

Rangitata Diversion Race Fish Screen

The Rangitata Diversion Race (RDR) is the largest irrigation scheme in New Zealand, taking water from both the Rangitata and South Ashburton rivers.

Built between 1937 and 1944, construction of the irrigation and hydro power scheme was a significant engineering achievement at the time.

Now another development in the RDR's engineering story has been realised – a new screening solution to improve protection for important fish life.

The Rangitata River

The Rangitata River is one of the major alpine rivers in Canterbury. It has its catchment in the Southern Alps and flows east across the Canterbury plains to the sea. The Rangitata is well known for its salmon fishery but is also important for many different native freshwater fish species.

As part of their life cycles, salmon and many of the freshwater fish in New Zealand migrate up and downstream in rivers, and between the sea and freshwater environments.

The RDR intake at the Rangitata River can take up to $34\text{m}^3/\text{s}$ flow into the canal for irrigation or hydro power use. This poses a major risk to the fish species entering the canal, given this is often a significant portion of the total river flow and those fish are then lost from the Rangitata.

67km

The length of the RDR, from an intake on the Rangitata River at Klondyke to a discharge at Highbank on the Rakaia River.

34m³

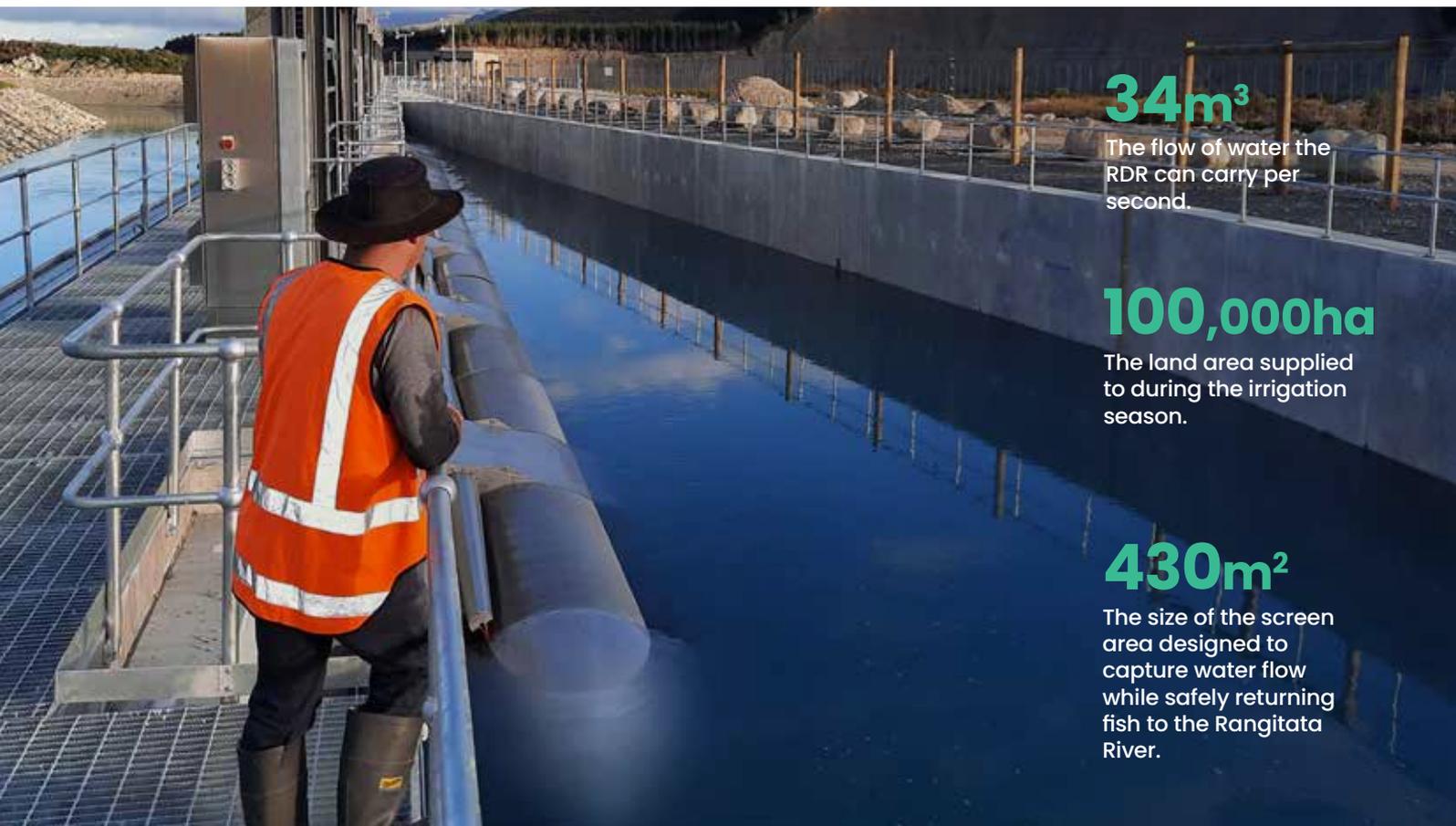
The flow of water the RDR can carry per second.

100,000ha

The land area supplied to during the irrigation season.

430m²

The size of the screen area designed to capture water flow while safely returning fish to the Rangitata River.



The fish screen

A fish screen was built in 2007 as a means to divert fish that had entered the canal back to the Rangitata River.

The screen was a bioacoustic fish fence that provided a bubble curtain and sound to direct fish in the canal to a bypass back to the river.

Over several years the system was tested and modified but found not to be sufficiently effective in diverting the fish, so in 2015 Rangitata Diversion Race Management Ltd (RDRML) looked at alternative options for a more effective means to keep the fish in the river.

Engineering input from Riley

Over seven years from 2015 Riley has provided RDRML with engineering services for a new RDR fish screen, including:

- developing concepts
- providing engineering input to resource consent application
- presenting expert evidence at consent hearing
- detailed design and construction monitoring
- commissioning.

In 2017 Paul Morgan, Riley's Project Director – Water Resources, travelled to California and Washington State to study various fish screen installations, along with RDRML, experts from Fish & Game New Zealand, Ryder Consultants and Environment Canterbury. The group met regulators, designers and manufacturers to gain insights into options for the new screen.



“For me personally, developing the concept for this fish screen has been a career highlight given the scale of the positive impact this will have on freshwater fish in the Rangitata River.”

Paul Morgan, Riley



The challenges

There are huge challenges in the design and construction of a fish screen downstream of an intake from a large braided river such as the Rangitata. The fish screen is just one component of designing an intake system.

As well as fish screening and upstream fish passage, a river intake needs to include:

- protection against floods
- management of debris and sediment
- control of flows
- safety for river users and operators.

The Rangitata River carries large volumes of sediment with the flow, and active sections of the river that change following floods.

The new screen design needed to account for all of these aspects, along with the challenge of fitting in with existing infrastructure.

Riley was the lead designer for the new fish screen. We worked with a variety of experts in a detailed and complex design process, which included:

- 1D, 2D, 3D hydraulic modelling
- 2D sediment modelling
- geotechnical investigations
- civil design, including liaising with screen manufacturers and other experts.

A new solution

The new screen was commissioned in May 2022 and full operation then started. Large groups have visited the fish screen, including on public open days. RDRML has found there is a lot of interest in the screen and how it will help to protect the freshwater fish in the Rangitata River.

New Zealand has 50 native freshwater fish species and over 10 are in the Rangitata, along with salmon. Most of these fish migrate up and downstream and have different swimming abilities and behaviours. This makes it challenging to screen for the different species.

The new screen uses wedgewire with 2mm gaps, which means fish as small as 30mm in length cannot penetrate the screen and will be directed back to the river via a fish bypass. The average velocity into the screens is less than 0.12m/s, which enables even very small fish to avoid being ‘sucked’ onto the screen; they swim past it and back to the river via the bypass.

The design was based on the principles outlined in the NIWA Fish Screening: Good Practice Guidelines for Canterbury and the Canterbury Land and Water Regional Plan.

- **2007**
BAFF screen installed
- **2007-2015**
Testing and modification of BAFF to improve performance
- **2015**
RDRML decide to look at new fish screen options
- **2017**
Study tour to USA to look at fish screen options
- **2018**
Resource consent hearings for new fish screen
- **2019-2021**
Design of new fish screen
- **2021-2022**
Construction of fish screen
- **May 2022**
Commissioning of screen and operation starts

