

Case study

Implementing a small weir removal – with infrastructure constraints



The small weir prior to removal. A large scour hole had formed immediately downstream of the weir.

When

Summer 2022 & Summer 2023

Where

Lambrigg beck, Cumbria

Background

Lambrigg Weir is located on the Lambrigg beck, a tributary of the River Mint – part of the River Kent and Tributaries SSSI/SAC. The weir was originally constructed to protect water supply to the Meeting House, however, over time the weir has caused scour downstream undermining the road bridge, whilst also preventing movement of smolts, trout and other aquatic organisms.

What we did

Dynamic Rivers were sub-contracted to conduct a full feasibility study determining different options that could be undertaken including leaving the structure as it is, weir removal, weir removal with bed regrading, weir notching, rapid/rock ramp and a bypass channel. The riffle-rapids/rock ramp was deemed to be the most suitable option and was taken forward to detailed design and hydraulic modelling was completed. The project officer invited several contractors to quote to do the works, I.T Shaw Limited were awarded the contract to complete the weir removal. Consents were obtained from Cumbria County Council and Natural England and the works started on the 5th of September 2022.

Prior to the weir removal, a series baseline monitoring was completed including the following:

- Baseline geomorphology survey completed by Dynamic Rivers. In summary this report highlighted the following:
 - The beck is an active, single thread, sinuous channel which flows over a moderate to steep bed gradient (0.015) but appears to be stable.

Case study

- Gravel supply is strong and has loose coarse gravels that are active.
- The weir is a small structure approximately 0.6m is composed from large masonry and has been failing for a long period with multiple of repairs.
- A small plunge pool has developed downstream of the weir as a result, which has destabilised the banks and is undercutting the right bank masonry wall.
- General bed lowering has occurred downstream which has impacted on the bridge with the bridge abutments now exposed, some of which are 0.3m above present bed level.
- The riffle-rapid (rock ramp) option was determined to be the best option for the works and was taken to detailed design.
- The designs were hydraulically modelled to ensure function and bed shear stress was tested to ensure the design would function at extreme flooding such as 1 in 100yr plus allowances for climate change events.
- Electrofishing both upstream and downstream of weir removal was conducted in 2022 prior to the weir removal. The results are shown in Table 1 and Table 2. The data indicates that the weir is a barrier to fish movement as a high population is identified downstream. It should be noted that no Atlantic salmon (*Salmo salar*) was recorded at either location. Repeats survey will be conducted in future years to determine if fish movement has been improved.

Table 1: Electrofishing data from 2022

Size (mm)	Trout – Upstream	Trout – Downstream
60		2
65	1	5
70	2	8
75	2	5
80	4	5
85		3
90	1	1
95		1
100		
105		
110		
115		
120	1	
125	4	
130		
135		
140		1
145	1	
150		
155		
160		
165		
170		
175		
180		
185		
190		
195		
200		
Total	16	31

Case study

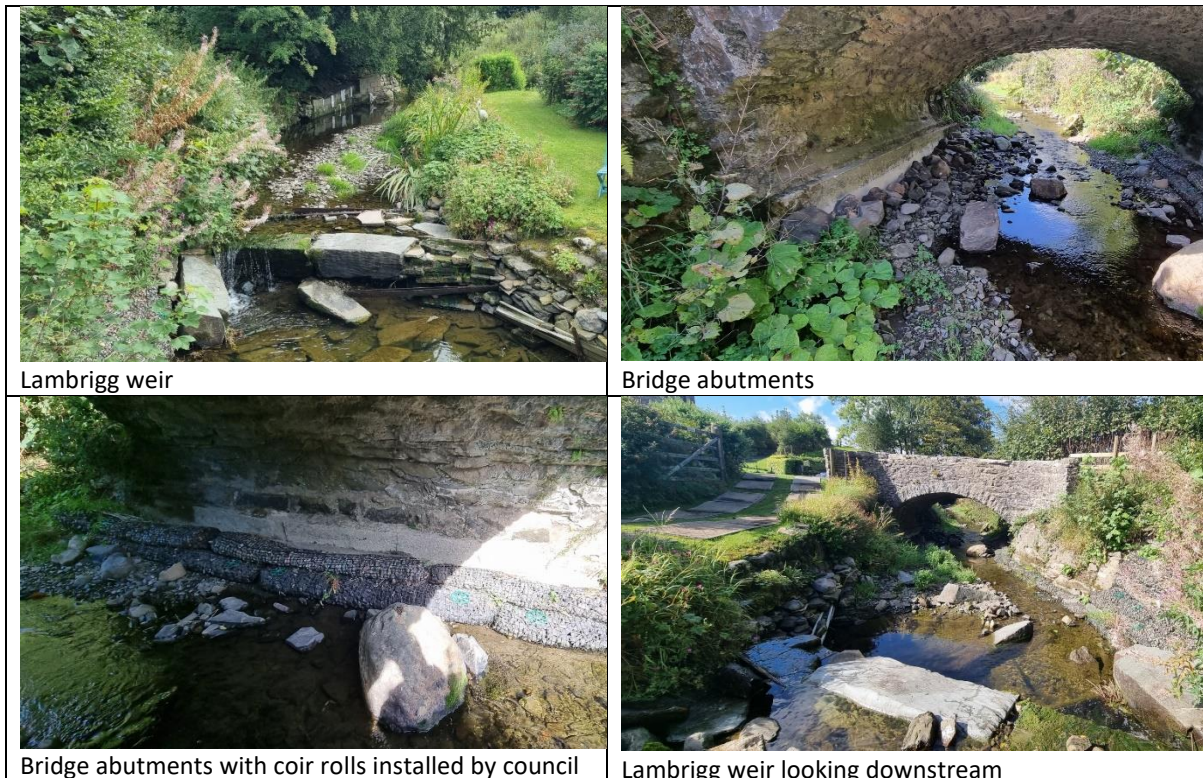
Table 2: Electrofishing data of minor species

Fish species	Upstream fish count	Downstream fish count
Bullhead	46	120
White-clawed crayfish	Present	Present
Loach	None present	None present
Minnow	None present	None present
Stickleback	None present	None present
Eels	None present	None present

- A River Habitat Survey (RHS) was conducted by a competent person, but not accredited.

Prior to the works starting a crayfish relocation survey was completed, by Enviro Tech, as the weir was removed slowly, further crayfish were re-located as they were buried deeply within the structure. Full sediment control measures including numerous sedimats, hay bales and a trash pump was deployed to control the silt.

Pre-restoration works



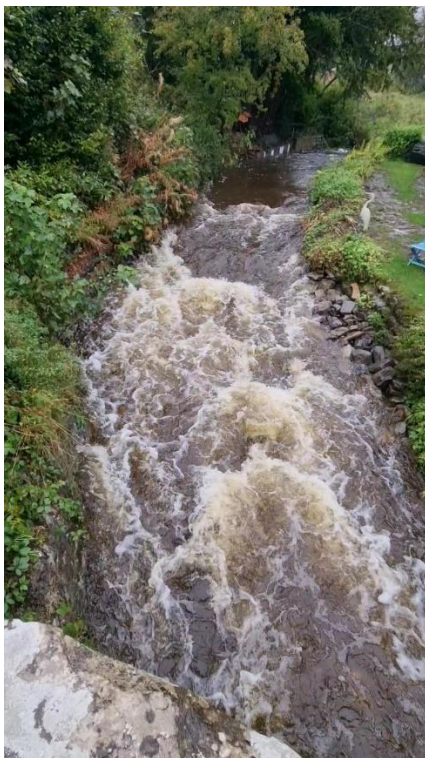
Post-restoration works

Case study



L: New regraded channel with the weir removed

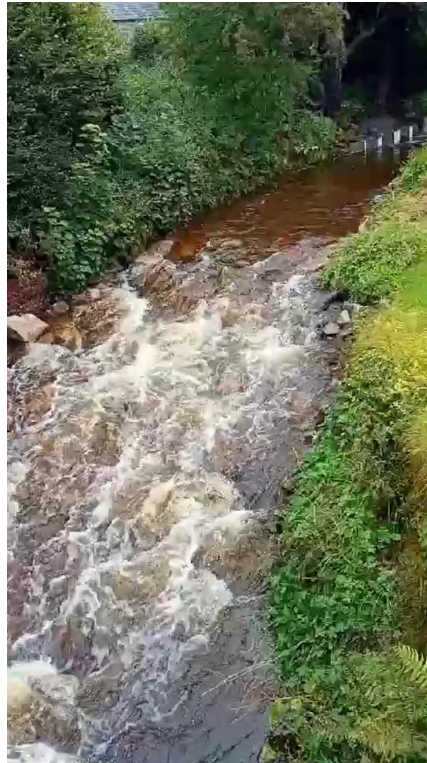
R: Downstream section bed raised to aid flows underneath the bridge



L: Weir removal site during high flows (taken October 2022)

R: Post weir removal in January 2023, the water pipe has become exposed as a result of high flows during the winter months.

Case study



L: Weir removal site with larger rocks installed to correct failed works and recover pipe

R: Revised works now holding well during high flows

Outcomes and Learning

- Further work was required at the site as the water pipe has become exposed. Following high water levels and flood events in winter of 2022, and early into 2023, the water pipe became exposed, leading to further works required at the site.
- An assessment of boulders that didn't move was determined at 550mm, in which these size rocks will be used to cover the water pipe.
- The further works began on the 4th September 2023, by IT Shaw, crayfish relocation surveys were completed each day prior to the works starting.
- Future electrofishing post works to be completed to determine the effectiveness of the weir removal.
- Post restoration River Habitat Survey.

Next steps

The weir is now removed and a natural rock ramp has been constructed. Initially the flows look good and fish passage is greatly improved, one of the main surprising outcomes of the project is how natural the beck now sounds. A timelapse camera is in situ collecting photographs to observe how the new features do and to check that they aren't mobile, further exposing the pipe.

Contact us

www.r4everkent.co.uk | hello@r4everkent.co.uk | Facebook LIFE R4everKent | Instagram @LIFE_R4everkent | X @LIFER4everKent