WASC 1879

Article by K. Fairclough

'Navigation Devices along the River Lea 1600-1767'

Navigation Devices along the River Lea, 1600–1767

by

Dr. Keith FAIRCLOUGH

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In 1767, following the recommendations of John Smeaton and Thomas Yeoman, the Trustees of the Lee Navigation obtained an Act of Parliament (7 Geo III,c.51) authorising the canalisation of the navigable river Lea from Hertford and Ware to the Thames.[1] The traditional navigation reliant on the provision of pens and flashes of water from fishing weirs, turnpikes and mills along the river which had sufficed for many years was replaced by an engineered navigation reliant on pound locks. Artificial navigation cuts and the use of existing millstreams rather than the traditional river channel along much of its course meant that the route as well as the mode of operation of the post-1767 navigation was substantially different from that traditional navigation under discussion in this paper. Such a policy of canalisation is obviously technically more efficient, and the engineers and the Trustees who sought such improvement did so in order to improve navigation along the Lea. Consequently their evidence to Parliament about the problems of the traditional navigation were stringent, and they expected much from the new system.[2]

Yet at times during the mediaeval period,[3] and ever since the late 1570s, the Lea had been an important supply route to London. In the 1570s a unique improvement scheme had been implemented, and although this scheme was jettisoned in the 1590s, it had been a success. For the first time in many years a regular and important traffic to London had been generated, and a substantial interest group had emerged who were determined to maintain the navigation along the Lea for the future.[4] This interest group ensured that by the end of the 1590s the traditional mediaeval system of navigation reliant upon pens and flashes had been restored, and it was this system which was to be retained until 1767. This system was not static, it was subject to alteration, to piecemeal improvement, and it was a more developed and efficient system of navigation by 1767 than it had been in 1600. A survey by John Smeaton in 1766 noted 18 flash locks, two pound locks, and a tidal lock at Bromley,[5] a far greater number than had existed in 1600 when there had been no pound locks, only one turnpike, and at most less than ten fishing weirs, but probably far fewer. This increase had stimulated, and had been stimulated by, an increase in traffic, particularly the down river carriage of malt and meal for the London brewers and bakers. The capacity of the barges had also risen during these years, from 8–10 tons to 40 tons. An attempt to describe this flash lock system and to evaluate its success has been made in an earlier paper.[6] The purpose of this paper is to list and discuss the various navigation aids along the non-tidal river between Hertford and Hackney, the nuts and bolts which allowed the system to flourish.

In part it is an attempt to add to information collected by Lewis, Slatcher, and Jarvis in their survey of the remains of flash locks on English rivers.[7] Their survey did not include the Lea for there are now no visible remains of such locks along either the navigation or the traditional river. This paper however concentrates on archival sources, no search has been made for archaeological evidence. A major problem is the lack of surviving archival records. If any contemporary ever did try to discuss or describe the system in detail, it has not survived. Leases and other legal documentation of fishing weirs or mills do not detail the nuts and bolts. What should have been the best source of information, the

records of the Commissioners of Sewers, are incomplete, and it is only for the 18th century that proper records of their deliberations, and those of the Lee Trustees, survive. Even then much is not minuted in the detail an historian would appreciate. There are large gaps, but it is still worth the effort to try and record what has been discovered, and what has not. It was a system of navigation that succeeded in its day, even though progress meant other systems came to be favoured, not just along the Lea.

POUND LOCKS

The very nature of the navigation and the lack of interest in improvement meant that this common form of 17th century technical advance was rare along the Lea. Between 1600 and 1767 only two pound locks were built, the first next to Ware Mills in 1658, the second not until 1760 when the proprietors of a new waterworks at Hackney built one at Lea Bridge. In the 1730s there was a proposal to build a pound lock at Hertford at the head of a proposed new cut across Hartham Common (see dotted line on Fig. 4) but it never proceeded beyond the planning stage.[8] By the 18th century these locks came to be known as cisterns, as contemporaries did not use the term pound locks. In 1766 Smeaton described the pound lock at Ware as a 'cistern or lock properly so called', whilst a similar emphasis on the word 'proper' was also made by the planners of the pound lock at Hertford. The specific use of the word 'cistern' to mean pound lock raises the problem that on a map of the Lea in 1741 Crooks Cistern is shown at Stanstead (see Fig. 4). Nothing has been discovered about this cistern. It is not counted as a pound lock in Smeaton's report, although it still appears on the accompanying maps, and it is never recorded in the Trustees' minutes. Perhaps it had something to do with port facilities at Stanstead rather than the river navigation?

Ware Pound Lock

During the late 1650s the Borough of Hertford initiated improvements along the Lea between Hertford and Ware, so that the navigation above Ware attained the same standard as that below. This was a rare example of municipal enterprise, stimulated by a desire to capture trade from Ware, the most important inland port along the river. This aim was not achieved, but the improvements did allow the larger barges to come to Hertford. The improvement scheme included the construction of two turnpikes at Hertford (see below), the opening of a new route down the head stream of Ware mills, the digging of a short cut from this head stream back to the Lea, and the construction of a pound lock in this cut next to Ware mills (see Fig. 1).

The pound lock was built after agreement in 1658 between the Borough of Hertford and Sir Thomas Fanshawe, lord of the manor of Ware and owner of Ware mills. The agreement outlined the new route, agreed details of those circumstances when the mill gates should be manipulated to augment the pen of water in the head stream or to provide a flash from the tail stream, and agreed a toll of 6d from every barge that used the pound lock. During construction of the lock the Borough hired carts to carry timber from Fanshawe's estate at Brickendon and paid some small bills for bricklaying. This suggests that the lock involved both timber and brickwork. Other than that nothing is known of its construction.[9]

Maintenance of the lock was the responsibility of the owners and lessees of Ware mills. In 1738 these mills were purchased by the New River Company as part of an improvement scheme authorised by Parliament in 1739.[10] From June 1741, the Company received reports that the lock was in such poor condition that it was surprising that it was still standing. One bargemaster, Thomas Pettit, even declared that 'no Publick thing of Such Consequence ever lay so much Neglected'. In September the Company ordered it rebuilt despite the approach of winter. Thereafter monthly reports were critical and sarcastic over the progress of this work. In November there were complaints that Henry Mill,[11] the Company's surveyor, did not arrive on site before 11 or 12 o'clock as he had been unable to obtain local lodgings. Since at this time of year this was the workmen's dinner hour, work was poorly supervised and slow. The following month there were complaints that Mill did not know his job, that many men were idle even though this cost £5 or £6 a day, and that the workmen were pilfering timber. The complainants said

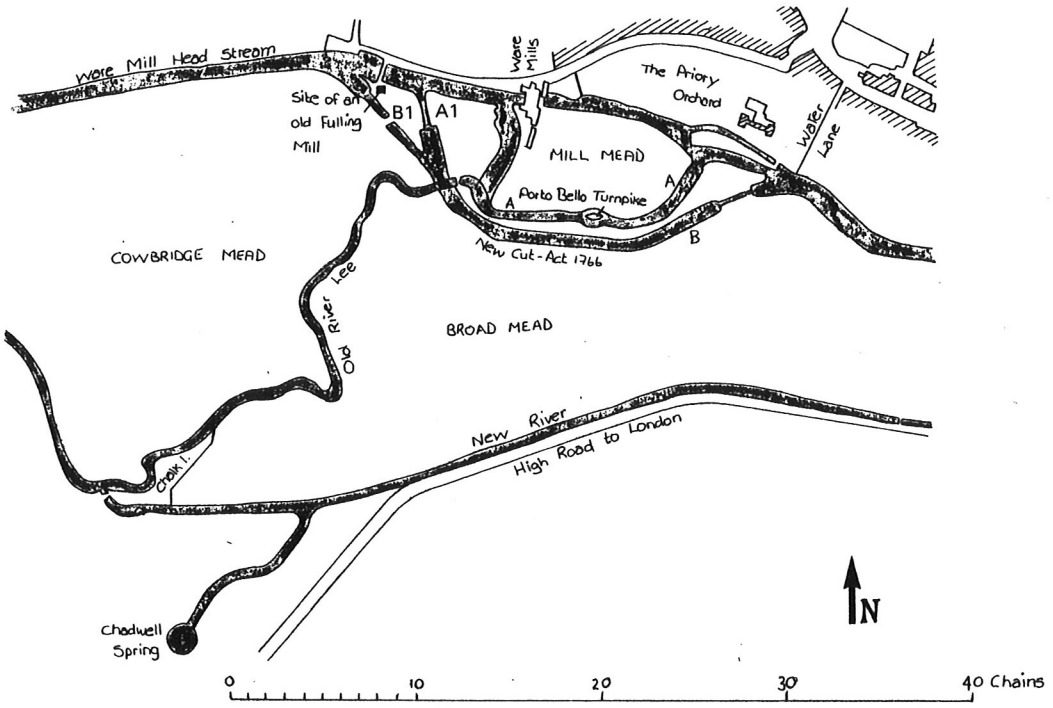


Fig. 1. Map showing Ware pound lock. A, route opened in 1658, pound lock at A1. B, route after Act of 1767, pound lock at B1.

that they had castigated Mill, but added loftily that 'the weather being so Severely Cold we would not wait his tedious Apologies'. The following months saw further comments in the same vein: 'so numerous a Retinue who for some time passt have been imployed only in blowing their Fingers'; 'the Brick Work . . . [is] a Mistery not only to us, but to all the Workmen there'; 'The Gates and Iron Work . . . in so grand a manner as if for a Cathedral'; and 'all upon the Spot joyn in Opinion with us the Sufferers, that the Expence will be monstrously more than such a Bauble of a Cistern could in any reason require'. There seems some justification for these reports, for in June 1742 the damaged fragments of the New River Company minutes record that Mr Orger of Hertford, carpenter, was to rebuild the lock for £400, and the minutes seem to suggest that he was to use the existing materials, and that he was to lengthen the lock so that barges could enter with the rudder in position. During this rebuilding the bottom of the lock was laid two feet lower as the Lee Trustees had ordered in October 1739.[12]

The pound lock continued to be let, along with the mills until 1767 when new arrangements were authorised as part of the canalisation scheme. A new cut was made from the head stream just above the pound lock to rejoin the Lea just below the tail stream of Ware mills, and a new pound lock was built at the head of this new cut. This meant that the original pound lock became superfluous. These arrangements exist to this day, though much improved from when they were introduced in 1767.

The pound lock at Hackney Waterworks[13]

In 1760 a group of business men set up a waterworks at Hackney, on the west bank of the Lea just below the newly erected Lea Bridge. These works included a new cut alongside the navigable channel

over which were erected mills designed to raise water and grind corn, a water tower to drive water through underground wooden pipes to a reservoir at Clapton from whence it was distributed to customers, and a lock in the navigable channel. This lock was a pound lock across the eastern half of the river and a single pair of gates across the western half (see Fig. 2). The lock soon attracted criticism from bargemen who thought it harmed the navigation. Disputes ensued, the Lee Trustees threatened to pull the lock down, the owners of the waterworks sought parliamentary sanction, but in 1762 an amicable settlement was reached. The Trustees leased the lock and appointed their own lock-keeper to supervise its use.

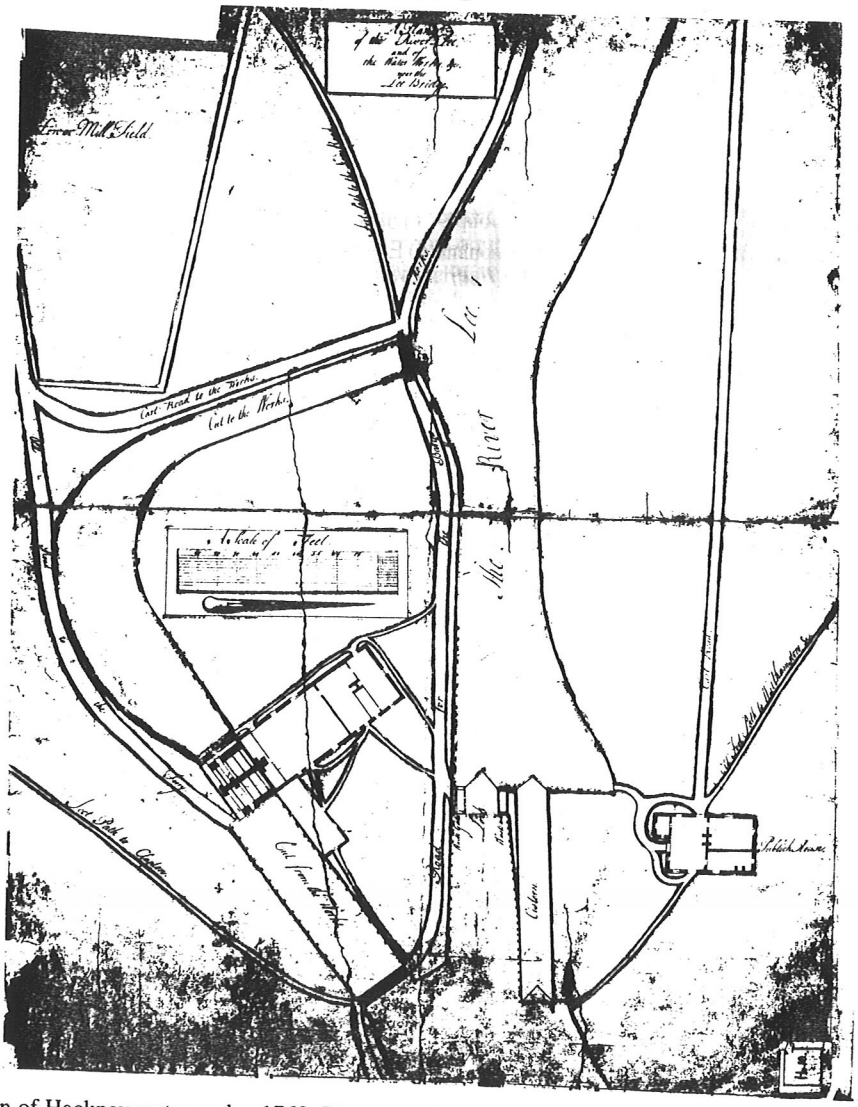


Fig. 2. Plan of Hackney waterworks, 1762. Plans v9. *By permission of the London Borough of Hackney Library Services.*

In 1766 Smeaton noted that this pound lock was only 'occasionally used', and he forcibly rejected its retention, 'I also entirely reject the new cistern lock at Hackney as part of my scheme, as neither its floor nor the river below is deep enough for navigation, without flashes there, as at present'. The tide could still come as far up river as Hackney at this date.[14] At high tides the level of the river above and below the lock was the same, allowing the single gates to be used, whilst at other times the pound lock could be used. But since movement along the lower Lea was easier when the tide was in, most bargemen preferred to wait and take advantage of the tidal waters to navigate between Bow Lock and Hackney. Thus the pound lock was little used. Smeaton was critical, but the Act of 1767 noted that the lock 'hath been found by Experience to be of very great Service and Advantage to the Navigation'. This Act authorised a new cut from just below the waterworks to Old Ford, and when this Hackney Cut was opened in August 1769 the waterworks lock was replaced by a pound lock which stood at the head of the cut.

FLASH LOCKS (Turnpikes and Weirs)

Flash locks were the most important navigation aid along the Lea before 1767. Contemporaries came to distinguish two distinct types, turnpikes and weirs. The meaning of the word turnpike was to change, but turnpikes were built specifically to improve the navigation, whilst weirs were erected by custom and right within fisheries, ostensibly to assist the catching of fish, though in practice they too were built to assist and improve the navigation. The evidence is far from complete, particularly for weirs, but there is sufficient to suggest differences in the mode of construction, in the mode of operation, and in the right to collect tolls.

TURNPIKES

There is evidence to suggest that the word turnpike changed its meaning during the 17th and early 18th centuries. About 1595–1600 a turnpike was erected at Waltham. This was a flash lock, as were two turnpikes built at Hertford during the 1650s as part of the municipal improvement scheme. However there are also some early references to the pound lock at Ware also being called a turnpike during the 17th century,[15] before the term 'cistern' came to be specifically used. Thus it seems that along the Lea the word 'turnpike' was used during the 17th century to describe any lock built specifically to improve the navigation, but that by the early 18th century the word was reserved for flash locks, whilst the word 'cistern' had come into use for pound locks. A further variation in meaning is also possible. In 1758 the minutes of the Lee Trustees noted that when Dobbs Weir was rebuilt 'instead of making the Passage Pier a Weir it shall be made into a Turnpike'.[16] Since all turnpikes erected after 1739 had guillotine gates in the passage pier through which the barges passed, it is obvious that by the mid-18th century the word 'turnpike' was used for a flash lock with guillotine gates. Unfortunately the lack of evidence about the construction of Waltham Turnpike, or of the construction of the Hertford Turnpikes before the 1730s when they did have guillotine gates, means that it cannot be determined whether the word turnpike implied guillotine gates or not during the 17th century.

Other features were associated with the use of the term turnpike, but they did not determine the use of the word. The method of toll collection was different, but not specific. Tolls were collected at most turnpikes, but not at all. When tolls were collected, by private agreement, not customary right, they were levied every time a barge passed through the turnpike, the fee covering the return journey as well. This was also the case at the pound lock at Ware, but was not so at the fishing weirs (see below). Also all turnpikes, with the exception of Portobello Turnpike, were normally kept shut, to divert more water to adjacent mills, and were only opened when barges required flashes. Portobello Turnpike was an exception because it stood across the tail stream of Ware mill, so it was closed only when bargemen required additional assistance, otherwise the tail water would not run away and the mills would have been prevented from working. Fishing weirs were normally left open during the day, only being shut if the bargemen requested a flash.

At the beginning of the 17th century there was one turnpike along the river, at Waltham. By the end of the century two more had been built, at Hertford. In the early years of the 18th century bargemen were forced to use a turnpike erected by the miller at Stanstead mills. Three turnpikes were built by the Lee Trustees using the authority of the Act of 1739, whilst three fishing weirs were converted to turnpikes after this same date, two by the Trustees, and one by private initiative. There was also a turnpike which was not a flash lock to assist navigation. A survey of the Lea in 1670 by Sir Robert Murray and Christopher Wren noted a 'Turnpike or moveable Dam' across Manifold Ditch at Chalk Island.[17] This turnpike did not stand along the navigable channel, its purpose was to raise the height of water in Manifold Ditch so that more water was turned into the New River. In the mid-1660s there had been some discussion about using Manifold Ditch as the navigable channel, and thus some discussion of using this turnpike to assist the navigation, but Manifold Ditch was not made navigable, so the turnpike continued solely as an aid to increase supplies of water to the New River Company, but the word turnpike was retained and always used to describe this particular dam.[18]

Waltham Turnpike

This was first built during the late 1590s after a private agreement that was part of the re-introduction of the traditional flash lock navigation. Of its construction nothing has been discovered except that in 1682 it cost £261 12s 1d to rebuild, that in 1743 £1 1s was spent on the purchase of rope, and that in 1771 Smeaton reported that it had a guillotine gate and had done so for some time.[19] It cannot be said whether it had a guillotine gate when first built or at any time during the 17th century. In 1670 Murray and Wren noted that this lock could lay the whole river dry. The turnpike stood across the navigable channel just below the mouth of the head stream of Waltham Abbey corn mills. When the turnpike was shut water was diverted into the head stream of the mills, and when opened it provided a flash to carry barges to and from Waltham High Bridge. The turnpike and the corn mills were the property of the lord(s) of the manor of Waltham, but the turnpike was often let separately from the mills, and the turnpike was the more valuable property. In 1643 Abraham Hudson, the miller, rented the mill for £80 a year and the turnpike for £123 a year.[20] The turnpike was such a valuable property solely because there was a right to collect a toll of 5s from every passing barge, an unusually high level which was a major source of contention throughout the 17th century.[21]

In 1767 Waltham Turnpike was purchased by the Lee Trustees, but although their canalisation plans meant that this stretch of the river was by-passed by a new cut, the turnpike was left standing as it played an important role in controlling the flow of water to Waltham Abbey Corn Mills and Waltham Abbey Powder Mills. After this date the turnpike was kept shut, only being opened to allow flood waters to pass downstream. In order to provide sufficient water to a calico printing works that stood on the east bank of the Lea just below the turnpike a bore of 6 in dimension was made in the turnpike, this on the recommendation of Smeaton who had made a special survey.[22]

Hertford turnpikes

As part of the same improvement scheme that saw the construction of a pound lock next to Ware mills, two turnpikes were built at Hertford in the late 1650s. In June 1656 the intention had been to build one turnpike, but at a series of town meetings the improvement scheme evolved, so that two turnpikes were built, at points 'c' and 'e' on a map produced in 1733 by William Whittenbury, a Hertford carpenter who was to become surveyor to the Trustees after 1739. This map is reproduced as Fig. 3.[23] By the 1730s both turnpikes had guillotine gates in the passage pier which were 13 ft 6 in wide, whilst the side or flood gates had flash boards, but whether guillotine gates were first introduced during rebuilding in the 1730s or whether they were present when first built is not known. There is a reference to flash boards when first built, but whether these were confined to the flood gates or whether they were in the passage pier as well cannot be determined. Can anything be made of the fact that during rebuilding in 1680 4s 5d was spent on 'a rope + corne hooke to drawe up the upper turnepike with'? One

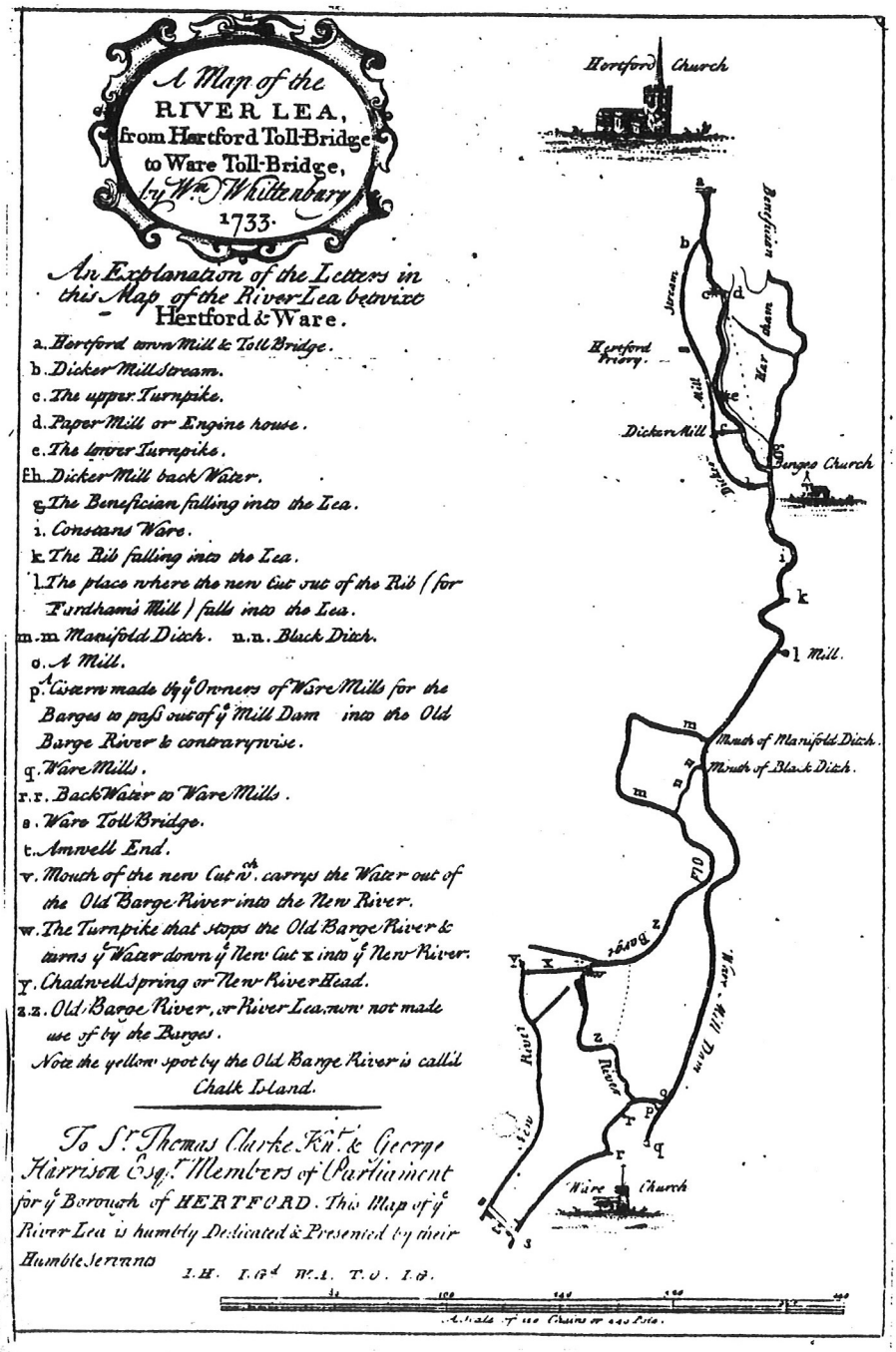


Fig. 3. The Lea from Hertford to Ware, William Whittenbury, 1733. Gough Hertford. 1. *By permission of the Bodleian Library.*

definite innovation during the 1730s was the use of 'Friction Wheels of Iron (and Iron Frames to the same) on which all the moving Parts . . . turns to ease its Motion' which was said to improve efficiency by about one third.[24]

These two turnpikes not only assisted navigation, they also controlled and manipulated the supply of water to and from Dicker mill. When the upper turnpike was shut water was diverted down the head stream of the mill, and when it was opened it provided a flash for the barges. In addition the waste gates at the mill and the lower turnpike could be operated in conjunction to provide further assistance to the bargemen if needed. Such were the benefits to Dicker mill that in 1657 the owner contributed £20 towards the cost of the turnpikes, and agreed to pay a rent of 10s a year thereafter. From about 1660 until 1720 the turnpikes were looked after by the miller at Dicker mill, either as the appointee of the Borough or as the tenant leasing the turnpikes. He was responsible for normal maintenance, but major rebuilding in the 1670s and 1690s was undertaken by the private initiative of Hertford townsmen, as the Borough refused to accept any continuing financial responsibility after 1660. In 1720 control of the turnpikes was transferred to the owners of Hertford waterworks, as had been promised in 1708 when these works were first set up. In the early 1730s the Borough had to repossess the waterworks and the turnpikes as the owners of the waterworks had gone bankrupt. The Borough did finance the subsequent rebuilding of the turnpikes but recouped their expenditure from the Lee Trustees in 1739. The Trustees and the Borough shared responsibility for the turnpikes thereafter. The turnpikes were no longer needed for navigation after 1767, as a new route was opened. The lower turnpike was taken down, but the upper turnpike was left standing to control the flow of water to the waterworks and to the new route.[25]

The Miller's Turnpike at Stanstead

When, after an absence of nearly 20 years, a Commission of Sewers set to work along the river in 1719 there were complaints about developments at Stanstead in the intervening period. The bargemen noted that the navigable channel had become so silted that for the previous 14 or 15 years they had been forced to use an alternative route down the head stream of Stanstead mills, through a turnpike at the head of another channel which led back to the river (see Fig. 4), paying the miller a toll of 1s for passing through his turnpike. This situation had arisen through the deliberate actions of the miller. He had thrown earth into the river, and had extended a point of land at the mouth of the head stream into the river channel so that more water was diverted to his mills. The bargemen had acquiesced in these developments but they were 'illegal', so the Commissioners decreed that the miller remove the encroachments so that the river channel could be used once more. The miller publicly consented, but either ignored the orders altogether or made the same encroachments soon afterwards, for by 1725 the bargemen were using his turnpike once more and did so until the early 1740s, when further attempts were made to re-open the river channel (see below). Of the construction of this turnpike nothing is known, except that it was always so described.[26]

Turnpikes, new built by the Lee Trustees in the early 1740s[27]

The Trustees of the Lee Navigation appointed by the Act of 1739 built three new turnpikes along the upper river, specifically to improve the navigation. The Act authorised one turnpike, between Ware pound lock and Ware Bridge, whilst the other two, at Stanstead and Broxbourne, were built under the authority of a general clause in the Act which gave them powers of 'the purchasing, building, or Hiring Locks . . . in such Manner as the said Trustees . . . shall direct'. The Act did not authorise the collection of tolls at these turnpikes. The turnpike at Ware, called Portobello Turnpike (see Fig. 1) was in operation by the spring of 1740, whilst that at Broxbourne, Carthagena Turnpike (see Fig. 5), was in use by November 1741. Both names were unofficial, but were obviously given to commemorate victories claimed in the War of Jenkin's Ear. By July 1743, when the turnpike at Stanstead came into operation, the war had petered out, and it was never known as other than Stanstead Turnpike (see Fig. 4). All three turnpikes were built by the surveyor appointed by the Lee Trustees, William Whittenbury.

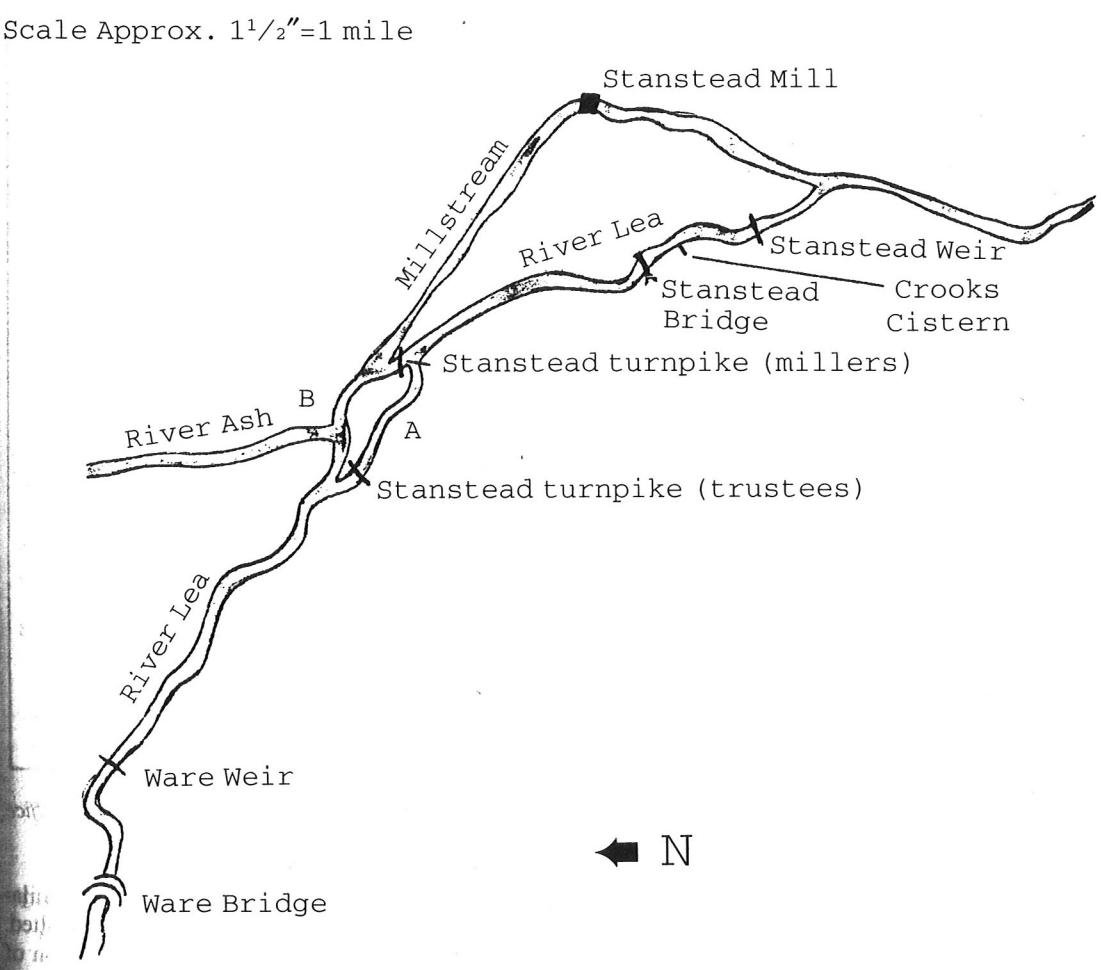


Fig. 4. The Lea through Stanstead.

The information minuted by the clerk to the Lee Trustees provides much information about these turnpikes. The layout of these turnpikes is reproduced in Fig. 6, and the original specifications for Carthagena Turnpike along with further information about the other turnpikes is given in the Appendix. All three had guillotine gates for the passage pier, operated by overhead rollers enclosed in a room on top of the turnpike. All three stood right across the navigable channel and were not linked to midstream islands as was the case with many fishing weirs. The turnpikes at Stanstead and Broxbourne had additional side gates to allow excess flood waters to pass downstream. Portobello Turnpike did not, as the navigable channel was narrower and this turnpike was normally left open, so allowing flood waters to pass down. Such turnpikes did not pose major technical problems, and were well within the competence of a skilled local carpenter and surveyor such as Whittenbury.

There was much local consultation about these turnpikes. Bargemen and local inhabitants met to view and decide the exact location of Portobello Turnpike, and after construction began there were

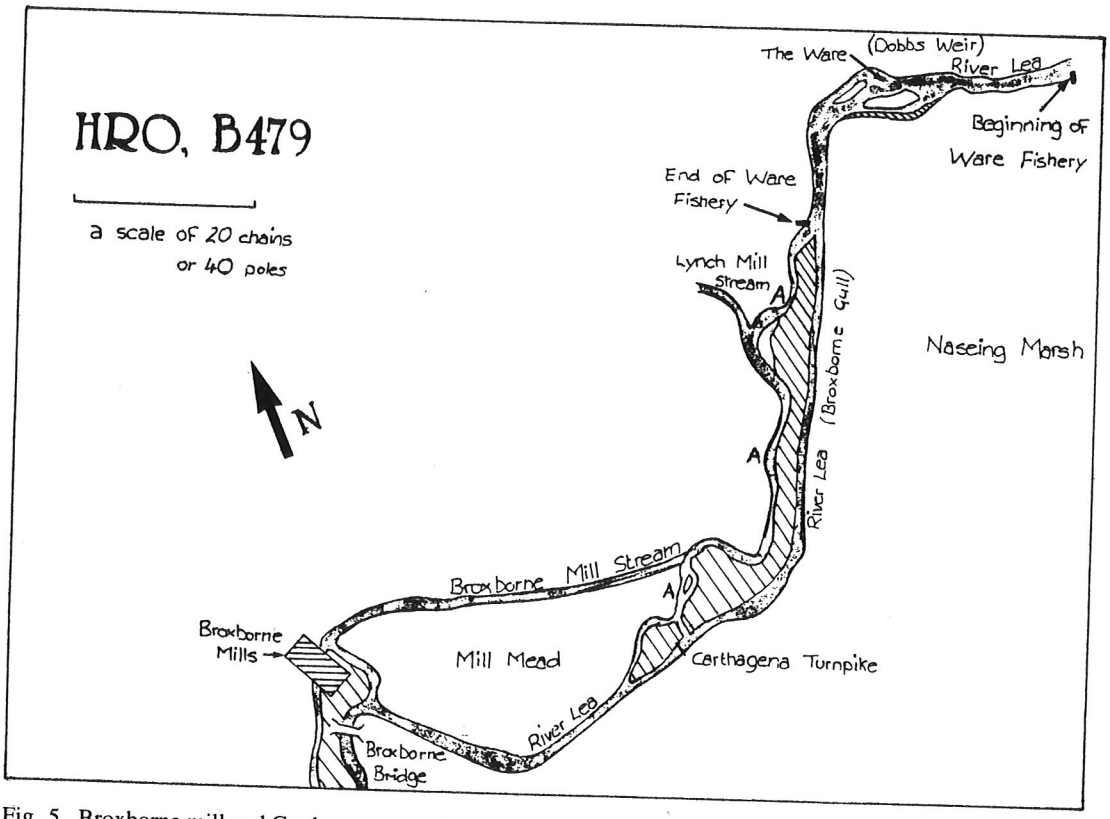


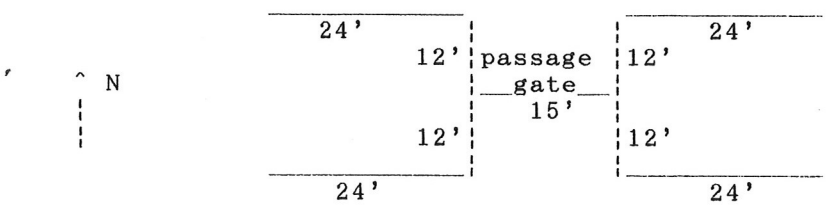
Fig. 5. Broxborne mill and Carthagena turnpike, Hertford Record Office B479. *Courtesy, Hertford Record Office.*

changes in the choice of navigable channel above the turnpike after further local representation. Similar meetings were held at Broxbourne, and from the first the miller at Broxbourne mills was consulted. Initial construction plans were changed substantially before work began, on the recommendation of Whittenbury, and further modifications were made after trials showed that the turnpike caused flooding above and that the force of the flash was washing away the banks below. After construction both these turnpikes were handed over to the care and control of the millers. Such a policy meant that the turnpikes were operated at no expense to the Trustees, and that the essential co-operation of the millers was obtained.

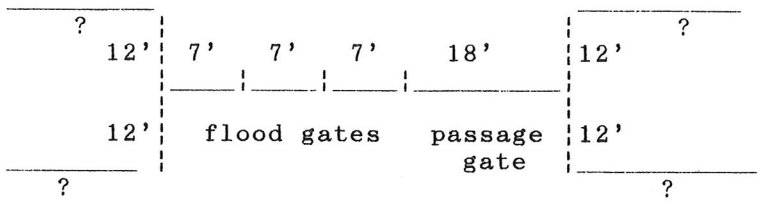
The operation of Carthagena Turnpike controlled the supply of water to Broxbourne mills, but to ensure that the miller provided the necessary assistance the Trustees issued precise instructions about the provision of flashes by the turnpike. For barges coming downstream the miller was instructed to leave the turnpike gates hung up for two hours after the barges had passed through and to open the mill back gates for the whole period that it took barges to pass down to Kings Weir a couple of miles downstream. For barges coming upstream the miller was instructed to open the turnpike when barges reached a point of land known as Cheshunt Mill Crooks just above Kings Weir. In return the miller was allowed a toll of 1s 3d from every barge that passed through the turnpike. The strict legal position was that this toll was not paid for the use of the turnpike, but was paid for the closing of the mill gates.

The turnpike at Stanstead was not handed over to the miller, Michael Pepper, after its construction, for both he and the owner of the mill, Thomas Feilde, opposed the plans to build it and

Portobello Turnpike

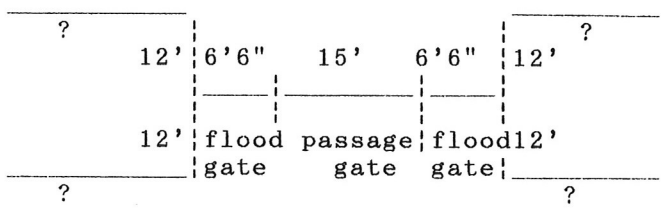


Carthagena Turnpike*



* The exact order of the flood and passage gates is assumed, it cannot be discerned from the source material.

Stanstead Turnpike



Dobbs Weir

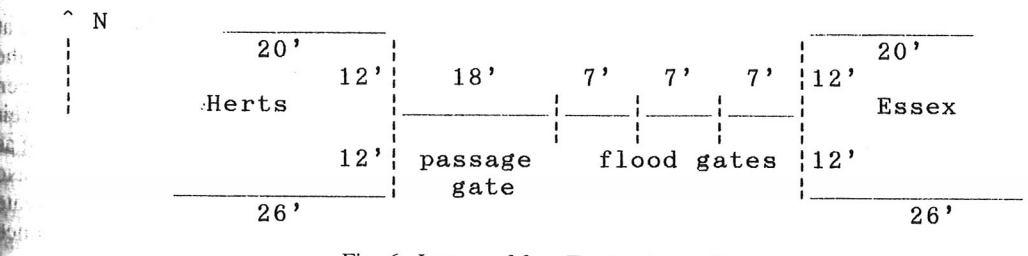


Fig. 6. Layout of four Trustees' turnpikes.

continued their opposition once it was built. Despite the instructions of the Commissioners of Sewers in 1719, the bargemen had been forced to continue to use the turnpike erected by the miller (see above), and Feilde and Pepper wished this state of affairs to continue, trying to persuade the Trustees to this effect when they first broached the problem of navigation at Stanstead. Initially the Trustees may have been prepared to accept this solution, but they received legal advice that such a change of route required an Act of Parliament, so they decreed that the traditional route be used once more, and that a turnpike be erected across the river just below the mouth of the head stream to Stanstead Mills (see Fig. 4). Such a

traditional solution must have been designed to obtain the co-operation of the miller, but this was not to be. Pepper and Feilde continued to oppose the plans, enjoying widespread support in the town of Stanstead. The disagreement over the new turnpike became the most contentious dispute faced by the Trustees, leading to court cases in the mid-1750s.

Feilde was himself a Trustee, and had attended meetings in the early 1740s when the problems at Stanstead had been first discussed. Thereafter he withdrew and it was not until 1762 that he attended once more. Pepper too mellowed with time, and in 1760 he helped scour and cleanse the lower tidal Lea. Had this accord been reached because the Trustees finally allowed them their way? The maps accompanying Smeaton's survey in 1766 show Stanstead Turnpike at that spot where the miller had erected his turnpike in the early years of the 18th century and not at the spot where the Trustees had erected their turnpike in 1743. Such a development is not minuted in the Trustees' records, but by the 1750s quorate meetings were infrequent and the quality of minute keeping had deteriorated, so this could explain the absence of such a minute. The only other explanation is that Smeaton had been lazy and merely copied the 1741 map on which his own 1766 and 1767 maps were based without properly noting the intervening changes. There is one case where such a change is not recorded, Constants Weir being reproduced as a weir by Smeaton instead of a turnpike, but the differences at Stanstead, in the situation of the two turnpikes, in the different routes involved, would have been such a major mistake that it is best to assume that Smeaton was correct, and that the Trustees had quietly dropped their initial stance and had allowed the miller to re-introduce the arrangements he favoured.

Fishing weirs converted to turnpikes.

After 1739 three fishing weirs were converted to turnpikes, two by the Lee Trustees, and one by an undocumented private initiative. In June 1746 the Trustees purchased Dobbs Weir, a fishing weir a mile above Carthagena Turnpike (see Fig. 5). They immediately repaired it, and in November 1748, at the request of the bargemen, reduced the toll from 1s 6d every time a flash was required to 6d for a return journey every time a barge passed through. In 1758 the weir needed rebuilding and it was decided to make it into a turnpike rather than rebuild it in the traditional manner (see the Appendix).[28] In 1750 the Borough of Hertford purchased Constants Weir, a fishing weir about half a mile below the two Hertford turnpikes (see Fig. 3). With financial assistance from the Trustees they erected a turnpike in its place, for £200, continuing to charge the 1s toll that had been payable previously, but on every occasion that a barge passed through not just when a flash was requested. No detail of the construction of this turnpike was minuted.[29]

Given the evidence about the specific nature of the terms used, then it seems that a fishing weir at Walthamstow was also converted into a turnpike. This weir was part of a fishery and ferry within the manor of Walthamstow High Hall. The ferry, which preceeded the weir, was an important link between Tottenham and Walthamstow. On the 1741 map of the Lea the weir is described as 'Tottenham Weir Publick House Ferry and toll bridge', yet the 1766 map accompanying Smeaton's survey describes it as Hilliards Turnpike, Hilliard (Hellyer) being the tenant who had taken over the property in 1745. No other details of this alteration have been discovered, but this rebuilding must have been the private initiative of the owner, presumably with the private agreement of the bargemen and the tacit acceptance of the Trustees.[30]

FISHING WEIRS

Ever since the early mediaeval period the non-tidal Lea was split into a series of precisely demarcated private fisheries usually belonging to riparian manors. By custom owners were allowed to erect weirs within the boundaries of their fisheries, to create pools for fish to congregate in, and to provide a fixture in which and on which to attach fishing implements such as eel traps or grig-wheels. Since the Lea below Ware was a navigable river, part of the King's Highway, these weirs, by custom and by law, had to be built so that barges could pass through or by them, for it was illegal for fishing weirs to

prevent or hamper navigation along a navigable river.[31] The legal necessity that weirs had to allow the passage of barges was along the Lea turned to the advantage of both the bargemen and the owners of the fisheries. At numerous points along the river these weirs provided pens and flashes of water to assist the passage of the barges, whilst in return owners of the weirs and their tenants were entitled to collect a toll from the bargemen for the assistance they provided.

During the 17th and 18th centuries the income from such tolls was a far more valuable property than any income from fishing. In 1767 the income from tolls at two fisheries within the manor of Sewardstone came to £60–£70 and £50 compared to £17 and £10 from fishing. At one of these fisheries the tenant received an additional £20 from tenants of the manor for flooding their lands. In 1581 a fishery within the manor of Netherhall was let at 30s a year when there was no weir, but at £5 a year in 1616 when a weir had been erected. A substantial profit could be made from tolls. In 1767 the tenant at Flanders Weir in Chingford stated that he had received £57 11s from tolls in a year, whilst his expences had been £8 for maintenance and £9 11s on wages for a man to attend the weir. Part of such profits had to be put towards frequent rebuilding; a weir in Sewardstone had cost £80 to rebuild in 1755.[32]

There is sufficient evidence to suggest that the normal custom was that weirs were shut at night to allow fishermen to operate. In 1719 a lease to a weir at Sewardstone specified that the weir was not to be stopped up for fishing 'save only in darke nights'. In 1743 one fishermen noted that he had caught eels to the value of £3 when he had set his eel leaps 'In the Darks before and after Lammas'. In 1767 it was noted that Waltons Weir was used to supply water to his gunpowder manufactory, but as it was a fishing weir, it could only be penned up at night. It was added that it was not known why. After canalisation these customs remained in force at fisheries along those sections of the traditional river which were no longer used for navigation. A 1783 map of Waltham Abbey Gunpowder mills noted 'Mr Waltons Eel Wear where he has a right to stop the Water and fish for Eels from Sun set to Sun rise'.[33]

When weirs remained open during the daytime, barges could pass through unaided if there was a sufficient depth of water, but if there was not, bargemen travelling downstream could request that the weir be shut to allow the build up of an increased depth of water above the weir and then opened to provide a flash to carry them further downstream. Barges travelling upstream were either empty or carried much lighter loads, and so required assistance less often, but if they did the weirs could be manipulated to help them too, it just took longer. It was only if the weir was shut at the request of the bargemen that tolls were paid, as was emphasised by the Attorney General in 1749:[34]

> There are upon the said River Lee several very ancient Fishing Weirs at which upon Request in Time of low Water Boards have been laid to raise the Water for the better Passage of Barges and for which the Bargeowners have always paid a Toll or Acknowledgement to the Weir Keepers some Times more and some Times less But at all Times when there has been Plenty of Water the Barges have passed thro' the said Weirs without paying any Toll or Acknowledgment or having any Demand made upon Them for the Same no Boards being laid at such Times.

This may have been the exact legal position, but in practice it may have been that tolls were normally paid at all weirs, for the downward journey at least. This was certainly the case in 1725 when a list of tolls survives for a three day journey down river. Such would be a sensible compromise to retain the co-operation of the fishermen who could easily enforce such a situation, by throwing earth into the river to assist the growth of shoals above and below the weirs, by surreptitiously syphoning water out of the river, or by manipulating the weir to provide less assistance than they should. The very importance of toll income to the fishermen encouraged such practices, but it also restrained them from refusing to co-operate at all, as was sometimes the case with the millers.

It is probably impossible to establish the exact numbers of fishing weirs that were erected when the flash lock navigation was re-introduced during the late 1590s, certainly no more than ten, and probably fewer. Many of the weirs along the upper river between Hertford and Waltham must have been erected at this date,[35] but none along the lower river below Waltham. It was not until the last decades of the 17th century and the first of the 18th that weirs first appeared along the lower river, as owners of

fisheries realised that there was a profit to be made from tolls. In 1721 bargemen complained to Parliament about several new weirs along the river, whilst in 1737 they stated that once they could pass from Waltham to Old Ford without the benefit of flashes but that this was no longer possible since the erection of the weirs.[36] By 1767 there were fifteen weirs along the river, three of which had been converted to turnpikes in the previous twenty years. In addition there were three or four fisheries along the navigable river that did not possess a weir, rents for which were far lower as a consequence.

Additional flashes of water to assist the navigation could also be obtained from fisheries in adjacent streams. A map of the manor of Langridge near Waltham shows a fishery along a stream falling into the Lea. A weir along this stream could be manipulated to provide a flash in the navigable channel if such assistance was required.[37] A similar situation existed at a fishery known as Rammey Reach in Enfield.[38]

Of the construction of these fishing weirs little has been discovered. Such weirs probably dammed the whole river, but had to have some form of removeable gates to allow the passage of flood waters and a gate at least 18 feet wide to allow the passage of barges. Such gates probably had flash boards that were inserted and removed manually. For want of evidence little else can be added. In 1668 there is a reference to 'Boards, Fludgates' within a Waltham fishery, and in 1755 William Newman promised to lay out at least £80 on repairs when he took out a new lease on a weir in Sewardstone, the lease specifying that within six months he would put down 23 new piles, 5 capsels [capsules?], 6 brasen [braces?], land keys from the weir to the bank, 123 feet wharfing above and below the weir, and a new apron using 460 feet of timber.[39]

What also seems probable from a study of the 1st edition of the Ordnance Survey 25 inch to 1 mile series (surveyed in the 1860s or 1870s) is that several fishing weirs had stood at sites where there were midstream islands. By this date no fishing weirs remained, for the sport of angling had replaced the commercial fisheries of the earlier centuries, but the frequent mapping of midstream islands and the presence of narrow channels or gutters in the vicinity of what had once been weir sites does suggest that the navigation had once been concentrated into a channel or gutter across which stood the passage gate of the weir whilst flood gates dammed up the rest of the stream. The best examples of midstream islands with narrow gutters to one side for the passage of barges on these maps are at Feildes Weir, Archers Weir, Kings Weir, Flanders Weir, and Cooks Weir (see Kings Weir in Fig. 7). Similar circumstances were found at Higham Hill Ferry and Hellyers Ferry. In both cases the ferry was below the site of the weir to allow the river to be forded when the weirs were shut. One problem with such supposition is that the same OS 25 inch survey shows similar midstream islands associated with the site where formerly Dobbs Weir had stood, yet other evidence (see above) suggests that the weir and turnpike stretched across the river and were not attached to any islands. The use of gutters at fishing weirs remains a hypothesis, contemporary evidence would be welcome.[40]

MILLS

The situation of the Lea close to London meant that the London market dominated not only the development of the navigation but also that of the mills. Throughout this period mills along the upper stretches of the navigable river, from Hertford to Waltham and Enfield, produced meal for the London bakers as well as the local populace, whilst mills along the lower stretches of the non-tidal river, from Waltham and Enfield down to Hackney, were converted from corn mills to a variety of industrial uses. In 1670 Murray and Wren emphasised that the mills were as important to London as the navigation, and that there had been an important expansion in their capacity. This expansion was to continue.

A feature of mills along the Lea during this period was that most did not have the right to own a lock in the navigable channel. This had not been the case during the mediaeval period,[41] so presumably it was a decision taken when the flash lock navigation was restored in the late 1590s. If so, no evidence of such a decision has been found, nor any evidence that such a decision was challenged during the 17th or 18th centuries. Some mills did utilise a lock in the navigable channel, but this was the result of

Fig. 7. Ki
the British

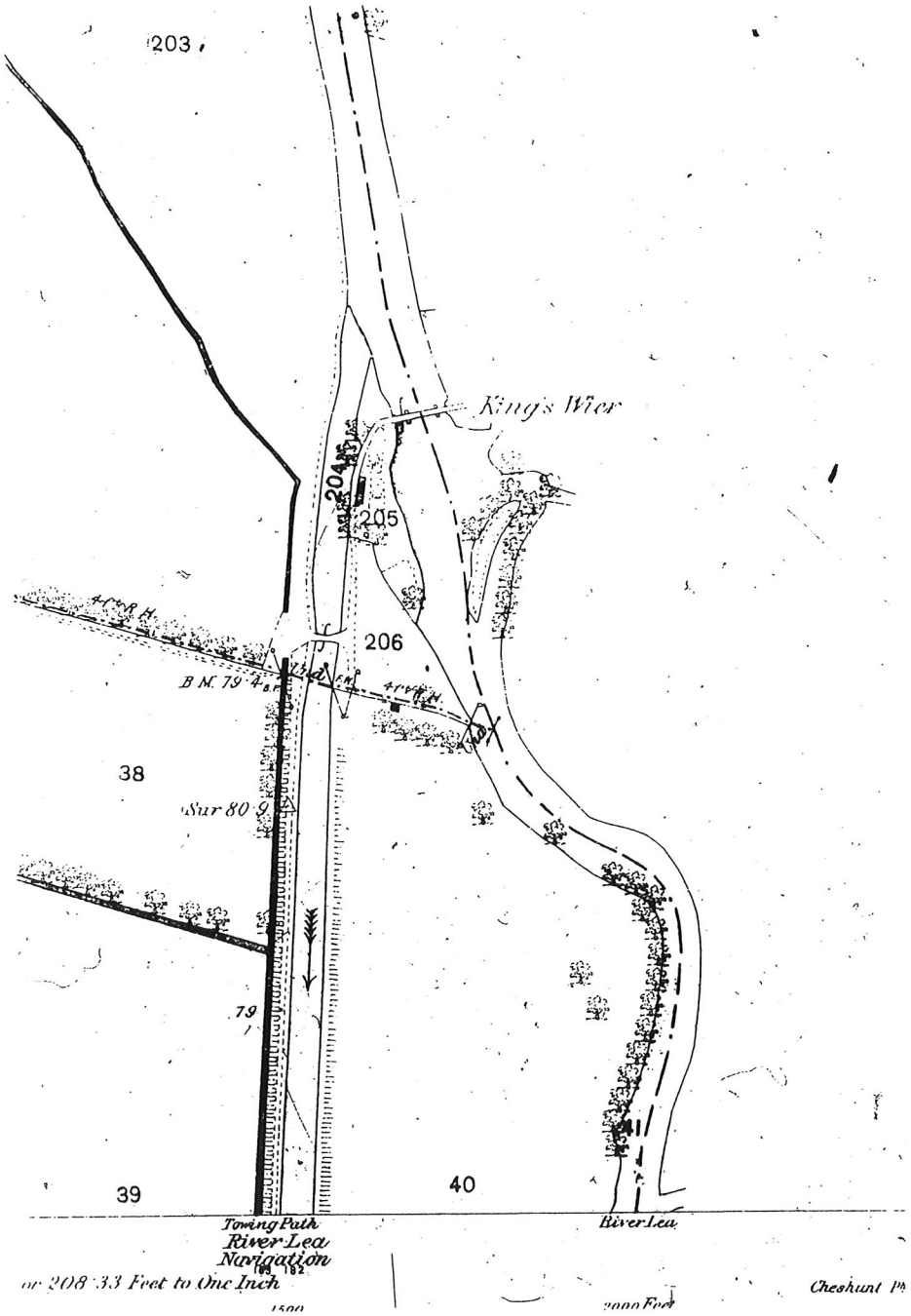


Fig. 7. King's Weir, Ordnance Survey 25 in to 1 mile, Hertfordshire 1st series, xxxvii. 13. *By permission of the British Library.*

unusual circumstances. As a result of an improvement scheme a pound lock built next to Ware mills became the property of its owner; as a result of an illegal encroachment the miller at Stanstead mills forced bargemen to use a turnpike he owned; whilst Waltham Turnpike acted as a lock controlling the supply of water to Waltham Abbey corn mills, but was often not let to the miller, and was treated as a separate property by its owners. Other millers benefitted from locks in the navigable channel which were not the property of the mill. Several turnpikes were put under the control of a miller, and there are several examples of millers leasing nearby fisheries in order to use the weirs to supply their mills.[42]

Assistance from mills was extremely important to the navigation, especially during dry weather, when pens and flashes from weirs and turnpikes were not sufficient. In theory assistance from mills should have been required less frequently than from the weirs and turnpikes, but there was a tendency for millers to take steps to assure that the bargemen had to ask for assistance as frequently. In 1670 Murray and Wren noted

> We find the natural inconveniences of the River made much worse by the practice of those who own the Mills; for tho' Flashes from the Mills be in some places necessary, for which the Bargemen pay, yet for the most part the Millers by deepening and enlarging their byestreams that bring water to the Mill, draw off from the main River very much more than they need, that so they may sell the same water to the Bargemen again and help those for money whom they have first themselves disabled. It is certain that some of the Mills do so command the Streams, that they can lay a whole fleet of Barges on ground upon the adjoining sharps and help them off again upon Composition.

The Commissioners of Sewers did try to regulate the situation. In response to complaints from bargemen they tried to maintain customary rights and practices, with regard to the width of the mouth of the head streams, with regard to the depth of millstreams compared to the river, with regard to the rules governing the shutting down of mills or the manipulation of locks in the millstream to provide an increased pen in the navigable channel above the head stream or to provide a flash from the tail stream.

These arrangements would be different for each mill. Little evidence of the exact arrangements remains, but for Broxbourne mills (see Fig. 5) before the construction of Carthagena Turnpike the following practices applied:[43]

> the Navigation is difficult to Barges heavy laden, especially in a dry season, the Water being then very shallow, and therefore time out of mind they have had Flashes from three several Locks upon the Mill Stream; the first of these called the little Lock is built at the upper end of the mill stream, the other lower . . . the great Lock, the third is near the mill & is called the back Gates. When the Barges require water of the miller they have constantly paid him three shillings for drawing these three gates, the uppermost of which seems to have been built for the sole service of the navigation and when lately decayed was rebuilt at the desire of the Navigators by the Tenant of the said Mills.

At Cheshunt and Enfield mills there were locks across the mouth of the head stream. When barges approached these locks were closed to concentrate all available water in the navigable channel, and the lock was only re-opened after the barges had passed some way downstream. At Hertford waterworks the water wheel was shut down every time a flash was required, and remained shut for a whole hour. All mills could be closed down if water was so short that it was deemed necessary, and they could remain shut down for some time, for however long it took for a sufficient pen of water to build up. The millers were entitled to tolls as recompence for shutting down their mills, but too persistent interruption would have been too damaging. Additional arrangements were customary to restrict such a possibility. Before 1713 the miller at Enfield Mills was allowed a toll of 1s for closing Enfield Lock on Tuesdays, Thursdays and Saturdays, but 2s on Mondays, Wednesdays and Fridays. In 1767 the arrangements at Waltham Abbey powder mills were that 'the Stated Days for this Supply of Water are Wednesdays and Sundays, but in short Water Times, Sundays only'.[44]

Such restrictions were there to try and ensure the co-operation of the miller, by confining any interruptions to predetermined days, but it did mean that the navigation was further constrained unless the bargemen were prepared to negotiate a higher rate on the spot. It is not surprising that most reports

of major hold-ups are at mills, or that several millers were able to make illegal encroachments which were then allowed to stand. The potential for conflict between the millers and the bargemen was great.

Of the actual contrivances with which mills provided pens and flashes, little has been discovered. The only reference found is that in 1708, an inventory of a powder works at Sewardstone Mills notes 'In the Water two Boates and the Gullies for drawing Water in the time of a Flash', whilst in an old stamping mill on the site there were 'wheeles Gulley Iron Crows for drawing the Water'. A subsequent inventory in 1713 described the first item as 'One boate & an Hitcher'.[45]

ACKNOWLEDGEMENTS

I should like to thank Dr. Denis Smith for his help with the preparation of this paper, but more particularly for the fact that it was at his night classes on Industrial Archaeology at Walthamstow that I first grew interested in the river Lea, and Professor A. W. Skempton for bringing Whittenbury's map of 1733 which is reproduced as Fig. 3 to my attention.

NOTES AND REFERENCES

Abbreviations used:

B.H.R. Borough of Hertford Records
B.L. British Library
C.L.R.O. City of London Record Office
E.R.O. Essex Record Office
G.L.R.O. Greater London Record Office
H.R.O. Hertford Record Office
N.R.O. Northamptonshire Record Office
P.R.O. Public Record Office

1. There is some debate about the proper spelling of the name of the river. I prefer Lea, and have used this spelling except when it is necessary to use Lee for legal reasons. Thus the river Lea, but the Lee Trustees, for that was the spelling adopted in Acts of Parliament in 1739 and 1767.
   It should be born in mind that during the period under discussion the river was as often known as Ware river as the river Lea.
2. *Commons Journals*, vol. 31,pp.308–11.
3. J. G. L. Burnby, M. Parker, *The Navigation of the River Lee (1190–1790)*, Edmonton Hundred Historical Society, Occasional Papers N.S.no.36 (1978); *Victoria County History, Hertfordshire*, vol. 3,pp.380, 383, 499, vol. 4,pp.173–4.
4. K. Fairclough, 'A successful Elizabethan project: the River Lea improvement scheme,' *Journal of Transport History*, 3rd ser., vol. 11 no.2 (September 1990), pp.54–65; K. Fairclough, 'The Waltham Pound Lock', *History of Technology*, vol. 4 (1979), pp.31–44. Please note that Waltham pound lock was built during the summer/autumn of 1576 not the spring/summer of 1577 as stated in the last article. Another addition, the gates of Waltham pound lock were opened by a mechanism known as a trundle, for one document notes that 4lb of soap was purchased 'for the trundles Cogges & gates': P.R.O., SP 13/27 no.6
5. Reports of the late John Smeaton (4 vol., London, 1812–14), vol. 2, pp.155–63. Maps accompanying Smeaton's survey show 21 flash locks. This discrepancy has not been accounted for: B.L., 1240 (18); E.R.O., D/DU 567/2.
6. K. Fairclough, 'The River Lea before 1767: an adequate flash lock navigation', *Journal of Transport History*, 3rd ser., vol. 10 no.2 (September 1989), pp.128–44.
7. M. J. Lewis, W. N. Slatcher, P. N. Jarvis, 'Flashlocks on English Waterways', *Industrial Archeology*, vol. 6 (1969), pp.209–53; ibid, 'Flashlocks: an Addendum', *Industrial Archeology*, vol. 7 (1970), pp.190–94. See also R. H. Clark, 'The Staunches and Navigation of the Little Ouse River', *Transactions of the Newcomen Society*, vol. 30 (1955–57), pp.207–19.
8. H.R.O., B.H.R., vol. 39 fos.61–62

9. H.R.O., B.H.R., vol. 20 fos.394,395,396–8, vol. 39 fo.21. For a discussion of this municipal improvement scheme: Fairclough, 'The River Lea 1571–1767: a river navigation prior to canalisation' (unpublished PhD. thesis, University of London, 1986), pp.161–69.
10. 11 Geo II, c.14PR; 12 Geo 11, c.32; Fairclough, 'The River Lea 1571–1767',pp.291–307.
11. Henry Mill was surveyor to the Company from 1720 to 1762. For brief detail of his career: *Dictionary of National Biography*; H. W. Dickinson, **Water Supply of Greater London** (London,1954), p.40.
12. G.L.R.O., Acc 2558/NR13/10/2–3,5–10, Acc 2558/NR13/7, Folder 4, sheet 276; P.R.O., RAIL 845/1, Trustees, 3 October 1739. The damaged minute reads 'useing the Materials now of . . . two foot long, that is, 14 foot longer . . . that a barge may pass with the rud . . . '. The dots mark where the rest of the line is missing
13. K. Fairclough, 'Hackney Waterworks', *East London Record*, vol. 7 (1985), pp.7–21. In this article I mistakenly situate an earlier waterworks at Hackney (c.1707-c.1723) above Lea Bridge, it was in fact on the same site as the venture started in 1760.
14. G.L.R.O., Acc 2558/NR13/188, Robert Mylne's Commonplace Book, part, questions put to Smeaton by Mylne when former was a parliamentary witness in favour of the canalisation scheme in 1767.
15. H.R.O., B.H.R., vol. 20 fo.394, vol. 39 fo.21; P.R.O., C6 263/25. It can be noted that pound locks built on the Thames between Oxford and Burcot in the early 17th century were called turnpikes: T. S. Willan, *River Navigation in England 1600–1750* (Manchester,1964 ed.), pp.89–92; M. Prior, *Fisher Row: Fishermen, Bargemen & Canal Boatmen in Oxford 1500–1900* (Clarendon Press,Oxford,1982), p.122.
16. P.R.O., RAIL 845/2, Trustees, 27 February 1758
17. G.L.R.O., Acc 2558/NR13/188, Robert Mylne's Commonplace Book, part, survey by Sir Christopher Wren. For a complete copy of this report and a discussion of it: Fairclough, 'A survey of the river Lea by Sir Christopher Wren', *Journal of the Railway and Canal Historical Society*, vol.31 (1993), pp.10–17, 107–11.
18. P.R.O., PC 2/59, 11 September 1667, PC 2/60, 16 October 1667, 28 August 1669, PC 2/61, 22 September 1669; B.L., *Extracts from the Books of the Mayor and Aldermen of Hertford . . . relating to the Navigation on the River Lea between Hertford and Ware* (London,1734), pp.21–22
19. P.R.O., C10 368/3; N.R.O., Additional Wake Papers 1965/129 Book D; Smeaton, op cit, vol. 1,pp.282–83
20. B.L., Add Mss 5506, fos.23–24
21. For a discussion of these disputes over the toll: Fairclough, 'The River Lea 1571–1767',pp.201–10
22. 7 Geo III, c.51; Commons Journals, vol. 31,pp.308–11; Smeaton, op cit, vol. 1,pp.279–81.
23. Bodleian Library, Gough, Hertford Papers, 1 (12).
24. H.R.O., B.H.R., vol. 20 fos.396–98, vol. 48 fo.54; P.R.O., RAIL 845/1, Trustees, 2 January 1740
25. Fairclough, 'The River Lea 1571–1767',pp.161–71,180–86, 332–37.
26. London Borough of Enfield Library Services, 'River Lee, Book of Sewers in the Years 1719 & 1720' (hereafter Enfield), Court of Sewers, 23 September 1719, 15 October 1719, 6 November 1719, 6 April 1720; H.R.O., B190; G.L.R.O., Acc 2558/MW/C/15/354; P.R.O., RAIL 845/53, Court of Sewers, 10 June 1741, 1 July 1741
27. For fuller discussion of the events noted in this section: Fairclough, 'The River Lea 1571–1767',pp.332–33,345–60.
28. P.R.O., RAIL 845/1, Trustees, 6 June 1746, 7 July 1746, 4 August 1746, 3 September 1746, 10 October 1746, 17 October 1748, 23 November 1748, RAIL 845/53, Court of Sewers, 6 June 1746, 7 July 1746
29. H.R.O., B.H.R., vol. 39 fos.73–77, vol. 38 fos.510–11; P.R.O., RAIL 845/1, Trustees, 26 September 1750.
30. B.L., Maps, K. TOP VI.6.II; E.R.O., D/DU 567/2; P.R.O., RAIL 845/3, Trustees, March 17 1767. For further details of this ferry and fishery: K. Fairclough, 'Mills and Ferries along the lower Lea', **Essex Archeology and History**, vol. 23 (1992), pp.57–66.
31. For a discussion of early legislation pertaining to fishing weirs and navigation: G. Boyes, 'The Legislative History of River Navigation and Canals, 1275–1603', *Journal of the Railway and Canal Historical Society*, vol. 29 (1987–89), pp.65–78,136. For a discusssion of medieval fisheries: M. Aston, ed., *Medieval Fish, Fisheries and Fishponds in England* (2 vol., B.A.R. no.182, Oxford, 1982).
32. E.R.O., D/DQT 125, D/DB T74, D/DHt T317/1; P.R.O., RAIL 845/3, Trustees, 1 April 1767

33. Enfield, Court of Sewers, 15 October 1719; P.R.O., RAIL 845/53, Court of Sewers, 14 September 1743; Commons Journals, vol. 31,p.308; P.R.O., MR593
34. P.R.O., RAIL 845/2, Trustees, 14 November 1749
35. Evidence of definite existence at the turn of the century has been found for only three weirs. In 1616 a weir in the manor of Netherhall (later Archers Weir) was described as 'the newe Ware'; whilst in 1650 it was stated that the fishing and weirs (two) within the manor of Sewardstone had been let for the previous 50 years at £10 a year. In addition a note was made, probably in 1602, ordering a search of the manorial records for any mention of a weir called Dobbs Weir which does suggest that a weir had been erected or was under discussion at this date: E.R.O., D/DB T74, D/DAc 370; Hatfield House, General 65/4
36. **Commons Journals**, vol. 19,pp.477–78, vol. 22,pp.825–26.
37. E.R.O., D/DC 27/317A
38. G.L.R.O., Acc 801/333–39
39. P.R.O., C8 182/8; E.R.O., D/DHt T317/1
40. B.L., Ordnance Survey 25" to 1 mile (Microfiche), Herts, xxxvii.6, xxxvii.5, xxxvii.13, Middlesex, vii.16, xii.4, Essex, lxv.5
41. C.L.R.O., Harte Mss, fos.153–63, verdict of a jury of Sewers, 10 December 1482
42. For at 70 or 80 years before 1767 Ware Weir was always let to the miller at Ware even though it was about half a mile further downstream. In 1736 John Walton, a partner in Waltham Abbey powder mills, took out a lease on a local weir. In 1738 John Edridge of Sewardstone, miller and weir keeper, was in prison for debt. In 1751 Peter Donn, the miller at Enfield Mills, was tenant of four adjacent fisheries: H.R.O., 82951; 11 Geo II, c.14PR; Treasury Solicitor, Taunton, 1136/50; *London Gazette* no.7692; P.R.O., RAIL 845/2, Trustees, 5 August 1751
43. H.R.O., B1110
44. Enfield, Court of Sewers, 23 September 1719; *Commons Journals*, vol. 31,p.308.
45. G.L.R.O., Acc 1953, Deeds & Papers '42', Indenture 27 December 1708, Indenture 1 and 2 December 1713

APPENDIX

Construction of Turnpikes

Carthagena Turnpike

Details of construction extracted from the report of William Whittenbury, surveyor to the Lee Trustees;

> Turnpike ought to be of the clear Wydth of thirty four Feet and to Consist of four Gates (that is to Say) One Gate thereof for Boats and Barges to pass through of fourteen Feet clear and the three other of the said Gates of Six Feet eight Inches clear each And that the Cill of the said Turnpike should lye one Foot three Inches below the Surface of the Back Water of the said Turnpike And that the Gates thereof should pen Four feet Six Inches above the Cill thereof That the Apron of the said Turnpike should be twenty four Feet long (That is to Say) twelve Feet above and twelve Feet below the said Gates and framed and Single planked with plank of two Inches and an half thick and Back piled at the Upper lower and Middle Cills of the said Turnpike That the Side thereof should be of the same Length with the said Aprons and framed and double planked with two Inch planks and rammed between with Earth And that the four Wings running to the Banks of the said River should be piled and planked on one Side with two Inch Planks That there should be a Wheel and Rolls to draw up the Gates of the said Turnpike and Suitable Iron Work and Land Keys to Support the whole with Friction Wheels of Iron in Iron frames running on Centers of tempered Steel for the moving Parts of the Increased Powers of the Great Wheel to move on and ease its Motion That an House of Fifteen feet long Eleven Feet wide and ten Feet high boarded and painted or tarred and tyled should be built to Cover the Wheel of the Great Gate from the Weather and to prevent its being shut or drawn by Passengers That the Principal Posts and Cill of the Great Gate should be Fourteen Inches and an half Square, The Posts to the Small Gates and to the Head and Tale Cills twelve Inches and an half Square, The Copings canted and twelve Inches and an half wide, The Studs and piles Six Inches and an half Square, The Sand Cills and Corner Posts nine Inches and an half Square, The Diameter of the Roll to the Great Gate ten Inches and an half

in the least Part thereof The Needles Canted and nine Inches and an half wide The Joyces Six Inches and an half Square The large Flash board five Inches and an half thick And the Small Flash Boards three Inches and an half thick

Unfortunately this specification does not detail the layout of the various gates, so it is not known whether the passage gate was at one end or in between the three flood gates.

Other turnpikes

The details for the Portobello and Stanstead Turnpikes were almost identical except for some small variations in the size of wood used for the various parts, and some variation in the number and mode of operation of the flood gates (see Fig. 6). The contract for the construction of Portobello Turnpike specified that the 'Iron Work to the said Turnpike with Friction Wheels of Iron (and Iron Frames to the same) on which the moving Parts of the said Turnpike turns to ease its Motions Which by an Experiment made on the New Turnpike already sett upon the said Stream will make it draw easier by one third'. This experiment had been first tried out on the turnpikes at Hertford when they were rebuilt during the 1730s, and it seems likely that all the turnpikes built by the Trustees had similar wheels and iron work. At Portobello Turnpike the room to contain and protect the wheels was 10 feet high, 15 feet long, and 7 feet broad, and was made of feather edged deal boards and a tiled roof. Oak was specified for most of the woodwork, but elm for the sills, joists, and back piling planks. When finished the turnpike was to be painted, pitched or tarred. The apron of this turnpike was three feet below the surface. Since the channel at Ware was narrow, and because this particular turnpike was to be normally left open, there were no flood gates.

The turnpike at Stanstead was similar to that at Broxbourne, except that there were only two flood gates rather than three. One innovation was that all three gates were operated by the same housed wheel, to prevent the mis-use of the unhoused smaller wheels over the flood gates that had been experienced at Broxbourne. Another was that in 1746 a lodging room with a chimney was built on top of the turnpike so that the keeper could attend on a more regular basis, and thus better prevent bargemen breaking open and using the turnpike at times they should not. When Dobbs Weir was rebuilt as a turnpike in 1758 two of the three flood gates were opened by wheels, but the other, on the Essex bank, had flashboards. The passage pier was on the Hertfordshire bank, and yellow fir timber was used for this gate rather than oak. The flood gates were still made of oak. Elm was still specified for the same parts as earlier, but an alternative wood, white willow, was allowed if this was feasible. An innovation at Dobbs Weir Turnpike was that a bridge was built specifically for the benefit of tow horses.

When Whittenbury obtained the contract for Portobello Turnpike the Trustees had rejected a more expensive tender of £390 from John Kirby, a Hertford bricklayer. His particular plans had included the use of brick for the side walls, wings, and apron. There was also a rejected tender for Stanstead Turnpike, from Andrew Spellar of Hunsdon, carpenter, who estimated that it would cost £509 19 3. His rejected tender does not suggest that he envisaged any major differences from that accepted, it was to be built primarily of wood, but his tender does indicate that labour costs were by far the largest single item (£160), and that the 'Great Wheel and frame, Rope and Leavers for drawing the same' would cost £16.

REFERENCES

Portobello Turnpike, P.R.O., RAIL 845/1, Trustees, 2 January 1740; Stanstead Turnpike, ibid, 1 December 1742, 25 February 1743; Carthagena Turnpike, ibid, 3 August 1741; Dobbs Weir Turnpike, P.R.O., RAIL 845/2, Trustees, 17 April 1758.