Instream Flow Control Systems

INSTREAM PRACTICES

Photo 1 – 'Aqua Barrier' water-filled isolation barrier

Photo 2 – Sediment fence isolation barrier

There are usually two sources of water flow that need to be managed while conducting instream works: firstly stream flows passing through the work area, and secondly lateral inflows, usually consisting of local stormwater runoff flowing towards the channel.

(a) Diversion of stream flows

The most critical flow diversion activities are those used to divert in-bank stream flows around the work site. There are basically three ways of diverting stream flows, those being:

- use of cofferdams with a gravity bypass pipe;
- use of cofferdams with a pumped bypass;
- use of an *Isolation Barrier*.

The advantages and disadvantages of the three systems are summarised in Table 1.

The greater the flow rate and the cleaner the stream flow, the greater the need and value of instream flow diversion. Therefore, the first option should always be to delay instream soil disturbances until channel flow and the risk of flood flows is at a minimum.

Wherever reasonable and practicable, flow diversion works should be designed to be structurally stable during at least the 1 in 2 year stream flow.

Once an instream work area has been isolated from the stream flow, it is important to take all reasonable and practicable measures to extract wildlife from the enclosure prior to commencing construction or maintenance activities. It should be noted that in most states the capture and release of aquatic wildlife is strictly regulated by state authorities, and may only be done by registered wildlife handlers. It is also highly likely that the use of a cofferdam or *Isolation Barrier* will require approval by one or more state authorities.

Table 2 provides recommended stream flow diversion options.

Table 3 provides the attributes of various stream flow diversion techniques.

Photo 3 – Floating silt curtain

Photo 4 – Sheeting piling

Photo 5 – Earth embankment

Photo 6 – Geo logs

(b) Diversion of lateral inflows

All reasonable and practicable measures need to be taken to convey the lateral inflow of stormwater runoff around or through the work area in a non-erosive manner. Wherever reasonable and practicable, this inflow of 'clean' water should not mix with any 'dirty' water generated within the work area.

The diversion of lateral inflow is recommended in the following cases:

(i) when rainfall is expected or likely; and

(ii) material stockpiles on the side of the channel contain clayey, silty or otherwise harmful material, and where any materials washed from these stockpiles are likely to wash into the drain or waterway; or

(iii) lateral inflows are likely to flow over exposed soil or cause bank erosion within the work area.

Catch Drains or *Flow Diversion Banks* (earth or straw bales) can be used to divert up-slope stormwater runoff around stockpiles and other soil disturbances. The diverted water can either be directed as sheet flow towards an undisturbed channel bank, or discharged to a temporary geotextile *Chute* constructed down the channel bank.

Table 1 – Advantages and disadvantages of various low-flow bypass options

Bypass option	Advantages	Disadvantages
Cofferdam with gravity bypass pipe	• No power cost.	• Bypass pipeline may interfere with work activities. • Flood flows still pass through the work site. • Disruption to fish passage.
Cofferdam with pumped bypass	• Bypass pipeline does not interfere with work activities.	• Added power and maintenance costs. • Flood flows still pass through the work site. • Disruption to fish passage.
Isolation barrier	• Minimal disturbance to normal channel flow. • Minimal disruption to fish passage. • Better able to isolate the work area from flood flows.	• Some *Isolation Barriers*, such as *Silt Curtains*, are not watertight. • Requires work across the channel bed to be staged.

Table 2 – Recommended stream flow diversion options

Condition	Recommendations
Default conditions	• Flow diversion should only occur if it is financially feasible and the environmental benefit gained by its use exceeds the potential harm caused by the installation and removal of the *Isolation Barrier* or cofferdams.
No base flow	• If there is no base flow (i.e. no obvious running water, but permanent pools may be present) and stream flow is **not** expected during the construction or maintenance activity, then refer to the default conditions.
	• If there is no base flow (i.e. no obvious running water, but permanent pools may be present) but stream flow is possible, then appropriate consideration should be given to the installation of an *Isolation Barrier*.
Base flow exists in the stream	• If there is base flow and increased stream flows are **not** expected, then appropriate consideration should be given to the installation of cofferdams with a low-flow bypass system.
	• If there is base flow and increased stream flows (i.e. in response to a storm) are possible, but not likely, then the choice between the use of an *Isolation Barrier* or cofferdams will depend on the likelihood of stream flows overtopping the cofferdams.
	• If there is base flow and increased stream flows are expected (i.e. in response to a storm), then the first option should be to delay the proposed works until stream flows are a minimum. In any event, priority should be given to the install an *Isolation Barrier*.
Fish passage required to be maintained	• First preference: an *Isolation Barrier* that isolates no more than 30% of the stream width at any given time. • Second preference: an *Isolation Barrier* that isolates no more than 50%, of the stream width at any given time if the first preference is either unreasonable or impracticable.

Table 3 – Attributes of various stream flow diversion techniques

	Cofferdams	Earth embankment (isolation barrier)	Floating silt curtain (isolation barrier)	Geo logs (isolation barrier	Inflatable dams (isolation barrier)	Sediment fence isolation barrier	Sheet piling (isolation barrier)
Standard drawing code	Dam	IB	FSC	Log	IB	SFB	IB
Installation							
Able to be installed across full channel width	✓				✓		✓
Stream flow velocity							
< 0.15m/s	N/A	✓	✓	✓	✓	✓	✓
0.15 to 0.25m/s	N/A	✓		✓	✓	✓	✓
> 0.25m/s	N/A			✓	✓		✓
Water depth							
< 0.8m	✓	✓		✓		✓	
> 0.8m	✓		✓		✓		✓
Wave height							
< 150mm		✓	✓	✓		✓	
> 150mm	✓		[1]		✓		✓
Debris flow							
debris rafts	✓				✓		✓
logs	✓				✓		✓
ice	✓						✓

N/R Not applicable.

[1] For depth greater than 3m, the wave height should not exceed 5% of the water depth.