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Hampshire Industrial Archaeology Society

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Cover photo:
Knowle Hospital Waterworks; the Ruston diesel engine being removed in 2003

Hampshire Industrial Archaeology Society

(formerly Southampton University Industrial Archaeology Group)

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The Contributors

Deane Clark

Deane Clark is Architectural advisor to Hampshire Buildings Preservation Trust Ltd. He was Head of the Historic Buildings Bureau, Hampshire County Council from 1988 -1996.

Martin Gregory

Martin Gregory's interest in the history of technology goes back over 40 years. He has researched and built model steam and Stirling engines for many years and also works on the history of the sewing machine. He has been a member of HIAS and its predecessor for over 30 years and is the present editor of the Journal.

John Horne

John Horne is an engineer, now retired, who has lived near Southampton since 1969, though originally from Liverpool. He served several terms as Secretary and then Chairman of the former SUIAG. Interested in most aspects of industrial and business history, he concentrates on transport and Public Utility matters. Current projects include a 'Virtual Archive' for the Gas Industry and the listing of material donated by Vosper-Thornycroft when they left their Woolston shipyard.

Ray Riley

Ray Riley's interest in industrial archaeology derived from his doctorate on Belgian coalmining. He has taught the subject for over 30 years at Portsmouth University and has published articles on topics including Portsmouth dockyard, Portsmouth corn milling, Lódz (Poland) textile mills and upper Silesian coal mines. He is currently Associate Director of the Institute of Maritime and Heritage Studies, Portsmouth University.

Jon Sims
Jon Sims moved to Southampton in 1972, as a mere slip of a lad, to work for the Ordnance Survey. Since then, he has pined for the canal system of the Midlands while seeking out the rare scraps of inland waterways in the South. He has written numerous articles for various canal magazines, especially Waterways World, and published his findings on the Southampton to Salisbury Canal in previous editions of this journal. He enjoyed three years as chairman of SUIAG and has always had a bee in his bonnet about encouraging young people to take an interest in IA or, indeed, anything else.

Ross Turle
Ross Turle is from Bournemouth. He studied History and Archaeology at King Alfred's College, Winchester (1993-6) and Historic Conservation at Oxford Brookes University, Oxford (1996-7). He has worked both as a field archaeologist and a standing buildings archaeologist and is now Curator of Recent History at Winchester Museums Service.

Editorial and Acknowledgements

Welcome to Issue 12 of our *Journal*. Once again the *Journal* has a wide variety of articles, all but one of which are contributed by members of the Society.
The article on Abbey Mill, Winchester recalls the silk industry in Hampshire, an industry of which Whitchurch Silk Mill is the sole survivor. The Knowle Hospital site and many of its buildings have been regenerated as housing in Knowle village. The rescue of some of the machinery from the hospital waterworks was carried out by volunteers from the Twyford Waterworks Trust. Jon Sims writes about abortive canal schemes in Hampshire. It is hardly surprising that they were never built as none of those constructed made much money for their shareholders. John Horne contributes an article on Hythe pier and its ferry. The pier made the news at the end of 2003 when it was severed when a ship collided with it. Ray Riley writes about the products of Portsmouth dockyard in the period 1800-1914. Deane Clark contributes a review of a book on Twyford parish church.

My thanks are due to all who have contributed to this edition of the *Journal*. Acknowledgements and thanks for the provision of illustrations are made as follows:
Deane Clark (Fig. 28); Martin Gregory (Front cover and Figs. 8-14,25,27); Hampshire Record Office (Fig. 5); Ordnance Survey (Fig. 6); Ray Riley (Figs. 20,21,23,24); Angela Smith (Fig. 16,17); Nigel Smith (Figs. 18,19); Ian Sturton (Figs. 22,26); Southampton City Archives (Fig. 15); Ross Turle (Figs. 2,4,7); Winchester Museums Service (Figs. 1,3).

Martin Gregory
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Abbey Mill and Abbey Mill House, Winchester

The 1816 drawing of 'Winchester Silk and Corn Mills' (Fig. 1) shows a building that is considerably different to the arrangement of structures that survives today. The most notable difference is a range, running in an east to west direction and connecting the old corn mill and Abbey Mill house. Whilst the picture cannot be accepted as a true photo image of the buildings at that time, there is little doubt that the picture and the later reproduction by Beatrice Olive Corfe in 1900 are of the mill in Colebrook Street. However, evidence confirming construction, destruction and relationship of the silk mill to the corn mill was sought.

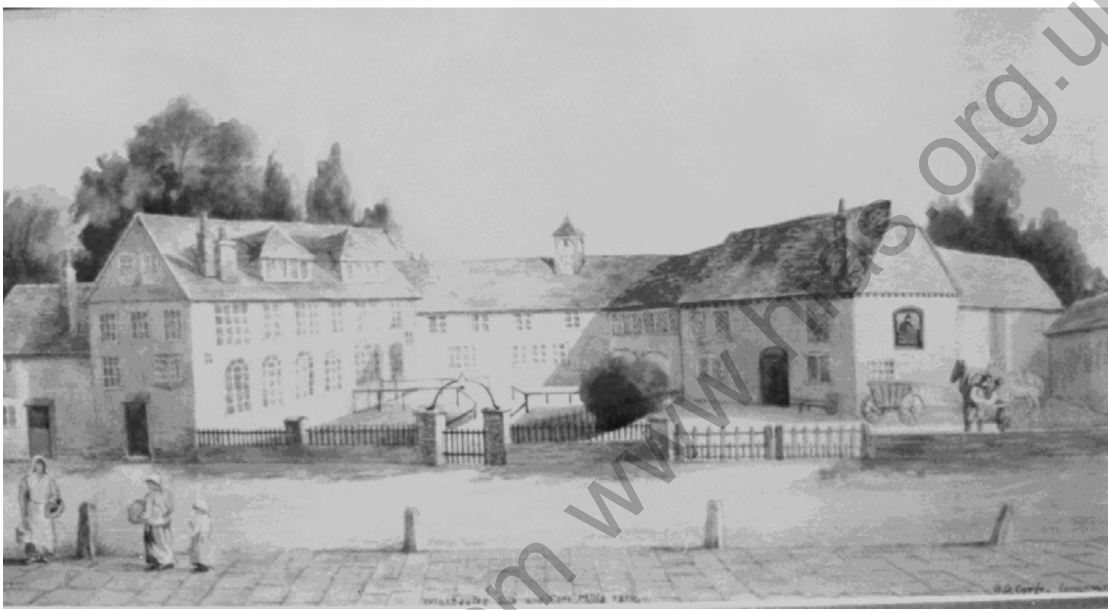

Figure 1 - Watercolour by B.O. Corfe of Winchester Corn and Silk Mill. (painted circa 1900 but based on an 1816 pencil drawing) (WINCM:A.222)

Location

Abbey Mill and Abbey Mill House are located on the north side of Colebrook Street in the City of Winchester (GR SU 48425 29231). Colebrook Street is located in the south-east corner of the old city, south of The Broadway and north of Wolvesey Palace. The mill gets its name from the former Abbey that occupied the site now known as Abbey Gardens and the area where the mill and mill house stand. Although not in this exact position a mill has existed in the vicinity since Saxon times.

Surviving Physical evidence

The house would appear once to have been closer to the road and has probably been truncated by one bay at the south end where it faces Colebrook Street. This would have been carried out early in the life of the building as the first edition Ordnance Survey map shows a house of the same footprint as today. The slate cladding on the south-facing wall also indicates that this end has been altered. The north facing wall is of a rough finish suggesting that this end of the house has also been altered. The north end of the house also shows evidence of the roof level having been raised as an extra brick has extended the top twenty courses of brickwork either side, pushing the cornice further out.

The present owner of Abbey Mill House has observed that there is a large cavity below the floor level of the most northern ground floor room of the house. There is also a very large relieving arch in the west-facing wall of the house, set higher than the other ground floor arches, indicating a former industrial use for this part of the house; although John Keevil (see below) knew this as a bacon curing area.

A relieving arch (Fig. 2) can still be seen in the north-east facing boundary wall near the point where it meets the present mill. This would have been a water race for the silk mill, which is known to have formerly run alongside the corn mill race. John Keevil and his father discovered a brick lined water wheel pit adjacent to this north-west corner of the mill when Mr. Keevil senior was the miller from 1928 to 1932.

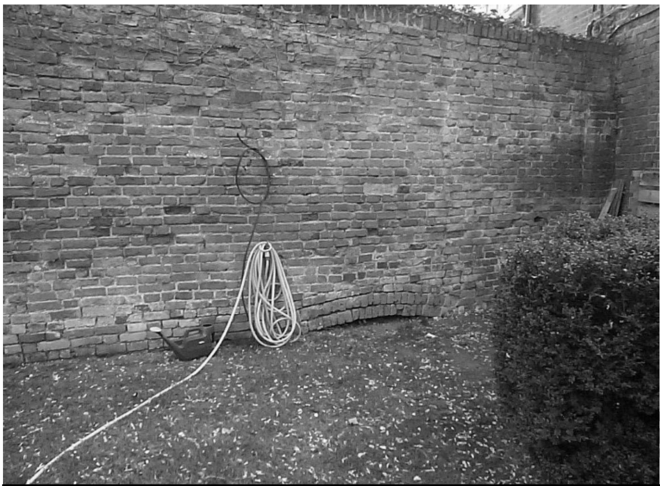

Figure 2 - Relieving arch in base of garden wall (east end)

Documentary Evidence

The main documentary evidence for Abbey Mill are Winchester Archives 248M87W and 13M86W (Abbey Mill Deeds) held by Hampshire Record Office.

A contemporary report on a silk mill indicates that one was erected and running by 1792. However this was the first silk mill in St. Peter Street, which now forms the southern part of the Royal Hotel. This mill was turned by a man-wheel. The silk mill had been moved to Colebrook Street by 1797 as the same contemporary publication mentions a procession on the 14th March 1797 from the 'new mill in the Abbey to the old mill in Peter Street'. The publication (dated 1801) also mentions the water wheel at the new mill. Shenton had presumably considered the move to Colebrook Street for some time as a letter held and dated to 1795 by Hampshire Record Office reveals his plans to '…erect a building on the same principle as Overton Silk Mill for spinning and manufacturing silk…' [1]. Despite the silk mill being finished and in operation it would appear the house was not, as in 1802 John Shenton took out insurance 'On his house only situated as aforesaid [parish of St. Peters, Colebrook] unfinished Brick & tiled not exceeding three hundred & fifty pounds…' [2].

Hampshire Record Office holds deeds to Abbey Mill dating to 1818. These refer to the 'abbey mill including a wheel house adjoining the mill with carpenter's shop over it, and court or yard belonging'. The deeds also refer to 'all buildings newly erected on the premises (1804) occupied by John Shenton and his brother William Shenton'. In 1818 Sarah Shenton is mentioned as being the benefactor of a reserve from a lease of 'the water wheel in the wheelhouse which was erected by John Shenton for the silk or throwsting mill contiguous to the water corn mill and the sluices for working the silk mill [3].

Hampshire Record Office 113M86W refers to Sarah Shenton having erected stove and drying rooms on land she owned on the site north of Colebrook Street but south of land owned by Robert Jessett, which is basically Abbey Gardens.

The Hampshire Chronicle holds further details on the history of the mill which throw further light on its productive history. The September 14 edition of 1812 carries an advertisement for the sale of:

> 'A Desirable Freehold Estate situate in Colebrook Street, late in the occupation of Mr. Allsop; consisting of a compact Dwelling-House, with a productive walled garden and spacious Workshops, in which an extensive Silk Manufactory has been carried on. These Premises are well calculated for any trade of manufacture requiring room, or might be, at a small expense, converted into ten or twelve tenements.' [4]

Obviously as early as 1812 the production of silk was not seen as viable and alternative uses for the site were being sought. However, the site did not sell and was again advertised for sale together with the corn mill in August 1817 after the death of Mr. John Shenton [5].

By 1829 the Silk Mill had 'recently' been converted into a dwelling house by William Shenton, the brother of John Shenton the previous owner. However, the silk mill is still described as having 'dams and sluices, watercourse and wheels belonging, one of which lately turned in the wheelhouse adjoining'. The silk mill was again put up for auction by Sarah and William Shenton in 1829 and again did not sell [6]. The property remained in the ownership of the Shenton family until 1879 when it was finally sold to William Frederick Gifford. The transfer of ownership in 1879 refers to:

> '…And also that late throwsting Mill (many years since converted by the said William Shenton deceased into a dwelling house) with the dams and sluices watercourses and wheels thereunto belonging one whereof formerly housed in the said wheel house adjoining the said water corn mill And also the garden or court thereto adjoining which said last mentioned heredaments and premesis (sic) were many years since called by the name of "The Silk Mills…'.[7]

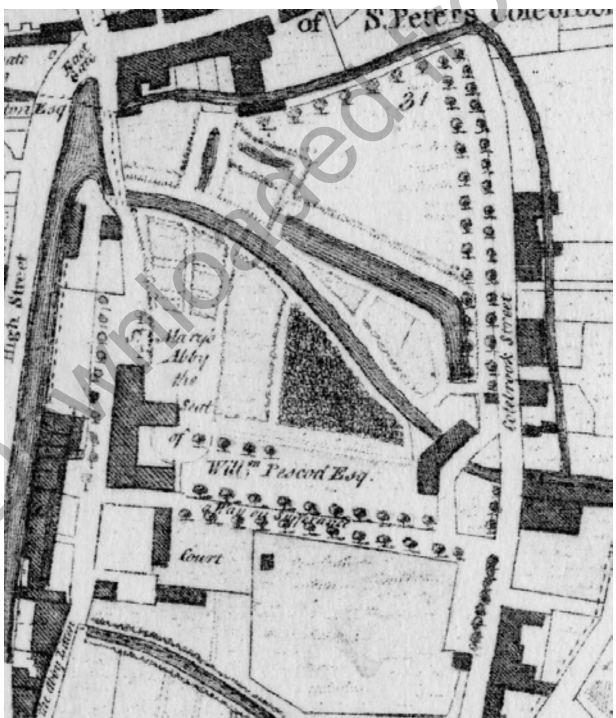

Figure 3 - Godson's 1750 map of Winchester (East at top)

John Keevil believes the silk mill and the south end of the house were demolished circa 1860. This would have been whilst it was still in the ownership of the Shenton family as Gifford did not purchase the mill house until 1879. This does not tie in with the 1879 document of transfer but is supported by the fact that the first edition Ordnance Survey map does not show the Silk Mill. It could be that either the 1879 document is just copying a previous deed or that the buildings it refers to is the present Abbey Mill House, which would have been part of the Silk mill originally.

Maps and Plans

The earliest seen map for the site is the Godson 1750 map of Winchester (Fig. 3). This shows Colebrook Street diverting over the mill race and a range running where the Silk Mill was to be located but no Abbey Mill House. The map seems only to show a single mill building on the site of the present mill and does not appear to show the classical portico either.

The 1818 deed (HRO 248M87W6) includes a drawn plan of the corn mill, which includes part of the silk mill (Fig. 4). This plan shows the wheel house over the race but set back slightly from the rest of the south-west facing wall. The wheelhouse has therefore been re-built post 1818; a straight joint in the south-west facing wall bears this out. It was north of the wheelhouse that the Silk Mill was joined to the corn mill, probably by a timber connecting building. Unfortunately this plan is not to scale but the silk mill is shown to run approximately along the line of a present garden wall (Fig. 5), which retains the slightly higher upper terrace.

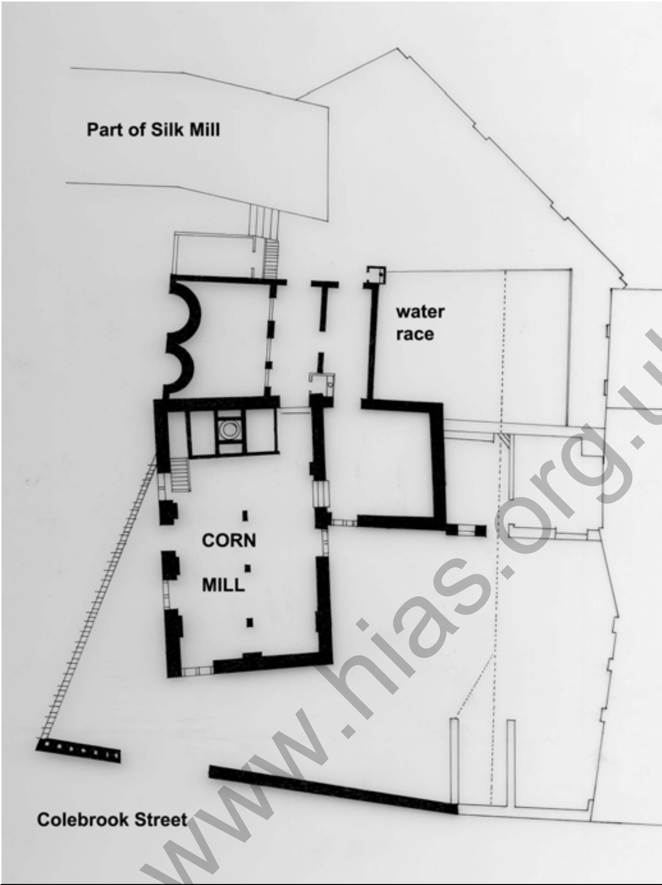

Figure 4 - Plan of Abbey Mill made in 1818, showing part of the Silk Mill (not to scale)

Figure 5 - Garden retaining wall viewed from the south-west

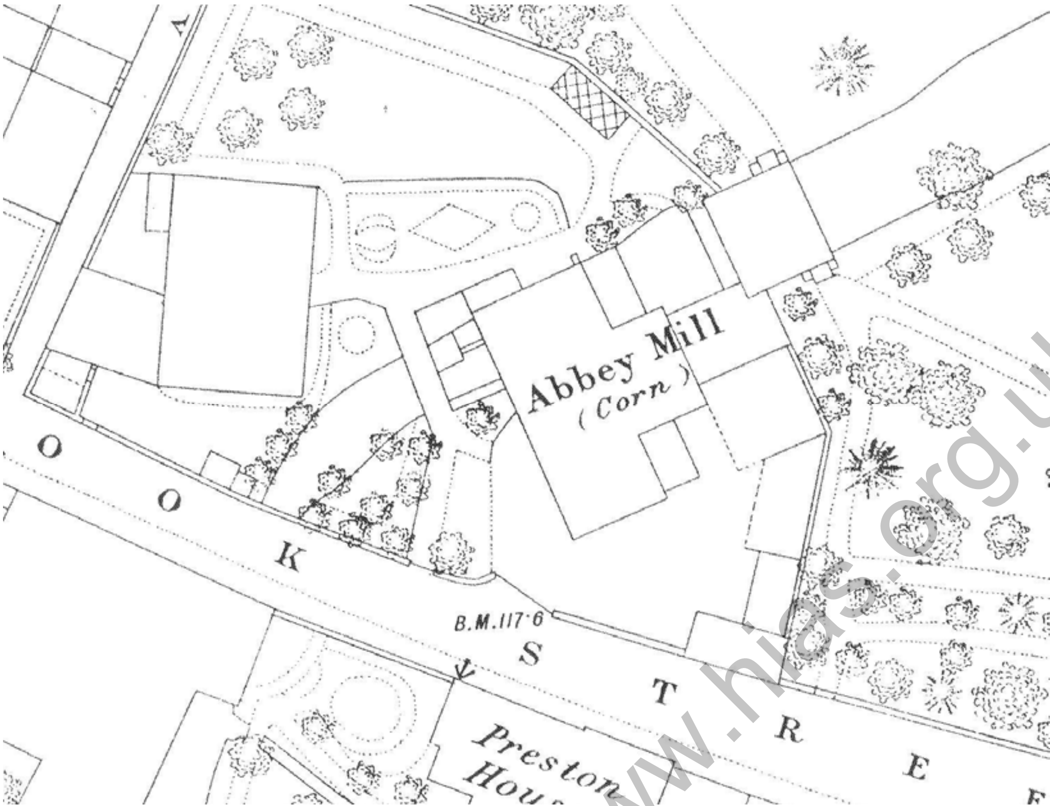

Figure 6 - First edition Ordnance Survey map dated 1873 and showing Abbey Mill (North is up)

The first edition OS map (surveyed in 1870 and published 1873) shows Abbey Mill House occupying the same footprint as it does today (Fig. 6). The part of the silk mill connecting the present Abbey Mill House and Abbey Mill had been demolished and the alterations have been made to the structure of the corn mill wheelhouse over the race. The garden to the house had been landscaped and the retaining wall, that is believed to be part of the footprint of the connecting range, is shown on the map.

The Roman Doric Portico

The Department of the Environment listings date the portico (Fig. 7) to circa 1750, possibly attributed to William Pescod in 1751. Pevsner mentions that it may well be the survivor of three former porticos, an idea based on research by Messrs. Farmer and Dark (not seen). Farmer and Dark were an architects' practice that was based in Abbey Mill in the late 1960s and early 1970s [8].

Figure 7 - The Roman Doric Portico, viewed from Abbey Gardens

Summary

Whilst not being absolutely conclusive the evidence for the construction, life and partial demolition of the silk mill is sufficient for a time line to be established. An initial proposal was made to erect the mill in 1795 and by 1797 the mill was up and running with its own water wheel congruent to one of the corn mill wheels. The building was built to the width of the site and included the building that is now known as Abbey Mill House, although the house was not quite finished in 1802. The life span of the silk mill was short and by 1812 the silk mill was seemingly unproductive and the site was advertised for sale. The site presumably did not sell as it was advertised again after the death of John Shenton in 1817 and again in 1829, by which time it had been converted into a dwelling house. It is at this point that the evidence is less precise: the 1879 deed transfer suggests that the silk mill is still standing but the first edition OS shows that the connecting range had been demolished. It is possible that when the conversion to a dwelling house took place the connecting range was demolished and only that part of the mill that is now Abbey Mill House was left standing. Certain other paraphernalia from the mill, such as sluices, seemingly still existed in 1879, but Gifford tidied the site up leaving the entirely domestic site seen today.

Ross Turle

Acknowledgements:

I would like to thank Mr. Harvey Jones, Mr. John Keevil and Mr. John Reynolds.

References:

[1] HRO *15M50/1172*
[2] Guildhall Library Sun Fire Insurance Records, *11937 Volume **50**, No. 739474*
[3] HRO *248M87W*
[4] *Hampshire Chronicle*, 14 December 1812
[5] *Hampshire Chronicle*, 11 August 1817
[6] *Hampshire Chronicle*, 8 June 1829
[7] HRO *113M86W/26*
[8] Pevsner, N., *Buildings of England: Hampshire and the Isle of Wight*, 1967, pp.714

Primary sources:

Guildhall Library, Sun Alliance Insurance records, *11937 Volume 50, No.739474*
Hampshire Chronicle, 14 December 1812
Hampshire Chronicle, 11 August 1817
Hampshire Chronicle, 8 June 1829
Hampshire Record Office, *15/M50/1172*
Hampshire Record Office, *248M87W*
Hampshire Record Office, *113M86W/26*
Ordnance Survey, First Edition, 1873, *Hampshire Winchester Sheet XLI.13.19*
Winchester Museums Service, Topographical Art Collection, *WINCM:A.* 222
Winchester Museums Service, Topographical Art Collection, *WINCM:A. 720*

Secondary sources:

Pevsner, N., *Buildings of England: Hampshire and the Isle of Wight*, 1967, Penguin

Knowle Hospital Waterworks

Knowle Hospital opened on the 13th December 1852 as the Hampshire County Lunatic Asylum. It closed in 1996. The Asylum was built on a 105 acre (42 ha) site in the Meon valley, three and a half miles (5.6 km) north of Fareham. It was originally designed to hold 400 patients and had expanded to more than 1000 beds by 1883.

Like most such large nineteenth century institutions in a rural setting it became largely self-sufficient. The Asylum had its own farm from the start and other facilities were added over its development period. A flourmill was built in 1867 and in 1881 a gas works was added adjacent to its private railway siding on the railway from Botley to Fareham. The Asylum had its share of problems with typhoid and other diseases and in the second half of the 1880s work was put in hand to improve the lot of patients and staff. The sanitation of the site was improved and a new dairy and meat store was built.

Early in 1889 the management committee visited the ‘field with springs by the river Meon’ and commissioned Mr. Matthews to report on the provision of a pumping station and pipework to the Asylum 1200 yd (1100 m) away. Mr. Matthews’ report and estimates were accepted and, by the end of July 1889, contracts had been awarded to LeGrand and Sutcliff of London for sinking the well (£300), to A. J. Gould of Stoney Stratford for a 6 inch (150 mm) diameter pipe to the Asylum (£440), and to George Waller and Co of London for the steam engines and boilers to raise the water (£1151-10s). To oversee the project, John Lewis was appointed as Clerk of Works at 45/- (£2.25) per week on 28th August. Relations cannot have been good as John Lewis was ‘dismissed forthwith’ on 25th September for ‘want of attention’. However, progress was being made as J. P. Hall’s tender of £1202 for the waterworks buildings (Fig. 8) was accepted and the well was sunk through 35 ft (11 m) of clay into the chalk to a total depth of 60 ft (18.5 m). The section through the clay was lined with brick. Even in these early days it must have been clear that the well on its own was an inadequate supply. Almost as soon as it was

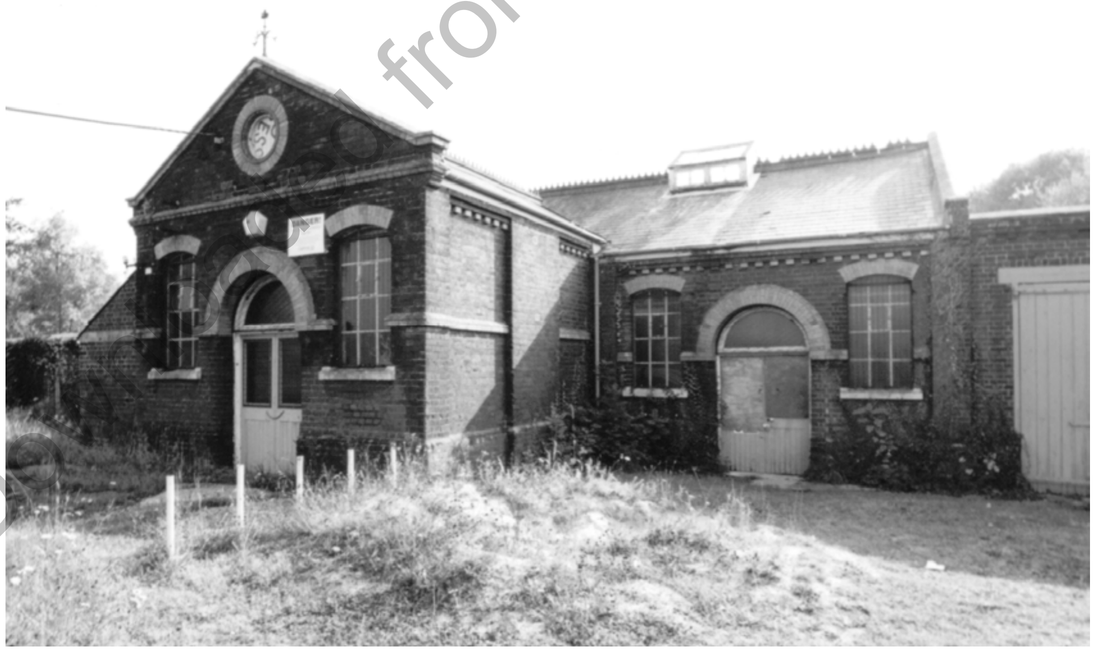

Figure 8 - Knowle Hospital waterworks in Funtley village

finished, a small borehole was drilled in the bottom of the well and two adits 5ft (1.5 m) in diameter were dug for 42 ft (13 m) and 62 ft (19 m) horizontally from the bottom. Mr Hill of Gosport contracted to dig the adits for 35/- (£1.75) per foot run, hard work indeed in wet chalk.

Not only were there problems with the well, there were problems with the steam pumping plant. In June 1890 it was reported that the boiler draught was insufficient to maintain a head of steam. This was blamed on the flue and chimney drying out and on air leaks in the brickwork. Matters got so bad that in October 1890, the Consulting Engineer, Mr Edward Hildred, was instructed to order George Waller and Co to complete the engine installation in seven days. The problems persisted as, in December, the contract with Waller was terminated and Mr. Hildred was asked to consult with Eastons or Simpsons 'to get the pumping plant in order'. The steam engines concerned seem to have been a pair of Easton and Anderson 'Grasshopper' beam steam engines mounted either side of the well. Fig. 9 shows an Easton 'Grasshopper' beam steam engine preserved at Lound Waterworks, Suffolk. Although earlier than Knowle, the Lound engine shows the typical Easton layout. There was also a small Tangye inverted vertical steam engine involved with the later water softening plant.

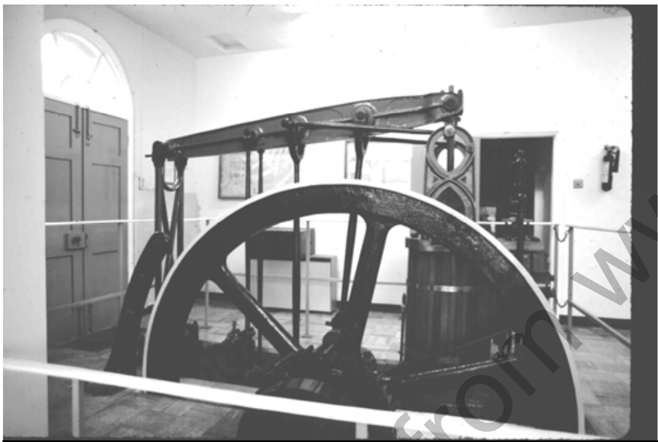

Figure 9 - Easton 'Grasshopper' engine at Lound

Eventually the plant settled down and the waterworks delivered its designed output of 6000 galls per hour ($7.5\ l\ s^{-1}$) to the Asylum water tower which had a capacity of 42 000 galls ($190\ m^3$). At the time it was built this was about one day's supply. Water straight from the chalk is very hard and, in 1895, approval was given to the installation of a water softening plant at the waterworks. Mr. Hildred continued to act as Consulting Engineer and selected equipment made by the Auti-Calcairi Co. This was also rated at 6000 galls per hour and was installed in 1896. Over the next 30 years the waterworks plant gave good service (Fig. 10). It consisted of two sets of pumps in the well to raise water to the surface for the water softening plant and two delivery pumps to pump the softened water through the main to the hospital water tower 160 ft (50 m) above the waterworks. The waterworks had to cope with a doubling of demand by the 1920s following extra increases produced by overcrowding during the 1914-18 war. During that war, Knowle remained a mental hospital and patients from other mental hospitals used as military hospitals, were transferred to Knowle.

In 1901, a power house and a laundry were built at the Asylum. In the power house, steam engines drove electrical generators to supply the newly installed electric lighting. The exhaust steam from the engines supplied the laundry and part of the heating needs of the hospital. On the 1st May 1907 'Knowle Asylum Halt' opened as a station on the Meon valley railway line adjacent to the private coal sidings of the hospital. Many passenger trains only stopped at the station on Thursdays which was visiting day. (The station closed on 6th April 1964.) The completion of a modern sewage works in 1909 completed the infrastructure of self-sufficiency for the Asylum.

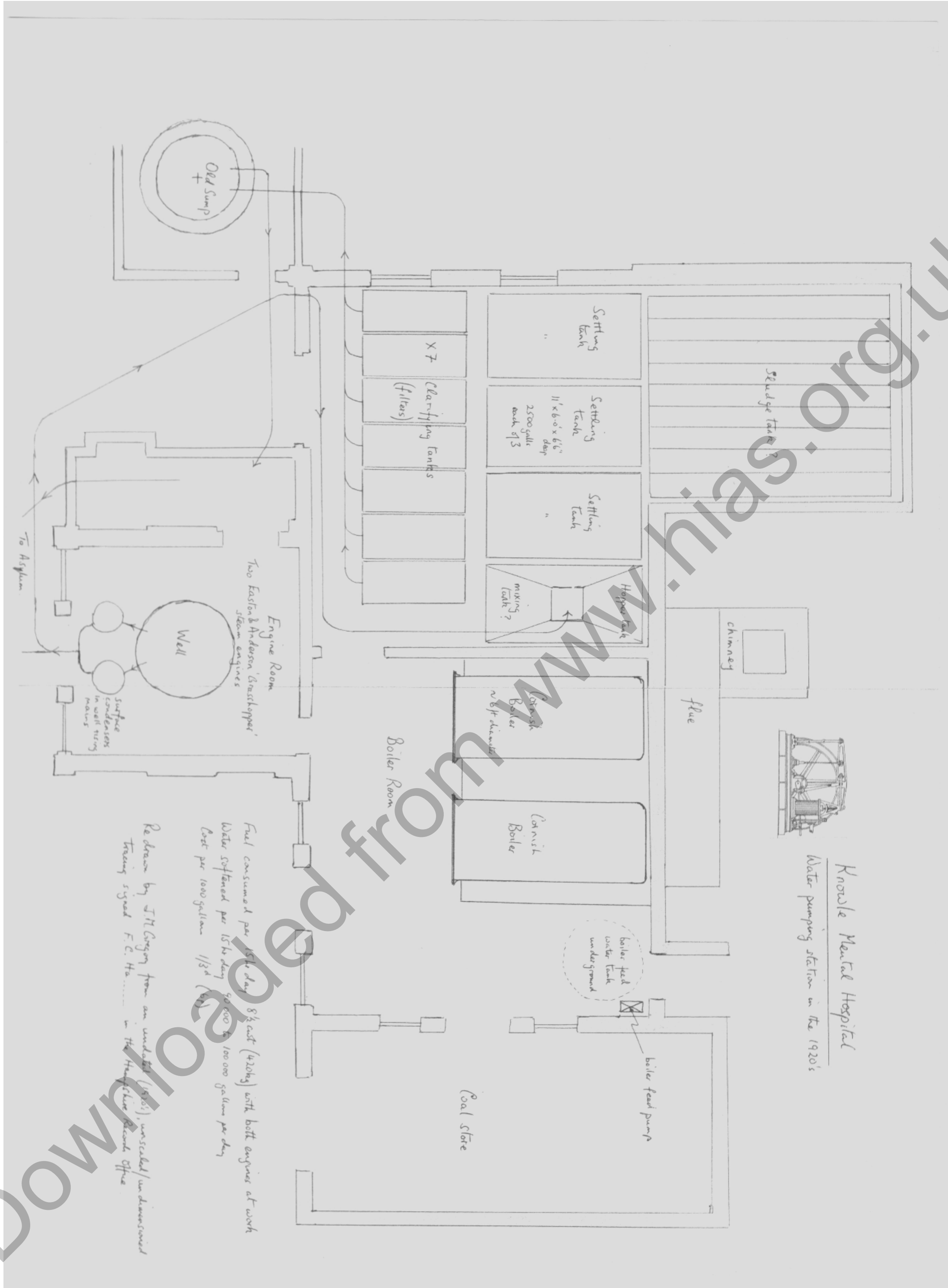

Figure 10 - Plan of waterworks in the 1920s (not to scale)

In 1921 the name was changed to Knowle Mental Hospital. By the late 1920s the waterworks plant was worn out. Increased water consumption at the Hospital had doubled the required daily output from the waterworks and both steam engines had to work over 15 hours per day. A Consulting Engineer, Mr. F. A. Greene was asked to produce a plan for modernising the plant and doubling its output. He pointed out that 'the present (1929) situation, which requires two shifts at the waterworks' makes 'any repair, etc a matter of considerable anxiety owing to the fact that the whole quantity of water stored at the Institution only approximates to half a day's supply.' His report proposed the replacement of the pair of steam engines with two pumping sets, one driven by electric motors and the other by a diesel engine. The electric motors would draw their supply from the existing hospital power house. Each pump set would be capable of delivering 12 500 galls per hour (16 l s^{-1}) to carry the whole load. The water softening plant was also worn out and should be replaced with a new system capable of softening water at twice the rate. A new water tower should be built up at the Hospital to store at least 100 000 galls (450 m^3) of water to give about one day's supply.

Implementation of Mr Greene's proposals was a major undertaking which required comprehensive planning to avoid disruption in the life of the Hospital. The works were carried out in the period 1931-33 and provided Knowle Hospital with the bulk of its water supply until its closure. A total of 35 companies tendered for various parts of the contract in 1931. Major sections of the contract were awarded to Lee Howl and Co. of Tipton (pumps, engine and motors), Bell Bros. and Co. of Manchester (new lime-soda water softening plant) and the Brightside Foundry of Sheffield (new water tower at the hospital). This being the time of the Great Depression, all the companies offered to start work immediately on receipt of contract. It was 1932 before most of the work was started and much was complete by the end of the year.

The electric pump set was installed in the old steam engine room in and alongside the well. It comprised a vertical axis centrifugal pump in the well, driven by a vertical axis motor on top of the well, to raise water from the well to the water softening plant. The softened water was then pumped through the existing pipes to the hospital, by a two-stage horizontal axis centrifugal pump driven by a second electric motor. The motors were d.c. machines operating at 480 V and a special 550 V power line had to be laid from the hospital power house to the waterworks.

The electric power was obtained from the existing steam engines in the power house, the exhaust steam from which was used for heating. As Mr Greene pointed out,- 'If the engines were not run the boilers would still have to be run to raise this steam so that the extra cost involved in power generation could not exceed 0.4 d (0.2 p) per unit. It is understood that further extensions to the Institution are contemplated, which will require an increased supply of low pressure steam, thus allowing more current to be generated…….. advantage might well be taken of it for electrical pumping. There will, however, no doubt be periods when large quantities of exhaust steam will not be required……. At these times it would be an economy to be able to change to oil for running the (diesel) pumps.'

The diesel pump set comprised a single cylinder Ruston and Hornsby diesel engine (Type 6XHR) driving two sets of slow speed three-throw reciprocating pumps. It was erected in the old boiler room. One set of pumps was mounted down the well to raise water from the well to the water softening plant (Fig. 11). These pumps were driven via a belt and pulley on one end of the crankshaft to a floor level lineshaft from the boiler room to the well head. The other set of three-throw pumps was alongside the diesel engine and connected through a clutch to the other end of the crankshaft (Fig. 12). They pumped the softened water to the hospital. The remains of one of the old cornish boilers from steam days had its flue removed and the ends plated up to act as the fuel tank for the diesel engine. This diesel pump set survived unchanged as the standby set up to closure.

Figure 11 - The well head showing the drive to the three-throw pump and, behind, the plinth for the original electric motor

As the modernisation went ahead, worries surfaced about the well. Tests at the end of 1929 reported poor water quality. Investigation suggested that the contamination came from the disused wells and cess pits of some cottages within 50 yds (47 m) of the waterworks. The wells and cess pits were dug out and filled with clay after which, the water quality improved and was judged acceptable. At the end of 1932, as the new equipment was commissioned, the yield from the well was very disappointing. Either set of new pumps could lower the water level in the well to the foot valves in under six hours. In fact the pumping regime was to pump for 3.5 hours at 12 500 galls per hour and then rest for 4 hours for the water level to recover. Then pump for a further 3.5 hours, rest for 4 hours, pump for 1 hour to get to 100 000 gallons for the day. To increase the yield, Mr Greene proposed sinking another access well and extending one of the adits by 100 ft (31 m). At the 30th November meeting the Clerk was instructed to 'obtain the particulars of the fee of a reliable water deviner (sic)' to increase the yield of the well. On 11th January following, Mr Greene wrote back to the Clerk: 'After many enquiries I do not seem able to get on the track of a good Diviner, all the good ones seem dead.'

Figure 12 - The Ruston diesel engine and three-throw delivery pump

With the modernisation complete it was hoped that worries over the water supply were a thing of the past. The only problem in the first few years seems to have been with the crankshaft of the Ruston diesel engine. The engine had twin flywheels with the belt pulley for the well pump overhung beyond one flywheel. This appeared to be the cause of some distortion of the engine crankshaft and, in February 1937, Rustons were asked to supply a replacement crankshaft lengthened to provide an extra bearing in a wall box, beyond the belt pulley. There had been problems with the fit of the flywheels and these were re-bored for the new crankshaft. The letter ordering the new crankshaft stressed the urgency of the problem: 'As this engine is used for driving the Water Pumping plant at this Hospital and we have no other source of supply, you will appreciate the fact that it is very important to us to have the Engine running again as soon as possible.' The tank still only stored one day's supply.

In 1942, the Ministry of Health asked whether the Hospital waterworks could help Fareham U.D.C. in case of emergency during the war. It was recognised that the well could only just cope with the Hospital's demand for water and that the Fareham main near the Hospital was only of 3 inches (75 mm) diameter. Nevertheless, a 2 inch (50 mm) diameter connection was made at the waterworks. The Hospital suggested to Fareham Council that the emergency supply be limited to 84 houses in Funtley village.

After the war the water demand had risen to 118 000 galls per day. At the end of 1954, the Hospital asked whether Fareham Council could supply 50 000 galls (225 m^3) per day to supplement the supply from the well, although they were 'still able to maintain sufficient for our consumption by a weird and quite uneconomical method of so doing.' Fareham offered a continuous supply of 2000 galls per hour (2.5 $l\ s^{-1}$) through the existing (1942) 2 inch pipe connection. This would have given 50 000 galls per day but was unacceptable as it would have required running the waterworks plant 24 hours per day as the pressure in the Fareham supply was inadequate to force water up to the Hospital. To make use of the Fareham supply two electric centrifugal high lift pumps were installed, each capable of delivering 2000 galls per hour from the Fareham main (the second pump was a standby) (Fig. 13). These two pumps were powered from the 415 V 3 phase mains supply passing the waterworks. They came on line in summer 1956 and delivered water into the softening plant when the main pumps were working, and direct to the Hospital when they were not.

Figure 13 - The pipe manifold connecting the filters to the water softening plant. The booster pumps from the Fareham supply are in the foreground.

By 1960 the plant was approaching its 30th birthday. The power station at the Hospital was worn out after nearly 60 years so the decision was taken to replace the d.c. motors with a.c. induction motors connected to the 415 V 3 phase supply brought in for the Fareham supply booster pumps five years earlier. Replacing the motors left the diesel set alone to provide the supply through the second half of 1960 and the start of 1961. The a.c. motors were still not delivering their rated power in the summer of 1961 when failures occurred with the diesel set. The discharge manifold on the triplex delivery pump cracked and there were bearing and gland problems with the well pump. A new manifold was fabricated locally for the delivery pump but it took five months for Lee Howl to supply the replacement parts for the well pump. While this crisis unfolded the Hospital refused to release the electric pump motors for modification until the diesel set was back in service. The correspondence highlights the very real difference in customer service between the 1930s and the 1960s. The motors were finally modified and accepted in January 1962.

In 1971 the well pump required further replacements including new bronze main bearing shells. Lee Howl wrote that the pump was 40 years old and they had neither drawings nor patterns for the pump. A new drawing was made to enable patterns to be made and new castings obtained. The last change came in 1985 when a pair of electric submersible pumps from Pumpserve Ltd. were installed in the well in place of the vertical axis centrifugal pump. These submersible pumps supplied the Hospital directly and the water softening plant was taken out of service. The diesel set remained as a standby but was run very rarely. By this time, numbers at the Hospital had begun to fall. The Hospital finally closed in 1996.

Figure 14 -

The Ruston diesel engine being unloaded at Twyford Waterworks, February 2003

The waterworks stood cold and forlorn, used for storage, until in the autumn of 2002 a group of volunteers from Twyford Waterworks Trust dismantled the Ruston diesel engine and triplex delivery pump for transport to the Twyford Waterworks Museum (Fig. 14). It is hoped to re-erect the engine and pumps in the extension to the filter house at Twyford.

Martin Gregory

Sources:

The Minute Books and other documents for Knowle Hospital are in the Hampshire County Records Office. Copies of the Engineer's report which led to the re-equipment of the waterworks in 1929-33, tenders, correspondence and drawings of the new plant at the water works are in the archives of the Twyford Waterworks Trust.

Hampshire's Canal Rings

Now that even some of the most abandoned of our canals are being revived, and brand new lines are under consideration, it may be worth considering some of the schemes which were proposed in the heyday of the Canal Mania during the 1790s. The recent suggestion for a link between Milton Keynes and Bedford highlights the desire to connect existing waterways and provide new routes. While such suggestions today are aimed at providing new cruising routes, the eighteenth century canal builders were driven by the commercial possibilities of linking markets to ports, factories to customers and coal mines to fire places.

The transport of coal and other heavy bulk items usually led to a clamour from investors enticed by the almost certain prospect of a healthy dividend. More agricultural areas held less certain prospects although that did not deter the more optimistic speculators. Hampshire and Wiltshire, while devoid of mines, were ripe for the import of coal from Somerset and further west, and from coastal colliers. Return loads of agricultural produce were also a temptation to hopeful canal builders and various maps lodged in the Southampton City Archives detail the several schemes put forward.

To the east was proposed an alignment for a ship canal linking the Thames to Portsmouth. Even bearing in mind the more modest size of ships in those days, realism eventually watered down this proposal to the Wey & Arun Canal (happily now under restoration). To the west was proposed the Dorset & Somerset Canal which had the curious distinction of almost completing its branch line to the Somerset Coal Fields without ever building its main line from Trowbridge to Poole.

It is in the south west of Hampshire, however, where the greatest possibilities lay, with the Kennet & Avon Canal and the Basingstoke Canal tantalisingly near to each other and looking towards the South Coast from where the earlier Redbridge & Andover Canal and the ancient Itchen Navigation reached northwards. The most exciting of the items in the Southampton City Archives is a map (Fig. 15) which proposes a whole network of connections between these waterways and comes with the added bonus of a commentary detailing various reports. The first of these, dated 30th December 1793, came from a survey by a Mr John Chamberlaine of Chester and a Mr Thomas Morris of Liverpool. This survey had been ordered by a sub-committee 'appointed by the subscribers to a proposed canal to form a communication between Bristol, Bath, Salisbury, Southampton and London'. As this order was dated 9th December in the same year, the surveyor's levels must have been fairly perfunctory, a supposition borne out later in the document.

The initial survey was for a line connecting the summit of the Kennet & Avon Canal near the village of Burbage to the canal basin in Basingstoke, passing near Ludgershall and around two miles north of Andover and Whitchurch. This line would run south of the Ridgeway, effectively paralleling the Kennet & Avon Canal at a distance of around ten miles (16 km) to the south. The Kennet & Avon Canal summit level would be maintained for the first thirty miles (48 km), falling 190 ft (58 m) with about 32 locks in the last five miles (8 km). The mention of 'fifty ton boats' indicates that these locks would be broad gauge. A tunnel of length about two miles (3.2 km) would also be required between Easton and the Collingbournes. The cost was estimated at £140 000. A connection from this line to the existing canal at Andover could be made by a branch of length 'two or three miles' (further evidence of an approximate survey). With a drop of 220 ft (67 m) through about 35 locks, this branch would cost another £16 000.

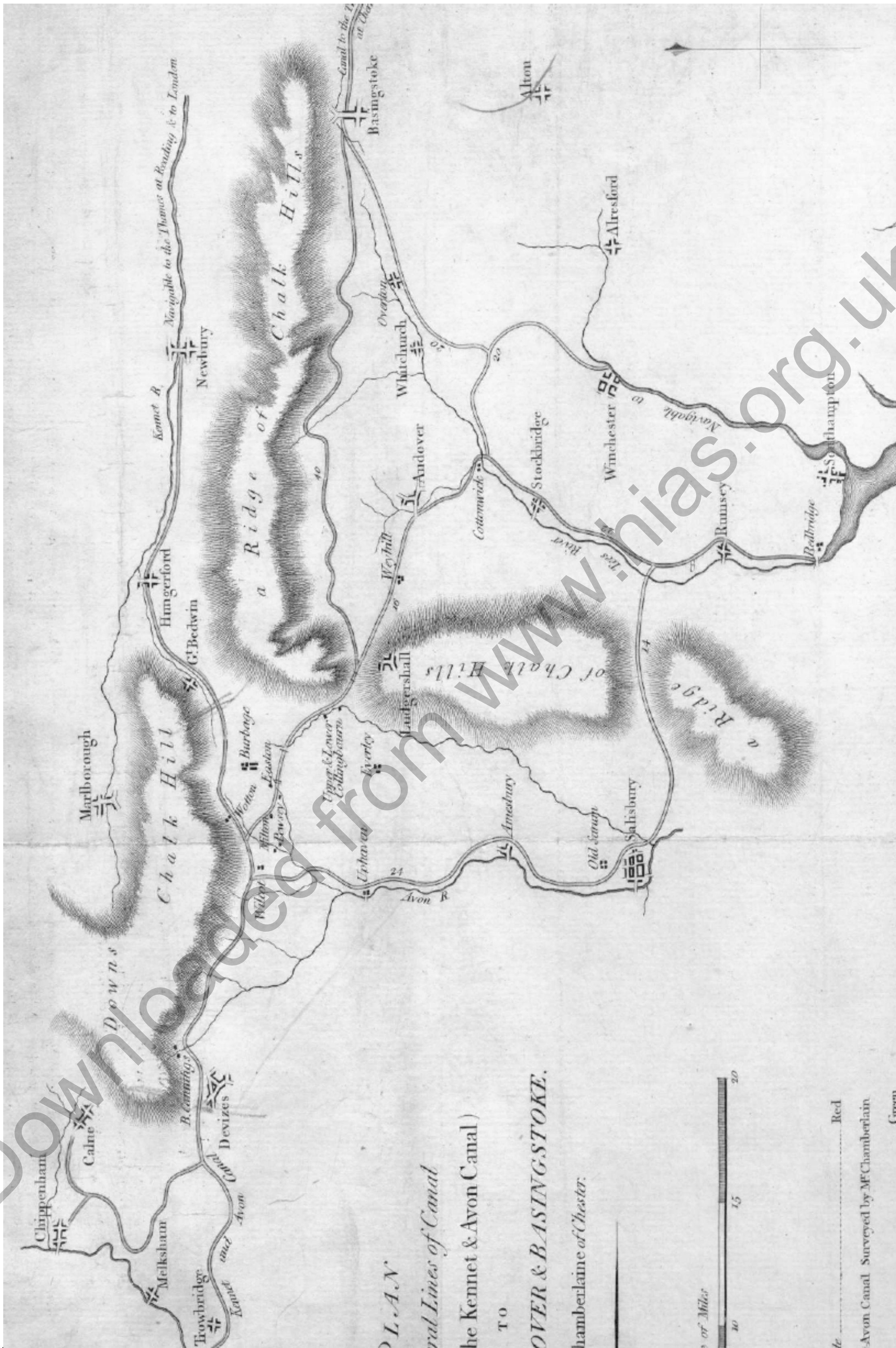

Figure 15 - John Chamberlaine's plan of 'three several Lines of Canal to Salisbury, Andover & Basingstoke'

The sub-committee's immediate response was to ask Chamberlaine, apparently now working without Morris, to investigate connections from 'the most convenient part of the Kennet & Avon Canal to Andover and New Sarum (Salisbury) respectively'. Chamberlaine was obviously not one to hang about. By February 3rd 1794, he reported that a link from the Kennet & Avon Canal near Pewsey could maintain the summit level for nine miles (14.5 km) through the tunnel previously mentioned, and a shorter tunnel of about one third of a mile, before descending 250 ft (76 m) in the last seven miles (11 km) to Andover canal basin. This line to Andover would have economised by being built narrow beam to match the Redbridge & Andover Canal. He states that '…for reasons specified in the report, he is of the opinion, that there is an absolute certainty that the canal in this line would be amply supplied with water.' This smacks of optimism as the River Bourne which gives its name to the local villages is, at best, meagre and, as the descriptive name 'bourne' indicates, decidedly seasonal. It is also hard to see the Kennet & Avon Canal willingly supplying water from their short summit pound, having gone to the expense of pumping it up from Wilton Water with the Crofton beam engines.

A more likely line was that proposed to Salisbury along the valley of the Wiltshire Avon via Amesbury, 'a distance of 24 miles and a quarter (39 km), with a lockage down of 275 ft (84 m)'. Unfortunately, '… in the course of the said line there are many houses, gardens, and other obstructions, the purchasing and removing of which would be attended with a very considerable expense'. For this line, Chamberlaine acknowledges the problem of water supply, stating that there would need to be 'a sufficiency of water at the summit to supply the lockage' as the canal would have to be on a level above the adjacent water meadows so as not to interfere with their supply from the river. Such water would, he says, have to come from the Kennet & Avon Canal unless it could be obtained by pumping, which expense he admits to be incapable of estimating. He puts the cost of this line at £65 300.

By the 14th of June 1794, Mr. Chamberlaine has had time to repent at leisure. He admits in a letter to the sub-committee that at the time of the original survey, he and Morris had not 'clearly understood' the level of the Kennet & Avon Canal, blaming shortage of time and the inclement season. Having now found it to be higher than first thought, he had reviewed the line to Basingstoke and, on account of it now having to cross several deep valleys, the length would have to be increased to 40 miles (65 km) and the cost to £175 000. The alignment would now lie further north of Andover, lengthening the branch to that town to three and a half miles (5.6 km) with a fall of 250 ft (76 m). The cost for this would now be £25 000, an artificial supply of water having been taken into account. To be fair to Chamberlaine, the Kennet & Avon Canal were finding it hard to settle on a final height for their summit level, so planning a link with them cannot have been easy!

Chamberlaine concludes that the link from the Kennet & Avon Canal to Basingstoke, with the branch to Andover, is 'a very desirable one and sees no other objection thereto than the great expense which must necessarily attend its completion'. He particularly recommends the Andover route as 'opening a communication between, Bristol, Southampton and Portsmouth, better than any other line'. Finally, he goes on to recommend a more direct link from the Redbridge to Andover Canal, which would proceed to the head of the River Test (mis-spelt as 'Tees' on the map) before crossing the watershed to Basingstoke. This would, with the benefit of modern contour maps, seem the most practical option. Another link indicated to Winchester and the Itchen Navigation, across the chalk downland, looks decidedly dubious. Yet another map in the archive links the Itchen to the Wey at Godalming with a possible connection to the Basingstoke Canal via Farnham. A highly detailed version of this is on display at the Basingstoke Canal Centre in Mytchett.

Had the ill fated Southampton and Salisbury Canal succeeded in reaching Salisbury, with an extension up the Avon to the Kennet & Avon Canal, this corner of Hampshire could indeed have had its own waterway network. As it is, nervous shareholders defaulted and poor engineering coupled with the lack of funds left a half built shambles of a waterway. The few remaining fragments of the long defunct local canals are of more interest to Industrial Archaeologists than boaters, as are the once hopeful schemes of those who sought to build them. A meeting to consider these reports and decide a plan of action was announced at the White Hart Inn, Bath, for the 12th November 1794 and then postponed to the 6th July in the following year. Did it ever take place? And if it did, oh to have been a fly on the wall!

Jon Sims

The Hythe - Southampton Ferry

The Hythe to Southampton ferry was in the news in 2003 because of the accidental severance of Hythe Pier by a ship (Fig. 16). The owners and operators of the service, White Horse Ferries, were quick to announce that the pier would be repaired. Meanwhile, the pier and its railway were closed and the ferry operated from Hythe Marina. The insurers of the ship at first offered to pay half the cost of repairing the pier but later found a way to reimburse the full cost of damage inflicted by their slightly inebriated client. Meanwhile, the dredger 'Donald Redford' is seldom seen without somebody humming "What shall we do with the drunken sailor?" White Horse Ferries did well to get the pier restored in time to reopen early in January 2004.

Figure 16 - Hythe pier in November 2003

This important transport link has been supported by Hampshire County Council for many years. There is also widespread public affection for the ferry, the pier and the railway. They are part of the overall attraction to visitors of the Waterside and New Forest area. Both the railway and the vessel 'Hotspur IV' are historic in their own right, although the railway continues in daily service and Hotspur IV is standby to the modern catamaran 'Great Expectations'.

Recent events apart, the railway and Hotspur IV are nearing the end of their service lives. Major investment in replacing or upgrading both seems inevitable. There is a need to plan for the 'preservation' aspects of these changes, rather than deal with them as crises.

The pier itself is an historic structure but it is capable of continuous piecemeal repair and replacement, as with the successful re-decking programme. In fact, SUIAG was among the many who have helped by buying an inscribed plank. The plank survived the recent impact (Fig. 17).

Figure 17 - HIAS plank on Hythe pier

The present pier railway replaced an earlier version in 1922, prior to which there was a 'Luggage Tramway' down the centre of the pier deck. Small trolleys were pushed along by sailorly gentlemen in navy-blue jerseys; sometimes passengers were carried as well. The present rolling stock was acquired in 1922 when the line was relocated on the edge of the deck and fenced, because an electrified 'third rail' was added. Little has changed since (Fig. 18).

Figure 18 - Postcard of the Hythe pier and train.

The usual train formation on Hythe pier, with a locomotive pushing (or pulling) from the landward end. The driver controls the locomotive remotely from the leading coach when outward bound. The controllers are marked “To Soton” and “To Hythe”! Note the luggage truck at the “Soton” end.

Three small electric locomotives were acquired from a former Mustard Gas factory at Avonmouth to work the new coaches and two of these locomotives remain in service at Hythe, where they were converted from battery to third-rail operation. The four coach bodies were supplied by a Plymouth firm but their varying profile suggests that not all were new. The chassis came from Baguley of Burton-on-Trent and, while new, resembled War Department designs of 1914-18. There was neither electricity nor gas supply in Hythe, so the Pier Company (General Estates Ltd. in those days) had to install generators to power their railway. A few other customers were also found. The track gauge of 60cm was probably dictated by the locomotives.

Small electric locomotives became common in mines and industry from c.1890 but, in the UK, the few modern examples are now found only in tunnelling work, and in a very different form. Few of the traditional types have been preserved, although one further ex-Avonmouth locomotive (Brush built 12 of them) survived in a derelict condition at Blaenau Ffestiniog. To find two such locomotives in daily service after 86 years is most remarkable and no parallel case comes to mind.

Hotspur IV (Fig. 19) takes her name from the family motto of the Percy family, long-time owners of General Estates Ltd. who used to control the ferry and pier. The vessel was built in 1945-46 specifically for the Hythe-Southampton service and has been in continuous use there for approaching sixty years.

This robust and handy type of passenger ferry/tender was once familiar in UK estuaries. Versions of varying size were used on the Dart, Mersey, Thames, Portsmouth Harbour ferries, but it is unusual to find an example in preservation, let alone in regular use. The vessel is not threatened by current hull or other major problems, so far as is known, but running costs and the level of passenger accommodation are no longer suited to year-round operation.

Figure 19 - 'Hotspur IV' is seen on standby at Hythe pierhead

The County Council is apparently considering a Parry People Mover (ultra-light rail, a kind of mini-tram) as a possible replacement for the present train. New vehicles of this type could be of the same track gauge, which might permit some of the old rolling stock to remain *in situ*, obviously the ideal solution. However, continued operation of the 1922 locomotives, perhaps on special occasions, would be influenced by the method of current collection chosen.

While the survival of the ferry link between Hythe and Southampton is important to those who use it, we need to ensure that the historical value of the present equipment is fully realised. The County Museums Service is certainly aware, and is working with colleagues in other Departments to see what might be done.

When their daily duties are finally done, it should be possible to return one of the locomotives to its original 1914-18 battery-powered condition at reasonable cost. As well as the historical merits of such a project, this would enable continued running either at Hythe without a third rail, or elsewhere. Whether people will approve of the historically correct 'livery' is another matter; not everyone will like khaki with a 'W-D' broad arrow! The locomotives are small enough for transport by road at modest cost. There are a number of 'leisure railways' of this gauge.

Let us hope that 'Hotspur IV' will remain in service as standby to the modern vessel 'Great Expectations' for as long as possible. Her future beyond that period really should be considered now. Hotspur IV might be regarded as a potential recruit for the ships collection of Southampton Maritime Museum, but kept afloat as long as reasonably possible. Sadly, Southampton Museums are already struggling to maintain the tug 'Calshot' and could hardly shoulder another burden. Yet the 'Story of Southampton' project will soon become impoverished if we cannot somehow cope with the crises which will inevitably crop up with the preservation of major artifacts.

Fortunately, neither the Pier Railway nor 'Hotspur IV' is in need of crisis management at the moment. They are both doing the same essential tasks they were doing a lifetime ago. With any luck, there is still time to provide for their eventual retirement.

John Horne

Ships: a neglected aspect of Industrial Archaeology? The Portsmouth case

Ships and Industrial Archaeology

By any standards in the scheme of manufactured products, ships are gigantic objects, being by far the largest man-made structures. *Queen Mary* and *Queen Elizabeth* were of more than 80 000 tons each, while *Queen Mary II* is 150 000 gross registered tons. In the bulk tanking field crude carriers of more than 100 000 tons are relatively common, and some in excess of 300 000 tons have been launched. Not only are ships large, but also they are of particular importance to the UK. In the 19th century the British Empire and the British economic system were underpinned by a vast merchant fleet, whereas other major contemporary economies such as Germany, France and the USA were much more self-sufficient and their fleets smaller. Moreover, the British shipbuilding industry not only supplied vessels to domestic owners, but also to much of the world; in the 1890s some 80% of world tonnage was launched in this country, much of it from Clydeside and Tyneside.

Against such a background it might be assumed that ships and shipbuilding would represent an important element of industrial archaeology, but this is simply not the case. The interest exhibited by members of the Hampshire Industrial Archaeology Society is not reflected elsewhere. Why should this be so? Firstly, as a general rule, industrial archaeology takes little interest in products. Brewing is central to the discipline, but not pubs where the beer is consumed; corn milling is avidly researched, but not bread or cake shops; textile mills but not dressmaking or tailoring; coal mining but not domestic electrical appliances; brick making but not buildings or houses, iron mining and smelting but not tools, hollow-ware, or indeed ships. But at the same time there is undoubted interest in final products such as steam engines, locomotives and metal bridges. To verify this proposition, an examination of abstracts carried in *Industrial Archaeology Review* between 2000 and 2003 inclusive was undertaken. Of the 621 abstracts, only 6 were ship-related, and only two of these were about ships themselves. One was about the Clyde ‘puffers’ and the other concerned the steam powered K class submarines. The other four considered hovercraft, the Albert Dock in Liverpool, Denny's experimental ship tank, and the Sheerness Boathouse. On the other hand, the totals of other, frequent abstracts were: non-metalliferous mining 43, inland waterways 38, railways 29, public utilities 28, water power 28 and textiles 27.

A second reason for the neglect of ships is that at the end of their useful lives, almost all of them are sold for scrap and broken up, that is if they are not sunk in service. Effectively then, there is nothing for the industrial archaeologist to research, given that practitioners do not seem to have exhibited much enthusiasm for wreck diving. A few wrecks have been raised, such as *Mary Rose,* at considerable cost, but so far as can be established there has been no industrial archaeology involvement. And thirdly, the discipline seems to have avoided studies of large industrial enterprises, shipbuilding included, and to have concentrated on small scale, often rural activities, with simple technology. The consequence is that material on the ships themselves has not been forthcoming.

Some vessels have of course been preserved after their working life is over. *Cutty Sark* and *Great Britain* are examples of commercial vessels, while warships are represented by *Victory, Trincomalee, Warrior, Gannet, Belfast, Alliance* and *Ocelot* for instance. But as with *Mary Rose,* industrial archaeology has no direct interest, and for most practitioners they are background objects commanding only passing attention. Industrial archaeology is undoubtedly strong in some fields, as the thrust of the abstracts mentioned above indicates, but it is weak in others. This is not a criticism, simply a factual observation.

However, it has to be said that in the absence of remaining artefacts, the study of ships must depend on surviving documents, plans, prints, photographs, descriptions and paintings, that is, what may be termed 'armchair' and not field or archaeological study. Thus, neither of the articles on Clyde 'puffers' or K class submarines is industrial archaeology, but rather technological history.

Portsmouth Ships

Having offered some reasons for the neglect of ships by industrial archaeologists, I would like to consider Portsmouth vessels, none of which survives, at the same time recognising that the study lies within the history of maritime technology, not industrial archaeology.

The term 'Portsmouth ships' may be defined in a number of ways: ships built at Portsmouth, ships working at Portsmouth, or ships based at Portsmouth. Having said that, the question of time has also to be considered. Since Portsmouth was, with Chatham and Devonport, one of the three major naval dockyards, it seems sensible to plump for the first definition, and then to select naval vessels, since civil building has always been small scale, and finally to consider the 19th century, a period during which warships underwent dramatic change, unequalled either before or after.

Table 1. provides a general picture of production at Portsmouth dockyard during the 19th century and the first 14 years of the following century. The five categories identified are based on the material used for the hull and on the method of propulsion. Size or armament could equally well have been employed, but arguably would have masked two of the relatively little known features of warship design, namely, that some 31 wooden-hulled vessels powered by both sail and steam were launched between 1846 and 1869, and that 8 metal-hulled ships similarly powered left the slips between 1873 and 1883. Overlap in time exists between each class, indicating that there was some doubt at the Admiralty as to the efficiency of each type, causing simultaneous building of different classes. Thus, most notable, was the introduction of a sail-less battleship, *Devastation,* in 1870, before the first of the eight metal-hulled sail and steam powered vessels, *Shah,* in 1873. Rather than list general characteristics of each class, details of the first and last ships are given; they offer a broad picture of change.

Table 1. NAVAL VESSELS BUILT AT PORTSMOUTH 1801-1914

Type: hull propulsion	Wood Sail	Wood Sail/paddle	Wood Sail/screw	Metal Sail/screw	Metal Screw
Date	1801-1848	1835-1850	1846-1869	1873-1883	1870-1914
Number built	74	10	31	8	40
First built					
Name	*Dreadnought*	*Hermes*	*Rifleman*	*Shah*	*Devastation*
Tonnage	2123 t	712 t	483 t	6250 t	9380 t
No. of guns	98	6	8	18	4
Engines	-	200 hp	100 hp	7480 hp	6650 hp
Last built					
Name	*Leander*	*Furious*	*Royal Alfred*	*Imperieuse*	*Q. Elizabeth*
Tonnage	1987 t	1286 t	4068 t	8400 t	27 500 t
No. of guns	50	16	18	14	8
Engines	-	400 hp	800 hp	10 000 hp	75 000 hp

NOTES:

1. Dates refer to launching; commissioning could be two years later
2. Prior to 1870, tonnages were calculated by builder's measure: [(Length - 3/5 max beam) x (max beam) x (0.5 max beam)] / 94
3. Number of guns shown refers to principal armament
4. An eleventh paddler, *Helicon*, was launched in 1864
5. The Wood-Sail/screw column total includes two composite ships, i.e. wooden hulled with iron frames
6. *Devastation* was not the first sail-less metal screw ship; three 200 ton vessels were launched earlier in the year
7. Five submarines were built after the period: 1916-7

During their era, wood sailers did not alter appreciably. They were restricted in size by the limitations imposed by wooden hulls, they had three gun decks within the hull and carried a large number of cannon; a first rate man o' war like *Dreadnought* had 100 or so guns. *Leander* was a fourth rate ship of the line. Paddlers remained small since the vulnerability of the wheels reduced their suitability for battle, and were never referred to as men o' war, although they did possess guns. They undertook auxiliary duties and were restricted in range causing them to be used for instance on coastal defence work, although if necessary they could undertake long voyages using sail. The small *Rifleman,* the first of the wooden screw vessels, was not really typical of the class, which was largely made up of traditionally hulled first rate ships with engines, boilers and screws fitted. Some first rate sailers which had seen decades of service were rebuilt. An example is *Neptune,* (Fig. 20) launched in 1832.

The ships themselves may not have changed much, as evidenced by *Victoria* (Fig. 21), launched in 1859. However, it is apparent that by the time *Royal Alfred* was launched in 1869, the notion that fire power correlated with the number of guns had been greatly modified. The table suggests that no real changes were effected in the reign of the metal-hulled sail steamers, but in fact it was an important transition period. *Shah* could make 13 knots (6.5 m s^{-1}) under sail, but only by virtue of carrying an enormous crew of 600; on the other hand the sails on the larger *Imperieuse* (Fig. 22) could make only l knot (0.5 m s^{-1}) and were effectively useless, being removed shortly after commissioning. Moreover, all vessels in this class carried an entirely new weapon, the torpedo; *Shah* was in fact the first warship to fire a torpedo at an enemy ship in 1877. The strides made between *Devastation* and *Queen Elizabeth* were substantial, to say the least, not only in respect of size. Breech loading guns were fitted to *Colossus*, launched in 1879, while *Dreadnought* launched in 1906

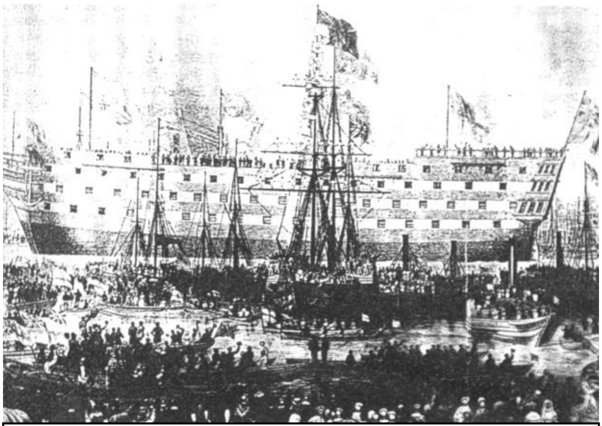

Figure 20 - Launch of the 110 gun *Neptune*, 27th September 1832. Several paddlers are in evidence in the foreground; the largest, masted vessel is almost certainly naval, although not built in Portsmouth

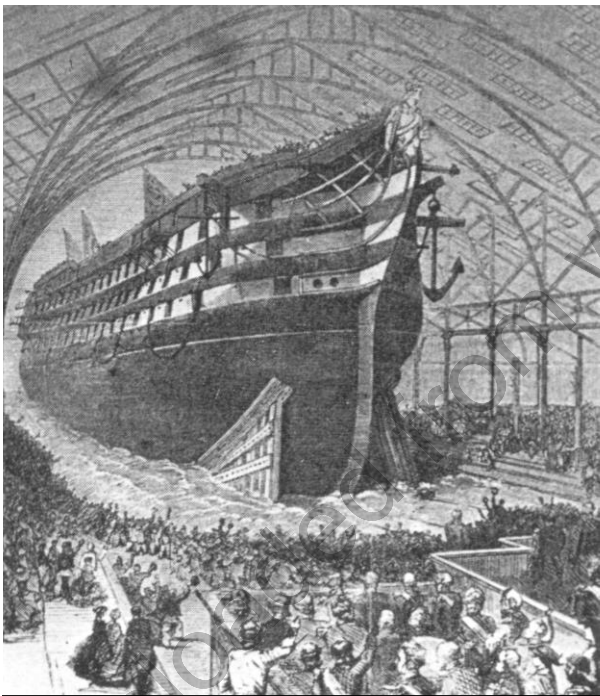

Figure 21 - Launch of the 131 gun *Victoria*, November 1859. Although looking very like *Neptune* launched 27 years earlier, she possessed a 1000 hp engine by Maudslay

had the benefit of steam turbines giving a speed of 21 knots (10.5 m s^{-1}). Not only did *Queen Elizabeth* look like a Second World War battleship, but she had oil-fired turbines driving four screws, could make 24 knots (12 m s^{-1}) and her guns had a range of 13 miles (21 km).

A number of questions emerge from this general discussion; I would like to consider three of them.

Iron Hulls

Two composite 467 ton gunboats, *Avon* and *Cracker,* whose wooden hulls were given iron frames, were launched in 1867, but the first iron-hulled warship was *Shah,* which left the slip in 1873. The question to be put is, why was iron eschewed for so long, given that Brunel's *Great Britain,* launched in 1843, had a wrought iron hull? Moreover, the same engineer had demonstrated the enormous possibilities of scaling up through the use of iron in his 19 000 ton *Great Eastern* of 1858. Iron-hulled commercial clippers were standard in the 1860s, since although they were more expensive to build, they offered a disproportionately large payload compared with a wooden hull, making iron very much an economic proposition. Additionally clippers were not engined, making sail entirely reconcilable with an iron hull. One justification was that until 1864, when gun turrets were mounted on the upper deck of *Royal Sovereign,* the standard armament was the between deck cannon, indeed, when she was launched in 1857, the same ship had no fewer than 131 guns on three gun decks (Fig. 23). To have cut so many gun ports into an iron hull was thought to create serious lines of weakness. This argument became invalid once gun turrets were introduced and a concomitant substantial reduction in the number of guns carried, but it was nine years between the rebuilding of *Royal Sovereign* and the launch of *Shah*.. To complicate the picture, the Navy's first ironclad, *Warrior,* had been launched some years earlier in 1860, and gun ports pierced one deck of her hull. No doubt allowance should be made for a period of experimentation, but there does seem to have been a degree of caution behind Admiralty thinking. Indeed, tradition was a powerful influence in the Victorian Navy.

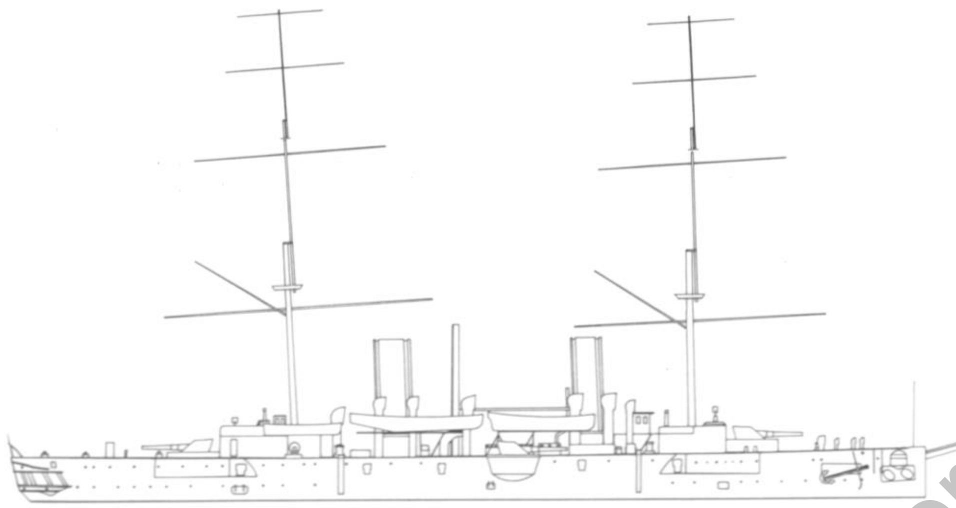

Figure 22 - *Imperieuse* launched in 1883, the last of the metal hulled steamers with sailing rig.

The Persistence of Sail

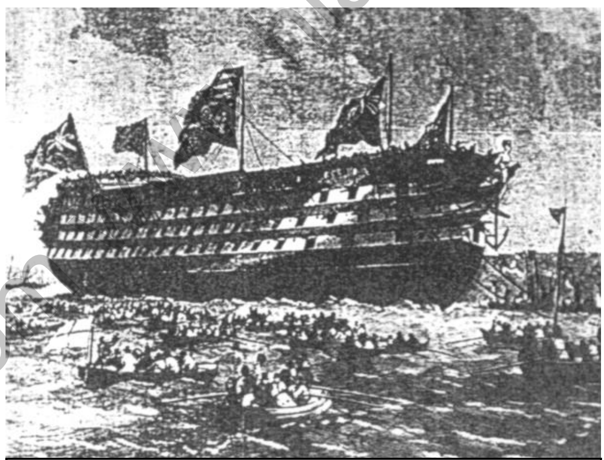

Figure 23 - Launch of the sail/steamer *Royal Sovereign* May 1857. Her upper deck was later removed and replaced with guns mounted in turrets.

Devastation may have been the first capital ship whose masts were used only for signalling when she was launched in 1870, but sail power persisted until 1883, as has been mentioned, in the case of *Imperieuse*. Of course, sail did not actually disappear until the last sail-steamer was taken out of service. Yet by this time steam engines had achieved considerable sophistication, raising the question of the apparently slow introduction of sail-less warships. It should be pointed out, however, that even Brunel's *Great Eastern* carried sails, and to assume that land-based technology could be equally applied to maritime operations is spurious. Furthermore, there were a number of strategic issues confronting warships which did not apply to commercial vessels.

Steam power was not an option for capital ships until the adoption of screw propulsion in the 1840s. But even in the 1840s low pressure steam engines working at only 10 psi (160 kPa) occupied considerable space, while their very inefficiency required large bunkers. In other words, sail-less vessels were constrained by the availability of coal. Commercial vessels on scheduled voyages could take on coal at predetermined bunkers, but warships required an almost unrestricted range and dare not rely on commercial supplies of coal becoming available. Even *Devastation* (Fig. 24) had non-compound engines restricting her to a range of 2700 miles (4300 km) at 12 knots (6 m s^{-1}). As steam engine efficiency improved warships gained greater flexibility and dependency on sail was reduced. The 1268 ton *Sirius* launched in 1868 was the first vessel to be fitted with a compound engine; by 1885 *Victoria* had triple expansion engines working at 135 psi (1.0 MPa), made possible by the use of steel rather than wrought iron in her boilers. Greatly assisting the demise of sail was the establishment of coaling stations round the world, but this did not come about until the 1870s; by 1880 there

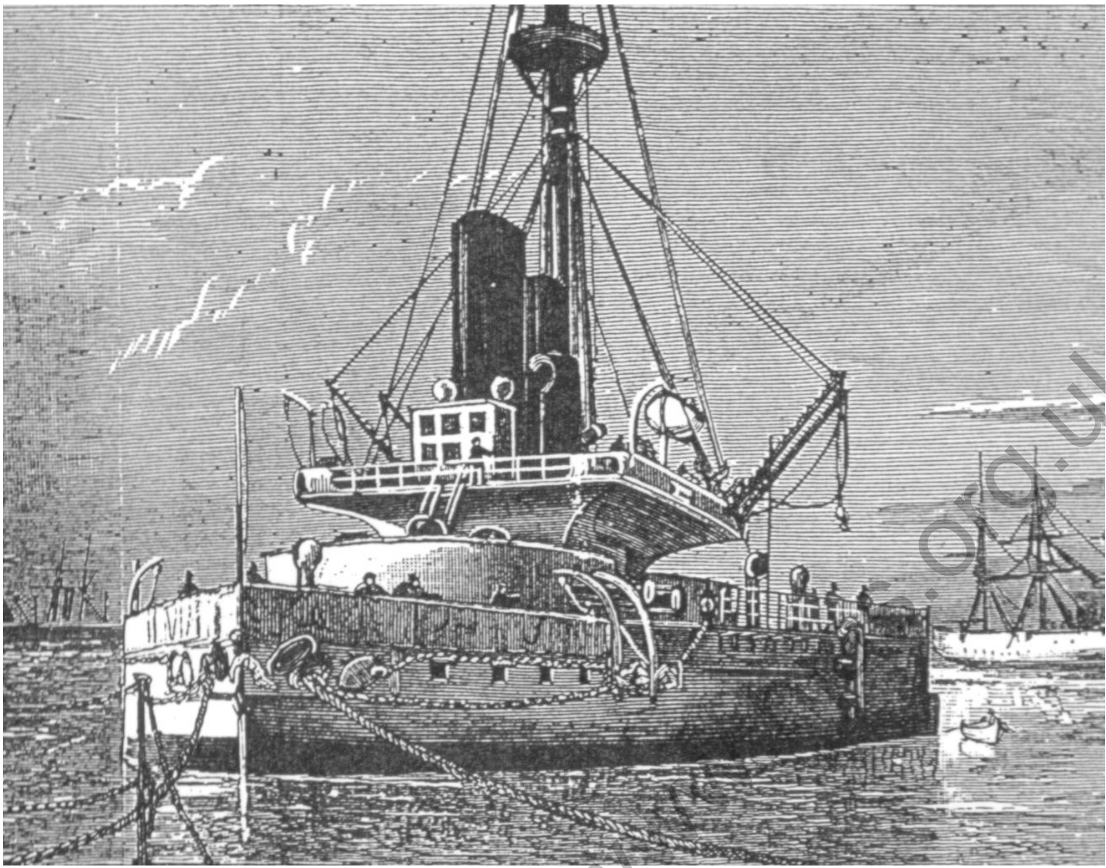

Figure 24 - *Devastation,* launched in 1870 in Portsmouth dockyard. The drawing is from *The Graphic* of 21st February 1885. It is foreshortened but nevertheless gives the impression of a floating gun platform.

were 75 coaling stations available to the Navy. It was not until this period that truly efficient boilers were fitted to warships, overcoming the often insuperable maintenance problem assailing earlier vessels in remote parts of the world. However rational these explanations may be, there is no doubt that naval tradition did play a part in the retention of sail. Beeler (2001, p.48) notes that it was believed that 'sails and masts are necessary to maintain the courage and resourcefulness of seamen', while it was said that sail was retained towards the end of its era for training purposes, even though sail training was barely necessary. Antipathy to steam took another form: engineering officers were not allowed in the wardroom until 1876.

Armament

Important though power and speed undoubtedly were, a warship's armament was the ultimate means of destroying or capturing enemy vessels. What were the influences dictating the change in armament from *Dreadnought's* 93 cannon firing 24 and 32 lb (11 and 15 kg) metal balls up to 1.5 miles (2.2 km), to *Queen Elizabeth'*s 8 x 15 inch (0.38 m) 97 ton guns capable of propelling a 17001b (770 kg) shell almost ten times further? By selecting two warships launched at the beginning and end of the period being examined, it might be thought that there was a steady fall in the number of guns carried as their size increased. The word to be questioned is 'steady', for in fact armament of the Napoleonic era endured for two-thirds of the century, and only then was there change, but when it occurred it was rapid. As we have seen, Royal *Sovereign,* a 3765 ton wooden sail steamer launched in 1857, carried 131 guns. They were smooth bore and fired irregularly shaped cast iron balls which bounced along the barrel, causing the exit direction to be dependent on the characteristics of the last bounce.

Their range was a maximum of 2000 yards (1.9 km), usually much less, and accuracy was largely a notion rather than a reality, especially if a high sea was running. *Royal Sovereign,* however, represented the end of an era, for the 1860s saw a number of important changes in naval gunnery.

Firstly, the efficiency of lining gun barrels with a series of spiral grooves, known as rifling, was accepted by the Admiralty in 1864. A projectile spinning during its trajectory improved both accuracy and the distance it could travel. Secondly, since spin could hardly be imparted to an iron ball, shells took their place; they were coated in lead so that as they were rammed into the barrel, protuberances would be made in the coating. An alternative was the fitting of studs to the shell. The maximum range as a result rose to 4000 yards (3.8 km). Thirdly, thinking moved away from large numbers of small cannon capable of firing only broadsides, to a small number of much larger guns mounted in revolving turrets located above the hull. Thus in the space of a few years armament moved from its centuries old to a distinctly modern form. The innovation was not initially supported through the design of a new vessel - one innovation at a time was enough - and instead in 1864 *Royal Sovereign's* upper deck was removed to lower the centre of gravity, and five 10.5 inch (0.26 m) guns, each weighing 12.5 tons, firing 300 lb (140 kg) shells, were arranged in turrets on the new, strengthened upper deck. It is difficult to imagine a *Victory*-like vessel with funnels, revolving gun turrets and most of its gun ports sealed off. But the rebuilt *Royal* Sovereign was very much an experiment, for in 1870, *Devastation* carried four 12 inch (0.30 m) guns each weighing 35 tons, firing 714 lb (320 kg) shells with a range of 6000 yards (5.5 km), mounted in two centre-line turrets revolved by means of steam power. Even the inaccurate illustration in the *Daily Graphic* gives the impression less of a sailing ship than of a floating gun platform; indeed a contemporary description declared that she was 'An impregnable piece of Vauban fortification with bastions mounted on a floating coal mine'. Inexplicably, for a while the centre-line turret was abandoned in favour of turrets amidships, causing them not only to have a restricted arc of fire, but also to render it impossible to deploy full fire at a particular target. *Inflexible* launched in 1876 is a good example of these curious central citadel battleships (Fig. 25).

Figure 25 - The central citadel battleship *Inflexible,* launched 1876. Turrets amidships were flanked by military looking ramparts.

The fourth development in the 1860s concerned the method of loading the guns. Until this time guns were muzzle loading, a somewhat laborious process which necessitated turret mounted guns to be depressed to allow a hydraulic ram to push the shell into the barrel. William Armstrong designed a breech loading gun in 1861, but while loading was facilitated, problems were experienced in satisfactorily closing the breech; gas escapes caused serious injury to gunners. Furthermore, it was found that rifled muzzle loaders (RML) had a superior rate of fire compared with breech loaders: 1 minute 36 seconds against 2 minutes 30 seconds. It was not until 1879 that breech loading gun technology had advanced sufficiently to justify their installation on a warship, *Colossus*. Even then, her five breech loaders were only 6 inch (15 cm), as against her 4 x 12 inch (30 cm) RMLs.

Centre-line breech loading guns made from steel became the standard armament during the last two decades of the century, while range and accuracy improved. However, an entirely new weapon arrived on the scene in the 1870s, the torpedo. Designed by Robert Whitehead in 1867-72, running on compressed air at 700 psi (5.1 MPa), the early torpedoes had a limited

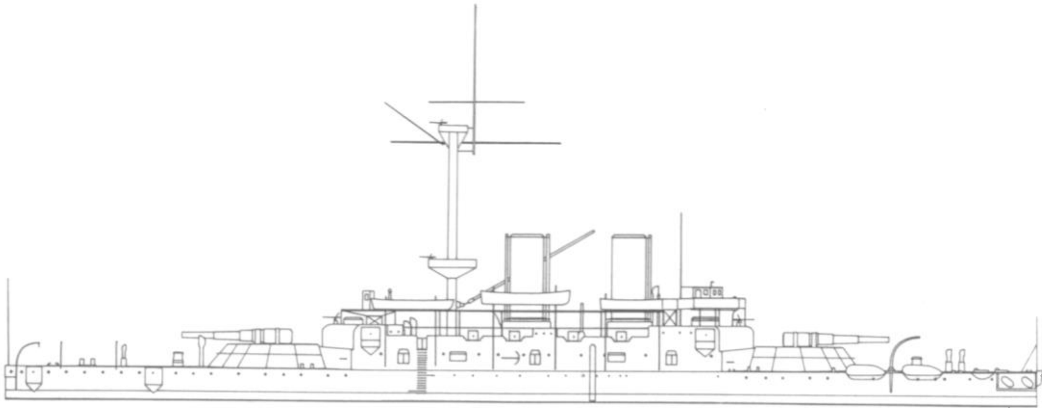

Figure 26 - *Camperdown,* launched 1885. Centre-line turrets have replaced amidships turrets, but notably there is no protection for the gun crew.

range of only 400 yards (360 m), rendering the launching vessel very vulnerable to enemy gunfire. Additionally, since it could only make 8 knots (4 m s^{-1}), a targeted ship could easily outpace the torpedo, were it spotted in time, of course. Early Whitehead torpedoes had a tendency to deviate to the left, leading to one embarrassing incident when a launching vessel was hit by its own torpedo, fortunately unarmed. *Shah,* launched in 1873 was fitted with two submerged tubes, while *Camperdown* (Fig. 26)*,* launched in 1885, had 5 above waterline tubes firing broadside. By 1909 the range had extended to 2000 yards (1800 m) at 35 knots (17.5 m s^{-1}), or 4000 yards (3600 m) at 29 knots (14.5 m s^{-1}). The last pre-Dreadnought battleship built at Portsmouth was *Britannia* (Fig. 27) of 1904. When in harbour, nets were hung from booms to explode torpedoes clear of the hull. When under way the booms were tied against the hull as seen on *Britannia*.

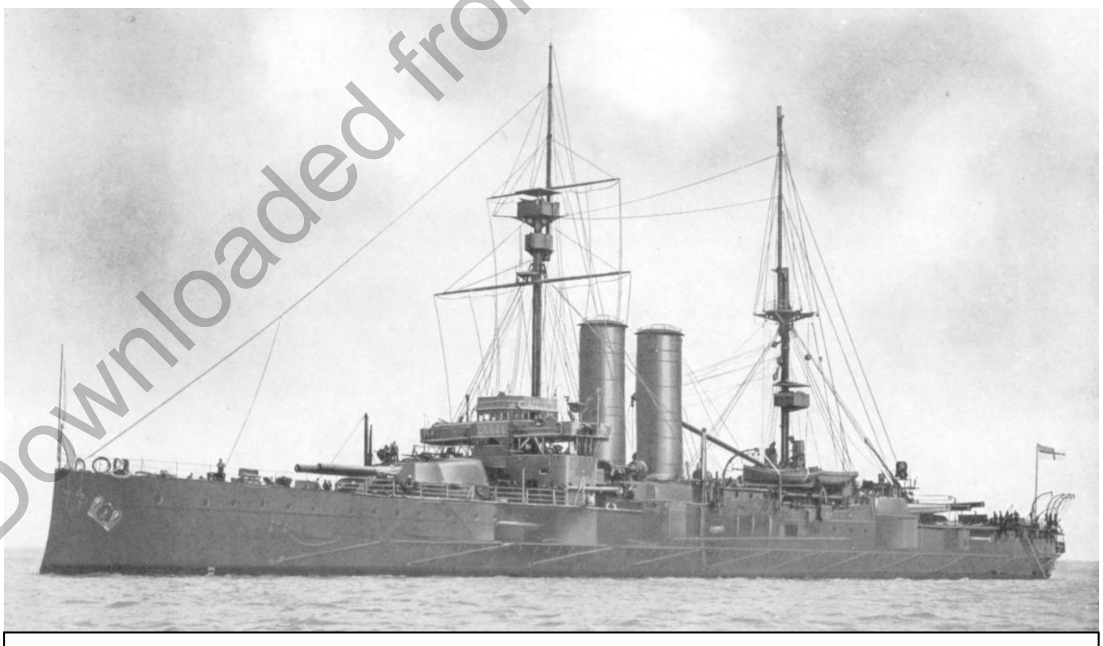

Figure 27 - *Britannia*, launched 1904, showing main and secondary armaments and stowed booms for anti-torpedo nets.

Torpedoes were retained by warships, but it quickly became apparent that the most effective way of delivering a torpedo was from a steam pinnace which, because of its low profile, could more easily approach a target without being observed. Two such boats were carried aboard *Inflexible.* Invisibility was later much more devastatingly achieved by submarines. Since one advance usually triggers another, the counter to the torpedo boat was the Hotchkiss quick firing gun delivering 15 rounds a minute, mounted aboard a steam pinnace, adopted by the Navy in 1888. A capital ship's big guns simply could not be deployed sufficiently quickly to target a torpedo boat.

It may not be industrial archaeology, but arguably the issues of iron hulls, power and armament in naval vessels, coupled with strategic considerations, are subjects not too far removed from the interests of many practitioners of the discipline.

Ray Riley

Bibliography

Beeler, John (2001) *Birth of the Battleship. British Capital Ship Design 1870-1881*

Goss, John (1967) *Portsmouth Built Warships*

Lambert, Andrew (1984) *Battleships in Transition. The Creation of the Steam Battlefleet 1815-1860*

Alfred Waterhouse in Twyford

Alfred Waterhouse in Twyford. The New Church of Saint Mary the Virgin, 1878.
A 125th Anniversary Commemoration by Stanley Crooks, 2003.

Stored in the back of an old safe in the Vestry of Saint Mary's Church in Twyford, Hampshire, was a bundle of old papers. The sharp eyes of the Parish Administrator Val Little spotted them. She had discovered the original hand written letters from Alfred Waterhouse to the Saint Mary's Building Committee between 1875 and 1879. This fortuitous discovery was the catalyst for the preparation of the book as a celebration of the 125th anniversary of the new church.

The Royal Institute of British Architects readily agreed to make available a set of drawings Waterhouse had prepared for the church, including his measured drawings of the mediaeval church which it was to replace. The letters and evocative photographs of both the old and new churches form the foundation of Stanley Crooks' account of the meticulous attention devoted by Alfred Waterhouse to providing the new church within a budget the parish could afford, and to a timetable which many modern builders would find hard to emulate.

All the Waterhouse letters are included, well over forty in number. From the very first, he has his likes and dislikes, sometimes giving the impression of being a little irritated by the pretentiousness of lay people on design issues when compared with his own tastes. for instance, on November 10th 1875 it is the notion of using varnish in the roof which he dislikes. The letters give a unique insight into practices in a Victorian Architect's office before the introduction of printing and copying machines: "two complete sets of traced drawings were made, so that one can go into the hands of the Quantity Surveyor who will require three or four weeks for his work".

Figure 28 - Saint Mary's church, Twyford, by Alfred Waterhouse.

Alfred Waterhouse was not familiar with the use of knapped flints in building work. He had to be reassured by a builder in Salisbury that the local material was reasonably priced. He discovered that flints would not cost 2/- (10 p) per square foot but more likely 6 d (2½ p). The cost of bricks was reduced by £160 by using the best of the local bricks instead of Fareham reds. Drawings from his London office were to be sent by rail addressed to Winchester Station for collection. As he noted in his letter of November 19th 1879, large drawings could not be sent by book post!

Although Twyford church is of only local significance when compared with his Natural History Museum in London or with Manchester Town Hall, it is nevertheless a fine example on a more intimate scale of the parish churches of this great Victorian Architect.

Stanley Crooks has done an excellent job in editing this fascinating account. The attractively laid out hardback book is very well illustrated, including eight splendid colour plates.

Deane Clark

Waterhouse in Twyford by Stanley Crooks is published by George Mann Publications, Easton, Winchester SO21 1ES, at £15. It can be purchased from Twyford Post Office or may be ordered from the Author (Telephone 01962 712664). All proceeds go to Twyford Church funds.

Publications

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No. 6 (1997); *No.7* (1998); *No. 8* (1999); *No. 9* (2000/2001)
£4.00 each to non-members

Published by Hampshire Industrial Archaeology Society
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Hampshire Industrial Archaeology Society

Hampshire Industrial Archaeology Society was founded as the Southampton University Industrial Archaeology Group in the 1960s from members of the University Extra-Mural classes who wished to continue their studies in industrial archaeology. Recording has included surveys of mills, breweries, brickworks, roads and farm buildings. Restoration is undertaken directly or by associated groups such as Tram 57 Project, the Hampshire Mills Group and the Twyford Waterworks Trust. In addition to the Journal, the Society publishes a newsletter (Focus) and lecture meetings are held every month.

To join, contact the Membership Secretary:
Keith Andrews, 13 Ashley Close, Harestock, Winchester, Hampshire, SO22 6LR.

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