

Kawarau Falls, at the time of my visit, was 385ft., but in this width there is a small island in the centre. If a lock were constructed at this point the falls could be lowered. The difference of level of the water in the river and the lake at the time of my visit was about 4ft. Mr. Robertson, at the flour-mills, stated that when the river is low there is a difference in level of about 7ft. 6in. In measuring the discharge of water at the Kawarau Falls, the whole of the measurements were only taken as approximate; they gave the discharge as 13,475 cubic feet per second. In the same afternoon I measured the width, depth, and velocity of the water at the Victoria Bridge. The width of the river at this point was 143ft., having an average mean depth of 12ft. 6in., and the velocity of the water was 8ft. per second, which is equal to 14,300 sluice heads or cubic feet per second. The difference in these two measurements—namely, 825 cubic feet per second, is partly accounted for by the inflow of the Shotover and Arrow Rivers between the outlet of Lake Wakatipu and the Victoria Bridge. The discharge out of Lake Wakatipu may be set down as 14,000 sluice-heads. It would raise the surface of water in the lake at the rate of 4·57in. in twenty-four hours. The level of the surface of the water in the lake at the time of my visit could not be raised more than 3ft. 6in. without damaging property in Queenstown, especially if a high wind was blowing down the lake. The falls at the outlet into the Kawarau River could, however, be easily lowered 2ft. in the event of locks being constructed, which would provide for the surface of the water in the lake being raised 5ft. 6in. above the level it was at the time of my visit, and this would be equal to a storage of the discharge for a period of about fourteen days.

If a lock was constructed at the Kawarau Falls the present outlet would have to be considerably widened to allow for passage being blocked up by the divisions between the different gates in the lock, and also for an additional water-way in the gates to provide for the extra friction of the water flowing through small openings. The water in this lake rises very rapidly during the melting of the snow on the mountains. During my stay in Queenstown, about Christmas, 1866, the water covered the low streets, and was about 1ft. deep in Eichardt's Hotel, and the flood in 1878 is said to have been higher than any previous one; in constructing a lock, therefore, ample provision will have to be made to carry off the flood-water. It has been suggested by some that the proper place for a lock is in a narrow gorge below the junction of the Arrow River. The great objection to this is that there is a considerable fall between the surface of the water in the lake and the surface of the river at this point, and if a lock were constructed at this place it would flood a considerable portion of low land before raising the surface of the water in the lake; and in order to provide for sufficient water-way in time of flood, the gorge would require to be considerably widened at the place where the lock was constructed, and there would be more difficulty in constructing foundations in a narrow gorge than there would be at the Kawarau Falls; also the increased pressure of water on the gates would be a consideration, as extra power would be required to work them.

The discharges from the three lakes were as follows:—

Hawea ...	...	3,200 sluice-heads, or	3,200 cubic feet per second.
Wanaka...	...	10,476 "	10,476 "
Wakatipu	...	14,000 "	14,000 "
Total ...	...	27,676	27,676

Although these measurements were made hurriedly, they may be taken as a near approximation of the mean annual discharge, and coincide very closely with the measurements taken by Mr. Balfour, as mentioned in his report to the Provincial Council on the discharge of the Clutha River in 1864, wherein he states that his measurements were taken when the water in the river was low, and even then he makes the discharge 1,690,400 cubic feet per minute, or 28,173 sluice heads. Taking my measurements of 27,676 sluice-heads as the discharge from the lakes, say that other tributaries, such as the Shotover, Arrow, Nevis, Lindis, Manuherikia, Teviot, Pomahaka, Tuapeka, and Waitahuna Rivers contributed 2,224 sluice-heads, it would make the discharge at the season of the year my measurements were made at about 30,000 cubic feet per second, or 1,800,000 cubic feet per minute. To compare these measurements with the rainfall over the area of the catchment-water basin, it will be found that the river, at the time my measurements were taken, was a little higher than its ordinary mean water-level.

It is difficult to ascertain the exact rainfall on the mountains forming the watershed of the lakes which empty into the Clutha River; it is well known that it is far greater than in Central Otago. The rainfall on the West Coast, on the opposite side of the watersheds of these lakes, is about 120in. per annum. The annual rainfall about Queenstown varies from 33in. to 45in., making a mean average of 37·5in. If this rainfall be taken over one-half of the drainage area, and the average of 82·5in. be taken for the annual rainfall on the mountains over the other half, it will give a mean rainfall over the whole area of 60in. per annum. The whole of the watersheds of the lakes and tributaries of the Clutha River comprise an area of 8,406 square miles, and allowing that 25 per cent. of the rainfall is lost in evaporation and absorption, it would leave 75 per cent. of the water to be discharged into the ocean by the Clutha River. On this basis, therefore, the total rainfall per annum would amount to 1,171,729,152,000 cubic feet, of which 292,932,288 cubic feet is lost in evaporation and absorption, and 878,796,864,000 cubic feet is discharged annually by the river, which is equal to a mean discharge of 1,671,987 cubic feet per minute of 27,866 sluice-heads. The maximum discharge is always during the melting of the snow on the mountains, and in heavy rains during the summer months, and the minimum discharge during frosty weather in the winter months; therefore, at the season of the year when the discharge is about at its minimum, the water could be dammed up for a longer period than is calculated for.

It has been inferred by a good many that the volume of discharge of water by the Clutha is about the seventh of any river in the world. The statement cannot be borne out, and it may be