averages about 27 ft. to the mile. Below Templar's Island the gradient rapidly flattens out down to where the present north and south branches join above the Empire Bridge, at which point the mean bed-level of the river is practically the level of high-water mark. From here down to the estuary at its outlet the fall to mean sea-level is less than 1 ft. to the mile under normal conditions of flow. Plan No. 4 (plotted from cross-sections A to H, plan No. 3) shows approximately the existing condition of flood and low-water slopes with corresponding mean bed-levels in the present north branch between the west end of Coutt's Island and the Empire Bridge. From this it will be noted that there appear to be two well-defined shoalings or shingle-waves in that length. At the present time this new north branch is carrying the greater part of the water, both during normal flow and flood-flow. We have little doubt but that in the past the south branch was the principal channel, carrying most water, and that during the last forty or fifty years the conditions have been so changed as to have diverted the main river-current over towards the north bank and down this new north channel. This diversion of the main stream over towards the north has had a serious effect, inasmuch as it has resulted in a very considerable erosion of the north river-bank below a point opposite No. 12 groyne. (See plan No. 2.) Of the banks so eroded on the north side the portions up-stream above McLean's Island consist of high banks from 12 ft. to 16 ft. in height, while those lower down-stream are in most cases low, or just about flood-level, with level land at the back right away to the Eyre and Cust districts. The area of land so eroded and washed away since 1878 appears to have amounted to over 2,740 acres, in addition to some 1,000 acres eroded on the south side of the river; and it is therefore probable that, expressed in cubic measure, not less than 15,000,000 cubic yards of material has been eroded from both river-banks, partly to be carried out to sea and partly to be deposited in the river-bed lower down.

As to the cause of this swinging-over of the main river-current from the south side to the north side, three contributing factors, acting either singly or together—but more probably in combination—may be adduced. In the first place, it is a well-known fact that all shallow rapid rivers with shingly or gravelly beds change their channels alternately from one side to the other, gradually filling up existing channels with detritus and scouring out new channels elsewhere; and it may be that the regimen of the river had reached that stage when a gradual swinging-over of the main current to the north side had become a natural process in the life-history of the river. It may be noted in this connection that Mr. E. Dobson, C.E., in 1866 reported that the gradual accumulation of shingle in the south branch was diverting the great bulk of the water over into the (old) north branch, causing injury to Kaiapoi Island and Town.

In the second place, the construction of the numerous groynes on the south bank, with the consequent accretion of shingle, may have diverted the main current over to the north side, thus inducing it to cut out a new and defined channel for itself. Much evidence has been given in support of this theory, although in the nature of things such evidence must of necessity be unsupported by any direct proof that this alone has been the cause. In the third place, owing to the formation of the new and more direct channel for flood-discharge down the north side of Coutt's Island, the main current may have been, if we may so express it, "drawn over" to this side by reason of this new north branch forming a more suitable and rapid means of discharge. That the effect of the construction of the groynes on the south bank marked 1 to 12, but more especially the latter, has been more or less to divert the current over to the north side may, we think, be admitted; but, assuming the new north branch to have been non-existent, we think that the diverted current would again have swung over to the south channel through the subsidiary channels between McLean's, Templar's and Coutt's Islands. Seeing, however, that this new north channel had been formed some years prior to the construction of the groynes on the south bank, we are inclined to the opinion that the principal cause of the main current having been diverted to the north side has been the formation of the new north branch, and that the subsequent erection of the groynes has been a contributing factor in a minor degree only. What proportion of the total effect is to be ascribed to each contributing factor we consider it is quite impossible for any one to say.