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Moutoa Sluice Gates

A feat of river engineering

Introduction

The Moutoa sluice gates are a unique feature of the flood protection scheme for the Lower Manawatu River. Since they were installed more than 35 years ago the gates have been opened 20 times, saving properties and many hectares of land downstream of Opiki from the destructive floods that used to affect residents and landowners alike.

Background

The Manawatu River originates north of Norsewood and drains 6000 square km on its way through the Manawatu Gorge to the sea at Foxton. On this circuitous route it is joined by several major, fast flowing tributaries, both above and below the Gorge, including the Mangatainoka, Tiraumea and Mangahao Rivers and the streams of the South East Ruahines above the Gorge together with the Oroua, Pohangina and to Tokomaru below the Gorge. On reaching the wide Manawatu plain the river adjusts to a shallower gradient and, for the last 48 km of its journey it meanders with a fall of just 18 cm per km.

The Manawatu plain was formed from silt carried downstream by the river. Much of this flat expanse of land is at sea level or below and consequently the area can flood easily.

Photo: **Faces of the River.** David Young, Bruce Foster

The big flood of 1953 at Half Crown Bend.

Lower Manawatu Scheme

Prior to the establishment of the Manawatu Catchment Board in 1944, various river and drainage boards had installed stopbanks and greatly improved the natural drainage on the plain. But the devastating flood in 1941 confirmed that effective, co-ordinated flood protection was badly needed.

The Lower Manawatu Scheme was designed in 1946 by Paul Evans, Chief Engineer of the Catchment Board. His brief was to protect 280 square km of pastoral, horticultural and urban land between Ashhurst and the sea. His design included the Moutoa floodway and the sluice or flood gates - features unique to the Lower Manawatu Flood Protection Scheme and the lynch pin of the flood control system.

Moutoa Sluice Gates

The design incorporated stopbanking along most of the Manawatu River from the Gorge to the sea, some of which was already in place when the scheme was given its first major test in the flood of 1953. Only with significant help from the army in laying sand-bags, was the flood water contained. It was patently obvious that the sluice gates were an essential part of the flood control scheme. They were built between 1959 and 1962.

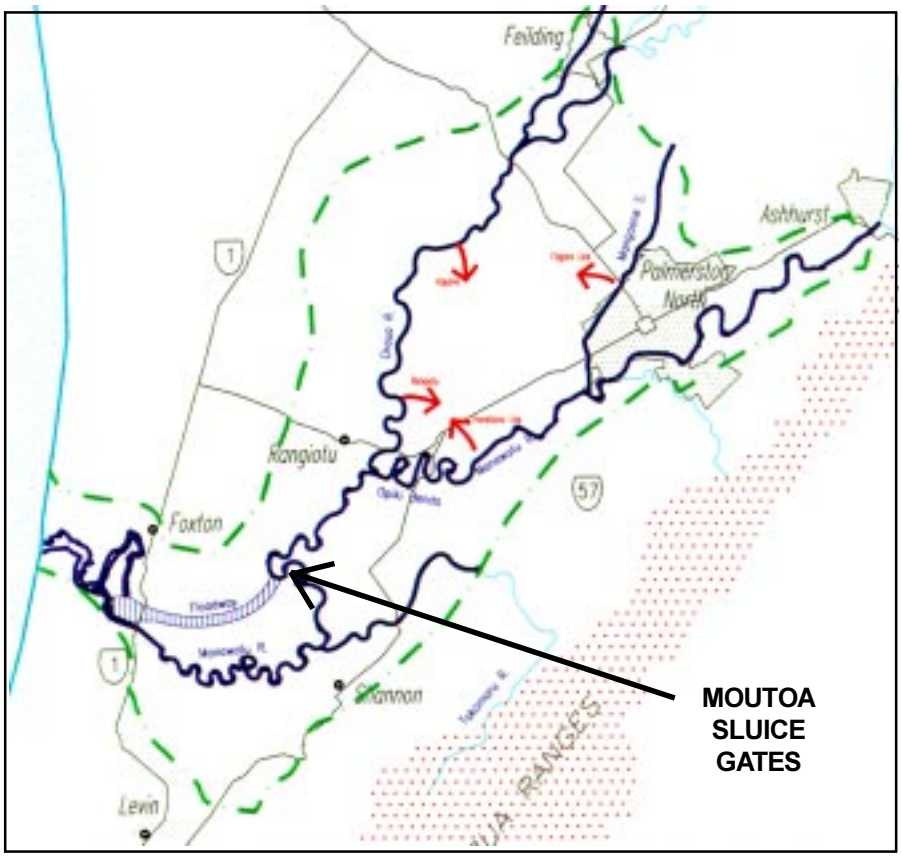
The Moutoa Floodway

Located on the Foxton-Shannon Road, south of Opiki and just above Moutoa, the gates are able to divert water from the main river into a specially designed 10 km floodway that rejoins the river at Whirokino. The Floodway bypasses the 30 km of slow-flowing, meandering channel that can so easily flood, pouring water over many hectares of valuable land.

The Moutoa floodway, an integral part of the system, is 600 m wide and is bounded on both sides by stopbanks 5.5 m high along its length.

Several features of the design prevent the floodway from being damaged by flood flows:

- energy dissipation blocks immediately adjacent to the gates reduce the speed of the water as it comes under the gates
- the curved shape of the structure enables the water to fan out and spread evenly across the floodway
- the floodway rises slightly away from the gates so the water has room to pool and does not gouge out a channel.



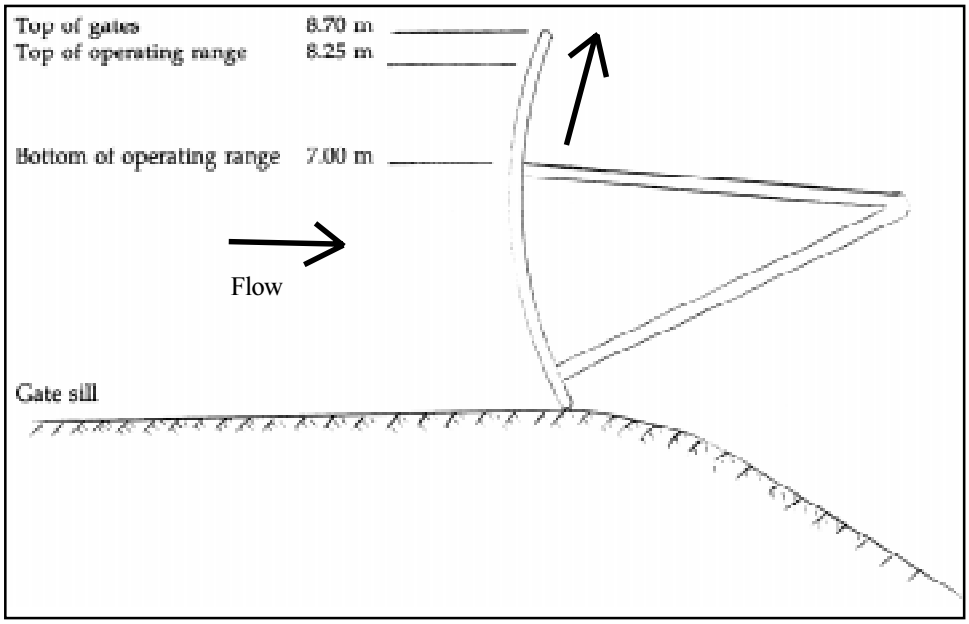
The Manawatu catchment showing the location of the gates and floodway.

Photo: **Faces of the River.** David Young, Bruce Foster

Paul Evans, designer of the Lower Manawatu Scheme, and his pride and joy - the Moutoa sluice gates.

The Moutoa Sluice Gates

The curving reinforced concrete structure contains nine gates. These are steel radial gates, each 15 m wide by 4.5 m high, weighing 15 tonnes. They are raised by a pulley system attached to the concrete piers, operated by a series of electric motors. Each gate can be operated independently and standby power is available in case of electricity failure.



Section through a sluice gate. The gate sill is at ground level of the surrounding land.

To open or not to open?

The gates are ready to be opened at any time should they be needed and **horizons.mw** staff are trained in their operation. The skill of controlling the flood water effectively is in judging the correct time to open, and subsequently close, the gates, by how much and how quickly.

The decision to open the gates has to take into account a number of factors.

The gates are designed to operate within a range of river levels as shown on the diagram above. As the water level in the river begins to rise, the point at which the gates are raised is timed according to the amount of water flowing, not only down the main Manawatu River, but also in tributaries swollen by local rainfall, such as the Tokomaru River. The amount of water in the Manawatu River is determined by weather conditions over the whole of its catchment area. The Tokomaru River is affected by rainfall in the immediate area and adds to the surface flooding on the Manawatu plain.

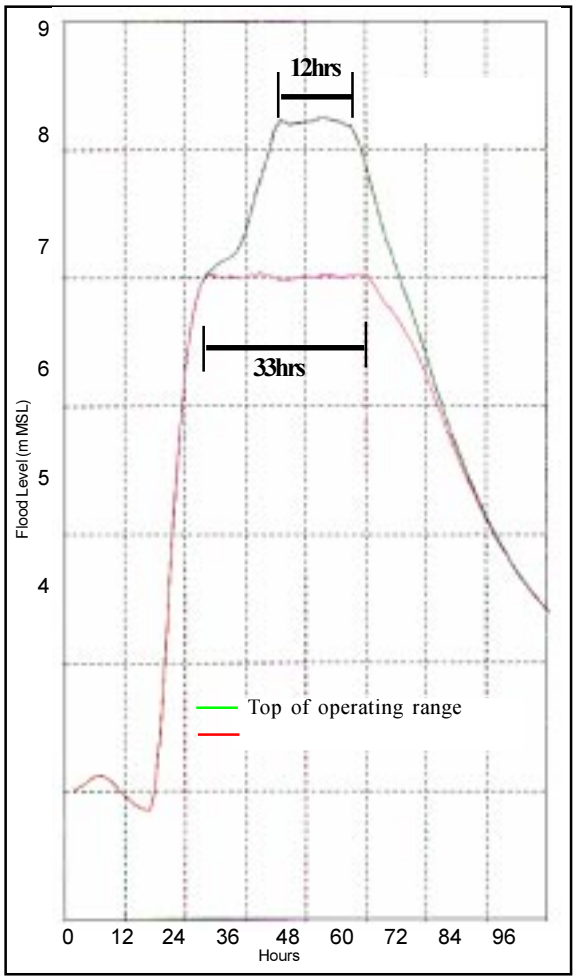
If the gates are opened too soon or too quickly, scouring of the river bed and banks may occur upstream; water flow in the main river will slow down and deposit silt in the already silted river bed. This partially closes the river channel and further restricts the flow of water along this meandering stretch.

The possible rise in water level has to be anticipated to allow gate opening to be very slow at the start. Opening them too quickly could cause a wave to surge down the floodway resulting in damage to both land and stopbanks.

Opening the gates in flood conditions has no effect on flood levels in Palmerston North City or on the drainage of water from low-lying land on the Manawatu plain. By the time conditions have made it necessary to open the gates, natural drainage from lower lying areas will have ceased. The river, contained by stopbanks, will be at a higher level than much of the surrounding land.

This means that gate opening can be delayed until the maximum operational level of the gates is reached. It will not disadvantage those with land upstream of the gates, but will avoid the floodway being under water longer than is really necessary.

Moutoa Sluice Gates



This graph compares the effect of opening the gates at their minimum (7m) and maximum (8.5m) operational water levels. Waiting until the water rises to 8.5m level leaves the floodway under water for only 12 hours compared with 33 hours if the gates are opened at the 7m level.

In practice, the gates would not remain at the maximum operating level for longer than is absolutely necessary. They are shut down slowly as the river falls, to avoid any sudden changes in water level.

The Moutoa flood gates are a remarkable feat of river engineering. The design won an IPENZ award recognising them as one of the key flood control structures of this century. Landowners and residents in the Lower Manawatu Scheme have a unique innovation helping to protect their properties from the devastation of past floods.

The Moutoa sluice gates in operation

Photo: **Faces of the River.** David Young, Bruce Foster

An unwelcome flood in 1914 affects drying flax from the Miranui Flax Mill, Shannon.

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