# Soil conservation waterways – construction and management

Constructed waterways in cultivated lands are used to collect runoff from contour banks and convey it at a safe velocity to a drainage line or creek. They should be designed, constructed, stabilised and maintained to reduce the risk of failure by gullying or by overtopping.

This science note provides information about the construction and management of waterways. It should be read in conjunction with the science notes L271 *Soil conservation waterways—plants for stabilisation* and L272 *Soil conservation waterways—planning and design*.

## Construction

The science note *Soil conservation waterways— planning and design* (L272) provides details about different types of waters used for soil conservation. Figure 1 below shows a typical waterway shape.

**Figure 1. A waterway with a trapezoidal cross-section**

Waterways are constructed with farm dozers, bulldozers, graders or scrapers. Dozers are most effective where gullied sections have to be filled during the construction and for the construction of parabolic–shaped channels. Graders and scrapers are well suited to long and wide waterways. Scrapers are more suitable than dozers for constructing subsurface waterways, as they can move the excavated soil well away from the sides of the waterway.

Soil type may control the maximum depth of excavation. Stability problems may be encountered if infertile, or unstable subsoils are exposed. Topsoil should be spread over excavated channels as the final part of the construction process. One way to achieve this when using a dozer is to construct the first 20 metres of the waterway deeper than it needs to be. Topsoil can then be moved in from the 20 metre section below and the process continued.

In situations with highly erodible subsoils, it is desirable to avoid disturbing the area where concentrated flow will occur. In such cases, the waterways are constructed by excavating the retaining bank from the outside so that the section for water flow is left undisturbed (refer to Figure 5 in the science note *Soil conservation waterways—planning and design* L272).

Where there are erodible subsoils on slopes less than 1.5 per cent, disturbance of existing vegetation can be minimised by obtaining subsoil for use in the banks from a series of shallow excavations in the middle of a wide waterway. Such an operation requires the use of a scraper. Topsoil is spread over the banks before planting grasses on them.

## Waterway stabilisation

Soil conservation waterways rely on a lining of grass to protect from erosion. An ideal waterway grass has stolons or rhizomes to give good protection. Tall growing species provide excessive retardance to flows and require frequent slashing.

The science note *Soil conservation waterways— plants for stabilisation* (L271), provides advice about the best species to use in waterways.

Waterways constructed in natural depressions are referred to as 'live' waterways and runoff will flow naturally towards them even before contour banks are built. This creates a period of risk until the waterway has been stabilised with vegetation. Depending on seasonal conditions, it may take two to three years for a constructed waterway to become stabilised by perennial grasses.

In some cases there may be an option to exclude runoff from a waterway until it is well grassed. A temporary waterway can be constructed beside the permanent waterway. A crop such as millet (summer) or oats (winter) can be planted to provide rapid cover in the temporary waterway and some protection from erosion. Contour banks can be extended across the temporary waterway to the main waterway when vegetation is well established.

Special turf products can be purchased for situations requiring high erosion resistance. A turf such as green couch is established on an organic geotextile reinforced with ultra–violet stabilised turf reinforcement mesh.

### Non–vegetative options for stabilisation

Bare soil waterways have been used on flat irrigation land (<1 per cent) in Coastal Burnett cane growing areas. They improve surface drainage to alleviate water logging as well as manage runoff for erosion control. A bare, consolidated waterway can be designed to carry runoff at a non–erosive velocity of 0.5 metres per second or lower.

## Managing waterways

Waterways are comparable to an irrigated pasture and need additional nutrients provided by a general fertiliser to support a dense sward of grass. Nitrogen fertilisers will promote vigorous grass growth and encourage a dense system of runners to develop. A suitable height for vegetation in most waterways is around 30 centimetres. Slashing maintains the desired length of vegetation and reduces tall weed growth but it also aids in persistence and vigour of the grasses. Strategic burning after rain can eliminate excessive, rank growth and improve vegetation vigour.

Waterways can be used for strategic grazing. However, if stock have regular access to waterways, cover will be reduced, stock pads will develop and erosion is likely to occur. In extensive cropping areas, wide waterways with Rhodes grass have been used to produce hay. Waterways in cropped paddocks are not normally fenced off. If they are fenced, a wire gate and strainer posts should be provided at each contour bank entry point to allow for bank maintenance. Waterways should not be used as a laneway or for vehicular access. Stock pads and wheel ruts will concentrate runoff leading to the development of gullies. When using herbicides that control grasses, care should be taken to ensure

## Waterway failures

Waterways may fail by overtopping or by gully erosion in the bed of the waterway because they have to deal with concentrated flows. The following factors may contribute to waterway failure:

- high intensity rainfall may produce runoff that exceeds the design capacity of the waterway
- the waterway may be too narrow or too shallow to handle the design runoff
- the waterway may have the incorrect shape— V–shaped waterways are very susceptible to erosion
- lack of suitable vegetation in the waterway channel will lead to erosion

- tall waterway grasses may restrict flows, cause excessive siltation and lead to overtopping
- a strip of grass along a drainage line is not likely to make an effective waterway. A properly constructed waterway with retaining banks is required to keep the runoff on the grassed area rather than flowing down the cultivation on either side
- ruts left by wheel tracks or cattle pads up and down a waterway will lead to failure by gullying
- waterways constructed into infertile and/or erodible subsoils are not likely to have good vegetation growth. Topsoil should be replaced after construction or the waterway should be built from the outside.

## Repairing eroded waterways

Gullies in eroded waterways can be filled and the waterway reconstructed to the required specifications.

Alternatively, a gully control structure such as a rock chute can be built at the head of the gully to prevent the gully extending further up the waterway. All bare and disturbed areas should be planted with grass and fertilised. Contour bank outlets can become unstable when a gully forms in a waterway. Grass can be established in the final section of the contour bank to improve stability or a rock chute can be constructed at the contour bank outlet. Small wire netting weirs up to 30 centimetre high can be installed at regular intervals along an eroding waterway floor to encourage sediment deposition and grass establishment.

## Trees and waterways

While trees and shrubs are a natural feature of riparian zones and provide many benefits including the stabilisation of creek banks, they are not considered to play a beneficial role in the stabilisation of waterways in contoured paddocks used for cropping. While tree roots provide stability to steep creek banks, this function is not required in a constructed waterway. In waterways for soil conservation purposes, stability is provided by dense swards of stoloniferous grasses. Tree regrowth in such systems can inhibit grass growth by competition for water and nutrients and by shading out the grass species. Grazing animals are attracted to the shade provided by trees and such areas are usually devoid of surface cover. Excessive growth of shrubs can cause high retardance to flows leading to overtopping of the waterway.

The clearing of native remnant vegetation and certain regrowth vegetation is regulated under the *Vegetation Management Act 1999*. Landholders should ensure they comply with any requirements under this Act before clearing native vegetation.

## Further information

This and other science notes are available from the Queensland Government website www.qld.gov.au – search ‘science notes’. For further information about this science notes series phone **13 QGOV** (13 74 68) – ask for science notes – Land series L270. Other science notes related to this topic include:

- L13—Erosion control in cropping lands
- L35—Runoff control measures for erosion in cropping land
- L271—Soil conservation waterways – plants for stabilisation
- L272—Soil conservation waterways – planning and design

For further information visit < http://www.qld.gov.au/environment/land/soil/ or email soils@qld.gov.au.