



NEW ZEALAND
GOVERNMENT GAZETTE,
(PROVINCE OF NELSON.)

Published by Authority.

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ALFRED GREENFIELD, Provincial Secretary.

VOL. XVI.

NELSON, FRIDAY, JULY 31, 1868.

No. 37.

Superintendent's Office,
Nelson, 31st July, 1868.

THE SUPERINTENDENT directs the publication of the following Report for general information.

ALFRED GREENFIELD,
Provincial Secretary.

REPORT ON MOUNT ROCHFORD COAL-FIELDS.

TO HIS HONOR THE SUPERINTENDENT OF NELSON.

SIR,—

1. On my return to Westport from visiting the Coal and Goldfields on the West Coast, accompanied by Mr. Morrison, I received on the 2nd of July, instructions from the Provincial Secretary, to "make an examination of the Mount Rochfort Coalfields, and report to Government especially as to the best means of bringing the coal to market."

2. The examination being limited to fourteen days (as per instructions), I had to proceed so as to comply as far as possible, within the time stated, and, therefore, the opinions which I may give in this report must be understood as based upon the information contained in the surveys and plans made by Mr. Burnett (marked Grey Coalfields, Nos. 2 and 3).

3. Having visited several of the trial drifts and outcrops of coal situate on the River David, Coal-

brook Dale, and the Waimangaroa Gorge, I found these very valuable seams of coal, accurately described by Mr. Burnett, as to their position, thickness, and apparent dip.

4. The south-east slope of the valley known as Coalbrook Dale, may be said to be almost one continuous seam of superior coal of various thickness, ranging from three to nine feet. From the highest trial drift, where the coal is exposed to view, I caused a line to be cut through the scrub on the face of the slope towards the saddle, which divides Coalbrook Dale from the River David. The length of this line was less than one quarter of a mile, yet, upon trial, I found coal in four different places along this line, giving me strong evidence that the seam of coal will be found to extend to the very summit of Coalbrook Dale. On the lower part of the Dale, coal seams are visible in various places on both sides of the valley, before its junction with the Waimangaroa Gorge.

5. From these facts, there is no reason to doubt but, that if a line of road or railway was constructed on the south-east slope of Coalbrook Dale, the necessary side-cutting would lay bare a seam of coal almost, if not altogether, continuous from the top to the bottom of the valley, thus giving extraordinary facilities for working the coal on an extensive scale, and at a minimum cost.

6. The thickness of the seams of coal in Waimangaroa Gorge far exceeds those in Coalbrook Dale, but, as they are exposed on the face of perpendicular cliffs, in broken ground, and in a gorge which descends from the general plateau, in a distance of fifteen chains, no less than nine hundred feet, approaching

these seams would be attended with a very heavy expenditure, in the construction of works and machinery of more than ordinary character.

7. Now, as there are enormous beds of coal in the valley of Coalbrook Dale, easily approached, in comparison with those in the Gorge of Waimangaroa, immediate operation on the latter is not necessary, so that my attention has been directed to the consideration of the practicability of a line of railway, from the head of Coalbrook Dale to Westport, that shall not pass through Waimangaroa Gorge, as "the best means of bringing coal to market."

8. As the whole of the coal seams in Coalbrook Dale are in the watershed of the Waimangaroa and Wariatea Rivers, which are *not* tributaries to the Buller River, and, as there is only one visible outcrop of coal at the head of the River David, which is a tributary to the Buller, it follows, that no part of Coalbrook Dale mines would come within any part of the land which it is proposed to give to any company who will construct a line of railway from Nelson to Cobden and Westport.

9. This being so, and the Brunner mines, on the River Grey, having been withdrawn from the limits of the land to be given to the contemplated railway company, there is no reason to hope, or expect, without alterations in the limits of the land to be given to the proposed company, that any capitalists will be found willing to construct the main intended line of railway in the valley of the Buller, and a branch from thence, for the purpose of the mere working of one outcrop of coal, situate at the head of the River David.

10. Under this state of things, "the best means of bringing the coal to market" must be by an independent line of railway, having no connexion with the proposed main trunk in the Buller valley, and the market *must be Westport alone*; and therefore, the mines at Coalbrook Dale must be worked on a comparatively small scale, because the harbor of Westport does not afford either depth of water, or sufficient security at all times, for every kind of vessel to enter into a coal trade. The export of coal from Westport would, no doubt, be considerable, but must be confined to small vessels frequenting the port at uncertain intervals, and, from this cause, the annual export of coal will vary very much. To remedy this there is only one mode,—that of employing steam colliers at an increased cost upon the selling price of coal. All these drawbacks would be avoided if the mines of Coalbrook Dale were brought within the limits of the land to be given to a company constructing the main trunk railway from Nelson to Westport, for then a branch line from Coalbrook Dale, down the slopes forming the valley of the River David, and forming a junction with the trunk line in the Buller valley, could be constructed at a cost of about £70,000, or about half the estimated cost of an independent line from the mines to the Port of Westport; in which case the two Ports of Nelson and Westport would be available for the shipment of coal,—steam colliers would be unnecessary, and a vast export of coal be insured.

11. Assuming, however, that the present conditions attached to the construction of the line of railway from Nelson to Cobden and Westport to remain undisturbed, there is, in my opinion, no hope of that line being carried into effect; and, therefore, if I am right in this opinion, an independent line from Coalbrook Dale to Westport, having no connection with the main trunk line, is the alternative, and I shall now proceed to consider that question.

12. In Mr. Burnett's report on the Coalfields of Mount Rochfort, he seems to have followed this view; proceeding as if a direct line from the mines to Westport was alone necessary; and enters, with

much care and consideration, into details; but, although I must give that gentleman the fullest credit for giving the subject considerable attention, so far as the principle forming the basis of his views is concerned, yet I cannot agree with that principle.

13. The line of railway, as proposed by Mr. Burnett, would have to be worked by Mr. fixed engines and self-acting inclines. Now, though what he suggests would give by far the shorter line, and would be quite practicable, self-acting inclines are especially to be avoided, when they are placed in any part of a line of railway otherwise than at the termini; for if they are otherwise placed, as in Mr. Burnett's plan, they necessarily entail the cost of two locomotive establishments, one below the self-acting incline, and one above—the outlay for locomotives is doubled, and the annual charges nearly so.

14. The matter for consideration, therefore, is whether it is cheaper to construct a shorter line of railway, on Mr. Burnett's system, at a lesser cost, but with larger annual charges; or a longer line, upon which locomotives could run throughout, at a larger outlay, but the least annual charges. I am of opinion that the latter plan is the correct one, even if the locomotive line was to terminate at Coalbrook Dale, and was not at any time hereafter to be extended; but, as the time will come when extension will be necessary, this should not be lost sight of; for once having reached the head of Coalbrook Dale with a line of railway, then locomotive lines in all directions become quite easy and inexpensive to construct, and ramifications of the system may extend to Mokihinui, Orikaka Valley, to the Buller by way of the river David, and almost to the very highest point of Mount Rochfort; thus opening out one of the best and finest Coalfields that can be well conceived.

15. Believing then that a locomotive line of railway is the most prudent to construct, and Mr. Burnett having on his plans (2 and 3) given the heights of various points, we are from them enabled to ascertain the approximate length of such a line, and, to a certain extent, the best direction as well. There are, however, some considerations that must be attended to, which are:—

A. The line must not on any account be carried through the gorge of the river Waimangaroa.

B. It should be carried at such a gradient down the valley, as would touch the most important seams of coal at about eight feet below their level, and at the same time enable a heavy train of coal-loaded wagons to be hauled from the mines over the saddle, dividing the watershed of coal-brook Dale and that of the river Wariatea.

16. The first of these is necessary in order to avoid extremely expensive works for a great length of line and undesirable gradients. By the second consideration we are enabled to avoid the Gorge of Waimangaroa, touch the principal outcrops of coal in the Dale, and conduct the line over the plateau at moderate gradients, and so giving the locomotives all the advantage of having the least amount of gravity to overcome, where their power is more required than on any other part of the line, in the hauling of coal-loaded trucks over a rising gradient; for, after passing the saddle, we get descending gradients which will be nearly uniform, and motion in the trains, on the main portion of the remaining distance to Westport would then be created by the gravitation of the loaded trucks.

17. Thus the gradient at which the line could be constructed from the top seam of coal in Coalbrook Dale until the saddle is crossed, is of the greatest consideration, as the utmost power of the locomotives would be required on this length, because it determines the weight of the trains to be passed over other lengths of line, where the full powers of a locomotive are not required, and, in fact, could not be used.

18. The level of the top seam of coal now exposed to view in Coalbrook Dale is 1942 feet above the sea. Other seams lower down the valley, which it would be desirable to touch with the line of railway, have levels of 1890, 1803 and 1810; so that a falling gradient for loaded trucks can be got which would strike all the best seams of coal in the valley. The bottom of the Gorge of Waimangaroa is 1000 feet high; the top of the precipice, which is the edge of the plateau, is 1900 feet. The plateau has various levels, but the highest, which may be called the saddle is 2129 feet. A passing point on the saddle adjoining the gorge may be taken at about 1970 feet, and as the last best seam of coal down Coalbrook Dale is at a level of 1810 feet, the height of about 160 feet has to be overcome in a distance of 8000 feet, which gives a rising gradient of 1 in 50 to get over the saddle. Detailed surveys and levels can alone show, if it would be justifiable at an increased cost, to seek an easier gradient than this, as being of more consequence than any other gradient upon the line, but sufficient data do not exist to give more than a very general opinion; there cannot, however, be any doubt but that it is of importance to get the easiest gradient that is practicable at a moderate cost, as upon this length the powers of a locomotive would be taxed to the utmost. After passing the saddle, with this rising gradient, a falling one of about 1 in 30 may be laid out along the slope of the mountain until the table land behind Westport is reached, from whence to Westport the gradient would be more moderate.

19. On plan No. 2, I have shown, by a brown line, the direction and probable length of the line I propose, the total length of which would be about 19½ miles, being as compared with that proposed by Mr. Burnett, 7 miles longer. As may be observed on the plan, the course of the line is very tortuous, and the curves numerous and severe; but the use of locomotives, on Farlie's principle, will secure perfect safety in working the line.

20. From Coalbrook Dale until the plateau is crossed, the whole surface is a barren waste, covered chiefly with loose blocks of grit of various sizes and thickness, and any cutting necessary will be in this material, which, however, is easily got; but, in descending from the plateau down the breast of the mountain, the slopes are so severe that it would not be safe, as a rule, to have any side-cutting, as there would be much risk of causing heavy slips, both at the time of execution and after the works were completed. I propose, therefore, that the whole breadth of way shall be embanked and constructed after the manner shown in cross section by the sketch attached hereto. Materials for the purpose can be got from adjoining surfaces, and from favorable places along the line.

21. Being purely a mineral line, a gauge of 3 feet 6 inches will suffice. A breadth of formation equal to 12 feet will be necessary, and with gradients so sharp as 1 in 30, and severe curves, the rails should not be less weight than 54lbs per yard.

22. The chief works for the locomotives running from Westport to the mines, would be to take back empty waggons, up a long gradient of about 1 in 30, as nothing but provisions for the miners and prop timber would be required as back carriage.

23. The cost of constructing the line will vary very much in different lengths. It is probable that about one-third of the entire length will have to be constructed after the manner shewn in the sketch attached, the approximate estimate for one mile of which is as follows:—

	£	s.	d.
Dry retaining wall, 11,400 cubic yards, at 10s. ...	5720	0	0
Embanking, 10,560 cubic yards at 1s. 3d. ...	660	0	0
Drainage ...	100	0	0
Ballasting, 2,077 cubic yards, at 2s. ...	207	14	0
Sleepers, 1760, at 2s. 3d. ...	198	0	0
Rails, 84 tons, at £11 ...	924	0	0
Fish-joints and spikes ...	35	0	0
Plate-laying, 1,760 lineal yards, at 2s. ...	176	0	0
Bridges and culverts, average per mile ...	600	0	0
	<u>£8620</u>	<u>0</u>	<u>0</u>

24. The estimate for one mile on about two-thirds of length of line would probably be nearly as follows:—

	£	s.	d.
Excavations, partly in rock, 4000 cubic yards at 5s. ...	1000	0	0
Drainage ...	100	0	0
Ballasting ...	207	14	0
Sleepers ...	198	0	0
Rails ...	924	0	0
Fish-joints and spikes ...	35	0	0
Plate-laying ...	176	0	0
Bridges and culverts ...	600	0	0
	<u>£3240</u>	<u>14</u>	<u>0</u>

25. The average cost per mile would therefore be about £5034.

26. The total cost of works of all kinds that would be necessary to be incurred by a company, before coal could be sold would be about as follows:—

	£	s.	d.
Railway, 19½ miles long, at £5034 ...	99,421	10	0
Coaltips, turntables, sidings, office and weighing platform at Westport, equal to put 200 tons of coal on board ship in 7½ hours ...	3,200	0	0
Three tank locomotives, at £2500 ...	7,500	0	0
One hundred coal waggons, at £50 ...	5,000	0	0
Three break-vans, at £200 ...	600	0	0
Telegraph for safety of up-trains ...	1,185	0	0
Repairing shops and tools, say ...	2,000	0	0
Miners' Houses, say ...	2,000	0	0
Manager's house, say ...	300	0	0
	<u>£121,206</u>	<u>10</u>	<u>0</u>
Contingencies and Engineering ...	12,120	10	0
Total probable cost ...	<u>£133,326</u>	<u>0</u>	<u>0</u>

27. The rolling plant I have allowed in the above estimate would enable 144,000 tons of coal to be delivered in Westport per annum.

28. Considering the length and severity of the gradient of 1 in 30, the cost of repairs will be considerable, and we should not reckon less than one penny per ton per mile to pay locomotive expenses and maintenance of permanent way and works. Assuming this, the following is my estimated cost of one ton of coal put on board ship at Westport:—

	£	s.	d.
Coal in waggons at pit mouth ...	0	5	0
Carriage to Westport ...	0	1	8
Discharging at coal depot ...	0	0	1½
Putting on board ship ...	0	0	8½
Cost of Management ...	0	0	2
Profit to Company ...	0	3	4
Cost per ton, F.O.B. ...	£0	11	0

29. Supposing 144,000 tons only to be sold annually, the company's profits would be yearly £24,000; which would, calling the gross cost £134,000, represent a dividend of £17 15s. 2½d. per cent per annum.

I have the honor to be,

Sir,

Your obedient servant,

HENRY WRIGG,

Civil Engineer.

Nelson, 24th July, 1868.