1873.

NEW ZEALAND.

THE COAL FIELDS OF NEW ZEALAND,

(REPORTS ON).

Presented to both Houses of the General Assembly by command of His Excellency.

MEMORANDUM for the Hon. the MINISTER for PUBLIC WORKS.

IN forwarding the correspondence which has passed relative to the development of the coal fields during the past year, I have the honor to report on the action which has been taken, and the results obtained in different parts of the Colony, and to make certain recommendations with reference to future explorations.

AUCKLAND.

1. *Wangaroa.*—The grant of £150 made to the Coal Prospecting Committee at Mongonui, which was formed for the purpose of prospecting this district, was not applied for until May last, and since then several bores have been put down in the Parapara Flat, near Mongonui, under the superintendence of a practical miner recommended by the Kawa Kawa Company. The latest samples forwarded show that a seam of coal, of moderately good quality, has been reached, but the thickness is not yet ascertained. Further expenditure in this district will probably be required for machinery at Kaiou Creek, Wangaroa Harbour, as recommended in my last report, but the application of the grant merely to boring has not been attended with good results, and is not advisable for the future.

Mr. Bell, a resident at Wangaroa, reports the discovery of a seam of superior quality to the north of the harbour, which, from his description, appears to be a continuation of the coal which crops out on the mud flats, referred to in my report of last year.

2. *Kawa Kawa.*—The Coal Company at this place has obtained a grant of £1,000 to assist the boring, so as to determine the best place for sinking shafts. No report has been received of the progress that has been made with this work.

3. *Wangarei.*—A fresh discovery of coal in the vicinity of this excellent harbour has been reported, and steps have been taken to have it thoroughly explored.

4. *Waikato.*—The northern part of this field has been recently taken up by a company, who propose a branch railway to connect with the main southern trunk from Auckland. From the reports appended, the quality of the coal appears to be good for a brown coal, and will no doubt find a ready market in Auckland.

5. *Raglan.*—An altered coal, of very excellent quality, has been discovered and reported to be within easy reach of this harbour. The extension of the Waikato brown coal formation to this district was shown by Captain Hutton's survey in 1866, but there is also an older formation at this place which contains thin irregular seams of coal, and it is not yet certain from which of these formations the samples of coal have been obtained. Specimens of brown iron ore, of very excellent quality, containing 67 per cent. of iron, were also sent with the coal.

WELLINGTON.

6. *Wanganui.*—Samples of brown coal from several localities in the Wanganui district, and also from Rangitikei, have been received, which, though of inferior quality, yet prove the existence of the brown coal formation beneath the marine tertiary series.

NELSON.

7. *Collingwood.*—The chief work at this place during the past year has been the extension of the tunnel for the purpose of exploring the coal measures, which was recommended in last year's report. The tunnel is now in about 390 feet, with favourable indications; and there still remains about 300 feet more before the main coal seam can be cut, which is expected to be accomplished about the end of this year. The total estimated expenditure for this work is about £1,500, of which sum the Government have undertaken to provide one-half, the remainder being borne partly by a grant from the Provincial Government, and partly by the Collingwood Coal Company. The importance of carrying out this work, with the view of exploring coal measures that extend over a very large area, and containing a very valuable description of coal, and in the vicinity of a good shipping place for vessels of

the largest size, has already been urged in a former report; and since the discovery of ironstone bands along with the coal, under circumstances that favour their being economically worked, there is still further reason for the expenditure in this district.

8. *Mount Rochfort.*—The sum of £300 was authorized for the further exploration of this district, and the following work performed:—The coal seam at the Ngakawau River has been traced on to the high level plateau, and outcrops found on various points, so as to indicate its extension over a very large area; one block, containing at least 7,000,000 tons, being proved by the natural sections observed in the gullies. The main seam, which has a greatest thickness of 25 feet, is a trough-shaped deposit, extending in a north and south direction for many miles, with a lateral extent of about one mile and a half, but it thins towards the margins to 3 feet. This trough of coal is broken by transverse faults, which reduce it from an average altitude of 2,000 feet on the plateau to the sea level at Ngakawau Mine. As the coal is all above the water level, a very large proportion of it can be profitably extracted. The discovery of coal in the bed of the Waimangaroa Stream, near the level of the sea, raised an expectation that the seam described in a former report as occurring on the seaward face of Mount Rochfort, might be found under circumstances favourable for its being worked. A drive put into the spur for 130 feet, with the view of cutting the seam, has not, however, resulted in the discovery of valuable coal; but I recommend that further explorations should be made, either by continuing the drive already commenced or by excavating in a fresh locality.

9. *Grey River.*—No change has been experienced in the character of the Brunner Mine; the rumour that was circulated to the effect that the fault had changed its direction, and that the extent of coal available was thereby diminished, being without foundation, as no fresh levels have been driven on the fault, nor have the workings been extended in that direction during the past year. Several areas of coal that can be worked by shafts have been marked out on the south side of the river, in that portion of the reserve leased to the Greymouth Coal Company; and though no active operations have been commenced, there is every reason to expect that by the time the railway to that place is completed, a sufficient supply of coal will be available to keep it fully employed.

10. *Kanieri.*—The explorations in this district during the year have not led to any important discovery. The area occupied by the coal formation is very limited, and the strata, which are highly inclined, do not appear to contain seams of sufficient thickness to enable their being profitably worked. Only a small portion of the field has not been explored; but works are in progress to set at rest the question of whether any workable seam of coal exists in the district, the total expenditure on the exploration of which has been £400.

OTAGO.

11. *Preservation Inlet.*—The works which have been executed towards the development of the coal seams at this locality by a private company, were inspected in January last. Coal of two distinct qualities has been found here. At Gulche's Head and on Coal Island, glance coal, in thin, much-disturbed seams, that have not proved on trial to extend over a sufficiently large area to be of importance; and on the mainland, south of Coal Island, a seam of brown coal 4 feet thick, on the opening up of which the chief part of the Company's funds have been expended. The extent of this coal seam is however too limited, even if the quality were better, to warrant the large expenditure on tramways and wharfage that would be necessary to work the coal successfully. My attention was directed to a supposed extension of this coal field, with available seams towards the south-east; but the examination of the section afforded by the sea cliffs convinced me that the strata are too much disturbed to justify exploration by boring as has been proposed, and that there is no surface indication of the existence of available seams.

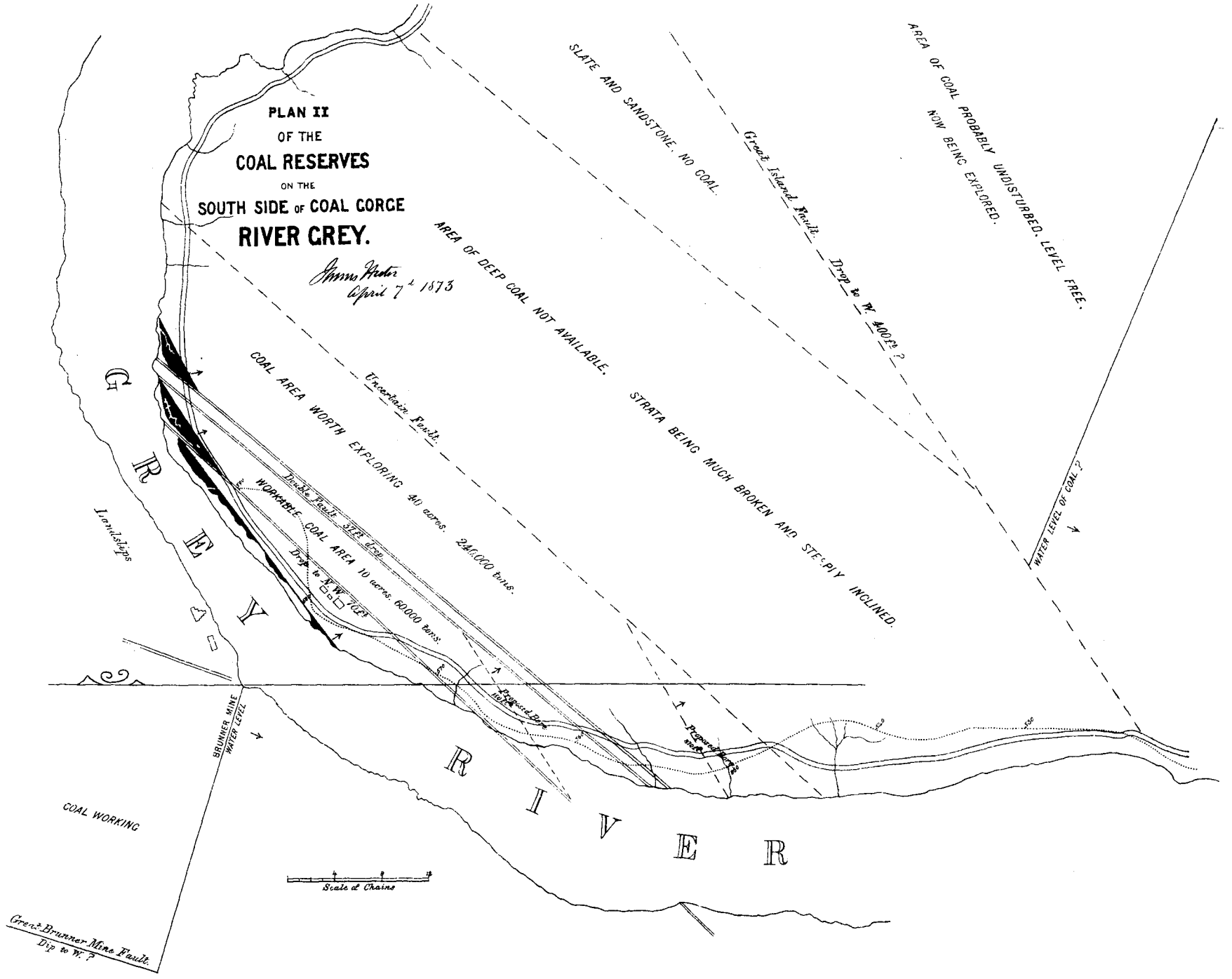
12. *Southland.*—A sum of £100 has been spent in tracing the coal from the west to the east side of the Nightcap Hill, as recommended by Captain Hutton. The seam has been ascertained to be 10 feet thick, and in a very accessible position; but the samples obtained show that it is a common brown coal, and very inferior in quality to the pitch coal that is supposed to be the continuation of the same seam at Moreley Creek. Under these circumstances, before recommending the construction of a line of railway to connect this place with the Bluff and Wakatipu line at Winton, it has been thought better to explore more carefully for seams of brown coal in the Seaward Bush, and at other points nearer to the existing railway line, as this was only set on one side owing to the supposed superior quality of the coal at Nightcap Hill. The works for this purpose are now in progress under the supervision of a local committee subsidized by Government.

13. *Waikava and South-east of Otago.*—The large area of carbonaceous strata belonging to the upper secondary period in this district, has naturally led to a keen search for coal seams by those who are locally interested, but no indication has yet been found of any valuable seam. The reported discovery of such a seam led me to re-examine the coast north of Waikava, where a fine section of the strata is exposed. The coal there seen occurs only as masses of driftwood converted into coal, which are imbedded in coarse sandstone. The shale beds with fossil plants, which at Waikava contain thin seams of coal, were traced in these sections, but without any coal being found.

14. *Clutha: Green Island and Shag Point.*—The coal deposits at these places are waiting only for the extension of the railway system to be fully developed. The prejudice against the use of these coals will no doubt be overcome whenever the price is reduced and the supply is sufficiently steady to bring them into general consumption for household purposes.

CANTERBURY.

15. *Malvern Hills.*—The extensive area of brown coal in this district is now well established, together with the existence of local patches, where the seams have been altered to glance coal, and have thereby acquired a higher value as fuel. These coals are in very accessible positions, and will be brought within reach of consumers at Christchurch by the branch railway that is in course of construction.

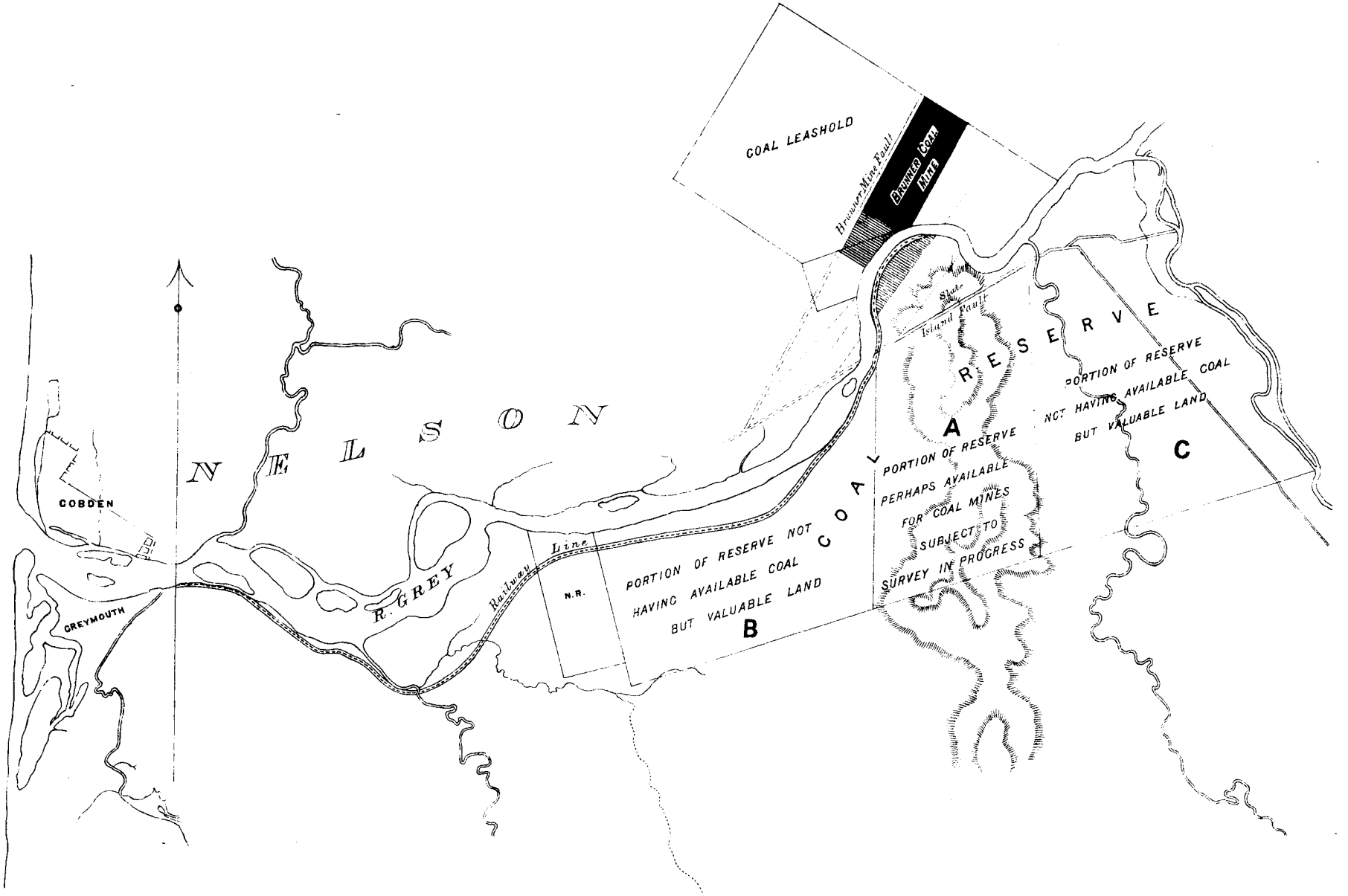

PLAN II
OF THE
COAL RESERVES
ON THE
SOUTH SIDE OF COAL GORGE
RIVER GREY.
James Hector
April 7th 1873
SLATE AND SANDSTONE. NO COAL.
Great Island Fault. Drop to W. 400 ft ?
AREA OF COAL PROBABLY UNDISTURBED. LEVEL FREE.
NOW BEING EXPLORED.
AREA OF DEEP COAL NOT AVAILABLE.
STRATA BEING MUCH BROKEN AND STEEPLY INCLINED.
Uncertain Fault.
COAL AREA WORTH EXPLORING 40 acres. 240,000 tons.
Trouble Fault. 300 ft drop.
WORKABLE COAL AREA 10 acres. 60000 tons.
Drop to N.W. 70 ft
Proposed Drive
Proposed Drive
WATER LEVEL OF COAL ?
GREY
RIVER
Landslips
BRUNNER MINE WATER LEVEL
COAL WORKING
Great Brunner Mine Fault.
Dip to W. ?
Scale 4 Chains

PLAN I

SKETCH MAP
OF
COAL RESERVES
GREY DISTRICT

40 80
SCALE OF CHAINS

James Hector
5 May 1873



Attention has been directed to the coal at Ben More, which lies in a less accessible position at the back of the Malvern Hill, as it was supposed to be of such superior quality as to warrant an extension of the railway system to bring it within reach of the market; but the samples submitted by the promoters of a company formed to mine this coal prove it to be a brown coal of the same value as that which is abundant in the front part of the range.

SUMMARY.

From the foregoing summary it is evident that the source of supply of coal adapted for marine steamers in the Colony has narrowed down to the coal fields at Collingwood, Mount Rochfort, and the Grey, and it is desirable that the effort to supply the market from our own coal fields should be concentrated on these districts.

I would also propose to assist in the development of the Northern coal fields, situated north and south of the Bay of Islands; for though not yielding such a useful description of coal, the coal found there is sufficiently good to be in demand for working stationary engines at the Thames, and for the supply of which demand they are most conveniently situated.

The remainder of the coal fields in the Colony, which yield only brown coal, are sure to be developed whenever they are easy of access and there is a local demand; and I would recommend that in future assistance should be given towards the development of such deposits only in the form of subsidies to local efforts.

At the same time, as brown coals are so abundantly distributed, I think it advisable that carefully conducted experiments should be instituted, with the view of ascertaining if they can be adapted by any artificial process for the use of locomotive engines.

The principal varieties in the quality of the brown coal found in New Zealand appear to arise from three causes:—

(1.) The coal seams in some localities have been on fire, and for a considerable area round the coal that is burnt, the seam is converted into pitch coal, containing less water, and having bituminous or resinous matter disseminated throughout its substance. It should be remarked, however, that the variety which I designate pitch coal frequently occurs where there is no evidence of such local action, and its character must then be attributed to the peculiar nature of the vegetable matter from which the coal seam was originally formed.

(2.) When igneous rocks, either contemporaneous or of subsequent date to the deposit of coal, have affected the seams, the coal has been changed into a glance coal of various degrees of hardness, from a laminated brown coal in which only incipient alteration can be observed, to a perfect anthracite or stone coal, but never in any case being converted into a caking coal, or one that yields a coherent coke.

(3.) Where extensive areas containing coal seams, such as the upper secondary strata on the West Coast, have been raised in anticlinal arches, and by complex disturbance have been subjected to pressure and thorough drainage, the coal is converted into a bituminous form which closely resembles in character and equals in value some varieties of coal found in the true carboniferous formation, as they form a coherent lustrous coke and yield an illuminating gas.

In each of the above cases the chief change in the coal is the expulsion of the combined or constitutional water, and in the first and third case the substitution for it of bituminous matter (hydrocarbon).

Such a change could undoubtedly be effected by artificial means, and all that requires to be determined is whether the manufacture of such artificial fuel from brown coal would be profitable.

During the ensuing year I recommend that the following explorations should be charged against the grant for the development of coal fields:—

Estimates.

A. Development of coal seams of estimated value:	
1. Completion of the Exploration Tunnel at Collingwood	£500
2. Exploration of the coal seams at Pakawau	150
3. Tracing the extent of the coal on the Mount Rochfort plateau, and at Waimongaroa	500
4. Tracing the coal measures on the south side of the Grey River	500
5. Proving the down-throw of the fault in the Brunner Mine, and determining the best way of working the coal on the north side of it	200
B. Subsidies to assist local committees in searching for coal	1,000
C. Grant already allotted to the Kawa Kawa Company	1,000
	£3,850

The following table gives the composition of the various coals which have been analysed during the past year, in continuation of the schedule appended to my last report.

20th August, 1873. JAMES HECTOR.

Enclosure.

SCHEDULE of NEW ZEALAND COALS which have been reported on by the Geological Survey Department, 30th June, 1872, to August, 1873.

AUCKLAND.

Locality.	Variety.	Evaporative Power.	Fixed Carbon.	Hydrocarbon.	Water.	Ash.	Nature of Ash.	Nature of Coke.	Laboratory Number.
Waikato	Brown coal	5·6	43·40	34·80	20·6	1·20	...	Non-caking ...	1275
Raglan (?)	Bituminous coal ...	7·5	58·25	31·36	1·01	9·38	Dark buff ...	Cakes strongly	1332
Raglan	Glance coal...	4·9	38·50	39·10	12·7	9·70	Buff	Non-caking	1337
		4·8	37·50	48·90	10·0	3·60	„	„	
		6·0	46·40	42·30	8·2	3·10	„	„	
„	Brown coal	5 6	43·33	33·23	17·37	6·07	„	„ ...	1394
Whareora, Wangarei ...	Glance coal	6·4	49·59	40·11	6 97	3·33	„	Frits slightly ...	1352
Coromandel	Brown coal	5·59	44·18	38·47	14·00	3·35	Light buff ...	Non-caking ...	1422 *b.*
„	Semi-bituminous coal	4·44	34·06	36·52	4·04	25·28	Buff	Frits slightly ...	„ *c.*
„	Carbon	8·87	68·27	...	13·33	18·40	Light buff ...	Non-caking ...	„ *d.*

WELLINGTON.

Wanganui District ...	Brown coal	5·2	40·6	24·4	23·9	11·1	Buff	Non-caking ...	1301
„ „ ...	„	4·7	36·4	31·2	18·9	13·5	„	„ ...	1323

NELSON.

Ngakawau	Bituminous coal ...	9·5	73·21	25·00	·51	1·28	White	Cakes & puffs up	1336
„	„ „ ...	9·25	71·16	25·75	2·31	·78	Grey	Cakes	1249
„	„ „ ...	10·30	79·28	18·00	1·94	·78	„	„	1368
„	„ „ ...	9·6	74·68	21·51	2·61	1·20	White	„	1393
Clarke River	Glance coal... ...	6·78	52·89	26·33	6·05	14·73	White, with red spots ...	Non-caking ...	1320
Charleston (W.C.) ...	Brown coal	5·30	40·82	33·16	21·09	4·93	White	„ ...	1367
Collingwood (W. slope)	Bituminous coal ...	7·50	58·65	35·33	4·06	1·96	Light buff ...	Coherent caking	1369
Otamataura Creek ...	„ „ ...	6·80	52·89	36·63	2·19	8·29	Pale buff ...	Cakes	1370 *a.*
„ „ ...	„ „ ...	7·20	55·61	29·29	1·36	13·74	„ ...	„	„ *b.*
Owen River	Semi-bituminous coal	6·87	52·85	38·21	4·82	4·12	Pale brown ...	Frits slightly ...	1427
„	„ „ ...	6·54	50·36	38·40	4·64	6·60	„ ...	„ ...	1430 *a.*
„	„ „ ...	6·64	51·12	37·47	4·93	6·48	„ ...	„ ...	„ *b.*
Richmond	Earthy-brown coal ...	3·76	29·16	48·21	16·67	5·96	Reddish ...	Non-caking ...	1410
„	Brown coal	5·90	45·61	43·97	8·19	2·23	Buff	„ ...	1441 *a.*
„	„ „ ...	6·10	47·20	34·42	8·82	9·56	„	„ ...	„ *b.*

CANTERBURY.

Clent Hills	Bituminous coal ...	7·1	55·10	11·95	2·27	30·68	Light buff ...	Cakes feebly ...	1255 (1)
„	„ „ ...	6·5	50·04	13·44	2·12	35·12	„ ...	Cakes very feebly	„ (2)
„	Brown coal	4·4	34·32	35·13	19 84	10·71	Light red colour	Non-caking ...	„ (3)
Big Ben...	„	4·8	38·51	35·52	22·83	3·14	White	„ ...	1446

WESTLAND.

Kanieri	Bituminous coal ...	6·06	46·60	37·40	2·20	13·80	White	Caking... ...	1248 (*d*)
„	„ „ ...	6·30	48·56	37·02	2·57	11·85	„	„	„ (16)
„	„ „ ...	6·37	49·01	44·27	·58	6·14	„	„	„ (42)
Hokitika (North side of Lagoon)	„ „ ...	7·5	57·66	38·01	1·55	2·78	„	„	1442
Grey Reserve	„ „ ...	7·63	58·73	29·53	4·21	7·53	„	Cakes strongly	1411 (1)
„	Brown coal	6·37	50·21	32·47	14·07	3·25	White, with red dots	Non-caking ...	„ (2)
„	„	5·94	47·19	30·96	17·01	4·84	White, with red dots	„ ...	„ (3)
„	Bituminous coal ...	8·34	64·16	21·02	5·53	9·29	White	Cakes strongly	„ (4)
South of Ross	... ...	8·18	31·43	42·53	6·58	19·46	Light buff ...	Dull, non-caking	1234
Grey River	Bituminous coal ...	7·39	56·86	36·49	1·16	5·49	...	...	1240

OTAGO.

Wangaloa	Brown coal	4·6	39·19	35·57	17·50	7·74	Buff colour ...	Non-caking ...	1253
Kaitangata	„	5·0	39·41	37·25	19·61	3·73	...	„ ...	1303
Waitaki	Lignite	5·0	38·07	37·32	20·50	4·11	...	...	1313 *b.*
Coal Island (Preservation Inlet)	Semi-bituminous coal	6·3	42·10	36·66	5·98	15·26	...	Non-caking ...	1329

SOUTHLAND.

Seaward Downs ...	Anthracitic coal ...	7·9	61·40	27·60	9·80	1·20	Light buff ...	Non-caking ...	1264 *a.*
„ „ ...	Semi-bituminous coal	6·4	49·61	35·08	8·06	7·25	Red	„ ...	„ *b.*
„ „ ...	„ „ ...	7·0	54·35	26·80	7·92	10·93	Red and buff ...	„ ...	1308
Nightcap Hill	Brown coal	3·7	29·30	45·96	21·38	3·36	Reddish colour	„ ...	1328

APPENDIX.

PROVINCE OF AUCKLAND.

WHANGAROA.

Mr. Thomas Ball to the Minister for Public Works.

Sir,— Mongonui, 22nd June, 1872.

I have the honor, under instructions of a Committee formed at Mongonui for the purpose of promoting prospecting for coal in the district, to urge upon you favourable consideration of the case, as represented to the Hon. Mr. Vogel by our representative, Mr. John McLeod, in a letter officially reported to have been forwarded to you.

Some desultory efforts have been made by aid of local contributions; but neither the character of the works nor the amount of money subscribed proved adequate to the development of the hidden treasure, although affording ample encouragment for further operations.

The honorable member has himself inspected the locality, with the view of forming an opinion on its coal-bearing indications, and expressed himself very confidently in favour of its capabilities. Dr. Hector has also expressed equally favourable views, formed on personal observation. So have other scientific authorities at different times during a period of many years.

This Committee therefore hope that you will recognize the reasonableness of the grounds of their application for aid from the fund set apart for such purpose during the last Session of General Assembly, and, with as little delay as public service admits, issue instructions to Captain Hutton or others competent to visit the district, with the object of advising the Government and the Committee.

Should success attend the enterprise, there is good reason to hope, from local advantages of harbour, &c., that it would be a great colonial benefit.

I have, &c.,
Thos. Ball,
Chairman to the Committee.

To the Hon. the Minister for Public Works.

The Under Secretary for Public Works to Mr. Thomas Ball.

Sir,— Wellington, 11th July, 1872.

I am directed by Mr. Ormond to acknowledge the receipt of your letter of the 22nd ult., in which you call the attention of the Government to the importance of exploring for coal in the Mongonui district, and in reply to inform you that the Government recognize the importance of the exploration alluded to by you and recommended by Dr. Hector in the enclosed reports, and have authorized Dr. Pollen to place at the disposal of the Committee the sum of £150 for that purpose.

I have, &c.,
John Knowles.

Thomas Ball, Esq.,
Chairman of the Coal Prospecting Committee, Mongonui.

Dr. Hector to the Under Secretary for Public Works.

Sir,— Geological Survey Office, Wellington, 10th July, 1872.

With reference to the recommendation in my letter (No. 74, 4th July, 1872, Appendix to Journal, H. of R., 1872, D. 3), respecting the further tracing of the coal seam in the Kaiou River, Whangaroa Harbour, I have the honor to suggest that an expenditure to the amount of £150 might be authorized for the purpose, to be placed at the disposal of the Committee which has been locally constituted for the purpose of searching for coal in the district.

Not having seen the place where the outcrop of the coal has been found, I cannot offer any details of the manner in which the exploration should be conducted, but the services of a competent coal miner could easily be obtained from the Kawa Kawa.

A sketch survey should be made of the place, especially showing the surface contour. The coal seam should be laid bare sufficiently to show its true strike and dip, and a cross-cut should be made to find the nature of the strata above and below. The indications thus obtained will be quite sufficient to guide a practical miner in a search for other outcrops of the same seam. Samples of the coal from different parts of the seam should be forwarded for analysis.

If these suggestions are acted upon, the results will greatly facilitate the further geological examination of the coal-bearing deposits, which will be undertaken as soon as possible.

I have, &c.,
James Hector.

The Under Secretary for Public Works, Wellington.

Mr. Thomas Ball to the Minister for Public Works.

Sir,— Mongonui, 7th August, 1872.

I have the honor to acknowledge receipt of your communication in reply to the application of Coal Committee for assistance in exploration, informing me that the Government have authorized Dr. Pollen to place the sum of £150 at the disposal of the Committee.

No time shall be lost in laying the communication before the Committee.

With thanks for information and enclosure,

I have, &c.,
Thos. Ball.

To the Hon. the Minister for Public Works.

WANGAREI.

Dr. POLLEN to the Hon. the COLONIAL SECRETARY.

SIR,— General Government Offices, Auckland, 7th April, 1873.

I have the honor to transmit herewith a letter from settlers and landowners at Whareora, in the Wangarei district, requesting that a sum of £250 may be granted for the expense of exploration of a coal seam discovered on the property of Mr. Frater at that place.

On receipt of this letter I requested the applicants to procure and send to me a sample of the coal; and on the 5th instant I received, with the memorandum annexed, a box, which I have forwarded by this opportunity to your address.

I have, &c.,
DANIEL POLLEN,
Agent General Government.

The Hon. the Colonial Secretary, Wellington.

Mr. ROBERT FRATER to Dr. POLLEN.

SIR,— Whareora, 1st February, 1873.

We have the honor to inform you that a seam of coal was discovered in this district, in a gully on the property of Mr. Frater, by a Native, while spearing for gum.

The coal, where found, is three miles from nearest water carriage for vessels drawing 6 feet, with no engineering difficulties to contend with in the construction of a tramway, or by another route six miles in length to Grahamstown, where vessels of any size can lie within twenty feet of the beach.

Several tons of coal have been taken out at this point by the Messrs. Frater and other parties for their own use. They state the coal answers admirably for household purposes, giving a strong heat and lasting well. Enclosed you have a report from the engineer of the "Halcyon" steamer as to its power for generating steam.

We may also mention that Mr. Ray, blacksmith, Wangarei, reports favourably of the coal for blacksmithing purposes.

It is a hard bright coal, and can be broken out in lumps of any size.

It has also been tried in a primitive way, and found to coke.

The seam was at least 4 feet thick at this place, but owing to the water—the workings being in a gully—further operations were impossible, except at considerable outlay, which the owners of the land were not in a position to incur.

The immediate owners of the adjoining land are absentees, and the Provincial Government also hold a considerable acreage adjoining.

I would therefore observe, that although the undersigned landowners are most anxious to have the coal opened out, both for their own interest and that of the country, still they do not consider themselves to be in a position to carry out successfully the undertaking. We would therefore petition that you would be pleased to grant a sum of not less than £250 towards the thorough prospecting of this field at points radiating from where it has been found.

Mr. Finlayson Smith, Chairman, and Mr. Robert Frater, Treasurer, of the Whareora Board of Highway Trustees, together with any other party you may name, will see to the judicious expenditure, and will render accounts and reports when required.

We have, &c.,
ROBERT FRATER, and 81 others.

Daniel Pollen, Esq.,
General Government Agent, Auckland.

MEMORANDUM by Dr. HECTOR for the UNDER SECRETARY.

THE seam referred to in this petition is in all probability a continuation to the northward of the seam that was worked by Mr. Walton some years ago, and a railway and other expensive works were then constructed, and afterwards abandoned, as the venture was not a commercial success, on account of the inferiority of the coal when worked in bulk. Subsequently Mr. Bedlington, who was manager to the Walton Mine, and who is an experienced mining engineer, made some further explorations by boring, and according to Capain Hutton's report, April, 1872, was down 209 feet, and expected to reach the coal at 250 feet.

No further reports have been received of the result of this trial; and I recommend, as the first step to be taken, that Mr. Bedlington be employed to make a report on the district generally, and on the particular merits of this fresh discovery, and also to state what further works are necessary to prove the coal sufficiently to promote its being mined. The probable cost of such a report would be £50.

Papers No. 73—1299, on this subject, are herewith returned.

JAMES HECTOR.

Geological Survey Office, Wellington, 24th May, 1873.

Mr. W. SKEY to Dr. HECTOR.

RESULTS of ANALYSIS of Specimen No. 1,352, forwarded by Dr. Pollen from Whareora, in the Wangarei District.

Glance Coal.

A free burning coal, of irregular appearance, but generally very compact, and therefore not liable to crumble *in transit*. Its colour is black brown on its cleavage planes, and generally black on cross fracture. On these fractures it exhibits considerable lustre. Its structure is laminated, fracture uneven. The coal is slightly pyritous. Heated in close vessels it frits slightly, but does not puff up and the coke possesses but little coherence. From the subjoined results of its analysis, it will be seen to compare with the best coals yet contributed from Walton's Coal Mine at Wangarei; it is therefore a very good average coal, and if occurring in quantity in easily accessible positions, it cannot fail to be of considerable value.

Approximate Analysis.

Water ...	6·97
Fixed carbon ...	49·59
*Hydrocarbon ...	40·11
Ash ...	3·33
	100·00
Evaporative Power ...	6·4

W. Skey.

KAWA KAWA.

The Under Secretary to the Chairman of the Kawa Kawa Coal Mining Company.

Sir,— Colonial Secretary's Office, 19th November, 1872.

I am directed by the Hon. the Colonial Secretary to enclose a copy of the report of the Joint Committee of both Houses of Parliament on Colonial Industries. With reference to that portion of the report upon Coal Fields which referred to the operations of the Kawa Kawa Company, I am to request that in order to enable the Government to decide in what manner and to what extent they can best carry out the recommendation of the Committee as to affording pecuniary assistance to test the extent and quality of the mine, you will favour the Government with information as to what has been recently done in this direction by the Company; what results have attended such examination; and whether any further steps having the same object are now in progress.

I have, &c.,
G. S. Cooper,
Under Secretary.

To the Chairman of the Kawa Kawa Coal Mining Company.

Mr. J. A. Gilfillan to the Hon. the Colonial Secretary.

Bay of Islands Coal Company (Limited),
Auckland, 3rd December, 1872.

Sir,—

Referring to the Under Secretary's letter of the 19th ultimo, I have the honor, by instruction of my Directors, to state in reply that very considerable sums have been expended in boring upon the Kawa Kawa Coal Feld, with varying results. I annex a memorandum showing the result and cost of recent borings. They have now one bore-hole in progress in the higher levels, but they regret that want of money has compelled them to abandon their intention of boring in several places to further prove the extent of the coal below the present levels.

My Directors estimate that a sum of £1,500 would be required for boring explorations before the erection of the railway, and they respectfully request the assistance of the Government to that extent.

I have, &c.,
G. A. Gilfillan,
Secretary.

The Hon. the Colonial Secretary, Wellington.

Memorandum of Results and Cost of Bore Holes recently sunk on the Kawa Kawa Coal Field.

	£	s.	d.
No. 1 Bore-hole.—Total depth 174 feet; coal measure reached at 166 feet 6 inches. Manager reported, "Mud or smut mixed with a very bright coal for 7 feet 6 inches, but without any defined thickness of coal by itself. Cost ...	326	0	0
No. 2 Bore-hole.—Total depth 282 feet 4½ inches. Hard coal of bright colour, reached at 272 feet, which continued for 5 feet, after which came fireclay and clayslate for 5 feet 4½ inches. Cost	519	0	0
(Of this hole a section with specimens was sent to Captain Hutton.)			
No. 3 Bore-hole.—Is in progress; result not yet ascertained. Cost to date ...	110	0	0
Cost of engine purchased for boring operations	165	0	0
Total expenditure to date	£1,120	0	0

Sites of holes Nos. 1 and 2 seen and approved of by Captain Hutton.
3rd December, 1872. J. A. Gilfillan.

Mr. T. Russell to the Hon. J. Vogel.

(Telegram.) Auckland, December 21st, 1872.

Kawa Kawa Coal Directors wish to know whether the Government will assist them in boring. See their letter to the Government. Reply to Mr. Firth, as I leave Auckland on Monday for one week.

Hon. Julius Vogel, Wellington. Thomas Russell.

Hon. E. Richardson to the Hon. the Colonial Secretary.

Auckland, 22nd January, 1873.

Can Captain Hutton be spared from Wellington to visit Kawa Kawa, to fix sites for proposed new shafts? Directors of Company wish it, and I think it very desirable. I purpose advancing Company about £1,000 for boring purposes.

The Hon. the Colonial Secretary, Wellington. Edward Richardson.

---

* With sulphur (not estimated).

The Hon. G. M. WATERHOUSE to the Hon. E. RICHARDSON.

Government Buildings, 24th January, 1873.

Re KAWA KAWA.—Referred your telegram to Hall, and have just seen Hector, who thinks no good would result from Hutton's going Kawa Kawa, as both Hutton and Hector remain of former opinion that the two bore-holes already sanctioned should first be completed. Submitted is Hector's report:—"*Re* Kawa Kawa Coal Mine.—Captain Hutton is at present engaged in an important survey which it would be inconvenient to suspend. He examined and reported on the mine last year, at the special request of the Directors of the Company, but as the mine was full of water he was not able to do more than confirm suggestions I made in 1866 for testing the field. One bore-hole commenced about that time has since been completed (17th April to 17th July), and the coal was cut in 277 feet from the surface, but was only 5 feet thick instead of 13 feet as reported. Two more of the bore-holes originally suggested have still to be made before any further data can be available for forming an opinion of the value of the property. I have consulted with Captain Hutton in replying to this reference, and he agrees with the above.—JAMES HECTOR."

The Hon. E. Richardson, Auckland. G. M. WATERHOUSE.

Dr. HECTOR to Hon. Dr. POLLEN.

Government Buildings, 25th January, 1873.

BORE-HOLE sites selected are marked on my map, 6 chains to inch, sent to Auckland in 1866, copy of which Mr. Whitaker has. Hutton also pointed them out on the ground to Williams, the manager, who knows exactly how to proceed if he gets funds; the bore that should be first done is the 300 feet one, 6 chains south of Moodie's bores 7 and 8, being as far up the gully as possible.

Dr. Pollen, Auckland. J. HECTOR.

The Hon. E. RICHARDSON to Mr. T. RUSSELL.

(Telegram.) Wellington, 4th February, 1873.

HAVE you sent papers relative to Kawa Kawa? If not, please do so by first boat.

E. RICHARDSON.

Mr. T. RUSSELL to the Hon. E. RICHARDSON.

DEAR SIR,— Auckland, 5th February, 1873.

I enclose the telegrams. We have sent instructions to the Bay to begin the bore-holes. Will you write us in reply to our letter, yet unanswered, or shall we write again in terms of the arrangement made with you here? which I understand to be that we go on with the holes indicated by Dr. Hector or Captain Hutton, and that you supplement the Company's expenditure to the extent of £1,000; the work to be certified as done by some Government officer to be appointed by you.

I have, &c.,

The Hon. Mr. Richardson. T. RUSSELL.

The UNDER SECRETARY to Mr. J. A. GILFILLAN.

SIR,— Colonial Secretary's Office, Wellington, 14th February, 1873.

With reference to your letter of the 3rd December last, and to subsequent correspondence on the subject of exploration of coal at the Kawa Kawa, I am directed by the Colonial Secretary to inform you that the Government will supplement the Company's expenditure to the extent of £1,000 in boring in the spots indicated by Dr. Hector, the work to be certified to by an officer appointed by the Government for that purpose.

I have, &c.,

J. A. Gilfillan, Esq., Secretary, G. S. COOPER.
Bay of Islands Coal Company.

Mr. J. A. GILFILLAN to the Hon. the COLONIAL SECRETARY.

Bay of Islands Coal Company (Limited),

SIR,— Auckland, 26th February, 1873.

I have the honor to acknowledge receipt of the Under Secretary's letter of date the 14th instant, informing me that the Government will supplement the Company's expenditure, to the extent of £1,000, in boring in the spots at the Kawa Kawa Coal Mines indicated by Dr. Hector, the work to be certified to by an officer appointed by the Government.

In reply, I am instructed to inform you that my Directors accept the conditions named, and that the work has been begun.

I have, &c.,

J. A. GILFILLAN,

The Hon. the Colonial Secretary, Wellington. Secretary.

The UNDER SECRETARY for PUBLIC WORKS to Mr. J. A. GILFILLAN.

SIR,— Public Works Office, Wellington, 14th March, 1873.

I am directed by the Hon. Mr. Richardson to acknowledge the receipt of your letter to the Hon. the Colonial Secretary, of 26th February, relative to supplementing the Company's expenditure, &c., and to inform you that when payment is asked for, Mr. Stewart, Resident Engineer, Auckland, will certify to the account from time to time.

I have, &c.,

JOHN KNOWLES,

J. A. Gilfillan, Esq., Secretary, Under Secretary.
Bay of Islands Coal Company.

The UNDER SECRETARY for PUBLIC WORKS to Mr. J. STEWART.

Mr. STEWART,—

Be good enough to certify to the Coal Company's vouchers for boring from time to time, submitted to you by the Secretary, ascertaining that the work therein vouched has been performed.

14th March, 1873. J. KNOWLES.

Mr. J. STEWART to ENGINEER-IN-CHIEF.

Memorandum in Reply to Minute by Mr. Knowles, Kawa Kawa Borings.

Public Works Office, Auckland, 19th March, 1873.

I HAVE the honor to acknowledge receipt of copies of correspondence, &c., on borings at Kawa Kawa, C.S. 73-842, No. 391, with minute by Mr. Knowles authorizing me to certify to the Company's vouchers for the above work. I will have pleasure in attending to this; but as I see the work has to be performed at the spots indicated by the Government Geologist, I do not well see how I can satisfy myself of this without personal inspection, or some other trustworthy source. I will, however, call on Mr. Gilfillan, and perhaps ascertain from his information what will be sufficient to satisfy me on the matter.

JAMES STEWART,

The Engineer-in-Chief, Wellington. Resident Engineer.

WHAREKAWA.

Dr. POLLEN to the Hon. the COLONIAL SECRETARY.

SIR,— General Government Offices, Auckland, 14th June, 1872.

I have the honor to enclose a letter from Messrs. Preece and Graham, agents for an English company who have purchased the Wharekawa Block, between the Waikato River and the Frith of Thames, as a coal field; and who propose, for a concession of land on the line of route, to make a railway from the Wharekawa to Mercer, in extension of their line from Pukorokoro.

I have, &c.,

The Hon. the Colonial Secretary, Wellington. DANIEL POLLEN.

Messrs. PREECE and GRAHAM to Dr. POLLEN.

SIR,— Vaile's Buildings, Auckland, 11th June, 1872.

As agents of an English company now engaged in developing the coal measure known to exist on the Piako side of the Gulf of Hauraki, we have the honor to submit the following propositions for the consideration of the General Government:—

The Company have acquired the freehold of the Wharekawa Block, containing about 10,000 acres, and situate in the above-mentioned district. The block at the nearest point is distant about four miles from the shore of the Gulf, and is immediately opposite the townships of Grahamstown and Shortland. The Company have obtained from the several owners a right-of-way from the block to a first-class landing-place. They propose to construct a light line of railway from the mines to the landing, a distance of nine miles, and to work the same with a double bogie engine, of the class known as Fairlie's patent. The Company purpose to go on with its plan at once, and have now several skilled persons employed in exploring the coal measure, and fixing upon a site for future operations. The seam, where it is now tested, has been ascertained to be at least 16 feet thick, and 50 tons are now being won for the purpose of testing its suitability as a domestic and machine coal on a large scale. Several tests of smaller quantities have given the most satisfactory results.

The mines are situate in the vicinity of the Surrey Redoubt, and nearly midway between the landing-place and the township of Mercer, on the Waikato. The Company are prepared, if sufficient inducement be held out to them, to continue their railway from the mines to connect with the proposed Waikato Railway at Mercer, a distance of about eleven miles. We need hardly point out that this proposition involves the expenditure of a large sum of money, and the Company could not enter upon the work without some assurance of assistance on the part of the Government. We have made inquiries, and find that the whole or nearly the whole of the land extending a considerable distance on both sides of the extended line is confiscated land, in the hands of the Government. The Company would be prepared to treat with the Government for the construction of the line upon the basis of their receiving a part of such an area of the above-mentioned land as would be commensurate with the capital proposed to be expended. We are informed that the land immediately abutting upon the line is of rather poor quality, and very swampy, but that it improves in quality further back on both sides.

The Company would expect the grant to be made to them in such a way as to give them a reasonable proportion of this better class of land. The Company would of course be prepared to comply with all such proper and necessary conditions and limitations as the Government might desire to make, so as to insure—

1. That the line should be built in a substantial, safe, and workmanlike manner.
2. That it should be open to be used fully and freely by the general public, travelling, and for carrying purposes, at reasonable rates, to be fixed as the Government and the Company may agree.
3. That the line itself should be worked in such a manner as to secure safety to the travelling public, and subject to such conditions as to the number of trains to be run, and the time of arrival and departure of trains, as will make it as fully available as possible for the public convenience.

We need hardly point out the important public advantages which will follow from the construction of the proposed railway. The following results will however, we feel assured, commend themselves to the favourable consideration of the Government:—

1. The expenditure of a large sum of money in the construction of the work, the cost being certain to reach £3,500 a mile, and the consequent large employment of labour.
2. The opening a through railway communication between the Gulf of Hauraki, the Waikato, and Auckland; and the securing to the City of Auckland a permanent and cheap supply of coal.
3. The settlement of a large tract of country now lying idle, as the Company would be deeply interested in utilizing the land included in their grant.
4. The greatly increased value which would be given to the large area of land now held by the General Government in that portion of the country, as, with the advantages of railway communication, a great deal of now unoccupied fertile land would be eagerly sought after for settlement.

We forward enclosed a rough tracing of the country, showing the probable course of the proposed line. We have endeavoured to set this matter clearly before the Government, but will be happy to furnish any other information which may be required. We hope that the proposition will commend itself to the favourable consideration of the Government, and will feel obliged by an answer being given to us at as early a date as possible.

We are, &c.,
PREECE AND GRAHAM.

The Hon. Daniel Pollen,
Agent for the General Government.

Dr. HECTOR to the Hon. Mr. ORMOND.

I HAVE consulted with Captain Hutton, who is acquainted with the district in question, having reported on part of it in 1869.

No coal mine has been opened in the district, but the coal is of the same description as that which is at present mined in the Waikato, at Kupakupa. The country is rough and covered with bush, so that the extent, thickness, and dip of the seams can only be determined by expensive works, such as boring and sinking, and which work, it appears from the passage I have marked in the application, is already in progress at the expense of the Company. I would recommend, therefore, that a few months should be allowed to elapse, so that these exploring works may be considerably advanced, and so facilitate the obtaining a report from this Department on the district. At the present time I am led to understand that no definite information could be obtained which would enable Government to form an opinion as to the prospective value of the coal field.

The proposal to make a railway in exchange for land in the district is, I think, deserving of every encouragement; and the advantages to be expected are not, in my opinion, at all overstated by the applicants.

15th July, 1872. JAMES HECTOR.

The UNDER SECRETARY for PUBLIC WORKS to Dr. POLLEN.

SIR,— Public Works Office, Wellington, 17th July, 1872.

I am directed by Mr. Ormond to acknowledge the receipt of your letter of the 14th June, covering an application from Messrs. Preece and Graham for a concession of land on the line of route of the suggested railway from Wharekaka to Mercer, in extension of their proposed line from Pukorokoro, and, in reply, to inform you,—

1. That Dr. Hector has been called on to report as to the value of the coal field, but from the nature of the country, and the scanty information at his command, he is unable to do so at present. The extent, thickness, and dip of the seams can only be determined by boring and sinking; and as the applicants state that they "have now several skilled persons employed in exploring the coal measure," Dr. Hector proposes to wait until these exploring works are sufficiently advanced to facilitate his making the exact and reliable report which it is necessary the Government should possess. So soon, therefore, as Mr. Ormond is advised that the works now being taken by the applicants are sufficiently advanced, instructions will be given to Dr. Pollen to have the capabilities of the mine examined and reported on.

2. The consideration of the proposal of Messrs. Preece and Graham, in reference to the extension of their railway and a concession of land along its route, necessarily hinges on the value of the mine. But I am directed at once to state generally, that, should the report be satisfactory, the Government are desirous of assisting the undertaking as far as they possibly can.

3. In the meanwhile it is requested that Messrs. Preece and Graham will be good enough to afford the Government information on the following points, viz.:—

(*a.*) What quantity of land they require.
(*b.*) What amount of capital they are prepared to expend.
(*c.*) Whether the English Company they refer to is a joint stock one, and, if so, its constitution, capital, name, &c.; and
(*d.*) What security they are prepared to give, to bind whatever arrangements may be entered on.

I have, &c.,
J. KNOWLES.

ENGINEER'S REPORT on the WHAREKAWA COAL FIELD.

AFTER a careful examination of the Company's block called Wharekawa No. 2 and 3, during the last eight days, I am happy to report as follows:—

Extent.—I am fully convinced that the coal extends over most of the Company's ground, and that at least 7,000 to 8,000 acres will be a good workable coal field. From the appearance of the easy dip of the coal seam at the outcrop (although not opened out sufficiently to arrive at a correct estimate at the greatest depth at which it will be found), and from my past experience in coal fields in Lancashire,

Cheshire, Derbyshire, and Staffordshire, in England, during a period of about thirty years, I consider that the coal should not be very deep, even in the centres of the basin.

Bearing.—The bearing of the seam is about north-west and south-east, and the dip about north-east; this is proved by the outcrop of coal on Mr. Fooke's property, at a distance of about six miles.

Quality.—The coal is very good at the outcrop, being much better than I expected at the surface, and will no doubt improve in quality and thickness as it goes down. The seam at the point from which the present sample is taken is about 10 feet in thickness; it is more than usually strong and compact at the outcrop, and in comparison with the Kawa Kawa coal is much superior to it, as taken from the present workings, at a depth of 128 feet. The coal is similar to the Wishaw coal of Scotland, and the Glanz-kohle of Germany, and contains about 75 per cent. of combustible matter. The amount of sulphur contained in this coal being very small makes it very suitable for smelting and engine purposes, and it will also be valuable as a good household coal.

Fireclay.—There is a layer of fireclay next the foot-wall of the coal seam, but not having been penetrated cannot at present say what thickness it may be.

Ironstone.—Ironstone has been found on the surface, and from tests yields about 50 per cent. of iron; and there can scarcely be a doubt but that iron band will be found overlapping the coal measures.

Limestone.—Limestone is found on the surface of the blocks, and is apparently in large quantities; a valuable flux for the iron is thus at hand, and it will also be available for building and agricultural purposes.

Timber.—The block is well-timbered with kauri, totara, and other useful trees, extending to some hundreds of acres.

Quality of Land.—The land, except where marked on the plan as hilly, is of fair average quality, and will be available for agricultural purposes—the swampy parts, being easily drained, will form the richest portion.

Flax.—There is an extensive flax field on the ground. The flax is of the finest quality.

Water Power.—The Mangatangi, a valuable stream, runs across the Company's land, having a considerable declivity, and estimate that in the dry season there is a body of water flowing of about fifteen millions of gallons per diem.

Further Purchases.—I would recommend that the land intervening between the present southern boundary of the Company's land and the Government road, from near the Esk Redoubt to the Surrey Redoubt, be purchased, and am sure, if my suggestion is followed, the Company will acquire in it a valuable addition to their present property, being directly on the dip of the coal seam, besides giving a road boundary to the block.

Railway.—The railway will be of easy formation, and I estimate that a single line of rails, of a 3 feet 6 inch gauge, with rails 30 lbs. to the yard, can be constructed at a cost of about £2,500 sterling per mile, including rolling stock. A great part of the work will be in the trestle work required for crossing the swamp between the high ground and the mouth of the Pukorokoro Creek; at present, however, I am not prepared to give a correct estimate of the cost of the line. An extension of the mine to the Whangamarino Creek, a distance of about eight miles, over easy country, would bring the whole of the Upper Waikato District in direct communication with the Thames Gold Fields—a large market for all kinds of produce.

Wharekawa, 8th July, 1872. JNO. LOWE, C.E.

ENGINEER'S REPORT NO. 2.

Wharekawa Mineral Railway.

HAVING now completed the field work, and partly compiled the plan, &c., of railway from the proposed shaft of the mine to a point on the beach suitable for shipping the coal, my attention was drawn to three places as being likely for purposes of shipment—namely, Pukorokoro Creek, Porter's Creek, and Smith's Point.

I have surveyed the line to each of the above-mentioned points, and will in due course forward the plans, sections, and estimates, leaving the Company to choose the most serviceable route.

Subjoined are a few remarks on the different routes, which meantime may be useful to the Company.

Pukorokoro Creek Route.—This line has been surveyed and staked out at every chain, and would be 9 miles and 50 chains in length. It will be seen from the list of gradients annexed, that they are all at a fair and easily-worked inclination. There are no objectionable curves, the quickest being 6 chains radius. I may state in regard to this, that on the extension to deep water of the Kawa Kawa Coal Company's Railway, which I surveyed and staked out for the General Government, curves of 4 and 5 chains are used; and Sir Charles Fox and Sons, on the light 3 feet 6 inch gauge railways in Canada, Queensland, and Norway, used curves of 5½ chains radius.

As to Pukorokoro Creek, there are 7 feet of water on the bar at high water at ordinary tides, but this passed, the creek itself is from 1 to 2 feet deeper, as per soundings; and there can be no doubt that, from the soft muddy character of the bottom, steamer traffic would gradually deepen the channel and entrance. The creek is deep enough for, and is entered by, vessels engaged in the coasting trade. Any vessels lying where the wharf would have to be erected are completely sheltered by the outer bank from any storms.

Porter's Creek Route.—This route diverges from the other line at stake marked 7 miles 14 chains, and from thence would be 2 miles 5 chains to terminus, making in all, if adopted, 9 miles 19 chains from the mine. The first portion of this line after the divergence would be costly, as 50 chains of this length is across a swamp about 9 feet deep. The remaining portion of the line, however, is similar to the Pukorokoro Creek route. This line, though shorter, would cost considerably more than the other. The creek itself has only 5 feet of water on the bar, also inside the point of the outer bank at high water of ordinary tides. A decided objection to this creek is that the outer shingle bank is moving

southward; and it is also very probable that the creek will break through the outer bank some distance up, as late storms have washed away part of the bank, and at high tides it is under water. Should this take place, the present entrance to the creek will soon fill up.

Smith's Point Route—Which commences at stake marked 1 mile 54 chains on the Porter's Creek divergence line, from which point it is 2 miles 14 chains in length, or 11 miles 2 chains from the mine to high watermark. The work on this section, 2 miles 14 chains, would be very light, being little more than formation and a few culverts; but at the end of this line a wharf 324 yards in length would require to be erected. This only takes to low water. The beach is of gravel to within 2 chains of low water. It is not good holding ground, and is very much exposed.

The Native owners are favourable to the construction of the railway to any point further on, if desirable.

Auckland, 2nd October, 1872.

JNO. LOWE,
Civil Engineer.

Mr. PATTERSON to the DIRECTORS of the WHAREKAWA COAL and TIMBER COMPANY.

GENTLEMEN,—

Having been requested by Messrs. Graham Brothers to report on the coal which has been discovered in your property, and the facilities for developing it, I have examined the coal field, and find that there is a large and valuable seam of coal cropping out at the Surrey Redoubt, where the thickness of seam and quality of coal might easily be tried at a very trifling cost, by driving a level into the dip of the coal, a distance of 25 fathoms, at a cost of about £2 2s. per fathom. This tunnel might be put in so as to be of advantage for the future working of the mine, and there is plenty of timber convenient. There is no doubt but that the coal dips under the valley in the centre of your property; but at present in the valley it would be much more expensive to commence work, and would require heavy machinery, which would be avoided at the Surrey Redoubt. I should, however, recommend a few bores being put down in the valley to ascertain the dip and thickness of the seam; this would also prospect the valley for other seams of which we have indications.

The Surrey Redoubt seam can be traced for many miles across the country in the direction of the Waikato, where a similar seam has been worked and found to be of good quality. The supply at the Surrey Redoubt is inexhaustible, and can only be limited by the demand, being a very large seam, over 14 feet thick, pure coal, free of bands, and has got the properties of a good steam coal, with little sulphur, and burns, with no clinkers, quick and fierce, and could be unearthed at a very trifling expense; the output would cost about 3s. per ton.

For the development of your coal mine, the Company would require to construct a tramway through the centre of your property to a tidal creek at the Miranda Redoubt, a distance of about nine or ten miles, with no great difficulty to surmount, and a gentle incline all the way, the cost of which I estimate at £900 per mile; they would also have to erect a depôt and jetty on the tidal creek, at the Miranda, on the Hauraki Gulf, about fourteen miles across from the Thames gold mines; at this landing there is 10 feet of water at full tide; the cost of the depôt and jetty would be about £1,800.

This tramway and depôt is also necessary for your forest, which is of 1,000 or 1,200 acres in extent, well covered with very fine kauri timber, and a large quantity of rimu, rata, tea-tree, totara, puriri, &c., which would be of great value for mining purposes on the Thames Gold Fields, and from which there could be a considerable revenue derived.

The valley is rich and well adapted for agricultural purposes, for which the tramway would increase its value, and could eventually be extended to the Waikato, a distance of ten or twelve miles further.

I have, &c.,
H. PATTERSON, M.S.

Queen's Hotel, Grahamstown,
6th January, 1872.

PROVINCE OF NELSON.

MOUNT ROCHFORT.

Dr. HECTOR to the UNDER SECRETARY for PUBLIC WORKS.

I BEG to recommend that authority be given to expend a sum not exceeding £300, from the Public Works Coal Field Exploration Fund, in the practical development of the coal seam at Ngakawau River, with the view of tracing the seam on to the Mount Rochfort plateau, in the manner suggested in my report of 22nd June last. (Parl. Papers, D. 3, p. 13.)

I have arranged with Mr. A. D. Dobson, District Engineer, to have the work commenced at once, in the event of the authority being granted, and I propose inspecting the work myself when it is advanced.

Wellington, 16th October, 1872.

JAMES HECTOR.

The UNDER SECRETARY for PUBLIC WORKS to Dr. HECTOR.

SIR,— Public Works Office, Wellington, 29th October, 1872.

In reply to your Memorandum of the 16th instant, in which you recommend that authority be given to expend a sum not exceeding £300 in the practical development of the coal seam at Ngakawau River, I am instructed by the Hon. the Minister for Public Works to inform you that authority will be given to the amount asked for, to be expended under your direction.

I have, &c.
JOHN KNOWLES,
Under Secretary.

Mr. W. Lloyd to the Minister for Public Works.

Sir,— Westport, 28th January, 1873.

I have the honor to transmit for your perusal the enclosed memorial from residents in the town of Westport, praying that you will take early steps to have the railway from Westport to the coal fields of Mount Rochfort and the Ngakawau surveyed and constructed as soon as possible. Late discoveries added to those already known have placed far beyond doubt the question of the sources of supply being equal to the requirements of a large export trade at Westport and the Ngakawau. The memorialists therefore are desirous of learning that steps are being taken in order that the district, and Colony at large, may profit from the immense beds of mineral lying at the very threshold of the town.

I have, &c.,

The Hon. the Minister for Public Works, Wellington. W. Lloyd.

Messrs. Bailie and Humphrey to the Hon. the Minister for Public Works.

Sir,—

We, the undersigned residents in Westport, have the honor to call your attention to the under-mentioned facts:—

1. That the Joint Committee on Colonial Industries have reported on the Mount Rochfort and Ngakawau Coal Mines as follows:—

"Your Committee have satisfactory evidence that the coal in this district is fully equal in quality to that of the Brunner. They recommend that in this case also, further explorations be made before any considerable expenditure is incurred in improving means of shipment, as it appears at present doubtful whether it would be expedient to adopt Westport or the Ngakawau River as the place of export."

2. That surveyors recently engaged in cutting lines have reported the discovery on the south branch of Mine Creek (a tributary of the Ngakawau) of a horizontal seam of coal, 5 feet thick. Thirty chains further up the same creek they discovered another of similar thickness. Half a mile beyond this seam, on the main south branch of the creek, they found a seam 20 feet thick. This seam also extends a considerable distance, and thousands of tons may be got by stripping off about 9 inches of soil from the surface, in many places the coal lying bare. On the south branch of the Ngakawau, under Mount Frederick, seven distinct faces of coal were counted, each from 15 to 20 feet in thickness. Two miles south of the Ngakawau, in an unnamed creek, 60 chains from the coast, another seam was found, dipping seaward, from 10 to 15 feet thick. All the coal thus found is the true black coal, as existing in the Mount Rochfort measures.

3. That recently, on two occasions, the s.s. "Waipara" came up from Hokitika for the purpose of taking coal from the Ngakawau Mine, but owing to the shallow state of the bar of that river, she could not enter, and therefore returned without cargo.

4. That daily experience proves the Ngakawau River unsuited, as a port of export, for the coal, there neither being sufficient water on the bar, nor available accommodation for vessels when inside.

5. That a sum of money has been placed on the estimates for the purpose of constructing a railway from Westport to these coal fields.

We therefore respectfully request you to use your best endeavours in having a line of railway surveyed and constructed as early as possible, in order that this district and the Colony at large may reap these great and lasting advantages which offer themselves in connection with the carrying out of such a reproductive undertaking.

We have, &c.,

Bailie and Humphrey (and 167 others).

The Hon. the Minister for Public Works.

Mr. Thomas Field to the Hon. the Minister for Public Works.

Sir,— Westport, 28th January, 1873.

A petition having been got up by the inhabitants of Westport, and forwarded to you by this day's post, requesting that you will take early steps with the money voted in past Sessions of the General Assembly to make a railway from Mount Rochfort to this port, the petitioners request that the money so voted be used to make a railway from the Ngakawau River to Westport (some eighteen miles distance over a level country), the recent discoveries there (Ngakawau) being without doubt a continuation of the Mount Rochfort coal field, only much more easily available, the pit mouth of the mine now working being only some 40 feet above the Ngakawau River, and the coal wharf and shoot under a chain distant from it. The gentlemen who drafted your petition, and seven-eighths of those who signed it, never saw the Ngakawau, or the present working, on which about £1,000 has been expended by us in developing the mine—a seam about 20 feet thick, and of excellent quality (see Dr. Hector's analysis and report thereon)—yet those persons, the petitioners, do not hesitate to make statements which are not founded on fact, by saying that there is no shelter in the river during freshets, which, on the contrary, affords good shelter in floods for a number of vessels in a large deep basin several chains in length by 140 feet wide, with a general depth of 10 feet at low water all over it. There are two other places where shelter from floods could be obtained. They also speak of the inability of the s.s. "Waipara" to enter the river, owing to the shallowness of the bar; the "Waipara" has been once up to the mine last May (when prospecting first commenced), and latterly on the occasion spoken of by the petitioners. In one of those instances the sea was too rough to enter safely, and in the other there was 7 feet of water shown by the signalman (being neap tides); and although the "Waipara" only drew 5 feet, yet the master declined to enter the river, as he feared getting bar-bound, the barometer being low, and having the mail steamer to tender at Hokitika. The steamer "Result" went in and loaded, coming out same tide, with over 7 feet water (an hour after high water).

We, the original projectors, and now the lessees of the Ngakawau Mine, do not wish you to infer from the foregoing that the entrance to the Ngakawau River is excellent, but it has sometimes 10 feet and over at high water (spring tides) and perfectly straight also, particularly after floods; and it is the opinion of the Provincial Engineer, and of Dr. Hector, as well as several other persons, that, with a comparatively small expenditure, the Ngakawau River could be made safe for vessels to enter or leave at high water drawing 10 to 11 feet water. There is but little doubt that an extensive coal field exists in this district; the seams already known number twenty-two, from 5 to 24 feet in thickness, and of the finest quality. No doubt the Government may find it necessary to make the railway to Westport, as well as the harbour at Ngakawau for a smaller class of vessels. Before closing, we may state that our only reason for troubling you is, that we have at a great expense opened up and proved this mine and district (as yet without any pecuniary assistance), and to correct statements made at random by individuals who have never seen or have the remotest idea of the neighbourhood in question, or of the difficulties connected with an undertaking of this nature, but who are always ready to seize anything good, always provided it cost them nothing.

We hope the Government will soon send the Engineer-in-Chief, or other competent person, to inspect the harbour.

Apologizing for troubling you with this lengthy epistle,

We have, &c.,
THOMAS FIELD,
(for the Lessees of the Ngakawau Coal Mine).

The Hon. the Minister for Public Works, Wellington.

The Hon. G. M. WATERHOUSE to Dr. HECTOR.

FORWARDED to Dr. Hector, who is requested to report the steps, in his opinion, best to be taken with a view to the development of the coal fields; and also whether he deems it desirable that the Government should proceed with the survey of the line of railway to Westport, as suggested by the petitioners.

10th February, 1873. G. M. WATERHOUSE.

The Hon. the COLONIAL SECRETARY to the SUPERINTENDENT of NELSON.

SIR,— Colonial Secretary's Office, Wellington, 20th February, 1873.

Herewith I do myself the honour of forwarding to your Honor the copy of a report I have received from Dr. Hector on the subject of memorials which have been sent in to the Government with a view to promoting the development of the Westport Coal Fields.

Before taking any further action, or incurring the expenditure recommended by Dr. Hector, the Government is desirous of ascertaining what is the true position of these coal reserves—how far they have passed from the charge of the Provincial Government; and what steps the Provincial Government of Nelson purpose taking to facilitate their working.

Any information on these or other points connected therewith, calculated to guide this Government to a correct decision, that your Honor can give, will be highly appreciated.

I have, &c.,
His Honor the Superintendent, Nelson. G. M. WATERHOUSE.

MEMORANDUM for the COLONIAL SECRETARY.

THERE is no longer any doubt that the Ngakawau will be the outlet from the coal field on the Mount Rochfort plateau, and that coal exists in large quantities in positions only accessible from that quarter.

I think it therefore very desirable that a railway line should be at once surveyed from Westport northwards to the Ngakawau, and that an estimate should at the same time be obtained of the cost of erecting and maintaining sufficient wharfage in the Buller River. An engineer should also report on the Ngakawau River, as perhaps a small expenditure would render it immediately available for shipping coal in small quantities during the long period that must elapse before the railway line can be finished. I have just received the enclosed letter from Mr. Dobson, who has at my request inspected the recently discovered outcrops. He reports that though the plateau coal has not yet been traced lower than 749 feet above the sea level, there is an area proved that he estimates will yield twenty millions of tons of good bright hard coal, by very easy mining.

A large block of this coal from the mine now being worked at Ngakawau has just been received at the Museum, and shows that the coal has greatly improved in quality and firmness as it has been followed in from the outcrop. The main drive is now in 220 feet, and the seam has thickened from 16 to 20 feet, and is also less steeply inclined.

19th February, 1873. JAMES HECTOR.

Mr. A. D. DOBSON to Dr. HECTOR.

SIR,— Westport, 13th February, 1873.

Yesterday I went over the Ngakawau field, to look at the outcrops Rome found. These were much higher than by his description I had expected. The first two seams I went to were on Mine Creek, about 1½ mile from the mine, 749 feet above sea level (the lowest), dipping to the north and west about 20°, about 4 feet of good coal. The higher of the two was 973 feet above sea level, dipping in the same way, about 3 feet 6 inches of good coal. As you remember when we came down together the day we went up Mine Creek, we crossed a swampy grass flat, just before we left the open

ground for the last time; these two seams are shining in the creek, just below that flat. The next seam I saw was 1,738 feet above the sea. I could not see the bottom of the seam; the creek cut right through, the creek bottom being coal. I measured one face 17 feet high, good hard bright black coal. This seam is a little beyond where you and I turned back from. From a point above this spot two faces of coal are visible a little further up the hill. I then went due west to within half a mile of the seaward face of the mountain, and in the main branch of a creek (which flows into the lagoon a little to the southward of the Mautoria rocks) examined two other outcrops; the highest was 1,603 feet above sea, and the other 1,355. In both cases the creek had cut through and exposed the seam for several chains. The top of the coal was covered, so I could not ascertain its thickness, but I measured 9 feet of good hard coal. The seams here lay close upon the granite and slates. In crossing the slopes going westward, every creek contained drift coal. The two last-mentioned seams were dipping to the north and west; one appears dipping slightly to the eastward, but that must have been, I think, only local. I returned to the beach, following down the creek to the lagoon, passing over sandstone and shale most of the way. I should not be surprised if the coal was found very much lower down; in fact, with a few faults intervening, I think it will be probably traced from the mine right up the mountain.

There is nothing new about what has been found, but it has proved beyond all doubt what you always said about the Mount Frederick seams.

It rained nearly all the day I was on the mountain, so I was unable to make a sketch map of the northern slopes as I had intended.

With the bush lines that are now cut, in ten hours one can see everything worth seeing. I think the seams are fairly continuous on the plateau at the head of Mine Creek; a drift coal abounds in every stream. I reckon (or estimate) this plateau to be about a mile in extent, and that it would supply at least twenty million tons without any trouble to get at it. From the dip of the seams in Granite Creek (the creek south of Mautoria), I think the outcrop should be found on the seaward face, about 1,000 feet above sea level.

I am, &c.,

Dr. James Hector. A. Dudley Dobson.

Mr. R. C. Chambers to the Hon. the Minister for Public Works.

Sir,— Wellington, 8th March, 1873.

I take the liberty to address you to call your attention to the advisability of early action being taken to assist in opening up the extensive coal field near the Buller, Province of Nelson, either by constructing a tramway to Westport or by harbour works at Ngakawau, and respectfully request an early inspection of the district, in order to decide the most advisable course to pursue.

I have been informed that a sum of money has been appropriated for the purpose of making a railway between Mount Rochfort and the Buller (subject to the coal not being found in a more accessible position). The proposed line to Mount Rochfort would only allow the working of a small portion of the upper part of the coal field, and would render the working of the coal to the dip an expensive operation; whereas by continuing the line along the coast to Ngakawau, thence up Mine Creek to the plateau, a large area will be opened up at comparatively small expense. I would respectfully submit to your Honor's attention the great importance of early action being taken on this subject, seeing that a sum of £100,000 is annually sent out of the Colony for a supply of coal inferior in quality for steam purposes to that proved to exist in abundance between the Ngakawau and Mount Rochfort. It therefore becomes a matter of national importance that no time be lost in utilizing the coal deposits that have been placed at command in such quantities as to allow not only supplying the wants of New Zealand, but also to admit the Colony to become a large exporter to California and Victoria, in order to compete with New South Wales in these markets. Large vessels of the screw-collier class will be necessary, and the only port on the West Coast where such vessels can be accommodated is the Buller, where a comparatively small outlay will make the harbour available for vessels specially constructed for the coal trade of 1,000 tons burthen.

As an example of what can be done in river improvement, I would respectfully refer you to the present state of the Tyne, compared to what it was eighteen years ago; and I have no hesitation in saying, that with the same spirit of enterprise, and judicious expenditure, the Buller would become the Tyne of New Zealand.

Your Honor and the Government have now an opportunity (that only occurs at rare intervals), by judicious assistance, of giving such an impetus to the coal trade of the Colony as will benefit all classes of the community.

Pleading the importance of the subject for thus addressing you,

I have, &c.,

R. C. Chambers,

(for the Shareholders of the Ngakawau Coal Mining Company, Westport).

The Hon. the Minister for Public Works, Wellington.

The Hon. the Colonial Secretary to the Superintendent of Nelson.

Sir,— Colonial Secretary's Office, Wellington, 13th March, 1873.

I have the honor to inform you that application has been made to the Minister for Public Works by a Mr. Chambers, representing the Ngakawau Coal Mining Company, to expend the whole or portion of the money appropriated by Parliament for purposes of constructing railway to Mount Rochfort Coal Fields.

Mr. Chambers also has furnished the Minister for Public Works with copy of letter from the Provincial Secretary of Nelson, dated 9th December last, defining the terms on which it is proposed to grant the above Company a lease of 400 acres.

Before the Government can go any further in this matter, it is necessary that they should be informed of the real position of the Mount Rochfort Coal Reserves.

As your Honor is aware, the Government is going to considerable expense in exploring the above reserves, and they view with surprise the proposal of your Government to grant a lease on such terms as those now submitted to them, as it would appear from the best information now in the hands of the General Government, the portion of land proposed to be leased is the key to the whole of this valuable coal field. Soliciting your early attention to this subject.

I have, &c,
JOHN BATHGATE.

His Honor the Superintendent, Nelson.

Mr. R. C. CHAMBERS to the Hon. the MINISTER for PUBLIC WORKS.

SIR,— Wellington, 10th March, 1873.

In compliance with request contained in yours of this date I have the honor to enclose a copy of a letter received from the Provincial Secretary of Nelson, *re* the granting of lease to the Ngakawau Coal Mining Company.

I may state the Company has already been at considerable expense in proving the value of the coal seam at Ngakawau, which was condemned in most of the reports on that coal field, and it was only after considerable labour and expense we have been able to demonstrate the value of this seam. Our perseverance and success has led to a more thorough examination of this coal field, and the result has been the proving of an extensive area of first-class coal in several separate seams. From the appearance of the seam in our lease, we must, at an early date, either erect machinery or put in a tunnel for some distance on the east side of Mine Creek in unproductive works to reach the coal level free. Either arrangement will necessitate a further outlay of £1,500 or £2,000, so that your Honor will see the necessity of treating our Company in a liberal manner, seeing we are the pioneers of this coal field, and also as soon as a tramway is made to Westport sufficient mines may be opened up to supply a large export trade.

I have, &c.,
R. C. CHAMBERS.

The Hon. the Minister for Public Works, Wellington.

The PROVINCIAL SECRETARY, Nelson to Messrs. THOMAS FIELD and others, Westport.

GENTLEMEN,— Superintendent's Office, Nelson, 9th December, 1872.

Referring to the telegram from this office, dated 6th December instant, wherein you are informed that Dr. Hector having waived his objections, a lease of 400 acres would be granted to you at Ngakawau, I have now to inform you of the special conditions upon which the lease will be granted, which are as follows namely:—

1. The term of lease shall be twenty-one years.
2. The rent shall be 1s. per acre for the first year, and 5s. per acre per annum for the remainder of the term.
3. The lessees shall raise during the first year not less than 5,000 tons of coal. During the second, third, fourth, and fifth years of the said term, not less than 10,000 tons each year. During the sixth, seventh, eighth, ninth, and tenth years of the said term, not less than 15,000 tons each year; and during the remainder of the said term not less than 20,000 tons each year.
4. That the block to be leased shall be subject to the approval of the Superintendent, and shall not be within two chains of the River Ngakawau.

In addition to the above, special conditions as to royalty required by "The Waste Lands Act, 1863," and those usually inserted in coal leases, will be imposed in the lease to be granted to you.

I have, &c.,
ALFRED GREENFIELD,
Provincial Secretary.

P.S.—The object of reserving one or two chains on the bank of the river is to prevent any monopoly of facilities for shipping by any one Company, whether for coal mining or other purposes.

A. G.

The SUPERINTENDENT of NELSON to the Hon. the COLONIAL SECRETARY.

SIR,— Wellington, 22nd May, 1873.

I have the honor to forward herewith a copy of a resolution passed unanimously by the Provincial Council of Nelson, relative to the late discoveries of coal at Ngakawau and Waimangaroa, and to the urgent importance of the immediate construction of a railway to convey the proceeds of the mines to the port of Westport.

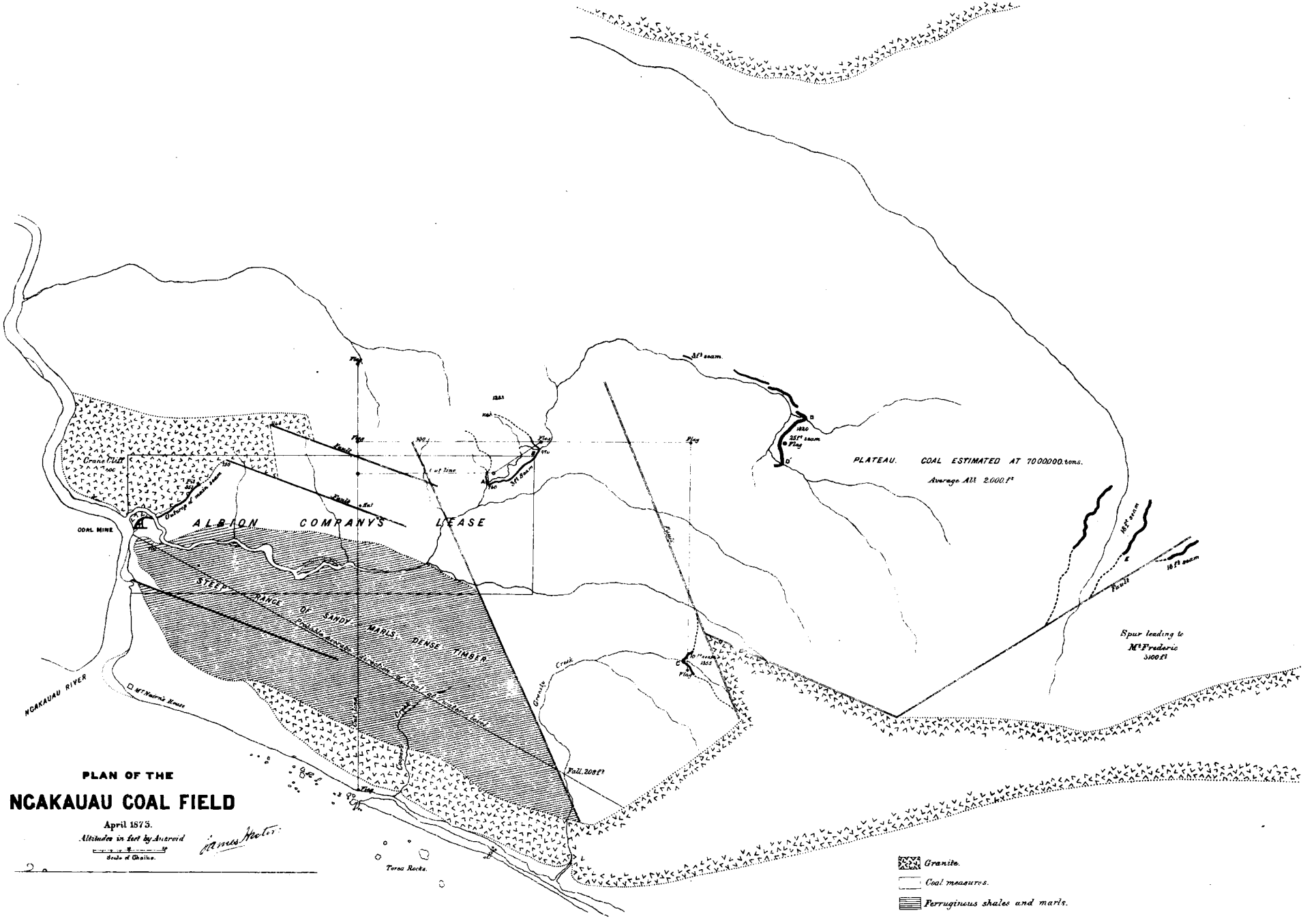
As I have already on several occasions recently pressed this matter on the attention of the Government, I need now only express my entire concurrence with the resolution, and my earnest hope that the Government will lose no time in coming to a decision upon a question of so great interest to the Colony, as well as to the Province of Nelson.

I have, &c.,
OSWALD CURTIS,
Superintendent of Nelson.

The Hon. the Colonial Secretary, Wellington.

COPY of a RESOLUTION unanimously passed by the Provincial Council of Nelson, on the 19th May, 1873:—

"That, in the opinion of this Council, the late discoveries of coal of high quality and in large quantities at the Ngakawau and Waimangaroa render the construction of a railway suitable for coal traffic from the Ngakawau to Westport a matter of urgent importance, and the Council trust that the Colonial Government will proceed with the work without delay under the authority of "The Railways Act, 1872," from funds therein appropriated for Mount Rochfort Coal Railway."



PLAN OF THE

NGAKAUAU COAL FIELD

April 1873.

Altitudes in feet by Aneroid

Scale of Chains.

James Hector

MEMORANDUM by Dr. HECTOR relative to Mount Rochfort District.

THIS coal field, the general features of which were explained in my report of last year, includes a large area extending parallel with the coast from the Buller to West Wanganui, and is about eight miles in breadth. It is probably the most important coal field in New Zealand, on account of the large extent of coal of fine quality which it contains, in addition to which many seams of coal of inferior quality are found in the district. As a general rule, which applies not only to this field but to all others on the west coast of the South Island, the coal that is at a high level above the sea, or which lies at a steeply inclined angle, is of the best quality, the low-lying coal being usually of the inferior varieties.

It must not be thought, however, that the coal is continuous throughout the above area, as it occupies detached basins and trough-like depressions on the undulating surface of the older rocks. Computations of the amount of coal available are therefore not to be depended upon, unless the extension of the seam can be absolutely traced, particularly in the more broken parts of the district, where large areas of the coal formation have been removed by the denudation of the valleys, which generally are cut right through the coal-bearing strata into the underlying rock.

During the past year, additional information has been obtained (1) by the works in progress at the Ngakawau Mine, (2) by explorations undertaken for the Department, and (3) by chance discoveries.

1.—*The Ngakawau Mine.*

As no facilities exist for shipping the coal at the Ngakawau River at the present time, nor for conveying it to the Buller River, the workings are still restricted to supply small shipments by the little steamer "Result," which plies to the Buller when the weather and bar are favourable. So far, they completely bear out my former estimate of the value of this coal seam. The main drive has been carried forward 230 feet, with a height of 18 feet, and the coal has decidedly improved in quality. Only one small drop of 4 feet has been encountered in the roof, and the seam is less steeply inclined than it was at the face where first opened. The thickness has also increased to 20 feet.

Besides the main drive, an air-shaft has been carried up at an angle of 40° to the outcrop of the seam, and it has been proposed to work the mine by a horse-wir from this incline.

The present level of the mine, if carried forward, would cut out into Mine Creek, so that it would be necessary to sink to a lower level to enable the coal to be followed under the creek, and from there rise into the block of coal formation that has now been proved to rise on the east side of the valley, as I shall afterwards describe. To reach the lower level thus required, it has been suggested that the steep incline from the outcrop should be carried down in the coal to the necessary depth, and a level drift then set off under the creek. This will, however, involve much handling and hauling of the coal; and I would recommend that, instead of this method of working, a gentle incline be carried from the mouth of the present drive at such an angle that horses will be able to drag the waggons out to the shoots direct from the face. This drive, where it passes under the creek, should be made as small as possible, with a good coal roof; and as Mine Creek, where the coal crosses it, is considerably above the level of the main river, this deep drive will be easily drained by a water level carried out, also in the coal to the river below the shoots.

The only other work that has been done by the Company towards proving the extent of the mine has been the tracing of the outcrop of the seam on the east side of Mine Creek, to the height of about 200 feet, and the direction obtained shows that the coal measures are remarkably steady for at least that distance.

As observations of the changes which take place at the outlet of a river may be useful in considering the erection of improvements, I enclose marine reports by Captain Leech, Harbour Master at Westport, and may state that, at the time of my last visit, on 11th April, the width of the channel at high water was considerably decreased from that shown on the plan attached to my report of last year; and at low water, where it crosses the beach, the channel of the stream was turned more to the north than formerly.

The bank which used to be exposed at low water on the north side had disappeared, but these changes appear to be due rather to rearrangement of the material than to any fresh accumulation. The inside channel, leading up to the mine, had been to a great extent cleared of the boulders that formerly obstructed it, but, probably in consequence of this, a considerable scour had taken place on the south bank, where it is formed of fine shingle.

2.—*Exploration.*

Lines have been cut through the bush from the sea across Mine Creek, and up on to the level of the plateau, and several fresh outcrops of the coal have been discovered by this means, as already reported in my memorandum of 19th February, and in the enclosed letter from Mr. Dobson, under whose direction the work was performed.

The position of these lines and outcrops is shown on the attached plan.

The area explored extends for three miles south of Mine Creek, with a width of two miles between granite of Mount Frederick on the west, and a wooded range on the east, that divides the south branch of the Ngakawau River from the valley of the Orakaka. This ridge is probably slate, but this has not been determined.

The area may be divided into (1) the Lower Mine Creek, which is a steep declivity on the east side of the valley, the west side being formed by long ridges of argillaceous sandstones overlying the coal-measures. The whole of this portion is included in the Coal Company's leasehold. (2.) The terraces, which are a succession of steps, lying east and west, by which the ground rises from 1,000 to 1,800 feet above the sea level. (3.) The plateau, which is from 1,800 to 2,500 feet above the sea level.

I have not been able to satisfy myself that there are several distinct coal seams, as has been reported, but rather that the coal varies in thickness from 3 feet on the eastern boundary to 20 feet in the middle, decreasing to 16 feet in the west, where it is cut off on the slopes of Mount Frederick. This is also the character of the seams at Coalbrookdale and on Mount William, which favours the view that the seam is continuous in that direction.

Coal has not yet been found between the vicinity of the coal mine and the edge of the first step of the plateau, where the east branch of Mine Creek commences to fall rapidly into the valley; but this is only due to the absence of natural sections, and as this part of the coal is included in the Company's leasehold, and will be worked as part of the present mine, I did not think it advisable to incur the great expense that would be necessary to prove the seam in this part of the field. Indications of two faults are visible in following the boundary of the formation in a south-easterly direction from Mine Creek. They both bring the granite to the surface, as shown approximately on the plan, and will interfere with the continuity of the coal workings, but will not materially diminish the area of available coal. The altitude at which the next outcrop has been found (marked A on plan) is at 750 feet above sea-level. The seam is exposed in the bed of the east branch of Mine Creek, and can be traced in the bank for some distance, with a dip of 20° to N.W., and a thickness of 3′ 6″ of clean bright coal, with a roof of hard sandy shale, and a floor of dark grey sandstone. Following up the creek to the S.E. the floor of the stream is formed by the strata beneath the coal for 15 chains, which are here coarse grits and sandstones, the ledges forming falls.

Several small faults are distinctly seen running S. 30° E., and dropping the strata 4 to 10 feet to the west. These are only mentioned as they serve to indicate the manner in which the coal measures are bent over the edge of the plateau, on which they are comparatively level, and acquire the high angle of dip which they have in Mine Creek. At the point marked B the bed of the stream has again risen on to the cover of the coal, and the seam is exposed in the face of a waterfall, showing 3 feet of coal, with a dip of 15° W. This outcrop is 980 feet above the sea, and is situated about the extreme S.E. corner of the leasehold that has been granted. At this elevation the open rolling country of the plateau commences, the bush and scrub being chiefly confined to the gullies. Terrace-like steps stretch to the westward, until they are cut off by the scarp of Mount Frederick, leading down to the sea, as shown in sections AB and CD.

Evidence of the extension of the coal seams throughout this part of the field is found in the occurrence of the two outcrops discovered by Mr. Dobson in Granity Creek, at 1,350 and 1,600 feet altitude. I examined the lower of these, marked C on the plan, and found the coal is very imperfectly exposed in the bottom of a deep ravine, but it appears to be at least 10 feet thick.

A short distance above this coal, a spur of the granite from Mount Frederick is at the surface, forming a wooded hill; and at the upper or eastern boundary of this, the true high level of the plateau commences, with an average altitude of 2,000 feet, the surface of which, though undulating, is never abrupt, except in the ravines, and is formed of the sandstones, grits, and interbedded shales of the coal measures, which dip at moderate angles, and are much less disturbed than in the part of the field above described. The ravines, which are from 50 to 100 feet deep, frequently expose good sections of the strata; and near the source of the east branch of Mine Creek the coal can be traced continuously for about 20 chains, with tolerable regularity.

At D, on the plan, this seam is seen to great advantage on both sides of a precipitous gorge, where it forms vertical cliffs of hard black coal, that appear to resist the action of the weather. As the floor of the creek is also coal, the full thickness of the seam was not ascertained; but about 22 feet is exposed in the section. The coal is laminated, with a bright fracture, and closely resembles the coal that was mined at Coalbrookdale, which differs from the Ngakawau only in its greater coherence and lustre, and in the larger proportion of gaseous matter which it contains.

The seam is easily traced in the bank of the river to the N.E., as shown on the plan; but in that direction it thins rapidly, and is cut by a succession of small faults.

In the opposite direction the outcrop is obscured by scrub for some distance, but it is again exposed in a landslip by a slight excavation. It is then seen crossing the bed of the next highest branch of the creek at D, which is the last exposure in that direction.

In a southerly direction, the seam underlies the area marked "Plateau Coal" for the distance of a mile, as what must be the same coal again appears in the ravine of the south branch of the Ngakawau River at the point marked E.

This is the largest block of coal which has yet in this district been defined with tolerable accuracy, and by a moderate estimate is computed to contain 7,000,000 tons. Coal has been seen in many of the ravines between this point and Coalbrookdale, which is distant seven miles to the south, so that it is very probable that the coal is continuous for that distance; but until there is a map of the country on which these can be accurately laid down, any reference to them might only tend to mislead in estimating the extent of coal which they indicate.

The chief difficulty in working this coal will arise from its inaccessible position, and the absence at that altitude on the mountain of any timber suitable for mining purposes. While the coal is obtained with such facility and economy of capital at the Ngakawau Mine. High level coal on the plateau is therefore not likely to be worked—not at least till a large trade is created; and as during the interval the district will become better understood, it is premature at present to discuss the manner in which access can be obtained to that part of the field. I am however confirmed in the opinion formerly expressed, that the natural outlet will be to the Ngakawau or its immediate vicinity, so that any works undertaken for the conveyance of the coal from there will serve ultimately for the whole field. It is true that a very direct but steep line might be found by following the west side of Granity Creek, but this would still reach the coast within a mile of the Ngakawau River. No coal has yet been discovered in the course of Granity Creek, except that already mentioned as occurring near its source; but there is reason to think a seam may be found at a low altitude, and under circumstances almost as favourable for being worked as at the Ngakawau Mine. For a mile back from the sea the stream is in a deep gorge, and flows over the same dark marly sandstone as those overlying the coal further north. A vertical fall of 200 feet then occurs, the upper part of which is over coal grits and sandstones, like those underlying the coal on the plateau. The cliff marked by this fall forms the edge of the terraced area between the plateau and Mine Creek; and the only difference between the section here exposed and that at the coal mine is, that the grits below the coal appear to have thinned out against the granite of Crane's Cliff. If this view is correct, the horizon of the coal should cross the gorge of Granity Creek below the fall, as indicated on the plan.

3.—*Waimangaroa.*

A party of gold miners when tunnelling under the drift in the side of the valley following the surface of the bed rock, discovered a seam of coal interstratified with gritty sandstone. The position is on the opposite side of the valley, and in the line of strike with the thin seam which I saw in 1866, when the miners were in the habit of using it for sharpening their tools, so that it is probably the same seam which is described in my former report as the 16-inch seam, found at intervals along the seaward face of Mount Rochfort. As it appears to be thicker at this place, and the quality to be somewhat different, being, in fact, identical with the coal from the Ngakawau seam, a drive has been put in for the purpose of cutting the coal in the solid part of the hill. It was expected that the coal should be cut at about 110 feet, and about that distance a shale parting was met with, but no clean coal has yet been struck, although the drive has been extended to 130 feet. The locality is about 30 chains up the gorge of the Waimangaroa, and in a very convenient situation for a coal mine.

The formation containing the coal seam forms a long spur from the south end of Mount Frederick. The strike is N. 10° E., with a dip of 60° to the west; and as the direction of the strike is across this spur, which is less than a mile wide, with an altitude of about 800 feet in the cross section at that part, the extent of the seam above water-level would probably be such as would yield about 100,000 tons of coal for each yard of thickness of seam.

The exploration at this place is still in progress, and, until more definite proof is obtained of the existence of a thick workable seam, the Waimangaroa must not be counted on as a feeder to the proposed railway along the coast. The other coal seam, which is frequently referred to as occurring higher up the Waimangaroa Valley, is only the outcrop of the Coalbrookdale seam, and being at an elevation of 1,800 feet is not easily accessible in this direction.

25th May, 1873. JAMES HECTOR.

Dr. HECTOR to the Hon. the MINISTER for PUBLIC WORKS.

MR. FISHER, of Westport, telegraphs that the contractors who are putting in the drift to cut the coal seam on the north side of the Waimangaroa River have struck the crossing at 113 feet. This is 13 feet further than I expected, and proves that the coal is not dipping so steeply, or the strike has changed in direction. The contract was only for 15s. per foot, so that the authority for £100 will cover expenses up to 130 feet. I have therefore telegraphed to go on cutting through the coal seam to determine its thickness.

24th May, 1873. JAMES HECTOR.

MEMORANDUM by Dr. HECTOR to the UNDER SECRETARY.

CASCADE CREEK, referred to in the attached telegram, is a tributary of the Buller River rising on the south slope of Mount Rochfort, and joining the Buller at fifteen miles from the sea. I think this is only the Mount Rochfort seam that has been struck by following up the creek to the position marked on the attached sheet map. The altitude is not stated, but at five miles up I should judge the creek to be 2,000 feet above the sea. If so, it is quite as inaccessible as the Mount Rochfort seams already known, and could not be reached with economy from the south side. This discovery should not divert attention from the Ngakawau seams.

15th March, 1873. JAMES HECTOR.

Mr. A. D. DOBSON to Dr. HECTOR.

(Telegram.) Westport, 15th March, 1873.

GREENWOOD reports 8 feet seam coal five miles up Cascade Creek. Specimens very good.

A. DUDLEY DOBSON.

Mr. LEECH to Dr. HECTOR.

SIR,— Harbour Office, Westport, 11th June, 1872.

I have the honor to inform you that, agreeably with your request, I took the soundings outside the River Ngakawau. With the largest rock bearing south, we steered north until the river's mouth bore east. We then kept away, and entered the river (3½ hours flood), carrying 6 feet over the bar.

The soundings were first 4 fathoms, immediately after getting the rocks on the proper bearing—depth nearly the same until past the rocks, then 3½ fathoms, shoaling gradually to 3 fathoms; the river then bore about east; steering in for the bar still 3 fathoms, then 2½ for four casts, then 2 fathoms, then 1½ twice, then 8 feet, 8, 7 (6½, 6, 6, bar; 7, 8, 8, 9, 9, inside). Outside, when sounding, brought up some of the bottom each cast, which proved to be dark sand in all cases. No indications of a rocky or hard bottom being visible.

Next time I go, if an opportunity offers, I shall try again closer in shore.

I have been obliged to go since to Ngakawau (overland), and beacon-off the channel, right up to the Deep Basin. The least water found at high water spring tides, with the beacons any way near in a line, was 8 feet. The bar I found a little deeper than on my first visit, and, as you observed, found it straighter than before. This I attribute to the late floods. In fact, both those good features are caused by the same agency.

The "Luna" can swing in the bay below the shallow place, but she must not be sent until that cluster of snags immediately below the point opposite the wharf are cleared away. Two of the largest are dangerously near the fairway, and lie on the edge of the deepest water. I estimate the cost of their removal at £50.

It being spring tides when I passed the rocks going to Ngakawau the other day, I had a fair opportunity of seeing the large shingle bank you spoke of. That large rock close in shore appears to stop nearly all the coast drift coming from the southward, and certainly does shelter the bar beautifully.

The stones in the shallowest parts of the river are pretty well cleared away. It wants a barge to do it properly. The water is too cold for men to remain long in it at a time just now.

I have, &c.,
S. A. Leech,
Harbour Master.

Dr. Hector, Government Geologist, Wellington.

Mr. Leech to Dr. Hector.

Sir,— Harbour Office, Westport, 19th July, 1872.

. . . The mouth of the river was very narrow when I was up there, owing to the effects of a westerly gale that had been blowing for two days prior to my going there on the 10th instant. The bar still retained its original depth, only the north spit extended to the northward, narrowing the channel to some 50 feet wide. Very little shingle had come from the southward, I presume owing to its interception by the rocks to the southward of the mouth. The soundings from outside the rocks were same as before, no indication of a rocky bottom; nothing but sand, dark and gray, coming up on the land. I went up in the "Lyttelton" from Westport.

The snags are being removed; the "Luna" cannot come yet. . . . A party has come to-day from the Ngakawau; reports the entrance again wide and straight, owing to a late flood.

I have, &c.,
S. A. Leech,
Harbour Master.

Dr. Hector, Wellington.

Mr. Leech to the Superintendent of Nelson.

Sir,— Harbour Office, Westport, 9th June, 1873.

I have the honor to inform you that, in pursuance of instructions from you, I proceeded to examine the Wanganui River, some thirty miles N.N.E. of Westport, as to its navigable capabilities, &c.

Leaving here on the 7th, at 10 p.m., in the steamer "Result," we arrived safely next morning and anchored off the river, which we entered about 8 a.m., high water; depth on bar, 10 feet; proceeded up the river some two miles, when the steamer grounded on one of the spits, backed off, and anchored in the channel.

After breakfast I proceeded up the river between two and three miles further in the boat; found it rather crooked, but not rapid, the general depth being about 4 feet; at that time two hours' ebb and four days before full moon (spring tides).

At low water springs there would only be about a foot of water at low tide, or just what the river discharges, although at high water it looks a fair-sized little river.

The sea water at low tide only backs up to the head of the first reach, or about twenty chains inside the bar. The maximum depth found here at low water was 12 feet, close to the rocky south shore, and the minimum depth which was on the bar 4 feet. The north side is sandy, and of course shoals gradually; at low water springs there would be about 3 feet on the bar; at high water 12 to 16 feet would be obtained.

At high water ordinary tides, vessels drawing 6 feet could go a mile up the river with safety; at high water spring tides they could go two miles up; but this would be unnecessary, except a large trade were doing. There is a site for a wharf about half a mile or so inside; vessels would lie aground, but the bottom is soft—chiefly small whitish gravel. The wharf site could be easily extended by removing some small stones and a few snags.

The river banks, two miles from the mouth, show no signs of strong floods, nor does the river appear to overflow its banks as far as I went up, although scum was apparent in the bends where the river impinges strongly when flooded.

The river up to the wharf site is comparatively free from snags; above that they increase as the river is ascended, but are not dangerously numerous for the first two miles or so.

The entrance to this river is perfectly straight, and is likely to remain so, owing, as already stated, to its being rock-bound on the south side, terminating in a steep bluff several hundred feet in height, and from which a reef six to ten chains long, and partially covered at high water, extends in a westerly direction, quite sheltering the bar from the south-west (see sketch enclosed), and giving this river an immediate advantage over all the others lying between the Buller and Rocks Point; of course it is exposed to all winds from W. to N.N.W.—so are all the other rivers in this bight. The north side, as already mentioned, is a sandy beach, and although it curves to the southward, running halfway across the mouth (as shown), still it is stopped from closing the entrance by the strong current sweeping past the steep rocks immediately opposite, and which maintains a depth, as you will observe, of 4 feet on the bar at low water. This is the narrowest part of the channel, being only some 45 or 50 feet wide at low water; just inside it widens to 120 feet, and a little further in an average width of 2 chains is obtained, until the creek running to the S.E. is reached, where it narrows to about a chain at the head of the reach. These distances are at low water; at high water it shows a fine wide channel, bearing by compass E.S.E. for entering, and W.N.W. for leaving the river.

The water deepens quickly outside the bar, and with the outer end of the reef bearing south by compass a depth of 5 fathoms was obtained. We left the river on the 8th, at 6.30 p.m., two hours before high water, depth on bar 9 feet; this was very good, seeing it will not be spring tides before the 11th.

In conclusion, I may state that I am much pleased with the Wanganui River, as in the event of its ever being required as a port, it could be worked much more safely than its sister rivers Ngakawau,

Mokihinui, Karamea, or I presume the Heaphy. I have never seen the latter. The goodness of the entrance is entirely owing to the long reef, which forms a breakwater, and protects it from the prevailing S.W. wind and sea, so prevalent on this part of the coast.

I have, &c.,

To His Honor the Superintendent, Nelson. S. A. Leech, Harbour Master.

COLLINGWOOD.

The Superintendent of Nelson to the Hon. the Colonial Secretary.

Sir,— Wellington, 25th October, 1872.

Referring you to that portion of Dr. Hector's report upon the coal mines of the Colony in which he recommends that assistance should be given from the funds available for that purpose to the Collingwood Coal Mining Company, to enable them to make a certain drive, in order further to prove the existence of coal in quantity, I have the honor to add my urgent recommendation that the sum of £750 be advanced from the fund referred to. The drive specified is estimated to cost about £1,500, and the Provincial Government have contributed £250, while the Company is prepared to find the remaining £500 which will be required.

The superior character of the coal, as reported on by Dr. Hector, the available nature of the port of shipment, added to the energy and perseverance displayed by the Company, which consists chiefly of working men with little or no capital but their labour, appear to me to form strong grounds for a claim to assistance from the Government, from funds devoted by the Legislature for the development of an industry of so great importance to the Colony.

I have, &c.,

Oswald Curtis,

The Hon. the Colonial Secretary, Wellington. Superintendent of Nelson.

The Hon. the Colonial Secretary to the Superintendent of Nelson.

Colonial Secretary's Office,

Sir,— Wellington, New Zealand, 11th November, 1872.

I have the honor to acknowledge the receipt of your letter of the 25th ultimo, recommending that an advance of £750 be made to the Collingwood Coal Mining Company, to enable them further to ascertain the existence of coal in quantity in their mine.

In reply, I have to inform your Honor that the Government are quite ready to afford assistance to the above Mining Company, to enable them effectually to test the quantity and position of the coal which can be got from their mine.

After consulting with Dr. Hector, however, the Government believe that the necessary cost of the tunnel has been over-estimated. Dr. Hector proposes to visit Nelson next week, and after receiving his report the Government will communicate further with your Honor.

In the meantime they are prepared to promise the Company a subsidy of £500 for the purpose above mentioned, which will doubtless enable them to proceed at once to call for tenders for the work.

I have, &c.,

His Honor the Superintendent, Nelson. J. Hall.

Dr. Hector to the Hon. the Colonial Secretary.

Sir,— Geological Survey Office, Wellington, 3rd December, 1872.

I have the honor to report that, in accordance with your instructions, I have surveyed the Collingwood Coal Mine, and made an estimate of the probable length of the tunnel recommended in a former report, with the view of ascertaining if the grant of £500 made by Government will be sufficient to enable the Company to carry out the work.

The Company, anticipating that they would receive assistance from Government, had the tunnel commenced in September last, under the enclosed contract, at the rate of 30s. per foot.

The tunnel, on the 25th ultimo, had been carried forward 102 feet, at an average rate of progress of 10 feet per week. The contract provides that only 75 per cent. of the amount done from time to time is to be paid to the contractors; but the Manager having, at their pressing solicitation, advanced the full amount, the contractors have taken advantage of this and abandoned the contract. This will cause some delay while fresh tenders are being called for; and I also doubt if a new contract will be obtained at the same rate as the first (which is very much below my previous estimate of 50s. per foot) notwithstanding that the hardest part of the rock has now been cut through.

A plan and section of the mine is being prepared from my survey, and will show the nature of the rock and the extent of the field that will be opened up by it.

The height of the workings above the drive I determined with a pocket level, and the remainder of the altitude by the aneroid barometer.

The direction of the drive was checked, and found to be within 1 degree of a line at right angles to the longest level course in the old workings.

The dip of the strata was determined at several points, and an average of 1 in 3 taken as the most reliable for the beds through which the tunnel will pass, although subject to variation in other localities in the immediate vicinity.

From these data the lowest known seam of coal, 1 foot thick (No. 6 of former report), should be cut at 140 feet in the drive, or about 40 feet further than its present extent; the lowest seam that has been worked (No. 4), at 330 feet; the middle seam (No. 3), at 540 feet; and the upper or main seam, that has been worked, at about 600 feet.

The following is an approximate estimate of the character of the rock that will be passed through:—

Already Driven.

	Feet.
Gray sandstone, with coaly layers in thick beds, with intervening bands of very tough breccia	102
Gray sandstone, with bands of breccia from 1 to 3 feet thick; shale partings at 3 to 8 feet	40
Coal	3
Gray sandstone and ironstone shales, with thin layers of breccia; frequent clay partings	240
Coal	3
Gray sandstone and black shale	48
Fine-grained breccia	24
Gray ironstone	9
Coal	2·5
Gray sandstone	36
Coal and shale	3
Gray sandstone	6
Ironstone shale	3
Gray sandstone	12
Coal	4
Ironstone shale	12
Clay band	12
Coal	4
Ironstone shale	7·5
Gray ironstone	4·5
Coal and shale	9
Coal	3·5
Shale	3
Clay iron band	1·5
Coal	2
Clay iron band	1·5
Coal	5
Coal and ironstone band	12
Total	613

The total expenditure for the drive may be estimated as follows:—

1. Contract price per foot, 102 feet already down, at 30s., and 500 at say 35s.	£1,029
2. Cost of certain tools and ventilation (under clause 5), say	60
3. Cost of inspection on behalf of Company; proportion of working manager's wages, 60 weeks at 30s.	90
Total	£1,179

This does not differ materially from my former estimate, £1,125; and until the work has made further progress, I do not recommend that the application for increased assistance beyond the £500 already granted should be considered.

With regard to the manner in which the Government grant will be paid, I have arranged with the Manager of the Company, in accordance with your authority conveyed by telegram, that 75 per cent. of the amount due under contract for driving the tunnel will be paid from time to time on the certificate of His Honor the Superintendent. A first payment has been made under this arrangement, being the proportion due on the 102 feet excavated by the late contractors.

I have, &c.,

The Hon. the Colonial Secretary, Wellington. JAMES HECTOR.

Mr. WEBSTER to Dr. HECTOR.

Collingwood Coal Mining Company, Registered,
Nelson, 18th January, 1873.

SIR,—

A most disastrous flood occurrred at Collingwood last Tuesday, carrying away the coal wharf bodily, and Mr. Marshall advises me that thirteen of the tramway bridges are completely wrecked; estimated damage about £200. Mr. Marshall also notifies that the new contractors for the tunnel have thrown up their contract, after doing about 10 feet, and recommends that 200 feet of the tough measures be tendered for, as it is difficult to convince men that the ground will become easier.

I have, &c.,
M. WEBSTER,
Legal Manager.

Dr. Hector, Wellington.

Mr. WEBSTER to Dr. HECTOR.

Collingwood Coal Mining Company, Registered,
Nelson, 1st March, 1873.

SIR,—

I have much pleasure in advising you that the contractors now driving the tunnel are likely to carry it through; it is now four weeks since they commenced work, and they have in that time driven 50 feet, cutting the first seam of coal as near as possible at the distance stated in the section

you kindly furnished. Mr. Marshall advises me that it is 3 feet, and cleaner than the outcrop, but not clean enough to work; they are now in the hard ground again, and, as you are aware, it will be some months before they come to the next seam; the present contract is 37s. per foot. There are six men employed, and the work is carried on night and day. I have security for £50, and the contractors leave the amount of the first 25 feet in my hands until the contract is finished. The entire distance driven up to Tuesday last is 169 feet, that is made up thus: first contractors, 102 feet; second, 17 feet (for which I refuse to pay at present); and 50 feet by the present contractors.

It is contemplated to make a new road to the Ruatanawa, consequently the old road is not to be repaired. The Ruatanawa has from 12 to 14 feet at low water inside, so that vessels would not have to lie aground at low water; and it is not disturbed with floods, &c.

I have, &c.,
M. Webster,
Legal Manager.

Dr. Hector, Wellington.

Mr. Webster to Dr. Hector.

Collingwood Coal Mining Company, Registered,
Nelson, 14th April, 1873.

Sir,—

I beg to advise you that Mr. Marshall reports having found ironstone both above and below the first coal seam cut in the new drive; he states that the bands vary from 6 to 12 inches; and as it appears to me better than anything got out before, I take the liberty of sending a sample herewith, trusting that, when opportunity offers, you may be able to analyze it, and let me know the result.

The contractors are still pushing forward with the drive, but the water increases every foot they proceed, so much so that they cannot work more than six-hour shifts. Up to the 8th instant, they had driven 101 feet, and under that date they addressed a letter to me, asking for an advance of 3s. per foot on account of the difficulties they had to contend with; but the Directors decline to entertain such an advance, as it is quite possible they may get into easier ground at any time.

I may add that the water blast is acting admirably, carrying abundance of air for the safe and proper working of the drive.

I have, &c.,
M. Webster,
Legal Manager.

Dr. Hector, Wellington.

Report by Dr. Hector relative to the Collingwood Coal Mine.

10th May, 1873.

In continuation of my former communication of 3rd December, I have the honor to report that I again inspected the Collingwood Coal Mine on 16th April, and found that the tunnel was excavated for a distance of 230 feet from the entrance, the new contractors having driven 113 feet in ten weeks. The rock continues to be very hard and tough, and only a few shale partings have been met with to favour the work. The lowest of the seven seams of coal was cut at 165 feet, and affords indications of a favourable change in the formation as it dips into the hill. At the outcrop, on the face of the waterfall, this seam only showed 6 inches of clean coal, distributed in thin layers through about 4 feet of sandy shale; but in the drive it showed 14 inches of clean coal, with a roof of sandy shale, and resting on a sandstone band 2 feet thick, beneath which is a second seam of coal 6 inches thick. In the shale roof there is a band of ironstone 10 inches thick.

At 200 feet several small cross-joints were encountered, from which water gushed with considerable force, greatly impeding the work and adding to the cost, by frequently causing the charges to miss fire. To overcome the difficulty, I recommended the use of dynamite instead of gunpowder, as its explosive properties are not affected by water.

The drive continues to be straight and at right angles across the strata, which show a tendency to flatten, the dip having decreased from 20° to 17° as the drive advanced.

Ventilation is effected by a very ingenious contrivance erected by the manager, Mr. Marshall. Water is led from stream above the mine, with a pressure of 120 feet fall, in a small tin pipe, and delivered through an open pipe into a cask at the mouth of the mine. Air is carried into the cask by the force of the jet of water, and by a simple arrangement is forced into a 7-inch square trunk or wooden pipe, that leads it to the working face, where it escapes with a blast sufficient to blow out a candle at 6 feet distance. The drive is thus thoroughly cleared of the powder-smoke and foul air without the usual expense of an extra hand to work a fan.

I may state that this ingenious plan was suggested by Mr. Moutre, in Nelson, who in this manner employs the high-pressure water supplied to him in Nelson to blow a forge.

A new coal seam has been found cropping out in the gully about 30 feet above the first seam, so that it will be cut at about 260 feet. It is about 6 inches thick, and on it rests a foot of very superior ironstone.

So large is the amount of carbonaceous matter distributed throughout the ferruginous sandstones excavated in the drive, that the spoil-heap in the gully caught fire, and burned with such vehemence that it was only extinguished after some difficulty, by turning the creek into the flaming mass. It is therefore very probable that many of the carbonaceous layers that would not be worth working for the clean coal they contain, might yet be profitably worked along with the bands of ironstone for the supply of a blast furnace.

The elevated position of the mine, with its coal and ironstone seams, and the close proximity of fine crystalline limestone, which is cut through by the tramway between the top of the incline and the mine, are all favourable circumstances for the establishment of iron works at this place, as the furnaces could be charged with the raw material, and manufactured iron delivered by gravitation at a favourable place for shipment. Having mentioned this to Mr. Webster, the legal manager of the Company, he applied for information respecting the cost of erection of suitable furnaces, and in reply received the appended estimate from a correspondent in England. (Enclosure A.)

Samples of the iron ores which occur along with these coal seams have been analyzed by Mr. Skey:—

1. From the coal and ironstone band, which is the highest bed in the series proposed to be cut in the tunnel, a specimen of compact brown or hydrous hematite was found to contain 46·06 per cent. of iron. The ore occurs in quantity immediately over the main or 3 feet 6 inch seam of coal, and is mixed with a large proportion of carbonaceous matter in irregular layers.

2. Concretionary ironstone from below the main coal. This is really a highly ferruginous shale, about 2 feet thick, but in two layers, separated by 1 foot of coal. The concretionary structure is only discernible on weathered surfaces. A fair average sample of the ironstone gave 43·26 per cent. of iron. Both of these ores contain a good deal of iron-carbonate disseminated throughout.

3. From the ironstone already mentioned in this report as underlying a newly-discovered coal seam low down in the series.

The coal is only 1 foot thick, and the ironstone is about 16 inches; but its full thickness and relation to the other strata will not be known till it is cut in the tunnel, in which it should be reached at about 270 feet. The ironstone is very compact, and from the large proportion of carbonaceous matter intermixed, and from its containing carbonate of iron, could be easily smelted. The percentage of iron it gave on analysis was 42·1.

Several other rich iron ores are found in this district, though not immediately connected with the coal mines. Thus, along with the graphite seams in the Ruataniwha and Pakawau, and on the Otamataura Creek, red hematite ore is found, though a solid vein has not yet been discovered. A rolled fragment from the last-mentioned locality has the following composition:—

Sesquioxide of iron	88·3
Siliceous matter	10·5
Water	·8
Loss	·4
	100·0

The percentage of iron contained in the ore is 61·81.

Within easy reach of any ironworks established in this locality would also be the valuable deposits of brown or hydrous hematite at Parapara, which is only four miles distant. This ore might be valuable to mix with other varieties of ironstone, although not well adapted by itself for the manufacture of iron of fine quality.

During the past season I have twice crossed to the western slope of the range behind the coal mine, and traced the coal measures till they sloped with the surface westward towards West Wanganui Inlet. No other rock is seen *in situ* but soft brown sandstone and shales; but in the creek above the mine there are large masses of a fine-grained conglomerate, which prove that there are conglomerates in the upper as well as in the lower part of the formation. On the crest of the range, at 2,000 feet altitude, the strike of the sandstones is almost N.E., with a dip of 12° to the N.W. About 400 feet below the summit, on the west side, is a 2-foot seam of bright coal, dipping 15° to N.W., the sample from which has the following composition:—

Water	4·06
Fixed carbon	58·65
Hydrocarbon	35·33
Ash	1·96
	100·00
Evaporative power	7·0

This coal forms a strong coke, and is quite as useful as that from the seams in the mine; but in extent, appearance, and the high percentage of water for a bituminous coal, it resembles the seam at Pakawau.

No calcareous beds were seen in the upper part of the formation on the top of the range, as stated on the authority of Mr. Marshall in a previous report, the limestone referred to by him being only the outcrop, on the spur south of the mine, of the crystalline limestone that underlies the coal formation.

Coal seams have recently been found on the face of the Whakamarama Range, about five miles south of the coal mine, in the bed of the Otamataura Stream, by Mr. Ellis, who guided me to the locality. We reached it by ascending a steep spur from the Aorere River, below the junction of the Otamataura, to the height of 1,800 feet, and then dropping into the valley of the latter stream at an altitude of 1,000 feet. Below this point the valley is precipitous, the stream leaping over precipices of conglomerate, being the "Ramparts" that are so distinctly visible from the Collingwood side of the valley. These ramparts are formed of the conglomerates at the base of the coal formation, the surface of which can be traversed by the eye along the face of the hills for many miles both to north and south.

There are four coal seams cut across in the bed of the stream, which exposes the following section in its course for 200 yards back from the top of the fall:—

	Feet.
(*a.*) Brown sandstone, forming the upper part of the range, and almost covered with vegetation, but showing beds of rather fine gravel conglomerate, at least	1,000
(*b.*) Coal shale	½
(*c.*) Gray sandstone	2
(*d.*) Coal (A)	3
(*e.*) Brown and gray sandstone	40
(*f.*) Coal	¾

	Feet.
(*g.*) Dark sandy shale	5
(*h.*) Coal (B)	3
(*i.*) Sandstone	6
(*k.*) Conglomerate.	

The thickness from the top of the fall to the base of the formation, where the conglomerate rests on granite, was not ascertained, but it is at a much lower level than in Mine Creek.

At 100 yards up the creek, from the top of the fall, the strata are cut by a fault which throws down the coal seam to the west, as shown in the section.

The prevailing dip of the strata east of the fault is 8° to 12°, to W. 20° N., and the strike of the fault, as far as could be made out, is W. 20° S., its inclination 60° to N.W.

The existence of broken coal in the crushed fragments, included in the fault, renders it pretty certain that there are higher seams in the formation than those above described.

The composition of samples taken from the above seams is as follows:—

	(A) Upper Seam.	(B) Lower Seam.
Water	2·19	1·36
Fixed carbon	52·89	55·61
Hydrocarbon	36·63	29·29
Ash	8·29	13·74
	100·00	100·00
Evaporative power	(A) 6·8	(B) 7·2

Both coals are hard, black, and lustrous, burning freely, and yielding a large quantity of coke. Their powder is brown, and in both iron pyrites is disseminated in minute quantities, giving to ash a pale buff colour. The upper coal is compact and homogeneous, while the lower is distinctly laminated.

Still further up the valley than the fault are heavy blocks of conglomerate like those already described as occurring in the upper part of Mine Creek; but as the ferruginous beds which are so prominent in the Mine Creek section are wanting, the formation must have been altered very much in character, the conglomerates at the base having thickened and replaced much of the proper coal measures; on the other hand, the coal seams must correspond with those on the western slope of the mountains above the coal mine, and other seams of coal may yet be discovered lower down the valley.

In the event of workable seams being found in this part of the field, access to them will be obtained by the valley of the Otamataura Creek, by the employment of inclines, the circumstances being similar to those in Mine Creek.

EXTRACT from a Letter received by Mr. W. WEBSTER from Messrs. FIELDING and PLATT, Atlas Iron Works, Gloucester.

WITH regard to the blast furnaces, we have had considerable experience in the erection and working of them, and machinery connected therewith, and shall be glad to furnish plans and estimates if you will give us particulars of the kind of fuel, ore, and whether the coal will be used raw or "coked," and just an outline of the ground.

We enclose estimate which we have just got out for the Forest of Dean District, in this country, for two small furnaces and appliances, where a very first-class hæmatite iron is made (suitable for Bessemer steel); and also cost of producing the iron, which at the present time is selling at £9 per ton. The ore holds a great deal of water, and much of it is very fine or small, so that it cannot be calcined, and consequently furnaces of small capacity are used. The dimensions are—50 feet high × 15 feet diameter of boshes, 6 feet hearth.

The gases are taken off and utilized under the boilers; but as the Forest ores require so much time to flux them, the gas is not reliable for the stoves. In most other English districts the gas is sufficient for stoves and boilers. The water-pressure you mention, if in sufficient quantity, would be an economical blowing power, and our water-engine is very well adapted for the purpose, and would come in at a very moderate price. The furnace, plant, &c., we refer to is for a very first-class job; iron-cased furnaces, gas apparatus, stoves, duplicates, blowing-engines, and everything to put them to work. By reference to the enclosed estimate of the working of two furnaces, as before described, you will see that iron-making is a most lucrative business in this country, even with the competition there is; and in your country we should say it would be still better, providing fuel is suitable and iron of good quality. With regard to working plans, we could supply thsee at anything from £20 to £200, according to the amount of details and completeness. However, we could make them so that any practical engineer could carry out the work from them in every detail for about £50.

We have, &c.,
FIELDING AND PLATT.

ESTIMATE of Cost of TWO FURNACES, 50 feet high, 16 feet boshes, 6 feet hearths.

Foundation of furnaces	£700
Stack, flues, and boiler seats	2,300
Engine-house and foundations	700
Hoist, well, and hoist	400
Stoves, brickwork, and castings	2,700
Furnaces and lining, with gas apparatus	8,000
Two blowing engines	3,000

Ten boilers	£2,000
Cast-houses, roofs, &c.	1,800
	£21,600

Estimate of cost of producing 360 tons of iron per week, or say 18,000 tons per annum, which two furnaces 50 feet high will make :—

Ore, 45,000 tons, @ 20s.	£45,000
Coke, 25,000 tons, @ 30s.	37,500
Shale, 7,500 tons, @ 5s.	1,875
Coal, 3,000 tons, @ 10s.	1,500
Labour, 18,000 tons, @ 8s.	7,200
Rates and taxes	200
Manager and clerks	800
Interest on £50,000	2,500
Depreciation on £20,000	2,000
	£98,575
18,000 tons iron, @ £9	£162,000
Cost of producing same, as above	98,575
Balance of profit	£63,425

Mr. Webster to Dr. Hector.

Collingwood Coal Mining Company, Registered,
Nelson, 27th May, 1873.

Sir,—

I have to acknowledge the receipt of your memorandum sent by Mr. Curtis, and now beg to advise you that I visited the mine on the 15th instant, and found that, although the contractors had not actually knocked off, their progress was very slow indeed; but with the promise of 3s. more per foot, they had commenced with renewed vigour; and having in a great measure lost the water overhead, I consider the prospect of their carrying the contract through is much improved.

The present contractors have driven 137 feet up to the 20th instant; and adding 117 feet driven before, makes a total of 254 feet. So far, the driving has been quite satisfactory to the Mining Manager, all the strata passed through being very regular, with an inclination to flatten. The first seam of coal was cut as near as possible at the distance indicated in your section, and shows much improvement from the outcrop; out of the formation of 3 feet, 2 feet of first-class coal could be mined. Above and below this seam there are two bands of ironstone, varying from 6 inches to 12 inches thick, a sample of which I left at your office on the 15th of April, and which has been reported on very favourably by Mr. Skey—the yield being 42 per cent. of iron.

From a personal inspection of the mode in which the "waterfall" has been utilized for the purpose of ventilating the drive, I have no hesitation in pronouncing it a great success,—supplying abundance of air to the fan, and since the water was turned on, some two months ago, has acted splendidly night and day without cessation.

Since my return from the mine, the Mining Manager has advised me "that the contractors have struck another burst of water," but they may lose it again at any time.

I have, &c.,
M. Webster,
Legal Manager.

Dr. Hector, Wellington.

Mr. Webster to the Hon. the Minister for Public Works.

Collingwood Coal Mining Company, Registered,
Nelson, 18th June, 1873.

Sir,—

In acknowledging the valuable aid the General Government has rendered this Company, in assisting them to prospect their mine with a Government tunnel, I beg to advise you that the cost per foot has increased considerably since the commencement of operations, having started with a contract at 30s., and we are now paying 40s. As it was hinted to Dr. Hector before the drive was commencep that assistance to the amount of £750 would be required, I am instructed by the Directors to inquire if the Government will make a further advance of £250. The £500 advance is not quite exhausted, but I make this application now to enable us to finance for finishing the drive.

The drive up to the present time has cost—say

75 per cent. of contract, management, piping &c. for air	£512
25 per cent. of contract held by Directors as security	100
	£612

Estimated cost to finish drive, £900.

I have, &c.,
H. M. Webster,
Legal Manager.

The Hon. E. Richardson,
Minister for Public Works, Wellington.

Dr. Hector to the Hon. the Minister for Public Works.

Colonial Museum, Wellington, 23rd June, 1873.

Sir,—

Reverting to the application from the legal manager of the Collingwood Coal Mining Company, dated 18th November last, for a further grant of £250 to enable the directors to make

arrangements for completing the prospecting tunnel now in progress, I have the honor to recommend that this additional assistance should be given. The work is being most satisfactorily executed, and at a cost still considerably below the original estimate. If it is merely looked on as work towards the exploration of the field, I consider the data obtained by the tunnel to be far more satisfactory, and I believe, less costly, than could be got by boring. A slight change for the better in the character of the coal measures between the outcrop and where they are cut in the tunnel, has already been found, so that the prospect of the venture being a commercial success is better than when the work was commenced. Even if the coal seams should not be worked for coal alone, as pointed out in my memorandum of 10th May, it is probable that they will be worked profitably in conjunction with the ironstone beds that are in contact with them. I do not think that the work could be more economically or rapidly pushed on than it is at present under the management of the company; and in the event of the tunnel proving the value of the mine to be satisfactory, the company will find no difficulty in increasing their capital, and repaying the advance, if required. This additional advance is made contingent upon the company being able to raise the balance necessary to complete the work. The best way to effect this will be to reduce the proportional payments made by Government from 75 per cent. to 30 per cent. of the amounts due from time to time under the contract.

I have, &c.,

The Hon. the Minister for Public Works, Wellington. THOMAS HUTTON.

The UNDER SECRETARY to Mr. WEBSTER.

SIR,— Public Works Office, Wellington, 14th July, 1873.

I am directed by the Hon. Mr. Richardson to acknowledge the receipt of your letter of the 18th June, and in reply to inform you that the Government have directed a further advance of £250 to be scheduled towards completing the Collingwood drive. This additional advance is made contingent upon the Company being able to raise the balance necessary to complete the work. The best way to effect this will be reduce the proportional payments made by the Government from 75 per cent. to 30 per cent. of the amounts due from time to time under the contract, which course be good enough to follow.

I have, &c.,

H. M. Webster, Esq., Legal Manager, JOHN KNOWLES,
Collingwood Coal Mining Company, Nelson. Under Secretary.

Mr. WEBSTER to the UNDER SECRETARY for PUBLIC WORKS.

SIR,— Nelson, 19th July, 1873.

I have to acknowledge the receipt of your letter of the 14th instant, advising me that the Government had made a further advance of £250 towards completing Tunnel B; and I now beg to convey the assurance of the Directors of this Company that the necessary funds will be raised by them to complete the drive. The work is being pushed forward as rapidly as possible, the contractor averaging about 50 feet per month.

I have, &c.,

John Knowles, Esq., Under Secretary, Wellington. H. M. WEBSTER.

Dr. HECTOR to the Hon. the COLONIAL SECRETARY.

SIR,— Geological Survey Office, Wellington, 2nd September, 1873.

I have the honor to report that, in consequence of my having received information to the effect that several faults or dislocations of the strata had been encountered in the tunnel which is being driven to explore the coal measures at the Collingwood Mine, I took the opportunity of the "Luna's" visit to the Spit Light to land at Collingwood and inspect the work. The tunnel is now in 400 feet, and the following is the section of the strata passed through:—

	Feet.
1. Tough sandstone and breccia, with carbonaceous matter ... ... Dip 19° to W.	165·0
2. Coal, clean and bright	·5
3. Sandstone band	2·0
4. Coal, clean and bright	1·2
5. Sandy shale	2·5
6. Ironstone	1·0
7. Sandstone, with bands of grit. Fault. Downthrow to W. 18 inches ...	28·0
8. Sandstone and breccia. Dip 12° W. Fault. Downthrow to S.W. 18 inches	39·0
9. Dark sandy shale with films of coal. Dip 30° to W.	18·0
10. Ironstone	1·4
11. Coal, not clean	·5
12. Sandstone	·7
13. Coal, clean	·8
Dip 30° to W., and passes under a thick mass of	
14. Dolomite of magnesia limestone, passing into breccia of the same. Contains carb. of lime, 53 per cent.; carb. of magnesia, 44 per cent. ...	15·0
The coal then rises again in the floor of the drive, and 10 to 13 are again cut with dip 16° W.	
15. Tough carbonaceous sandy shale. Dip 10° to N. 30 W.	27·0
16. Coal mixed with shale	4·0
17. Ironstone.	1·0
Fault. Downthrow 9 feet to W. at 45°.	
18. Tough crown carbonaceous sandstone, not bedded	45·0

The coal seam (16) was cut only in the roof of the drive, and, had the level of the drive been a few feet lower, it would have been missed altogether. On the other hand, had the level been even a few inches higher, the true nature of the dolomite (14) would not have been ascertained, and it might have been taken for a dyke instead of a local variety in the stratified rock forming the cover of the coal.

The only fault of any importance is that occurring at 17, and its effect will be to shorten the length of the drive required to cut the main coal by about 50 feet, and also thereby avoid the cutting of some of the hardest rock that had to be excavated in the course of the work.

I have therefore to report that the work is progressing even more favourably than was anticipated. The rate at which the drive is advanced averages 2 feet per day, and the distance which still remains to be driven, in order to cut the main coal, is about 200 feet.

As I returned from Collingwood I took the opportunity of re-examining the deposit of brown ironstone at Parapara, and found that my former estimate of its extent is nearly correct.

The ore occurs as large patches in a stratum of gravel. The greatest thickness of the stratum is 100 feet, and the area of the patches of ironstone showing at the surface is about 100 acres.

The ironstone weathers to a dark colour, and covers the surface of the hills with blocks of all sizes up to many tons in weight. A rough estimate made on the spot gave the quantity of ore available by mere surface excavation as at least 15,000,000 tons.

The ironstone everywhere shows traces of its origin as a bog ore that was deposited as a cement among gravel, as it contains rolled pebbles of quartz—but much of it is free from such admixture—and by hand-picking, and a simple modification of the smelting process, much of the siliceous matter could be eliminated, and the ore profitably smelted.

All the varieties of iron ore occurring at this place, and also at the coal mine, were collected on this occasion, and will be reported on as soon as they have been analyzed.

I have, &c.,

The Hon. the Colonial Secretary. JAMES HECTOR.

OWEN RIVER AND RICHMOND.

Dr. HECTOR to His Honor the SUPERINTENDENT of NELSON.

SIR,— Geological Survey Office, Wellington, 21st July, 1873.

I have the honor to report the results of the analytical examination of the samples of coal from the Owen River and Richmond.

No. 1,427 | L., OWEN RIVER.

This is a semi-bituminous coal, resembling in external appearance the Collingwood coal, and also some of the coal from Mount Rochfort, but differing from them in not being a strong caking coal.

It is massive, homogeneous, hard, and lustrous. Colour—in mass, black; in powder, brown. Its structure is laminated with rhomboidal fracture.

It cokes very imperfectly, and does not puff up. From its ash being of a light brown colour, it may be inferred to contain but little iron or sulphur.

This coal is, from its composition, of average quality as a steam generator, and will be useful as a household coal. Its value is about the same as that formerly worked at Pakawau.

Composition.

Water	4·82
Fixed carbon	52·85
Gaseous	38·21
Ash	4·12
	100·00

Evaporates 6·87 times its weight of water.

No. 1410 | L., RICHMOND.

Brown coal, of very soft, friable nature; its very inferior appearance being due, I suspect, to the sample having been taken from an exposed outcrop. It burns freely, with a clear, voluminous flame, but does not yield any coke. Its ash is reddish.

Except in the lower percentage of water and fixed carbon, this coal resembles the common brown coals of New Zealand, and is different from the coal formerly worked at Jenkins' mine, which contained 62 per cent. of carbon.

It is very desirable that this deposit should be examined with the view of determining if the seam improves in quality, and whether it occurs under conditions favourable for working. I consider it quite equal to the brown coal that is largely mined in some parts of the Colony, but would not answer for raising steam.

Composition.

Water	16·67
Fixed carbon	29·16
Gaseous and oils	48·21
Ash	5·96
	100·00

It evaporates only 3·76 times its weight of water.

I am, &c.,

His Honor the Superintendent of Nelson. JAMES HECTOR.

Dr. HECTOR to His Honor the SUPERINTENDENT of NELSON.

SIR,— Geological Survey Office, Wellington, 8th August, 1873.

I have the honor to report the result of the analysis of the samples of coal from Richmond, referred to in the report by Mr. T. Mackay, herewith enclosed.

Though still soft and friable, these samples are decidedly superior to the coal formerly reported on (No. 1,410), as they contain less water and more fixed carbon. They burn freely, but do not form a coherent coke. Two of the most distinct varieties in the bag were examined.

No. 1,441.—A. AND B.

	A.		B.
Water	8·82	...	8·19
Fixed carbon	47·20	...	45·61
Hydrocarbon	34·42	...	43·97
Ash	9·56	...	2·23
	100·	...	100·

Evaporative power—(A.) 6·05; (B.) 5·84.

I consider that the quality of this coal is sufficiently good to warrant its being opened up, with the view of ascertaining if it becomes more solid when it gets further from the outcrop. Even in its present friable condition it would be a valuable fuel for many purposes, such as brick-making and the like.

I may point out that Dr. Hochstetter, in describing the coal at Jenkins' Mine, near Stoke, mentions that "Various indications lead one to suppose that, further south, on the outskirts of the Waimea Plain, in the direction of Richmond, there are also beds of coal. Experiments by way of boring would probably be most apt to decide the question."

From Mr. Mackay's report, however, I am inclined to think that driving into the spur of the hill would be a better way of exposing the strata.

I have, &c.,

His Honor the Superintendent, Nelson. JAMES HECTOR.

Mr. T. MACKAY to the SUPERINTENDENT of NELSON.

Coal Seam on Mr. Higgs's Land, Richmond.

SIR,— Nelson, 23rd July, 1873.

In accordance with your instructions, received on 21st instant from Mr. Greenfield, Provincial Secretary, to inspect the coal seam on Mr. Higgs's land at Richmond, I have to report that I went out there on the 22nd instant.

The site of the seam is on Section 88-9, Sheet No. 1, of the Plan of the Province. It is, respectively, distant by road about 90 chains from the cross roads at the turn to the main street of Richmond, 130 from Messrs. Hodder and Talbot's corner, and 130 from the bridge over the stream which crosses under the main road between Holdaway's section, No. 69, and Eyles's, No. 79. Its height over the bridge is about 190 feet, and above sea level about 205 feet. It is situated in a gully in which the stream in question takes its rise. There is an easy ascent to it from Mrs. Higgs's farm-yard, and it is got at by a drive, barely 4 feet square, into a spur of the hill, the entrance to which is about 5 yards from the stream, and almost on a level with it. The drive first runs at a right angle with the stream for about 5 yards, and then turns to the right for about 4 yards more, at the end of which a fall of clayey stuff has taken place, evidently very lately, which completely precluded me from ascertaining either the strike, dip, or width, or the nature of the roof and floor of the seam. I was, however, able to get my hand through a slit in the side timbering, and get out of the seam the few pieces of coal which I send over in a box to Dr. Hector.

The inside of the drive being so unsafe from the slight and rotten timbering, and the entrance to it being also liable at any moment to be closed up from a fall of clay and drift from above, which were hanging very loosely over it owing to the hard frosts of the two previous nights, that I was obliged to rely on Mrs. Higgs's son, who accompanied me, for the following information, so far as I could make him understand its technicalities:—

The seam is about 4 feet wide; its strike about W.S.W. to E.S.E.; its dip about 30° to S.S.W. It was first worked over twelve years ago by a person named Roberts, who took out about 100 tons; secondly, by a person named Weir, who took out about a similar quantity; thirdly, by Higgs himself, about a year since, who took out about 30 tons.

The two first sunk on and worked it at a lower level than the present drive, but the water came in on them, and they had to abandon the work. These workings have since fallen in.

Higgs sold his output for 15s. per ton at the mine, principally to Mr. Symonds, the flax manufacturer, and to Messrs. Snowden and Gapper, of Richmond, for their portable steam engines. They mixed it with Newcastle coal in the proportion of three tons of the former to one of the latter, and found it to burn well in that way, and of strong heating power.

There is apparently a thin vein of mineral resin running through the seam, from the small sample, the only one I could get, and which is wrapped up in pink paper.

It would be quite impossible to form any proper judgment of the seam until the present drive and its entrance were first made safe, and then properly cleared out so as to get a good face on the seam. The re-timbering and labour should not cost £25. They could be contracted for.

In the event of the mine being ultimately worked, there is sufficiently available water-power to keep it pumped dry to a considerable depth for eight months of the year.

From what I can learn, the same coal is to be found in several places along the face of the hills between Mrs. Higgs's and the Wairoa River.

I have, &c.,
THOMAS MACKAY, C.E.

His Honor the Superintendent of the
Province of Nelson.

PROVINCE OF CANTERBURY.

MALVERN HILLS.

Dr. HECTOR to the Hon. the COLONIAL SECRETARY.

SIR,— Colonial Museum, Wellington, N.Z., 22nd May, 1873.

With reference to the application from the Provincial Secretary of Canterbury for further information respecting the Malvern Hills Coal Field, I have the honor to enclose an extract from a report by Captain Hutton, dated 7th ultimo, which is the only information on the subject obtained by the Department since the reports which have already been published. In doing so, I beg to call attention to the opinion expressed by Captain Hutton, that the superior quality of the coal in Hart's and Hill's mines is not in any way due to the local influence of volcanic rocks having altered it, as this view of the subject would make a material difference in the estimate of the amount of valuable coal in the field.

I am not aware of any fresh facts having been discovered bearing on this subject since those disclosed in Mr. Mill's shaft, described in my report of 6th July last, and which indicated that the influence of the volcanic rocks had only extended to a limited distance. The association of volcanic rocks with the altered coal at all the localities where it is found in the Malvern Hills, such as the Kouhai, Rakaia Gorge, Hart's, Hills, and the Acheron, while in all other places the seams have the ordinary characters of hydrous brown coal, and the circumstance that specimens of coal from some of these localities can be obtained exactly similar in appearance to the so-called anthracite at the Acheron which Captain Hutton admits to be an altered coal, led me to adhere to the opinion I have previously expressed on this subject, "That the improvement in quality observed in some seams is entirely due to the manner in which they have been affected by volcanic rocks subsequent to their deposition."—(Geological Report, 1871–72, p. 147.)

The apparent exception mentioned in my first report (November, 1869), as occurring at Hart's mine, has since been disproved by the discovery, according to Dr. Haast, of volcanic rocks in contact with the coal measures.

With reference to this subject, I also beg to forward a letter and enclosure received from Dr. Haast, explaining why he used the term "pitch coal" for Mr. Hill's brown coal, in a previous report; and in doing so, I beg to explain that the implied criticism to which Dr. Haast takes exception was quite unexceptional; but the term pitch coal not having been used by him in the report to which my comment referred, and as Dr. Haast has elsewhere used the term as meaning an altered brown coal,* I was anxious to guard against the impression that the seam in Mr. Hill's shaft was either a different kind of coal from that commonly found in the district, or that it was an altered coal. Besides which, the specimen received was noted at the time as "dull, without lustre, and cracking on exposure," which certainly does not answer to any definition of pitch coal, which term I first applied to a New Zealand coal in 1863, on finding Dr. Percy's definition applied exactly to the coal mine at Shag Point in Otago. I have since adhered to the same definition, and have never applied the term to an altered brown coal. I had to define the names given to New Zealand coals in the schedule referred to by Dr. Haast, which was published for the purpose of showing at a glance the comparative values of the seams that had been found throughout the Colony. It was obviously necessary to distinguish our hydrous coals that show no liqueous structure into two varieties, which, following Dr. Percy's definitions, with certain modifications, I termed brown coal and pitch coal.

According to the German nomenclature as given in Cotta's work, Dr. Haast should have used the term, pitch-brown coal (*pech-braun kohle*, p. 329) as in that work pitch coal (*pech kohle*, p. 333) is a totally different thing; but when he forwarded the specimen for analysis, Dr. Haast was evidently under the impression that the coal was of superior quality and different from the unaltered coal commonly found in the district, and from which I understood him to distinguish it by calling it pitch-coal in his letter of advice, which I also attach.

I feel it necessary to enter on the above matter, as any uncertainty whatever as to the extent or value of the coal seams might raise expectations that would not be realized, and perhaps lead to an expense being incurred in opening up these coal seams disproportionate to their value.

I have, &c.,
JAMES HECTOR.

EXTRACT from Report by Captain HUTTON on the Geology of the North-East portion of the South Island.

Malvern Hills Coal Fields.—Although by far the larger part of the coal of this district is inferior in quality to that from several other localities in New Zealand, its extent, its easily accessible position, and its proximity to Christchurch, make it one of the most important coal fields that we possess. The coal formation can be traced above the level of the Rakaia, from the Acheron all round

* "Beds of brown coal * * * * * altered for a considerable distance to anthracite, glance and pitch coal."—(Geological Report, 1871–72, p. 53.) This seems also to be Dr. Zinken's idea of pitch coal, from his description of the Hirschberg mine, cited by Dr. Haast at p. 54.

the southern and western edge of the Malvern Hills as far as the Hawkins, a distance of forty miles, with but one break, situated between the Gorge of the Rakaia, and the Point Station. In this district, coal has been found at the Acheron, Rakaia Gorge, Rockwood, Selwyn River, and the Hawkins, so that there can be little doubt but that it extends continuously from one end to the other. The beds dip under the plains, but how far they extend it is impossible to say. The occurrence of an outlier in the Burnt Hills, north of the Waima Kiriri, and of another at Glentiri, north of the Ashley, shows that the formation once extended across the whole valley; and it is highly probable that a large portion of it still remains below the shingle plains; thus giving a great extent to the field. The coal seams have, as yet, been but very imperfectly explored, and details of all that is known about them at present will be found in the report of Dr. Hector, and Dr. Haast, already mentioned. The quality of the coal is variable, but undoubtedly by far the larger portion is brown or pitch coal. I do not think that the superior quality of the coal in Hart's and Hill's mines is in any way owing to the heat of volcanic rocks, and think that a far more probable explanation may be found in the seams having been formed by different kinds of vegetable matter, or possibly by their having been covered up by different kinds of rock, for the quality of coal in the same mine is known to vary with a difference in the roof. The anthracite of the Acheron, however, is a true altered coal, and appears to be due to the heat of the volcano which has burst through it, although I am aware that Mr. L. C. Miall has lately stated that there is 'no evidence to show that a seam of anthracite has ever resulted from contact with heated rock.' (Proc. Geol. Soc. of West Riding of Yorkshire, 1871–72, p. 24.)

Dr. Haast to Dr. Hector.

Sir,— Christchurch, 10th May, 1873.

Will you be good enough to add the enclosed notes, either as a postscript or a foot note to one of my reports, as it will clearly show why I used the term pitch coal for Mr. Hill's brown coal?

I have, &c.,

The Director of the Geological Survey, Wellington. Julius Haast.

I have hitherto used the term "pitch coal" according to the old and well-recognized designation for *external* characters only, namely, for a compact coal, having a more or less conchoidal fracture, with a pitch-like appearance.

Thus, there are true pitch-black coals, pitch-brown coals, or even pitch peats.

Dr. Hector's proposition to divert the old and well-recognized name "pitch-coal" from its former meaning, to use it *only* for a superior or slightly altered brown coal, of which he gives the characteristics in "Report of Geological Explorations during 1871–72," page 173, may be a good one; but as he states that the coal which I sent from Mr. Hill's pit, as a pitch coal, is only a common brown coal (see papers relating to the development of coal mines, 1872, and "Reports of Geological Explorations during 1871–2," page 147), I beg to refer to all geological or mineralogical works of German authorities, who have almost exclusively treated on the subject, such as Zniken, Lengt, Zickel, Cotta, and many others. And even in Lawrence's somewhat free translation of Cotta's rocks, *common* brown coal is described as compact, with a *dull* fracture and *brown* colour, whilst the *pech-braun kohle* (pitch-brown coal) is there translated as resinous brown coal, and very compact and dark, almost black, and its fracture shining like pitch, a description which is fully applicable to the coal in question. Moreover, if Dr Hector intends to use Cotta's nomenclature, I wish to point out that there is no *common* brown coal in the Malvern Hills.

Julius Haast.

Canterbury Museum, 10th May, 1873.

Extract.

March, 1871.

I have the honor to inform you that Mr. Hill has at last succeeded to master the water in his pit, and has now laid open a fine seam, containing seven feet of coal, of which I have sent you a specimen by the book post. You will observe that this seam contains a fine pitch coal, in which the altering agency of the dolerite stream has had much less influence than in the seams opened up in the drive. Will you be good enough to have this coal analyzed at your earliest convenience, as Mr. Hill is very anxious to know the result? That gentleman tells me that this coal welds iron very well. * * * * * * I need scarcely say that the results of Mr. Hill's trial shaft are highly gratifying, and that there is now no doubt that great quantities of coal will be soon available for sale.

BIG BEN MINE.

Dr. Hector to the Under Secretary for Public Works.

Sir,— Geological Survey Office, Wellington, 12th August, 1873.

I have the honor to forward the result of the analysis of an average sample taken from a bag of coal from the Big Ben Mine, which has been forwarded at my suggestion by Mr. John Jebson through Mr. P. Pavitt. I also give for comparison the composition of coal from other localities in the neighbourhood, and an early analysis of Big Ben coal, made in 1864.

From these results it appears that the coal now submitted is a common brown coal, containing a large percentage of water, and not differing in any important character from the common brown coal of the district, which can be obtained in much more accessible positions. Under these circumstances cannot recommend any expenditure for the purpose of opening up the deposit at Big Ben by

a tunnel, as suggested to me in conversation by Mr. Jebson; nor that any steps should be taken towards the immediate construction of a branch railway to the place, unless coal of a very superior quality to that submitted can be found there.

I have, &c.,

The Hon. the Secretary for Public Works. JAMES HECTOR.

		Fixed Carbon.	Hydro-carbon.	Ash.	Water.
A.	Big Ben (sample per Mr. Pavitt)	38·51	35·52	3·14	22·83
B.	Ditto (per Dr. Haast, 1864)	45·41	41·10	1·90	12·00
	Jebson's Mine, *a*	46·02	26·99	5·33	21·66
	Ditto, *b*	36·60	31·40	5·80	26·20
	Ditto, *c*	36·60	31·70	5·60	26·10
	Selwyn River (Surveyor's Gully), *a*	44·54	30·10	6·76	17·50
	Ditto, ditto, *b*	40·01	37·61	3·50	18·88
	Ditto, ditto, *c*	35·50	36·80	·60	27·10
Average of B for comparison with A		40·66	33·67	4·21	19·21

CLENT HILLS.

EXTRACT from NOTES on the GEOLOGY of the CLENT HILL and MOUNT SOMERS DISTRICTS, by Dr. HAAST, F.R.S.

IN my Preliminary Report on the Coal Deposits of the Ashburton District (Parl. Papers, 1872, D. 3, p. 16), I had already occasion to point out that the porphyry conglomerates, brown coal-bearing and saurian beds above them, were missing. I added, however, that there are some series of beds containing seams of brown coal, deposited in small basins in several localities, which possibly might be their equivalent in age, but that, owing to not observing any characteristic fossils, it was at present impossible to settle this point.

There are principally three isolated localities where seams of brown coal are exposed to view, of which two occur in depressions amongst the porphyries, whilst the third is found on the flanks of the palæozoic sedimentary rocks in the Lake Heron Plains.

Beginning with the latter, of which section No. 8 gives the details, I have to observe that only a small remnant of what once must have been a large formation remains, the rest having been removed by the huge post-pliocene glacier which here ploughed so effectually into the ranges. These beds lie against the palæozoic rocks, in a small bay scarcely 150 yards long, covered with morainic accumulations or alluvium. We owe their discovery to the occurrence of a small watercourse which has cut through the latter accumulations, thus exposing the former to view.

In ascending the hill side close to the Clent Hill Station, and after passing through 10 to 12 feet of shingle deposit, the lowest beds belonging to this formation are reached, consisting of 42 feet of loose ferruginous sands, dipping E.S.E. 76°, and containing pockets and concretions of ferruginous clays. Upon them reposes a band of clay marls, 12 inches thick, full of casts of a bivalve allied to *Cyrena*, thus proving the freshwater origin of the beds under review. They are overlaid by 14 feet of arenaceous sands, gradually becoming sulphurous, separated in many layers by small bands of clays, through which the whole obtains a well-stratified appearance; they are succeeded by a bed of under-clays several inches thick, upon which a large seam of brown coal reposes, dipping E.S.E. 63°, 28 feet 6 inches thick, separated by several small bands of shales into different banks. This seam of brown coal, of fair quality, is covered by loose quartzose sands, first white and afterwards assuming yellowish tints, and which eighty feet above the coal seam abut against the palæozoic rocks, here forming steep cliffs, and being greatly decomposed; the whole overlaid, as before stated, by post-pliocene alluvium.

It is evident from this section, that these newer beds must have been formed in a bay of which the lowest portion, and the rocks on which they were originally deposited, have disappeared, without doubt through the effect of glacier action.

On the opposite side of the valley, on the left bank of the River Cameron, in some slips amongst the morainic accumulations, I observed also beds of a similar character to those of the Clent Hill Station. In one of them slips occur—white loose sands with streaks of coaly matter—probably drift trees; they are succeeded by a seam of lignite 3 feet 2 inches thick, generally showing woody structure covered by sandy clays, with a layer of shale about 1 foot thick, the whole dipping N.E. 61°.

In another locality, a few hundred yards distant, similar beds occur, but so much disturbed that I was not able to ascertain their real position and extent. In any case, the presence of these strata on the opposite side of the Lake Heron Plains proves at least that we may anticipate the occurrence of seams of brown coal to be of great extent in that region, which, owing to a great scarcity of firewood in the district, will some day be of great value to its inhabitants.

A second basin, already at present of practical value, is situated in the neighbourhood of the junction of the River Stour with the Ashburton. It occurs in a depression amongst the quartziferous porphyries, which, before the main river had cut through their eastern boundary, formed here, doubt-

less, a ridge of considerable dimensions, behind which the sedimentary beds of lacustrine or littoral origin could be accumulated. This basin, somewhat triangular in shape, is about two miles broad and long. It appears that the porphyries had already undergone considerable denudation before the newer beds were formed, they having been deposited on the sides of steep escarpments and cliffs.

The lowest beds consist of porphyry tufas, lying generally at a high angle, and following the outlines of the spurs. They are of great variety in colour and texture, often with a fine ribboned appearance, white and yellowish colours being predominant. They are well exposed in Coal Creek; gradually they become darker, and are succeeded by shales in that locality upon which a seam of brown coal of good quality reposes, 14 feet in thickness, of which, however, only the lower portion of 8 feet is extracted—strike 158°, with a dip of 8° towards S.S.E. The seam is capped by shales, with smaller seams of brown coal interstratified and sandy clay marls, overlaid unconformably by post-pliocene alluvium.

On the opposite side, and on the southern banks of the River Ashburton, I discovered another portion of the same basin, consisting of porphyry tufas, shales, and two seams of brown coal, about 4 and 5 feet thick, separated by a few feet of inferior coal or shale. However, as the outcrop was very much decomposed, the two might possibly belong to one seam, which can easily be ascertained by opening up the ground, and which also here is covered by post-pliocene alluvium.

The deposits in Alexander Creek, a tributary of the River Stour, and of which section No. 6 gives the details, is doubtless only a portion of this large Ashburton-Stour Basin; the coal seams are however too small and too irregular to be of any practical value.

A third locality to which I alluded in my preliminary report is situated in the bight which is formed by the junction of the Cox Range with Mount Somers. The beds forming this series, and which have generally a northerly dip of 15° to 18°, ranging between N.N.E. and N.N.W., consist first of porphyry tufas, white, yellowish, or sometimes black from an admixture of organic matter, of fire-clays, shales, with a considerable series of seams of lignite ranging from 2 inches to 5 feet. These seams vary very much in character; some are tertiary deposits, whilst others are formed of timber, the woody structure of the trees of which they are formed being still clearly visible.

The coal is generally of inferior quality, and sometimes full of nodules and concretions of iron pyrites. Small bands of clay ironstone occur occasionally. Section No. 4 passes through this basin.

Finally, I may observe that these deposits are unconnected with the beds forming the next and more extensive series, so that we have—not being able to obtain characteristic fossils—no clue as to their real age.

PROVINCE OF OTAGO.

BLUESKIN.

The Superintendent of Otago to the Hon. the Colonial Secretary.

Sir,— Superintendent's Office, Dunedin, 11th December, 1872.

The enclosed application from Mr. William Evans, of Blueskin, soliciting aid towards the development of a supposed coal field, appears worthy of attention.

As the Provincial Government has no appropriation at its disposal for the object in question, I venture to forward the application for the favourable consideration of the General Government, which I understand has moneys at its command available for the purpose indicated.

I would only observe that the applicant is a practical miner, and that a very small sum, as compared with that which has been expended upon scientific coal exploration, would suffice to test the existence or otherwise of what may turn out to be a most valuable coal seam.

I have, &c.,

J. Macandrew,

The Hon. the Colonial Secretary, Wellington. Superintendent of Otago.

Mr. W. Evans to the Superintendent of Otago.

Dear Sir,— Blueskin.

I have been engaged in boring for coal for the last two months on my section No. 3 of 37, block 2, North Harbour and Blueskin, which adjoins the bay, with the main North Road going through the middle of it, and also the projected Northern Railway, according to Blair's report, goes close by the place that I am boring; and also water enough for small vessels to come into the bay.

But I am sorry to say that the coal, if any, is deeper than I at first imagined, and is very expensive for a private individual with small means to give it a thorough trial, as it takes four men to work the rods, and I am now down to the depth of 145 feet, being 130 feet below the level of the ocean.

The first 40 feet is the rough and alum shale, containing also sulphur and iron.

From 40 to 145 feet is through a fossilized grey sandstone reef, containing a great quantity of lime.

This reef runs from half a mile inland right across the bay, and down the coast to near Waikouaiti; and it is under this reef, according to general opinion, that the coal lies.

Now, I humbly beg your Honor's pardon if I am out of order in soliciting a small sum of money, with the consent of your Executive, to enable me to go on with the work in a more efficient and satisfactory manner.

I have already been under heavy expense in wages testing it, and am not willing to give up until I reach what I fully believe to be a great deposit of coal.

A small assistance from the Government will be thankfully received.

I have, &c.,

William Evans.

Dr. HECTOR to the Hon. the COLONIAL SECRETARY.

SIR,— Geological Survey Department, Wellington, 23rd January, 1873.

With reference to the letter from His Honor the Superintendent of Otago, enclosing an application from Mr. William Evans for assistance in searching for coal at Blueskin Bay, which was referred during my absence from Wellington, I have the honor to remark as follows:—

Blueskin Bay is a deep indentation in the coast line, twelve miles north of Dunedin, occupied by extensive mud flats, that are laid bare at low tide, the sea entering by a shallow passage that is not available as a harbour.

The headlands are formed of the same volcanic rocks as those surrounding Dunedin Harbour, and these rest on beds of the same lower tertiary strata, with brown coal seams, that occur between Dunedin and Green Island; though to what extent they are exposed at the surface in the Blueskin district I am not able to state, as they have not yet been surveyed in sufficient detail to determine that point.

The ranges round the head of the harbour and to the westward are composed of schist rock, but are also capped by volcanic rocks rising to an altitude of 2,000 feet. Any coal seams that are likely to be found will therefore belong to the same formation as that in which the seams at Green Island occur, there being no evidence, so far as I know, of the existence in the district of any of the upper secondary strata in which a better class of coal seams might be looked for.

As no immediate advantage would be gained by the discovery of common brown coal seams in this district, which must remain practically inaccessible until the construction of the first section of the railway north from Dunedin, I therefore think it will be premature to undertake its exploration at the present time, and especially as the railway works, when they are commenced, will most probably lay open sections that will enable the structure of the country to be better understood, and lead to the selection of the best localities for future trials.

From the information given by Mr. Evans, it does not appear that he has actually found any coal, and the rocks that he mentions as being passed through in his trial bore are such as indicate a much higher level in the formation than that at which any seams have yet been discovered elsewhere.

I will, however, endeavour to have the locality specially examined and reported on as soon as the other engagements of the Department will permit, together with the other coal seams which have been recently found in the neighbourhood of Port Chalmers, and to the development of which I should be inclined to attach far more importance.

I have, &c.,
JAMES HECTOR.

The Hon. the Colonial Secretary, Wellington.

SOUTHLAND.

The UNDER SECRETARY for PUBLIC WORKS, to Dr. HECTOR.

SIR,— Public Works Office, Wellington, 4th July, 1872.

I am directed by the Hon. Mr. Reeves to forward to you the enclosed copy of a letter from His Honor Mr. Macandrew, on the subject of coal deposits around Nightcap Hill, in the Province of Otago, and to request that you will take the necessary steps at once to carry out the recommendations to test these coal deposits which you made in your letter of the 6th April last. For this purpose a sum not exceeding £200 will be available.

I have, &c.,
JOHN KNOWLES,
Under Secretary.

Dr. Hector, Wellington.

The SUPERINTENDENT of OTAGO to the Hon. the COLONIAL SECRETARY.

SIR,— Superintendent's Office, Dunedin, 22nd June, 1873.

Referring to your letter of date 10th May, 1872, with map and enclosures, on the subject of coal deposits around Nightcap Hill, I have the honor to state, that as the whole subject had been remitted to a Select Committee of the Provincial Council, I deemed it right to furnish said Committee with a copy of the correspondence and map in question. Enclosed I have the honor to forward copy of the Committee's report, which recommends a railway from Winton as the best mode of developing the coal field.

In the meantime, I think it would be well to send a practical miner to further explore that portion of the supposed coal field which has been reserved from sale. I may state that there are in this Province several practical men, whose services can be obtained if necessary—men who have been bred as working coal miners and proprietors.

I have, &c.,
J. MACANDREW,
Superintendent.

The Hon. the Colonial Secretary, Wellington.

Dr. HECTOR to Mr. PEARSON.

SIR,— Geological Survey Office, Wellington, 9th July, 1872.

With reference to the coal exploration in progress at Nightcap Hill, I have the honor to acknowledge receipt of your memorandum of 29th May, enclosing a report by Mr. Thompson, stating that he had traced the coal to the eastern slope of the Nightcap Hill, according to contract, and giving your certificate that he was entitled to £100, and also the receipt of your letter of 14th ult., enclosing plans and sections of the work.

I beg now to enclose a voucher for the sum due to Mr. Thompson, under his contract, and to request that you will be good enough to have it passed in the ordinary manner, after you have certified to it.

The bonus of the second £100 will of course be due to Mr. Thompson as soon as the seam of coal which he has discovered is leased, or otherwise taken up and worked. I cannot concur in his proposal to sink for 60 feet in order to cut the seam, as I would rather see it traced into the rise of the hill, when it could be worked above the water-level of the country, and where the coal could not only be more easily obtained, but would probably be of better quality. In any case, however, as the coal has now been found in a place conveniently situated as regards the railway, there should be no difficulty in getting a company or private individual to work it. Under the circumstances, I see no reason to advise Government to undertake any further works for the present.

I have, &c.,
JAMES HECTOR.

W. H. Pearson, Esq., Commissioner for Crown Lands, Invercargill.

Dr. HECTOR to the UNDER SECRETARY for PUBLIC WORKS.

SIR,— Geological Survey Office, Wellington, 10th October, 1872.

I have the honor to enclose, for the information of the Minister for Public Works, correspondence relative to the existence of coal seams on the Seaward Downs within five miles of the Mataura Railway.

As the coal is of good quality, and would be serviceable for locomotives, the only point to determine is the thickness of the seam or seams, which should be done by boring. £200 has been already authorized for exploring for coal in the Southland district, at the Nightcap Hill; but before proceeding with that work, I recommend that the sum of £50 be spent in putting down a bore at this new locality, as it is not only more accessible, but the coal is of better quality than that at the Nightcap Hill. That sum might be placed at the disposal of the Committee which has been formed, on the condition that it is to be expended only in boring. I am informed that there is a skilled borer and a very complete set of tools at Invercargill. In the event of this suggestion being approved, I can instruct how the work is to be proceeded with; and I have no doubt that Mr. Pearson, Commissioner of Crown Lands, would undertake to inspect the work and sign the vouchers from time to time.

I have, &c.,
JAMES HECTOR.

Dr. HECTOR to Mr. PEARSON.

SIR,— Geological Survey Office, Wellington, 12th September, 1872.

In reply to your letter of the 29th ultimo, forwarding samples of stone, with fossils and coal, from a locality on the Seaward Downs, I have the honor to report that there is no doubt of the formation to which the former belong being of the same description as that at Waikawa and Otapiri. The coal, which I understand is from a different locality six miles distant, is superior to that found at either of the other places, on account of its containing less ash, and, with the exception of the thin seams at Mount Hamilton, it is the best sample of coal I have yet seen from the Southland district. The composition of the two varieties you indicate is—

	A.	B.
Carbon	49·61	61·4
Gaseous	35·08	27·6
Water	8·06	9·8
Ash	7·25	1·2
	100·00	100·0

One pound weight of A. should convert 6·45 lbs. of boiling water into steam. It does not cake in cooling, but adheres slightly, and when completely consumed leaves a pale buff ash. It is a free burning coal.

B. is the bright coal that is mixed with veins of carbonate of lime, and is remarkable for its ash being chiefly oxide of iron.

I have, &c.,
JAMES HECTOR.

Walter H. Pearson, Esq.,
Commissioner of Crown Lands, Invercargill.

Dr. HECTOR to Mr. BROWN.

SIR,— Geological Survey Office, Wellington, 24th October, 1872.

I have the honor to acquaint you that the sum of £50 has been authorized for the purpose of exploring the coal at the Seaward Downs, in compliance with the application made in your letter of the 23rd August last, and to state that the money will be paid on Mr. Pearson's signing the vouchers from time to time. The course I would recommend to be adopted would be as follows:—

1. Lay bare a sufficient area of the seam at the outcrop, or excavate a short drive, if the form of the surface is more favourable, in order to ascertain the exact angle and direction in which the coal dips. Run a level in that direction over the surface, so as to ascertain the most favourable point in which to put down a bore so as to gain advantage for any depression of the surface; by laying off the surface section and the dip to scale, it can be at once determined at what depth the coal should be struck, if it is regular. Too deep a bore should not be at first attempted, as the sum authorized is not very large. If good results are obtained, further expenditure will be recommended.

A practical borer will be able to follow the above instructions without difficulty. A journal should be accurately kept of all proceedings, in which the levels of surface, dip of the outcrop beds,

and strata passed through in boring, must be entered; small samples of any variety of rock, &c., alluded to in the journal should be forwarded along with it, and especially all the borings that show indications of coal.

The journal should be accompanied by a rough plan, and a section drawn to scale, on which all letters or marks referring to the journal or specimens should be entered in their proper place.

I am, &c.,

Mr. James Brown, Invercargill. JAMES HECTOR.

Dr. HECTOR to the Hon. the COLONIAL SECRETARY.

SIR,— Geological Survey Office, Wellington, 24th January, 1873.

I have the honor to report the progress that has been made in searching for available coal seams in the Southland district of the Province of Otago.

The excavation that was authorized on the 4th July last to be made in the east slope of the Nightcap Hill, as recommended in my report of the 6th April, was suspended at first on account of the unfavourable season of the year, and afterwards in consequence of the supposed discovery of a valuable deposit of coal at the Seaward Downs, which is a much more convenient locality to the railway system that is now in the course of construction, as pointed out in my memorandum of 10th October last.

The sum of £50 was therefore placed at the disposal of a local committee that had been formed in Invercargill to promote the search for coal in that district; and having been informed by the Secretary that the coal was sufficiently exposed, I took the opportunity, during a recent trip round the South, to examine the locality.

In doing so I was accompanied by Mr. Brown, the Secretary to the Committee; and by Mr. Thompson, who had discovered the seam and made the excavation.

The locality is within a short distance of the Seaward Downs Station, and on the east side of the Mataura River, twelve miles from the sea. The country is undulating, and formed of the sandstone and shales of the upper secondary formation, which, though near the surface, and not covered by any heavy drift or newer formation, are yet completely masked by surface decomposition and deposits formed on the slopes of the gullies. Four excavations had been made to cut the coal seam—

1. An open drive from the side of a creek for about 10 feet in a westerly direction.
2. A shaft above the same drive to cut the coal in the rise of the hill.
3. A shaft further down the gully, to cut the coal on the dip.
4. A shaft cutting the coal in the line of strike, at a distance of 30 chains. As the shaft was full of water, I was only able to see the coal in the first-mentioned drive, and found it to be of fair quality, but mixed with shale, and not more than 10 inches in thickness, with a westerly dip, at an angle of 18°. The appearance of the coal in all the different places where it had been reached, was described to me as being the same as the above.

It has been contemplated to sink a shaft to a still greater depth than has yet been reached, in order to test the formation for thicker seams, but I could observe nothing in the nature of the strata to indicate that such a search would be more successful than that already made. The same formation has been traced over a large portion of Southland, and in the district east of the Mataura, where there are splendid natural sections of the rock laid open both on the sea coast and in the valleys, without any thick seam being discovered. Also, at Toitois, nearly 300 feet in thickness of the same strata are exposed, and have been explored by driving a tunnel at the expense of Mr. Brunton, C.E, the only result being the discovery of eight thin seams with shale, none of which are a foot thick.

Although I do not wish to discourage the search for valuable coal seams in this formation merely on account of the thinness of the seams yet found, I do not think that the locality near the Seaward Downs is at all a favourable place for making such a search, on account of the absence of any natural sections. As far as I have been able to judge of this particular formation, it consists of very heavy beds of sandstone or conglomerate, several hundred feet in thickness, separated by 40 to 50 feet of shales, with plant remains and layers of coal more or less free from shale. Several such alternations occur; and as nothing but masses of drift wood, converted into coal, has yet been found in the sandstone, it is only necessary to trace each of the shale bands separately, and not to bore or sink on a large scale, in the event of indications such as those at the Seaward Downs being discovered. To examine the group of shales from the sandstone floor to sandstone cover, would, if this view is correct, be all that is necessary to determine if there is any available seam of coal present; and it was to enable this to be done, either by boring, sinking, or driving, as might be most suitable, that I recommended the grant to be made.

After examining the locality, I am of opinion that a drive 40 to 50 feet in length would have been the most satisfactory work; and I regret that this course has not been adopted, instead of the few slight excavations that have been made, with the view merely of estimating the extent of the thin and practically useless seam already discovered.

For the reason stated, I do not however consider that any useful result will be obtained by a further experiment at this place, and I therefore recommend that the contemplated exploration at the Nightcap Hill should be at once proceeded with. With this in view I conferred with Mr. Pearson, Commissioner of Crown Lands at Invercargill, on the subject, and beg to forward a communication from him enclosing an offer from Mr. Thompson to make the necessary excavations on the terms I proposed, and which I recommend should be adopted.

I have, &c.,

Tha Hon. the Colonial Secretary. JAMES HECTOR.

Mr. PEARSON to Dr. HECTOR.

SIR,— Crown Lands Office, Invercargill, 6th January, 1873.

I have the honor to enclose copy of an offer to develop the coal seams at the Nightcap Hill Run, 153, Southland, which I have accepted in terms of your letter of 3rd instant, and to request you will be

good enough to inform me (by telegram to save time) whether you purpose allowing Mr. Thompson to draw against the first £100 as he proceeds with the work.

I have, &c.,
WALTER H. PEARSON,
Commissioner, Crown Lands.

Dr. Hector, Government Geologist, Wellington.

Mr. THOMPSON to COMMISSIONER of CROWN LANDS, Invercargill.

SIR,— Invercargill, 4th January, 1873.

I hereby agree to trace or test the outcrop of coal on west side of Nightcap Hill as follows:—

1. To lay bare the seam for 20 feet along the outcrop, and by pits in the line of the strike, so as to get the trace trend of the seam.

2. A surveyor to be approved by you to set his level on the true strike, and strike the seam on the east side of this hill, in line of bearing.

3. To flag out outcrop to lowest level.

This I will do for the sum of £100; and if the seam prove to be a payable one, I will receive a bonus of another £100.

I have, &c.,
T. J. THOMPSON.

To the Commissioner of Crown Lands, Invercargill.

Mr. THOMPSON to Dr. HECTOR.

DEAR SIR,— Invercargill, 23rd January, 1873.

I have the honor to furnish you with a report of my labours in trying to trace and find outcrop of coal in S.E. slopes of Nightcap Hill. I have ascertained the dips or strike at the outcrop at the fence for a length of 30 feet, which I find has a strike 1¼ inch to 1 foot to the south, and 2½ inches to 1 foot to the east. I took Mr. Aitken, an authorized surveyor, up with me, and we took the levels over the hill to the lowest level for a distance of half a mile, and found that we were 25 feet above the coal outcrop. I send you a plan and tracing of elevations, and line taking, and sample of ironstone and coal that I got up the hill side, 20 chains from coal face.

Taking into consideration the angle which the coal dips at, it would require a great depth to tap the coal. I thought it proper to acquaint you of particulars. I walked over towards Wray's Bush to look if any tramway truck could be got to the coal, and find that a line could be constructed without any heavy cutting by following up south side of the gully which all the south spurs end in; the line would be nearly straight with Winton and Wray's Bush and coal crop. It is a gradual ascent from Opio Creek, with the exception of going down of the terraces to the creek, about half a mile to south from coal crop, which a siding road could well be made cheap.

Please to let me know particulars of ironstone.

I have, &c.,
T. J. THOMPSON.

Dr. HECTOR to Mr. PEARSON, Invercargill.

(Telegram.) Wellington, 5th February, 1873.

THOMPSON'S report not clear, as seam can only dip one way at a time. Averaging his statements, gives N.N.E. as direction in which coal should be sought for at lowest level. No pay till he finds coal on east slope of hill. What thickness does he consider seam at fence? Sample sent is good.

J. HECTOR.

Mr. PEARSON to Dr. HECTOR.

(Telegram.) Invercargill, 11th February, 1873.

Re Nightcaps.—Thomson states dips were taken from right-angle sections by spirit level, the mean of the two giving strike of coal, and, according to dips, has little chance to find same seam on east side near surface. Does not understand no pay till he finds one east side. Not according to agreement. Will stop till hears further.

WALTER H. PEARSON,
Commissioner, Crown Lands.

Mr. PEARSON to Dr. HECTOR, Wellington.

(Telegram.) Invercargill, 15th February, 1873.

Re my telegram of 11th instant.—Thompson says he has offers of other work. Is he to go on with Nightcap exploration? Expense going on. Thickness of seam at fence 7 feet 6 inches, and not through when he left.

WALTER H. PEARSON.

Dr. HECTOR to Mr. PEARSON, Invercargill.

(Telegram.) Wellington, 15th February, 1873.

THOMPSON'S contract is to find the coal on the east side of Nightcap. Of course I expect him to go on with the exploration. If he thinks it can't be found, he should give it up and let you get some one else to try. Have written fully.

J. HECTOR.

Dr. Hector to Mr. Pearson.

Sir,— Geological Survey Office, Wellington, 15th February, 1873.

I have the honor to acknowledge the receipt of a short report from Mr. Thompson on the exploration of the Nightcap Hill, the reply to which I direct to you, as you have kindly undertaken to superintend this matter.

Mr. Thompson (as already stated to you by telegram) appears not to have clearly ascertained the true direction of the strike of the coal, which I gather from his stating it to have two directions. I am therefore not surprised that the direction of the line which he laid off for the surveyors to level over did not bring him to the coal. From the average of the two directions he gives (which from the way he describes them are dips, not strikes), I should expect that the coal would be found on the east side of the hill at the same level as the outcrop at the fence in a N.N.E. direction, whereas the level line, as indicated on the plan, runs east and west. I only mention this as a hint for Mr. Thompson's consideration, as he should be able to judge of the direction in which to look for the coal better than I can without seeing the ground.

From Captain Hutton's report (see Parl. Papers, D. No. 3, 1872, p. 19), a copy of which I enclose for reference, it appears that he did not anticipate any difficulty, and Mr. Thompson told me that he clearly understood what was required; and his offer (see above), which is in exactly the same terms that were originally proposed to him, is quite clear, and I shall therefore expect him to find the outcrop on the east side.

The sample of coal which was forwarded, though good, is not equal in quality to that from Morley Creek. I beg to append the analysis.

Lustrous, colour black; compact shaly structure; colour of ash reddish; coke non-caking.

Approximate Analysis.

Water	21·38
Fixed Carbon	29·30
Hydrocarbon	45·96
Ash	3·36
	100·00
Evaporative power	6·9

I have, &c.,
James Hector.

Mr. Pearson to Dr. Hector.

Sir,— Crown Lands Office, Invercargill, 17th March, 1873.

I have the honor to forward copy of a report from Mr. T. J. Thompson on his recent exploration for coal at the Nightcap Hill, from which it appears that though he has not been able to trace the seam of 11 feet in thickness round to the east side, he has discovered a 3-feet thick seam there. I also enclose a voucher of his for the expenses he has up to the present been put to.

I have, &c.,
Walter H. Pearson,
Commissioner, Crown Lands.

Dr. Hector, Government Geologist, Wellington.

Enclosure.

Mr. T. J. Thompson to Dr. Hector.

Sir,— Invercargill, 17th March, 1873.

I have the honor to report to you that I have executed your last instructions to ascertain thickness of coal at boundary fence west side of Nightcap Hill by going through it, and find there is 11 feet thick of solid coal, and rests on a white plastic clay, which I penetrated to the depth of 4 feet. I find that there is a seam of coal crossing the creek twenty chains to the south of the above, and having prospected the east slopes of the hill, as contract, to the Opio Creek, and discovered one seam of coal 3-feet thick about one mile east of trig. peg; it dips to the east 15°, rests on a clay the same as coal on west side. The quality is not so good as west coal; it appears to be the top seam in the formation, as there are quantities of shale and fossil rosin mixed. I have bared the face on both sides of the creek. I find it so that I can see that it runs under the Nightcap Hill.

I have, &c.,
T. J. Thompson.

To Dr. Hector,
Per Mr. W. Pearson, Land Commissioner.

Mr. Pearson to Dr. Hector.

Sir,— Invercargill, 24th April, 1873.

In terms of your letter of 27th ultimo, I instructed Mr. T. J. Thompson to open up without delay the seam of coal he reported he had discovered in the east side of the Nightcap, and beg to enclose his report, with a sketch attached.

As he stated to me, he was certain from indications he had perceived that the coal seams could be struck on the flat within a mile and a half of Ray's Bush, a position so much more accessible that its value would be greatly enhanced. I telegraphed at once this morning whether you would wish him to engage men to sink for it for say 60 feet, this expenditure being outside the sum of £200, which

Thompson claims under his agreement with you for what he has already done. Certainly, to find a coal field at this last place would materially reduce the cost of a railway to Winton, and the delivery of coal at the Bluff.

I have, &c.,
WALTER H. PEARSON,
Commissioner, Crown Lands.

Dr. Hector, Wellington.

Mr. THOMPSON to Dr. HECTOR.

DEAR SIR,— Invercargill, April, 1873.

I have the honor to report to you that I have trenched across the gully and exposed the face of coal as requested. I send you the accompanying sketch of position; and I hereby respectfully apply for the full amount of contract, with bonus, as I have fulfilled the conditions by tracing coal to Opio Creek Valley, east side of hill.

I have, &c.,
T. J. THOMPSON.

Dr. Hector, Government Geologist,
Per Mr. W. H. Pearson, C.L.C.

Dr. HECTOR to Mr. PEARSON.

SIR,— Colonial Museum, Wellington, 10th May, 1873.

In reply to your letter of 24th April, enclosing a report from Mr. Thompson, saying that he has traced the coal across the gully to Opio Creek Valley, on the east side of the Nightcap Hill, and applying for the full amount of the sum due under the contract, and the bonus, and also asking whether he may engage men to sink for the coal, say 60 feet, this expenditure to be outside the sum of £200 already authorized; I have to remark as follows:—

By referring to the contract, a copy of which was forwarded to you on 17th February last, you will observe that the bonus is only to be paid if the seam proves to be a payable one. I assume that as Mr. Thompson proposes further expenditure to prove the seam, that this condition has not been complied with, for if he has shown the seam to be a payable one, and if the position is so favourable as you report, the exploration contemplated by Government must be considered as completed.

On referring to Mr. Thomson's report, however, I find no mention (1) of the thickness of the seam which he has discovered at the Opio Creek; (2) nor its quality; (3) nor is there any plan forwarded showing the position of the coal; and (4) there is no mention of the dip or extent of the seam and facilities for working. His section also would seem to show that the seam he has found cannot be the same as that at the fence on the west side of the hill, but must be considerably higher in the series, so that minute information on the above points is absolutely necessary before it can be ascertained whether he has actually traced the coal to a fresh outcrop.

Under these circumstances I cannot admit that Mr. Thompson has got any claim to the bonus; and before I can certify to the payment to him of the balance of the £100, it would be necessary that I should be furnished with a plan showing the work which has been done towards the exploration of the coal on the east side, and a report from some qualified person whom you may appoint to inspect the work.

I have, &c.,
JAMES HECTOR.

Mr. PEARSON to Dr. HECTOR.

Crown Lands Office, Invercargill, 29th May, 1873.

MEMORANDUM.—I forward two letters of 17th March (copy of which I think I forwarded some time ago), and of 17th instant, from Mr. T. J. Thompson, having reference to his coal explorations at Nightcaps, Southland. From what I saw when I visited the locality with him, I think he is fairly entitled to the £100; and I think the second £100, which he was to get as a bonus, would be well spent as indicated in his letter of 17th instant.

WALTER H. PEARSON, C.C.L.

Enclosure.

Mr. T. J. THOMPSON to Dr. HECTOR.

SIR,— Invercargill, 17th May, 1873.

In reply to yours of the 10th instant, in which you consider that I am not entitled to the bonus, because I have not proved that the seam on the east slopes is a payable one, I beg to state there are no conditions in my contract as to what constitutes a payable seam of coal, nor how to prove it a payable seam. I consider that there are plenty of thinner seams of coal wrought, and pay, than the above seam. With respect to no particulars being sent to you in my last report about the coal at Opio Creek, I have to inform you that I sank 12 feet below the creek water level, and obtained the blue shale that rests upon the coal, with water in the hole. It is my opinion that if a bore or shaft was put down near the creek, to the depth of 60 feet, I could get more than one payable seam of coal, and there would be no difficulty in the way of making a railway; indeed, I think it would almost pay to cart it to Winton. If I employ men to sink or bore on east side of the creek to the depth of about 60 feet, will you pay expenses by giving me the £100 presently at your disposal for coal prospecting, and which I was to get as a bonus?

I have, &c.,
T. J. THOMPSON.

Dr. Hector (per Mr. W. Pearson).

Mr. Pearson to Dr. Hector.

Sir,— Crown Lands Office, Invercargill, 14th June, 1873.

In reply to your letter of 10th ultimo, No. 230–73, commenting on Mr. Thompson's report *re* tracing coal from west to east side Nightcaps, and requesting to be furnished with a plan showing the work which has been done towards the exploration of the coal on the east side, and a report from some qualified person whom I may appoint to inspect the work, I have the honor to state that I visited the locality, accompanied by Mr. Thompson, in March last, ascertained by inspection that the thickness of the coal seam at the fence was 11 feet, according to the hole bored, and that he had laid bare a face of coal in the valley of the Opio, east of Nightcap Hill. I am further informed by him that he has traced, by boring, the fence seam westward up to the top of the rising ground half a mile west of outcrop; and also traced coal to the bank of Opio Creek, as marked (No. 11) on enclosed tracing No. 1, cross section of country.

I also enclose tracing No. 2 of map of country between Winton and Nightcap, showing the recently surveyed line of railway between the two places. This is all the information I can furnish; to appoint a qualified person to report on it would, in my opinion, be only a waste of money. In the first place, I do not know of any such person in the district; and if there were, he could only see what I have seen, which is simply the result of Mr. Thompson's testing the country by bores.

As I understand Mr. Thompson, what he wants now is to be allowed to expend the £100 which he was to have received as a bonus in boring on the east of Opio Creek (see tracing 1, No. 11), to the depth of 200 feet, if the money will admit of it. By this expenditure he anticipates cutting through two or three seams; and as the discovery of a good coal bed so much nearer Winton would be of the greatest importance, I would strongly recommend he should be allowed to expend the money in this way.

I have, &c.,
Walter H. Pearson,
Commissioner, Crown Lands.

Dr. Hector, Government Geologist, Wellington.

Dr. Hector to Mr. Pearson.

Sir,— Wellington, 9th July, 1873.

With reference to the coal exploration in progress at Nightcap Hill, I have the honor to acknowledge receipt of your memorandum of 29th May, enclosing a report by Mr. Thompson, stating that he had traced the coal to the eastern slope of the Nightcap Hill, according to contract, and giving your certificate that he was entitled to £100, and also the receipt of your letter of 14th ultimo, enclosing plans and sections of the work. I beg now to enclose a voucher for the sum of £ , which is the balance due to Mr. Thompson under his contract, and to request that you will be good enough to have it passed in the ordinary manner after you have certified to it.

The bonus of the second £100 will, of course, be due to Mr. Thompson as soon as the seam of coal which he has discovered is leased, or otherwise taken up and worked. I cannot concur in his proposal to sink for 60 feet, in order to cut the seam, as I would rather see it traced into the rise of the hill, where it could be worked above the water-level of the country, and where the coal could not only be more easily obtained, but would probably be of better quality. In any case, however, as the coal has now been found in a place conveniently situated as regards the railway, there should be no difficulty in getting a company or private individual to work it.

Under the circumstances, I see no reason to advise the Government to undertake any further works for the present.

I have, &c.,
James Hector.

By Authority: George Didsbury, Government Printer, Wellington.—1873.

Price 1*s.* 6*d.*]