= Claverton Pumping Station =

Claverton Pumping Station in the village of Claverton , in the English county of Somerset , pumps water from the River Avon to the Kennet and Avon Canal using power from the flow of the River Avon . It is a grade II listed building .

The pumping station was built by John Rennie between 1809 and 1813 to overcome water supply problems on the canal . It uses a 24 @-@ foot (7 m) wide wooden breastshot water wheel to drive two Boulton and Watt 18 @-@ foot (5 m) long cast iron rocking beams , which power lift pumps to raise water 48 feet (15 m) up to the canal . The pumping station has undergone several modifications since its initial construction , including revising the wheel into two sections each 12 feet (3 @.@ 7 m) wide separated by a 9 @-@ inch (23 cm) gap . The station 's operational life ended in 1952 , by which time its maintenance and repair had become uneconomical in the light of falling traffic on the canal .

In the 1960s and 1970s restoration was carried out by students from the University of Bath and the Kennet and Avon Canal Trust , who replaced and repaired the buildings and equipment and returned the pumping station to a functional state by 1978 . It is now operated by volunteers from the Trust , open to the public as an industrial heritage museum .

= = Description = =

At Claverton , the Kennet and Avon Canal is cut into the side of the Avon valley 48 feet (15 m) above the River Avon . The pumping station is located in a pump house built of Bath Stone , located at river level and separated from the canal by the Wessex Main Line . It was designed by John Rennie and built by Fox of Bristol . The pump house has a slate hipped roof . The wheelhouse projects to the west of the pump house and has weatherboard sides . The east gable wall has three doors allowing access to the wheel itself .

Water is diverted from the river by Warleigh Weir , about 200 yards (183 m) upstream . The water flows to the pumping station down a 30 @-@ foot (9 @.@ 1 m) wide leat , which is crossed by a single segmental arch bridge with a central keystone . The water passes over depressing sluices which can be raised or lowered by hand cranking , and then powers a breastshot water wheel . The 24 @-@ foot (7 m) wide wheel is in two sections each 12 feet (3 @.@ 7 m) wide and 17 feet (5 m) in diameter with a 9 @-@ inch (23 cm) gap between them . The wheel has 48 wooden " starts " , supporting 96 float boards each of which is 13 inches (33 cm) by 1 inch (2 @.@ 5 cm) by 12 feet (3 @.@ 7 m) and made of Iroko . The breastshot wheel is vertically mounted , and falling water strikes the blades . Breastshot wheels are less efficient than overshot wheels , more efficient than undershot wheels , and are not backshot .

At full power the wheel uses 2 tons (2 tonnes) of water per second and rotates five times a minute . The water wheel drives a flexible coupling to a pit wheel with a diameter of 16 feet 3 inches (4 @.@ 95 m) , which has 408 hand @-@ fitted wooden teeth that mesh with a 5 feet 1 inch (1 @.@ 55 m) cast iron gear , increasing the speed to 16 rpm . From there , cranks drive vertical connecting rods that transfer the energy to two 18 @-@ foot (5 m) long cast iron rocking beams made by Boulton and Watt . Each rocking beam drives an 18 @-@ inch (0 @.@ 46 m) diameter lift pump , which also takes its supply from the mill leat . Each pump stroke raises 50 imperial gallons (230 litres) of water to the canal via 150 feet (46 m) of 19 @-@ inch (0 @.@ 48 m) diameter cast iron pipe .

= = History = =

= = = Construction = = =

The idea of an east to west waterway link across southern England was first mentioned in Elizabethan times , between 1558 and 1603 , to take advantage of the proximity of the rivers Avon

and Thames , only 3 miles (4 @.@ 8 km) apart at their closest . Plans for a waterway were shelved until the early 18th century . In 1723 the Kennet Navigation through Reading opened . The Avon navigation from Bristol to Bath was opened in 1727 . In 1788 the so @-@ called " Western Canal " was proposed to improve trade and communication links to towns such as Hungerford , Marlborough , Wiltshire , Calne , Chippenham and Melksham . The following year the engineers Barns , Simcock and Weston submitted a proposed route for this canal , although there were doubts about the adequacy of the water supply . The name was changed from Western Canal to Kennet and Avon Canal to avoid confusion with the Grand Western Canal , which was being proposed at the same time .

In 1793 a further survey was conducted by John Rennie , and the route of the canal was altered to take a more southerly course through Great Bedwyn , Devizes , Trowbridge and Newbury . The proposed route was accepted by the Kennet and Avon Canal Company . In July 1793 Rennie suggested further alterations to the route , including the construction of the Bruce Tunnel in the Savernake Forest . On 17 April 1794 the Kennet and Avon Canal Act received the Royal Assent and construction began .

The new route added several locks to the canal , making water supply problems more severe . Because of the way the system of locks work , water is lost from the upper part of a canal each time a vessel passes through . This is a particular issue for the pound between Bradford Lock at Bradford on Avon and the Bath Locks , where a series of locks need to be opened each time the gates are opened . Most lock gates are not watertight , therefore some water leaks from the higher levels of the canal to those lower down . The water has to be replaced , or eventually the upper levels of the canal would not hold enough water to be navigable . Canals are usually fed by diverting water from streams and rivers into the upper parts of the canal , but if no suitable source is available or sufficient , a pumping station , such as the one at Claverton , can be used to maintain the water level . Crofton Pumping Station was built to supply water to the summit pound of the canal , opening in 1810 but , unlike Claverton , was powered by steam .

Protracted negotiations over water rights with the owners of Saltford Brass Mill and around 30 other mills on the river between Bath and Bristol , delayed construction until 1809 ; the wheel was installed in March 1810 . Further delays relating to obtaining specific items of machinery meant that the pumping station did not open until early 1813 , and until then boats were prohibited from using Bath Locks during periods of low rainfall .

= = = Operation and decline = = =

The pumping station operated continuously , providing water for the increasing traffic on the canal . Problems with the size of the water wheel , which was supported at either end , meant that the middle of the wheel sagged , putting strain on the bearings and stays . In the 1840s the trussing was changed from stays to tension rods to strengthen and lighten the wheel , along with improvements to the pumps . The changes to the wheel were unsuccessful , and in the 1850s a central bearing was added dividing the wheel in two .

The opening of the Great Western Railway in 1841 led to a significant decline in the canal 's traffic , even though the canal company lowered tariffs . In 1852 the railway company took over the canal 's operation . In 1877 the canal recorded a deficit of £ 1 @,@ 920 and never subsequently made any profit . The Somerset Coal Canal and Wilts and Berks Canal , which each supplied some of the trade to the Kennet and Avon , including freight from the Somerset coalfield , closed in 1904 and 1906 respectively . At Claverton various minor repairs were needed to the wheel and pump , and the wheel had to be levelled at regular intervals during the later part of the 19th and early 20th centuries . The 408 " green oak " teeth on the pitwheel also had to be replaced several times .

In 1926 , following a loss of £ 18 @,@ 041 the previous year , the Great Western Railway sought to close the canal by obtaining a Ministry of Transport Order , but the move was resisted and the company charged with improving its maintenance of the canal . After the Second World War the Transport Act of 1947 meant that control of the canal passed to the British Transport Commission , but by the 1950s large sections had been closed because of poor lock maintenance following a

breach in the bank west of the Avoncliff Aqueduct . Claverton Pumping Station ceased operation in 1952 , after the failure of a number of the pitwheel 's oak teeth . The British Transport Commission installed a 6 @-@ inch (15 cm) centrifugal pump to maintain the statutory minimum water level .

= = = Restoration = = =

After its closure the pumping station lay derelict until the late 1960s , when the Kennet and Avon Canal Trust proposed to the British Waterways Board that students from the University of Bath conduct a survey and report on the viability of returning the pumping station to working order . Work started in 1969 with engineering students from Bath providing the labour under the supervision of John Butt , and the Trust providing the funding . Within the building rotten woodwork was replaced and electric lighting installed . To work on the sluices and the waterwheel the leat was dammed . Specialist wood and metal work was undertaken by apprentices from the British Aircraft Corporation in Filton . By 1972 some progress had been made ; John Butt retired and Derrick Dudden took over as restoration manager , with more volunteers from the Canal Trust helping to provide the labour . Silt was removed from the pond , hatches replaced and the waterwheel restored . The 408 oak teeth on the pitwheel were replaced and the pumps overhauled with new rope packing . By February 1976 all the machinery was working and water could be pumped from the river to the canal . The pumping station was formally re @-@ opened in 1978 .

In 1981 , British Waterways installed two 75 @-@ horsepower (56 kW) electric pumps and presented the old diesel pump to the Kennet and Avon Canal Trust for preservation . Wessex Water Authority agreed to the extraction of 1 @,@ 000 @,@ 000 imperial gallons (4 @,@ 500 @,@ 000 l) per day from the Avon at Claverton to be pumped east ; the costs of the pumps was £ 175 @,@ 000 .

The pumping station is maintained by volunteers from the Trust and is open to the public every Wednesday , Saturday , Sunday and Bank Holiday except during the winter maintenance period , when opening is only on Saturdays . There is a working model of the pumping station at the Kennet & Avon Canal Museum at Devizes . The restoration work received an Engineering Heritage Award from the Institution of Mechanical Engineers .