

# Heritage *in* Wales

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Celebrating  
the canal in  
the sky

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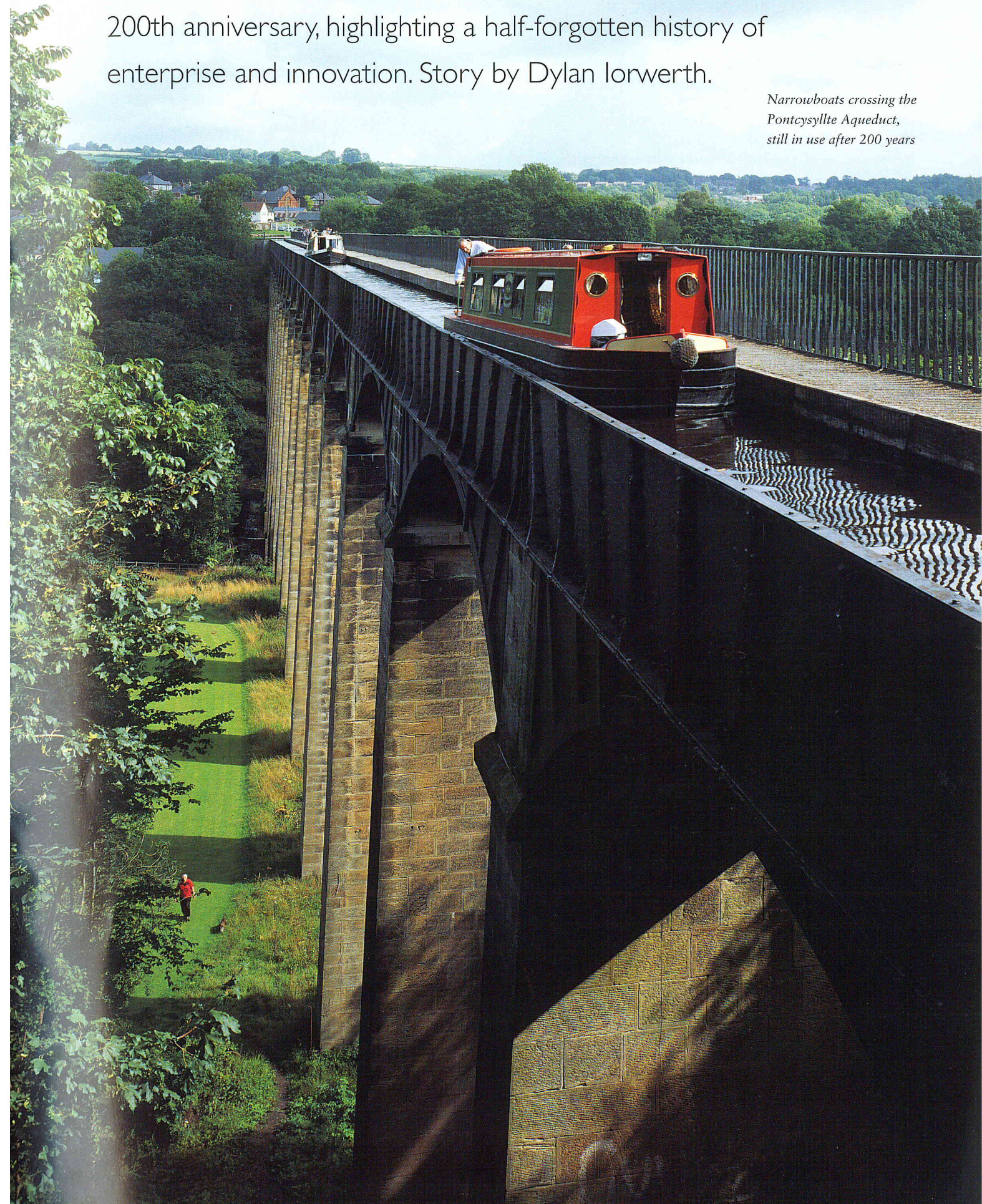
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# The canal in the sky

One of Wales's greatest engineering feats is celebrating its 200th anniversary, highlighting a half-forgotten history of enterprise and innovation. Story by Dylan Iorwerth.

*Narrowboats crossing the Pontcysyllte Aqueduct, still in use after 200 years*





It is one of the most dramatic journeys in Wales. On one side is the industrial landscape of Acrefair and Ruabon; on the other, the Vale of Llangollen winding its way down to the steep loneliness of Castell Dinas Brân.

The drama, though, is not only in the scenery. Looking over the side of your canal boat, only a few breathless inches of cast iron protect you from a 126-foot (38m) drop down to the river Dee.

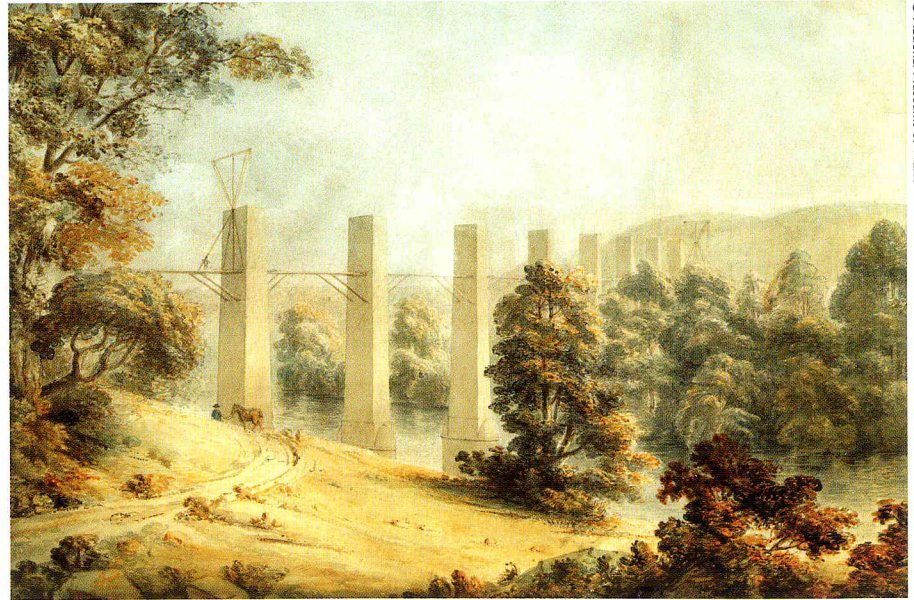
This is Pontcysyllte Aqueduct — the canal in the sky — one of the most spectacular feats of engineering of its time and a reminder of the skills and ingenuity that helped create modern Wales.

This year, the stone and cast-iron structure is celebrating its 200th birthday; it was the fourth aqueduct of its kind in the world and remains the tallest. It is still in daily use and, apart from the replacement of one arch in 1976 and a recently completed restoration project, is almost exactly as it was on its official opening back in 1805.

Whilst many parts of Great Britain were still celebrating Nelson's victory at Trafalgar a month before, the people of north Wales were marvelling at their own example of human genius — a creation not just of the attention-grabbing Scot, Thomas Telford, but also of Welsh craftsmen and engineers who helped to construct what was already a symbol of the Industrial Revolution.

'Engravings of the aqueduct have been found all over the world,' says Stephen Hughes, head of survey at the Royal Commission on the Ancient and Historical Monuments of Wales. 'It was an icon of the Industrial Revolution and must have been one of the largest masonry building feats since the pyramids. At the time, industrial spies from all over the world would visit this corner of Denbighshire to have a look at the construction work.'

In today's motorway-strewn countryside, it



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*A Moses Griffith (d.1819) watercolour of Pontcysyllte Aqueduct under construction*

is difficult to imagine the awe created by the sight of the elegant stone piers rising out of the pastoral, wooded landscape of the Vale of Llangollen; 200 years ago, local people could hardly have foreseen the significance of the canal as part of a network of transport routes that would transform the eastern slopes of the Denbighshire hills into a smaller version of the coal valleys of south Wales.

Building work started in 1795 under contract to the Ellesmere Canal Company. The labourers worked from precarious wooden platforms around the stone piers that would have risen as work progressed. There would have been simple cranes on top of the columns to raise the lengths of cast-iron trough. Although the work was done before the days of the travelling navvies who left Ireland in the wake of the famine of the 1840s, much of the local workforce would probably have squatted on land nearby.

Welsh craftsmen used the opportunity to become experts in the new technologies and

building techniques. In contrast to Napoleonic France, there were no dedicated engineering colleges, and local stonemasons like William Edwards evolved into engineers through their work elsewhere in Wales on pioneering schemes similar to Pontcysyllte.

Recently the aqueduct has been the subject of considerable research, partly to provide information about its construction and design for the massive conservation exercise undertaken last year, and partly to support a proposal to nominate the structure for World Heritage status. The aqueduct has already been included on the tentative list, the first step in this process.

Now a statement of significance is being produced by specialists to establish the international status of the aqueduct, both as an engineering and innovative technological masterpiece and as part of a transport and economic corridor that was a vital part of the industrialization of the early nineteenth century.



© British Waterways

*For months during the winter of 2003 to 2004, the aqueduct was shrouded in scaffolding and weatherproof sheeting while conservation work progressed*



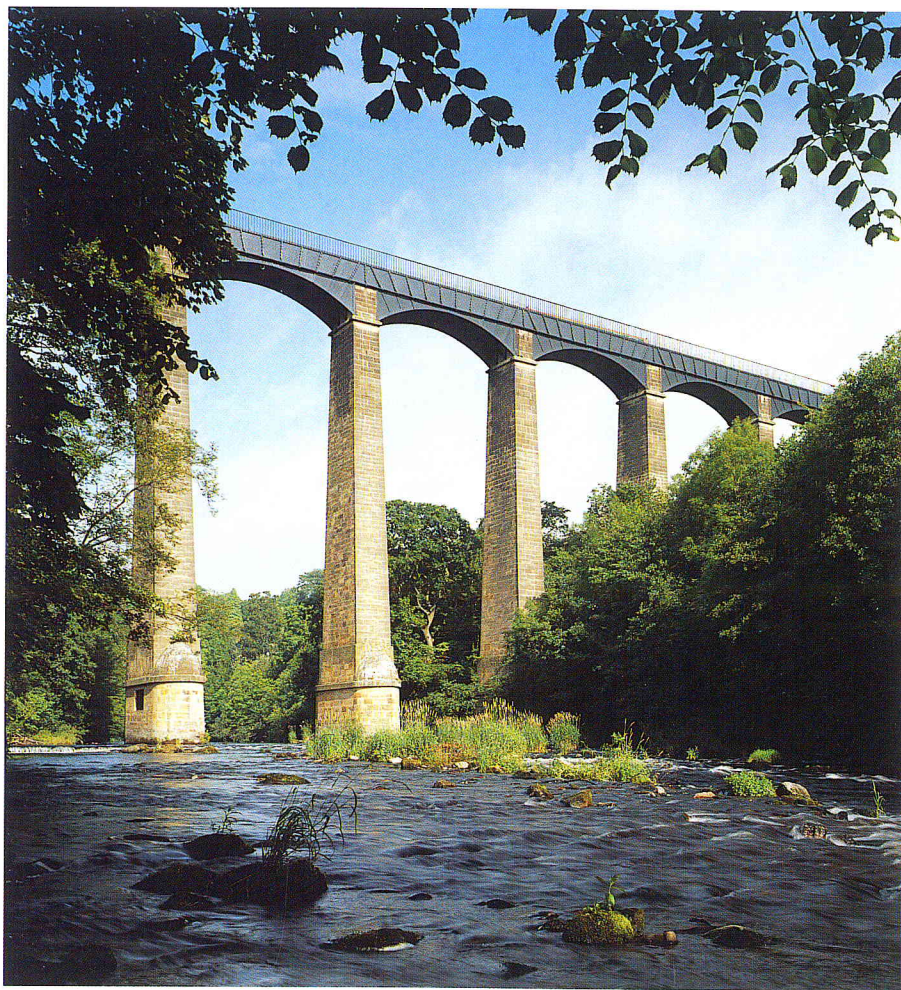
## Pontcysyllte, point by point

- The aqueduct was officially opened on 26 November 1805, before about 8,000 people. It cost a total of £45,000.
- The cast-iron trough is 11 feet (3.4m) wide and 5 feet 3 inches (1.6m) deep, more than 1,000 feet (305m) long and holds 329,954 gallons (1 1/2 million litres) of water.
- There are 19 arches and each of the slender masonry piers is partly hollow.
- Pontcysyllte (The Bridge that Connects) is the most famous of several early cast-iron aqueducts in Wales. The first one in the world was Pontycafnu (Bridge of Troughs) at Cyfarthfa Ironworks in Merthyr, designed by an engineer called Watkin George in 1793.

Telford, the 'general surveyor and agent' who also helped build the A5 and Menai Suspension Bridge, is the name usually linked with Pontcysyllte, but he worked under another famous engineer called William Jessop, the most prolific of all the engineers of the British canal mania 200 years ago. Men like William Hazeldine, the foundry master, and the foreman, William Stuttle, also had vital roles. With them were teams of self-taught local engineers and craftsmen who would go on to work on major projects in many parts of the world, including the Caledonian Canal through Scotland's Great Glen, one of the first big shipping routes.

Hazeldine, Stuttle and Telford went on to work on a series of cast-iron bridges, including the Waterloo Bridge over the river Conwy at Betws-y-Coed and the chains of the Menai Suspension Bridge. All the metal for these was cast at Plas Kynaston foundry, which now lies under the Monsanto chemical works at Acrefair. While earlier historians believed that the castings for the aqueduct must have been made in foundries over the border in Shropshire, it is now accepted that the resources and expertise were available on site.

'Cast iron was a brand new material at the time and there were no cast-iron structures of similar size anywhere else,' explains Stephen Hughes. 'When the Union Canal was being built in Scotland, the engineer came down to Pontcysyllte to consult with Thomas Telford and William Stuttle.'



*The aqueduct carries the Llangollen Canal across the valley of the river Dee*

'William Davies, a local contractor, built the southern abutment to the aqueduct and this is still one of the largest earthworks of its kind in the world. The cutting that was made to extend the canal to Chirk and which provided the earth for the embankment was also the deepest of its kind at the time.'

The aqueduct was, of course, only part of a much more extensive engineering project. An eight-mile (13km) stretch of canal runs from the Horseshoe Falls at Llangollen to beyond Chirk and the engineering challenges posed by this rugged, undulating terrain required considerable ingenuity and innovative thinking by Jessop and Telford. Another aqueduct was required at Chirk, which, says Stephen Hughes, was an experimental model for Pontcysyllte, with a cast-iron bed and more traditional brick sides bonded with hydraulic mortar.

'The canal was originally meant to be part of a main-line canal to Chester, exploiting the Denbighshire coalfield on the way,' he explains. 'For landowners like the earl of Powis or the Wynns of Wynnstay at Ruabon, the development of the coalfield depended on securing bulk access and transportation. While a main-line canal was eventually built at lower

altitude through Shropshire, the Pontcysyllte Aqueduct contributed substantially to the development of the coalfield.'

The effects of the work at Pontcysyllte itself were felt as far away as Bala in old Merionethshire, where the level of Llyn Tegid was raised by a few inches to increase the flow along the river Dee to provide water for what was originally meant as a feeder canal to the main waterway.

The industrial impetus may have long gone, but the Llangollen Canal with its leisure boats is now vital to the area's tourist trade. This comparatively small stretch of waterway featured prominently in the narrowboat revival, due to the interest of a man called Tom Rolt, who also inspired the railway preservation movement through his work on the Tallylyn narrow gauge line in Merioneth. From being a harbinger of the Industrial Revolution, Pontcysyllte aqueduct became part of one of the first leisure canals in the United Kingdom and recently gained celebrity status with a visit from Indiana Jones himself, the actor Harrison Ford.

'It is a miracle of survival,' says Stephen Hughes. 'When the railways were developed,





*The cast-iron trough was drained while contractors carried out the conservation work*

the railway companies bought up the canals to annul the competition. If it had been converted into a railway line, the Aqueduct would have been lost, but what really saved it was its use as a channel for carrying water to Chester and Liverpool. That retained an economic use for the aqueduct.'

There is more research to be done; there is evidence of another feeder canal and ambitious plans for a 4,500-yard (4,115m) canal tunnel at Ruabon, later abandoned in favour of one of the world's first double-track railway lines. There would have been horse-drawn railways on both sides of the aqueduct during its construction and there may still be evidence of an eighteenth-century boat lift and of Plas Kynaston foundry itself.

There is another mystery that Stephen Hughes would love to solve — what was the exact relationship between the two colleagues and rivals, Thomas Telford and William Jessop. The younger Telford was adept at publicity and has been given most of the praise for the aqueduct and, while he may have been influential, for instance, in taking a risk with the narrowness of the stone pillars, one surviving letter shows William Jessop giving instructions and asking questions about the building process.

'There are things to be found in the future,' says Stephen Hughes. 'William Jessop's papers are missing, for instance. They would be fascinating.'

## Conservation on a grand scale

The importance of Pontcysyllte Aqueduct is reflected in its status as both a scheduled ancient monument and a Grade I listed building.

British Waterways (BW) wished to celebrate the aqueduct's bicentenary by ensuring that its condition and appearance were exemplary and, so, embarked on an ambitious conservation project between November 2003 and March 2004. Several new pieces of research were undertaken as part of the scheduled monument consent process as BW and Cadw staff worked together to make sure that every detail of the work reflected the original design and craftsmanship.

Highly specialized contractors worked on the repair of the masonry piers, the cast-iron canal trough and the towpath.

The survival of the original wooden patterns for the iron members in the BW workshops at Ellesmere allowed replacement ironwork to be constructed to exactly the same design as the original. In particular this allowed the re-establishment of the original buckle-plates for the towpath, replacing some 'cheap and nasty' trestles inserted in the 1960s.

In the main, however, the condition of the original masonry piers and ironwork was remarkable, a testimony to the quality of the original work.

The small quantities of replacement stone required were cut from nearby Rhosymedre quarry, the source of the original stone.

After the canal trough was drained of water, the ironwork was cleaned, resealed and painted, and the bolts were inspected for corrosion. Many bolts needed to be replaced, but, even in the case of these workaday items, the majority of the originals remain doing their job to this day.

Since the decision had been taken to use traditional materials and techniques, the craftsmen cleaned the ironwork by hand with wire brushes, and traditional methods of sealing the joints were employed.

'The trough was clad in covered scaffolding and when we entered this long dark tunnel lit up by flickering flames used to heat the pots of bitumen paint, the pungent smoke and the sound of wire brushes on iron made it seem as though we had stepped back into the 1790s,' said Sian Rees, Cadw's inspector of ancient monuments. 'It was one of the most spectacular and atmospheric projects I have ever worked on'.

The aqueduct is still used by about 1,000 narrowboats a year and so the conservation work had to be completed in the winter months ready for reopening on National Boating Day on 12 March. It now stands resplendent, ready for its 200th birthday celebrations on November 26th. 🌟