Waterway rehabilitation – Shays Creek

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Abstract

The Wimmera Catchment Management Authority region is home to a unique range of waterways that support life in an otherwise dry landscape. Unfortunately, these waterways are under threat from reduced flows, sedimentation and erosion, invasion by pest plants and animals and declining water quality. Gully and land erosion occurs extensively throughout the catchment, particularly in the upper Wimmera. In 2001, Wimmera CMA undertook a geomorphic investigation and analysis of the sediment source and transport processes within the Wimmera River catchment. The investigation identified a length of the Wimmera River located between the localities of Glynwylln and Glenorchy as having significant ecological and geomorphic value, in near pristine condition. This reach has since become known as a "High Value Reach" in the Wimmera Waterway Health Strategy (Wimmera CMA, 2006). The investigation also identified a number of tributary streams impacting on the health of the Wimmera River through the introduction of large volumes of sediment. Due to its confluence with the Wimmera River being located upstream of the "High Value Reach", Shays Creek was identified as being a high priority for restoration works. This paper describes waterway rehabilitation works implemented on Shays Creek, and outlines the present and future benefits on the catchment. The aim of these works is to control the bed grade allowing sediment to be stored in the waterway whilst addressing bank erosion through rock groynes and managing overland flows.

Keywords

Sediment, Wimmera, waterways, erosion

Introduction

As a major upper catchment tributary of the Wimmera River, Shays Creek, with a catchment area of 44km^2, has been identified as a potential large sediment contributor (Figure 1). Soils within the sub-catchment are dispersive and erodable. This, combined with widespread clearing since settlement, has led to a majority of the drainage lines becoming deeply eroded.

Some of the key impacts unnaturally high sediment loads have on a waterway are:

- Filling of waterholes;
- Smothering of habitat in the form of large wood debris and vegetation; and
- Decreased channel capacity resulting in increased flooding.

Catchment location

Located approximately 30km east of the township of Stawell, Shays Creek is close to and clearly visible from a number of public roads with the Joel Joel-Crowlands Road being the major traffic thoroughfare.

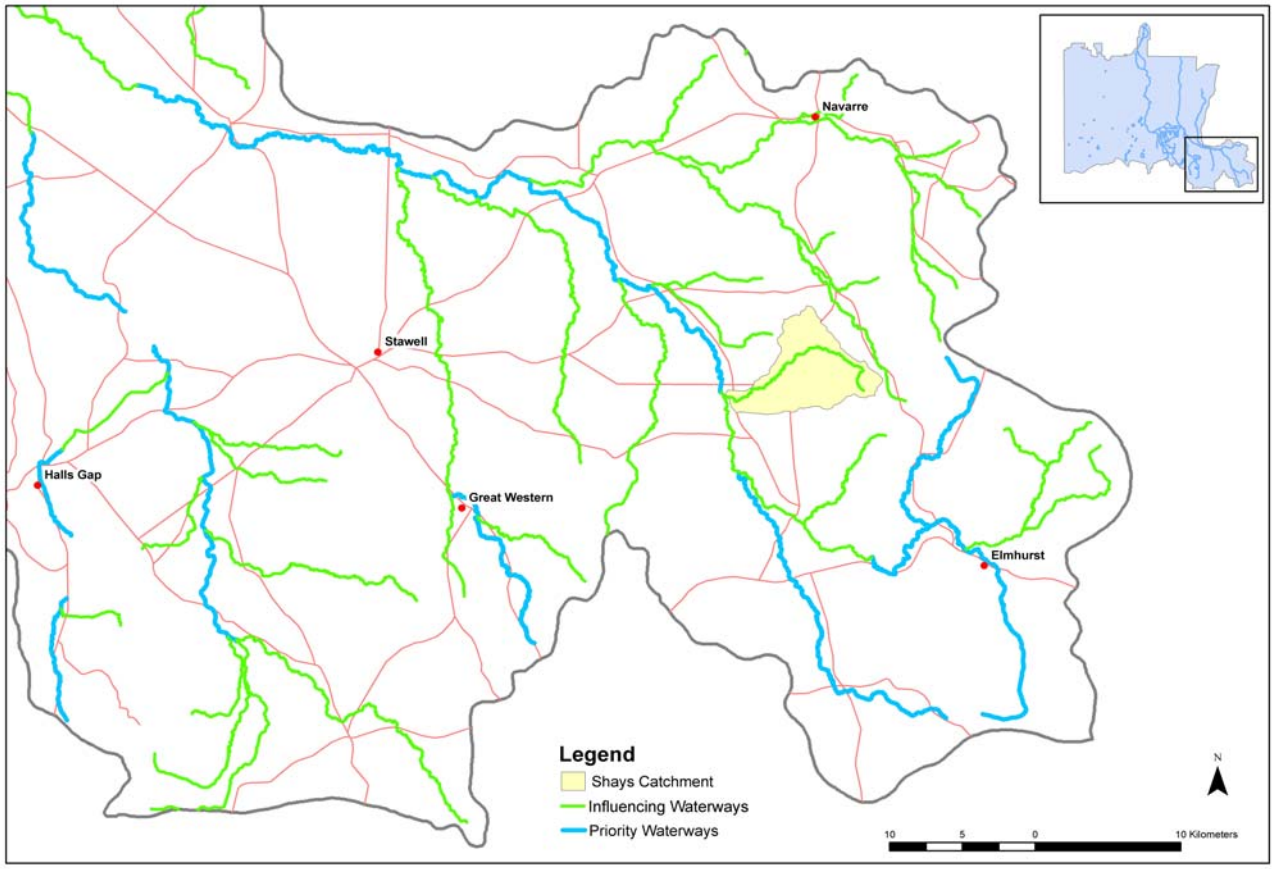

Figure 1. Location of the Shays Creek catchment within the Wimmera CMA region

Geomorphology

The upper reaches of Shays Creek consists of a combination of poorly vegetated slopes limiting the capacity for infiltration, the steep nature of these reaches results in the rapid concentration of rainfall runoff. This results in short high intensity rainfall events having high stream powers that erode bare banks and transport large volumes of sediment. Smaller flow events following these flows then have the potential to transport the finer sediment particles downstream leaving the coarser bed material to form an armouring gravel layer. When left undisturbed, this layer has the ability to limit further bed incision reducing the likelihood of the streambed deepening further. Unless restricted, the channel then undergoes a process of widening as illustrated in Figure 2 (SKM, 2006).

The lack of woody vegetation in the riparian zone on the floodplains and surrounding hill slopes limits the habitat values within the catchment. Ecological in-stream values improve in the steep headwaters where stock access to the riparian zone is limited by steep banks and channel gradients. Where the streamside vegetation has been cleared and the in-stream vegetation allowed to grow this has prevented the incised channel from further widening, and in places has encouraged the bed elevation to become raised, thereby reducing the stream bed gradient, and subsequently reducing the erosive power of the flows.

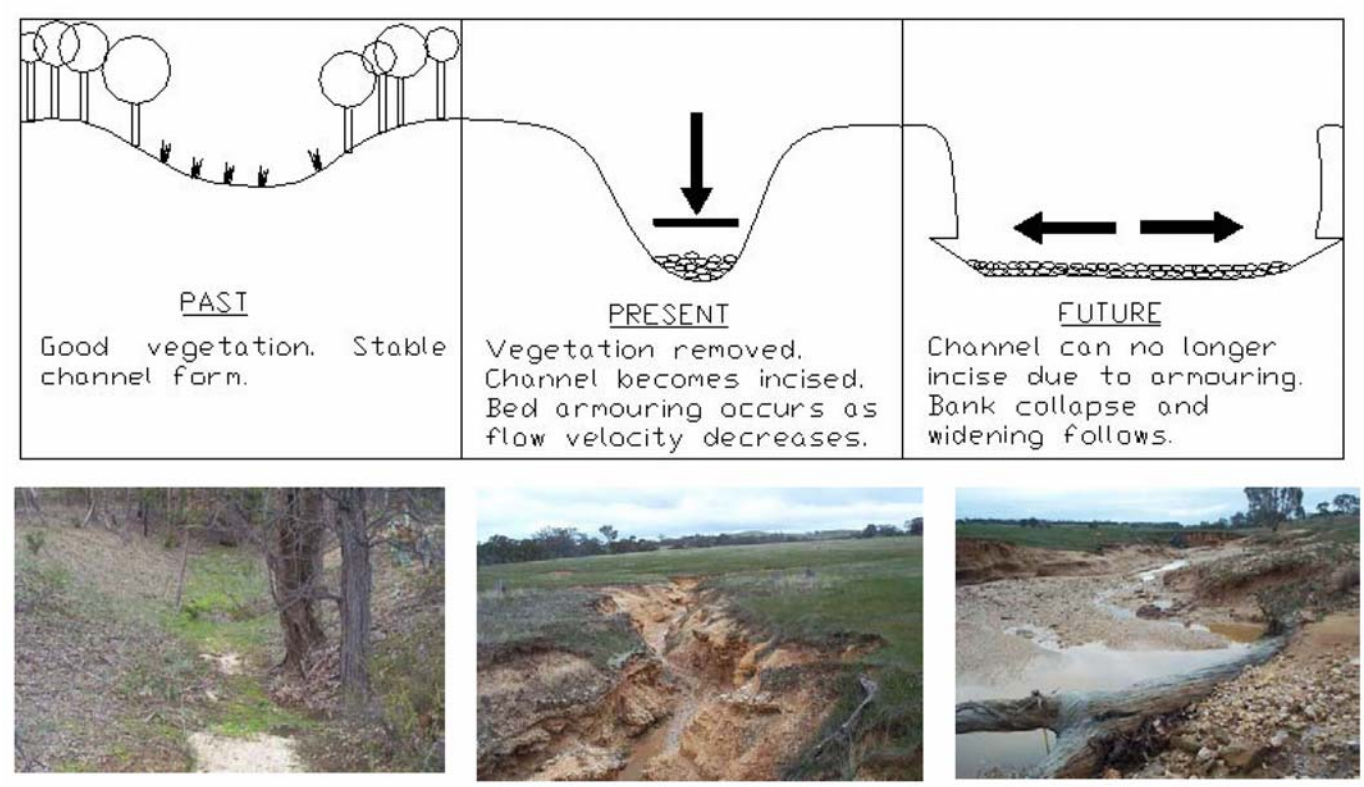

Figure 2. The process of vegetation removal that leads to stream incision and later bed armouring.

History of works

Soil conservation works that aim to reduce erosion within Shays Creek catchment have been ongoing since the 1940's. These works have included the construction of concrete drop structures, gully plug dams, contour water diversion banks, gully battering, and fencing and revegetation with both pasture and tree species (Earth Tech, 2004). Many of these works have succeeded in stopping the progress of actively eroding gullies, while some of the works have failed re-initiating headward erosion. Hard engineered structures are more prone than other methods to failure as they age; this is particularly the case in highly dispersive soils such as those found within the Shays catchment.

Wimmera CMA works

Over the last 18 months, Wimmera CMA has worked closely with local landholders to develop and implement a whole of system strategy to address the problem of sediment generation and transportation in Shays Creek. The aim of the works is to control the bed grade allowing for sediment to be stored in the creek (Figure 3). Whilst addressing bank erosion through rock groynes and managing overland flows. The works are being implemented in stages, with a series of rock chutes, entry points and rock groynes already completed and showing a significant reduction in the sediment load reaching the Wimmera River.

Figure 3. Evidence of sediment build up and storage on upstream side of existing rock chute.

2004/2005 works

2004/2005 works were primarily focused on a site consisting of eroding bed and banks and a failed rock structure that appears to be privately built. Gravel extraction is also likely to have occurred in the vicinity of the site. Works focused on re-establishing the failed rock chute whilst also stabilising the surrounding bed and banks.

The works included the construction of the following structures:

- 2 elevated crest porous drop structures; and
- Numerous log/rock groyne structures.

2005/2006 works

2005/2006 works focused on a site in the upper reaches where the major channel incision from the lowlands intersected with the foot hill slopes. Increased velocities and stream powers from upstream slopes combined with incision resulting from downstream channelisation have resulted in an excessively large incised channel forming at this site.

Works focused on stabilising the bed and banks limiting the undercutting process and subsequent bank failure. A stable grade was achieved by constructing a four 'elevated crest' rock chutes, dropping a total of 4.5m head. These structures will act as a low lying instream obstruction allowing low flows to pass through causing backwaters to pond and slow behind them enabling sediment to drop out. In larger flow events the ponded water will overtop these structures allowing them to act as a standard rock chute. Stabilisation of the banks was achieved through a series of rock groyne structures being constructed deflecting flows away from the toe of the banks.

These stabilisation works will stem the current active bed and bank erosion, reducing the transport of sediment downstream whilst encouraging the stream to start to store its sediment and commence the infill process. These works are unlikely to impact on overbank flooding frequency.

Summary of structures constructed over the 1km length of the works (Figures 4 and 5 (SKM, 2006)):

- 4 elevated crest porous drop structures;
- 5 re-entry structures for lateral flow re-entry;
- Numerous rock groyne structures;
- Bank protection works at high energy location;
- Redistribution of sediments forming a new low flow channel and encouraging toe of bank infill and instream vegetation;

- A drop structure, assisting in arresting of bed load; and
- Revegetation of bed and banks with native sedges and grasses.

Extensive fencing and revegetation of riparian zones has also been undertaken on all work sites through Wimmera CMA's landholder Property Enhancement Grants Scheme.

Figure 4. Before and after – 'Elevated Crest' rock chute.

Figure 5. Before and after – rock groynes.

2006/2007 works

In the 2006/2007 works season, Wimmera CMA plans to continue implementing the whole system strategy for Shays Creek by implementing the following works upstream of the works completed in 2005/2006.

Construction of:

- 7 'elevated crest' rock chutes;
- 2 standard rock chutes;
- 2 flood breakaway chutes;
- Diversion banks;
- Log and rock groynes;
- Vehicle access crossing; and
- Re-entry chutes.

Works downstream of 2005/2006 works, to secure an existing sediment storage structure, will also be undertaken.

Assessment

Due to these works being implemented in drought conditions, Wimmera CMA recognises the need for follow up revegetation and monitoring of works during a wet sequence of years to assess their effectiveness before undertaking further works on Shays Creek.

Conclusion

Being close to a public road, and with complimentary revegetation works being undertaken, Shays Creek is becoming a "showcase" site for Wimmera CMA. Demonstrating the benefits to more landholders to complete future works focused on stabilising the bed and banks to limit the undercutting process and subsequent bank failure on their properties. These works will stem the current active bed and bank erosion reducing the amount of sediment transported downstream whilst encouraging the waterway to store its sediment, commencing the infill process.

Extensive fencing and revegetation of riparian zones has also been undertaken by landholders on all Wimmera CMA work sites through the Wimmera CMA Property Enhancement Grants Scheme. Wimmera CMA has worked closely with local landholders to develop and implement a whole system strategy addressing the problem of sediment generation and transportation.

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