



NEW ZEALAND
GOVERNMENT GAZETTE
(PROVINCE OF NELSON).

Published by Authority.

All Public Notifications which appear in this Gazette, with any Official Signature thereunto annexed, are to be considered as Official Communications made to those Persons to whom they may relate, and are to be obeyed accordingly.

By His Honor's command,

J. C. RICHMOND, Provincial Secretary.

VOL. XI.

NELSON, MONDAY, APRIL 20, 1863.

No. 8.

Provincial Secretary's Office, Nelson,
April 20, 1863.

HIS Honor the Superintendent directs the publication of the following Reports, for general information.

J. C. RICHMOND,
Provincial Secretary.

REPORT ON THAT PART OF THE
GREY COAL FIELDS SITUATED AT
MOKIHINUI.

Nelson, March 6, 1863.

HIS HONOR THE SUPERINTENDENT,

SIR,—In compliance with your letter of instruction, dated Nelson, Nov. 1, 1862, I have the honor to report that during my last visit to the West Coast I spent upwards of a fortnight at Mokihinui, with a view to examine that part of the Coal Field. I now beg to lay before you the result of that examination.

On Plan No. 1, of my report of September 3, 1862, it will be seen that the Mount Frederic chain terminates almost abruptly at the Ngakumaho river, beyond which towards the north the part shown blank, consists of low hills backed by a high range of mountains, seven or eight miles towards the east, called the Lyell range. Between these mountains and the coast the part of the Coal Field to be treated of in this report is situated.

The Plans to accompany the report are—

- No. 1. A Plan of the Mokihinui River, with a rough section of strata on the margin. Scale 20 chains to one inch.
- No. 2. An enlarged Plan of part of No. 1, to show the mouth of the river. Scale, five chains to one inch.
- No. 3. An enlarged Plan of part of No. 1, to show the outcrop of coal and other details, with a rough section of strata on the margin. Scale, five chains to one inch.

On looking at No. 1 Plan it will be seen that the flat land at the mouth of the river, is terminated by a range of hills crossing it about three-quarters of a mile from the mouth, and projecting into the sea about $1\frac{1}{4}$ miles to the north, forming there a very rugged point. The next half mile up the river to Salt-water Creek, both banks are formed by the steep sides of the hills. From Salt-water Creek to Hunter's Creek the right bank continues pretty much the same, but the left is low flat land. From Hunter's Creek to the gorge, where the coal crops out, the left bank continues flat, and the right is formed by the gently sloping sides of the low hills; and at the gorge both banks are formed by perpendicular cliffs of rocks of the coal formation, see No. 3 Plan, and rough section of strata on the margin of it. Above the gorge the right bank is formed by the steep sides of hills and the left by flat land as before, and this continues nearly to the Lyell range, round the north base of which I think the principal branch of the Mokihinui flows.

From the gorge to the base of the Lyell range the country is almost flat, and continues so, or gently undulating, for many miles towards the S.S.E., passing on the east side of the Papahaua or Mount

Rochfort range, and forming, in fact, part of the great opening through the country, which extends from this point to the Buller, thence up the Inangahua, down the Mawheraiti and Grey, and thence to Lake Brunner.

At the gorge it will be seen that a seam of coal, about six feet six inches, crops out a little above the level of the river, dipping to the N.N.W. about 15° . On the other side of the river, high up in a very rough gully, coal is again found, which is probably the same seam, but the dense vegetation and the rugged nature of the hill-side prevented a very satisfactory examination; however, it appears to be very much confused and broken.

The Section from N to M on the margin of Plan No. 3 shows the position, and the Section at P the measured thickness, of the different beds near the coal seam; those not shown on this are merely estimated.

Following down the right bank of the river no rocks are to be seen till you arrive at 29a, which is a sandstone rock, dipping to N.N.E. about 7° ; on tracing this outcrop 10 or 12 yards further down the river, there is a marked change in the strata, the hard solid sandstone, &c., of the coal-measures is overlaid by a kind of soft marl; as far as this can be traced it continues to dip very regularly, and is evidently conformable with the coal-measures.

From a little below 29a no strata are exposed till you get to Stony Creek, where the river bed and the steep hill-sides are both formed by the same marly rock, inter-stratified with numerous thin beds of hard gritty sandstone, from one to six inches thick, and here and there a layer of ironstone nodules from one to three inches thick, the beds of marl varying from six inches to two feet, and the whole striking very regularly N. 31 E with a dip to W.N.W. of 45° degrees. As this platform of rock is very flat and the soft marl is washed out between the harder beds, these are left projecting slightly above the general surface, in long straight parallel lines, giving the whole the appearance of having been ruled. These rocks continue the same, or nearly so, to Station XXXIII, where they are covered with debris.

Following down the same side of the river and along the coast nothing is to be seen of the geological formation, till the rocky part of the river's mouth is reached; where you again find similar rocks inter-stratified with beds of limestone, often very crystalline, and the whole formation much harder than it is further up the river, and dipping very nearly in a contrary direction, i.e. to E.N.E. at an angle of 60° degrees.

Returning to the gorge and continuing up the right bank, at D the shales, grits, and sandstones above the coal seam are exposed, dipping rapidly down to the river, but at Station d gradually flattening, and at this point forming a projecting shelf, from under which for many yards and for upwards of 20 feet in depth the underlying rocks are scooped out into a cavern under water; at the extreme point d, the shelf is exactly at the surface of the water, and so thin that you almost expect your weight will snap it off as you step into it. The seam is here from 70 to 80 feet below the surface, and great part of it, from this point to the outcrop at E, is exposed to the constant pressure of a heavy column of water.

From D to F the dip gradually moderates and at F it is about 5° deg., and the marly rocks seen at 29a are again found; here, as there, regularly overlying the coal measures. This same formation continues and is exposed on the same side of the river for some miles further up, probably to the base of the Lyell range. According to Mr. Haast (see his report, page 115) these rocks belong to the Cretaceous formation; and that this is found imme-

diately above the coal measures at Mokihinui is satisfactorily shown; proving at the same time that this is the top of the coal field, and the seam in the gorge probably the highest one of the series, so that we may confidently expect that the whole will be found below.

Page's Creek is a small stream flowing from the S.W. and forming at its junction with the Mokihinui a very peculiar rocky gorge, in some places not six feet wide, with perpendicular rocks on both sides from 40 to 50 feet high. For the first quarter of a mile the rocks are entirely of the coal measures, including conglomerate similar to that found on the top of Mount Rochfort; the strata are confused and broken and I did not find any seams of coal, though there is drift coal in the bed of the stream. About half a mile up, very coarse granite is found forming perpendicular cliffs of nearly 100 feet on each side, and beyond this, so far as I have been, there is nothing but igneous rock, but I have not been able to find the point of contact between it and the coal measures, everything being very much covered up with debris. But it is evident that in this direction the coal field is thrown up, broken and cut off by igneous rocks. As granite is again found on the left bank of the Mokihinui a little below Salt-water Creek, we may presume that it continues between these two points, and that, in fact the hills rising to the south of Salt-water Creek are thrown up by granite, though their northern slopes are composed of coal bearing strata.

Further up the river I have found no solid strata, except the before mentioned cretaceous rocks on the right bank, but there is plenty of drift coal in the shingle beds, and large seams are repeated further up which, from the comparatively level and regular nature of the surface, will probably be much less disturbed than any hitherto found.

These remarks will be better understood by referring to the Section on the margin of No. 1 Plan, along the line G. H. L. J. E. I. It will be observed that from G. on the sea coast to near E at the gorge, the whole is colored yellow and marked Cretaceous. This as before mentioned may be seen to overlie the coal measures at F and at station 29a. At H near Stony Creek nothing is to be seen of the coal formation, and the dip of the strata there, shows that it is thrown down, but how far it is impossible to tell, as I do not know where this change of dip takes place. But at all events we may conclude that the part from H to G is too deep to be available at present. What may be the position of the rocks between these two points I do not know, but evidently there is great disturbance, and as granite appears on the coast again about a mile north of G, probably it is the cause. From E to I the coal measures come to the surface, and are cut off at I by granite and other igneous rocks; so that at this place the actual breadth of coal bearing strata at the surface is very limited; but as the hills which are here cut through by the river, are running nearly north and south, and as between these hills and the Lyell mountains there is a large valley, it is probable that the coal field will be found pretty regular; and extending many miles to the south; but towards the north, dipping deep under the cretaceous rocks which are here largely deposited on the right bank of the Mokihinui.

I feel very diffident in making geological statements for I know how difficult it is even for a geologist, to say definitely in a new country, to what formation a series of rocks belong; but at G the limestone and other beds are pronounced to be cretaceous by Mr. Haast (see his report, page 115) and at H, J, and E the rocks immediately above the coal measures are of the same character, I therefore conclude that they belong to the same class. They are different from anything seen in the coal formation, and resemble the rocks which appear to cover the coal measures in

that part of the field near the Grey, but there, I have never seen them so distinctly associated with the coal as at Mokihinui. Having given a slight sketch of the general features of this part of the coal field, I will now make a few remarks on the working of coal here.

It will be seen by Plan No. 3 and the section on the margin of it, that on the right bank of the river no coal can be worked by free level; there being only a breadth of a few yards above the ordinary height of the river at the outcrop, and the whole is a dozen feet at least below the flood line; so that except a few tons which might be got as a sample, all mining here must be under water level, and will therefore require apparatus for pumping and raising coal.

A shaft sunk (of course above the flood line) near 29a would probably win the whole of the coal from there to the outcrop, supposing the strata to continue moderately regular. As to the depth at this point to the seam which crops out at the Gorge, it is impossible to speak with certainty; if the dip continued as it is where exposed (about 15°) it would be nearly 600 ft. But as it rapidly decreases, as before mentioned, to 5 deg. at F, and 7 deg. at 29a, we will suppose that it is 5 deg., and this would make the depth about 270 feet. But as the cretaceous rocks are seen to commence here in the same way as at F, I think it probable that the actual depth will be less than 100 feet; but till borings or sinkings are made it is mere speculation.

It is very likely that in sinking here a great deal of water will be met with; for, as before mentioned, near the projecting shelf at D the outcrop of the seam is constantly covered with water, and for some distance exposed to a pressure of 20 feet. It is also quite certain that the outcrop of the coal crosses the river, a little below the Gorge, with probably only a thin cover of shingle. We may therefore consider that almost the whole of the seam to the rise of the shaft is constantly exposed to a considerable pressure of water. As the strata here are evidently more or less broken, it is certain that the cracks and fissures, if not filled up with some substance impervious to water (which is unlikely so near the surface) will act as channels to conduct it below. Under these circumstances a powerful engine will be required to work a mine here.

On the left bank at the Gorge the seam is found high above the river; and probably on the northern slopes of the hills from there to the turn of the river at Salt-water Creek, it will also be found in the same position, so that a good deal of coal might be worked there by free level. But from what I have seen in Page's Creek, this appears to be very broken and confused, so that I have not much hope of extensive workings, but in this I may be mistaken.

At the point K a seam crops out 65 feet above high water mark, dipping about four degrees to S.W. There is a drive put about eight yards into this seam, to the full dip, at the face of which the coal appears to be thrown down by a trondle; but as the drive is nearly full of water (within 20 inches of the roof at the face) I could not examine it very closely, without clearing out the drain, which would have required some considerable time. However, from what I could see of the position of the rocks a few yards further up the hills, I think on the other side of this trondle the seam will rise to the S.W. *i.e.* up the hill, which will allow of its being drained by free-level. I could not measure the thickness of this seam on account of the water, but I presume the bottom of the drive is the bottom of the seam,

which make it about four feet six inches. This would give the following section.

	Feet	in.
Sandstone (not measured)
COAL	1	2
Sandstone, soft and jointy	2	2
COAL	4	6?

What position this holds with regard to the coal in the Gorge I cannot tell, possibly it may be the same; but if so it is very much changed, the thickness being much less, and the bed of sandstone above it reduced by six feet, and changed from a hard solid rock to a soft broken one, but this may be merely owing to local circumstances. I have been told by Messrs. Battey and Hunter that they have traced this small seam for more than half a mile on the hill-side, between the mouth of Salt-water Creek and the drive, and that it appears moderately regular. I have surveyed up Salt-water Creek as shown on the plan, but so far as I went saw no indication of solid rock, but there is drift coal in the bed of the stream.

I think the best place to work coal at Mokihinui in the first instance, will be somewhere on the left bank of the river in the neighborhood of Salt-water Creek, as it is probable that some might be obtained there by free level. And I think in sinking there would be less water to contend with than on the other side, where the outcrop of the seam is so much exposed to the action of the river. Being nearer the sea would also be a great advantage, for the difficult part of the road below Stony Creek would be avoided.

There is no doubt that coal might be most advantageously worked here; the disadvantage of being under water level (even supposing the whole to be so) is to a great extent balanced by the short distance to the port. Here as elsewhere the question of a harbor is the great point to be considered, for where the best harbor is there will be the great coaling-port.

The great body of this part of the coal-field will, doubtless, be found further up the river, and more towards the south in the low country before spoken of. In this part large seams are reported by the four people who have been up the river, and there is a great deal of drift coal. I have only been about a mile further up than the Gorge, having left the river before I expected, or I should have continued the survey to the base of the Lyell range, and explored the country to the south. I did traverse the river about a mile further than is shown in ink on the plan, but as I find in plotting that there is some error in this part of the survey I have merely put it in pencil.

As to the fitness of Mokihinui as a harbour for colliers, I can only state a few facts which may assist a nautical man to form an opinion.

No. 2 Plan shows the mouth of the river at low water in ordinary tides; all that is colored yellow is dry at low water, and the edge of the bush may be considered as extreme high water mark, though it can only be in high spring tides, accompanied by heavy gales that the water reaches so far, the outside of the line of drift timber being the usual high water mark. Since I came to Nelson I have heard that there is a reef of rocks from the end of the north spit, extending to the north and dry at low water springs, if so the water must be very much lower than I have ever seen it, as there was no indication of the reef when I was at the end of the spit, as shown on the plan.

The channel must be very narrow indeed if the water is much lower than represented on Plan No. 2, which shows low water in the morning tide of January 25th, 1863, five days after new moon. The extreme ends of the spits are very flat but what the

The additional Plans and Diagrams are as follows viz:—

No. 4. Is a branch of the Waimangaroa River, from Coal Brook Dale to its junction with the north branch in the gorge; showing the position of several important seams of coal, and the height above the sea of most of the survey stations and other interesting positions.

On the margin there is a rough section of the Gorge of Waimangaroa showing strata. Also a rough section on a larger scale showing the strata of the perpendicular and overhanging cliff A. As this was inaccessible further up than the 5 ft. 6 in. seam of coal (which I measured on the spot) the other part of the section was constructed from observations taken by the theodolite placed on the opposite side of the gorge at B. The distances between the different beds were measured by taking the vertical angles, and the nature of the rock was judged as best I could by examining it through a glass; so that this section cannot be depended on as absolutely correct, though it is sufficient to give a very good idea of the face of the cliff. Also a section of strata at C, showing a seam of coal 16 feet thick; this section is from actual measurement on the spot.

No. 8 Diagram is a rough section along the lines from station a. K (see Plan 2. Sheet II) to station 5 S in blue; and from station 7 V to station 18 T and 17 U and the Wariatea River in red. And other lines and positions on the same hill-side in black. This section is so arranged as to show places as near their true position with regard to each other as the nature of such a section will admit: to do so correctly, except as regards the vertical measurement, of course is impossible.

No. 10 Diagram shows a section of strata at O, (see No. 2 Plan, sheet 11, and Diagram No. 8.) This was taken by exposing the outcrop of the different beds where they were found solid at a moderate depth from the surface. This is from accurate survey and shows everything in its true position, the horizontal and vertical scale being the same.

No. 11 Diagram is a section of the surface of the hill P, (see Plan II. and Diagram 8), showing a bed of crushed coal in its position; the horizontal and vertical scale being the same.

I will now endeavour to give you some account of the steps taken in searching for workable seams of coal, at a lower elevation than they had hitherto been found, and the result of this examination. While the store was being built, and the provisions carried over from the mouth of the Wariatea river, I cut a line up the left bank of that river to near station 17, and examined it as minutely as possible. For some considerable distance, the recent formation of soft white sandstone and black marl, spoken of in my last report, is found, but above it no solid rock appears till you get about 1000 feet up, then the solid beds of grit, sandstone and conglomerate appear, a good deal confused and in many places in perpendicular precipices, this continues for some hundreds of feet, after which the strata are more regular, dipping generally to the N.N.W. at angles varying from 8 deg. to 20 deg. I found no seams of coal here, which is not surprising for in such a rugged gully, where the softer beds of coal and shale are washed out, the overhanging rocks fall down and cover everything up.

After finishing the dépôt, I moved the camp up the

hill and started a line from station 14a K (see Plan second Sheet 11) along the side of the hill, shown by a series of red lines on the plan, and blue lines on the section (Diagram 8). While this was doing I kept four men constantly employed in digging into the hill-side, in the hope of finding seams of coal, or at all events solid rock, so as to enable me to form an idea of the position of the strata. The most important places where these trials were made are marked on the plan and section, and I will endeavour to give you an idea of what I found in these various localities. The first trial was in a narrow gully near the point L, about 450 feet above the sea: here no solid rock was seen, but immense blocks of grit and sandstone were found in loose earth and broken stones, to a depth of eight or nine feet; neither could I find anything solid down the stream till I got to the recent formation. Further up the same stream near the point L_a 950 feet above the sea, I fancied the rock was more solid but digging down I found that everything was loose, though the broken fragments of rock were so large as to have the appearance of being in the solid. The whole appearance of this part of the hill side, leads me to suppose that large masses, probably acres in extent have slipped down solid, and been afterwards broken up, thus forming a comparatively level step about half way up the hill. So far as I can judge it is hopeless to endeavour to find rocks *in situ* in this locality.

Station 4 is the top of a spur running down from the edge of the table land near station 18 T to the plain, this spur divides the hill-side into two distinct districts to the north and south of it. After examining the streams on the south side of it, and finding nothing satisfactory, I met with a bed of loose soft coal nine inches thick and almost flat, in a deep gully on the north side, at the place marked M, and 673 feet above the sea. Encouraged by this I set all hands to work and laid bare the face about 6 yards wide, brought up a trench from below, and cleared the face of the hill above, as far as the rock continued solid. Just below the outcrop, the strata dip to N.N.W. 45 deg. then suddenly flatten where the coal was first found exposing there the following section, viz.,

	Ft. in.
Small beds of Sandstone and platy matter	14 0
Yellow Sandstone (strong).....	1 6
COAL very soft and loose	0 9
White Sandstone (thickness unknown)	

About 60 feet below this there are solid beds of grit and sandstone dipping to N.W. and N.N.W. 60 deg.

Above this there are several places where I endeavoured to find solid rock without success. It appears strange that immediately above these edge beds, the strata should be almost level for a short distance, and then all trace of them be lost. Whether they are in their natural position or part of a large slip, I can scarcely form an opinion.

At the point where the river "Rapid" is crossed at N, 671 feet above the sea, the strata dip to the N.W. 30 deg.; five chains further up (750 feet) the river falls over a perpendicular precipice of about 40 feet, composed of thick beds of grit and conglomerate with a small bed of shale at the bottom, apparently dipping two ways, viz., to N.N.W. three degrees and to S.S.E. six degrees. From the edge of the table land to the top of this fall, the river flows over solid beds of grit, sandstone and shale, dipping pretty regularly to N.W. and N.N.W. at from three to seven degrees. This is the lowest point on the whole mountain side, where I have found the strata regular and moderately flat and unbroken. In the streams to the north of this and about the same elevation where solid rock is found, they are generally pretty regular, with a moderate dip.

At the point O, I found a bed of grit cropping out on a steep part of the hill-side, and by clearing the surface I got a section of the strata about 70 feet thick, shown on Diagram 10, the dip here is to S.S.E. four degrees. Both above and below the regular beds shown, the accumulation of debris is so great as to stop the work of excavation, the face of the trench at *a* being nine feet deep, yet nothing solid was seen above the bed of black sandstone. Below the first bed of grit at *b* no solid rock is found, though a great many places were examined to the depth of eight or nine feet, for I was unwilling to abandon a place where the strata, whenever found, were so regular and containing so much shale, which is always found in the immediate neighbourhood of coal. The lower part of this section is 970 feet above the sea.

At P, 805 feet above the sea (see Diagram 11) loose small coal was found spread over the surface of the ground, on the side of a steep spur, at the place marked *d*, and on tracing this up, a regular bed of one foot six inches thick was found, composed of small coal mixed with a little broken shale and other rocks, above this was a bed of broken shale, and above this again, surface soil and debris. This bed of coal was resting on a solid stratum of hard white sandstone, quite smooth and polished, with longitudinal scratches, the whole evidently formed by the friction of loose soft matter mixed with harder particles sliding down the surface of the rock. This section like the last shows everything in its true position from actual measurement, for I was anxious where it was possible to show exactly how the strata lie on this hill side. You will observe that in the lower part it is very steep and irregular but gradually becoming more level as it ascends. I traced it by digging a trench down to the top of the hard sandstone, from *d* to *a*, at which point, being nine feet from the surface, I abandoned it and commenced a fresh one at the surface at *c*, keeping on the top of a bed of sandstone to *b*, when the depth of the trench again obliged me to desist, and as there was no satisfactory bed above, from which to commence again, I left the place, as it was not worth while to drive for a seam one foot six inches thick. However it is satisfactory that at this point the strata have the appearance of being regular. It will be observed that at several places the strata are cracked, this I expect has been caused by the sudden bending. Further up the same spur the strata are still pretty regular, and at Q there is a small seam of shale and coal dipping to the W. at an angle of 10 degrees.

At R, 1258 feet above the level of the sea, there is a seam of coal three feet thick dipping to the N.W. 10 degrees. I cleared the face of the seam and intended to have driven in a few yards, but the outside was so very soft and wet that it could not be done without close timbering, which was not worth doing at that time, as the position is not favourable for working, even if a three feet seam can be considered workable in the first place, in a district where so many larger ones exist. It is unnecessary to mention all the places where trials were made, for in most of them nothing was found but debris.

On the whole this exploration on the mountain side, though it has not exposed the outcrop of workable seams, has been very useful as showing the position of the strata at various points, and different elevations, and from what I have seen I have come to the following conclusion, viz:—

That on the side of the table land of Mount Rochfort, between the Wariatea and the Waimangaroa Rivers, it is useless to seek for coal seams or indeed solid rock at all, (except in a very broken and distorted shape), at a less elevation than from 600 to 800 feet above the sea. Above this the strata are much more regular, and continue to get more level and less broken up to the edge of the table land. Perhaps much regularity of surface need not be ex-

pected under 1000 feet; but I think this distortion may only continue a short distance from the surface, on the steep hill side, where the beds appear to have been folded over and broken off while the whole mass was being elevated and that regular strata will be found at a much lower elevation in the body of the hill. For it is evident that while the whole was being forced up the surface would bend and slide while the interior of the mountain might remain almost unchanged except in elevation.

From the edge of the table land and over it to the Base of Mount William, the nature of the surface and probable condition of the strata have been treated on in my report of September 3, 1862.

The lines from station 15 to 27 were cut down a spur to the plain, to connect the upper with the lower part of the survey.

After completing this part I traversed over the table land from station 18 T to the gorge at the junction of the north and south branch of Waimangaroa, and connected this part with Coal Brook Dale on Plan 4.

The gorge of Waimangaroa is a most extraordinary chasm, having apparently been torn open by some great convulsion; the sections from A. to B. will give some idea of its nature, it is from survey and rough measurements, and the horizontal and vertical scales are the same.

The walls of the Gorge on all sides drop from the level of the table land in perpendicular and in many places overhanging cliffs from 300 to 400 feet high; from the base of which to the edge of the river on each side, there is a steep shelving base bank formed of the broken rocks alone; in one place this bank is almost covered with hundreds of tons of coal fallen down from the large seams on the face of the precipice at A, here there is a splendid section exposed, about 350 feet deep, shown on the margin of Plan 4; in this there are several seams of coal but it is impossible to examine them closely on the face of the precipice, as I could only get to the lowest which is five ft. six in. thick; the remainder of the section was constructed as before described; but at the distance of nearly half a mile it is almost impossible to distinguish the different rocks, particularly coal and shale which have long been exposed to the sun and atmosphere. The section, such as it is, is given below.

	Ft.	in.
Grit and Sandstone ...	49	0
Sandstone and Shale ...	32	0
Grit ...	27	0
Grit, Sandstone, and Shale ...	34	0
Sandstone ...	22	0
Coal and Shale ...	13	0
Sandstone ...	9	0
Coal and Shale ...	12	0
Grit ...	42	0
Coal ...	5	6
Shale ...	5	0
Yellow Sandstone ...	20	0
Slaty rock, apparently not belonging to the Coal formation, thickness unknown.		

A little further to the south on the same precipice the whole of the beds of coal and shale join, (the intermediate bed of 42 feet of grit having run out,) and form after their junction a very large bed of coal and shale; this cannot be traced further, as there is a slip which covers everything up, but beyond this again there is a large seam exposed on both sides of the river at C, *Ca*, *Cb*, *Cc*, *Cd*. I measured this seam and the strata above it carefully on the spot, and got the following section which is drawn to scale on the margin of Plan 4.

Section of Strata at C, 1692 feet above the level of the sea, Dip to N.W. 15 degrees.

	Ft.	in.
Grit with beds of Sandstone (thickness unknown)
Soft fine grained Sandstone	...	4 0
Hard white Sandstone	...	15 0
Grit	...	16 0
Hard white red-sandstone (good reef)	...	2 2
Coal	...	3ft. 3in.
Shale	...	0 3
Coal	...	4 6
Shale and Coal	...	0 5
Coal	...	5 7
Shale	...	0 1½
Coal	...	1 3
Shale	...	0 4
Coal	...	1 0
Fine grained grey Sandstone (thickness unknown)		16 8½
		53 10½
Thus giving, Coal	...	15 7
" Shale	...	1 1½
Thickness of seam	...	16 8½

The bands of shale in this seam are far from being a disadvantage, for they form partings which will facilitate the working, but it is probable that the two lowest seams of one foot and one foot three inches will be lost in the working, leaving 13 feet 4 inches or say 13 feet of available coal. This is the finest seam I have seen in the district, and the quality is equal to any. I lighted a fire to try it, and had some difficulty in extinguishing it, as the small coal took fire and burnt so freely that at one time, I feared the seam itself might take fire from it. At Cc I again measured the seam 13 feet above the water in the stream, but I could not get to the bottom of it. You will observe from the direction of the arrows that the strata here dip both east and west, and the whole appearance of the place shows that the Gorge has been rent open by violent upward movement. The general dip here both ways is about 15 degrees.

On the very top of the precipice at D, on the right bank of the north branch there is a large seam, but as I have only seen it from the other side of the Gorge, I cannot tell either its quality or thickness, but as seven or eight feet, at least, were visible above the tops of the trees, there is no doubt of its being large. About a mile above the junction on the left bank of the branch, I found the following section, viz.:-

	Ft.	in.
Surface soil of the level table land	0	6
Grit and Sandstone	40	0
Slaty Sandstone	1	0
Coal	11	0

Dip to S. S. W. five deg.

This seam is 70 or 80 feet above the river.

Below the 16 feet seam in the Gorge there is a sort of slaty formation, and below this again nothing is found but igneous rocks, so it is quite evident that this is one of the lowest, if not the very lowest seam in the coal field.

From these observations I have come to the following conclusion, viz.:-

That as the west side of the mountain between the Wariatea and the Waimangaroa Rivers wherever it has been tried, is composed entirely of rocks belonging to coal formation, except in the lower part which is covered by the more recent beds of soft sandstone and marl, without any indication of igneous rocks, the lower part of the coal field at all events must exist there.

And as it has been shown in the Gorge of Waimangaroa and the neighbouring streams, that large and valuable seams are found in the lower part of the field, it is almost certain that these seams exist on the western side of the mountain, at a much lower level than the edge of the table land. But as they do not show themselves cropping out there, being covered by the enormous accumulations of debris, it will be necessary to search for them by sinking or boring. Diagram 9 will illustrate this: in it the 16 feet seam is shown in its true position in the Gorge of Waimangaroa, and the surface is from actual survey, and may be depended on as moderately correct. For the sake of illustration I have continued the seam from the Gorge to the edge of the table land, though the dislocations are merely to show that for part of the distance (judging by the surface) a good deal of disturbance may be expected, and that the remainder is moderately level and regular. What I wish particularly to illustrate, is that it is almost certain the seams exposed in the neighborhood of the Gorge, will be found on the western side of the mountain, probably many hundred feet below the edge of the table land, and in that position and for some considerable distance to the east, north and south of it, they may be expected to be moderately regular, and in a favorable position for working. But there is every reason to expect a good deal of irregularity even here, and I do not hope to find in any part of this coal field the uniformity met with in many parts of England where there are tracts of thousands of acres having scarcely a dislocation more than a foot or two, and the angle of dip not varying more than two or three degrees over the whole extent. In a field which has evidently undergone such violent convulsions this cannot be expected. But seams such as we have here, will compensate for many disadvantages. Now as up to a certain level (say 800 feet) on the mountain side, no regular strata have yet been met with, I would recommend borings to be made, in some convenient place about that level where it is quite certain the strata are solid and regular,—probably in the neighborhood of the river Rapid, near N (see Plan 2, Sheet 11, and Diagram 8). Let the boring if possible pass through the whole coal formation: it is impossible to form an opinion how deep that is, but I think there are sufficient data to justify the conclusion to which I have come, that some of the finest seams in the series will be found here, at an elevation of less than 800 feet above the sea.

Supposing a number of seams to be found, which is very probable, the next question would be, which of these ought to be worked first? Other things being the same it would be the best to commence at the lowest, for the work necessary to win would serve the same purpose for those above, at the same time the length of the drift or tunnel, necessary for bringing the water and coal out of the mine to the railway on the hill-side, would be increased in proportion to the depth, though this would probably be compensated by the mouth of the mine being so much nearer the base of the mountain, thus shortening the railway and what is of more importance reducing the elevation. There are other things more purely mining, which would have to be considered, in determining the order of working the different seams. For instance, suppose we have a 16 feet seam in a certain position favourable for working, and above it, say 50 feet, another of 6 feet; if the lower seam is worked first and all the coal removed, of course the settling down of the superincumbent mass of strata to fill up the open space of 16 feet, would very seriously affect the upper seam and render it much more difficult, if not impossible to work, from being so much broken. And in places where much inflammable gas is generated, the difficulty would be increased, by its

rising through the cracks of the broken strata below into the seam. But in a coal field situated as this is, I do not anticipate much trouble from inflammable gas, though from the quality of the coal, a good deal might be expected, if it were at any great depth; however it is quite possible that it may be found in places, and is certainly not to be forgotten in the working of any coal mine.

Now I will suppose that a little further up the River Rapid than the point N, at an elevation of 800, feet a bore hole is put down, and at the depth of 150 feet, a seam is found, which it is determined to work; the first thing would be, to find the nearest suitable place to put in a drift or tunnel, to drain the water and bring out the coal. As an important object is to get the mouth of the mine at as low an elevation as possible, it would be advisable, instead of driving level, to go sufficiently below the seam to allow of a proper inclination for working a self-acting incline to the greatest advantage. The length of the tunnel would of course be regulated by local circumstances; but supposing it to be 400 yards with a fall of 1 in 15, it would give 80 feet, which being added to 150 feet (the depth to the seam) makes 230 feet below the top of the bore hole, or 570 feet above the sea. To admit the waggons used on the railway into the mine, would require the tunnel to be of considerable size; but it would probably be more convenient to use smaller ones underground in which case six feet square would probably be sufficient, with additional room where the waggons pass each other in the middle; where for a short distance the way would be double, and in the upper half where there would be three instead of two.

It is probable that a considerable length of this tunnel would pass through loose debris, and would require to be secured either by timber or arching; it would therefore be advisable to reduce its dimensions to the smallest size consistent with thoroughly efficient working capabilities. If there were more seams above, it would be well to continue the tunnel, perhaps with a sharper rise, and so cut them all diagonally.

It would be necessary to sink a shaft for the permanent ventilation of the mine, but six feet in diameter would be sufficient for that purpose for a long time. Possibly also a small shaft might be required for the ventilation of the tunnel itself during its formation. But it is unnecessary to enter into these particulars, indeed it is impossible without data to do so; but I will suppose that £5,000 is necessary to win the coal and put the mine in a working state at this place, viz.: about nine miles from the mouth of the Buller and 570 feet above the sea. Now the highest point on the line marked out from the Buller before ascending the hill, is at No. 6 station of my former survey, 123 feet above the sea.* (see Plan 2, Sheet 11,) if therefore the line is kept skirting the hill-side, as partly shown by the dotted line on the plan, at an uniform ascending gradient, which will allow a locomotive to take back the empty waggons, a considerable height will be overcome in the next three miles, which is about the distance to the proposed mouth of the mine. What that gradient ought to be is an important engineering question with which I will not meddle; but on looking at heavy gradients on English locomotive lines, I find on the "Birmingham and Gloucester Railway" a plane upwards of two miles long with a gradient of 1 in 37. This is called the "Lickey incline," and is worked entirely by locomotives, and that with traffic both ways, whereas the whole of the traffic on the Buller line would be descending, and nothing going up but empty waggons and light articles, such as timber for mining purposes, and provisions for the workmen,

* This was incorrectly put down before as 110 feet.

&c. Now a gradient of 1 in 37 in three miles will overcome an elevation of 142 feet, so we have the following figures.

	Feet
Mouth of the mine above the sea	570
Deduct height of No. six station	123
<hr/>	
Deduct height overcome in three miles,	147
by a gradient of one in 37...	...
	<hr/>
	Ft. 305

thus leaving only 305 feet to be overcome by self-acting inclines. Whether it would be better to continue the locomotive line so far as here suggested, or use the self-acting inclines more extensively, is a question to be determined by an engineer after a minute survey of the ground. But on all these points you will shortly have the report of the Provincial Engineer. I was so unfortunate as to miss that gentleman on his visit to the West Coast, which I regret exceedingly.

You will observe that in my report of September 3, 1862, all the calculations are based on the supposition that the mine would be in Coal Brook Dale, and that I merely suggested the probability of its being obtained on the side of the mountain below the level of the table land; for at that time though I felt very little doubt in my own mind, I touched very lightly on the subject, as I had not sufficient data to justify me in expressing a confident opinion; I therefore confined myself to what I knew.

At that time I had no means of judging in what part of the field the known seams were situated; now I have proved that some of the most valuable are in the lower part and therefore must be below the level of the edge of the table land. I feel confident that for years it will not be necessary to take the railway on to the higher part of the field at all, though eventually it must go there. Probably at present it will not require to go more than 600 feet above the sea, thus avoiding at least three miles of the very worst part of the line and 1529 feet of perpendicular ascent.

To set against those advantages there is the expense of boring for and winning the coal in this position; but even if it cost £10,000 to do this instead of the £5000 I mention before, there will be an immense saving in the first outlay and a great reduction on the cost of conveyance to the port.

Whether I am justified in those conclusions, by the data I have laid before you in this report is for others to judge, but I feel very confident on the subject.

It would be a great satisfaction to me, as I have before mentioned to your Honor, to have the opinion of some other mining Engineer on this most extensive coal field, for I feel that the subject is of great importance both to the province and the Colony, and deserves the greatest attention.

I think no time should be lost in making the necessary borings, &c., to ascertain the exact position of the different seams on the mountain side. But before this can be done, it will be necessary to form a packing road at least, to enable the apparatus and stores to be taken up: this I think could be done at a very moderate expense.

As the chief item of expenditure in this work will be the railway, I will not venture to form an estimate, as you will have the views of the Provincial Engineer on the subject; neither have I attempted to mark out any line up the mountain side. But in cutting survey lines and paths, one of my great objects was to enable any one to get from place to place so as thoroughly to examine the nature of the ground. I also burnt as much as possible, one of my standing orders was "use

the fire stick whenever there is a chance," so that now there is a good deal of cleared land, and very little difficulty in moving about, where before it was almost an impenetrable thicket. After my return to Nelson, I sent the Provincial Engineer a plan showing the cut lines, and a rough table of the heights above the sea of the stations on these lines; from this table corrected by more careful calculations, I constructed the section shown on Diagram 8, this I trust would be useful in his examination.

As an opinion has been expressed by so competent

an authority as Dr. Hector, that the Buller coal is superior to any yet found either in New Zealand or Australia, I hope and think that it will shortly compete in price as well as quality, with any coal in the Southern Hemisphere. And nothing could be more fortunate than to find, that the splendid coal discovered by Mr. Rochfort nearer Nelson, could be brought into the market of the world at a lower rate still.

I have, &c.,

JAMES BURNETT.