"Stewart's Gully" refers to that portion of the present main river about one mile below Empire Bridge and about one mile in length. The old south branch lies to the west of Stewart's Gully, and is now a subsidiary channel only.

"The Gorge" is situated at the point where the railway-bridge on the Sheffield–Oxford line crosses the Waimakariri River.

"Coutt's Island" is that portion of Kaiapoi Island which has been cut off from the latter by "the cutting" referred to elsewhere.

Physical Characteristics.

The Waimakariri River has its source in the high lands near Mount Rolleston, and, with its principal tributaries the Bealey, Poulter, Esk, Kowai, and Broken River, drains an area of approximately 1,000 square miles. In former years many thousands of acres in the upper portion of the watershed were heavily covered with bush; these hills are now bare, and shingle-slides discharging their debris into the tributaries are increasing both in number and extent. Although this river is to a certain extent snow-fed, the influence of the melting snow on the flood-discharge is not very great, and the big floods in the lower reaches of the river are mainly due to heavy rains coming from the West Coast. These westerly rains do not appear to extend east below the Cass and Mount White on the Esk; and, although no rainfall records are available, it is well known that these downpours are not only extremely heavy and prolonged, but are also fairly frequent, with the result that the Waimakariri may be flooded many times in one season. This latter fact is important as having a distinct bearing on the travel and deposition of shingle in the lower reaches of the river, as will be referred to later on.

The Waimakariri River, the total length of which from its source to the sea is about eighty-five miles, has the following approximate fall: From its junction with the Bealey down to its junction with the Esk, twenty-one miles, at 23 ft. to the mile; between the Esk and the Kowai, seventeen miles, at 33 ft. to the mile; between the Kowai and the top of Coutt's Island, thirty-two miles, at 29 ft. to the mile; from the top of Coutt's Island (old north channel intake) to Empire Bridge the slope rapidly flattens out, until from the Empire Bridge down to the sea, a distance of five miles, the slope is less than 1 ft. to the mile.

From the rapid flattening-out of the river-slope between the top end of Coutt's Island and the Empire Bridge, with the subsequent flat gradient down to mean sea-level at the estuary, it will be seen that the Waimakariri River differs from most of the other Canterbury rivers, which continue their steep gradients more or less down to their outlets, and consequently that the Waimakariri River is in a more advanced stage of river-development as compared with rivers like the Rangitata, for instance. This in a great measure may be due to the presence of Banks Peninsula, which, acting as a groyne protection against the influence of the heavy south-east seas, would thus assist in the more speedy formation and extension of the low-lying delta at the river-outlet. The existence of beds of gravel and small shingle underlying the river-deposited alluvium, at depths ranging from 100 ft. near the coast to 35 ft. on Coutt's Island, would seem to indicate that the extensive river-flat or flood-plain had been originally laid down on a sinking shore, and that this had subsequently been raised to its present level. The river below the tidal limits has all the characteristics of a "delta river," with the tendency to form numerous branch outlets to the sea. The river for the last five miles or so has cut down to what is known as the "base level of erosion." Any future development of this portion of the river must inevitably be in the direction of gradually raising its bed-level from Coutt's Island down, the ultimate effect being to do away with the present rather sudden transition from a sharp to a flat river-gradient. Although it may take very many years to effect this alteration in the bed-gradient, it must be remembered that the causes operating to bring about this result are constantly at work, and are being augmented by protective works and other human efforts to control the river. Consequently it may be that the advancing toe of shingle below Empire Bridge, and the accretion of sand and shingle in both the north and south branches—but more especially in the latter—are evidences that the above-mentioned phase in the development of this river is now in progress.