

Coutt's Islands more to material introduced into the river through erosion of the banks, augmented possibly by an increase in the number of small floods within recent years, or since the drainage area has been denuded of bush and vegetation. Apart from this cause, however, there must inevitably be—as has been already pointed out—a tendency for the river to gradually shoal with sand and fine gravel and to build up its bed in this vicinity, where the gradient rapidly flattens out; and there is no doubt but that the present shoaling is an indication that this process is at present in active operation, and that it has been greatly augmented by material from the erosion of the river-banks.

From about three miles above McLean's Island right down to Coutt's Island the bed of the south branch is thickly overgrown with gorse and other vegetation. Evidence was given showing that north-east winds deposited a considerable quantity of air-borne dust and sand in the south branch; if this were the case it would materially assist in the rapid growth of vegetation. Winds from the south-west, by causing wave-action in the north branch, accelerate the undermining and erosion of the north river-banks.

The calculated mean velocity of flood-water is between 7 ft. and 8 ft. per second just above the Empire Bridge, in which case the bottom or bed velocity would be about $4\frac{1}{2}$ ft., and it is improbable that any shingle greater than $2\frac{1}{2}$ in. average diameter would be moved or transported under such conditions.

BRIDGES.

The bridge known as "Coutt's Bridge," connecting Coutt's Island with Kaiapoi Island, is 360 ft. long. The capacity for discharge underneath the bridge, based on a flood-slope of 1 in 1,200, is about 29,000 cusecs (cubic feet per second) with the flood-level 2 ft. below the bridge-decking. During floods the bulk of the water flows round the west end of the bridge and across the approach road.

The Empire Bridge is 550 ft. long, and the discharge capacity, with flood-level 2 ft. 9 in. below decking, is about 60,000 cusecs.

The railway-bridge crossing Stewart's Gully (main river-channel) is 811 ft. in length, and the railway-bridge crossing the old south branch is 386 ft. in length. This latter bridge was originally much longer, but was shortened when the river shifted to Stewart's Gully.

FLOODS.

The earliest recorded serious flood in the Waimakariri occurred in 1865, when the overflow from the river flowed down the old channels and flooded Christchurch, causing considerable damage.

The highest recorded flood in the river appears to have been in February, 1868, when the whole of the Canterbury rivers were heavily flooded. The Eyre and Cust Rivers were also in flood at the same time, and, assisted by the overflow from the Ashley River and the backwater from the Waimakariri overflow, seriously flooded Kaiapoi Township and the surrounding country. It was this flood which was mainly responsible for the scouring-out of the cutting made by the Provincial Government in 1863-64 through Kaiapoi Island, and making it the present north branch.

Another big flood occurred in 1888, and this flood also overflowed the banks on the south side and found its way via the old river-channels down to Christchurch.

Other big floods in the Waimakariri occurred in 1905 (next in size to the 1868 flood), 1913, 1915, and recently in November, 1920. The 1905 flood burst through the railway-line at Chaney's and flowed down the old overflow-channel there and into the Styx.

In addition to these floods, Kaiapoi has been inundated by local floods coming from the Eyre and Cust Rivers, and also by flood overflow from the Ashley River. As a rule, floods in the Eyre and Cust do not synchronize with floods in the Waimakariri, but this happened in 1868 and 1905. Since 1913 there have been no floods in the Eyre.

The cause of the principal floods in the Waimakariri appears to be severe rains coming from the West Coast; but, unfortunately, scarcely any information is available as to rainfall and other conditions conducing to floods. It is to be