Roads and tracks

Erosion solutions for the Lockyer Valley

Erosion hazards

Roads, tracks, gateways and firelines built for access to rural lands are potentially a major sources of sediment entering waterways in rural catchments.

Within the Lockyer catchment there are numerous examples of well constructed low sediment contributing roads but, equally, there are many roads that are contributing to sediment loads. Even in small rainfall events (e.g. twenty to thirty millimetres), sediment has been observed in table drains and waterways of the catchment.

Roads generate rapid runoff because of their impermeability and this increased runoff can also create gullies (Croke et al., 1999), especially in highly erodable soils.

Although no measures of sediment contribution from roads in the Lockyer catchment have been studied, forestry roads in south-east Queensland show erosion rates of one to four tonnes per hectare (Constantini et al., 1999) from a single storm. Measurements in a forested catchment in southern Australia show unsealed roads can generate twenty to sixty times more sediment than undisturbed forest (Motha et al., 2003). In general, rural catchments roads can be responsible for up to 25 to 50% of sediment entering waterways.

This farm track south of Gatton shows serious erosion and is contributing to sediment in waterways. The highly erodible soil creates difficulties. Better design could avoid most of the problems.

Planning and Construction Guidelines

Some key guidelines when planning and constructing roads and tracks on rural properties are:

- Minimise site disturbance
- Construct stormwater drains with flat bottoms rather than vees to minimise erosion
- Construct roads and tracks across slopes with sufficient camber for drainage but still allow the safe movement of traffic.
- Locate roads and tracks in areas where soils are stable in order to minimise erosion.
- Locate access tracks and laneways along ridgelines to facilitate the shedding of water.
- Install whoa boys (i.e. speed bumps, traffic calmers) on steeper grades, at twenty to thirty metre spacings and ensure stormwater is discharged on to a stable, well grassed area.
- Creek crossings should be at right angles to the creek flowline.
- Additional constructions may be required on steeper embankments. e.g. whoa boys, diversion banks. Avoid creating tracks in waterways and spillways of contour banks and dams.
- Avoid constructing roads and tracks that redirect overland flows and runoff water. Design for the free and continuous runoff flow across roads and tracks. Include inverts or pipes of an adequate size to handle the run-off.
- On flat land (i.e. flood prone land), construct roads and tracks at the same level as the land on both sides and gravel the surface. Wide inverts are recommended across natural water flow lines.
- Ensure that upslope table drains are shallow and broad.
- Ensure there are well grassed table drains at both sides of the road or track. Where pipes and inverts are required, discharge must be towards a stable area.

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Road erosion processes

A critical factor in determining the contribution of sediment from roads to waterways relates to the level of connectivity of table drains entering these receiving waterways (Takken et al., 2000; Croke & Mockler, 2001). Lowering connectivity requires that either water is discharged from table drains and spread across vegetated landscapes where sediment can settle, or that the flow is directed into detention basins for sediment settling.

Other factors that determine the amount of sediment in road runoff are:

- The amount of disruption of road surfaces by traffic,
- Unsealed roads contribute more sediment than gravelled roads,
- The type of gravel used,
- Soil types where roads are constructed, and
- The type of vegetative cover of table drains.

Studies also indicate that the majority of sediment from roads entering streams is often contributed by only a small fraction of the road network.

Attention to planning, access to rural properties via roads and tracks, as well as gateways, laneways and firelines is essential, not only during construction but also in operation and maintenance phases. One of the most effective methods of reducing sediment from property roads and tracks is by gravelling them.

Sediment deposition from road erosion.

1. Roads and tracks

Whether a property is for lifestyle, production or a business enterprise, access to the property requires planning in order to coordinate road and track location with the soil types and the location of fences, gates, dams, watering points and infrastructure.

The development of a whole property plan provides a better understanding of the property characteristics and planning requirements, and is an excellent way to approach the development challenge.

The system of access roads and tracks on a rural property should enable the landowner to:

- Reach all parts of the property throughout the year, allowing vehicles to move without too steep a grade, while fitting in with the landscape,
- Move stock between paddocks and watering points easily,
- Examine paddocks, stock and crops efficiently
- Manage paddocks for easier feral animal and weed control,
- Use paddocks to their full capability,
- Develop an efficient farm layout for paddock subdivision, gateway locations, windbreaks and laneways,
- Utilise laneways for stock movement and to act as firebreaks.

Minimising impacts

Access roads and tracks can accumulate and transmit water runoff within a property. If they are well designed, constructed and maintained the effects can be minimised, otherwise soil erosion and sediment contamination of waterways can result.

Whatever the size and complexity of the road or track, the management principles are to minimise exposed earth and to avoid concentrating and channelling the flow of water.

2. Gateways and Laneways

Additional access considerations should include the locations of gateways and laneways based on the following guidelines:

Gateway design:

- Locate on stable soils not susceptible to erosion,
- Avoid locating gateways in depressions or in sites prone to seasonal waterlogging,
- Avoid locating gateways where the water drains or is likely to drain,
- Gravel gateways to improve access and minimise erosion, and
- Design gateway width to accommodate machinery requirements as well as stock.

Laneway design:

Where laneways are to be used for vehicular access as well as stock movement, consider:

- Locating laneways on soils that have low erosion risk,
- Cambering the track surface to easily shed water,
- Constructing spoon drains to collect and direct the runoff into well grassed areas,
- Gravelling the track,
- Ensuring that the width of the laneway is sufficient for machinery access,
- Designing laneways to include windbreaks, native vegetation corridors for wildlife or to be part of the farm's fire protection.

Maintenance:

Ongoing maintenance (such as grading and drain cleaning) is essential. This should be done once every six months in hard setting soils and once every three months in loose soils.

Regularly check laneways or gates for access or evidence of erosion or waterlogging. Special attention needs to be given to newly constructed laneways and gates.

3. Fire lines

Fire lines constructed for the management of fire on properties can be subject to erosion because they often have the topsoil removed and the subsoil exposed. They often have mounds of soil along the sides of them that increase runoff interception and concentration of stormwater. Hastily built fire lines are most likely to exhibit these problems. Often, once a fire line is constructed, it is likely to be used as a road or access track.

Many of the principles discussed in the sections above on access roads, tracks and laneways also apply to fire lines. Some additional principles for fire lines are:

- Fire lines adjacent to well positioned fences will have less erosion potential,
- Where it is necessary to plough or cultivate a fire line, special attention should be given to the direction of furrows that may concentrate or divert overland flows causing erosion. Rather than have continuous furrows, it may be practical to lift the implements so that any concentrated runoff is allowed to disperse. Alternatively, short diversion or contour banks, or whoa boys may be constructed across a fire line to divert runoff onto a safe disposal area away from the fire line,
- Windrows beside fire lines should have gaps at regular intervals to discharge runoff and avoid concentration of stormwater flows,
- If a fire line is planned through areas of native vegetation, landholders need to clarify whether any proposed clearing of native vegetation is controlled by the *Vegetation Management Act, 1999*. There are provisions in the Act that exempt certain clearing activities where fire lines are proposed. These exemptions vary depending on the tenure of the land and the purpose of the break (including the type of infrastructure protected). More information is available in the document Guide to exemptions from the vegetation management framework (December 2006), obtainable from the Queensland Department of Natural Resources and Water web site at: www.nrw.qld.gov.au/vegetation/pdf/exemptions.pdf.

4. Whoa boy – key erosion control

Whoa boys are a basic method for controlling erosion on unsealed roads, tracks and firelines. They are small embankments strategically placed across tracks and roads to catch water and divert it off the road and reduce flow concentration and erosion risk. Their spacing is of critical importance to their effectiveness.

Below are some guidelines for whoa boy spacing.

	Whoa boy spacing (m)	
Land slope %*	**High erosion hazard**	**Moderate erosion hazard**
1	90	180
2	60	120
3	45	90
4	40	80
5-10	30	60
10-15	30	45
15-20	Not recommended	30

* % slope is calculated by dividing the height difference by the length of slope. i.e. a 5 metre fall over 100 metres equates to a 5% slope.

A suitable outlet must be located for each whoa boy to ensure that run-off does not cause erosion. In grazing lands a stable grassed area is adequate.

There should not be any obstruction to the redirected water flow and the outlet should be stable. The direction of flow should be such that the runoff from the whoa boy does not flow back onto the road.

Basic erosion control – A steep track in the Helidon Hills area has been constructed on a ridge line with cross drains (whoa boys) to take water off the road to reduce erosion.

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