

very steep, and there will likely be a large proportion of drive and flume in the conduit. Though the rainfall at Fairlie is relatively low, I think the mountain-areas should yield water enough to give at least 6,000 to 7,000 b.h.p. for continuous working, or, say, 13,000 b.h.p. for twelve hours a day.

A power-scheme at Opihi would command a large tract of country from Oamaru up to, say, Ashburton, or to Christchurch, to join up with a transmission-line from the Clarence scheme at Jollie's Pass.

A full survey of the whole scheme is, I think, warranted, with extended observations on the flow of water in the various streams, so that the probable amount of power and the cost of the necessary works may be estimated.

LAKE TEKAPO.

The Tekapo River is the largest volume of water at a very high level (2,323 ft. above the sea at the lake-outlet) available for power purposes in the colony. Lake Pukaki, thirteen miles distant, lies 735 ft. below Tekapo on the south, while on the north the valley of the Opihi at Silverstream is 1,060 ft. lower than the lake, and the distance from the lake is eleven miles and a half in a straight line.

The drainage-area of the lake is about 610 square miles, and the area of the lake thirty-four square miles. The length of the Alps drained is relatively short, only ten miles. The flow from the lake, when gauged, was 5,100 cubic feet per second. Water from the Forks River and the Edwards could be diverted into the lake to slightly reinforce the flow.

The question of how best to utilise the water flowing from the lake, in whole or in part, for the generation of power, is one of interest, even though the complete carrying-out of so vast a scheme is quite beyond present-day requirements.

Trial lines for races have been run from Tekapo to Pukaki Lake, and a branch from this down Mary's Range to Simon's Pass, and from Tekapo through Burke's Pass down the Opihi; also from this line branching down the Tengawai.

The line to Pukaki Lake has a final fall of 600 ft. between the end of the race and the lake, and the pipe-line would be 145 chains long. The race would be 16 miles 7 chains long. There would be six tunnels, one 94 chains long, starting at the lake; the total length of tunnels being 3 miles 21 chains. The first four tunnels are necessary if water is taken out of the lake at about its present level. About 93 chains of flume would be required, and about 11 miles 53 chains of race. The difficulties in this line lie in getting out of the Tekapo Lake and clear of the terraces along the Tekapo River. The lake-level is now much too low to enable the best ground for a conduit being got. Raising the water-level by a dam would help, but only partially. The lake-level could be raised about 50 ft. by a dam. After that height the cost would increase by the dam lengthening. There would be difficulty in providing for flood-flow in exceptional seasons. The dam would be built on moraine drift, and protecting the toe of a dam would be expensive.

A line was run branching from the Pukaki line at about fourteen miles towards Simon's to ascertain what fall was obtainable from a suitable point on Mary's Range. Simon's Pass was too low and wide to allow of a race being carried over it. A race terminating at Simon's Pass would only have 360 ft. fall, and be twenty-five miles long.

A grade was run from Tekapo towards Burke's Pass, and then down the Opihi to a point about five miles and three-quarters below the pass, where a fall of 560 ft. is available. The length of race would be about seventeen miles and a quarter. There would be 3 miles 44 chains of tunnels on this grade—one at the outlet of Tekapo two miles long, and one through Burke's Pass 74 chains long. About 135 chains of fluming would be required, and about twelve miles of ditch. The pipes from the end of the race to a power-station would be about 28 chains long. It would be less expensive to carry a given volume of water by this route than to Pukaki. The shorter length of pipe between the end of race and power-station would cause a great saving if a large quantity of water were used. The power-station would be nearer settled districts, and over thirty miles of transmission-line would be saved. A race to carry 600 cubic feet of water per second would give 30,000 b.h.p. at the power-station about ten miles from Fairlie.

Branching from this line at Burke's Pass, an exploration was made towards the Tengawai, and split into three branches. The first ran through the hills towards Fairlie, and gives a line about 20½ miles long, with a final fall to the flat at the back of Fairlie of 600 ft. There would be four and three-eighths miles of tunnelling on the line, and some fluming.

The second terminal branch of this line ends over the Tengawai gorge, giving a line 27½ miles long, with a final fall of 1,030 ft. into the Tengawai. The length can be reduced by about two miles by a tunnel. Rough hillsides would be traversed, and in the last seven or eight miles a number of expensive flumes would be required. The cost of the works would be great as compared with the other line to Opihi. The power obtainable would be about 56,000 b.h.p. for a race carrying 600 cubic feet of water.

A third branch of this line goes down a spur to the junction of McKenzie Creek with the Tengawai. Its length is 21 miles 50 chains, and the final fall obtainable is 550 ft. A great length of fluming would be required over the last three miles and a half of the race. This would be a longer line than to the point selected on the Opihi, and would be much more expensive, while slightly less power would be got.

To attempt to utilise all the water from Tekapo by taking it either to Pukaki Lake or to Opihi by the respective routes above described would be very costly, and tunnelling through the moraines would be attended with some risks during construction, and after, if leakage of water through the tunnel-lining occurred. It is possible that fluming along the river-bank would be cheaper and safer. I have no doubt this would be seriously considered if any scheme were ever undertaken. If all the water were taken the wear of the river on the banks would cease, except in exceptional floods, and then would not last long.

Any water brought from Tekapo to a power-station in the upper Opihi could be used again at a power-station in the Opihi gorge, and a very large additional amount of power be thus got.