



**LAND MANAGEMENT
AND
REHABILITATION SERVICES**

**MERRYWOOD COAL MINE
REVEGETATION PLAN**

ACN 056 572 779

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Introduction

The abandoned Merrywood Coal Mine Site has been divided into 7 areas based on their revegetation requirements. These areas are identified in Figure 1 and are as follows:

- Area 1 : Landslip
- Area 2 : Revegetated Areas
- Area 3 : Main Central Section
- Area 4 : Eastern Section across Creek
- Area 5 : Compacted Roads
- Area 6 : Coal Wash Fines
- Area 7 : Wash-down Facility

Earthworks and drainage specifications are being prepared by Nigel Bedford, a Civil Engineering Consultant. The following revegetation specifications assume and are based on Areas 2,3,4 and 5 being prepared to a loose friable condition suitable for the establishment of vegetation and the sites being stable from the effects of surface run-off and erosion.

Site 1 is inaccessible and sites 6 and 7 may be utilised during a coal recovery process altering the revegetation requirements.

Revegetation Components

Nutrient Application

Based on soil analysis results provided by Serve Ag, all sites are nutrient deficient. Nutrients will be applied aurally due to on-ground access difficulties over the majority of the mine site. It is also the most cost effective method to apply fertiliser over the whole area.

The most cost effective fertiliser to apply aurally will be a granular N:P:K mix of 14:16:11 at 300 kg/ha. The use of this fertiliser has been based on a number of trials on the revegetation of dolerite clays.

Direct Seeding

Local provenance native seed should be collected and applied on Areas 3, 4, 5, and parts of 6 and 7.

The following seed mix is recommended for use :

	%
<i>Acacia dealbata</i>	20
<i>Acacia melanoxylon</i>	05
<i>Eucalyptus amygdalina</i>	10
<i>E. delegatensis</i>	10

<i>E. ovata</i>	05
<i>E. rubida</i>	05
<i>E. viminalis</i>	10
<i>Cassinea aculeata</i>	10
<i>Leptospermum scoparium</i>	15
<i>Goodia latifolia</i>	10

Spot Seeding

Colonisation of Area 4 has occurred naturally, however, there are gaps within the establishing vegetation cover. These “gaps” should be revegetated by spot application of the specified seed mix.

Seedlings

Seedlings of Poa, Lomandra and Juncus (wetlands) should be propagated as a component of the revegetation program. They should be propagated as 18cm³ cells, virocells or equivalent.

Separate fertiliser application for seedlings will not be required as sufficient nutrients will be applied during aerial broadcasting

Fenced Plots

Browsing is a major issue over the whole site, limiting plant growth particularly seed development of native grasses. Fenced revegetation plots measuring 30 m x 30m should be established as on-going seed sources for colonisation in the longer-term .

Recommended Revegetation Guidelines and Quantities

Area 1. : Landslip

Area = 3.1 ha

Area 1 is a historic land-slip site and is difficult to access by machinery. Revegetation will involve aerial fertiliser application (in order to encourage growth of established plant species) and the planting of Poa and Lomandra seedlings as 18 cm³ plugs by hand. As the surface can not be prepared for direct sowing of native seed, it will not be applied.

The fertiliser mix 14:16:11 will be applied at 300 kg/ha

Material Summary

Fertiliser 14:16:11 @ 300 kg/ha = 0.93 t

Poa Seedlings =	2500
Lomandra seedlings =	500

Area 2 :Revegetated Areas

Area = 17.6 ha

Area 2 is composed of a number of separate sites that have either been revegetated during mine operations or are being colonised naturally from the surrounding forest. In these instances the sites will be fertilised only in order to encourage increased growth rates.

The fertiliser mix 14:16:11 will be applied at 300 kg/ha

Material Summary

Fertiliser 14:16:11 @ 300 kg/ha = 5.3 tonnes

Area 3 : Main Central Section

Area = 22.8 ha

The main central section has been aerially seeded with little effect, mainly due to inadequate surface preparation. Revegetation will involve direct seed application of the above mix at 4 kg/ha and the planting of local provenance Poa, Lomandra and Juncus as plugs. Juncus will be planted in the developed wetland areas. Sediment traps / wetlands have been identified by Nigel Bedford in the earthworks plan.

Three 30 x 30 browsing animal proof fenced plots will be established in order to protect and assist in the development of an on-going long-term seed source. Browsing severely limits seed production and the rate of colonisation and growth of plant species.

A stabilising ryecorn cover crop will be applied to this open central section at 30 kg/ha

The fertiliser mix 14:16:11 will be applied at 300 kg/ha over the whole site.

The site will be prepared to a loose friable condition (via ripping) suitable for plant establishment. Ripping and drainage provisions will be made during the earthworks component of the rehabilitation program.

Material Summary

Fertiliser 14:16:11 @ 300 kg/ha =	6.8 t
Seed for direct broadcast =	91.2 kg

Ryecorn seed =	700 kg
Fenced Plots 3 x 120m =	360 m
Poa Seedlings in fenced plots =	2500
Poa seedlings for planting outside plots =	20,000
Lomandra seedlings in fenced plots =	500
Lomandra seedlings for planting outside plots =	2500
Juncus species for wetland sections =	1000

Area 4 : Eastern Section Across Creek

Area = 5.8 ha

Natural colonisation has occurred in patches over this site. Revegetation will involve spot seeding the above mix on the bare sections at 1 kg/ha. Spot seeding will be implemented following scarification of the surface with a rake and the seed will be applied by a puffer pack similar to a "Saxa" salt container.

A fenced plot will be established as for Area 3.

Fertiliser will be applied aerially at 300 kg/ha of N:P:K fertiliser mix 14:16:11.

Material Summary

Fertiliser 14:16:11 @ 300 kg/ha =	1.75 t
Seed for spot seeding =	5 kg
Fenced Plots 1 x 120m =	120 m
Poa Seedlings in fenced plots =	800
Lomandra seedlings in fenced plots =	200

Area 5 : Compacted Roads

Area = 1.6 ha

The old mine access roads are compacted and require ripping prior to revegetation. Revegetation will involve fertiliser application at 300 kg of N:P:K 14:16:11 and direct seed application at 4 kg/ha.

Material Summary

Fertiliser 14:16:11 @ 300 kg/ha =	0.5 t
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Seed for direct broadcast = 6.4 kg

Area 6 : Coal Wash Fines

Area = 6.5 ha

Two revegetation options have been provided based firstly on the removal of the coal wash fines and secondly, on them remaining and being partially covered by insitu clay (generally at the perimeter of the fines).

Option 1 : Removal of coal fines, exposing clays

Area for Revegetation = 6.5 ha

The first option of coal fines removal and treatment of the clays underneath will involve nutrient application of N:P:K 14:16:11 at 300 kg/ha/, direct seeding of the above mix at 4 kg/ha and the planting of Poa, Lomandra and Juncus seedling plugs. A fenced plot similar to Area 3 will also be established. Sediment traps / wetlands locations have been identified by Nigel Bedford.

An assumption has been made that the clays under the coal fines will be extremely nutrient deficient and a maintenance application may be required in the future. This requirement should be based on a monitoring nutrient analysis 12-18 months in the future.

Material Summary

Fertiliser 14:16:11 @ 300 kg/ha =	1.95 t
Seed for direct seeding =	26 kg
Fenced Plots 1 x 120m =	120 m
Poa Seedlings in fenced plots =	800
Poa seedlings outside fenced plot =	6000
Lomandra seedlings in fenced plots =	200
Lomandra seedlings outside fenced plot =	1500
Juncus for wetlands (sediment ponds)=	500
Maintenance fertiliser 14:16:11 @ 300 kg/ha =	1.95 t

Option 2 : Coals Fines Remain

Area for Revegetation = 1.6 ha

The above area for revegetation assumes that 25% of the coal fines area can be covered with clay from the perimeter of the coal fines. The remaining 75% will be left to colonise naturally. Sediment traps / wetlands locations have been identified by Nigel Bedford.

Fertiliser will be applied at 3000 kg/ha of N:P:K 14:16:11 to be followed in 12-18 months by maintenance fertiliser application based on monitoring analysis.

Material Summary

Fertiliser 14:16:11 @ 300 kg/ha over 1.6 ha only =	0.48 t
Seed for spot seeding =	6.4 kg
Fenced Plots 1 x 120m =	120 m
Poa Seedlings in fenced plots =	800
Poa seedlings outside fenced plot =	1600
Lomandra seedlings in fenced plots =	200
Lomandra seedlings outside fenced plot =	200
Juncus for wetlands (sediment ponds)=	500
Maintenance fertiliser 14:16:11 @ 300 kg/ha =	0.48 t

Area 7 : Wash-down Facility

Area = 3.3 ha

Only one revegetation option is recommended regardless of the removal of the majority of coal fines or if the fines are to remain and are profiled. Regardless of the future of the coal fines, the site will still be covered by coal based material. Revegetation will be based on nutrient application as set out below, direct seeding at 4 kg/ha of the above mix and planting of Poa, Lomandra and Juncus seedlings.

Material Summary

Fertiliser 14:16:11 @ 300 kg/ha over 3.3 ha only =	1.00 t
Seed for direct seeding =	13.2 kg
Poa Seedlings =	3000
Lomandra seedlings =	300
Juncus for wetlands (sediment ponds)=	500

Maintenance fertiliser 14:16:11 @ 300 kg/ha = 1.35 t

Cost Estimate

A cost estimate for the completion of revegetation works is attached in Table 1.

Material Summary

Fertiliser 14:16:11 = 18.23 tonnes (including Area 6 Option 1)
= 16.76 tonnes (including Area 6 Option 2)

Seed = 140 kg (including Area 6 Option 1)
= 122 kg (including Area 6 Option 2)

	Including Area 6 Option 1	Including Area 6 Option 2
<i>Acacia dealbata</i>	28	24.5
<i>Acacia melanoxylon</i>	7	6.0
<i>Eucalyptus amygdalina</i>	14	12.0
<i>E. delegatensis</i>	14	12.5
<i>E. ovata</i>	7	6.0
<i>E. rubida</i>	7	6.0
<i>E. viminalis</i>	14	12.0
<i>Cassinea aculeata</i>	14	12.5
<i>Leptospermum scoparium</i>	21	18.5
<i>Goodia latifolia</i>	14	12.0

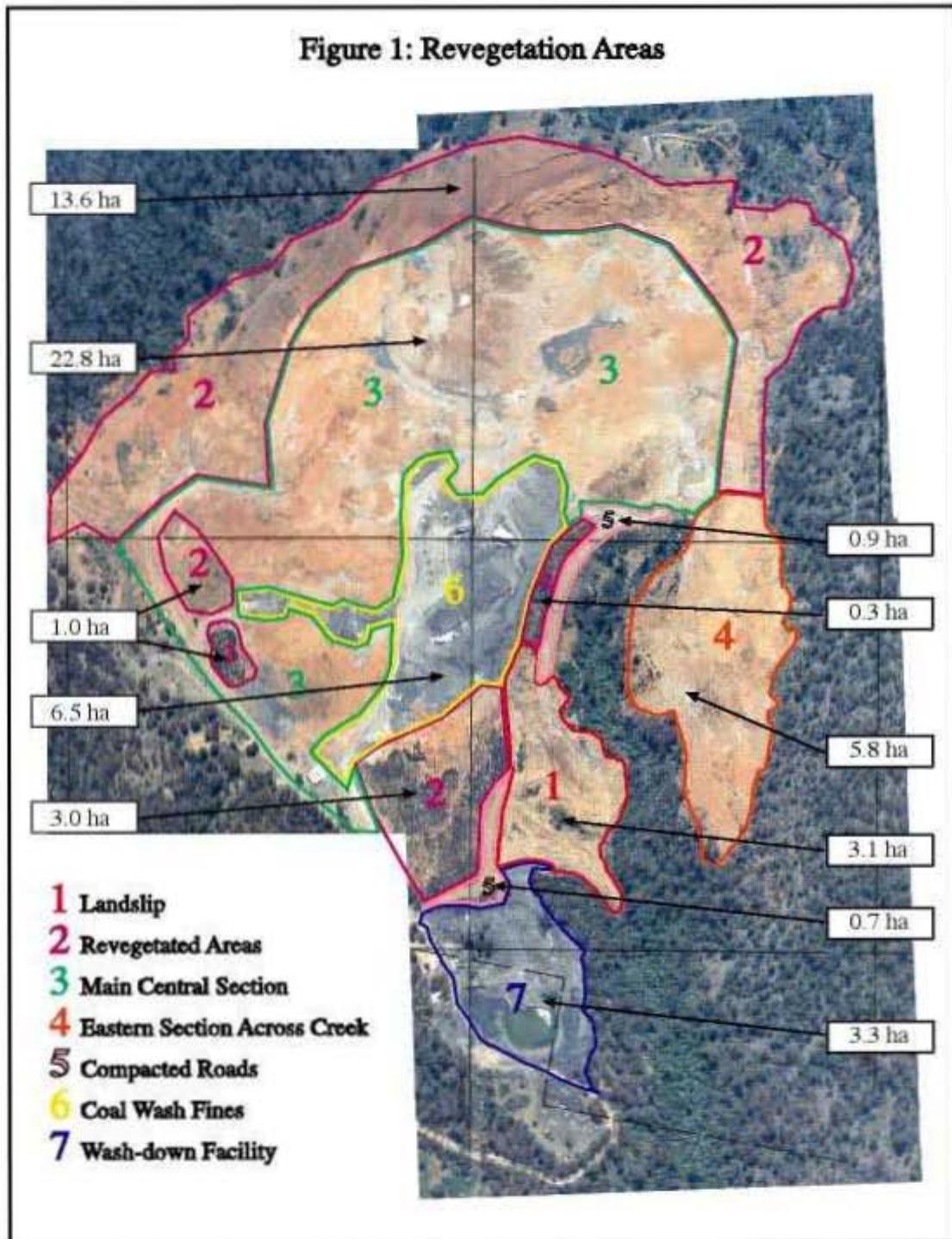
Ryecorn Seed = 700 kg

Poa seedlings = 35600 (including Area 6 Option 1)
= 31200 (including Area 6 Option 2)

Lomandra seedlings = 5700 (including Area 6 Option 1)
= 4400 (including Area 6 Option 2)

Juncus seedlings = 2500

Fencing (in metres)= 600 m



Inspection Summary

An inspection of the Autumn 2002 revegetation works implemented by Woodlands Corporation at the abandoned Merrywood Coal Mine site was conducted by Tim Duckett of Land Management and Rehabilitation Services (LMRS) on the 7th of June 2002.

Woodlands Corporation have supplied DIER with a works implementation summary dated the 27th of May 2002. A query has been sent to Woodlands Corporation concerning wildlife damaged Poas (2048) prior to planting and their fate. A future response is expected and should be included with this inspection report as an addendum.

Based on the inspection the following observations were made :

- The *Poa* grass and *Lomandra* seedlings were well planted over the whole site.
- The cover crop was well distributed over Section 3 and was germinating.
- The seed at some locations was not evenly distributed as indicated by clumps of seed and sawdust mix on the ground. (**Ref Photograph 1**).



Photograph 1 : Uneven seed distribution at Site 6

- The gorse infestation has been cut stump treated. Follow-up inspections and treatment will be required in 2003 and 2004. (**Ref Photograph 2**).
- The fenced plot for the establishment of non-browsed seed sources was completed successfully. (**Ref Photograph 3**). Evidence already existing of native animals being diverted around the plot via well used tracks.
- The loose surface created by dozer ripping and cultivation is suitable for future plant establishment. (**Ref. Photograph 4**)





Photograph 2 : Gorse cut stump treatment



Photograph 3 : Fenced plot Section 3.



Photograph 4 : Surface preparation Section 3



General Observations

- The central access track through Area 6 is compacted and due to poor drainage will erode in the future. Revegetation works appear to have involved the planting of some grasses and the application of seed. This site of approximately 2 ha, will required treatments including cultivation, compaction relief, re-seeding and fertilizer application. However, at this stage this section should remain in this condition for at least 2 years as it is the main access to the bulk of the site and can be used should maintenance be required. This site should be rehabilitated in 2004. (Ref Photographs 5 & 6)



Photograph 5 : Central track requiring rehabilitation



Photograph 6 : Central track requiring rehabilitation

- The remaining grasses that have not been planted should be planted on Section 6 as the area (ha) rehabilitated was greater than first envisaged.
- Maintenance inspection will be required
 - Spring 2002 particularly for drainage and erosion problems



- Autumn 2003 for weed and seedling establishment and potential drainage and erosion problems that may require rectification before winter.
- Spring 2003 for weed establishment and additional fertilizer requirement.
- Annual Autumn inspection should be conducted from 2004 until the site is deemed satisfactorily rehabilitated.



Introduction

The Merrywood Coal Mine site was inspected on the 6th of February 2003 by Tim Duckett of Land Management and Rehabilitation Services (LMRS). The purpose of the inspection was to report on the early stages of vegetation development following the implementation of rehabilitation works in Autumn 2002.

General Observations

- In June 2002 a revegetation inspection summary report was prepared by LMRS. That report identified a major issue of uneven native seed distribution. The extract from the report is as follows : *“The seed at some locations was not evenly distributed as indicated by clumps of seed and sawdust mix on the ground”*



Photograph 1 : Uneven seed distribution (photo extract from June 2002 Revegetation summary report).

As a result of the uneven seed distribution high numbers of seedling have germinated in concentrated clumps and the distribution of germinating seedling is uneven.

- It appears that native seed was not applied to those areas within the fenced plots.
- The southern section of Area 5 has not been ripped.
- The effect of the aerial fertilizer application is not yet evident as the planted Poas have not developed as anticipate even in the fenced plots.
- Poa survival within the fenced plots is high (80-90%). Hand application of fertilizer to the Poas within the fenced plot is recommended for Autumn 2003. 5 kg of 14:16:11 fertilizer per plot will be sufficient
- Eucalypt germination is evident over the whole site. Acacias are also germinating, however, they will continue to germinate over the Autumn/Winter months and will increase in density.

- A future inspection should be conducted in Spring 2003 in order to identify any weed establishment and for on-going assessment of the success of the 2002 rehabilitation activities.



Photograph 2 : Seedlings density is too great after uneven seed distribution from Autumn 2002 application.