

REPORT  
ON  
PUBLIC WORKS

BY THE

ASSISTANT ENGINEER-IN-CHIEF.

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PRESENTED TO BOTH HOUSES OF THE GENERAL ASSEMBLY, BY COMMAND OF  
HIS EXCELLENCY.

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WELLINGTON.

—  
1872.



## REPORT ON PUBLIC WORKS, BY THE ASSISTANT ENGINEER- IN-CHIEF.

SIR,—

Public Works Office, Wellington, 30th June, 1872.

I have the honor to forward for your information my Annual Report on that portion of the Public Works of New Zealand included under the head of "Roads."

In order that this might be as clear and comprehensive as possible, the several District Engineers were instructed by circular to prepare their reports in a particular way, and in all cases to accompany them with a skeleton plan of their district, showing distinctly the road works completed and in progress. Copies of these plans you will find attached in illustrations of the reports, arranged consecutively.

I have adopted in a great measure the wording of these reports, but where the descriptions were too long or too much in detail, have condensed and abbreviated them as much as possible consistent with clearness.

Owing to the mass of work which has passed through the Public Works Office during the past year, connected not only with roads but with railways and other undertakings, I have been unable to visit all the districts where work is in progress, but trust that the manner in which the information has been prepared will, notwithstanding, be thoroughly satisfactory and trustworthy.

The district reports are made to one common date, 31st May, 1872, and include generally all the work done under the "Public Works and Immigration Acts."

### ROADS.

#### NORTH OF AUCKLAND, AND IN THE WAIKATO.

(T. HEALE in charge.)

Those authorized or in progress are,—

1. Waimate to Okaihu.  
Mangonui to Victoria Valley.
2. Wairoa, navigation, northwards to Kaikohe and Waimate.  
Waimate to Puketutu, and thence to Pahia.  
Mahurangi to Port Albert.
3. Mangapai to Arapawa, Kaipara.
4. Shoal Bay Road.
5. Whata Whata to Raglan.
6. Rangiaohia to Cambridge.
7. Cambridge to the Thames.

On No. 1 the following work is in progress:—Clearing scrub and stones, 170 chains; formation, 40 chains; two small bridges, seven culverts, and one large bridge over the Oruru at Mangonui.

On No. 2 the survey is in progress but is not yet complete in the Maungakahia Valley. Of road work, about thirteen and a half miles are under construction by resident Natives; and between Kaikohe and Waimate, arrangements are in progress for making eight miles of road.

The plans of the road Wairoa and Waimate to Puketutu and Pahia are being altered, but no work is yet in hand.

Mahurangi to Port Albert, the engineering survey is yet in progress.

No. 3. *Mangapai to Arapawa-Kaipara*.—The survey for this line of road is not yet complete.

No. 4. *Shoal Bay Road*.—The contract for this work has been let for £1,190, but no report of work executed has been received.

No. 5. *Whata Whata to Raglan*.—On this line contracts have been let for the construction of bridges over the Mangakowhai and Kaniwhaniwha Creeks, on the western bank of the Waipa River, at a cost of £550, one-half of which will be borne by the Provincial Government.

No. 6. *Rangiaohia to Cambridge*.—About two and a half miles of ditching and road-forming appear to have been executed across the Moana Tua Tua Swamp and near the Mangapiko River, by the Constabulary, assisted by the Pukekuru and Rangiaohia Highway Boards, to each of which has been paid the sum of £100, the cost of this work being estimated at £500.

No. 7. *Cambridge to the head of the Thames*.—The survey of this is in hand, but not yet completed.

### BAY OF PLENTY.

(A. C. TURNER in charge.)

1. *Tauranga to Taupo*.—Sixty-six and a half miles. Dray Road.—The work completed on this road last year consisted of nineteen and a quarter miles, formation 18 ft. wide, viz., six and three-quarter miles in forest and twelve and a half miles in open land; also one plain bridge over Waioroi River 40 feet long, and one truss bridge over Whakapaukarakia 66 feet long, besides 376 feet of culverts of various sizes.

During the last year, twenty-nine and a half miles of formation have been completed, viz., ten and three-quarter miles in bush, and eighteen and three-quarter miles in open land, including 7,580 cubic yards of rock excavations and bridges, as follows, viz.:—

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|                              |                         |
|------------------------------|-------------------------|
| 1 truss bridge, 45 feet      | 1 strut bridge, 41 feet |
| 1 " " 51½ "                  | 1 plain " 26½ "         |
| 1 plain " 12 "               | 1 truss " 31½ "         |
| 1 truss " 84½ "              | 1 " " 46½ "             |
| 1 " " 66 "                   |                         |
| Total length of bridging ... | 404½ feet               |

24 box culverts have been erected of a total length of 628 feet.

The above for the two years give totals as follows:—

|                         |     |           |               |
|-------------------------|-----|-----------|---------------|
| Road formation, in bush | ... | 17½ miles | } = 48½ miles |
| " " open                | ... | 31½ "     |               |
| Bridges, lineal         | ... | 510½ feet |               |
| Culverts, various       | ... | 994 "     |               |

There yet remain to complete this section seventeen and three-quarter miles of formation, and the erection of fifteen bridges of various sizes, giving a total length of 507 feet; also the erection of about thirty-five box culverts.

Of these bridges, the erection of the first two has been retarded by delay in rock excavation, a kind of work in which the Natives make very slow progress, and of which in the Mangorewa Valley there yet remains to be excavated about 6,000 cubic yards, and in other places about 7,000 cubic yards.

The timber for these bridges is now being cut in the Parekerangi and Horo Horo forests, but very much delay has been caused in their erection by difficulties thrown in the way by the Natives.

The portion of this road between Tauranga and Oropi, about twelve miles in open land, is in good order; that beyond, to Tererenga, about ten miles in forest, is now under repairs after severe floods.

2. *Tauranga and Kati Kati*.—Horse road from Judea (about three-quarters of a mile from Tauranga) to Aongatete, a distance of nineteen miles and a quarter, is now completed, with the exception of four bridges, measuring respectively 52½ feet plain, 56 feet truss, 82½ feet plain, 63 feet plain. These will be built wide enough for drays, and are now in hand. Culverts also are required as follows, for which the timber is cut, and the work progressing:—Two 6-feet opening, three 4-feet opening, nine 2½-feet opening, and six 12-feet opening. It is expected that the unfinished work will be completed about the middle of July.

3. *Maketu and Rotorua Dray Road*.—Length, about thirty-eight miles, of which twenty-two were constructed before January, 1871. Since then the whole of the road has been improved, by easing grades and other alterations, and nearly the whole of the formation is finished. A plain bridge, 25 feet long, has been built over the Ngai, and two 18-feet culverts fixed. Timber is being cut for truss bridges over the Taheke and Waipu (the former 51 feet long; the latter 40 feet); and for the repairs of the Morea and two smaller bridges, timber is now ready. When the works now in hand are complete, this road will be in good order.

*Maketu and Whakatane Horse Road*.—This is about thirty-four miles long, following nearly the line of the coast through open country, broken in places. The work in hand consists of one bridge of 53 feet for the Otaramakau, and two from the main land to the island, at Whakatane, respectively 340 feet and 69 feet long; total, 462 feet. The timber for these is now being cut, and tenders for their erection will be called for immediately; arrangements will be made for the necessary road work near Otaramakau by Native labour.

*Matata (Richmond) and Te Teko, inland, Horse Road*.—The first section, from Matata to Otakiri, ten and a half miles, is nearly finished, with the exception of about three chains of heavy swamp work at the latter place. On this line are twenty-three culverts, eight of wood and fifteen of stone, and one small bridge 6 feet long. The work has been done by Natives, and the road, as far as completed, is in good order. It runs through very broken, swampy, but open country.

*Opotiki and Otara Dray Road*: Five miles.—This work was completed in February, 1871—19 feet wide, with ten culverts. It is now being widened to 18 feet, and generally improved by raising embankments over swampy places, gravelling where necessary, and fixing four additional culverts, 20 feet long each, one 4 feet wide, and three 21 inches wide. These improvements are about half completed, and will make this an excellent road, which will form part of that ultimately leading to Poverty Bay.

*Opotiki and Torere, thence to Mareinui*.—Horse road; twenty miles; of this, three and three-quarter miles were completed in early part of 1872; it has been found necessary to alter a portion about one mile long, and this with other work, altogether about two miles, is contracted for by Natives. It is proposed to extend this road to a considerable distance along the coast, to Omaiko.

*Opotiki and Ohiwa Horse Road*.—Eleven miles through open country. From Waioeka to Hunter's Creek, one mile and a quarter, is about to be commenced by the Armed Constabulary stationed at Opotiki.

*Tauranga and Judea Dray Road*.—Three-quarters of a mile long, across Kopurererua Swamp, with bridge over the swamp 50 feet long. This was completed in June, 1871, and has been of the greatest service to the settlers, giving easy and safe access to the town and port; it is in good repair.

*Matapihi and Maketu Dray Road*.—Three and three-quarter miles were completed by Native labour in latter part of 1870, including one large culvert, 5 feet opening and 30 feet long. The country here is open, and the road is in good order, the beach is used for the greater part of the remaining distance as a road between these places.

*Whakatane and Ohape Horse Road*.—Three and a quarter miles, in open country, but very broken, was completed in August, 1871, and has been kept in repair by the Armed Constabulary stationed at Whakatane.

*Opotiki and Waioeka*.—One mile fifteen chains of road formed 14 feet wide; including one plain bridge, 14 feet span; was finished in March, 1871. This runs in the direction of the Waioeka Gorge through open country, and is in fair order.

*Works which have been Surveyed or proposed for Construction.*

*Rotorua to Tapapa*.—The latter place is about twenty-seven miles north-west of the lake, nearly

the whole distance being through forest. It is proposed to connect these places with a road, but the arrangements with the Natives necessary for this purpose have not yet been concluded.

*Galatea to Ahikereru*—another proposed line of road—is in the same position as the last described; about two-thirds of it will be through bush, the whole distance being about eighteen miles, in the direction of Lake Waikare-Moana, which is about fifty-three miles from Fort Galatea.

*Whakatane and Te Teko Horse Road*.—Thirteen miles through flat, swampy, open country. This is another line of road as to which arrangements are in progress with the Natives, but have not yet been concluded.

*Ohiwa and Waimana Horse Road*.—Eight and a half miles. This road has been surveyed, with gradients suitable for a dray road, and the work will at once be offered to Natives at Ohiwa; the country is open, but the first four miles very broken.

*Tauranga to Tapapa*.—About thirty miles, of which eight and three-quarter miles have been surveyed to the crossing of the Wairoa; this portion is about to be let out and will be formed 10 feet wide, where absolutely necessary. Tenders are now invited for building the Omanaroa pile bridge, 66 feet long, and wide enough for drays. As far as the Wairoa, this road lies through open country.

*Opotiki and Poverty Bay Horse Road*.—Estimated length, seventy-five miles. This was explored by Mr. A. C. Turner in November last, and specially reported on, but no steps have yet been taken to form the road. It is one on which Native labour might be employed with advantage, and could be worked from both ends. The country is not very favourable for good road-making.

*Ohineroa Horse Road*.—Branching off the Tauranga and Kati Kati Road at Terereatuakahia. Distance about fifteen miles, principally through forest. The arrangements with the Natives as to opening this road are not yet completed.

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*Work executed by Militia and Armed Constabulary during the past year, under Captain Preece, Native Contingent.*

*Te Teko to Galatea*.—About thirty miles formed, 14 feet wide. On this line the country is very broken about two miles south of Te Teko, and thence to Fort Clarke, seven miles, the gradients are steep on the several side cuttings, which were originally formed by the field force under Colonel Whitmore in 1869.

Between Fort Clarke and Galatea the road has been much improved, and a quantity of work done, including four bridges, of a total length of 89½ feet, roughly but substantially built of heart of totara. Bullock drays can now travel between Te Teko and Galatea. From Te Teko to Otakiri, northwards towards Matata, a distance of about four and a quarter miles, a dray road is in progress, and one mile and a quarter is already completed, 55 chains of which is heavy embankment over a deep swamp. The work also includes four bridges, of a total length of 60½ feet. It is expected that the whole will be completed in about a month.

Southwards of Galatea, towards Opepe, east of Lake Taupo, the dray road is in progress as far as Wai-irobia, two and a half miles, and timber is being prepared to build a bridge (about 30 feet) over this stream, from which, to a point three miles beyond Arawhata, a distance of twenty-seven miles, it is estimated that a serviceable road could be made for about £500, which would be of great service in improving the internal communication of the country.

The work on the above described roads was prosecuted under many difficulties, principally those connected with obtaining an adequate supply of provisions and material, coupled with constant opposition from the Natives. Under Captain Mair, Native Contingent, the Militia have formed a road from Kaiteiriria to Tarawera Road, on the south side of Rotokakahi, a distance of three miles, 8 feet wide, in side cutting, the whole way; it is of great service in getting up stores; also, one mile and a quarter of similar road between Kaiteiriria and Ohoki.

Sundry works have been executed by the Armed Constabulary during the present year, viz.:—

At Tauranga, 31 chains of formation in the Cameron Road, and other works to the extent of 27 chains in the town, all 30 feet wide.

At Opotiki the streets have been formed 55 feet wide for 27 chains, also 9 chains of foot path 12 feet wide, gravelled, one culvert 90 feet long, opened and refitted, three small bridges and two culverts built, two bridges and one culvert repaired.

At Whakatane the road to Ohape, three and a quarter miles, has been kept in repair.

## NAPIER TO TAUPO—TAUPO TO NIHI-O-TE-KIORE.

(E. H. BOLD in charge.)

*Section 1.—Napier to Taupo*.—The total length of this road is ninety miles, measuring from the Western Spit, Napier, to Tapuaeharuru on Lake Taupo. A length of four miles only between Tarawera and Runanga requires to be opened to enable vehicles to travel the whole distance from Napier to Taupo.

*Subdivisions*.—The first fourteen miles from Napier to Kaiwhaka is maintained by the Provincial Government, and is in a fair state of repair for traffic.

*Kaiwhaka to Mohaka*.—Sixteen miles: On this portion five contracts, covering eight miles of ground, have lately been completed, consisting mostly of deep side and block cuttings in clay and soft rock, the erection of small bridges, culverts, and box drains. The new cuttings have been formed 14 feet in the solid, giving a roadway at least 20 feet wide. The remaining eleven miles are in a very passable state for ordinary traffic, but on the new portions metalling will be required for about two and a half miles between Pohui and Mohaka, for which purpose gravel is easily obtainable a short distance from the road. The total length of bridging on this section is 92 feet, the principal bridges being respectively 40 feet, 20 feet, 15 feet, and 15 feet. The total

length of box drains (102 in number) is 1,848 feet, and of culverts varying from 2 feet to 4 feet, 382 feet, all of heart of matai, squared and sawn.

*Mohaka to Tarawera.*—Sixteen miles, ending at Waipunga Bridge. The work on this section is of the same character as the last, with the addition of embankments in places, and at the Turangamuku of cutting in slate rock. The road is open from Napier to a point three miles north of Tarawera, to which place a coach runs twice a week.

In the Te Haroto bush, and at Ohaue, near Tarawera, about a mile and a half of metalling will be required, and may be easily obtained; the rest of the road, it is hoped, will maintain a good surface for light traffic without metal, the ground being dry and porous, consolidating with rain. Bridges have been built as follows, namely:—One of 62 feet, near Haroto; one of 32 feet, near Mohaka—both over deep ravines, and resting on frames bedded on rock; five plain bridges, respectively 25, 24, 22, 27, and 23 feet; and one large bridge over the Waipunga, 87 feet long, consisting of a centre span of 45 feet, and side spans of 20 feet each; the roadway is 25 feet above water-level, to allow for passage of drift timber. Of box drains, fifty-seven have been constructed, of a total length of 1,320 feet, and of culverts, eighteen, varying from 2 feet to 4 feet, of a total length of 544 feet. Four miles of this section lie through bush which has been cleared 1 chain wide. Several slips have occurred on the deeper cuttings, and have been cleared as they occurred.

*Tarawera to Runanga.*—Nine miles, five of which are open for cart traffic, two in course of construction; and for the two not yet under contract, it is hoped that arrangements will shortly be made for their execution. Of this section, five miles are in bush, felled 1 chain wide; the cuttings are through pumice drift and slate rock, and at Runanga through points of basalt, the material from which has been used in culverts and retaining walls. The culverts, stone and wood, will be of an aggregate length of 247 feet, ranging from 1 to 3 feet in width; about 20,000 feet of timber is cut for culverts, outlet drains, and small bridges. A bridge has been built over the Waipunga upper crossing, 70 feet long, with one centre span, 33 feet trussed, and two side spans each 18 feet.

*Runanga to Taupo.*—Or, from the upper Waipunga bridge to Tapuacharuru, thirty-five miles; first opened by Native labour, and afterwards improved by the Constabulary. The improved parts extend over twelve miles, and consist of earthworks and formation, and the erection of one large and three small culverts; the deep cuttings and embankments forming the approaches to the proposed bridge across the Waikato have also been made; the cuttings are through pumice cement, difficult to work. The whole length of the road above described has been well laid off, with easy gradients; the timber for bridges and culverts has been well selected,—heart of totara and matai wherever obtainable; in very few cases has rimu been used, and then only where easily renewable.

The direct benefits accruing from the construction of this road, even in its incomplete state, are becoming very apparent in the reduction of the cost of transport to the Taupo district, which is now only one-third of what it was two years ago; and judging from the number of buildings being erected, and in contemplation, it would appear that the posts at Tarawera and Taupo will become permanent settlements.

*Section 2.—Taupo northwards to Niho-o-te-Kiore.*—Twenty-two miles, being part of Tauranga and Taupo Road, and extending between the two crossings of the Waikato River, was reported last year as having been formed 16 feet wide, as a dray road, mostly by Native labour. This work included 100 feet of culverts, and 24 feet of bridging. Since then, contracts for the supply of the timber for the proposed bridges over the Waikato are all but completed; the timber for the bridge at Aoteamuri, the northern extremity of the road, has been hauled to within a mile of the site, but no actual contract has yet been concluded for its erection. The design includes one trussed span of 50 feet, and one land span of 20 feet in clear; total length 74 feet, width  $13\frac{1}{2}$  feet. A serious bush fire in December last destroyed the first supply of timber cut for this bridge, and it has been necessary to replace it. For the erection of the bridge at Tapuacharuru the contract has been let. This will be 84 feet long in one span, trussed. Both will be built of heart of totara.

For culverts and box drains about 10,000 feet of timber have been cut, to be used in improving the drainage of the road, which has as yet been subjected only to light traffic, and retains a very good surface, but about a mile of it will require metalling near Tuahu Hill. Material for this, volcanic rock (trachyte), is close at hand all along the line.

A portion of the road, twelve miles, has been maintained under contract by Natives.

#### POVERTY BAY TO HICKS' BAY.

The distance between these places is about 112 miles, and the tracks between them lie for almost the whole way very close to the coast, the beaches being used wherever practicable. It is proposed to improve the line of communication, by cutting a horse track about 7 feet wide, and clearing the bush, where it occurs, about half a chain wide, also erecting culverts, small bridges, &c., the estimated cost of the necessary work being a little over £4,000. A certain amount of Native labour has already been expended on the line, a proportion of which may be utilized as part of the future road; other portions must however, it is feared, be rejected, not being in the right place or properly laid out.

The Natives living along the line will be employed by contract, at rates to be fixed by the Surveyor in charge, who has had instructions to lay the road line off carefully, so that when completed it may be really a useful work.

#### WAIROA AND POVERTY BAY.

1. *Wairoa to Opoiti.*—Thirteen miles. The construction of this road will establish dray communication between the military settlements on the Upper Wairoa and the township of Clyde. Of the whole distance, it is only necessary to execute work over about seven miles, the rest of the road passing over flat land, where, at present, work is not necessary.

About four miles of the above, namely, from Clyde to Scamperdown Creek, were formed during 1870 and 1871; the work consisting of 342 chains of formation 30 feet wide, 640 chains of side

ditching, seven culverts, and six bridges, each about 18 feet long, also cutting of approaches of Scamperdown Creek bridge. The work now in progress includes 246 chains of side cutting, 12 feet wide in solid; five small bridges, each 18 feet long; and eleven culverts, of a total length of 212 feet; and of these, 108½ chains of formation are finished, and the timber for bridges has been prepared and hauled to the different sites. The bridge is designed for the Scamperdown Creek, with one centre span of 55 feet, truss, and two side spans of 18 feet each, and tenders will at once be invited for its erection.

The completion of this road will tend greatly to fix the population of the settlements, and its progress so far has induced many to return to their farms, abandoned during the late disturbances.

2. *Bridle Road, Wairoa to Waikare-Moana*.—This branches from the last-described road near Te Kapu, where there is an Armed Constabulary station, about five miles from Clyde; and the distance thence to the lake is estimated at about twenty-four miles.

The route has been carefully examined, and the estimated cost of forming a bridle track along the best elected line by the valleys of the Waiau and Waikare-Tahike is rather more than £1,000; it is proposed to have the work done by Natives resident near the line, which will establish easy communication with the Uriwera country, and be of great importance strategically.

3. *Bridle Road, Wairoa to Poverty Bay, inland*.—The country between these places has been well examined to determine the best line for an inland road. The first line explored lay along the valleys of the Hangaroa and Mangawehi Rivers, but one much to be preferred has been discovered across the Ahimanu Range, which may be travelled safely throughout the year, and will avoid the many dangerous crossings of the streams above mentioned, besides materially shortening the distance, estimated at fifty-three miles, measured from Opoiti, the end of the dray road under construction to the Poverty Bay plains. This road will open a considerable extent of pastoral and grazing country, and will be valuable for settlers and military purposes. The estimated cost is £2,000.

4. *Bridle Track, Wairoa to Poverty Bay, by Coast*.—From Wairoa to Maraetaha, south of Poverty Bay, the distance is fifty-eight miles. The worst portions of this line are at Waikokopu, where about one mile of side-cutting is required, and between Mahunga and Maraetaha, where it passes through bush for eighteen miles; this was very much improved in 1870 and 1871 by Native labour, by clearing the bush 12 feet wide for ten miles, and side-cutting some of the steepest places, of which several yet require to be improved. A ferry is about to be established over the Nuhaka River, and a bridge erected over the Waimana, a deep tidal creek: both works are very necessary as the crossings are frequently dangerous.

5. *Gisborne to Ormond*.—The distance between these places is twelve miles, over which a dray-road is being made. The work finished, and in hand, extends over about five miles, from Mahakaraka to Waerenga-a-hika: the finished portion includes about 720 chains of side-ditching; 30 chains of outlet drains; 142 feet of culverts; 15 chains of fascined formation, 16 feet wide; 20 chains of embankment, 2 feet deep; and 23 chains of road metalled, 12 feet wide and 12 inches thick; while the works in hand consist of about 332 chains of formation and embankment 20 feet wide, and 663 chains of side drains, and completing and metalling the approaches to eight culverts. Besides these, it is expected that at least one-half of the whole length of the road will require to be metalled, material for which may be obtained from the Waipaoa River, about one and a half mile distant. This road passes through a very valuable agricultural district.

6. *Mahakaraka to Arai*.—Dray road four miles long, over one and three-quarter miles of which the necessary works are extended. This branches from the Gisborne and Ormond road at Mahakaraka and joins the inland track from Wairoa at the Arai Creek. It is useful in connecting the settlements at the south-west part of the Bay with Gisborne. The works executed are 213 chains of side ditches and two culverts; and those in progress are about 107 chains of formation in open and 30 chains in bush, 20 feet wide; 60 chains of side ditches; 36 chains of outlet drains; 30 chains of bush clearing, 40 feet wide; and 10 chains grubbing and clearing, 16½ feet wide; and two culverts, with other incidental work.

7. *Gisborne to Maraetaha*.—Twelve miles, joining the coast line from Wairoa. This road has been pegged off and surveyed. The only work at present in hand is the erection of a bridge over the Karawa Creek, 65 feet long, in three openings. This, in conjunction with the ferry established by the Highway Board over the Waipaoa, secures very good communication between Gisborne and the settlement at the southern end of the Bay.

## SEVENTY-MILE BUSH.

(D. Ross in charge.)

The road work in this district is situated between the Manawatu Gorge and the Ruataniwha Plains, in the Province of Hawke's Bay. The length of the road is 37½ miles, 29½ of which is through bush, and 8 through open land. Through the bush the road has been felled one chain wide, in the centre of which a width of 33 ft. has been cleared of everything close to the ground—one portion of the above road has been formed for 104 chains—viz., that lying within the Gorge, and consists of side cuttings 12 ft. wide; at the Ruataniwha end 16 chains have been formed and metalled over soft ground. Twelve plain pile bridges have been completed, all 16 ft. wide, and of the following respective lengths:—20 ft., 18 ft., 32 ft., 24 ft., 18 ft., 18 ft., 32 ft., 28 ft., 18 ft., 18 ft., 32 ft.—total, 290 ft.; and one is now in progress, 49 feet long, in two spans.

Of culverts 23 have been constructed, averaging 19 feet to 26 feet long, giving a total length of 500 feet, all made of heart of totara, 3 to 4 inches thick. Twenty of these are in the side cuttings in the Gorge, and three in the metalled portion above described. In progress are two chains of road formation, with timber breastwork, in the Gorge; this and the bridge in progress will have been completed since receipt of District Report. The soft and swampy portions of this road have been roughly corduroyed, and the small soft-bottomed streams roughly bridged, so that the road is now in very fair order as a horse track. The work of forming and finishing the road for cart traffic will be reserved for future settlers in the Seventy-Mile Bush.

## MASTERTON AND MANAWATU GORGE.

(A. MUNRO in charge.)

THE railway line cut through the Forty-Mile Bush between these places by Mr. Rochfort has been, with a few modifications, adopted in the first instance as a road line, and as such is now being felled and cleared, the felling one chain, and the clearing half a chain wide.

For convenience, and for the purpose of accommodating and affording work to several classes of workers, the line has been divided into sections, as follows, namely:—

- No. 1.—About ten miles, has been allotted to the Scandinavian immigrants lately arrived.
- No. 2.—To the Wairarapa Natives.
- No. 3.—Divided into short contracts for public tender.
- No. 4.—To other Natives.
- No. 5.—Divided as No. 3.
- No. 6.—To other Natives; and
- No. 7.—Divided as Nos. 3 and 5.

A considerable amount of work has been done on No. 1 section by the immigrants, who show an aptitude for this particular kind of work.

Two sets of contracts have been advertised for public tender, 520 chains and 840 chains respectively. A part of the first set only has been accepted; the rest are still open for tender, with the second set, till 6th August.

The road line is being rapidly pegged off for future contracts, in sections, as above described; and it is proposed that, as the work proceeds, the several creeks and soft places, shall be roughly bridged, so as to make the road line immediately useful as a horse track. This will materially affect the price of future tenders, by giving a greater facility for getting up supplies of all kinds.

## MANAWATU DISTRICT.

(J. T. STEWART in charge.)

*Main Road.*—Foxton to eastern part of the Manawatu Gorge, about thirty-eight miles. The work on this had progressed so far as to allow of the passage of drays in March last, the formations, cuttings, bridges, and culverts being then complete, as well as a considerable amount of metalling, the progress of which latter work was stopped by the bad weather, and the unmetalled parts have become unfit, or nearly unfit, for dray traffic.

Between Foxton and the Oroua, thirteen and a quarter miles, the road is made through sandy country, which is rather heavy for traffic, and does not readily admit of being gravelled. Over this portion the driest ground has been selected, and the swampy parts, where unavoidable, have been drained. From the Oroua to the western end of the Gorge, twenty and three-quarter miles, the road lies through a dense bush country, broken at two places by open flats, one at Palmerston, one mile and a half, and one at Otangaki, half a mile wide. Eight and a half miles of this, between Ngawhakarau, the head of the river navigation, and Palmerston, were originally opened by the Provincial Government, about two-thirds of the work being executed. The lower portion of the road, viz., between the Oroua and Palmerston, about ten miles, is unmetalled, and unfit for traffic in winter; the district is low and flat, and destitute of gravel near the line. Along this the tramway is now being laid, confining the traffic to one side of the road, which is thus more cut up than it otherwise would have been.

The completion of the tramway will relieve the road of heavy traffic, but it will still be necessary to metal it for local purposes. I suppose this work will be executed by the Provincial authorities, and it may be conveniently done by means of the tramway, gravel being obtainable at or near Palmerston. It will be seen how the existence of the sandy country, followed by that of the clay country, destitute of gravel, led to the tramway being designed, as the best means of providing for the heavy traffic that may be expected when this valuable district becomes settled. Between Palmerston and the Gorge the country is higher and drier, and gravel is easily obtainable. This section, ten and a quarter miles, has been double ditched and formed 26 feet wide throughout, and seven miles of it have been gravelled. Some heavy cuttings occur on this part of the road through gravel terraces, respectively 18, 20, and 50 feet. The latter occurs on the descent to the Manawatu. This section may be regarded as a fair sample of road-making through a new country—tolerably level, and covered with dense bush. Its cost, including all expenses and six months' maintenance, averaged about £700 a mile.

An unusually wet season has delayed the completion of this road; December, January, February, and March being the only months really favourable for the prosecution of the work.

The formation of the road in the Gorge (three and three quarter miles of side cutting) is all completed, to a minimum width of 12 feet. The culverts and bridges are being erected, and the whole will soon be completed. This section is level throughout, except a length of 20 chains with a grade of 1 in 88; it is kept high above the reach of all floods.

The cutting is made through a great variety of materials—sandy clay and coarse gravel, loose rock and earth, soft rock capable of being worked by pick and crowbar, and in some parts very hard rock, requiring blasting.

As might have been expected, a number of slips have occurred along this piece of road, and a gang of men will be required, during the present winter at least, to keep the road open. Their spare time will be employed in widening the roadway where the curves are sharpest.

Ferries have been established at both the crossings of the Manawatu,—one in the Gorge on the site of the future bridge, and one below the Gorge, also on the road line. Correct sections of the river bed have been taken, and designs for both bridges will shortly be prepared.

A great length of outlet drains has been necessary on this road, particularly in the lower parts

which are subject to be flooded. This has had the most beneficial effect not only on the road, but on the whole of the fine district through which it runs; the flood water now runs off in one or two days, whereas before the outlets were cut it took as many weeks.

Of these, there have been cut 103 chains five feet wide, 106 chains seven feet wide, and 117 chains ten feet wide.

The number of culverts erected is 106, varying in size from 2 feet wide to 7 feet; and from 14 feet to 68 feet in length—their aggregate length is 2,315 feet.

Thirty-four bridges of a plain construction have been built, of a total length of 674 feet. These and the culverts are mostly of sound totara timber.

*Horse Track.*—Along the proposed railway line, Manawatu to Wanganui, the bush has been felled 1 chain wide, and cleared  $\frac{1}{2}$  chain wide about eight miles, leaving the main road about three miles above Palmerston, and proceeding in the direction of the Rangitikei to the Oroua River, where there is open ground. The small creeks on this line have been roughly bridged for horse traffic.

*Tramway, Palmerston to Foxton.*—Twenty-four and three-quarter miles. This is intended to be laid along one side of the main road already described. On this line one contract has been completed at the Palmerston end, 3 miles, 71 $\frac{1}{2}$  chains, with two sidings of 5 chains each. And another contract of twenty and three-quarter miles is now in progress. The sleepers are of heart of totara, the rails heart of matai.

The sleepers are laid on a raised formation close to one of the side ditches; and in the lower lands in the bush this is kept high enough to be clear of ordinary floods, but those of an extraordinary character, like that of 1871, will submerge the line for about four miles. Floods are however of rare occurrence, and the water is comparatively still during their continuance, so that no damage from them of any consequence is anticipated.

The formation of the tramway through the bush, about eight miles, is nearly completed, and sleepers and rails are laid for about three and a half miles, but not yet ballasted. The formation for the tramway in the sandy country, about thirteen miles, is completed. The gradients throughout are good, corresponding nearly to the natural face of the country which is almost level; a few short grades, not over 1 in 40, occur near the boundary line between the bush and open country.

Curves of less than 5 chains radius occur only in two or three cases where the radius is 4 chains.

The tramway will cross the Oroua on a new bridge now being erected alongside the present dray-bridge, the length of which will be 162 $\frac{1}{2}$  feet, it will be built entirely of totara sawn or squared, already delivered at the site. The contractors for laying the tramway though working under very unfavourable circumstances as regards weather and roads deep in mud, are nevertheless prosecuting their work with energy.

#### WANGANUI TO CARLYLE, PATEA.

(W. HALES in charge.)

In reference to a portion of this line of road, namely, that between Wanganui and Waitotara, it was decided (see last year's Report) to adopt what was known as the Inland line of road, as distinguished from the Coast line; and the whole of this section, with the exception of 46 chains of forming and metalling in the descent to the Waitotara, is now completed and in good working order. The piece yet in hand is intended as an improvement on the cutting originally laid out and partly executed, which seems much too steep for safe and easy traffic.

Beyond the Waitotara a length of 3 miles 34 chains has been formed and metalled, and about five and a quarter miles formed ready for metalling; and in the town of Carlyle a contract is now in hand for forming and metalling 55 chains of road, about one-fourth of which is completed. The width of formation ranges from 20 feet to 33 feet, and that of metalling is 12 feet, being 12 inches thick in the middle. About five and a half miles of this road is made through bush.

Three bridges have been constructed on this line with approaches and embankments complete, viz., Puketotara Bridge, 69 feet long, in three spans—21 $\frac{1}{2}$  ft., 24 ft., and 21 $\frac{1}{2}$  ft.; Kai-iwi Bridge, 144 ft. long, in four spans—18 ft., 78 ft., 23 ft., 21 ft.; Okehu Bridge, 52 $\frac{1}{2}$  feet long, in three spans—13 $\frac{1}{2}$  ft., 24 ft., 13 $\frac{1}{2}$  ft. These are all 12 feet wide in the clear, and are built substantially of sawn timber and on piled foundations. Also, one large culvert, at Ototoko Stream, 109 ft. long by 9 ft.  $\times$  8 ft. inside, piled and framed of sawn matai timber.

The following is a summary of the work completed or in progress:—

|                       | Miles. | Chains. |
|-----------------------|--------|---------|
| Formed and metalled   | 21     | 38      |
| Formed only           | 4      | 56      |
| Formation in progress | 1      | 60      |
| Metalling             | 1      | 20      |

Three bridges, total length 266 feet, by 12 feet wide

One piled culvert, 109 feet long, 8 ft.  $\times$  9 ft.

Two piled culverts, 14 feet long, 8 ft.  $\times$  10 ft.

118 box culverts, of a total length of 408 feet, and varying in size from 12 in.  $\times$  12 in. to 18 in.  $\times$  24 in.

Two stone culverts, 66 feet long, by 24 in.  $\times$  24 in.

Thirteen log culverts, total 108 feet long, varying from 2 ft.  $\times$  2 ft. to 3 ft.  $\times$  4 ft.

Twenty box culverts, in progress, 33 feet each, by 14 in.  $\times$  10 in. These are all made with 2-inch planking.

The finished work on this road is all standing very well; and, until lately, very few slips had occurred in the cuttings, but after the last wet weather small slips were rather numerous, requiring constant attention to keep the drainage open. The crossings at the Rivers Waitotara and Whenuakura, by punt and wire, are, owing to the peculiar sections of the river bed, awkward at all times, especially for coach traffic, and in times of flood not a little dangerous. I should strongly recom-

mend the bridging of these rivers, and have given instructions for taking correct sections of the rivers, for the purpose of forming an estimate of the cost of each. The progress of both formation and metalling on this road has been arrested by wet weather; the work will be proceeded with when it becomes more favourable.

*Coast line.* Before it was decided to adopt the inland line as far as Waitotara, two bridges had been built over the Kai-iwi and the Okehu, respectively 66½ feet and 46 feet long, and 12 feet wide; total, 112½ feet of bridge. By adopting the old coast line as a district road, these bridges might be utilized, with advantage to the settlers in the neighbourhood.

A great improvement could be effected at the Wanganui end of this road, by avoiding that portion which lies amongst the sand hills (689 chains), and adopting a new line by way of Kaikokopu Valley, where good hard ground and abundance of metal could be obtained to form a substantial and durable road. To accomplish this through the sand would scarcely be possible, even at a very great cost. A special report has been made on this by Mr. Hales, and the two lines are shown on the plan attached to this report.

#### WEST COAST ROAD, CARLYLE (PATEA), TO WAI-ITI—about 125 Miles.

(O. CARRINGTON in charge.)

Wai-iti is situated about twenty-seven miles north of New Plymouth, and is the site of a camp occupied by a party of Armed Constabulary. Proceeding from this southwards to Urenui River, four miles, the road has been improved from time to time by the Constabulary. Between the Mimi and Urenui, seven and three-quarter miles, the road was originally formed by the Constabulary and Natives, but no work has been done during the past year.

At Urenui it is proposed to erect a dray bridge near the present ferry, and the Constabulary have already cut about 18,000 feet of timber (rimu) for this purpose (out of 36,000 required), and are preparing the approaches on the southern side by side-cutting round a hill.

Urenui to Waitara, ten miles, over which little or nothing has been done by the local authorities. A small bridge, 20 feet span, has been built over the Waiau, and 15 chains of road repaired by the Constabulary.

Over the Waitara River a new bridge has been erected by the Provincial authorities, consisting of two spans of 100 feet each, and two of 50 feet, total 300 feet, and a considerable portion of the road to New Plymouth, a distance of ten miles, has been metalled.

From New Plymouth to Hangatahau, seventeen miles, under the same authority, the road has been metalled as far as Allen's Hill, five and a half miles; from thence to Oakura, three and a quarter miles, the road will need a considerable outlay to render it serviceable, probably not less than £2,000, including metalling. The embankments at the Tapuae Bridge are failing, and it is proposed to substitute for the earthwork two additional spans at each end of the bridge. The timber for this alteration is cut and delivered. The inland line from Oakura to Hangatahau Bridge, eight miles, has only been partly formed, and will require considerable expenditure to complete it, including the erection of a bridge over the Kaihihi, which is considered as a necessary work. At present the coast road between those places is used for coach traffic.

Between Hangatahau and Waiweranui, four and a half miles, the road has been formed for three and a quarter miles, as far as Wairongomai, between which and Waiweranui no work has yet been done. The remaining work, including two bridges, is estimated to cost £480.

The coast road from Oakura to Waiweranui has been repaired and considerably improved, the steep cuttings reduced materially, culverts repaired, and about 25 chains gravelled, at a cost of £123 19s. These works have been carried as far as Kaihihi; and they will, it is expected, be advanced as far as Hangatahau during the month of June.

*Waiweranui to Umuroa*, twenty-three miles, on which no work, for Native reasons, has yet been undertaken, the beach line being still the only one available, and it is almost impassable during wet weather.

*Umuroa to Waingongoro*.—Twenty-six miles. Great difficulty has been experienced on this section in connection with Native labour, which is applied, although under contract, in the most disadvantageous way: the oldest men and the youngest boys, as well as the able-bodied men, all assisting, and expecting an equal share of the payment. It is proposed, and the proposal is worthy of consideration, that only strong able men should be employed by day work on important works under careful supervision, and that, to content the others, small contracts might be let out to them as at present, to be carried out in their own peculiar fashion. It has been found necessary, in connection with some kinds of work—culverts, small bridges, and gravelling—to employ European labour, to which the Natives do not object; and it seems to have had a beneficial effect on them, as they appear now inclined to encourage the system themselves, with the view of being employed by the Europeans.

On this section one truss bridge has been erected over the Waingongoro River, 81½ feet long; 24 substantial stone culverts, 17 wood culverts, together 866 feet long; and 172 chains of formation, with ditching; besides 299 chains of road cleared only. In progress are seven truss bridges and one plain bridge, 122 chains of forming, and 20 chains of gravelling; and tenders have been accepted for the erection of four other bridges, all of which will be built over rivers which in time of flood are quite impassable.

*Waingongoro to Carlyle*.—Twenty-one and a half miles. The work on this section executed during the last year is as follows:—Road formed and gravelled, 156 chains; formed only, 940 chains. Bridges erected over the Tongahoe and Manawapou respectively 89 feet and 74 feet long (the main spans trussed 60 feet and 50); 65 culverts of wood, ranging from 1 foot to 8 feet wide, with an aggregate length of 2,170 feet. Of road formation, 95 chains are in progress.

On the line of road described above, a considerable length of formation has been ready for some time to receive the gravel; but since the wet weather has set in it has been deemed advisable to defer this operation, not only on account of the expense attending it in winter weather, but because it is better

to allow the formation, which is in general very soft, to settle and become hard before the gravel is applied; by this means a much less quantity of gravel will be required, and the work will be more permanent and substantial.

Working sections have been prepared for the formation of about five and a quarter miles of road north of Carlyle, leaving only about one mile next the town not yet prepared, and the work will be put in hand when the weather is more favourable.

The whole line of made road is in fair order, with the exception of a few chains at Manawapou, where considerable slips have occurred in the long side-cuttings, and which will yet give trouble, and necessitate the employment of a small working party during the winter.

Though much remains to be done on this line of road, it will be evident that great improvements have been made, when it is considered that the coach has continued to run almost regularly between Wanganui and New Plymouth, the great obstacle to its regularity being the rivers, which are now in course of being bridged, and some of which in time of fresh, are extremely dangerous, and at times a complete bar to traffic of any kind.

### ROADS IN WESTLAND.

(C. Y. O'CONNOR in charge.)

The general scheme of these roads was to form a main trunk line between Greymouth and Ross, with a branch road joining the Christchurch and Hokitika Road; and the report below, describing the road in subdivisions, will show how much of this has been accomplished since the beginning of the work in June, 1871. Greater progress might have been made under a more favourable season, the character of which may be judged of, when it is known that the rainfall for eight months, up to February, averaged four-tenths of an inch per day. This also increased the cost of the work, which was additionally enhanced by the very high rate of wages prevailing in Westland.

The trunk line as designed, and necessarily passing over some rough country, serves not only its purpose as such, but fulfils that usually served by local roads—that of connecting all the principal mining centres, mostly situated inland—and this, probably, at a cheaper rate than if a road had been constructed over easier ground near the beach, with branch lines to those centres of population.

*Greymouth to Omotomoto*.—Two miles eleven chains. This proceeds from Greymouth up the left bank of the Grey, and is mostly in side-cutting on the side of a steep hill; the formation width will be  $14\frac{1}{2}$  feet, with metalling 10 feet wide and 9 inches thick. The work includes 171 chains of bush clearing; rock excavations, 3,900 cubic yards; clay, 16,500 cubic yards; retaining walls, 240 cubic yards; 124 feet of culverts, 34 in number; turnouts, 21 chains.

Of this, 111 chains of bush have been cleared, 500 yards of road excavated, and 8,400 yards of clay, equivalent to about 41 chains of road, completed. The cost of the above line is £3,350, or about £1,567 per mile.

*Omotomoto to Marsden*—eleven miles three chains—and alternative line, *Greymouth to Marsden direct*.—The first of these lines was surveyed, and plans and specifications prepared for contract by December, 1871. It is at an average distance of four miles from the beach, and traverses a hitherto almost unknown bush country the greater part of its course. For three miles, the average gradient will be 1 in 10 in steep side-cutting. The estimated cost of a 12-foot metalled road from the termination of road last described is £15,900.

The second line was only blazed throughout, and barometer levels were taken. Its average distance from the beach is a mile and a-half; the grades are easy, and the distance would be 9 miles 51 chains, giving an estimated cost of a 12-foot metalled road of £11,100.

No work has yet been done on either of the above described lines.

*Marsden to Hohonu*.—Seven miles seventeen chains. Crossing the New River close to Marsden, this road ascends one side of an intervening ridge, and descends on the other side to the Greenstone, attaining a maximum altitude on the ridge of 650 feet. The formation will be 17 feet, and the metalling 12 feet wide and 12 inches thick. The amount of work and progress made is shown below:—

|                                                                             | Total<br>Quantity. | Quantity<br>Completed. |
|-----------------------------------------------------------------------------|--------------------|------------------------|
| Clearing heavy timbers ... ..                                               | 490 chains         | 473                    |
| Clearing heavy scrub ... ..                                                 | 77 chains          | 77                     |
| Earthwork ... ..                                                            | 51,422 cub. yds.   | 42,100                 |
| Retaining walls ... ..                                                      | 290 cub. yds.      | 50                     |
| Drains ... ..                                                               | 311 chains         | 270                    |
| Culverts, 48 ... ..                                                         | 246 lin. ft.       | 220                    |
| Bridges, one lattice 108 ft., three plain 20 ft.,<br>113 ft., 50 ft. ... .. | 291 lin. ft.       | 130                    |
| Metalling ... ..                                                            | 577 chains         | 370                    |
| Turnouts ... ..                                                             | 45 chains          | 40                     |

The whole cost of the above will be £9,752 17s. 8d., or about £1,352 a mile; the work completed is equivalent to 430 chains of finished road.

*Arahura to Stafford*.—Three miles sixty-three chains; all completed by 17th March last. The line of country is easy, with moderate grades. Formation width throughout, 17 feet; metalling, 12 ft. by 12 in. thick. The work included clearing of heavy timber, 206 chains, and of scrub, 65 chains; earthwork, 13,132 cubic yards; drains, 368 chains; 30 culverts, in all 251 feet; bridges, one lattice, 45 feet, and the completion of a 60-foot truss bridge over Waimea Creek, and 16 chains of turnouts. The cost was £3,415 8s. 2d., or about £902 per mile. The whole is now in good repair, and is being maintained under contract.

*Hokitika to Kamieri*.—One mile sixty-seven chains; all completed on 1st December, 1871. Its course is nearly parallel to the Hokitika River, over easy flat country. Formation and metalling as before. The work included the clearing of 147 chains of heavy timber; earthwork, 3,000 cubic yards;

drains, 206 chains; 10 culverts, in all 101 feet; one 45-foot log bridge; metalling, 147 chains; and 11 chains of turnouts.

The cost was £1,822 6s., or about £999 per mile; it is in good repair, and is under contract for maintenance.

*Kanieri to Ross.*—Fourteen miles fifty-five chains, commencing on the south bank of the River Hokitika, which is crossed by a punt kept by a private individual. The course of this road lies about two miles distant from the sea, and crosses a succession of ridges, some of which are 300 feet high.

At the Hokitika end, for 7 miles 71 chains, the formation, for economy, is specified as 12 feet, and metalling as 8 feet wide and 8 in. thick; the remaining distance to Ross, 6 miles 64 chains (first prepared for contract) as 17 feet, and metalling 12 feet and 12 in. thick. The work is divided into fourteen contracts, ten of which have been let. The cost of these, with the estimated value of the remaining four added, will be £12,340 4s. 3d., or about £840 a mile. The work executed is equivalent to 5 miles and 17 chains of road completed, including a mile and a half open for traffic at the Ross end. The amounts of works required on this section are as follows:—

|                                                            | Total.         | Quantity completed. |
|------------------------------------------------------------|----------------|---------------------|
| Clearing heavy timber ... ..                               | 1159 chains    | 650                 |
| Clearing scrub ... ..                                      | 18 "           | 18                  |
| Earthwork ... ..                                           | 24,428 c. yds. | 14,500              |
| Drains ... ..                                              | 926 chains     | 370                 |
| Culverts, 76 ... ..                                        | 428 lin. ft.   | 190                 |
| Bridges 7 — 87 ft., 35 ft., 57 ft., 19 ft., 29 ft., plain; |                |                     |
| " 2 — 34 ft., lattice ... ..                               | 295 "          | 90                  |
| Metalling ... ..                                           | 1,176 chains   | 290                 |
| Turnouts ... ..                                            | 85 "           | 21                  |

*Branch Road from Christchurch Road to the Greenstone Road.*—Four miles sixty-five chains, all completed by end of May, 1872. This is a connecting link between the Canterbury Road and the trunk road of the County, joining the latter at a point nearly midway between Hokitika and Greymouth, the ground offering great facilities for the junction. The formation is 17 feet, and the metalling 12 feet wide and 12 inches thick, and the total cost £3,598 1s., or about £748 a mile. It is in good repair throughout. Its construction involved the following work—viz., clearing of heavy timber, 290 chains; scrub, 95 chains; earthwork, 7223 cubic yards; drains, 445 chains; culverts, 24 = 74 feet in line of road; metalling, 385 chains; with 30 chains of turnouts.

#### WATER RACES.

*Waimea District Water Supply.*—The survey for this was completed 11th May. It is thirty-two miles long, the line being carried into the heart of this district, and thence to all the surrounding workings of importance. Two reservoirs, respectively 48 and 29 acres in extent, have also been surveyed at the head.

An approximate estimate of the amount of each kind of work required is as follows:—

|                                                             |
|-------------------------------------------------------------|
| 300 chains of piping, with an average pressure of 110 feet. |
| 200 " fluming, averaging, 17 feet high.                     |
| 700 " boxing or tunnelling.                                 |
| 1,360 " ditching.                                           |

Apparently a much cheaper undertaking, and one more likely to be remunerative, would be to make the main race alone, which would be fifteen miles thirty-four chains of conduit, made up as follows:—

|                                   |
|-----------------------------------|
| 260 chains piping as before.      |
| 125 " fluming, averaging 17 feet. |
| 400 " boxing or tunnelling.       |
| 449 " ditching.                   |

The attached diagram is a reduction from the working plans.

*Greymouth Protection Works.*—It will be remembered that these were undertaken after the occurrence of a flood in the River Grey, the destructive effects of which on the river banks and to property in the town of Greymouth were unexampled, and which convinced those who were interested in the conservation of the town and the roads connected with it, that nothing less than works of the most substantial character would resist the action of floods of like extent for the future. The necessity for these works was duly reported on, and their execution approved of, and no time was lost in putting them in hand. They consist of:—

1. *Quay Wall along River Bank from the Maori Cemetery to Tainui Street.*—Twenty-five chains in length. This will be built with the largest stones that can readily be procured from the adjacent limestone hill; the average height being about 22 feet and the average width about 9 feet, the base being kept wide and sloping, to resist the action of the river.

It is calculated to be of material assistance in the construction of a railway, and the delivery of coal from the Brunner Mine, as well as serving its more immediate object—that of preserving the town of Greymouth from absolute destruction. About one-fifth of the work, including outlay for plant, has been completed for the sum of £1,504 8s. 4d. of which the Native Trust has already contributed £999 4s. 8d., the total estimate being £6,000.

2. *Strengthening the Wharf from Tainui Street to Boundary Street.*—This work was commenced on 27th May, and its cost is being defrayed out of the loan of £4,000 made to the Corporation of Greymouth by the General Government—about one-sixteenth of the whole work contemplated has been completed, at a cost of £58 14s. 9d., the estimate being £1,000.

3. *Wharf—Boundary Street to Johnston Street.*—This work is also being executed out of the loan as above. It is composed of three rows of piles with intervals of 14 feet. The face piles are driven in line with the existing wharf, and the back rows approach nearly to the face of the river bank,

as left by the February freshets. More than nine-tenths of the work are now completed, and have cost £2,455 2s. 8d., the estimate for the whole being £2,700.

## ROADS IN NELSON SOUTH-WEST GOLD FIELDS.

(A. D. DOBSON, Provincial Engineer, in charge.)

The object of the works undertaken in this district is to connect the Valleys of the Buller and the Grey with a main trunk line of road laid out in such a way as to serve the principal centres of population, and utilizing and improving what had already been done in this direction. Commencing at the north end at the junction of the Inangahua River with the Buller, it proceeds up the valley of Inangahua and over the intervening saddle or watershed line into that of the Little Grey, passing Reefton (which is situated on or near the watershed) on the way, thence down the Little Grey Valley, and crossing the Grey near the junction of the latter, proceeds across the intervening flat land to the Ahaura township, situated a short distance up the river of that name. The road joins the rivers Buller and Grey at points to which supplies of all kinds can be brought up those rivers by means of cargo-boats built expressly for the trade.

For convenience of description the work will be divided into sections, viz., the Inangahua Road, reaching from the Buller to Reefton—and the Grey Road, from Reefton to the Ahaura.

*Inangahua Road.*—Section 1, from Buller to the ferry crossing the Inangahua, five and a half miles, of which three miles thirty chains are under construction in four contracts, but progressing slowly on account of the difficulty of getting an outfall for the water of a swamp through which the road must run. Sections 2, 3, and 4 are progressing favourably, and the work is well done. The cost of the work under contract will be £2,602, or about £600 per mile; in addition some heavy cuttings to the river banks and a short bridge will be required, costing probably £600 more.

*Section 2:* Six and a half miles, in six contracts, £3,600. The work on this has been much delayed by bad weather and other unavoidable causes. The main part of the work is done, but the metalling over two swamps will occupy a considerable time, on account of the distance of haulage.

*Section 3:* Three and a half miles, in four contracts, £2,880. This work is nearly completed, and the contractors are pushing it on vigorously.

*Section 4:* About four miles—from Waituhu to Reefton—in four contracts, £2,880. The work on this will commence at once, the contracts having been just let.

*Reefton to Grey.*—Section 1: Seven miles—Reefton to Plain near Mai Mai. This is being executed by day labour (about 200 men), the contractor having entirely failed to carry out his contract. The work will be pushed forward as rapidly as possible.

*Section 2* lies entirely through open ground; and although the road will eventually require to be formed and metalled, drays can work at present on the natural surface of the ground.

*Section 3:* Along this, the river bed and part of an old track is used by the drays, but the road must be formed as soon as possible, particularly through about five miles of bush, swampy in part. Probable cost of this section, £3,000.

*Section 4:* This includes the improvement of the existing road between the Little Grey junction and the Ahaura, and its cost was estimated at schedule prices at £1,170. The work required was the levelling of the steep gradients; the forming and metalling of that part between Lardi's and McNiel's, and thence to the Little Grey.

The amount above named will be increased by about £500 by reason of a greater amount of traffic being thrown on to the road, consequent on the completion of some cuttings by the Provincial Government. The goods are now landed at the Ahaura instead of Totara Flat, and will be carted over the road in question. This will necessitate the metalling of many parts not before provided for.

The cost of all the roads in this district will be, it is feared, thought high; but this follows naturally on the execution of so much work being required in a limited time, coupled with the unfavourable nature of the season.

It is estimated that to complete the road for through traffic the following works will be required:—

|                                       | £      | s. | d. |
|---------------------------------------|--------|----|----|
| Grey Road, section 3, estimate        | 3,000  | 0  | 0  |
| Cutting at Sandstone Bluff, Inangahua | 300    | 0  | 0  |
| Punt, &c.                             | 250    | 0  | 0  |
| Side-cuttings near Inangahua Junction | 500    | 0  | 0  |
|                                       | £4,050 | 0  | 0  |

Tenders were called for the construction of the punt required at the crossing of the Inangahua; but only one was received, and, being too high, was declined. It is hoped, however, that satisfactory arrangements will be made shortly for the establishment of this ferry, as an eligible offer has since been received. Some difficulty will be experienced in getting good approaches, with reasonable gradients, to the punt-crossing; and the cuttings, it is expected, will be heavy.

Summary.—The cost of the works in progress may be stated approximately as follows, viz.:—

|                                             | £       | s. | d. |
|---------------------------------------------|---------|----|----|
| Contracts in progress                       | 13,632  | 15 | 0  |
| Day-labour and piecework                    | 5,320   | 0  | 0  |
| Paid to surveyors, overseer, labourers, &c. | 358     | 3  | 0  |
|                                             | £19,310 | 18 | 0  |
| Estimate of remaining works                 | 4,050   | 0  | 0  |
|                                             | £23,360 | 18 | 0  |

## REPORT BY ASSISTANT ENGINEER-IN-CHIEF.

It will be seen from the foregoing report that a large amount of work has been executed in the different districts, the full benefit and importance of which will not be fully apparent until the completion of the contracts now in progress, and the consequent opening of the several roads, which, owing to the unfinished state of the work, do not offer that convenience for traffic which might be expected from a statement of the number of miles really made. It is expected, however, that before the expiration of another summer the facilities for travelling and transport of provisions, especially to the rich gold fields now being worked on the West Coast of the Middle Island, will be enormously increased, and the full benefit of the expenditure on roads realized.

I have, &c.

JOHN BLACKETT,  
Assistant Engineer-in-Chief.

To the Hon. the Minister for Public Works,  
&c.,            &c.,            &c.

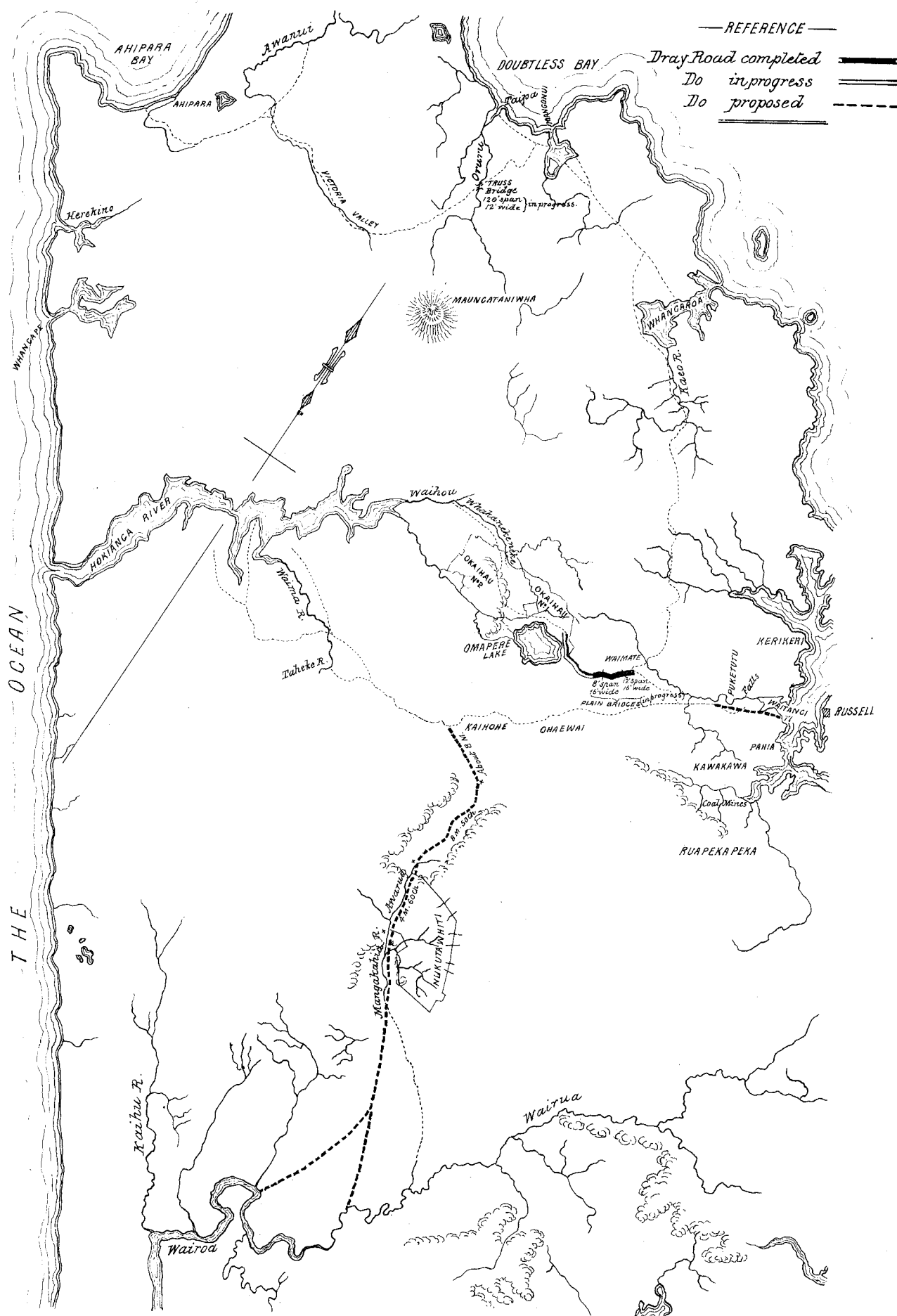
---

## ROADS NORTH OF AUCKLAND.

Scale—8 Miles=1 Inch.

T. PERHAM, DEL.

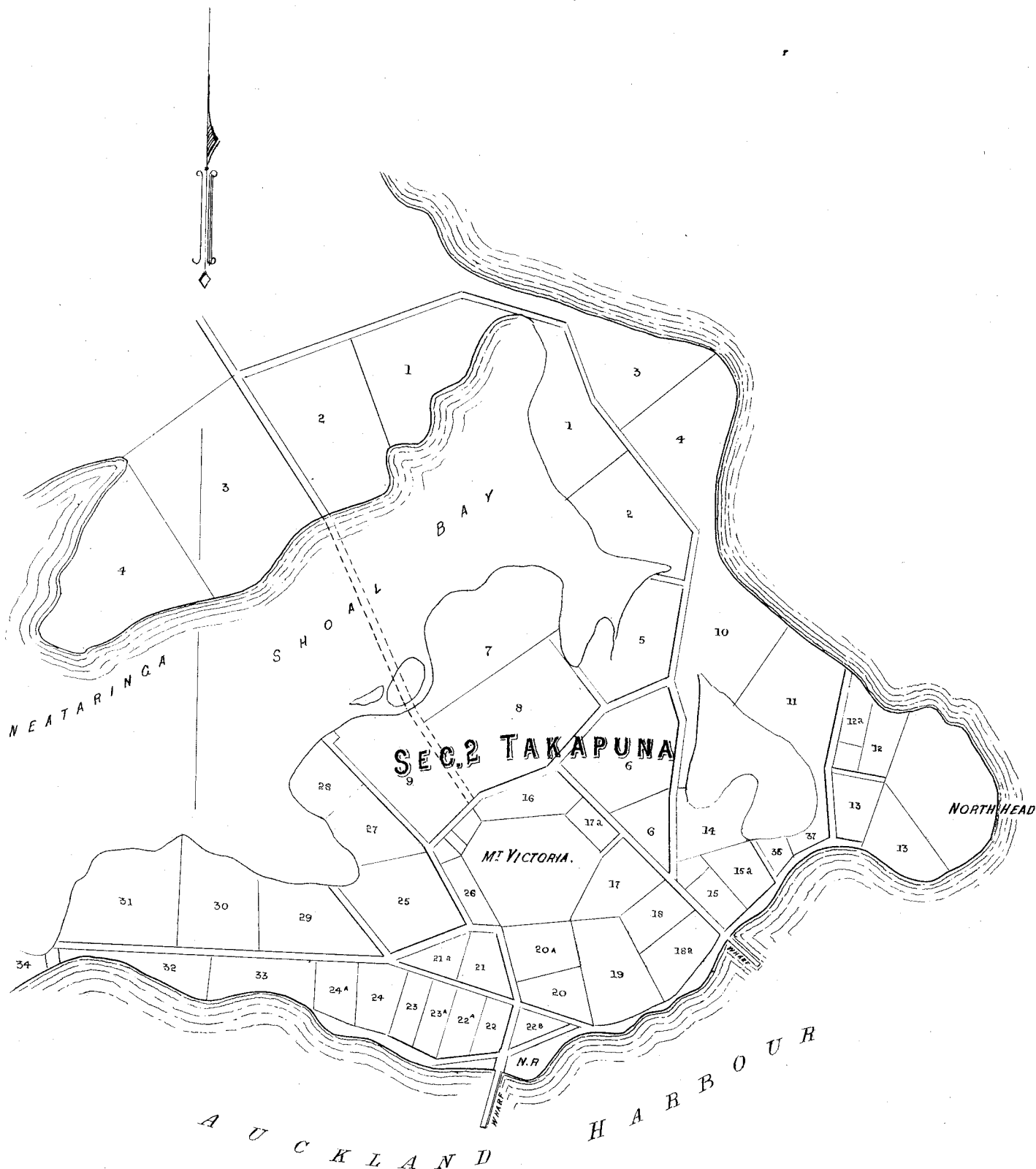
*SHEET N<sup>o</sup> 1.*





# Roads. North of Auckland.

— SHEET N<sup>o</sup> I. —



— REFERENCE. —

Road under Formation -----

Scale, 20 Chains to One Inch.



ROADS IN WAIKATO No 1.

FROM WHATA WHATA TO RAGLAN

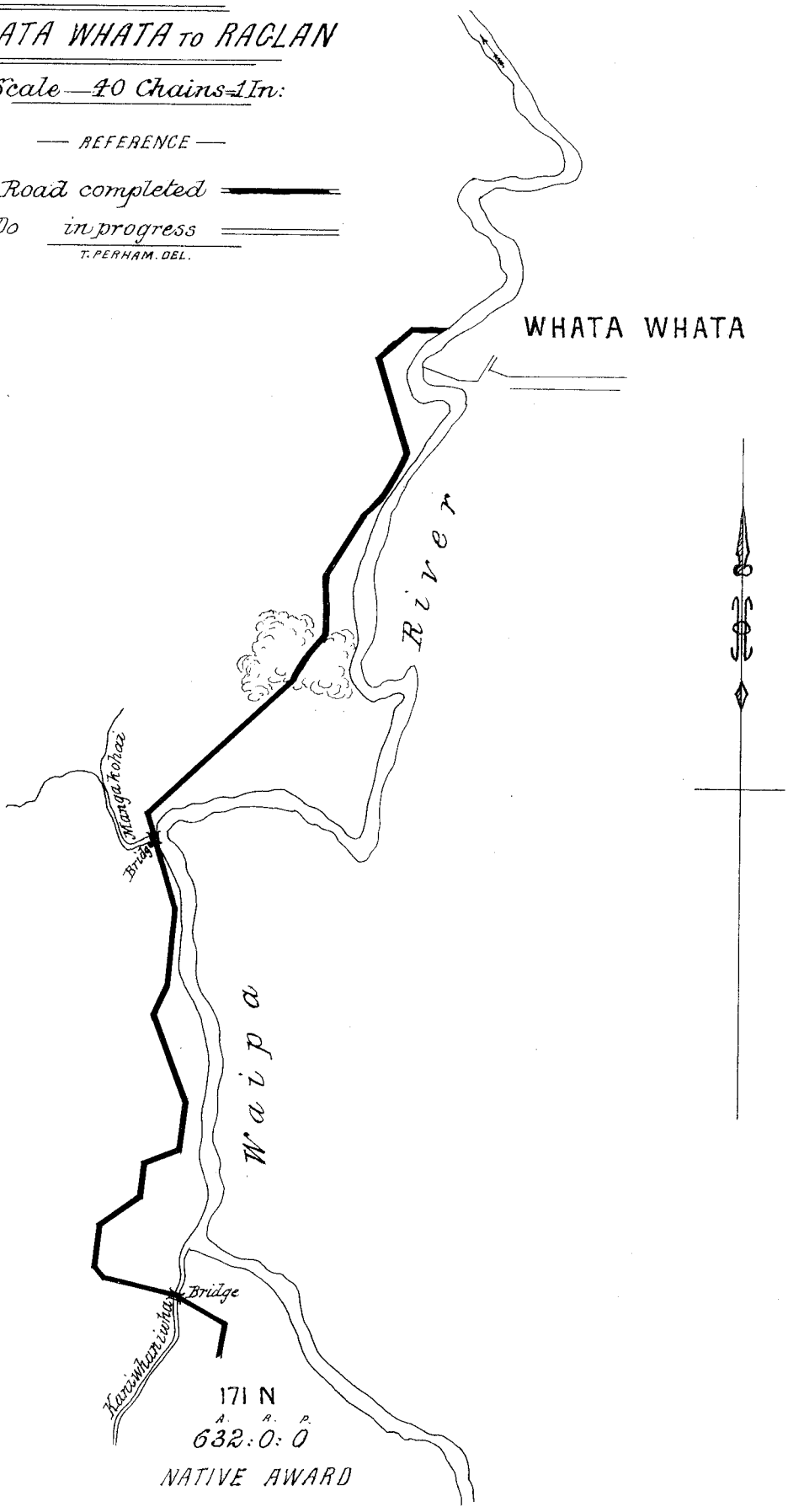
Scale—40 Chains=1 In.

— REFERENCE —

Dray Road completed 

Do in progress 

T. PERHAM. DEL.





# ROADS IN WAIKATO N<sup>o</sup> 2. ACROSS MOANA TUATUA SWAMP

Scale — 40 Chains to 1 In.

— REFERENCE —

Dray Road completed —————

Do in progress =====

T. PERHAM, DEL.

Moana      Tua      Tua

Land

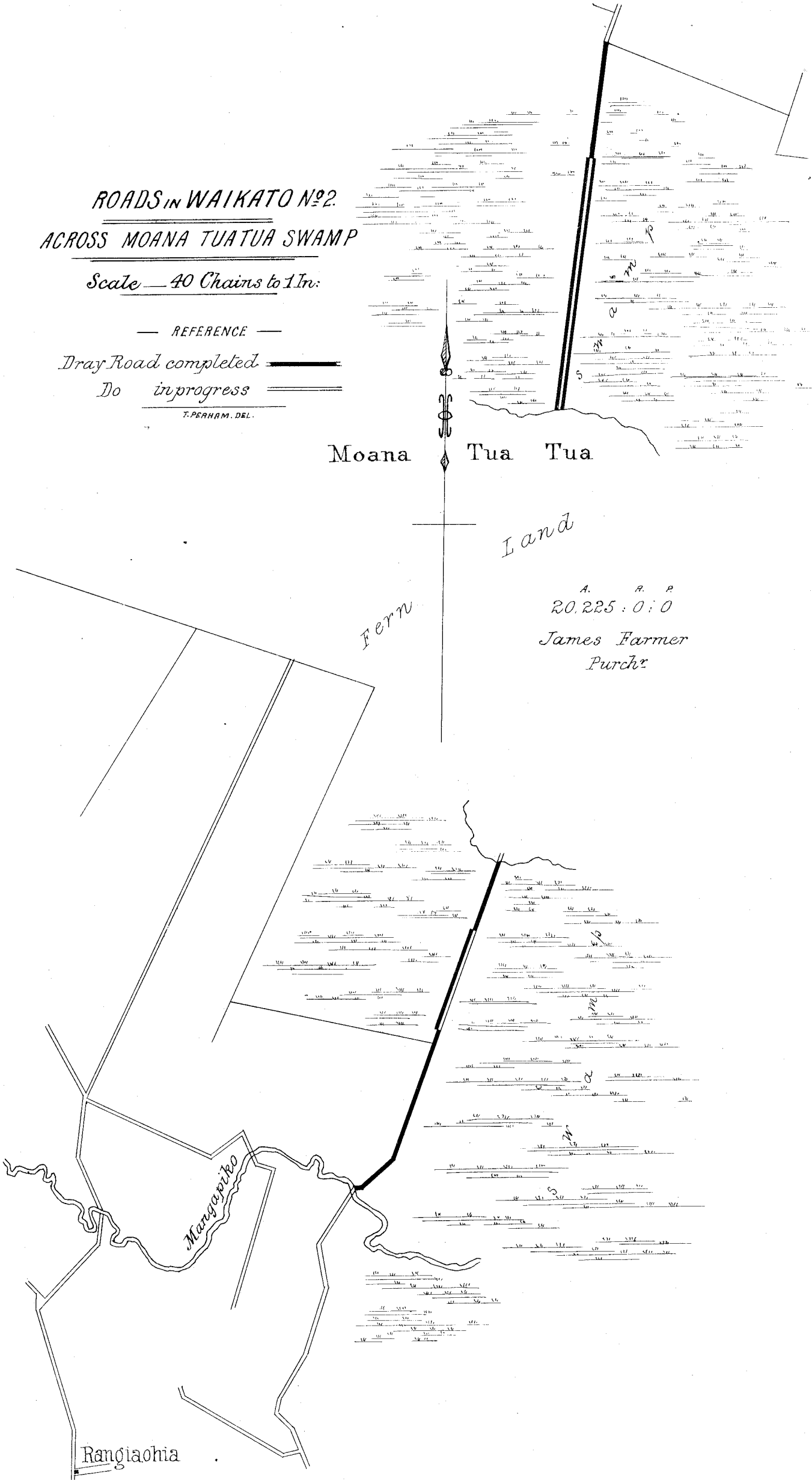
A.      R.      P.  
20,225 : 0 : 0

James Farmer  
Purchr

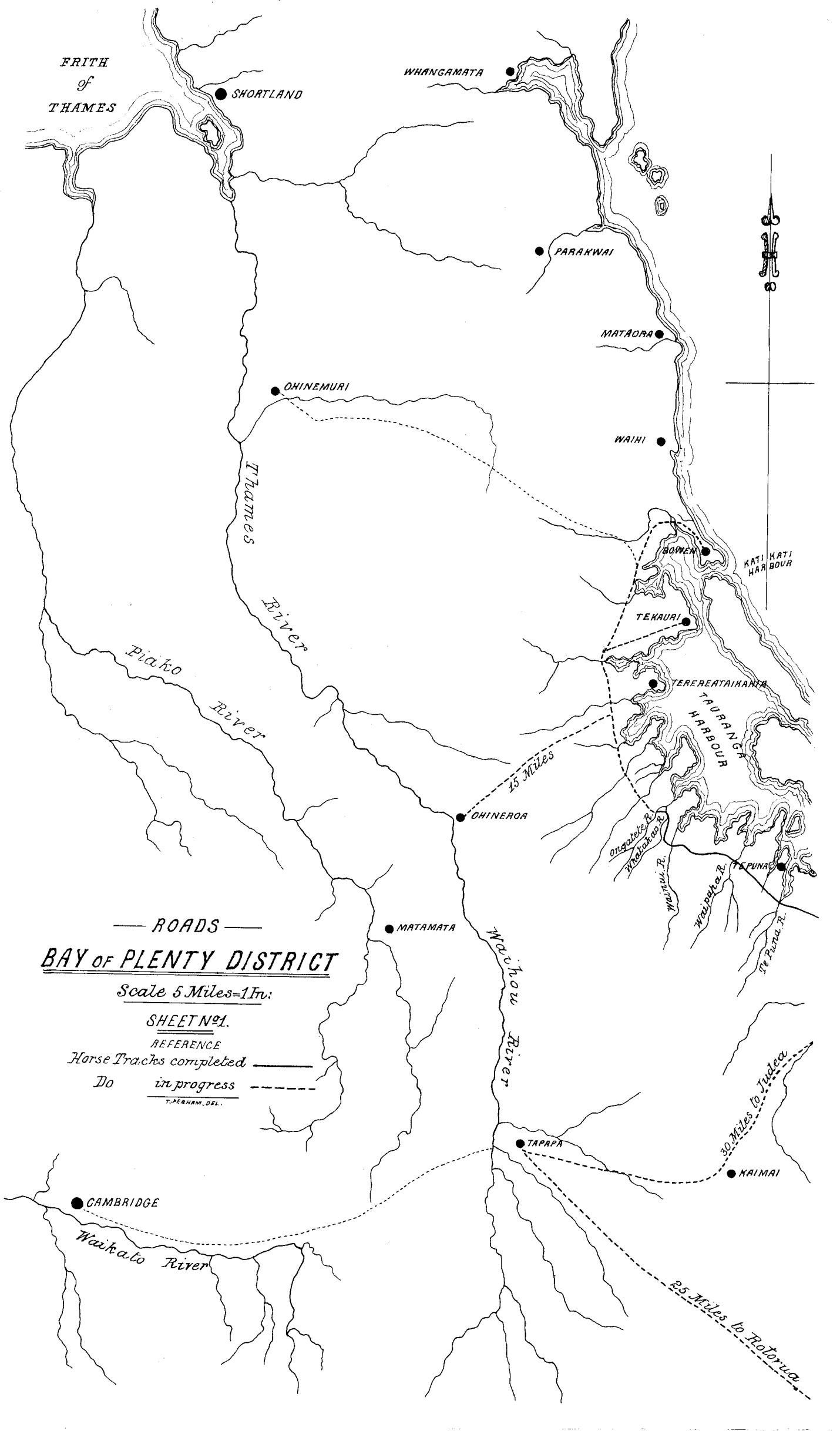
Fern

Mangapiko

Rangiaohia







FRITH  
of  
THAMES

SHORTLAND

WHANGAMATA

PARAKWAI

MATAORA

OHINEMURI

WAIHI

Thames  
River

Piako  
River

KATI KATI  
HARBOUR

BOWEN

TEKAURI

TEREREATAIHANA  
TAURANGA  
HARBOUR

15 Miles

OHINEROA

Ongatete R.  
Whakakao R.

Waipatu R.

Waipatu R.

Te Puna R.

MATAMATA

Waikou  
River

TAPAPA

30 Miles to Tudea

KAIMAI

25 Miles to Rotorua

CAMBRIDGE

Waikato River

— ROADS —  
**BAY OF PLENTY DISTRICT**

Scale 5 Miles=1In.

SHEET No. 1.

REFERENCE

Horse Tracks completed ———

Do in progress - - - - -

T. PERHAM, DEL.



SHEET N<sup>o</sup> 2.  
—ROADS—  
BAY OF PLENTY DISTRICT

Scale 5 Miles to 1 Inch.

## REFERENCE

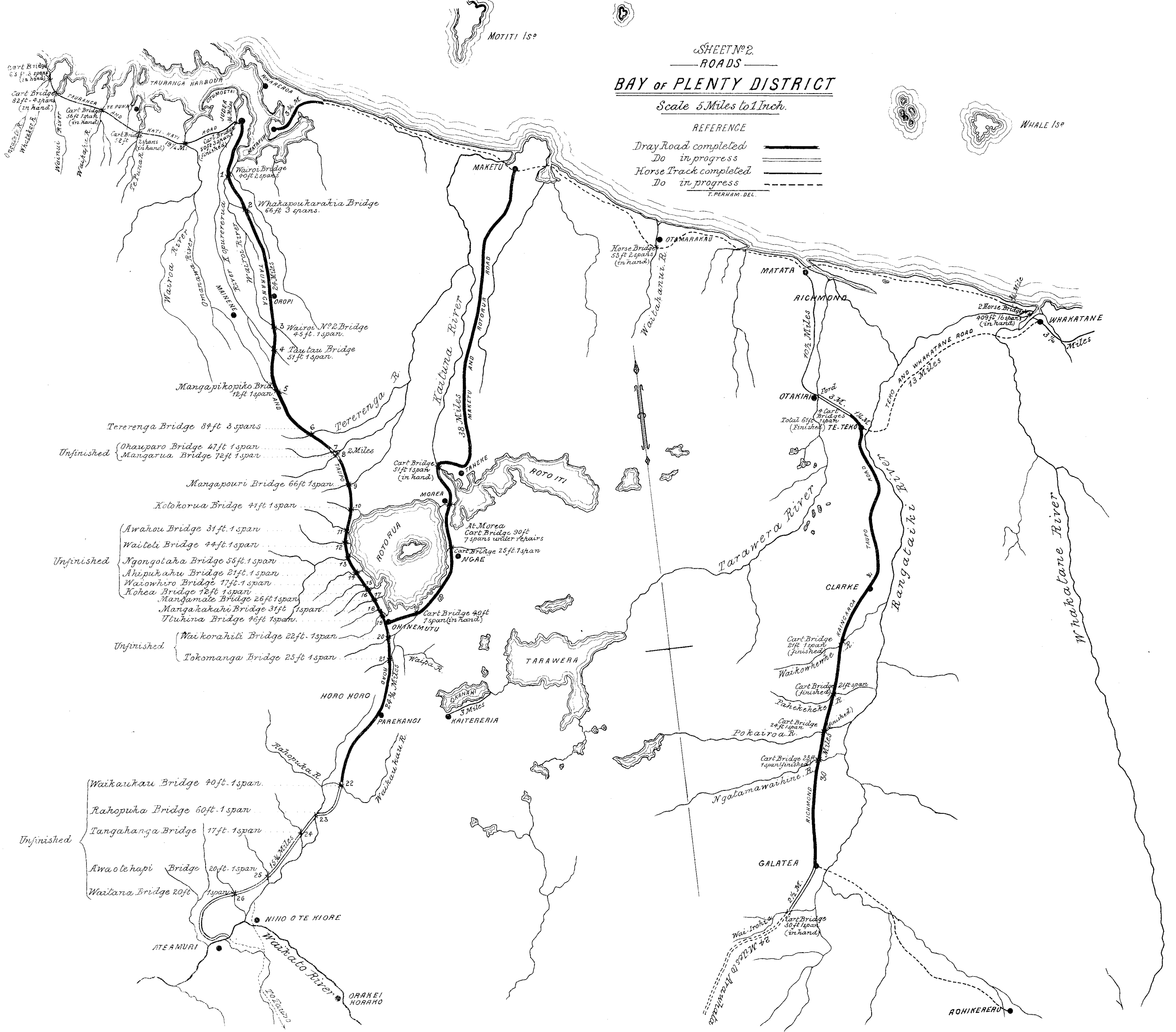
Dray Road completed

*Do in progress*

Horse Track completed

*Do in progress*

T. PERHAM. DEL



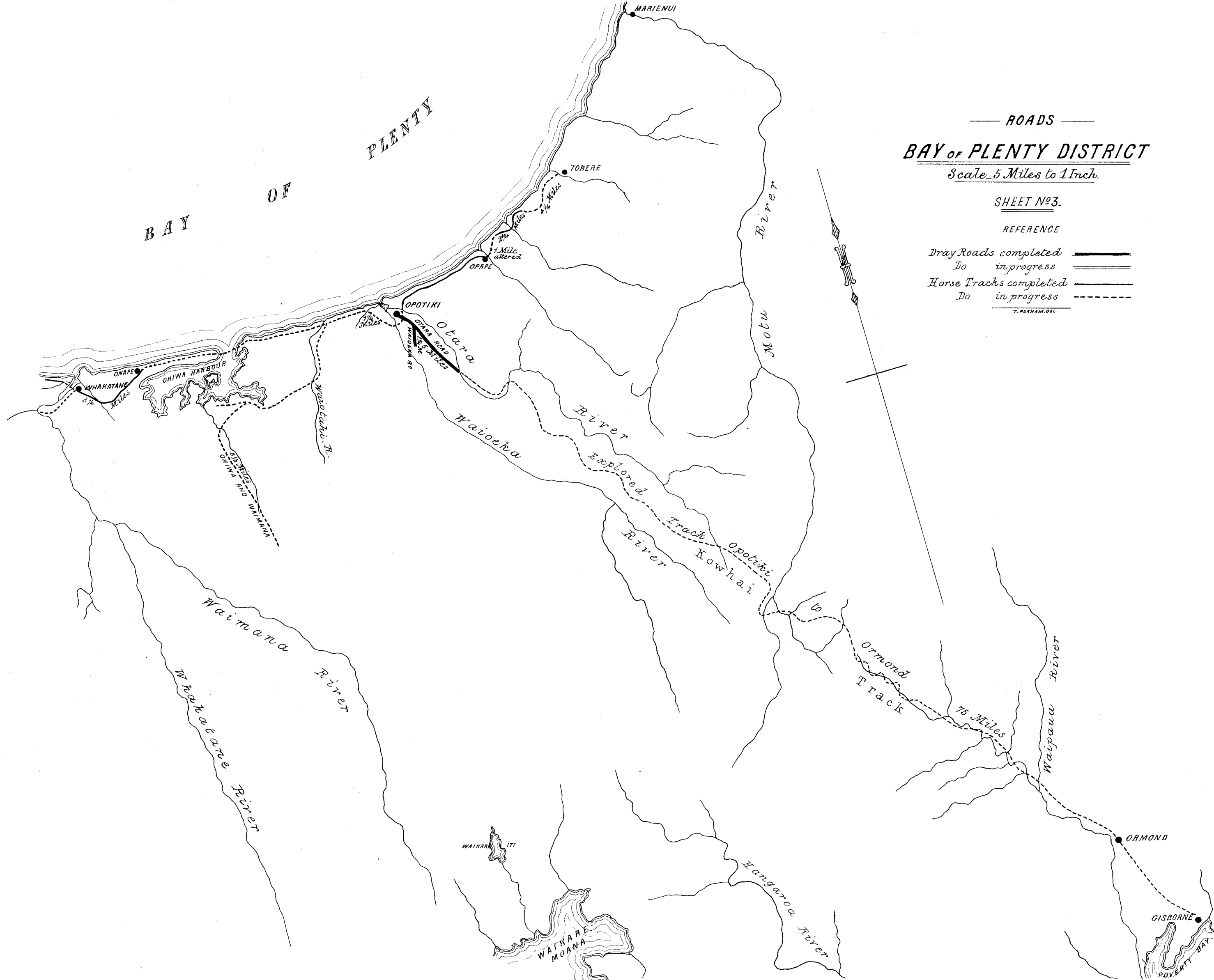


BAY OF PLENTY

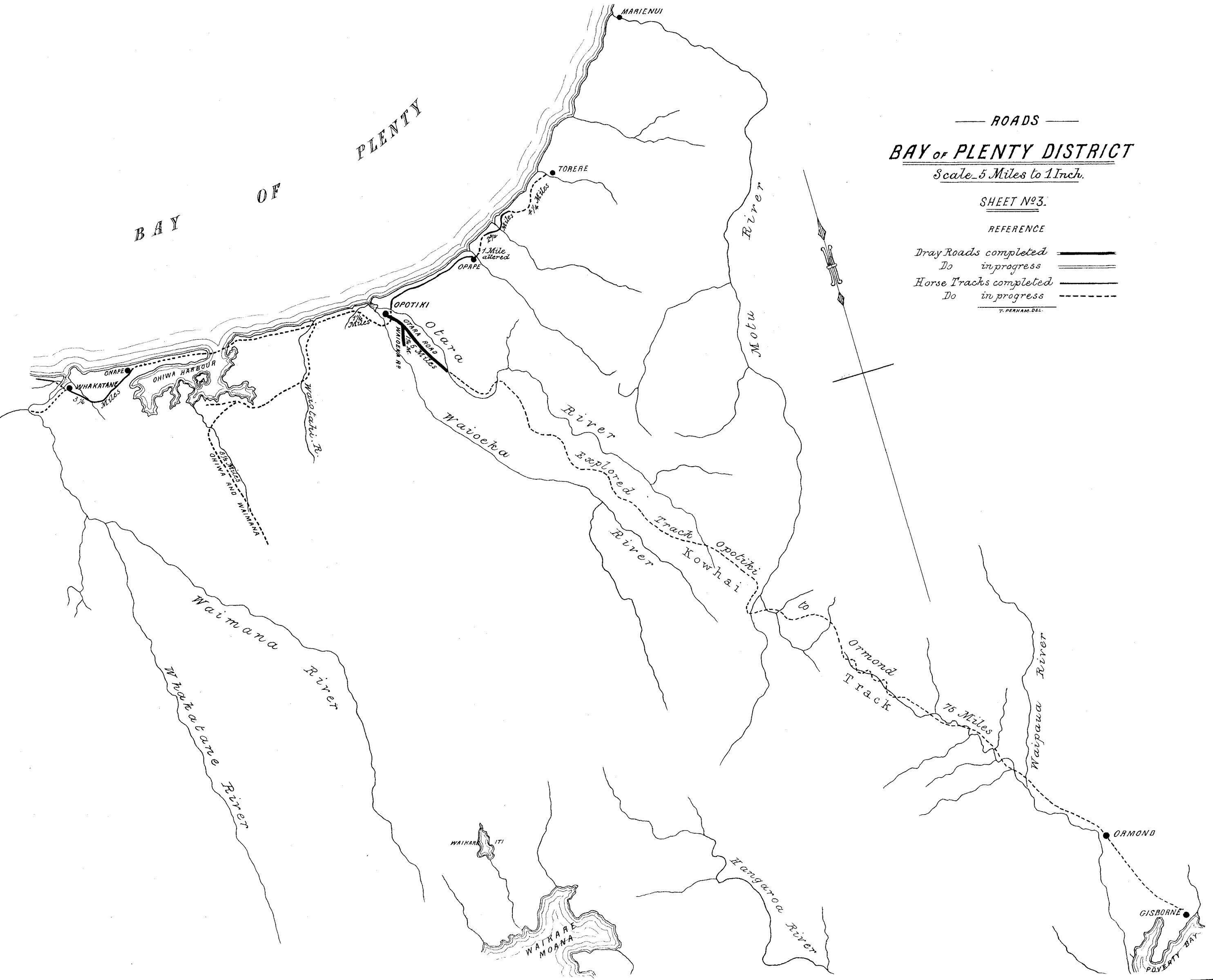
*SHEET No 3.*

|                        |       |
|------------------------|-------|
| Dray Roads completed   | _____ |
| Do in progress         | ===== |
| Horse Tracks completed | _____ |
| Do in progress         | ----- |

T. PERHAM, DB







— ROADS —  
**BAY OF PLENTY DISTRICT**  
*Scale 5 Miles to 1 Inch.*

**SHEET N°3.**

REFERENCE

Dray Roads completed —————  
Do in progress ————  
Horse Tracks completed —————  
Do in progress - - - - -

T. PERHAM, DEL.



*NAPIER-TAUPO ROAD*

Scale 5 Miles to 1 Inch.

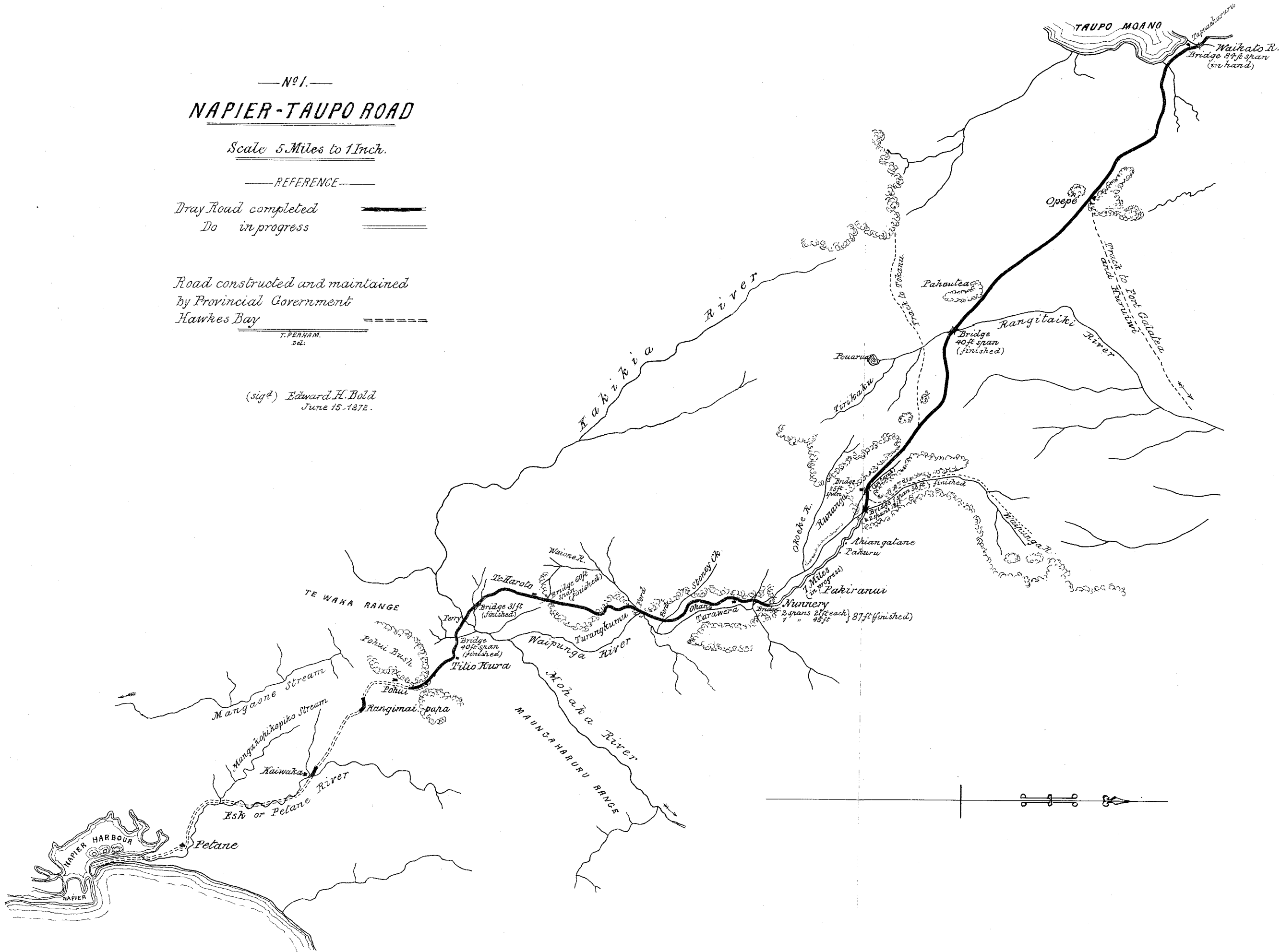
Dray Road completed

*Do in progress*

Road constructed and maintained  
by Provincial Government  
Hawkes Bay

T. PERHAM.  
Del:

(sig<sup>d</sup>) Edward H. Bold  
June 15. 1872.



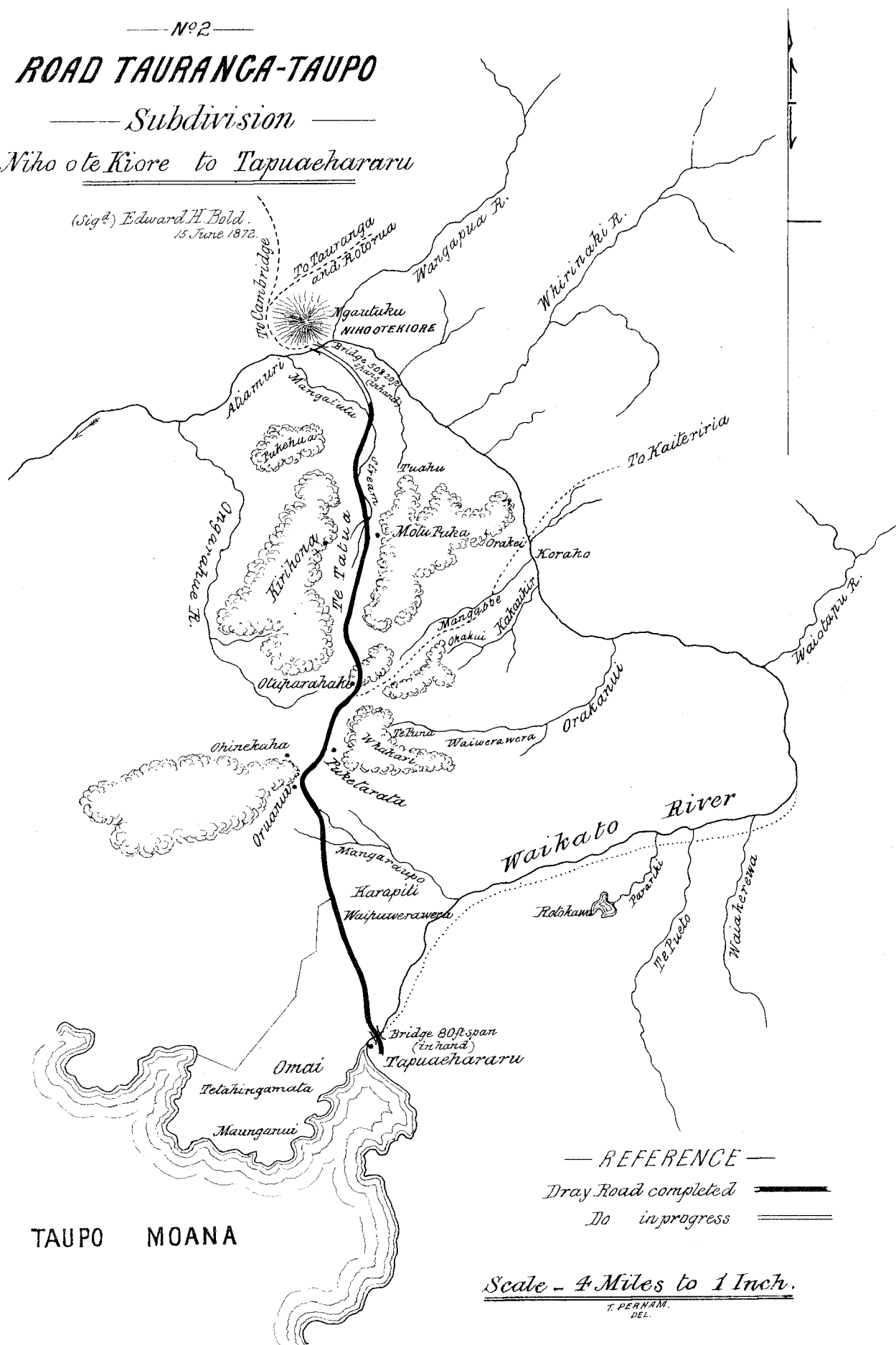


## ROAD TAURANGA-TAUPO

— *Subdivision* —

*Niho o te Kiore to Tapuaehararu*

(Sig<sup>d</sup>) Edward H. Bold.  
15 June 1872.

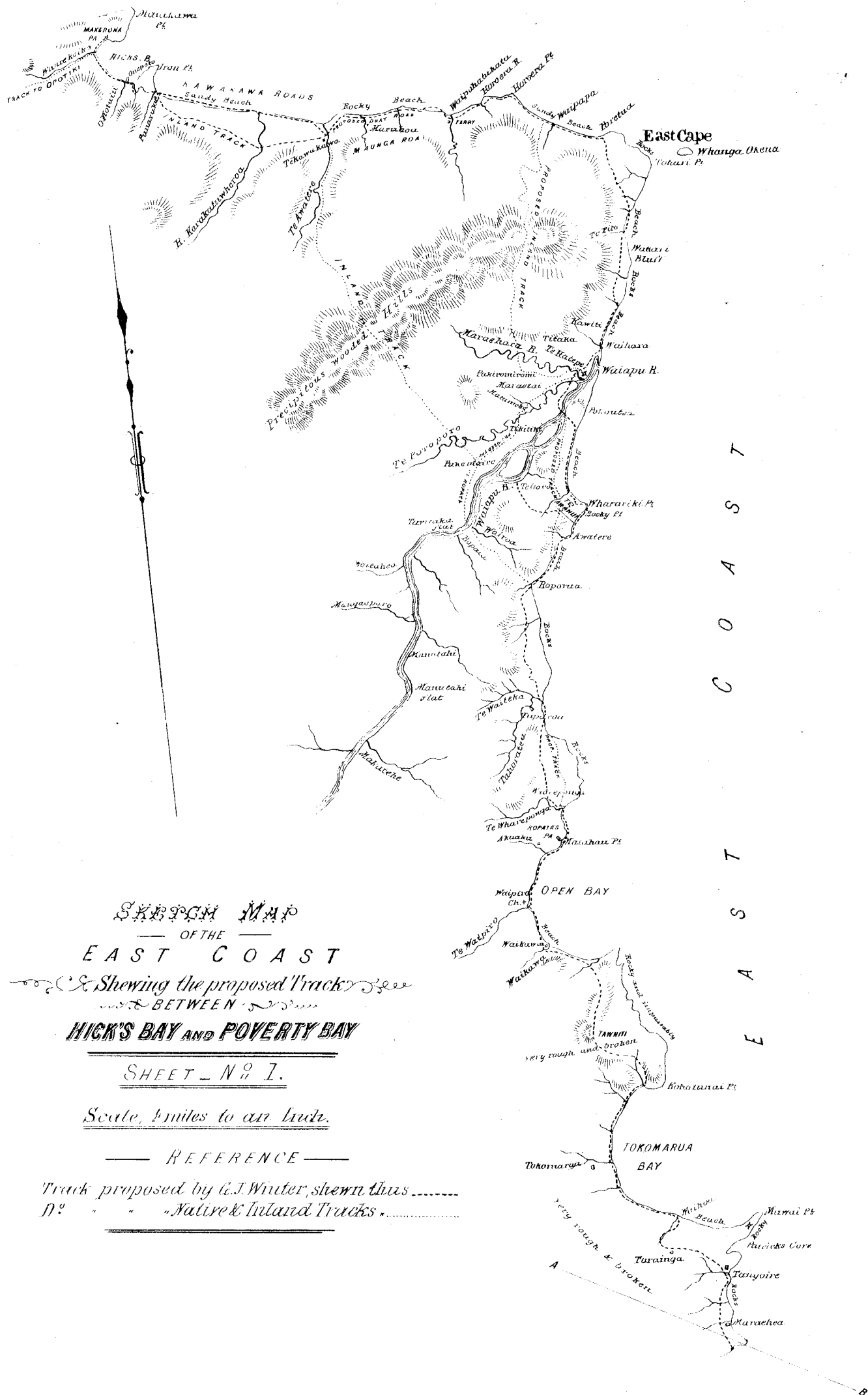


TAUPO MOANA

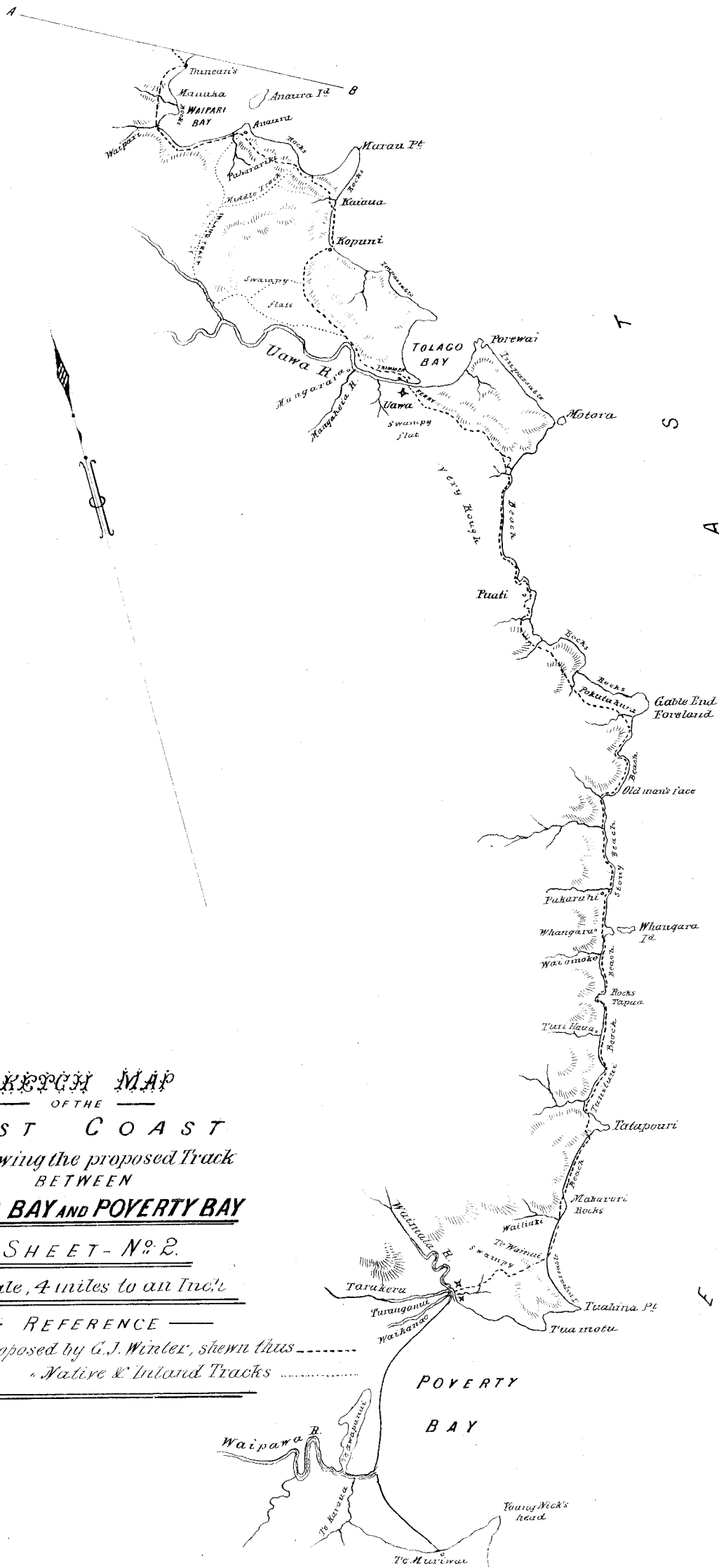
Scale - 4 Miles to 1 Inch.

T. PERMANO.  
DEL









# **SKETCH MAP**

OF THE  
**EAST COAST**

Shewing the proposed Track  
BETWEEN

**HICK'S BAY AND POVERTY BAY**

**SHEET - N<sup>o</sup> 2.**

Scale, 4 miles to an Inch

REFERENCE

Track proposed by G.J. Winter, shewn thus -----  
D<sup>o</sup> " " Native & Inland Tracks .....



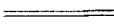
Tangatuta

ROADS

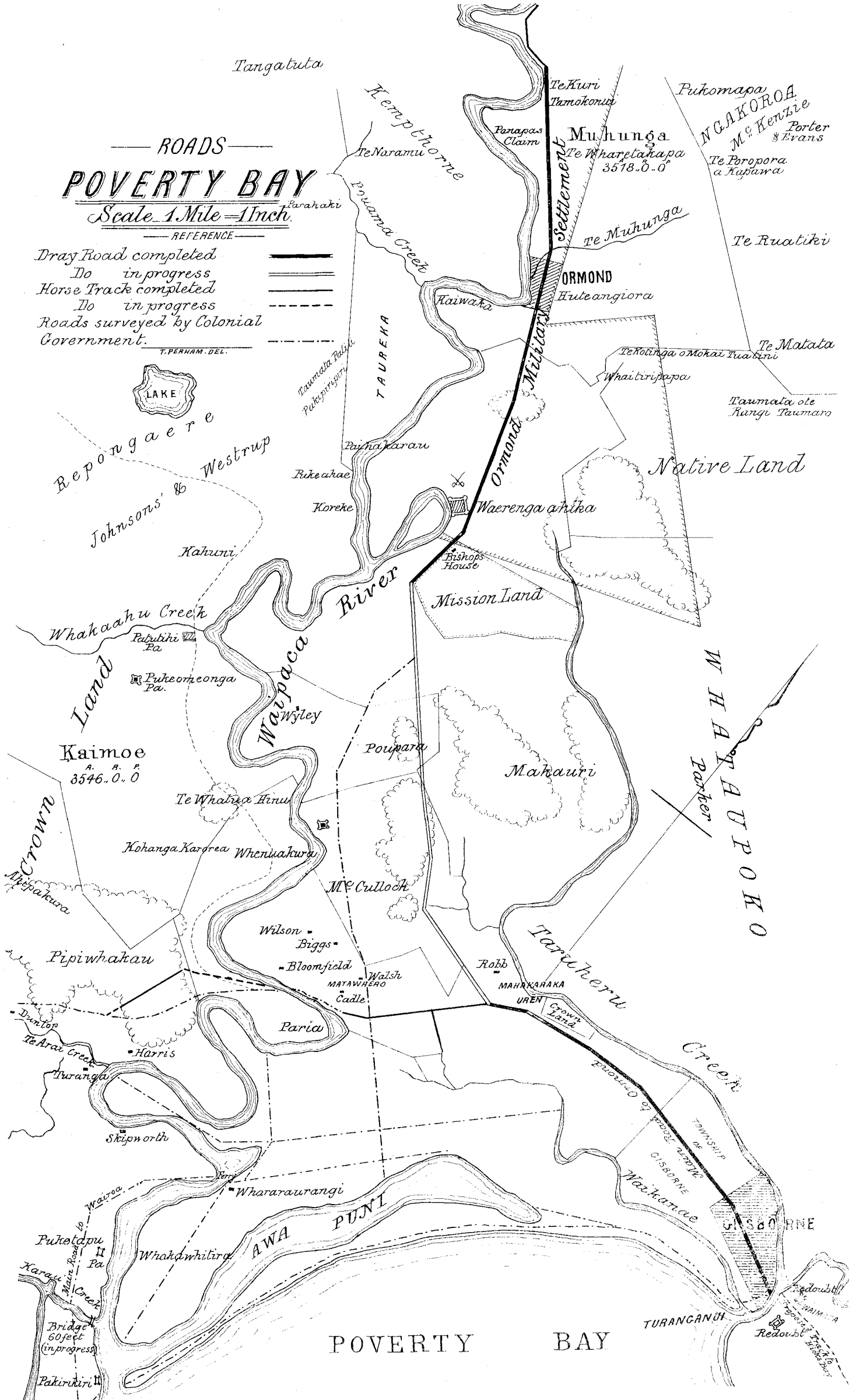
# POVERTY BAY

Scale 1 Mile = 1 Inch.

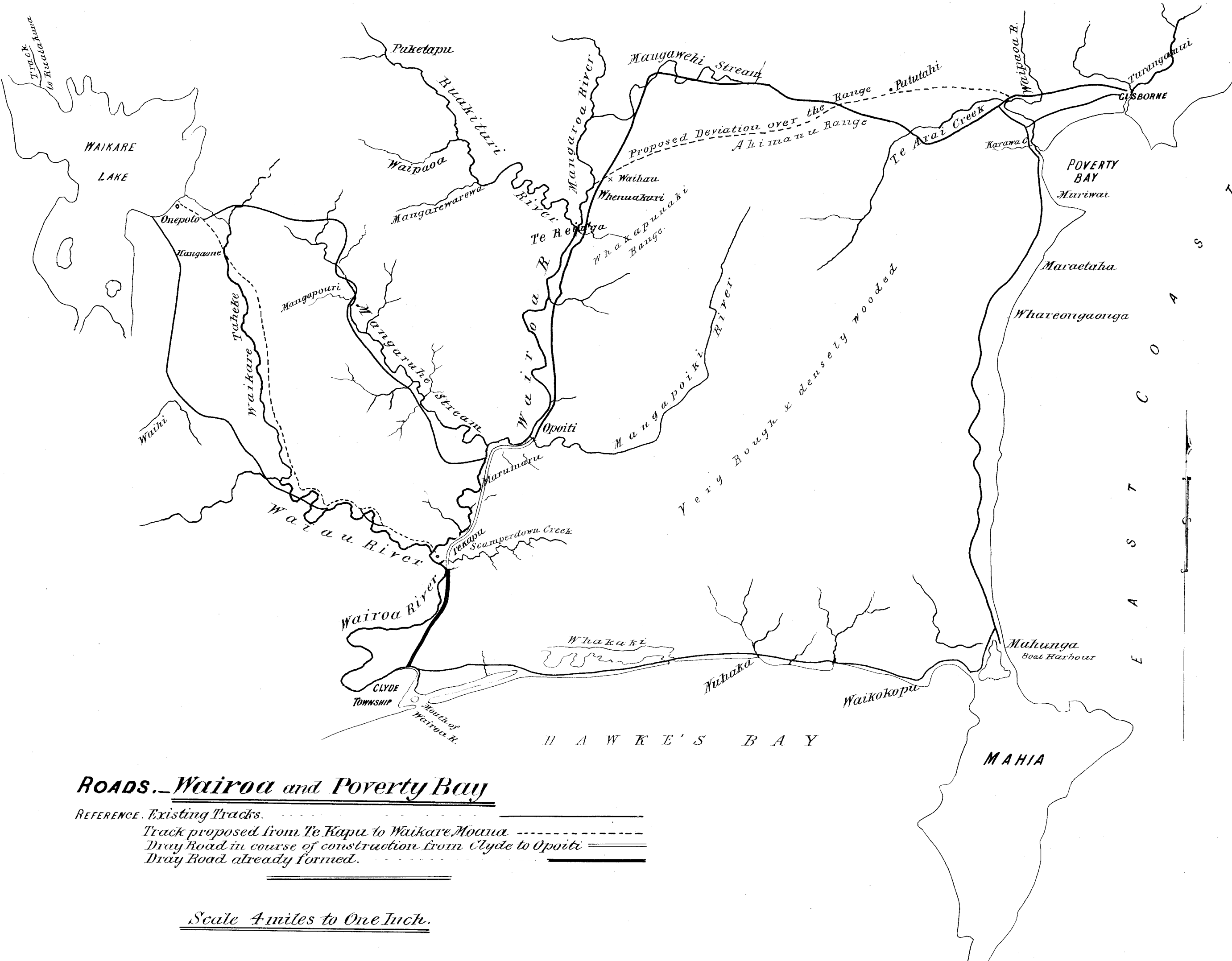
REFERENCE

- Dray Road completed   
Do in progress   
Horse Track completed   
Do in progress   
Roads surveyed by Colonial Government. 

T. PERHAM. DEL.







**ROADS.—Wairoa and Poverty Bay**

REFERENCE. Existing Tracks. ....  
Track proposed from Te Kapu to Waikare Moana -----  
Dray Road in course of construction from Clyde to Opoiti =====  
Dray Road already formed. =====

Scale 4 miles to One Inch.

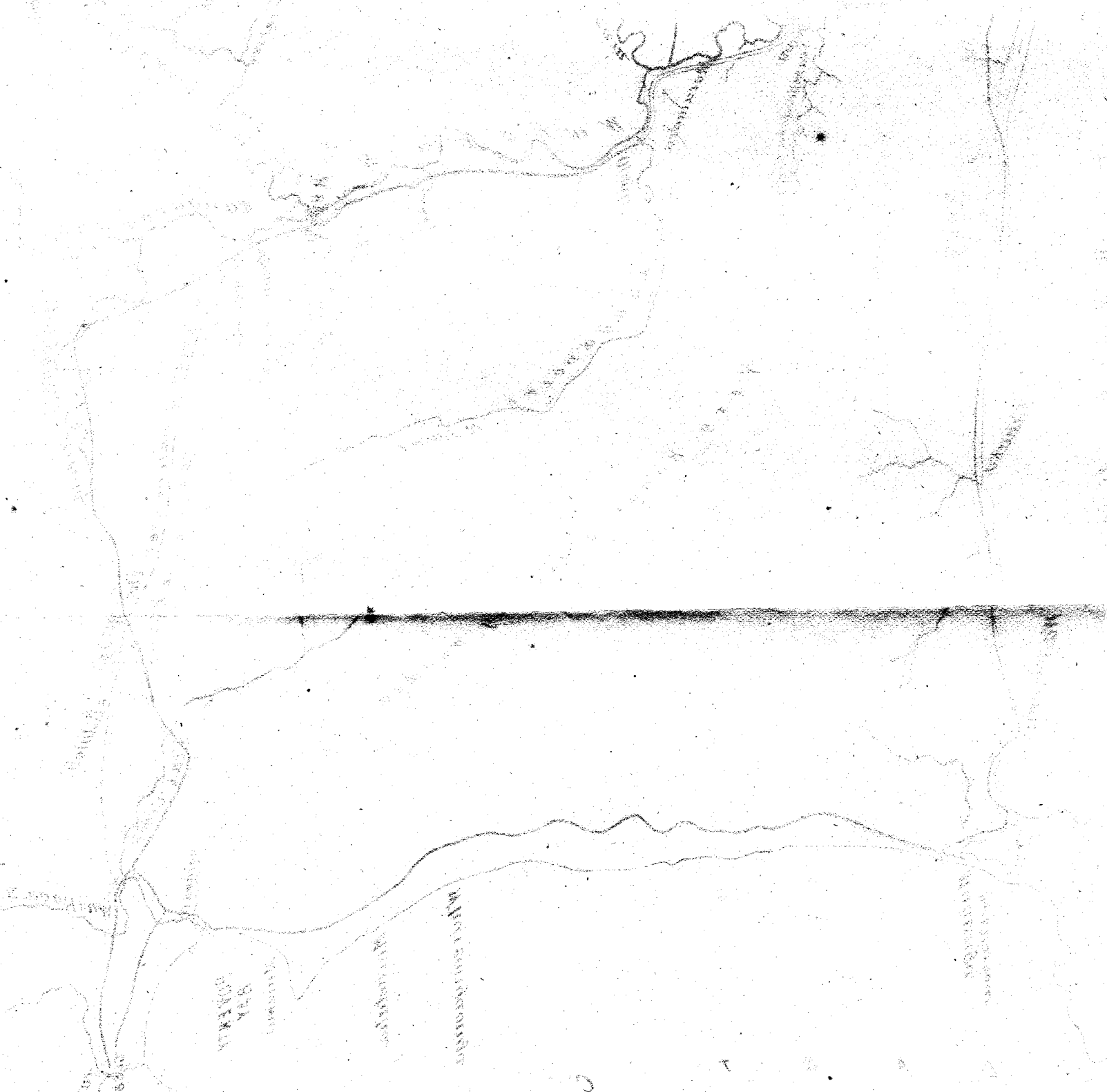
POWERS - MICHIGAN - 1916

Map of Michigan showing the location of the Powers family in 1916.

Map of Michigan showing the location of the Powers family in 1916.

1916

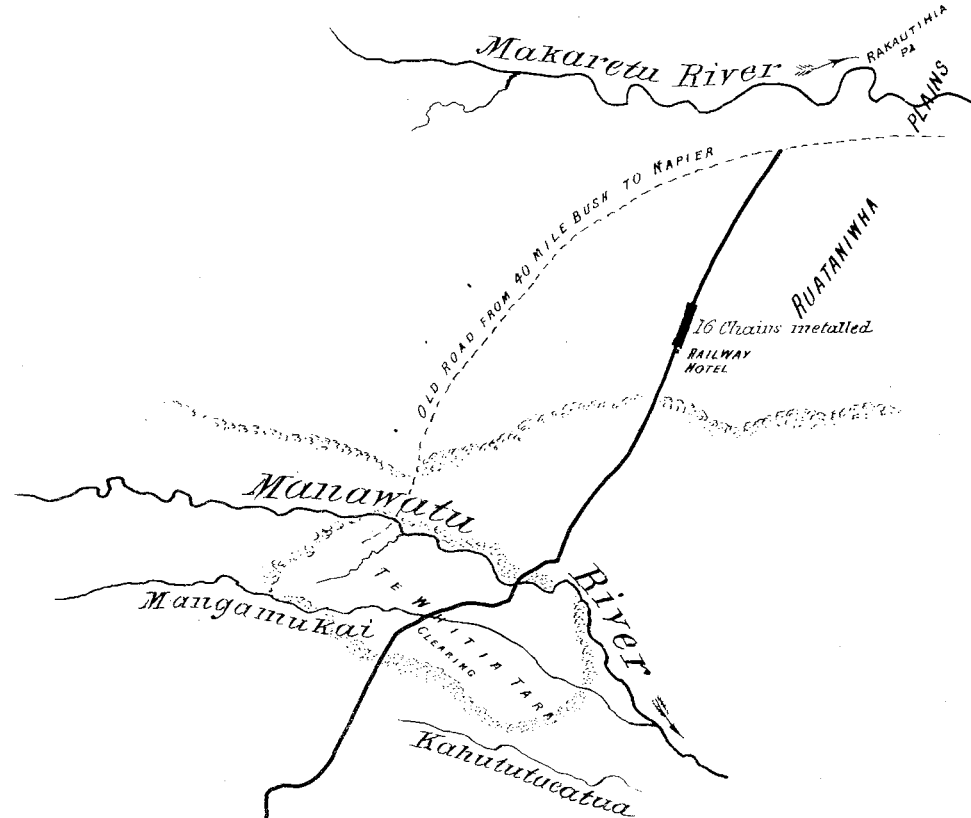
Map of Michigan showing the location of the Powers family in 1916.



Ruataniwha to Manawatu Gorge  
ROAD through Seventy Mile Bush.

— Sheet No. 1. —

A. KOCH. DEL.



— REFERENCE. —

Dray Road completed ————  
 Horse Road completed ————

Scale: One inch to a mile.



# Ruataniwha to Manawatu Gorge

## ROAD through Seventy Mile Bush.

Sheet No. 2.

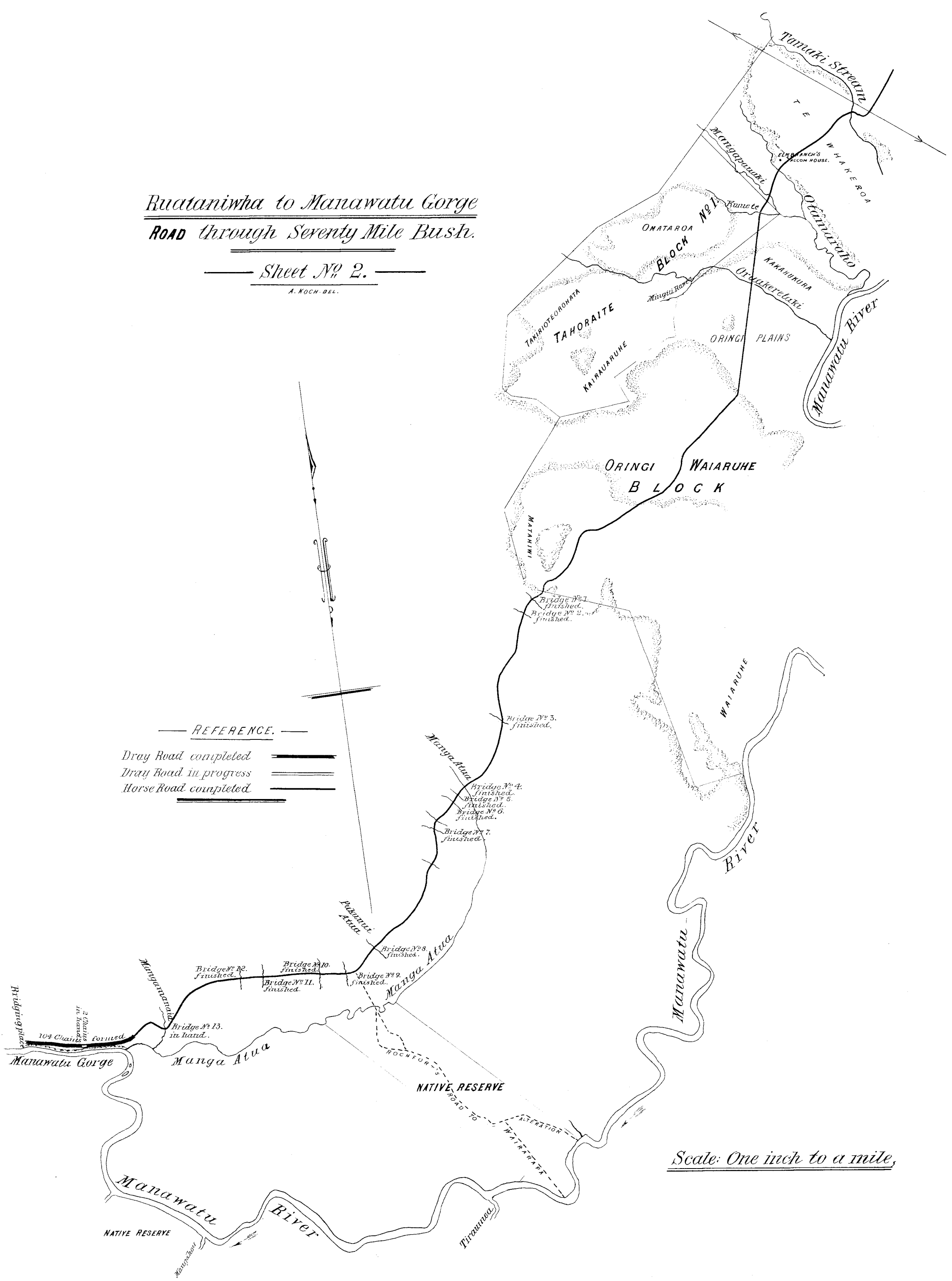
A. KOCH. DEL.

REFERENCE.

Dray Road completed

Dray Road in progress

Horse Road completed



Scale: One inch to a mile.



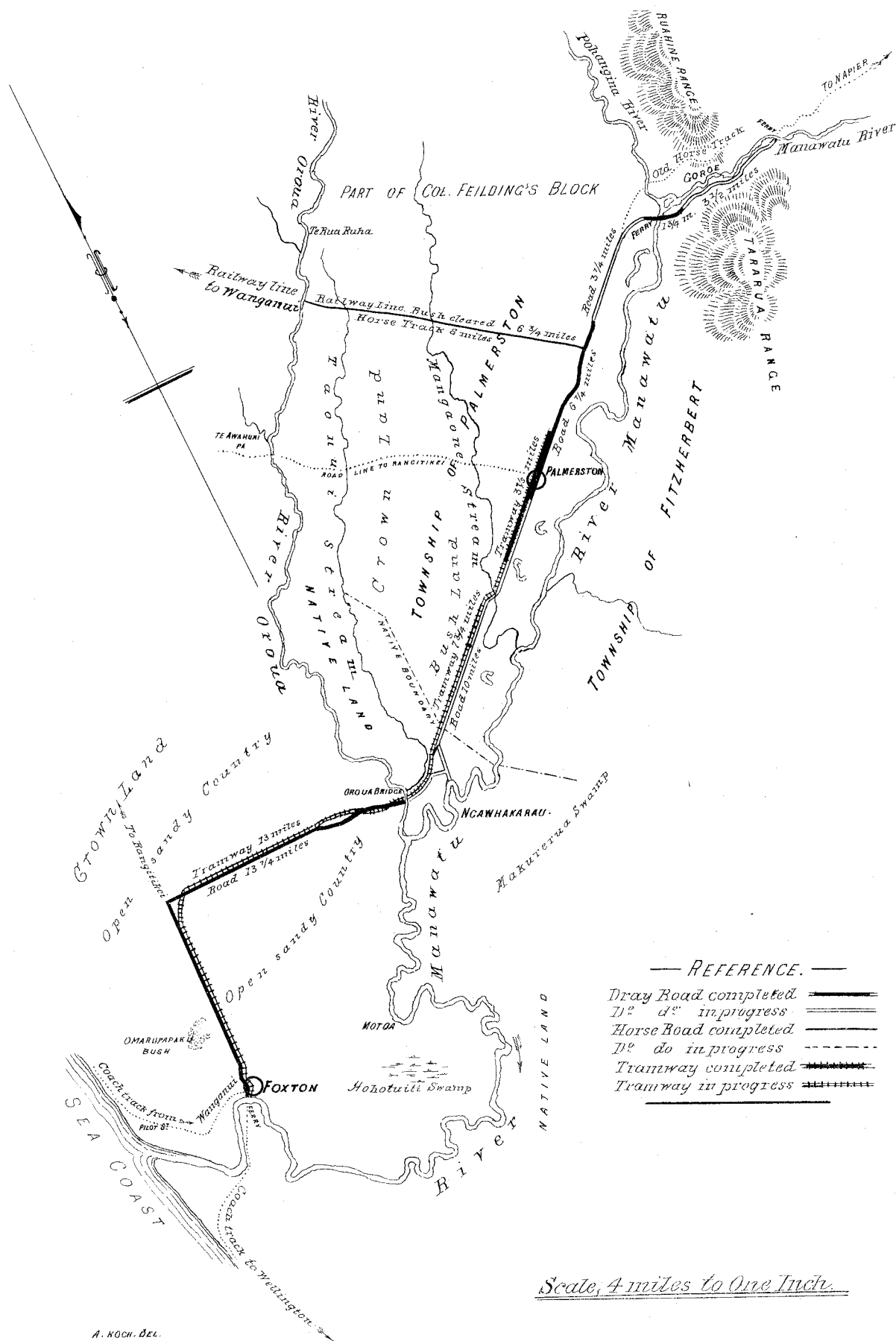
# MANAWATU DISTRICT

## LINE OF ROAD. Foxton to Gorge

### — joining Line to Napier —

ALSO

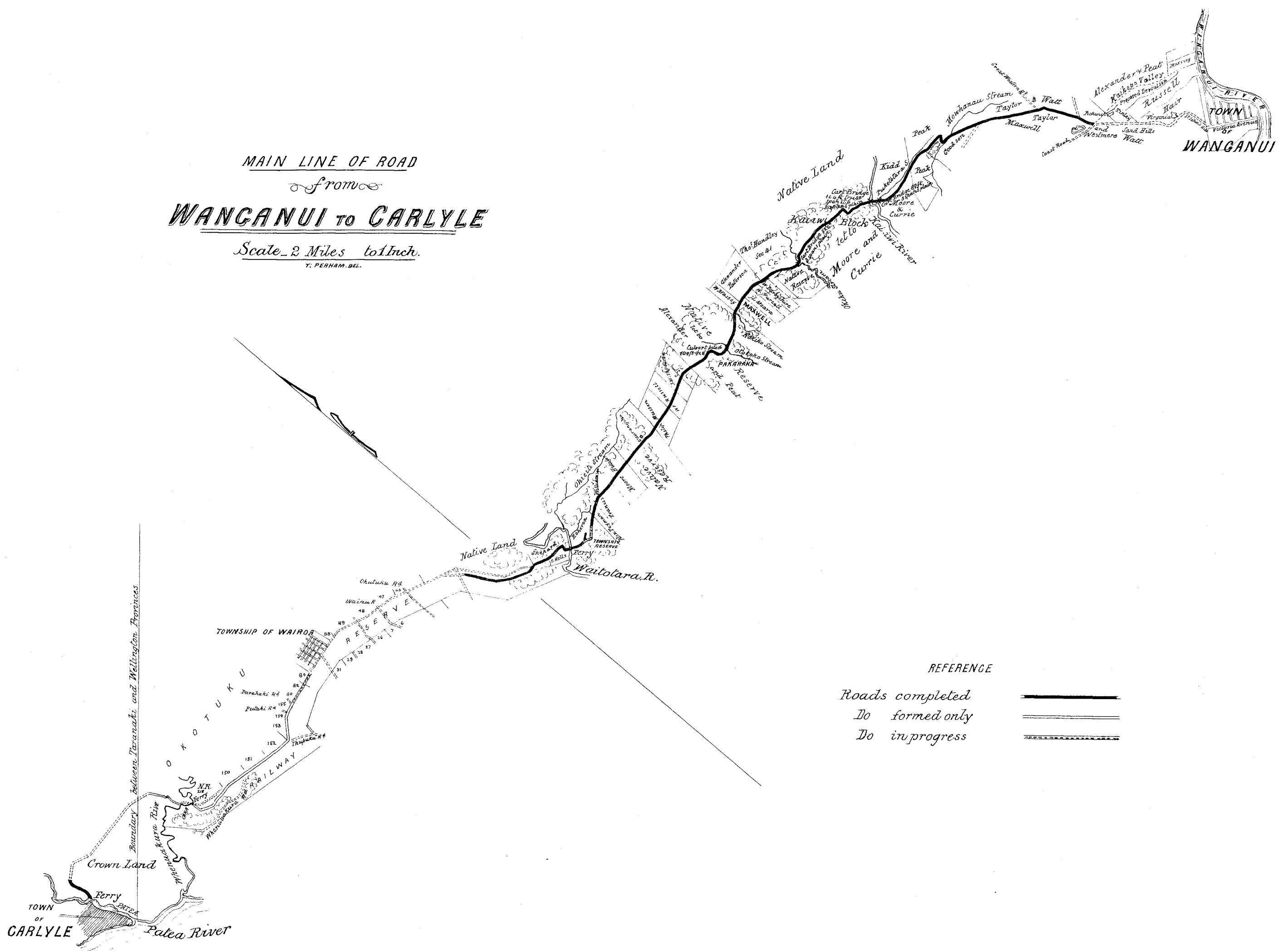
TRAMWAY Foxtown to Palmerston.



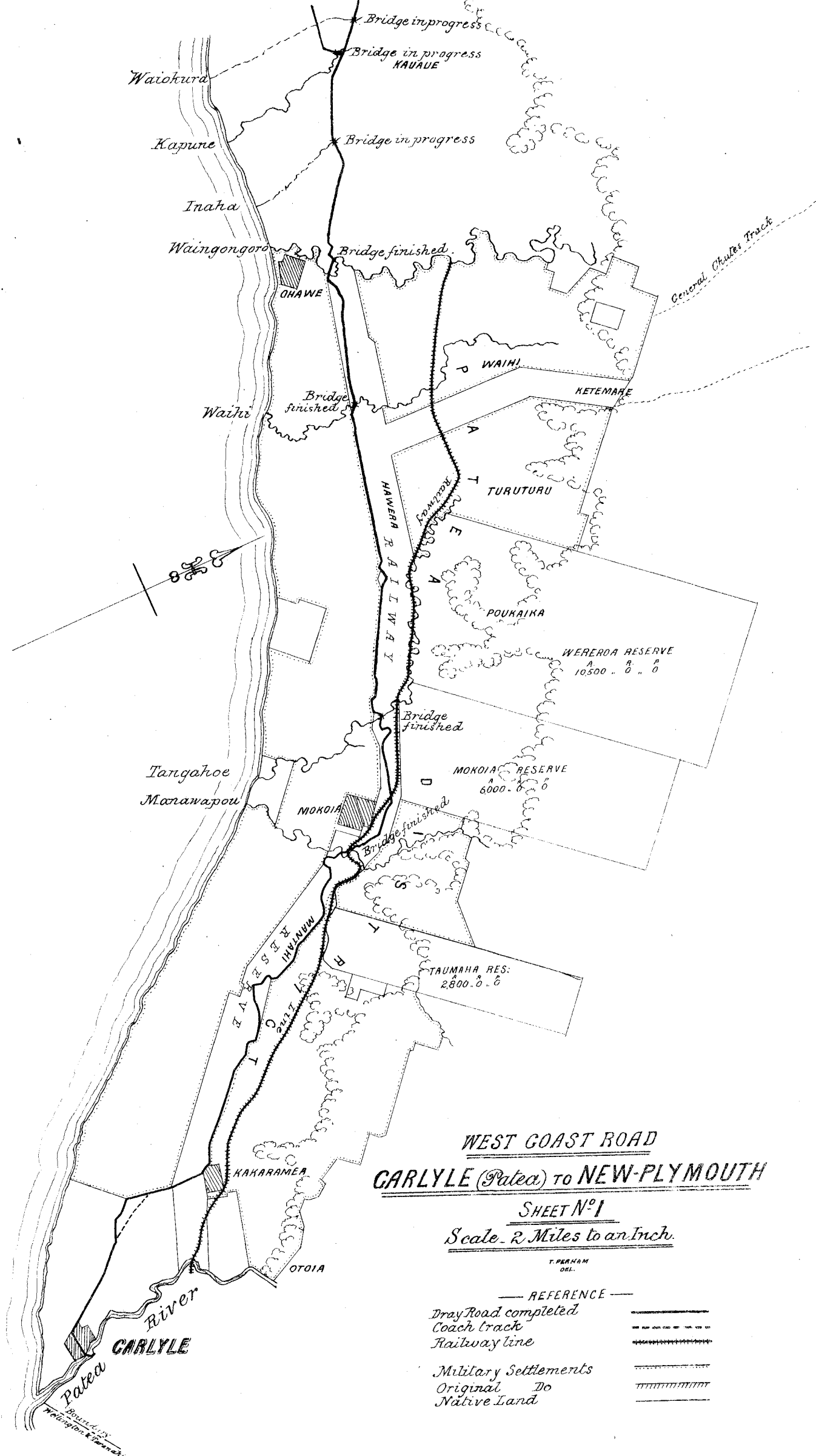


MAIN LINE OF ROAD  
from  
**WANGANUI TO CARLYLE**

Scale 2 Miles to 1 Inch.  
T. PERHAM, DEL.





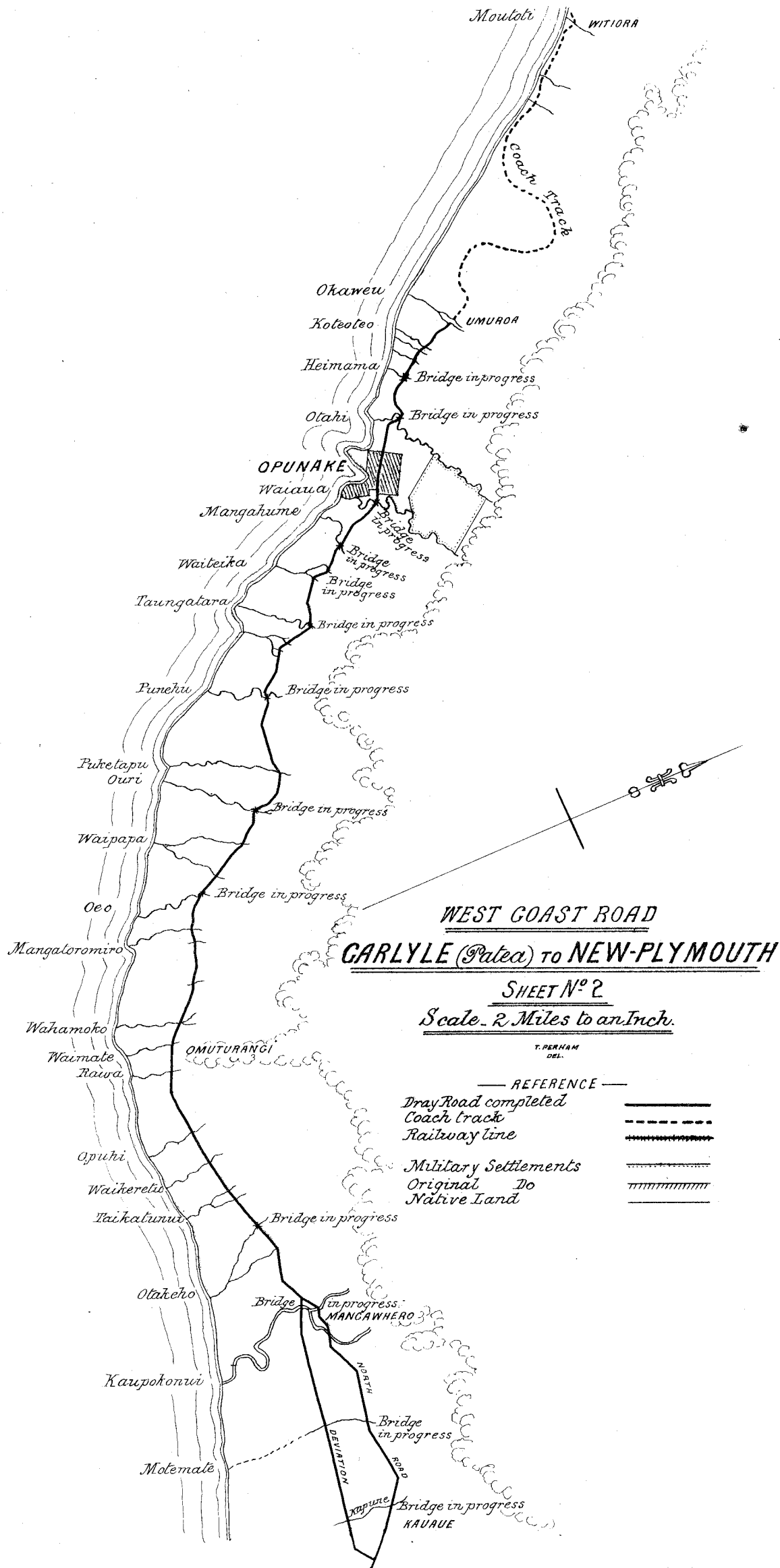


WEST COAST ROAD  
CARLYLE (Patea) TO NEW-PLYMOUTH  
SHEET N°1  
Scale 2 Miles to an Inch.

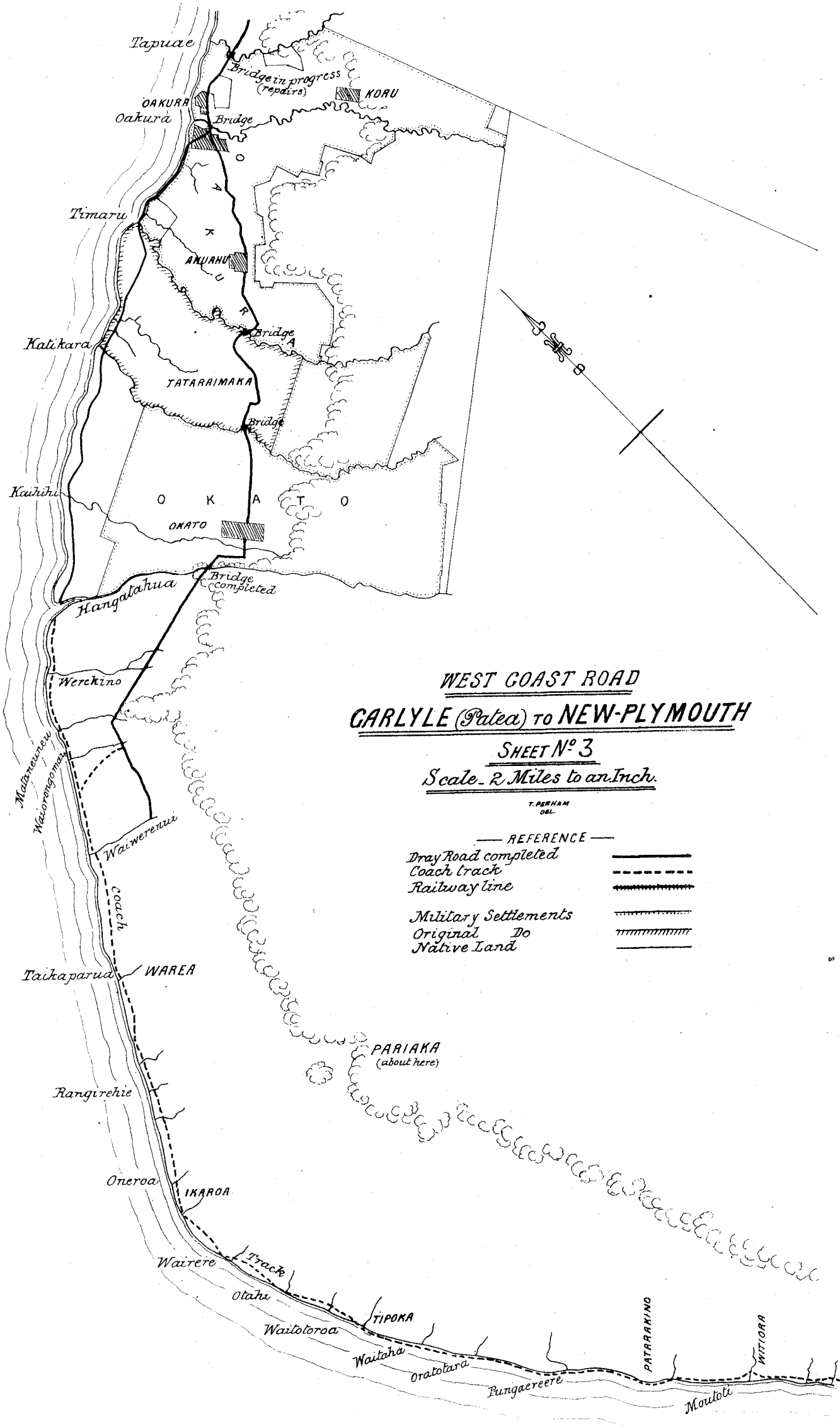
T. PERHAM DEL.

- REFERENCE —
- Dray Road completed —————
  - Coach track ————
  - Railway line ————
  - Military Settlements ————
  - Original Do ————
  - Native Land ————









WEST COAST ROAD  
CARLYLE (Patea) TO NEW-PLYMOUTH

SHEET N° 3  
Scale - 2 Miles to an Inch.

T. PERHAM  
 DEL.

| REFERENCE            |           |
|----------------------|-----------|
| Dray Road completed  | —————     |
| Coach track          | - - - - - |
| Railway line         | +++++     |
| Military Settlements |           |
| Original Do          |           |
| Native Land          |           |

# WEST COAST ROAD CARLYLE (BANK) to NEW PLYMOUTH

SHEET No. 3  
Scale 1:50,000

REFERENCE  
 Railway line  
 Coach road  
 Military Settlement  
 Original Do  
 Native Land



# WEST COAST ROAD CARLYLE (Patea) TO NEW-PLYMOUTH

SHEET N° 4

Scale - 2 Miles to an Inch.

T. PERHAM  
DES.

## REFERENCE

Dray Road completed

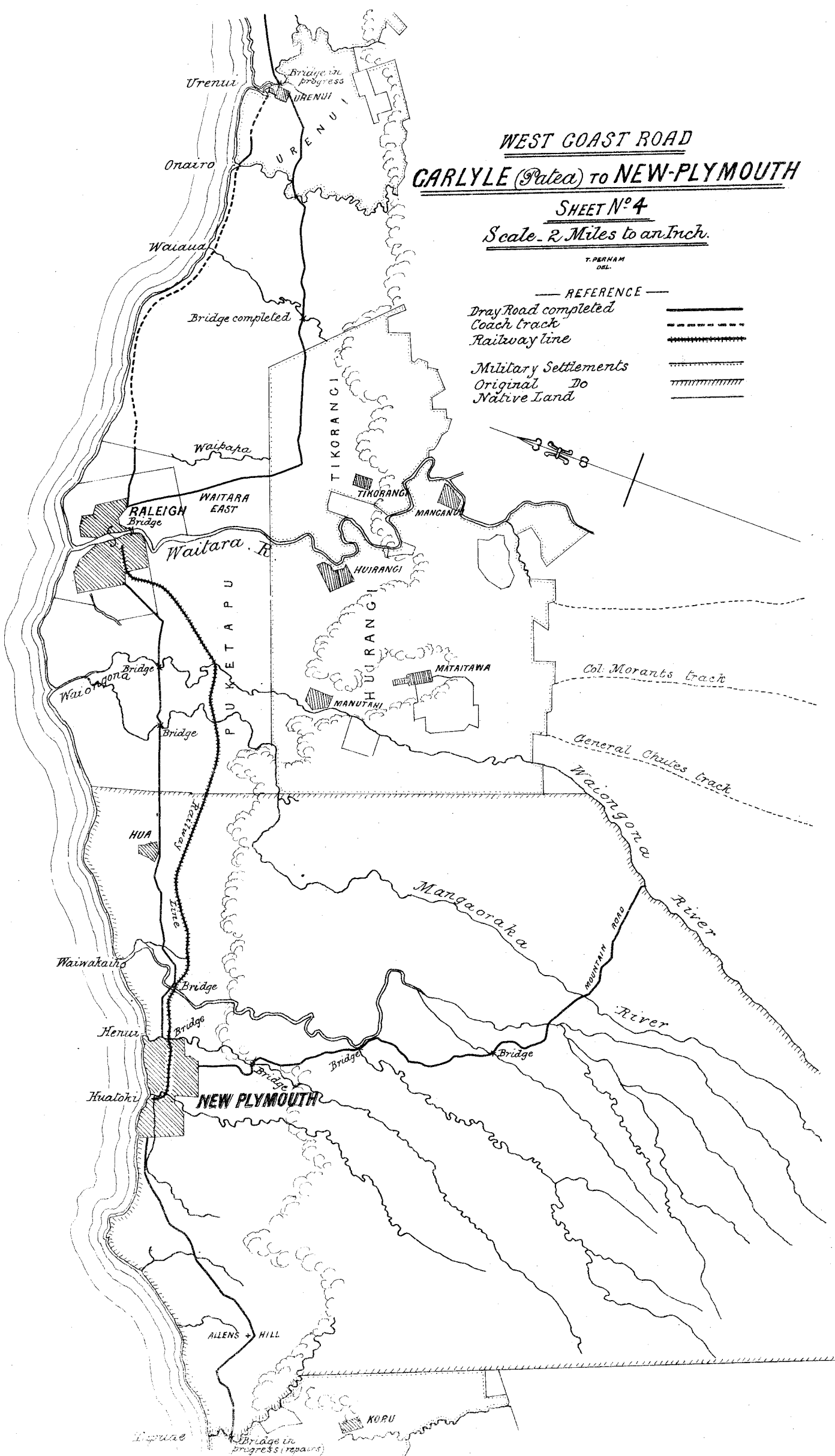
Coach track

Railway line

Military Settlements

Original Do

Native Land

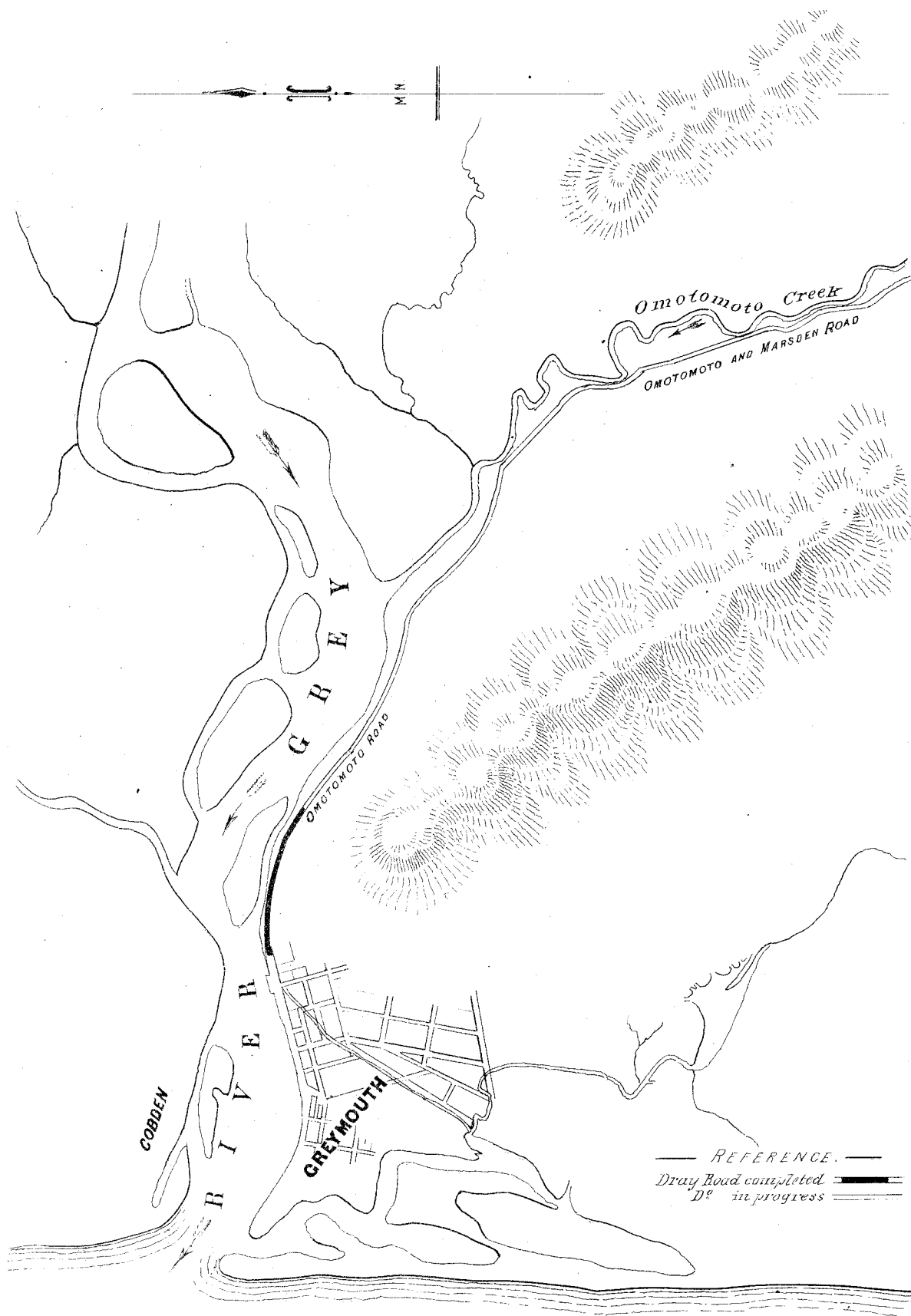




COUNTY OF WESTLAND N.Z.  
ROAD. — Grey to Omotomoto.

2 miles. — Work completed equal to 41 chains.

A.

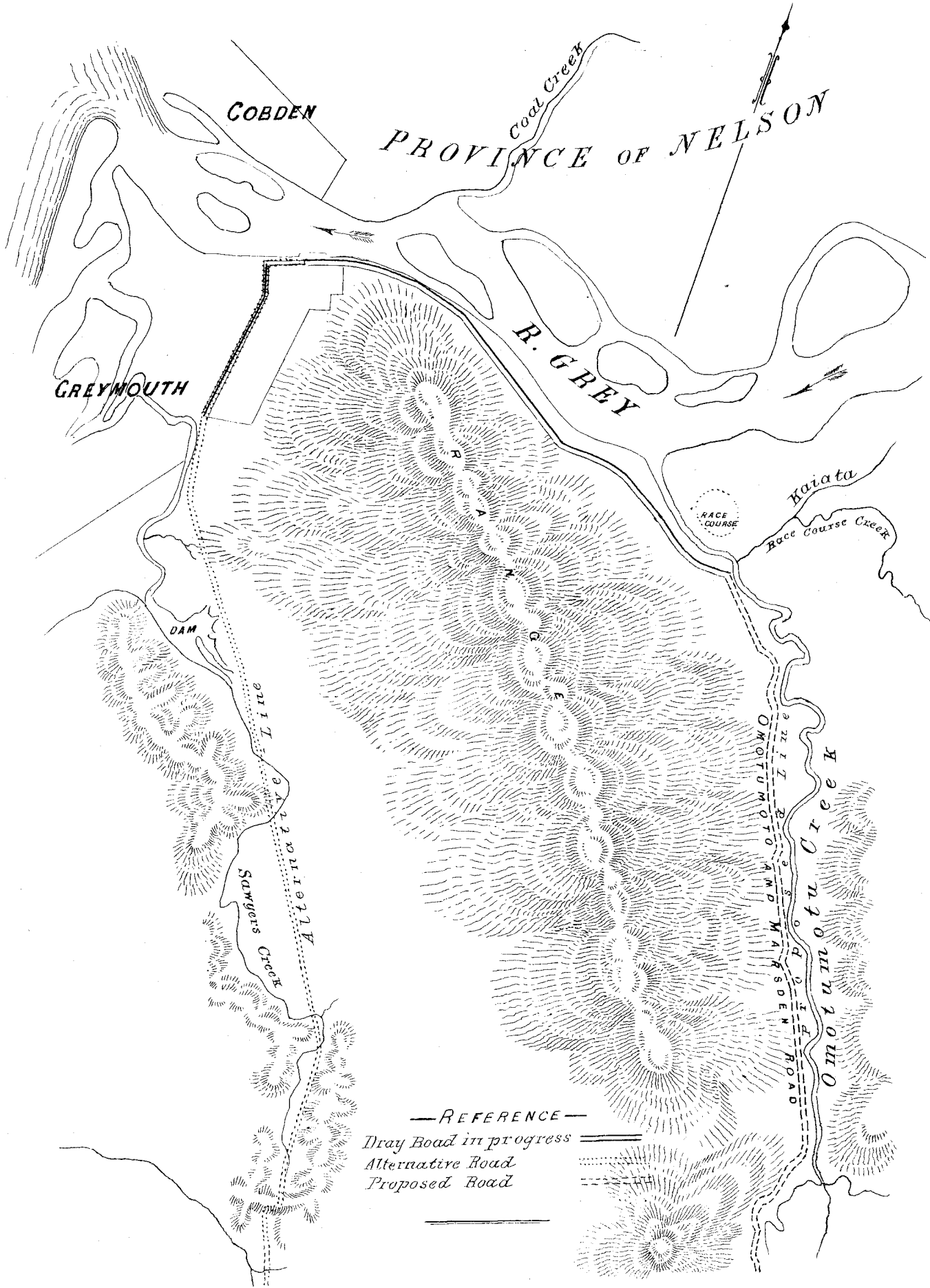


Scale, 40 Chains to One Inch.



COUNTY OF WESTLAND N. Z.  
Alternative Routes, Greymouth to Marsden.

(B.)  
 SHEET No 1.

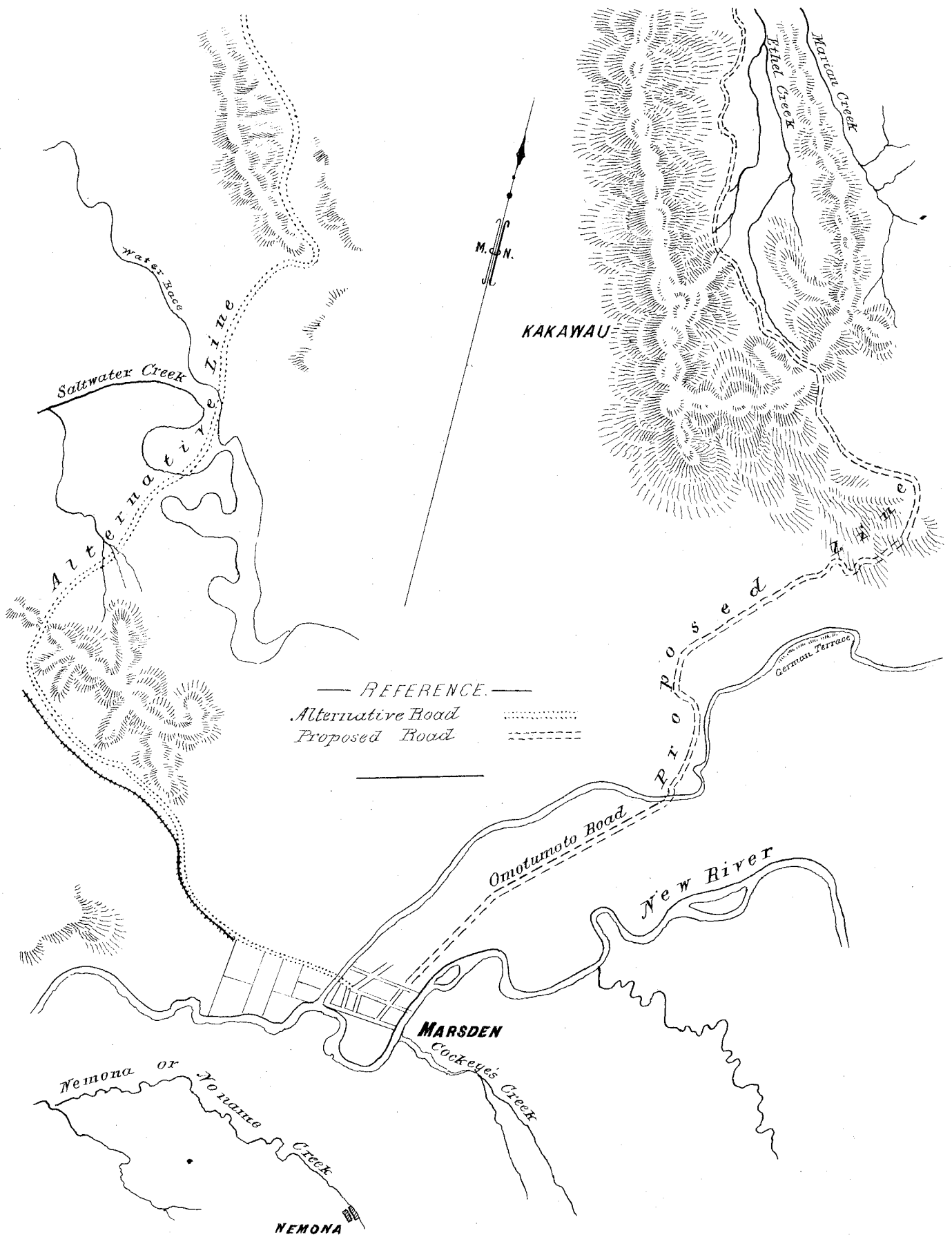


— REFERENCE —  
 Dray Road in progress ————  
 Alternative Road .....  
 Proposed Road - - - - -



**COUNTY OF WESTLAND N. Z.**  
Alternative Routes, Greymouth to Marsden.

**C.**  
 SHEET No. 2.



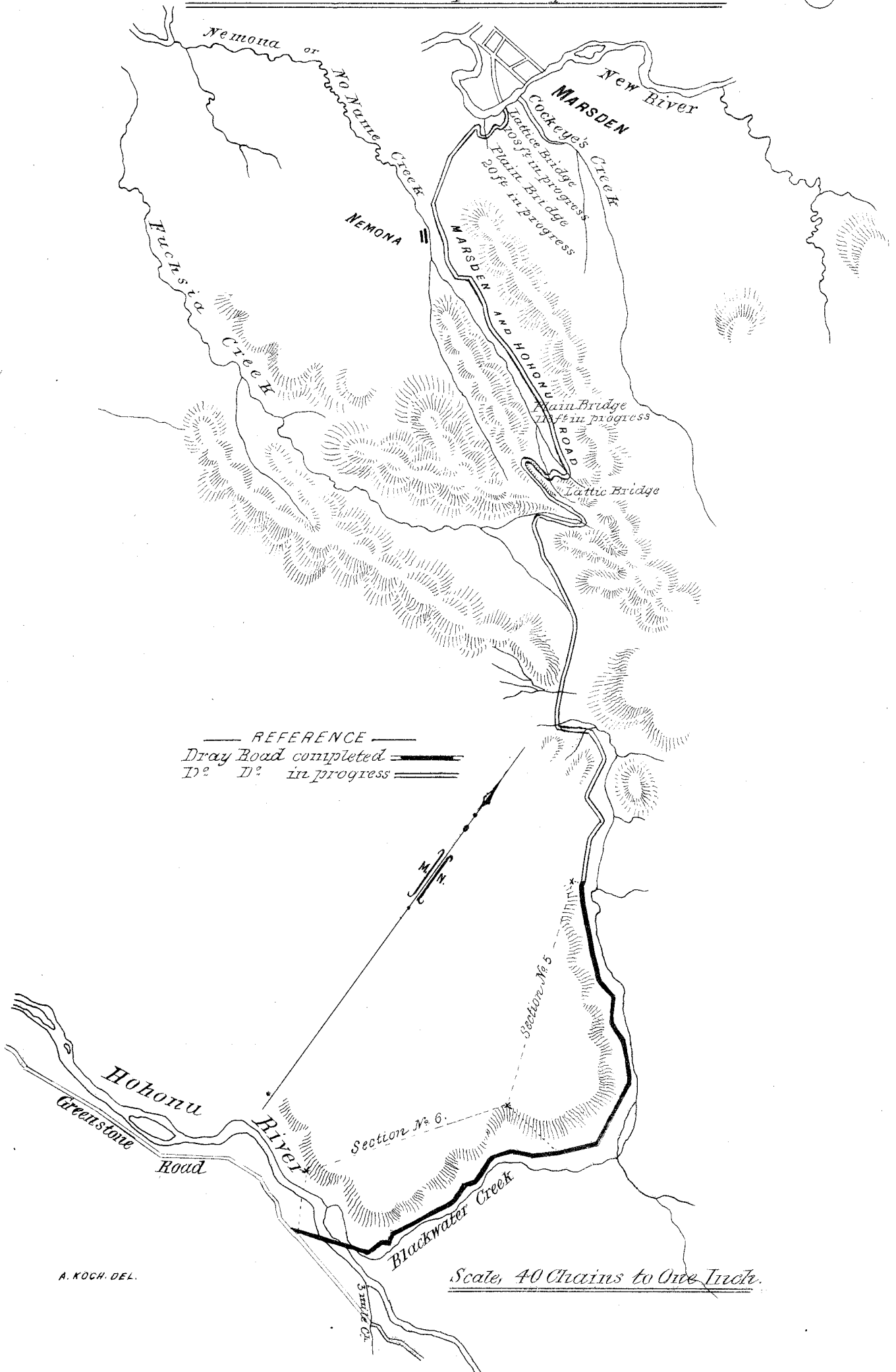


COUNTY OF WESTLAND N.Z.

ROAD. Marsden to Hohonu. —

7 miles 17 chains. Work completed equal to  $5\frac{5}{8}$  miles.

(D.)

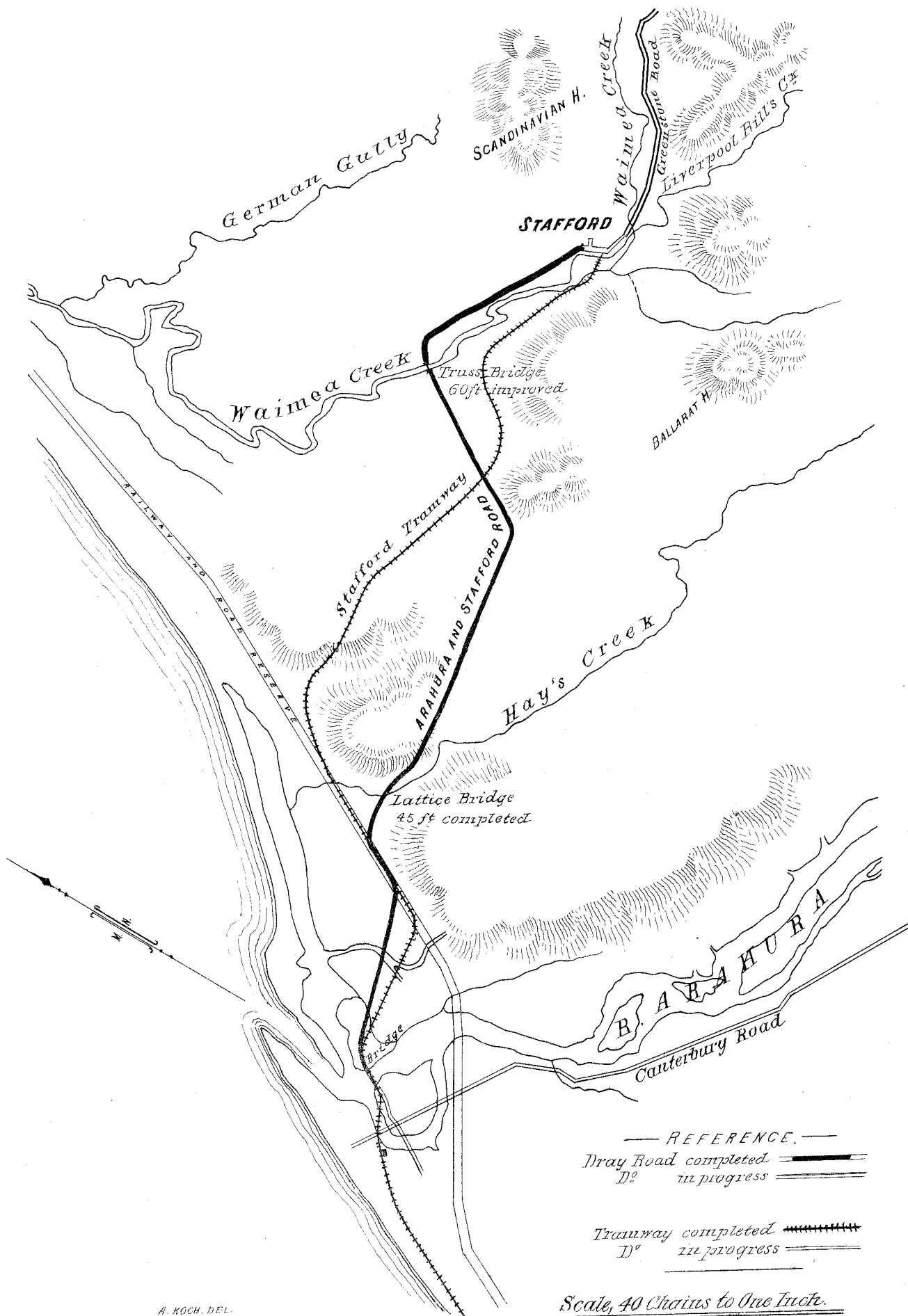




COUNTY OF WESTLAND N.Z.  
ROAD. Arahura to Stafford Town.

3 miles & 63 chains. All completed.

(E)

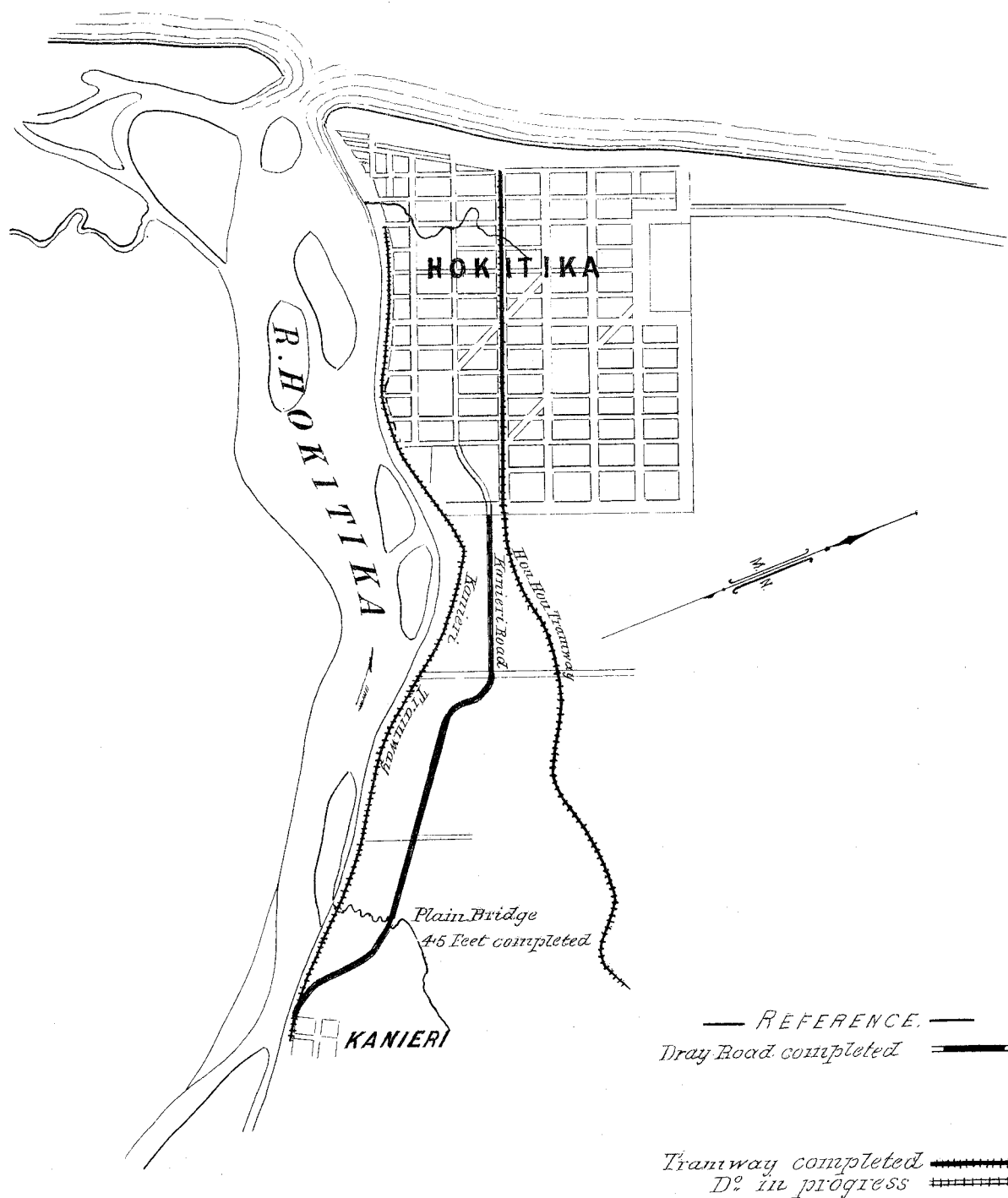




COUNTY OF WESTLAND N.Z.  
ROAD. Hokitika to Kanieri.

1 mile & 67 chains. All completed ~

(F.)





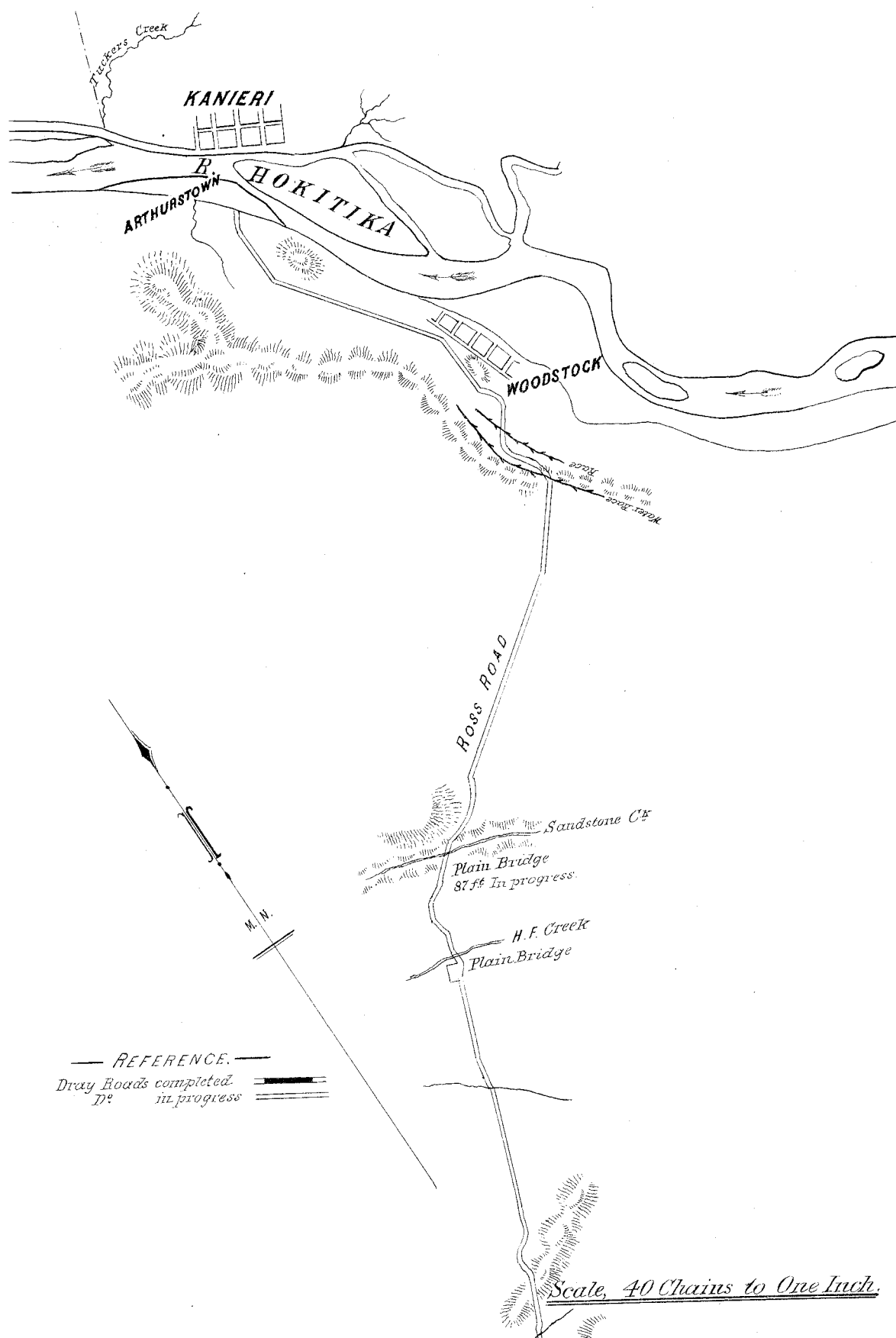
# COUNTY OF WESTLAND N.Z.

## Road.—Kanieri to Ross.

14 miles 55 chains — in three Sheets  
 Work completed equal to  $5\frac{7}{8}$  miles.

(C.)

SHEET N<sup>o</sup> 1.



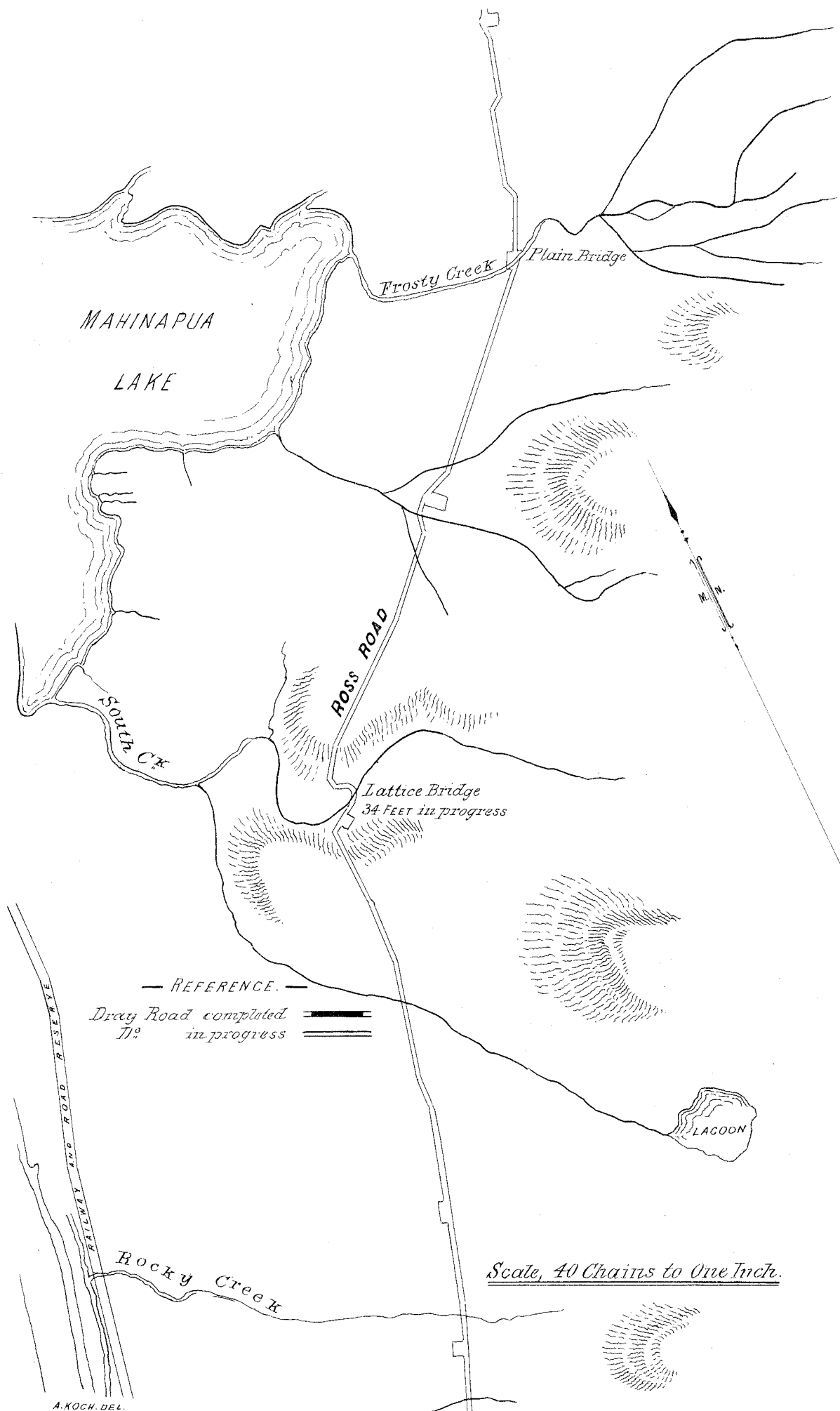


COUNTY OF WESTLAND N.Z.  
ROAD. *Kanieri to Ross.*

— continued —

(H.)

SHEET No 2.

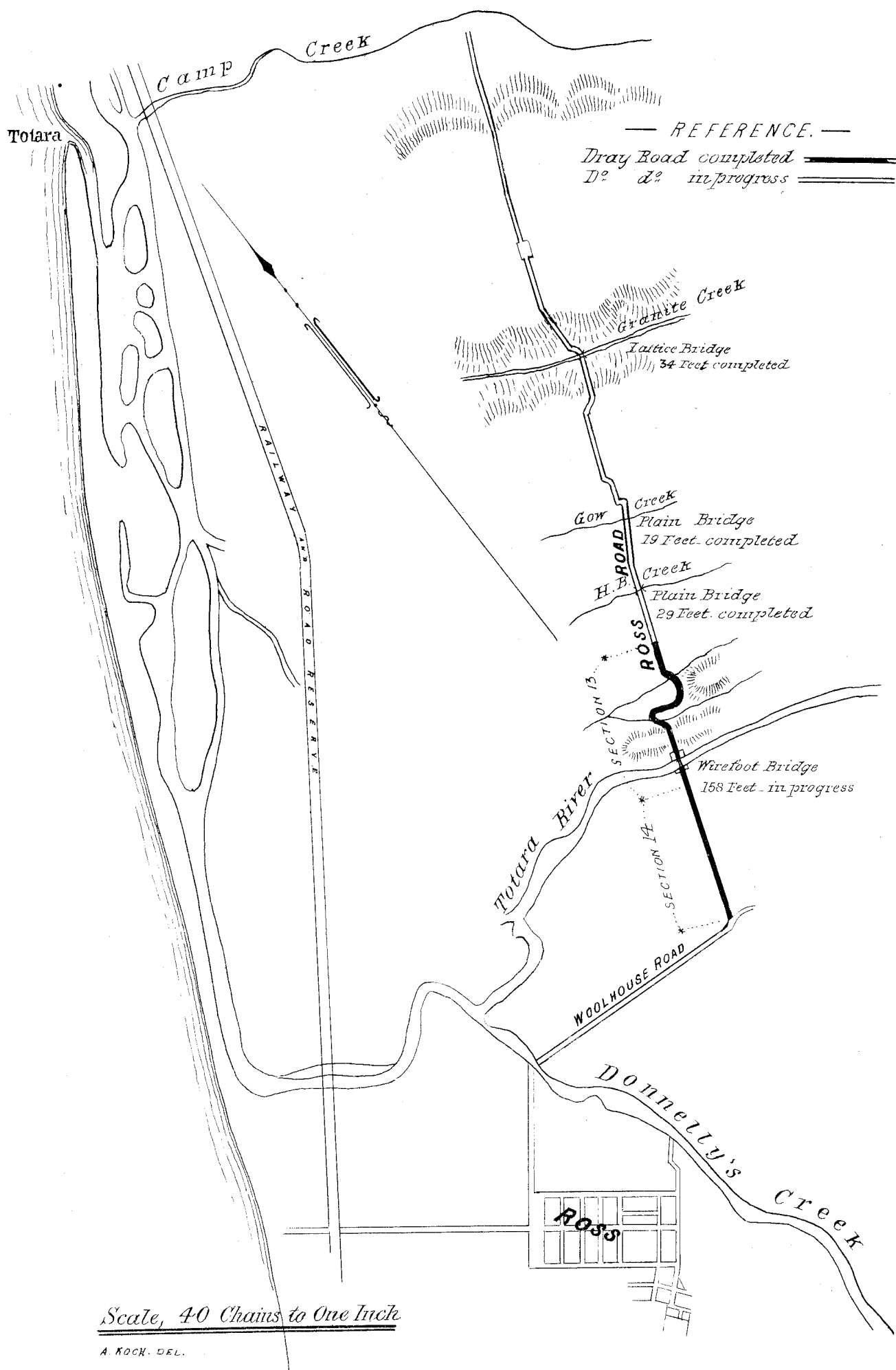




COUNTY OF WESTLAND. N. Z.  
ROAD. Kanieri to Ross.  
 — continued —

(J.)

SHEET N<sup>o</sup> 3.



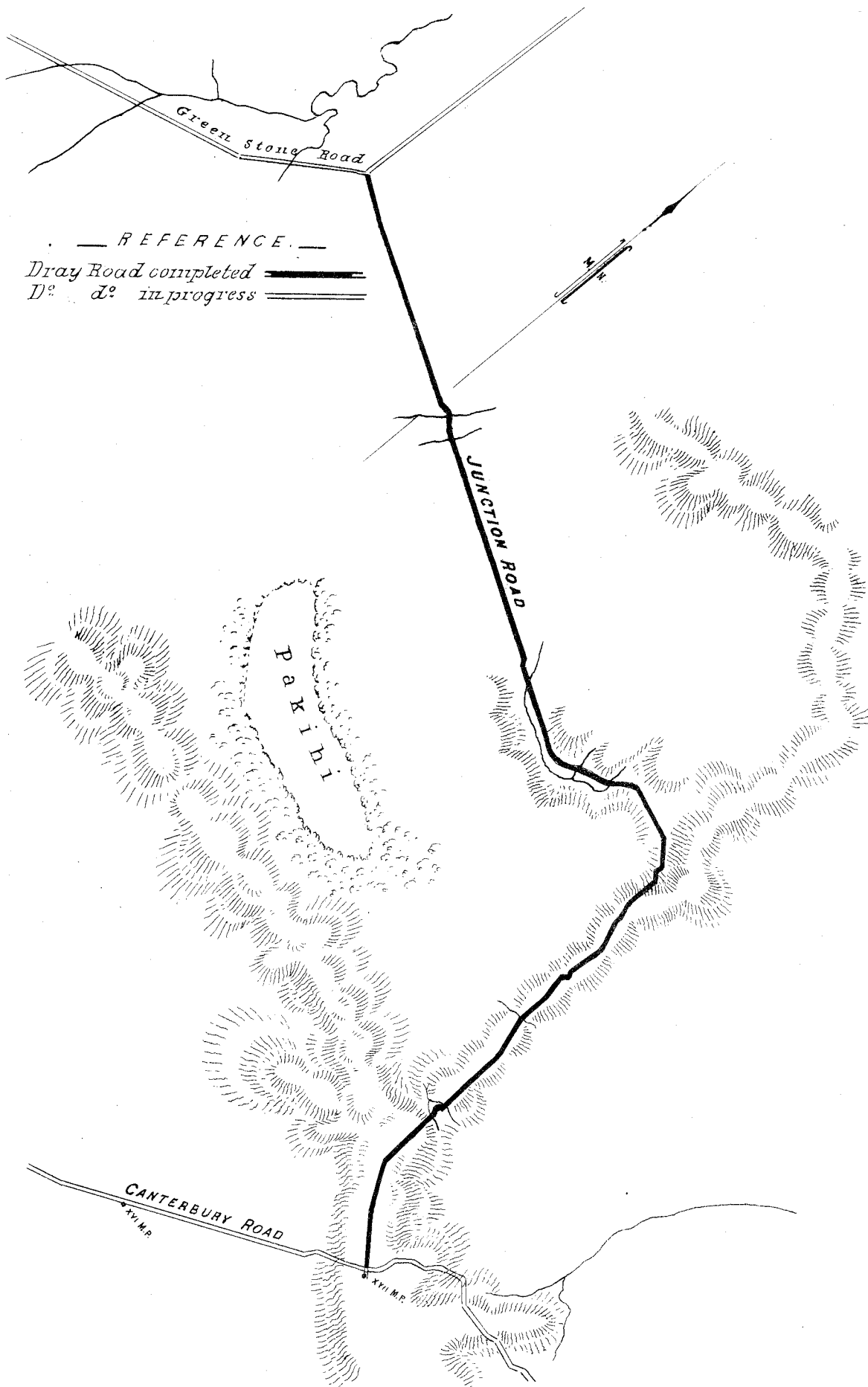


COUNTY OF WESTLAND N.Z.

ROAD. 17 M.P. Christchurch Road to Greenstone Road.

4 miles 65 chains. All completed.

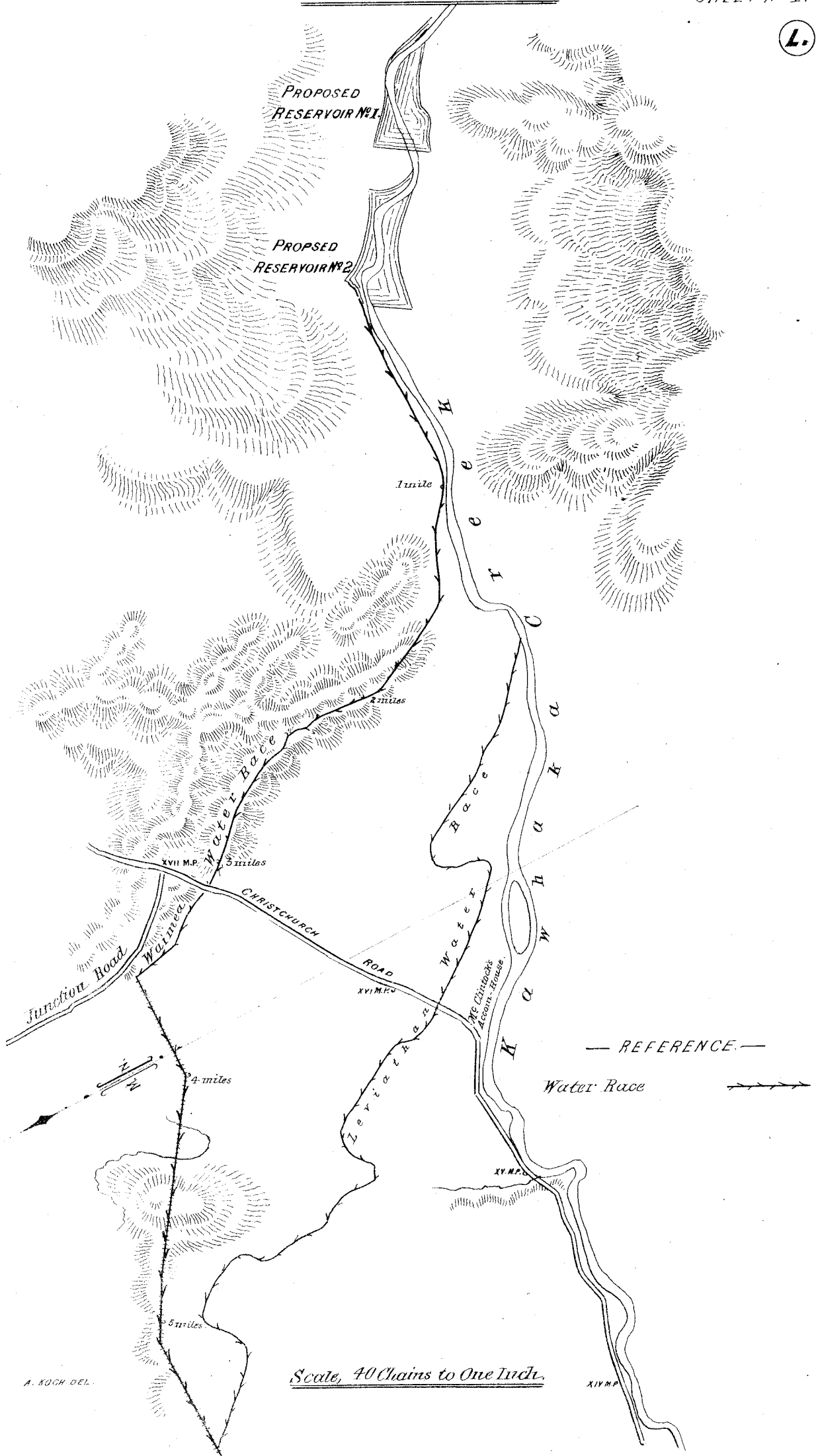
(K.)





*Waimea Water Supply.*

**L.**



A. KOCH. DEL.

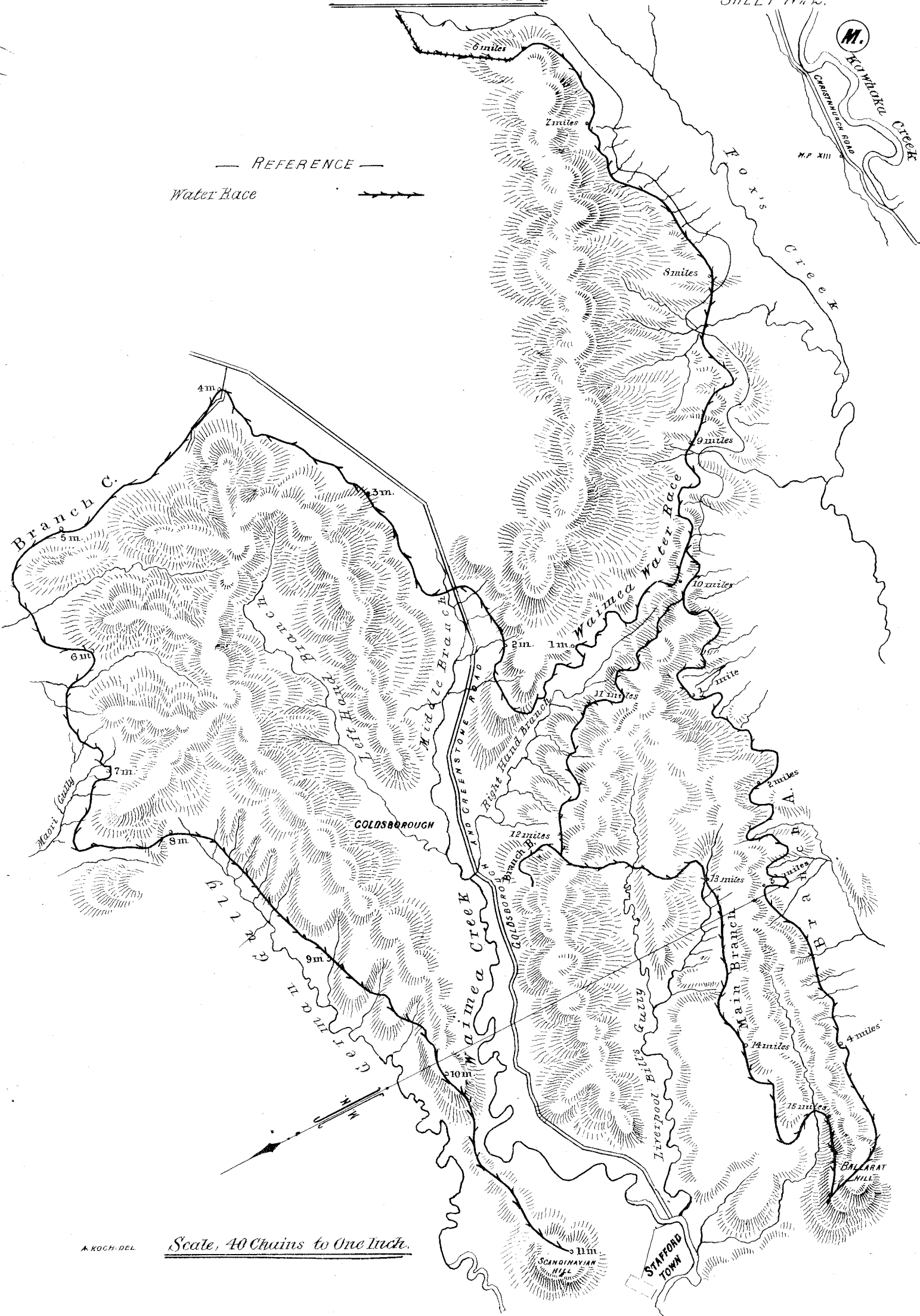
Scale, 40 Chains to One Inch.



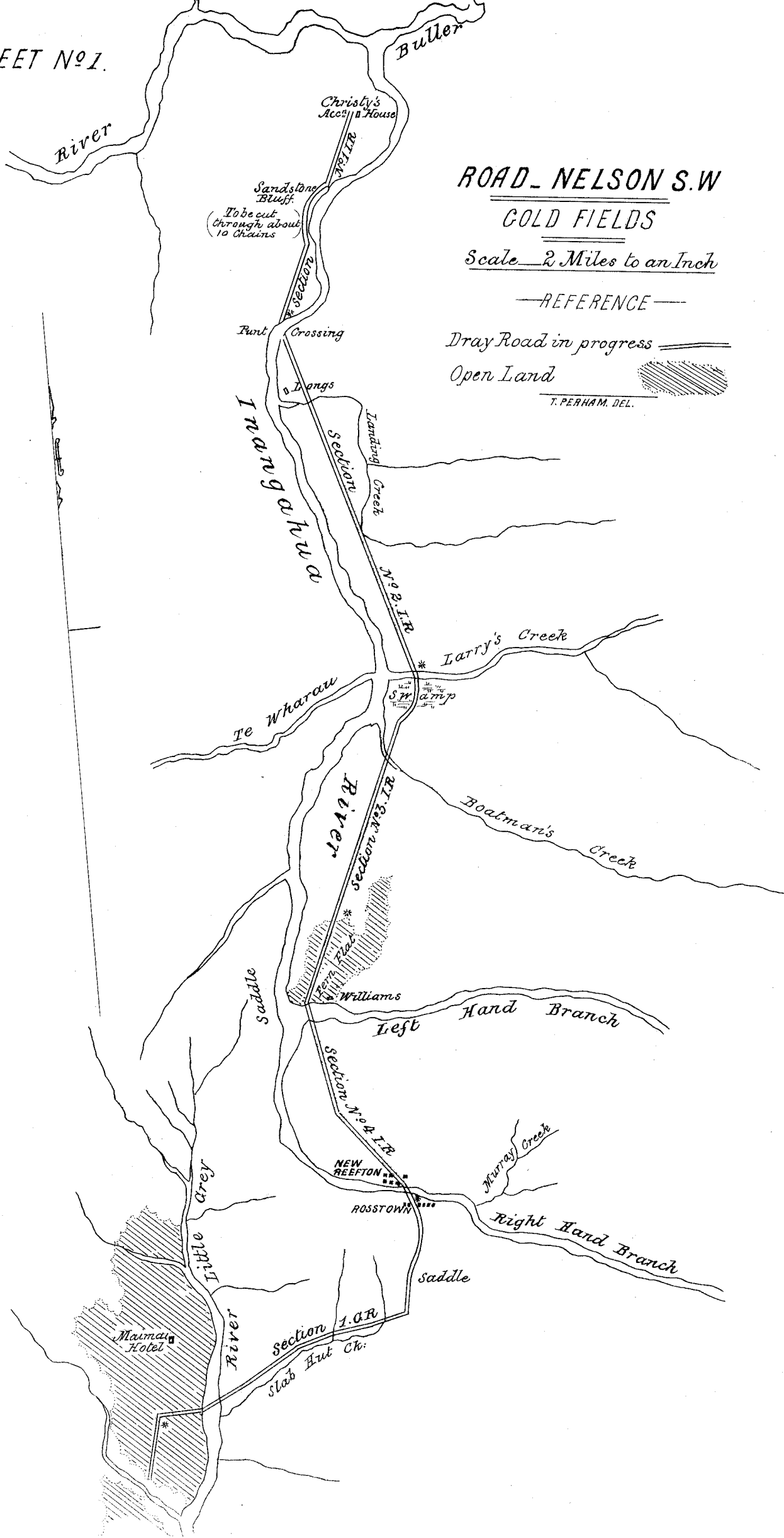
COUNTY OF WESTLAND N.Z.

Waimera Water Supply.

SHEET No 2.







**ROAD - NELSON S.W**  
**GOLD FIELDS**

Scale 2 Miles to an Inch

—REFERENCE—

Dray Road in progress

Open Land

T. PERHAM, DEL.



**ROAD - NELSON S.W**  
**GOLD FIELDS**

Scale — 2 Miles to an Inch

—REFERENCE—

Dray Road in progress

Open Land

T. PERHAM, DEL.

