# Conserving Fish Passage – Managing Waterway Barriers

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***frc environmental's specalist and suitably qualified freshwater ecologists provide innovative fish passage solutions for all types of waterway barrier works, ensuring cost-effective, practical solutions that are readily accepted by the regulator.***

## What is a Waterway Barrier and what constitutes 'Waterway Barrier Works'?

A waterway barrier is any form of infrastructure built on a waterway[1] that impedes flow or connectivity. This includes permanent structures (e.g. dams, weirs, culverts, and bed-level road crossings) and temporary installations (e.g. temporary workspaces, silt curtains, and litter booms).

Under the *Fisheries Act 1994* and *Sustainable Planning Act 2009*, 'waterway barrier works' include the construction, raising, and replacement of such structures, and also some maintenance works.

Waterway barrier works may impede the movement of fish along waterways, and negatively impact fisheries resources. Proponents of waterway barrier works projects are consequently required to demonstrate that adequate fish passage will be conserved.

## Why is Fish Passage Important?

All freshwater fish, large and small, migrate at some scale, at some time in their life. Some species make infrequent migrations over relatively short distances, whereas others may migrate regularly over large distances.

Migration enables fish to:

- move between feeding and breeding areas, which are often in different habitats (e.g. some freshwater fish need access to estuaries to breed)
- move from waterway channels to floodplains during high-flow events
- locate mates and suitable habitats along the course of a river (the distribution of suitable habitat and potential mating partners may be patchy along a river), and
- find refuge (e.g. permanent water) during dry seasons or droughts, and then dispurse from refuge areas after the rains come again.

There are four general patterns of fish migration in riverine systems:

- potadromous migration: migration by adults and / or juveniles within freshwater sections of a river system
- catadromous migration: migration by adult fish from freshwater habitat to estuaries (or the ocean) where they breed, with both adults and post-larvae migrating back up river to freshwater habitat once breeding is complete
- amphidromous migration: migration between freshwater and estuaries as part of the lifecycle of predominantly freshwater species, but not for the purpose of reproduction. Movement is back and forth between freshwater and estuarine habitats by adults in some species, whereas for

[1] a 'waterway' is defined under the *Fisheries Act 1994* as ' including a river, creek, stream, watercourse or inlet of the sea', with 'watercourse' further defined as per the definition of a watercourse under the *Water Act 2000*. The key element of a 'watercourse' as defined under the *Water Act 2000* is the presence of a clearly defined channel, which is indicated by *banks* that distinguish the watercourse from the adjacent floodplain or valley.

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other species migration involves the passive transport of eggs or larvae from freshwater breeding / spawning locations to estuaries, where early development occurs in salt water, with post larvae migrating back up river to freshwater habitat, and

- anadromous migration[2]: migration by adult fish from oceanic habitat up river to freshwater breeding / spawning habitats, followed by migration of juveniles down river to oceanic adult habitat.

The latter three types of migration all require movement between freshwater and marine waters, and are collectively referred to as diadromous migration.

Other types of aquatic fauna including river prawns, glass shrimp and turtles also migrate along rivers. Further, the dispersal of some freshwater invertebrates requires fish passage (e.g. the larvae of freshwater mussels hitch-hike on the gills of fish, meaning that fish migration is essential for mussels to maintain their distribution). Fish communities of continental rivers typically have a mix of potadromous and diadromous species, whereas fish communities on oceanic islands (e.g. South Pacific Islands, Caribbean Islands) are comprised almost exclusively of diadromous (mainly amphidromous) species.

A permanent waterway barrier on a downstream reach may cause significant changes to fish communities along the whole river if diadromous migration is impeded. Indeed, on some oceanic islands significant waterway barriers totally exclude all fish and shrimps (as they are all diadromous) from areas upstream of dams, creating biological 'deserts' in upstream areas. Multiple waterway barrier works may cause cumulative impacts and can severely change aquatic communities. Secondary ecological impacts such increased rates of benthic algal growth, sedimentation and accumulation of organic matter may result from the exclusion of migratory fish and shrimps due to waterway barrier works.

To account for differences in the level of 'risk' to fish passage by waterway barrier works in Queensland, the Queensland Department of Fisheries has developed the GIS-based determination of waterways spatial layer '*Queensland waterways for waterway barrier works*'. The risk categories are low to major risk of impact (i.e. low, moderate, high and major), with small headwater streams typically mapped as 'low risk' and large riverine channels typically mapped as 'major risk' of impact to fish passage, with all estuaries and tidal waters also mapped as 'major risk' of impact to fish passage.

## Types of Waterway Barrier Work Approvals in Queensland

All wetlands and waterways are Matters of State Environmental Significance (MSES) under the Queensland Sustainable Planning Regulation 2009 pursuant to the *Sustainable Planning Act 2009* (SPA). SPA integrates several legislative instruments relevant to wetlands and waterways, including the *Fisheries Act 1994* (protection of fisheries resources, including fish habitats, fish passage and marine plants).

SPA allows for self-assessment of low impact minor, temporary and regularly re-built waterway barriers, providing that the works adhere to the standards and requirements of Fisheries Queensland self-assessable codes. Other types of waterway barrier work are subject to the development approval process.

[2] Australia has no species of fish that have a strong anadromous life history, but this class of migration is included here for completeness. The classic example of anadromous migration is the upstream movement of salmon in North America from oceanic habitats to freshwater breeding habitats.

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### *Self-assessable Waterway Barrier Works*

The Fisheries Queensland self-assessable codes relate to specific categories of waterway barrier works, being:

- construction of minor dams and weirs - allows construction, raising or replacement of minor weirs on 'low' risk watercourses, providing that the spillway design achieves prescribed design standards of the code to ensure adequate fish passage
- replacement of existing floodgates - allows for the replacement of existing lawful floodgates, with specifications for both design (i.e. flood gate design to ensure adequate fish passage) and construction (acid sulfate soil disturbance, marine plant disturbance, disturbance of bed and banks) phases of floodgate replacement
- construction and maintenance of culverts - allows for the construction and replacement of culverts on 'low, moderate and high risk' waterways, providing that culvert design achieves prescribed design standards of the code to ensure adequate fish passage
- construction and maintenance of bed-level crossings - allows for the construction and replacement of bed-level crossings on 'low, moderate, high and major risk' (excluding estuaries and tidal waters) waterways, providing that bed-level crossing design achieves prescribed design standards of the code to ensure adequate fish passage
- temporary waterway barrier works - allows for the installation of temporary waterway barrier works on 'low, moderate, high and major risk' waterways, providing that temporary waterway barrier works achieve the prescribed standards of the code
- regularly constructed temporary waterway barrier works - a code that relates specifically to construction of temporary dams in the lower Burdekin River, providing that fish passage is achieved via a bypass channels in an anabranch.

### *Waterway Barrier Works Requiring Development Approval*

Where the proposed design or type of waterway barrier is not considered a low or minor impact, or a temporary impact, or where the level of risk to fish passage is high[3], then development approval is required.

The Sustainable Development Application Provisions (SDAP) set out the environmental Performance Outcomes to be achieved by development applications in relation to MSES to achieve compliance with SPA. Module 5 of SDAP relates to Fisheries Resources, with module 5.2 relating to the construction or raising of waterway barrier works. Many of the Performance Outcomes of module 5.2 relate to the provision of adequate fish passage, including the incorporation of effective fishways in the design of permanent waterway barrier works.

Development applications for waterway barrier works require detailed responses to each SDAP Performance Outcome, describing how the Performance Outcome will be achieved, with the assessment supported by appropriate data analysis of the fish passage requirements of local native fish species (possibly including application-specific survey data depending on the nature of the development and / or the nature of the waterway), and by detailed analysis and description of how the design of the waterway barrier work will afford adequate fish passage for these species (e.g. by the incorporation of a fishway, such as fish ladder or bypass channel for low barriers, or trap and haul, fish lock or fish elevator for high barriers).

[3] Higher than 'low' for minor weirs, and higher than 'high' for culverts.

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## Early and Rigorous Assessment of Fish Passage Mitigates Risk

The rigorous assessment of fish passage by Suitably Qualified persons for *both* self-assessable and development approval processes substantively lessens the risk of:

- delays to project implementation,
- the department imposing unduly onerous conditions (e.g. excessive monitoring programs), and
- reputational damage due to 'non performance'.

Even ground-truthed validation of the waterway and of the risk posed by a proposed waterway barrier at the Project conception stage can save considerable time and expense, particularly where mapped waterways are found to meet the definition of 'drainage feature' rather than 'watercourse' (and therefore are not 'waterways' under the *Fisheries Act 1994*). Where defensible assessment indicates a potential risk to fish passage, input during the design phase by a Suitably Qualified fisheries biologist is the most reliable way to ensure an outcome acceptable to the regulator (i.e. that demonstratably provides 'adequate fish passage').

Post-construction fish passage monitoring is generally required as a condition of development approval, with both the design and implementation of the monitoring program requiring Suitably Qualified fisheries biologists. Where up-front assessment is of high standard, giving a *priori* confidence to the regulator, monitoring requirements are likely to be relatively modest. However, we know of instances where pre-development assessments were of poor standard (leaving the regulator in doubt as to the likely impacts), and the resultant development approval conditions required onerous post-construction monitoring.

The provision of adequate fish passage is a legal requirement to meet acceptable standards of environmental management. Having Suitably Qualified fisheries biologists involved from the early design phase of a waterway barrier work project is critical to scheduling and budgetary certainty.

frc environmental offers Suitably Qualified and experienced fisheries biologists, together with the credibility earned over 3 decades of practice.