

# D

## Appendix D

### Maintaining Fish Passage/Habitat – Design

**Superseded/repealed from 1 November 2021 – refer to  
<https://www.dit.sa.gov.au/standards/environment>**

#### Introduction

Construction work within a watercourse can have significant impacts on fish and fish habitat. This appendix describes a range of issues which should be considered in the planning, design and construction phases of a watercourse crossing.

#### Managing Construction Impacts

Accessing bridge pylons or getting machinery into the watercourse to build a structure may require restriction or redirection of water flow. Where possible it is important that fish passage is not blocked or impeded during construction. Instream works should be completed as quickly as possible to minimise impacts on fish.

Every effort should be made to ensure that construction work is undertaken during the time of year when stream flow is either zero or very low. Work should also be avoided during significant rainfall events.

Timing of works should take into account the migratory seasons of fish and other aquatic fauna, and avoid disturbing migratory movements.

Water quality should be protected when undertaking construction work within a watercourse. A Soil Erosion and Drainage Management Plan should be prepared and sediment control measures be put in place to minimise sedimentation of the waterway. In-stream works should be completed as quickly as possible.

#### Design of Structures

To retain fish passage, the natural stream width should be maintained to minimise increases in water velocity at crossings. Natural tidal flows in coastal areas and inundation of estuarine areas should also be maintained. In some cases it may be appropriate to design culverts of three differing flow capacities:

- for fish passage during low flows
- for fish passage during high flows
- able to cope with flood events.

It is important to take into account the swimming speeds of the native fish species in the watercourse and the individual characteristics of the structure such as flow conditions and stream environment when designing modifications or structures. Refer to Section 2.7 for references on native fish in South Australia.

#### Invert level of the crossing

Vertical or steep drops should be avoided as most native fish are unable to leap over even small structures. The invert levels of culverts should reflect the natural level of the stream bed, so that water velocities, both through and immediately downstream of the culvert are the same as the natural flow rates upstream of the crossing.

## Managing a drop or apron

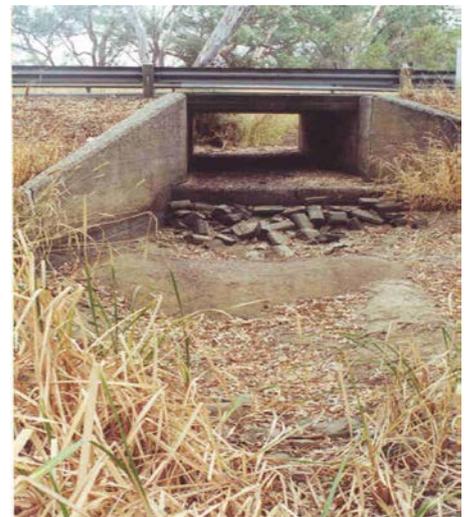
If a drop needs to be created, provide resting places for fish on the downstream apron or a fish ladder.

Providing resting places for fish on the downstream apron is critical to successful fish passage. Fish must be able to pause in high velocity water as they approach the weir, or any obstruction, so that their passage can occur in a stepwise fashion. This is important when fish are using burst speeds, which can only be maintained for a few seconds. Wooden baffles, boulders or large rocks can be successfully added to the downstream apron of a weir to provide resting areas. The order of placement of obstruction objects is important and an ordered pattern of staggered rows suited to the size of fish in the waterway, should be used.

If using rocks they should have crevices under them to provide access for fish to hide and rest. The placement of jutting, irregular shaped and sized rocks immediately upstream and downstream of the culvert and on the apron of a structure or weir provides shelter and rest areas for fish entering and exiting the culvert.



Roughened surface provides a fish ladder.  
Tookyerta Creek



Avoid steep drops which prevent fish passage during low flows.  
Brookman Rd. Meadows

## Improving habitat within a culvert

There are a number of options to maintaining natural substrate or stream bed conditions within culverts and pipes:

- bottomless culverts/pipes ensure minimal disturbance to the stream bed
- the base of the pipe/culvert is set into, rather than on the stream bed
- natural sediments from the site (eg. mud, sand and gravel) can be placed on the bottom of the culvert which can then provide continuous stream bed habitat
- the top surface of the base of the culvert/pipe can be roughened at the concrete pouring stage to create small depressions – these will then allow natural sediments to be trapped in the base of the culvert/pipe creating a more natural substrate for fish or a fish passage can be built into the culvert base (see photo below).
- pipes/culverts create a foreign environment which may be difficult for fish to negotiate and may even inhibit fish movement because of the dark conditions – in these situations consideration should be given to minimising the width of the structure or incorporating grates or sky lights in the top of the culvert/pipe.



Fish ladder in culvert, Margaret Creek, Oodnadatta track

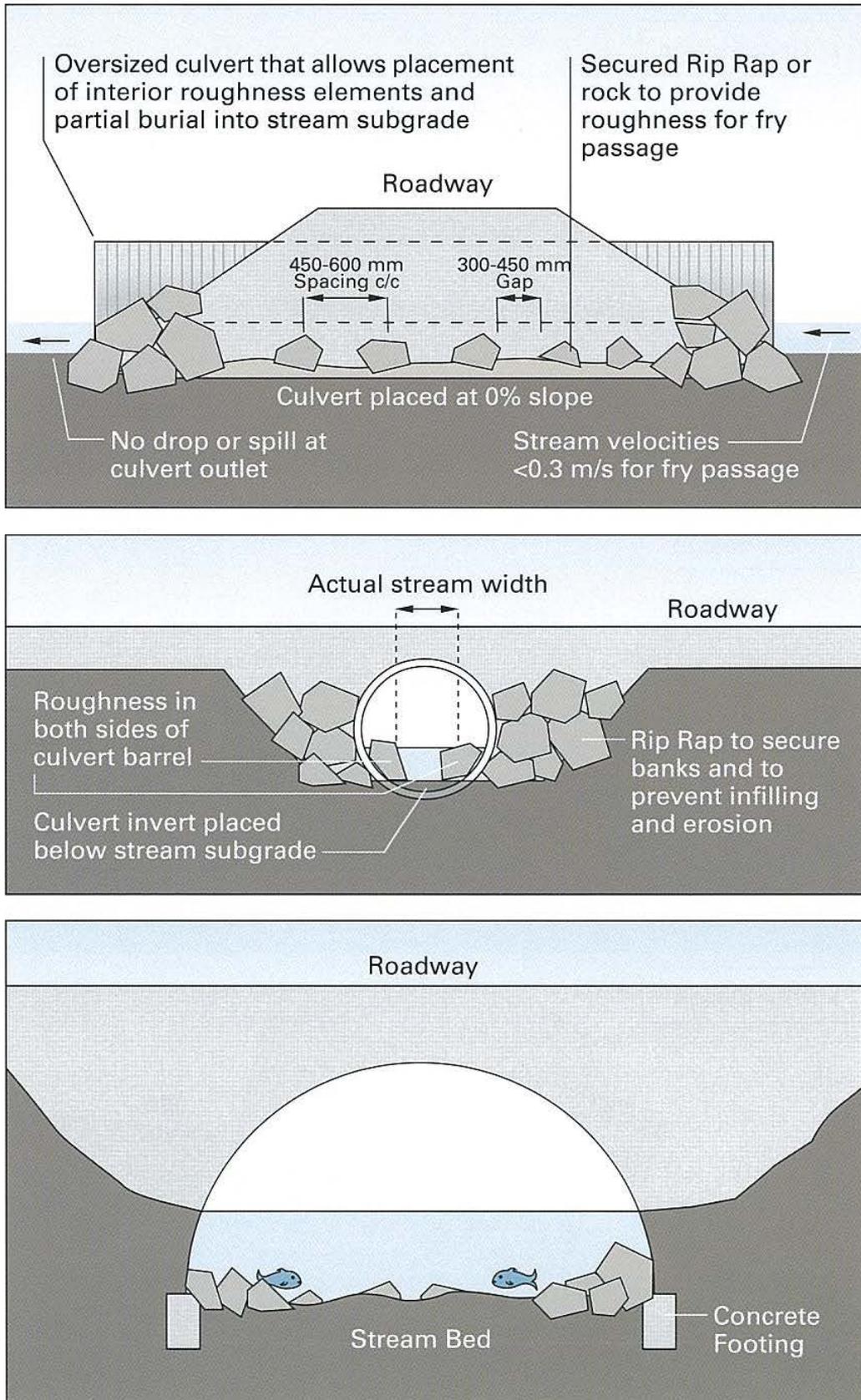
## Fords

Where possible fords should be located in areas of minimal river gradient. The gradient should be even over the entire section. Vertical or steep drops should be avoided by use of the above techniques.

## References and Further Information

- NSW Fisheries (1999) *Policy and Guidelines for Bridges, Roads, Causeways, Culverts and Similar Structures*. Eds. S. Fairfull and S. Carter.
- QLD Department of Primary Industries (1998) *Fish Passage in Streams – Fisheries Guidelines for Design of Stream Crossings*. E. Cotterel. Fish Habitat Guideline FHG 001
- QLD Department of Transport and Main Roads (2010) *Fauna Sensitive Road Design Manual Volume 2: Preferred Practices*
- Adelaide and Mount Lofty Ranges Natural Resources Management Board Video, *West Beach Fish Ladder*, Access: <http://www.youtube.com/watch?v=spFgpWOWq3E&feature=youtu.be>
- Fairfull, S., Witheridge, G. (2003) *Why do fish need to cross the road? Fish Passage Requirements for Waterway Crossings*. NSW Fisheries Cronulla, Access: [http://www.dpi.nsw.gov.au/\\_data/assets/pdf\\_file/0004/202693/Why-do-fish-need-to-cross-the-road\\_booklet.pdf](http://www.dpi.nsw.gov.au/_data/assets/pdf_file/0004/202693/Why-do-fish-need-to-cross-the-road_booklet.pdf)
- Kapitzke, R. (2010) *Culvert Fishway Planning and Design Guidelines. Part C – Fish Migration Barriers and Fish Passage Options for Road Crossings*. James Cook University, School of Engineering and Physical Sciences, Access: [Culvert Fishway Planning and Design Guidelines](#).

Figure D-1 Fish Friendly Culverts



Source: Choctawhatchee Watershed Management Authority (2000)

Figure D-1 (Continued) Fish Friendly Culverts

