Standard for Temporary Fish Screens on Christchurch City Council Projects

1. Purpose of this Standard

All manner of temporary fish screen designs and materials have been employed in the past on construction Council projects; many have failed. This standard provides guidance on how and where to place a temporary fish screen when works in a waterway are required as part of a Christchurch City Council ("Council") project. It is very difficult to state with any certainty that there are no fish within any given body of water, even for an expert ecologist, therefore where a fish screen is required this standard shall apply **as a minimum**.

2. Exceptions

On a project specific basis, where a suitably qualified and experienced freshwater ecologist (who is registered on the Council's Freshwater and Marine Ecology panel) provides advice that contradicts or supersedes this standard, the advice of the ecologist will apply. In such instances, the ecologist will need to describe in writing the reason for the exception and either: detail the new fish screen design; or explain the reason why screening is not necessary.

This standard only applies to temporary screens for works in waterways. For permanent fish screens, refer to separate guidance for fish screen facilities[1].

3. Fundamental Considerations

Fish screens are used to keep fish out of an area that may cause them harm, such as when physical works occur in a waterway, and/or when a section of waterway needs to be dewatered to undertake work. The underwriting principal of a fish screen is to create a barrier which fish cannot pass, but which allows the passage of water with the minimum of impediment. The greater the degree of flow impairment, the greater the risk of the fish screen failing due to water pressure.

The most common forms of fish screen failure include:

- Incorrect mess size.
  If the mesh size is too course, it will not prevent the passage of all fish. If the mesh size is too fine, it will impede flow too greatly.
- Water pressure at the base and/or sides of the fish screen exceeds the structural integrity of the screen.
  This causes the screen to disconnect from the bed and/or banks of the watercourse, creating a pathway through which fish can pass the screen.
- The fish screen is not high enough.
  Rising water level on the upstream side of the screen (due to a rain event or because the screen and/or trapped debris impedes the flow too much) causes the screen to be overtopped. As a minimum this creates a pathway for fish to pass the screen, but it may also cause the screen to fail completely.
- The screen fails completely.
  Overtopped, washed away, damaged by debris. Whatever the cause, the materials used to construct the fish screen are now just more flotsam in a waterway.

If a fish screen fails, works within the isolated area must cease until the fish screen is replaced and an ecologist has undertaken fish salvage from within the isolated area, and the new fish screen has been accepted.

[1] Hickford M, Jellyman P, Bowie S, McCormick T, McNally S, Meredith A, Morgan P, Webb M, Pringle BZ. 2023. Toward national guidance for fish screen facilities to ensure safe passage for freshwater fishes. Report prepared by NIWA for SFF Project 4405972: Adoption of good practice fish screening, Milestone 14 - Final Report, May 2023.

4. Constructing a Fish Screen

Material such as windbreak or shade cloth is often used to provide a screen of appropriate mesh size. The drawback of such soft material is that it requires structural support to retain shape and integrity in a flowing water environment, especially where water depth/velocity may increase in response to storm events or other activities. Use of steel mesh is preferable where this is available.

There are two commonly used types of fish screen; for the purposes of this Standard, they are referred to as a 'fence' and a 'box'. Fence refers to a fish screen that spans the full width of waterway; box refers to a cage like fish screen that is used to enclose a discrete intake, such as a pipe or pump. An image of each type of fish screen is shown below.

On Council projects, fences are typically used where fish must be excluded from a length of waterway where the passage of water must be maintained. They work well in steep sided waterways such as box culverts. Box screens are most commonly employed on a pump intake hose and can be used in any waterway that is large enough to accommodate a suitably sized box.

Example of a 'fence' type fish screen.

Example of a 'box' type fish screen.

5. Installation

They key requirements for an effective fish screen are:

5.1 General

- The fish screen must be constructed with a mesh size of 2-3mm gaps.
- If a soft material like shade cloth is used for the fish screen this will need to be supported by a strong wire mesh within a frame (e.g. hurricane fencing or concrete reinforcing mesh for a fence, a gabion basket or IBC frame for a box). This will provide strength and support to the screen material with minimal reduction in cross sectional area relative to flow.
- If the fish screen becomes regularly clogged with debris, consider installing an additional trash screen upstream of the fish screen to trap larger debris. This will facilitate easier cleaning and minimise damage/blocking of the fish screen.
- Check the fish screen prior to commencing any works and regularly thereafter to ensure it has not been damaged or failed in any way and to remove any collected debris.
    - Once satisfied that the screen is effective, works can commence, with ongoing regular checks. More frequent checks (every 1-2 hours) will be needed in locations with higher water velocities and/or soft sediments, due to the greater risk of erosion and screen failure, or when there is a lot of debris (e.g. leaves) that may clog the screen and result in it overtopping.

5.2 Fence Screens

- Install a fence on an angle (30-45^0) to increase cross sectional area and minimise risk of the screen being undercut or bypassed (or blowing out completely) due to flow pressure on the screen. It will also encourage debris to slide down the fence to the lowest corner; this will help keep the fence clear and also make debris clearance easier from the bank.
- Ensure a fence is well keyed into the bed and banks of the waterway and use sandbags to ensure no gaps along the bottom edge of the fence. Ensure a fish screen fence extends far enough up the bank to ensure it is not overtopped if the flow backs up.
- Ensure any pump intake hose is positioned away from the fence by at least 1m to avoid fish and debris getting sucked onto or through the screen.
- If a fence is used in a waterway with shallow banks, it is important to ensure there are no gaps at the sides/ends of the fence. Consider using a sheet pile or steel plate (or similar) pushed into the bank to create a straight vertical surface the fence can butt up against and be fixed to securely.

5.3 Box Screens

- A suitably sized box screen must be used on any pump intake.
- If the pump is 4" or smaller a box screen should be at least 500mm on a side, if the pump is larger than 4" the box screen should be 1m on a side[2].
- The bottom of the box must be covered with a solid sheet (e.g. plywood) that prevents fish entry as well as disturbance/induction of bed sediments.
- Ensure the box and the pump hose are both adequately secured/supported (e.g. using warratahs or fence posts) so that the box screen does not get tipped over by the weight of the hose.
- A pump intake hose must be capped with a rose with the smallest hole diameter available for that pump size/make, and the rose should be suspended mid water depth. Avoid resting on the base where possible.
- If a box is used in a flowing water environment, install the box at 45^0 to the direction of flow to encourage debris to slide of the box.

6. Other Related Requirements

Council holds a number of resource consents which in unison authorise the damming, diversion and bypass pumping of surface water. Therefore, the following considerations must also be allowed for when planning to installation and use a fish screen:

- The pump intake and discharge must be set up in a way that does not generate suspended sediment or cause scour/erosion of the bed banks of the waterway, particularly at the discharge point. The discharge water quality will need to be to a standard that is acceptable to Council and Environment Canterbury.
- To avoid fish stranding, ensure sections beyond the area of works do not go dry because of dewatering or bypass pumping activities. This is a particular risk in small waterways with little flow. In such waterways, it may be necessary to walk some distance downstream, to ensure the entire flow is not lost to the bed.

[2] In small/narrow waterways, boxes of these dimensions may not always be practicable. Where this is the case, form a box that fully encompasses the pump intake with as much space between the box and the intake as possible so as to minimise damage to the fish screen and chocking of the pump intake. Alternatively, seek expert advice from an ecologist.

Fish Screen Installation Checklist

Item Not	Yes	No	N/A
1. General			
a) Screen mesh gaps no greater than 3 mm?			
b) If mesh is soft material, is it adequately supported?			
c) Are screen checks frequent enough for this operation/environment?			
2. Fence Screens			
a) Is the screen at an appropriate angle to flow?			
b) Is the screen sufficiently keyed into the bed and banks?			
c) Confirmed the screen is not being undermined? (look and feel under the screen)			
d) Sandbags in place?			
e) Is the screen far enough up the bank?			
f) If the screens have overtopped, has fish salvage occurred again?			
3. Box Screens – For All Pumps			
a) Is the pump intake fully enclosed within a box screen?			
b) Is the box screen big enough for the pump (see Section 5.3 above)?			
c) Is the bottom of the box solid?			
d) Are the pump and hose adequately supported?			
e) Are the pump intake holes the smallest available for pump size/type?			
f) Is the box installed at an angle to the flowing water, if applicable?			
4. Other Related Requirements			
a) Has the person doing the work read this standard & the accompanying Plan?			
b) Has the work been done or checked by experienced workers?			
c) Are appropriate erosion & sediment controls in place?			
d) Is there sufficient flow downstream to prevent fish stranding?			
Notes (include any observable non-conformance, non-standard alterations, or adjustments undertaken)			