Stabilising active gully heads

Western Local Land Services

What are gully heads and what causes them?

Gully heads are the vertical faces at the top of gullies. They actively erode and move upslope, driven by run-off water from above the gully head. As the water tumbles over the vertical face it plunges into a hole, which causes undercutting of the vertical face eventually causing the ground to collapse and the process starts again (Figure 1).

The vertical faces always head toward the strongest incoming run-off water, expanding as they move upslope. In most cases gullies are caused by a nickpoint, which is a cut in the land that is below the natural base level. This cut starts the waterfall erosion process if there is enough run-off water flowing over the nickpoint. The most common services of nickpoints are vehicle tracks, fencelines and livestock paths.

Gullies develop most aggressively where incoming run-off water is the strongest. Run-off water can be the strongest due to decreased groundcover from overgrazing. The decreased groundcover allows run-off water to flow unimpeded. Maintaining groundcover at 40 per cent improves water infiltration, slowing run-off water which in turn slows the formation and expansion of gullies.

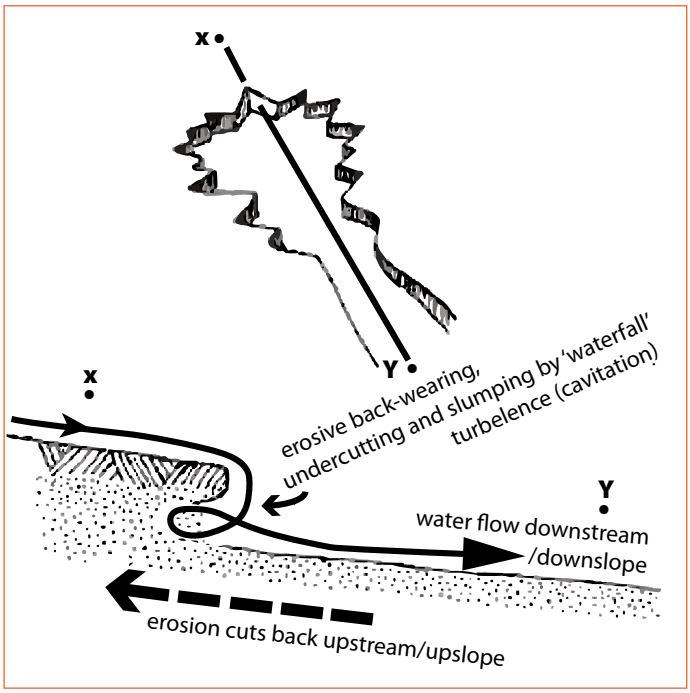

Figure 1: The structure and functioning of gully heads.

Impacts of gully heads

Gully heads eat away at the soil and there is no easy way of replacing this soil. Halting this soil loss has been the motivation for stabilising gully heads. However, another overlooked impact of gully heads is their de-hydrating effect on the landscape.

Gullies provide an easy way out for raindrops that have fallen on the land surface. They suck water to them that would otherwise have gone into the soil to grow groundcover. Gullies also steal water that would have recharged local aquifers. As a result, the surrounding country becomes degraded and bare.

The soil removed from gullies is eventually deposited somewhere. It may bury more productive soils, create sand bogs on vehicle tracks or silt up ground tanks and waterholes.

Figure 2: A gully head moving upslope - dehydrating the most productive part of the landscape.

Gullies are usually found in the most productive landscapes on a property. These productive areas are in low-lying drainage tracts which receive and hold water. They grow the most groundcover, dry out last and stay green longer. They are important for agricultural productivity and for biodiversity, providing valuable habitat for native plants and animals. When gullies encroach into these areas the broader landscape becomes less resilient and more susceptible to the negative impacts of drought.

Different ways of stabilising gully heads

Battering low vertical faces

The key objective is to stop the waterfall erosion process from moving further up-slope. This is achieved by battering, which is flattening out the flow path. The low vertical face is battered by deep ripping across the direction of the on-coming water. This method is effective when:

- the vertical face is less than 30 cm in height
- the oncoming run-off water is not particularly strong.

Any gutters immediately below the ripping area should also be battered or flattened out. If this doesn't occur they will start the erosion process again.

A soft filter below the deep ripping will slow water flowing down the batter and improve the success of rehabilitation. More soft filters within the gully below the repaired gully head will accelerate rehabilitation of the gully floor. A soft filter is a 'leaky barrier for flows. They are usually constructed with logs and branches, anchored with star pickets.

Armouring battered slopes

Where water flows are stronger, the battered down gully heads will need specific protection. This can be done by armouring the batter with an erosion-resistant layer, for example: geotextile material, rock or material that sets hard when rolled by heavy machinery (for example, calcrete). Vegetation material can also be used to protect small batters. The vegetation can include small logs, branches and bushes and may need anchoring with wire and steel pickets.

Battering and armouring the slope avoids diverting natural water flows, however this approach can be labour intensive and expensive.

Figure 3: A shallow gully head before and after the low vertical face was deep ripped.

Figure 4: Bunging bank below a treated gully head (not shown). Ideally the bank should be at least half as wide as the gully on both sides. Soft filters could have been used.

Figure 5: A soft filter made with logs and branches anchored with steel posts.

Check banks

Battering and armouring will not be successful if the gully head is deep and wide. These gully heads require carefully surveyed check banks above them, constructed with heavy earthmoving machinery.

The design and layout of check banks varies greatly and depends on the surrounding shape of the landscape.

In some cases, the fall of the slope is away from the gully. If this is the case, a simple check bank above the gully head will block water flows entering the gully and re-establish the natural flow path away from the gully. This scenario is common where a road has initiated the gully.

Where the gully is in the bottom of the watercourse, a series of check banks will need to be constructed to keep the water flows out of the gully.

A check bank at the top of the gully head will spread the water flows away from the main gully head, but the water will tend to return into the gully via side gully heads.

To prevent this, a series of check banks, called champagne banks, will need to be constructed to keep the water flow out of the gully.

The champagne banks continue along the side of the gully until a stable re-entry point is found or an area is found where water will flow away from the problem area.

It is important to use a level to determine the direction and slope of the land before choosing a repair strategy. Surveying should take place before and after all on-ground works.

Figure 6: A newly completed check bank. The spilling end is on the right, the flattened gully was in the centre.

Figure 7: A check bank above a gully head released water onto the adjacent plain. A series of check banks (called champagne banks) prevent water re-entering the gully.

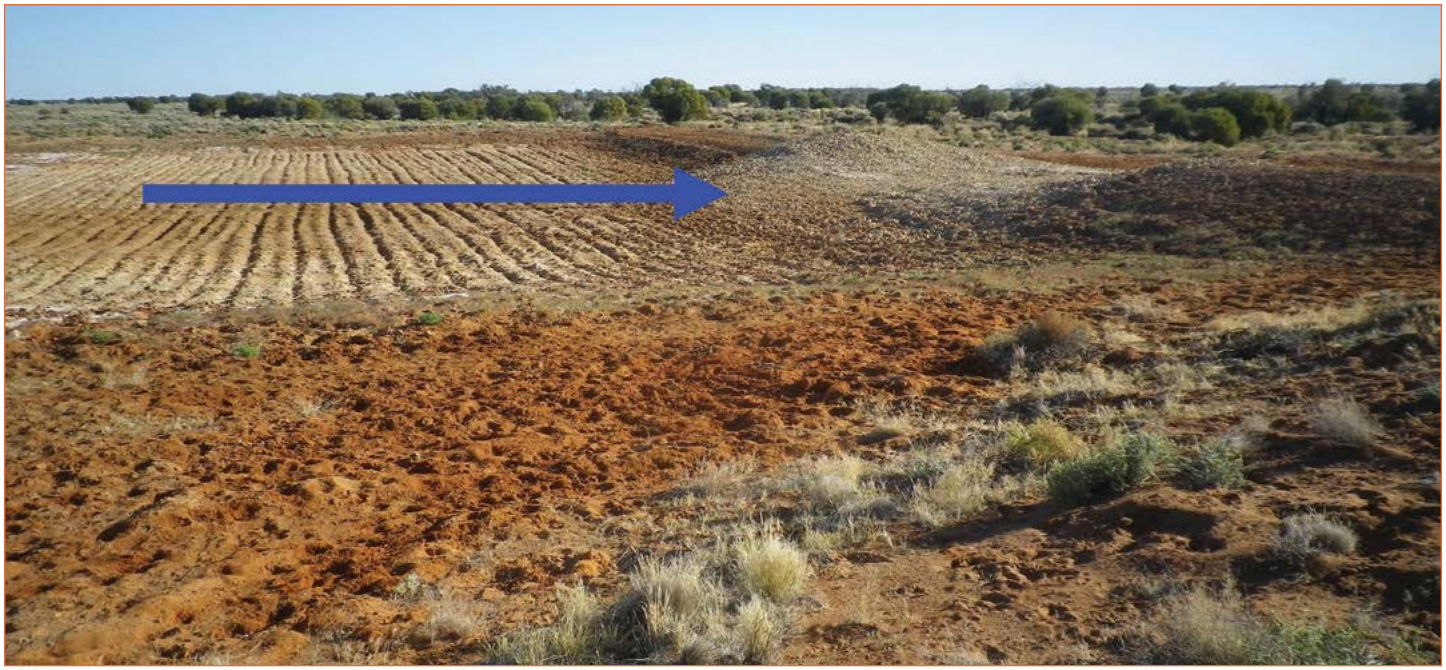

Figure 8: A drop structure armoured with partially crushed rock. Note the deep ripping, which flows water before flowing over the central point.

Drop structures

In some cases, water flows cannot be spread away from gully heads using check banks or champagne banks. This occurs where the land rises sharply on both sides of the gully. In this situation, the water flow should be allowed to enter the gully via a drop structure which is a controlled entry point.

A drop structure needs careful planning and construction. Professional input is recommended to improve chances of success.

A drop structure is like a weir placed in a gully that ponds some water and allows the excess to flow over a central point. They vary from simple structures made with fence pickets holding wooden posts, to major structures armoured with geotextile and rocks.

Recommendations

1. Prevent creating new gullies by maintaining groundcover and minimising ground disturbance, especially when establishing or maintaining tracks and fence lines.
2. Fix problems before they become a costly headache.
3. Match the solution to the landscape and your desired outcome.
4. Incorporate all banks into the landscape by ripping and removing vegetation where banks will be placed.
5. Do not disturb spilling areas and let the water out calmly onto a stable surface.
6. Consider seeding where key plant species are missing from the surrounding landscape.
7. Seek professional assistance for the stabilisation of major gully head systems, from your nearest Local Land Services office.

For more information contact your nearest Western Local Land Services office:

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