

Power at Lower Redbrook on Wye in the Early 19th Century

DG Tucker

The leat

It is perhaps somewhat unusual for a stream which had provided power for a number of mills and industrial enterprises in one valley to be diverted before it reaches its mouth to provide power in another valley. This, however, is what was done last century to the stream at Upper Redbrook (Parish of Newland, Glos., and about 3 miles below Monmouth.) A leat was constructed to take the water of the Upper Redbrook stream (which Hart ⁽¹⁾ calls the Swan Brook) from just below the tramway incline, along the hillside to Lower Redbrook, where an aqueduct on piers conducted it to the Rolling Mills water-wheel of the Lower Tinplate Works. After providing power there, it discharged into the River Wye, jointly with the Valley Brook, some 500 yards below its original mouth.

This leat is mentioned by Dr Cyril Hart in his new book ⁽²⁾, and shown in two diagrammatic maps which he reproduces, one a bird's-eye view by Gregg ⁽³⁾ dated 1848 and one of his own ⁽⁴⁾. In view of the generally high quality and scholarly nature of this fine book it seems a little ungracious to criticise adversely, but it is to be feared that in this particular matter Dr Hart has made some errors. To correct these and discuss the leat more fully is our present purpose.

Although Dr Hart is vague about the date ("Around this period"), Rhys Jenkins ⁽⁵⁾ is quite specific: "... in 1824 an additional supply of water was brought in from the stream passing through Upper Redbrook." This date is confirmed by legal documents ⁽⁶⁾. Dr Hart states the cross section of the leat (or "culvert") to be "about 3 ft x 3 ft", but

as the leat still remains over some of its length and is quite accessible behind the church, it can readily be measured and is found to be about 24 in wide and 20 in deep. It is possible it is of a different size in the covered portions; a document of 1827 ⁽⁷⁾ states that at the upper end the culvert is "round", and that there is a square culvert next to "the wood Troughing supported by wood pillars which conveys the water into the Penstock for supplying the Water-Wheel." The square culvert probably extended from French Lane to the aqueduct. He says it was built to bring water "to the first pond above the Lower Tinplate Works." However, both Gregg's map ⁽⁸⁾ and Dr Hart's own map show the leat running into the Tinplate Works itself. Gregg's map more specifically shows the leat running into the Rolling Mill building, against which he has written "LARGE WATER WHEEL for turning Rolling Mills." Further confirmation of this is obtained from the document of 1827 quoted above and from an undated map ⁽⁹⁾ (probably of 1828) which shows both this leat and the one from the pond on the Valley Brook just above the Tinplate Works, entering a building in the Works with a clear indication of a water-wheel there. And by way of good measure there is also extant a layout drawing ⁽¹⁰⁾ of the Works - again undated (but clearly after 1848 as it shows a good deal of development as compared with Gregg's map) - which clearly labels a "Wheel" in the rolling mill building. However, the leat must have been diverted into the pond itself at a later date, for in a document of 1933 ⁽¹¹⁾ we read that "there was a culvert from Upper Redbrook running right into the Works Pond of the Redbrook Company."

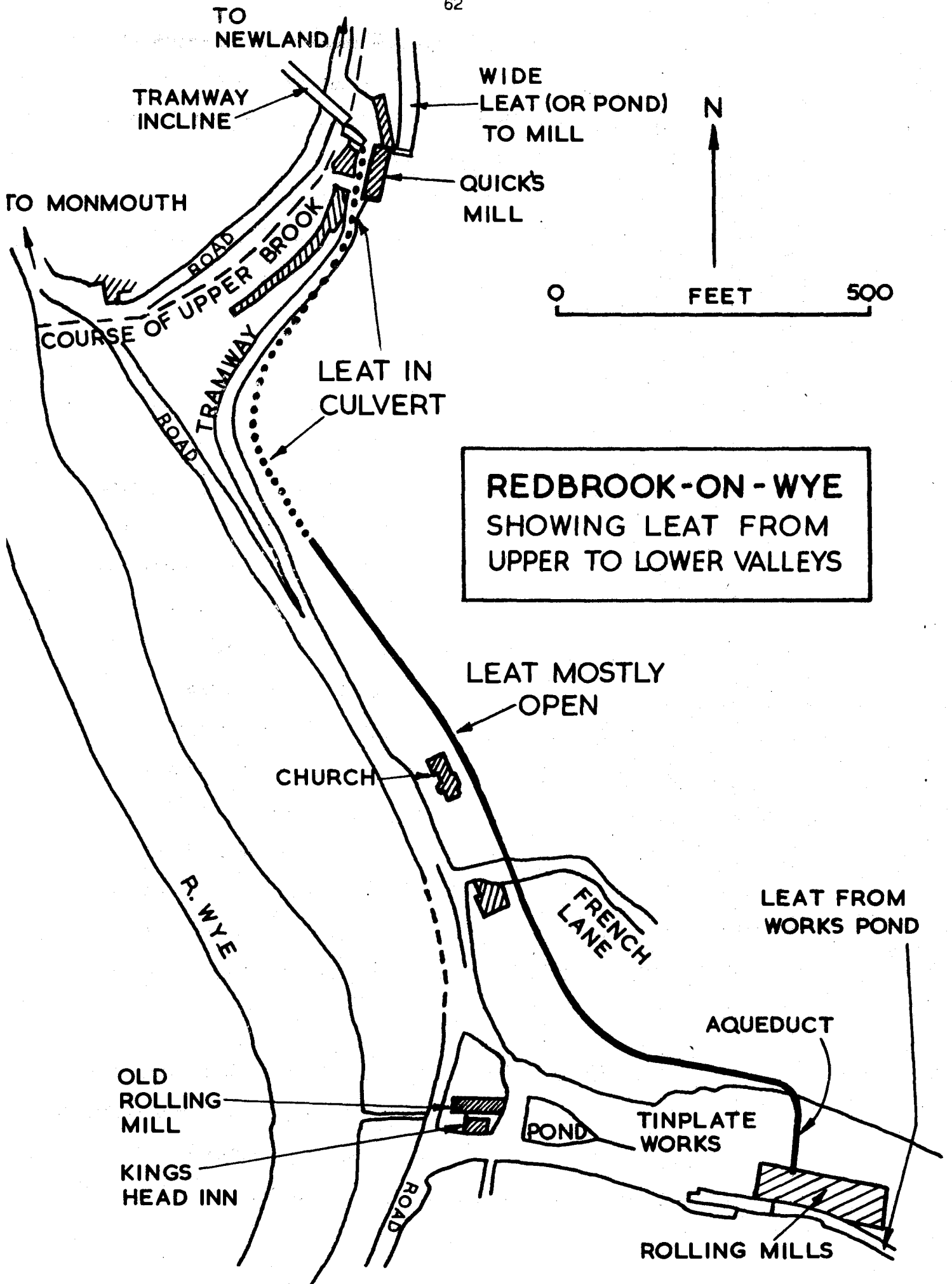
Another point is that Dr Hart in his own map shows the leat as a continuation of the leat which ran to the corn or flour mill called Quick's Mill at the beginning of the 19th century and the Wye Valley Flour Mills later on. There is, however, no possible doubt that the leat started from the main stream just below the tramway incline at an altitude about 25 ft below the mill leat; the remains of the sluice

gate into the leat can still be seen, although there is some excuse for missing it because the leat ran straight into a culvert to cross the tramway and continued thus invisible for some hundreds of yards. The line of the leat is shown clearly and correctly on one of the supplementary maps referred to above (9). The author's sketch-map accompanying this article indicates the situation around the middle of the 19th century. Where it is exposed the leat is constructed of roughly-dressed stone blocks.

Power at Lower Redbrook

Having thus disposed of the facts, we may turn to a consideration of why the leat was built. It was, from what we have said above, evidently intended to supply power to drive a rolling mill installation. It can fairly easily be calculated just how much power could have been provided by the leat. Formulae are available (12,13) which relate the flow of water to dimensions, roughness and gradient of the leat. A very careful survey would be necessary to determine the gradient accurately, but from the contours on the 6-in O.S. map and from direct observation it would seem that the fall is about 10 ft in a length of about 2000 ft, i.e. a gradient of 1 in 200. The maximum possible flow, when the leat is quite full, then works out at about 6 cubic ft per second. Assuming a head of 20 ft at the water-wheel, this would provide a maximum of about 10 horse-power. This really is a maximum; it was indicated in 1933⁽¹¹⁾ that the minimum summer flow of the Upper Redbrook stream was about 200,000 gallons per day, which is less than half a cubic ft per second.

It must be remembered that the leat was built to supplement the normal water flow of the Valley Brook as obtained from the large Works pond, and augmented by the adit above the pond, also referred to by Dr Hart⁽²⁾ and described in another document of about 1933⁽¹⁴⁾.



REDBROOK-ON-WYE
 SHOWING LEAT FROM
 UPPER TO LOWER VALLEYS

This flow would have been rather larger than that of the upper brook. It is unlikely, however, that a total maximum water power in excess of say 25 h.p. was obtained.

Now it is generally supposed that steam power was provided for driving rolling mills at Lower Redbrook just before 1800. For example, Rhys Jenkins⁽¹⁵⁾ stated that "The Tanners converted the copper works into an iron forge and tinplate works, and finding the water power insufficient, they put down a steam engine." The evidence for this appears to rest on two drawings⁽¹⁶⁾, one dated 20 May 1798 and showing a steam engine driving two pairs of rolls (each 18 in wide), and the other dated 26 February 1799 showing water wheels driving two pairs of rolls. Both are by W. Taylor, and the second is labelled "A Plan of Lower Redbrook Tin Mill." The former is merely labelled "A side view of a Steam Engine for Rolling Tin Plates &c." If this is indeed all the evidence, then it is far from proven that this particular steam engine was installed at Lower Redbrook.

A steam engine of some kind, however, was installed, because its presence was clearly stated in a Particulars of Sale dated 1802⁽¹⁷⁾. In 1827, the inventory of the Works⁽¹⁸⁾ included " A steam-Engine — on Mr Watt's Principle. A Substantial Well Built Engine House the Engine 40 Horse Power, comprising a 34 Inch Steam Cylinder and a 12 foot driving Cogwheel to unit the power of the Steam Engine with the water wheel." It is possible that this was the engine of the 1798 drawing, although the latter shows a cylinder with an outside diameter of 45 inches.

In Gregg's map, which includes a bird's-eye view of the works, there is no chimney to the main Rolling Mills building, but there is a building with a chimney next to the Kings Head Inn labelled "Rolling Mill" and in the later plan (Ref 10) this is shown as "Old Rolling Mills".

It is therefore possible that there was, or had been, a steam-driven rolling mill there, and the union with a water wheel would have been possible there, since there was a small pond above this building (see map accompanying this article). It is interesting, however, that an engineer's drawing of the rolling mills dated as late as 1856⁽¹⁹⁾ shows a water wheel as the sole drive to four thick plate rolls and two cold rolls, in addition to shears and miscellaneous machinery.

It seems possible that the sequence of events was :

- (1) water power found inadequate and steam engine provided for a new set of rolling mills (just before 1800).
- (2) steam engine found uneconomic, and so water power augmented by leat from Upper Redbrook and steam mills abandoned (1824).
- (3) more efficient steam-driven mills installed some time after 1856.

Hart⁽²⁰⁾ says that electric power displaced "water and coal" in 1944, and the total power was then several thousand horse-power. Plans of the works in 1941⁽²¹⁾ and at their closure in 1962⁽²²⁾ exist.

It is extremely unlikely that the statement by Grey-Davies⁽²³⁾ that the water-wheel was removed when the steam engine was installed around 1800 can be true. It is, however, possible, as the particulars of 1802 (Ref.17), while mentioning a steam engine, do not mention a water-wheel.

Acknowledgements

The author gratefully acknowledges help from Mrs Joan Day (who drew his attention to the map, Ref.9, and provided him with a tracing of it), from the Monmouth Local History Centre, and from the Gloucestershire Record Office.

References :

- 1 Cyril Hart, "The Industrial History of Dean", David & Charles, Newton Abbot, 1971, p.375.
- 2 ibid, p.195. 3. ibid, pp.188.9. 4 ibid, p.446
- 5 Rhys Jenkins, "The Copper Works at Redbrook and at Bristol", Trans. Bristol & Glos. Arch. Soc., 63, 1942/3 p.160.
- 6 Deed of Grants and Covenants relating to a Water Channel at Redbrook, 17 April 1824, Glos. Record Office, D.2441.
- 7 Inventory of Works, 25 Oct.1827, Glos.R.O. D639/13.
- 8 Glos.R.O. ,D.639/14; full-size copy in Monmouth Local History Centre.
- 9 Glos.R.O., D2166. This map is in poor condition, but by careful examination the author believed he could read the date 1828 at the top.
- 10 Copy in the Monmouth Local History Centre.
- 11 Minutes of a meeting with West Deal & Coleford Joint Water Supply Committee, 14 June 1933. Glos.R.O.D2441.
- 12 Encyclopaedia Britannica, 1970, Vol.15, p.59.
- 13 Chambers's Encyclopaedia, 1950, Vol.7, p.330.
- 14 Typescript notes associated with Ref.11
- 15 Rhys Jenkins, loc.cit.
- 16 Birmingham Public Reference Library, Boulton & Watt Collection copies also in Monmouth Local History Centre.
- 17 Sale particulars of "... a Freehold Estate.... called Lower Redbrook Works To be Sold by Auction....Wednesday July 28,1802." Glos R.O.,D639/12. Quoted by C.Hart,loc.cit.pp.193-4.
- 18 As Ref. 7.
- 19 Plan by J.A. Jackson dated 23 March 1856,,Glos.R.O.D639/14.
- 20 C. Hart, loc.cit.,p.197
- 21 Copy in Monmouth Local History Centre.
- 22 Monmouth Local History Centre.

- 23 T.Grey-Davies, "Redbrook Tinplate Works: The Last of an Era"
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