Water and Rivers Commission | WN6 January 2000

Natural Heritage Trust

Water notes

GOVERNMENT OF WESTERN AUSTRALIA

ADVISORY NOTES FOR LAND MANAGERS ON RIVER AND WETLAND RESTORATION

Livestock management: construction of livestock crossings

Traditional agricultural practices have often involved unrestricted livestock access to rivers and riparian zones and many stream sections continue to be used to provide livestock watering and summer feed. Uncontrolled livestock access to stream foreshores has resulted in bank erosion and degradation of the riverine environments throughout the State's southwest. Restricting livestock access is an important river restoration management tool and this water note addresses the design and building of livestock crossings on fenced waterways.

Problems with livestock access to waterways

Controlling livestock access is the single most important management tool in the protection and restoration of riparian zones in rural areas. This can be achieved through fencing[i], the provision of off site or restricted access watering points[ii], and the implementation of sustainable grazing systems.

Unrestricted livestock access to waterways causes disturbance of stream banks and water pollution resulting in environmental degradation and loss of productivity[iii]. Problems related to unrestricted livestock access include:

- loss of native fringing vegetation;
- weed invasion;
- compacted soils;
- erosion; and
- poor water quality.

Unrestricted livestock access results in environmental degradation and loss of productivity. *I. McCarthy*

Benefits of crossings

Formalised crossings protect livestock and the river from the problems associated with unrestricted access. The benefits include:

- improved water quality by limiting sedimentation and nutrient enrichment;
- enhanced livestock health through access to cleaner water;
- reduced loss of productive land and livestock deaths;
- provision of a relatively cheap option for providing livestock watering;
- maintaining river pools to provide a water source that is available for longer periods of the year;
- stabilisation of the river banks and bed; and
- improved riparian vegetation and riverine habitats.

Crossings can be designed to provide many other ecological benefits such as:

- having a riffling effect which aerates the water and provides a variety of riverine micro-habitats;
- allowing for fish passage;

- maintaining river pools that are important in providing summer refuges and breeding areas for certain aquatic animal species, such as marron; and
- contributing to channel stability by controlling the velocity of flow and reducing the downstream movement of sediments into the river.

Trampling causes loss of fringing vegetation and pollutes the water. *L. Pen*

Alternative livestock watering techniques

The preferred management strategy is to keep livestock out of the river channel by providing off-stream livestock watering points. Pumping systems such as solar pumps and nose pumps or using a reticulated water supply and troughs are alternative options [ii].

Building of livestock crossings

Planning

Under the Rights in Water and Irrigation Act, approval from the Water and Rivers Commission is required before undertaking works that obstruct or interfere with the waters, bed or banks of any watercourse proclaimed under the Act. Information about proclaimed watercourses is available from the Water and Rivers Commission.

Any major works on proclaimed watercourses should be referred to the Water and Rivers Commission for approval, for example crossings that will:

1. raise the height of the channel by more than 300 millimetres above the existing natural level,
2. significantly impound the watercourse, or
3. significantly alter the natural shape of the channel.

Design guidelines

The following are guidelines for designing and building stable livestock crossings that do not adversely affect the flood conveyance or stability of the channel.

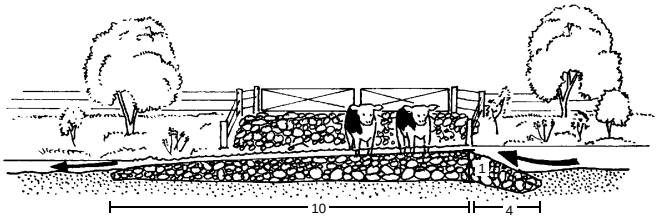

Figure 1: The basic geometry of a livestock crossing.

Figure 1 outlines the shape and geometry of a crossing. The upstream slope of the crossing should be a maximum 4:1 (horizontal:vertical). The rock scour apron of the crossing should have a maximum downstream slope of 10:1 (20:1 is preferred to allow fish passage). The height of the crossing should be as low as practicable. As the height of the crossing is increased, so is the associated potential for damage by floodwaters.

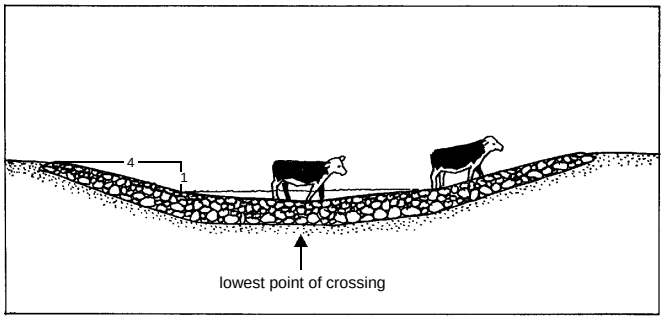

Figure 2: The basic geometry of a livestock crossing.

The crossing should be constructed by bed hardening and should not significantly change the profile of the channel. On soft bed material, the channel should be dug out and the rock laid to below bed level to provide resistance to flow passing beneath the crossing and causing destabilisation. Alternatively, filter cloth can be layed between the rock and the bed material to stabilise the bed. The upstream edge should be buried about 1 metre into the bed and banks and overlayed with rock.

The rock banks should extend to the full height of the embankment (above high water level) to prevent scouring of the banks and to stabilise the access points to the crossing. The banks of the crossing should also be graded to a maximum 4:1 slope, with the lowest section of the crossing being in the centre of the channel (Figure 2).

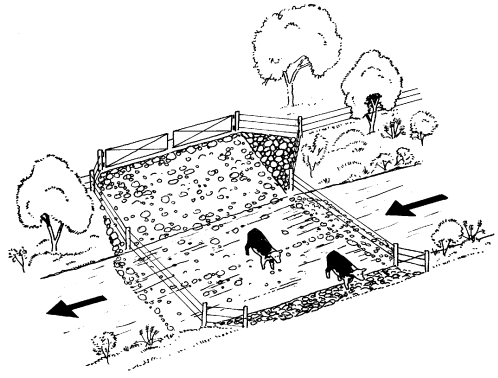

Figure 3: The basic geometry of a livestock crossing.

Both sides of the crossing must be fenced across the full width of the waterway, connecting to existing fencing so that livestock cannot have access along the channel to the riverbanks (Figure 3). Hanging fences or electrified fences can be used across waterways to allow flood flows, limit accumulation of debris and reduce potential damage to the fences[i]. Gates should be installed at the entry and exit to control access through the crossing.

Timing of the works

Ideally building should be undertaken earlier in summer and disturbed vegetation around the crossing be reinstated before the following winter. The site should be monitored through winter and modified if required.

Where to build a crossing

The site selection for building of the crossing is very important. Incorrect siting or alignment of crossings can initiate or accelerate channel erosion. Crossings should always be built along a straight section of the river or at the crossover point in the middle of a meander where the main flow is naturally directed to the centre of the channel (Figure 4). The crossing should be built perpendicular to the main flow channel.

The crossing should never be built on a bend as the main flow typically accelerates around the outside of the meander and can cause bank scouring. However, by building a crossing following a bend, the energy of flows that can erode the outer bends of the river is reduced. The crossing reduces the flow velocity by creating a pool upstream that back floods and dampens the power of these flows.

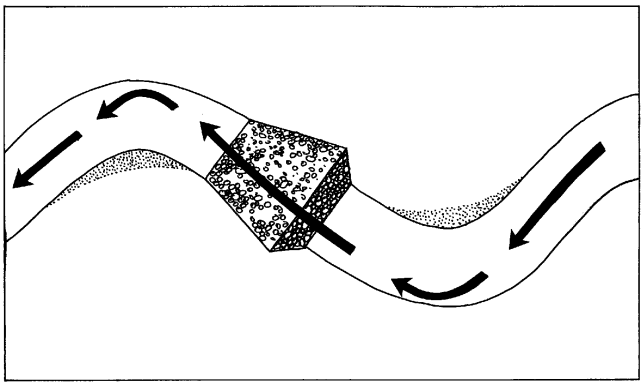

Figure 4: Crossings should be built on a straight stretch of river or at a crossover point in the middle of a meander.

The selection of a crossing location should also consider the existing bed profile. The siting should take advantage of naturally high points along the profile (Figure 5), thus reducing the height to which the crossing must be built in order to create deeper, longer pools that will retain water for longer periods of the year. However, pools may fill with sediment in unstable systems.

The bed material and conditions at the site should also be taken into consideration. Boggy areas should be avoided. Existing river sills or where the bed is naturally hard can be enhanced to form a crossing. The siting should also consider where existing livestock trails are located which could be stabilised to formalise a crossing point. At the crossing site, the banks of the channel should not be too steep. Ideally the grade should be less than 4:1 for the banks to be stable.

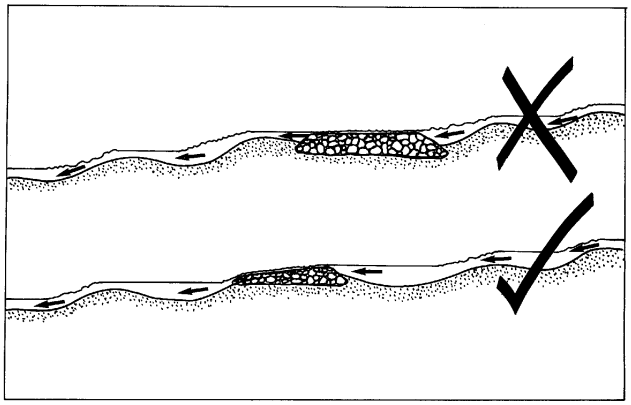

Figure 5: Take advantage of natural high points along the profile when siting a crossing.

Building materials

Rock is typically used to build crossings. If the crossing is being used as a watering point, a rough, variable surface should be created so that livestock do not remain in the river channel for prolonged periods of time. A range of diameter sizes of bedrock should be used to form the base of the crossing. Suitable rock sizing should be selected to resist the tractive forces of the flow.

If the crossing is used only to provide access across the river, then the surface can be smoother. The crossing can be protected by using large rock or overlaid with smaller gravel and compacted to form an interlocking rock matrix.

A livestock crossing built of rock. *L. Chalmers*

Cost

The cost will vary depending on the site and conditions. Typical rock crossings on 5 metre and 10 metre wide channel beds cost in the order of $2,500 and $4,000 respectively. Part funding may be available through several funding bodies. Enquires and applications should be made through your local LCDC and community groups. Design advice is freely available from the Water and Rivers Commission.

Demonstration sites

A demonstration rock crossing has been built on the South Dandalup River by Alcoa at Fairbridge, Pinjarra. The crossing was constructed in 1996 as part of the Streamlining program.

The Dandalup Murray Land Conservation District have constructed several demonstration crossings on the Dandalup and Serpentine Rivers. The crossings demonstrate construction using rock and revetment matting on different bed materials. A local construction guide is also being produced by the LCDC.

Further information and technical assistance

For further information and technical assistance please contact:

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Further reading

Available from the Water and Rivers Commission

[i] Water note, *Livestock management: fencing* (in production).

[ii] Water note WN7 *Livestock management: Stock watering points.*

[iii] Water note WN10 *Protecting riparian vegetation.*

ARMA (1995) *Control of Livestock in the Avon River.* Policy Discussion Paper. Avon River Management Authority, Northam.

Available from other sources

LWRRDC (1996) *Riparian Management Guideline 6 - Managing Stock.* Land and Water Resources Research and Development Corporation, Canberra.

Newbury, R.W. and Gaboury, M.N (1993) *Stream Analysis and Fish Habitat Design - A Field Manual.* Newbury Hydraulics Ltd, Gibsons B.C.

Raine, A.W. and Gardiner, J.N (1995) *Rivercare - Guidelines for Ecologically Sustainable Management of Rivers and Riparian Vegetation.* Land and Water Resources Research and Development Corporation, Occasional Paper Series No. 03/95, Canberra.

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This water note is produced as part of the Waterways WA Program. Managing and enhancing our waterways for the future. Text by Antonietta Davy. Illustrations by Dickinson Art. Crossing design diagrams adapted from the Dandalup Murray Management Plan. Water note project coordination by Jodie Oates and Heidi Oswald.

Printed on recycled paper January 2000
ISSN 1442-6900