

= River Tone =

The River Tone is a river in the English county of Somerset . The river is about 33 kilometres (21 mi) long . Its source is at Beverton Pond near Huish Champflower in the Brendon Hills , and is dammed at Clatworthy Reservoir . The reservoir outfall continues through Taunton and Curry and Hay Moors , which are designated as a Site of Special Scientific Interest . Finally , it flows into the River Parrett at Burrowbridge .

An act of Parliament granted in 1699 authorised work that made the river navigable as far as Taunton . The act specified that profits should be used to benefit the poor of Taunton , but the Proprietors succeeded in avoiding their obligation until 1843 , when they used the proceeds from the sale of the navigation to fund a wing of the Taunton and Somerset Hospital , and to aid the Taunton Market Trust .

The Bridgwater and Taunton Canal opened in 1827 , which provided an easier route than the river , and protracted legal battles followed over ownership of the river and water rights for the canal . These were not finally resolved until 1832 , when the Canal Company formally took over the river navigation . The ability to navigate the river gradually deteriorated , not helped by the abandonment of the River Parrett as a navigation in 1878 . Following flooding in Taunton in 1960 , much of the river between there and its mouth was straightened , and the navigation locks were removed . That at Ham was blown up by the Territorial Army . Navigation rights were repealed in 1967 .

= = Course = =

The river is about 33 kilometres (21 mi) long . Its source is at Beverton Pond . Over its first 1 @. @ 8 miles (2 @. @ 9 km) it follows a south @- @ easterly course and drops around 490 feet (150 m) before discharging into Clatworthy Reservoir , which also impounds the waters of 5 other streams .

The river continues as the outflow from the main dam of the reservoir , passing to the west of the village of Clatworthy before following a southerly course which passes to the east of Huish Champflower . The river enters a steeply wooded section at Washbattle bridge . The B3227 road from Wiveliscombe crosses from the east to the west side of the valley at Waterrow bridge . By the time it reaches Stawley bridge and turns south @- @ east , it has lost another 410 ft (120 m) and is just 330 ft (100 m) above sea level . At Tracebridge , the river turns to the north @- @ east and then the north . Here the course of the derelict Grand Western Canal crossed the Tone on an aqueduct which now carries a footpath .

The river passes over weirs at Greenham , Tone and Nynnehead , after which it is crossed by the aqueduct of the Grand Western Canal and the railway , both on their own routes to Taunton . A disused bridge , constructed in 1817 , spans the river at Nynnehead . The river turns to the north @- @ east near Bradford on Tone , with its two listed bridges , including the Bradford Bridge which was originally built by the 15th century , and then to the east near Upcott bridge , where there were two mills . At Roughmoor its course is crossed by Silk Mills Road . There is a scheme to make the river navigable from here to the town centre as a way of encouraging transport with less environmental impact .

The French weir in Taunton is the head of navigation as boats can not be taken upstream of this point . As it makes its way through the town centre to Firepool weir and the junction with the Bridgwater and Taunton Canal , it passes under the North Bridge , which was constructed in 1895 , and Priory Bridge Road . Next comes the A358 Obridge viaduct , the A38 Bathpool Bridge and the M5 motorway bridge . Firepool weir was reconstructed in 1967 as part of the plans to straighten the river through the town centre and down to Bathpool in order to provide better flood defences . These works swept away the remains of the original navigation . There is a disused five @- @ arched railway bridge built in 1863 at Creech St Michael . Nearby is the aqueduct that carried the Chard Canal over the river from 1842 until 1866 . The Brewhouse Theatre & Arts Centre , is close to the riverside . Ham weir stands as a reminder of the location of the lock there . After Knapp bridge , the sluice at Newbridge marks the upper tidal limit of the river . Curry and Hay Moors , an area of low @- @ lying fenland close to the river , are a Site of Special Scientific Interest . A railway bridge

carries the Taunton to Castle Cary railway line over the river , after which is the Curry Moor pumping station . Two more road bridges at Athelney and Stanmoor cross the river before it joins the River Parrett at Burrowbridge , where the junction is overshadowed by Burrow Mump .

= = Geography and geology = =

The catchment area of the river is approximately 414 square kilometres (160 sq mi) and the average daily flow for the entire catchment is estimated to be 4 @. @ 76 cubic metres per second (168 cu ft / s) . Water from tributaries such as Hillfarrance Brook , Halse Water , Haywards Water , Three Bridges Stream , Sherford Stream and Broughton Brook feed the river but are supplemented by controlled releases from Clatworthy and Luxhay Reservoirs during dry periods . The tributaries flowing into the Tone from the south bring water from the Blackdown Hills .

The rivers source is in the Brendon Hills which fall within the Exmoor National Park . The hills are quite heavily cultivated unlike their neighbouring upland areas of Exmoor and the Quantock Hills . The Brendon Hills are largely formed from the Morte Slates , a thick faulted and folded sequence of Devonian age sedimentary rocks . It then flows through an alluvial floodplain underlain by sub @-@ alluvial gravels , underlain by rocks of the Mercia Mudstone Group . The floodplain is between 5 metres (16 ft) and 50 metres (160 ft) above the ordnance datum (mean sea level) . The surrounding land is dominated by wet meadow and wooded areas including willow trees .

Water quality in the river can be affected by dredging work .

= = Hydrology and water quality = =

The Environment Agency is responsible for monitoring water quality on the river and its tributaries , which have been divided into seventeen separate water bodies . In 2013 , seven water bodies were assessed as having good quality and ten as being moderate . The reasons for not achieving good status included pollution from waste water , pollution from agriculture and physical modifications . The physical modifications include dredging work on the lower reaches , near the junction with the Parrett to increase the channel flow to reduce flooding . The use and storage of the dredged material in bank restoration may also have an impact . In 1998 improvements were sought to treatment works and surface water outfalls to improve water quality . A vegetable washing plant on the Chelston stream at Wellington was also identified as a source of pollution . The waters of the Upper Tone have been classified as having good ecological status , whereas the section from Wellington to Taunton and downstream of Taunton are rated as moderate .

There are three monitoring stations on the river tracking the water levels . At Greenham the normal level of the river in average weather conditions is between 0 @. @ 15 metres (5 @. @ 9 in) and 0 @. @ 50 metres (1 ft 8 in) with the highest recorded being 2 @. @ 2 metres (7 ft 3 in) on 7 December 2000 . At Bishops Hull the normal range is 0 @. @ 09 metres (3 @. @ 5 in) to 0 @. @ 54 metres (1 ft 9 in) and the high 2 @. @ 59 metres (8 ft 6 in) on 30 October 2000 . At Taunton market the normal range is 0 @. @ 88 metres (2 ft 11 in) to 0 @. @ 93 metres (3 ft 1 in) with a high of 2 @. @ 77 metres (9 ft 1 in) on 24 December 2013 .

The flow in two tributaries and two points on the river is also monitored , primarily to act as an early flood warning system for Taunton . On Halsewater the mean flow is 1 @. @ 128 cubic metres per second (39 @. @ 8 cu ft / s) while at Milverton on the Hillfarrance Brook it is 0 @. @ 53 cubic metres per second (19 cu ft / s) and at Greenham on the river itself it is 1 @. @ 025 cubic metres per second (36 @. @ 2 cu ft / s) . At Clatworthy Reservoir near the source the flow rate is 0 @. @ 322 cubic metres per second (11 @. @ 4 cu ft / s) .

= = History = =

The river has a long history of improvements to facilitate navigation from Bridgwater to Taunton , and has also been used to power mills along its length . These two objectives are often antagonistic , and this has been the case on the River Tone .

The earliest known record of improvements to the river is recorded in a document of 1325 from the Dean and Chapter of Wells Cathedral , where it was proposed to widen the river between Ham Mill and a new mill which was to be built at Knapp . The Dean and Chapter owned the river as far as Athelney weir , which was presumably a fish weir , as the river was an important source of fish for the local population . Records from 1494 record the intent to build a new mill at North Curry , which was operational in 1504 , and caused flooding in 1505 , resulting in the Bishop of Winchester having to complain to the Dean and Chapter of Wells . There is also mention of boats using the river at this time , as their use was restricted by the construction of the new mill at Ham .

== River improvements ==

Navigation on the first 7 miles (11 km) from Burrowbridge to Ham Mill was much easier than on the final stretch to Taunton , and in 1638 , John Mallett , the Sheriff of Somerset and member of parliament for Bath , obtained a Commission under the Great Seal from King Charles II . This granted him and his heirs sole navigation rights from Bridgwater to Ham Mills , and allowed him to improve the river at his own expense . He saw this as a philanthropic action , as it reduced the price of coal to the poor people of Taunton , as well as improving the transport infrastructure .

With the death of Mallett and later his son , work on the maintenance of the river ceased , and its condition declined . By 1697 , trade was threatened , and a group of 34 merchants and traders petitioned parliament for powers to take over the navigation . An Act of Parliament dated 24 March 1699 created the Conservators of the River Tone , giving them powers " for making and keeping the River Tone navigable from Bridgwater to Taunton , in the county of Somerset " , which included the purchase of the navigation rights from Bridgwater to Ham Mills from the Mallett estate , for which a price of £ 330 was agreed .

The Conservators applied for a second act of parliament in 1707 , as they needed a further £ 3 @, @ 800 to finance projects including the building of a half @-@ lock and the removal of a shoal just below Knapp Bridge . Boats carrying 15 tons of cargo could reach Taunton by 1717 . The navigation included a lock and two or more half @-@ locks , consisting of a pair of gates to hold back the water , and an agreement to build a towpath between Ham Mills and Taunton was reached in 1724 .

The number of locks on the navigation varied over the years , and by 1804 there were four full or pound locks , situated at Ham , Creech St Michael , Bathpool and Obridge . In addition , there were at least four half locks . Curry Moor gates were the lowest on the river , which were followed by a second half lock 100 yards (91 m) further upstream , just below Newbridge . A third gate was located 450 yards (410 m) below Ham lock , and the fourth one was just below the lock at Bathpool .

== Profits ==

The 1699 act of parliament had stipulated that the Conservators could receive dividends of six per cent on the money they had invested into the undertaking , until the capital was repaid , and that after that the tolls were to be reduced , while profits were to be used for " the benefit and advantage of the poor of Taunton " , particularly by the building of hospitals . Local landowners complained about rights of access across their land and increased flooding in a petition of 1707 , however in 1708 another act was passed to allow the completion of the navigation to Taunton .

Because the receipts were initially insufficient to cover the six per cent dividend on the £ 5 @, @ 697 that the Conservators had invested , they added the difference to the capital , so that the debt steadily increased . This state of affairs was challenged in 1735 , when it was decreed that the original capital had been repaid , and the poor should now benefit , but the decision was overturned in 1738 on appeal .

Profits for the undertaking showed a steady rise , due in part to the low maintenance costs of the river . Income from tolls rose from £ 321 in 1712 to £ 1 @, @ 137 by 1802 . By this time , traffic consisted of about 11 @, @ 500 tons of coal carried from Bridgwater upstream out of a total tonnage

of 14 @, @ 000 tons . Dividends for 1797 were 11 @. @ 5 % , but the capital debt had risen to £ 85 @, @ 466 by 1800 , when the auditors refused to examine the accounts , because the likelihood of the poor ever benefitting from the navigation was receding . After much negotiation , the capital debt was reduced to £ 13 @, @ 000 . An act of parliament dated 14 July 1804 enshrined this position , and ensured that interest was limited to six percent , with profits being used to reduce the debt . By 1828 , the amount owing had reduced to £ 4 @, @ 426 .

= = = Canal Company Takeover = = =

The building of the Bridgwater and Taunton Canal , which opened in 1827 , directly affected the River Tone Navigation , as it provided a more direct route between Taunton and Bridgwater . The Conservators attempted to limit the supply of water from the river to the canal , while the canal company breached the river bank near Firepool lock , in order to ensure that boats could reach Taunton Bridge wharf from the canal . In order to compete with the canal , they chose to reduce the tolls , although they were unsure of the legality of this action while they had outstanding debts . The canal company challenged their right to reduce the tolls in court , but the action was defeated , and the tolls remained at the lower level .

On 28 August 1827 , the canal company announced that they were taking over the River Tone Navigation , under the terms of their acts of parliament of 1811 and 1824 . This they did in November , when William Goodland , the river superintendent , was evicted from his cottage , the tolls were raised again , and maintenance ceased . This action was ruled to be illegal by the Court of King 's Bench , as the canal company had not complied with the time limits enshrined in the act , but the canal company held on to the river despite the order to give it back to the conservators . Both sides took their case to the High Court , which ruled that the Conservators should have the river in February 1830 . A further series of legal actions followed , after which the canal company attempted to obtain a new act of parliament to obtain the Tone by compulsory purchase . The Conservators then decided to negotiate , and an act of parliament passed in July 1832 authorised the takeover .

Under the terms of the act , the canal company inherited the debts of the Conservators , and paid them an additional £ 2 @, @ 000 . They were required to rebuild part of the North Town Bridge in Taunton , and to return the Tone Navigation to good order . The Conservators were empowered to carry out an annual inspection , and to re @-@ possess the river if the canal was not properly maintained . The £ 2 @, @ 000 was held by the Conservators until 1838 , when they applied for an order to dispose of it , but it was not until 1843 that the order was granted . £ 1 @, @ 000 was used to build a new wing for the Taunton and Somerset Hospital , and £ 1 @, @ 000 was invested in the Taunton Market Trust , in line with the intentions of the 1699 act .

= = = Decline = = =

Traffic on the river in 1823 was 39 @, @ 516 tons , which generated tolls of £ 2 @, @ 194 . After the construction of the canal , traffic steadily declined , until income was insufficient to cover maintenance by the early 1860s . The canal company used a similar accounting practice to manage the Tone debt , inflating it at six per cent each year , to ensure that they could demonstrate that the river was unprofitable .

Navigation was further affected by the passing of the Somersetshire Drainage Act on 1 July 1878 , which resulted in the River Parrett being taken over by the Drainage Commissioners , and abandoned as a navigation . Limited traffic continued to use the lower reaches of the Tone , with the last barge using the Burrowbridge to Ham Mills section in 1929 . In 1967 the Somerset River Authority applied to the Ministry of Agriculture for permission to remove the navigation rights , and the original acts of parliament were repealed under section 41 of the Land Drainage Act (1930) . This allowed the river through Taunton to be straightened , and a weir to be constructed at Firepool , to improve the flood defences for Taunton . Above the weir , the river is still navigable as far as French Weir .

== Watermills ==

Ham Mills was a site of milling activity from mediaeval times until about 1914 . The mill was situated on an island in the middle of the river , with a weir and bypass channel to the north and the lock channel to the south . The Conservators were required to light the area after a boatman fell into the river and drowned while attempting to use the lock after dark in March 1826 . The coroner who instructed that the lighting should be installed noted that " boats were passing at all hours of the night . " Water levels in the river fell as more water was extracted further upstream , and by the 1890s the waterwheels were assisted by a steam @-@ driven turbine which the miller installed . Milling ceased in 1914 , when the boiler which supplied the steam was removed by the War Department , so that it could be fitted into a minesweeper . A surviving mill house which dates from the early 19th century has been designated by English Heritage as a Grade II listed building .

There had been a mill at Bathpool for several centuries , which had been rebuilt or adapted as required . In March 1812 , the structure was burnt down by a fire , caused , according to the Taunton Courier , by " the excessive friction excited in the stones used in the process of shelling clover seeds " . Stocks of flour , grain and flax valued at £ 2 @, @ 500 were destroyed . The mill was rebuilt and later owned by Captain George Beadon . The mill was purchased by Thomas Redler in 1889 on the death of Beadon , but another fire damaged much of it two years later . Redler rebuilt it with safety in mind , and as at Ham , installed a steam @-@ driven turbine as water levels were often inadequate to power the wheels . Two more turbines followed , and the water wheels were removed . Steam from the turbines was also used to heat bread ovens , which were amongst the first in the country to be heated in this way . In September 1915 , another fire gutted the building , which was not rebuilt , and the ruins were demolished in the 1920s .

There were originally mills at Firepool and Obridge as well . Because of the difficulties of navigating past the mill pools , the Conservators of the River Tone decided to buy the mill at Firepool in December 1793 with a view to demolishing it " for the benefit of the navigation " , and they obtained it for just £ 32 . In 1797 , they decided to follow the same course with Obridge Mill . The mill at Creech St Michael was the subject of a court action at the King 's Bench . In October 1830 , while replacing the mill stones , the millers had opened the flood gates for 16 days , and built a dam across the river , thus preventing navigation . The case was heard in 1831 , and the judgement was that both parties were obligated to use the water in a way that did not cause injury to the other party .

== Flood defences ==

The first Curry Moor pumping station was built in 1864 , to house a steam engine and pump . A cottage for the operator was built next to it at the same time . This installation lasted until 1955 , when a new pumphouse was constructed to house two diesel pumps . The steam engine was retained for historical reasons , and is located in part of the new building . The diesel pumps were supplemented by an electric pump in 1983 , and a programme of refurbishment was carried out in 2008 , which included the construction of a new outfall into the river .

In 1951 , very heavy rainfall resulted in large portions of the Tone valley below Taunton flooding . Analysis of what had happened indicated that the channel was of insufficient size to carry the volume of water , which fell on the hills to the west and then flowed down the river . The easy solution of widening the channel was not available , as there were houses built along the south @-@ eastern bank for around 2 miles (3 @. @ 2 km) above the junction with the River Parrett . The flooding revealed that although these properties were not normally affected by floods , there was significant seepage through the banks . There was no likelihood of sufficient money being available to buy all the houses to demolish them , and so a program of constructing concrete cores in the centre of the banks began in 1956 and continued until 1964 .

Rainfall in October 1960 was even heavier , when 9 @. @ 72 inches (247 mm) fell on the Somerset Levels , representing 249 % of the normal levels . Again the valley flooded , and large areas of Taunton were under water to a depth of 3 feet (0 @. @ 91 m) . Plans for a flood relief

channel centred at first on the Bridgwater to Taunton Canal , which follows a slightly higher course to the west , and does not run through peat , but the estimated cost of £ 1 @. @ 7 million was prohibitive , and so a scheme to upgrade the river costing around one third of that was implemented . This involved straightening of the river where it meandered , widening the bridge openings , and the demolition of navigation locks and weirs .

A new sluice was constructed at Newbridge , incorporating tidal gates , which effectively prevent tides from passing further up the river . The removal of the navigation works at Ham proved particularly difficult , and acted as a training exercise for the Territorial Royal Engineers . Men from the 205 (Wessex) Field Squadron RE (TA) used 200 pounds (91 kg) of explosives to blow up the half @-@ lock and a mud @-@ filled barge which could not be moved . The river banks were raised to give more protection to the villages of Creech St Michael , Ham and Ruishton , but the channel was still only capable of discharging 2 @, @ 500 cubic feet per second (71 m³ / s) , whereas the channels through Taunton were designed to handle 4 @, @ 500 cu ft / s (130 m³ / s) , and were unlikely to overflow until discharges reached 6 @, @ 000 cu ft / s (170 m³ / s) . Curry Moor is therefore used as a washland , and excess water floods over it , to be pumped out at a later date by the Curry Moor pumping station , situated on the banks of the river below the railway bridge . The programme began in 1965 and was completed in 1967 .

During the winter flooding of 2013 ? 14 on the Somerset Levels , the River Tone overflowed at new year , during the rain and storms from Storm Dirk , with many residents asking for the Environment Agency to resume river dredging . On 24 January 2014 , in light of the continued flooded extent of the Somerset Moors and forecast new rainfall as part of the winter storms of 2013 ? 14 in the United Kingdom , both Somerset County Council and Sedgemoor District Council declared a major incident , as defined under the Civil Contingencies Act 2004 . As a result of the extensive flooding dredging work was carried out . In addition plans were developed for a flood storage area or " Superpond " with a capacity of 1 @, @ 800 @, @ 000 cubic metres (64 @, @ 000 @, @ 000 cu ft) , on the Tone at Taunton . Studies of the potential impact on the hydromorphology were carried out .

= = Biology = =

Clatworthy Reservoir is an important wildlife habitat managed by Wessex Water , and offers facilities for fishing and walking . The river and its tributaries support populations of European water vole (*Arvicola amphibius*) . There may also be populations of white @-@ clawed crayfish (*Austroptamobius pallipes*) and northern crested newts (*Triturus cristatus*) . The fish species in the river include : chub , carp , grayling , roach , tench , rudd , perch and pike .

Curry and Hay Moors is a 472 @. @ 8 hectares (1 @, @ 168 acres) biological Site of Special Scientific Interest adjacent to the Tone . They form part of the complex of grazing marshes known as the Somerset Levels and Moors . The low @-@ lying site is situated adjacent to the River Tone which annually overtops , flooding the fields in winter . Soils are predominantly alluvial clays overlying Altcar series peats . The flora and fauna of the ditches and rhynes is of national importance . Over 70 aquatic and bankside vascular plants have been recorded including frogbit (*Hydrocharis morsus @-@ ranae*) , flowering rush (*Butomus umbellatus*) , wood club @-@ rush (*Scirpus sylvaticus*) and lesser water @-@ plantain (*Baldellia ranunculoides*) . Over 100 species of aquatic invertebrates inhabit the ditches including one nationally rare soldier fly , (*Odontomyia ornata*) and 13 nationally scarce species including the water beetles *Agabus uliginosus* , *Hydaticus transversalis* and *Helophorus nanus* . In winter the flooded fields provide food for large numbers of waterfowl with several thousand lapwing (*Vanellus vanellus*) , hundreds of snipe (*Gallinago gallinago*) and smaller numbers of golden plover (*Pluvialis apricaria*) and dunlin (*Calidris alpina*) regularly present . Over two hundred Bewick 's swans (*Cygnus bewickii*) have been recorded , making the site an internationally important wintering ground for this species . Raptor species such as short @-@ eared owl (*Asio flammeus*) , merlin (*Falco columbarius*) and peregrine (*Falco peregrinus*) regularly hunt over the site in winter . Vertebrate species present include grass snake (*Natrix natrix*) and common frog *Rana temporaria* . Otters (*Lutra lutra*) are regularly recorded on the site .

Southlake Moor is another biological Site of Special Scientific Interest , this one covering 196 @. @ 1 hectares (485 acres) near the junction of the Tone and Parrett at Burrow Mump and Burrowbridge . Southlake Moor is unusual in that , when conditions in the River Parrett are suitable , it may be deliberately flooded in winter by means of a sluice in the river floodbank . Some 96 species of aquatic and bankside vascular plant species have been recorded from Southlake Moor , of particular interest is the greater water @-@ parsnip (*Sium latifolium*) . When the moor is flooded , large numbers of wildfowl may be present ; with up to 22 @, @ 000 wigeon (*Anas penelope*) , 250 Bewick 's swan (*Cygnus bewickii*) and good numbers of pochard (*Aythya ferina*) , teal (*Anas crecca*) and tufted duck (*Aythya fuligula*) . Regular signs of the otter (*Lutra lutra*) are to be seen on the muddy banks of the River Parrett . The ditches on the east side of the site contain a population of the palmate newt (*Triturus helveticus*) .