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NEW ZEALAND.

ORARI AND WAIHI RIVERS IMPROVEMENT

(REPORT ON) BY INSPECTING ENGINEER, PUBLIC WORKS DEPARTMENT.

Laid on the Table of the House of Representatives by Leave.

Wellington, 1st May, 1915.

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ACTING under instructions from the Hon. F. H. D. Bell, Minister of Internal Affairs, I visited the country drained and flooded by the Orari and Waihi Rivers in Canterbury, and examined the beds of both streams from their mouths up to the mountains in which they rise.

The Orari River is much the larger, draining 220 square miles above the railway-bridge (over 200 of these are above Blair's Road). The Waihi drains approximately sixty-five square miles, about forty of which are above Geraldine. In addition to the difference in their drainage area the flow in the Orari is in the spring-time much augmented by melting snow, which, if synchronizing with heavy rain, causes severe floods. The Waihi is not much affected by melting snow, but, being a shorter stream with smaller watershed, is subject to rain-floods more intense in relation to its drainage area than the Orari.

Both rivers possess the peculiar characteristic that in normal times their flows get smaller as they leave the hills and approach their mouths for a certain distance, and then increase slightly again. This may be so marked that after leaving the hills a certain distance they may become quite dry for a number of miles, and then a small stream appears again, and various springs augment their flow, until at their mouths they always have a considerable flow. This peculiar behaviour is due to the materials of which the greater portion of the Canterbury Plains is composed, and which form the beds of the streams in question. A portion of the water sinks in the coarse shingle as the streams flow on, until at some point (depending on the initial quantity and the porousness of the shingle) it has all disappeared. Farther down the shingle becomes finer and impervious layers force the water, or a portion of it, again to the surface as springs, and thus partially restore the flow.

In times of high flood the volume of water discharged from the hills is very much larger: the shingle is probably already soaked by the local rains, and consequently the flood-waters cannot sink into it, and the stream is augmented by the rain actually falling on the lower plain. The result of these causes is that in flood-times the diminution referred to in the previous paragraph is replaced by an actual increase in the flow. Other smaller floods may show a slight diminution, or a steady flow or increase according to the relative intensity with which the above cause may be acting.

A further disturbing element in these streams is the shingle being brought down from the hills. Examination of these and other shingle rivers has shown that avalanches or other spasmodic causes sometimes deliver into the bed of the river vast masses of shingle beyond what is always being brought into them by the ordinary regular agencies of denudation. These spasmodic accumulations of debris are carried forward by the rivers more or less in the form of a wave, which gradually flattens out and is lost in the general travel of shingle, if we follow it far enough down the river. In exceptional cases it is possible that this wave may reach the mouth. What I have called a "wave" is often spoken of as a "bar" of shingle. The rate at which it moves down the river is slow, and may occupy years before it is disposed of: it all depends on the magnitude of the initial disturbance.

The immediate result of the progress of these waves of shingle is to cause variations of the flood-level, abnormally raising it at the point and above where the crest of the wave occurs. Thus banks, whether natural or artificial, which have always proved of ample height for safety may be overtopped by a flood carrying perhaps less water than those which have been safely passed in years gone by.

It has been suggested—and, I think, with reason—that the depredations of the rabbits and other stock, and more especially the practice of burning off the natural vegetable covering of the ground (tussock particularly), has caused much more detritus to be carried into the river-beds than was the case in years gone by. All the evidence of old settlers is to the effect that the rivers now carry more shingle than they did when the land was first settled.

The gradual filling-up of the river-beds results ultimately (in the absence of remedial measures, natural or artificial) in a change of course, the water flowing into a lower channel or one offering a less encumbered passage, and then proceeding to fill it up and shift again, and so on. This results in the formation of flood-plains, such as Canterbury, which is covered in all directions by either live, dead, or moribund river-channels.

Old maps show that when the Canterbury Development Company first explored the country the Orari River flowed through a depression which still to some extent exists near the Geraldine Racecourse, and did not have any defined flow along its present bed below this point.