

## 6 BOOROWA CATCHMENT ACTION PLAN

### 6.1 DRYLAND SALINITY ACTION PLAN

#### Why Do Anything?

Protect our landscape from further salinisation, to ensure that our farmland remains productive.

Minimise the impact salinity has on our natural resource base, and the local community, and communities downstream of our catchment.

#### What Can We Do?

We need to manage our landscapes in a way that reduces the volume of water reaching the watertable.

#### How Will We Do It?

The Government has created Catchment Management Authorities, which have delivered Blueprints to assist in targeting actions focused at particular priorities. Dryland Salinity is one of these priorities. The codes you see in italics, in brackets, beside the actions, relate to which Salinity Management Target that action parallels in the Lachlan Catchment Blueprint.

#### Identify the problem

1. Develop ‘user-friendly’ tools such a Salt Identification Kit to assist in early recognition of salinity symptoms. (*PA10 and SA37*)
2. Maintain and improve links with expert advisors to assist in ascertaining local causes and developing focused solutions. (*SA04 and PA12*)
3. Target priority areas using current salt mapping technology (Nick Henry DIPNR) and Landholder knowledge (see Dryland Salinity BMP).
4. Identify and map local groundwater systems to assist in identifying likely causes, and apply best relative solutions (See Dryland Salinity BMP). (*SA01*)

#### Plan a strategic approach to applying Management actions

5. Plan management actions on a sub-catchment scale to ensure continuity of management action application, and to maximise natural resource outcomes. (*PA05 -06*)
6. Plan on-ground works to implement above management actions at the Property Plan Scale. (*PA01 – 04*)
7. Extend Network of Landcare members to fill any gaps in sub-catchment scale management actions.

#### Implement management actions

8. Manage grazing to promote ground cover and pasture species diversity. This will ensure good groundcover all year, reducing groundwater recharge and erosion. (*SS03, SS04, SA24, SA30*).
9. Replace annual pastures with perennial species, including native species that are well adapted to region.
10. Maintain soil health to enable the establishment and maintenance of pastures. eg: Lime applications to reduce pH. Encourage soil health through maintenance of soil-based biodiversity. (*SS02*)

11. Develop best management practices for the protection and enhancement of remnant vegetation. The planning of these practices should occur at the sub-catchment Scale (VA10). These practices should abide by the conservation ideals presented by NSW National Parks in their report: Native Vegetation of the Boorowa Shire (VA19 - 20). Consider the functionality of the remnant in question relative to biodiversity outcomes, and the ability of the vegetation present to reduce recharge. (VA23 - 24).
12. Identify areas in which Intercept plantings would assist in discharge reduction. (SA01).
13. Plan such plantings at the sub catchment scale to maximise groundwater response as well as providing stock shelter, riparian protection and corridor links with above mentioned remnant vegetation and other existing or planned plantings (SA08)
14. Revegetate identified high recharge country.
15. Rehabilitate high priority saline discharge areas by fencing to control stock, revegetate with salt-tolerant pasture and tree species, promote groundcover using fertiliser and gypsum application, mulching and earthworks where necessary. Graze to encourage water use where appropriate. (SA37, SA38, SA41).

#### **Promote and educate**

15. Promote practices that minimise recharge to groundwater, and reduce salt in streams, in both urban and rural situations by developing educational and awareness raising material/activities. Target audiences should range from School children, (encourage further development of Junior Landcare Groups in our schools), to Landholders and Local Government Members. All stakeholders need to be continually challenged. (PA08 -PA09)
16. Encourage and facilitate continued participation of University Students and Post Graduate students in research and mapping projects within the region. (PA08)

#### **Monitor**

17. Develop Discharge Site and River Monitoring programs. This will enable the measurement of success rates and allow for the evolution/improvement in Management Practices employed.  
Learn from failures, promote successes, and encourage innovation.

## **6.1a SALINITY BEST MANAGEMENT PRACTICES**

### **RECHARGE**

The strategy you adopt to reduce recharge on your property will depend on the severity of the problem, your resources, the physical characteristics of the site, and most importantly, what system of groundwater flow is operating beneath the surface.

Before you start planning your approach to Recharge management, you should consult an expert (Refer Appendix 1). The strategy you might employ will be some combination of the following management practices:

#### **1. Pumping Pastures:**

Maintain pasture cover all year round. Most effective pastures contain a large component of deep-rooted perennial grasses. Manage grazing to benefit the plants that are working for you. Allow time for your pasture to recover between grazing episodes. Encourage (through grazing control) the re-establishment of native perennial pastures that are well adapted to utilising the rainfall zones that they have evolved in.

#### **2. Multifunction Tree Plantings:**

Plant deep-rooted trees and shrubs up-slope from the salinity out-break, high enough out of the discharge zone to allow ease of establishment. These plantations may double as shelter belts, fodder, biodiversity links or farm forestry enterprises. Similar (larger) plantings may be useful at the top of the landscape where other forms of farm enterprise are often difficult anyway.

#### **3. Careful Management:**

Engage in appropriate management practices. Avoid inefficient irrigation, long fallow periods and cropping practices that could lead to rainwater leaking into the groundwater system. Over-grazing will result in poor plant health, which reduces the pumping ability of the pasture over the entire area.

#### **4. Maintain Good Soil Health:**

This is imperative to enable all other aspects of best management practices.

### **DISCHARGE:**

The management for discharge sites revolves around the idea reducing the chance of soil erosion on the affected area. This can be done with a combination of several Best Management Practices.

#### **1. Fence off the Site.**

Early stock exclusion will reduce the damage caused by hard hooves and mouths (licking salt crystals). Fences should be placed at least 20 metres from the edge of the affected area (as indicated by salt tolerant species range).

#### **2. Create a Seed Bed**

Broadcast Gypsum to improve the soil structure, add calcium, improve drainage and break the surface crust. DO NOT Deep Rip. Organic matter and nutrients can be added in the form of straw mulch, turkey/chicken litter or other fertilisers. Care must be taken to avoid adding fertilisers too “hot”.

### **3. Plant Salt tolerant Grass species.**

This should be done with absolute minimal soil disturbance to reduce the risk of erosion. Light harrowing or “Bag dragging” may be used to “open the crust” to allow seed penetration. Seed should be broadcast or direct drilled. Some advances have also been made on the use of tree and shrub species on discharge sites (see salt tolerant species list pg.??..).

### **4. Manage and Monitor the Site.**

Stock access to the site should be limited to when they will do the least damage and when the pasture established can stand crash grazing. Desirable species should be allowed to go to seed. High numbers of stock should be used over a very short time period. This ensures all plants are lightly grazed. It also lays vegetative matter and manure all over the site where it replenishes the biological material in the soil system.

The site should be monitored for signs of spreading. Placing survey pegs at the outermost physical signs will facilitate this. Piezometers may be utilised to track the rise and fall of groundwater levels more closely.

NB: It should be noted that even a seemingly successful discharge management program is only dealing with a symptom of a much bigger problem. A combination of Recharge and Discharge Best Management Practices need to be employed to truly address the full extent of the problem causing your discharge issue. This often involves cooperation and planning across more than one property. Active Landcare networks should enable this sort of cooperation.

## WHAT ARE THE SIGNS OF DRYLAND SALINITY?

Even though dryland salinity is a well-known problem, it is sometimes hard to recognise the early signs of salinity until the impact becomes severe. Here are some events that may indicate salinity. If you recognise one or more of these on your property and believe you have a salinity problem, you should seek advice on early action you can take to prevent the problem becoming more severe. (see contacts below). These signs are likely to occur at the bottom of slopes and in drainage depressions and be known as 'discharge' sites.

- 1. Waterlogged soil and areas of new wet patches.**  
Waterlogging does not indicate salinity in every case, but is an early warning sign.
- 2. Trees dying**  
As the saline groundwater table rises, trees begin to die for no apparent reason, usually before any impact on pastures is evident.
- 3. Loss of productive annual and perennial vegetation species**  
As the ground becomes more saline, annual and perennial species die. Often, in their place grow more salt tolerant plants, such as sea barley grass, couch, annual beard grass, spike rush and/or strawberry clover.
- 4. Bare patches of soil**  
Bare areas of soil appear and become larger. The soil may also set hard as it dries out. Often referred to as a 'salt scald'.
- 5. The area attracts stock**  
Stock love to lick the salt from the ground, and usually gather together around the saline area.
- 6. Visible salt crystals**  
When the surface is dry, salt crystals appear on the surface of the soil. It may look like white dust or powder.
- 7. Puffy soil**  
When dry, the surface of the soil is "puffy" and shatters when walked on.
- 8. Excess water runoff**  
The area is eroding from large quantities of water runoff.
- 9. Clear dam water**  
Water in dams close to the site tends to be quite clear as the salt settles the sediment.
- 10. A salty smell**  
Salt can be smelt in the area.

### Who can help?

Department of Infrastructure, Planning and Natural Resources,  
Yass Office. Phone (02) 6226 1433;

Lachlan Catchment Management Authority, Cowra Office. Phone (02) 6341 1600

## HOW TO MANAGE SALINE DISCHARGE SITES

### What is a saline discharge site?

A saline discharge site is an area where the water table has risen and salt has affected vegetation and soil on the surface. Its impact varies, but usually results in

- a reduction in pasture and crop performance,
- bare scalded areas,
- dead trees,
- salt crystallisation and
- excessive erosion.

### How do I manage it?

The appropriate way to manage a discharge site will vary depending on the severity of the problem. The main options are below, but also ask the local extension officer from agencies such as the Department of Infrastructure, Planning and Natural Resources office for advice (contact details below).

#### 1. Fence the site

Stock should be kept off the site (they like to lick the salty ground). The fence should be at least 20 metres from the edge of the salt affected area. Vegetation changes will indicate the boundaries of the salt affected site. If the land is flat around the site, the fence should be placed further away as salt is likely to spread.

#### 2. Carry out earthworks

Earthworks are usually needed for more severely affected areas. The type of earthwork will depend on the site, but some options include creating diversion banks to divert the flow of water away from the site, gully control structures, and deep ripping to assist in revegetation.

#### 3. Plant salt tolerant grass species

Grasses, rather than trees, are usually more successful in revegetating saline areas. However, trees are useful in planting above and around the site to contain it. Good grass species include Tall Wheat Grass, Puccinella and Strawberry Clover (see the *Salt Tolerant Species Fact Sheet*).

#### 4. Apply straw mulch, gypsum and fertiliser

Straw mulch protects the bare soil and reduces evaporation. It also protects seed for revegetation and provides organic material. Gypsum improves the soil structure, drainage, adds calcium and breaks the surface crust on bare soil. Fertiliser should also be applied on all saline sites to improve nutrient levels.

#### 5. Manage and monitor the site!

Stock access to the site should be limited to when they will do least damage and when the area can stand some grazing ('crash' grazing method can be used ie high stock numbers for short periods). The site should be monitored for any spreading and any increase in salinity level. Piezometers may be useful to assess and measure the depth of the ground water. Once productive species are established, keep them well grazed so they use as much water as possible.

### Who can help?

Department of Infrastructure, Planning and Natural Resources,  
Yass Office. Phone (02) 6226 1433;

Lachlan Catchment Management Authority, Cowra Office. Phone (02) 6341 1600

## HOW TO MANAGE SALINE RECHARGE SITES

### What is a saline recharge site?

Recharge areas are the points at which water (rainfall) enters the groundwater table. Recharge occurs in all parts of the landscape except for discharge sites. Highest rates of recharge are usually in the higher parts of slopes or hills and where the vegetation has been cleared or altered.

### How do I manage it?

There are many options for managing recharge sites. Your choices will depend on the severity of the problem, how it fits your whole farm plan, your resources (time, money), and the physical characteristics of the site such as access. Some options are to;

1. Revegetate  
Revegetate the area with deep-rooted trees, shrubs and grasses.
2. Establish perennial pastures  
Increase water use on the rest of your property by ensuring growth of deep-rooted perennial grasses and pasture. Ensure you carry out appropriate weed, pest and disease control, as well as fertiliser treatment to maintain good growth. Graze well to maximise water use.
3. Native grasses  
In areas where pasture improvement is not suitable, ensure good growth of native grasses.
4. Engage in appropriate management practices  
Avoid inefficient irrigation, long fallow periods and poor cropping practices in recharge areas.

### Further Reading

Dryland Salinity 8. Options for Control DLWC 1994

### Who can help?

NSW Department of Agriculture, Yass Office (02) 6226 2199  
NSW Department of Infrastructure, Planning and Natural Resources,  
Yass Office (02) 6226 1433;  
Lachlan Catchment Management Authority, Cowra Office. Phone (02) 6341 1600

**PASTURE MANAGEMENT**

Pastures are a dynamic system. They include native and introduced species and are subject to grazing, pest and disease attacks, as well as varying inputs, such as rainfall.

The management of pastures to address and prevent dryland salinity means using pastures to increase water use. The choice of pasture must fit the site on-farm taking into account soil type, pH, depth, drainage, degradation or erosion, and enterprise (wool, beef etc).

Seek advice about which option will best suit the different areas on your property.

**What can you do?**

- Sow pasture species that are suited to the land capability. eg. salt tolerant, acid tolerant.
- Plant pasture species that use more water than annual pasture species, such as lucerne, phalaris, cocksfoot.
- Don't fallow. Recharge is increased if left to long fallow periods.
- Take advantage of extra moisture for opportunity cropping when conditions are appropriate, but make sure the land is able to sustain such activities.
- Use a phase cropping system. Rotate annual crops with perennial pastures for example, after 5-7 years of continuous cropping plant 5-10 years of perennial pastures
- Use the alley cropping method. Plant annual crops in alleys among rows of perennial plants that will provide shelter, increase water use and provide other benefits such as fodder and habitat.
- Ensure existing native and introduced pastures are productive and self-sustaining. It is important to have a significant component of perennial pasture.
- Plant and maintain trees, particularly near grazing pastures.
- Fertilise pastures to maximise growth and therefore water use.

**Who can help?**

NSW Department of Agriculture, Yass Office (02) 6226 2199



## FACT SHEET

### SALT TOLERANT TREE & GRASS SPECIES FOR THE BOOROWA AREA

The tree and shrub species listed below have varying levels of tolerance to salinity. Trees and shrubs generally should not be planted directly into scalded discharge areas (i.e. bare salty patches), but rather on the boundary of the affected area (see also the Fact Sheet; *How to Manage Saline Discharge Areas*). Bare saline sites are best managed by sowing salt tolerant pasture species (listed below).

#### SALT TOLERANT TREES AND SHRUBS

| BOTANICAL NAME                  | COMMON NAME          | SALT TOLERANCE                              | GENERAL COMMENTS                                      |
|---------------------------------|----------------------|---|---|
| <i>Acacia longifolia</i>        | Sydney golden wattle | slight-moderate                             | tolerates wet sites, frost tolerant                   |
| <i>Acacia mearnsii</i>          | Black wattle         | Slight (varies with provenance)             | fast growing  |
| <b>Acacia melanoxylon</b>       | Blackwood            | slight-moderate<br>(varies with provenance) | tolerant of periodic waterlogging, slow growing       |
| <i>Acacia retinoides</i>        | Swamp wattle         | moderate-high                               | tolerant of wet sites with saline sub-soils, frosts   |
| <i>Casuarina glauca</i>         | Swamp she-oak        | moderate-high<br>(varies with provenance)   | tolerates waterlogging, mild-moderate frost tolerance |
| <i>Eucalyptus aggregata</i>     | Black gum            | slight                                      | good in wet areas                                     |
| <i>Eucalyptus camaldulensis</i> | River red gum        | moderate (large variation in provenance)    | tolerates waterlogging                                |
| <i>Eucalyptus camphora</i>      | Swamp gum            | slight-moderate                             | good in wet areas                                     |
| <i>Eucalyptus melliodora</i>    | Yellow box           | slight-moderate                             | slow growing  |
| <i>Eucalyptus ovata</i>         | Swamp gum            | slight                                      | tolerates waterlogging, frost tolerant, slow growing  |
| <i>Melaleuca ericifolia</i>     | Swamp tea-tree       | moderate                                    | highly frost tolerant                                 |

#### OTHER REVEGETATION SPECIES USEFUL FOR SALINE AREAS

| BOTANICAL NAME                | COMMON NAME             | SALT TOLERANCE   |
|-------------------------------|-------------------------|--|
| <i>Callistemon citrinus</i>   | Crimson bottlebrush     | medium salt tolerance  |
| <i>Casuarina obesa</i>        | Swamp she-oak           | highly salt tolerant<br>tolerates waterlogging & mild frosts         |
| <i>Eucalyptus astringens</i>  | Brown mallet            | slightly salt tolerant   |
| <i>Eucalyptus botryoides</i>  | Bangalay                | low-moderate salt tolerance<br>tolerant of waterlogged soils         |
| <i>Eucalyptus leucoxylon</i>  | Yellow gum              | slight/moderate salt tolerance<br>sub-species variation in tolerance |
| <i>Eucalyptus robusta</i>     | Swamp mahogany          | moderately salt tolerant<br>highly tolerant waterlogging             |
| <i>Eucalyptus sideroxylon</i> | Mugga ironbark          | slightly salt tolerant   |
| <i>Melaleuca bracteata</i>    | River tea-tree          | moderately salt tolerant<br>moderately frost tolerant                |
| <i>Melaleuca decussata</i>    | Cross-leaf honey myrtle | highly salt tolerant<br>highly frost tolerant                        |

## FACT SHEET

### SALT TOLERANT PASTURE MIX

#### For slightly saline sites - 2-4 dS/m\*

| COMMON NAME  | RATE OF MIX |
|--|-------------|
| Australian phalaris  | 2 kg/ha     |
| Tall wheat grass   | 4-6 kg/ha   |
| Demeter fescue   | 4 kg/ha     |
| Trikkala or gosse sub clover   | 2 kg/ha     |
| Perennial ryegrass   | 2 kg/ha     |
| Palestine Strawberry clover  | 1 kg/ha     |
| Paradana Balansa clover  | 1 kg/ha     |
| Fertiliser - nitrogen and phosphorus mix with sulphur present, eg Starter 15 | 125 kg/ha   |

#### For moderately saline sites - 4-8 dS/m\*

| COMMON NAME  | RATE OF MIX |
|--|-------------|
| Australian phalaris  | 2 kg/ha     |
| Tall wheat grass   | 4-6 kg/ha   |
| Demeter fescue   | 4 kg/ha     |
| Puccinellia  | 2-4 kg/ha   |
| Perennial ryegrass   | 1-2 kg/ha   |
| Palestine Strawberry clover  | 2 kg/ha     |
| Paradana Balansa clover  | 2 kg/ha     |
| Fertiliser - nitrogen and phosphorus mix with sulphur present, eg Starter 15 | 125 kg/ha   |

#### For severely saline sites - 8+ dS/m\*

| COMMON NAME  | RATE OF MIX |
|--|-------------|
| Tall wheat grass   | 6-10 kh/ha  |
| Puccinellia  | 2 kg/ha     |
| Palestine Strawberry clover  | 2-3 kg/ha   |
| Fertiliser - nitrogen and phosphorus mix with sulphur present, eg Starter 15 | 125 kg/ha   |

\* *deci-Siemens per metre*

## **FURTHER SALINITY READING**

**Assessing the Texture of Your Soil.** Save Our Soils. NSW Agriculture and NSW Department of Infrastructure, Planning and Natural Resources.

**Detecting Dryland Salinity on the Southern Tablelands of New South Wales,** DIPNR and Salt Action

**Dryland Salinity,** Salt Action Series, DLWC , 1993, 1994

1. The Causes
2. How Severe is Your Discharge Area
3. Piezometers - How and Why
4. Productive Use of Salt Affected Land
5. Crop Management for Central and Southern NSW
6. The Role of Vegetation Management
7. The Economic Picture
8. Options for Control

**Identifying and Treating Dryland Salinity** Lachlan Soil Management Guide. NSW Agriculture, NSW Department of Land and Water Conservation & National Landcare Program. Nicholson, A. and Wooldridge, A. (2000)

**Dryland Salinity - a land management issue, not a disaster,** in Rising Water Tables and Salinity in the Yass River Valley, J.Franklin, DLWC 1999 (pp 31-55)

**NSW Salinity Strategy,** NSW Department of Infrastructure, Planning and Natural Resources, 2000

**Dryland Salinity and its Impact on Rural Industries and the Landscape.** Prime Minister's Science, Engineering and Innovation Council, Occasional Paper No 1, Department of Industry, Science and Resources, Canberra 1999

**Productive Solutions to Dryland Salinity** GRDC Canberra, July 2001.

**Trees, Water and Salt: An Australian guide to using trees for healthy catchment and productive farms.** Joint Venture Agroforestry Program, Rural Industries Research and Development Corporation 2000.

## 6.2 NATIVE VEGETATION ACTION PLAN

### WHAT WILL WE DO ?

#### **Retain and enhance remnant vegetation and increase the area of native vegetation**

### WHY WILL WE DO IT?

To maintain and improve ecological health. To protect areas of high conservation value. To ensure sustainable productivity. Native vegetation provides ecological, social and economic benefits. It contributes to biodiversity, protects against land degradation, maintains water quality, acts as a carbon sink, and provides for recreation, natural heritage, and research. It provides fodder, products such as timber and honey, and habitat for beneficial pest predators. It also has important social, economic and cultural values for Aboriginal people.

### HOW WILL WE DO IT?

The Government has created Catchment Authorities, which have delivered Blueprints to assist in targeting actions focused at particular priorities. Protecting Native Vegetation and Biodiversity is one of these priorities. The codes you see in italics, in brackets, beside the actions, relate to which Native Vegetation and Biodiversity Management Target that action parallels in the Lachlan Catchment Blueprint.

#### **Identify the problem**

1. Identify and target areas of high conservation value and areas of threatened vegetation using *The Native Vegetation of the Boorowa Shire (NSW National Parks and Wildlife, 2002)*, as a guide. (*VA01*)
2. Develop user-friendly kits to help assess the functionality of remnant vegetation. (*VA02*)
3. Seek expert advice to establish local reasons for decline (eg dieback).

#### **Implement management practices**

4. Develop a Sub-catchment scale plan to address the issue (*VA10*)
5. Develop and trial new best management practices to improve the functionality of existing vegetation blocks.
6. Communicate Best Management Practices with resource users like firewood collectors, and timber millers. These people should be part of the solution.
7. Identify and communicate with stakeholders with ownership of, or interest in, areas of remnant vegetation, (This will include landholders, resource users, and the wider community), to assist in implementation of best management practices.
8. Implement best management practices for remnants at the farm plan scale. (*VA15, 16 and 19*). This process should be an integral part of farm planning and should be done with the assistance of an accredited person.
9. Encourage the adoption of Voluntary Conservation Agreements or Joint Management Agreements with NPWS.
10. Develop and encourage the use of “chain of custody” approach to seed collection to ensure improvement of endemic gene pool. Establish provenance based plantations for seed collection purposes. (*VA27, VA28 and VA29*).
11. Create an extensive network of vegetation to link revegetation and isolated remnants. These should utilise wide corridors and “stepping stones” of vegetation, maximising the multi-benefits possible through well designed plantings.

12. Promote revegetation of native ecological communities listed as threatened or endangered, through fencing, reducing competition etc.
13. Look for ways of incorporating all tree plantings into Remnant Vegetation Management Practices.

#### **On-ground works**

14. Enhance the health of remnants by encouraging natural regeneration and re-introducing a large range of local native understorey plants. (VA30)
15. Manage weeds and feral animals. (VA38)
16. Selectively retain dead standing and fallen timber for habitat.
17. Fence areas of important native vegetation & manage grazing appropriately.
18. Support more research on germination of native vegetation especially native grasses.
19. Encourage more research into causes of remnant vegetation decline, ecology, and landscape function. Factor results into best management practices. (VA32 and VA33)
20. Encourage the continued evaluation of vegetation extent using GIS and Ground-truthing.

#### **Promote and educate**

21. Raise awareness of the importance of remnant vegetation. This should occur at and above Primary School level.
22. Encourage local government to actively participate in the protection of high quality vegetation, particularly where it will be affected by development.
23. Identify and Encourage financial rebates or incentive schemes for revegetation works.
24. Develop identification information sheets for native perennial pasture management – grazing techniques, fencing, fires, allowing for seed set.
25. Promote native farm forestry through trial farm forestry sites.

#### **Monitor**

26. Develop user friendly protocols to monitor revegetation and remnant management activities to improve techniques, species selection and practices.
27. Utilise GIS technology to review remnant linking and replan approach to reducing remnant isolation.

## **6.2a NATIVE VEGETATION BEST MANAGEMENT PRACTICE**

Manage remnant native vegetation to improve its condition. Incorporate management strategies for these areas in your farm plan. Think about where they will provide the most benefit to your farming system. They might be to provide livestock shade and shelter, protect buildings, prevent groundwater recharge, stabilise stream banks or provide wood production.

### **How do I do it?**

#### **Plan**

- Seek professional advice to assist in devising a management plan for your remnant vegetation blocks.

#### **Retain**

- Retain large trees, standing/fallen hollows, leaf litter, sticks and understorey vegetation for habitat.

#### **Protect**

- Fence native vegetation areas to protect from stock
- Avoid fragmenting existing areas of vegetation by roads or fences.
- Keep a buffer between native vegetation remnants and other intensive land uses

#### **Manage**

- Manage grazing to allow regrowth of vegetation. Don't graze in seed setting/flowering, or germination periods.
- Look after existing patches of remnant vegetation to allow natural regeneration
- Use appropriate native species when planting vegetation, particularly in existing vegetation areas.
- Control weeds
- Minimise disturbance of soil and vegetation to maintain ground cover, keep weeds out and allow the understorey plants to establish.
- Reduce chemical and fertiliser drift from adjacent farm activities.

### REVEGETATION ESTABLISHMENT

#### Why should I establish native vegetation ?

Native vegetation provides many environmental benefits to flora and fauna through providing habitat and food sources. However, it also contributes to farm productivity through providing shelter, alternative grazing areas and providing habitat for beneficial pest predators.

#### What can I do ?

- Use local native species including trees, shrubs and grasses.
- Concentrate on expanding and enhancing existing vegetation remnants.
- Retain existing clumps of remnant vegetation. Where trees already exist it is easier and cheaper to fence them off and encourage regeneration.
- Link shelterbelts together and with existing vegetation to provide additional food, shelter and corridors for wildlife.
- Revegetate along creeks and gullies.
- Include local native understorey plants (shrubs) that flower at different times throughout the year to attract a variety of wildlife.
- Revegetated areas can become a shelter and habitat for pest species. Develop pest animal management plans for these areas and consult local agencies regarding appropriate control measures.
- Consider fencing drainage lines for multi benefits (erosion reduction, biodiversity, and stock shelter).

#### Who can help ?

- Contact your local Landcare group, Greening Australia or the list of local nurseries for local plant selection.
- Refer to Greening Australia "Green Notes" for plant establishment guidelines.

## **VEGETATION ESTABLISHMENT TECHNIQUES - TUBESTOCK**

*Fencing and weed control are vital for successful vegetation establishment*

### **TUBESTOCK**

Tubestock are seedlings grown in narrow tubes of between 10-30 cm high and approximately 6-9 months old. They will establish and grow quickly under the right conditions.

### **When do I plant ?**

Plant seedlings in early spring when soil moisture is high. If the soil tends to dry out in late spring, planting in early autumn is suitable. The site should be already ripped (usually best done in summer), along contour lines if planting on a hill. Run the tractor rear tractor wheel over the rip line to minimise channelling. Sites should be sprayed with non residual herbicide at least twice in the preceding autumn and spring.

### **Where and what do I plant ?**

Greening Australia has site specific species lists outlining species suitable for different areas, for example wet or dry areas, stony hills, deep soils, acid and saline soils. See contact details below.

### **What to remember when planting tubestock**

- Water seedlings well before planting.
- Make sure the planting hole is as close as possible in size to the tubestock.
- Break-off any roots sticking out the bottom of the tube before planting.
- Remove the seedling from the tube (holding it upside down) with one knock, trying to minimise damage. Do NOT brake up root ball.
- Ensure the stem of the seedlings is no deeper in the soil than in the tube.
- Leave a small depression around the seedling to allow water to collect.
- Water immediately after planting.
- If mulching, keep mulch away from direct contact with the stem.
- Fence the area to protect seedlings from stock and pest animals.
- Remember to keep free of weeds.
- Blocks of plantings or lanes of at least 20m wide are much more beneficial to the landscape than narrow tree lanes.
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It is best to plant close to existing patches of vegetation than in an open location.



## VEGETATION ESTABLISHMENT TECHNIQUES - DIRECT SEEDING

Direct seeding is where seed is directly drilled into the ground. It is significantly cheaper than planting tubestock, and takes a lot less time. Historically, it is slightly less successful than planting tubestock. Greening Australia will do direct seeding on a contract basis, or a direct seeding machine can be hired from the Boorowa Regional Catchment Committee.

### When do I plant?

It is recommended that herbicide applications up to 12 months before planting are necessary to reduce competition from weeds and grasses, and to build up soil moisture. Spring is the best time to carry out direct seeding. Fence the area before planting.

### Where and what do I plant?

See Greening Australia or Boorowa Landcare for site-specific species recommendations (contacts below). A seed mix of 30-40 species is recommended with seeding rates of 0.5 to 1kg per hectare or 200 to 400 grams per kilometre of tree line. Seed can be bought or collected from nearby remnant vegetation.

### Pre-Seeding Weed Control

Experience in the Boorowa area has shown that the major cause of poor results from direct seeding is excessive weed and grass competition. Surface scalping (restricted to the non-erodible soils) and chemical control are the preferred options. Ploughing is not recommended for machine planting, unless done well in advance of seeding, and often has the effect of increasing the weed & grass competition.

Chemical control generally involves strip (1 to 1.5m wide) spraying of tree lines up to 12 months ahead of seeding with a knockdown herbicide. Repeat about 6 months later (depending upon seasonal conditions) to remove new weed and pasture germination and ensure maximum moisture retention in the soil. Bear in mind that 1 hectare is equivalent to about 7 kms of a 1.5 m wide strip. Finally respray immediately prior to seeding.

Many residual herbicides can seriously effect tree seed germination and should be avoided. Sites with particular weed problems may need to be treated with specific herbicides.

All herbicide applications should be accompanied by treatment for red legged earth mite. Try using either LeMat or Saboteur in the early sprays and one of the endosulfan-based compounds (up to 140 days residual effect) in the final spray or immediately before seeding.

Grasses between sprayed tree lines are available for grazing (subject to the pesticide conditions of use) and if possible should not be let go to seed during the spray programme. The grassed areas play an important role in controlling downslope water movement during heavy rain and in saline areas, minimise groundwater recharge.

### Soil Preparation

The seeds of most native tree and shrub species best germinate on or just below the soil surface. Machine seeding generally requires no soil preparation. Ripping is not necessary on most sites to be machine seeded (undesirable in recharge areas) and there is some evidence that ripped sites, if not graded or rolled well ahead of seeding, result in substantial seed loss, poor germination and

development of inferior seedling root systems. Heavy clay based soils with high water tables, little organic matter and poor structure may need some preparation.

### **Fencing**

Most direct seed sites are intended as permanent belts or blocks of vegetation. Fences generally need to be permanent and stock proof. If rabbits or hares are a problem, netting or adequate electric fencing may need to be considered. Light grazing or overnight off-shears yarding is often possible after 3-4 years.

### **Species Selection/Seed Supply**

Direct seeding provides the opportunity to establish a mix of tree and shrub species. A variety of suitably selected species will ensure a satisfactory germination regardless of seasonal conditions.

As a general rule, the species occurring naturally in the remnant vegetation on the property or nearby provide the best chance for successful direct seeding. To this mix might be added small quantities of specific purpose out-of-area species seed to cater for problem areas or specific objectives ie: salt tolerance, fast growth, bird & insect habitat etc.

Nearby vegetation provides the preferred source of seed can be collected and stored progressively ahead of seeding. Commercial suppliers may also be able to provide locally collected seed. The cost of seed can be a major component of project expenditure at \$60-80 per km, depending on species.

At the present time the recommended seeding rates for machine direct seeding in Southern NSW range from 0.5 to 1 kg per hectare or 200 to 400 grams per kilometre of tree line. The seed of some trees and shrubs will need to be treated to break dormancy, i.e. wattle seeds need to be soaked in boiling water. At time of seeding it may be necessary to add ant repellent to the seed mix.

### **Time of Sowing**

The technique of direct seeding seeks to emulate the natural vegetation processes while increasing the chances of success by seeding when conditions are optimal, i.e.

- ~ when temperatures are sufficient for germination,
- ~ when moisture conditions are sufficient for germination,
- ~ when competition for light and moisture are minimal,
- ~ when there is a reasonable growing period ahead of summer or winter dormancy.

Past experience with direct seeding in the Boorowa Catchment suggests that the optimal window for seeding is from Early September to Late October. The above conditions should be taken into consideration before deciding when to sow.

### **Post Seeding Maintenance**

It is important that the young seedlings be maintained in an environment free of weed and grass competition allowing them to make maximum use of available moisture and light. Grasses and weeds adjacent to tree lines can be controlled by use of a shielded herbicide spray, or herbicide wick wiper. If grasses and weeds look like becoming a problem take early action, ideally within 3-4 months of germination of the tree seeds. When trees/shrubs are well established, weed control becomes less important.

## **Direct Seeding Diary**

Spring - Year 1: Strip spray future tree lines to remove existing pasture competing, treat for red legged earth mite.

Autumn – Year 2: Respray tree lines with non residual herbicide to remove weed and pasture regrowth and conserve maximum winter rainfall.

Spring – Year 2: Final spray of tree lines ahead of seeding, treat for red legged earth mite.

Summer – Year 2: Check for weeds and apply shielded herbicide spray if necessary, check for earth mites and grasshoppers.

## **For further information**

Greenotes, Greening Australia ACT & SE NSW PO Box 538, Jamison Centre, ACT 2614 ph (02) 6253 3035 fax (02) 6253 3145 email [gaact@netinfo.com.au](mailto:gaact@netinfo.com.au)

- Greenotes #5 Collecting Australian Native Tree Seed
- Greenotes #6 Propagating Australian Native Trees

### **Who can help ?**

Greening Australia ACT & SE phone (02) 6253 3035

DIPNR, Yass phone (02) 6226 1433

The Southern Tablelands Farm Forestry Network, 0412 195 499

**FACT SHEET**

**RECOMMENDED SPECIES FOR UNDERSTOREY REVEGETATION  
(RED GUM / YELLOW BOX WOODLANDS)**

The following species are readily available and are reliable for direct seeding

| <b>Scientific Name</b>                 | <b>Common Name</b>        | <b>Preferred Habitat</b>       | <b>Description*</b>                    | <b>Flowering</b> |
|--|---------------------------|--------------------------------|--|------------------|
| <i>Acacia buxifolia</i>                | Box-leaf Wattle           | acid, skeletal, rocky outcrops | <b>S</b> , shrub 1-2m                  | Aug-Oct          |
| <i>Acacia brownii</i>                  | Juniper Wattle            | poorly drained sandy soils     | prickly shrub 0.5-2m                   | Mar-Sept         |
| <i>Acacia cultriformis</i>             |                           |                                |  |                  |
| <i>Acacia dealbata</i>                 | Silver Wattle             | dry, acid skeletal soils       | <b>S</b> , tree 2-7m                   | July-Oct         |
| <i>Acacia decora</i>                   | Western Silver Wattle     | dry rocky outcrops, red loams  | rounded, spreading shrub 1-4m          | Aug-Sept         |
| <i>Acacia genistifolia</i>             | Spreading Wattle          | dry, shallow soils             | <b>S</b> , shrub 1-2m                  | May-Oct          |
| <i>Acacia implexa</i>                  | Lightwood                 | sandy, shallow, dry            | <b>S</b> , small tree 5-15m            | Dec-Mar          |
| <i>Acacia lanigera</i>                 | Woolly Wattle             | shallow, rocky/quartz slopes   | shrub 1-2m                             | Winter to Spring |
| <i>Acacia melanoxydon</i>              | Blackwood                 | prefers deeper soils           | <b>S</b> , small-large tree 6-30m      | Aug-Oct          |
| <i>Acacia paradoxa</i>                 | Hedge Wattle              | dry, shallow soils             | <b>S</b> , small, spreading shrub 2-4m | Aug-Nov          |
| <i>Acacia rubida</i>                   | Red Stem Wattle           | dry soils                      | <b>S</b> , shrub-small tree 2-10m      | Aug-Oct          |
| <i>Acacia verniciflua</i>              | Varnish Wattle            | sandy, shallow, rocky soils    | <b>S</b> , shrub 1-4m                  | July-Nov         |
| <i>Acacia vestita</i>                  | Hairy Wattle              | dry hillsides                  | spreading shrub 1-4m                   | Aug-Oct          |
| <i>Bursaria lasiophylla</i>            | Bursaria                  | dry                            | <b>S</b> , shrub to small tree 1-8m    | Nov-Feb          |
| <i>Bothriochloa macra</i>              |                           |                                | <b>S</b> ,                             |                  |
| <i>Bursaria spinosa</i>                | Bursaria                  | dry sites, gullies             | <b>S</b> , shrub                       | Nov-Feb          |
| <i>Cassinia aculeata</i>               | Common Cassinia (Dogwood) | sandy, clay                    | <b>SC</b> , shrub 2-3m                 | Nov-Feb          |
| <i>Chionocloa pallida</i>              | Redanther Wallaby Grass   |                                | <b>DS</b> ,                            |                  |
| <i>Dodonaea viscosa subsp. viscosa</i> | Giant Hop-bush            | clay, sandy                    | <b>S</b> , tall shrub 1-6m             | Sept-Mar         |
| <i>Eucalyptus blakelyi</i>             | Blakely's Red Gum         | dry, well drained              | <b>S</b> , tree 10-24m                 | Aug-Sept         |
| <i>Eucalyptus bridgesiana</i>          | Apple Box                 | clay                           | <b>S</b> , tree 8-25m                  | Jan-Mar          |
| <b>Scientific Name</b>                 | <b>Common Name</b>        | <b>Preferred Habitat</b>       | <b>Description*</b>                    | <b>Flowering</b> |

|                                |                  |                                     |                                 |          |
|--------------------------------|------------------|-------------------------------------|---------------------------------|----------|
| <i>Eucalyptus melliodora</i>   | Yellow Box       | wet/poorly drained                  | <b>S</b> , tree 12-30m          | Sept-Feb |
| <i>Gompholobium hueglinii</i>  | Giant Wedge Pea  | poor sandstone soils                | <b>S</b> , shrub 1-3m           | Aug-Nov  |
| <i>Hakea sericea</i>           | Bushy Needlewood | hill country, within scrub          | shrub 2-5m                      | May-Sept |
| <i>Hardenbergia violacea</i>   |                  |                                     | <b>S</b> ,                      |          |
| <i>Hovea heterophylla</i>      |                  |                                     | <b>S</b> ,                      |          |
| <i>Hovea linearis</i>          |                  |                                     | <b>S</b> ,                      |          |
| <i>Indigofera australis</i>    | Austral Indigo   | poor shallow soils                  | <b>S</b> , shrub 0.5-2m         | Aug-Sept |
| <i>Juncus species</i>          | Rush             |                                     | <b>SD</b> ,                     |          |
| <i>Kunzea ericoides</i>        | Burgan           | clay, sandy, wet/poorly drained     | <b>S</b> ,                      | Nov-Feb  |
| <i>Kunzea parvifolia</i>       | Violet Kunzea    | rocky slopes                        | <b>S</b> , shrub 0.5-2.5m       | Oct-Dec  |
| <i>Leptospermum juniperum</i>  | Prickly Tea-Tree | poorly drained soil                 | prickly shrub 1-4m              | Oct-Mar  |
| <i>Leptospermum lanigerum</i>  | Woolly Tea-Tree  | along streams, swampy flats         | shrub to small tree 2-6m        | Sept-Dec |
| <i>Leptospermum multicaule</i> | Silver Tea-tree  | dry hills                           | <b>SC</b> , shrub 0.5-2m        | Spring   |
| <i>Melaleuca ericifolia</i>    | Melaleuca        | poorly drained, swamps stream flats | shrub-small tree 2-9m           | Oct-Nov  |
| <i>Melichrus urceolatus</i>    |                  |                                     |                                 |          |
| <i>Microlaena stipoides</i>    | Weeping Grass    | tolerant of low soil pH             | <b>S</b> , small-med. perennial | Nov-Feb  |
| <i>Vittadinia spp.</i>         |                  |                                     | <b>S</b> ,                      |          |

Developed with the assistance of Rainer Rehwinkel (NPWS) and John Weatherstone

\* Method of Propagation: **S** - seed, **C** - cutting, **D** - Division

### SUPPLEMENTARY LIST for UNDERSTOREY REVEGETATION

The following species are suitable for understorey revegetation, but may be more difficult to obtain

| Scientific Name              | Common Name          | Preferred Habitat               | Description*                        | Flowering   |
|------------------------------|----------------------|---------------------------------|-------------------------------------|-------------|
| <i>Acacia gunii</i>          | Ploughshare Wattle   |                                 | <b>S</b> , small shrub              | Late Winter |
| <i>Aristida ramosa</i>       | Purple Wiregrass     | sandy                           | <b>S</b> , med.-large tussock grass | Dec-Feb     |
| <i>Brachyloma daphnoides</i> | Daphne Heath         | poor, dry, rocky or sandy hills | small, heathy shrub, to 1m          | Aug-Sept    |
| <i>Bracteantha viscosa</i>   | Sticky Everlasting   |                                 | <b>S</b> , perennial forb 80cm      |             |
| <i>Bulbine bulbosa</i>       | Bulbine Lily         | rocky sites                     | <b>S</b> , perennial 40cm           | Oct-Dec     |
| <i>Calytrix tetragona</i>    | Common Fringe-myrtle | rocky, sandy or gravelly sites  | <b>S</b> , heathy shrub 1-2m+       | Sept-Dec    |

| Scientific Name                   | Common Name                         | Preferred Habitat        | Description*                                   | Flowering          |
|-----------------------------------|-------------------------------------|--------------------------|--|--------------------|
| <i>Carex appressa</i>             | Tall Sedge                          | wet sites, above creeks  | <b>D</b> , perinnial, 40-120cm                 |                    |
| <i>Cassinia longifolia</i>        | Shiny Cassinia (Cauliflower Bush)   | dry, shallow             | <b>SC</b> , shrub 1-3.5m                       | Dec-Mar            |
| <i>Cassinia quinquefaria</i>      | Cassinia                            |                          | <b>SC</b> , shrub 1-3m                         | Jan-Mar            |
| <i>Cheiranthra linearis</i>       | Finger Flower                       |                          | shrub to 30cm                                  |                    |
| <i>Chrysoccephalum apiculatam</i> | Common Everlasting (Yellow Buttons) |                          | <b>SDC</b> , upright/creeping perinnial 7-60cm | Late Winter-Spring |
| <i>Cryptandra amara</i>           | Bitter Cryptandra                   |                          | heathy shrub -35cm                             |                    |
| <i>Cymbopogon refractus</i>       | Barbed Wire Grass                   |                          | <b>S</b> ,                                     |                    |
| <i>Danthonia spp.</i>             |                                     |                          | <b>S</b> ,                                     |                    |
| <i>Daviesia species</i>           | Pea                                 | dry rocky or sandy sites | <b>S</b> , shrubs 0.5-2m                       | Aug-Dec            |
| <i>Dianella spp.</i>              | Flax Lily                           |                          | <b>SD</b> , tufted perinnial - 80cm            | Nov -Feb           |
| <i>Dichantheum sericeum</i>       | QLD Bluegrass                       |                          | <b>S</b> ,                                     |                    |
| <i>Dillwynia sericea</i>          |                                     |                          | <b>S</b> ,                                     |                    |
| <i>Epacris spp.</i>               | Heaths                              | near swamps, streams     | small heath 0.5-2m                             | various            |
| <i>Exocarpus cupressiformis</i>   | Cherry Ballart                      | shallow soils            | small tree 3-8m                                | Dec-May            |
| <i>Exocarpus strictus</i>         | Pale-fruit Ballart                  |                          | shrub 1-2.5m                                   | Aug-Nov            |
| <i>Glycine clandestina</i>        | Twining Glycine                     |                          | <b>S</b> , creeping perennial                  |                    |
| <i>Gonocarpus tetragynus</i>      | Common Raspwort                     |                          | <b>S</b> , perennial -35cm                     | Sept - Feb         |
| <i>Grevillea alpina</i>           | Cat's Claw                          | stoney, sandy ground     | shrub to 2.5m                                  | July-Sept          |
| <i>Grevillea juniperina</i>       | Prickly Grevillea                   | sand or rock near rivers | <b>SC</b> , prickly shrub 1-2.5m               | Oct-Jan            |
| <i>Grevillea lanigera</i>         | Woolly Grevillea                    | sandy, rocky sites       | <b>SC</b> , shrub 1-2m                         | Aug-Dec            |
| <i>Haloragis heteophylla</i>      | Swamp Raspwort                      | wet, drainage lines      | <b>C</b> , sparse perennial 20cm               | Summer             |
| <i>Helichrysum thyrsoideum</i>    | Sticky Everlasting                  | rocky highland sites     | shrub 1-2m                                     | Nov-Feb            |
| <i>Hibbertia obtusifolia</i>      | Grey Guinea Flower                  |                          | <b>SC</b> ,                                    |                    |
| <i>Isotoma fluviatilis</i>        | Swamp Isotome                       | wet, drainage lines      | <b>CD</b>                                      | Nov-Feb            |
| <i>Leucochrysum albicans</i>      | Hoary Sunray                        |                          | <b>S</b> ,                                     | Sept-Feb           |

| Scientific Name | Common | Preferred Habitat | Description* | Flowering |
|-----------------|--------|-------------------|--------------|-----------|
|-----------------|--------|-------------------|--------------|-----------|

| Name   |                     |                         | g                         |         |
|--|---------------------|-------------------------|---------------------------|---------|
| <i>Lissanthe strigosa</i>                          | Peach Heath         | rocky ground            | <b>S</b> , shrub -1m      |         |
| <i>Melaleuca armillaris</i>                        | Giant Honey-myrtle  | sands, granite outcrops | large shrub-tree 2-14m    | Nov-Feb |
| <i>Poa species</i>                                 | Poa                 |                         | <b>D</b>                  |         |
| <i>Pomaderris angustifolia</i>                     | Pomaderris          | near streams            | dense shrub 1-3m          | Oct     |
| <i>Pomaderris betulina</i>                         | Birch<br>Pomaderris | near streams            | shrub 1-3m                | Oct     |
| <i>Pultenaea foliosa, procumbens or subspicata</i> | Bush Peas           | dry                     | <b>SC</b> , low shrub -2m | Spring  |
| <i>Sorghum leiocladum</i>                          | Wild Sorghum        |                         | <b>S</b> ,                | Dec-Feb |
| <i>Stipa species</i>                               | Grass               |                         | <b>SD</b> ,               |         |

Developed with the assistance of Rainer Rehwinkel (NPWS) and John Weatherstone

\* Method of Propagation: **S** - seed, **C** - cutting, **D** - Division

## **NATIVE SEED COLLECTION**

### **Why should you collect native seed?**

The cost of seed is a major part of the cost of revegetation projects. Collecting your own seed keeps costs down, and also ensures the best source of seed from local species suited to local conditions.

### **How do you collect seed?**

- ❖ Seeds of native plants are usually found in a pod, woody capsule or cone. The seed is ready to be collected as the seed matures (usually December-January).

For eg wattles and the pea flower family in our region produce pods that open as they mature and can be picked when they are brown and just starting to open.

- ❖ Collect the seeds in calico bags, pillowslips or cardboard boxes.
- ❖ Dry them in a warm dry place on a sheet or newspaper until seed has been shed. This may take anywhere between a few days to several weeks.

Banksia cones and Hakea fruits may need to be put in a very slow oven for an hour or more to encourage them to open up and release their seed.

- ❖ Store the dried seed in jars in a cool place away from sunlight.

### **REMEMBER!**

- ! Only collect seed from healthy trees and shrubs that have minimal insect damage and healthy leaves and foliage.
- ! Choose seed from a site that has several healthy specimens of the desired species.
- ! Never collect seed from a single remnant tree.
- ! Collect seed from different parent trees of the same species within a distance of 100 metres apart. This will ensure a good genetic diversity.
- ! Take the smallest branches possible to reduce parent tree damage.

#### **Who can help?**

DIPNR Yass, (02) 6226 1433  
John Weatherstone, "Lyndfield Park Nursery" (02) 4845 1282



## NATIVE PLANT PROPAGATION

### How do I treat the seed before sowing?

- ❖ Wattle seed: Boil 6 times the volume of water relative to the volume of seed. Add seed to boiling water after turning off heat (but while still boiling).
- ❖ Allow standing for at least 3-4 hours, or overnight.
- ❖ Use the seed immediately or after drying (dry seed is easier to handle than wet seed).

If drying, lay out seed on hessian, shade cloth etc until dry.

### What type of soil mix should I use?

*The basic soil mix includes coarse river sand, loam and peat, used in equal proportions. A small amount of slow release pelleted fertiliser with a low phosphorus content can be mixed in with the soil.*

### How should I sow the seedlings?

- ❖ Ensure the soil mix is moist (not wet).
- ❖ Make a small depression in soil and drop in seeds (4-6 seeds each for small seeds such as eucalyptus, 2-4 seeds for acacias and other large seeds).
- ❖ Large seeds should be covered with 3-5 mm layer of the soils mix and watered gently.
- ❖ Smaller seeds should be covered with a thin layer of coarse, washed river sand and gently sprayed with water. Try not to move the seeds and sand when watering.

### How do I take care of the seedlings?

- ❖ Keep the seedlings moist, but not wet.
- ❖ Keep them in open sun or part shade with good air circulation to prevent fungal disease.
- ❖ Leave all seedlings to grow until they develop their second set of leaves. Then select the healthiest - one per tube - and cut the rest off at soil level.
- ❖ To 'harden off' seedlings, place them in full sun and water less frequently 3-4 weeks before planting. These seedlings can be planted when 10 cm tall. Otherwise, wait until they are about 25-30 cm tall, and then plant.

#### Who can help?

Yass Landcare Office C/- DIPNR Yass, (02) 6226 1433  
John Weatherstone, "Lyndfield Park Nursery" (02) 4845 1282

## GRAZING MANAGEMENT IN NATIVE VEGETATION

### Why should I manage grazing in areas of native vegetation?

Unmanaged grazing in areas of native vegetation does not allow regeneration of native plants. It can also result in high levels of damage to plants, introduction of weeds, and soil compaction. However, grazing does not have to be completely stopped.

### How do I manage grazing?

These strategies will depend on the condition of the native vegetation.

#### FENCES

To control grazing access, native vegetation needs to be fenced.

#### TIMING

Avoid grazing during flowering and seeding of native plants, usually between September and January. Avoid stocking during significant regeneration events, such as rainfall during seeding.

#### DURATION

Control the length of time stock are left to graze. For highly degraded areas, crash-grazing (high stock rate over a short period) is effective in reducing weed cover to allow natural seed regeneration.

#### STOCKING RATE

The best method is varying stocking rates.

### **Who can help?**

NSW Department of Primary Industries, Yass Office (02) 6226 2199

## **REVEGETATING AREAS AFFECTED BY DIEBACK IN BLAKELY'S REDGUM**

### **What is dieback?**

Dieback refers to the thinning of a tree's crown or canopy. In Red Gum, this is due to the removal of foliage by intense insect attack. It ultimately results in the death of the tree due to a lack of enough leaf area to photosynthesise.

Extensive dieback can affect;

- soil structure
- watertable levels
- salinity
- loss of shelter
- flora & fauna biodiversity
- landscape

Dieback in Red Gum is primarily caused by psyllid (lerp) attack. Research suggests the main causes of lerp infestations are loss of predators, a reduction in the number of trees in the landscape through clearing, and a weakening of the vigour of the tree due to stress.

### **Lerps !**

Psyllids (lerps) are 1-2mm long, feed on sap and can fly long distances. They shelter beneath a white, fan shaped covering or cocoon called a "lerp" attached to leaves. They feed by injecting toxin into the leaf causing the leaf to die. They breed three to four times a year with eggs hatching after one to two weeks. The newly-hatched psyllids immediately commence feeding.

### **Reducing the impact of dieback**

Revegetation is the most effective way to reduce the impact of dieback caused by insect attack. Revegetation will reduce stress on the trees and attract natural predators of the insects.

### **Things you can do**

- ❖ fence trees (mature trees in clumps of 5 - 10) from stock to encourage revegetation
- ❖ encourage a diverse understorey including indigenous grasses, wildflowers, shrubs and trees which provide shelter for predatory fauna.
- ❖ choose plants with a range of flowering times
- ❖ choose a range of plant shapes & sizes to attract diversity of birds & insects
- ❖ monitor the revegetation areas for evidence of a range of birds & insects, their preferred plants and changes in the conditions of trees.

### **Who can help?**

NSW Department of Infrastructure, Planning and Natural Resources, Yass Office (02) 6226 1433

## 6.3 SOIL MANAGEMENT ACTION PLAN

### Why Do Anything?

Our soil is the most valuable asset a landholder can own. It underpins almost every enterprise a landholder may be involved with. Improving and maintaining good soil health will increase the efficiency and future sustainability of agricultural enterprises, whilst reducing the extent of land degradation, thus improving the health of the Catchment.

### What Can We Do?

Adopt improved management practices, improve our knowledge of the soil types, structure and health of our soils, monitor changes in soil health.

### How Will We Do It?

Below is an action plan to help identify the actions required to improve soils in the Boorowa Catchment. The Lachlan Catchment Management Authorities Blue Print also lists soil health as one of the Lachlans key issues. The codes you see in italics, in brackets, beside the actions, relate to where the LCMAs Soils Management Actions parallel our actions.

#### Identify the problem

1. Continued Investigation into soil acidity and sodicity in our catchment (*SS07, SS20* SS06).
2. Identify Perennial Pasture Species suited to our soil types and climate. (*SS01*).
3. Identify Landholders using conventional farming techniques or farming country above Land Capability Designation.

#### Plan a strategic Approach to Implement Management Action

4. Plan an approach which address the above problems. Include in this plan possible sources of funding etc.

#### Implement management actions

5. Raise awareness through a newsletter and Newspaper Column.
6. Assist Landholders in the purchase/acquisition of soil test kits. These could be part of a Landcare Members "Start-up kit". Ensure adequate training in kit use is available.
7. Promote the use of soil ameliorants as a "Quick Fix" for soil chemistry imbalances. The main emphasis should be on changed management approaches to maintain soil health. (*SS08*).
8. Encourage liming of soils with pH below 4.8 CaCl<sub>2</sub>
9. Encourage increased perenniality in pastures, managed to maintain soil health (see best management practices below). (*SS03*)
10. Encourage the acceptance and use of native perennial grasses which are well adapted to low pH, and climatic conditions (*SS06*)
11. Encourage, through field days, demonstrations and presentations, the uptake of Reduced Till and No Till techniques, including Stubble Management. This should include machinery conversion techniques as well as management changes required for implementation of these

- systems, tailored to the soil type, landscape and enterprise. (SS17, SS15, SS13, SS26).
12. Utilize the Landcare Network to create an environment where Landholders discuss issues, problems and solutions, and encourage innovation.
  13. Provide support through advice and information on how to manage acidic and/or sodic soils. (SS21).

#### **Promote and educate**

14. Engage educators capable of teaching landholders about their soil, subsidise attendance costs for landholders.
15. Promote the uptake of Best Management Practices for soil management outcomes (See below). This should include training landholders who are moving towards No Till systems in the management actions/techniques that are required within such systems. (eg: chemical weed/pest control cycles)
16. Advertise, using the network, funding opportunities which help in any aspect of this action plan.
17. Promote soil testing prior to addition of ameliorants, and ensure, through training, that Landholders understand results and management implications.

#### **Monitor**

18. Continued monitoring of soil parameters by landholders, to track changes in soil health. Make results available to other landholders. Use good and bad examples in future promotions.

### **6.3a SOIL MANAGEMENT BEST MANAGEMENT PRACTICES**

The approaches you take in order to maintain good soil health will depend greatly on your soil type/types on your property. It is this factor that should determine what enterprise(s) you can undertake.

#### **Education.**

It is very important to understand the soil types, where they change, and what capabilities each soil has on your property. Equip yourself with the knowledge and tools required to monitor your soils physical, biological and chemical state.

Utilise professional soil testing, but use your understanding of the figures to analyse the results.

#### **Fencing.**

It can be very useful to fence your property according to changes in soil type. This will allow you to manage each soil type to best suite its health.

#### **Grazing.**

Manage your grazing enterprise to encourage an increase in perennial ground cover. The more species (whether introduced or native the better) Aim for 80-100% groundcover at all times with a legume content of no more than 30%.

Use ameliorants such as lime if your pH is below 4.8. and gypsum to improve poorly structured (sodic) soils. Base your rates on professionally analysed soil test results.

Use minimal till or no till techniques to replace degraded pastures. Implement a grazing system which enables long term (10+ year) maintenance of these pastures. This may involve High intensity, short duration grazing with long rest periods.

#### **Cropping.**

Reduce tillage of soils to a minimum. This may require the purchase of new, or conversion of existing equipment to minimal or no till.

Retain stubble to reduce wind and water erosion, and to retain biological matter. There is equipment available that can assist in knocking down stubble to aid in assimilation. As your soil health improves, stubble will break down faster, adding valuable carbon to the system.

Understand the use of chemical weed and pest control used within these systems. Keep burning to a minimum. Avoid mechanical weed control (ie: ploughing or scalping).

Reduce the area affected by compaction under wheeled equipment by employing tramline, or GPS technology, use “light-footed” equipment where possible.

Understand the varying crop moisture and nutrient needs, within paddocks, to reduce fertiliser waste, which contributes to pH imbalance through leaching. This may require close crop inspection or technology such as that used in Precision Farming techniques.

## 6.4 WATER MANAGEMENT ACTION PLAN

### Why Do Anything?

The large-scale landscape changes mentioned to this point will take a long time implement. To minimise the impact of current landscape condition, on our water resources, we need to implement “quick fix” solutions to protect our waterways. We need to prevent loss of productive farmland. We need to minimise sediment, salt and chemical content in our waterways. We need to maintain flows and water quality in our creek and river systems to benefit riparian and aquatic habitat functionality, as well as considering downstream users.

### What Can We Do?

We can manage the drainage lines, creeks and rivers on our properties, to reduce the risk of soil eroding into our waterways. We can manage areas higher in the landscape to reduce the contribution of salt, sediment and pollutants entering our waterways. We can address the issue of bed lowering and bank destabilisation through our management actions.

### How Will We Do It?

We will maintain and manage all existing riparian vegetation. We will target areas at high risk of erosion. We will manage them according to the best management practices listed.  
(codes in *brackets* indicate Matching Blueprint Actions)

### Identify the problem

1. Use mapped extent of Gully Erosion, combined with local knowledge, to target areas of high priority. (WA06 - 08)
2. Seek expert advice on the severity of the problem and possible local causes. (WA14)
3. Explore options including Engineering solutions, Vegetation Management and Water Sharing to address identified priority areas. (WA09)
4. Utilise existing modelling and ground truthing experiments to establish water use efficiency regimes of different land uses to help assess impacts on flow regimes. (WA01, 02)

### Plan a strategic approach to applying Management Actions

5. Plan management actions on a sub-catchment-scale to ensure continuity of management action application, and to maximise natural resource outcomes.
6. Plan on-ground works to implement management actions at the Property Plan Scale.
7. Develop best management practices for the establishment and management of buffer zones near stream banks. (WA10)

### Implement management practices

8. Manage stock access to protect areas of identified stream bank erosion, eg: large mobs grazing for short periods to maximise ground cover and plant health. (WA22)
9. Change practices to include buffer zones near stream banks.
10. Utilise well managed perennial pasture to maintain cover in buffer zones. (WA11)
11. Encourage zoning of appropriate stream bank areas for public use, access and environmental benefit. (WA27, 28, 29)
12. Use 'environmentally-friendly' chemicals near waterways, and ensure other chemicals do not enter the stream bank zone.
13. Utilise erosion control works and establish areas of native vegetation in severely eroding riparian zones. (WA09)

**On-ground works**

14. Where the need arises, fence off sections of stream bank that have potential for, or are showing signs of erosion due to stock movement. Exclude stock until stability is achieved. Careful use of stock as buffer management tool. It may be necessary to provide alternative watering points for stock. (WA15)
15. Remove weeds such as Cumbungi, Crack willows or Black willows from streambeds if they are diverting flow into the banks, creating erosion. Departmental approval is required for such activities (see who can help)
16. Improve stream bank vegetation cover and biodiversity. (WA15)
17. Undertake structural earthworks on severely eroding banks. (WA07).
18. Control Vermin.
19. Control carp populations through participation in regional actions.

**Promote and educate**

19. Develop information kit/guidelines for landholders.
20. Utilise Water Watch to encourage Junior Landcare participation and learning.
21. Utilise demonstration sites.
22. Encourage voluntary agreements such as land retirement, management agreements and covenants for stream bank areas.

**Monitor**

23. Establish regular assessment and mapping of stream bank conditions (building on existing GIS data).
24. Monitor riparian and aquatic ecosystems to ascertain health and ecological functionality. Develop Macroinvertebrate monitoring program (utilise Junior Landcare) to monitor change and the impacts of management practices.
25. Utilise Rapid Bio-assessment Techniques for Aquatic Habitat/Ecology Monitoring
26. Monitor downstream sediment loads to test impact of actions taken.



## 6.4a Water Management Best Management Practices

### What is Gully Erosion ?

Gully erosion is the loss of soil along water channels caused by water and/or wind. It is caused by continuous cropping, overstocking or clearing leading to vegetation decline along water channels and erosion.

### Why do we need to fix it ?

Sediment transported by gullies causes problems in watercourses, farm dams and water storages. It also causes management problems on-farm such as access across or around the gully, danger to livestock and a decrease in farm water quality.

### What can you do?

- Improve grazing/cropping management practices to control erosion
- Reduce grazing pressure to allow for regeneration
- Fence off pockets of remnant native vegetation near gullies to use as seed producers
- Divert water from the gullies to allow stabilisation (structural earthworks)
- Revegetate gullies using native species appropriate for the local area.
- Reduce siltation and sediment build up in streams
- Arrest active gully erosion  
(headward advancement or deepening)

### What is the stream bank zone ?

The stream bank zone is the area adjoining a waterway including the vegetation on both the banks up to 30 metres from the waterway channel.

### Why do we need to manage it ?

- to maintain good water quality
- to prevent erosion
- to maintain aquatic habitat
- to provide a wildlife corridor

### What can I do ?

There are a number of things you can do to improve the sustainability and health of the stream bank. As a first step, the stream bank zone should be managed to allow controlled access of stock and to assist regeneration and weed control.

- willow control
- weed control
- revegetation, and
- structural works.

Facts sheets on each of these activities are attached.

Some general principles :

- don't build structures on, or close to a stream bank, leave a buffer zone
- don't remove trees, shrubs or grasses from the stream bank (unless noxious weeds)
- only allow stock watering points on gently sloping banks, and ensure erosion control measures are in place, eg paved ramp etc.
- don't allow excessive build-up of debris in the stream which can divert the stream flow
- access ramps to the stream should only be built on the inside of bends
- never excavate a stream without getting advice and permission !

**!!! Remember: any works undertaken on a stream, creek or river may require a permit or permission from one or more agencies - ask for advice!!!**

**Call The Lachlan CMA 63411600**

## **REPAIRING GULLY EROSION**

Before you begin repair works, consider the characteristics of each gully. What is its size (length, depth, width), soil type, the size of the catchment, and the amount of runoff. These will dictate which option you might undertake to repair the gully. The following options are suitable for small to large gullies

**Fencing** - In most cases fencing out the gully will assist in stabilisation of the gully sides and allow vegetation to establish. It is also important to keep stock from the gully, particularly if it is eroding.

**Gully diversion and shape** - Water is diverted away from gully head to a safe disposal area via a diversion bank on low grade. The gully below the bank can then be shaped and revegetated. This is a good option for small to medium gullies. It allows gullies to become productive providing topsoil is stockpiled and spread back over the site after the gully is reshaped.

**Rock Flume** – provides a more stable base. Rock should be placed on filter fabric so that water flows over it and not around the sides. This is a cheap alternative to concrete, however, they should not be designed for large or prolonged volumes of runoff.

**Concrete Flume** – forms a long life stable structure for highly active gullies where there are high volumes of water. These need to be properly designed and constructed. Contact DLWC for advice.

**Dam** -This can be built above the gully to stop the water flowing over the gully head or can be built in the gully with top water level drowning the active head. Storm water can be diverted away from the gully, or contained in the dam and released into the gully slowly over time through a trickle pipe.

**Low Cost Wire Weirs** - For gullies where earthworks are impractical or uneconomic, such as large gullies, or where the gully head is off the property, other measures can be taken. Gully bed and gully wall stabilization can be undertaken with low cost wire weirs. These are built from a combination of steel posts, reinforcing mesh, wire netting, concrete blocks, etc. They catch sediment, reducing the grade on the gully floor. This slows water down decreasing its erosive force.

**Revegetation** - Trees, shrubs and grasses assist in gully control in several ways. They; hold soil together with roots, dry out wet areas, protect the soil surface, and act as silt and debris traps.

**Future Management** - The fill area and water entry points to the creek/stream should be fenced out (at least temporarily) and de-stocked for a minimum of 12 months to allow establishment of ground cover. After this time the site may be brought back into production to a limited extent. Grazing should be undertaken on a rotational or crash grazing basis with the emphasis being on maintaining at least 70% ground cover, and not grazing grasses lower than 4.5 cm in height.

Once works are complete they need to be looked after to increase their life span. Overgrazing and stock tracks can erode the works, reducing their effectiveness.

### **Who can help?**

Department of Land and Water Conservation, Yass (02) 6226 1433

## FACT SHEET

### SUITABLE SPECIES FOR REVEGETATING GULLIES

Good vegetation coverage is very effective in providing long-term gully stability. The combined root systems of trees, shrubs and grasses bind together cobbles, gravel, sand and soil.

#### TOE

The area where the gully floor and side walls meet (the toe), is the most susceptible part of a gully to erosion. Stabilisation requires the establishment of a good cover of vegetation. Some good species to use include;

| COMMON NAME                                   | SCIENTIFIC NAME   | REVEGETATION INFORMATION  |
|---|---|---|
| Alpine Bottlebrush                            | <i>Callistemon ptyoides</i>   | Prefers periodically wet ground near swamps and watercourses  |
| Broad-leaf Cumbungi                           | <i>Typha orientalis</i>   |   |
| Common Reed*                                  | <i>Phragmites australis</i>   | Likes damp to saturated soil and will also grow in deep brackish water. Is commonly seen growing along stream banks in the region, very useful at stabilising stream banks and undercuts, and can tolerate deep shade |
| Common Rush                                   | <i>Juncus usitatus</i>  | Will grow in shallow water as well as the bank because it likes damp to well saturated soil   |
| Cumbungi*                                     | <i>Typha spp.</i>   | Grows on damp or saturated soils, usually in stationary or slow flowing water up to two metres deep, has the potential to blanket areas of slow moving water  |
| Purple Loosestrife                            | <i>Lythrum salicaria</i>  | damp mud or wet sand, perennial herb to 1.5m, dies back in winter, re-shoots from crown   |
| Red Stem Wattle*                              | <i>Acacia rubida</i>  | dry, alluvial soils, including steep well drained banks   |
| Rice Sedge                                    | <i>Cyperus difformis</i>  | poorly drained soils, grass-like perennial tussock, to 2m   |
| River Clubrush                                | <i>Schoenoplectus validus</i>   | damp or saturated soils, perennial to 3m, survives periodic wet, prevents erosion   |
| River Tea Tree                                | <i>Leptospernum obovatum</i>  | sandy, gravelly sites and rock outcrops, excellent for protecting stream banks,   |
| Rushes  | <i>Juncus spp.</i>  | damp or saturated soils, perennial to 1m, survives periodic wet conditions  |
| Silver Wattle                                 | <i>Acacia dealbata</i>  | dry sites, frost and drought hardy, vigorous spreading and anchoring root system, regenerates easily by seed and suckering  |
| Spiny Headed Mat Rush                         | <i>Lomandra longifolia</i>  | height to 80cm, dense, fibrous root system  |
| Tussock Sedge<br>Tassel Sedge<br>Tufted Sedge | <i>Carex appressa</i><br><i>Carex fascicularis</i><br><i>Carex gaudichaudiana</i> | Sedges: generally grow in poorly drained soils along streams and wetlands, copes with periodic wet and dry conditions. Tassel and Tufted Sedge: perennial tussocks, helps prevent erosion                             |

## BANK FACE

Shrubs and grasses are generally best for revegetation of banks. Many of the following species can also be planted as River Corridor Species.

| COMMON NAME                      | SCIENTIFIC NAME   | REVEGETATION INFORMATION  |
|----------------------------------|---|---|
| Australian Anchor Plant          | <i>Discaria pubescens</i>   | near streams, shrub 1-2m  |
| Bertya                           | <i>Bertya rosmarinifolia</i>  | prefers near streams, height 1-2m   |
| Blackthorn                       | <i>Bursaria lasiophylla</i>   | thorny shrub, grows readily along river, creeks and gullies, wide spreading root system that binds the soil effectively, 2-4m                         |
| Box Micranthem                   | <i>Micranthemum hexandrum</i>   | rocky sites near streams, shrub 2-4m  |
| Burgan                           | <i>Kunzea ericoides</i>   | near streams, shrub 2-4m, may invade cleared country  |
| Cauliflower Bush                 | <i>Cassinia longifolia</i>  | shallow soils, shrub 1-3.5m   |
| Common Cassinia                  | <i>Cassinia aculeata</i>  | shrub 1.3-5m  |
| Common Fringe-myrtle             | <i>Calytrix tetragona</i>   | rocky, gravelly soils and sand, shrub 1-2m  |
| Crimson Bottlebrush              | <i>Callistemon citrinus</i>   | damp, sandy flats and near swamps, shrub 1-3m   |
| Dagger Wattle                    | <i>Acacia sicutiformis</i>  | prefers sandy or rocky soils, very hardy  |
| Giant Hop-Bush                   | <i>Dodonaea viscosa</i> subsp. <i>spatulata</i>   | rocky outcrops, dry sandy soils, shrub to 6m  |
| Hemp Bush                        | <i>Gynatrix pulchella</i>   | near streams, shrub 2-4m,   |
| Long-leaf Lomatia                | <i>Lomatia myricoides</i>   | Will grow on poorer soils, along creeks and gullies, shrub 2-5m, intolerant of high phosphorus alluvial sites   |
| Narrow-leaf Bitter Pea           | <i>Daviesia mimosoides</i>  | various soils, shrub to 2m, hardy, useful for poor open sites, regenerates quickly after fire   |
| Narrow-leaf Hopbush              | <i>Dodonea viscosa</i> subsp. <i>angustissima</i>   | rocky outcrops, dry sandy soils, shrub 1-4m   |
| Ovens Wattle                     | <i>Acacia pravissima</i>  | common near streams and on damp sheltered sites, shrub to small tree 3-8m   |
| Prickly Grevillea                | <i>Grevillea juniperina</i>   | sand or rock near rivers, creeks, shrub 1-2.5m, suitable for low phosphorus soils   |
| Poa Tussocks*<br>(Tussock Grass) | <i>Poa sieveriana</i> ,<br><i>Poa labillardiera</i>   | perennial, prefers dry, alluvial soils on stream banks and low-lying sites, unpalatable for stock   |
| Pomaderris species               | <i>Pomaderris andromedifolia</i> ,<br><i>angustifolia</i> , <i>subcapita</i> ,<br><i>aspera</i> , <i>eriocephala</i> ,<br><i>betulina</i> | in scrub, usually near streams, shrub 1-4m  |
| River She-Oak                    | <i>Casuarina cunninghamiana</i>   | along streams, roots bind banks   |
| River Tea-Tree                   | <i>Leptospermum obovatum</i>  | sandy, alluvial soils and rocky outcrops, periodically wet sites along watercourses, shrub 2-3m, excellent for streambank protection, thinning may be |

|                            |  |   |
|----------------------------|--|---|
|                            |  | in riverbed   |
| <b>Slender Tea-Tree</b>    | <b><i>Leptospermum brevipes</i></b>    | near streams, damp or rocky sites, shrub 2-4m   |
| <b>Small-fruited Hakea</b> | <b><i>Hakea microcarpa</i></b>         | rocky soils, next to watercourses and swamps, shrub to 2m, not tolerant of phosphorus, therefore no suited to rich, alluvial soils  |
| <b>Swamp Paperbark</b>     | <b><i>Melaleuca ericifolia</i></b>     | poorly drained soils, swamps and stream flats   |
| <b>Swamp Tea-Tree</b>      | <b><i>Leptospermum myrtifolium</i></b> | periodically wet soils, near streams, swamps and soaks, shrub 1-2.5m, may invade cleared, wet areas   |
| <b>Tussock Grass</b>       | <b><i>Poa labillardieri</i></b>        | grows readily along stream banks, unpalatable for stock   |
| <b>Woolly Grevillea</b>    | <b><i>Grevillea lanigera</i></b>       | Small shrub, grows readily in lighter soils along watercourses, well draining sandy or rocky soils with clay subsoil, will regenerate naturally during good seasons, soil with low phosphorus content |
| <b>Woolly Tea-Tree</b>     | <b><i>Leptospermum lanigerum</i></b>   | wet, sandy or alluvial soils and rocky sites, shrub 2-6m  |

### Who can help?

Lachlan Catchment Management Authority (02) 63411600

### FURTHER REFERENCES

Rizvi, S.A and Crouch R.J. *Gully Stabilisation: 20 Promising Native Species*. CaLM Technical Paper 2, Department of Conservation and Land Management, Sydney, 1993.

## IMPORTANT THINGS TO KNOW ABOUT REPAIRING GULLIES

### ❖ Active gullies take priority.

While filling a stable gully is possible, it is a low priority as there is no environmental benefit compared to treating an actively eroding gully.

### ❖ Design and Construct Earthworks.

Have all earthworks designed and construction to Council/DIPNR standards. In the site plan allowance should be made for vehicular access so that heavy trucks do not create an erosion problem.

### ❖ Catchment Size >25 ha.

Catchments above 25 ha can periodically yield large volumes of water, which is difficult to control. Any works would require a detailed design to cater for appropriate storm events (ie. 20 year return period).

### ❖ Catchment Size 15 – 25 ha.

Jobs should be designed and approved by Council and DIPNR.

### ❖ Catchment Size <15 ha.

Below 15 ha catchment, DIPNR minimum standards is recommended and no further design is usually necessary.

### ❖ Suitable Dam Site.

A site is suitable for a dam if the site is flat <5% and/or in a minor gully or flow line where there is suitable earth material for dam construction (ie. clay).

## What is a

**Diversion Bank?** A bank constructed by a dozer or grader, which is designed to safely divert runoff water from one point to another.

**Flume?** A stable area which allows water to flow into the bottom of a gully without causing erosion.

**Bank and Pipe?** A diversion bank with a pipe (usually 150-mm poly pipe) to cater for flows from minor run-off events or from spring flows, which protects the outlet from eroding.

### Who can help?

Yass Office C/- DIPNR (02) 6226 1433

