

# Rodley Fish Pass Scheme

providing Yorkshire Water and Rodley Nature Reserve an asset with biodiversity benefits to the River Aire and Rodley Nature Reserve for years to come

by Stephen Pike MEng MA

From its source in the Yorkshire Dales beauty spot of Malham Cove, to its confluence with the River Ouse at Airmyn, the River Aire runs through many of the industrial centres of West Yorkshire. Industry had a devastating impact on wildlife within the river, such that by the 1970s the watercourse was all but dead and little more than an open sewer. Efforts driven by Yorkshire Water Services (YWS) have seen significant improvements in water quality over the last 20 years, allowing wildlife to return to the River Aire once more. However, obstacles still remained to further improve its biodiversity, such as the legacies of the weirs and canalisation that were once so important to the survival of industry of West Yorkshire. Weirs and locks presented a particular problem for migratory species of fish, such as salmon and trout, which limit the potential for their re-colonisation of the upper reaches of the River Aire, and therefore limiting further improvements in the biodiversity of the river to its pre-industrial past.



Rodley Fish Pass – Courtesy of Mott MacDonald Bentley

## Background

Rodley Weir presented the largest barrier to migratory fish and the increase in biodiversity; the weir is located in north east Leeds, on the site of the former Rodley STW. The land and weir is still owned by YWS, although following the decommissioning of the sewage treatment works, much of the land is now leased to the Rodley Nature Reserve Trust, who have created a wetland environment to entice wildlife back to the Leeds area. There were multiple drivers for constructing a fish pass around the weir, including Water Framework Directive (WFD), Natural Environment and Rural Communities Act (NERC) 2006, Department for Environment, Farming and Rural Affairs (DEFRA) Statement of Obligations 2007

and the UK Biodiversity Action Plan (UK BAP) and River Aire Action Plan. Alongside YWS and the RNR Trust there are a number of other stakeholders including Aire Action Leeds, Leeds City Council (LCC) and the Environment Agency (EA).

The scheme was instigated by Yorkshire Water Services (YWS) and delivered via a successful collaborative approach, incorporating; Mott MacDonald Bentley (MMB), the Environment Agency (EA) and design consultants ARUP. This collaborative approach ensured that each stakeholder was given the opportunity to provide valuable input into the delivery of the scheme, which formed part of Yorkshire Water's AMP5 Capital Programme of Works.



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Rock ramp – Courtesy of Mott MacDonald Bentley

### Project scope

The scope of the scheme was to construct a fish pass to allow a variety of species to bypass Rodley Weir, connecting the upper and lower reaches of the River Aire. Feasibility studies undertaken by YWS and Arup ruled out the possibility of removing the weir altogether due to the effect this would have on river levels, and options for 'in river' type passes were discounted due to the difficulty of accessing and working directly in the river and the unknown construction of the weir itself. An out of river fish pass promised advantages not only for construction, but also offered the potential to provide additional biodiversity benefits further enhancing the habitats provided in Rodley Nature Reserve.

### Design objectives

The 2.5m high weir presents too greater barrier for fish to pass; as evidenced through sightings by staff from the nature reserve of brown trout attempting to jump the weir without success. The primary aim of the design is to provide a safe passage for fish past Rodley Weir to enable them to access spawning grounds higher up the river, while maintaining or improving the biodiversity and natural appearance of Rodley Nature Reserve. It was therefore determined that the fish pass should have a naturalised appearance,

similar to that of an upland stream, with a meandering layout and a backwater habitat 'rest area' to maximise the biodiversity enhancements of the development.

In order for the fish to be able to pass the 2.5m head differential and high flows at the weir, the head must be reduced to a more manageable gradient. To provide suitable flow conditions, the fish pass has 13 (No.) check weirs, with a head difference of 100-150mm between each one, and 3 (No.) rock ramps with perturbation boulders of 550-700mm nominal diameter to provide areas of faster and slower flowing water. The check weirs also provided hard engineered features to prevent the fish pass from changing its course over time. Rock armour lines the channels between the weirs and the rock ramps providing erosion protection in keeping with the desired natural appearance of the pass. In addition to the flows in the pass, the exit flows must be suitable to attract the fish into the pass. To enable the fish to locate the downstream end of the fish pass the entrance must be located as close to the weir as possible and also provide exit flows as close to parallel with the weir as can be achieved. Large rocks were placed in the river between the fish pass exit to provide additional turbulence to further increase the attractiveness of the pass to fish.



Rodley Fish Pass construction – Courtesy of Mott MacDonald Bentley



Rodley Fish Pass – Courtesy of Mott MacDonald Bentley



The route of the fish pass was heavily constrained by the presence of an overhead pylon located on the left bank of the Aire adjacent to the weir carrying 132,000V electric cables, around which the utility provider imposed a 12m no-dig zone as well as a 6m height restriction beneath the cables. The fish pass therefore had to circumnavigate the no-dig zone, finishing as close to the weir as possible without compromising the stability of the pylon.

### Engineering challenges

The construction team faced challenging conditions working in and adjacent to the River Aire during the wettest summer in 100 years. River levels would rise rapidly over a matter of hours so it was necessary for the team to monitor levels throughout the day, and cease work if levels were too high. The fish pass was designed considering the standard flows between the 10th and 95th percentiles (Q10 and Q95) - however, in the unprecedented weather conditions water levels were regularly observed to be above the Q95 level. This was particularly challenging working in the river immediately downstream of the weir, where levels could vary by 2-3 metres between low and high water levels.

Access into the site was restricted as the only access route was via a narrow swing bridge across the Leeds-Liverpool canal, with a weight restriction of 25 tonnes. The 40 year old bridge had a history of jamming shut, with fines imposed by British Waterways (now the Canal and River Trust) if the canal was blocked. Deliveries had to be divided into smaller loads and careful selection of plant was necessary to ensure it could pass through the width restricted bridge. This also applied to waste being removed from site.

### Collaborative working alongside the nature reserve

It was inevitable that a construction project of this nature would have an impact on Rodley Nature Reserve and those who visit. The reserve is open to the public on Wednesdays and at Weekends, and also has regular visits from school groups. Deliveries were arranged not to arrive when the reserve was open, and close liaison with the reserve was maintained at all times to ensure the safety of the visitors and volunteers at the reserve.

Additionally, the construction team assisted the reserve in providing permanent speed limit signage painted onto the road, for the benefit of construction vehicles and visitors alike, along with 'No Cycling' and 'No Dogs' signs for the nature reserve. A bird hide near the fish pass was raised using recycled construction materials, providing an improved viewing platform across the lagoon and to the fish pass itself.

### Engineering sustainable outcomes

From excavations from the fish pass it was estimated that it would be necessary to dispose of approximately 5,000m<sup>3</sup> of spoil. To reduce the volume of waste being removed from site, an option was sought for reusing excavated material on site, managed under the CL:AIRE Code of Practice. This was beneficial not only from the point of view of reducing waste to landfill but also to protect the 40 year old swing bridge on the access route into the site. After considering a number of options it was decided to reuse the spoil to create a landscape of ephemeral rain fed ponds, providing new wildlife habitats. This was both in keeping with the existing wetland habitats in the nature reserve and provided a flexible solution that could accommodate more or less spoil as required – and required minimal import of additional materials. The ponds will be left to colonise naturally, which provides biodiversity benefits by providing a habitat for early colonising flora and fauna, and eliminating the risk of importing unwanted plants, animals or diseases from external sources.

To construct the check weirs in keeping with the naturalised appearance of the fish pass, Redi-Rock free standing wall blocks were utilised. Redi-Rock, supplied by the CPM Group, is a precast concrete modular wall system with the look of natural stone.



Redi-Rock wall blocks - Courtesy of Mott MacDonald Bentley

The blocks are large and weigh up to 1.5 tonnes each, and have two domes and a groove forming the joint between them. The 'big block' system is normally used for the retention of earth and freestanding boundary walls. It has been available in the UK since 2006 and in the USA since 2000.

These are typically used to provide natural stone appearance walls, but having previously used Redi-Rock successfully at other visually sensitive sites; Mott MacDonald Bentley proposed their use for constructing the weirs in the fish pass. The larger wall blocks do not have a finished top surface as the blocks need lifting eyes for ease of handling. Instead, this finish was provided by lighter coping blocks. In order to prevent the copings from being dislodged under high flow conditions, they were fixed to the larger blocks by steel dowels and epoxy resin. The Redi-Rock retaining blocks were also used for the downstream retaining structure, where piling was not possible due to the overhead cables, and swift construction was beneficial due to the challenge of working in the river under the varying flow conditions.

### Conclusion

The construction was challenging due to the on-site constraints of overhead utilities and access restrictions and weather conditions faced. However, through careful diligent project management and close collaboration with all stakeholders, (namely Yorkshire Water Services, ARUP, Rodley Nature Reserve, the Environment Agency and CPM Redi-Rock) the scheme was successfully completed and in doing so has provided Yorkshire Water and Rodley Nature Reserve with an asset that will provide biodiversity benefits to the River Aire and to Rodley Nature Reserve for years to come.

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