden Bridge.

We have incorporated the Rochdale Canal into our river model of the River Calder and Hebden Water. This enables us to investigate options to reduce canal flooding alongside our proposals for managing river flooding through Hebden Bridge.



Interventions considered on the canal



Ref	Option Type	Location	Description
A	Containment	Stubbing Locks (Lock locations are shown in inset)	Improve existing walls beside towpath by waterproofing and closing gaps between Stubbing Lock 1 and 2. Undertake alongside water level management to pass flow through to Calder downstream of aqueduct – principle applied to all containment options
B	Containment	Stubbing Locks to Hebble End Bridge	Improve existing walls beside towpath by waterproofing and closing gaps
C	Containment	Stubbing Wharf	Improve existing walls beside towpath by waterproofing and closing gaps
D	Water level management	Aqueduct Lock	Improve existing walls and property level protection by water proofing and closing gaps
E	Water level management	Stubbing Lock 2	Allow water through or around this lock under flood conditions to improve management of water levels at this location
F	Water level management	Aqueduct Lock	llow water through or around this lock under conditions to improve management of water levels, either under current conditions or where flows are increased due to upstream containment or water level management measures
G	Water level management	Aqueduct	Double the width of the canal overflow spillway – aims to allow more water through the impounded reach and into the Calder whilst keeping water levels lower than towpath levels surrounding property
H	Water level management	Aqueduct	Lower the canal overflow spillway by 0.5 m – same aim as Option G
I	Water level management	Aqueduct	Lower the canal overflow spillway by 1.0 m - same aim as Option G
J	Water level management	Stubbing Wharf	Create a spillway from the canal at Stubbing Wharf allowing more water into the Calder at this location
K	Diverting water sources away from canal	Throughout reach	Options for diverting water from all above highlighted sources of flooding away from the canal have been assessed, some of which are included as discrete elements in the above mentioned options

Summary of option group findings

Containment – Improving existing walls, provision of new walls and demountable defences (Options A to D)

Containing flood water in the canal corridor will reduce flood risk under present day conditions. Existing walls and property level protection would need to be improved and waterproofed to a level of up to ~0.8m in the contained reaches.

Because these measures (under the various option reaches A-D) retains more water within the canal corridor, they will likely need to be partnered with water level control methods and increased property level protection between Hebble End Bridge amd the aqueduct lock, where there are more property entrances on to the towpath.

Water Level Management - Enlarging the overflow weir by the aqueduct

Option G - The location of the existing overflow weir and relative locations of the river and canal mean that there is limited opportunity to widen the overflow weir or add additional overflow points. We modelled widening this structure as much as considered possible. This results in limited reduction of flooding under the flood flow conditions present day conditions and consequently is unlikely to be taken further.

Options H and I – We have modelled different configurations for this spillway, dropping the invert as far as considered possible based on engineering constraints as shown in the inset. These options enable water levels to be managed upstream of the aqueduct lock, either in isolation or in combination with increased flows due to upstream containment options B and C. For higher Standards of Protection (e.g. 1 in 100yr) a combination of these options and containment would likely be required throughout the reach.

Due to the requirement to maintain navigable water levels, it is likely that these changes to the spill way geometry would be achieved through a moveable sluice, responding to changing water levels during a flood event.

Water Level Management - Passing water through the lock system

Active measures (E and F): Passing water through the lock system under flood conditions may alleviate flood risk throughout Hebden Bridge for the target flood events.

However, this may create problems in lower reaches of the canal downstream of Hebden Bridge to Mytholmroyd. It is considered more cost effective to manage the additional flows once in the Calder, either through routing canal flows back into the Calder at the upstream extent of Hebden Bridge or at the aqueduct, as discussed above.

Relying on manual opening of lock gates is likely to block progress of these options due to issues ensuring that gates are opened at suitable times and levels are managed throughout the impounded reaches in an appropriate and safe manner.

Passing water through or around Stubbing Lock 2 (E) in the canal reach upstream of the aqueduct combined with improving the overflow weir from the canal into the Calder (Options H and I) will reduce flood risk under present day conditions under the target flood events. However, containing flow within the canal corridor at this location in conjunction with improved capacity at the aqueduct overflow weir is likely to be a preferred configuration, due to engineering constraints at Stubbing Lock 2.

Diverting water sources away from the canal (Option J and K)

Options to stop water getting into the canal would be difficult to achieve due to the number of interventions that would be required over a large area, each targeted at different nature events (surface water driven, canal – river interaction etc.) Consequently, it is considered unlikely that this option would be applied in isolation. However, elements of this are addressed at appropriate locations such as Stubbing Wharf. (Option J). Here, options are being assessed for allowing more water to exit the canal and enter the Calder via an existing flow route. This will provide flood benefit along the downstream canal reaches, though because of the numerous interaction points between river and canal it is unlikely to be taken forward to isolation. Consideration will also be required to formalising overland flow routes if this option is progressed, and protecting existing property from any increased depths or frequency of flooding along these routes.

Performance Summary Key

Modelling shows little or no benefit

Modelling shows significant benefit, other constraints mean these options are less preferable

Modelling shows significant benefit, other constraints acceptable