No. 3.

Mr. H. A. Gordon, F.G.S., Inspecting Engineer, to the Hon. R. J. Seddon, Minister of Mines.

Mines Department, Wellington, 21st July, 1893.

Sir,— Re *Electrical Plant, Thames.*

In accordance with your instructions to visit and report, in conjunction with Mr. Fletcher, on the practicability of getting water as motive-power to generate electricity to work either crushing-batteries or a pumping-plant at the Thames, I have the honour to report as follows:—

Before reporting on this work, I arranged with Mr. Fletcher to report on the practicability of getting water as a motive-power to generate electricity, also on the power required to be transmitted to the Thames to work machinery for pumping the deep levels; and he was to report on the electrical plant and the cost of the same.

From the information previously received from the County Chairman, and those interested in the mining at the Thames, the principal object of our visit was to ascertain whether an electrical plant could be got to do the pumping at the deep levels at the Thames, and whether water could be got as a motive-power to generate the electricity. It was represented to me that there was abundance of water at the Billy-goat Falls, up the Kauaeranga River, to give the required power.

The County Chairman had previously some communication with Mr. Orchiston, Inspector of Telegraphs, who was erecting a telephone line from the Thames to the head of the County Water-race. He recommended the construction of a dam across the Kauaeranga Stream, near the hotel in the Kauaeranga Valley, at a point high enough to supply the County Water-race with water, so that the upper portion of this race could be dispensed with, and thereby lessen the cost of repairs. The scheme, therefore, that we were to examine and report on were: the practicability of getting a sufficient quantity of water at a high elevation near the head of the Kauaeranga River to generate electricity to transmit sufficient power to the Thames to pump the deep levels; and also to report on the practicability of construction of a reservoir across the Kauaeranga River at the hotel referred to, so as to get sufficient water and fall at this point for the required power.

The first thing to consider is the power required to pump the deep levels; and the only thing to guide one in this respect is the quantity of water there is to lift at the 500ft. and the 640ft. levels. The present pump is 24in. in diameter, and has to be worked from $3\frac{1}{2}$ to $3\frac{3}{4}$ strokes per minute. The stroke is 8ft., and, from all the information that I could obtain in the district, when this pump is working at the 640ft. level, it takes about five strokes per minute to keep the water down. The quantity of water lifted would, therefore, be: $0{\cdot}034 \times 24^2 \times 8 \times 5 = 0{\cdot}034 \times 576 \times 40 = 783$ gallons per minute. It was stated that the water did not seem to increase from the 560ft. level to the 640ft.; but, be that as it may, there is a great possibility of more water being got at the deeper levels, and, therefore, provision should be made to cope with it in the event of it being struck. The depth of the shaft spoken of to test the deep levels is from 1,500ft. to 2,000ft. If the former distance be taken, and, say, that the quantity of water to be lifted is 800 gallons per minute, then the power required to lift this from a depth of 1,500ft. would be: $\frac{800 \times 10 \times 1,500}{33,000} = \frac{800 \times 15}{33} = 367$ theoretical horse-power, to which should be added four-tenths for friction, $367 + 147 = 514$-horse power; but if the shaft had to be sunk to a depth of 2,000ft., then the power would be: $\frac{800 \times 10 \times 2,000}{33,000} = \frac{8,000 \times 2}{33} = 485$ theoretical horse-power, to which must be added four-tenths; then $485 + 194 = 679$-horse power would be required. The diameter of pumps to lift this quantity of water, say that two pumps were being used, the stroke being 7ft. and six strokes per minute, would be $\frac{400}{0{\cdot}034 \times 7 \times 6} = 16{\cdot}73$ plus a quarter the area: this shows that it would require two pumps, $18\frac{3}{4}$in. in diameter; but in point of fact it would require two pumps, 20in. in diameter, to insure sufficient provision to cope with the water.

The next question is the quantity of water available in the Kauaeranga River that can be applied as motive-power without interfering with the present supply of water for the County Water-race; and in dealing with this question I will first take the scheme propounded by Mr. Orchiston, of the Telegraph Department, namely—a dam across the Kauaeranga River, at the Kauaeranga Valley Hotel.

According to the barometer levels, the water-race crossing in front of the door of the hotel referred to is about 72ft. above the level of the river at this point, and the bed of the river is about 90ft. above high-water mark. To raise the water from this river it would be necessary to construct a concrete weir; the height of which would be 74ft., and the distance across at the top would be about 15 chains. There is always a quantity of kauri-logs coming down this river when it is in flood, and these going over the top of a weir of the height mentioned would very soon break up the concrete at the toe of slope of the wall, and be a continual source of expense in keeping it in repair. It was suggested by Mr. Orchiston that a fence could be put on the top of the weir to stop the logs from going over, and that a sluice could be made at one side to let the logs go down the creek; but this would interfere with a continuous supply of water, as when the sluice-gates were opened to allow the logs to go down, the water would be below both the present race-level, and also below the level of the race that would require to be constructed to work the water motors.

This reservoir would back the water for about two and a half miles up the valley, and therefore cover a considerable area of private property, for which compensation would have to be paid, and this in itself would amount to a considerable sum; still it would be but a mere mite to the cost of construction of a weir across the river-bed, and the great height of this weir would necessitate a water cushion being made at the back, which would add considerably to the quantity of concrete required. It would be impossible to give anything like a correct estimate of the cost of this work without a survey being made, and the depth of foundations ascertained, but in all probability it would be about £76,000; and probably between compensation for land, and cost of constructing a