

Fingerboards Mineral Sands Project Inquiry and Advisory Committee

Technical Note

TN No: 018

Date: 5 May 2021

Subject: Rehabilitation planning and activities

This technical note is intended to provide further information about the planning for, and activities being undertaken as part of, the rehabilitation of the Fingerboards mine, including the proposed restoration of approximately 200 hectares of native grassy woodland within the project area.

1. Rehabilitation works

1.1 Overview

Rehabilitation works will return mined land to pre-mining land use capability and productivity, unless an alternative land use is agreed with stakeholders.

Kalbar will carry out rehabilitation works progressively behind the active mining area to minimise the areas of disturbance at any given time. As mining moves, the mine voids will be backfilled with coarse sand tailings, dry cake from the centrifuges and overburden (including manufactured subsoil), shaped, then covered with topsoil and revegetated. Where required, subsoils and topsoils will be conditioned (i.e. with calcium ameliorants, and organic mulches) before placement.

For rehabilitation planning, the project area has been divided into the following 'rehabilitation zones', on the basis of the landform and intended final land use:

- plateau grazing
- swales and plateau edges
- valley slopes
- channel and riparian
- native grassy woodland
- road verges

These rehabilitation zones are shown in Figure 1 below, which replicates Figure 17 in the rehabilitation report included as Appendix A020 to the Fingerboards environment effects statement (EES) (available [here](#)). The figure refers to other detailed maps but these have not been set out in this technical note. Please refer to Figures 18 – 22 in EES Appendix A020 for these detailed maps.

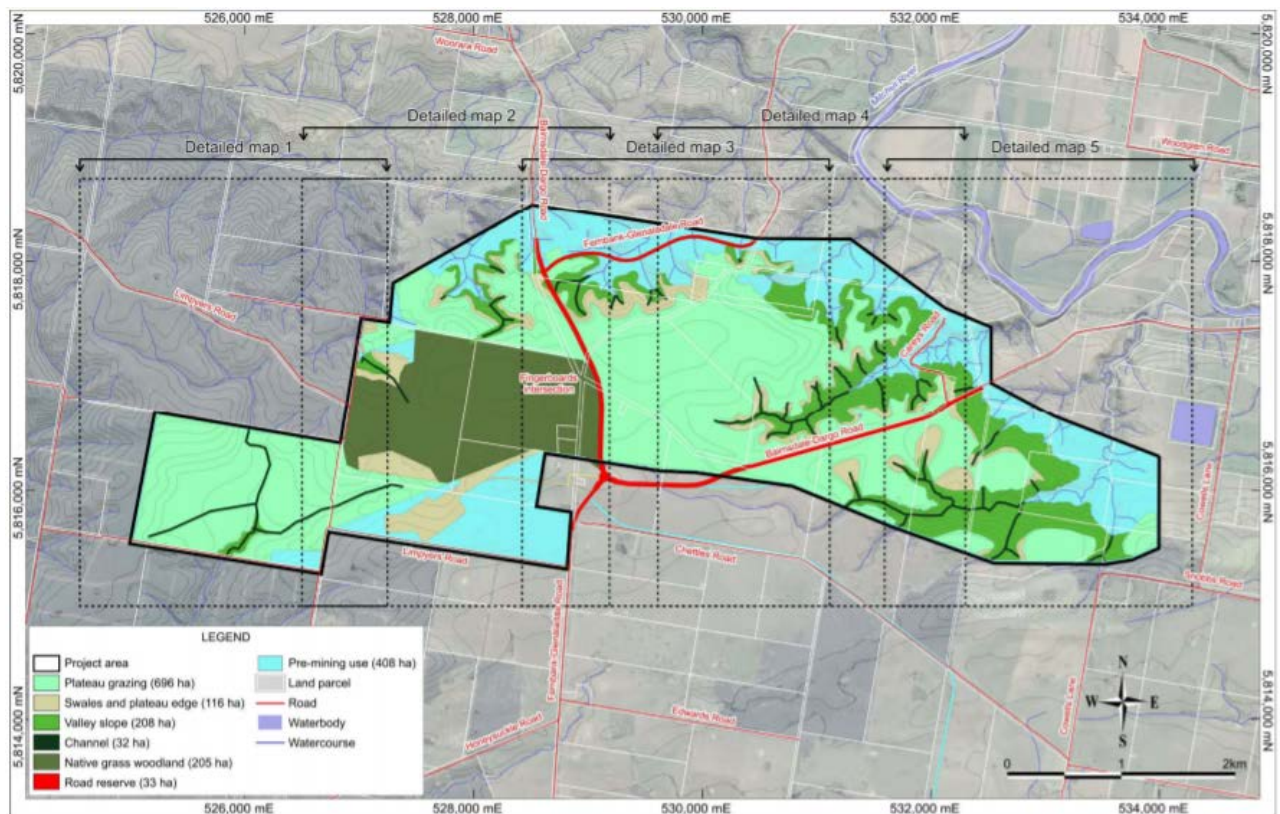


Figure 1 - Rehabilitation zones.

Kalbar's strategies for the revegetation of each rehabilitation zone are described in section 7.5 of EES Appendix A020. Broadly, Kalbar intends to:

- restore the plateau grazing zone (approximately 700 ha) with grazing pasture, including native grasses to improve resilience to drought and fire;
- restore the swales, plateau edges, slopes and channels (approximately 325 ha) with complex native vegetation to increase faunal habitat value and improve stabilisation;
- restore the land currently occupied by blue gum plantation (approximately 200 ha) with species-rich Red Gum grassy woodland and associated grassland. See section 2 below for further details; and
- restore local wildflowers and grasses to re-aligned road verges.

1.2 Rehabilitation activities undertaken to date

Over the past two years, Kalbar has committed significant time and resources to undertake preliminary work for the rehabilitation works, including:

- identification of target species required for rehabilitation works;
- definition of restoration domains and their seed and ameliorant requirements;
- sourcing of wild genetic resources for initiating seed production activities;
- development of seed production infrastructure;
- propagation, establishment and maintenance of native seed crops within the seed production nursery at Bengworden (see section 3 below);

- collection of base line data on relevant site characteristics to inform restoration activities (e.g. soil structural and nutrient characteristics, seed bank characteristics, soil microbial health, and plant biomass); and
- establishing pre-works trials, including for determination of optimal mixing rates of coarse tailings and centrifuge cake and soil treatments (e.g. topsoil, subsoil and organic amendments), plant salvage and translocation and for seeding rate, species mix and seed delivery approaches.

2. Restoration of the native grassy woodland

As flagged above, Kalbar intends to revegetate approximately 200 ha of land currently occupied by blue gum plantation in the south-western portion of the Fingerboards project area, with species that comprise the 'Gippsland Red Gum Grassy Woodland and Associated Native Grassland' ecological community (**Woodland Restoration Project**).

This ecological community would have once been widespread on the Gippsland Plains, but has been reduced to a small fraction of its original range and quality and is listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (**EPBC Act**).

2.1 Background

Grassy woodlands with open grassy paddocks and scattered large trees are a common feature across many Australian agricultural landscapes. However, at the ground level most are dominated by exotic species including pastures and crops and very few are dominated by native species.

Before Europeans arrived in Australia, Indigenous peoples meticulously managed these landscapes to ensure their food, cultural and spiritual needs were met. In large part, this was done using carefully planned firestick burning to manipulate both the structure and composition of native vegetation. These practices meant that the open grassy woodlands and grasslands first viewed by European settlers were, to a large degree, artefacts of Aboriginal management.¹

In these open states, native grassy woodlands were viewed as prime lands for agriculture (rather than denser treed bushland that had to be laboriously cleared). As agricultural practices became more intensive over time (e.g. artificial fertilizers, pesticides, and hybrid varieties), key factors such as overgrazing and extensive cropping led to the steady decline of native grassy woodlands and grasslands and, in many cases, local extinction of native species.

Today, the Gippsland Red Gum Grassy Woodlands and Associated Grassland are among Australia's most threatened ecosystems, occurring only as small, isolated remnants and listed as threatened under the EPBC Act.



Figures 3-4 Examples of native grassy woodland

The Woodland Restoration Project aims to play a part in reversing the critical loss of the Gippsland Red Gum Grassy Woodland and Associated Native Grassland ecological community in the Gippsland

¹ Gamage, B. 2011. *The biggest estate on earth – how Aboriginals made Australia*. Allen & Unwin. Sydney.

region. It is also likely to represent the largest and most complex ecological restoration of this community type in Victoria.

2.2 Research and experimentation

The core on-ground approach and ecological principles underpinning the Woodland Restoration Project are based on long-term applied research into native grassy community reconstruction over the past 20 years (which have demonstrated feasibility). For this reason, embedding ongoing research as part of the restoration project is considered to be instrumental in continuing to inform and refine earlier approaches and to interpreting on-ground outcomes. While there are now numerous examples of successful grassy woodland restoration, these have only been undertaken at small scale (1-10 ha). Kalbar is conscious that the scale of the Woodland Restoration Project will require significant time and resource investment from the company to understand site-specific characteristics, and to monitor and measure its success against current site baseline conditions.

Kalbar's restoration team has undertaken a variety of investigations to understand current site conditions. This has involved soil sampling and analysis to characterise many facets of the site's soils (including nutrient, structural and infiltration features), seed bank dynamics, and microbial community health — all of which will inform planning for the Woodland Restoration Project. Further trials are planned to test optimal rehabilitation soil profiles and potential amendments (e.g. organic amendments) for optimal establishment and growth of native (and pasture) seed mixes. As the project progresses, it is envisaged that further research avenues will be explored as restoration and post-restoration management.

2.3 Long-term protection of the restored area

In addition to the significant environmental and community benefits that will come from the Woodland Restoration Project, Kalbar views it as a key part of its legacy.

Kalbar proposes to enter into an agreement under section 173 of the *Planning and Environment Act 1987* (Vic) to ensure the long-term protection of the restored area, if this can be agreed with the responsible authority (i.e. East Gippsland Shire Council). If agreed, the section 173 agreement would be registered on the title to the land and would require the landowner (Kalbar) to manage the land in a way that prioritises its conservation.

If Council and Kalbar are unable to agree to a section 173 agreement, another option would be to enter into an agreement with the Secretary under the *Conservation, Forests and Lands Act 1987*.

3. Native seed production

A significant challenge to implementation of the Woodland Restoration Project is the large amount of native seed from a wide range of species required to restore such a large area (given so little is available commercially or from the wild). To obtain this key resource, Kalbar's restoration team is using small amounts of genetically appropriate seed taken from wild populations across the region and to produce cultivate native seed crops. These crops are being (and will continue to be) grown and maintained using horticultural approaches to produce seed in the quantities, quality and from the diversity of species required for the Woodland Restoration Project.

To that end, Kalbar has leased and upgraded an ex-wholesale plant nursery at Bengworden near Bairnsdale, to begin generating seed and to test growing methods and technologies. Following project approval, Kalbar intends to develop a larger seed nursery on the Fingerboards project site.

Establishing cultivated seed production crops and developing the infrastructure required to support them is a long and involved process typically taking several years. For this reason, the seed produced at the Bengworden nursery will be essential to establishing much larger cropping beds in the coming years at the Fingerboards seed nursery.

Kalbar's seed growing facilities will not only provide a key component for the Woodland Restoration Project, but will also represent an important long-term resource for the wider Gippsland region by providing rare native seed (and plants), as well as educational and training opportunities for the wider Gippsland community.

3.1 Bengworden seed production nursery

Figure 5 below shows the location of the Bengworden nursery, approximately 20 km south-east of the project site.

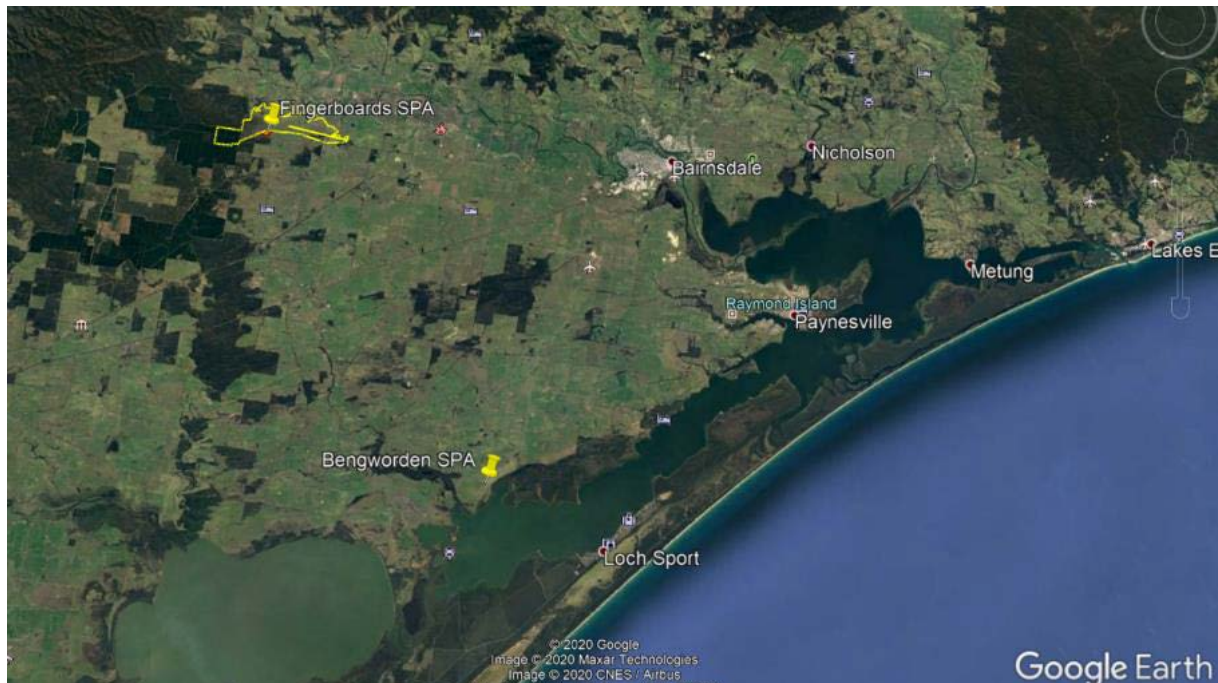


Figure 5 - Location of Bengworden nursery relative to the Fingerboards project site

The Bengworden nursery has been fitted with propagation and growing houses, crop beds (in-ground and container), irrigation (subsurface and overhead), and has undergone soil improvement. Seed generated from the crops at Bengworden nursery will be used to initiate beds at the larger (~10ha) Fingerboards seed production facility.

Kalbar has collected seed from ~100 species and is currently establishing crops of various sizes of 30-50 of those species at the Bengworden nursery (with that number to increase in following year). The essence of cultivated seed production is that it utilises well-established horticultural and agronomic techniques to germinate, grow and manage plants for seed output. It also greatly reduces the impact of repeated collections on wild populations. Many species can produce large amounts of seed in production (compared to the wild), and numerous genetic individuals can be grown in small areas to facilitate genetic health of the resultant crop outputs. Production techniques also allow a high level of management control over many variables that normally limit plant growth and seed production in the wild.



Figures 6 and 7 - Bengworden nursery (April 2021)



Figures 8 and 9 - Seed trays at Bengworden nursery (April 2021)

Please also see this short [video](#) on the Bengworden nursery.

3.2 Fingerboards seed production nursery

If approvals for the Fingerboards project are secured, Kalbar intends to develop a second, larger seed nursery on the project site of up to 10 ha, which is intended to generate the bulk of the seed quantity required to effect the Woodland Restoration Project. This seed will also be used to revegetate other areas within the project area such as road verges, gully slopes, and to provide seed stock to incorporate native grasses into the pasture mix of land returned to agricultural use.

Kalbar intends to begin establishing the Fingerboards nursery in Year 1 of the Project. This will involve the initial set up of approximately 2ha of crop beds, with additional cropping areas to be established in subsequent years. The intention is for this facility to produce sufficient seed resources for the commencement of the full rehabilitation plan in Year 3 of the mine. Kalbar also intends to continue to run the Bengworden nursery while the Fingerboards nursery is established, to maximise seed supply.

4. Revegetation of road verges

Roadsides in Gippsland (and in Victoria more generally) do not typically contain high quality native vegetation. While tree and shrubs are prominent features of roadsides in some regions, broadly speaking the ground layer is dominated by high biomass weedy grasses and flowers.

As part of its rehabilitation planning, Kalbar intends to rehabilitate the realigned roads within the project area by creating functional roadside native vegetation using low biomass grasses and native wildflower coverage. This will result in ground coverage that represents a comparatively lower fuel risk and one that is easier for road authority/council to maintain. It will also create an aesthetic visual display – presenting many native flora to the community and tourists and provide habitat for wildlife, particularly for native invertebrates.

5. Kalbar's restoration team

Kalbar's restoration team is headed by Dr Paul Gibson-Roy, who is a restoration ecologist specialised in re-establishing species-rich native grasslands and grassy woodlands.

In 2004, Dr Gibson-Roy instigated the Victorian Grassy Groundcover Research Project (Melbourne University and Greening Australia): a state-wide, field-scale grassy restoration program which was the first to demonstrate approaches and techniques for restoring native grassy communities under Australian conditions. In 2011, he expanded the project to NSW focusing on EPBC-listed Cumberland Plain Grassy Woodland. There, he developed one of the country's most advanced seed production facilities, growing wildflowers and grasses for restoration across the region. He was the recipient of a Churchill Fellowship in 2016, and toured the USA investigating local native seed and restoration sectors (Gibson-Roy 2018). In 2017, Dr Gibson-Roy co-developed an ANPC-led national native seed sector survey, gathering critical information and feedback from restorationists nationally. He has published widely on topics of native restoration, seed and the restoration sector. Dr Gibson-Roy joined Kalbar in 2019, to oversee its rehabilitation strategies, and in particular its plans for restoration of native vegetation.

Dr Gibson-Roy is supported by a talented and committed on-ground team of locals, with significant background in native restoration and mine rehabilitation (Rob and Veronica Logan, Murray Holland, and Jake Thunder).

6. Community engagement

The Woodland Restoration Project has tremendous potential for community outreach, education and training. A field day is planned at Bengworden nursery in October 2021, which will enable the community to visit the nursery to gain further insights into current activities and to better understand how those activities link into the Woodland Restoration Project.

The Bengworden nursery also currently provides work experience to an Indigenous horticultural student who attends the site once a week, enabling the student to experience first-hand working with the propagation and maintenance of native plants. In future, both production facilities and on-ground restoration works will offer the potential for Kalbar to host schools and community groups in education and training programs.

Another benefit of the development of seed production nurseries is that excess seed can also be shared with local councils, NGOs, community and Indigenous groups, enabling subsequent trials and restoration projects. It is hoped that the scope and ambition of the Woodland Restoration Project will also serve as a precedent for what other mining companies can achieve.

Several research organisations have expressed interest in collaborating with Kalbar on research. These include the ARC Centre for Mine Site Restoration — Curtin University (Prof Kingsley Dixon), the Geotechnical and Hydrogeological Engineering Research Group — Federation University (Prof Thomas Baumgartl) and the Hawkesbury Institute for the Environment — Western Sydney University (Dr Paul Rymer). Kalbar is also seeking Federal Government support for research collaboration through its Innovation Connections program, which supports industry and University research partnerships. These are likely to include graduate, postgraduate and post-doctorate involvement in studies that encompass all areas of rehabilitation including soils, vegetation establishment and faunal.

7. Examples of restored grassy communities

The Goon Nure site, situated approximately 40 km from the project site, provides an excellent example of successful native grassy woodland restoration in the local Gippsland region. This 3 ha restoration on private land was initiated in 2006 as part of the Grassy Groundcover Restoration Project (GGRP)

and managed by Dr Paul Gibson-Roy. Formerly degraded pasture growing on very sandy soils, the restoration was sown in 2008. The successful establishment and long-term resilience of the Goon Nure site as of 2021 represents an important demonstration of the techniques and approaches to be used in the Fingerboards restoration. Even more so, it is demonstrative of clear evidence that diverse arrays of grasses, wildflowers and canopy species can be re-established in the Gippsland region under prevailing climatic and soil conditions. As such, the Goon Nure restoration site is also likely to represent one of the finest examples of intact, diverse native grassy woodland in the region.



Figure 10 - Goon Nure (A) in 2008



Figure 11 - Goon Nure (A) in 2019

There are many other GGRP sites in western and central Victoria (and NSW) where diverse and resilient grassy communities have been successfully established on farms, public reserves and roadsides² (Gibson-Roy et.al 2010, Gibson-Roy and Delpratt 2015, Cuneo et al. 2018). Their long-term persistence and stability also provide strong evidence that given appropriate resourcing, timelines and commitment, the much larger Fingerboards restoration may eventually stand as the prime example of grassy woodland restoration in Australia.



Figures 12 and 13 - Laharum Western Victoria pre-seeding and post seeding (3 yrs)

² Gibson-Roy, P., G. M. Moore, C. J. Delpratt, and J. Gardner. 2010. **Expanding horizons for herbaceous ecosystem restoration: The Grassy Groundcover Restoration Project.** *Ecological Management & Restoration*. 11:175-185; Gibson-Roy, P., Delpratt, J. 2015. **The Restoration of Native Grasslands** in *Land of Sweeping Plains – managing and restoring the native grassland of south-eastern Australia*. Eds, Williams, N. Marshall, A. Morgan, J. CSIRO Publishing. 331-389; Cuneo, P. Gibson-Roy, P. Fifield, G. Broadhurst, L. Berryman, T. Crawford, A. Freudenberger, D. (2018). **Restoring grassy woodland diversity through direct seeding: insights from six ‘best-practice’ case studies in southern Australia.** *Ecological Management and Restoration*. 19:2. 125-135.



Figures 14 and 15 - Moolapio Geelong pre-seeding and post seeding (4 yrs)



Figure 16 Example of seed production infrastructure and seed storage at Richmond - Sydney