Contour bank specifications

Contour banks, combined with effective stubble management, are recommended to control erosion on sloping land used for growing crops.

Before building contour banks, decisions have to be made about the:

- gradient in the bank channel
- length of the banks
- spacing of the banks
- proposed bank shape and dimensions.

Contour bank specifications vary with the land slope. Most broad-acre cropping areas in Queensland are under 3 per cent. Slopes of up to 8 per cent are cropped on the Eastern Darling Downs, inland Burnett and the Atherton Tableland. Some horticultural crops in coastal areas are grown on steeper slopes.

Gradients

Contour bank gradients are normally expressed as a percentage. A bank with a gradient of 0.2 metres in 100 metres would have a gradient of 0.2 per cent. Selecting suitable gradients for contour banks has to be a compromise. If gradients are too high, bank channels with bare soil may erode. If gradients are too low, banks lined with crops may overtop or there may be excessive pondage in the bank following run-off.

Recommended contour bank gradients are shown in Table 1. Gradients are highest on steeper land where banks are shorter and have less capacity than banks on low sloping land. It is normal practice for a contour bank to be constructed to the same capacity for its entire length. Since the amount of run-off to be carried increases with the length of the contour bank, variable gradients can be used along a contour bank channel.

Table 1. Gradients for contour banks

Land slope (%)	Contour bank gradients (%)		
	Top section	Middle section	Outlet section
2	0.15	0.15	0.2
3–5	0.2	0.25	0.3
5–10	0.3	0.4	0.5

In intensive cropping areas (e.g. sugar cane), parallel contour bank systems are preferred. Such systems require flexibility in contour bank gradients. Gradients can be modified over short distances to improve workability of the layout. If the channel is permanently grassed, higher gradients can be used.

Gradients at bank outlets may need to be increased for the last 30 metres if the waterway is stable and well grassed or the banks empty into an adjacent grassed area.

Length

Table 2 provides a guide to maximum bank lengths based on land slope. It is based on well-maintained contour banks and the minimum contour bank spacings normally recommended on such slopes. It assumes that run-off is travelling in the one direction in the contour bank channel. Note that on steeper landscapes average contour bank lengths are likely to be shorter because the distance between natural drainage lines is less than on low slopes.

Table 2. Recommended maximum bank lengths for various land slopes and single contour bank spacing

Land slope (%)	Maximum bank length (m)
1	2500
1.5	2000
2	1750
3	1500
4	1000
5	750
6	600
7	450
8	400
9	350
10	300

Spacing

There are no strict rules that determine the correct spacing for a particular situation. The concept of a single and double spacing has been used to allow variations in contour bank spacings—depending on the average conditions likely to be experienced in a paddock (Table 3).

Single spacings should be used where paddocks are seriously eroded and lower levels of ground cover are likely. Double spacings can be used where there is minimal erosion and high levels of cover are to be maintained. Spacings between single and double can be chosen when there is a need to compromise. For example, in the Central Highlands where high rainfall intensities often occur and dry seasons often lead to low cover levels.

Table 3. Recommended contour bank spacings (VI = Vertical interval; HI = Horizontal interval)

Slope (%)	Single spacing		Double spacing	
	VI (m)	HI (m)	VI (m)	HI (m)
1	0.9	90	1.8	180
2	1.2	60	2.4	120
3	1.4	45	2.8	90
4	1.6	40	3.2	80
5	1.8	36	3.6	72
6	1.9	32	3.8	64
7	2.1	30	4.2	60
8	2.4	30	4.8	60
9	2.7	30	5.4	60
10	3.0	30	6.0	60

Shape and dimensions

Narrow-based banks normally have batters of 1:3 (VI:HI) while broad-based banks may have batters varying from 1:4 to1:8 (VI:HI). The amount of soil required to build a bank increases significantly as the bank batter becomes flatter.

The amount of run-off a contour bank has to handle depends on its length, the distance between banks, rainfall intensity, and the condition of the soil surface in terms of its ability to produce run-off.

Contour banks must be able to handle vastly different conditions in the channel. They vary from a smooth and bare channel (comparable to a highway) to one with a growing crop or standing stubble (comparable to a traffic jam).

Table 4. How flow depth affects velocities and flow rates in contour banks

Depth of flow in the channel (m)	Conditions in the contour bank channel			
	Standing wheat stubble		Bare cultivated channel	
	Velocity (m/s)	Flow rate (m^3/s)	Velocity (m/s)	Flow rate (m^3/s)
0.2	0.08	0.14	0.38	0.72
0.3	0.10	0.35	0.48	1.74
0.4	0.11	0.67	0.57	3.35
0.5	0.13	1.13	0.65	5.65

This data is based on a contour bank on a land slope of 2 per cent and a gradient of 0.2 per cent with the same shape as shown in Figure 1.

If necessary, a suitable design can be obtained by preparing a spread sheet as shown in Table 4 (based on Mannings formula for a typical contour bank cross section). For a given cross section shape, velocities and flow rates can be compared for different flow depths and different channel conditions.

Erodible velocities (0.5–0.6 metres per second) may occur once the depth of flow in a bare channel exceeds 0.3 metres. However, when the channel has standing stubble a flow depth of 0.5 metres will only be flowing at 0.13 metres per second.

Contour banks are not normally individually designed. A bank that can handle a depth of flow of 0.4 to 0.5 meters will provide satisfactory capacity for typical contour bank layouts. To accommodate such a flow, a contour bank needs to be constructed to a height of 60 to 70 centimetres to allow for settlement and some freeboard.

Table 5 shows some typical contour bank cross sections with a height of 0.5 metres on slopes ranging from 2–5 per cent. Note how the capacity of a contour bank for a given height is very dependent on the land slope.

Table 5. Contour bank specifications for banks of a height of 0.5 m on a range of slopes

Land slope %	Batter on bank	Batter on inlet into channel	Bottom width (m)	Cross sectional area (m^2)
2	1:4	1:50	4	8.75
3	1:4	1:20	4	5.00
4	1:3	1:10	2	2.63
5	1:3	1:5	2	2.00

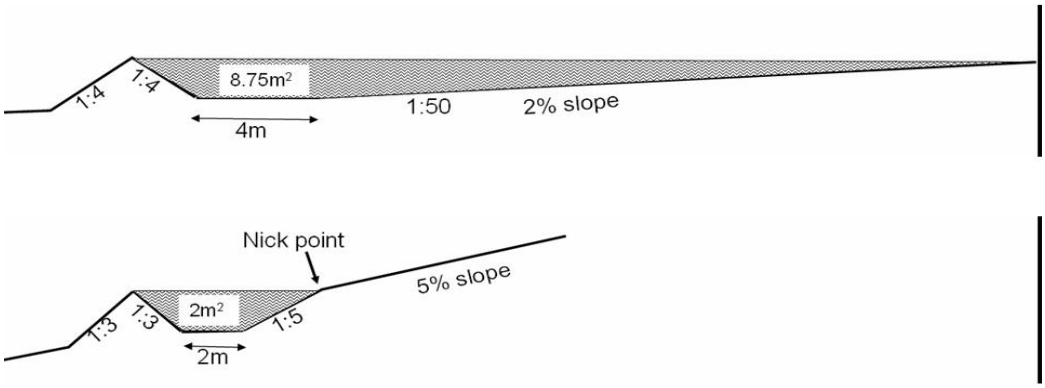

Figure 1. Contour bank cross sections for banks 0.5m high on a 2% and a 5% slope.

Further information

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- L35—Run-off control measures for soil conservation
- L202—Maintaining contour banks

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