Improving fish passage at pump stations

New Zealand Fish Passage Advisory Group

Why should you consider fish passage at your pump station?

A pump station is a site that hosts one or more motorised pumps that push water over or through a stop bank to prevent land from flooding.

Many of Aotearoa New Zealand's original drainage/flood protection pump stations are reaching the end of their useful lives. This is the perfect time to consider improving fish passage, especially if migratory fish are present or the habitat upstream would support them, as it will not only reduce the environmental impact of the asset but may deliver cost savings over the life of the asset too.

Our country is home to several species of migratory native fish, such as tuna (shortfin and longfin eels) and galaxiids (whitebait). These fish need to move within our waterways and to and from the sea to complete their lifecycles. However, they currently face major challenges, with the longfin eel and some of our whitebait species being identified as At Risk or Threatened. Pump stations can kill and injure fish trying to migrate downstream and impede their passage upstream.

Current legislation requires owners of pump stations to maintain or improve fish passage at these assets. Regional councils and the Department of Conservation Te Papa Atawhai (DOC) are responsible for managing fish passage in our waterways, which includes enforcing the:

- Resource Management Act 1991, including the Resource Management (National Environmental Standards for Freshwater) Regulations 2020
- Freshwater Fisheries Regulations 1983 (FFR83)[1].

Tuna migration and pump station management

- Tuna can live for many decades in streams, drains and other freshwater habitats before migrating to the sea to breed.
- They only make the heke (migration) once, and after they breed they die.
- It is usually the larger, older tuna (0.6 to >1 m long) that make the heke, which mostly occurs during elevated flows when the pumps need to run (typically January to April).
- When they reach a pump station barrier, tuna are forced to pass through the pump to continue downstream. With non-fish-friendly pumps, this nearly always results in terrible injuries or death.
- If they do not reach their spawning grounds (Pacific deep-sea trenches) in good condition, they cannot breed and the long-term survival of the species will be threatened.
- Newly hatched tuna larvae make their way back to New Zealand river mouths with ocean currents before trying to move inland with flood tides as glass eels (c. 50 mm long).

[1] Replacing pumps within a pump station built after 1 January 1984 will not 'trigger' regulation 43(1) of FFR83, on the basis that it is not a proposal to build a dam or diversion structure. However, regulation 48 may apply if the pump formed part of an approved fish facility under regulation 43/44. If a new dam or diversion structure is proposed, then approval will be required from DOC. A pump station with a culvert within the overall pump structure will be considered as a dam/diversion structure under FFR83.

Department of Conservation Te Papa Atawhai

Te Kāwanatanga o Aotearoa New Zealand Government

What can you do?

Making a pump station ‘fish friendly’ is not always a case of spending millions of dollars on a full rebuild. Nowadays, a range of fish-friendly pumps are available that can replace existing pumps (Figure 1). Most of these were developed in Europe, where they were independently tested for fish mortality. However, the New Zealand owned and operated company MacEwans Pumping Systems is currently developing a fish-friendly variant of their ever-popular PPF 24/30 axial flow pump, which will undergo fish mortality testing in 2023.

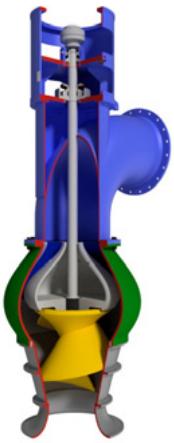
There is no global standard for fish friendliness, so the ability of these pumps to safely pass fish varies with pump type and model – it is up to you to select the best pump to meet your needs. For example, while the Bedford SAF is a fish-friendly model of pump, the SAF 90 model (900 mm diameter) will provide better fish passage than the SAF 45 model (450 mm diameter), especially for larger tuna, simply due to the larger internal clearances within the pump. It is also good to be aware that New Zealand tuna are known to be longer and thicker than their European counterparts.

Here are some of the important considerations when selecting the type of fish-friendly pump to use.

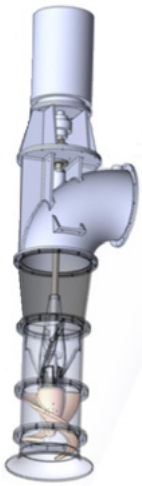
- Which species do you need to provide fish passage for?
- What is the typical size range of the fish in the catchment?
- What level of mortality is acceptable?
- Does the existing civil structure have a long-term future?
- Will the pump provide a long-term (80-year) or medium-term (30-year) solution?
- Is there a need to balance cost against fish passage?
- How do pump options compare in terms of whole-of-life cost of ownership?

Bedford SAF

Bosman MC Vision

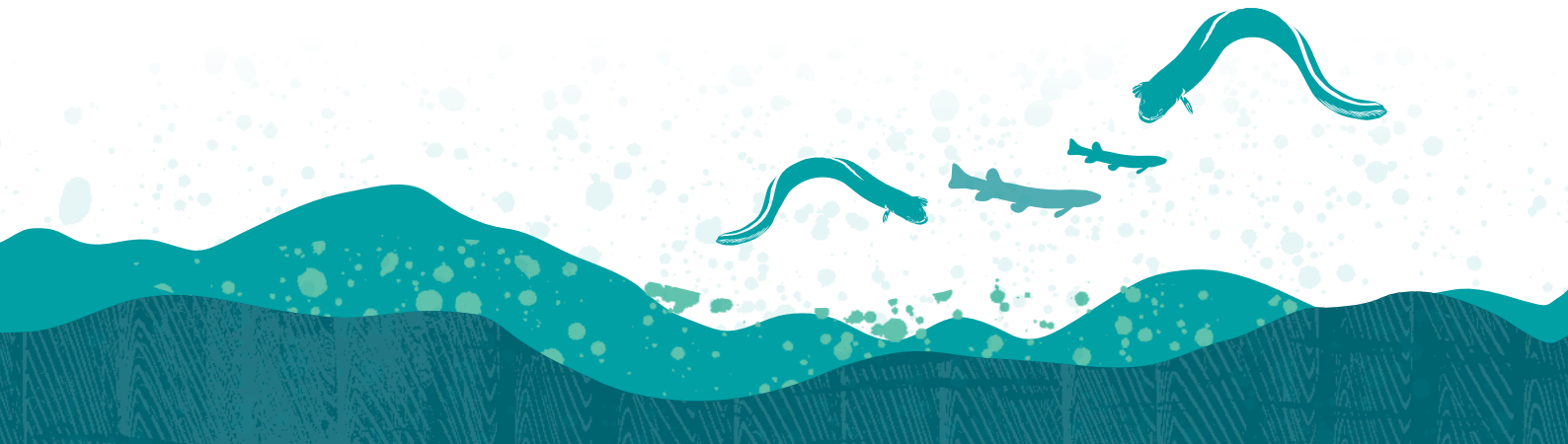


MacEwans FF 24/30 (prototype)



Fish Flow enclosed Archimedes screw pump

Figure 1. Fish-friendly pump options



Additional resources

de Graca, T.; Kemper, J.H. 2019: Fish survivability test for Bosman Vision MC50 at Pumping station Obdam. VA2018_22. Contact Bosman Water management. 19 p.

Spierts, I.L.Y. 2016: Fish safety tests for De nesse pumping station. 20150870/02. Report produced for Bosman Water Management. 25 p.

Vaipuhi Consulting 2018: Eel passage at Orchard Road pump station stage 2, Vai 201802. Report produced for Waikato Regional Council. 55 p.

Vis, H.; Kemper, J.H. 2012: Test fish survivability Bedford Pumps SAF.90.05.12 pump at 330 rpm (1.3 m^3/s). Project number VA2011_28. Prepared on behalf of Bedford Pumps Ltd by VisAdvies, The Netherlands. 17 p + appendices. https://edepot.wur.nl/278558

Vriese, F.T. 2009: Research into fish-friendly screw pumps. Project Number VA2009_19. Prepared on behalf of FishFlow Innovations by VisAdvies, The Netherlands. 14 p. https://fishflowinnovations.nl/wp-content/uploads/2016/12/Research_into_the_fish_friendly_screw_pumps.pdf

Fish-friendly pump suppliers[2]

Enclosed Archimedes screw pumps:

- FishFlow Innovations (The Netherlands) https://fishflowinnovations.nl
- MacEwans Pumping Systems (New Zealand) https://macewans.co.nz

Submersible fish-friendly pumps:

- Bedford Pumps Ltd (UK) https://www.bedfordpumps.co.uk

Direct-drive, axial-flow, fish-friendly pumps:

- MacEwans Pumping Systems (New Zealand) https://macewans.co.nz

Direct-drive, mixed-flow, fish-friendly pumps:

- Bosman Watermanagement (The Netherlands) https://bosmanwater.nl/en

Further information

For general fish passage information, visit Fish passage management.

For information regarding DOC permit requirements, visit Fish passage authorisations.

R235174

[2] Note that the manufacturers listed here were known to be actively supplying their products to New Zealand at the time of writing. This is not intended as a complete list of pump suppliers that manufacture fish-friendly pumps.