

**CHIPPING SODBURY AQUEDUCT
OLD SODBURY, SOUTH GLOUCESTERSHIRE
NETWORK RAIL & BAM NUTTALL**

BIG Biodiversity Challenge Award Category: Client

Project overview

This project involved the replacement of an aqueduct carrying the River Frome above the railway whilst taking in to consideration the local biodiversity. It included the realignment of a 200m section of watercourse upstream of the aqueduct and the provision of a flood attenuation pond.

What were the biodiversity conditions on site, prior to the enhancement?

Prior to the works, the ecological status of the watercourse upstream of the aqueduct was poor due to a sluggish flow rate and heavy shading by vegetation. A Water Framework Directive Assessment was undertaken to ensure that the biological and physico-chemical characteristics of the new channel were preserved and improvements delivered where possible, taking into account hydromorphology, phyto-benthos, macroinvertebrates, macrophytes, and fish, and notably eels, a UKBAP Priority Species listed as Critically Endangered on the International Union for Conservation of Nature (IUCN) Red List of Threatened Species.

What were the reasons behind this project ?

This project was delivered to allow electrification of the railway between London and Cardiff by providing the necessary clearance for the overhead line equipment. Network Rail, together with their contractor BAM Nuttall and ecological advisors ADAS and APEM, actively engaged with the Environment Agency and South Gloucestershire Council to ensure best practices were followed and mitigations as well as enhancements incorporated into the design. The new channel is subject to full Water Framework Directive (WFD) monitoring for 3 years commencing in 2018, to ensure the biodiversity enhancement targets have been achieved.



New aqueduct (upstream), December 2017

What were the biodiversity measures taken?

The new channel provides a better habitat for fauna and flora and an increase in biodiversity in the longer term:

- The River bank was planted with native trees, matching the species found alongside the original channel, and a native wildflower mix, providing river bank stability and enhancing biodiversity.
- The log deflectors, introduced to regulate the flow within the channel, allow more variance (“ripple effects”) which encourages bed scour. These willow logs are already showing signs of regeneration and, as these mature together with the bankside planting, wet meadow habitat will be created in what was previously semi-improved grassland used for pasture.
- Bare gravel was added as an advantageous substrate for spawning fish, whilst the eel pass is an additional benefit provided by the scheme allowing for the natural migration of eels up and down stream. Bespoke eel tiles are mounted on the edge of the channel allowing eels to pass under a broad range of flows. A rock ramp, comprising of large boulders, spaced to suit the modelled flows and anchored in concrete, extends to the upstream section to provide a transition from the eel tiles into the main channel.
- The attenuation pond is an additional newly created wetland habitat which shall provide ephemeral pools for invertebrates and amphibians as well as feeding areas for wintering and passage wildfowl and wading birds.

An operational and maintenance (O&M) manual has been developed in order to ensure that the monitoring and enhancement activities are carried out by the Network Rail maintenance team, long after The Greater West Programme design and construction team have moved on, providing a long lasting legacy.



Eel pass, June 2017



Log deflector, December 2017

Further information

The works associated with the new aqueduct are in line with current Environment Agency understanding of Working with Natural Processes to reduce flood risk. The introduction of log deflectors in the new channel providing natural obstacles to flow and acting as “leaky barriers”, as well as the addition of an attenuation pond deliver an increased resilience to flooding and climate change. This is of particularly significant importance in this area where the railway floods frequently, impacting transport links between London and the West of England and Wales. In addition, this attenuation will help in mitigating the flood risk of the River Frome downstream, where properties in Yate are currently at risk.

The log deflectors are taken from local willow, which have already started to show regenerative growth thereby also providing riparian woodland. As they become more established this will help reduce levels of nitrates by nutrient uptake and provide natural shading, reducing water temperatures on hot summer days. They also provide natural silt traps reducing pollution downstream whilst the root systems provide nursery areas for fish and invertebrates alike. As the scheme matures, planted vegetation as well as colonising species will enhance the habitats provided by the river channel and attenuation pond.

The above demonstrates the social, economic and environmental benefits of the scheme which, together with long term management of the area, will contribute to a sustainable development of the railway network.

Project Team

- Network Rail (Client)
- BAM Nuttall (Principal Contractor)
- ADAS and APEM (Ecology Advisors)



New channel and flood attenuation pond, December 2017

What was the motivation for carrying out the enhancement?

The Chipping Sodbury Aqueduct project was not only an engineering challenge but also involved some of the most extensive ecological works carried out on the railway network. Innovative thinking and collaborative working were paramount to see this project to successful completion, with the eel pass, log deflectors and overflow flood alleviation pond being a demonstration of what can be achieved through these behaviours. The improvements delivered will not only allow a more energy efficient transport system to operate from London to the West of England and Wales, it will also increase the flood resilience of this part of the railway network whilst providing increased benefits to aquatic wildlife, leaving the local environment better than it was found.