Public Health and Water Supply in Bridgwater, Somerset

by Tony Woolrich

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Technical Developments in Water Supply

DURING the C19 there were considerable advances in water-supply technology. Pumping engines had undergone various changes of design and from 1825 horizontal engines of various types began to be installed. The engineer mostly responsible was the American, Henry R. Worthington (1817-80). Progress in the use of horizontal engines was slow, however, and it was not until the well-established firm of James Simpson reached an agreement in 1885 to manufacture the Worthington pattern engine that this configuration became a common pattern. At about the same time the vertical inverted pumping engine began to be introduced, following the introduction of this configuration for propelling steam vessels. Later in the century the steam turbine coupled with centrifugal pumps came into operation. Electrical pumps also began to be used. The beam engine continued to be probably the most popular type for waterworks pumping, notwithstanding their relative inefficiency compared with more modern designs.

Cast iron water pipes began to be widely used from early in the C19 due to the extreme fall in the cost of producing cast iron then. The higher pressures possible with cast iron meant that water could be supplied to the upper floors of properties.

Water supply systems were usually designed and built to make water available under continuous pressure 24 hours a day in order to meet demand fully, but in some instances the supply was intermittent, being turned on for only part of the day, which served different users at different times.

In the earliest days water was used raw, as drawn from wells and streams; the only purification was that achieved by settlement in the vessels used to store the water, or by pouring the water through domestic filters containing sand or charcoal immediately prior to use. In the case of pumping from rivers, the only precaution was a screen or perforated pipe at the inlet. If the water was turbid some of the London concerns installed settling ponds where the water remained for about a day before the clean layer was pumped away for use.
The Chelsea company suffered particularly from turbidity and its engineer, James Simpson (1799-1869) carried out some experiments during 1825-26 with a small sand filter. He paid a series of visits to various paper mills and textile print works in the provinces where the processes required clean water, and, as a result of what he discovered, in 1829 he constructed a large filter bed covering about an acre in extent. In this plant the raw water was pumped into one of two settling tanks and then it passed in turn by gravity into the filtering beds. Layers of brickbats, gravel and then fine sand were laid in the bottom of the filter bed to a total thickness of about 2'. The bulk of the sediment lodged in the top three inches of sand, and by scraping off the top half an inch of sand, washing and then replacing it was found to restore the filter to its original efficiency.

Simpson was one of the most important waterworks engineers of the time, though he also undertook work on piers, docks and harbours. In his later years he was President of the Institution of Civil Engineers.

Sand filter beds received little application for about two decades, and then were mainly installed as the result of complaints from customers about the quality of the water they received. In London, the major epidemics of the 1840's resulted in legislation prohibiting the use of river water drawn from below Teddington Lock and insisting that all supplies were properly filtered. The sand filter method continued in use for the rest of the century, when rapid mechanical filtration came into use.

Until the 1870's it was held that the amount of organic matter it contained was a measure of purity of water. Pasteur showed that fermentation and putrefaction were due to living micro-organisms, and that some of these bacteria were the cause of certain diseases. The acceptance of the germ theory of disease led to the development of the science of bacteriology, and was soon applied to water examination. From 1885 when viruses began to be identified it was found that sand filters were not able to remove all sources of disease. Sand treatment, however, did remove 95% or more of all disease organisms, depending on the state of the filter bed. Chemical treatment with chlorine removed

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the last of the organisms, but this was not developed until the early years of the C20.

Water for Bridgwater

During the discussions about the best way of procuring a supply of water for the town which took place in the 1860's, various options were considered:

1) Boring for water
The geological formation underlying the town had not, at that time, been accurately investigated, but it was known that under the various surface strata of both halves of the town and descending to a considerable depth was a layer of New Red Sandstone. Below this was thought to lie either coal measures or the rock which made up the Quantock Hills. If the latter, then soft water might be expected to be found. Should boring only go into the New Red Sandstone then a very hard water would be expected to be found. In either instance the quantities likely to be obtained were quite unknown. This option was rejected because of the uncertainty of the result, and the undoubted heavy costs of the initial boring and the subsequent pumping.

2) Town Brook
a) Town Mill
The Durleigh Brook derived its water from three springs, one at Barford, one at Heathcombe and the other at Bush. It was harder than any of the alternative streams considered but softer than the water obtained from the town's wells. The disused town mill at the end of Blake Street could be made available for baths and wash-houses, and if an engine were constructed there, water could be supplied to all parts of the town. However, it was found that the flow fell away considerably during the summer and unless a reservoir was constructed the stream could not be relied on for a source of supply. In addition, analysis showed that the water when it reached the town was unfit for human consumption.

b) St. Matthew's Field
This was essentially the same as the 1824 scheme, and was rejected because of the need to construct a storage reservoir on the level of the Durleigh Brook at Friarn Mead, or near the pumping engine.

3)North Petherton Stream
Lack of flow again acted against this idea, since a storage reservoir would be needed above North Petherton village, which was felt to be potentially dangerous in the event of a leakage.

4) Spaxton Stream
The Spaxton stream was the most copious, and being nearer to Bridgwater would be cheaper to utilise. The water was softer than the Durleigh Brook but harder than that of the Petherton stream, and the Seven Wells and Cockercombe streams, which was the softest of all.

5) Seven Wells and Cockercombe Streams
The source favoured by Hawksley, the Seven Wells and Cockercombe streams united above Radlett Common and then was renamed the Curry Pool stream before being joined by the Spaxton stream. The combined flow of these streams was known as the Cannington Brook and entered the Parrett opposite Pawlett Hams. The Seven Wells and Cockercombe streams drained 2500 acres almost all of which was unimproved rock, the amount of arable land being small. The watershed was almost entirely free from peat. Hawksley estimated that in the dry period of the year the stream would supply 600,000 gallons.

Whichever stream was utilised there would be a problem from mill-owners who would claim that their water-rights were affected and so require compensation.

None of the discussions touched on the need for filtering and pumping plant, but in his estimate for the favoured scheme, that of utilising the Seven Wells and Cockercombe streams, Hawksley included the following items:

1)Pipes etc	£12,500
2)Filter beds	£800
3)Service Reservoir	£1,500
	£14800
Land, mill compensation and contingencies	£5200
[Total]	£20,000

The Construction of the Waterworks

Once the decision was made in 1876 to proceed with the scheme, Hawksley returned to Bridgwater, and it is clear that changes were

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made to his original concept, for it was decided to abstract the water at the junction of the Spaxton stream with the Curry Pool stream at Ashford Mill, downstream from Radlett Common. The Curry Pool stream water was to pass through the filtering plant, while the Spaxton stream water fed the waterwheel of the old Ashford Mill, for it is clear that there was some thought at this stage to use the power from this stream to work waterpumps in the old Ashford Mill to supply the town, and use the steam plant as an auxiliary. The total cost had risen by £12,000 to reach £32,000, probably reflecting the decision to use steam power for pumping.

Early in 1877, whilst the Corporation and its advisers were working on the details of the Bill, there were letters from the agents of the Earl of Cavan about compensation for the loss of the Earl's water rights on his land, and a few months later a similar demand for compensation from the agent of Lord De Mauley for loss of water rights at the Pawlett Hams irrigation water supply, which took its water from the outfall of the Cannington Brook.

The Royal Assent to the Bill was given in early August and in October 1877 the Town Council advertised tenders for the supply of the cast iron pipes, and the work of laying them had begun by February 1878. In April the newspapers reported that sections of the wooden pipes of the first Bridgwater water supply had been dug up in Eastover, and by the end of the month work had begun building the Wembdon Road reservoir.

During the autumn of 1877 there were further claims for compensation, this time from Lady Oglander and Lady Cooper. In November, Hawksley recommended to the committee the appointment of a clerk of works for the project at a suggested salary of 3 or 4 guineas a week and suggested a Mr Bishop from Malvern. In the event Mr F.J.Jones was appointed with the committee's recommendation that he later be appointed waterworks manager.

At a meeting held on 11 June 1878 the water committee agreed they did not intend to limit the amount of water they wished to take and they planned to supply 20,000 people in Bridgwater and Wembdon, and 5,000 people in Cannington and neighbourhood. Provision should be made for two 10 HP engines. The present residence at Ashford Mill should be reserved for the engine-man and a second house should be built there; plans of the Ashford Mill were produced at the meeting. Tenders for the supply of the engines and machinery were to be issued.

In August the contracts were let for the manufacture of the steam engines and for the building work at Ashford. In September pipes were laid under the Parrett connecting the two halves of the town. On 27 August the committee appointed, at Hawksley's suggestion, Mr G.L.Lambert of Birmingham to act as inspector to oversee on the Corporation's behalf the erection of the engine and plant at Ashford.

In January 1879 Cochrane and Grove contracted to supply for £150 a standpipe at Wembdon reservoir and for £58 a mechanical sand washer for use at the Ashford Mill filter beds. By May 1879 £23,000 had already been spent on the project, and in August a proposal by Hawksley to prevent contamination of supply by culverting the water leat to the Ashford Mill from the Currypool weir, a distance of 250 yards, was rejected by the water committee as too expensive and unlikely to succeed.

A sub-committee sat for much of the summer drawing up the water regulations and charges for the supply. Water could be supplied either by meter or by a rate based on property value. Extra charges were made for the use of a fixed bath and additional water closets, for watering horses and cattle, for watering gardens and greenhouses by hose, and for supplying water to shipping in the docks. Water was also supplied at special charges for various kinds of trades such as innkeepers and photographers who used copious amounts for processing. The plumbing of properties could only be done by plumbers authorised by the water committee.

In early October water was for the first time allowed to pass from the impounding reservoir to the filters at Ashford. At the end of October the Archdeacon of Taunton, the Venerable George Denison, (1805-1896), fired for the first time the boilers at Ashford. On the face of it Denison seems to have been an odd choice for the honour of firing the boilers, for today he is is only known as a clerical controvertialist, being involved in disputes about ritualism and education in the Church of England. In fact he was well known locally for the elaborate private waterworks he constructed at East Brent to supply the vicarage and village. In 1877 he had written a lecture about it for a Sanitary Congress.

Early in November the pipes between Ashford and Wembdon reservoir were charged up with water. Some burst and had to be replaced. At the end of November the pipes as far as Wembdon Road Cemetery were filled.

A curious feature of the Bridgwater waterworks is that water for fire prevention was not mentioned in the discussions reported in the press during the period of agitation. It does not figure in Hawksley's report of 1866, nor in the Act of Parliament of 1877 authorising the construction. However Hawksley's plan for the layout of the mains in the town clearly indicates the places where fire hydrants were fitted in the streets. Hawksley was in fact an influential proponent of the idea that a town's piped water service should also serve for fire-fighting, and recommended that fire-hydrants should always be incorporated in the mains as they were constructed. This, of course, could only deal with fires in the built-up areas where properties were within reach of the mains. In the country districts residents had to rely on horse-drawn steam fire engines if they were lucky, and on the descendants of the old manual fire engines of C18 design if they were not.

Before 1879 the West of England Fire and Life Assurance Company maintained a brigade with a fire station in George Street, and there was a rival brigade maintained by the town with a station in what is now Clare Street.

Evidently fires were few in Bridgwater, a tribute to the brick and tiled construction of the properties. In 1868 Wembdon church was badly damaged, and in 1870 shops were destroyed on the South side of Clare Street. In 1875 the Globe Hotel on the junction of Eastover and Salmon Lane was burned to the ground. In May 1879 a fire escape was presented to the Corporation by the Royal Society for the Prevention of Death by Fire, and the town acquired a wheeled hose cart to accompany it.

The Opening of the Waterworks

The opening ceremony occurred on December 2 1879 with great high jinks. In the centre of Cornhill a fountain with five jets had been erected by Messrs Thompson Bros, the local ironmongers, and this was profusely decorated with evergreens as were the railings surrounding the Market House. The tradesmen were invited to close their premises early and in Cornhill and Fore Street flags were put up. A dais for the dignitaries was also erected.

At 3.00 p.m. a civic procession left the Town Hall, headed by the town crier and the mace-bearers. The mayor was accompanied by four ex-mayors all in their robes of office and a large number of the leading inhabitants, followed by some members of the Yeovil fire brigade and the newly-formed Bridgwater fire-escape team. The band of the 26th Somerset Rifle Corps was drawn up on Cornhill. The ceremony attracted a vast crowd of inhabitants, thought to be larger than the turn-out for elections.

After a succession of speeches from the dignitaries, the mayor turned on the fountain to the accompaniment of the crowd cheering, the band playing and ladies waving their handkerchiefs from the upper windows of the surrounding buildings. The mayor returned to the dais and called for 'Three cheers for the waterworks to which the crowd responded with enthusiasm. The ceremony was completed by the band playing the National Anthem.

Some members of the Yeovil fire brigade, assisted by some members of the Bridgwater fire brigade, took charge of the fire hose recently bought by the Council and ascended by the fire escape to the top of the Market House, where they sprayed water in all directions, including onto the roof of the Royal Clarence Hotel on the opposite side of the road. The firemen then slid down the inside of the fire escape, much to the amusement of the crowd, many of whom had received a soaking.

When darkness set in, gas stars were ignited on the front of the Royal Clarence Hotel, and on the shop premises of Messrs Thompson Bros. on Cornhill. The fountain was illuminated by coloured flares. A well-patronised public dance later took place in the Market House.

A public dinner was held that evening in the Royal Clarence Hotel, under the presidency of the mayor. The company was far larger than had been anticipated, numbering in all about 170, but enough food and drink was found and several of the guests acted as stewards, so everyone was eventually accommodated happily. During the meal an amateur orchestral band, under the direction of Mr Harry Lovibond, which had recently made its debut at a church bazaar, played a selection of pieces, to the frequent applause of the guests. The mayor at the top table was supported by the ex-mayor of Taunton, Mr Hawksley jr. in the unvoidable absence of his father, and various other dignitaries. Then followed a stream of toasts and speeches. After the ladies withdrew the dinner became more convivial.

Description of the Waterworks - 1879

At the Ashford plant the civil engineering works were quite modest, compared with many others being constructed at the time. Water from the Currypool stream was first led into a depositing or subsiding tank, where it remained for several hours, when any suspended matter in the shape of mud brought down from the hills in times of flood was deposited on the bottom. The surface layer of water was then led off and conducted into three filtering-beds having a surface area of nearly 14,000 square feet. These beds were composed of a stratum of sand about 2 feet thick, through which the water passed. These were rapid and not the slower bacteriological filters. Special means were taken to prevent the sand from washing into the pipes. After passing the filtering beds the water flowed into a pure-water tank, where it was raised by two steam engines, each of ten horse-power, to the covered service reservoir on Wembdon Hill. This contained 350,000 gallons when full and was 12 feet deep. The reservoir was at an elevation of 90 feet higher than the road level on Cornhill, but as that elevation did not give enough pressure to supply some of the properties on the higher ground in the area, a 40 ft high standpipe was erected at the reservoir over which the water was pumped. If the demand was heavy the water was pumped straight over the standpipe into the mains and did not run into the reservoir first.

The water was conducted to the reservoir by 12" cast iron pipes. A branch was laid into Cannington village from the stretch of pipes between the pumping station and the reservoir. The water was conducted from the reservoir into the town by 15" pipes, as far as the town bridge, under the Parrett by 12" pipes and from there they were reduced to 9" or smaller to the extremities of the service.

The reason why 15" pipes were used from the reservoir was that whilst 12" pipes were adequate for the constantly-pumping engines, the larger ones were required to cater for the widely fluctuating demands on the service.

The costs of the project were listed in the newspaper:

Cost of obtaining the Act and law costs	£1500
Land costs for the Ashford site	£3200
Building costs at Ashford to Mr Chamberlain of Anstey, Leicestershire	£9425
Cost of steam engines & boilers to James Watt & Co	£1580
Wembdon Reservoir to Mr Kreuse of Bristol	£4990
Turncock's lodge at Wembdon reservoir to Mr Escott,of North Petherton	£732
13 miles of cast iron water pipe to Messrs Cochrane,Gould & Co of Middlesbrough	£8000
Cost of laying the pipes to Mr Walker of Crewe	£3449
Total	£32,876

The Act only sanctioned a maximum outlay of £33,000, and the newspaper reported there were many extra expenses not covered. These included:

Salary of the Clerk of Works, Mr J.T.Jones of Wembdon.
Fees of Mr Hawksley, the consulting engineer.
Interest on various private loans.
Balance of Mr Chamberlain's costs.
Cost of linking the customers to the service.

In all this extra outlay would come to around £7000, making a total bill of £40,000, double Hawksley's original estimate of 1867. The newspaper commented that for this further sum to be borrowed under the Act, application would need to be made to the Local Government Board, and this would require a local inquiry by one of the Board's inspectors. A leader in a later edition of the newspaper commented about the secrecy of the Council on this deficiency, and the fact that nothing was said about it in the speeches at the opening ceremony.

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Description of the Ashford Pumping Plant

Ashford Mill, the site of the pumping station is about seven miles from Bridgwater, beyond Cannington on the Minehead road. It is just in Spaxton parish, and a mill has stood on the site since the thirteenth century. When it was purchased for the Bridgwater waterworks in 1877 it had been used for a number of years as a flour mill. It was the intention initially to link the waterwheel to a pump in the old mill building for use in regular pumping to the Wembdon Reservoir, and to keep the steam engines for times of high demand. Little information has so far been discovered about this equipment, but the practice seems to have continued for several decades, since in the 1890's a more efficient water turbine-driven pump was installed in the old mill building.

The engine house, which survives mostly unaltered, has much the same proportions as the well-known pumping stations designed by Hawksley's firm at Bestwood and Papplewick, Nottingham. It is much smaller, and lacks the ornamentation of these buildings, but nevertheless it is a handsome, brick-built building with a flight of stone steps leading to the ornate double doors of the front entrance.

The beam engines, which were made by James Watt & Co, were of 10hp each, and could deliver 400,000 gallons daily, enough for a population of 20,000 inhabitants. They were house-built, and the beams were supported by an ornate cast-iron entablature which ran from side to side of the engine house. Under each of the beam bearing centres was a plain turned cast iron column, bolted between the floor and the underside of the entablature. The top of each column had a simple stylised acanthus leaf cast into it. As built the underside of the entablature had a series of carved wooden arch-pieces. Each engine could be run independently of the other. In the roof of the engine house over the engines was an elaborate queen-post truss, with a series of substantial eye-bolts by which parts of the engines could be lifted for installation and maintenance. The doors and windows of the engine house were elegantly designed in 'chapel Gothic'. A simple dado ran round the upper part of the walls, following the outline of the door and window openings, and the doors themselves were oiled wood. Bolted to the side walls of the engine house, near the rims of the flywheels, were a pair of iron barring quadrants, containing a series of holes in which the end of a pinch-bar could be placed to act as a fulcrum for turning the flywheels.

The steam cylinders, 15" bore x 36" stroke, were mounted on pedestals bolted to the floor, and the valves were at the back, worked by a rotary camshaft, driven through morticed bevel gears from the crank shaft. The cut-off, which could not be altered when the engines were running, was controlled by sliding the cams on the back of the cylinder along their shaft by a big threaded nut. The Pickering governor was driven by a flat belt from a large-diameter pulley on the rotary valve shaft running the length of the engine from the crank shaft to the rear of the cylinder.

Access between the engine and boiler houses was through a door onto the top of the boiler seating, and then by a wooden stair down to the firing level which was on the main ground line of the site.

Underneath the engine house floor, which was about five feet above the prevailing ground line, were voids containing the condensing gear and allowing access to the underside of the engine for adjustment to the holding-down bolts of the various parts. The beam, which had centres of 12ft had at the end opposite the steam cylinder the centre for the connecting rod to the crankshaft, on which a flyweel of 11' diameter was fixed. The ends of the crank shafts are shown on the drawings as protruding a significant way beyond the outboard bearings, which were lodged in openings in the side walls of the engine house. These openings are now sealed with small wooden doors. Just inside the crankshaft centre of the beam was the centre for the bucket pumps. These were 8½" bore x 30" stroke. Under the floor at the flywheel end of the engines was another void containing the pumping equipment. The engines ran at about 20-30 rpm. Steam pressure for 50ft head of water was 14 lb/sq', and for 90ft, 20 lb/sq'.

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Water was fed from the clean-water tank to either engine from the side of the engine house through a substantial pipe and an air-vessel. After passing the pumps the water pipes joined into a larger single pipe and bigger air-vessel which was situated in a void under the front steps of the engine house. From here the pipe made its way to the Wembdon reservoir, with a branch from the waterwheel-powered pumps in the old Ashford Mill building, which in turn had received their water from the clean-water tank.

Steam was raised by a pair of Cornish boilers, 6' dia x 18' long. These were situated in a boiler house at right angles to the centre line of the beam pumps; beyond this was a covered coal store, behind which was a store containing a cloakroom for the staff. The chimney, approximately 70' high x 6' square was in the angle of the rear wall of the boiler house and the side wall of the back store.

Coal was purchased by the shipload from South Wales and transported by horse and cart from Combwich wharf, where it had been unloaded.