Knapp Creek – modelled loads reduction

(confidential briefing note 1)

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This report

This report is part of the Healthy Country Project. The Healthy Country project is a Queensland Government funded 'proof of concept' initiative to demonstrate that bringing together the best science, planning and on ground implementation can significantly reduce non-urban diffuse source pollutants entering the waterways. It started in January 2008 with an $8 million investment. Project partners include the SEQ Healthy Waterways Partnership (SEQ HWP), SEQ Catchments Ltd, Queensland Primary Industries and Fisheries (QPIF) Dept of Employment and Economic Development and the SEQ Traditional Owners Alliance (SEQTOA). The project aims to develop methods for reducing sediment loads to Moreton Bay by 50%. This report documents the distribution of catchment works in the Knapp Creek catchment and estimates the likely effects of those works on sediment supply both in the treated subcatchments and at the whole of catchment scale.

Sediment Loads in Knapp Creek

The Phase 2a report: Rehabilitation priorities Knapp Creek – Final Report (December 2009) showed that sediment supply to the catchment outlet is dominated by sub-catchments in the middle reaches of the catchment. The 10 highest yielding subcatchments cover ~10% of the total catchment area but supply ~76% of the sediment load (Figure 1). The next ranked 10 cover a further 10% of the total catchment area and supply a further 14% of the load. In summary 90% of the sediment leaving the Knapp Creek catchment comes from 20% of the catchment area in the middle reaches of the catchment. The top three yielding catchments generate ~50% of the sediment from 5% of the catchment area. Gully and stream bank erosion are predicted to input ~5970 t of fine sediment to the stream network each year, hillslope erosion is predicted to contribute ~450 t/yr, and ~174 t/yr is deposited on unchannelled valleys in the lower catchment. The net export from the catchment is estimated in the report to be ~ 6250 t/yr.

Modelling assumptions

Note: The modelling assumptions below are made on the basis of catchment works being at or close to maximum efficiency.

Sediment control structures: Where erosion control structures have been placed across drainage lines it has been assumed that they have similar sediment trap efficiency to small farm dams. For similar sized farm dams in the SE region of Australia Neil and Fogarty (1991) predicted the sediment trap efficiency to range from 24% to 91%, with a mean value of 64% (also see Verstraeten and Prosser, 2008). No figures are yet available for similar semi-tropical regions and a more conservative estimate of 50% trap efficiency is used here. Where the structures have been placed in sequence it has been assumed that each structure has the same trapping efficient such that two structures in sequence will reduce the sediment supply from the upstream catchment area by 1 – (0.5 x 0.5) = 0.75 or 75%, and so forth.

Riparian Fencing: Fencing along stream-lines has been assumed to improve riparian cover to 100% effectively decreasing bank erosion to 0.

Re-vegetation: Improve vegetative cover to 100% - effectively stopping hillslope erosion

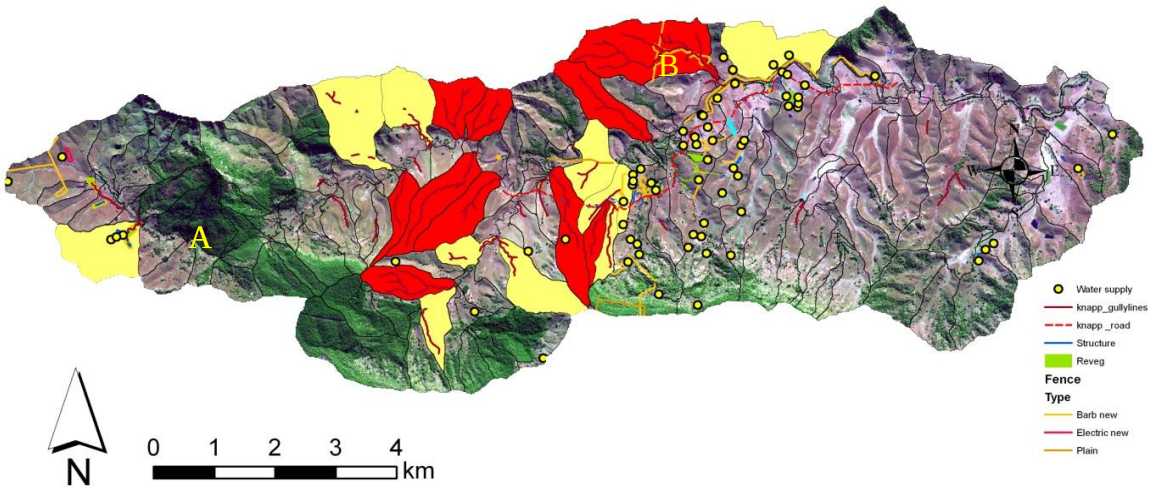

Figure 1: Map of the Knapp Catchment showing the ten highest yielding (red) and the next 10 highest yielding subcatchments (yellow), and the location and type of catchment works: fencing, sediment control structures, re-vegetation, and off channel watering points. For reference a section of the Knapp Creek Road and the mapped gully networks are shown.

Modelled sediment reduction

The type and distribution of catchment works is shown in Figure 1. This data was provided by SEQ-catchments as ARC-GIS files.

Whole of catchment scale: As Figure 1 shows, most of the works are not located in identified priority areas as indicated by the colored areas. A consequence of this, and the high proportion of sediment coming from the priority areas, is that the net effect of the works on the overall sediment budget for the catchment is predicted to be a reduction of 650 t/y, about ~10% of the total sediment production, according to our sediment modelling. Most of this reduction (525 t/yr) comes from the works carried out in priority subcatchment 17 (B in Figure 1). It has been assumed that fencing 50% of the gully in this subcatchment will enable the gully to re-vegetate and stabilize both the gully floor and walls reducing sediment supply from the whole gully by 50%. This is likely to be an over-estimate.

Subcatchment scale: The concentration of works in the upper catchment upstream of A in Figure 1 is predicted to decrease total sediment load from ~160 t/y to ~80 t/y from the 10 subcatchments in this area, meeting the target reduction of 50%. According to our modeled, across all of the subcatchments that were treated the average sediment reduction was ~30%, ranging from 0% to 90% depending on how closely the works addressed the primary sediment sources. These sub-optimal results can be understood when we realize that many of the proposed works focused on local erosion issues such as erosion from roads or localized areas of hillslope erosion which the catchment sediment export budget did not identify as the major contributors to net sediment export from the focal area.

Summary

- Most of the rehabilitation works in Knapp Creek were not in areas identified as high priority subcatchments by our initial sediment budget modelling.
- At the subcatchment scale the works, particularly in the upper catchment, are predicted to have produced a 50% reduction.
- However at the whole of catchment scale the modelled effect on sediment loads is low, the works are predicted to decrease sediment export by less than 10%.
- The previous modeling indicated that had works been concentrated in the priority areas sediment loads at the outlet could have been decreased by more than 50%.
- Note that the above results rely heavily on sediment budget modeling and expert opinion to determine the effectiveness of catchment works. There is little data with which to judge the veracity of the current models or to determine the effectiveness of the catchment works. This highlights the need for a properly designed and resourced monitoring, evaluation and learning program to accompany future works.

Neil, D.T., Fogarty, P., 1991. Land-use and sediment yield on the Southern Tablelands of New South Wales. Australian Journal of Soil and Water Conservation 4, 33–39.

Verstraeten, G., Prosser, I., 2008. Modelling the impact of land-use change and farm dam construction on hillslope sediment delivery to rivers at the regional scale Geomorphology 98 199–212