

HAWKESBURY-NEPEAN ALLUVIAL DEPOSITS AND IRRIGATION

DISCUSSION ON MR. HENSON'S PAPER—
"THE HAWKESBURY-NEPEAN ALLUVIAL
DEPOSITS AND IRRIGATION."

MR. NORMAN SELFE said it appeared that very little exception could be taken to Mr. Henson's statements as to the natural formation of the valley generally, and none present would be found hardy enough to deny the advantages to be gained by irrigation on that tract of country little more than thirty miles from the metropolis, the principal subject therefore, for consideration was the question of cost in providing the supply of water; and it might be taken as granted that if the water could not be dammed back to give such supply by gravitation, it would have to be raised by pumping.

There was not the slightest doubt that the Warragamba could be dammed at its confluence with the Nepean, ten miles above Penrith, and that such a dam would throw back an enormous stretch of reservoirs for miles, that would have sufficient elevation to irrigate by gravitation the whole of the river valley below—right down to Wiseman's Ferry if necessary.

Such a gravitation scheme would doubtless be a great and costly one. But it is believed the difficulties of constructing a dam on the Warragamba were greatly over-estimated by the several members of the Water Commission in 1868, and afterwards by Mr. Clark, when he came out to recommend the Upper Nepean scheme in 1877; for (singularly as it appears) not one of these investigators gives any estimate of a solid masonry or concrete dam built as an arch, with its extrados to the pressure, and its abutments in the solid rock of the gorge; and all were frightened to let the overflow go over the dam itself. Apparently none of these gentlemen knew that there are already scores of reservoirs constructed by squatters in the interior of Australia, in a comparatively rough-and-ready way, which have over-shot dams. Now, if a few sheets of roofing

iron, hammered out and roughly nailed on the cap and apron of a timber dam, would protect it on a station, it might be possible to design a casing in a somewhat similar way, of metal or something else, that would protect a dam that was to be a national work erected in a river only 700 feet wide, and that it might be done at a less cost than one and a half millions of money, which Mr. Clark put down as the cost of the waste or overflow weir on this site. It was, perhaps, unfortunate for the colony that there was no practical mechanical engineer on that Water Commission, for although it would hardly have led to the adoption of the Warragamba scheme, such an expert might at any rate have entered a protest against the conclusions arrived at regarding the relative cost of the Upper and Lower Nepean schemes. However, as it turns out, much that was predicted at the time, and since, with regard to these schemes, has actually come to pass.

On 19th October, 1876, he (Mr. Selfe) had the honour to read a paper before the Association in which he expressed his belief that not only the cost of the Warragamba scheme, but also that of the Lower Nepean supply from Penrith, had been much over-estimated in the Commissioners' report, while the Upper Nepean scheme actually adopted by the Government, without any independent inquiry into the subject by colonial experts other than the scientific members of the Royal Commission, was very much under-estimated. The facts showed that the Upper Nepean scheme was actually estimated at about one-third of its real cost as carried out.

From the latest information laid before Parliament it was gathered that about two and a half millions had already been expended on our new water supply, and it seemed as if it would take at least another half-million before it is complete.

Making the ultimate cost, say, ... £3,000,000

The estimated cost according to the report of the Commission (page 40) was ... 790,029

In the interval between 1869 and 1877 material and labour had risen a little. Mr. Moriarty's

revised estimate at request of Mr. Clark (Clark's Report, page 14) was £863,525

Mr. Clark's own estimate made independently, including valuable subsidiary works, (Report, page 16) 1877 ... 1,086,768

The Hon. John Lucas, M.L.C., as given in paper printed at Government Printing Office, 1876 (page 6) ... 2,600,000

General opinion of outsiders before its commencement, in letters to the Press and common talk, derived from a comparison of the work and Commissioners' quantities with the cost of other similar works in the colony and elsewhere, about 3,000,000

So it appears that in this as in other great national works in which great differences of opinion existed between the promoters and the public before they were carried out, the outsiders were pretty nearly right after all.

Now, you may say, "What has all this to do with the irrigation of the Penrith Valley?" Well, with a hope to show you presently, as it all turns on the cost of supplying the water, he (Mr. Selfe) would first point out that in all the water schemes in which the Government of the colony have hitherto been engaged, the services of practical engineers, such as the members of this Association, have never been sought, or otherwise the Government never appear to have selected one of their competent officers (of whom it may confidently be asserted they have many), and then have allowed him to mature and be responsible for a whole and complete scheme; but they have put up a number of costly waterworks, under the Department of Harbours and Rivers, and have never established from their officers, a Department of Waterworks, with a proper head, and most of these works carried out are altogether, as it would appear, beyond the means, if not the requirements, of the people to be served, and they have created, in many cases, an immense burden for the ratepayers of the towns or districts supplied to have to bear. If this Association by its members

exerts any influence collectively or individually to prevent such unnecessarily grand and expensive schemes which cause a waste of money in the future, we shall have done the State some service.

Now, Mr. Henson's scheme would require pumping from the Lower Nepean somewhere if the river is not to be dammed, and as it appears from the figures just quoted that the estimate for the Upper Nepean scheme of the Commissioners was under-estimated at about one-third of what the actual cost will really be, so also the Lower Nepean scheme was greatly over-estimated: perhaps it was set down at a rate nearly double what would be actually required if carried out with judgment; if such is the case it will be good for the irrigation proposal.

It is hardly necessary to here go into very full details to show that for some reason or other the Lower Nepean pumping supply does not appear to have been in favour with the members of the Royal Commission. But if they would refer to page 162 of the Report, they would see how the poor scheme was worked out in the estimate for a supply of twelve million gallons a day, viz., eight millions to Sydney and four millions to Paddington. And here let us note that there were first to be two separate mains for the high and low pressure; of course the duplicate pipe had advantages in case of accident to the other one to compensate for the extra cost: still Botany always did with one main, as did also some of the largest works in the world. Secondly, when they considered the cost set down for pumping—the engines themselves were put at an enormous price, and the modest sum of £5,000! a year is allowed for their repairs—they also found that the consumption of coal for fuel was put down at 8 lbs. per horse-power per hour, and the cost of the same at 20s. per ton in making up the capital cost and annual charges. Now, as is well known, pumping engines were worked at a great deal less than 3 lbs. per horse-power per hour fifty years ago, and as coal could be supplied at Penrith for say 15s. per ton, if not at 10s., more was hardly needed to show that matters were not strained very much to show off the advantages of this scheme in the general comparison.

Mr. Clark's estimate for this scheme was much fairer, and many persons think it unfortunate that it was never adopted in lieu of the Pheasant's Nest source; but he kept to cast-iron pipes in his calculations when wrought iron or steel ones would only have been half their cost. Mr. Clark set the coal down at 12s. per ton, and he made the whole cost of supplying twelve millions per day £1,066,600, with £11,500 annual expenses.

Mr. Clark's comparative estimates for the three most likely schemes were as follows:—

	COST PER 1,000 GALLONS.		
	6 Millions.	12 Millions.	18 Millions per diem.
Upper Nepean	...	3'327d.	2'45d.
Lower Nepean	4'37d.	4'28d.	4'27d.
George's River	3'67d.	2'95d.	2'7d.

It is not necessary to say anything about the George's River scheme. Letters to the Press over twelve years ago showed that while the Prospect Dam was estimated on a basis of 1s. 6d. per yard, and to cost with reservoir and other necessary works £176,136, the George's River scheme was estimated at an altogether higher schedule of rates, often double; and to those desiring more information on these anomalies, he must refer to the pamphlet of Mr. Lucas, published at the Government Printing Office, 1876, and come at once to the scheme for pumping from Penrith.

The great advantage of the Upper Nepean scheme, as pointed out by Mr. Clark, was its elasticity, the price decreasing with the quantity. But, as they were not getting the water yet at 2½d., but at 1s. 6d. per thousand gallons, although the quantity was said to have been enlarged still further beyond the 18 millions per diem.

They were aware that on the instructions of the late Minister for Works there had recently been an investigation by special experts, and a report laid before Parliament, on the Potts' Hill storage reservoir, and the Kenny Hill reservoir and scheme suggested by Mr. Gipps. Now, he would not for one moment pretend to give an opinion as to the comparative merits of these proposals, unless

he was paid for it; but the perusal of the documents, which any citizen could understand, clearly showed that the wind had changed in the world of water supply since the Upper Nepean scheme was selected, and that gravitation was now at a discount. It had, therefore, occurred to him to compare the estimates adopted for the cost of large mains from Kenny Hill, and the cost per thousand gallons for pumping, as adopted by that Board in their argument when showing reasons against carrying out the Kenny Hill gravitation scheme, and apply these estimates to ascertain the cost of pumping from Penrith.

Without going into details, and with the hope that should any of the members detect mistakes, they will point them out, as there was no desire to do anything but draw fair comparisons, they might consider, say, a supply of twenty-six millions per diem, the pipe for this to be, say, 66 in. diameter. Now, on the basis of the price given by Mr. Gipps for steel mains and with the increased cost added by Messrs. Bishop, Mestayer, and Sawyer, it will, he thought, be found that with a charge of 6 per cent. per annum, the transportation of the water would cost at the rate of 1.12d. per thousand gallons.

The standard cost of pumping adopted by the Board was 6d. per million gallons one foot high, which would be at 258 ft. lift 1.54d. per thousand, making cost total 2.66d. per thousand gallons in Sydney, or say one-half the cost set down by Mr. Clark. It had not been calculated how much less this was than the cost under Mr. Moriarty's estimate in the Commissioners' report.

He wished to call attention to another matter which showed that there is plenty of room for discussion by the members of the Association and all interested in the engineering industries of the colony in connection with water supply; it had relation to a pumping scheme which, it would appear, was in course of construction for the city of Sydney and suburbs.

The following statements which had been recently made in the Press and official public documents, had attracted attention; and they seemed to be of so much importance to the public, and to many manufacturers who were members of the Association, that no personal scruples, or *esprit de corps*, should prevent one from saying what he knew on the matters referred to.

From the Press it was ascertained that :

1. The pumping machinery at Crown Street is now insufficient for the supply of the higher levels of the city, and it was proposed to put on an intermittent supply in place of the present continuous one, until additional engines are erected.

2. The Government have on this account ordered, by cable, a most expensive set of Worthington's pumping machinery from abroad, and this has been done without giving colonial engineers any opportunity either of designing the same, or tendering for their supply.

3. The Government have also invited tenders for the supply of the North Shore pumping machinery. The specification for this was at first so worded that the contract could only possibly go to one maker (Worthington) or to his agents, who could thus ask any price they chose for the pumping engines, while at the same time there were no conditions in the specifications as to the duty or efficiency of such machinery as would be of any value to protect the interests of the Government.

4. There was then, after some complaint, he believed, another and second specification for the pumps submitted, which does give an opening for other pump-makers to tender, but with this important difference—there were now very severe and extraordinary tests to be applied.

5. In the printed evidence recently given by Mr. Trevor Jones, the Engineer to the Water and Sewerage Board, before the Parliamentary Works Committee on the Potts' Hill Reservoir, amongst other things it is stated to questions :

Question 671. Engineers in various parts of the world construct engines for pumping water, but nothing like the excellence of the Worthington engines.

Question 673. They (Worthingtons) have made their pumps do the same work with half the former quantity of fuel.

Question 674. The only pump that has any pretensions to equalling the "Worthington" is the "Hathorn and Davy."

Question 676. There was an engine placed at Botany in a remarkably short space of time by a Sydney firm, but it was already made in California. Mr. Selge brought it out.

Question 678. A colonial firm could have made a pump to answer an emergency. I wanted to get an engine on the efficiency of which I could depend to do the work, no matter who made it.

Question 679. I recommended the Worthington pump after careful deliberation with Mr. Darley.

Question 672. Pumps made a great noise and disturbed a populous neighbourhood.

As a reply to the foregoing, the following statements are made, which are, no doubt, known also to others present:—

In the year 1877 the author was the Scientific Engineer to Mort's Dock Company, and in that capacity made three different designs for high-level pumping engines to be erected at Crown Street. The Municipal Council selected one of these designs, for which he then prepared the working plans, and the firm made the whole of the machinery under a contract.

These pumping engines went into operation, supplying the high-level reservoir at Paddington, about January, 1879, and they had now been working ten years, with an economy at least double that of the Botany engines. In the design of those engines special provision was made for keeping the crank-shaft bearings true, and generally for making good all ordinary wear and tear, as it might arise.

In the Twenty-fifth Annual Report to the City Council on Water and Sewerage Works in 1882, the following words occur, "These engines at Crown Street have worked continuously since the beginning of 1879 without being overhauled as they should have been." That this was most unfair treatment of them goes without saying.

These engines have long been working at a much greater speed and capacity than they were contracted for (see official reports), and although they were not the type of engine that the author would at the time have selected from the designs he made, they are so good that they are still working, and with attention to their

bearings they are good for fifty years' more work; but they have lately broken their solid-forged crank shaft—not an unusual event with hard-worked machinery, and probably in this case caused through the bearings not being renewed at shorter intervals.

In the year 1880, the City Council instructed me to communicate with the City Engineer, and to report on the pumping engines at Botany and Crown Street. That report was furnished; it was dated June 23rd, and adopted by the City Council on August 3rd of the same year. Among other things this report showed that owing to the wasteful character of the machinery at Botany, new engines could be erected there that *would pay for themselves in four years by the saving in coal alone*, and also that the Crown Street engine was fairly economical. It further recommended that new engines should be erected at Crown Street to supply the still higher levels of the city, *i.e.*, Woollahra and Waverley, at a cost of £6,100, sketch plans for which accompanied the report, and also that the immediate wants of Woollahra and Waverley should be met by the erection of *temporary steam pumps* at a cost of £700 or £800 to work for *six months* pending the construction of the permanent engines.

These temporary pumps were shortly after put to work, and they no doubt made the noise referred to in Mr. Jones's evidence, as they were of cheap make and stood out of doors. They had now, however, been in operation nearly eight years, instead of the six months for which they were only originally intended.

Connections to the Woollahra mains, for the attachment of the newly designed permanent engines, were put in when the temporary pumps were set down, so that there should be no delay in setting the new plant to work, when completed. It will be found, however, that while a house has been built over the much-abused temporary tank pumps, the permanent pumps for Woollahra and Waverley (for which those designs were prepared when they were wanted eight years ago) have either been totally forgotten, or else the report has been ignored. There seemed now to be a sudden scare about the water supply, and instead of calling upon local