

## Enclosure I. in Appendix I.

REPORT ON ENCROACHMENTS of the RANGITATA RIVER, by the RESIDENT ENGINEER,  
CHRISTCHURCH SECTION, NEW ZEALAND RAILWAYS.

SIR,—

I have the honor to append to my annual report on the Christchurch section of New Zealand Railways the following report on the encroachments of the Rangitata River.

The effect of floods in the Rangitata River, and its encroachments on its banks, have for a long period occasioned anxiety. Temporary expedients have been resorted to, which have done service in the past, but the danger increases, and gives rise to very serious apprehension. The subject has been reported on on previous occasions, but, as it is one of such grave importance, it appears desirable that a comprehensive description of the river and banks, effects of floods, and proposals for a system of protective works should accompany the annual report on the railway works which are liable to be so seriously affected by the river.

The Rangitata River flows over a shingly bed in numerous channels. On the north bank is a bold terrace, which completely confines it on that side. The south bank is low and easily flooded, and consists of a gravel substratum, and light sandy soil on the surface. About four miles above the railway crossing the river divides into two branches, forming a large island. The railway crosses by two bridges, the north bridge being 1,950 and the south bridge 1,964 feet in length. The bed of the river, for several miles above the bridges, is considerably higher than the neighbouring country to the right or southward of it, and when the river overflows its southern banks, as it frequently does, the water runs rapidly down a well-defined channel, and crosses the railway about three-quarters of a mile from the end of the south bridge. A temporary opening is left in the railway to allow this water to pass. The river is continually breaking down the natural banks on the south side, to which by reason of the lay of the country it naturally tends. It is much to be feared that it may, during any large fresh, deepen the outlet, and flow down the channel already described with increasing volume, until the whole river leaves its present bed, and takes an entirely new course to the sea. There is nothing that I can see in the natural course of events to hinder such a catastrophe occurring at any time, although it is quite possible that it might not happen for a long while. If this should ever occur the result will be an enormous loss of valuable agricultural and cultivated land, the complete stoppage of railway traffic, destruction of the present station and a considerable length of railway, and the necessity of providing a new bridge at the cost of about £20,000. The interests at stake are therefore very large.

I have, by your instructions, carefully examined the river and neighbourhood, in order to ascertain the possibility of checking the threatened outbreak. It is to be observed that this river has larger boulders and more of them than any other of the Canterbury rivers in the proximity of the railway. The large boulders are chiefly in the stream, and the smaller in the back waters. This indicates that the river is carrying away material from this part of its bed, and therefore the channel must, on the whole, be deepening. If we had to cope with a river-bed where the *débris* brought from above is deposited, protective works might be more easily constructed, but they could not be permanent, for as the bed rises the river must inevitably sooner or later overtop the works. Under such circumstances smaller shingle and sand would appear, for, the fall being too slight to move the larger boulders, they would either remain behind or be buried. Considering it established that the river is already gradually deepening its present channel in the part we have to do with, there is good reason to hope for success in dealing with it, and all that can be done by way of concentrating the scattered streams will assist this natural process, and tend to keep the river within bounds. The first parting of the river, forming the upper end of the Rangitata Island, occurs about four miles above the railway, but there are several cross streams lower down carrying water from the north channel to the south. During floods the quantity thus thrown into the south channel is immensely increased. The points where the river overflows are mainly over a space of half a mile, about halfway between the upper end of the island and the railway bridge.

Some stop-banks where erected when the line was constructed, and they must have done good service formerly, but they were calculated only to stop the surface-water from overflowing the natural banks. This no doubt they did more or less completely for a time, but by degrees the ground they stood upon has been undermined by the action of the river, and they have been partly destroyed, and the flood-water now outflanks them on all sides. As there is no high ground to work from as a base of operations, it is impossible to erect any barrier to the river at this point. I have no hesitation in expressing a full conviction that the points where the river can be most completely and economically controlled are upon the falls where it divides; and this for the reasons that at those points the river has the least tendency to rise upon the works, and, further, that it has the greatest fall away from the works in the opposite course. There are four distinct channels by which the river flows from the north branch to the south; three of these are above the part now being encroached on, and one below.

The next consideration is, what character of works can be constructed in such situations. I propose to form three banks or groins, one in each of the three upper channels above described. The sites chosen for each are just on the turn of the fall to the right, so that they shall stand in the back-water of the current that will flow down the fall to the left when the groin is completed. The *débris* brought down by the floods is expected to be deposited in the backwater, and so will protect the works. Where the groins are exposed to the current they will be constructed of the largest boulders procurable, which will be taken from the channel to the left, so as to improve the flow of the river to the north side. The banks will be made very wide, and very flat, so as to present the least possible face to the scour, the breast of the groin is to be filled with tussock and flax, to stop the silt from washing through, so as to cause the river to grout the boulders full, after which the decay of the grass will not signify. The first groin constructed will be the lowest down stream, and will be formed by working