Soil Note

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The Impact of Land Management and Erosion Control Measures on Sediment Yield and Water Quality - Southern Tablelands

The purpose of the erosion mitigation scheme operating in the outer Warragamba Dam catchment is to maintain the quality of water entering the dam by ensuring low sediment yields and negligible turbidity levels.*

In addition to Sydney water users, other beneficiaries of the scheme are landholders in the catchment, through reduced erosion and improved stock water supply, and local councils and ratepayers, through lower water treatment costs and the maintenance of reservoir storage capacity.

The principle landuse in the catchment is grazing, therefore land management options are reasonably limited. The use of improved pastures and stock management to maintain cover levels are the main options.

The erosion control measures in the catchment are principally aimed at treating severe gully erosion. These include: concrete flumes to treat gully heads; dams in gullies to drown active heads, trap sediment and divert flows; in-gully grade stabilisation structures to increase deposition of suspended sediment and stabilise the gully floor; and gully side stabilisation measures such as tree planting and fencing.

Local data (see Figure 1 and Figure 2) and overseas information have been combined to produce a simple procedure to examine the impact of soil conservation measures on sediment yield* and water quality.

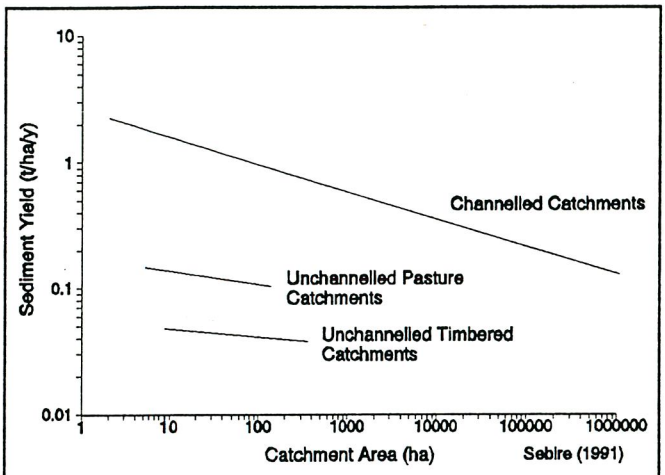

Figure 1 Sediment yields from southern tablelands catchments.

Application to Southern Tablelands

Using this procedure, a range of scenarios relating to southern tablelands grazing country were examined.

A) Effect of Land Management and Gully Stabilisation Measures

Sediment yields and turbidity levels under different conditions were estimated for two small catchments which have soils and landuse which are reasonably typical for the area. The scenarios looked at the effect of changing landuse from native timber to pasture, the effect of over grazing, and the effect of gully development in a previously ungullied catchment.

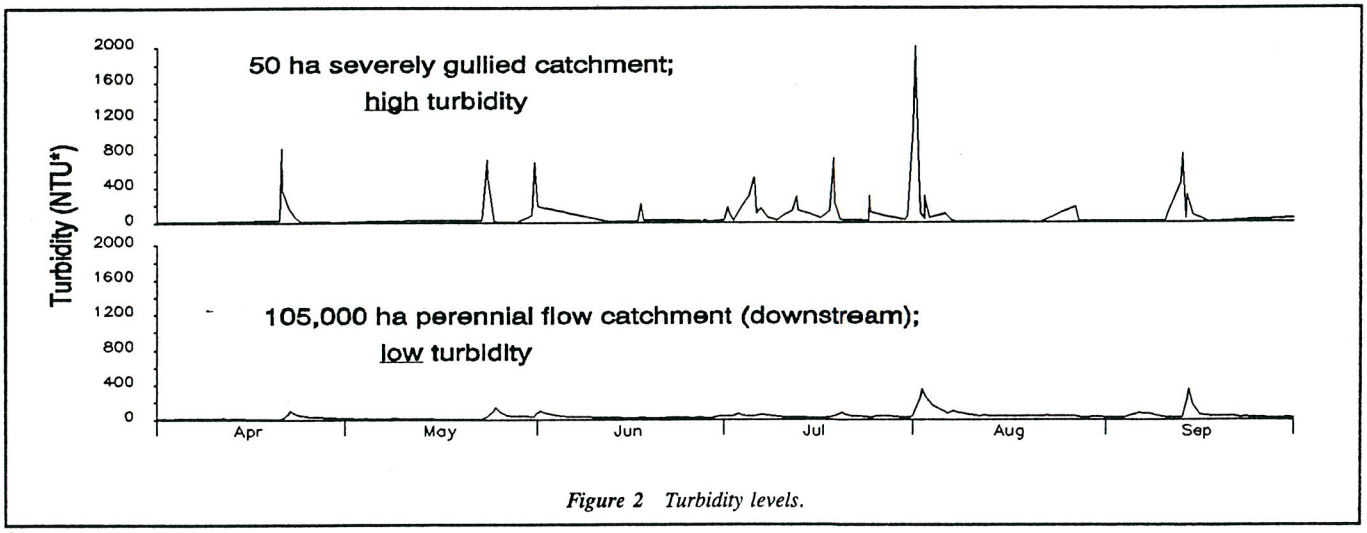

Figure 2 Turbidity levels.

* see glossary

For example, it was found that sediment yield could be reduced from 64 tonnes per year (t/y) to 8 t/y, and turbidity from 201 NTU* to 11 NTU if a 50 ha catchment was treated. The treatment would involve shaping and revegetating the sides of the gully and stabilising the gully floor with grade stabilisation structures. The effect of landuse on turbidity is summarised in Figure 3. For conservatively grazed pasture catchments with 70 per cent of ground cover, soil losses will be low (less than 0.3 t/ha/y) and turbidity levels will generally be less than 20 NTU. Sediment yields and turbidities rise dramatically with the development of gullies.

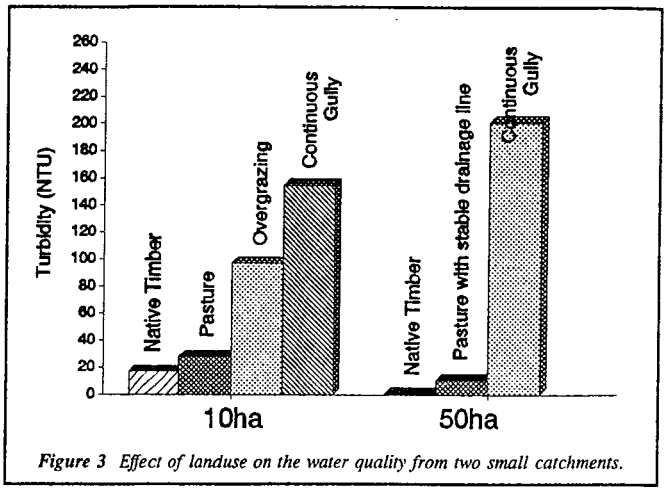

Figure 3 Effect of landuse on the water quality from two small catchments.

B) Effect of Dams in Gullies

The effectiveness of dams as sediment trapping structures is governed by a number of factors such as the ratio between storage capacity and inflow, the shape of the structure and type of outlet, and the particle size distribution of the sediment. The amount of incoming sediment retained in the dam (trap efficiency) is often better than 70 per cent for farm dams with small catchments.

Simulations were done for two small grazing catchments (10 ha and 50 ha) and at a point downstream of these catchments (Rossi Weir). The impact of placing dams at the outlet of the catchment or at some point higher up was investigated (Figure 4).

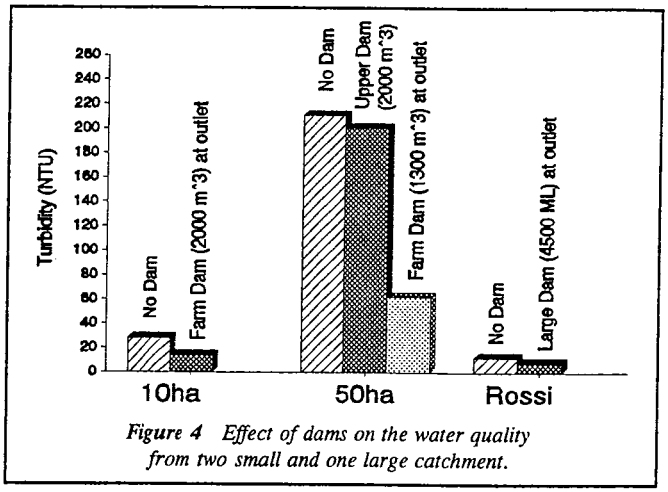

Figure 4 Effect of dams on the water quality from two small and one large catchment.

In catchments without gullies, locating a dam at the outlet has only a small effect. In small gullied catchments however, the location of a dam at the outlet has a relatively large impact (eg reduction in sediment yield from 64 to 17 t/y and turbidity from 211 to 62 NTU). The impact of locating a dam at the outlet of large perennial flow catchments, such as the Rossi Weir catchment, is much less. This is because as catchment size increases, turbidity levels are generally much reduced (see Figure 2) because of dilution and the effect of a significant base flow.

Conclusions

- soil losses from southern tablelands grazing country are very low **unless** the catchment is actively gullied (90 per cent of sediment comes from gullies)
- at a farm scale, gully stabilisation measures can significantly reduce sediment yield and the turbidity of water leaving the catchment
- farm dams can trap significant amounts of sediment and lower turbidity - a single dam at the outlet will have a greater effect on water quality than several dams located higher up in the catchment

* Glossary

Sediment Yield - the total amount of sediment produced by a catchment and delivered by flowing water to a point under evaluation, usually the catchment outlet.

Turbidity - a measurement of water clarity. It is caused by suspended inorganic particles such as clay and silt and organic material. High turbidity levels add considerably to the cost of treating water for domestic supply.

NTU - turbidity is measured using a nephelometer. The measurement units are called nephelometric turbidity units.

Reference

Armstrong, J L (1994), *Estimated Impact of Land Management Practices and Erosion Control Measures On Sediment Yield and Water Quality from Small Sub-catchments, Southern Tablelands, NSW.* Department of Conservation and Land Management, Report, Southern Region.

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