



Managing Erosion

A guide for managing and preventing erosion on your farm

*A gully at Greta West fenced and revegetated approximately 15 years ago with a mix of native trees and shrubs. The waterway is completely vegetated by rushes (*Juncus* sp.) and sedges (*Carex* sp.) and surrounded by a mix of wattles and Eucalypts that are now naturally regenerating.*

What is erosion?

Erosion is the movement of soil by water, wind or gravity. Erosion is a natural process that is often intensified by land use and management practices associated with farming.

This guide outlines the common types of erosion, discusses probable causes and identifies typical solutions for the management and prevention of erosion.

Types of erosion

Across North East Victoria, the process of the movement of water is the primary reason for most of our erosion. The impacts of water are strongly influenced by soil type, slope, location within the catchment, vegetation cover and land use. Common types of erosion directly caused by water include:

- **Splash erosion** is caused when raindrops hit bare soil. The impact of the rain causes a crust to form on the soil surface. This crust causes a reduction in infiltration and increases runoff.
- **Sheet erosion** is the removal of soil in thin layers by raindrop impact and shallow surface flow. This results in the loss of top soil and organic matter, which in turn makes vegetation establishment difficult.
- **Rill erosion** forms when surface flows concentrate into shallow drainage lines and soil is removed along thin channels. Rill erosion is common in overgrazed land and in freshly cultivated soils.
- **Gully erosion** is the removal of soil along drainage lines by surface water runoff. Gullies are defined as channels deeper than 30cm. Over time, and unless

managed by the landowner, gullies often move in an upstream direction (by undercutting and collapsing) and may grow in width as their sides collapse to achieve a more stable bank angle.

- **Tunnel erosion** is the removal of sub-surface soil by the action of water and is typical in dispersive subsoils. The tunnel starts when surface water moves into small cracks, follows old tree root lines, stump holes or runs through rabbit burrows, and as the space enlarges more water enters causing the tunnel to expand. Eventually the tunnel may collapse forming a gully.
- **Bed and bank erosion** is the direct removal of soil material from the bed and banks of streams. Erosion is a natural process in all stream systems. However, the normal rate of erosion can become accelerated when changes are made to the stream system (e.g. loss of streamside vegetation, increases in stream flows or removal of timber from instream).

- **Wind erosion** is the movement of soil by wind. This can occur when wind picks up the finer particles into the air known as 'suspension' or when particles of soil are lifted and moved for short distances along the ground known as 'saltation'. Adverse environmental conditions (e.g. drought) and over-grazing by stock lead to a loss of protective vegetation cover and increase the likelihood of wind erosion occurring. Wind erosion is more common in low rainfall areas and in normal years is not common in our area.
- **Mass movement** is the downward movement of soil under the influence of gravity. This is most frequent on steeper slopes (>25 degrees) that have little vegetation and where annual rainfall exceeds 900mm. Types of mass movement include slumps, landslips and landslides. These are not common features in our landscape and are not discussed further in this fact sheet.

Impacts of erosion

Erosion can affect environmental assets on your property and farm production due to:

- **Loss of topsoil** exposing poorer subsoil such as clay. Disturbed sites are often more prone to weed invasion and may make crop and pasture establishment more difficult. Topsoil also contains valuable organic matter and nutrients that are then lost from the system.
- **Loss of land** through bank erosion and gullying, which reduces the available productive land on your property.
- Potential **damage to farm infrastructure** such as fences and tracks, making access on your property more difficult or requiring costly repairs.
- **Sedimentation** of dams and waterways on your property, which can greatly impact on water quality for stock and lead to your dams filling with sediment over time.
- Sedimentation in smaller waterways can have a large cumulative effect on our priority waterways like the King and Ovens Rivers. Sedimentation can cause a loss of instream habitat for fish and aquatic invertebrates, as instream features like logs and aquatic vegetation become partially submerged and the depth of a river may shallow over time. Increased turbidity can also reduce light penetration in the water affecting plant growth and consequently invertebrate and fish feeding, as well as impacting on water temperature and the amount of dissolved oxygen.

An example of sheet erosion at Greta West. The presence of an old wagon cart track early in the century has led to the development of this feature over time in clay soils that have high slaking and moderate dispersion characteristics.





Sheet erosion at Greta West recently fenced to exclude stock access and revegetated using a mix of native tree and shrub species.

The importance of vegetation

The loss of native vegetation with its soil-binding roots destabilises soil. Deep-rooted species have the ability to remove excess water, while foliage and leaf litter soften the impact of rainfall on the soil. Healthy soil with a high level of organic matter is better at sticking together in clumps, or 'aggregating' together. Soil particles that clump together are more resistant to erosion.

Ground cover is any material that is on or near the soil surface that protects the soil against the erosive actions of water and wind. This can include plant

material and leaf litter, bark and twigs. **Ground cover is essential for the protection of soil.** The amount of ground cover that you need will depend on your annual rainfall, soil moisture, site slope and soil characteristics. Maintaining 70% cover is a good general guide. Generally, your groundcover is adequate when you have minimal runoff and are not losing any soil from your paddocks. Without ground cover up to 85% of rainfall from storms can run off into creeks and streams rather than soak into the soil and be available for plant growth.

General guidelines for preventing erosion

Appropriate management of vegetation on your property can address nearly all erosion problems. Below are some general guidelines for management:

- Prevent erosion problems from developing through good management and regular inspections on your property, and always treat erosion sites early before problems escalate. It is much cheaper to prevent erosion than repair gullies and fix other erosion sites.
- Retain existing native vegetation along drainage lines and waterways, as the re-establishment of trees and shrubs through revegetation takes time to stabilise sites and requires a financial and labour investment.
- Grazing management is a key consideration. Manage stocking rates and avoid overgrazing that can lead to a loss in ground cover and increased disturbance of the top soil. Increased grazing pressure by kangaroos and wallabies and feral animals like deer and rabbits can also contribute to higher than desirable grazing pressures and needs to be considered. Keep groundcover at 70% or above.
- Consider establishing deep-rooted perennial grass pastures to provide for greater soil binding capability and greater biomass.
- Avoid soil disturbance and removing vegetation in areas that have historically been susceptible to erosion.

- Retain topsoil and minimise cultivation. Also note, some sub soils can be more dispersive when exposed. Soils that are dispersive means that they break down easily into fine particles when wet and appear to dissolve and be carried away by water.
- Think about undertaking a Whole Farm Planning course to help you identify the areas prone to erosion. When sub-dividing your property into new paddocks consider doing so based on land classes. Land classing determines land and soil with similar agricultural potential and management requirements and groups these areas together.
- Carefully consider where to site the construction of any new assets like tracks, roads, dams, cattle yards, etc. to minimise the removal of vegetation. Locate such infrastructure on stable ground to prevent new erosion problems from starting.

Managing erosion sites

Some time, thought and effort can help to address small scale erosion issues on your property. Consider following this sequence of actions to address your erosion problem:

1. **Monitor the site** to understand the erosion issue and causes behind it (e.g. what type of erosion is occurring, location of the site, slope, water flow, soil types, etc).
2. **Develop an appropriate strategy** for the site, which will address the causes of the erosion and meet your objectives for use/management of the site. Depending on the type of erosion, there could be several different options for treatment. Seek advice from your local Landcare Facilitator or the North East CMA if your site is located on a waterway.
3. **Implement the strategy** by working to your plan. Consider seasonal timing for fencing projects, revegetation works and any machinery work on your site. Always accept that there will be ongoing management of your site e.g. weed control, watering in new plantings, removing guards, etc.
4. **Monitor the outcomes.** Keeping good records helps to determine the success or otherwise of your project:
 - *Take regular photographs* once or twice a year of your site at similar times from the same locations. Date the photos and compare the new photographs with earlier versions. Photographs provide an excellent visual indicator of the extent of erosion and potential improvements of vegetation cover over time.
 - *Establish erosion pegs* by using as a steel tent peg or a star picket to mark where the ground surface is at your site. If you are concerned with the loss of top soil, use a marker pen or paint a line where the peg enters the soil surface. If you are measuring the rate of movement at a gully, place a peg at a distance from the vertical erosion face and measure a distance to the face of erosion. Keep a record of your measurements and revisit sites twice a year (e.g. end of winter, end of summer) to measure and record for a comparison over time.



A small gully at Greta West, where subsurface flows seep from the base of the cleared hillslope out onto the paddock. Fine sediment has been deposited in the base of the gully and surface rills are evident on the clay sides.

Gullies

Gullies can form on hillslopes or in alluvial deposits (floodplains or river frontages). They result from the concentration of flow into a defined course and the removal of soil over time and formation of typical 'steps' in the bed of the drainage line (these are often also referred to as knickpoints or erosion heads). Over time, there is deepening of the channel downstream of the erosion head. Bare soil tracks made by stock and vehicle tracks provide drainage lines for runoff and can

create points where gullies can easily start. A loss of vegetation cover during drought or by over grazing is often also a contributing factor.

Often degraded areas like gullies are preferred by stock for grazing. This is because the grass that grow in gullies is 'fertilised' by extra minerals during the erosion process and is more tasty and palatable to stock. This increase in stock browsing in highly susceptible areas exacerbates the erosion problem.

Objectives for managing gullies

- Reduce the volume of runoff entering the gully (e.g. don't over-graze nearby areas, site a woodlot or shelterbelt upstream, improve the type of pasture species on surrounding paddock).
- Reduce the concentration of runoff at gully heads, by diverting or spreading flows around the site. This is very difficult to do successfully without creating problems elsewhere on your property.
- Increase vegetation cover at the site, as vegetation increases surface roughness and slows water velocities. Roots provide reinforcement, and vegetation can bend and lay directly over the soil surface in higher flows thereby providing direct protection of the soil surface from rainfall and flowing water.
- Retain and plant native tussock-forming grasses, rushes and sedges like *Poa*, *Carex* and *Juncus* species along waterways, in drainage lines and in the base of gullies to trap sediment and provide stabilisation. These plants are well suited to wet conditions and have a key role to play in these environments.
- Keep revegetation densities at a suitable spacing to allow for grass growth between plants. Always avoid ripping in dispersive soils prior to planting.
- Improve organic matter at the site over time to help to build soil structure and provide cover to protect soils from splash, sheet and rill erosion.
- Minimise soil disturbance and any vegetation removal when doing rehabilitation works.
- Avoid placing old rolled up fencing wire and rubble in gullies. This does little to stabilise these sites, looks unsightly and can often cause more erosion problems.

Possible activities for gully control

Revegetation and fencing is the key step at all sites. Revegetation is often the main option for management because it is low cost and addresses the root causes of the problem. Fence with appropriate setbacks that consider the movement of the gully over time - a minimum of 5m from the gully sides and 10m at the gully head.

Sediment traps work to capture sediment e.g. specialised erosion products such as porous check dams, silt worms, and simple staked straw or lucerne bales. Sediment deposits will then normally stabilise with vegetation over time. This prevents sedimentation of downstream assets like waterways and dams.

Use of **erosion matting** or **geotextile fabrics** to aid vegetation establishment and soil retention. There are many different types of products available to suit individual sites and these products will have different lifespans depending on material type (e.g. coir or geotextile).

Construction of **grade control structures** can be expensive, but can address erosion at large gullies if done correctly. A grade control structure is like a rock weir that is built over the erosion head to prevent further erosion in the bed of the waterway. Such structures can also trap large volumes of sediment, so are suited to particular catchments that generate high volumes of sediment. These structures have a high design and construction cost. We are moving away from this approach now, although in the 1960-90s this was probably the main solution used for gully erosion.



Over time gullies can form deep channels that will continue to erode in an upstream direction. Addressing erosion of this magnitude requires careful consideration. Erosion problems are much easier to treat before they develop to this scale.

Stream bank erosion

Stream bank erosion may result from the removal of individual soil particles from the bank face or by failure or slumping of the whole bank face. The method of treatment will depend on which erosion process is operating at the site.

As with gully erosion, fencing and protection of existing native vegetation and/or re-establishing vegetation, is the most cost effective means of treatment. The creation of fenced riparian corridors leads to many benefits for both farm production and the environment including:

- Fenced riparian land can also be a valuable wildlife corridor, providing shelter and food sources for local fauna species.

- Vegetation acts as a filter strip, improving water quality and therefore habitat for instream species.
- Riparian vegetation provides shade for adjacent stock and acts as a windbreak for crops and pastures.

Note that any work on or near a designated waterway will require a **Works on Waterways Permit from the North East Catchment Management Authority** (North East CMA).



Bank erosion on this waterway occurred during repeated high river flows and floods during spring 2016. There is no woody vegetation on the bank face or on the top of the bank at this site to help prevent erosion.

Objectives for managing stream bank erosion

- Increase vegetation cover on the bank face and beyond the top of the bank for a minimum of 5-10 metres. This should include a mix of native trees, shrubs and ground covers.
 - Revegetation should involve the careful selection, siting and planting of local native species.
 - Consider a weed management strategy for the site to ensure the long-term success of your revegetation.
- Fence to exclude stock access to the stream and limit further erosion of banks.
 - This may require the provision of off-stream watering. Consult with the North East CMA regarding technical support for such works.
 - The width of the fencing from the stream should consider the width of vegetation required for stabilisation and allow access to the riparian zone for management activities. In narrowly fenced sites, it is difficult to control weeds and fences may be easily damaged by overhanging and fallen branches.
- Assess the way in which willows affect the local environment at your site. Excessive willow growth instream may be resulting in bank erosion. The optimal long-term goal at your site should be for the phased replacement of willows with suitable native species, as native species have many more biodiversity benefits for our landscape. Again, talk with the North East CMA or your local Landcare Facilitator for advice on willow management.
- Minimise any disturbance to the site during revegetation or bank stabilisation works.

Possible activities for bank erosion control

Typical activities used to address bank erosion in our catchment include:

- **Revegetation and fencing** is the key step at all sites. Revegetation is the most cost effective form of erosion control. Consider planting densely with spacings of 1m between tube stock. If reeds and rushes are not present at your waterway, consider planting these at the toe of the bank.
- **Bank battering** is a useful technique where banks are unstable due to the type of bank material, rather than due to the high stream flows. Bank battering means that the slope or gradient of the bank face is reduced or flattened using machinery. This technique may be useful in order to obtain a suitable bank profile for revegetation.
- **Erosion control matting** is of greatest value where revegetation will solve an erosion issue but initial stability and protection is required to prevent soil loss, protect vegetation against damage and increase vegetation growth rates by retaining soil moisture. There are a variety of materials used for this matting and longer lasting fabrics should be used where soil quality is poor and revegetation establishment will be slow. The matting must be pinned on the bank face.
- **Placement of timber.** Timber logs can be used to direct flow away from an eroding bank. This is a specialised process and guidance from the North East CMA is recommended. The timber (trees or large logs) must be anchored to the bank using suitable means like star pickets or driving timber logs. The timber needs to be aligned with consideration of the shape of the bank and placed where the erosion is actively occurring on the bank face. Smaller branches or 'brushing' can also be placed directly over a bank to act like erosion control matting and help protect soils whilst revegetation is being established.
- **Rock beaching** involves the placement of rock directly on the bank face. Rock beaching is very expensive and is only suited to specific erosion problems on waterways. Avoid tipping rubble like broken concrete and bricks on your banks, this is not adequate protection and only results in the littering of our waterways. Advice on rock beaching and suitable contractors can be sought from the North East CMA.

Further information on addressing bank erosion can be found in the *Other Resources* section of this guide.

A large section of bank has been scoured away in the spring 2016 floods. The existing riparian fence has been completely undermined. The large blockage of willow debris would have contributed to the development of this bank erosion.





Tall Sedge (Carex appressa) is a perennial native sedge that can tolerate seasonal and permanent inundation. These sedges can recolonise easily from the dispersal of seeds along drainage lines and waterways at flowering.

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Other Resources

The following references provide further information and detail on soil erosion process and management to help manage your site. These references are available on www.gretalandcare.org.au.

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Further information on Whole Farm Planning can be found on the Agriculture Victoria website at www.agriculture.vic.gov.au

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