



Fish-friendly culverts and rock ramps in small streams

New Zealand's freshwater fish are part of our natural freshwater ecosystems. They are a traditional food source and an important part of our recreational and commercial fishery.

There are 30 freshwater fish species in the rivers, lakes and wetlands of the greater Wellington Region. Eighteen of our 22 native fish species need to migrate between freshwater and the sea during their life. Their survival depends on it. Fish like whitebait and elvers (young eels) swim up rivers from the sea. They must pass through culverts and over weirs on their journeys. Other freshwater fish, such as the introduced trout, must also be able to move upstream to spawn.

Poorly installed culverts or weirs that restrict fish passage will reduce the amount of habitat available for fish, causing a decline in fish numbers. You can help ensure a successful journey for our freshwater fish by following these simple guidelines for building culverts and rock ramps in small streams.



Culverts are placed in rivers and streams to enable people and stock to cross safely and easily. Fish can't get up culverts unless they are built and installed properly.

Weirs are built across rivers and streams to slow the flow of water and raise the level of water upstream. They can prevent fish passage.

Rock ramps are a simple solution for fish passage over low obstacles such as culvert outlets and small weirs.

Why do fish need passage?

Most freshwater fish migrate between rivers and the sea as a necessary part of their lifecycle. For example, whitebait – which are the youngsters of five of our native fish species – migrate upstream to live as adults. Trout don't usually move between the sea and freshwater but, they do swim upstream to spawn.

Culverts or weirs that restrict fish migration limit the number and species of fish in our rivers even if there is habitat available for them upstream.

Installing a new culvert or weir

If you're planning to install a new culvert or weir in a stream, you will probably need a resource consent from the Greater Wellington Regional Council. To find out, contact us or check our Regional Plan User Guide at www.gw.govt.nz/em/planguide/rmguide.htm.

Your culvert or weir design will need to consider and provide for fish passage. In most cases this can be done quite easily.

What about existing culverts or weirs?

Many existing culverts or weirs were designed without fish passage in mind and others are no longer fish-friendly because they have deteriorated over time.

Problems with small culverts can often be fixed with simple alterations. This information sheet can help you fix existing culverts as well as build new ones. Weirs are more difficult to alter. In small streams, replacement of a concrete weir with a rock ramp should be considered. You should also think about removing a weir that is no longer used.

Maintenance

Culverts and weirs need to be regularly checked and maintained to make sure they work properly. You need to watch out for – and act on – any scouring of the stream bed and banks, blockages, structural damage and stream bed movement.



Sandbags and rock placed around the outlet of this culvert help prevent erosion



reeftinned bully

Tips for fish friendly culverts

Reducing water speed

Fast-moving water will prevent fish swimming upstream through a culvert. You can slow down the water speed by:

- choosing a stable site with a minimum stream bed slope
- attaching objects such as rocks or small concrete blocks to the culvert bed. These increase the culvert's roughness, which can reduce water speed and provide resting areas for fish. Make sure the objects won't cause the culvert to become blocked by debris during floods
- placing a rock ramp below the culvert, as described in this information sheet.



giant kokopu

Concrete blocks attached to a culvert floor are fish-friendly



Fish can't migrate up a "perched" culvert

Preventing erosion

Erosion of stream banks and stream beds can happen around culvert inlets and outlets. Channel scour can result in "perched" outlets – one of the most common barriers for fish in small streams.

To avoid "perched" outlets and other erosion problems, make sure your culvert is at least as wide as the stream bed during normal flows. If erosion is likely, protect the stream banks and bed around both the inlet and outlet with rocks or other suitable material. A rock ramp placed below a culvert can also help prevent erosion.



koaro



banded kokopu

Fish-friendly culvert design

The 30 freshwater fish species recorded in the greater Wellington Region all have different swimming and climbing abilities. The following two fish-friendly culvert designs will suit most of these fish and are simple to build. The designs use pipe culverts, which are generally suitable for small streams. When using these designs, you will need to be sure that your culvert is large enough for flood flows as well as providing fish passage.

More complex culvert designs may be needed for specific circumstances depending on location, the species involved, and its swimming capability – contact us if you'd like to know more about culvert designs and the likelihood of particular freshwater fish species being present in your area.

The “low-slope” culvert

“Low-slope” culverts are suitable if your stream is nearly level. They are suitable for all fish species.

With low-slope culverts:

- the culvert is as wide or wider than the stream bed
- the culvert aligns with the natural stream bed channel
- the depth of water in the culvert is the same as in the natural stream bed
- stream bed material is allowed to settle throughout the culvert's length
- if erosion is likely, the stream banks and bed around the inlet and/or outlet should be protected (see “Tips for fish-friendly culverts” in this information sheet).

You will need to keep a close eye on your “low slope” culvert to ensure it's performing as it should.



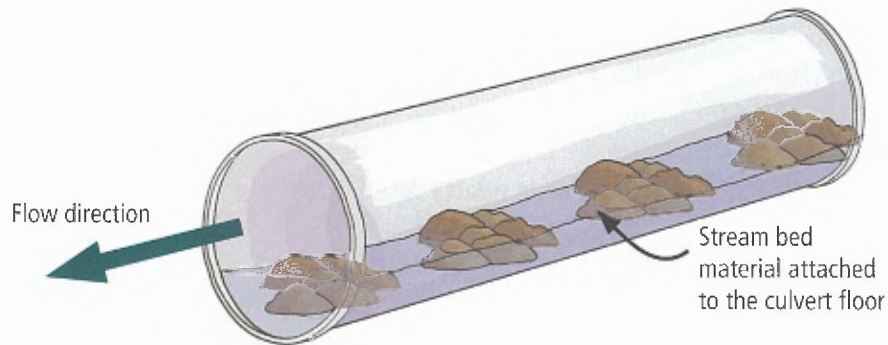
A “low slope” culvert

The “natural stream bed” culvert

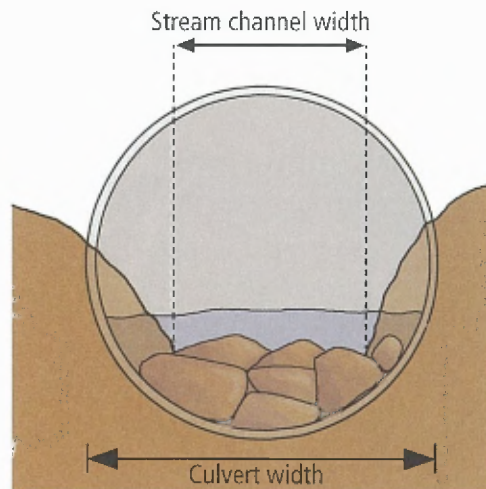
“Natural stream bed” culverts are suitable where the stream has a low to moderate slope. Flow conditions inside them are similar to the natural stream, both upstream and downstream of the culverts.

With natural stream bed culverts:

- stones, rocks or artificial material are arranged and stuck to the culvert floor to simulate the stream bed



- the culvert is wider than the natural stream bed channel. You will need to be careful choosing the width of your culvert and the height of any fixed material in the culvert because flood flows must be able to pass through



- the culvert aligns with the natural stream bed channel
- the slope is the same as the natural stream bed slope
- you will need to consider protecting the stream banks and bed around the inlet and outlet (see “Tips for fish-friendly culverts” in this information sheet) because erosion is more likely than with the “low slope” culvert.

You will need to check your natural stream bed culverts to make sure the simulated stream bed and the rest of the culvert are performing properly.



Rock Ramps

Rock ramps can be used below culverts and as an alternative to steep concrete weirs up to about 1.5 metres in height.

Large rocks are placed across the stream bed to form a zig zag stairway. This will slow water flow and form small pockets of still water and eddies in which fish can rest. Make sure there is at least one clear channel of water that meanders through the rock ramp at low stream flows.

The cross section of the rock ramp from bank to bank should form a shallow "v" shape to help ensure suitable water depths for fish at a variety of flows.

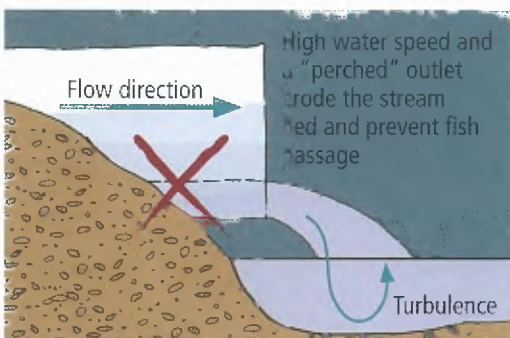
An alternative to steep concrete weirs

As well as providing better passage for fish, your rock ramp will be more visually attractive than a concrete weir. You should aim for a slope of 1:20, but for structures less than 0.75 metres high, a slope of 1:15 can be considered.

Improved passage for fish can be achieved by placing rocks at the top of the rock ramp so that the water channel is a lot narrower than the stream bed. A confined channel at the top of the rock ramp will create flows that "fan out" as water passes over the rocks. This gives fish a better chance of finding their way onto the rock ramp and up it.



A rock ramp on a small stream is more fish-friendly than a vertical concrete weir



Below a culvert

A low rock ramp downstream of a culvert will help prevent "perched" outlets and other erosion problems by slowing down the flow of water at the outlet.

To allow fish passage, build your rock ramp the width of the stream and take care to ensure that the placement of rocks does not cause water to back up in the culvert at high flows.

The outlet of a culvert can be altered to make it fish friendly

