Public Health and Water Supply in Bridgwater, Somerset

by Tony Woolrich

2) The first water supply and the 1824 scheme

Early History

UNTIL the end of the seventeenth century Bridgwater obtained its water from local streams – mainly the Durleigh Brook – from wells and from stored rainwater. For the poorer residents who did not have private wells it was carried round the town by hawkers who filled their carts at places like Horsepond Lane which in 1680 had been fitted out to allow the inhabitants to obtain water directly from the Durleigh Brook.

As well as these simple supplies larger towns and cities often had water piped by gravity from neighbouring springs which discharged at public conduit heads. These were originally laid on in medieval times by monastic foundations for their own use or by the governing corporations, and, being charitably inspired, were often free, but no evidence has been found that such a supply was ever in use in Bridgwater. The Friary was very close to the Durleigh Brook, and presumably used that. In the C12 a ditch was cut for supplying St John's hospital in Eastover. It ran from south of the Bridge and then, after leaving the Hospital, turned north to discharge into the Parrett. The water must have drained into it from the surrounding land, but at this time the property was on the outskirts of the town and so would not have suffered pollution problems. The castle would undoubtedly have had wells within the curtain wall for use in times of siege.

Some towns had proper drainage systems, flushed by running water, but again no evidence has been found that Bridgwater ever did. It is known, however, that many of Bridgwater's sewers were of considerable antiquity, some dating from the end of the middle ages. The town's rubbish and sewage was collected by scavengers who sold it to nearby farmers as manure.

A major need was for water for fire-fighting. The Great Fire of London in 1666 is still very well known today, but many small towns suffered similar catastrophic fires. Tiverton in Devon was badly damaged in 1598, with 400 houses destroyed and 35 people burnt to death, in 1612 600 houses were burned and 1731 300 houses destroyed. Dorchester was nearly destroyed in 1613. Beaminster in Dorset was burned in 1644, 1684 and 1781. Northampton was almost totally destroyed in 1645. Blandford in Dorset was badly damaged over 2 days in 1731. Crediton in Devon lost 450 houses in 1743. As today, many smaller fires took place frequently.

Water-supply technology

By the beginning of the sixteenth century advances in technology allowed the development of a pumped water supply to any community which desired it. There was an advance in the technology of pump making which meant it was practicable to force water to a sufficient height to give it a pressure head, so by means of lead pipes to carry it to the upper floors of houses. In the early stages of this technological advance the motive power was by means of animal power, windmills and water mills operating through gearing. It was found that the lift of a pump could be extended considerably by the addition of a pipe below the barrel with a foot valve at the bottom; the pump thus became a lift and suction one. The working barrel was usually of wood lined with lead and the bucket was packed with leather. It was found in practice that the water would only rise in the suction pipe at the utmost about 28' – the pressure of the atmosphere balancing a column of water at that height when a vacuum was formed above it.

It was also found that the bucket pump could be used reversed to constitute a piston pump to force a liquid to a level that was only limited by the power that could be applied. This knowledge reached England and led to much activity in projects for raising water and draining mines. Bevis Bulmer, (fl. 1568-1610) for example, developed pumping equipment in the Mendip lead mines during the reign of Elizabeth I, but few details have come down to us about what his equipment comprised. As well as the usual common bucket pump and its developments, water could be raised by a counterbalanced bailer, the chain of pots (and its cousin the rag and chain pump), and the Archimedian screw. There is little evidence, however, that any of these were used for water supply purposes in England then.

As well as improvements in pump technology, the developments in the techniques of gun boring, which allowed the production of cannon with bores of 6" and 7", were known to artisans who bored the wooden water pipes used then.

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The Early Water Companies

As the population of towns and cities grew so did the demand for water and in Germany and Spain mechanical pumping plants were built in the sixteenth century to supply some of the larger cities. In flat country the only place where water wheels could be used on any scale was by the power of the tide or a river where the flow was restricted by a bridge or weir to such an extent that a fall was obtainable. At Danzig in 1570 the River Radaune was utilised to raise water by means of water wheels driven by the current to supply 564 conduit heads in the city. The first attempt to supply London was made in 1582 by a German engineer named Peter Maurice (or Morris). His machine comprised waterwheel - driven pumps erected on the Thames near London Bridge. The London Bridge machine was considerably extended and altered from time to time, and finally demolished when the bridge was rebuilt in 1822.

The foremost engineer of these machines at the end of the seventeenth century was George Sorocold. His particular line was a waterwheel geared to a three-throw crank from which the force pumps were worked by overhead levers. In ten years he built waterworks at Derby, Leeds, Macclesfield, Wirksworth, Great Yarmouth, Portsmouth, Norwich, King's Lynn, London Bridge, Deal, Bridgnorth, Islington and Bristol. Similar waterworks were erected by other engineers elsewhere then; in the north of England at Chester, Doncaster, Hull, Newcastle on Tyne, Nottingham and Sheffield; in the south of England waterworks were erected at places like Gosport, Exeter and Barnstaple.

Just why there was so much endeavour expended on starting up waterworks then is a mystery. It occurred at the time of the Glorious Revolution and the accession of William and Mary, so Dutch technical influence might have been involved. It may have been because of the success of the London supply, but more likely through the efforts of the engineers themselves in persuading local town councils of the value of such an enterprise to their citizens.

The First Bridgwater Supply

Bridgwater also had a pumped water supply in those pioneering days. In 1694 an agreement was drawn up by the Corporation allowing Richard Lowbridge, an ironmonger of Stourbridge, Worcs., to dig up the streets and lay water pipes from the old Town Mill on the Durleigh Brook (now next to the Blake Museum) to a cistern constructed in the roof of the High Cross on Cornhill. Lowbridge had recently purchased the mill from John Smith of Barnstaple. The Council had agreed to pay him £100 once the water was flowing to the cistern on Cornhill. The Council later reversed its decision and a deed releasing them from the agreement survives in the County Record Office. A second deed in which Lowbridge and David or Daniel Dunnell of Gloucester assigned the property at the Town Mill to George Balch also survives.

Both Lowbridge and Dunnell were partners in the waterworks at Exeter and Barnstaple where among their fellow directors was Ambrose Crowley I the Quaker ironmaster of Stourbridge. Lowbridge was also a Quaker and by 1700 was an elder of the Exeter Meeting. No other contemporary written record appears to survive about the waterworks. Since Dunnell was a carpenter it is likely he was the engineering specialist, building the wooden waterwheel and machinery.

The early history of the Town Mill goes back several centuries before this; it was originally used for grinding corn. The building is quite small, and the site today indicates that a breastshot water wheel ran in the narrow bed of the Durleigh Brook. With later building in the neighbourhood, and the work carried out when the Broadway was built it is not now known whether there was ever a mill pond, and the reduction in the flow today, following the construction of the Durleigh Reservoir, makes it hard to assess the kind of flow it once had. It is known, however, that the flow did vary during the course of the year, and was often meagre in summer.

The Durleigh Brook discharges into the River Parrett at what today is known as St Saviour's Clyse, which can be seen on the west bank of the river near Blake Bridge. The clyses on the Parrett contain flap gates to hold back the tide, especially at high water, to stop the river water from breaching the river banks and flooding the low lying land behind them, and for a part of each month the mill would have been unusable for a few hours each day as the water in the

brook backed up from the flap valve to the waterwheel in the mill. Observation of the clyse at Huntworth now shows the flow in the rhynes stops only for a few hours, and then at either side of an exceptionally high tide. For the reason of this intermittent action of the water pumps the cistern at Cornhill had to be big enough to hold a supply during the time the mill was idle, especially for use in the case of fire, when the demand could be heavy. The gates on the Durleigh Brook are presently lacking, so the stream regularly silts up below the mill with high tides.

No information has been found about the machinery at the mill, but from the present layout it is possible to conjecture how it might have been. The waterwheel of about 15' diameter rotated at approx 15 rpm and drove through gearing a number of forcing pumps which drew the water from the stream and pumped it to the cistern on Cornhill. Sorocold's system involved three pumps driven by half beams actuated by a three-throw crank geared up from the waterwheel axle. It is possible that a corn mill was attached to the plant, so that water could be pumped during the miller's slack times. There is no evidence for this, however.

Numbers of the wooden waterpipes were dug up from the streets of Bridgwater over the years: in 1795 when the stone town bridge was replaced by the iron one, in the 1830s when the gas mains were laid and in the 1870s when the Water Company's pipes were laid. In 1917 more than 60 yards of elm water pipes were found in the bed of the Durleigh Brook in the garden of Ivy House, Friarn Street. They were re-buried before they could be photographed. A complete section of a large-bore wooden water pipe has recently been recovered from the bed of the Durleigh Brook next to the Town Mill. Just why pipes were sunk in the bed of the Durleigh Brook in this way is something of a mystery. One explanation is that they are part of the pipe line from the pumps to the cistern on Cornhill, but if this is true it seems to be going rather a long way round to get there, since the shortest route would be to bury them below the road in what is now Blake Street and George Street to Fore street where a bend would take them to the cistern. Another explanation is that this run of pipes is in fact the feed to the pumps, bringing water into the town from an inlet higher up the stream where perhaps it was less polluted.

The pipes were usually made of elm or alder; oak being far too expensive and much harder to bore. They were best made of proper trees with the bark left on, since this was held to preserve them. In the London area the lengths were standardised at roughly 9'. The hole was bored by a succession of hand-operated long augers, increasing in size, but larger water companies used mechanical boring machines, worked by horses or water. It was found that a man might bore by hand 39' of 2" bore per day in elm, but only about 6' in oak. The diameter of the timber selected for the water pipes was important, since it had to withstand the pressure of the water within it. It was necessary that the bore was in the heart wood of the tree and there was sufficient thickness of heartwood left to withstand the pressure after the bore was cut out. For a nine-inch bore pipe, with a pressure head of less than 30', (the vertical distance between the cistern on Cornhill and the pump at the Town Mill, would have been less than this) the diameter of the pipe would have been about 14". Tree branches were also bored in the same manner to allow a supply to be split in different directions when running the mains along the streets. Stopcocks were at first enlarged wooden beer barrel plug cocks, but during the C18 cast iron cocks were produced. Domestic supplies were taken off the main by boring a hole in it, and driving in a hollow brass plug to which the lead service pipe was soldered.

Lead pipes were not suitable for use between the water pumps and the cistern, since the shock of the foot valves closing would cause the lead to creep imperceptibly, and in due course a weak spot would become thin enough to burst. Lead pipes could be used to take the supply from the main coming from the cistern to any properties which took it, since there was no significant pressure in them.

The lengths of wooden pipes were joined together by enlarging the bore at one end by a conical auger and cutting the opposite end to a matching taper which was driven into the conical end of the adjacent pipe; this was then hooped with iron to stop splitting. Sealing compounds, mostly made of tallow, were smeared on the jointing faces before the pipes were hammered home. Wooden pipes were defective since they were liable to decay once they were buried in the streets. Leakages were

very common, and could only be repaired with great difficulty, since long lengths of the street would need to be dug up to discover them. The loss of water through leakage and fracture was estimated to be 25% of the water which entered the system. It was held that pipes were best preserved by being buried in well-drained gravelly soil. Some authorities held they would last about 40 years, but experience showed that in London they were good for about 4. In the search for leaks it was common for the sewers to be examined to detect seepage of the water where a leak was not visible from above ground. Serious problems arose when the water was needed to put out a fire, because of the small bore of the mains and the frequently encrusted condition of the interior.

During the C18 several water companies used earthenware pipes, but they were held to be prone to fracture at places where vehicles passed overhead, so their use was only very occasional.

By the beginning of the C19 iron pipes were used by the larger London water companies, but there was a prejudice against them since they were thought to rust. Several alternatives were tried, and a company was even formed to manufacture turned and bored pipes made of stone. There is no evidence that iron or stone pipes were ever tried at Bridgwater then.

The ownership, operation and finances of the Bridgwater service during the C18 is not known. Water carriers would have taken the supply round the streets, and it is probable that some large properties would have had an independent piped supply as well. It is unlikely there were public drinking fountains, since the owners of the supply would have charged for every drop they supplied. The water was piped to Eastover over the stone bridge then and it is possible there was a second cistern there somewhere, but no evidence of this has so far been found. The 1694 deed had, however, given the proprietor of the water company the right to build such cisterns as he thought fit.

Virtually all buildings would have used waterbutts or cisterns to collect rain water for non-drinking use and for fire precautions. A fine ornamented lead cistern was once to be seen at St Mary's Church. This was made in 1668 and had the monogram letters WSF cast on its surface. This suggests this came from the private house of the Sealy family and is to be interpreted as WS and FS. Underground water cisterns for rainwater storage were sometimes constructed in larger house properties, from which the water could be pumped.

Little more information has yet been found about this water service. None of the tourists' guidebooks published at the end of the C18 mentioned the waterworks. Joshua Gilpin, the American paper-maker who toured industrial Britain between 1795 and 1805 recording manufacturing processes, noted in his diary on May 12 1796 that the town obtained its water from the cistern under the High Cross, which was supplied from a nearby stream, so it is clear that the plant was still operational then. The High Cross and the cistern were demolished around 1800, and for the next eighty years, during which the population grew three-fold, and there were frequent severe epidemics, the town depended entirely on rainwater butts and cisterns, wells and what water was drawn from the Durleigh Brook and hawked around the houses.

Steam

By the time the first Bridgwater waterworks closed, steam was being introduced generally for pumping in water supply. The Newcomen atmospheric engine had been first used in 1725 at the York Buildings water works in London. Two Bridgwater inhabitants at the beginning of the C18 had very close connections with the introduction into Britain of the Newcomen engine. Edward Elliott, d 1716, who had been Baptist pastor at Bridgwater between 1696 and 1704 was one of the original members and treasurer of the 'Committee of Proprietors of the Invention for Raising Water by Fire'. This was a London-based group of mostly Baptists, centred on the Apothecaries Society which purchased the steam engine patent and marketed it. Elliott is otherwise a very shadowy figure. The second Bridgwater resident was Dr John Allen, FRS (c 1670-1741). He is known now as the author of a well-respected medical textbook, *Synopsis Universae Medicinae Practicae***,** published in 1719, but he had a far wider activity. He took out only the third patent issued in Britain for steam engines. (no 513 of 1729*).* This in fact involved the design of steam engine boilers. Allen wrote a book titled *Specimina Ichnographica***,** published in 1730, in which he described his inventions

and included a fascinating account of some tests he conducted on the Parrett to gauge the flow of the river. It is clear from this book that he had detailed knowledge of the York Buildings engine, and he commented that he had been a friend of Thomas Newcomen. He was also a friend and perhaps a relative of John Oldmixon, the Whig writer. In 1718 the pair were up before the Bridgwater magistrates accused of public order offences. Allen was later involved in building part of Castle Street and lived in one of the houses there.

By 1765 John Smeaton had improved the efficiency of the atmospheric engine and he designed one in 1767 at New River Head, for the New River Company, London. He was a partner in the Ravensbourne water company at Deptford, and also in the water company which supplied York. One of his surviving letter books for 1778 contains a valuable series of letters from his partner about the installation and operation of the wheel-driven pumps at Ravensbourne, which seem to have been on much the same scale at the Bridgwater scheme.

By the 1770s James Watt had perfected his separate condenser, and the firm of Boulton & Watt were installing steam engines in various water works. They supplied engines to the Shadwell and the Chelsea Companies in London in 1778, and a further one to Shadwell in 1784. Between then and the expiry of Watt's patent in 1800, the firm supplied ten more engines to London water companies and in the 1790's were receiving inquiries to supply them overseas as well.

By 1819 London had 16 engines on the banks of the Thames employed by the various water companies which had sprung up, and steam engines were in use by water companies in some of the major provincial cities such as Newcastle.

The Bridgwater Scheme of 1824

In 1824 a new steam-powered waterworks scheme was proposed for Bridgwater. This involved cutting an adit from the Durleigh Brook northwards under St Matthew's Field, where it was pumped by a steam engine into a reservoir built on St Matthew's Field near the present Westfield United Reform Church. From here the water would have been piped by gravity to both sides of the river.

The only record of this scheme so far discovered is a fine large-scale coloured plan which also indicates clearly how far the built-up area of the town extended then. Who the proposers were is not known, but the plan, which was lodged, as the law required, with the Clerk of the Peace, was signed by Mr Anstice, solicitor of Bridgwater. This scheme was not referred to Parliament for approval, so it would seem that it was not proceeded with.

The Anstice family, who were ship-owners and merchants had links with the Quaker Reynolds family, ironmasters of Coalbrookdale. William Reynolds (1758-1803) married in 1789 his cousin Hannah Ball (1768-?) of the Bridgwater Quaker family. The Anstice family were not Quakers. William Reynolds was brother-in law to Robert Anstice (1757-1845), who had eloped with Hannah's sister Susannah Ball (1761-1816) in 1777 or 1778 and married her in Gretna Green. It was this link which explains why one of the earliest of the Coalbrookdale cast iron bridges was erected over the Parrett in Bridgwater in 1789, and why the first book to be published in Bridgwater, Robert Anstice's *Remarks on the comparative advantages of wheel carriages,* (1790), included a discussion of the canal inclined planes which Reynolds was developing in Shropshire. As well as his mercantile interests in Bridgwater, Robert Anstice was three times Mayor of the town and an anti-slavery reformer. He was also an all-round naturalist. At one stage he was resident engineer to the Axe and Brue drainage schemes, and sea wall work at Huntspill and Blue Anchor and it is probable he had a hand in the design of this water supply scheme.

Firefighting

The Great Fire of London resulted in a development of the fire engine, but these machines were quite crude, simply a pair of plunger pumps on wheels with a cistern needing to be filled by a bucket chain. A gooseneck swiveling branch pipe was coupled to the outlet and the water was delivered by a series of pulses as each pump made its delivery. It was usual to place the engine on a cart for transport, and this method continued in some places until early in the C19.

Great impetus for improvements in fire engine design came from Holland; the ship which brought William and Mary to Britain from

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Holland in 1688 carried several fire engines. They did not require to be supplied by buckets of water since they were able to suck water up and deliver it to the fire by means of a leather hose. They were fitted with proper wheels and could be rapidly taken to where they were required.

English makers were quickly producing fire engines, and in 1712 Nicholas Mandell and John Grey obtained a patent for a new machine for fire fighting. Richard Newsham greatly improved fire engine design with his patented design of 1721.

In 1707 Parliament took action about fire precautions in London and passed a law (6 Anne, c.58) entitled "An Act for the better preventing the mischiefs that may happen by fire". The main enactments were that the churchwardens of each parish must fit stopcocks on the street water-pipes and mark the front of the property nearest to the stopcock. The Act imposed penalties on defaulting churchwardens and laid down rewards for the keepers of the fire engines. Further clauses related to party walls and wooden buildings and about the need to instruct the constables and beadles. This act was amended in the following year (7 Anne, c17) to give the parish authorities powers to levy a rate for the maintenance of engines.

These two acts excluded the provinces, and there was no legal obligation placed on town councils, churchwardens or vestries to provide proper fire-fighting equipment. However in many cases corporations did accept the responsibility.

Bubb Doddington (Bridgwater member of parliament) presented Bridgwater with a fire engine – presumably the Newsham type – in 1725 It was housed next to the Poorhouse by the South Gate, where, incidentally it would have been adjacent to the Durleigh Brook and so be able to be kept topped up with water ready for every emergency. This machine was used by a Bridgwater mob, including the then Vicar who used it to break up a prayer meeting addressed by the Methodist George Whitefield.