KALBAR

FINGERBOARDS MINERALS SANDS PROJECT

DRAFT WORK PLAN

under the Mineral Resources (Sustainable Development) (Mineral Industries) Regulations 2019

QUALITY INFORMATION

Document	Draft Work Plan – Fingerboards Mineral Sands
Ref	
Date	~~May 2020~~March 2021
Prepared by	~~ST/~~LC
Reviewed by	~~VH~~LF

REVISION HISTORY

Revision	Revision Date	Prepared by	Checked	
0	7 March 2019	LC	ST	Draft issued for TRG review
1	29 July 2019	LC	ST, VH	Revised draft incorporating changes requested by TRG to 14 June 2019.
2	20 December 2019	ST/LC	ST/VH	Further revisions in response to TRG comments to end September 2019.
3	25 May 2020	LC/ST	VH	Further revisions in response to TRG comments to end February 2020; updating of proponent name.
4	5 March 2021	LF~~C~~	LC~~F~~	Revisions to include changed tailings strategy (use of centrifuge) and correct editorial errors.

ACRONYMS AND ABBREVIATIONS

Acronym / abbreviation	Meaning
% w/w	Percentage weight of solute in a total weight of solution after mixing
°C	Degrees Celsius
ABS	Australian Bureau of Statistics
AEP	Annual Exceedance Probability – the probability that a given rainfall total accumulated over a given duration will be exceeded in any one year
AHD	Australian Height Datum
AMC	Accelerated mechanical consolidation
ANCOLD	Australian National Committee on Large Dams
ANZECC	Australian and New Zealand Environment and Conservation Council
AS/NZS	Australian Standard / New Zealand Standard
ASLP	Australian Standard Leaching Procedure
BCM	Bank cubic metres
bgs	Below ground surface
BOM	Bureau of Meteorology
Bq/g	Becquerels per gram
CaCO3	Calcium carbonate
CFA	Country Fire Authority
CHMP	Cultural Heritage Management Plan
CoA	Certificate of analysis
CRD	Cumulative rainfall departure
CRG	Community Reference Group
D50	Median (50^{th} percentile) particle size diameter
D80	80^{th} percentile particle size diameter
DEDJTR	Department of Economic Development, Jobs, Transport and Resources
DEPI	Department of Environment and Primary Industries
DJPR	Department of Jobs, Precincts and Regions
DN	Nominal diameter (refers to pipe size)

Acronym / abbreviation	Meaning
DPI	Department of Primary Industries
DSDBI	Department of State Development, Business and Innovation
DSE	Department of Sustainability and Environment
~~DTPLI~~	~~Department of Transport Planning and Local Infrastructure~~
EC	Electrical conductivity
EES	Environment Effects Statement
EGCMA	East Gippsland Catchment Management Authority
EGSC	East Gippsland Shire Council
EHP	Ecology and Heritage Partners
EMF	Environmental management framework
EMS	Environmental management system
EPA	Environment Protection Authority
EP Act	*Environment Protection Act 1970*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (C'wlth)
ERC	Environmental Review Committee
ERR	Earth Resources Regulation
EVC	Ecological Vegetation Community – native vegetation types used for biodiversity planning and conservation assessment at landscape, regional and broader scales in Victoria
FFG	*Flora and Fauna Guarantee Act 1988*
g/cm3	Grams per cubic centimetre
g/t	Grams per tonne
GAI	Global abundance index
GL	Gigalitres
GLaWAC	Gunaikurnai Land and Waters Aboriginal Corporation
GLpa	Gigalitres per annum
GRZ	Geotechnical risk zone
H:V	Horizontal to vertical ratio
ha	Hectare

Acronym / abbreviation	Meaning
HAZID	Hazard identification study
HAZOP	Hazard and operability study
HCO3	Bicarbonate
HCV	Heritage Council of Victoria
HDPE	High density polyethylene
HfO_2	Hafnium oxide
HHF	Haunted Hill Formation
HIL	Health-based investigation level
HM	Heavy mineral
HMC	Heavy mineral concentrate
ISO	International Organization for Standardization
JORC	Joint Ore Reserves Committee of the Australasian Institute of Mining and Metallurgy, Australian Institute of Geoscientists and Minerals Council of Australia
kBq/kg	Kilobecquerels per kilogram
kg	Kilogram
kL	Kilolitre
km	Kilometre
kt	Kilotonne
kV	Kilovolt(s)
L/s	Litres per second
LoR	Limit of reporting
LVCM	Latrobe Valley Coal Measures
m	Metre(s)
m^3/a	Cubic metres per annum
m^3/h	Cubic metres per hour
Ma	Million years ago
mAHD	Metres above Australian Height Datum
Mg	Magnesium

Acronym / abbreviation	Meaning
mg/L	Milligrams per litre
Mha	Millions of hectares
ML	Megalitre(s)
mm	millimetres
Mm3	Million cubic metres
MNES	Matters of National Environmental Significance
MRSD Act	*Mineral Resources (Sustainable Development) Act 1990* (Vic)
Mt	Megatonnes
Mtpa	Million tonnes per annum
MUP	Mining unit plant
MW	Megawatt(s)
µm	Micrometres
N/Mag	Nonmagnetic
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measure
PM10, PM2.5	Particulate matter having an effective diameter 10 micrometers or less; particulate matter having an effective diameter 2.5 micrometers or less
PN	Nominal pressure (refers to pipe pressure rating)
Ppm	Parts per million
O/S	Oversize
REO	Rare earth oxides
RO	Reverse osmosis – a commonly-used method of water purification
ROM pad	Run of mine pad – storage area for mined ore awaiting crushing
SG	Specific gravity
SO4	Sulphate
SRW	Southern Rural Water
t	Tonne(s)
TAFE	Technical and Further Education

Acronym / abbreviation	Meaning
TC	Total concentration (of metals)
Th-232	The most common isotope in naturally occurring thorium
Th-nat	Naturally occurring thorium
TiO_2	Titanium dioxide
TMP	Tailings management plan
TN	Total nitrogen
TP	Total phosphorus
tpa	Tonnes per annum
tph	Tonnes per hour
TPH	Total Petroleum Hydrocarbons
~~TSF~~	~~Tailings storage facility~~
U-238	The most common isotope in naturally occurring uranium
U-nat	Naturally occurring uranium
U/S	Undersize
USA	Upper Sands Unit A
VAHR	Victorian Aboriginal Heritage Register
WCP	Wet concentrator plant
WSPA	Water Supply Protection Area
Y_2O_3	Yttrium oxide
ZrO_2	Zirconium dioxide (or zirconia)

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1 INTRODUCTION

1.1 About this draft Work Plan

Kalbar Operations Pty Ltd (Kalbar) is currently preparing an Environment Effects Statement (EES) in accordance with a decision by the Minister for Planning on 18 December 2016 that the proposed Fingerboard Mineral Sands Project will require assessment under the *Environment Effects Act 1978*. This draft work plan has been prepared in response to a recommendation included in the EES Scoping Requirements issued by the Victorian government for the Fingerboards Minerals Sands Project ('the project') in March 2018. The EES takes the place of the planning permit for this project.

The draft work plan addresses regulatory requirements set out in the Mineral Resources (Sustainable Development) (Mineral Industries) Regulations 2019 ('MRSD Regulations') and has been prepared in accordance with the Department of Jobs, Precincts and Regions' (DJPR's) *Guideline for Mining Projects: Preparation of Work Plans and Work Plan Variations* (September 2019). A checklist of compliance against requirements of the MRSD Regulations is provided in Appendix A.

The draft work plan draws from the outcomes of the EES findings and addresses these through the mitigation measures proposed in draft Risk Management Plan and associated Risk Treatment Plans.

Preparation of a work plan is a requirement of the *Mineral Resources (Sustainable Development) Act 1990* (Vic) (MRSDA) for those intending to do work under a mining licence. The work plan:

- describes the mining and related activities proposed to be carried by Kalbar in implementing its Fingerboards mineral sands project;
- provides an overview of technical aspects of the project;
- summarises the key technical, public safety, environmental and social risks of implementing the project.
- identifies potential social and environmental impacts of the project and how these impacts would be avoided or managed; and
- presents conceptual and technical information on mine rehabilitation.

If approved, the work plan will serve as one of the primary instruments by which the Fingerboards project would be regulated under the MRSDA. The information presented in the work plan will also inform the calculation of the rehabilitation bond applied through the project's mining licence.

The work plan contains a number of important Appendices which provide further detail on key aspects of the work plan. These include:

- Risk Management Plan (Appendix B), which includes the risk register; the list of mitigation actions; and risk treatment plans for key areas of activity;
- Mine Rehabilitation Plan (Appendix C);
- Community Engagement Plan (Appendix D); and
- Kalbar Health, Safety and Environment Policies~~, plus the Environmental Management Framework developed for the EES~~ (Appendix E).

~~Any additional~~Additional management plans will be submitted as appendices as part of the final work plan. These include:

- the Cultural Heritage Management Plan (CHMP);
- Tailings ~~and dam design report~~Management Plan;
- Ground control management plan; and
- Radiation management plans.

The work plan forms part of Kalbar's Environmental Management Framework (EMF), which is shown in Figure 1-1 and provided ~~as Appendix E~~in Chapter 12 of the ~~draft work plan~~Fingerboards EES. As shown in Figure 1-1, the work plan is linked to the Environmental Management Plan (EMP) within the EMF. The Environmental Management Plan addresses commitments in the EES and conditions of approval for the project including risks, mitigation and roles and responsibilities.

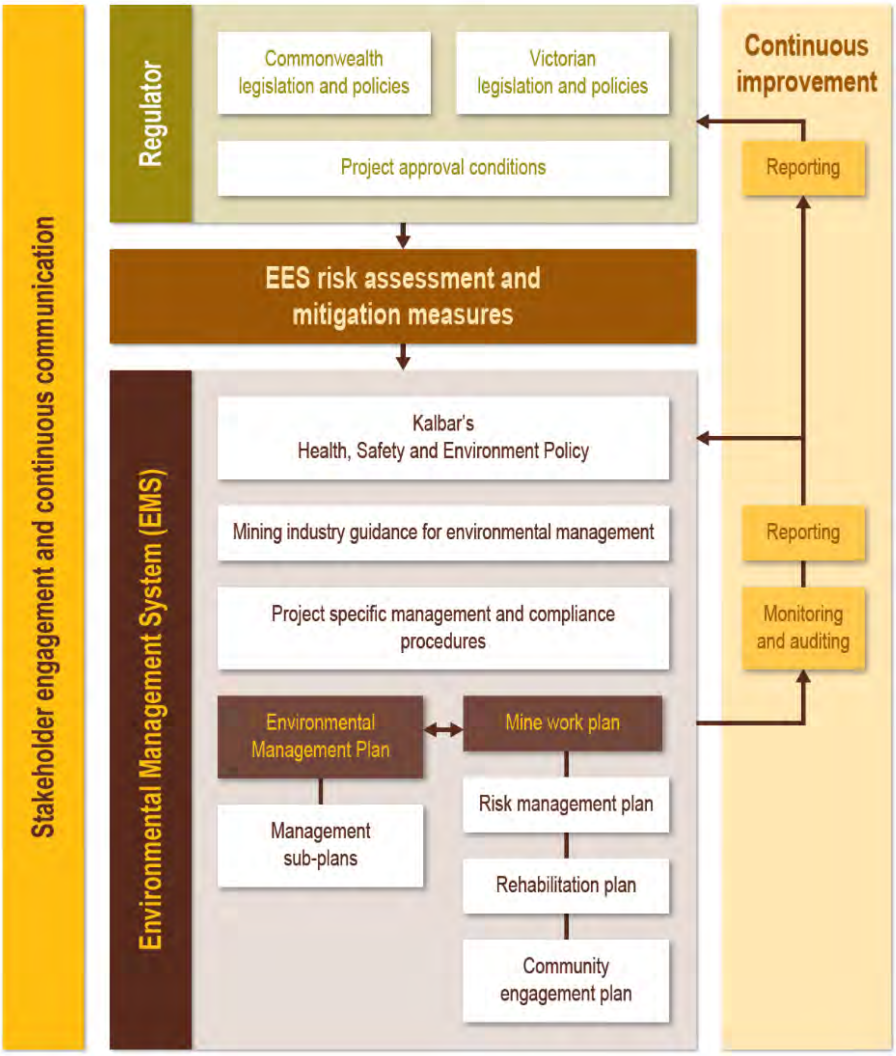
The work plan and risk management plan (Appendix B) has been developed from the relevant findings of the EES, in particular the mitigation measures developed as part of the Environmental Management Framework. A common numbering system has been used between the two submissions.

A series of risk treatment plans sit under the management plans. The scope and content of these plans is driven by the key environmental risks and impacts of the project identified through this EES, regulatory requirements and applicable policies and guidelines. The following proposed risk treatment plans are provided in ~~Attachment C~~Appendix B of the work plan:

- Airborne and deposited dust;
- Noise;
- Biodiversity; and
- Water.

The proposed mining licence area is equivalent to the 'project area' described in the EES and is located approximately 25 km west northwest of Bairnsdale Victoria (Figure 1-3). This work plan does not address continuing exploration activities by Kalbar in areas outside the proposed mining licence area. Kalbar will submit separate work plan(s) for activities conducted under exploration licences, as required.

The work plan does not address project-related activities outside the proposed Fingerboards mining licence area. Examples of excluded activities are: modification to roads and road infrastructure outside the proposed mining licence area; groundwater extraction from bores outside the licence area; rail sidings; pipelines, power transmission infrastructure outside the proposed mining licence area. The proposed mining licence area (equivalent to the EES project area) and the nature of activities outside the proposed mining licence area are shown in Figure 1-4.


Stakeholder engagement and continuous communication
Regulator
Commonwealth legislation and policies
Victorian legislation and policies
Project approval conditions
EES risk assessment and mitigation measures
Environmental Management System (EMS)
Kalbar's Health, Safety and Environment Policy
Mining industry guidance for environmental management
Project specific management and compliance procedures
Environmental Management Plan
Mine work plan
Management sub-plans
Risk management plan
Rehabilitation plan
Community engagement plan
Continuous improvement
Reporting
Reporting
Monitoring and auditing

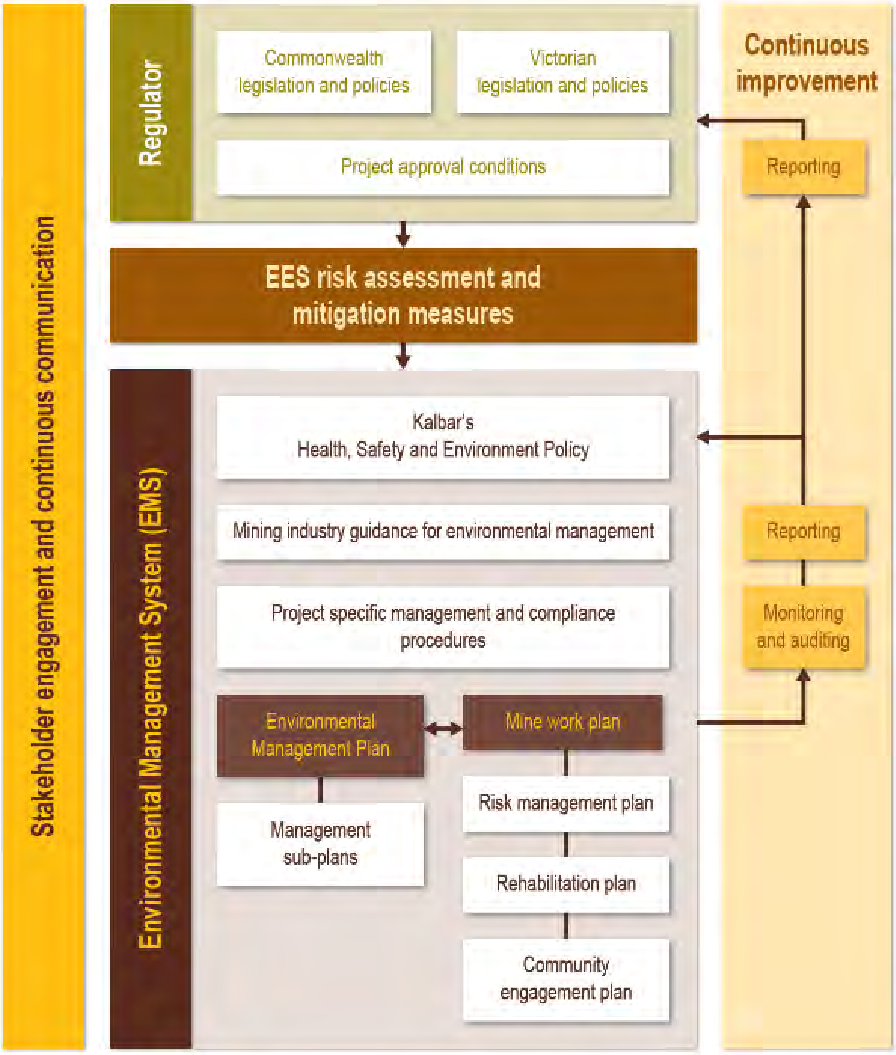


Figure 1-1: Kalbar Environmental Management Framework (EMF)

1.2 Regulatory context

The Minister's assessment of the Fingerboards EES will be presented in an assessment report which presents findings on environmental effects and risks, pursuant to guidelines issued under the *Environment Effects Act*. The Minister's assessment Is issued under the EE Act to provide authoritative statutory findings on environmental effects and environmental risks, as well as recommendations to be taken into account by statutory decision makers (local and state government agencies and authorities). This will inform whether or not the project is approved and in what form, including the approval decision on the work plan.

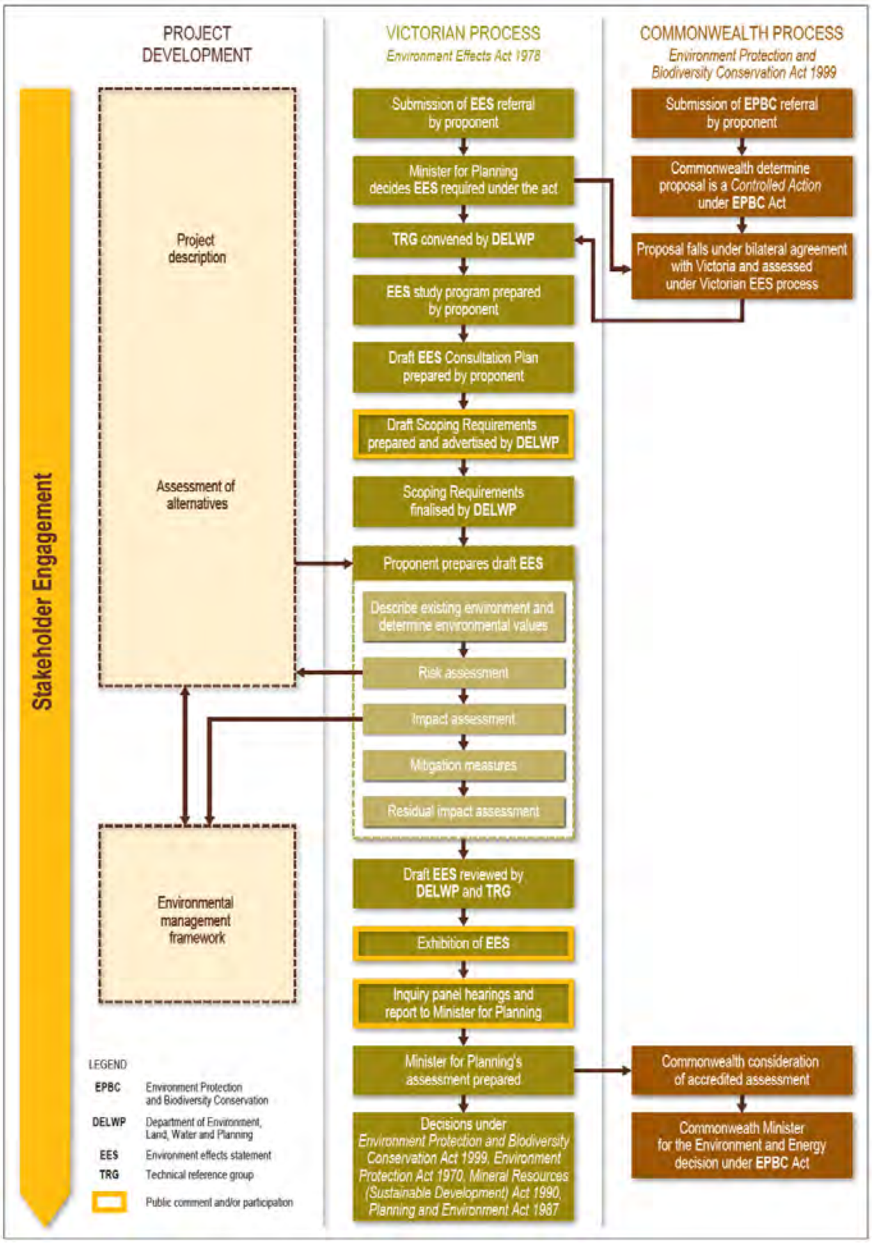
The Minister's EES report is not itself an approval: rather, the Minister's assessment will present analysis and advice to guide local and state government agencies and statutory authorities who will decide whether or not to issue permits and consents (including approval of the work plan) necessary for the project to proceed. It is usual for recommendations contained in the Minister's Assessment report to inform the regulatory conditions imposed on the project by decision makers, including the agency responsible for approving the work plan.

Once the project has been assessed under the *Environment Effects Act 1978* a range of approvals will be required to authorise commencement of mining and related activities:

- The primary approvals required by Kalbar to construct and operate the Fingerboards project are: a mining licence and a work plan (this document) under the MRSDA. Kalbar will be required to lodge a rehabilitation bond and to enter into compensation agreements with owners and occupiers of the land affected by the project.
- A planning approval to use and develop land issued under the *Planning and Environment Act 1987* (Vic) is required for some infrastructure associated with the project, but not for mining and related activities conducted on mining tenure, as these are exempt from a requirement for planning approval where an EES has been prepared and an assessment of that EES by the Minister administering the *Environment Effects Act 1978* has been submitted to the Minister responsible for administering the *Mineral Resources Sustainable Development*.
- Regulation of discharges and emissions to the environment from industrial activities is normally administered through the granting of works approvals and licences under Part 3, Divisions 2 and 3 of the *Environment Protection Act 1970* (EP Act). However discharges to land involving only mining wastes are exempt from the need for permitting under the EP Act (as they are regulated under the MRSDA).
- Approvals will be required under the *Water Act 1989* to construct dams (including a tailings dam) or other works on waterways (Section 67) and to take and use water from mine voids, from the Mitchell River or from a purpose-built bore field (Section 51).
- An approved Cultural Heritage Management Plan will be required before commencement of on-ground works (Section 49(2) of the *Aboriginal Heritage Act 2006*; Regulation 51 of Aboriginal Heritage Regulations 2018, S.R. No. 59/2018).

The project also requires a federal approval under the EPBC Act 1999 due to the potential impacts on Matters of National Environmental Significance (MNES), following completion of the State's assessment, issued by the Minister for Planning under the EE Act.

An overview of the regulatory framework is shown in Figure 1-2 and further details of the regulatory framework are provided in Chapter 5 of the Fingerboards EES.



PROJECT DEVELOPMENT
VICTORIAN PROCESS
Environment Effects Act 1978
COMMONWEALTH PROCESS
Environment Protection and Biodiversity Conservation Act 1999
Stakeholder Engagement
Project description
Assessment of alternatives
Environmental management framework
Submission of EES referral by proponent
Minister for Planning decides EES required under the act
TRG convened by DELWP
EES study program prepared by proponent
Draft EES Consultation Plan prepared by proponent
Draft Scoping Requirements prepared and advertised by DELWP
Scoping Requirements finalised by DELWP
Proponent prepares draft EES
Describe existing environment and determine environmental values
Risk assessment
Impact assessment
Mitigation measures
Residual impact assessment
Draft EES reviewed by DELWP and TRG
Exhibition of EES
Inquiry panel hearings and report to Minister for Planning
Minister for Planning's assessment prepared
Decisions under Environment Protection and Biodiversity Conservation Act 1999, Environment Protection Act 1970, Mineral Resources (Sustainable Development) Act 1990, Planning and Environment Act 1987
Submission of EPBC referral by proponent
Commonwealth determine proposal is a Controlled Action under EPBC Act
Proposal falls under bilateral agreement with Victoria and assessed under Victorian EES process
Commonwealth consideration of accredited assessment
Commonweath Minister for the Environment and Energy decision under EPBC Act
LEGEND
EPBC Environment Protection and Biodiversity Conservation
DELWP Department of Environment, Land, Water and Planning
EES Environment effects statement
TRG Technical reference group
Public comment and/or participation

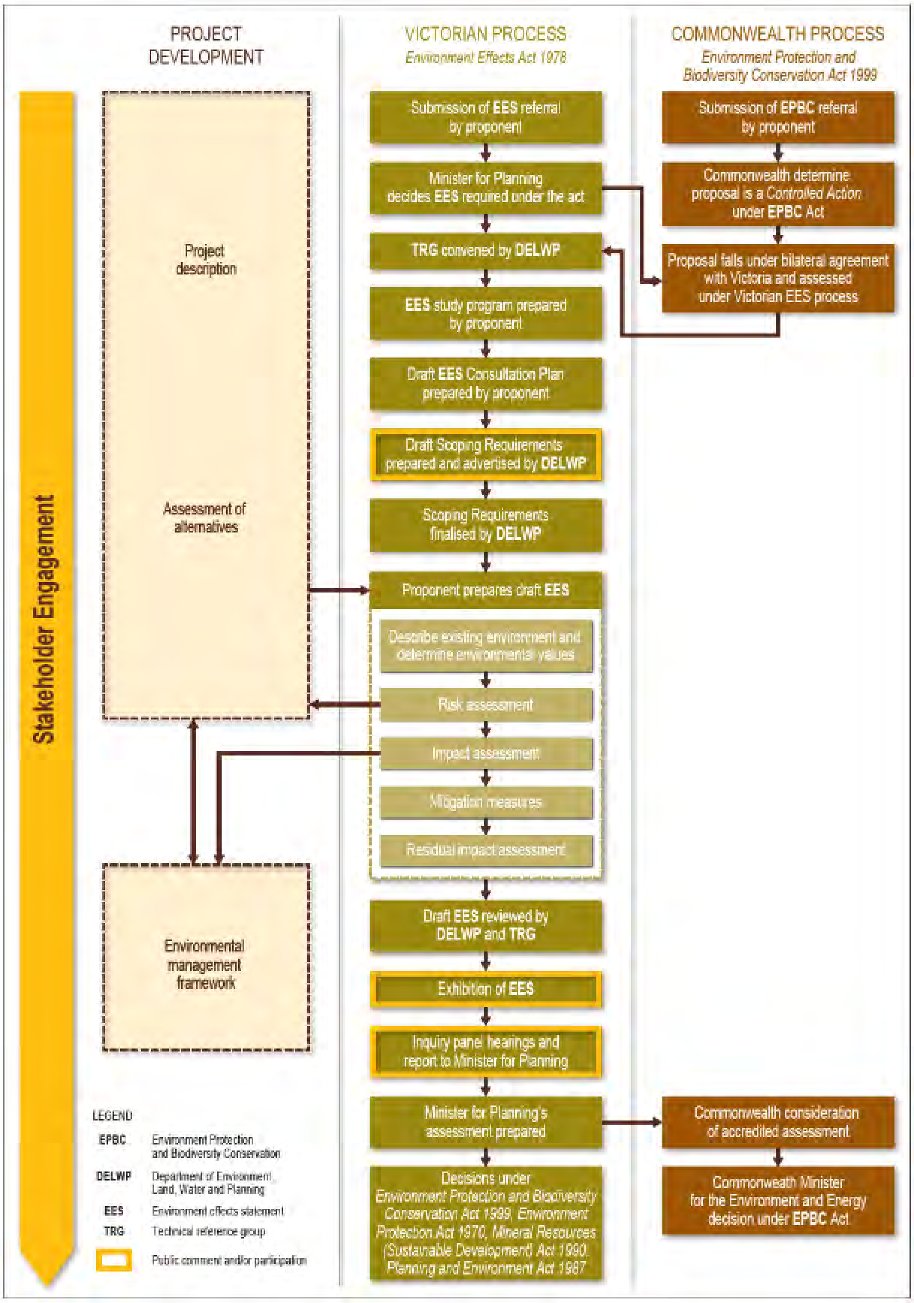


Figure 1-2: Overview of regulatory framework

1.3 Project summary

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Kalbar plans to mine mineral sands containing zircon, rutile, ilmenite and rare-earth bearing minerals (monazite and xenotime) from the 'Glenaladale Deposit', . The project is a greenfields mining project, meaning that no mining or mineral processing has previously been conducted on the land where mining activities will take place. Mining would be conducted by means of a shallow, open cut mining operation. No mine dewatering is required as the orebody is above the watertable. Areas disturbed by mining would be rehabilitated progressively.

Key operational characteristics of the Fingerboards project are summarised in Table 1-1. Indicative mine layout figures are provided in Section 4 of the work plan.

Products from the Fingerboards Project feed into three distinct industries:

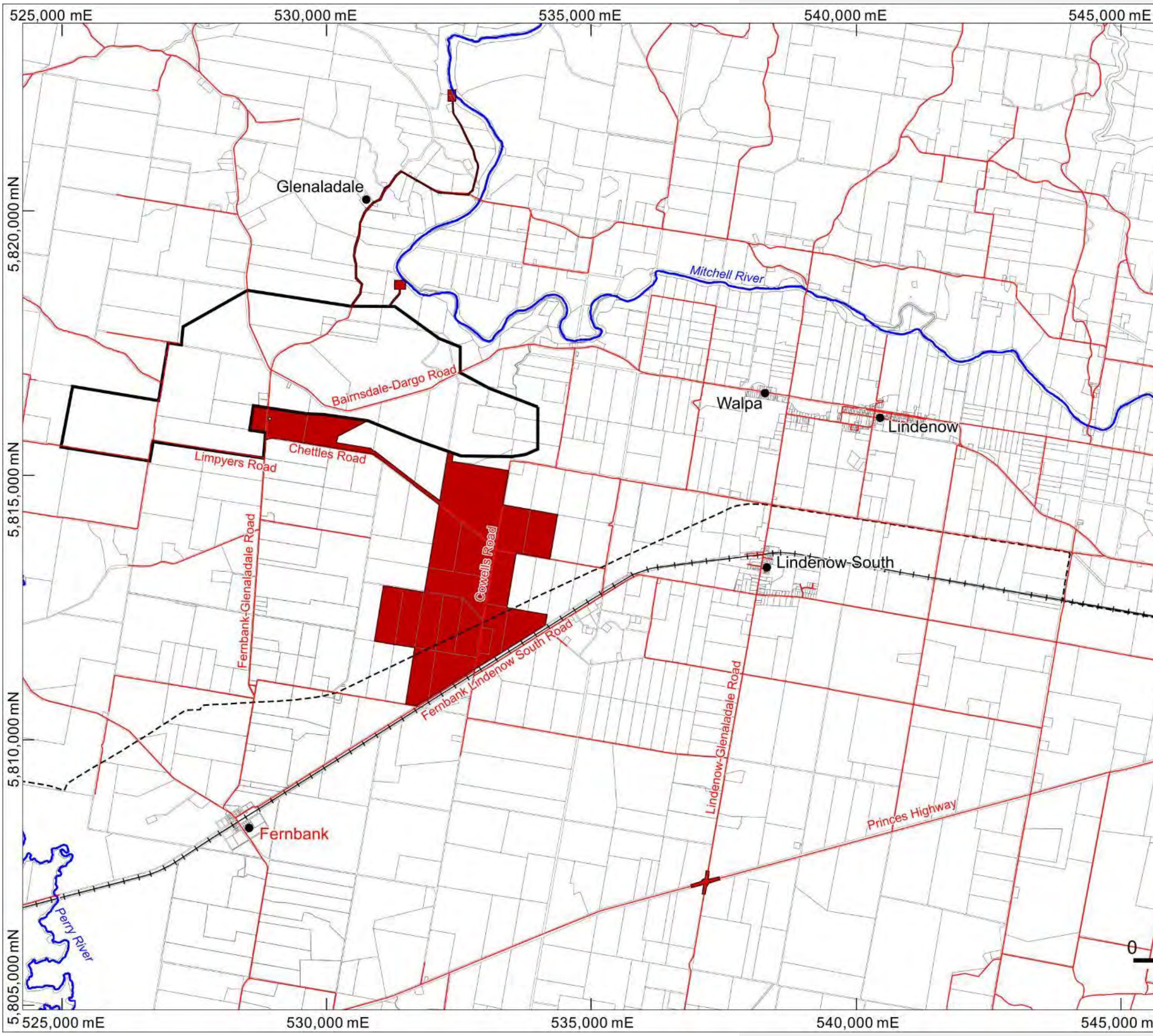
- zircon industry
- titanium feedstock industry
- rare earth feedstock industry

The mineralized sand minemined at Fingerboards would be processed on site to produce a heavy mineral concentrate, which would be exported to overseas customers for further processing. Kalbar will produce and sell two kinds of mineral concentrate – a non-magnetic concentrate, which is zircon-rich with minor amounts of rutile and rare-earth minerals and a magnetic concentrate, which is ilmenite-rich, with minor amounts of rare-earth minerals. About 60% of the concentrate would be non-magnetic concentrate and the rest would be magnetic concentrate. Approximately 8 million tonnes (Mt) of heavy mineral concentrate (HMC) would be produced from 170 Mt of ore over a 17 to 20 year period. Mining and mineral processing would occur on a continuous basis, 24 hours per day, 365 days per year.

Kalbar aims to export about 580,000 t per year of heavy mineral concentrate (HMC) from the Fingerboards Project. The new rail bridge overacross the Avon River atin Stratford is due to be completed in 2021, prior to commencing transport of HMC fromwas replaced in December 2020 which now enables the project. Kalbar'suse of freight rail east of Stratford. Accordingly, Kalbar plans to build a purpose-built rail siding close to the project area at Fernbank East and to use a private haulage road within the infrastructure corridor to access this siding from the project area. The alternative to a nearby purpose-built rail siding would be to upgrade the existing rail siding in Bairnsdale. This option would involve haulage of HMC via Bairnsdale-Dargo Road and Lindenow-Glenaladale Road to the Princes Highway and then to Bairnsdale. For both options, concentrateConcentrate will be transported by rail from the rail siding to the Port of Melbourne for shipment to customers.

In the event that the upgrading of the Avon River rail bridge is delayed, approximately half of the concentrate will be transported in bulk by road from the mine site to Port Anthony or the adjacent Barry Beach Marine Terminal, and the remaining concentrates will be transported in containers from the project area to the existing rail siding in Maryvale. Containerised concentrate will be transported by rail from the Maryvale rail siding to the Port of Melbourne. No more than 40 trucks containing concentrate, either for bulk or container shipments, are expected to leave the project area every 24 hours.

Product transport route options are shown in Figure 1.5.



Approximateuy 40 return truck trips are required to haul the concentrate from the plant to the rail sidingevery day. Truck haul operations will occur in the day period from 07h00 to 18h00.

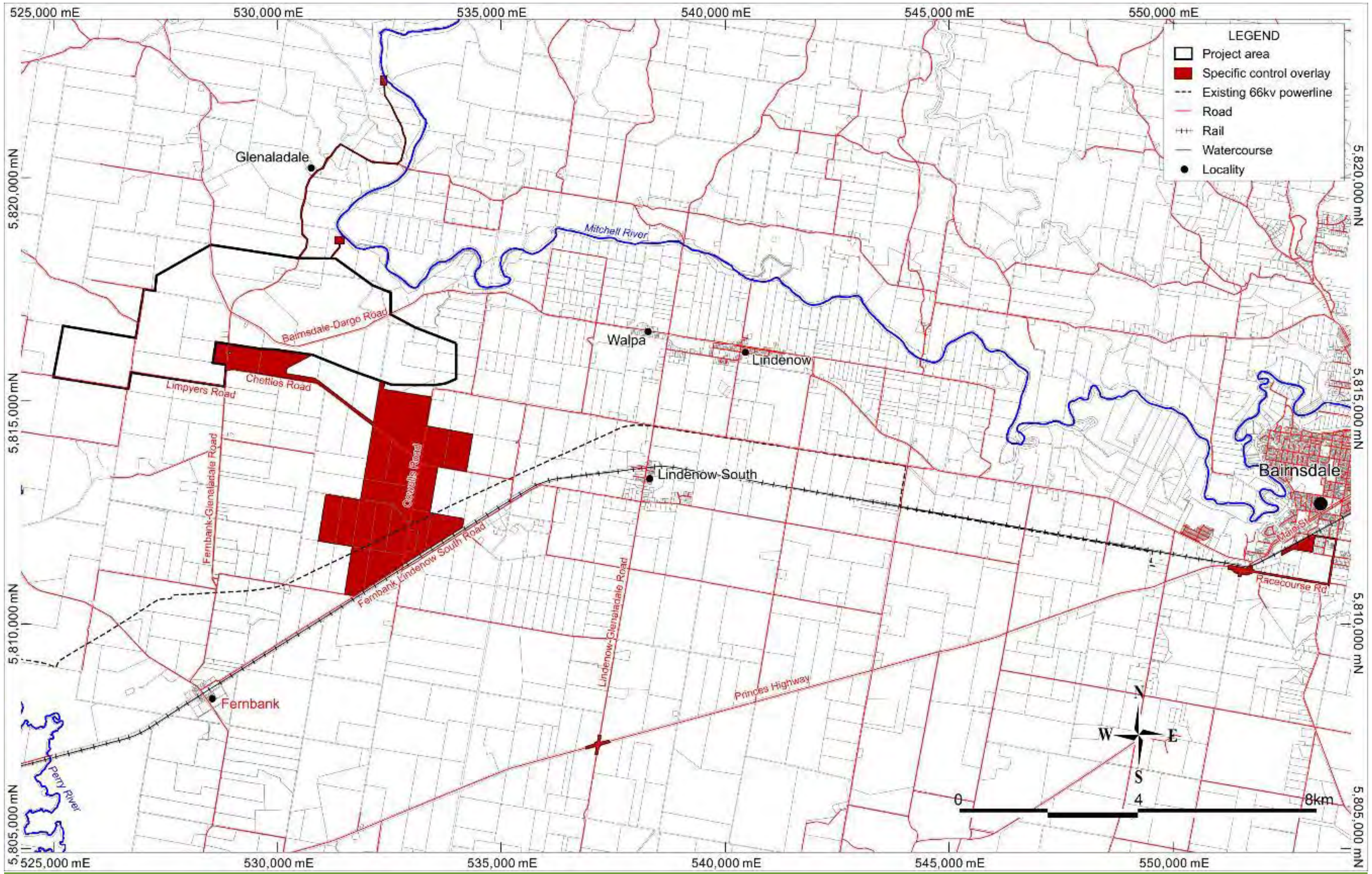


Figure 1-3: Location of the proposed mining licence area (black polygon) and work plan exclusion areas (in red). The proposed mining licence area and the project area outlined in the EES are equivalent.

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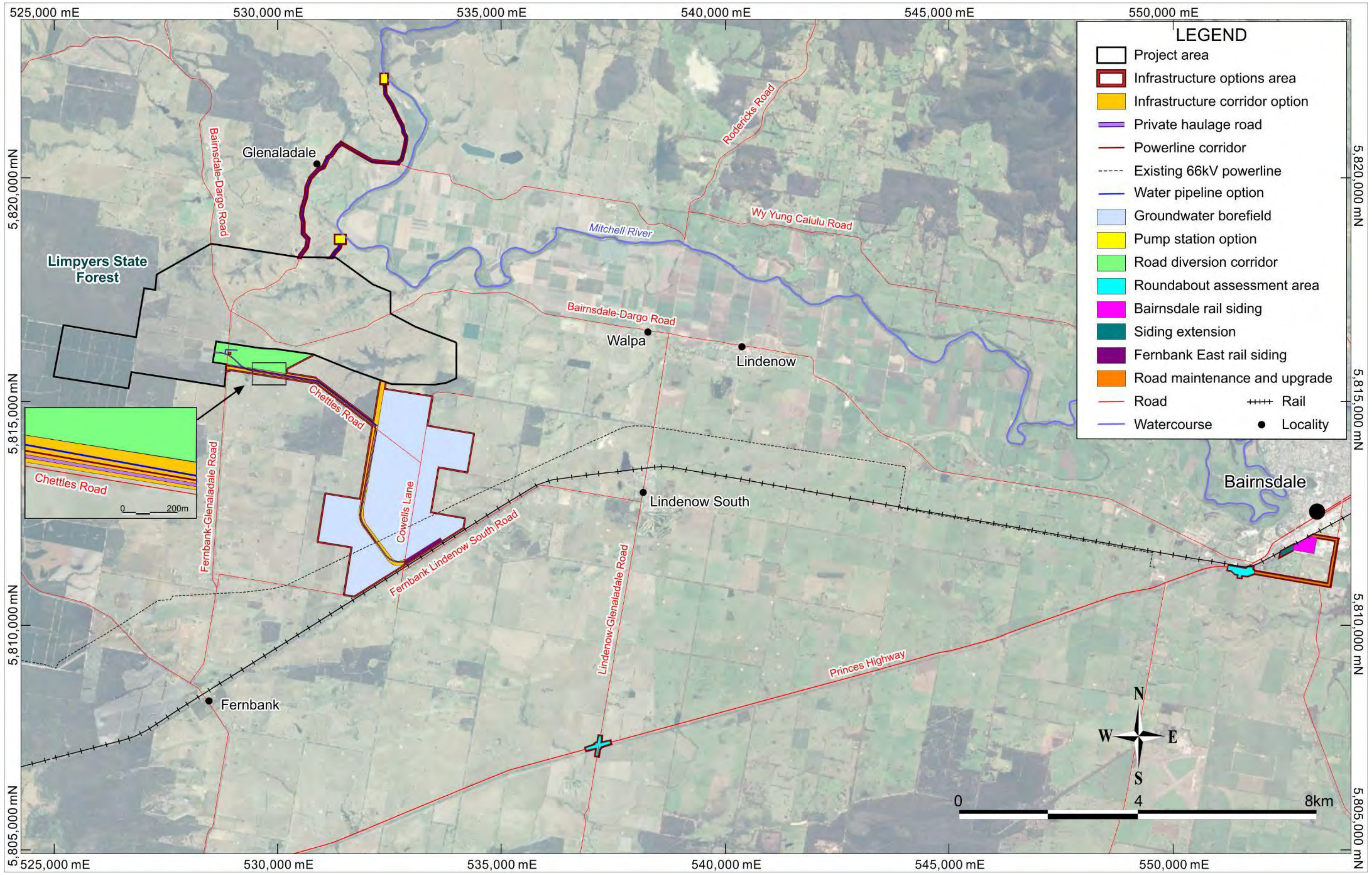
LEGEND
Project area
Infrastructure options area
Infrastructure corridor option
Private haulage road
Powerline corridor
Existing 66kV powerline
Water pipeline option
Groundwater borefield
Pump station option
Road diversion corridor
Roundabout assessment area
Bairnsdale rail siding
Siding extension
Fernbank East rail siding
Road maintenance and upgrade
Road
Rail
Watercourse
Locality
Glenaladale
Limpyers State Forest
Walpa
Lindenow
Lindenow South
Bairnsdale
Fernbank
Mitchell River
Wy Yung Calulu Road
Rodericks Road
Bairnsdale-Dargo Road
Chettles Road
Cowells Lane
Fernbank Lindenow South Road
Fernbank-Glenaladale Road
Lindenow-Glenaladale Road
Princes Highway
525,000 mE
530,000 mE
535,000 mE
540,000 mE
545,000 mE
550,000 mE
5,820,000 mN
5,815,000 mN
5,810,000 mN
5,805,000 mN
0 4 8km
N S E W

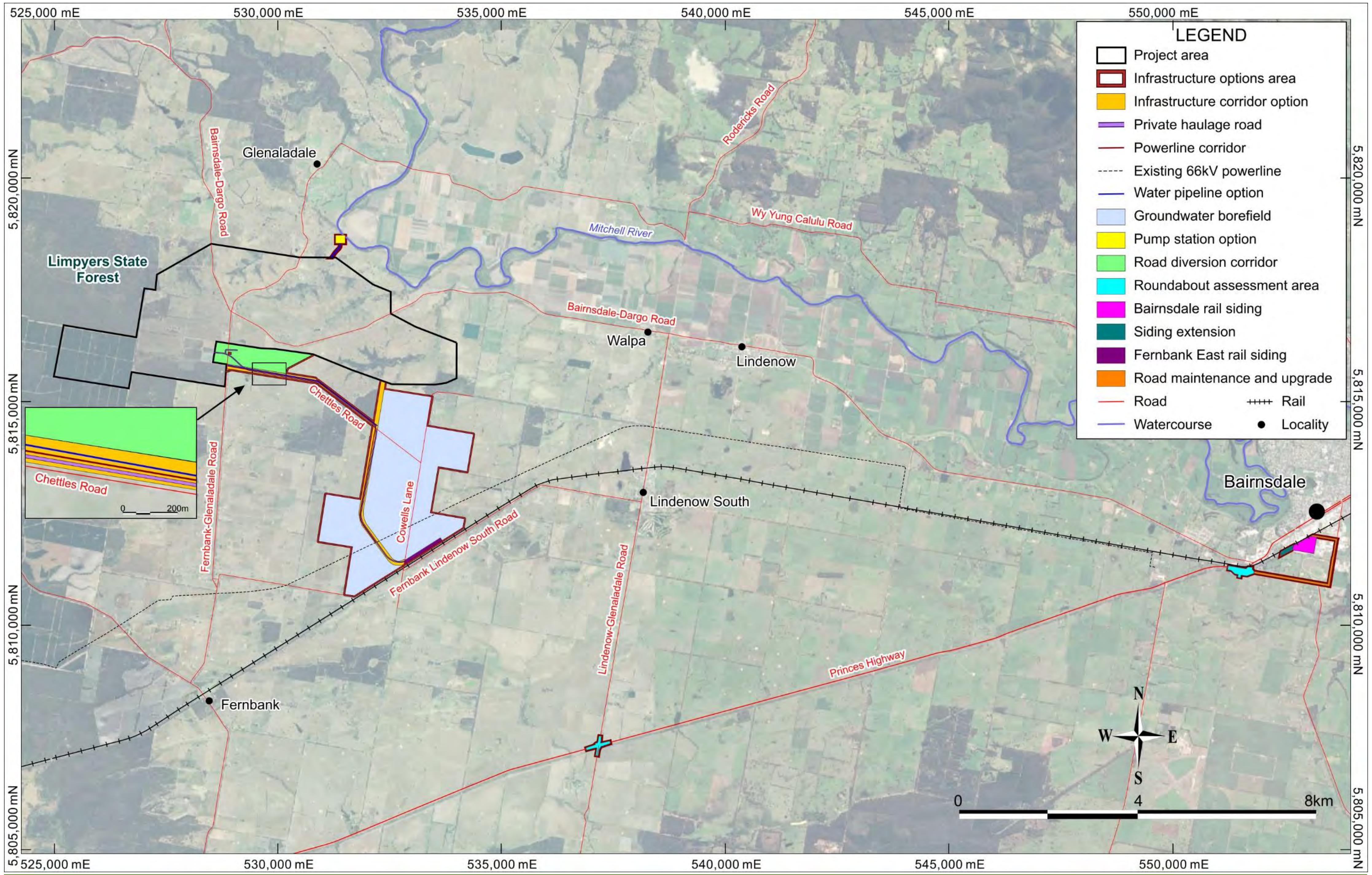

Figure 1-4: Location of Fingerboards proposed mining licence area (project area) in relation to planned activities outside this area.

Table 1-1: Key characteristics of the Fingerboards Mineral Sands Project

Item	Description
Project location	East Gippsland Shire, Victoria. The associated infrastructure extends to the Wellington Shire.
Mining licence	The proposed mining licence required for the Fingerboards project extends over an area of approximately 1,675 ha. About 1,350 ha of this area will be mined or disturbed by mining-related activities. A summary of land parcels lying wholly or partly within the proposed mining licence area is provided in Table 1-2 below.
Mining method	Open cut dry mining operation using conventional earthmoving equipment. Conventional earthmoving equipment will include scrapers, bulldozers, excavators and trucks and tractor scoops for topsoil removal. Mine dewatering will not be required. The mine void location will move over the life of the project. The void will be backfilled and rehabilitated progressively.
Mining production and feed rate	An estimated 170 Mt of ore will be extracted to produce approximately 8 Mt of heavy mineral concentrate (HMC).), depending on the mineral grade of the ore being processed. Following construction and commissioning, production will ramp up gradually initially commencing at 500 tph. At peak production, two mining units, operating in different areas of the mining licence, will be used to extract the ore. The second mining unit plant (MUP) is expected to start operating about 12 months after mine start up, but this could be delayed, depending upon market conditions. The expected maximum combined feed-rate of the ore to the two MUPs is 1,500 tph. Each MUP will have a capacity to treat up to 1,000 tph. Ore willcould be stockpiled and blended to provide suitable feed for the MUPs and ultimately the wet concentrator plant (WCP). This approach aims to manage levels of clay and economic minerals in the feed.
Mine life	Up to 20 years (including up to a two-year construction and commissioning period).
Processing methods	Ore processing will involve: • Screening and slurrying of ore at the MUPs. • Pumping of ore slurry to WCP. • Hydrocycloning of the ore to remove the fines tailings. • Dewatering of fines tailings by means of centrifugation • Processing of slurried ore by wet gravity to produce HMC. • Wet magnetic processing of the HMC in the WCP to produce magnetic (mainly ilmenite) and non-magnetic (mainly zircon) concentrates
Processing rate	The ore processing plant will have the capacity to treat 1,500 tph of slurried ore at the WCP at peak production, which equates to 12 Mtpa of ore.
Operating hours	24 hours a day, seven days a week, 365 days a year.

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Table 1-2: Land parcels lying wholly or partly within the proposed mining licence area

PARCEL_PFI (Persistent Feature Identifier)	PARCEL_SPI (Standard Parcel Identifier)	ADDRESS	Limitation on depth
45302707	53C~E\PP3311	290 Fernbank-Stockdale Road Fernbank 3864	50 ft
45302755	1\TP410901	2025 Bairnsdale-Dargo Road Walpa 3875	50 ft
45302754	60B~E\PP3311	2185 Bairnsdale-Dargo Road Fernbank 3864	15.24 m
45302753	59~E\PP3311	2185 Bairnsdale-Dargo Road Fernbank 3864	15.24 m
52598629	2\PS420109	2250 Bairnsdale-Dargo Road Walpa 3875	15.24 m
45302752	58~E\PP3311	2425 Bairnsdale-Dargo Road Fernbank 3864	'Nil'
45302793	13C~C\PP3311	1430 Fernbank-Glenaladale Road Walpa 3875	50 ft
45302791	12~C\PP3311	1500 Fernbank-Glenaladale Road Walpa 3875	50 ft
45302792	13~C\PP3311	2460 Bairnsdale-Dargo Road Walpa 3875	'Nil'
45310039	10~C\PP3311	1520 Fernbank-Glenaladale Road Walpa 3875	15.24 m
45303573	1\TP79707	2495 Bairnsdale-Dargo Road Fernbank 3864	15.24 m
52594463	3\PS418957	2610 Bairnsdale-Dargo Road Glenaladale 3864	15.24 m
5327493	1\LP127897	2495 Bairnsdale-Dargo Road Fernbank 3864	15.24 m
52594461	1\PS418957	1505 Fernbank-Glenaladale Road Glenaladale 3864	15.24 m
52594462	2\PS418957	1505 Fernbank-Glenaladale Road Glenaladale 3864	15.24 m
45302796	11A~C\PP3311	1375 Fernbank-Glenaladale Road Glenaladale 3864	50 ft
45302697	48~E\PP3311	1095 Fernbank-Glenaladale Road Fernbank 3864	No information available
50005294	3\PS343168	1175 Fernbank-Glenaladale Road Fernbank 3864	No information available
5327494	2\LP127897	2465 Bairnsdale-Dargo Road Fernbank 3864	15.24 m
45302695	52~E\PP3311	1235 Fernbank-Glenaladale Road Fernbank 3864	50 ft
5328058	2\PS333641	1255 Fernbank-Glenaladale Road Fernbank 3864	15.24 m
5328057	1\PS333641	1265 Fernbank-Glenaladale Road Fernbank 3864	15.24 m
50005293	2\PS343168	1334 Fernbank-Glenaladale Road Fernbank 3864	No information available
5327484	1\LP69778	2705 Bairnsdale-Dargo Road Glenaladale 3864	50 ft

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PARCEL_PFI (Persistent Feature Identifier)	PARCEL_SPI (Standard Parcel Identifier)	ADDRESS	Limitation on depth
50005292	1\PS343168	1334 Fernbank-Glenaladale Road Fernbank 3864	No information available
45302968	1~A\PP2436	190 Cowells Lane Walpa 3875	15.24 m
45302859	71\PP2436	150 Cowells Lane Walpa 3875	'Nil'
124195167	2\PS527892	80 Cowells Lane Walpa 3875	'Does not apply'
45302833	61A~E\PP3311	2025 Bairnsdale-Dargo Road Walpa 3875	'Nil'
45302834	61B~E\PP3311	2025 Bairnsdale-Dargo Road Walpa 3875	No information available
45302788	K\PP3311	2095 Bairnsdale-Dargo Road Walpa 3875	'Nil'
45310023	J\PP3311	2070 Bairnsdale-Dargo Road Walpa 3875	'Nil'
52598651	2\PS420110	50 Careys Road Walpa 3875	15.24 m
52842782	13F~C\PP3311	50 Careys Road Walpa 3875	15 m
52842781	13E~C\PP3311	1 Careys Road Walpa 3875	15 m
45310021	F\PP3311	120 Careys Road Walpa 3875	'Nil'
45310020	G\PP3311	120 Careys Road Walpa 3875	'Nil'
45302836	1\TP382368	425 Chettles Road Lindenow South 3875	50 ft

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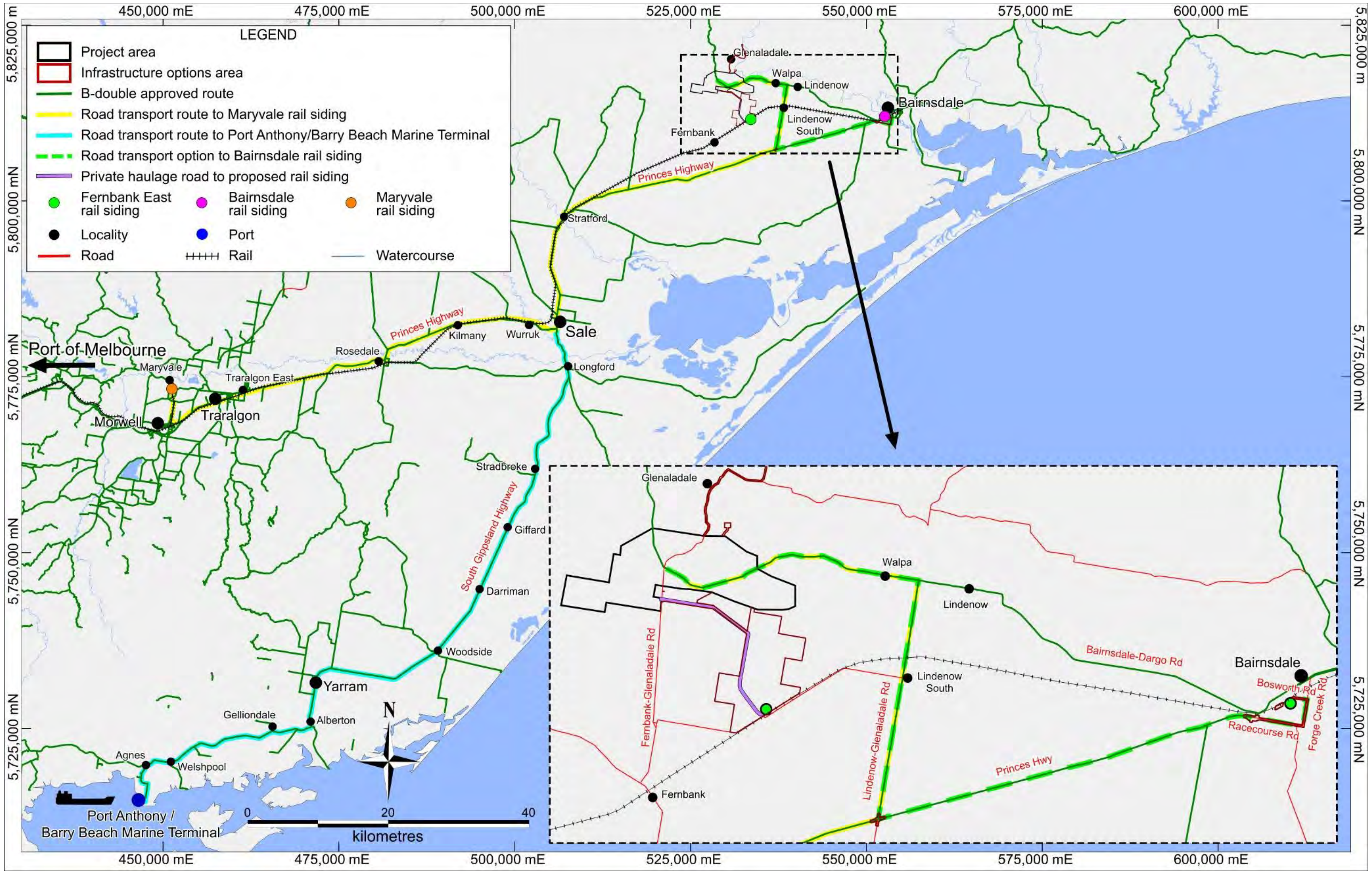

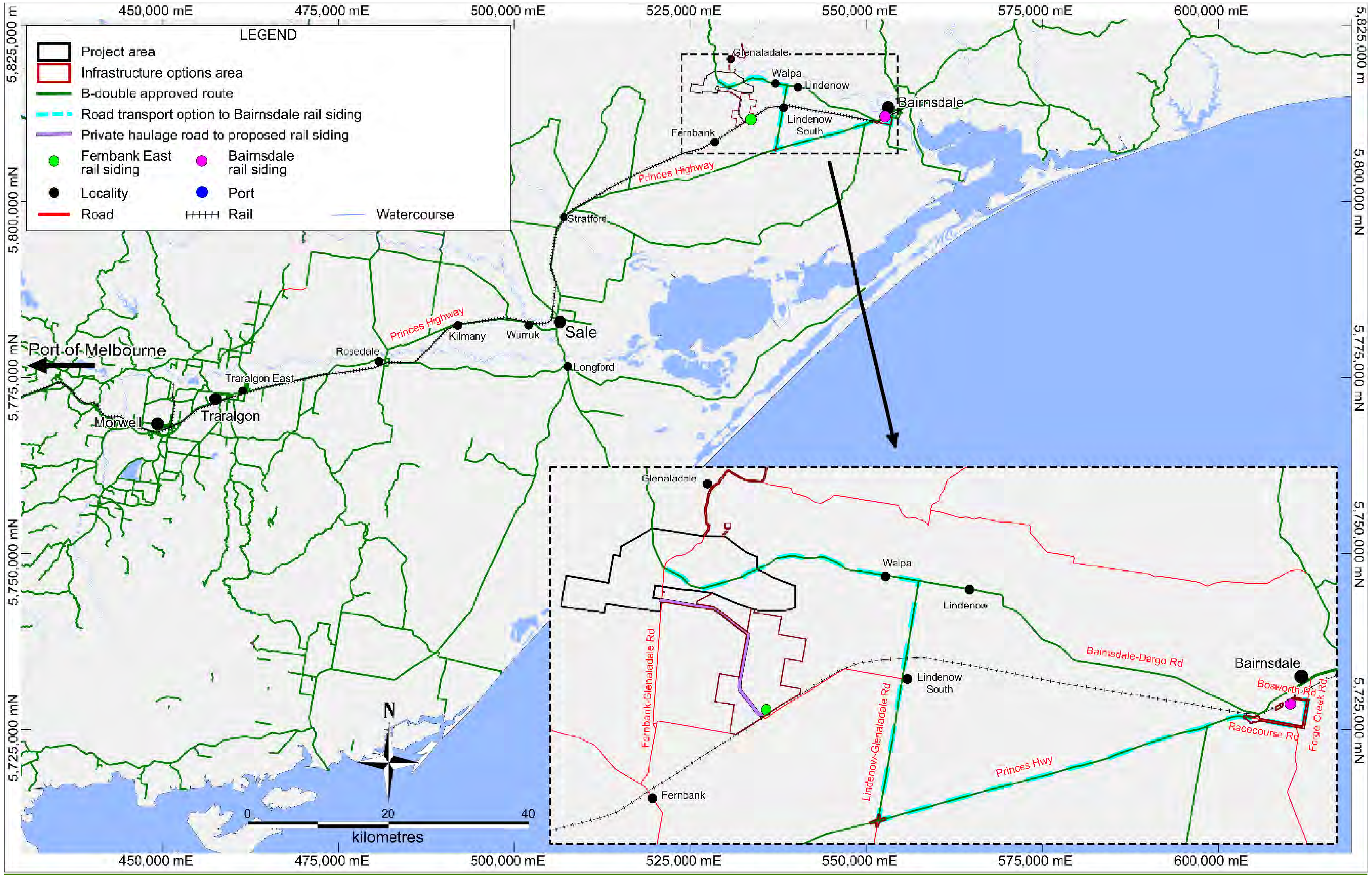

Figure 1-55: Proposed B-double transport routes from the project area to rail sidings or export ports

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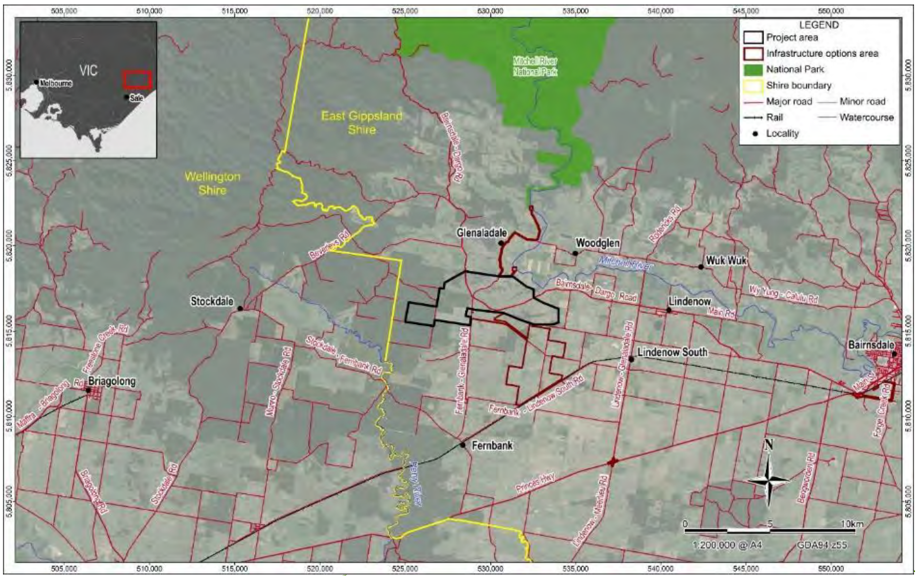
2 PROJECT CONTEXT

2.1 Project location

The mineral resource targeted by the Fingerboards project – the Glenaladale mineral sands deposit (Glenaladale deposit) is situated in the East Gippsland region of Victoria and straddles the East Gippsland Shire and Wellington Shire boundaries near the locality of Glenaladale, approximately 25 km west of Bairnsdale and about 250 km east of Melbourne (Figure 2-1). The operational areas of the Fingerboards project are located entirely in the East Gippsland Shire.



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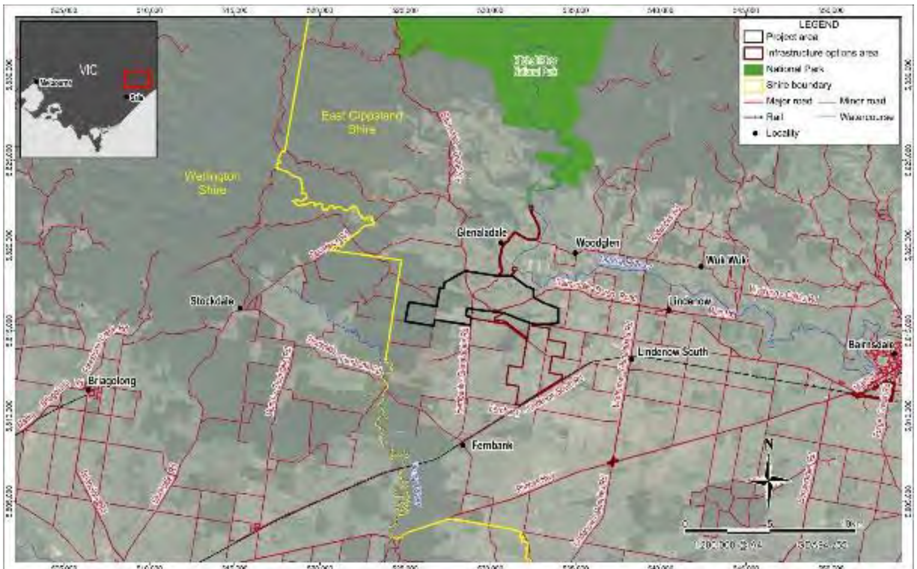
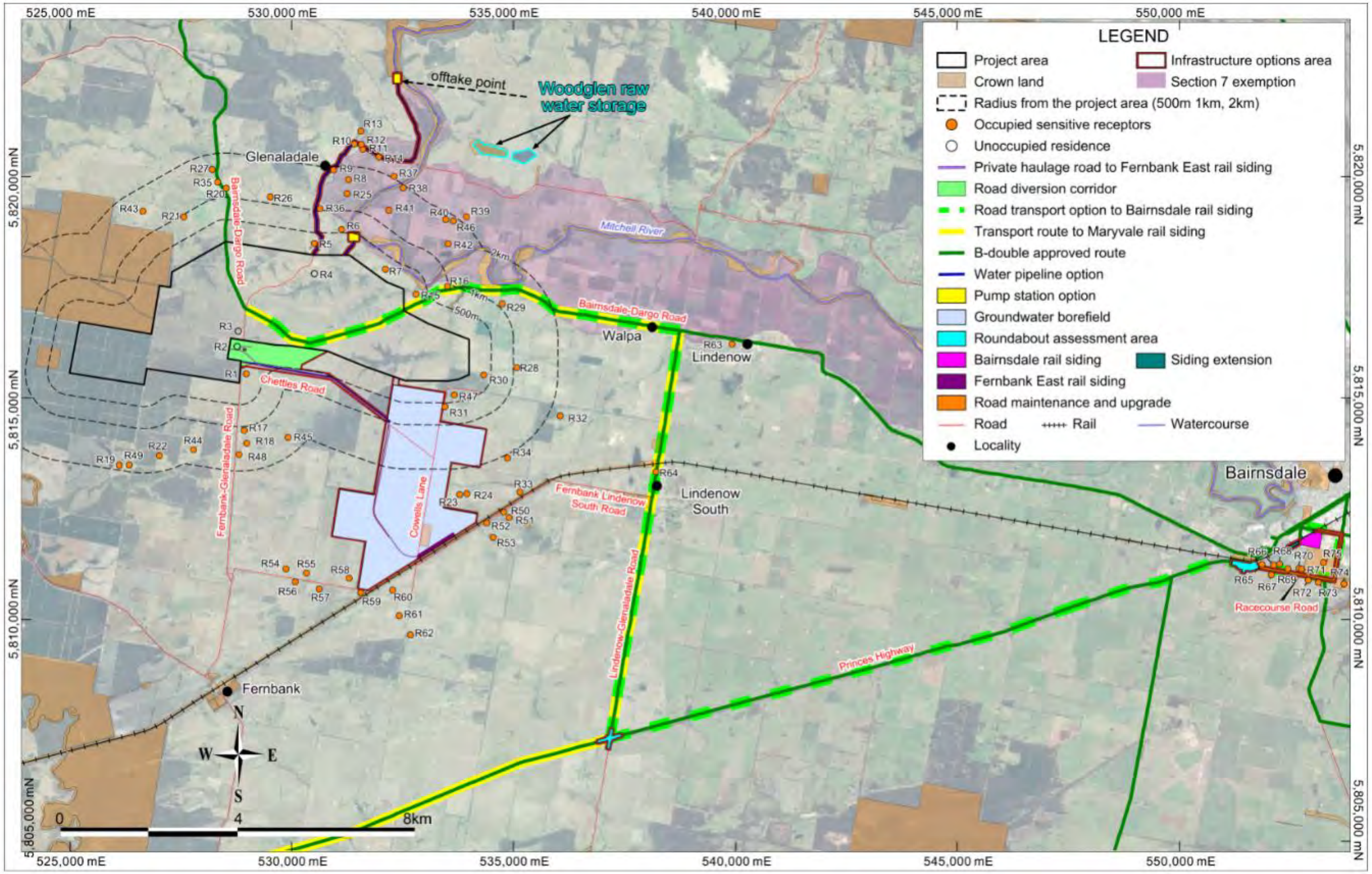


Figure 2-1: Location plan showing local government boundaries

2.2 Land tenure and use

The proposed mining licence area will match the project boundary (Figure 2-1) and lies within the traditional territory of the Brabralung people, one of five clans of the Gunaikurnai nation. The Gunaikurnai people occupied the Tambo, Nicholson and Mitchell River catchments between the Victorian Alps and the Gippsland Lakes. The project lies within an area circumscribed by the determined native title claim area of the Gunaikurnai people (VCD2010/001). The Gunaikurnai traditional owners, through the Gunaikurnai Land and Waters Aboriginal Corporation (GLaWAC), continue to play an active role in planning and management of land in parks and reserves in central, south and east Gippsland.

The proposed mining licence area is in a predominantly rural, agricultural landscape, intersected by roads. There are no historic land uses at the Fingerboards site that are likely to materially impact the proposed mine design. Private residences are the main sensitive human receptors within a 5 km radius of the proposed mining licence area. No schools, hospitals, churches or other non-residential sensitive receptors are located within a 5 km radius of the project boundary. Figure 2-2 shows the locations of residential properties identified within and around the proposed mining licence area. Other types of sensitive receptors – for example, public roads and other public infrastructure, surface water bodies, existing groundwater bores, horticultural cropping areas – are considered in this work plan where relevant, in the context of potential environmental impacts. Figures showing the locations of non-human receptors (for example, water bodies or public infrastructure) are presented throughout the work plan.



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~~Figure 2-2: Locations of residential properties and other sensitive receptors, relative to the proposed mining licence area (project area) boundary.~~

Two residences exist within the project boundary (shown as 'R3' and 'R4' on ~~Figure 2-2~~Figure 2-2), both of which are owned by Kalbar. A third dwelling ('R2') ~~just~~ outside the proposed mining licence area, is also owned by Kalbar. There are ~~eleven~~twelve residences and four vacant small holdings which are considered as house lots outside the project boundary, but within 1 km of the proposed

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mining licence boundary (Figure 2-2).

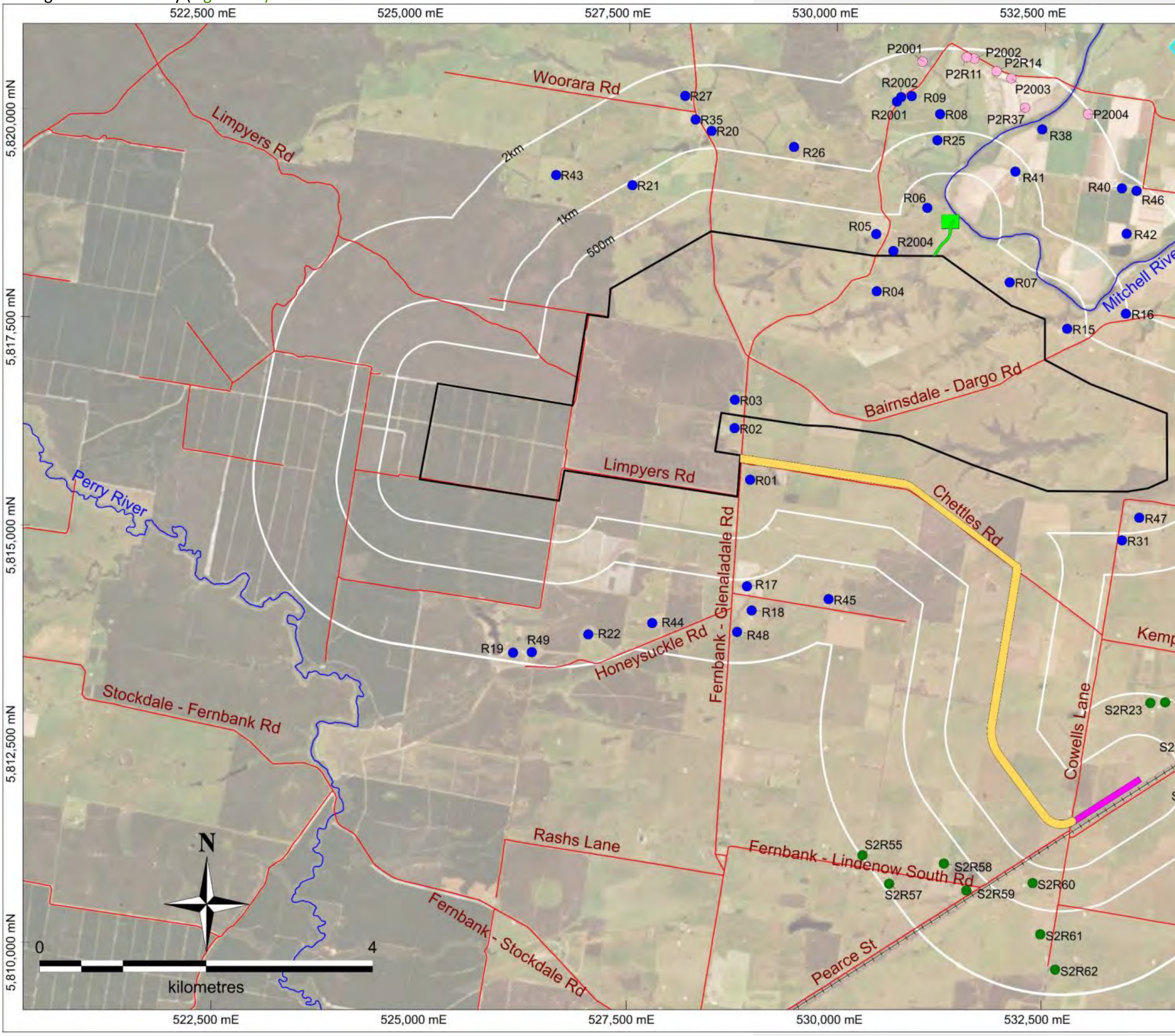

Figure 2-2Figure 2-2). Several gazetted roads cross the proposed mining licence area and a telecommunications tower sits in close proximity to the southern boundary of the project.

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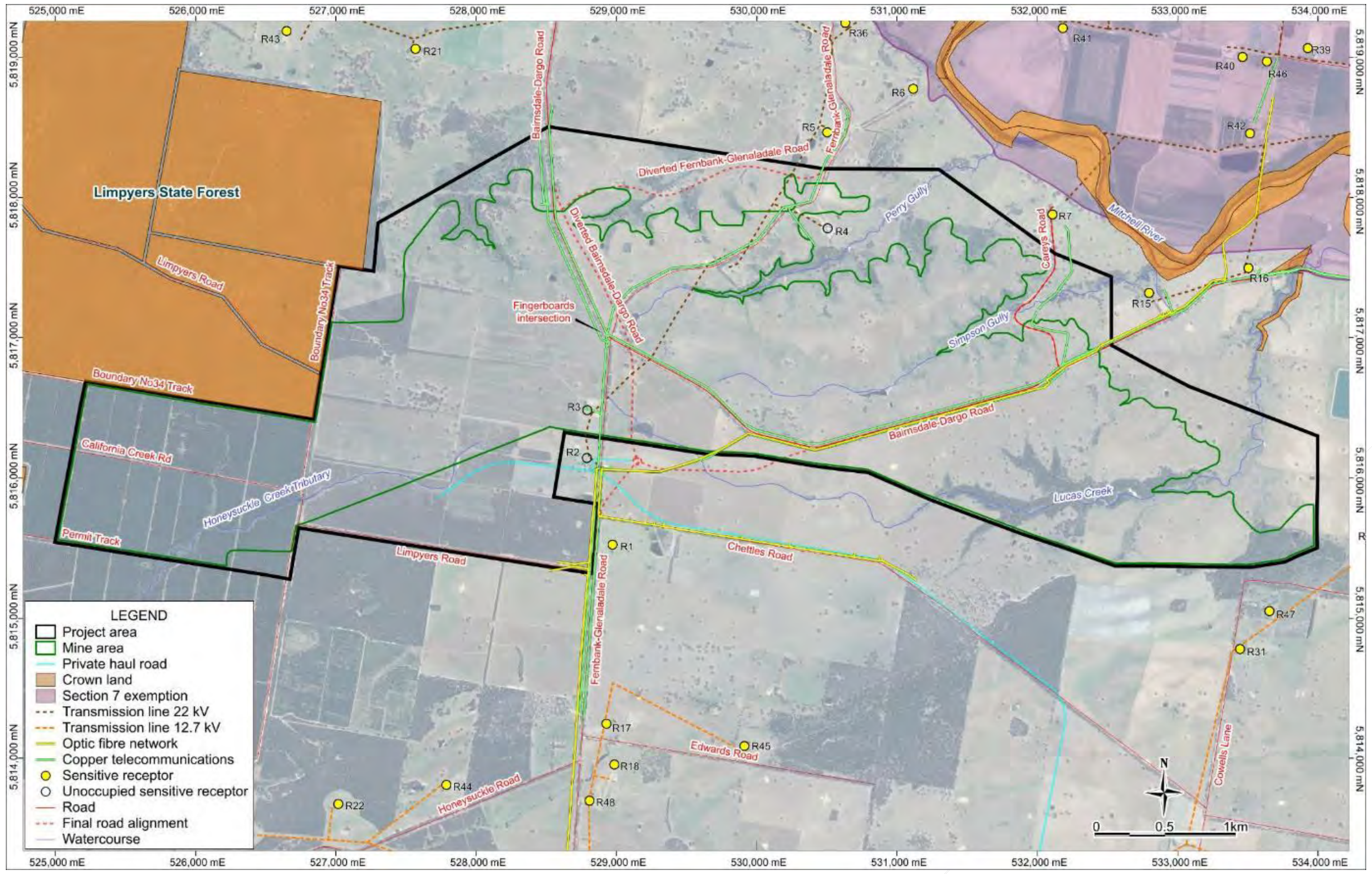
Transmission lines, optic fibre networks, copper telecommunications lines and crown land are presented in Figure 2-3.


LEGEND
Project area
Mine area
Private haul road
Crown land
Section 7 exemption
Transmission line 22 kV
Transmission line 12.7 kV
Optic fibre network
Copper telecommunications
Sensitive receptor
Unoccupied sensitive receptor
Road
Final road alignment
Watercourse
Limpyers State Forest
Limpyers Road
Boundary No34 Track
California Creek Rd
Honeysuckle Creek Tributary
Permit Track
Fingerboards intersection
Bairnsdale-Dargo Road
Fernbank-Glenaladale Road
Diverted Fernbank-Glenaladale Road
Diverted Bairnsdale-Dargo Road
Perry Gully
Simpson Gully
Lucas Creek
Mitchell River
Chettles Road
Edwards Road
Honeysuckle Road
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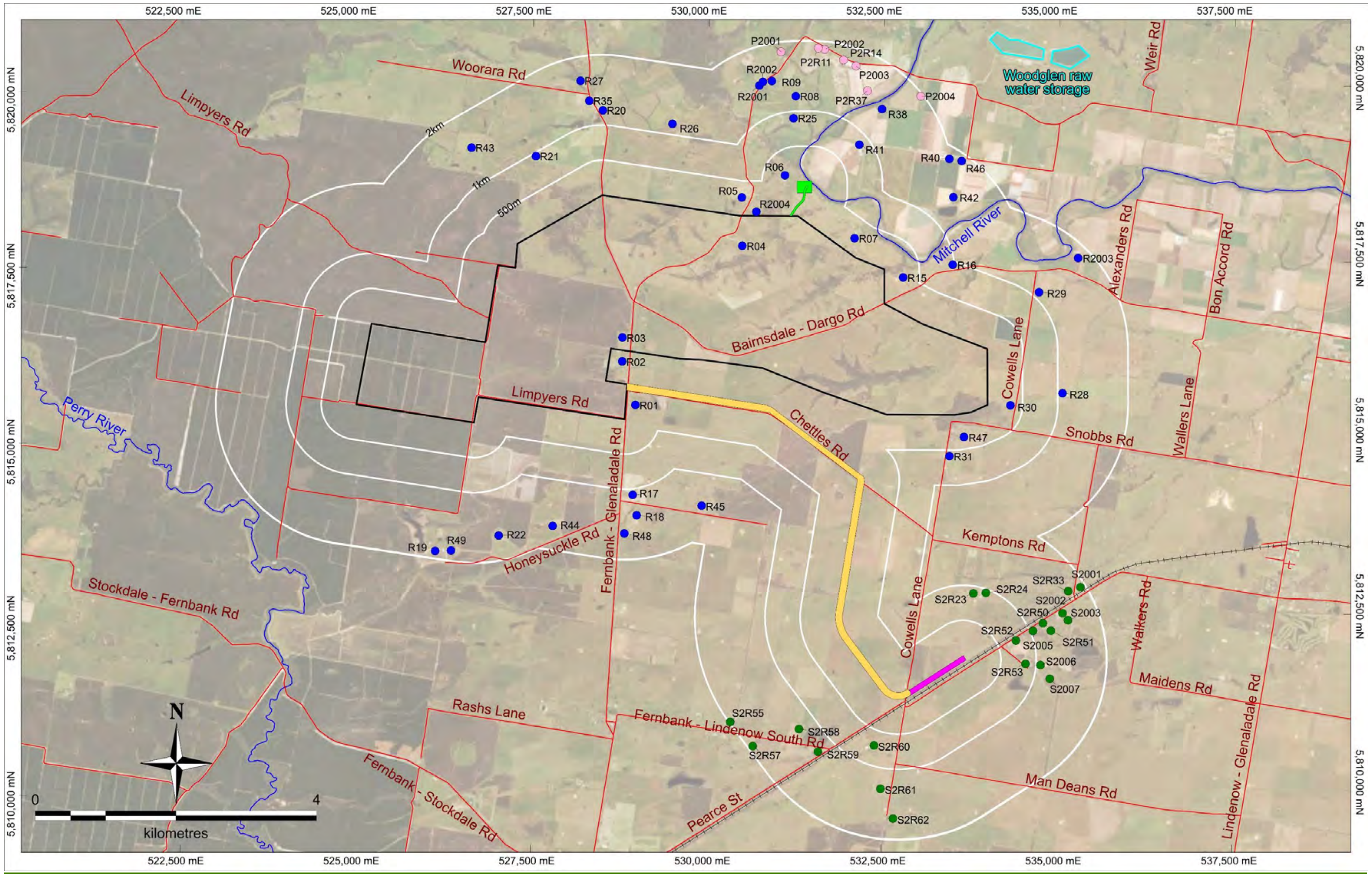

Figure 2-2: Locations of residential properties and other sensitive receptors, relative to the proposed mining licence area (project area) boundary.

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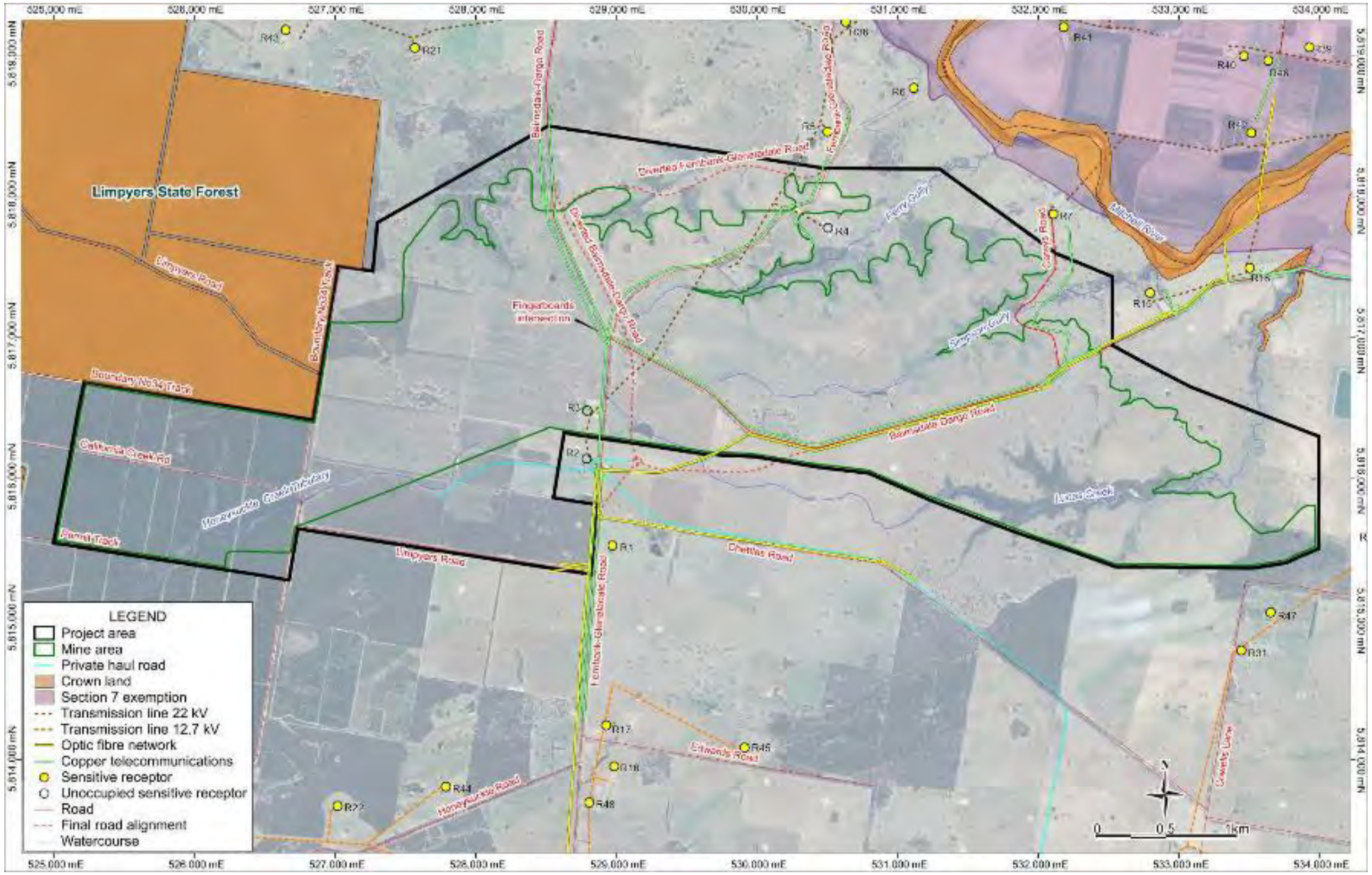
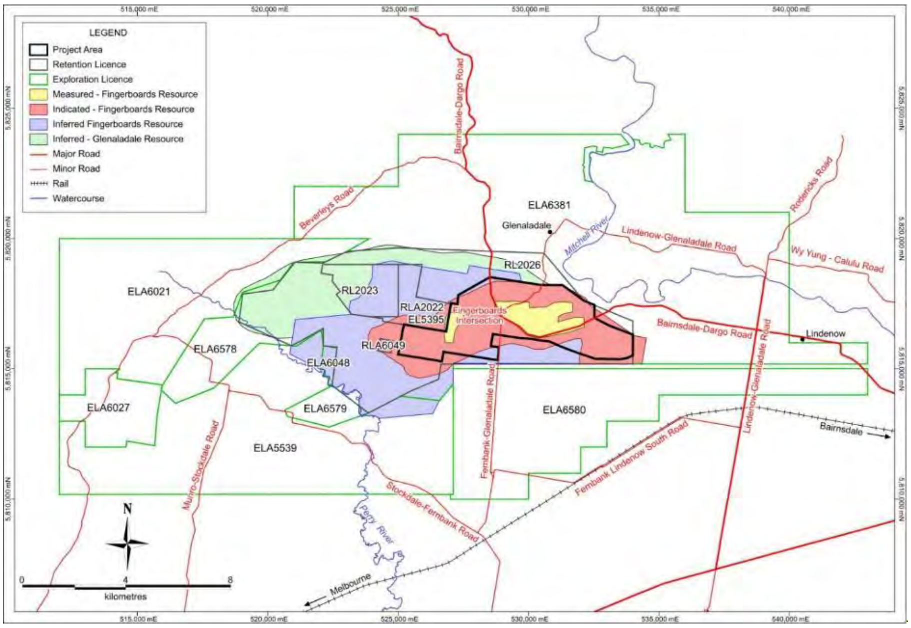


Figure 2-3: Map showing infrastructure and Crown Land within and around the proposed mining licence area

The Fingerboards Project lies within a single retention licence (RL2026), which covers part of a very large mineral sands deposit known as the Glenaladale Mineral Sands Deposit (Figure 2-4). The Glenaladale Mineral Sands Deposit ~~comprises~~extends over 57.4 km^2 of mining tenure under three retention licences and one exploration licence.

The project primarily overlies freehold land (the remaining land is made up of road reserves). Kalbar is the largest landowner in the proposed mining licence area.



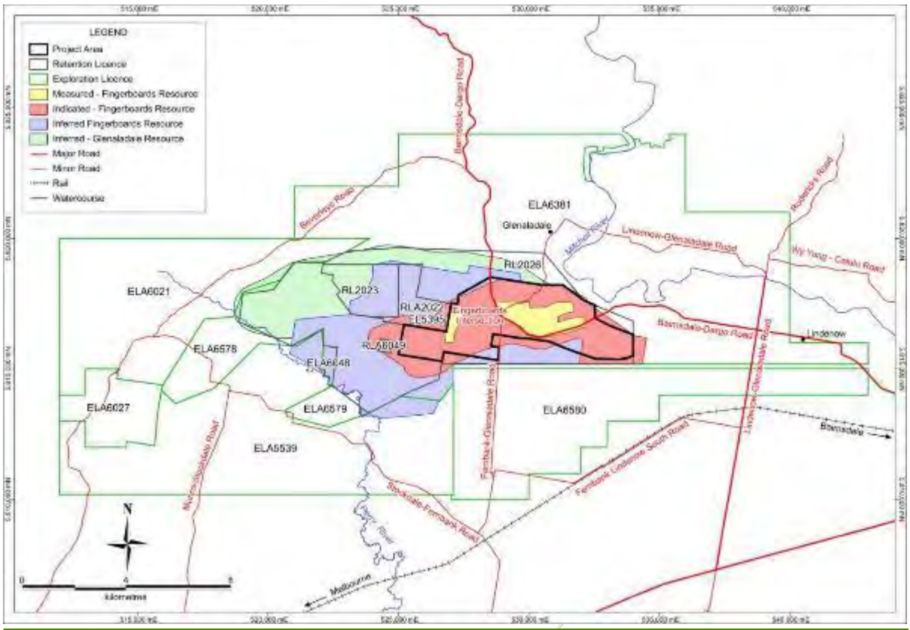


Figure 2-~~4:~~ 4: Mining tenure – Fingerboards exploration and retention licences

The mining operations area lies within a designated farming zone. Currently, the mine site and its environs are predominantly used for dryland agriculture and to a lesser extent for timber production and rural living purposes (Figure 2-5~~Figure 2-45~~). Dryland agricultural uses within the project footprint include grazing of livestock (beef cattle and sheep for wool). There are three timber plantations (pine and blue gum) within the project footprint, one which was largely felled after a bushfire in 2013 and is now owned by Kalbar, one being blue gums nearing maturity. Approximately 189 ha of a regionally extensive pine plantation overlies the western part of the proposed mining licence area. There are areas of remnant native vegetation along gullies, creeks and roadside reserves.

Surrounding land uses include wool and meat sheep production, grazing of beef and dairy cattle, vegetable production and broadacre cropping, timber production and areas of native vegetation suitable for conservation, recreation and tourism purposes. The settlements of Walpa and Lindenow South ~~lies~~lie to the east of the proposed mining licence area. The Gippsland Line railway passes to the south of the proposed mining licence area. The Mitchell River National Park lies approximately 4 km northeast of the proposed mining licence area.

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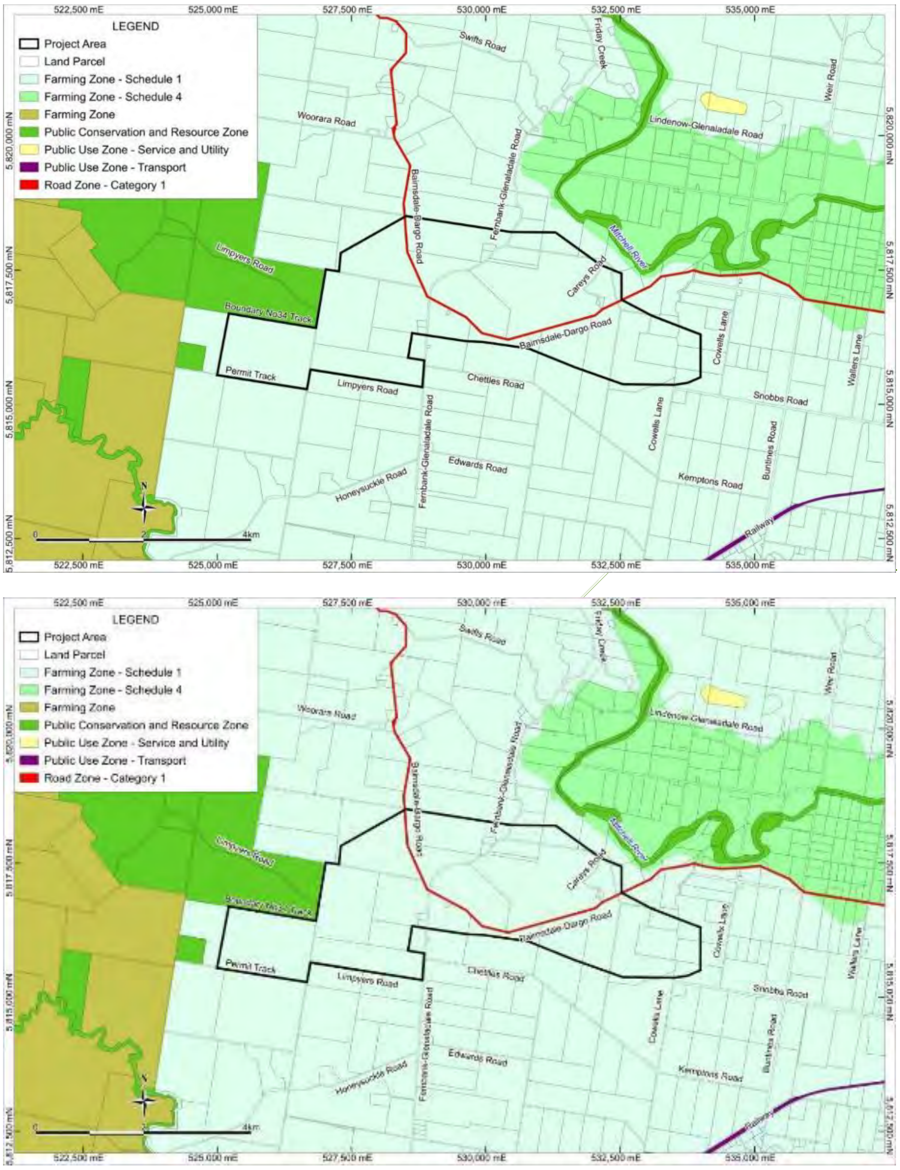

Figure 2-545: Land use planning zones in proposed mining licence area (project area).

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2.3 Climate

Average monthly rainfall in the project locality has historically been highest in spring or early summer and lowest in winter, but with a relatively even distribution of rainfall through out the year (Figure

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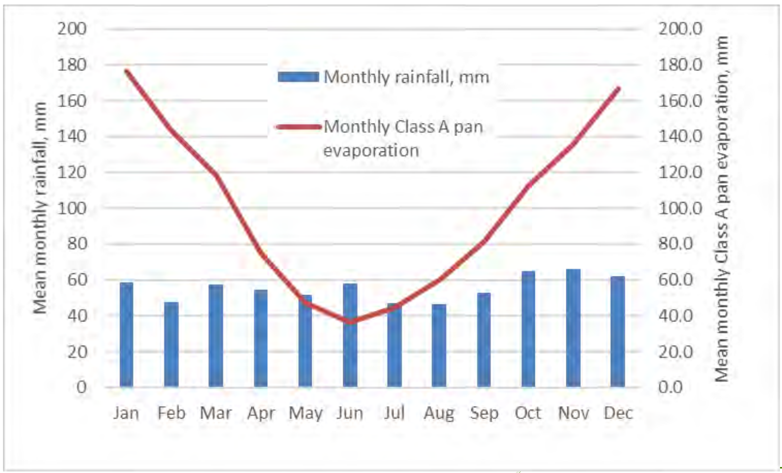
2-6Figure 2-56). Year to year rainfall can show large deviations from the long term median value of approximately 650 mm/year (Table 2-1; Figure 2-7Figure 2-67). Annual average potential evaporation is approximately 1350 mm. On average, potential evaporation exceeds rainfall in all months except June (Figure 2-6Figure 2-56).



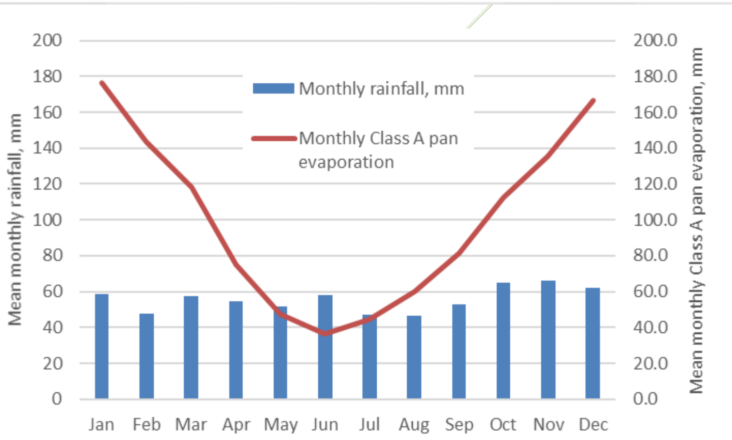


Figure 2-656: Mean monthly rainfall and potential evaporation (Lindenow, Stn noNo 085050)

Table 2-1: Annual rainfall statistics, Lindenow (Station No. 085050)

Annual rainfall statistic	Annual rainfall, mm
Minimum	379
10th percentile	486
50th percentile	650
90th percentile	880
Maximum	1118

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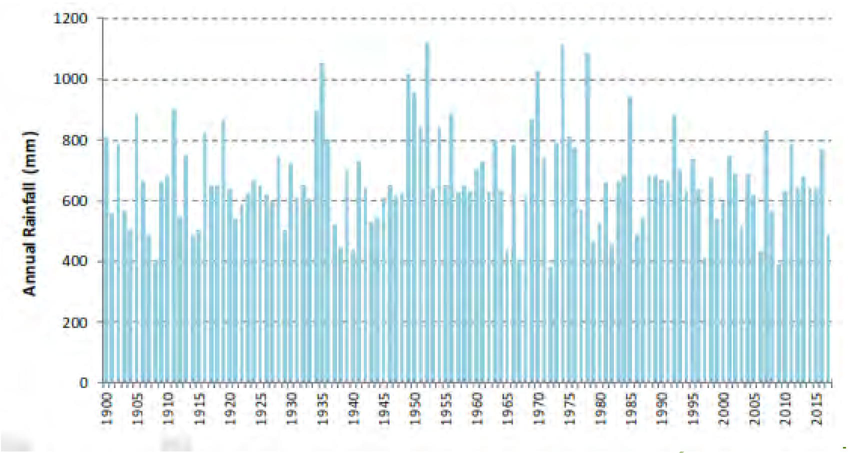

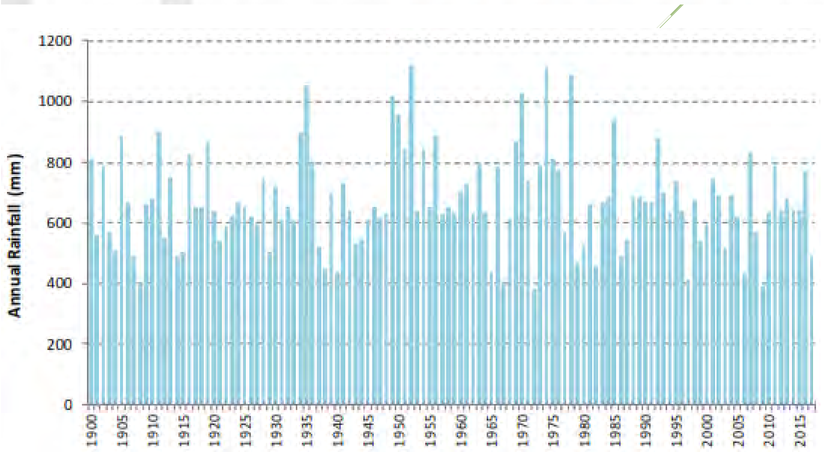

Figure 2-767: Annual rainfall, 1901 – 2017 (Lindenow meteorological station, Stn no 085050)

Significant long duration storm events for the Gippsland region are typically caused by intense low pressure systems forming off the east coast of Australia, commonly referred to an “east coast low”. These weather systems can cause intense rainfall over a period of 1 to 3 days. The critical storm intensities for the site are associated with ‘east coast low’ weather events. A summary of rainfall amounts and probabilities for various storm durations is provided in Table 2-2.

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Table 2-2: Design rainfall depths – various storm durations and exceedance probabilities

Duration (hrs)	Annual exceedance probability (AEP), %						
	63.2%	50%	20%	10%	5%	2%	1%
1	16.5	18.7	26.2	31.8	37.6	46	52.9
2	21.4	24.2	33.6	40.5	47.8	58.2	66.9
3	25.1	28.4	39.3	47.4	55.8	68	78
6	33.4	37.8	52.8	63.7	75.1	91.2	104
12	44.7	51	72	87.2	103	124	142
24	58.6	67.5	96.4	117	138	165	186
48	73.3	84.8	121	146	171	201	224
72	80.9	93.6	133	159	184	215	238
96	85.6	98.8	139	165	190	221	243
120	88.7	102	143	168	192	223	246
144	90.9	105	145	170	194	224	247
168	92.7	106	146	171	194	225	248

Note: Data sourced from Australian Rainfall Runoff Data Portal April 2018

2.4 Surface hydrology

The proposed mining licence area is dominated by a plateau which is incised in the east by sharply rising river terraces, eroded gullies and drainage lines that flow mostly towards the Mitchell River. The western side of the proposed mining licence area drains more gradually to the south west, to headwaters of the Perry River.

Approximately 75% of the proposed mining licence area drains to the Mitchell River catchment. In the north this is via tributaries to Long Marsh Gully and Moilun Creek, which join the Mitchell River approximately 600 m upstream of the project site. Eastern and southern portions of the proposed mining licence area drain via eroded gullies and waterways (namely Perry Gully, Simpson Gully and Lucas Creek) directly to the Mitchell River. The remaining western portion of the site drains to a tributary of Honeysuckle Creek, which itself is a tributary of the Perry River. All water courses in the mining licence area are ephemeral in nature and typically flow only a few times a year following moderate to heavy rainfall. Subcatchments in the proposed mining licence area are shown in Figure 2-8~~Figure 2-78~~.

The Mitchell River, which lies approximately 400 m northeast of the proposed mining licence boundary, is the largest perennial river in Victoria. Baseflow indices suggest that the Mitchell River is a mildly baseflow-fed system: it receives groundwater discharge from surrounding land. However, during times of high rainfall and river flow the river is most likely a source of recharge to the adjoining alluvial sediments. The Perry River, located to the west of the Fingerboards project site, generally only flows during times of high rainfall and thus ~~would~~ only ~~represent~~represents a source of groundwater recharge during these episodic events.

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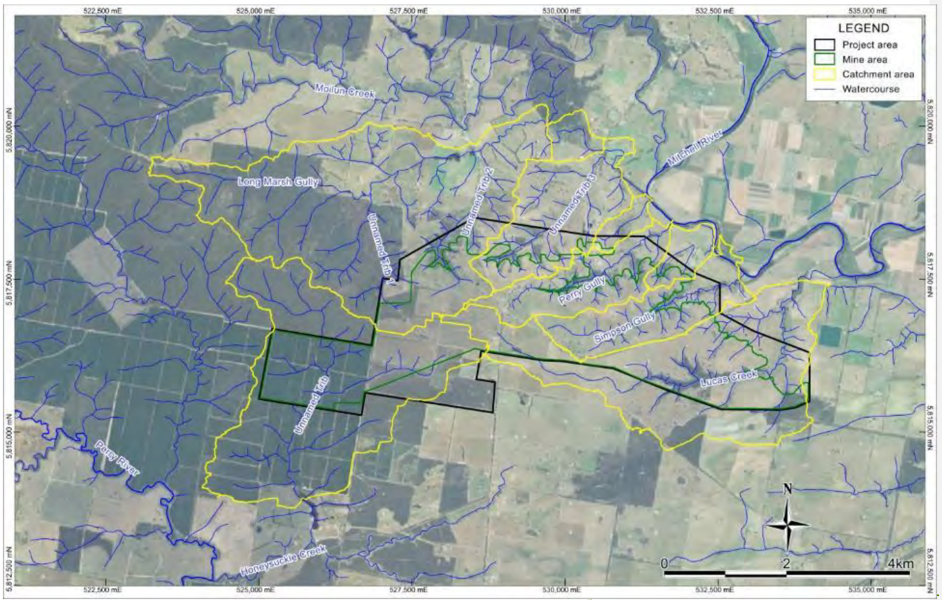

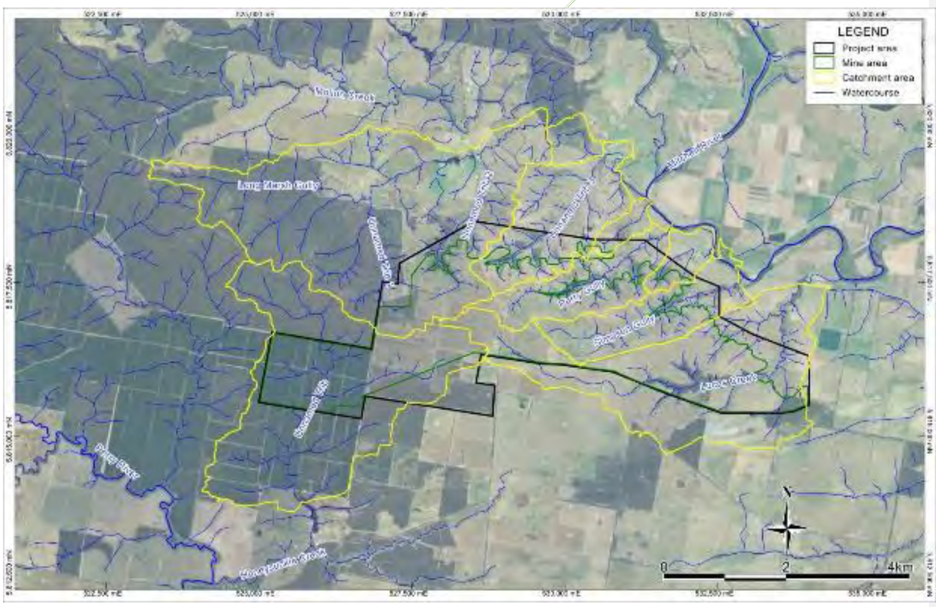

Figure 2-~~87~~8: Proposed mining licence area (project area) subcatchments

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2.5 Groundwater

2.5.1 Hydrostratigraphy

Three stratigraphic units overlie the pre-Tertiary age basement bedrock that extends over the entire East Gippsland region. Recharge to all aquifer units within the basin is likely to be dominated by rainfall infiltration in the outcrop areas towards the Great Dividing Range. Recharge to deeper units relies on leakage from overlying units and through-flow.

The basement rock comprises sedimentary, metamorphic and igneous rocks of the Ordovician, Silurian and Devonian ages. These indurated mudstones and sandstones function as a fractured rock aquifer system but are generally very low yielding and not used for development purposes. The main stratigraphic units which lie above the basement rock are summarised in the sections below.

Upper System

The Upper System comprises (from most recent to oldest): Quaternary alluvial sediments, the Haunted Hill Formation/Coongulmerang Formation and the Boisdale Formation. The Quaternary alluvial aquifers are typically thin and occur at shallow depths along river valleys and flood plains and in dune deposits near the coast. They comprise undifferentiated sands, gravels and clays. Groundwater from these shallow, unconfined aquifers discharges to streams, wetlands and the Gippsland Lakes.

The Haunted Hill Formation is an extensive upper Tertiary to lower Quaternary sedimentary unit which conformably overlies the older Tertiary units across most of the Gippsland Basin and the East Gippsland coastal plain. It consists of sands, gravels and clays and is characterised by a wide range of ~~particles~~particle sizes. The Haunted Hill Formation overlies the Coongulmerang Formation, which contains the minerals sands targeted by the Fingerboards Project. The Coongumerang Formation typically comprises yellow micaceous silt and fine quartz sand with occasional coarser sandy lenses.

The Boisdale Formation is an extensive fluviatile system comprising an upper unit (Nuntin Clay) and a lower sand unit (Wurruk Sand). The Boisdale Formation is the recognised groundwater resource in the Sale region, with sediments laterally grading south-eastwards into the marine Jemmy's Point Formation. The Wurruk Sand unit of the Boisdale Formation is thought to be up to 70 m thick south of the project site but thins and becomes discontinuous towards the Lakes Entrance Platform (north of the Princes Highway~~.~~).

Middle System

The Middle System can be broadly classified into two main sub-systems: the Latrobe Valley Coal Measures (LVCM)/Balook Formation and the Seaspray Group.The Latrobe Valley Coal Measures mostly lie to the west and northwest of the Fingerboards Project locality and grade laterally into the barrier sands of the Balook Formation and other Seaspray Group units. In a strict sense, the Balook Formation falls within the Seaspray Group.

The Seaspray Group is the lateral, seaward equivalent of the Latrobe Valley Coal Measures. It comprises marine sediments and the term 'Seaspray Group' is used as the collective nomenclature for the Wuk Wuk Marl, Lake Wellington, Gippsland Limestone and Lakes Entrance ~~Formation~~Formations. These carbonate units are typically 100 to 500 m thick onshore, increasing in thickness offshore towards the south and east. The marine sediments tend to be fine grained, low permeability formations. They are typically low yielding and development is generally limited to stock and domestic use only (GHD 2015).

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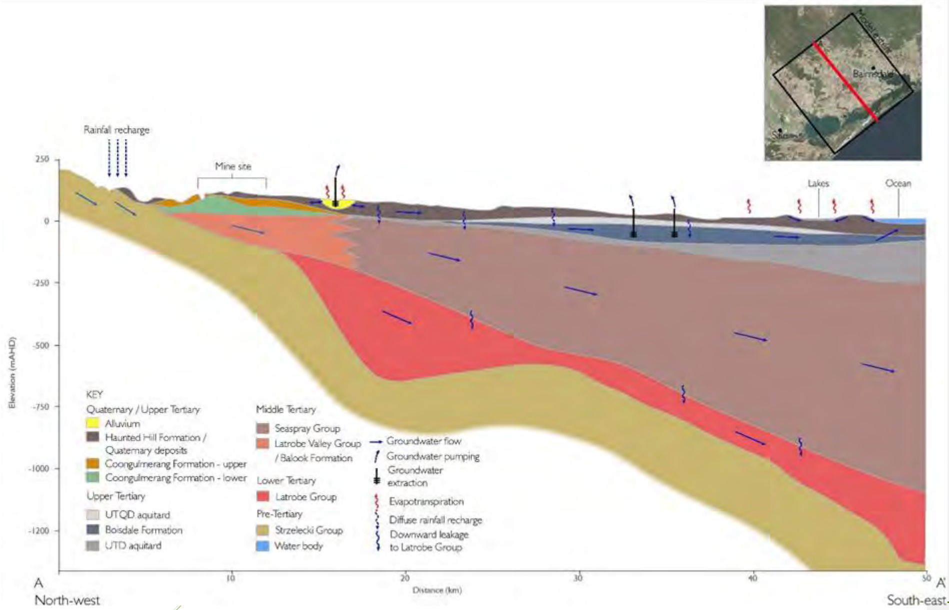
Lower System

The lower system comprises the Latrobe Group, specifically the Traralgon Formation (onshore) and its offshore equivalent, the Cobia Subgroup. The Traralgon Formation is a non-marine unit, consisting of sandstone, claystone and coals. The Victorian Aquifer Framework (DSE, 2012) shows that the Latrobe Group pinches out south of the southern boundary of the Fingerboards Project site and recent delineation drilling undertaken by Kalbar supports this concept. Therefore it is likely that in the immediate (proposed) mining licence area the Middle System units are in direct contact with the underlying Pre-Tertiary Strezlecki Group basement rock (Figure 2-9~~Figure 2-89~~).

Where present, the upper part of the Latrobe Group is a recognised groundwater resource and has been developed for both irrigation use and industrial use, including for the Longford Gas Plant and associated power generators located in the Latrobe Valley, which depressurise the lower system as part of the open cut mine operations.



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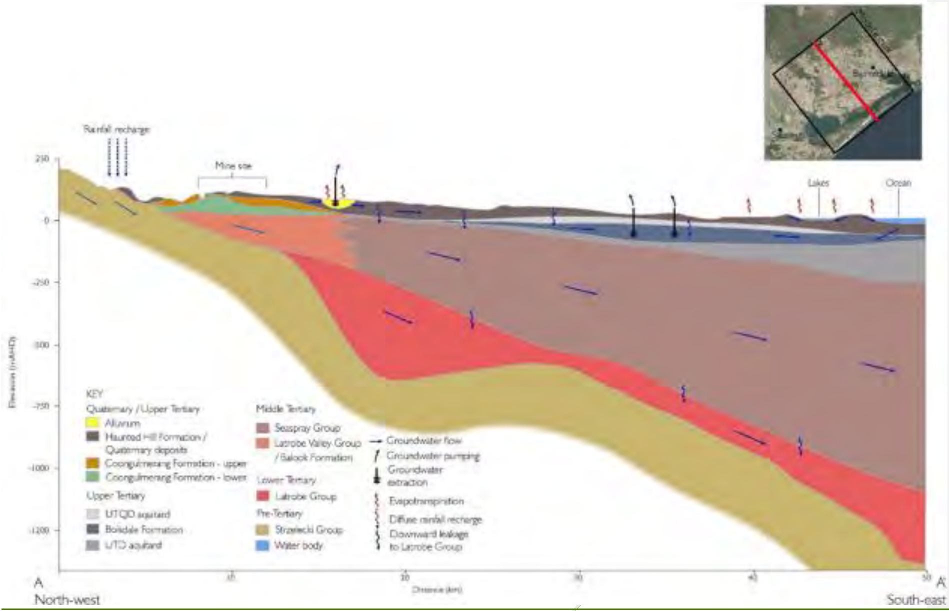
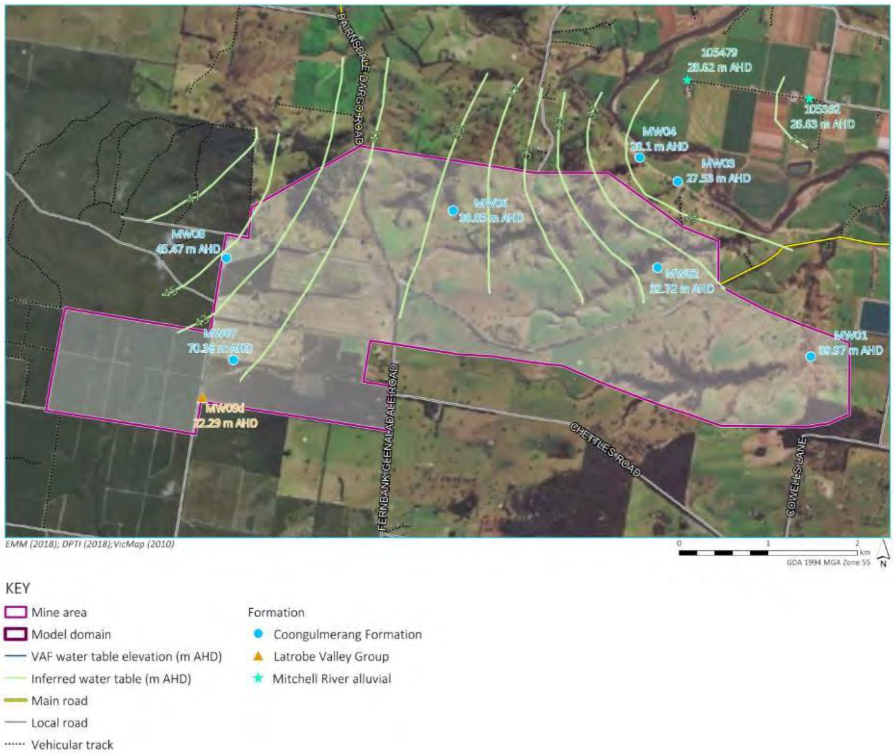


Figure 2-989: Stratigraphic cross section (NW-SE)

The pre-mining water table is hosted within the basal section of the Coongulmerang Formation, with pre-mining groundwater levels ranging from around 39 m AHD (corresponding to a depth of approximately 75 m below surface) at the centre of the project site to around 27 m AHD within the Mitchell River floodplain (corresponding to a depth of approximately 8 m below surface). Groundwater levels measured within the underlying Latrobe Valley Group/Balook Formation are lower, with site-based measurements of around 22.3 m AHD being recorded. The depth of open cut mining at the Fingerboards will range from just a few metres to a maximum depth of 50 m below surface (the maximum depth of mining corresponding to an elevation of approximately 70 m AHD). No part of the mine pit will intersect the groundwater table. Typically, the mine pit floor will lie about 30 m above the shallowest watertable level.

The local groundwater system flows from the west or northwest towards the east, where the majority of groundwater discharges to the alluvium floodplain system, supporting baseflow to the Mitchell River (Figure 2-10Figure 2-910). Regional groundwater flow in the underlying Boisdale Formation has a more southerly flow direction (Figure 2-11Figure 2-1011).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MW04
28.1 m AHD
MW03
27.53 m AHD
MW05
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MW08
45.47 m AHD
MW02
32.72 m AHD
MW07
70.36 m AHD
MW01
38.97 m AHD
MW09d
72.29 m AHD
EMM (2018); DPTI (2018);VicMap (2010)
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Formation
Coongulmerang Formation
Latrobe Valley Group
Mitchell River alluvial

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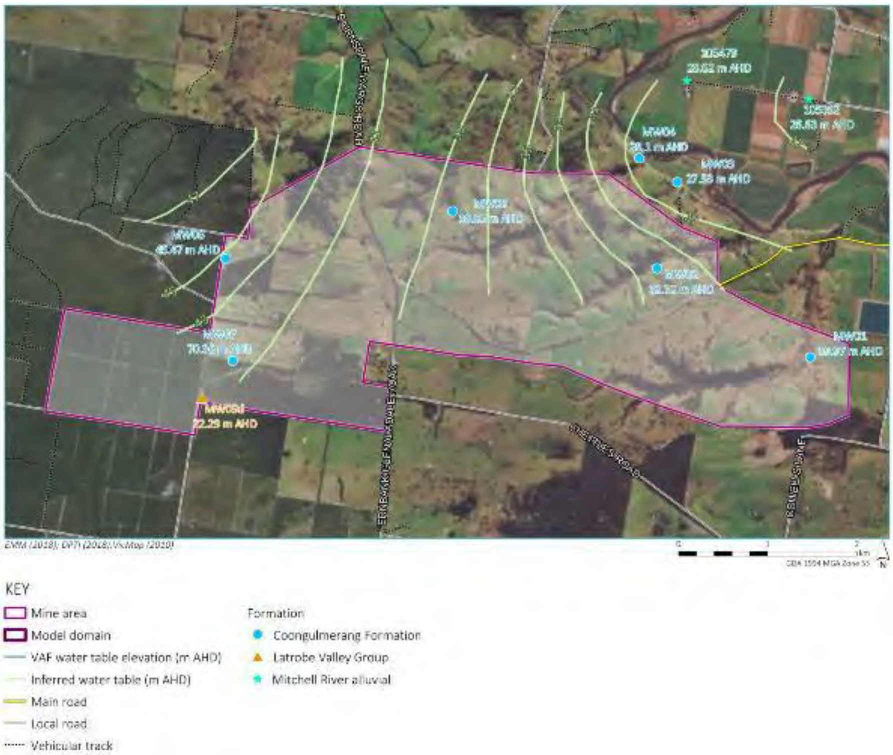

Figure 2-10910: Groundwater flow directions – shallow alluvial system

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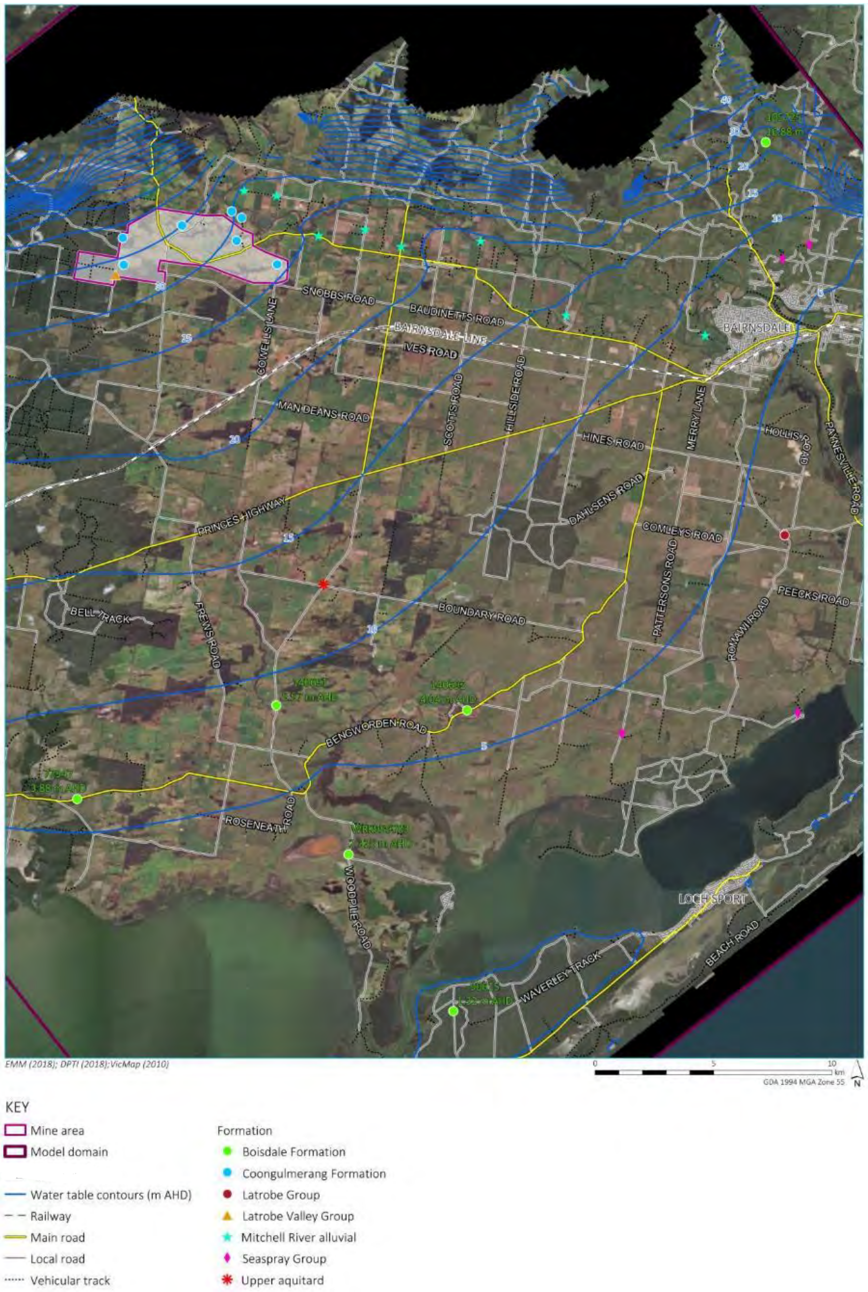

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Figure 2-111011: Groundwater flow directions – Boisdale Formation

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2.5.2 Localised Hydrostratigraphy

The variable clay content within the Coongulmerang Formation may ~~feasibly~~ result in locally perched groundwater lenses that exist above the regional groundwater table (such as that encountered at borehole MW07). The available data, including 380 exploration boreholes, suggest that~~,~~ where these clay horizons exist, they are laterally discontinuous and are unlikely to significantly influence the geometry of the groundwater mound that has been predicted by the groundwater model.

There were three logged occurrences of water noted in Rio Tinto borehole logs. Two of these boreholes are located west of the project area and indicate perched groundwater in the Haunted Hill Formation. The other borehole (GD001), which is located at the north end of the project, and intercepted water at 34.7 mAHD, is consistent with the mapped water table in this region and does not suggest perching. There were no (zero) logged intervals of perched water in the underlying Coongulmerang Formation.

The variable clay content within the saturated aquifer zone may have produced local preferential groundwater flow paths which may also alter the development of the groundwater mound. Aquifer heterogeneity is a common phenomenon across most geological settings and is typically addressed as an inherent uncertainty of groundwater modelling. Monitoring and management of potential mounding is documented in the Water Risk Treatment Plan (Attachment C of Risk Management Plan).

2.5.3 Groundwater quality

Groundwater within the Coongulmerang Formation aquifer ranges from fresh (total dissolved solids of 125 mg/L to brackish (2,666 mg/L). The variation in groundwater salinity does not follow a discernible spatial pattern. Field measured groundwater pHs ranged between 4.55 and 7.42 but mostly fell in the range from pH 5 to 6, indicating slightly acidic groundwater conditions. Groundwater is generally oxidising, with positive redox potential values and dissolved oxygen concentrations generally above 1.0 mg/L. Groundwater in the vicinity of Mitchell River typically contains less dissolved oxygen.

A summary of typical dissolved metals concentrations in groundwater within the Coongulmerang Formation is presented in Table 2-3.

Major ions chemistry in groundwater underlying the Fingerboards (proposed) mining licence area is dominated by sodium and chloride, with lesser amounts of sulfate (SO_4), magnesium (Mg) and bicarbonate (HCO_3) ions. Groundwater within the underlying Boisdale aquifer is also sodium-chloride type and does not appear distinctly different from that of the Coongulmerang Formation (Table 2-4).

Nitrogen has been detected, primarily in the form of nitrate, at all groundwater monitoring locations. Concentrations ranged from below detection up to 2.82 mg/L (MW01). Phosphorus is also present at elevated concentrations (<0.01 to 3.54 mg/L). Both phosphorus and nitrate are a common groundwater contaminants associated with the agricultural industry.

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Table 2-3: Metals in groundwater in Fingerboards proposed mining licence area

Parameter	Coongulmerang Formation Groundwater				ANZECC (2000) ecosystem protection guideline (mg/L)[1]	ANZECC (2000) Long term irrigation (mg/L)	ANZECC (2000) Livestock water (mg/L)
	LoR, mg/L	Min, mg/L)	Max (mg/L)	Median			
Aluminium	0.01	0.01	**2.09**	**0.215**	0.0008 (pH <6.5)	5	5
Arsenic	0.001	0.001	**0.014**	0.0025	0.013	0.1	0.5 to 5
Barium	0.001	0.004	0.573	0.044	--	--	--
Boron	0.05	0.07	0.08	0.075	0.37	--	5
Copper	0.001	0.001	**0.029**	0.001	0.0014	0.2	1 (cattle)
Iron	0.05	0.06	111	1.53	--	0.2	--
Manganese	0.001	0.001	**4.06**	0.199	1.9	0.2	--
Molybdenum	0.001	0.001	0.004	0.0025	0.034	0.01	0.15
Nickel	0.001	0.001	**0.587**	**0.0265**	0.011	0.2	1
Strontium	0.001	0.003	0.328	0.043	--	--	--
Zinc	0.005	0.006	**0.814**	**0.056**	0.008	2	20

[1] Note: ANZECC values shown in the table are for 95^{th} percentile ecosystem protection where available; if no 95^{th} percentile values have been defined, the default freshwater ecosystem guideline is shown. ANZECC default water quality guideline values for toxicants were under review at the time this work plan was drafted. Future versions of the work plan will take account of any changes to the ANZECC guidelines and/or to water quality values referenced in the SEPP (Waters).

No pesticides or herbicides have been detected in baseline groundwater monitoring conducted at the Fingerboards site to date.

Table 2-4: Boisdale Formation groundwater quality (MW09d, 26/06/2017)

Analyte	Units	LoR	Result	ANZECC ecosystem protection guideline (mg/L)[1]
Alkalinity (Hydroxide) as $CaCO_3$	µg/L	1000	<1000	--
Alkalinity (total) as $CaCO_3$	mg/L	1	50	--
Alkalinity (Bicarbonate as $CaCO_3$)	mg/L	1	50	--
Alkalinity (Carbonate as $CaCO_3$)	mg/L	1	<1	--
Ammonia as N	mg/L	0.010	0.060	0.90
Total Dissolved Solids	mg/L	1	556	--
pH (lab)	pH units		6.2	--
Chloride	mg/L	1	268	--
Sulphate (turbidimetric)	mg/L	1	63	--
Total nitrogen	µg/L	100	<100	--
Total phosphorus	mg/L	0.01	0.18	--
Mercury (Filtered)	mg/L	0.0001	<0.0001	0.0006
Aluminium (Filtered)	mg/L	0.01	**0.01**	0.0008 (pH <6.5)
Antimony (Filtered)	mg/L	0.001	<0.001	0.009

Analyte	Units	LoR	Result	ANZECC ecosystem protection guideline (mg/L)[1]
Arsenic (Filtered)	mg/L	0.001	0.006	0.013 (As V)
Barium (Filtered)	mg/L	0.001	0.164	--
Cadmium (Filtered)	mg/L	0.0001	<0.0001	0.0002
Chromium (Filtered)	mg/L	0.001	<0.001	0.0004 (Cr VI)
Copper (Filtered)	mg/L	0.001	<0.001	0.0014
Iron (Filtered)	mg/L	0.05	14.1	--
Lead (Filtered)	mg/L	0.001	<0.001	0.0034
Manganese (Filtered)	mg/L	0.001	0.231	1.90
Molybdenum (Filtered)	mg/L	0.001	<0.001	0.034
Nickel (Filtered)	mg/L	0.001	**0.026**	0.011
Selenium (Filtered)	mg/L	0.01	<0.01	0.011
Zinc (Filtered)	mg/L	0.005	**0.023**	0.008
Strontium (Filtered)	mg/L	0.001	0.168	--

[1] Note: ANZECC values shown in the table are for 95th percentile ecosystem protection where available; if no 95th percentile values have been defined, the default freshwater ecosystem guideline is shown.

2.5.4 Existing groundwater use

Groundwater licences in the proposed mining licence area are administered by Southern Rural Water (SRW) on behalf of the Minister for Water and are registered within the Victorian groundwater database. A search of registered groundwater bores within a 10 km radius of the Fingerboards site identified 270 bores listed as either functioning, proposed, or unknown (~~Figure 2-5 and~~ Figure 2-12 and Figure 2-13~~Figure 2-613~~). These do not include seven groundwater monitoring wells installed by Kalbar as part of its baseline field assessments.

Five production bores were installed within the Latrobe Valley Group and screened between 34 and 90 mbgl. These form part of East Gippsland Water water security program located at Woodglen, north west of Bairnsdale and directly north east of the Fingerboards project. The project uses the bores as part of ~~their~~its Aquifer Storage and Recovery (ASR) system and forms part of the domestic water supply for East Gippsland.

The groundwater modelling study of the Fingerboards EES has reviewed potential for water from the Fingerboards site to flow towards the ASR site in the groundwater environment. Even with the ASR site extracting at the maximum licensed rate, the presence of seepage and mounding of the water table from mining does not result in any significant deviation in flow paths towards Woodglen. ~~Leachate analysis (analysis of the water after thorough mixing with the sample) of representative samples of tailings and concentrate all met *Australian Drinking Water Guidelines*, 2018.~~

Most other bores (146) are registered for stock and domestic use. One bore (ID. 85910) lies within the proposed mining licence area, to the southeast of the intersection of Bairnsdale-Dargo Road and Fernbank-Glenaladale Road. This stock and domestic bore is 107 m deep and is likely to be sourcing groundwater from the Latrobe Valley Group aquifer. The two closest bores outside the licence area (bore IDs 85900 and 85899) are located within a few hundred metres of the northern and eastern project boundary and are likely to screen the shallow Coongulmerang Formation at depths between 8 and 11 m bgs.

Bores near streams and rivers along the northern and eastern project boundary are generally shallow (10 to 15 m below ground) and are likely to source groundwater from shallow alluvial aquifers. The

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existing groundwater bore within the proposed mining licence area is deeper (107 m, with a surface elevation of 120.78 m AHD), potentially screening the Balook Formation. Registered bores to the south of the proposed mining licence area typically access groundwater from depths more than 50 to 70 m below ground level.

The majority of bores in the project locality registered for stock and domestic use or for irrigation. Many stock and domestic bores, and the majority of registered irrigation bores, are concentrated around Briagolong (10 km west of the proposed mining licence area) and within the Wy Yung Water Supply Protection Area (WSPA) (<500 m east of the proposed mining licence area (~~Figure 2-6).~~Figure 2-12). In these areas bores are generally shallow, accessing groundwater from the Haunted Hill Formation and from recent Quaternary alluvium associated with nearby surface water features. While the proposed mining licence area does not directly overlie the Wy Yung ~~Water Supply Protection Area (WSPA),~~WSPA, the eastern extent of the proposed mining licence area passes within less than 1 km of the Mitchell River and the Wy Yung WSPA. The high-value aquifer protected under this WSPA has 60 licensed groundwater abstraction bores with a combined total licensed annual extraction volume of approximately 21.4 GL. Kalbar will not extract any groundwater from the shallow alluvial aquifer from which local agricultural and domestic users draw much of their water.

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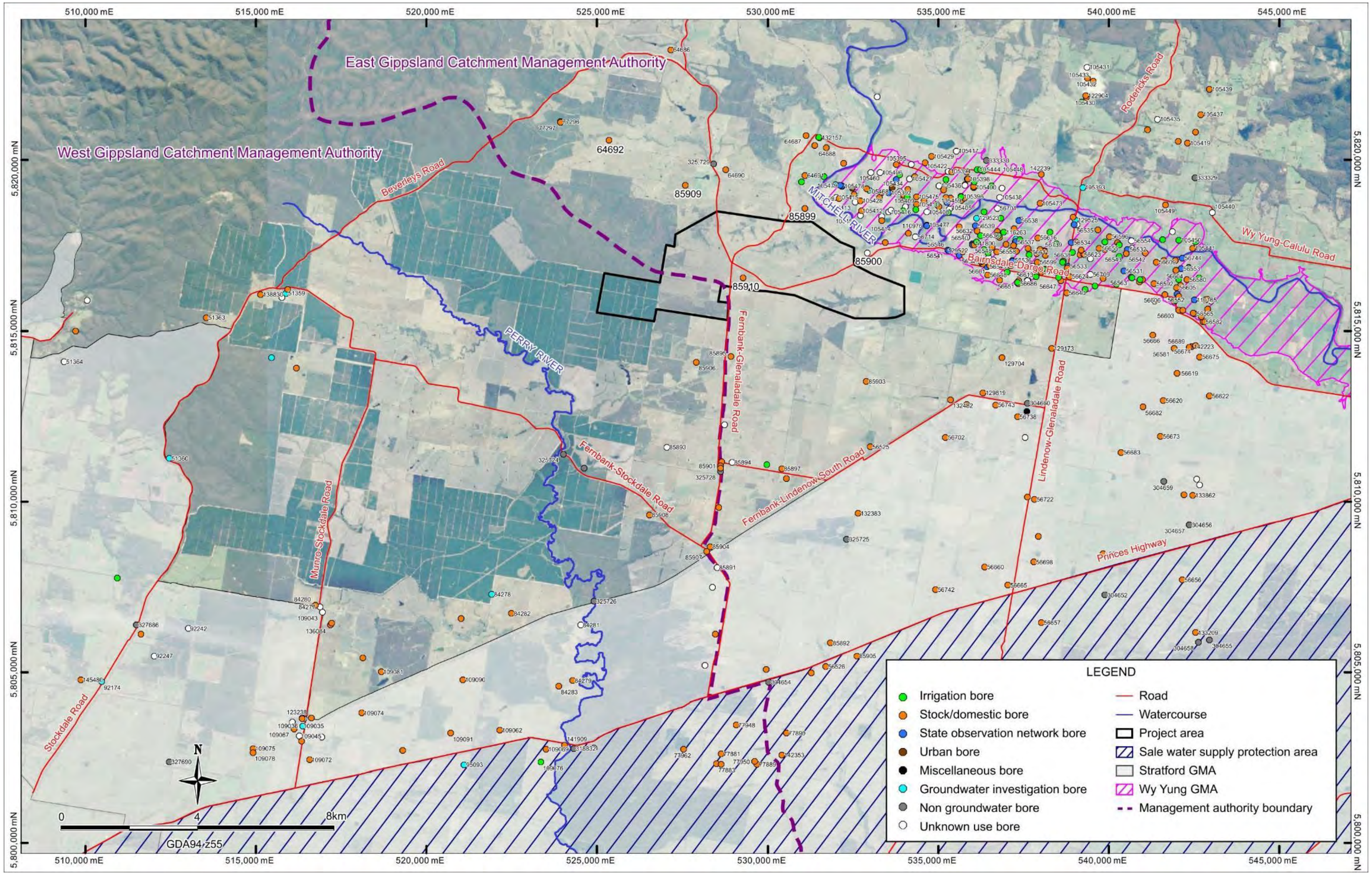
East Gippsland Catchment Management Authority
West Gippsland Catchment Management Authority
PERRY RIVER
MITCHELL RIVER
Fernbank-Glenaladale Road
Fernbank-Stockdale Road
Fernbank-Lindenow-South Road
Lindenow-Glenaladale Road
Bairnsdale-Dargo Road
Wy Yung-Calulu Road
Princes Highway
Munro-Stockdale Road
Stockdale Road
Beverleys Road
Rodericks Road
85909
85899
85900
85910
64692
LEGEND
Irrigation bore
Stock/domestic bore
State observation network bore
Urban bore
Miscellaneous bore
Groundwater investigation bore
Non groundwater bore
Unknown use bore
Road
Watercourse
Project area
Sale water supply protection area
Stratford GMA
Wy Yung GMA
Management authority boundary
0
4
8km
GDA94 z55
N
510,000 mE
515,000 mE
520,000 mE
525,000 mE
530,000 mE
535,000 mE
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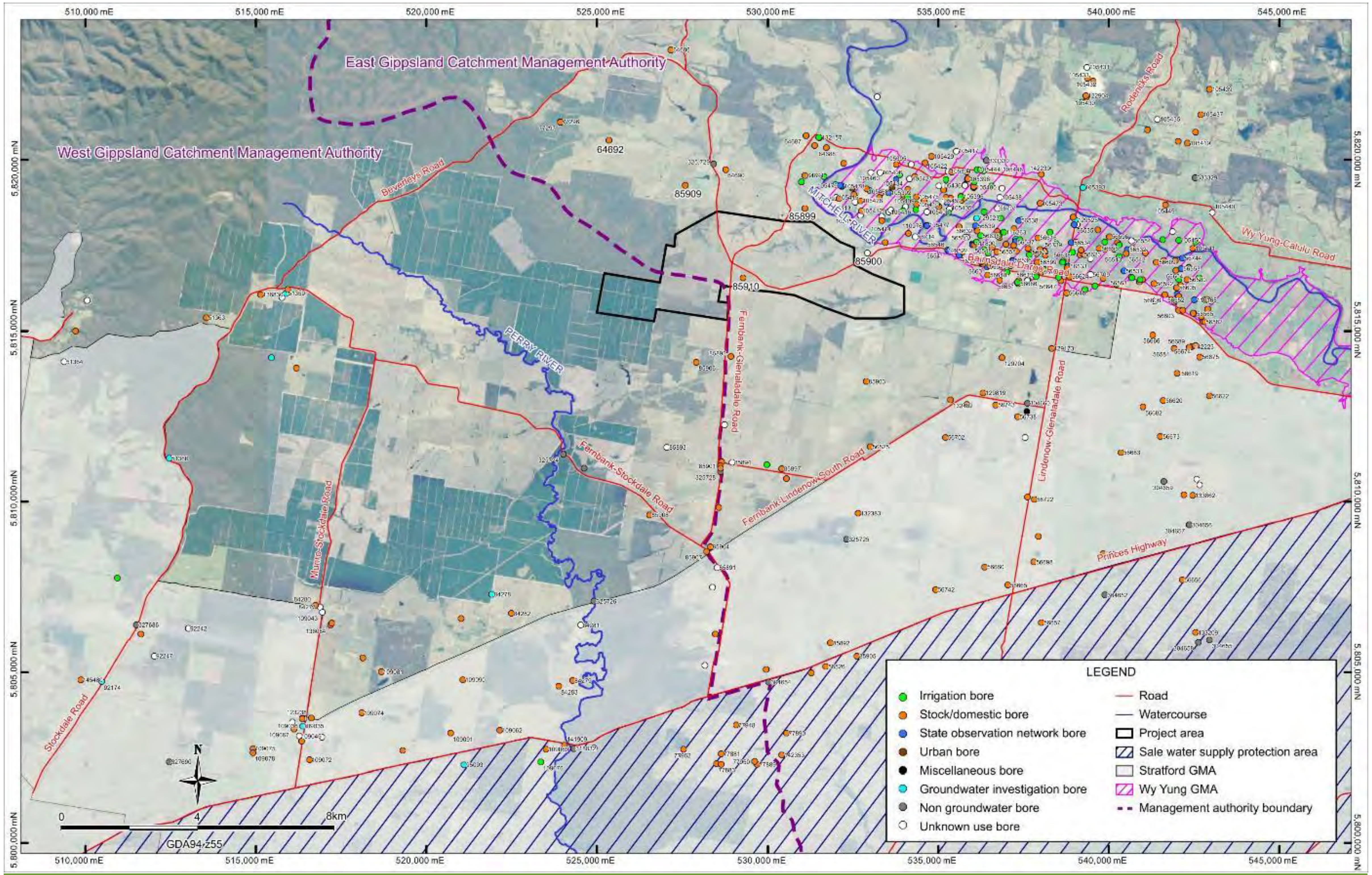
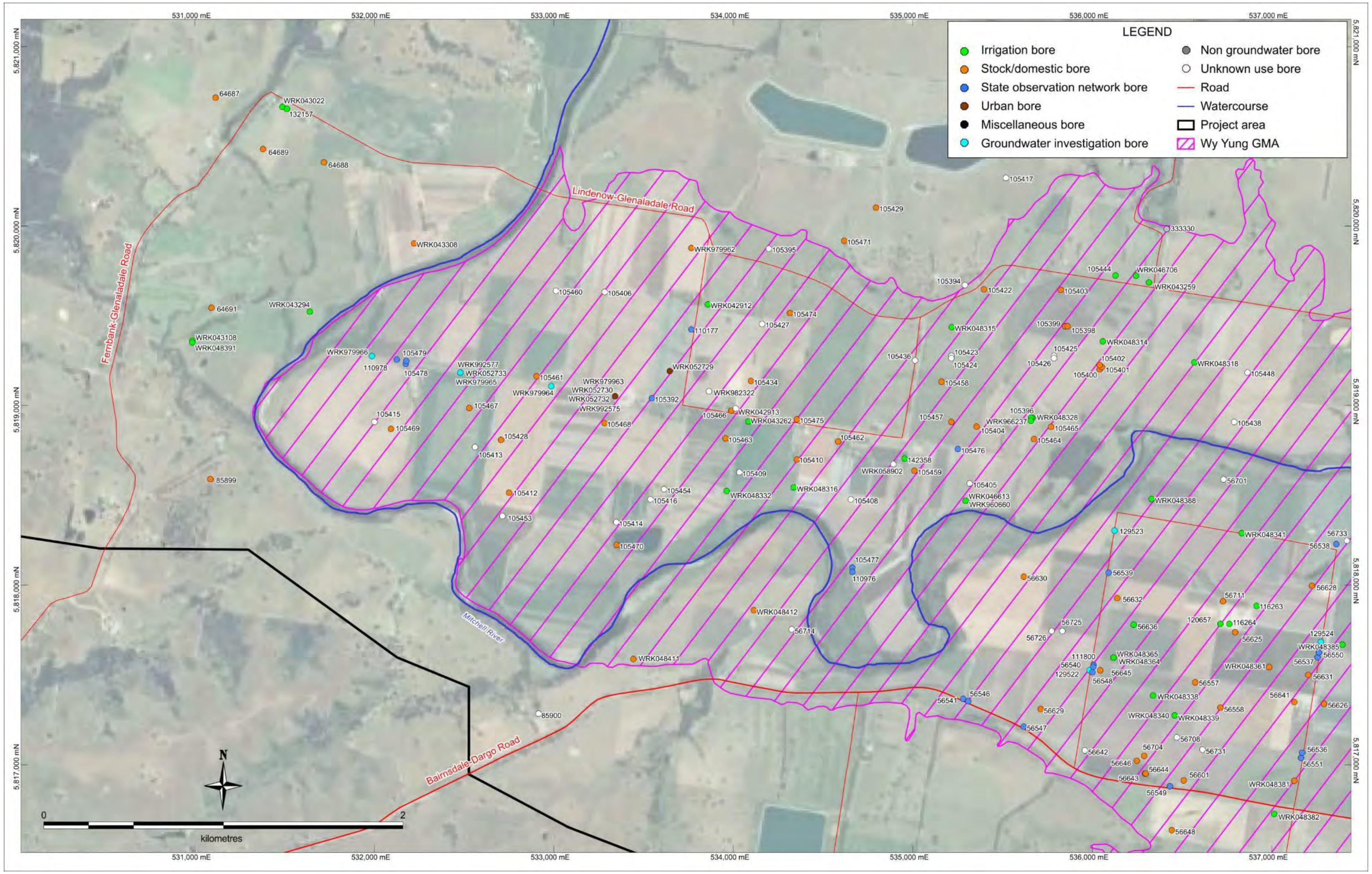


Figure 2-~~12~~~~11~~12: Registered groundwater bores (as at June 2018)


LEGEND
Irrigation bore
Stock/domestic bore
State observation network bore
Urban bore
Miscellaneous bore
Groundwater investigation bore
Non groundwater bore
Unknown use bore
Road
Watercourse
Project area
Wy Yung GMA
Lindenow-Glenaladale Road
Fernbank-Glenaladale Road
Bairnsdale-Dargo Road
Mitchell River
531,000 mE
532,000 mE
533,000 mE
534,000 mE
535,000 mE
536,000 mE
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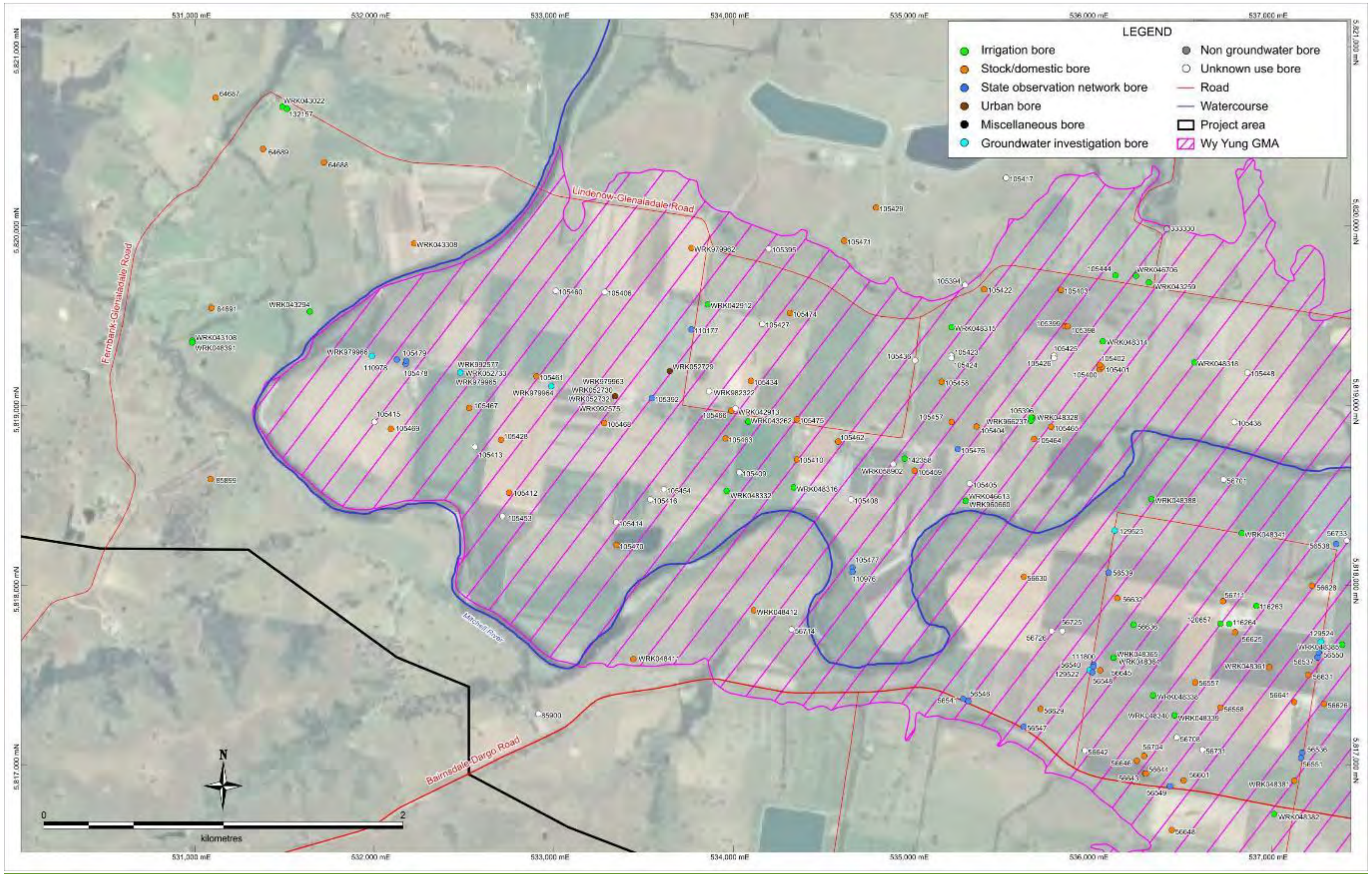

Figure 2-131213: Registered water bores northeast of Fingerboards site

2.6 Soils and landscapes

2.6.1 Topography

The Gippsland region lies on the southern flank of the Great Dividing Range, and the landform is characterised by: high elevation and high relief mountains and foothills, and the flatter coastal plain (GHD 2010). Within the Fingerboards locality, surface topography ranges from approximately 200 m AHD in the northwest, to near sea level towards the lakes system and the coast in the south (Figure 2-13).Figure 2-14). At the project site (Figure 2-15Figure 2-1415), the physiographytopography is characterised by elevated plains reaching elevations of 130 m AHD, with incised gullies bordering the Mitchell River Valley, which has a typicallytypical surface elevation around 35 m AHD adjacent to the project site. The southern part of the proposed mining licence area is generally flat to gently undulating. The northern portion, which contains a number of creek lines is more steeply sloping.

There are four main geomorphic units in the proposed mining licence area:

- Plateau: The upper planar surface of the proposed mining licence area, which has a low gradient.
- Swales: Broad flow paths draining the plateau, which are important drainage pathways for runoff from the plateau to the flow channels.
- Valley slopes: The steeper outer faces of the plateau that adjoin the flow channels.
- Flow channels: Ephemeral drainage lines that convey surface runoff across the area.

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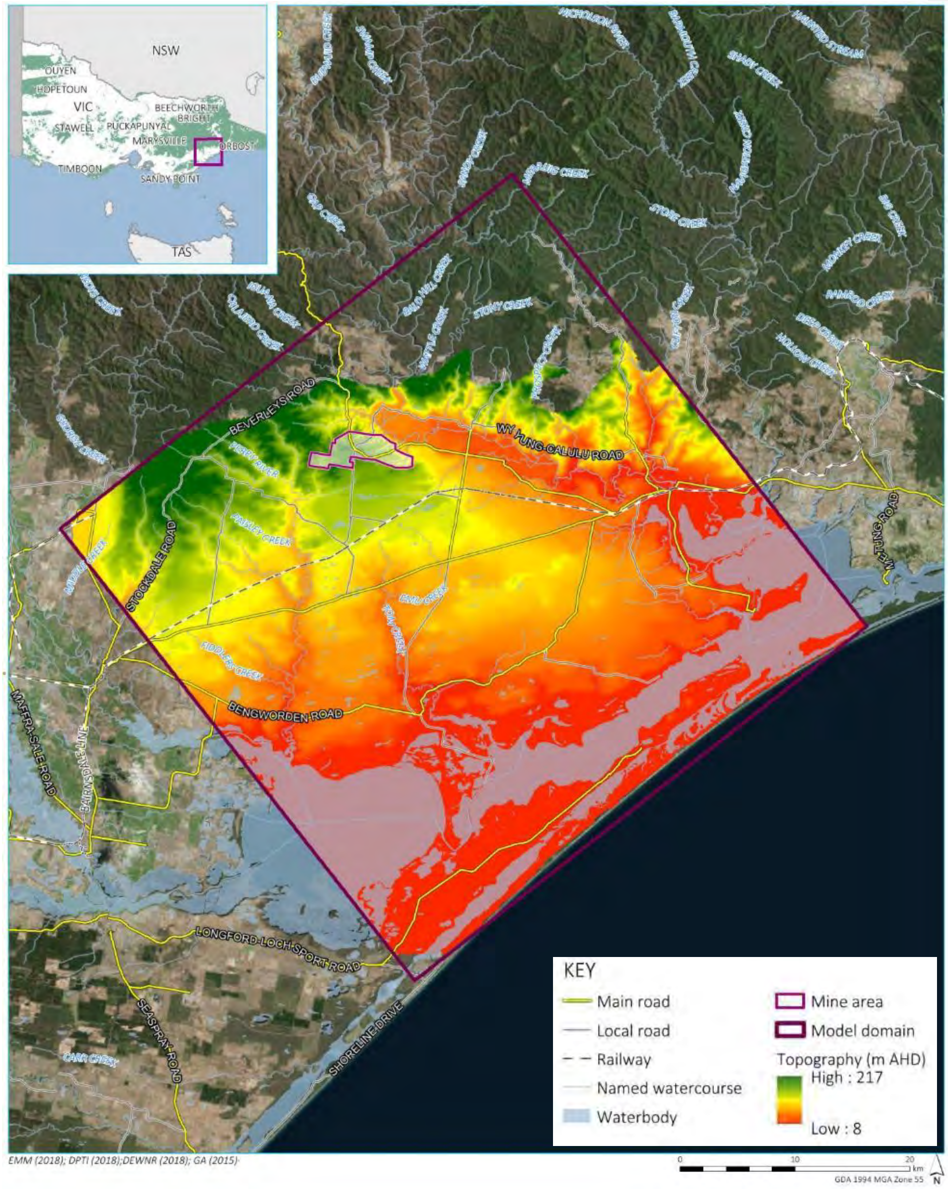

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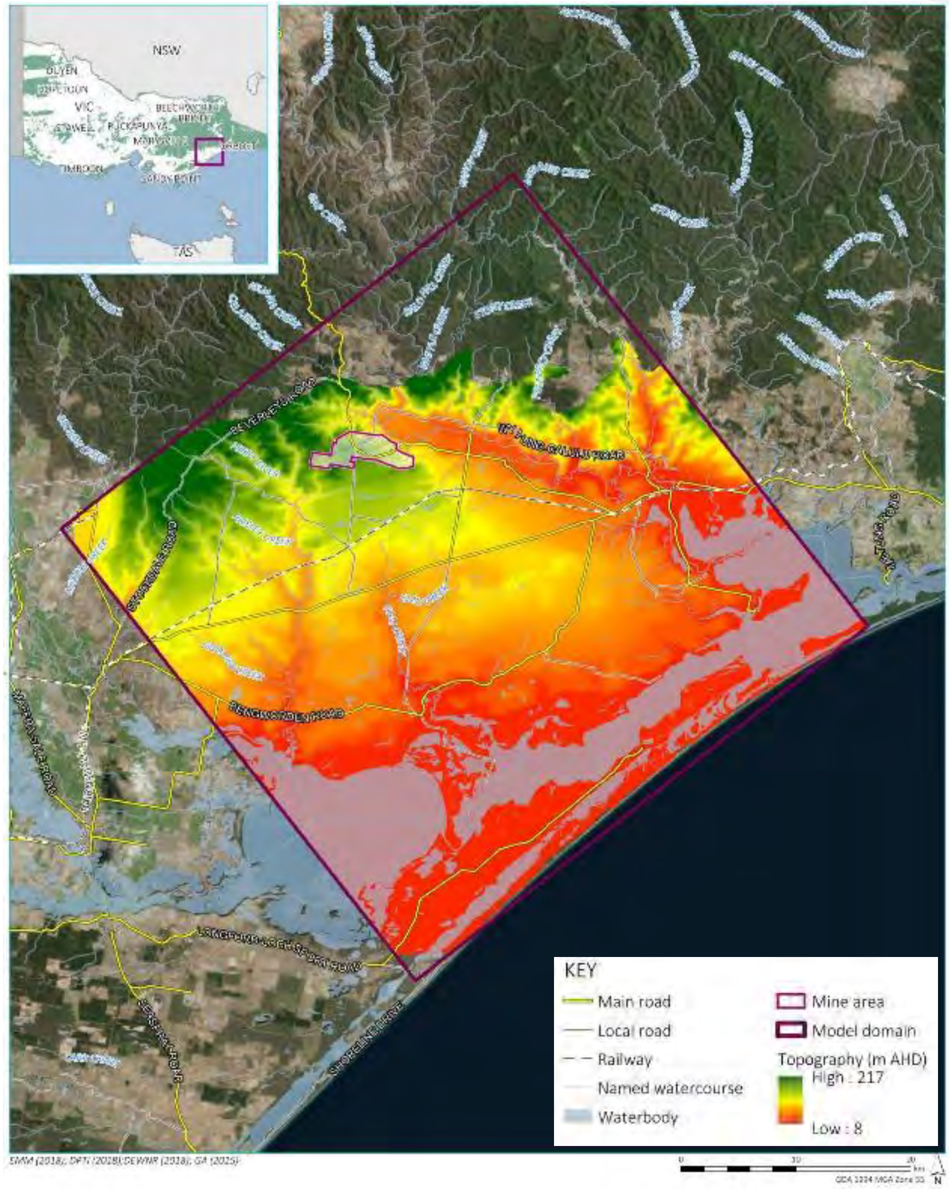
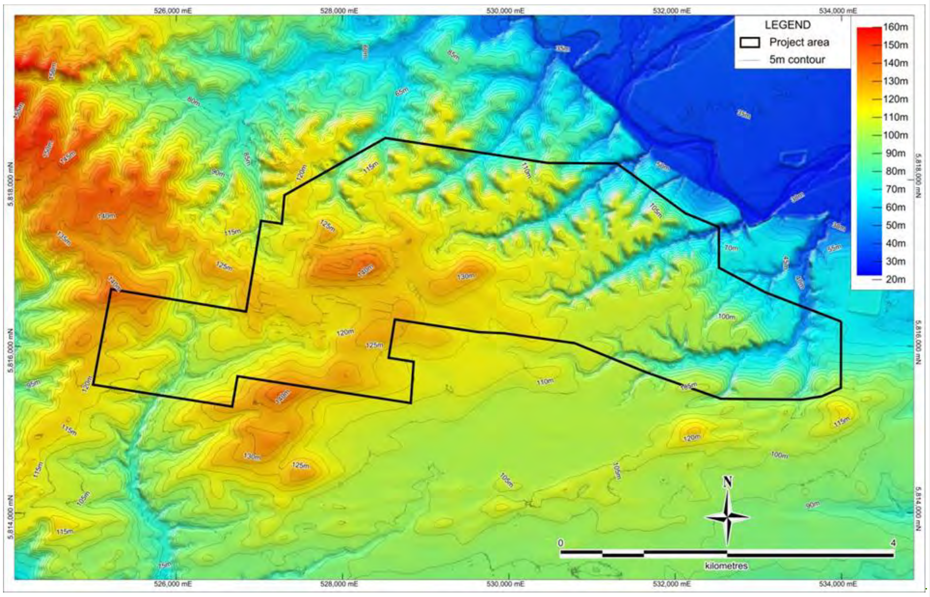


Figure 2-141314: Regional topography



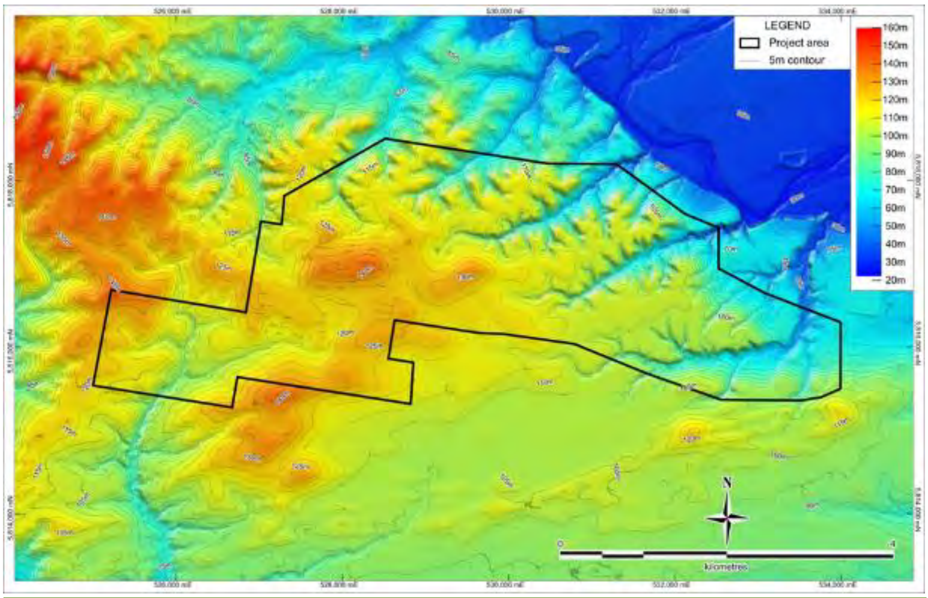


Figure 2-151415: Site topography

2.6.2 Soils

Two soil types occur in the proposed mining licence area:

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- Texture-contrast soils (sodosols) with an acid, sandy A horizon overlying a high clay, sodic B horizon overlying gravel. These soils are largely associated with the plateau tops in the mining licence area. The sodosols in the proposed mining licence area are susceptible to tunnel erosion as they are strongly layered and have dispersive B horizons.

- Sandy soils (podosols) of reasonably uniform texture throughout the profile, acid pH, and almost all non-sodic, overlying gravel, with variable soil depth to gravel. These soils are largely associated with slopes adjoining the plateau tops in the proposed mining licence area. Shallow soils of this type are commonly associated with flow lines.

The two soil types have broadly similar physical characteristics and fertility (Landloch, 2020a).

Surface soils in the proposed mining licence area have several inherent limitations to plant growth, including moderately to strongly acidic pH and high levels of exchangeable aluminium; a moderate tendency to hardsetting and/or dispersion; low water holding capacity; deficiency in some trace elements (chiefly boron and copper) and variable deficiencies in potassium and phosphorus.

Subsoils in the proposed mining licence area are generally of poor quality for agriculture and other uses, being either deep sands with low fertility and water-holding capacity, or sodic clays which are prone to dispersion and hardsetting.

Overburden in the proposed mining licence area is made up of the Haunted Hill Formation, ~~which~~ a fluvial deposit comprising two distinct units: a lower gravel unit, and an upper clay and sandy clay unit. Material properties that are of concern in both the gravel and sand/clay units include a high percentage of exchangeable magnesium (approximately 65 to 72%) and sodium (approximately 20 to 24%), and a low calcium to magnesium ratio (0.1). These properties have the potential to cause clay dispersion and render the subsoils / overburden susceptible to tunnel erosion. The salinity level of the overburden (0.31 to 0.44 decisiemens per metre) is low: release of saline seepage or leachate is unlikely. The overburden contains insufficient concentrations of sulphide to cause acid mine drainage.

2.7 Biodiversity

The Fingerboards Project area is located within a transitional zone between the East Gippsland Lowlands and Gippsland Plain bioregions, and a short distance from the Highlands Southern Fall and East Gippsland Uplands bioregions (DEPI, 2015) . The transitional zone is important biogeographically as it overlaps between southern cool temperate and eastern warm temperate zones and as a result, diverse flora and fauna communities are present, many of which are absent from, or rare in, the rest of Victoria.

Most of the study area has been highly modified by human activities, such as clearing for agricultural practices, and is dominated by pasture supporting non-indigenous grasses and weeds. Much of the indigenous vegetation and high quality terrestrial fauna habitat remaining within the study area is confined to roadsides and the dissecting gullies, which have been less affected by land clearing and sustained agricultural land use.

2.7.1 Vegetation and flora

The proposed mining licence area is typical of many areas within the East Gippsland region, with large areas of improved pastures and derived native grasslands, scattered patches of remnant vegetation and regrowth from past clearing. Approximately 90% of the mining licence area contains vegetation that has been modified or disturbed. This includes a timber plantation in the western section of the proposed mining licence area, which comprises approximately 30% of the proposed

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mining licence area. The remaining approximately 10% of the proposed mining licence area supports native vegetation, which is concentrated around roadsides and in gullies. Patches of native vegetation in the proposed mining licence area include areas of Plains Grassy Forest (Ecological Vegetation Class 151), Plains Grassy Woodland (Ecological Vegetation Class 55) and Valley Grassy Forest (Ecological Vegetation Class 47). Remnant trees in the proposed mining licence area include *Eucalyptus tereticornis* subsp. *mediana* (Gippsland red gum), *E. polyanthus* (red box) and *E. globoidea* (white stringybark). Detailed maps of the vegetation types within the proposed mining licence area are shown in Appendix F.

The timber plantation located in the western section of the proposed mining licence area supports scattered native trees and vegetation classified as remnant patches of Lowland Herb-rich Forest, Plains Grassy Woodland, Aquatic Herbland and Plains Grassy Wetland. This vegetation is largely retained along forestry tracks and in areas where forestry planting has been constrained. The scattered trees and remnant patches provide some level of connectivity within a landscape dominated by monoculture plantings and highly modified by plantation activities. No conservation significant species have been recorded within these areas (EHP, 2020).

The road reserves of Fernbank-Glenaladale Road and Bairnsdale-Dargo Road support scattered native trees and linear tracts of Plains Grassy Woodland, Plains Grassy Forest and Lowland Forest. High quality patches of this vegetation correspond with ecological communities listed under the EPBC Act and FFG Act and these areas are also known to support the significant flora species such as Slender Wire-lily.

Field surveys of the Fingerboards site have confirmed the presence of the critically endangered Gippsland Red Gum Grassy Woodland and Associated Native Grassland ecological community in high quality Plains Grassy Woodland remnants within the road reserve of Fernbank-Glenaladale Road and Bairnsdale-Dargo Road. This threatened ecological community is protected under the EPBC Act. The presence of the Forest Red Gum Grassy Woodland ecological community (an ecological community protected under the FFG Act) was also confirmed within the road reserve of Fernbank-Glenaladale Road and Bairnsdale-Dargo Road.

Scattered farm dams and soaks occur across the proposed mining licence area. However, they represent a very small proportion of habitats present and mostly support non-native vegetation. Ephemeral drainage lines within the proposed mining licence area are known to support several conservation significant species, including Slender Wire-lily, Blue Mat-rush and Sandfly Zieria.

Field surveys of the Fingerboards site have recorded an abundance of species listed as 'Protected' under the FFG Act, including *Acacia* (42 plants), Asteraceae (194 plants), Ericaceae (59 plants), Orchidaceae (394 plants), Pteridophyta (68 plants), *Stylidium* (two plants) and *Xanthorrhoea* (two plants) species.

The following impacts on flora and vegetation are predicted as a result of implementation of the Fingerboards project (not all of the impacts arise as a result of activities within the proposed mining licence area):

- Removal of 160.30 hectares of remnant patches (~~including~~excluding DELWP mapped 'current wetlands'~~) 461 mpacted large and small scattered trees;~~);
- Removal of ~~704 large trees, which comprise~~ 373 ~~large trees within a patch~~Large Trees in patches of native vegetation and 461 scattered trees (331 scattered large trees and 130 scattered small trees~~;~~);
- Removal of 1.74 hectares of the nationally significant Gippsland Red Gum Grassy Woodland ~~and Associated Native Grassland (GRGGW)~~ ecological community~~;~~

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- Removal of 14.54 hectares of the State significant (FFG Act-listed) Forest Red Gum Grassy Woodland ecological community; and
- Removal of three State significant flora species, including Slender Wire-lily (33 plants), Blue Mat-rush three(3 plants) and Sandfly Zieria (10 plants).

The EES ecological study is Appendix A005 in the EES Appendices folder.

There will be a requirement to offset these unavoidable impacts. Offsets under the EPBC Act will be in developed accordance with the Environmental Offsets Policy (DSEPaC 2012a) and calculated using DoEE's Offsets Assessment Guide (DSEWPC 2012). Based on a preliminary analysis using the EPBC Act offset calculator, an offset area of eight hectares of GRGGW would be required to compensate for the removal of 1.74 hectares of the listed ecological community. State offset requirements will be determined in accordance with the 'Guidelinesfortheremoval,destruction or lopping of native vegetation'(the Guidelines) (DELWP 2017). The estimated general project offset requirements are estimated as 1.001 General Habitat Units (GHU), with a minimum Strategy Biodiversity Value of 0.253, along with 704 Large Trees. Species Habitat Units (SHUs) offset requirements are summarised in Table 2-5 (EHP, 2020).

The majority of the required offsets for the project can be met through the purchase of credits over the NVOR.Native Vegetation Offsets Register (NVOR.) There is also an opportunity to secure offsets on Crown land if there is evidence of demonstrable additionality which constitutes actions that are above the expected role of a public land manager (DELWP 2017).

Table 2-5: Specific Habitat Unit offset requirements (flora) – whole of Fingerboards project[Note]

EHP, Sticky wattle – 92.054 SHU	Rough-grain Love-grass – 98.532	Slender Wire-lily – 102.403 SHU
Yellow-wood – 38.170 SHU	Slender violet-bush – 67.568 SHU	Thin-leaf Daisy bush- 57.395 SHU
Thick-lip Spider orchid – 48.867 SHU	Star cucumber – 28.189 SHU	Forest Red-box – 94.446 SHU
Purple diuris – 98.059 SHU	One-flower early Nancy – 97.586 SHU	Gaping Leek-orchid – 0.048 SHU
Bushy Hedgehog-grss – 102.403 SHU	Limestone blue wattle – 86.671 SHU	Heath Spider-orchid – 40.749 SHU

Note: The SHU offset requirements include impacts arising both inside and outside the proposed mining licence area. The SHU values shown in the table are the maximum estimated offset requirements. These may be reduced if Kalbar's preferred rail siding option at Fernbank East is approved.

2.7.2 Fauna and habitats

Aside from the large, contiguous patches of native vegetation within road reserves and the dissecting gullies, other areas of native vegetation in the project area are not contiguous with larger areas of habitat in the local area and do not constitute a wildlife corridor. These areas are likely to act as a means of connectivity, providing habitat and facilitating the movement of species throughout the landscape. The project area contributes to the role that remnant native vegetation in the local area has in conserving fauna.

The 2016 field surveys recorded 96 fauna species including 88 native and eight introduced species. No nationally significant fauna species were recorded within the project area during baseline surveys. One state significant species was recorded during the survey, the yellow-bellied sheathtail bat (*Saccolaimus flaviventris*), which is listed under the FFG Act and classified as 'Near Threatened' on

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the Victorian Advisory List. The Anabat acoustic survey also recorded one potential call of the eastern bent-wing bat (*Miniopterus schreibersii oceanensis*), which is listed under the FFG Act and classified as Vulnerable on the Victorian Advisory List.

During field surveys, eight aquatic fauna species were recorded in the Mitchell River, including two captures of the Australian grayling, which is listed as Vulnerable under the EPBC Act and the Victorian Advisory List and listed under the FFG Act. Three aquatic fauna species were recorded in dams within the project area. Kalbar will have to secure appropriate offsets to compensate for potential impacts to Australian Grayling (29.975 Species Habitat Units) and to Flinders Pygmy Perch (60.031 Species Habitat Units) before commencement of any mining activities.

2.7.3 Parks, conservation areas and other natural assets

The Mitchell River National Park is located approximately 10 km north of the Fingerboards mine site. Significant features within the park include the Mitchell River, a State Heritage River; the Den of Nargun (a shallow cave under a small waterfall which is valued by the Gunaikurnai people) and other small caves of local geological and cultural significance; sites of state geological significance associated with the Mitchell River and its tributaries; rainforest communities of national significance and a number of rare and threatened flora and fauna species and habitats supporting threatened fauna species (Parks Victoria, 1998). The Gippsland Lakes system is a Ramsar-listed wetland located approximately 28 km southeast of the project area. The wetland extends over 60,000 ha and includes three main waterbodies: Lake Wellington, Lake King and Lake Victoria. Briagolong State Forest is located 8 km north-west of the Fingerboards site. These natural assets support a range of outdoor activities such as bushwalking, cycling, boating and scenic drives.

2.8 Social and cultural context

2.8.1 Aboriginal culture and heritage

A review of the Victorian Aboriginal Heritage Register identified 43 registered places located in the general project locality. One of the 43 registered sites – a scar tree (VAHR 8322-0090) - is located within the proposed mining licence boundary. Field surveys conducted at the Fingerboards site in 2017 and 2018 found a burnt tree stump at the approximate location specified in the heritage register and it is inferred that this stump represents the remnants of the registered scar tree.

Baseline field surveys at the Fingerboards site in 2017 and 2018 identified 68 surface artefacts within five investigation areas (Figure 2-16~~Figure 2-916~~). Most of the artefacts identified were located along exposed tracks and in areas of localised disturbance. Approximately 97% of the artefacts were classed as 'angular fragments and flakes', with the remaining 3% described as 'cores and tools'. The dominant materials used in the artefacts were quartz and silcrete. The low occurrence of tools and cores across the project area suggests a low-intensity use of the landscape, i.e., infrequent and short periods of visitation. In addition to these tangible artefacts at the Fingerboards site, it is possible that some intangible values also attach to the area. No intangible values of significance to the Traditional Owners of the area have yet been identified.

2.8.2 Non-indigenous culture and heritage

Little European activity occurred in East Gippsland until the late 1830's despite the region being one of the first parts of the eastern Australian mainland to be sighted by Europeans. From this time, land in the Buchan, Tubbut and Gelantipy areas was taken up by graziers moving south into Victoria from southern New South Wales (East Gippsland Shire Council, 2015).

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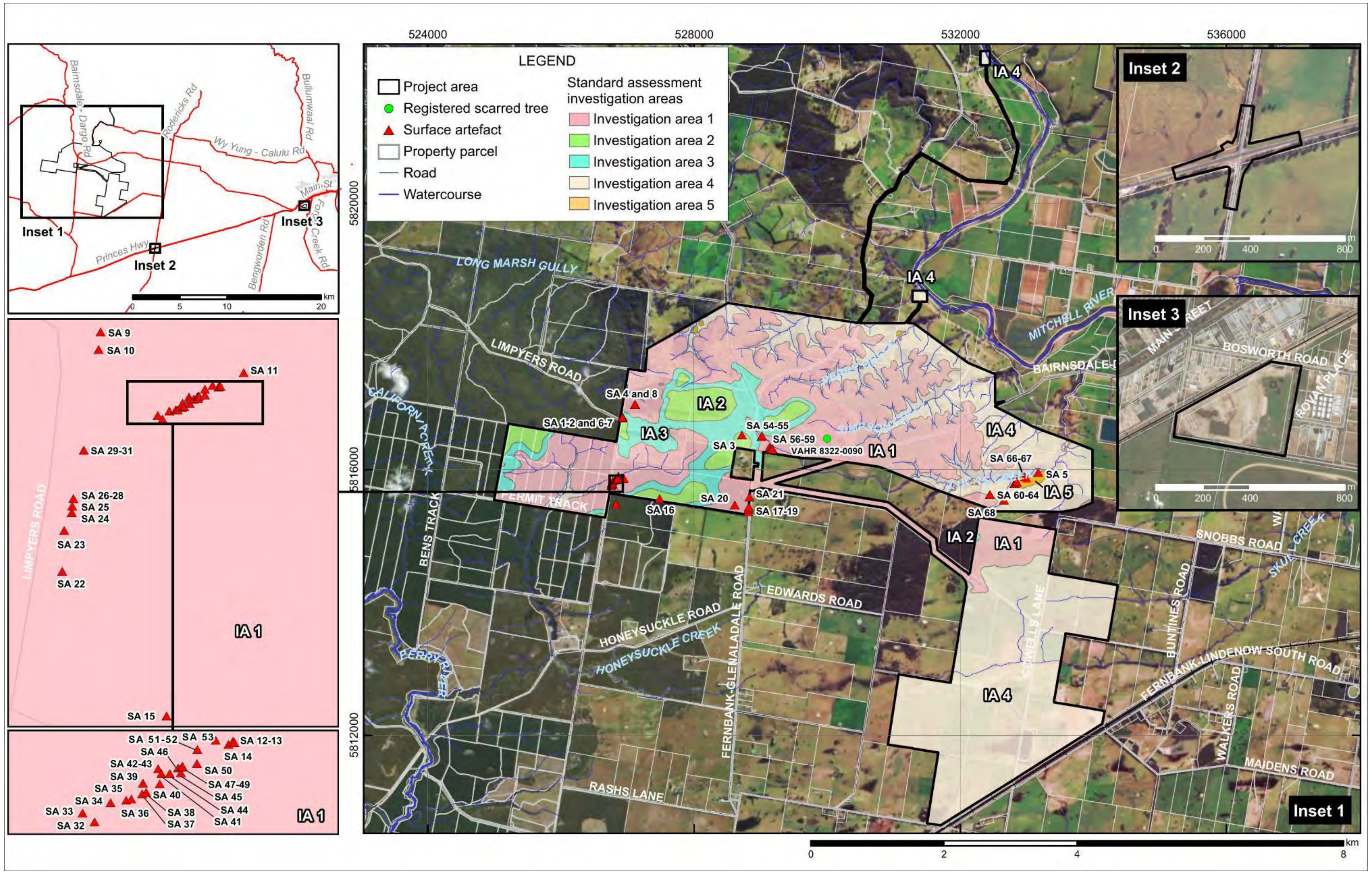
Many of the townships surrounding the project area still contain historic buildings and relics that provide a record of the European history of the area, including the unregistered former Fernbank School (established in 1908). The Fingerboards, located at the intersection of the Bairnsdale-Dargo Rd and Glenaladale-Fernbank Road, is considered to have local significance due to its association with past grazing activities.

The Victorian Heritage Database contains several listed heritage places in areas outside the proposed Fingerboards mining licence area, including the Glenaladale Weir and Wuk Wuk Bridge (both of which are listed on the National Trust register, a non-statutory register). The weir is located near the junction of the Mitchell River and Stony Creek. Construction of the weir commenced in 1891, although it was damaged by floods in 1893 and never repaired. Sections of the weir wall are still present today (EGCMA, 2015) The Wuk Wuk Bridge on the Lindenow-Glenaladale Road was constructed over the Mitchell River in 1937. The bridge is a representative example of Victorian bridge engineering of the mid to late 1930s (HCV, 2015) and is of state significance.

Two nineteenth century weatherboard structures with intact corrugated iron roofs and external brick chimneys were identified within the proposed mining licence area, at 2495 Bairnsdale-Dargo Road. Following consultation between ALA and Heritage Victoria, the structures were not found to meet the criteria for registration on the Victorian Heritage Inventory.


LEGEND
Project area
Registered scarred tree
Surface artefact
Property parcel
Road
Watercourse
Standard assessment investigation areas
Investigation area 1
Investigation area 2
Investigation area 3
Investigation area 4
Investigation area 5
Inset 1
Inset 2
Inset 3
IA 1
IA 2
IA 3
IA 4
IA 5
VAHR 8322-0090
LONG MARSH GULLY
LIMPYERS ROAD
MITCHELL RIVER
BAIRNSDALE-DARGO ROAD
SNOBBS ROAD
EDWARDS ROAD
HONEYSUCKLE ROAD
HONEYSUCKLE CREEK
FERNBANK-GLENALADALE ROAD
RASHS LANE
FERNBANK-LINDENOW SOUTH ROAD
MAIDENS ROAD
WALKERS ROAD
BUNTINES ROAD
COWELLS LANE
BENS TRACK
PERMIT TRACK
PERRY RIVER
CALIFORNIA CREEK
BOSWORTH ROAD
MAIN STREET
ROYAL PLACE
Wy Yung - Calulu Rd
Princes Hwy
Bairnsdale - Dargo Rd
Bullumwaal Rd
Rodericks Rd
Bengworden Rd
Forge Creek Rd
Main St
524000
528000
532000
536000
5820000
5816000
5812000
SA 1-2 and 6-7
SA 3
SA 4 and 8
SA 5
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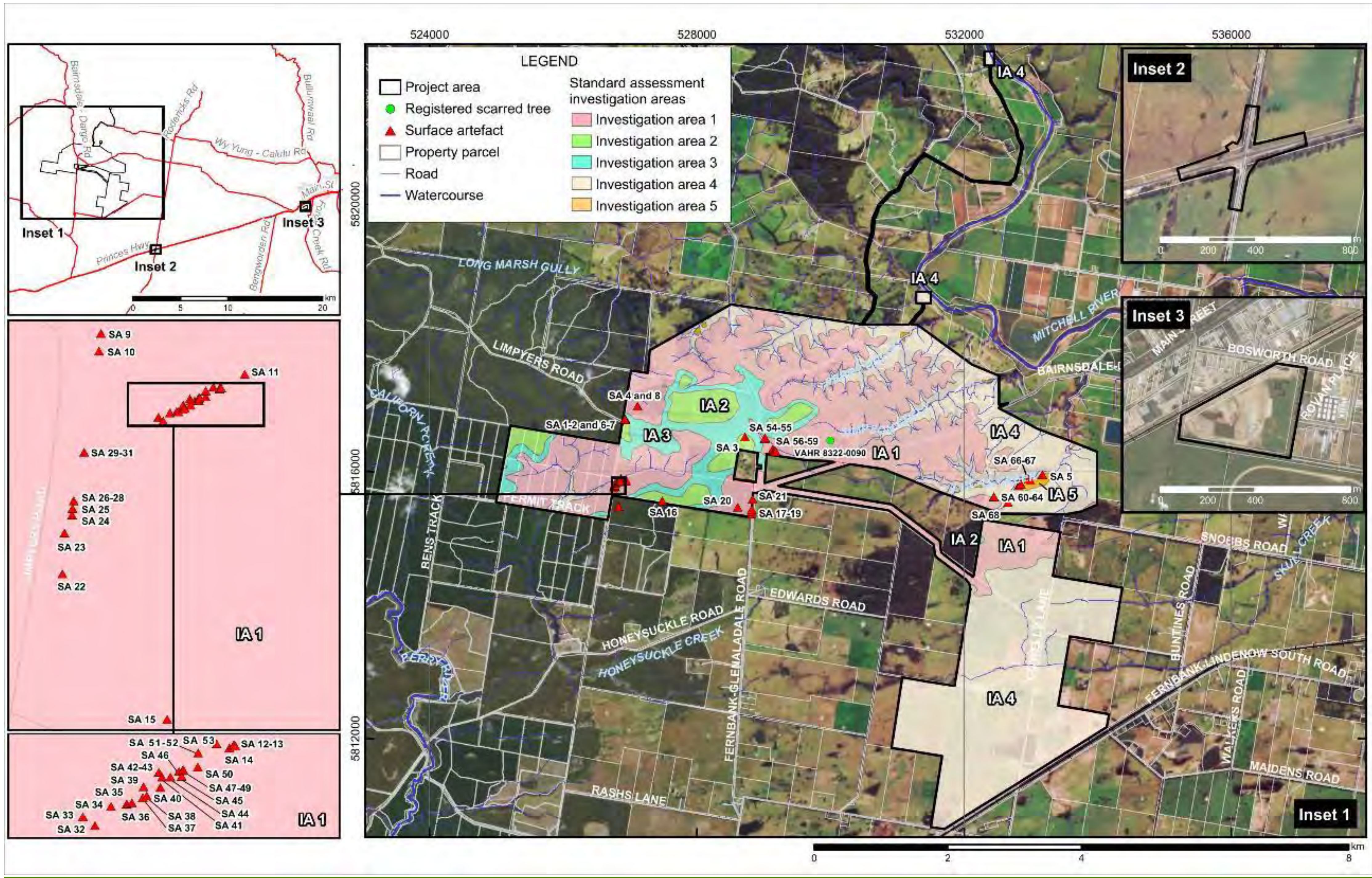

Figure 2-16~~15~~16: Aboriginal heritage sites and artefact scatter locations

2.8.3 Contemporary socioeconomic context

Nine settlements and towns are located within 10 km of the project area. The nearest settlement to the Fingerboards site is Glenaladale, approximately 1.5 km north of the mine site. Glenaladale has a population of 61 people and consists of scattered residences (approximately 30), a community hall, a recreation reserve, a playground and Country Fire Authority facilities. Other settlements within a nominal 10 km radius of the project include Woodglen, Fernbank, Iguana Creek, Walpa, Wuk Wuk, Lindenow, Lindenow South and Stockdale. Some of the settlements/towns consist of a small number of scattered residences, whereas others have local facilities and services such as primary schools, short-term accommodation and general stores.

The regional centre of Bairnsdale is located approximately 25 km east of the project. It is the largest town in proximity to the project area with a population of 14,728 people (ABS, 2016) and a median age of 44. The town has a range of facilities and services including health services, kindergartens, primary and secondary schools-, a TAFE, recreation facilities, arts and cultural facilities, shops, cafes, restaurants and short-term accommodation. Sale is located approximately 30 km southwest of the project area in Wellington Shire and has a population of 14,646 (ABS, 2016). The town contains a range of facilities and services such as health services, kindergartens, primary and secondary schools, recreation facilities, arts and cultural facilities, shops, cafes, restaurants and short-term accommodation.

Other towns in the general project locality include Briagolong, Stratford and Maffra, all of which are located in Wellington Shire (between 20 and 30 km southwest of the project area). Briagolong has a population of 1,081 people (ABS, 2016), Stratford 2,617 people (ABS, 2016), and Maffra 5,280 people (ABS, 2016).

The East Gippsland Economic Development Strategy (East Gippsland Shire Council, 2017b), which establishes focus areas for economic and employment growth in the shire, identifies manufacturing, construction, agriculture, forestry, fishing, retail, health services and tourism as priorities. The strategy also outlines a focus on maximising the opportunities in the mining industry for local businesses and the community. The Wellington Shire Economic Development Strategy (East Gippsland Shire Council, 2017b) identifies manufacturing and tourism sectors as key growth areas, as well as the opportunities to expand into new economic activities by capitalising on the National Broadband Network.

Baseline socioeconomic studies conducted for the Fingerboards project have identified a wide range of social and economic values that have the potential to be affected (either positively or negatively) by implementation of the Fingerboards Project. These are summarised in Table 2-6.

Table 2-6: Socioeconomic values

Theme	Socioeconomic value	Description
Health, public safety and wellbeing	Amenity and wellbeing	Quiet, peaceful environment not affected by noise, dust and artificial light.
	Cohesive community	The social and cultural fabric that keeps the community together and makes people feel supported and involved.
	Access and connectivity	Access to and connection with social networks, places of work and recreation (e.g., schools and sporting clubs).
	Healthy people	A healthy living environment not exposed to harmful substances such as air pollution, dust and chemicals.

Theme	Socioeconomic value	Description
	Safe community	A crime-free community where people know each other, care and support one and other, and feel safe.
	Safe roads	Roads that are well constructed and maintained to enable safe travel by all road users.
Connection to and use of the land	Beneficial use	Includes drinking water and water for agriculture sourced from the Mitchell River, drinking water sourced from rainwater tanks
	Landscape	Views and ambience of the area including views over the Lindenow Valley.
	Connection to land	The bond that people have with the land. This may be associated with a spiritual connection, family history in the area, work on the land and/or involvement in the land and environmental management.
	Rural lifestyle	Farmers and other people electing to live in a rural community who enjoy the agricultural or country setting.
	Clean green environment	Healthy natural environment and high-quality horticultural produce and agricultural land.
Livelihoods, employment and training	Crops and livestock	All types of crops (such as grain, horticulture and viticulture) and livestock (such as sheep, cattle and goats).
	Livelihoods	Any source of income such as employment, business, farming and tourism.
	Employment and training	Ability to source local employment and training.
Economy and local businesses	Local and regional economic growth	A thriving local and regional economy including a community supported sustainable agricultural industry.
	Local businesses	A community of progressive businesses that encourage sustainable business development that is sensitive to the environment and supportive of water security for the agricultural industry.
Infrastructure and services	Basic community needs	Ability to meet basic needs in the local area.
Housing and accommodation	Property values	Maintaining the value of agricultural land and rural residential properties
	Housing availability and affordability	Ability to source local housing that is affordable.

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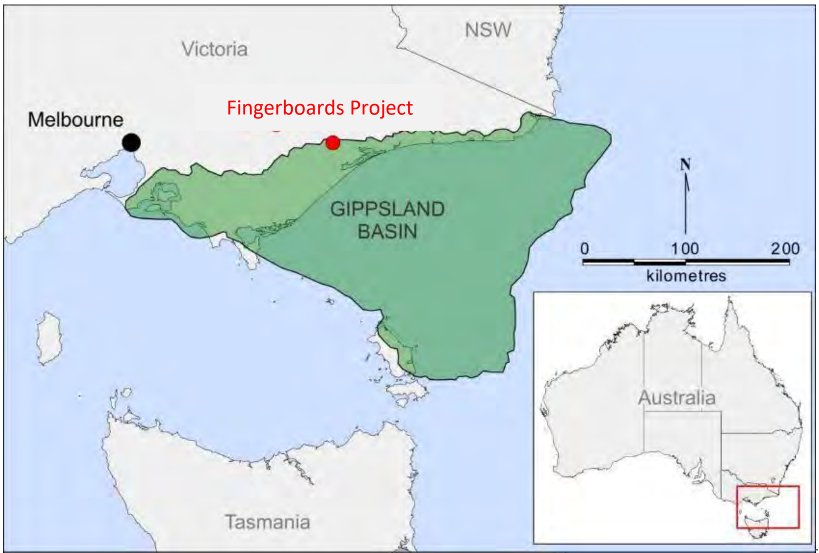
3 GEOLOGY

3.1 Regional geology

The project is located near the central northern margin of the Gippsland Basin, a Cretaceous to late Tertiary sedimentary sequence that formed as a consequence of the break-up of Gondwana in the late Jurassic to early Cretaceous Period. Approximately two-thirds of the extent of the Gippsland Basin lies offshore in the Bass Strait between the States of Victoria and Tasmania (Figure 3-1). The northern onshore part of the Basin makes up the southern part of the Gippsland region of Victoria where the younger Tertiary sediments lap onto the Palaeozoic rocks of the Eastern Highlands.



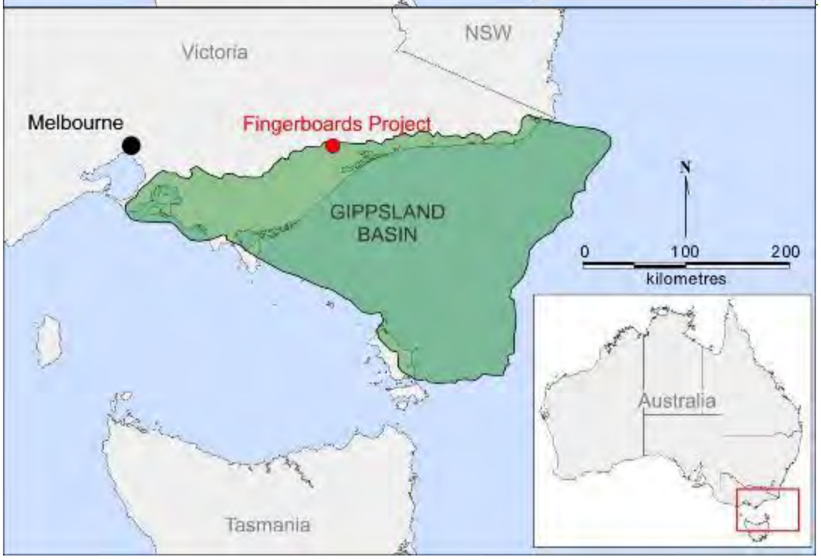


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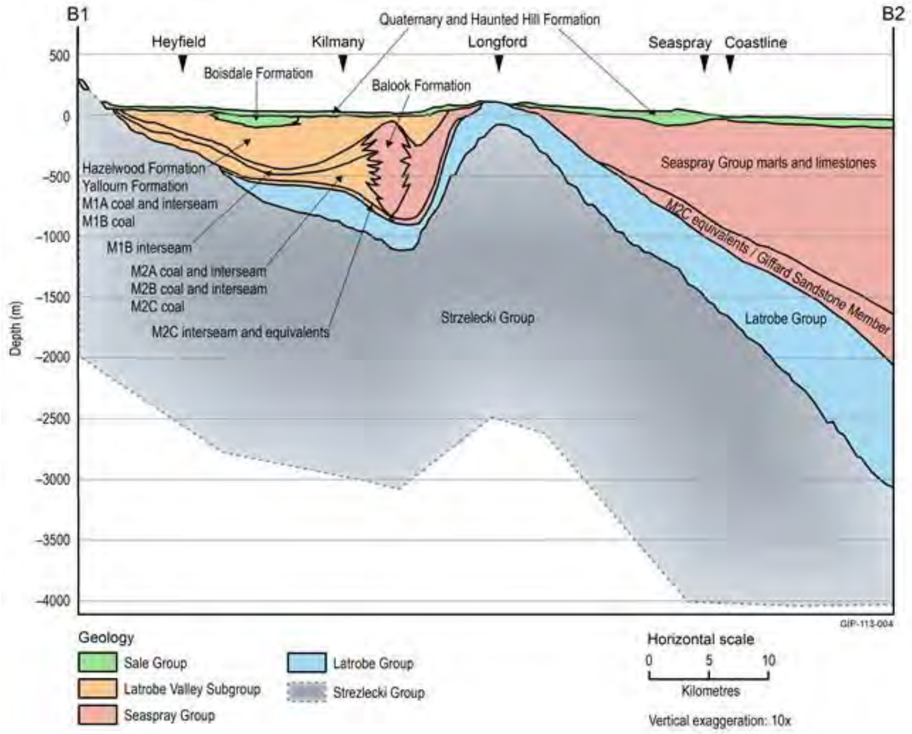
Figure 3-1: Location of Gippsland basin

Early Cretaceous rifting and crustal extension produced a rift valley complex of grabens and half-grabens. Rift-related extensional tectonism continued until the early Eocene. By the middle Eocene, sea-floor spreading had ceased in the Tasman Sea and a period of basin sag occurred, during which the offshore basin deepened but little faulting occurred. In the late Eocene, a compressional period occurred, initiating a series of fold structures in the Latrobe Group which became hosts for numerous oil and gas accumulations in the Gippsland Basin.

Post-rift sedimentary processes dominated from the early Oligocene, with the deposition of the basal unit of the Seaspray Group, including the Lakes Entrance Formation which represents the earliest fully marine sediments in the onshore Gippsland Basin. The upper part of the Seaspray Group hosts the Coongulmerang Formation, which is of Pliocene age, and the Pleistocene to Holocene Haunted Hill Formation. The Haunted Hill Formation extends west into the Latrobe Valley sequence.

Figure 3-2 shows an approximately north-south cross-section, viewed facing east, through Longford where the Seaspray Group begins to transition to the Latrobe Valley Subgroup which hosts the Yallourn and Hazelwood Formations. The folding of the deeper sequence can be seen, with a gradual transitioning upward to the younger and less folded upper Seaspray Group.



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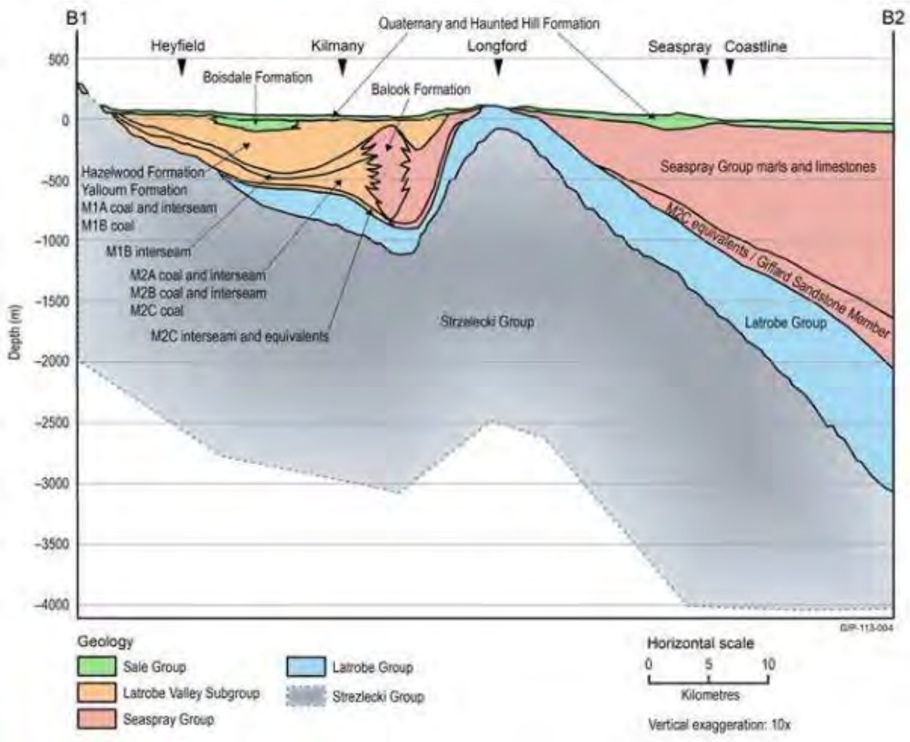

Figure 3-2: Regional geology, approx. North-South section (west of Project)

Figure 3-3 shows an approximately east-west section, viewed facing north, with greater detail of the upper Seaspray Group, which hosts the Coongulmerang Formation, and which is overlain by the Haunted Hill Formation. The sediments at the proposed mining licence area were deposited toward the latter stages of the Gippsland Basin sequence. They comprise relatively unconsolidated, flat-lying sediments, which are unaffected by earlier basin tectonism and structure formation. They are essentially soils, not rocks and no shears, faults or other tectonic structures are expected to be intercepted.

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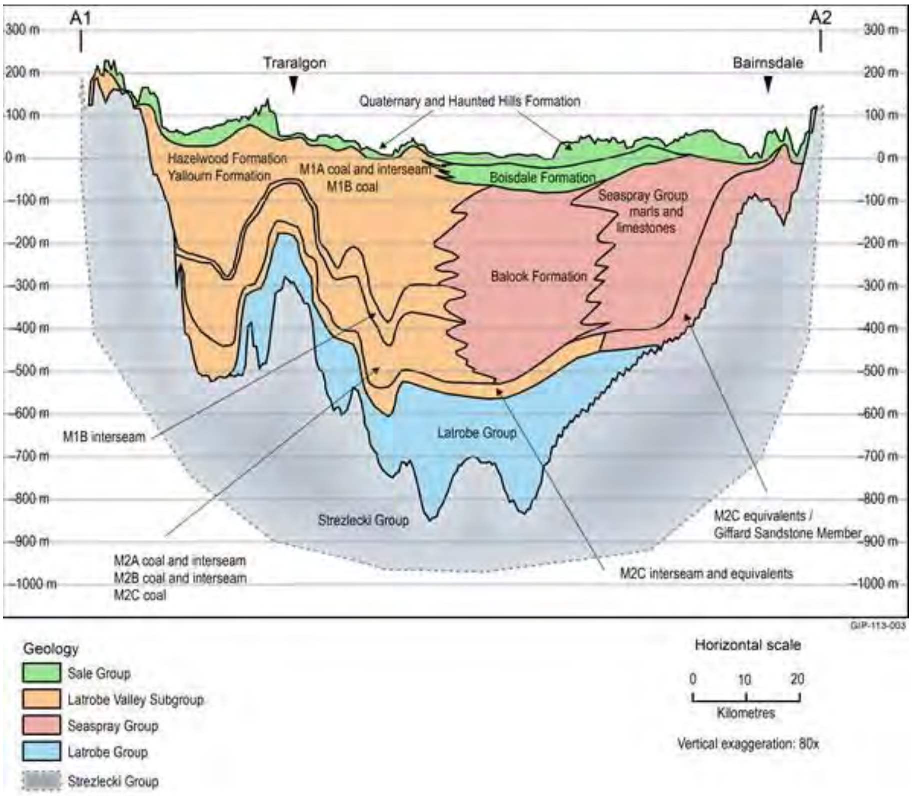

Figure 3-3: Regional project geology – east-west cross section, looking north.

3.2 Local geology

3.2.1 Glenaladale deposit

The Glenaladale mineral sands deposit lies on the northern edge of the Gippsland Basin and is bounded by the Great Dividing Range, which rises to the north. Wide expanses of Haunted Hill Formation cover the southern part of the deposit. The area is characterised by plains and stepped terraces bordering the Mitchell River Valley, with plains typically consisting of widespread tallus deposits, alluvial sheets and Quaternary sediments.

Within the Mitchell River valley there are east-northeast trending dunes. Barrier sands of former marine sequences become more prevalent to the south, towards the modern beach-barrier system that hosts the Gippsland Lakes. Unconformably overlying the Glenaladale deposit in the southern part of the proposed mining licence area are wide expanses of the Quaternary Haunted Hill Formation, consisting of mixed gravels with rounded cobbles and layers of gravelly sands and clays.

The Glenaladale deposit appears to result from significant accumulations of mineralised sediments in a near offshore environment. The distinctly curved mineralised envelopes suggest they were formed

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within an embayment of the palaeo-coastline. In this regard, they may be considered as broadly analogous to the WIM-style deposits of the Murray Basin. However, the very large thicknesses of mineralised sediment at Glenaladale suggests longer periods of accumulation, most probably due to significant rifting and associated sagging of the Gippsland Basin during the Miocene and Pliocene. Lying adjacent and to the east of the deposit is the Mitchell River system, a major long-lived river system which has followed approximately its current path throughout the Tertiary. It seems highly likely that this river was a major source of the sediment load which contributed the heavy minerals.

Paleozoic basement underlies the Pliocene sands and is exposed in river cuttings a few kilometres to the north of the proposed mining licence area. Basement rock has been intersected at depth in several drill holes within the proposed mining licence area.

3.2.2 Fingerboards resource

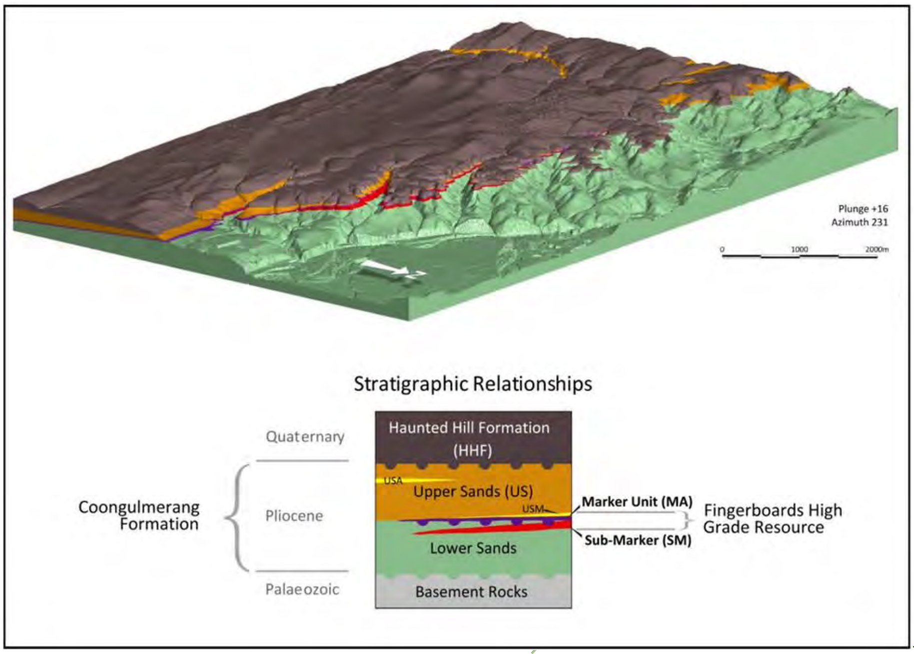
The Fingerboards Resource sits within the Glenaladale mineral sands deposit. The Fingerboards Resource is entirely contained within the higher-grade upper sequence of the Glenaladale deposit, namely the Upper Sands, Marker and Sub Marker Units. The orebody targeted by the Fingerboards Project is contained within part of the Fingerboards resource.

The mineralisation targeted by the Fingerboards project is hosted within a thick sequence of over 90 m of Pliocene age Coongulmerang Formation – an unconsolidated, uniform, well sorted, fine, silty sand formed in a shallow marine setting, which tends to become more clayey towards the base of the sequence. Within this mineralised sequence there are two distinct depositional sand sequences - the Upper and Lower Sands. The Upper Sands layer varies between 0 and 20 metres thick and consists predominantly of fine silty sand to clayey silts and sands, with low grades of heavy minerals (1 to 3% heavy minerals (HM)). The Lower Sands are up to 100 metres in thickness and consist of fine silts, clay and fine sandy horizons, within which zones up to 50 metres thick of lower grade (1-4% HM) mineralisation occur. Variation in mineralogy can occur within the Lower Sands.

Between the Upper and Lower Sands, there are several layers of significantly elevated heavy mineral grade. The most significantly enriched layer lies unconformably on the Lower Sand at the base of the Upper Sand and is referred to as the ‘Marker Unit’. This very high-grade layer, while only a few metres thick, is laterally extensive covering an area of close to 30 km^2. The Marker Unit averages approximately 10% HM, of which approximately 35% is zircon. It lies close to the surface over a wide area and outcrops over a strike length of several kilometres in the east of the Fingerboards Project.

The relationship between the various stratigraphic units is shown in Figure 3-4. The overlying Haunted Hill Formation is relatively flat, while the Marker Unit dips at approximately 0.8 degrees to the south. Numerous enriched layers within the Lower Sands sequence dip relatively more steeply to the south (approximately 1.2 degrees or greater). The Marker Unit has the highest levels of zircon, monazite and xenotime, compared to the other layers. On average, the various layers have nearly 30% zircon within the HM assemblage, which is at the higher end for mineral sands deposits.

The stratigraphy and its relationship to the mining pit is presented in Figure 3-4 and Figure 3-5igure 3-7. A summary of the deposit stratigraphy is provided in Table 3-1. Typical cross sections through the proposed mine pit area are shown in Figure 3-6 and Figure 3-7.



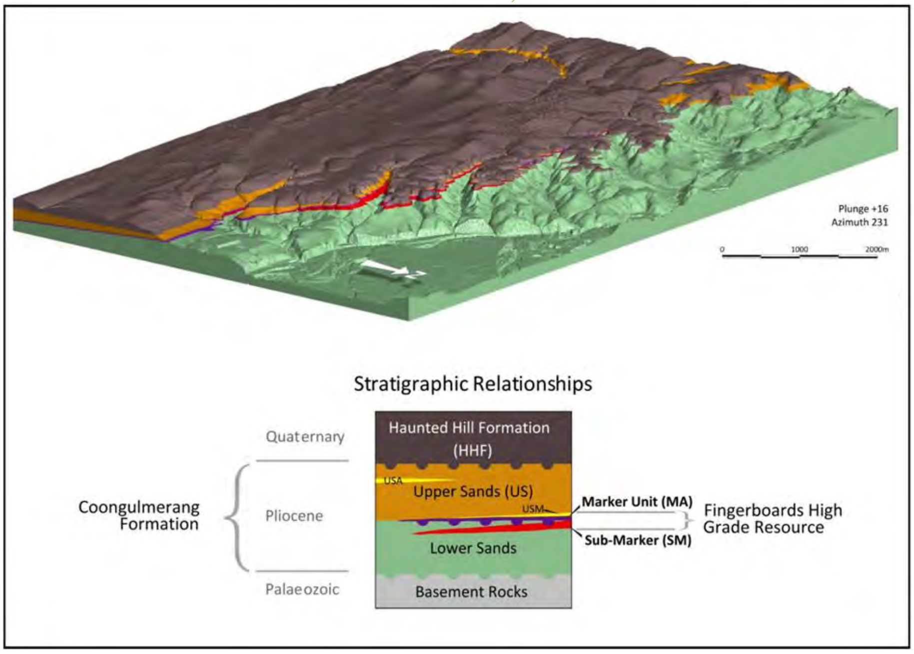


Figure 3-4: Stratigraphic relationships within the proposed mining licence area

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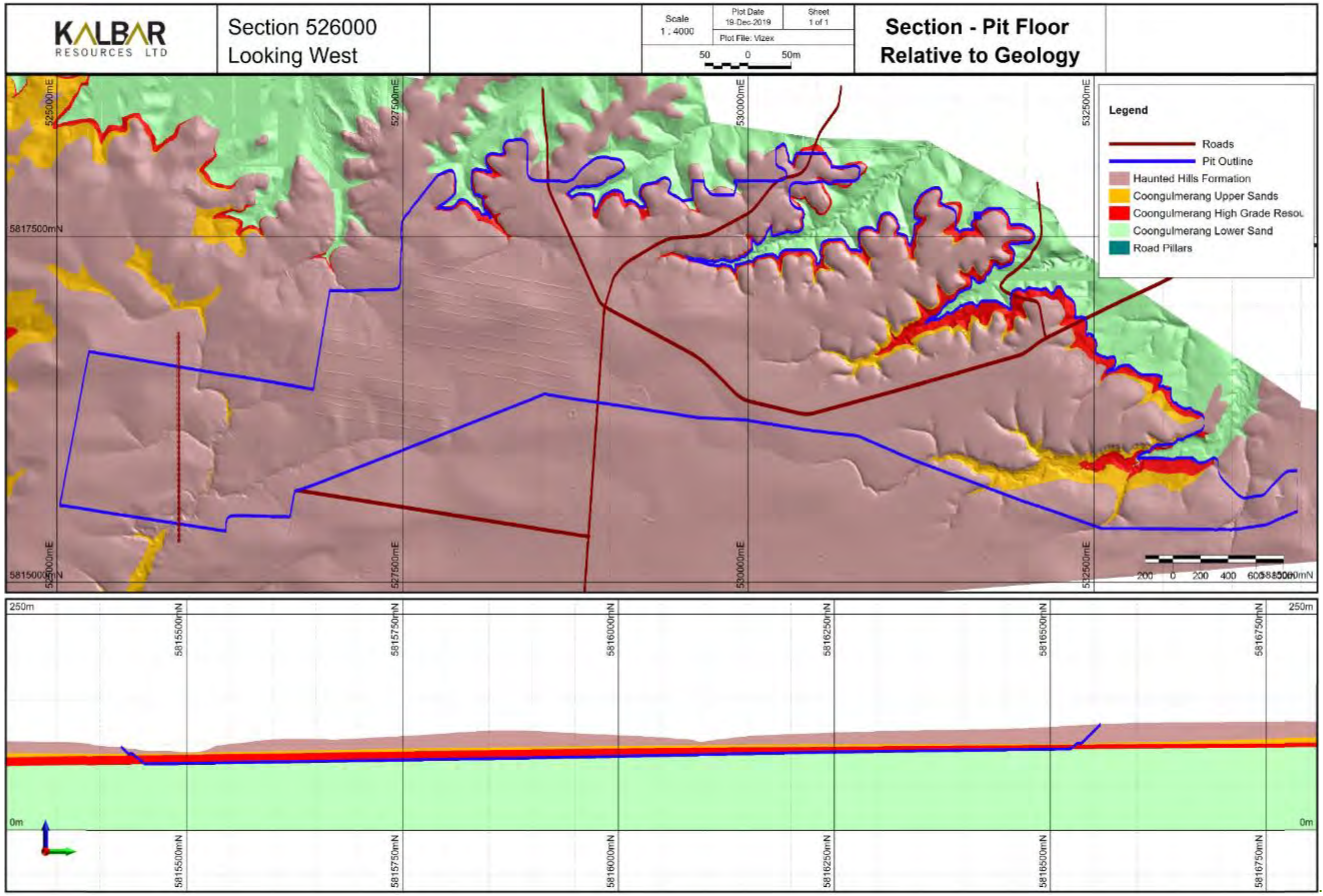
Table 3-1: Geological units in the proposed mining licence area

Unit	Thickness, m	Description	Geological age
Alluvium	0.2 – 0.7	Silty sand, fine to medium grained, non-plastic fines	Pleistocene to Holocene
Dune deposits	Up to 0.75	Silty sand, fine to medium grained	Pleistocene
Haunted Hill Formation: Upper Clay	2.4 – 15.5	Clay, sandy clay, clayey sand in layers and/or cross bedded; medium plasticity with variable sand content	Pliocene to Pleistocene
Haunted Hill Formation: Basal Gravel	5.7 – 10.1	Gravel, clayey sandy gravel, low plasticity clayey fines, variably cemented	Pliocene to Pleistocene
		Erosional disconformity (Figure 3-5)	
Coongulmerang Formation	Up to 32.5	Fine-grained silty sands, subdivided for grade purposes into five ore stratea and an underlying sand unit	Pliocene

Figure 3-5: Haunted Hill Formation overlying Coongulmerang Formation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Roads
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Haunted Hills Formation
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Coongulmerang Lower Sand
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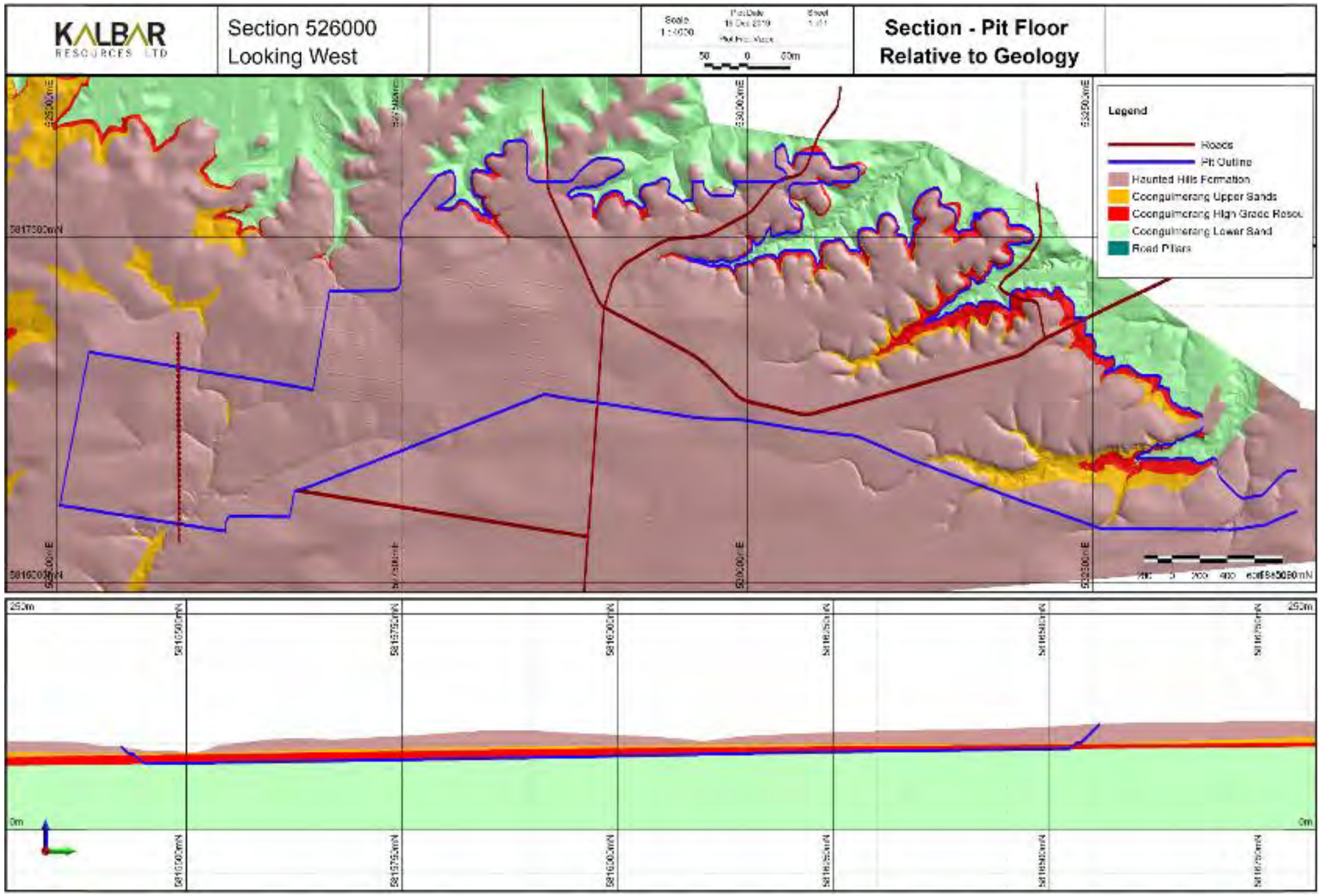
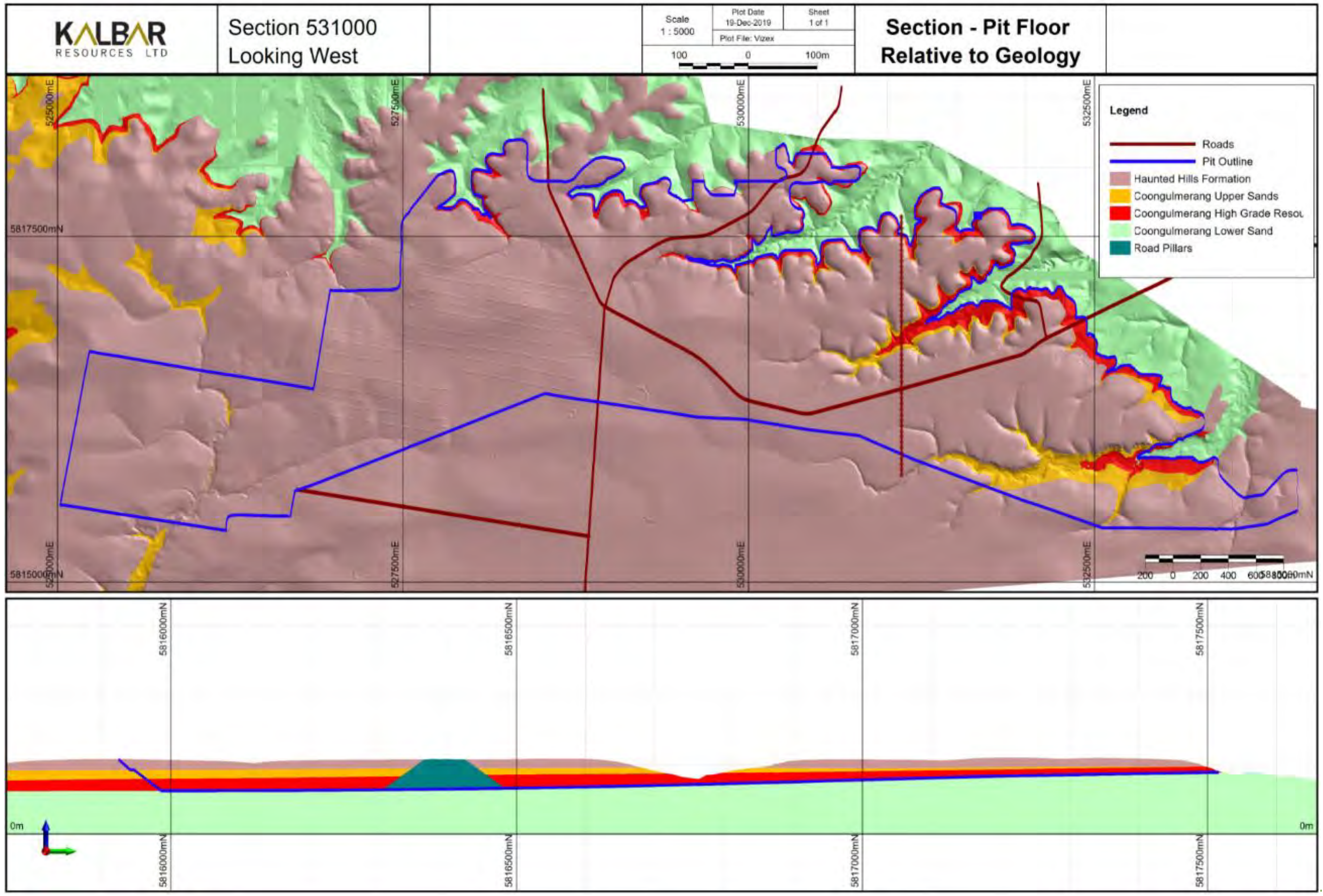


Figure 3-6: Cross-Section Geology and Mining Extent – 526,000 mE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Section 531000
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Section - Pit Floor Relative to Geology
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Roads
Pit Outline
Haunted Hills Formation
Coongulmerang Upper Sands
Coongulmerang High Grade Resou
Coongulmerang Lower Sand
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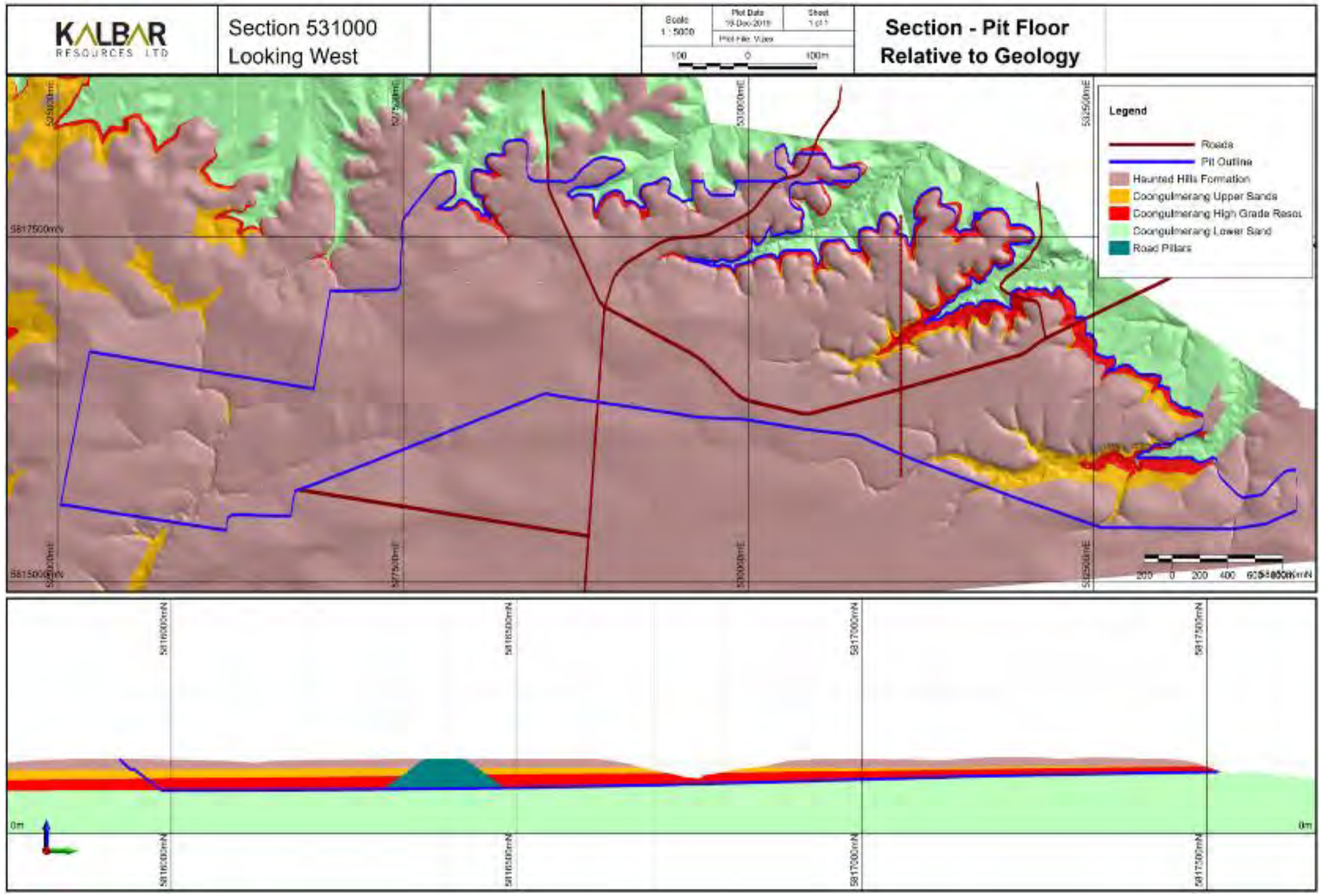

Figure 3-7: Cross-Section Geology and Mining Extent – 531,000 mE

3.3 Resource assessment

The Glenaladale deposit contains zircon, rutile, ilmenite and rare-earth bearing minerals (monazite and xenotime). These valuable minerals are denser than sand and clay particles and can be efficiently separated using gravity separation to form a heavy mineral concentrate (HMC). The Fingerboards resource lies within the eastern part of the Glenaladale deposit.

The Fingerboards Mineral Resource Estimate contains 910 Mt of ore at 0.7% zircon, 1.2% titanium minerals and 0.06% rare earths. A Joint Ore Reserves Committee (JORC) 2012 compliant ore reserve has been demarcated within this mineral resource (Kalbar BFS, 2018). The ore reserve contains 173 Mt of ore at 1.2% zircon, 1.9% titanium dioxide and 0.11% total rare earth oxides (Table 3-2).

Table 3-2: Fingerboards ore reserve estimate (2018) – JORC Code 2012

	Ore, Mt	In situ grades					Contained tonnes		
		ZrO_2 + HfO_2, %	TiO_2, %	TREO, %	Zircon, %	Zircon equiv, %	Ziron, kt	TiO_2, kt	TREO, kt
Proven	73	0.79	1.8	0.11	1.2	2.1	870	1340	77
Probable	100	0.82	1.9	0.11	1.2	2.2	1240	1890	114
Total	173	0.81	1.9	0.11	1.2	2.1	2110	3230	191

TREO means 'Total rare earth oxides + Y_2O_3')

Notes

1 *The Mineral Resource and Ore Reserve are prepared and presented to the guidelines of the Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves, 2012 Edition (JORC Code).*

2 *Fingerboards Ore Reserve is contained within the Fingerboards Resource which forms part of the Glenaladale Mineral Sands Resource. The reserve lies entirely within the Fingerboards Project Area.*

3 *Mineral resource cells are nominated as ore if within the Fingerboards Mine Package of SM, MA, USM, or USA and carrying a recoverable revenue in excess of $2/t of ore.*

4 *Zircon Equivalent considers the recoverable revenue of the valuable minerals and presents the zircon grade that would be required to produce that recoverable value without credits of the other valuable minerals. Assumed recoveries and sales prices shown below.*

Notes

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3 *Mineral resource cells are nominated as ore if within the Fingerboards Mine Package of SM, MA, USM, or USA and carrying a recoverable revenue in excess of $2/t of ore.*

4 *Zircon Equivalent considers the recoverable revenue of the valuable minerals and presents the zircon grade that would be required to produce that recoverable value without credits of the other valuable minerals. Assumed recoveries and sales prices shown below.*

In 2018 CSA Global completed an independent mineral resource estimate for the Fingerboards Project in accordance with the JORC Code 2012 (Table 3-3). The Mineral Resource is reported above a cut-off grade of 0.2% zircon equivalent. Applying economic factors derived from a marketing study carried out as part of the Pre-Feasibility Study (Hugo, 2017), has enabled a zircon equivalent grade to be estimated from the value of rare earths and TiO_2 content as well as the contained zircon.

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Table 3-3: Fingerboards mineral resource estimate (CSA, 2018)

Class		Measured	Indicated	Inferred	Total
	Vol, Mm^3	52.9	189	300	550
	Tonnes, Mt	88.5	314.6	510	910
	Bulk density, g/cm3	1.68	1.67	1.7	1.7
In situ grades, %	$ZrO_2 + HfO_2$	0.69	0.52	0.3	0.4
	TiO_2,	1.65	1.34	1	1.2
	REO + Y_2O_3,	0.093	0.073	0.05	0.06
	Zircon, (Note 2)	1.04	0.79	0.5	0.7
	Zircon equivalent, (Note 3)	1.69	1.3	0.8	1.1
Contained tonnes	Zircon	924,000	2,480,300	2,601,000	6,006,000
	Rare earths (REO + Y_2O_3)	82,100	230,000	241,000	554,000
	TiO_2	1,457,000	4,209,500	4,943,000	10,609,000

Note 1: In situ zircon content is based on direct analysis by X-ray fluorescence (XRF) and back-calculation only (ZrO_2+HfO_2/0.66).

Note 2: Zircon equivalent is calculated based on ZrO_2/t, TiO_2/t and REO/t pricing, which is derived from the contained value of zircon (ZrO_2), ilmenite, Hyti and rutile (TiO_2) and monazite and xenotime (REO) in the HMC sold to mineral processing companies in China and South-East Asia. The values are calculated from final mineral product prices and takes into account mineral recoveries, product quality and processing margins. As at 1 October 2017, the prices used are US$1450/t of contained ZrO_2+HfO_2, US$200/t of contained TiO_2 and US$5,000/t of contained REO+Y_2O_3

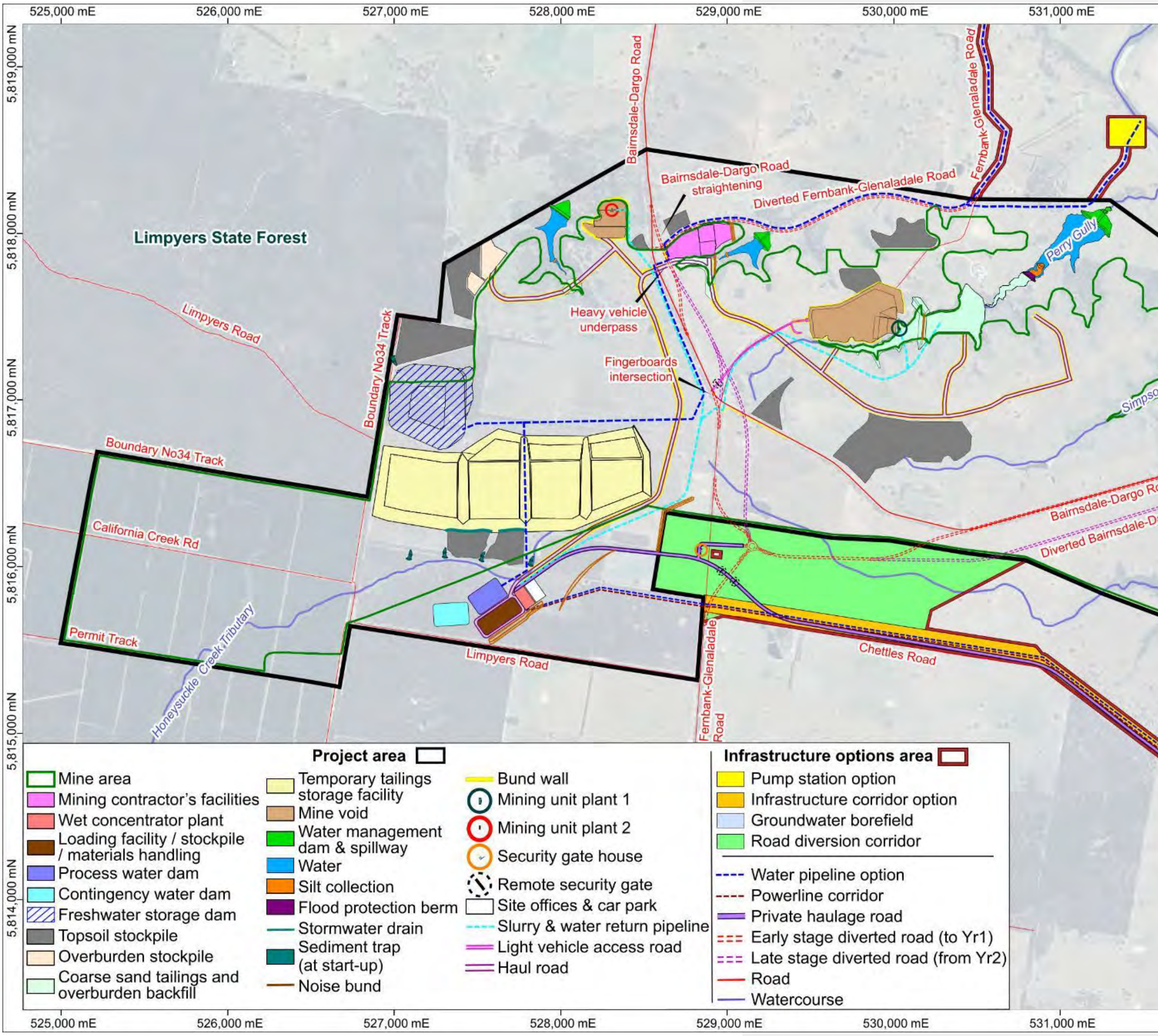
4 MINING

4.1 Site layout and surrounding land

A general layout plan for Year 1 of mining operations is presented in Figure 4-1. Unlike a hard rock mining operation, the mining footprint for the mineral sands operation will change year by year. Approximate mine configurations for Years 1, 5, 8, 12 and 15 are shown in Figures 4-3 through 4-7. A general arrangement for the Fingerboards processing plant site is provided in Figure 4-2.

The processing plant location and layout was designed having regard to the following:

- Sloping terrain allowed for an appropriate amount of fall from the WCP and stockpile areas to a process water dam, allowing for better plant and rainwater drainage and control.
- Use of existing vegetation and topography to provide visual and acoustic screening.
- Use of natural topography to enable gravity flow of water throughout the feed preparation circuit (surge bin, thickener, process water tank, etc.).
- Efficient configuration of piping and separation of overhead power reticulation from active mining areas.
- Separation of pedestrian / commuter traffic to administration and office areas from mobile equipment operating in and around the processing plant and stockpile area.



525,000 mE
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5,819,000 mN
5,818,000 mN
5,817,000 mN
5,816,000 mN
5,815,000 mN
5,814,000 mN
Limpyers State Forest
Limpyers Road
Boundary No34 Track
California Creek Rd
Permit Track
Honeysuckle Creek Tributary
Bairnsdale-Dargo Road
Bairnsdale-Dargo Road straightening
Diverted Fernbank-Glenaladale Road
Fernbank-Glenaladale Road
Heavy vehicle underpass
Fingerboards intersection
Perry Gully
Chettles Road
Diverted Bairnsdale-Dargo Road
Project area
Mine area
Mining contractor's facilities
Wet concentrator plant
Loading facility / stockpile / materials handling
Process water dam
Contingency water dam
Freshwater storage dam
Topsoil stockpile
Overburden stockpile
Coarse sand tailings and overburden backfill
Temporary tailings storage facility
Mine void
Water management dam & spillway
Water
Silt collection
Flood protection berm
Stormwater drain
Sediment trap (at start-up)
Noise bund
Bund wall
Mining unit plant 1
Mining unit plant 2
Security gate house
Remote security gate
Site offices & car park
Slurry & water return pipeline
Light vehicle access road
Haul road
Infrastructure options area
Pump station option
Infrastructure corridor option
Groundwater borefield
Road diversion corridor
Water pipeline option
Powerline corridor
Private haulage road
Early stage diverted road (to Yr1)
Late stage diverted road (from Yr2)
Road
Watercourse

•

- Locating the centrifuge plants (two total – one near each MUP mining area) near the active mining area to minimise overland haul distance in consideration of dust and noise generation. The centrifuge plants are relocatable and will follow mining areas.

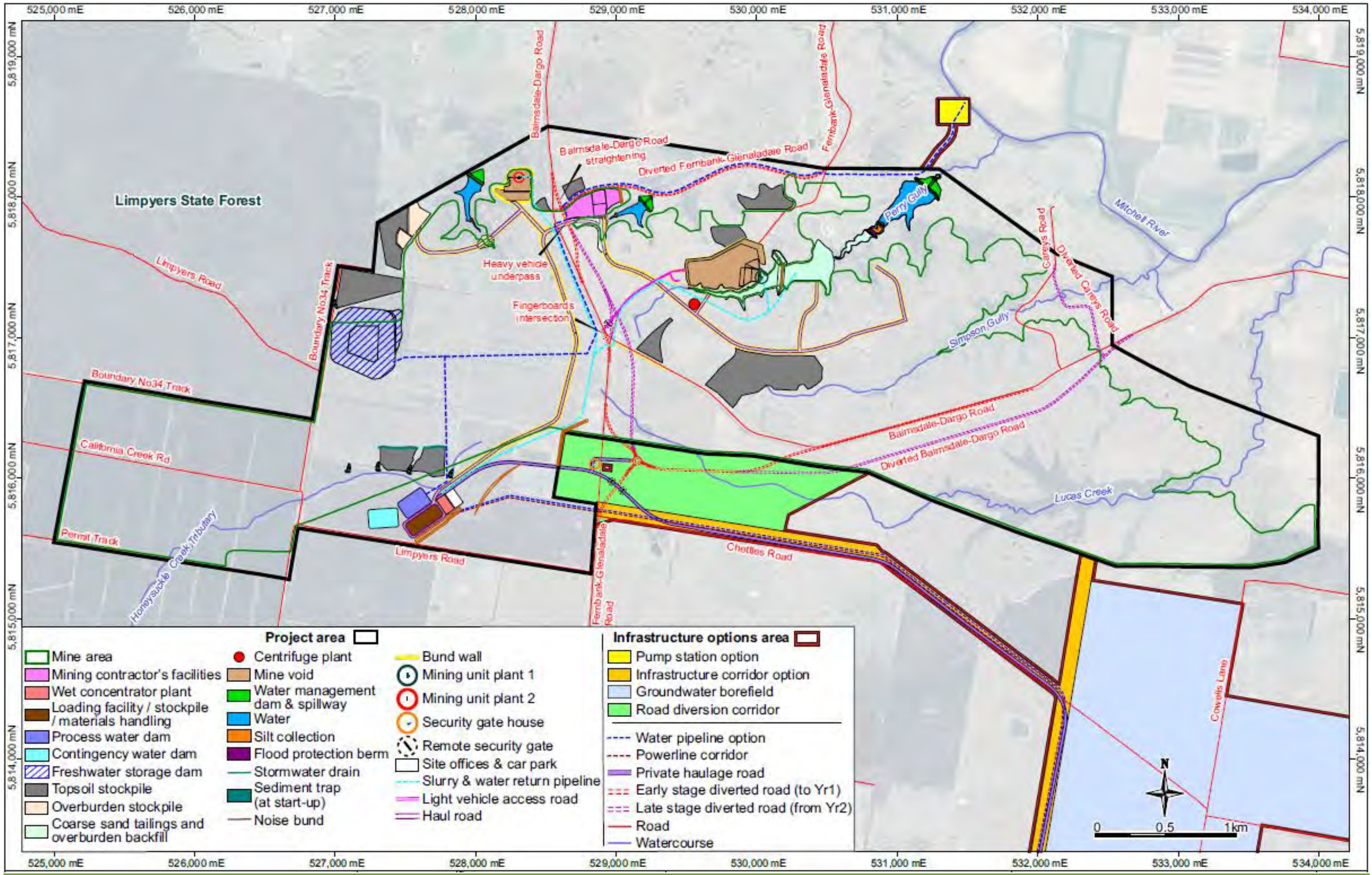


Figure 4-1: General arrangement layout around the project area at start up and Year 1

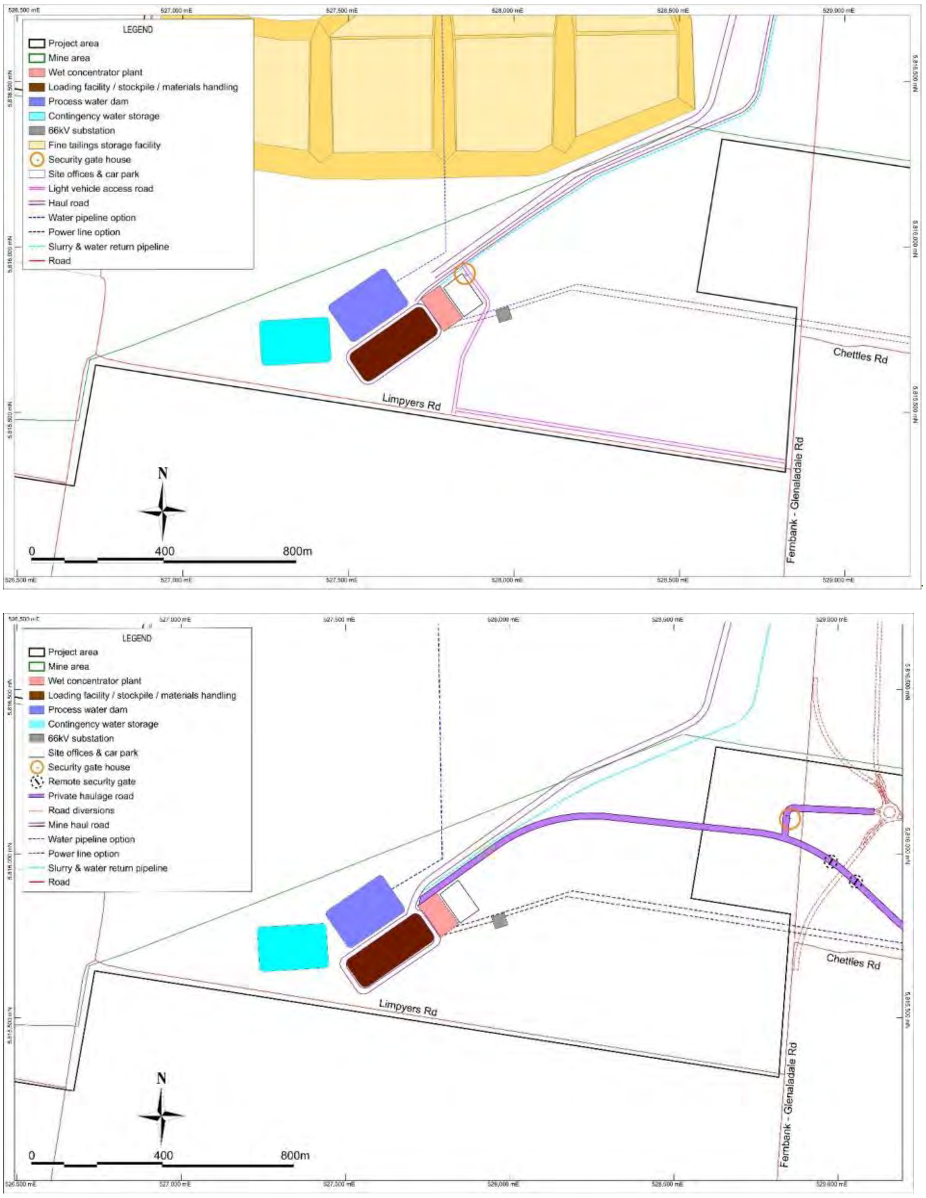
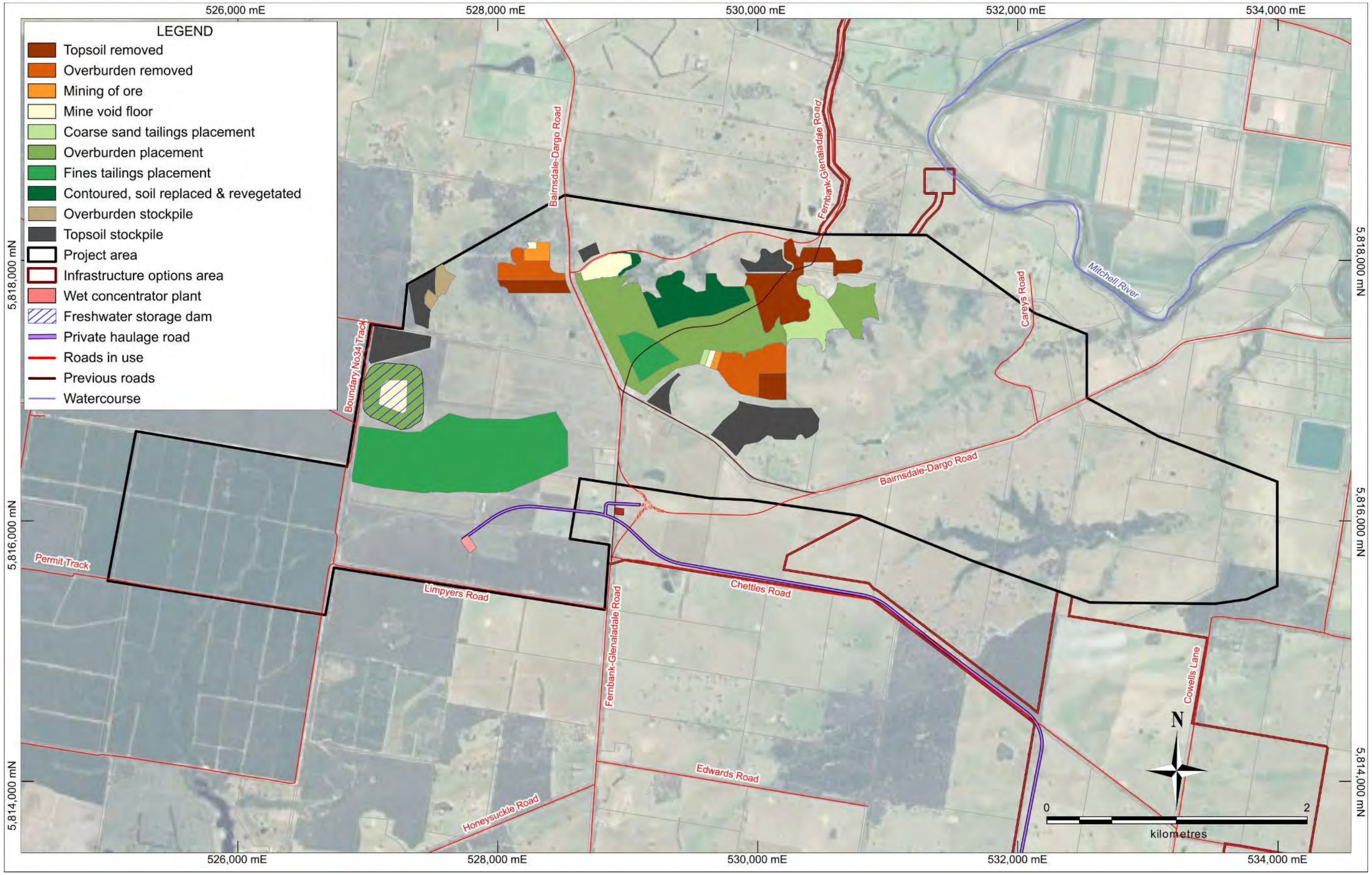


Figure 4-2: Plant layout detail


LEGEND
Topsoil removed
Overburden removed
Mining of ore
Mine void floor
Coarse sand tailings placement
Overburden placement
Fines tailings placement
Contoured, soil replaced & revegetated
Overburden stockpile
Topsoil stockpile
Project area
Infrastructure options area
Wet concentrator plant
Freshwater storage dam
Private haulage road
Roads in use
Previous roads
Watercourse
526,000 mE
528,000 mE
530,000 mE
532,000 mE
534,000 mE
5,818,000 mN
5,816,000 mN
5,814,000 mN
Bairnsdale-Dargo Road
Fernbank-Glenaladale Road
Boundary No34 Track
Careys Road
Mitchell River
Permit Track
Limpyers Road
Chettles Road
Edwards Road
Honeysuckle Road
Cowells Lane
N
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2
kilometres

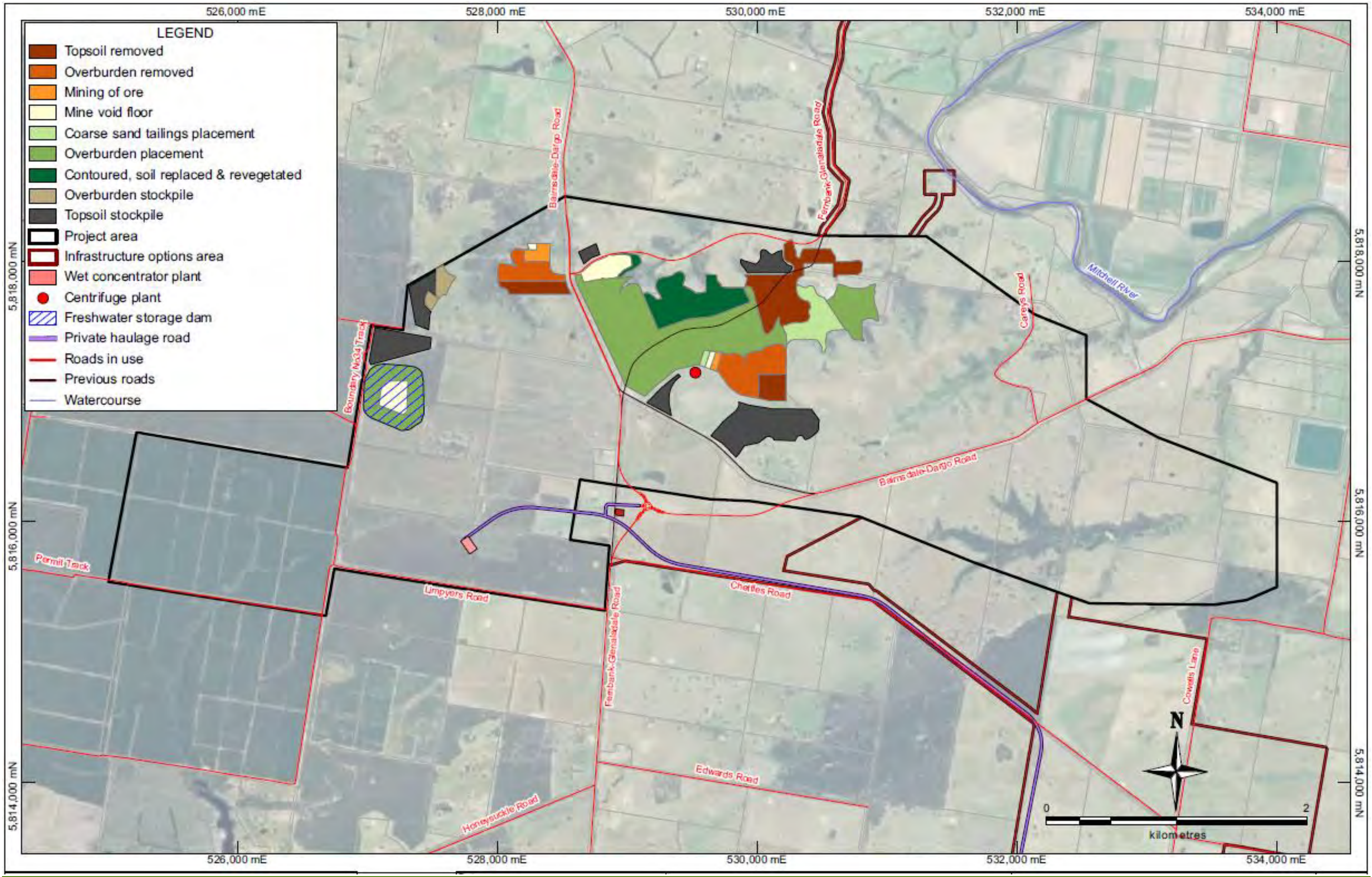
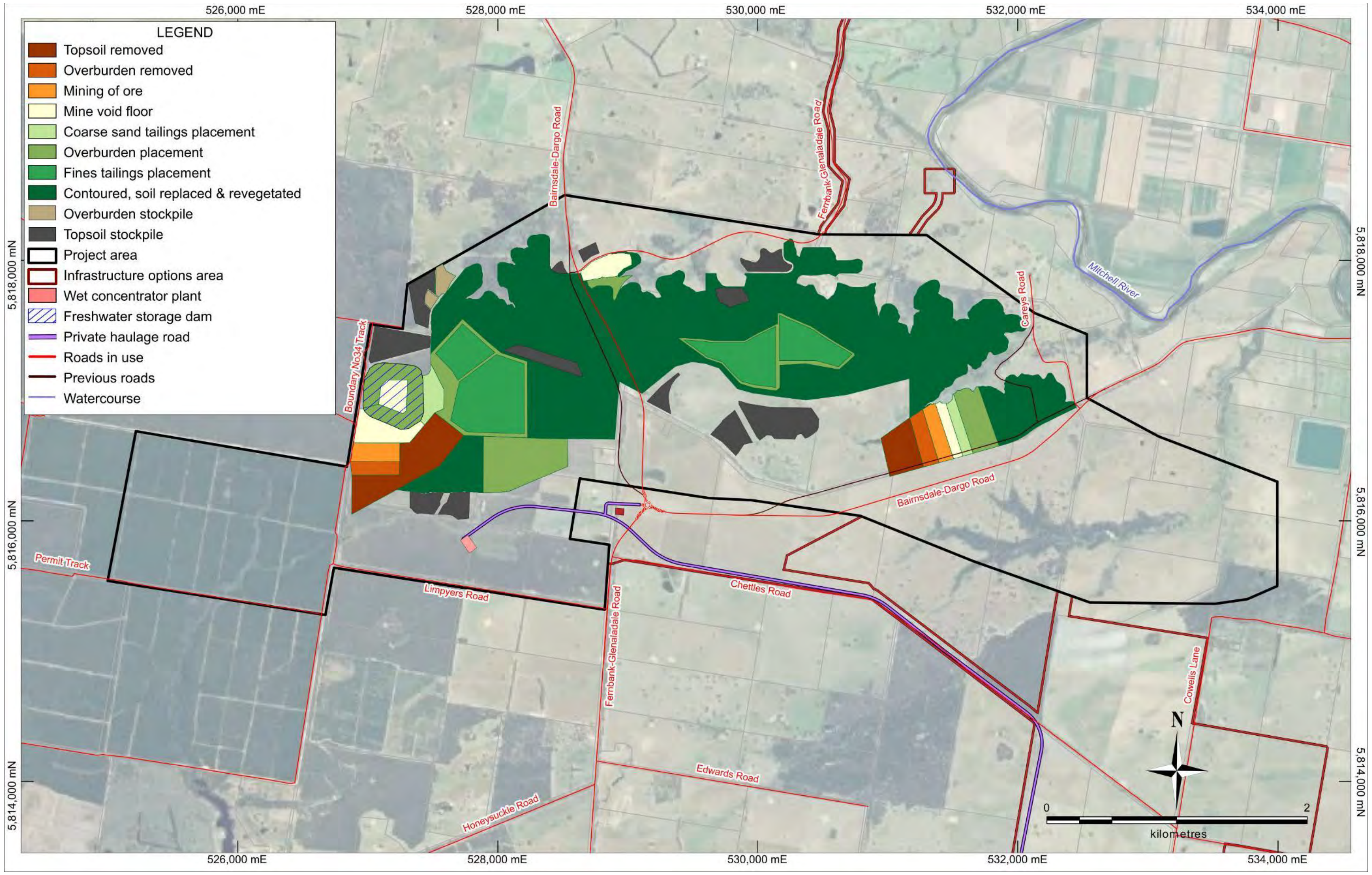


Figure 4-3: Indicative mine layout – Year 1


LEGEND
Topsoil removed
Overburden removed
Mining of ore
Mine void floor
Coarse sand tailings placement
Overburden placement
Fines tailings placement
Contoured, soil replaced & revegetated
Overburden stockpile
Topsoil stockpile
Project area
Infrastructure options area
Wet concentrator plant
Freshwater storage dam
Private haulage road
Roads in use
Previous roads
Watercourse
526,000 mE
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532,000 mE
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5,818,000 mN
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Bairnsdale-Dargo Road
Fernbank-Glenaladale Road
Careys Road
Mitchell River
Boundary No34 Track
Permit Track
Limpyers Road
Chettles Road
Cowells Lane
Edwards Road
Honeysuckle Road
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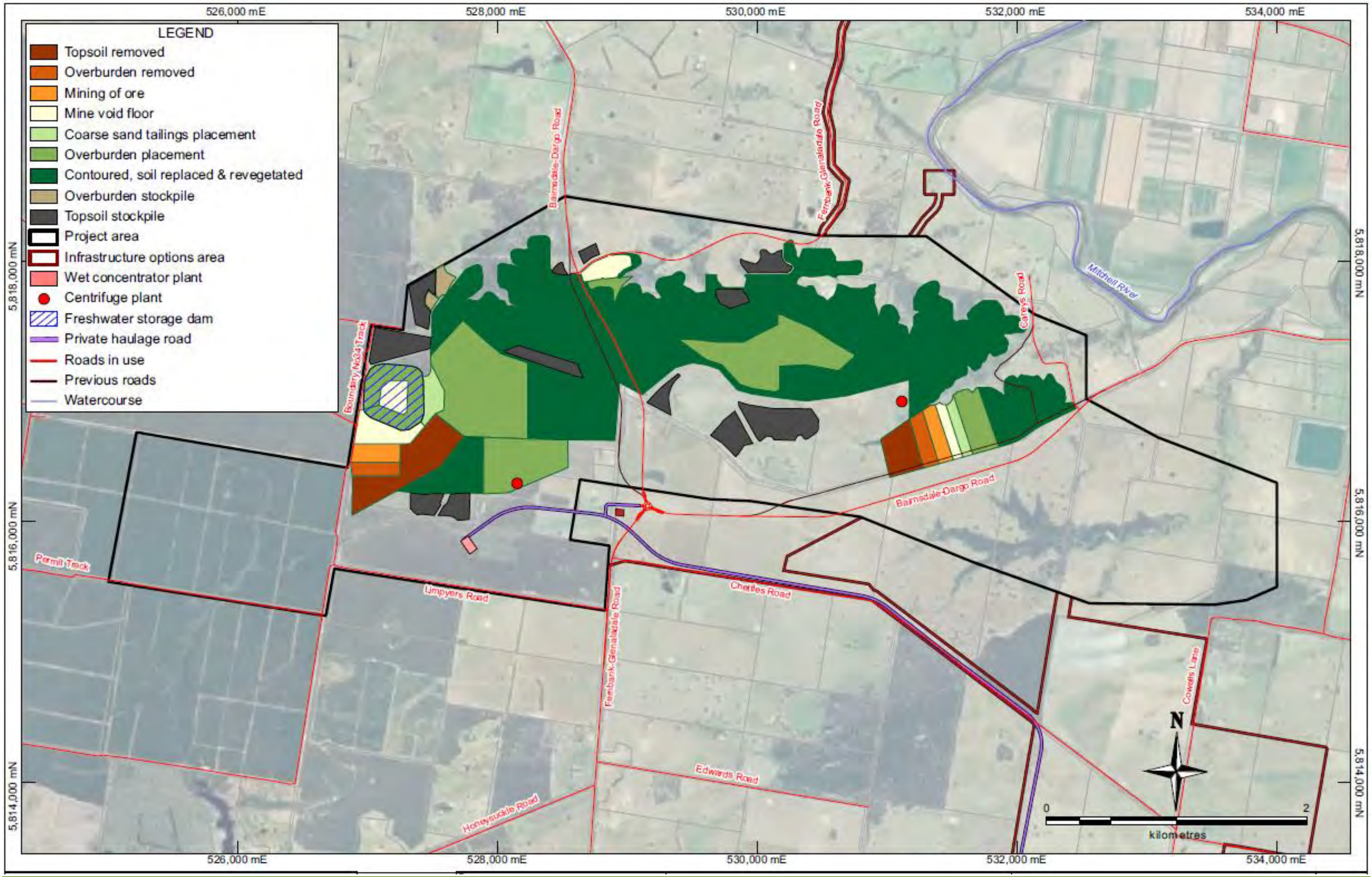

Figure 4-44: Indicative mine layout – Year 5

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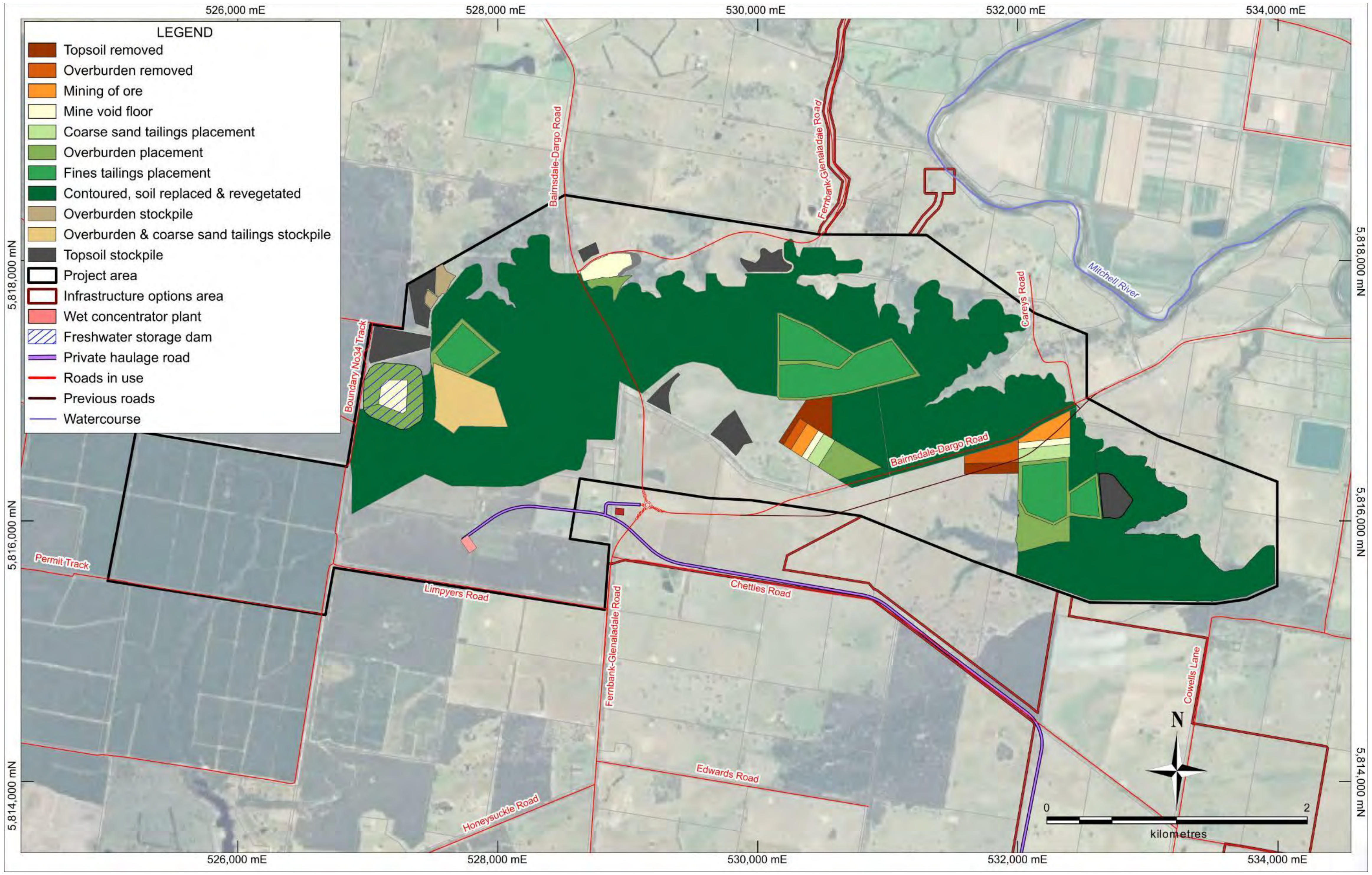
LEGEND
Topsoil removed
Overburden removed
Mining of ore
Mine void floor
Coarse sand tailings placement
Overburden placement
Fines tailings placement
Contoured, soil replaced & revegetated
Overburden stockpile
Overburden & coarse sand tailings stockpile
Topsoil stockpile
Project area
Infrastructure options area
Wet concentrator plant
Freshwater storage dam
Private haulage road
Roads in use
Previous roads
Watercourse
526,000 mE
528,000 mE
530,000 mE
532,000 mE
534,000 mE
5,818,000 mN
5,816,000 mN
5,814,000 mN
Bairnsdale-Dargo Road
Fernbank-Glenaladale Road
Boundary No34 Track
Careys Road
Mitchell River
Permit Track
Limpyers Road
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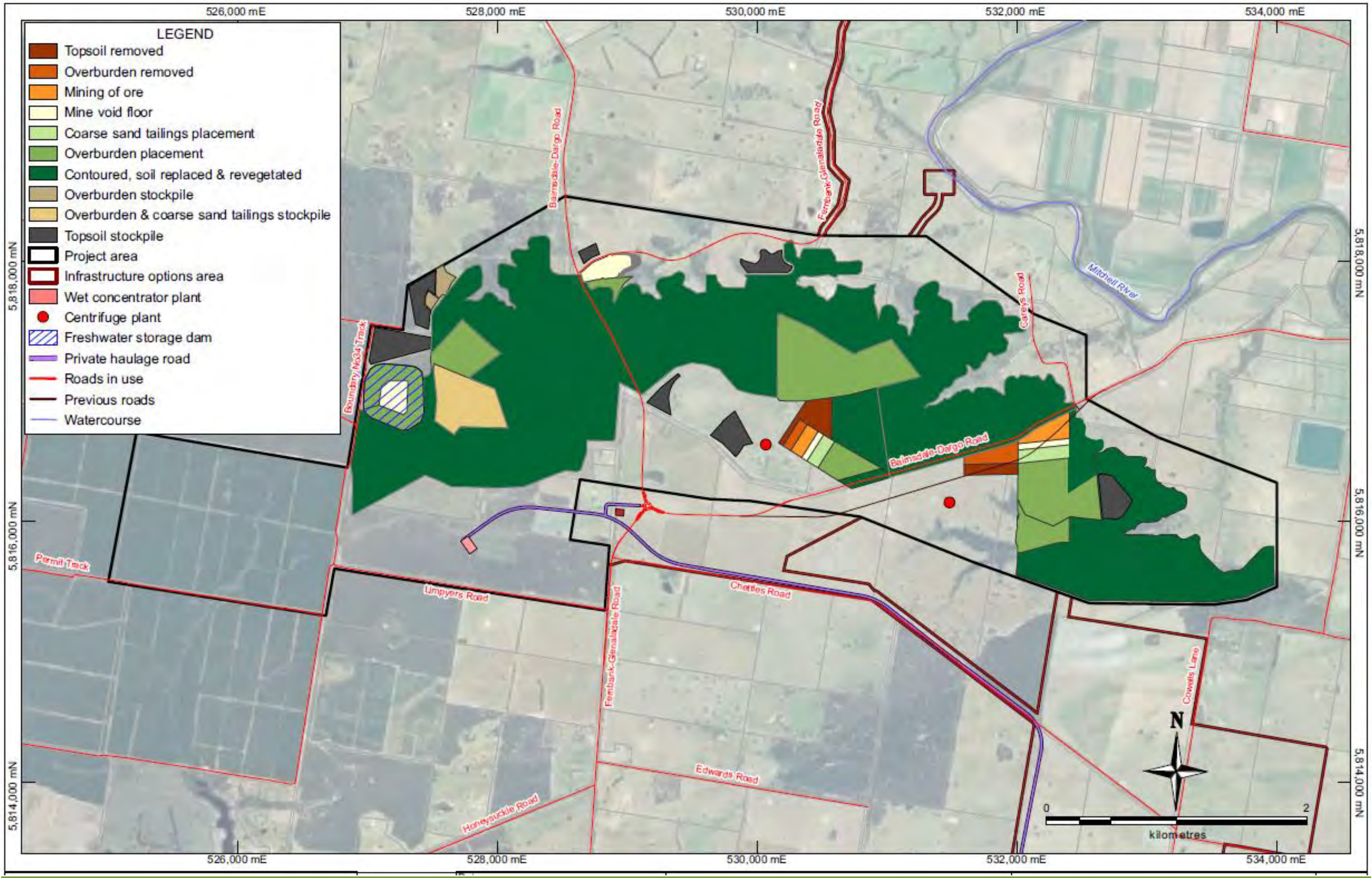

Figure 4-55: Indicative mine layout – Year 8

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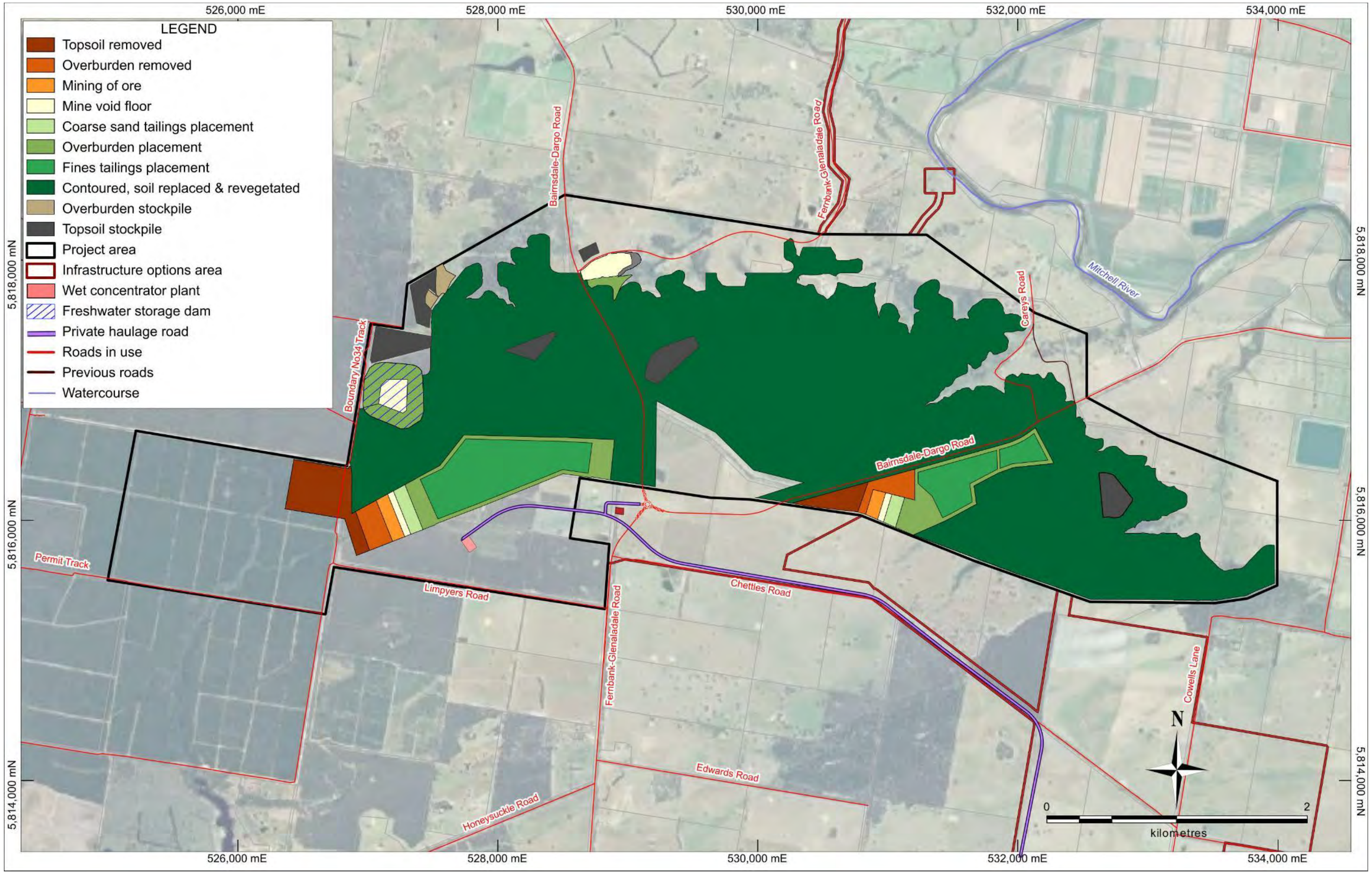

LEGEND
Topsoil removed
Overburden removed
Mining of ore
Mine void floor
Coarse sand tailings placement
Overburden placement
Fines tailings placement
Contoured, soil replaced & revegetated
Overburden stockpile
Topsoil stockpile
Project area
Infrastructure options area
Wet concentrator plant
Freshwater storage dam
Private haulage road
Roads in use
Previous roads
Watercourse
526,000 mE
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532,000 mE
534,000 mE
5,818,000 mN
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5,814,000 mN
Bairnsdale-Dargo Road
Fernbank-Glenaladale Road
Careys Road
Mitchell River
Boundary No34 Track
Permit Track
Limpyers Road
Chettles Road
Cowells Lane
Edwards Road
Honeysuckle Road
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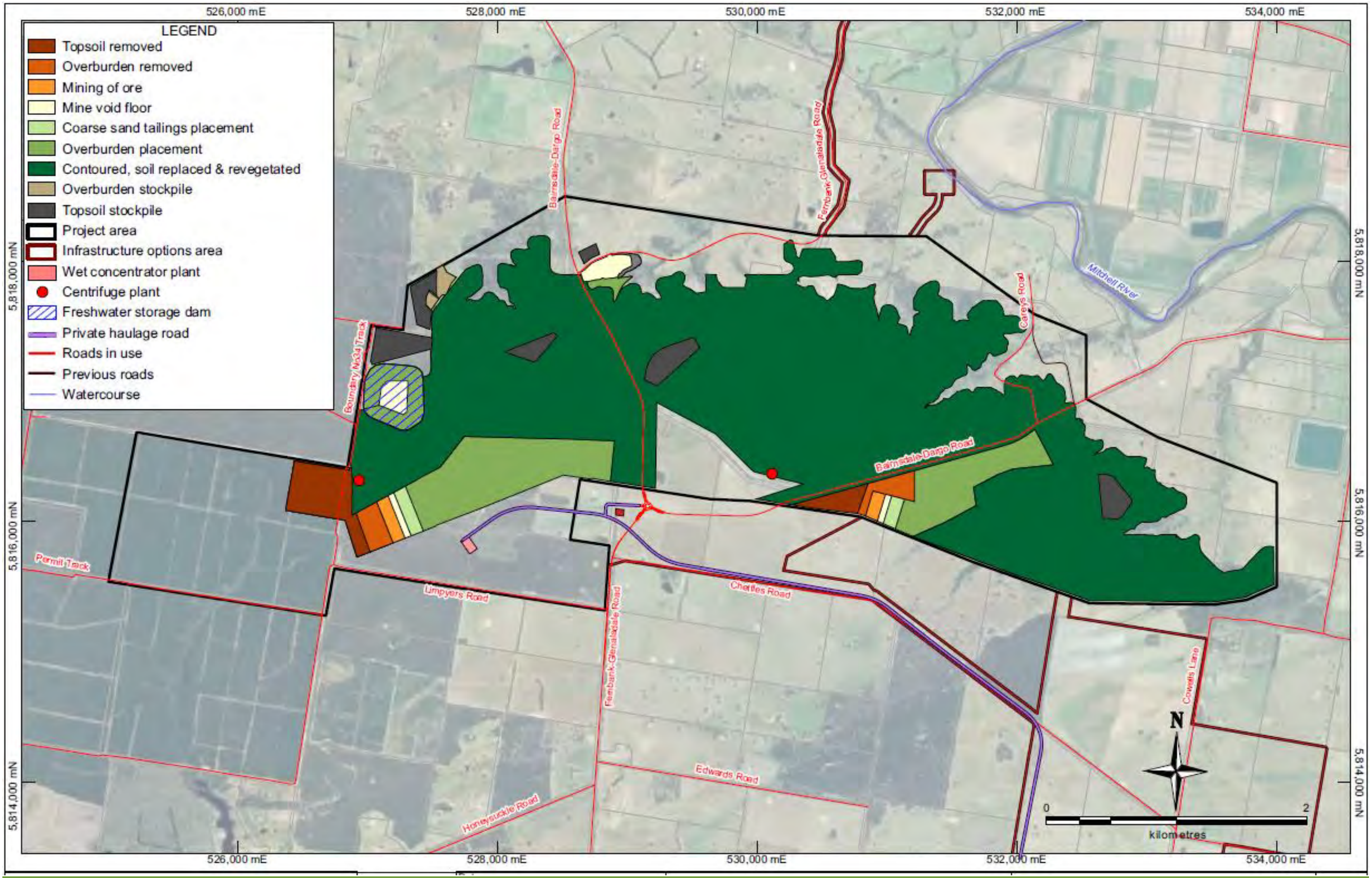

Figure 4-66: Indicative mine layout – Year 12

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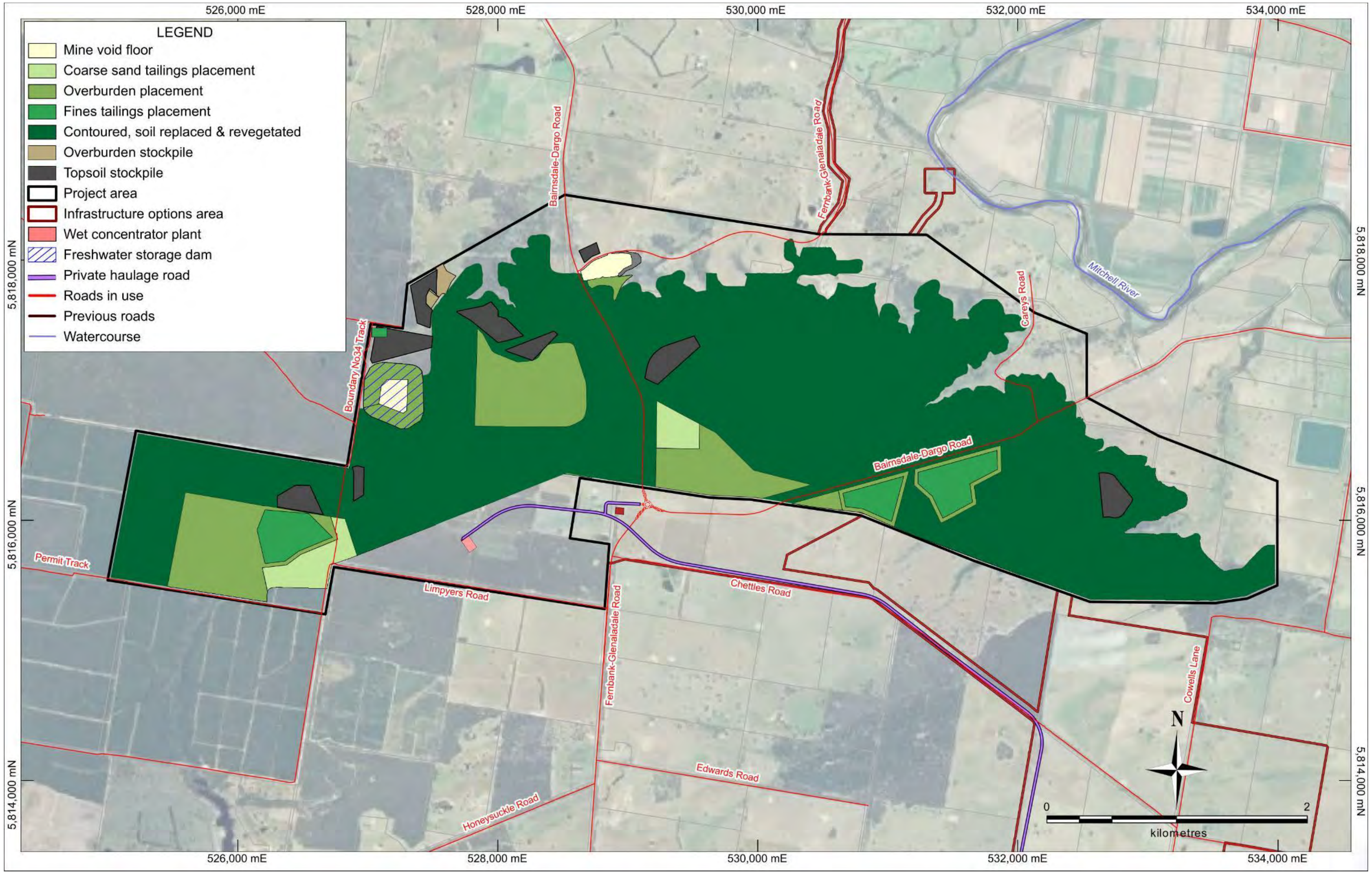
LEGEND
Mine void floor
Coarse sand tailings placement
Overburden placement
Fines tailings placement
Contoured, soil replaced & revegetated
Overburden stockpile
Topsoil stockpile
Project area
Infrastructure options area
Wet concentrator plant
Freshwater storage dam
Private haulage road
Roads in use
Previous roads
Watercourse
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534,000 mE
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Fernbank-Glenaladale Road
Boundary No34 Track
Gareys Road
Mitchell River
Permit Track
Limpyers Road
Chettles Road
Cowells Lane
Edwards Road
Honeysuckle Road
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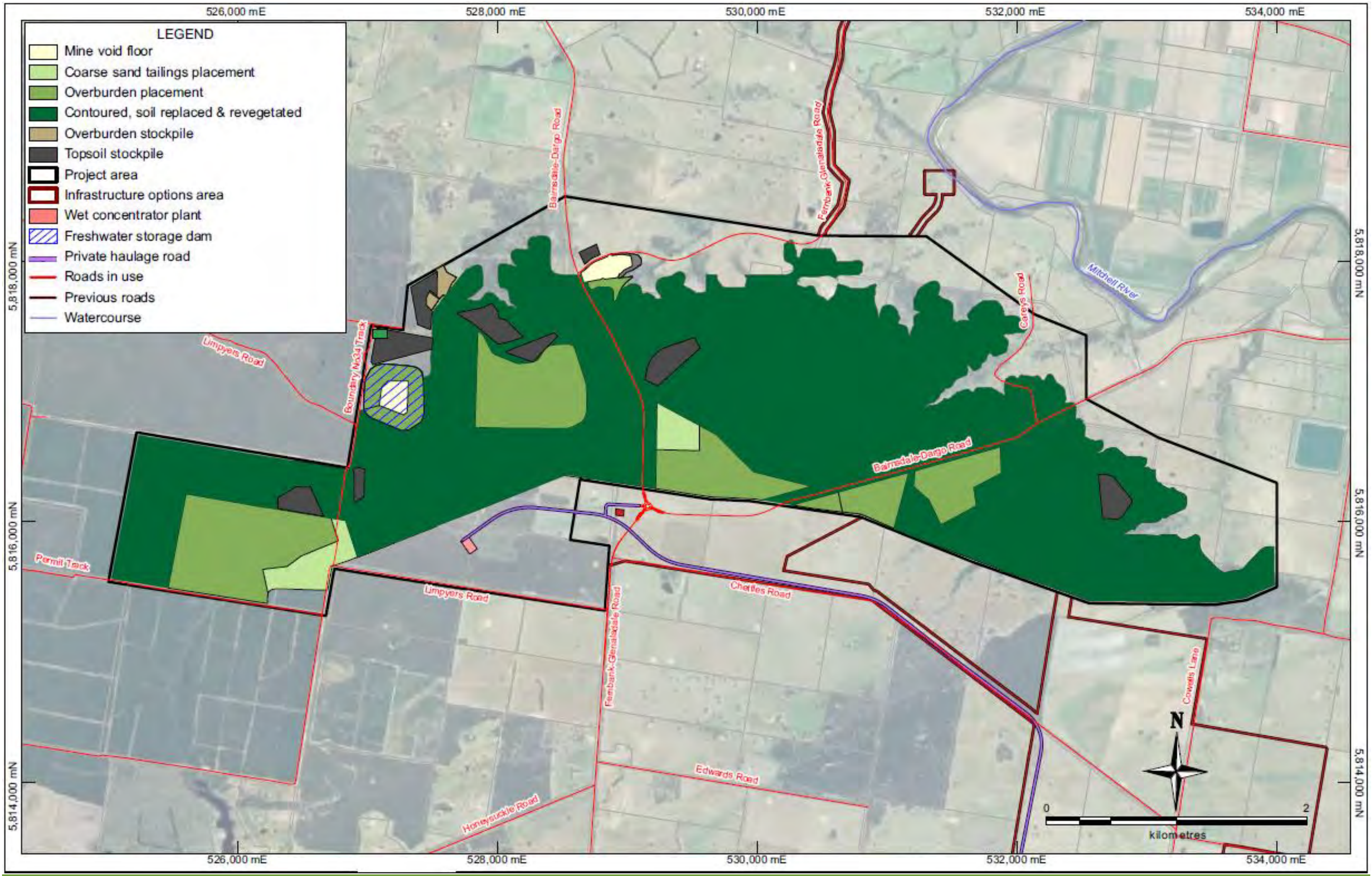

Figure 4-77: Indicative mine layout – Year 15

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4.2 Land access and clearing

The total maximum area of mining disturbance at any time (using two mining unit ~~plant~~plants) is expected to be up to ~~360~~285 ha. An approximate breakdown of disturbance is outlined below (Table 4-1).

Clearing of vegetation and stripping of topsoil and overburden will occur ahead of mining. During peak production the aim will be to minimise stockpiling and rehandling: overburden will be directly returned to areas undergoing backfilling and rehabilitation behind the active mining area. The mine layouts presented in this work plan include topsoil stripping and placement areas which provide sufficient space to accommodate up to six months' material storage, to allow for the seasonal nature of the activity.

Topsoil at the Fingerboards site is commonly acidic, with deficiencies in P, K and trace elements being common. Consequently, the topsoils will require amelioration to improve their value as growth ~~media~~medium if used for improved pasture. Regular sampling and analysis will be used to develop tailored amelioration programs. Where possible, ameliorants such as lime, organic mulches, and fertilisers will be spread on in-situ topsoils prior to stripping. The process of stripping, transporting and spreading the topsoil then provides effective mixing and allows ameliorants to take effect more rapidly and more effectively. Where topsoil stockpiling is required for periods of over ~~4~~four months, the stockpile depth will be a maximum of two metres.

Table 4-1: Break down of mining disturbance types

Nature of Disturbance	Area (ha)
Topsoil strip	35
Overburden strip	23
Ore and mining void floor	18
Coarse sand tailings ~~and fines tailings cell construction (in mine void)~~	19
Overburden placement	5
Topsoil placement	35
Mining Sub-total	**135**
~~Fines tailings storage facility (includes embankments)~~	~~90~~
Centrifuge Buildings and associated infrastructure	15
Topsoil stockpiles	45
Off Path Sub-total	**~~135~~60**
Infrastructure Sub-total	**90**
TOTAL	**~~360~~285**

4.3 Overview of mining method

The project will be mined by progressive open-cut mining methods, with progressive mining, backfilling, and rehabilitation~~.~~ rehabilitation as shown in the cross section pictorial representation in (**Error! Reference source not found.**~~Figure 4-8: Cross Sectional representation of the mining cell~~). The mining operations area is approximately 9 km across, with maximum mining depth of 50 m. The mine void will average 29 m deep. The greatest depth of mining will be along the southern part of the deposit~~.~~ as the deposit dips to the south. All mining will occur above the regional watertable and no dewatering is required. The wall angle of the mine void will be approximately 40 degrees.

Mining will be undertaken using conventional earthmoving equipment and two mining units. The two mine voids will progress around almost the entire project site and will be progressively backfilled with tailings and overburden as mining advances.

The main steps in mining are:

- Mining area is cleared of vegetation and topsoil is removed.
- Overburden is excavated with buldozers, trucks and excavators until the top of the orebody is exposed.
- Ore is pushed into the Mining Unit Plant (MUP) at the toe of the ore slope, where it is mixed with water and pumped to the Wet Concentrator Plant (WCP) away from the pit.
- Where required, road pillar backfill materials are placed and compacted in the location of future public roads.
- Several different backfilling strategies will be used, depending upon the location of the void, relative to final landforms (Table 4-2). Fine tailings will not be placed in areas close to, or underlying, hillsides and valley side slopes (in recognition of the higher erosion risk in these areas).
- Topsoil is placed on the final landform and ripped ready for rehabilitation to be completed with seeding.

Topsoil will be mined by tractor scoop on the plateau or by dozing on the steeper northern pit edges. Overburden removal will be undertaken using truck and face shovel, with support from a scraper fleet on shorter hauls. Ore mining will be by dozer pushing into two dozer traps for slurrying and pumping to the WCP. The deposit is free-digging and therefore the use of explosives or blasting will not be required. Kalbar plans to mine from areas of enriched grades, occurring close to the surface within the Fingerboards resource area.

Table 4-2: Backfill treatments, in order of placement

	On plateau without fine tailingsareas		On plateau with fine tailingsOn hillside areas	Hillside without fine tailings
Final land surface	Conditioned topsoil mix by deep tilling with underlying layer as required, containing fertiliser and organic amendment added prior to enhance productivitystripping	Conditioned topsoil mix by deep tilling with underlying layer as required to enhance productivity	Erosion resistant topsoil mix by deep, tillingplaced over subsoil mix with underlying gravelly overburdenadded gravel/rock to provide increased erosion resistance. Tilled to bring rock close to surface.	
Base of mine void	SubsoilConstructed subsoil mix, designed to enhance farmvegetation productivity, tilled to mix in amendments and fertilisers as required to maximise productivity and stability	Subsoil combination of consolidated fine tailings and overburden	Gravelly overburden +/- coreCore of sand tailings (If possible, keep HHF away from slopes)	

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	Overburden to fill margins and profile to design floor of subsoil level	Overburden and fine tailings cake to fill margins and above consolidated fine tailings profile to designeddesign floor of subsoil level		
			Fine tailings cell walls and consolidated fine tailings	
		Sand tailings	Sand tailings	
		Engineered road pillar where required	Engineered road pillar where required	Engineered road pillar where required

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	On plateau areas	On hillside areas
Final land surface	Conditioned topsoil mix, containing fertiliser and organic amendment added prior to stripping	Erosion resistant topsoil mix placed over subsoil mix with added gravel/rock to provide increased erosion resistance. Tilled to bring rock close to surface.
	Constructed subsoil mix, designed to enhance vegetation productivity, tilled to mix in amendments and fertilisers as required to maximise productivity and stability	Core of sand tailings (If possible, keep HHF away from slopes)
	Overburden and fine tailings cake to fill margins and profile to design floor of subsoil level	
	Sand tailings	
Base of mine void	Engineered road pillar where required	Engineered road pillar where required

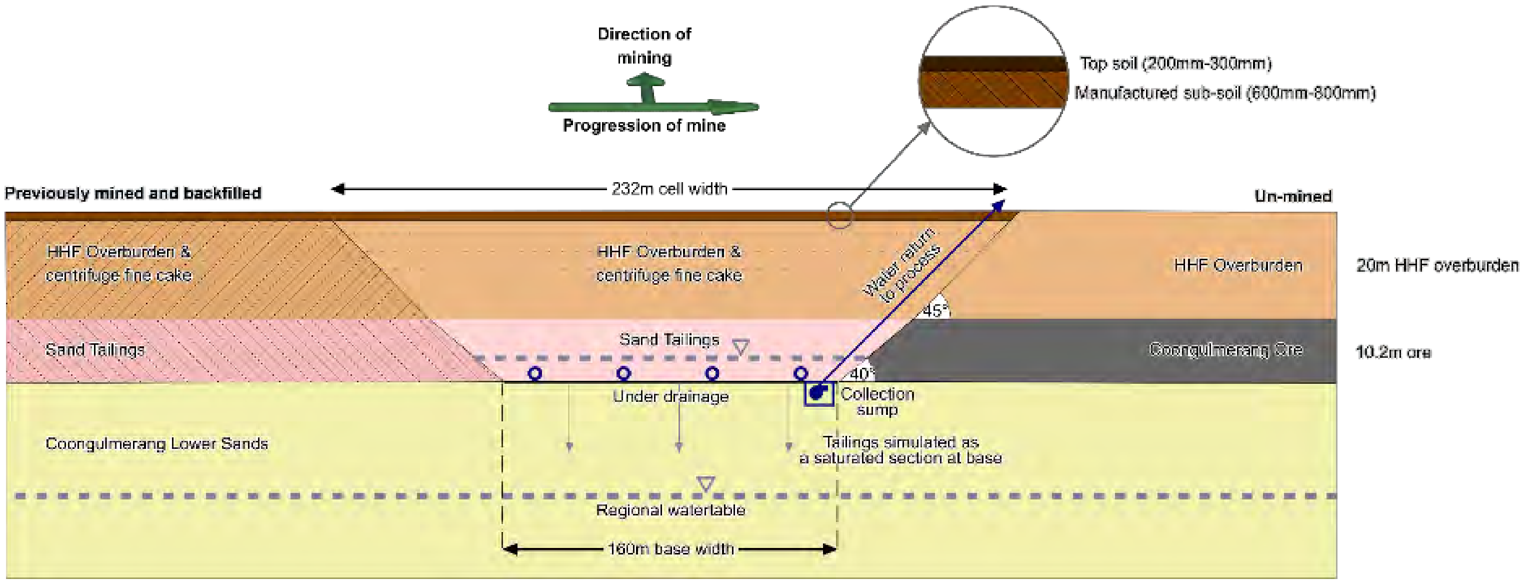

Figure 4-8: Cross sectional representation of the mining cell

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4.4 Types of equipment

An indicative list of mining and ancillary equipment required for project implementation is provided in Table 4-3. In this table, the item “Other” comprises items such as mobile crib room, mobile ablution block, additional light vehicles and lighting plant and similar items required during civil works.

Table 4-3: Mining and ancillary equipment list

	Item	Number required			Number required
Mining equipment	Excavator Type 1 - Hitachi 1900	3	Ancillary equipment	Mining IT	1
	Excavator Type 2 - Hitachi 1200	1		Service Truck	1
	Excavator Type 2 - Hitachi 870	1		All Terrain Crane	1
	Truck Type 1 - CAT 777D	~~9~~11		Workshop IT	1
	Track Dozer Type 1 - CAT D10	7		Workshop EWP	1
	Track Dozer Type 2 - CAT D11	1		Boilermaker truck	1
	Grader Type 1 - CAT 14M	2		Lighting Plant	12
	Water Truck Type 1 - CAT773	2		Light Vehicle	13
	Front End Loader Type 1 - CAT 980	1		Bus	1
	Scraper Type 1 - CAT657B	6		Pad foot roller	1
	Agricultural Tractor	1		Other	8

4.5 Mine schedule and materials movements

Mining will occur over a mine life of up to 20 years. This includes approximately two years for construction and commissioning, and final rehabilitation. Total overburden and topsoil removal for the planned life of mine is 215 million bank cubic metres (BCM) (effectively the in-situ material volume). The estimated total pit volume over the life of the operation is 317 million BCM.

Overburden from the Haunted Hill Formation makes up the greatest volume of mined material and accounts for about half of all the material that will be mined (Figure 4-9~~Figure 4-89~~).

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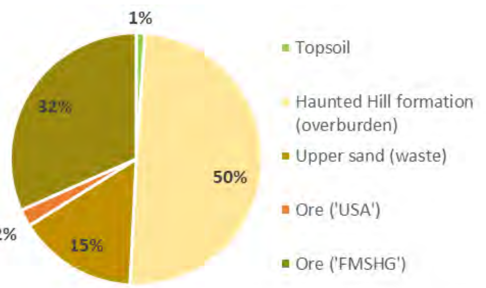

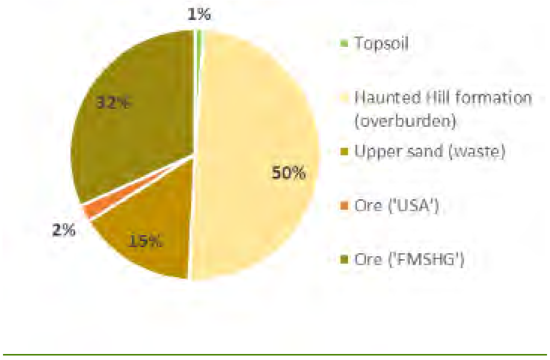

Figure 4-989: Volumetric contribution to mined materials by stratigraphic unit (life of mine)

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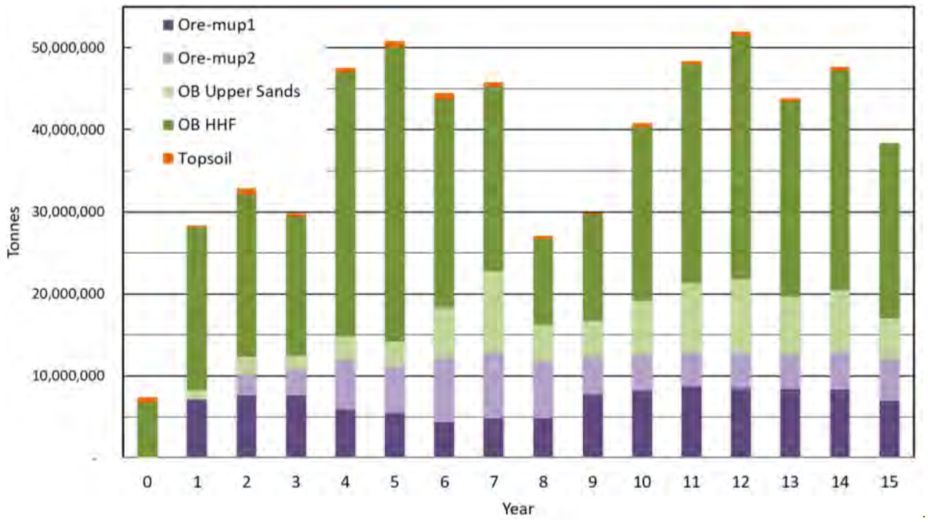
Approximately 22 Mtpa of overburden will be stripped in the first three years of the mine life. The rate of mining will increase over time, with the stripping rates for overburden also increasing. For the remainder of the mine life, the overburden stripping rate will be variable, averaging 32 Mtpa.

The mining schedule targets the highest value path by progressing from the northern, high grade and shallow areas to the southern, lower grade and deeper areas. The mine will initially operate with a single MUP. and an associated relocatable centrifuge. Commissioning of the second MUP will be delayed for 12 months while the first is in high grade ore to delay capital expenditure while benefiting from the initial higher-grade ore. As the ore grade reduces toward the end of the first year, the second MUP willand a second centrifuge could be brought online to maintain high levels of production. The introduction of the second MUP also realises the benefit of blending the feeds from differing sections of the orebody to smooth and control feed grade and HMC production.

The topsoil stripping and backfill schedules are in accordance with the ore mining and overburden mining schedules. Topsoil stripping is delayed as long as possible and backfilling is undertaken (and completed) as soon as possible. Figure 4-9 shows the material extraction schedule.



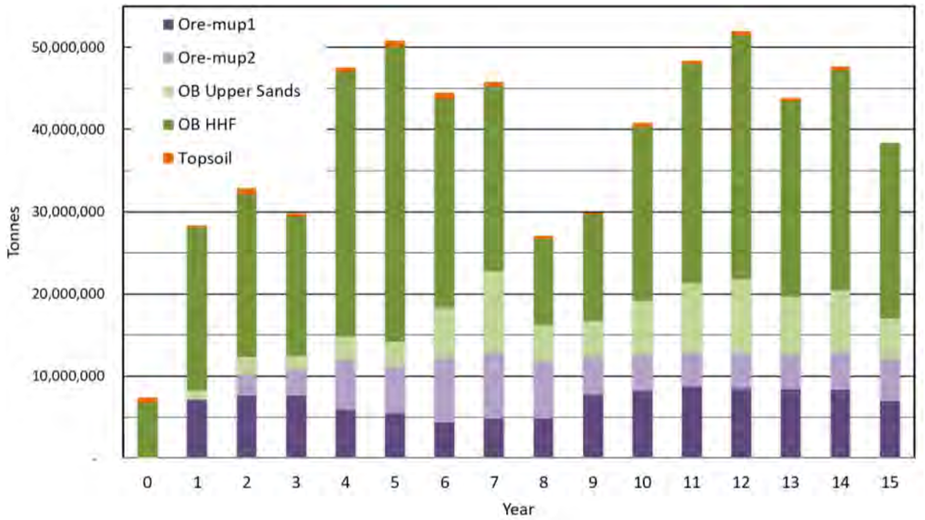
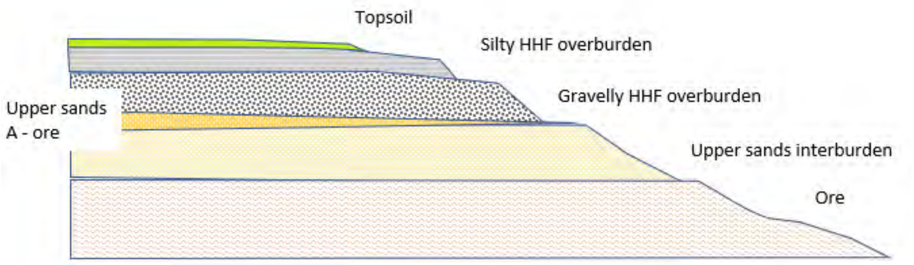


Figure 4-10910: Material extraction schedule

4.6 Open pit design

The pit design and extraction sequence has been designed around the stratigraphy of the mining units. Approximately 300 mm of topsoil will be removed in advance of mining, leaving two or four stratigraphic units to be mined, usually at one bench per stratigraphic unit. In parts of the proposed mining licence area, a shallow enriched Upper Sands Unit A (referred to as 'USA') exists in the mining profile. (Figure 4-11). Where this unit is present, this unit will be mined as a single bench. Where the enriched shallow USA unit is absent, benches will be established to follow three stratigraphic units: topsoil, overburden and ore. Overburden will be mined in one to three benches of up to 15 m height. The remaining ore will be mined as a single sloping bench to the pit floor.



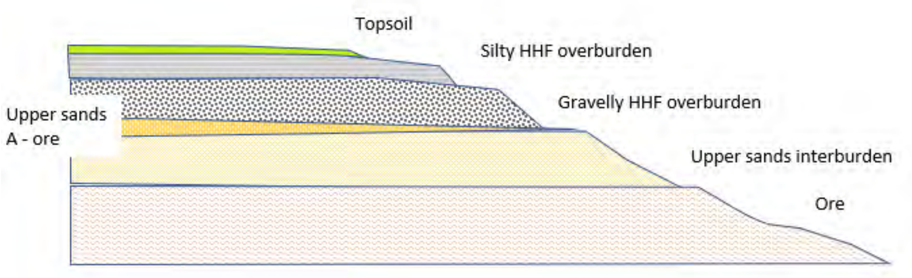
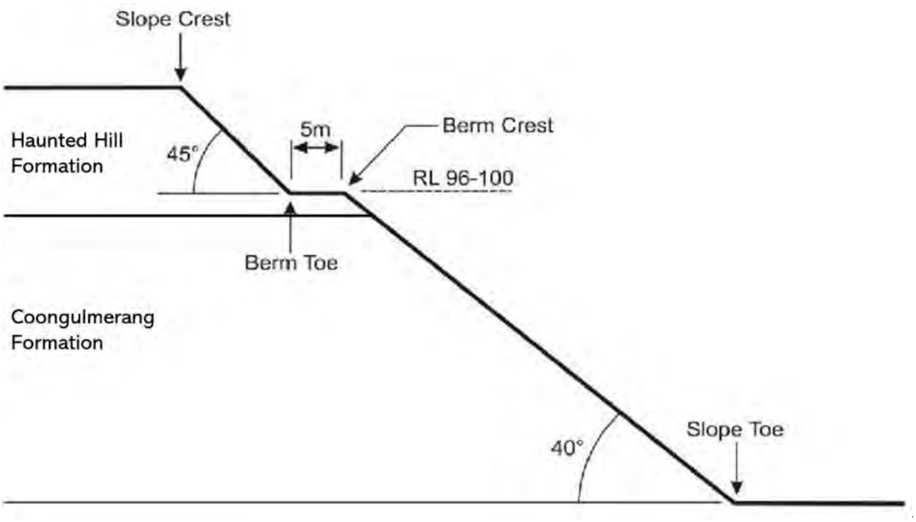


Figure 4-111011: Mine pit stratigraphy (schematic – not to scale)

Batter angles will vary depending upon materials properties, ranging from approximately 37° in the Coongulmerang Formation, which hosts the ore horizon/s, up to approximately 45° in the gravelly parts of the Haunted Hill Formation. -Figure 4-12Figure 4-1112 presents a cross section of a typical pit wall configuration in HHF and upper sands overburden.



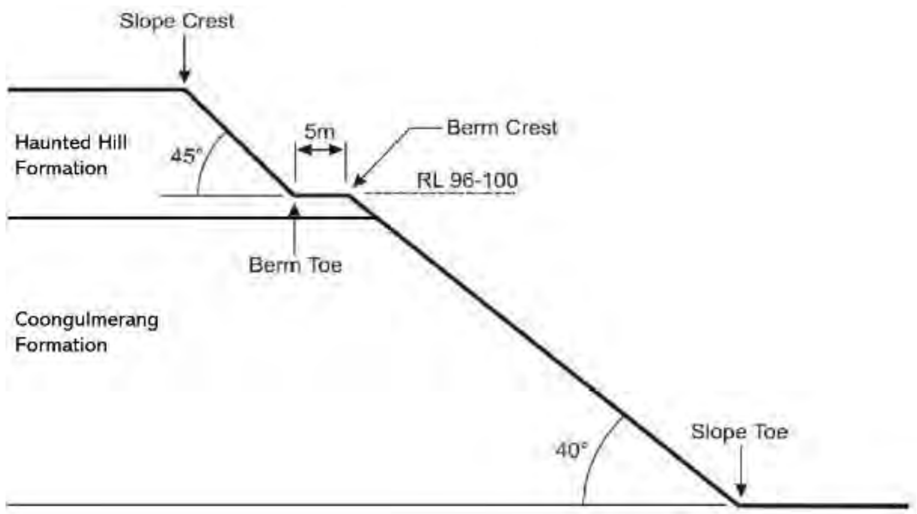


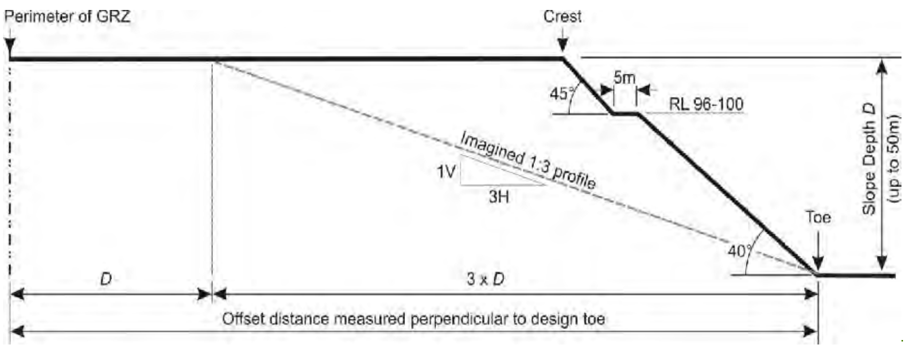
Figure 4-121112: Typical pit wall configuration in overburden

Geotechnical drilling and assessment will continue as the mine develops and to provide a greater level of confidence before the mine void progresses into deeper areas. The approach has been to apply a conservative choice of batter design across the minesite, with opportunity to refine as more drilling, testwork, and pit observation becomes available.

The batter design features a, 40 degree batter angle in the lower strength Coongulmerang Formation, a 5m berm located approximately a meter above the contact with the Haunted Hll Formation and a batter angle of 45 degrees in the more competent Haunted Hill Formation. The location of the berm makes use of the erosion resistant basal Haunted Hill Formation to provide greater erosion resistance to the berm.

Geotechnical modelling of this batter configuration in one of the deeper sections of the pit has produced a minimum Factor of Safety (FOS) of 1.29 and probability of failure of 4.4%. This compares favourably with typical industry design levels of around 1.2 at 10%.% probability of failure. At a distance of 25m from the crest the FOS increases to 1.57 and POF reduces to 0.001%.

Geotechnical risks are risks associated with ground movements. They include subsidence, natural rebound, or batter collapse. People, infrastructure or the environment may be harmed by ground movements, and accordingly the risks of harm arising from ground movements must be identified and minimised during the period of operation, rehabilitation, and after closure of the site. -The ‘Department of Jobs, Precincts and Regions (DJPR) and Earth Resources Regulation (ERR) requires that geotechnical risks at a mine are to be assessed as part of a submission of a workplan. As part of the ERR guidance documents, a Geotechnical Risk Zone’ is a zone within and surrounding the mine voidZone (GRZ) should be defined within which the impacts on public safety, the environment and public infrastructure may occur.should be examined. Figure 4-13Figure 4-1213 shows the definition of the GRZ as it is applied to the Fingerboards pit slope profile.



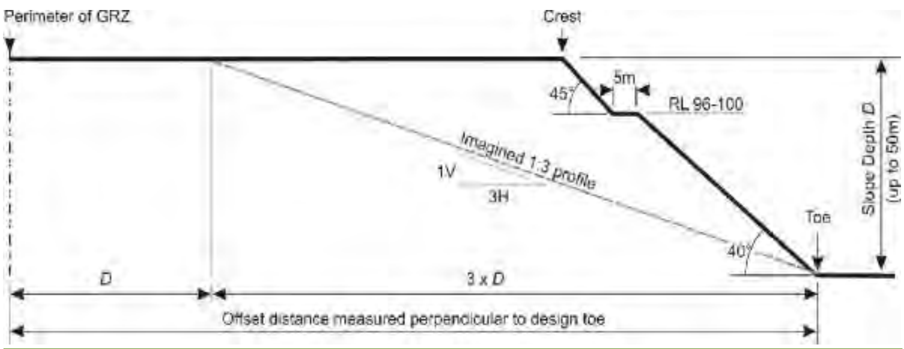


Figure 4-13~~12~~13: Definition of GRZ for Fingerboards pit slope profile (not to scale)

Geotechnical risk zones have been determined for each Fingerboards mining panel, so that assets within each GRZ can be identified throughout the progression of mining. In the case of the Fingerboards Project, which is traversed by some public infrastructure, it was important to capture assets within the project boundary, such as roads that are mined alongside of, then reinstated on a new alignment. Simply defining a GRZ around the outer mine extents would not have achieved this.

A plan of the mine layout, showing indicative mining panels is shown in Figure 4-14~~Figure 4-13~~14.

Field Code Changed

Figure 4-14~~13~~14: Mining panel layout (indicative)

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The panels shown in figures depicting the GRZs (Figures 4-~~13~~14 to 4-~~25~~26) will not be mined as homogeneous blocks. As mining progresses, mine slopes will be progressively formed and backfilled along panel boundaries. Table 4-4 provides a summary of GRZ extents and assets lying within the GRZ. Lots numbers are listed in the table, but landowners' names are not given for privacy reasons, except for lots shown as currently owned by Kalbar. Properties actually mined out by each panel are *not* listed, as it is obvious that these will be impacted by mining. The tabulated information is intended to show properties that are within the GRZ (and which therefore have the potential to be impacted by mining) in cases where that risk may not be evident because mining will not occur on the property.

All depths and distances in Table 4-4 are rounded to the nearest metre. Some minimum pit depths are shown as zero, where the ore outcrops. A GRZ is not defined around these margins. The minimum GRZ distance is given as the minimum distance for GRZ surrounding slopes of non-zero depth. Where the GRZ is not defined due to zero depth, it is not shown in the figures (that is, the GRZ perimeter has an open section).

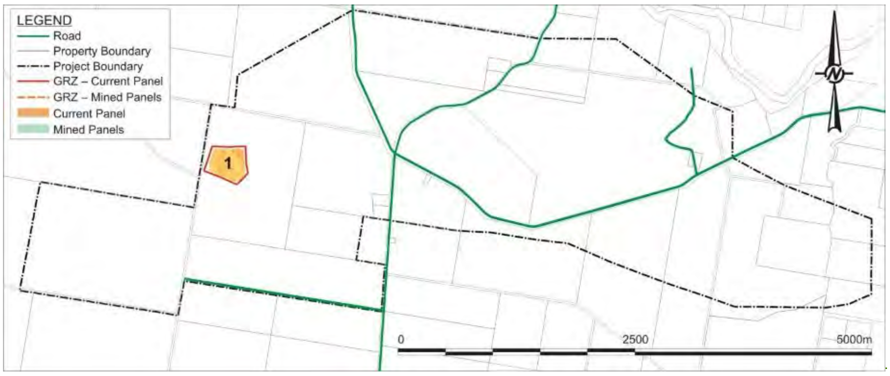
Table 4-4: Summary of GRZ extents and potentially impacted assets

Panel number	**Min pit depth, m** (Distance of GRZ from pit crest, m)	**Max pit depth, m** (Distance of GRZ from pit crest, m)	**Assets within GRZ - properties**	**Assets within GRZ - roads**	**Comment**
1	12 (19)	30 (43)	1\PS343168 (Kalbar)	None	Panel 1 is the small initial cut and is also shown as such in the mining sequence documents. The mined area and its associated GRZ are entirely contained within land owned by Kalbar.
2	0 (26)	25 (80)	1\LP69778 (west of road)	Realigned Dargo Road	One property to the west of Dargo Road that is not mined at this stage lies within the GRZ. The deepest part of the panel is at the southern margin. GRZ is not defined in places due to zero pit depth, where the pit floor intersects the topography. The GRZ line on figure appears open in those locations. This is not an error.
3	0 (25)	32 (84)	1\LP69778 (west of Dargo Road), 1\LP127897 (south of Bairnsdale Road), 2\PS343168 (Kalbar)	Realigned Dargo Road, current Bairnsdale-Dargo Road, current Fernbank Road, current Fingerboards intersection	The GRZ encroaches on three properties to the west of the Bairnsdale-Dargo Road, one of which is currently owned by Kalbar.

Panel number	Min pit depth, m (Distance of GRZ from pit crest, m)	Max pit depth, m (Distance of GRZ from pit crest, m)	Assets within GRZ - properties	Assets within GRZ - roads	Comment
4	0 (21)	39 (110)	1\LP127897 (south of Bairnsdale Road)	Current Bairnsdale-Dargo Road	The GRZ extends to one property, Lot 1\LP127897 to the south of Bairnsdale Road and east of the Fernbank Road. The deepest slopes of this panel are along its central southern margin, on properties that will be acquired, and nowhere near roads.
5	0 (29)	39 (151)	None that are not mined	None	The panel mines on three property allotments, two of which are owned by Kalbar, and the GRZ is wholly contained on those allotments. No roads are within the GRZ. The deepest part of this panel is at the southernmost corner.
6	10 (50)	42 (159)	53F-E\PP3311 (outside project bdry), 53E-E\PP3311 (outside project bdry), 53C-E\PP3311	Diverted Fernbank Road	Three properties are impacted by the GRZ outside of the mining panel. These are at the western boundary, and two are outside the project boundary.The deepest part of the panel is in the south-eastern corner
7a	0 (32)	42 (117)	58-E\PP3311, 59-E\PP3311, 60B-E\PP3311	Existing Bairnsdale Road	Three properties south of Bairnsdale Road are outside of the mined panel but are within the GRZ. The deepest part of the panel lies at its southern margin.
7b	32 (90)	50 Note 1 (139)	1\LP127897, 2\LP127897, 58-E\PP3311	Existing Bairnsdale Road	The deepest part of this panel is adjacent to the Bairnsdale Road, and at 50 m deep, is the deepest mining area that will be adjacent to a road. The GRZ is very close to the project boundary in one location, but it does lie within it.

Panel number	Min pit depth, m (Distance of GRZ from pit crest, m)	Max pit depth, m (Distance of GRZ from pit crest, m)	Assets within GRZ - properties	Assets within GRZ - roads	Comment
7c	13 (39)	51 Note 1 (204)	53E-E\PP3311 (outside project bdry), 53C-E\PP3311 (outside project bdry), 53B-E\PP3311 (outside project bdry), 52A-E\PP3311 (outside project bdry), 49-E\PP3311 (outside project bdry), 58-E\PP3311	Existing Bairnsdale Road; existing Fernbank Road	Five allotments outside the project boundary are impacted by the GRZ to the west of this panel. The remaining allotment has been identified as impacted by other panels. This panel has the project's equal deepest location of 45 m (the other is Panel 8c). The deepest point is near to but not impacting on the diverted Fernbank Road.
8a	0 (32)	43 (155)	1\TP382368 (outside project bdry)	None	Numerous property allotments are impacted by mining, but only one outside the mined area and impacted by the GRZ. A small northern corner of the allotment is impacted, partly outside the project boundary. No roads are affected. The deepest parts of this panel are along its southern margin.
8b	17 (71)	45 (215)	None that are not mined	None	No roads are impacted, and no properties are within the GRZ that are not also in the mining area. The panel is around 38 to 45 m deep along its southern margins, with a shallower area where it intersects a valley.
8c	45 (133)	51 Note 1 (144)	None that are not mined	None	No roads are impacted, and no properties are within the GRZ that are not also in the mining area. This panel has the equal greatest mining depth of the whole project, with the other being in Panel 7c.
9	7 (28)	31 (85)	53F-E\PP3311 (outside project bdry)	None	One allotment outside the mining area is impacted. The deepest part of the panel is at the south-western corner.

Note 1: Geotechnical modelling of the GRZ adopted assumptions about the final pit floor level that were more conservative than the current planned pit design. The planned maximum pit depth is 45 m, however to accommodate variations in surface topography and to accommodate advice from ERR, Kalbar has specified a maximum mining depth of 50 m in this work plan. GRZ distances associated with pit depths greater than 45 m in the table above may be overestimated.



~~Figure 4-14: GRZ – mining panel 1~~

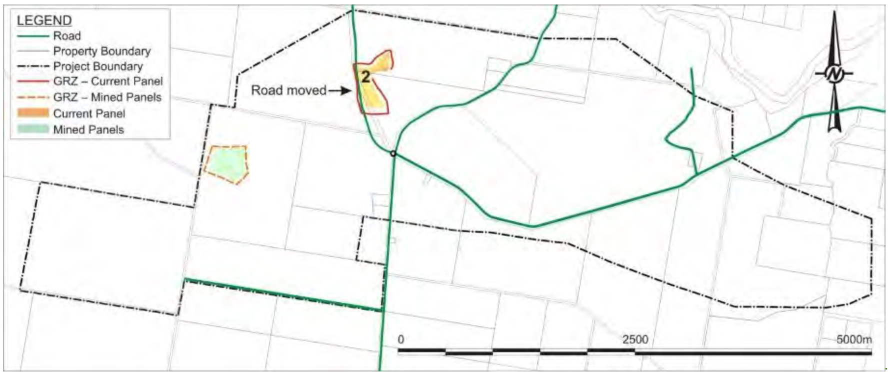


Figure 4-15: GRZ – mining panel ~~2~~1

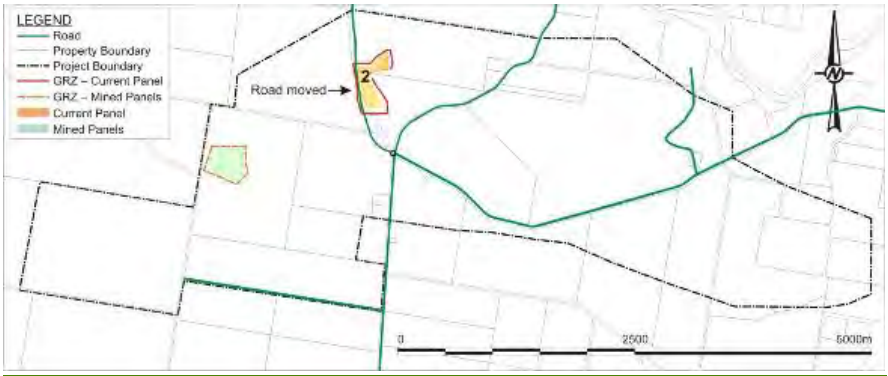


Figure 4-16: GRZ – mining panel ~~3~~2

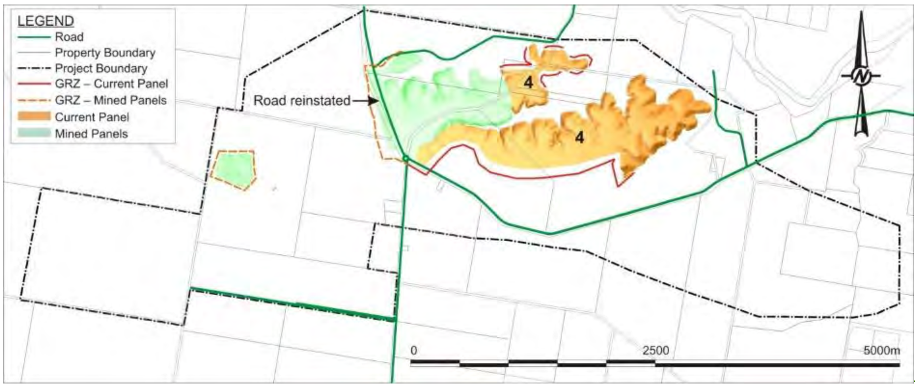
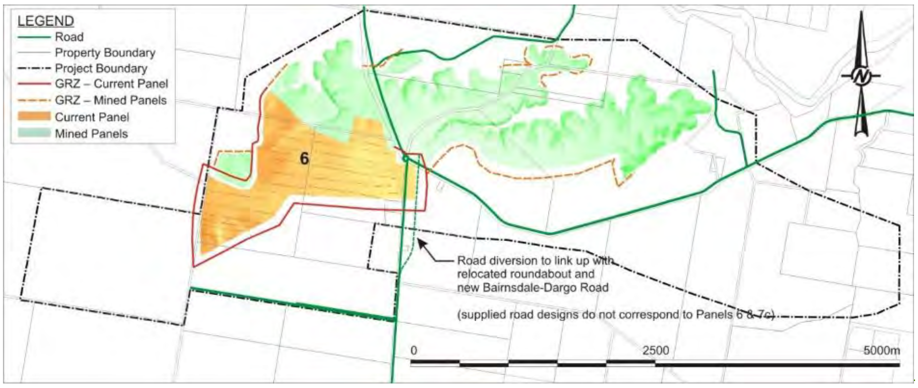


Figure 4-17: GRZ – mining panel ~~4~~3

Figure 4-18: GRZ – mining panel ~~5~~4



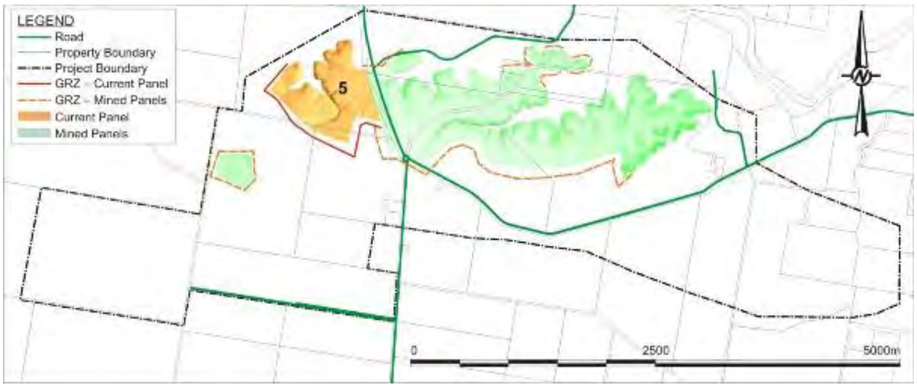
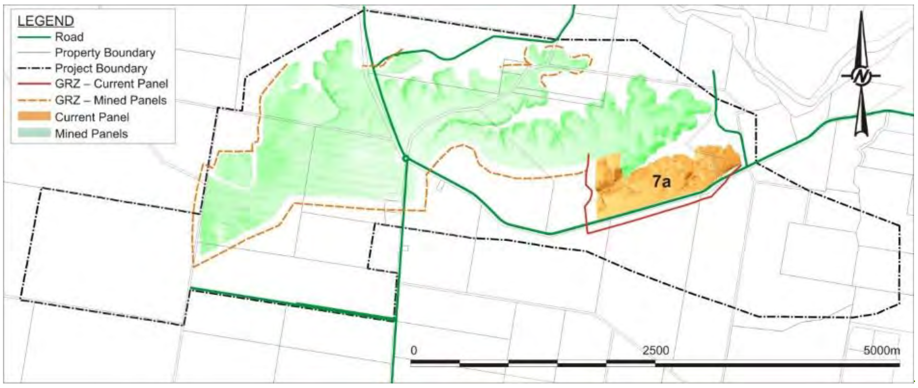


Figure 4-19: GRZ – mining panel ~~6~~5



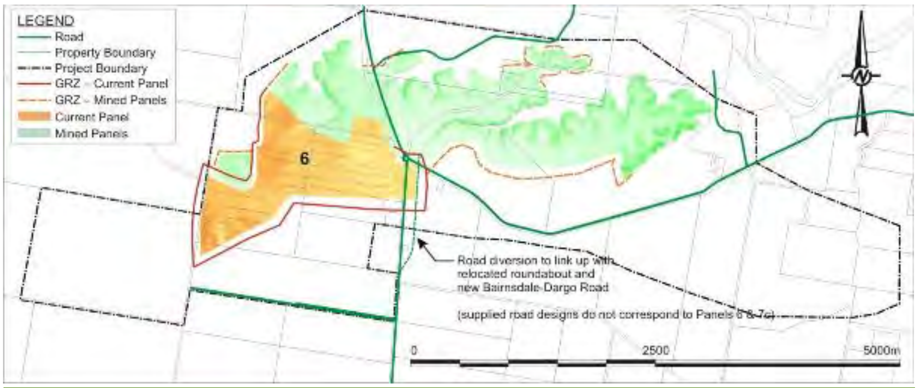
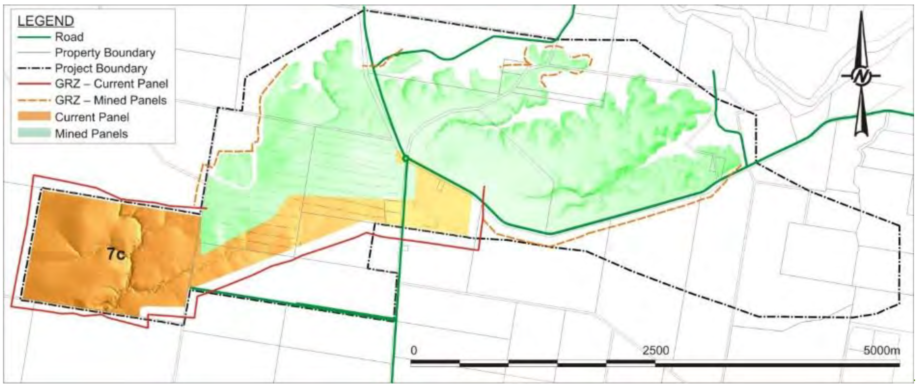


Figure 4-20: GRZ – mining panel ~~7a~~6

Figure 4-21: GRZ – mining panel ~~7b~~7a



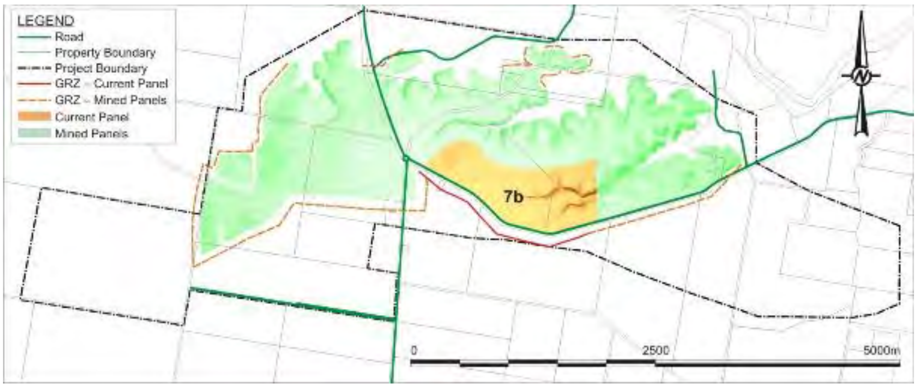
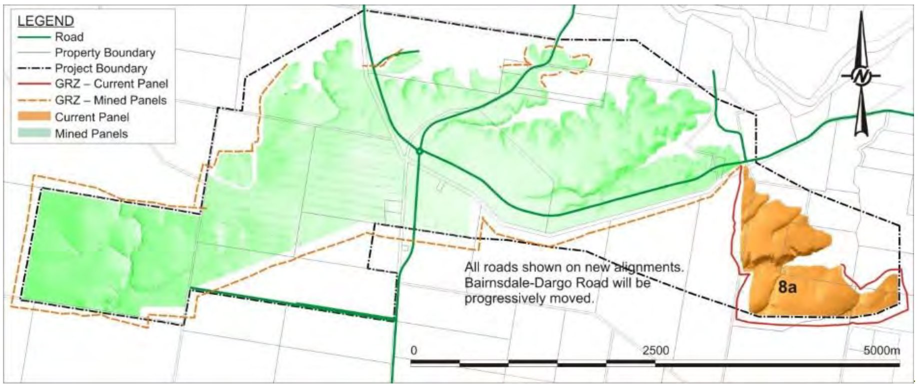


Figure 4-22: GRZ – mining panel ~~7c~~7b



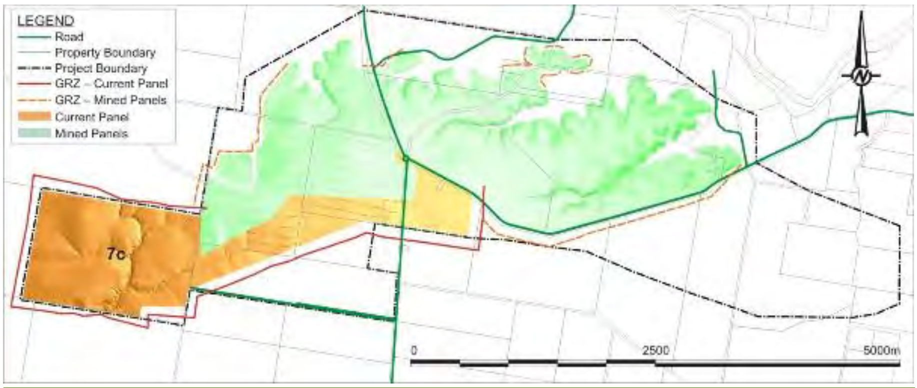
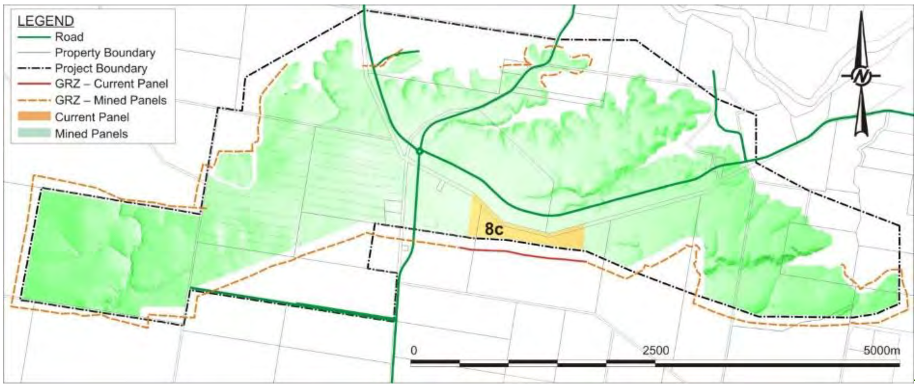


Figure 4-23: GRZ – mining panel ~~8a~~7c

Figure 4-24: GRZ – mining panel ~~8b~~8a



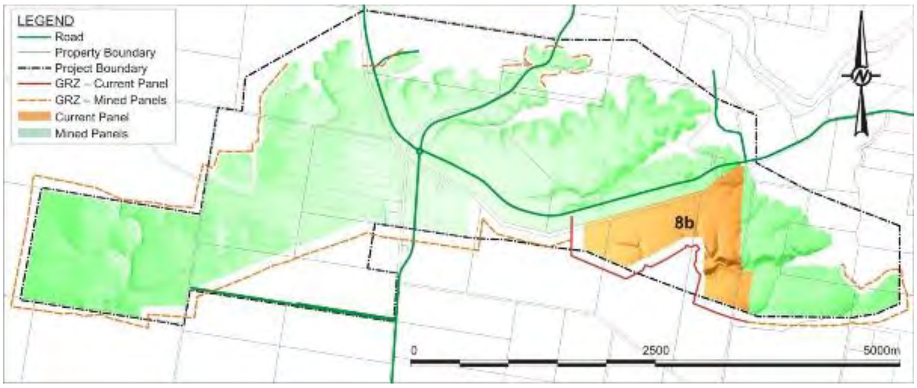


Figure 4-25: GRZ – mining panel 8b

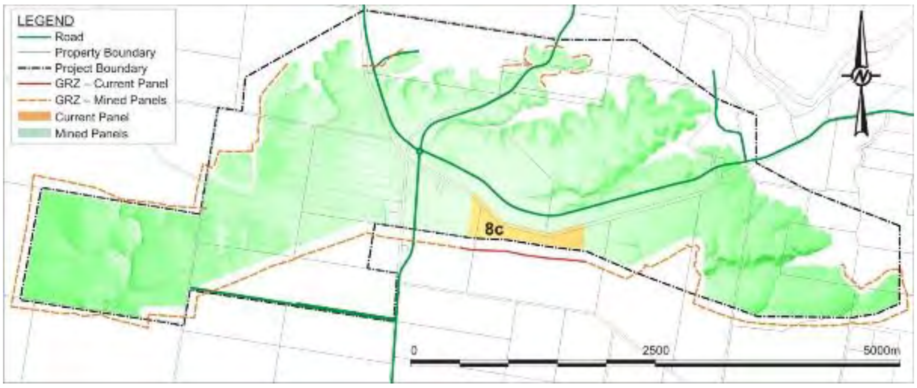


Figure 4-26: GRZ – mining panel 8c

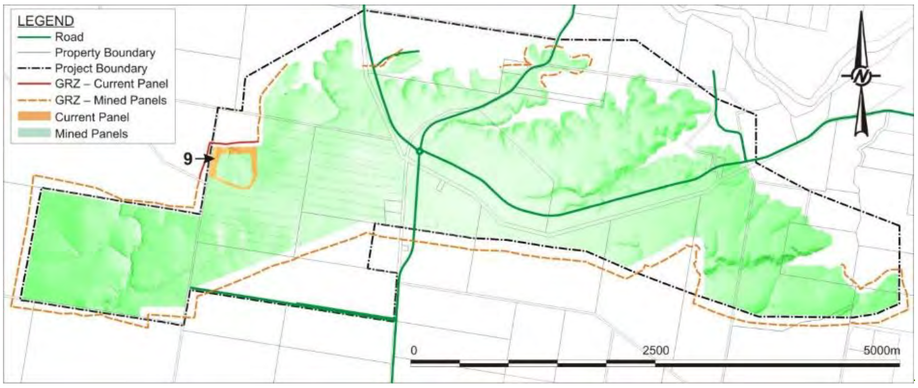


Figure 4-272627: GRZ – mining panel 9

4.7 Backfilling and rehabilitation of mine voids

Overburden and tailings (non-economic sand, silts and clay) from the mining and primary processing will be returned to the mining void as part of the rehabilitation process. Coarse sand tailings will initially be deposited into Perry Gully. After approximately four months, when the mine void has enough capacity, coarse sand tailings will be deposited into the mining void.

While placing tailings sand into Perry Gully, risk of erosion and subsidence will be minimised by:

- Construction of a large toe bund constructed using Haunted Hill gravels,
- Under drainage to dry the stack and improve stability,
- Bypassing of upstream gully flow so that surface runoff does not enter the area where tailings are being deposited, and
- Prior construction of the water management dam in the gully below the sand stack to intercept water that may have contacted the tailings or other materials disturbed by mining.

Fines tailings (smaller than 38 µm), equivalent to about 23% of the ore tonnage, will initially be deposited into a constructed TSF on the future mine path. This will occur for approximately four years. As mined out areas of the void become available, the fines tailings will be placed within containment cells within the mine void. Deposition of fines tailings into the mine void will continue throughout operations. The TSF will remain available for contingency storage (for example, during upset conditions) until the ore under the TSF is mined.

Fines tailings are generated from the desliming stage, separate to the coarse sand tailings. The fine tailings are dewatered by means of solid bowl centrifuges located within a building near the mine void to produce a damp cake. Two centrifuge buildings are proposed, each one serving an active mining area and MUP. The cake will be stockpiled at the centrifuge plant and from there trucked to the mine void, where it will be dumped with overburden before placing a final subsoil rehabilitation layer.

The mine void will be progressively backfilled with coarse sand tailings, fines tailings cake and overburden (Table 4-2) before the proposed mining licence area is reprofiled and revegetated and the land returned to pre-mining land use and capability, or other agreed post-mining land use. Additional information on mine rehabilitation is provided in Appendix C (Mine Rehabilitation and Closure Plan).

4.8 Hours of operation

Mining will be conducted 24 hours per day and 365 days per year, subject to any requirements or conditions to avoid or mitigate potential impacts on local amenity caused by noise, dust and visual changes. Transporting and backfilling of centrifuge cake will occur between 07:00 h and 18:00 h, except for Saturdays when haul operations cease at 13:00h. No haulage will occur on Sundays.

5 MINERAL PROCESSING

Processing of mineral sands involves physical separation methods to separate target heavy minerals from quartz sand and other non-valuable minerals. Chemical reagents are not used in the treatment of ore~~.~~ and only water is used to slurry the ore for gravity separation.

The Fingerboards processing plant design includes a combination of modularised and non-modularised components. The lower levels of the WCP are non-modularised, with steelwork and equipment on a conventional concrete bunded floor area. Non-modularised construction takes advantage of the ready accessibility of trades and labour in the Bairnsdale locality. The upper parts of the plant, such as the ~~spiral~~gravity separation modules, wet high intensity magnetic separation (WHIMS) modules, stair towers, laundering, piping and instrumentation modules, are all modularised to allow for an offsite preassembly and rapid placement on the lower steelwork sections. This design approach provides a balance between site labour costs, speed of construction and minimising steelwork.

5.1 Production rate and products

Kalbar aims to produce 8 Mt of heavy mineral concentrate (HMC) from 170 Mt of ore over a 17 to 20-year period. Two types of concentrate products will be produced:

- Non-magnetic concentrate, consisting predominantly of zircon and rutile, with minor amounts of monazite
- Magnetic concentrate, consisting predominantly of ilmenite with minor amounts of monazite and xenotime

Both concentrate streams have levels of radioactivity below 10 Bq/g.

5.2 Processing method

Processing will involve the following steps:

- Screening and slurrying of ore at the MUPs.
- Pumping of ore slurry to WCP
- ~~hydrocycloning~~Hydrocycloning of the ore using centrifugal force to remove the fines tailings, which will be treated in a thickener to remove excess water and thicken the fines tailings to ~~35% solids~~30% - 35% solids. Overflow water from the thickener will be collected and reused in the process water circuit.
- Dewatering of thickener underflow slurry by means of a centrifuges, so that the fine tailings solids in the slurry form a cake (target density ~70% solids content) suitable for that can be returned to the mine void.
- Wet gravity separation of slurried ore to produce HMC. Between 3 and 10% of the ore entering the gravity circuit will becomebe separated as HMC . The amount of concentrate generated will be dependent upon the feed grade of the ore.
- Wet high intensity magnetic processing of the HMC in the WCP to produce magnetic (mainly ilmenite) and non-magnetic (mainly zircon) concentrates
- Dewatering of the concentrate and loading from product silos into enclosed shipping containers for transport to the rail siding.

- Stockpiling Storage of the concentrates in containers (For Option 1 transport case) at a loading ~~facility~~faciltity the rail siding for transportation by road and rail to a port for export.

Up to 500,000 t of concentrate may be stockpiled on a temporary basis adjacent to the WCP, depending on market demand for the concentrate.

5.2.1 Mining unit plants

The MUP is a mobile unit that is placed at the mining face. The two MUPs at Fingerboards will operate independently of each other and can be positioned up to 4 kms apart at various stages of the mine life.

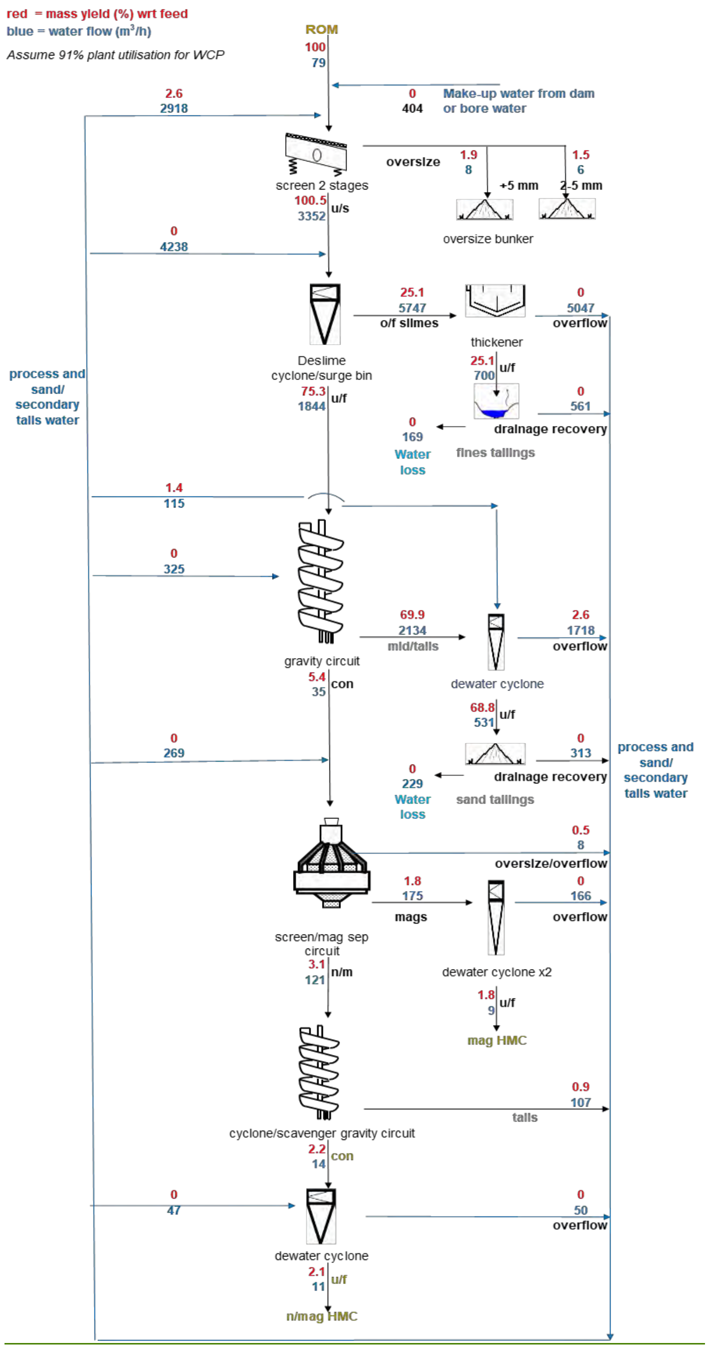
Ore is introduced to the process with surface mobile equipment such as bulldozers, front end loaders or scrapers. In order to achieve the required 1500 t/h mining rate, two mining units with a nominal throughput of 750 t/h solids each will be required. The MUP screens out very coarse (+300 mm) material, using a static grizzly or wobbler screen to ensure large rocks don't enter the downstream apron feeder. The apron feeder then directs the grizzly underflow to a double deck vibrating screen. This screen removes oversize material (+25 mm) to allow for more efficient pumping overland to the WCP. The oversize is deposited directly adjacent the MUP for removal with surface mobile equipment. Water sprays and bulk water addition are used at the screen to maintain a nominal 50% solids concentration in the WCP feed slurry. WCP feed is pumped independently from each of the MUP screen underflow sumps via an overland pipeline.

5.2.2 -Wet concentrator plant

The methods used to process ore at the WCP include:

- Initial screening to remove oversize material.
- Hydrocycloning of the ore using centrifugal force to remove the fines particles, which are then treated in a thickener to remove excess water and thicken the fines tailings to 30% - 35% solids.
- Dewatering of fine tailings contained in the thickener underflow by means of a centrifuge.
- Wet gravity separation to produce HMC.
- Wet magnetic processing of the HMC to separate magnetic (mainly ilmenite) and non-magnetic (mainly zircon) concentrates.
- Dewatering of the WHIMS magnetic and non magnetic slurry to the final product concentrate ready for transport.

A process flow diagram showing these steps is presented in Figure 5-1.



red = mass yield (%) wrt feed
blue = water flow (m³/h)
Assume 91% plant utilisation for WCP
ROM
100
79
0
404
Make-up water from dam
or bore water
2.6
2918
oversize
1.9
8
1.5
6
+5 mm
2-5 mm
screen 2 stages
100.5
3352
u/s
oversize bunker
0
4238
25.1
5747
o/f slimes
thickener
0
5047
overflow
Deslime
cyclone/surge bin
75.3
1844
u/f
25.1
700
u/f
0
561
drainage recovery
0
169
Water
loss
fines tailings
process and
sand/
secondary
talls water
1.4
115
0
325
69.9
2134
mid/tails
dewater cyclone
2.6
1718
overflow
gravity circuit
5.4
35
con
68.8
531
u/f
0
269
0
313
drainage recovery
0
229
Water
loss
sand tailings
process and
sand/
secondary
talls water
0.5
8
oversize/overflow
1.8
175
mags
0
166
overflow
screen/mag sep
circuit
3.1
121
n/m
dewater cyclone x2
1.8
9
u/f
mag HMC
0.9
107
talls
cyclone/scavenger gravity circuit
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con
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47
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50
overflow
dewater cyclone
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11
u/f
n/mag HMC

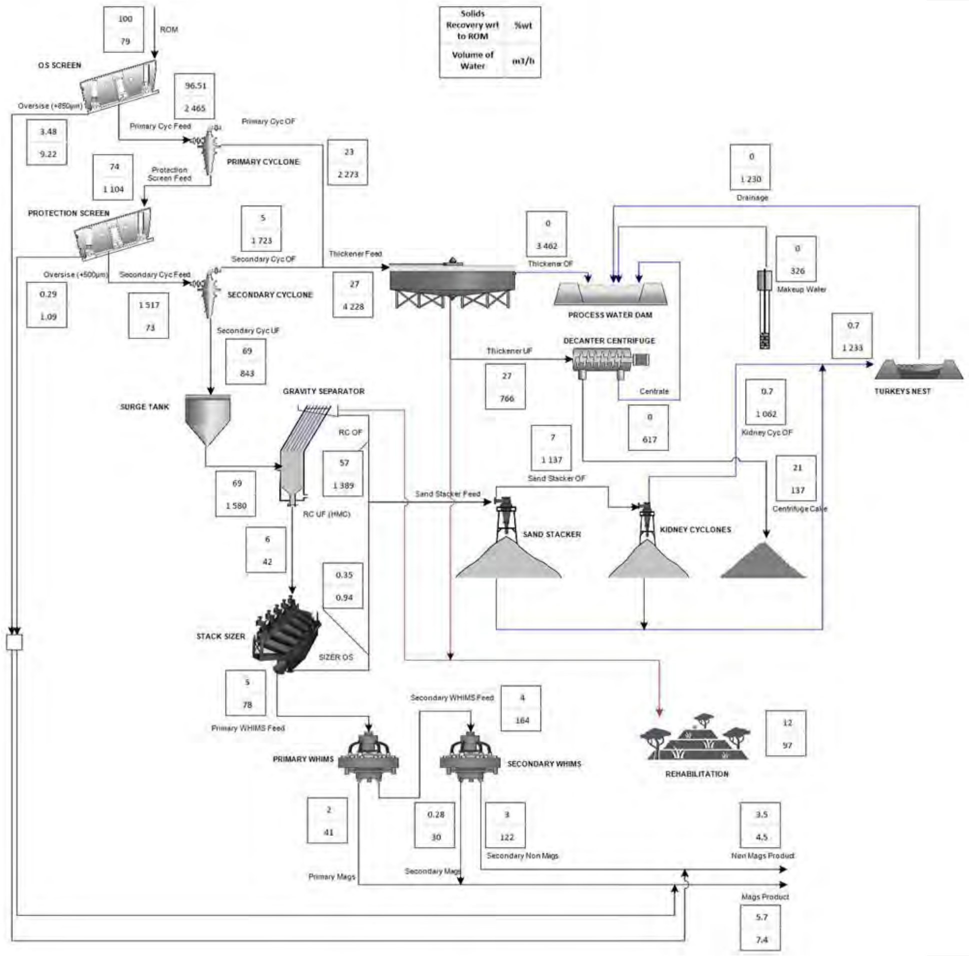


Figure 5-1: Process flow diagram – Fingerboards wet concentrator plant

5.3 Crushing and grinding

There is no requirement for crushing or grinding of processing plant feedstock.

5.4 Reagents and grinding media

No reagents or grinding media will be used in the processing of ore.

5.5 Concentrate handling and transport

Up to 500,000 t of mineral concentrate may be stockpiled on a temporary basis adjacent to the WCP, depending on market demand for the concentrate. Kalbar has conducted geochemical testing on a representative sample of HMC to assess the potential environmental mobility of metals and metalloids in the stockpiled concentrate. Leachable metals were determined using distilled water as the leaching solution, to simulate contact of rainwater with the stockpiled HMC (Australian Standard Leaching Procedure). Total metals were extracted using an *aqua regia* digest. The results of this work are summarised in Table 5-1. The pH of the HMC extract was 7.0. The electrical conductivity of the leachate was 72 µS/cm, which is approximately equivalent to a total dissolved solids concentration of 42 mg/L. This indicates that leachate from the HMC is near-neutral and has low salinity.

Table 5-1: Total and leachable constituents – Fingerboards HMC (Envirolab CoA 217289-B)

Metal / metalloid	LoR, mg/L	Leachable metal, mg/L	ASLP0 (EPA waste classification criteria), mg/L	ANZECC ecosytem protection, mg/L	LoR, mg/kg	Total metal, mg/kg	TC0 (EPA waste classification criteria), mg/kg	NEPM HIL-A, mg/kg
Aluminium	0.1	**0.33*****	--	0.055*	1	260	--	--
Antimony	0.001	<0.001	1	0.009	0.5	0.5	75	--
Arsenic	0.05	0.004	0.35	0.013**	0.5	11	500	100
Barium	0.001	0.003	35	--	0.5	32	6,250	
Beryllium	0.01	<0.0005	1	--	0.5	<1	100	60
Bismuth	0.001	<0.001	--	--	1	<1	100	--
Boron	0.02	<0.02	15	0.37	1	11	15,000	4500
Cadmium	0.0001	<0.0001	0.1	0.0002	0.1	<0.1	100	20
Chromium**	0.005	**0.042*****	2.5	0.0004	0.5	58	500	100
Cobalt	0.001	<0.001	--	--	0.5	<1	--	100
Copper	0.001	**0.002*****	100	0.0014	0.5	12	5,000	6000
Fluoride	0.1	0.2	75	--	--	--	10,000	--
Iron	0.01	0.39	--	--	1	5,000	--	--
Lead	0.001	0.001	0.5	0.0034	0.5	18	1,500	300
Mercury	0.00005	<0.00005	0.05	0.0006	0.01	<0.01	75	40
Molybdenum	0.001	0.001	2.5	0.034	0.5	1.2	1,000	--
Nickel	0.001	0.001	1	0.011	0.5	3.1	3,000	400
Selenium	0.001	<0.001	0.5	0.011	0.1	0.4	50	200
Silver	0.001	<0.001	5	0.00005	0.1	<0.2	180	--
Manganese	0.005	<0.005	--	1.9	1	44	--	--
Thallium	0.001	<0.001	--	0.00003	0.5	<0.5	--	--
Thorium	0.0005	0.0034	--	--	0.5	120	--	--
Uranium	0.0005	<0.0005	--	0.0005	0.1	9	--	--
Zinc	0.001	0.002	150	0.008	0.5	11	35,000	7400

Note: ANZECC ecosystems guidelines values shown in the table are for 95^{th} percentile ecosystem protection where values have been defined. Where no 95^{th} percentile value has been defined, the default freshwater ecosystem guideline value is shown. *ANZECC guideline for waters with pH>6.5. **ANZECC and EPA guideline values are for As V and Cr VI. Measured values are for total As and total Cr. ***Lab report shows that dissolved Al in reagent water was 0.08 mg/L. Total chromium in reagent water was report as 0.038 mg/L. Copper in reagent water was reported as 0.001 mg/L.

A dash (--) means no criterion or guideline value has been defined.

The ~~principle~~principal framework for the regulation of radiation protection and radioactive waste management is set out in the Victorian *Radiation Act 2005* and the Radiation Regulations 2017. The Act and Regulations define levels of 'prescribed radioactive substances' and set limits on occupational and public exposures arising from the mining and processing operations. Under the

Regulations, the prescribed activity concentration for combined U-nat + Th-nat combined is 1 kBq kg^{-1}. The heavy mineral concentrate produced at the Fingerboards project (which includes the 'spiral cons', 'mag cons' and 'non-mag cons' process streams -Table 5-2) triggers the activity concentration threshold and is accordingly classified as a prescribed radiaoactive substance under Regulation 6. Accordingly, licensing and management provisions of the *Radiation Act* and Regulations ~~would~~will apply. Consequently, the Act ~~would~~will apply. Kalbar will need to apply for a management licence to cover the radiation safety related aspects of operations within the mine, in accordance with the provisions of the Victorian Radiation Regulations 2017.

Table 5-2: Radionuclide content (kBq·kg) Fingerboards process streams and concentrates

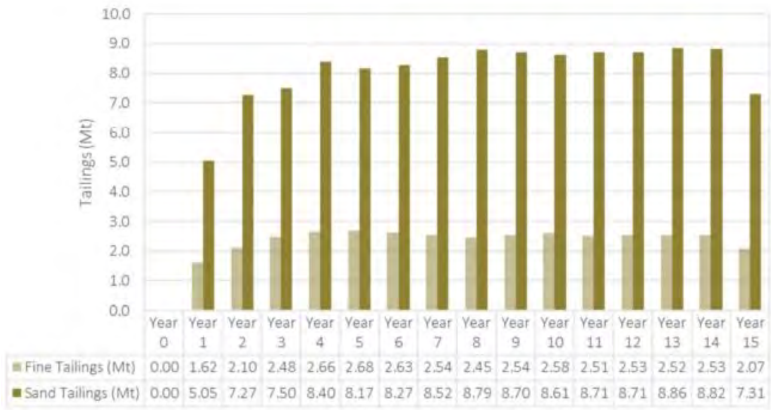
Material	Uranium mass concentration (ppm)	Thorium mass concentration (ppm)	U-238 Activity ($kBq \cdot kg^{-1}$)	Th-232 Activity ($kBq \cdot kg^{-1}$)
Ore	25	120	0.31	0.48
Screen U/S	27	125	0.33	0.50
Spiral Feed	32	148	0.39	0.59
Spiral Cons	250	1600	3.08	6.40
Mag Cons	240	1700	2.95	6.80
N/Mag Cons	300	1400	3.69	5.60

Note: Greyed out rows indicate materials that are *not* classified as prescribed radioactive substances under the Radiation Act.

5.6 Processing wastes (tailings)

5.6.1 Tailings production

Annual rates of tailings production will range from approximately 1.62 Mt to 2.68 Mt for fines tailings and from 5.05 Mt to 8.86 Mt for coarse sand tailings (Figure 5-2).



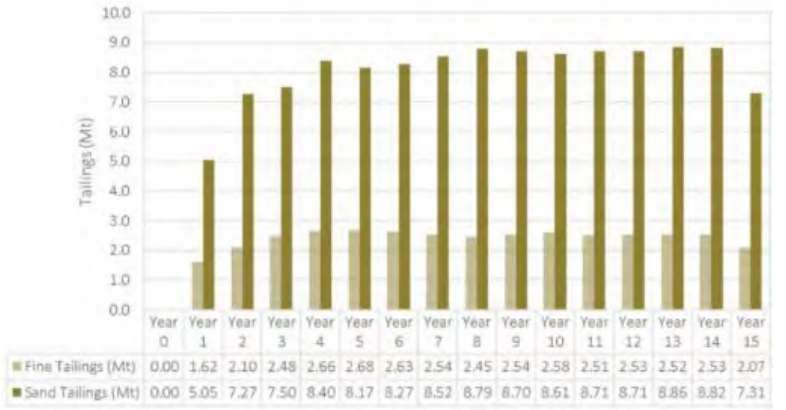


Figure 5-2: Estimated annual tailings production

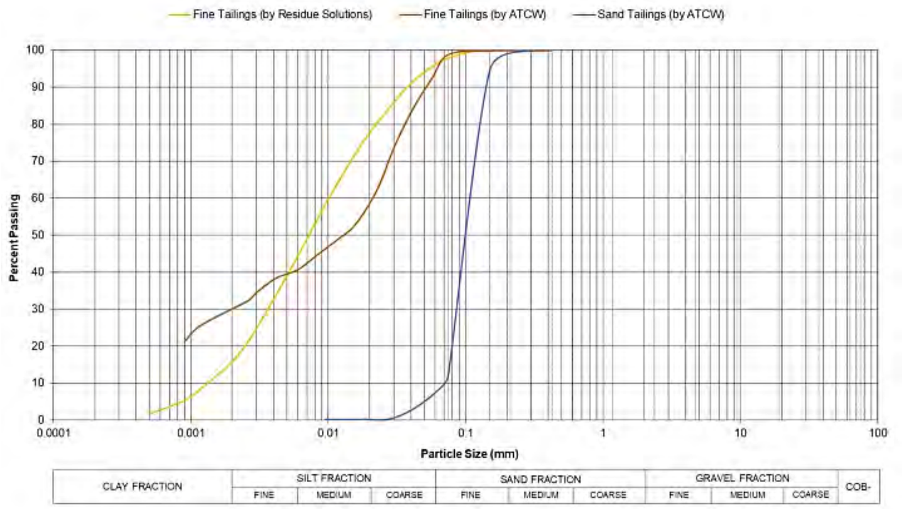
5.6.2 Tailings characteristics

The tailings consist of coarse sand tailings (about 80 µm) and fines tailings (<38 µm). The coarse sand tailings may contain minor amounts of coarser sand particles (>250 µm) and consist predominantly of quartz sand. The fines tailings contain mainly quartz, with minor amounts of kaolinite clay and mica. Both tailings fractions will contain minor amounts of zircon, ilmenite, rutile, monazite, xenotime and other trace minerals which are not ~~all~~ recovered to concentrate. Radioactivity levels in the coarse sand tailings 0.25 Bq/g and fines tailings ~~will be~~0.69 Bq/g are well below 1 Bq/g (meaning that the tailings are not classified as radioactive). Both tailings ~~stream~~streams typically have a specific gravity of approximately 2.7.

The coarse sand tailings resemble a poorly graded fine sand, while the physical properties of the fines tailings are similar to those of a low- to medium plasticity silty clay (Table 5-3, Figure 5-3).

Table 5-3: Tailings geotechnical properties (ATC Williams, 2017)

Property	Fines tailings	Coarse sand tailings
Particle density (SG)	2.76	2.67
Atterberg limits		
Liquid limit, %	34	
Plastic limit, %	21	
Plasticity index, %	13	
Min / Max dry density, t/m3	--	1.24 / 1.55
Particle size D50, µm	12.9	110
Particle size D80, µm	36.9	137
USCS classification	CL	SP



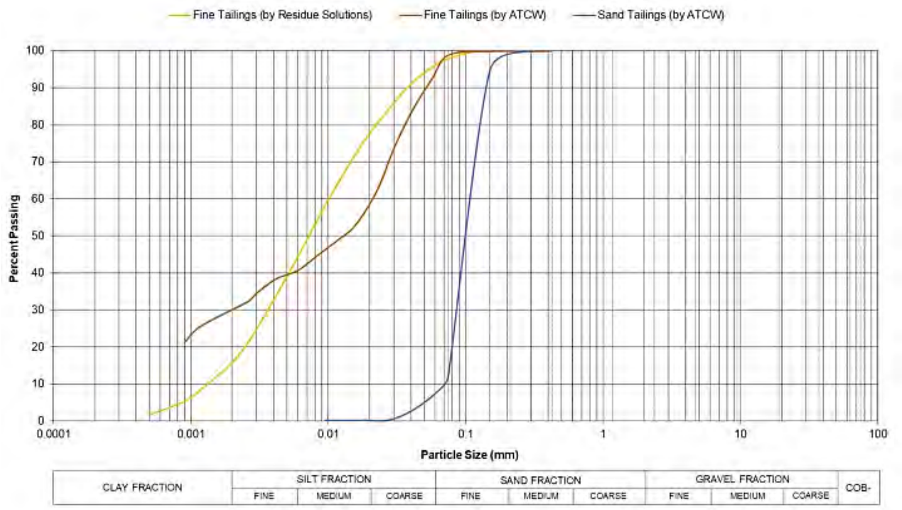


Figure 5-3: Tailings particle size distribution

The salinity level of both the coarse sand tailings (0.03 decisiemens per metre) and fines tailings (0.09 dS/m) is low and will not generate saline seepage or leachate. The mineral composition of the fine tailings is dominated by quartz, mica and kaolinite (a type of clay mineral), with trace amounts of rutile and other titanium oxides (Table 5-4:). Sulfide concentrations in the coarse sand tailings and fines tailings contain insufficient concentrations of sulfide to cause acid mine drainage (EGI, 2020). This is supported by resource drilling where 2014 samples of ore have been analysed for SO_3. The assays of the ore samples show that the SO_3 levels average 0.015%. Only four samples have SO_3 levels above 0.04% with a maximum of 0.1%.

Table 5-4: Mineral composition of fine tailings (by X-ray diffraction)

Mineral	Abundance (range), %
Quartz	40.5 - 47
Mica	24.8 - 28
Kaolinite	20.7 - 25
Rutile / anatase	1 – 1.2
Other and non-diffracting	0 – 10.9

Source: Residue Solutions, 2017

Total elemental analysis

The elemental compositions of representative fines and coarse sand tailings samples are presented in Table 5-5.

Table 5-5: Total elemental analysis – Fingerboards tailings

Element	Units	Fines tailings*	Coarse sand tailings*	EPA clean fill upper limit (T0)**	NEPM HIL-A***
Antimony (Sb)	mg/kg	<0.5	<0.5	--	--
Arsenic (As)	mg/kg	~~37~~35	4	20	100
Bismuth (Bi)	mg/kg	<1	<1	--	--
Cadmium (Cd)	mg/kg	<0.1	<0.1	3	20
Chromium (Cr)	mg/kg	86	10	1 (Cr VI)	100 (Cr VI)
Cobalt (Co)	mg/kg	2	<0.5	--	100
Copper (Cu)	mg/kg	18	2	100	6000
Lead (Pb)	mg/kg	11	1.9	300	300
Manganese (Mn)	mg/kg	24	6	--	3800
Mercury (Hg)	mg/kg	0.02	<0.01	1	40
Molybdenum (Mo)	mg/kg	1	<0.5	40	
Nickel (Ni)	mg/kg	5	0.7	60	400
Selenium (Se)	mg/kg	0.3	<0.1	10	200
Silver (Ag)	mg/kg	0.1	<0.1	10	--
Sulfur (S)	%	0.01	<0.01	--	--
Thorium (Th)	mg/kg	11	1	--	--
Tin (Sn)	mg/kg	2	<0.5	50	--
Uranium (U)	mg/kg	4	0.4	--	--
Zinc (Zn)	mg/kg	17	2	200	7400

* Envirolab Services (WA) Pty Lrd (MPA Laboratories), Cerificate of Analysis 217289-B. Chromium in tailings was measured as total chromium, not hexavalent chromium.

** - EPA Victoria, 2009. Industrial Waste Resource Guidelines - Soil Hazard Categorisation And Management.

*** - National Environment Protection Council (NEPC), 2013. Health-based investigation levels specified in National Environment Protection (Assessment of Site Contamination) Measure 1999

To provide a comparison for elements that are commonly regarded as environmentally important, the compositions of the tailings solids were compared to typical concentrations reported for soil in non-mineralised areas. The purpose of this comparison was to highlight any elements that were significantly enriched, and which could have implications for management of the tailings. The comparison is expressed as a Geochemical Abundance Index (GAI), which relates enrichment to the median crustal soil abundance value.

The GAIs for the tailings are shown in Table 5-6. Neither the fines tailings nor the coarse sand tailings showed significant metals enrichment (GAI≥3). The only minor enrichment was arsenic (~~44~~35 mg/kg) in the sample of fines tailings. Even with the minor enrichment above average global abundance values, the total arsenic concentration reported in fines tailings is still well within the range of values considered appropriate in soils used for residential purposes (and other sensitive uses), according to the National Environmental Protection Measure (NEPM).

Table 5-6: Global abundance indices – selected metals in Fingerboards tailings

Element	Median soil content * (mg/kg except %S)	Fines tailings	Coarse sand tailings
Antimony (Sb)	1	0	0
Arsenic (As)	6	**2**	0
Bimuth (Bi)	0.2	<1	<1
Cadmium (Cd)	0.4	0	0
Chromium (Cr)	70	0	0
Cobalt (Co)	8	0	0
Copper (Cu)	30	0	0
Lead (Pb)	35	0	0
Manganese (Mn)	1000	0	0
Mercury (Hg)	0.06	0	0
Molybdenum (Mo)	1.2	0	0
Nickel (Ni)	50	0	0
Selenium (Se)	0.4	0	0
Silver (Ag)	0.05	0	0
Sulfur (S)	0.07	0	0
Thorium (Th)	9	0	0
Tin (Sn)	4	0	0
Uranium (U)	2	0	0
Zinc (Zn)	90	0	0

* Median soil data from: Bowen, H.J.M. (1979) Environmental Chemistry of the Elements. Academic Press, London and Berkman, D.A. (1976) Field Geologists' Manual, The Australian Institute of Mining and Metallurgy,Australia.

Leachable metals

The environmental mobility of metals and metalloids in Fingerboards tailings was assessed using the Australian Standard Leaching Procedure (ASLP) (AS4439.2 and AS 4439.3—1997).

The ASLP results for the Fingerboards tailings are summarised in Table 5-7**.** The ASLP extracts of the tailings samples were circum-neutral (pHs of 6.7 and 7.5), and overall the assay results indicate only low concentrations of leachable elements. For most other elements that are commonly regarded as environmentally important the concentrations in the extracts were close to, or below the analytical limits of detection.

Table 5-7: Leachable metals in Fingerboards tailings

Parameter	Units	Limit of reporting	Fines tailings*	Coarse sand tailings*
pH of final leachate	-	0.01	7.5	6.7
Aluminium (Al)	mg/L	0.01	1.1 (0.07) #	0.54 (0.08)
Antimony (sb)	mg/L	0.001	<0.001	<0.001
Arsenic (As)	mg/L	0.001	0.009	0.005
Barium (Ba)	mg/L	0.001	0.005	0.003
Beryllium (Be)	mg/L	0.0005	<0.0005	<0.0005
Bismuth (Bi)	mg/L	0.001	<0.001	<0.001
Boron (B)	mg/L	0.02	<0.02	<0.02
Cadmium (Cd)	mg/L	0.0001	<0.0001	<0.0001
Calcium (Ca)	mg/L	0.5	<0.5	<0.5
Chloride (Cl)	mg/L	1	2	<1
Chromium (VI)	mg/L	0.005	<0.005	<0.005
Chromium (Cr)	mg/L	0.001	0.012	0.007
Cobalt (Co)	mg/L	0.001	<0.001	<0.001
Copper (Cu)	mg/L	0.001	0.002	<0.001
Fluoride (F)	mg/L	0.1	0.3	<0.1
Gallium (Ga)	mg/L	0.001	<0.001	<0.001
Iron (Fe)	mg/L	0.01	1.1 (0.09)	0.44 (0.07)
Lanthanum (La)	mg/L	0.0005	0.0009	0.0007
Lead (Pb)	mg/L	0.001	<0.001	<0.001
Lithium (Li)	mg/L	0.0005	0.0006	<0.0005
Magnesium (Mg)	mg/L	0.5	<0.5	<0.5
Manganese (Mn)	mg/L	0.005	<0.005	<0.005
Mercury (Hg)	mg/L	0.00005	<0.00005	<0.00005
Molybdenum (Mo)	mg/L	0.001	0.003	<0.001
Nickel (Ni)	mg/L	0.001	<0.001	<0.001
Phosphorus (P)	mg/L	0.5	<0.5	<0.5
Potassium (K)	mg/L	0.5	1.3	<0.5
Selenium (Se)	mg/L	0.001	<0.001	<0.001
Silicon (Si)	mg/L	0.1	2.7 (1.3)	1.0 (0.3)
Silver (Ag)	mg/L	0.001	<0.001	<0.001
Sodium (Na)	mg/L	0.5	2	<0.5
Strontium (Sr)	mg/L	0.001	0.001	<0.001

Parameter	Units	Limit of reporting	Fines tailings*	Coarse sand tailings*
Sulfate (SO4)	mg/L	1	<1	<1
Thallium (Tl)	mg/L	0.001	<0.001	<0.001
Thorium (Th)	mg/L	0.0005	0.0017	0.0008
Tin (Sn)	mg/L	0.001	<0.001	<0.001
Titanium (Ti)	mg/L	0.001	0.55	0.24
Tungsten (W)	mg/L	0.001	<0.001	<0.001
Uranium (U)	mg/L	0.0005	0.0005	<0.0005
Vanadium (V)	mg/L	0.001	0.029	0.013
Zinc (Zn)	mg/L	0.001	0.002	0.003
Zirconium (Zr)	mg/L	0.01	0.02	<0.01

< indicates release of element is less than the limit of analytical reporting

 # values in brackets represent repeat assays recorded after 3 days of settling

** Envirolab Services (WA) Pty Ltd (MPA Laboratories), certificate of analysis 217289-B*

Comparison with EPA Victoria Soil Hazard Categorisation Limits

The Earth Resources Regulation (ERR) branch of the Victorian Department of Economic Development, Jobs, Transport and Resources (now Jobs, Precincts and Regions) has published a *Technical Guideline for Design and Management of Tailings Storage Facilities* (April 2017). With respect to design and consequence assessment, the guideline states:

> *In assessing the consequence category, consideration is given to the concentration and type of contaminants present or expected to be present in the tailings and decant water as well as physical characteristics such as turbidity. The consequence assessment includes the potential health and environmental impacts associated with that level of contamination in the event of a dam failure or spill.*
>
> *For initial consideration, tailings that have the potential for higher impact are defined in this guideline as:*
>
> 1. *tailings solids with contaminant concentrations (or predicted concentrations) above any of the levels specified in Table 1, and/or sulphidic tailings with the potential to cause acid and metalliferous or saline drainage and/or*
> 2. *decant water with (or predicted to have) a total cyanide concentration exceeding 1 mg/l, and/or a pH outside the range 5 to 9.*

The *ERR Technical Guideline* states that the concentrations in *Table 1 of the Technical Guideline* were adapted from *Table 2 of EPA Publication IWRG621 Soil Hazard Categorisation and Managemen*t, whereas methods for determining acid generation potential are referenced to *Managing Acid and Metalliferous Drainage* (Australian Government 2007b) and *EPA Publication 655.1 Acid Sulfate Soil and Rock* (EPA 2016).

Table 5-8 presents a comparison of the Fingerboards tailings assay data with guideline values in the Environment Protection Authority (EPA) - Industrial Waste Resource Guidelines for wastes and resources regulated under the Environment Protection (Industrial Waste Resource) Regulations 2009 (the Regulations).

The guidelines allow for categorisation of potentially contaminated soil or waste into one of four categories, namely Category A, B, C or clean fill (in which Category A contains the highest level of contaminants and Category C and clean fill the lowest). The guidelines include soil hazard categorisation thresholds that refer to total elemental concentrations in the waste solids as well as leachable thresholds based on the ASLP. The inorganic species included in the guideline are arsenic, cadmium, chromium (VI), copper, lead, mercury molybdenum, nickel, tin, selenium, silver and zinc.

For the fines tailings sample, the only element that exceeded the upper limits for clean fill was arsenic. The reported arsenic content in the sample of fine tailings was ~~37~~35 mg/kg. This is approximately double the upper limit for clean fill of 20 mg/kg, but well below the upper limit for Category C waste of 500 mg/kg, which is the category that is referenced in Table 1 of the ERR Technical Guideline, indicating "tailings with contaminant concentrations above these levels are considered to have potential for higher impact~~.~~”.

The ASLP results for the fines tailings sample indicate an arsenic concentration in the extract of only 0.009 mg/L, which is well below the upper limit of 0.7 mg/L specified for Category C wastes. Therefore, based on the arsenic results for both the solids and ASLP leachable, the fines tailings as represented by the sample analysed are considered Category C with respect to the EPA soil hazard guideline, and correspondingly ~~would~~should not be considered material with potential for higher impact under the ERR guideline.

Table 5-8: Tailings geochemistry relative to EPA hazard categories

	Fines tailings		Coarse sand tailings		EPA Victoria - Soil Hazard Categorisation Fill Upper Limit	**Category C** Upper Limits	
	ASLP (mg/L)	TC (mg/kg)	ASLP (mg/L)	TC (mg/kg)	TC 0 (mg/kg)	ASLP 1 (mg/L)	TC 1 (mg/kg)
Arsenic (As)	0.009	~~37~~35	0.005	4	20	0.7	500
Cadmium (Cd)	<0.0001	<0.1	<0.0001	<0.1	3	0.2	100
Chromium (Cr-VI)	<0.005	86 *	<0.005	10 *	1	5	500
Copper (Cu)	0.002	18	<0.001	2	100	200	5,000
Lead (Pb)	<0.001	11	<0.001	2	300	1	1,500
Mercury (Hg)	<0.00005	0.02	<0.00005	<0.01	1	0.1	75
Molybdenum (Mo)	0.003	1	<0.001	<0.5	40	5	1,000
Nickel (Ni)	<0.001	5	<0.001	1	60	2	3,000
Selenium (Se)	<0.001	0.3	<0.001	<0.1	10	1	50
Silver (Ag)	<0.001	0.1	<0.001	<0.1	10	10	180
Tin (Sn)	<0.001	2	<0.001	<0.5	50	-	500
Zinc (Zn)	0.002	17	0.003	2	200	300	35,000

	Fines tailings		Coarse sand tailings		EPA Victoria - Soil Hazard Categorisation		
					Fill Upper Limit	**Category C** Upper Limits	
	ASLP	TC	ASLP	TC	TC 0	ASLP 1	TC 1
	(mg/L)	(mg/kg)	(mg/L)	(mg/kg)	(mg/kg)	(mg/L)	(mg/kg)

* Refers to analysis of total chromium in tailings solids

Radioactivity of tailings

The activity concentrations of U-238 and Th-232 in oversize material produced from initial ore screening at the MUPs and in coarse sand tailings and fines tailings produced at the WCP are summarized in Table 5-9. Neither the oversize nor the tailings are radioactive. The activity concentrations of tailings and oversize also fall below the minimum value specified for 'prescribed radioactive substances' under the Victorian *Radiation Act 2005* and the Radiation Regulations 2017.

Table 5-9: Radionuclide content – Fingerboard tailings

Material	Uranium mass concentration (ppm)	Thorium mass concentration (ppm)	U-238 activity (kBq·kg-1)	Th-232 activity (kBq·kg-1)
Screen O/S	10	70	0.12	0.28
Fines tailings	15	80	0.18	0.32
Coarse sand tailings	10	100	0.12	0.40

6 SUPPORT INFRASTRUCTURE

6.1 Water supply

6.1.1 Process water

Process water includes:

- Water required for slurrying of ore so that it can be pumped to the WCP.
- Water used for mineral separation and other ore processing activities, and
- Water required for dust suppression.

It also includes moisture contained in plant feedstock and water recovered from tailings, product dewatering or intermediate process steps.

At the design capacity of 1,500 tph, the annual demand for process water at the Fingerboards Project will vary between 5,200 ML/year and 5,500 ML/year. Water ~~recovered from~~ exits the plant in tailings ~~is recovered~~streams (coarse and fine tailings) and is subsequently recovered, returned to the process water dam, and reused by the process water system. ~~Approximately~~ For the sand tailings placed in the pit, containing approximately 2,~~500 ML~~300ML/year water per year, some 1,150ML/year of water will be recovered ~~from the coarse sand tailings emplacement areas~~ via sub stockpile ~~drainage~~underdrainage and perimeter channels. ~~This water is returned to the process water system so that the~~ A further 1,500ML/year is lost to entrained moisture in the centrifuge cake. These tailings water losses require top up from external sources. The net process water demand ('make up water') accordingly ranges between 2,700 ML/year to 3,000 ML/year. ~~The process water system therefore requires constant top-up.~~. A schematic representation of the key components of the Fingerboards water management system is presented in Figure 6-1.

In order to satisfy process water demands Kalbar will source top-up water from:

- Runoff (the rain water that lands on and flows over the surface) captured on the site in mine contact water dams, or
- External water sources (Mitchell River or groundwater from the Latrobe group aquifer), or
- Combination of on-site water harvesting and external sources.

The project will reuse water where practicable (such as flood run-off ~~and supernatant~~, water recovered from the ~~TSF and~~centrifuging of thickener underflow, seepage collected from the sand tailings deposition ~~area~~ within the mine void) and will generally seek to maximise water use efficiency throughout the Fingerboards operation. Nonetheless, water balance modelling (EMM, 2020a) indicates that during typical dry conditions (approximately 10th percentile lowest annual rainfall conditions) only about 2% and 3% of the net process water demand can be provided by harvesting runoff to the mine contact water dams. During wet conditions (approximately 90th percentile wettest annual rainfall conditions) between 12% and 16% of the net process water demand can be provided by the mine contact dams. The remaining process water demand will have to be sourced externally (i.e. by transfers from the Mitchell River and /or groundwater extraction). The estimated average annual external water requirement is ~~approximately~~ bewteen 2,~~850~~700 and 3,000 ML/year. For construction and initial start-up, annual water requirements are approximately 1.5 GL.

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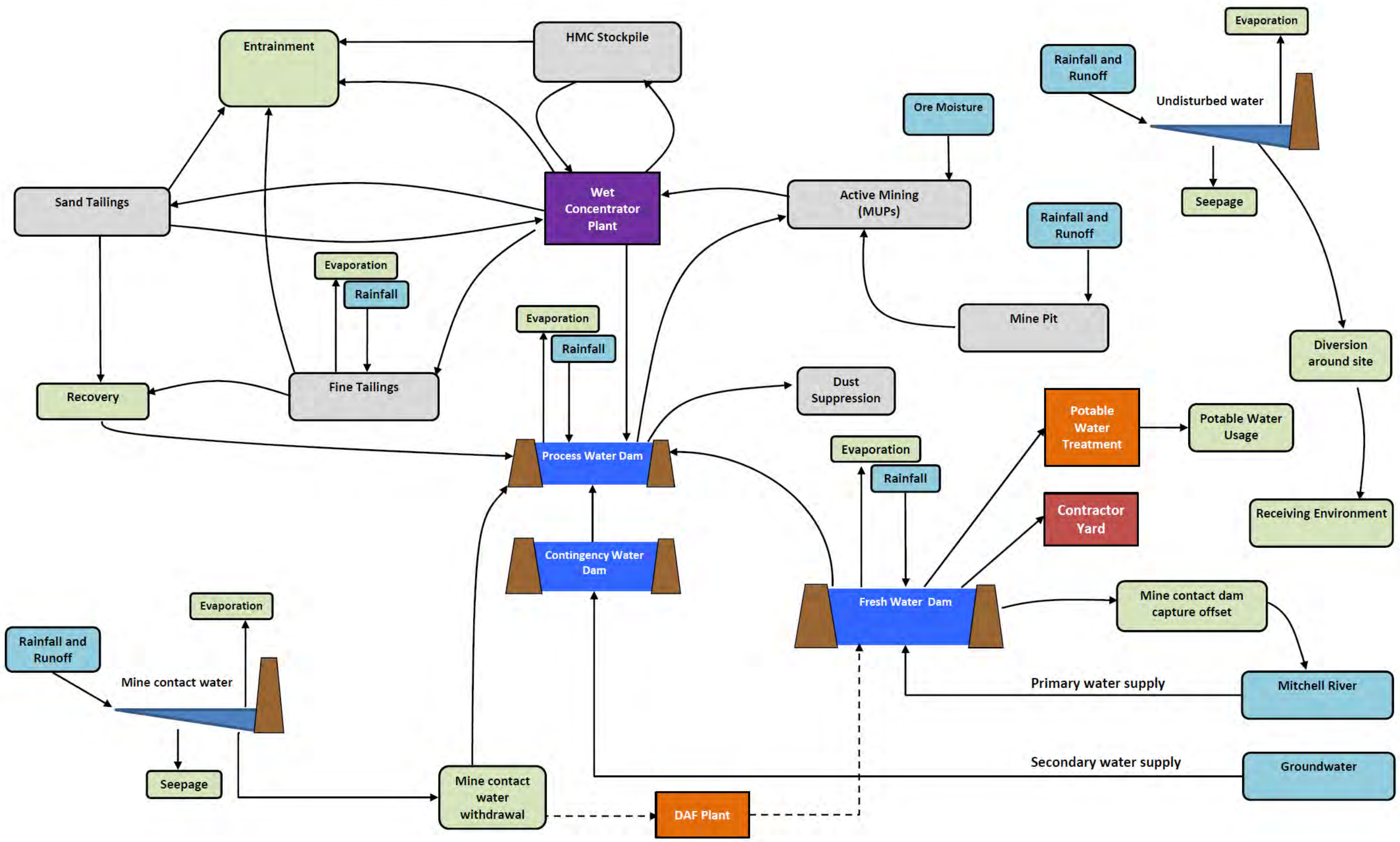
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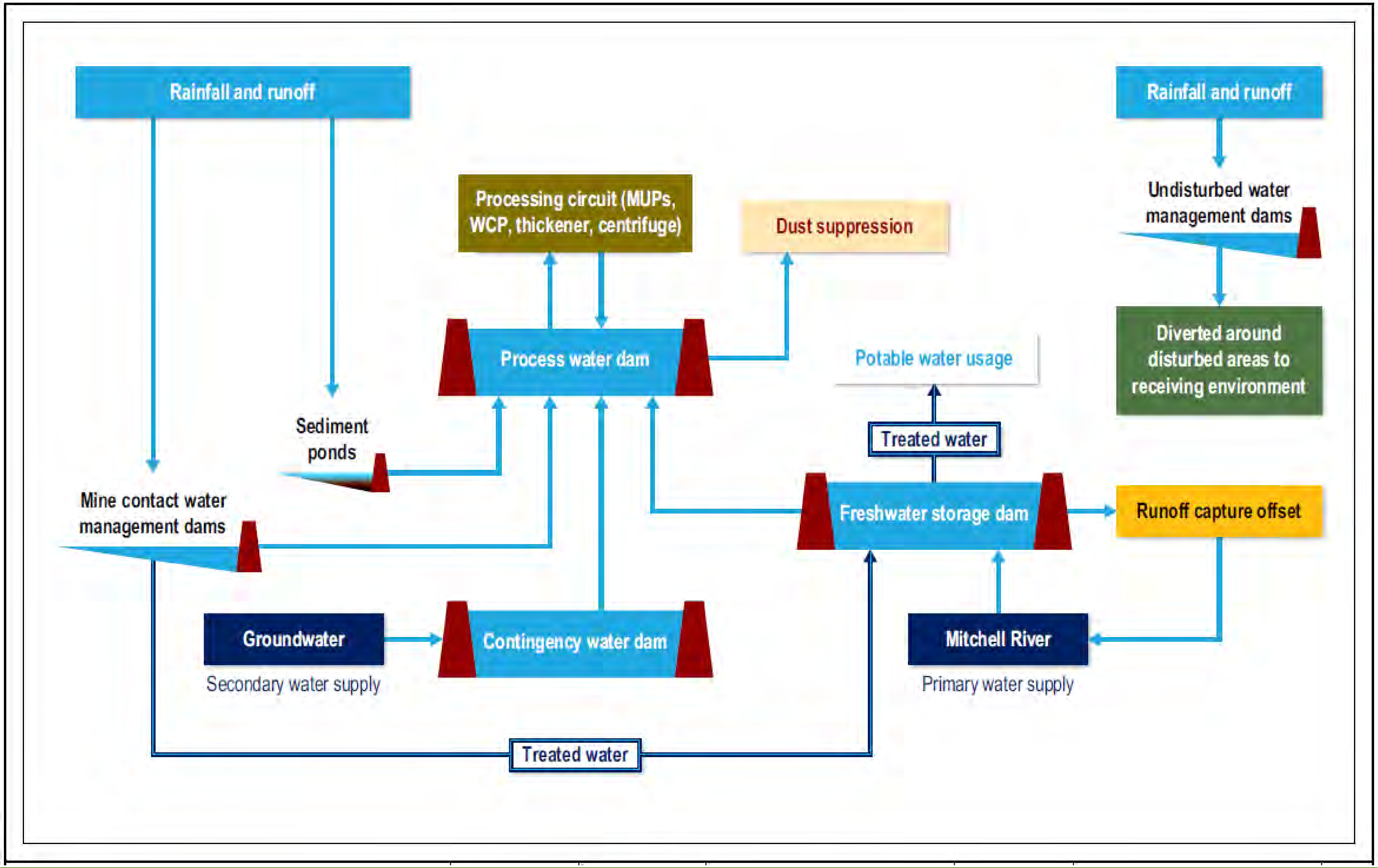
Evaporation
Rainfall and Runoff
Undisturbed water
Ore Moisture
Sand Tailings
Wet Concentrator Plant
Active Mining (MUPs)
Seepage
Rainfall and Runoff
Evaporation
Rainfall
Mine Pit
Evaporation
Rainfall
Diversion around site
Recovery
Fine Tailings
Dust Suppression
Potable Water Treatment
Potable Water Usage
Process Water Dam
Evaporation
Rainfall
Contractor Yard
Receiving Environment
Contingency Water Dam
Fresh Water Dam
Mine contact dam capture offset
Evaporation
Rainfall and Runoff
Mine contact water
Primary water supply
Mitchell River
Seepage
Secondary water supply
Groundwater
Mine contact water withdrawal
DAF Plant



~~Figure~~

AFigure 6-1: Fingerboards water management system (schematic)

External water sources

Kalbar will source top up water primarily from winterfill from the Mitchell River. Water extracted from the Mitchell River ~~would~~will be stored in a lined 2.2 GL freshwater storage dam located near the WCP. ~~Two options have been identified for the pipeline route from the Mitchell River to the freshwater storage dam. One option would use the existing East Gippsland Water pump station and pipeline, the other would be to construct a~~A new pump station and pipeline~~.~~ will be constructed from the Mitchell River.

The new river inlet pump station will consist of an inlet pump well arrangement, pumping away from the river to a second booster pump station (approximately 60 m away). The required flow rate and head necessitate such a design. The pump well is located below and the booster pump station above the 1 in 100-year average-recurrence interval storm event flood level. The pumps and pipeline are sized to supply sufficient water during the available pumping days of the four month winterfill period to satisfy project operational water requirements and at the same time fill the freshwater storage dam. A 560 mm diameter high-density polyethylene (HDPE) pipeline will be installed to convey water from the Mitchell River to the freshwater storage dam. The pressure classes used for the pipeline will be in accordance with Australian Standards.

Kalbar will also use groundwater pumped from the Latrobe Group Aquifer to meet part of its top up water demand. Because water from the Latrobe Group is fully allocated, Kalbar can only access this water by purchasing water from an existing user. Groundwater will not report to the freshwater storage dam. It will be stored in the contingency water storage dam or fed directly to the processing water circuit (Figure 6-1). An HDPE pipeline will be constructed from the borefield (south of the proposed mining licence area - Figure 1-3) to the contingency water storage within an infrastructure corridor.

On-site water harvesting

Mine contact water is water that comes into contact with the mine void and disturbed mining areas. It also includes runoff from infrastructure areas and the mining contractor's facilities. Mine contact water will be intercepted and managed in the mine voids and in mine contact water dams and will be used in the process water system. Mine contact water dams will be located on drainage lines downstream of mining activities. The mine contact water dams serve the dual function of controlling release of turbid (or otherwise unsuitable) water to the environment and providing a local distributed system of water storage for rainfall or runoff within the proposed mining licence area. The dams will be engineered structures designed to accommodate rainfall and runoff from events up to and including an 1% AEP, 72-hour rainfall event. All dams will be provided with emergency spillways. The dams will be designed, constructed and operated in accordance with relevant ANCOLD requirements (ANCOLD, 2012).

Preliminary dam capacities, catchment areas and embankment heights are provided in Table 6-1. Dam specifications presented in Table 6-1 are indicative and subject to detailed design, including geotechnical assessment. The 'dam ID' numbers shown in the table correspond to the dam locations shown in Figure 8-1. Final dam locations and dimensions may vary from those presented in this draft work plan, but will still meet the proposed water management design objectives.

Water management dams will include engineered spillways. The dam embankments will be designed and engineered as water holding embankments with consideration of local conditions. Where relevant, spillway capacities will be established using the methods recommended in the ANCOLD guidelines.

If mine contact water is produced at a rate greater than can be used in the processing plant, up to 24 ML/day of water will be pumped to a bulk water treatment plant where water will be treated to a standard which is sufficient to allow discharge to the Mitchell River via the winterfill pipeline. During rare, extended heavy rainfall, it is possible that mine contact dams will fill and overflow via engineered spillways to the downstream environment.

The water management dams will be constructed, removed and rehabilitated progressively as mining advances along the mine path. The mine contact water dams will only be decommissioned when it has been demonstrated that runoff reporting to the dam is of a suitable quality for return to the natural or reinstated drainage system.

Table 6-1: Preliminary contact water dam specifications (EMM, 2020a)

Dam ID	Maximum Catchment Area (ha)	Storage Volume (ML)	Approximate Spillway height (m above toe)	Approximate Embankment Length (m)
2	132	125	13	150
3	61	57	11	130
4	15	15	12	80
5	13	13	15	100
6	7	7	14	100
7	222	211	24	240
8	24	23	17	100
9	128	122	20	130
10	134	127	1[1]	53
11	41	39	12	400
12	22	21	9	220
13	135	128	15	220
14	76	72	1[1]	20
15	42	40	12[1]	70
16	280	266	14[1]	180
17	101	96	4.5	830
18	207	197	8	310
19	230	219	8[1]	130
20	175	166	1[1]	20

[1] Dam construction includes void generation by pre-mining of overburden.

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Surface water intercepted by the site, that is not exempt from surface water licensing (DSE, 2004), will be offset by the release of water from the fresh water dam (EMM, 2020a).

The offset requirement of the project will be determined by a monitoring array which will be designed to enable a site wide water balance of sufficient detail to confirm water licensing conformity. The required monitoring array will include:

- water meters on extraction points from each of the water management dams,
- water meters on flows in and out of the fresh water storage dam and the contingency water dam, and
- monitoring of the storage levels in dams on a regular or continuous basis.

Undisturbed water dams will pipe intercepted water into the receiving waterway and therefore won't require offsetting from the fresh water dam.

The Mitchell River Basin Local Management Plan (SRW 2014) dictates that for winterfill users, water may be extracted from 1st July to 31st October if river flows are not less than 1,400 ML per day. Flows are measured as the passing flows at the Glenaladale gauge site prior to extraction of the water allocation. Additional information on licensing conditions and historical water availability is provided in the ~~ESS~~EES specialist study, Surface Water Assessment - Regional report (Watertech, 2020c).

6.1.2 Potable water

Two proprietary water filtration (treatment) package plants will be used to treat Mitchell River winterfill water stored in the freshwater storage dam. One package plant will be located at the process water dam for supply of potable water to the WCP, administration offices, workshop and stores. The other package plant will be sited at the mining contractor's workshop for supply of potable water to the mining contractor's offices, workshop and stores. A take-off pipeline from the freshwater supply line supplying fresh water to the process water dam will supply river water to the treatment unit at the process water dam.

6.1.3 Water storage

A lined freshwater storage dam will be constructed to store Mitchell River winter-fill water for operational supply. The freshwater storage dam will have sufficient capacity to supply the WCP and MUPs during the eight months when extraction from the Mitchell River is restricted. The freshwater storage dam will have design storage allowance to accommodate a 1% Annual ~~exceedance~~Exceedance Probability (AEP), 72-hour storm event in addition to the storage requirements for winterfill. The dam will be designed, constructed and operated in accordance with relevant requirements of the ANCOLD guidelines (~~2012a, b~~2012).

The lined process water dam will be an engineered turkey nest dam constructed using local overburden. It will be sized to provide storage of process water for 17 hours of processing requirements and will, additionally, have storage allowance to accommodate rainfall from an 1% AEP 72-hour storm event. The process water dam will receive make-up water from the freshwater storage dam, excess stormwater from the mine contact water dams, water from centrifuges and reused thickener overflow water from the WCP. The dam design will incorporate compartments to extend water flow paths for trapping silt.

The contingency water dam will also be an engineered turkey nest style dam and constructed from overburden near the wet concentrator plant. The dam will receive predominantly groundwater from the borefield pipeline. The design storage capacity will be 12 ML and will allow for a 1% average exceedance probability, 72-hour storm event.

6.2 Power

The power demand for the MUPs, WCP and WCP centrifuge plants is estimated at 914,000 kVA on average. Kalbar will construct a new 66 kV line and 22 kV line in the infrastructure corridor. The new power lines would connect with the the existing 66 kV network, which runs about 5 km south of the proposed mining licence area. A 66 kV sub-station and transformers to lower voltagesthevoltage to 22 kV will be installed within the proposed mining licence area. Power will be reticulated through the proposed mining licence area using 22 kV power lines. No gas is required for the processing of heavy mineral concentrates. During the construction phase six diesel generators will be required.

6.3 Access and haul roads

Access roads will be used by mine construction and operations staff, contractors and delivery personnel and trucks transporting concentrate from site. Access to the mine site for light and medium vehicles will be provided via a private road adjacent to the Limpyers Road and Fernbank-Glenaladale Road intersection. A dedicated light vehicle road will be constructed in the proposed mining licence area parallel to Limpyers Road, to avoid impacts on native vegetation. This road will run to the mine offices and WCP area. A security gate will control vehicles entering the mine office area.

Access for concentrate transport trucks will be via an automatically gated entrance off the Fingerboards intersection roundabout or the Chettles Road intersection roundabout (depending on which product transport option is undertaken).

Haul roads will connect the mining contractors' workshop, mine void and overburden stockpiles and will enable the movement of overburden around the mine site, as required. The local road network will not be used for mining operations traffic. A heavy vehicle underpass will be built under the Bairnsdale-Dargo Road, near the Fingerboards roundabout to allow mobile mining equipment to move around the mine site without interfering with local traffic. A second heavy vehicle underpass will be built at later stage to access ore in the south-eastern part of the deposit.

Mine haul roads and access roads will be unsealed and will be constructed using overburden and local stone material and of sufficient width to allow safe passage for haul trucks and light vehicles. For the rail siding option east of Fernbank, a sealed haulage road will leave site via the Chettles Road roundabout and run along the infrastructure corridor from the mine site to the rail siding.

Public roads within and outside the proposed mining licence area will need to be progressively diverted, realigned, re-constructed and/or enhanced during the mine operation and as part of the final rehabilitation. Kalbar's preference is for public road diversions to be permanent, as this approach expedites rehabilitation of the proposed mining licence area. Any permanent diversions will require planning scheme amendments. Modifications to public roads are addressed in the Fingerboards EES and an associated planning scheme amendment.

6.4 Heavy Vehicle underpassUnderpass

The Bairnsdale-Dargo Road currently divides the proposed mining tenement in two, separating the fines tailing storage facility (TSF) from the area that will initially be mined during the life of mine. Haul trucks will have to cross the Bairnsdale-Dargo Road during construction and raising of the TSF embankments... A haul road underpass will be constructed to create a grade separated crossing for heavy mining vehicles to pass under the highway safely and maintain production rates when constructing and raising the TSF embankmentsroad safely and to negate the risk of accidents when using a level crossing.

A 40 m long, deep corrugated-plate arch type B381 x HA10 bridge structure, will be constructed to serve as a haul road underpass. The steel structure consists of field bolted galvanized steel plates that, once erected, will have a span of 18.0 m and a rise of 9.3 m. A similar deep corrugated-plate arch constructed at Rio Tinto's Yandi Mine site for a heavy vehicle overpass is shown in FFigure 6-2. The total volume of structural gravel fill required that will be sourced from borrow pits is 11,900 m^3.

Figure 6-2: Corrugated-plate arch bridge structure

6.5 Workshops

The fixed plant workshop will be a dome shaped shipping container shelter (Figure 6-3). The galvanised steel frames, clad with a flexible high-tension fabric cover, are erected between shipping containers to create a permanent storage area and shade.

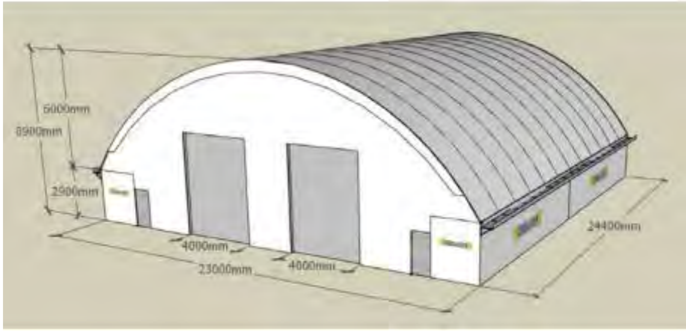

Figure 6-3: Fixed plant workshop design

6.6 Laydown areas and other hardstand

Laydown areas will be located adjacent to the administration area, the WCP and within the construction contractor's workshop area. The processing plant, administration, product storage and 66 kV susbstation areas will be constructed and sheeted with local gravel material. Gravel will be sourced from borrow pits within the proposed mining licence area.

6.7 Explosives magazine

No explosives are required for mining. There will be no explosives magazine at the Fingerboards site.

6.8 Chemical and fuel storage

Because the processes used in ore processing are mainly physical processes, only limited quantities of chemical will be stored on site. Any hazardous materials, such as fuel and laboratory chemicals, will be stored in designated areas in accordance with their safety data sheets. Hazardous materials will be transported in accordance with the *Australian Code for the Transport of Dangerous Goods by Road and Rail* (National Transport Commission, 2016).

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Bunding for the fuel storage area (fuel farm) will be in accordance with Australian Standard 1940:2017 (Standards Australia, 2017). The capacity (i.e., bund height), storage, stormwater control and maintenance, and operation of bunded areas will comply with EPA liquid handling and storage guidelines (EPA, 2018), including vehicles operating in bunded areas.

The flocculant will either be delivered to site in a dry powder form or as a concentrated emulsion. There will be a dedicated storage area for the flocculant and a floc-plant, which is where the flocculant will be diluted and transferred to the tailings dewatering circuit at the prescribed dose rate. The flocculant will be introduced into the Wet Concentrator Plant at the thickener at very low dose rates (50 to 100 g per tonne of tailings). The floc storage, floc plant and thickener are all located within the WCP area and will be bunded to catch spillage or run-off water.

The same type of flocculant used in the thickener is added to the centrifuge to improve flocculation of the fines during centrifuge process. Floculant will be diluted with water to a 0.2% concentration before being dosed into the centrifuge. Flocculant and coagulant will also be used in the Dissolved Air Flotation plant (DAF) used to treat excess water from the catchment dams prior to discharge to the environment.

Handling of the concentrated floc will be done in accordance with safety data sheet recommendations. The probable flocculants to be used at Fingerboards are anionic polyacrylamides (eg. Nalco Optimer® 83384 and BASF Magnafloc 5250®) which are not acutely toxic to fauna or people and are not expected to bioaccumulate in the environment (Auckland Regional Council, 2004), as is stated in the Safety Data Sheets provided by these companies for these materials. Coaggulant used in the DAF water treatment plant will be polyaluminum chlorides (PAC's), which are commonly used in water treatment plants internationally and in Victoria.

6.9 Other industrial infrastructure

An administration building, change rooms, crib room, laboratory, security building, warehouse, geo store and fixed plant workshop will be constructed at the WCP. All buildings (apart from the WCP and associated processing plant) are modular, prefabricated fit-for-purpose buildings.

A 970 m DN110 PN16 HDPE firefighting ring main with seven DN75 standpipes equipped with fire hydrants will be installed to convey firefighting water around the processing plant, administration area, workshop and store.

Mining contractors' facilities will be provided by the mining contractor as part of the overall mining contract. An engineered pad and key facilities and services will be provided by Kalbar under a site wide earthworks contract. The location of the mining contractor's facility is in an area where ore has to be mined first, before the yard, buildings and facilities can be constructed and serviced. The mining contractor will have to construct a temporary facility at the WCP site (Figure 4-1) for servicing plant and for supporting mining operations until the overburden and ore has been removed from this area and until the permanent facility has been constructed, serviced and buildings erected.

6.10 Telecommunications

A telecommunication system will be installed to the mine site offices. The mine site falls within an area of existing mobile telephone coverage.

6.11 Accommodation

No construction camp will be required it is expected that there will be adequate accommodation in nearby towns (Lindenow, Bairnsdale, Briagolong, Stratford and Sale) for non-local workers.

6.12 Sanitation and waste management

Septic wastes from the WCP, administration area and workshop will be treated in a proprietary package treatment plant. ,. Sewage from the from the mining contractor's offices, workshop and stores will be stored in a purpose built tank and removed from site by a licenced waste disposal operator. The sewage treatment system uses aerobic treatment to treat up to 4,000 L/day. The treated effluent is clear and odourless and will be used in a dripper irrigation system. The effluent disposal system will be designed and operated to meet requirements detailed in EPA 464.2 *Guidelines for Environmental Management: Use of reclaimed water* (2003). The locations of the treated effluent disposal fields will be close to the WCP and the mining contractor's facilities

No domestic or construction waste will be disposed of on site. Waste will be securely stored on site in appropriate receptacles, then removed from site by licensed contractors for recycling or disposal.

Runoff water from mobile equipment service areas and the mining contractors' workshop will be directed to an interceptor trap to extract hydrocarbons, prior to the treated effluent being discharged to the processing water circuit. The trap will be emptied of hydrocarbons routinely by a licensed contractor for disposal at a licensed facility.

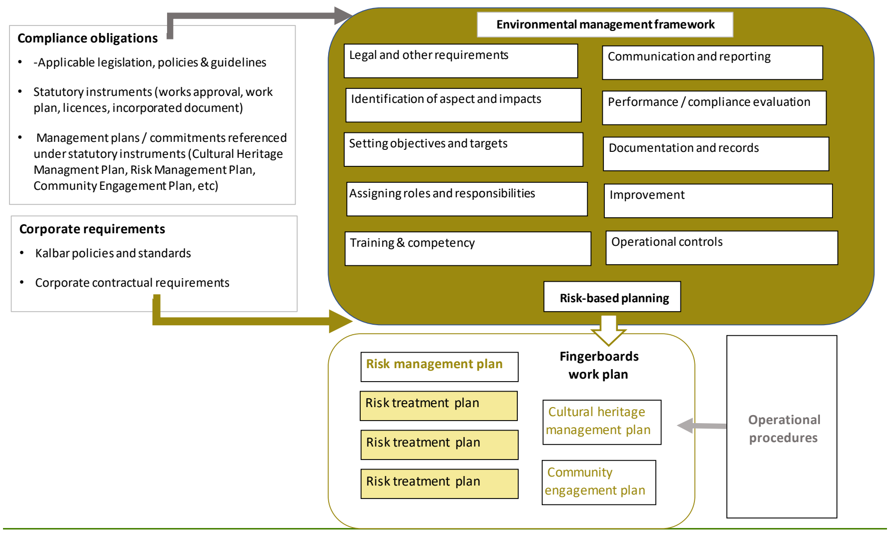
7 RISK MANAGEMENT

7.1 Overview of Environmental Management System

Potential environmental and safety / health risks arising from the implementation of the Fingerboards project will be managed as part of the Environmental Management Framework (see Figure 1-1) under an integrated Environment Management System. The framework guiding Kalbar's management system derives from two key sources (Figure 7-1):

- Statutory compliance obligations (including commitments made in legally binding management plans developed as part of project approvals), and
- Kalbar's corporate policies, standards and company commitments (for example, agreements made with individual landholders).

If statutory and corporate requirements are inconsistent, the more stringent requirement will apply under the Environmental Management Framework (EMF). A copy of Kalbar's health, safety and environment policy is presented in Appendix E, together with other key policies and a copy of the EMF.



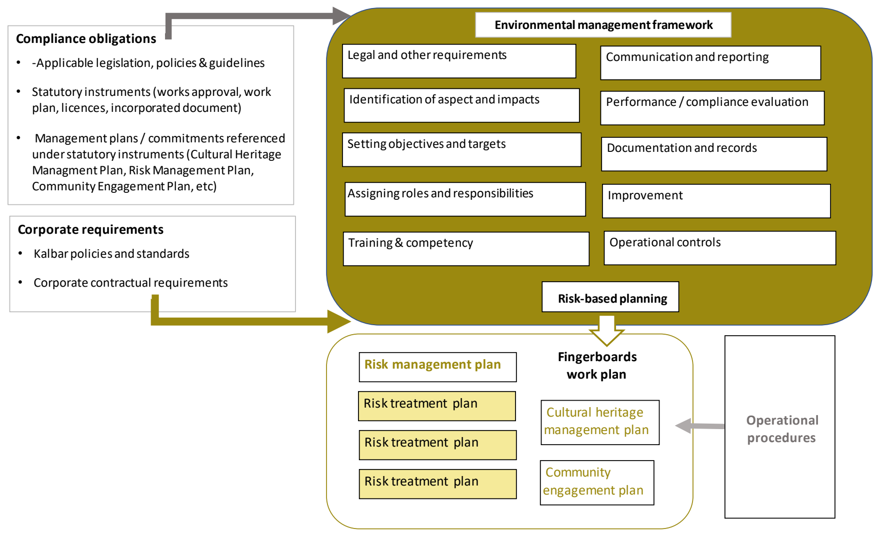


Figure 7-1: Fingerboards work plan in context of Kalbar environment management system

The management framework used in the development of Kalbar's Environmental Management System is aligned with requirements set out in Australian Standard AS/NZS ISO 14001:2016 (*Environmental management systems— Requirements with guidance for use*). The Environmental Management System will cover all company activities with potential to adversely affect the environment..

Individual management plans developed outside the work plan under Kalbar's environmental management framework (for example, the Cultural Heritage Management Plan required under the Aboriginal Heritage Act)) may not strictly align with AS/NZS ISO 14001, as the content and structure of these plans is mandated under government guidelines or other obligatory instruments and those guidelines may not be based on AS/NZS ISO 14001.

The Mineral Resources (Sustainable Development) (Mineral Industries) Regulations 2019 require mining proponents to include a risk management plan as part of work plan documentation. The risk management plan must:

- Identify the control measures to eliminate or minimise, as far as reasonably practicable, the risks associated with mining hazards.
- Specify the objectives, standards or acceptance criteria that each control measure or a combination of control measures will achieve.
- Include a monitoring program that will measure performance against all the specified objectives, standards and acceptance criteria.
- Describe arrangements for reporting on performance against all the specified objectives, standards and acceptance criteria.

A draft Risk Management Plan is provided in Appendix B of this work plan. The Risk Management Plan has been developed in accordance with the Department of Jobs, Precincts and Regions'

Guideline for Mining Project – Preparation of Work Plans and Work Plan Variations (September 2019) and includes:

- a summary of Kalbar's risk assessment process; AND
- a risk register.

Kalbar has prepared risk treatment plans to address significant residual risks (mainly those with a residual risk rating of 'medium' or higher, but also including some hazards – such as airborne and deposited dust - which were determined during the EES assessment process to have low residual risk but which are a central focus of public concern). Some risks will be addressed under specific plans required under the MRSDA – for example, risks arising from public perception will be addressed in the Community Engagement Plan; the risk of inadvertent impact to previously unidentified Aboriginal sites will be managed under a Cultural Heritage Management Plan developed in consultation with Traditional Owners.

As required under Kalbar's ~~Environmetal~~Environmental Management Framework, the Risk Management Plan considers risks related to compliance objectives, as well as risks related to performance (impact) objectives. The Risk Management Plan is a live document and will be regularly updated to address project activities for the relevant phase of the project. Changes to mining activities or new work not covered in the current Risk Management Plan ~~would~~will require a work plan variation (if there are new / increased associated risks) or notification to ERR (if there are no new associated risks and existing risks are rated low or medium). Under some circumstances (described in Section 42(A) of the MRSDA), a further environmental impact assessment report of the proposed new works may be required before a variation can be approved. New data and information (for example, as a result of monitoring activities) ~~would~~will also inform updates of the Risk Management Plan and associated risk treatment plans.

The Risk Management Plan used the same mitigation measures developed through the environmental risk assessment undertaken in the EES. The key differences between the environmental risk assessment and the Risk Management Plan, is that the latter focuses on:

- activities occurring within the proposed mining licence area; and
- on the presumption that approval has been given for these activities to proceed in accordance with mining work plan and any other approvals (eg. a Works Approval).

The Risk Management Plan therefore focuses on impacts beyond what has been approved. For example, it assumes that approvals for vegetation clearing and any necessary biodiversity offsets are in place.

Risks related to offsite traffic and transport events have been identified in the Fingerboards risk assessment, but will not be administered under the work plan or associated Risk Management Plan. Instead, traffic and transport risks will be addressed in a separate Traffic Management Plan to be developed in consultation with VicRoads, local government, emergency services and other stakeholders.

7.2 Identification of mining hazards

Mining hazards are identified primarily through an aspects and impacts analysis. To date, the identification of hazards has drawn on technical studies, expert advice and stakeholder information compiled as part of the EES process, as well as the professional experience of Kalbar staff.

Hazards identified as potential risks of implementing the Fingerboards Project are summarised in Table 7-1. For each hazard, one or more risk events was identified in the risk register. Events that may contribute to an impact could arise from internal or external sources. Risk events are not always associated with physical hazards: they may result from organisational, political or social factors, for example. A copy of the risk register is included in the Risk Management Plan.

Table 7-1: Hazards considered in Fingerboards risk assessment

Release of sediment to surface waters	Noise emissions	Ground movements
Release of contaminated water to surface waters	Ground vibration	Land access / vegetation clearing / ground disturbance
Seepage of contaminated water into groundwater	Erosion	Vehicular traffic / movement of plant & equipment
Altered surface water hydrology	Introduction or spread of weeds or pathogens	Storage / use of hazardous materials
Increased in airborne and /or deposited dust	Light emissions	Fire / explosion
Altered groundwater hydrology (water abstraction)	Radiation	Handling / storage of mineralised materials
Increase in airborne toxicants / greenhouse gases	Rehabilitation failure	Modified landscapes / landforms
Public perceptions	Economic / social disruption	

7.3 Setting objectives and targets

The current Australian and international standard on risk (AS ISO 31000:2018) defines risk as 'the effect of uncertainty on objectives'. Accordingly, Kalbar's environmental management framework requires it to define and communicate environmental objectives (and targets by which attainment of objectives can be evaluated) as part of its risk assessment process. The objectives do not necessarily map to individual hazards. However, in order to realise the objectives and achieve project targets it will be necessary to effect adequate control of hazards and the risk events associated with the hazards. Table 7-2 provides an overview of the Kalbar's environmental objectives for the Fingerboards project, along with the indicators and targets that will be used to test whether the objectives are being achieved.

The Risk Management Plan (Appendix B) provides additional detail on the environmental management actions that will be implemented to avoid or mitigate adverse environmental impacts so that Kalbar can realise its environmental objectives.

Table 7-2: Environmental objectives, indicators and targets

Environmental Aspect	Objectives	Indicators	Targets
Social, health and wellbeing outcomes and community engagement.	To protect the health and wellbeing of residents and local communities.	• Compliance with project approvals and regulatory requirements, including for environmental monitoring. • Regular review of stakeholder engagement forums and approaches, with subsequent actions in response to community feedback. • Community represented on the environmental review committee.	• No material non-compliance with project approvals and regulatory requirements. • Number of community comments or complaints.
	To provide the community with access to information on the environmental performance and socioeconomic impacts of the project during all phases.	• Regular contact with adjacent residents. • Availability of environmental monitoring results to the public.	• Quarterly engagement with the community.
	To effectively address community complaints in a timely manner.	• Timely response to all complaints.	• All complaints responded to in accordance with the complaints handling policy and procedure.
	To maximise the economic benefits from the project for the region.	• Locally employed workforce. • Goods and services sourced from the Gippsland region.	• Tracking demographics of workforce and publicly reporting outcomes.

Environmental Aspect	Objectives	Indicators	Targets
Biodiversity values, including offsets and establishing a sustainable vegetation cover.	To avoid, minimise or offset adverse effects on native vegetation and listed threatened flora and fauna species.	• Extent of vegetation removal. • Vegetation health and diversity. • Weed and pest species density and coverage. • Fauna mortality. • Unintended vegetation clearing.	• No unauthorised clearing • Weed and pest species occurrence in rehabilitated areas is no greater than occurrence of weeds and / or pests at agreed analogue sites. • 70% of average plant diversity in agreed analogue sites for given EVC • Vegetation cover within range of average cover in given EVC analogue sites. • No fauna killed as a result of vehicle incidents, entrapment or other project-related causes (fire, for example). • Approved offset strategy is fully implemented.
Ecological character of the Gippsland Lakes Ramsar site.	To maintain the ecological character of the Gippsland Lakes Ramsar site.	• Change in habitat condition. • Alteration of hydrological regime. • Change in water quality between upstream and downstream locations.	• Median water quality at monitoring locations immediately downstream of the Fingerboards site are within the 75th percentile of upstream monitoring results. • No measurable difference in habitat condition or hydrological flows (with allowance for metered project extraction) between monitoring points immediately upstream and downstream of Fingerboards site.
Groundwater and/or surface water usage and stormwater runoff.	To minimise effects on water resources and protect beneficial uses and licensed uses of surface water and groundwater.	• Change in groundwater quality . • Groundwater drawdown or mounding. • Change in surface water quality between upstream and downstream locations.	• No exceedance of groundwater beneficial use criteria • Groundwater levels consistent with modelling predictions. • No adverse impact on existing surface water and groundwater users (including environmental users).

Environmental Aspect	Objectives	Indicators	Targets
Geotechnical and geochemical landform stability, including potential erosion and sedimentation.	To maintain landform stability and prevent erosion during all project phases.	• Erosion extent and number of slope failures. • Land surface subsidence • Factors of safety for water storage structures • Verified dam capacity, freeboard and spillway capacity • Change in surface water quality from historic baseline.	• No evidence of subsidence or displacement affecting public infrastructure near to proposed mining licence area or areas from which groundwater is extracted. • Calculated factors of safety on final slopes are at least 1.6; calculated risk of fatalities associated with geotechnical failure or subsidence in geotechnical risk zone (per person, per year) does not exceed 10^{-5}. • Calculated factors of safety for water storage structures are at least 1.5. • Dams are constructed and operated to maintain design freeboard and spillway capacity. • No erosion features incompatible with safe use of the land for agreed post-closure uses: – in areas of natural vegetation, density of rills / gullies and rate of sediment discharge does not exceed that on agreed analogue areas. – on agricultural land, erosion features greater than 300mm deep occupy less than 0.5% of the rehabilitated surface; no gullies greater than 500 mm deep. – in all rehabilitated areas, frequency of tunnel erosion features does not exceed that on agreed analogue areas. • Concentration of soluble contaminants and suspended sediment / turbidity in runoff water from rehabilitated areas does not exceed that present pre-mining runoff or (if insufficient data available for pre-mining runoff) does not exceed concentrations in runoff from agreed analogue areas.

Environmental Aspect	Objectives	Indicators	Targets
Solid and liquid waste, including recycling and handling of potentially hazardous or contaminated waste, including radioactive materials.	To minimise generation of waste, maximise reuse and recycling, and where required, responsibly dispose of wastes.	• Number and volume of spills and/or uncontrolled release of soil and liquid wastes. • Volumes of waste (by type) produced and disposed of.	• Complete and consistent reporting of spills. • Continuous improvement in proportion of waste recycled. • Continuous reduction in non-process waste generated. • All non-recyclable waste properly disposed of to approved disposal sites.
Noise, vibration and emissions to air, including dust and greenhouse gases.	To minimise effects on air quality and protect the amenity of residents and local communities.	• Actual (measured) plant and equipment noise levels. • Number of exceedances of project noise or vibration predictions at sensitive receptors. • Number of exceedances of project air quality criteria beyond the proposed mining licence boundary.	• Full compliance with State Environment Protection Policy (Control of Noise from Commerce, Industry and Trade) No. N–1, by complying with applicable provisions of EPA Publication 1411 (Noise from Industry in Regional Victoria) and with elements of EPA Publication 1254 Noise Control Guidelines applicable to construction / demolition activities. • No more than 5 validated air quality complaints per year. • Continuous improvement in greenhouse gas emitted per unit of product.
Aboriginal and cultural heritage values.	To avoid or minimise adverse effects on Aboriginal and non-Aboriginal cultural heritage values.	• Damage to known cultural heritage items, sites or places beyond that predicted in the EES. • Reports of chance finds.	• Full compliance with CHMP. • No unauthorised disturbance of Aboriginal heritage sites.
Traffic during construction and operation.	Maintain road safety and performance during construction and operation of the project.	• Number of accidents or near misses on roads used by project traffic. • Number of community complaints related to project traffic.	• No project-related traffic incidents. • No community complaints related to project traffic. • Full compliance with driver Code of Conduct.
Disruption of or hazard to existing infrastructure.	Avoid disruption or degradation to existing infrastructure due to project activities.	• Number of community complaints related to use of infrastructure. • Change in road pavement condition.	• Excepting during road construction and maintenance, no decrease in Level of Service, relative to existing traffic infrastructure. • Infrequent nuisance impacts (eg, dust from trucks, construction vehicles leave dirt on road,).

Environmental Aspect	Objectives	Indicators	Targets
Requirements for protection of the environment from radiation.	To protect project personnel, the public and the environment from the harmful effects of radiation.	• Radiation levels in water and groundwater. • Radon levels in air. • Radiation levels in airborne dust.	• Full compliance with *Radiation Act* and with actions presented in the Radiation Management Plan.
Site rehabilitation, including handling of topsoil, tailings and mining by-products.	Establish rehabilitation conditions that are safe for humans, non-polluting, geotechnically stable, not prone to erosion able and to sustain post-mining land uses agreed with stakeholders.	• Number of structural failures of engineered elements of rehabilitation. • Extent of erosion in rehabilitated areas (refer previous indicators under 'landform stability'). • Change in vegetation cover and species diversity compared to pre-mining conditions. • Change in surface and groundwater quality over historic baselines.	• Full compliance with Mine Rehabilitation and Closure Plan. • Land surface configuration complies with the approved landform design and any relevant farm plans. • Rehabilitated land is capable of pasture production equivalent to pre-mining levels. • No legacy contamination at project completion.
Fire management and emergency response.	No unintentional fires or increase in fire risk to surrounding properties.	• Number, cause, frequency and extent of unintentional fires. • Damage to property caused by fire.	• No fires initiated by project activities. • Full implementation of site Emergency Preparedness and Response Plan.

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8 MINE MANAGEMENT

This section provides an overview of how key aspects (activities) of the Fingerboards project will be managed. Details of management controls (risk treatments) are discussed on an impact-by-impact basis in the Risk Management Plan (Appendix B).

8.1 Land access and clearing control

A formal internal permitting system will be established to control land access and clearing. Both Kalbar personnel and project contractors wil be required to comply with the permitting system. The purpose of the permit to work system is to:

- Prevent unauthorised access to the project site
- Limit the risk of harm to Aboriginal cultural heritag sites or ensure compliance with the cultural heritage managment plan
- Limit the risk of harm to flora or fauna, including through trampling, spread of weeds or disease or accidental clearing of areas not approved for disturbance
- Minimise intrusion / amenity impacts on neighbouring properties
- Ensure that hazardous activities (for example hot work or dust-generating activities) are only conducted when safe to do so
- Prevent safety impacts that could result from conflict with mine operations infrastructure, plant or equipment

Authorised site disturbance must be carried out in accordance with the internal permit, including any requirements relating to the documentation and reporting of clearing works.

8.2 Topsoil and overburden management

Approximately 600,000 tonnes of topsoil will be removed on an annual basis. This will be stripped during appropriate weather conditions to reduce the impact on soil structure and fertility. Prior to stripping, topsoils destined for areas to be rehabilitated to pasture or other agricultural land uses will be treated with soil conditioners, if requiredto maintain soil fertility and structure during stockpiling.

Topsoil and overburden (which includes subsoil) will be stockpiled separately, adjacent to the active mine void within the disturbed area. Topsoil will be stockpiled to a maximum height of 2 m.

Overburden will be used to build containment walls, redevelop topographic profiles and to develop roads, embankments or tailings cell walls. Noise bunds made of overburden (7 to 10 m in height) will be constructed to protect sensitive receptors (see Figure 2-2 for locations of sensitive receptors). These noise bunds will be temporary and will follow the active mining area.

Visual screening bunds (up to 4 m high) will be built with overburden material to protect visual amenity. The bunds will be placed in several locations along Bairnsdale-Dargo Road and Fernbank-Glenaladale Road and near local residences and will be temporary as the active mining areas move and sites are rehabilitated.

If temporary overburden stockpiles are necessary, these will be constructed to a maximum height of 15 m.

Long term stockpiles and bund walls (those to be retained for more than 18 months) will be revegetated with crops and grasses to stabilise and prevent erosion by wind and water. Short term stockpiles (those to be retained for less than 18 months) will be treated with dust suppressants to reduce fugitive dust and maintain the integrity of the stockpile.

8.3 Mine dewatering

All mining will occur above the regional water table and no dewatering is required. If required, occasional influx of incident rainfall will be managed by directing it to in-pit sumps. This water will then report to the processing water circuit.

8.4 Surface water and drainage management

Water runoff management systems for the Fingerboards project have been designed to achieve the following objectives:

- Maintain pre-mining form and shape of streams aside from the Perry and Simpson Gullys and allow "undisturbed" water to bypass the mine workings and flow along the gully downstream of the mine.
- Capture and reuse water that has been used in ore processing or movement of ore.
- Capture and reuse water that has been in contact with the area of disturbance (mine contact water).
- Use passive treatment methods (sediment detention) to reduce turbidity and other contaminants in (sediment laden) water running off topsoil stockpiles and minor disturbance areas before releasing to the environment.
- Use a water treatment system, such as dissolved air flotation to treat significant accumulation of water in mine contact dams: treated water will be pumped to the fresh water dam.
- Size water detention structures so that they have sufficient storage capacity to retain all inflow except during severe and prolonged rainfall events.

The management of surface water runoff from within the project area will be segregated according to its water quality, as far as practically possible. The water management plan considers undisturbed runoff, sediment-laden runoff, and mine-contact runoff. These are summarised below:

- **Undisturbed runoff** (rainfall runoff from undisturbed or rehabilitated areas, upstream of active mining areas). Undisturbed runoff will be diverted around active mining areas where possible and released to the downstream catchment. Diversion may include temporarily capturing undisturbed runoff in undisturbed water management dams to prevent it from entering active mining areas. Water will then be reticulated to downstream of the mine areas in a controlled manner, and released to the downstream environment. The use of scour-resistant materials will be included in the design, where necessary, to reduce erosion downstream of the discharge point. Pipelines will be used to divert clean water around mining operations.

- **Sediment-laden runoff** (runoff from topsoil stockpiles and minor disturbance areas where the water quality may be characterised by increased suspended solid concentrations). Water from these areas will be managed by sedimentation dams designed in accordance with the International Erosion Control Association Australasia's *Best Practice Erosion and Sediment Control* (BPESC) (IECA, 2008). Type D sedimentation dam design guidelines are adopted and dams sized to achieve an average annual overflow frequency of 2 to 4 spills/year, with a settling zone sized for the 90th percentile, 5-day rainfall depth (DECC, 2008) (EMM, 2020). Sedimentation dams will be dewatered

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following storm events with sediment-laden water to be transferred to the process water system using pumps fitted with flow meters.

- **Mine contact runoff** (includes runoff that comes into contact with the mine void and other disturbed mine areas). Mine contact water has potential to contain higher concentrations of suspended solids, nutrients and elements. Mine contact runoff will be managed in mine contact water dams ('water management dams') located on drainage lines downstream (and upstream where necessary) of mining activities. Dams in the Perry River catchment will be sized to capture runoff for a 1% AEP 72-hour storm event, selected as representative of a storm event caused by an 'east coast low'. Dams in the Mitchell River catchment will be designed utilising a continuous daily water balance approach to achieve a probability of spillway activation of less than three events per 100 years on average (3.3% AEP). Diversion bunds will be used where necessary to divert mine contact water towards the mine contact water dams.

Dams will be managed to allow maximum freeboard for storm events and will be emptied to the process water system as soon as practicable in anticipation of further storm events. Water will be transferred from water management dams to the process water system using pumps fitted with flow meters, and volumes will be recorded by Kalbar to inform licence or offset requirements.

Nineteen water management dams are proposed to be located across the project area over the life of the project (~~Figure 8-1).~~Figure 8-1~~Figure 8-2~~). The number of operational water management dams is dependent on the configuration of mine contact areas at any one time. The dams will be designed, constructed and operated in accordance with applicable ANCOLD requirements, including requirements relating to emergency preparedness. The Fingerboards water management dams are sized ito accommodate rainfall and runoff from a 1% AEP 72-hour storm event. This storm event was selected as representative of a storm event caused by an 'east coast low'. The dams will be engineered to limit discharges via the dam spillway to a 3.3% AEP frequency, meaning that the likelihood that any dam would have a discharge event in any given year is no more than 3.3% (that is that no more than three discharge events ~~would~~shwould be expected to occur in the space of 100 years).[1] For dams in the Perry River catchment dams will be designed and constructed to achieve a probability of spillway activation of less than once per 100 years on average (1% AEP) (EMM, 2020a). If a discharge event does occur, water from the mine contact water dams would be released via the spillway to the Mitchell River or Perry River catchment.

When mine contact dams contain water following rainfall, the mine contact water will be pumped from the mine contact dams to the process water system at a rate of up to 8 ML/day and used as the daily process make-up water. During periods when there is a need to pump more than 8 ML/day from the mine contact dams, the excess water will be pumped to a dissolved air flotation (DAF) treatment plant at a rate of up to 24 ML/day. Water treated via the DAF system would be directed to the freshwater dam. The rate of 24 ML/day is calculated at the maximum capacity needed to lower the water levels in the dams in the heaviest rainfall periods modelled. This modelling has also taken into account climate change impacts on rainfall. This will reduce the volume stored in mine contact dams and the risk of spillway discharge during subsequent rainfall events. The 24 ML/day capacity of the DAF translates to an annualised capacity of 8,760 ML per year, which is well in excess of the fresh water off-set of 630 ML per year for the 90th percentile of rainfall (see Section 5.2.5). It is

[1] Although containment storage for a design storm event (for example, a 1 in 100 year, 72-hour storm event) may be achieved by an appropriate dam size, the ability of the associated water management system to draw down storage levels in dams in time for subsequent rainfall events may cause overtopping of the system more frequently than the design storm AEP (EMM, 2019a).

noted that under the highest rainfall year (1978) over the 117 years modelled with the year 5, 8, and 15 scenarios, the DAF system would treat 1,800 ML (Water Technology, 2020, Table 3.1).

This treatment plant would operate on days when the volume of water recovered from the catchment dams exceeded the process water lost to tailings. or consumed by other operational purposes. The DAF treatment is designed to improve water quality such that it meets the water quality objectives (WQO) relevant to the receiving environment (Mitchell and Perry Rivers) when released from the freshwater dam. Treated water would be transferred to the freshwater dam for storage or release, depending on the level of the freshwater dam. If the freshwater dam is full when the DAF plant is operating, excess freshwater storage water (meeting the WQO) would be discharged from the freshwater dam to the Mitchell River via the winter-fill pipeline.

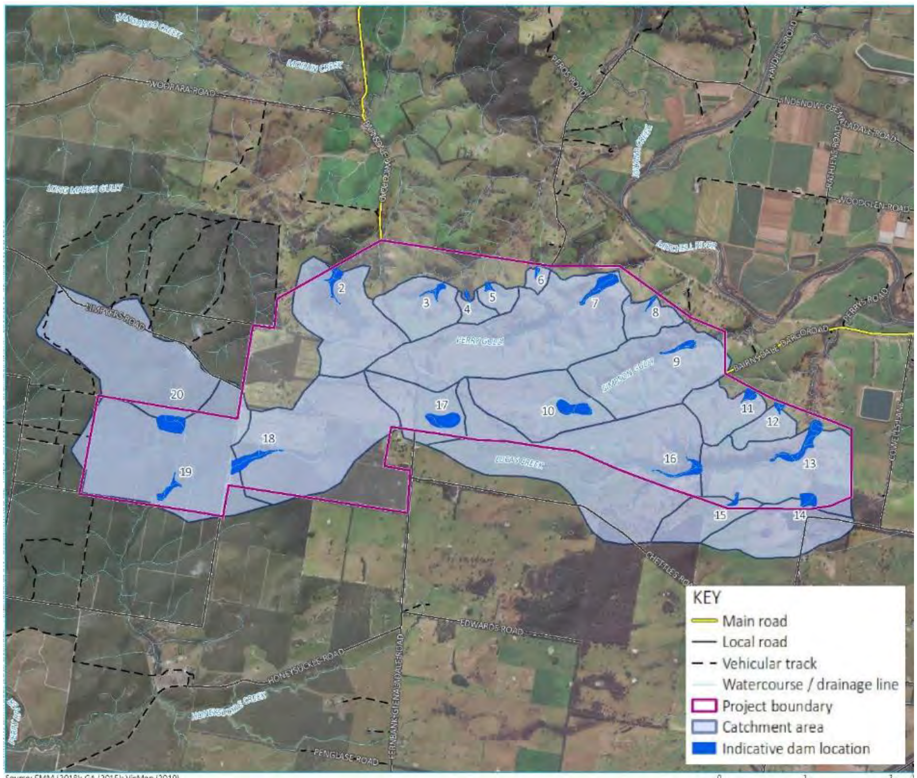
The Perry River and its catchment have been assessed as more sensitive to mine contact water overflows than the Mitchell River, the latter having higher flows that reduce the impact of uncontrolled discharges. For this reason, a system of priority for pumping from mine contact dams will be established:

- Dams in Perry River catchment (once mine contact water dams are required) - priority rating 1; and
- For all other dams:
  - Dams with volume >90% of capacity - priority rating 1
  - Dams with volume 70% to 90% of capacity - priority rating 2
  - Dams with volume 40% to 70% of capacity - priority rating 3
  - Dams with volume below 40% - priority rating 4

Mine contact water would be taken firstly from all priority 1 dams, split equally if there is more than one priority 1 dam. If there are no priority 1 dams, then water would be taken from priority 2 dams, split equally if there are more than one priority 2 dams, and so on.

Management of surface water will also include:

- The treatment of up to 24 ML per day of mine contact water through a dissolved air flotation unit (DAF), to achieve water quality meeting the required water quality objectives (WQO) in the proposed receiving environment.
- Controlled discharge of up to 630 ML per year of treated process water to the Mitchell River. Treated water would initially be stored in the freshwater storage dam then released to the Mitchell River via the same pipeline used for winterfill extraction.



Source: EMM (2018); GA (2015); VicMap (2010)

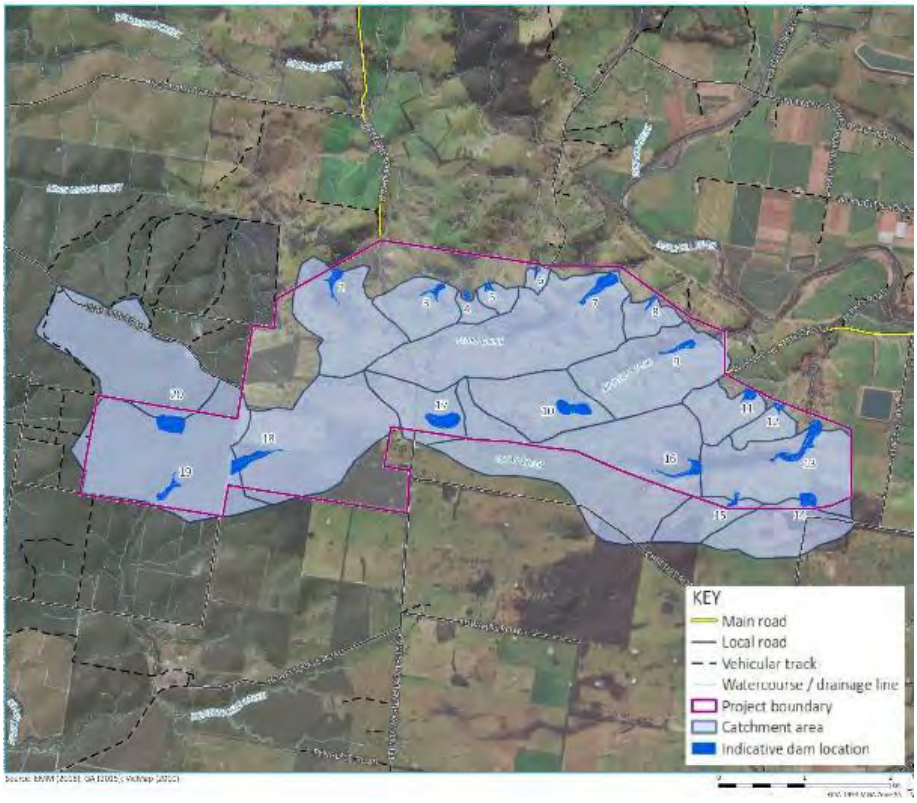


Figure 8-~~1~~12: Water management dams – indicative locations (EMM, ~~2019a~~2020a)

Runoff from the processing plant, contractor facilities, and other mining infrastructure will also be directed to mine contact water dams. Water held in the dams will be recycled to the process water system.

Water falling directly ~~onto fines tailings cells and coarse sand tailings~~into the mine void will be recovered and report to the process water circuit. The process water dam has been designed with sufficient freeboard to accommodate rainfall from a 1% annual exceedance probability (AEP), 72-hour event.

Runoff from topsoil stockpiles will be detained in sedimentation dams. The sedimentation dams will have sufficient capacity to store runoff from a 90th percentile, 5-day rainfall event, in accordance with the International Erosion Control Association guidelines. Water stored in the sedimentation dams will report to the processing water circuit to provide maximum freeboard for later storm events. In the unlikely event that runoff from topsoil stockpiles exceeds the capacity of the sediment detention structures, spillway discharge from sedimentation dams will report to downstream gullies and receiving waters.

8.5 Tailings management

The tailings arising from ore processing will be managed as two separate waste streams. ~~It is estimated that during operations approximately 110 ha would be required for storage of both fine and coarse tailings at any given time.~~ Coarse sand tailings will be dewatered to approximately 65%-73% solids by means of dewatering cyclones and then will be pumped back to the tailings disposal areas in the mine void (and adjacent areas until there is sufficient space within the mine void). An underdrainage system will be provided beneath the in-pit coarse tailings storage~~.~~ to improve water recovery. Water collected in the underdrainage system will be returned to the process water circuit.

Fine tailings will be partially dewatered in a thickener by dosing with flocculant (~100 g/t). The thickened fine tailings will be removed from the thickener as underflow. ~~Fines tailings will initially be managed in an on mine path TSF, consisting of four cells, which will be located close to the WCP. 'Mud Farming' or accelerated mechanical consolidation (AMC) will be used to assist with the management of the tailings, maximizing water return to the WCP and to ensure adequate consolidation of the fine tailings to allow future mining through this area, i.e. mechanical relocation of the fine tailings material.~~

~~Following establishment of sufficient mined-out areas, fines tailings will be deposited within engineered cells within the mine void. While staged capacity of the initial TSF is set conservatively to have adequate capacity for up to five years, it is intended to commence in-pit fine tailing cells before that time. In-pit placement of fines will result in lower environmental impact and is also commercially attractive because it avoids rehandling costs of lifting and hauling compacted fine tailings back in the mine void.~~

~~The ground underlying the original TSF location will be eventually mined for the underlying ore. Thus there is no long term environmental legacy associated with the initial TSF.~~

~~8.5.1 TSF Location~~

~~An off-path TSF will be constructed 500 m north of the WCP and will consist of four compartments covering a tailings area of about 69 ha. The embankment heights will range between 3 m and about 15 m. The off-path TSF will provide storage capacity for approximately 60 months (five years) of tailings production. The TSF will be raised in two stages to provide a total storage volume of 9.17 Mm³. The TSF will therefore meet national and international definitions of a 'large dam'. The dam will be designed, constructed and operated in accordance with relevant requirements of the ANCOLD guidelines (July 2019) will comply with ERR's *Technical Guideline Design and Management of Tailings Storage Facilities* (DEDJTR, April 2017).~~

~~The location of the TSF has been selected to avoid existing drainage lines and to minimise up-stream catchment areas. The TSF is positioned on relatively flat terrain near the catchment divide between the Perry River drainage system and the subcatchments that flow to the Mitchell River system. The general fall of the TSF is towards the south. The ground water table lies well below the level of the TSF floor and, in any event, the materials encountered on site are not expected to be "sensitive" (lose significant strength and release water when disturbed).~~

~~The TSF will be founded on the upper clay unit of the Haunted Hill Formation. The material upon which the TSF will be founded is free of gravels and varies in thickness from between 11 to 16 metres in the area of the TSF. Geotechnical testing of this material showed that it is stiff to hard, with moderate plasticity. More recent dune deposits are present over part of the TSF footprint but loose silty sand / alluvium will be stripped off along with topsoil as part of foundation preparation. A complete geotechnical assessment of the TSF incorporating physical properties of the foundation~~

material, the construction material and the contained fine tailings will be conducted following project approval.

8.5.2 TSF Design

ANCOLD (2019) requires a risk assessment be undertaken on all TSFs and a consequence category then assigned for the following categories:

- dam failure consequence; and
- environmental spill consequence.

An assessment of TSF hazard rating was undertaken based on ANCOLD Guidelines on Tailings Dam Design, Construction and Operation considering embankment failure and uncontrolled release or seepage. Based on severity of potential damage and loss, in conjunction with the population at risk (PAR), further assessment of hazard rating was conducted based on ANCOLD Guidelines on Assessment of the Consequences of Dam Failure. Based on population at risk (PAR) 1 to 10 and highest damage and loss severity level 'Medium', a hazard rating of 'Significant' was adopted for the TSF designs as per the ANCOLD guidelines. This is a conservative assessment as the population in the immediate vicinity of the TSF at risk is minimal.

The TSF design and operations strategy have taken into account the ANCOLD risk assessment and consequence classification.

The Temporary TSF is divided into four cells (Figure 8-2). This will provide two active tailings deposition cells (maximum depth of 1.0 m per cycle) and two cells that can be treated mechanically with amphirol equipment (MudMasters®).

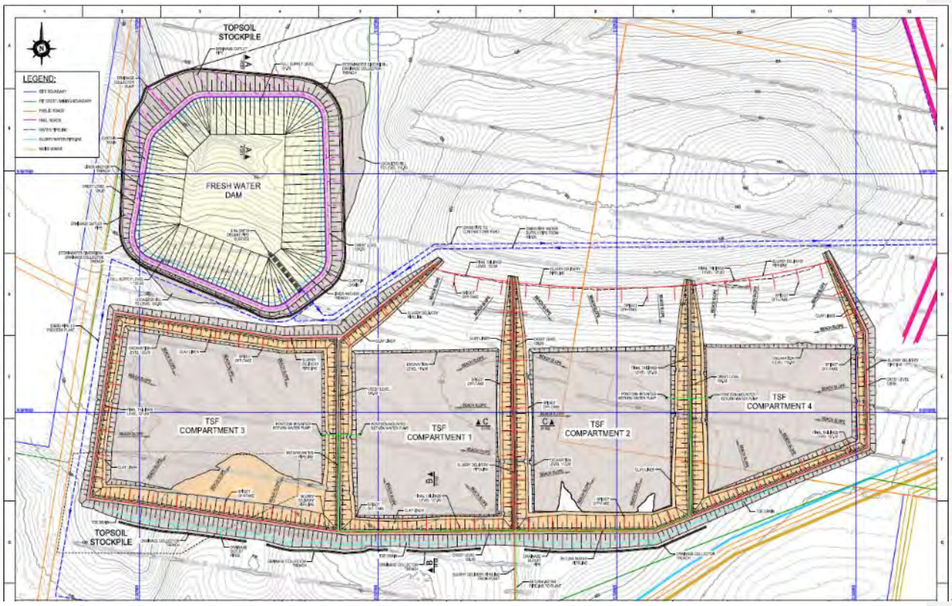


Figure 8-2: TSF configuration (plan view)

The external walls of the tailings storage cells will comprise homogeneous earth embankments with 1:2.5 (v:h) slopes both upstream and downstream, as dictated by stability analyses and design economics . The embankments will be constructed using low permeability material sourced from local borrow pits and HHF overburden. Due to the potentially dispersive nature of the on-site soils, the upstream slopes of the perimeter embankments will be stabilised with 3% lime, a technique that has been successively used in water storage structures in the project locality. However, further testing is required during the detailed design stage to confirm this. Unsuitable material including alluvium and topsoil will be removed from the embankment footprint areas prior to construction. A general crest width of 10 m has been designed to accommodate pipework and other TSF operational infrastructure. A typical TSF embankment cross section is shown in Figure 8-3.

Testing of any material to be used in TSF or water storage dam construction will be required to demonstrate that the material meets design specifications. Investigations and testing will be done in accordance applicable Australian Standards (AS 1289 series; AS 1726:2017; ISO 18674; ISO 22477) and with ANCOLD guidelines.

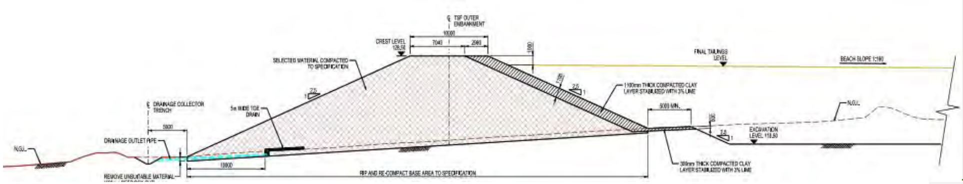


Figure 8-3: Typical TSF embankment cross section

The design philosophy is to operate the TSF so that tailings beaching will create a depression around the decant water collection points from where water will be returned (pump back) to the WCP for re-use. The location of decant ponds will ensure water is kept away from the perimeter embankments.

The cells in which fine tailings will be stored do not have an external catchment and the 1:100 ARI flood-related overtopping analyses was used in freeboard analyses. The tailings beach angle of 0.63% will result in a centrally located depression against the division embankments that will provide additional volume for containment of storm events. The critical design case during the operation phase will occur when the maximum volume of tailings occupies the TSFs. The design storm storage allowance is based on the 1:100 year ARI, 72-hour storm event, which could generate 243 mm of direct rainfall (corresponding to approximately 167,670 m^3 inflow to the TSF). The off-path TSF is located above the natural ground and will have no external catchment. Small perimeter drainage ditches are likely to be required around the facility to manage local runoff.

8.5.3 Staged construction

The TSF will be raised to provide a total storage volume of 6.8 Mm^3 (Table 8-1). The Stage 1 embankments will be constructed to RL 128.5. A construction report and independent review of QA/QC test results will be prepared and submitted to ERR prior to TSF commissioning (and to Southern Rural Water in the case of water storage dams).

Tailings consolidation occurs continuously during deposition and will continue after completion of operations until all excess pore pressures have dissipated. AMC will be used at the site on 1.0 m thick layers of tailings to accelerate the consolidation process and allow excess pore pressures to dissipate.

Table 8-1: Tailing embankment raises

Stage	RL	Capacity (Mm³)
Stage 1	128.5	4.2
Stage 2	133.0	2.6
Total		6.8

8.5.4 Tailings deposition

The tailings are delivered to the off-path TSF from the WCP through HDPE pipes. Tailings deposition takes place in the facility via multiple spigots located on the perimeter embankments of the facility, with spigots located at up to 50 m centres. Spigot points are to be rotated in such a way to maintain a supernatant pool around the decant water collection pumps to facilitate water return to the WCP. The decant pools for the cells are to be located away from the outer embankments. Tailings deposition will be sub aerial.

It is estimated that the fine tailings beach slope will vary along the beach towards the decant pool. The flow rate per discharge point can be manipulated by operating 3 to 5 discharge points simultaneously to create a flatter or steeper beach slope.

Tailings will be deposited in 1.0 m thick layer and then mechanically consolidated with amphirol equipment. This will release water from the deposited tailings slurry and will further reduce the permeability with the accelerated consolidation. It is expected that the TSF will not generate a significant phreatic surface during its operating life. Seepage losses are estimated to be low and between 60 to 360 m3/day from the TSF footprint. The seepage losses during commissioning and the initial few months may be at the upper limit and it is expected that it will then reduce to about 80 m3/day. Seepage from the embankment underdrainage will be collected in a surface drain along the toe of the embankment and will report to a seepage collection pond/sump located at the toe of the southern embankment.

8.5.5 TSF water management

Tailings deposition will be managed to allow tailings beaching towards the dividing embankments and the supernatant pool. Decant barges will be located against the central division embankments. Water will be recovered via a floating pontoon mounted pump and returned to the process water dam via a HDPE return water pipeline. Water recovery will be an important part of tailings management. The sub aerial deposition will not only facilitate evaporation from the beached tailings surface, but also allow control of discharge points to force the decanted water (liquor) to the required pond area for immediate pump back.

Assuming that rain water has to be returned to the WCP during the wet season, approximately 80°m3/h to 145 m3/h (per Cell) of water will have to be pumped to the WCP (based on 21 hours/day). The 1:100 72-hour storm volume will not be stored on the TSF cells and will have to be removed within a reasonable time (approximately 7 to 10 days). The return water pumping system for each of the cells will be designed to return approximately 145 m3/h of processing water and 200 m3/h of stormwater, i.e. pump capacity of 350 m3/h.

In addition to the above controls, a spillway system will be implemented in forthcoming designs to control water in the case of power outage during a large rainfall event or during storm events significantly more intense than a 1 % AEP event. Spillways will release to the northern walls of the cells and the overflow water will be directed by flumes to the north east corner of the TSF. From that location, the water may be directed into the Perry Gully for capture within the mining void or north to Long Marsh gully.

Spillways will be located towards the end of the northern wall closest to the decant location. That is, the east end of the westernmost cell, the west end of the next cell, the east end of the next and the west end of the easternmost cell.

The water balance analysis completed for the Fingerboards TSF estimates an annual average water return of 76% of the tailings slurry water deposited into the facility under average climatic conditions. Return water from the TSF will be pumped back to the process water dam or MUPs for re-use. The calculation of the volume of water available for return to the WCP is based on the following data and assumptions:

- Water return will be maximised by 'mud farming' (AMC) and water retained in void of the tailings material (entrained water) are based on tailings consolidated to 70% solids (w/w).
- Low seepage losses were assumed based on the estimated low permeability of the fine tailings material.
- The decant pond is kept to minimum to reduce evaporation losses.

All significant water flows on the site are considered as well as rainfall, evaporation, and seepage.

Although continuous decanting of water from the tailings beach is planned, an allowance of 1.0 m height between the end of deposition tailings surface and the TSF embankment was allowed for in the feasibility design. The TSF wil be operated in accordance with the ANCOLD (2019) minimum freeboard requirements.

The fines tailings underflow from the thickener will be pumped to one of two centrifuge buildings, each located near an active mining area within which a MUP is operating. A dewatering centrifuge works by increasing the G-forces that act on the slurry, increasing the separation of the heavier solids from the lighter water in fine tailings. A flocculant is added to the slurry in the centrifuge to increase coagulation of the clay particles. Typical operating bowl speeds are in the 1,000 to 1,800 rpm range, where the developed G-force range is from 600 to more than 1800 G. Two products are produced by the centrifuges. Firstly, a clear overflow water (called the centrate) containing very little suspended solids and secondly, a readily transportable solid cake of fine tailings.

Filter cake will be trucked to a stockpile near the mine void. The stockpiles are designed to store up to a maximum volume of up to 24 hours fines production. This will result in a total stockpile volume of approximately 3,600 m^3 (6,000 tonnes) at each of the two centrifuge plants. A front-end loader (FEL) will reclaim material from the cake stockpile and load it into dump trucks.

In the mining void, the centrifuge cake will be placed as backfill, along with overburden. In total, the fines cake will represent only 7% - 8% of the total overburden backfill volume and stability of the backfill will not be compromised. Filter cake will be "paddock dumped" with the overburden to ensure that the fines cake and overburden is evenly distributed to avoid localised areas of high fines content,which could cause perching of groundwater after closure.

The centrifuge fine material will be co deposited into the mining void according to the strategic backfill management plan. The backfill management process will be designed to maximise mining void space within environmental standards. An overburden and fine cake dumping procedure will be developed to ensure that the fines are managed accordance with the backfill management plan to ensure even distribution of the fines during dumping. Daily dumping destination will be provided to truck operators hauling the cake fines. On-site supervision will visually monitor and audit the backfill process.

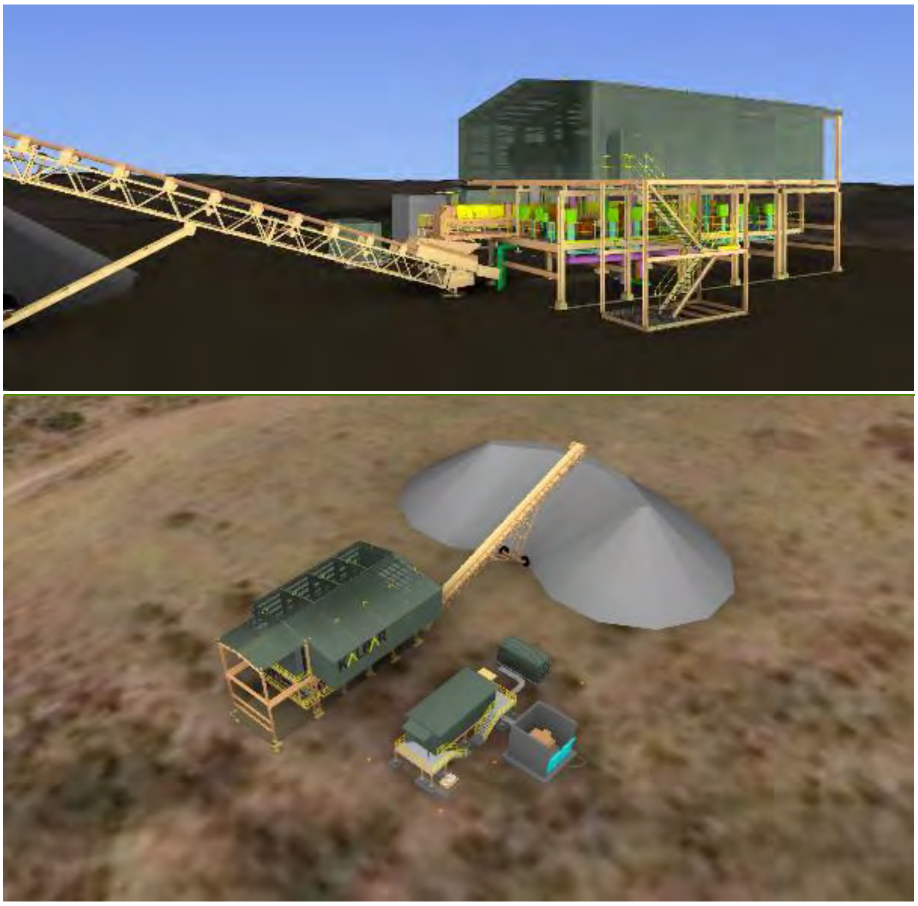


Figure 8-2~~3~~: Typical layout of the centrifuge building

The centrifuge plants (Figure 8-2~~Figure 8-3~~) will be located in close proximity to the mining area in order to reduce the overland haul distance of the centrifuge cake back the mining void, and thereby minimise noise and dust generation. Based on the preliminary mine planning, it is anticipated that each centrifuge plant will be relocated to a new position every four to five years. The plant has been designed to be modular and will dismantled and trucked to the new location, when required. The plant positions have been selected such that the average one-way haul distance from the plant to the mine void is an average of 750m for all locations.

8.5.1 Fine tailings water management

The centrifuge plant generates a clear water centrate that is pumped directly from the centrifuge plant to the process water pond at the process plant for re-use in the process water circuits. The cake that is transported to the mining void has been dewatered to the maximum extent possible and no further seepage could be created from the fines cake going into the void as backfill.

A bypass sump is located at the centrifuge building area to allow for the containment of fines tailings slurry in the event that power supply to the buildings is interrupted and the slurry pipeline must be emptied.

8.5.68.5.2Sand tailings water management

Sand tailings are pumped in a slurry, with water being recovered from three areas:

- released from dewatering cyclones above the sand stack
- immediate drainage into drains at the perimeter of the stacking area
- seepage to subfloor drainage systems.

Recovered water is re-introduced to the process water circuit as slurrifying water in the MUP or through capture in water management dams. A further source of water recovery may become available through dewatering bores located in the mining area if monitoring and surveillance identifies mounding of seepage water (Section 8.5.7)..

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Figure 8-3 shows a series of conceptual models illustrating three cross sections of how tailings are deposited within the mine voids, the development of potential mounding and the implementation of typical tailings water and groundwater control strategies as follows:

- the first cross section shows typical conditions immediately after reinstatement of sand tailings, followed by slime tailings, overburden and sub-soil/topsoil within the mine void. Water is captured in an underdrainage system and re-used for mineral processing;

•the second cross section, continual. Continual sand tailings seepage has the potential to induce groundwater mounding. Mounding will vary depending on a number of factors including water content of the deposited sand tailings, the effectiveness of the subfloor drainageunderdrainage system and the infiltration capacity of the sediments below the pit floor. If mounding occurs sufficiently, the phreatic surface has the potential to increase and rise to elevations within the backfill area, potentially interacting with the subfloor drains. If this occurs, return water from the drainage system may increase; and.

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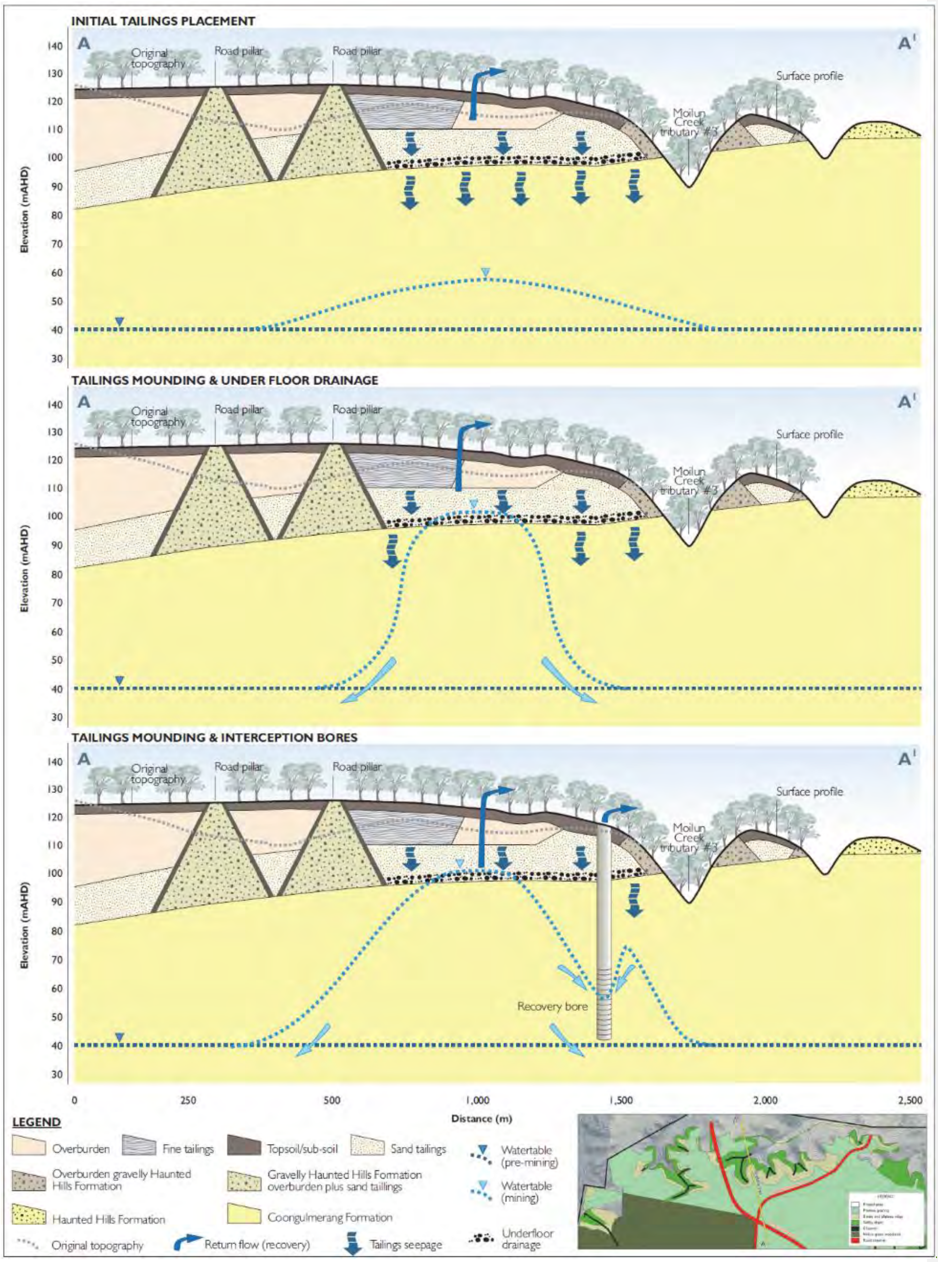
•the final cross section shows conceptually whatWhat can occur over a period of extended sand tailings seepage and subsequent mound development. Typically, a comprehensive monitoring network will be installed around the mine site to continually monitor groundwater levels , to assist the mine with its environmental obligations. If extensive mounds develop and start to move towards sensitive areas such as gullies and deep-rooted vegetation, recovery bores are typically installed to intercept this water, which is then pumped back to the plant for recycling.

In addition to the above strategies, the mine will also dewater the fine tailings deposited above the sand tailings using the MudMasters as previously discussed. Kalbar will implement the above control measures as part of the Fingerboards project to maximise water return and minimise tailings seepage to the environment.



~~Figure 8-3: Sand~~ Kalbar are committed to more detailed modelling once appropriate samples are collected and laboratory based soil data has been received. The model can be further validated based on the data collected during the planned test pit program, should this go ahead.

8.5.3 Tailings Seepage Monitoring and Management (After EMM, 2020b)Surveillance

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8.5.7 TSF Monitoring and surveillance

A Tailings Management Plan (TMP) will be developed for the project. The TMP will address the design, construction, operation and closure of the TSFs. The plan will including a monitoring and maintenance schedule and emergency planning and response procedures.

8.6 Radiation management

The most significant worker exposure to radiation is likely to occur from the handling of HMC product during processing or transport, or from being near bulk HMC. Modelling conducted as part of baseline impact assessments concluded that the highest estimate of annual exposure for workers was less than 1.5 mSv per year. The maximum permissible dose rate for workers is 20 mSv per year.

Under its operating licence Kalbar will be expected to comply with the *Code of Practice on Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing* (RPS 9, 2005). The Code requires the development and implementation of a Radiation Management Plan (RMP) by the operator for any stage of operations. The Plan must be developed in accordance with the specific requirements of the relevant regulatory authority, in this case the Victorian Department of Health and Human Services, and, also take into account any special conditions or, exemptions from specific provisions of the Victorian radiation regulations that might apply to the Project. Exposures of workers and members of the public will be controlled through the Fingerboards Radiation Management Plan. Main elements of the RMP include:

- identification of all significant exposure sources and pathways, including plans of the mine and primary processing plant, descriptions of the equipment to be used in mining and processing, the processes involved and estimates of the radionuclide content of various process streams
- identification of those groups of workers or members of the public most at risk
- measures to control radiation exposures for workers.

The control measures likely to be included in the Radiation Management Plan are

- engineering controls, such as ventilation, dust control, and machinery shielding, where applicable
- use of standard operating procedures for handling and transport of materials
- operational practices to limit occupancy within certain areas or to restrict of time for certain activities, to minimise exposure times for workers
- use of warning signs and labels within certain areas
- provision of adequate facilities for personal hygiene
- provision and use of personal protective equipment for specified operational procedures

A radiation monitoring programme to demonstrate compliance with regulatory standards, dose estimation, and effectiveness of engineering controls will be implemented. The scale of the monitoring programme will depend on the level of potential exposure. Employees likely to receive significant doses (e.g. > 5 mSv per year) are commonly classified as “designated employees” and subject to more comprehensive monitoring.

Targeted training on radiological aspects of the Fingerboards operations will be provided to employees and contractors. Training will be delivered through:

- induction programs;
- training in measures adopted to reduce or minimise radiation exposures;
- job specific training and additional training for supervisors; and
- on-going training and professional development of radiation safety personnel.

Routine performance and compliance reporting on radiation management will be required. The company will be require to report results of personal dosimetry,area and dust monitoring and worker dose records to the Victorian Department of Health and Human Services. Any incident reports and other operational issues relevant to radiation management will also be reported to relevant regulatory bodies.

8.7 Non-process waste management

A proprietary in-ground system will treat sewage from the WCP, administration area and workshop. Sewage and wastewater from the contractor yard will be removed periodically by a ~~licenced~~licensed waste removalist operator.. The sewage treatment system uses aerobic treatment to treat up to 4,000 L/day. The treated effluent is clear and odourless and will be used in a dripper irrigation system. The treated effluent disposal fields will be sited close to the WCP facilities. The treated effluent will meet EPA requirements for the treated effluent including:

- 5-day biochemical oxygen demand (BOD5) < 20 mg/L.
- Suspended solids (SS) < 30 mg/L.
- Faecal coliform organisms: < 10 per 100 mL.

All non-process waste (including putrescible and inert) will be securely stored in appropriate receptacles. All waste will be removed from site and disposed of by licensed contractors. Construction waste will be avoided, minimised, reused and recycled where possible.

Waste hydrocarbons will be stored in suitable containers for removal from the mine site for disposal at either an EPA-approved hydrocarbon waste site or a recycling depot.

Runoff water from mobile equipment service areas and the mining contractors’ workshop will be directed to an interceptor trap to extract hydrocarbons, prior to it being discharged to the drain and sump network which will report to the process water circuit. The trap will be emptied of hydrocarbons routinely by a licensed contractor for disposal at a licensed facility. All non-toxic waste (including perishable and inert) will be securely stored in appropriate receptacles.

8.8 Traffic management

This section addresses management controls for on-site vehicle movements. Management of traffic and the design, construction and use of road infrastructure off the proposed mining licence area is not discussed in the work plan. Those aspects of the Fingerboards project are covered in documentation prepared as part of proposed planning scheme amendments.

Existing roads within the proposed mining licence area will be used as a priority. Wherever possible, access ways that will experience heavy traffic will not be constructed next to areas of high ecological sensitivity. Access tracks and roads will be clearly marked to prevent the establishment of secondary tracks that could cause disturbance to adjacent vegetation. Construction machinery, vehicles and pedestrians will be confined to formed tracks and designated construction areas and roads.

Speed limits will be established and enforced. Speed limits on unsealed project roads will be set to minimise dust generation. Rumble or shaker strips will be installed on project roads to prevent mud tracking onto the public road network.

Traffic will be minimised as far as practicable during night, dusk and dawn in areas containing remnant native vegetation to reduce the risk of fauna collision.

9 REHABILITATION AND CLOSURE

Mined cells will be progressively backfilled with coarse sand tailings and overburden and fines tailings, which will then be covered with formulated suboil mixes, and topsoil. It is expected that the time from overburden stripping to completion of rehabilitation and re-establish of agriculture is between 3 to 5 years. The plan for progressive rehabilitation plan includes:

- Allowing the disposed tailings and overburden material to settle and dry sufficiently to support earthmoving machinery.
- Profiling to landforms designed for productivity, and long term stability
- Placement and preparation of formulated subsoil mixes.
- Applying and replacing topsoil stripped from the area.
- Applying gypsum and other required soil conditioners.
- Applying cover crop/pasture or native vegetation, where required.

With the exception of re-located roads, Kalbar does not plan to retain mine infrastructure (dams, pipelines, telecommunications or electricity infrastructure) at project completion. Plant and infrastructure will be decommissioned and removed as part of mine closure activities.

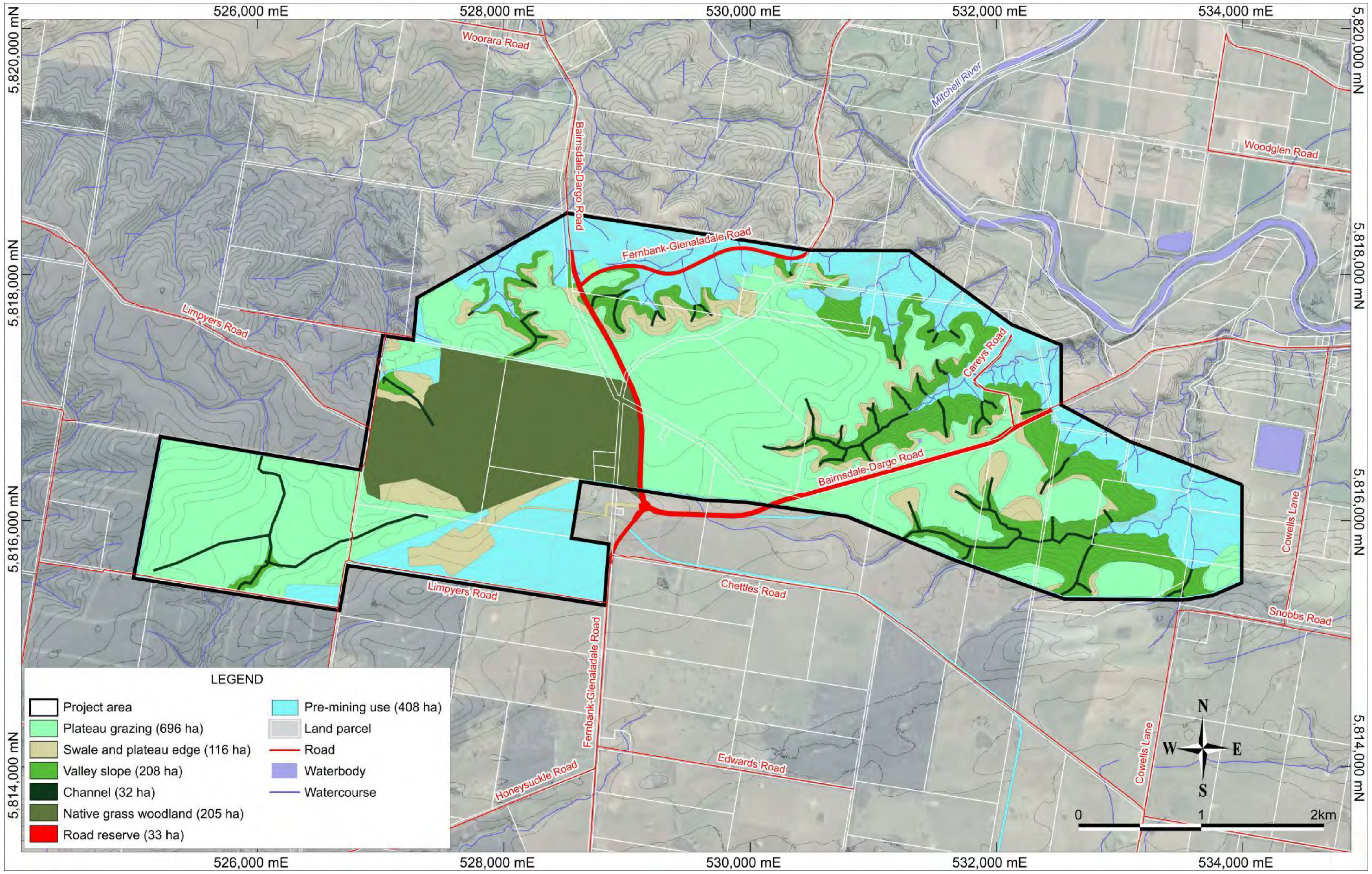
A draft Rehabilitation and Closure Plan has been prepared and is appended to this work plan (Appendix C). The current draft Rehabilitation and Closure Plan is conceptual. It is intended to signal Kalbar's commitment to closure and rehabilitation and to provide a basis for focused consultation with stakeholders to inform the development of a more detailed Mine Rehabilitation and Closure Plan within 2 years project commencement.

The post-closure land uses within the proposed mining licence area include a combination of agricultural and ecosystem support uses. Most of the land will be returned to pasture, but selected areas – especially along drainage lines and the adjoining valley slopes – will be targeted for establishment of native vegetation communities closely resembling the naturally occurring ecosystems in the locality. Areas along public roads will be revegetated with suitable native vegetation to provide aesthetic benefits, as well as to serve a habitat connectivity function for native fauna. A significant, contiguous block of land has been identified for the establishment of a native ecosystem similar to the endangered 'Plains Grassy Woodland' vegetation unit (EVC55). When fully implemented, the amount of land in the proposed mining licence area occupied by native vegetation communities will be approximately 319 ha greater than in the pre-mining setting. A summary of post-mining rehabilitation treatments is presented in Table 9-1..

Additional information about proposed mine rehabilitation and closure approaches is presented in Appendix C.

Table 9-1: Post-mining land uses and vegetation types

Zone code	Zone name	Zone area (ha) (%)	Final land use	Description/example
A	Plateau grazing	679 (55.7%)	Grazing	Large area of open woodland, native and improved pasture on broad undulating plateau top.
B	Swales and plateau edges	94.7 (7.8%)	Grazing/native vegetation	Relatively small area bordering plateau slopes where gradients begin to increase and runoff flows concentrate prior to discharge onto plateau slopes, supporting native trees and shrubs and native and exotic grasses.
C	Valley slopes	202.7 (16.6%)	Native vegetation	Native vegetation (trees, shrubs, groundcover species and exotic and native grasses) on more steeply sloping plateau edges.
D	Channels	30.8 (2.5%)	Riparian areas and drainage lines	Existing and re-established drainage lines and associated riparian zones: vegetated with native riparian tree, shrub and ground cover species and/or aquatic and emergent plant communities, as appropriate.
E	Native grass woodland	191.4 (15.7%)	Native vegetation	Native grass woodland in western part of project area broadly consistent with EVC 55 (Plains Grassy Woodland), EVC 47 (Valley Grassy Forest), and EVC 877 (Lowland Herb-rich Forest). Located on plateau landform.
F	Road Verge	21 (1.7%)	Road verge. Predominantly native vegetation	Verges of realigned public roads vegetated with predominantly native grass with low-density trees and shrubs.


526,000 mE
528,000 mE
530,000 mE
532,000 mE
534,000 mE
5,820,000 mN
5,818,000 mN
5,816,000 mN
5,814,000 mN
Woorara Road
Bairnsdale-Dargo Road
Fernbank-Glenaladale Road
Mitchell River
Woodglen Road
Limpyers Road
Careys Road
Chettles Road
Snobbs Road
Cowells Lane
Fernbank-Glenaladale Road
Honeysuckle Road
Edwards Road
LEGEND
Project area
Plateau grazing (696 ha)
Swale and plateau edge (116 ha)
Valley slope (208 ha)
Channel (32 ha)
Native grass woodland (205 ha)
Road reserve (33 ha)
Pre-mining use (408 ha)
Land parcel
Road
Waterbody
Watercourse
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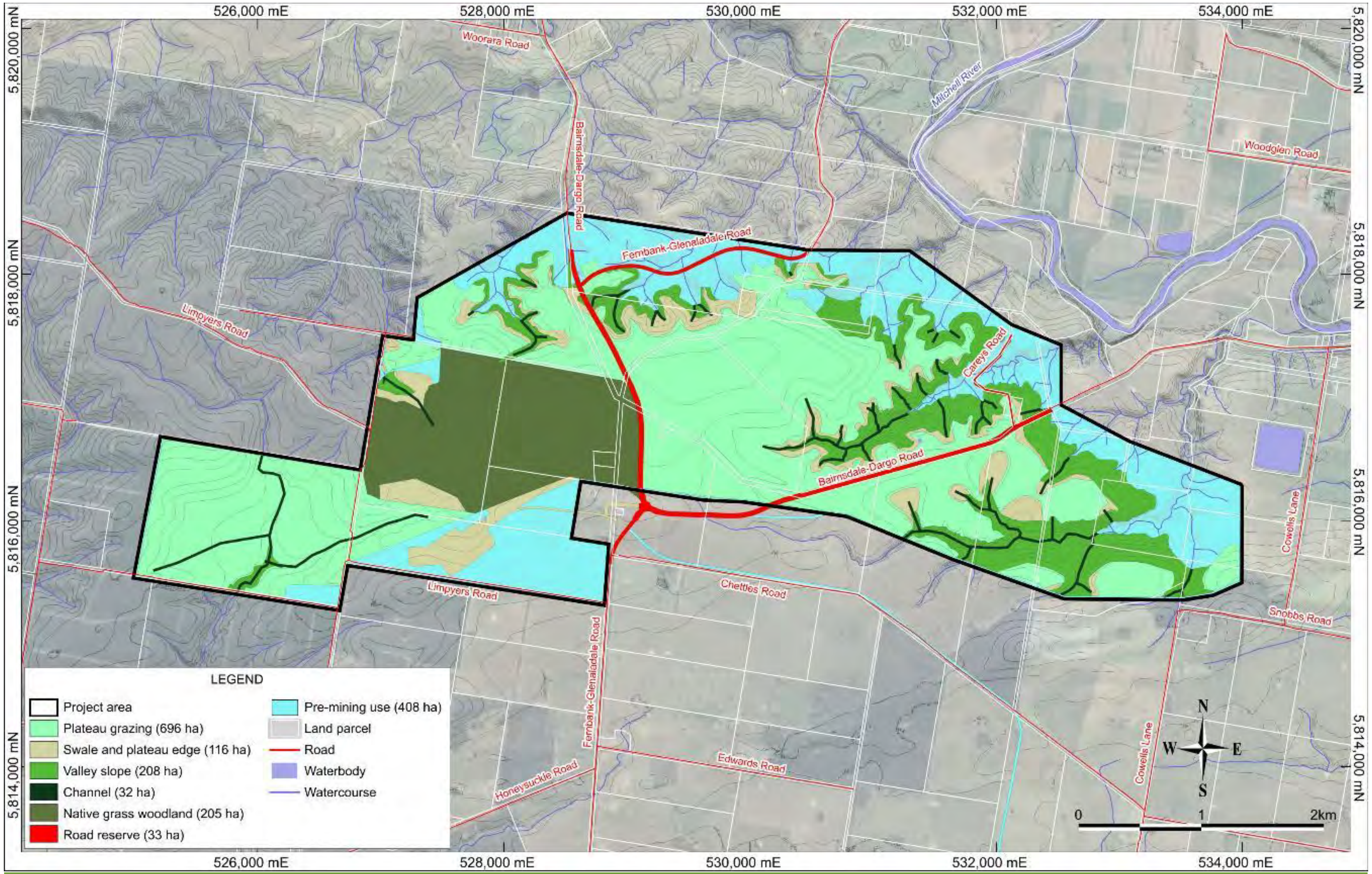


Figure 9-1: Post-closure land uses - Fingerboards mineral sands project

10 COMMUNITY IMPACTS AND ENGAGEMENT

Interactions with the community during the construction and operation of the Fingerboards project will be guided by Fingerboards Community Engagement Plan. A copy of the current Community Engagement Plan is provided in Appendix D.

The current version of the Community Engagement Plan has been developed in accordance with the *Community Engagement Guidelines for Mining and Mineral Exploration in Victoria* (DEDJTR, 2018) and with the *EES Consultation Plan Advisory Note: Preparing an EES consultation Plan, November 2018* (DELWP, 2018). It incorporates public participation concepts developed by the International Association for Public Participation (IAP2). The plan will be updated at the completion of the EES process, before Kalbar progresses to commencement of construction activities.

The following principles, which are included in the Community Engagement Plan developed for the assessment phase of the Fingerboards project, are also relevant to the construction and operations phases of the project. Kalbar will:

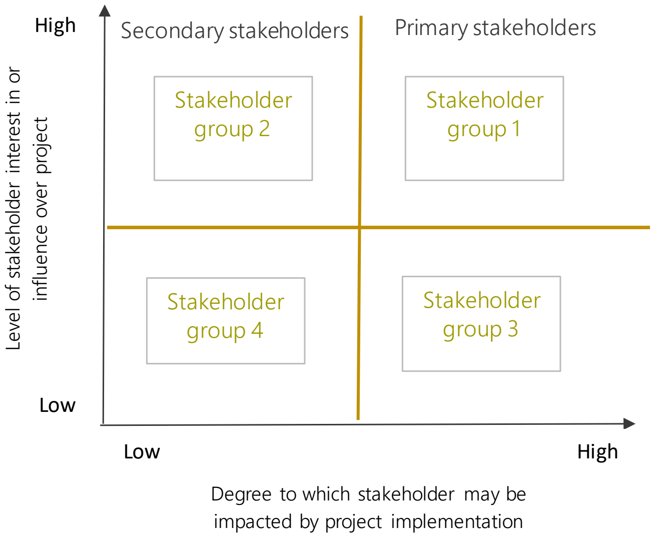
- demonstrate a commitment to engaging with all community and stakeholder interests
- promote inclusiveness by encouraging and supporting a diverse representation of community participation in consultation
- clearly communicate the purpose of consultation activities
- foster mutual respect by recognising and responding to the rights, values and interests of all stakeholders
- show transparency by documenting community issues and input in a timely, open and effective manner
- clearly document and share information on how stakeholder feedback contributes to the assessment process.

10.1 Identification of affected communities

Community stakeholders encompass the following categories:

- Communities in and surrounding the proposed mining licence area, such as neighbouring properties (Communities of place)
- Communities of similar practice, such as local community groups, sports groups, residents' associations, service clubs, farmers' groups, rate payers' associations, local businesses, sports clubs, tourist or seasonal groups and other groups (Communities of interest).
- Communities that have a special or legal interest in the land, such as Indigenous communities or some environmental groups (Communities of standing).

Kalbar has defined primary stakeholders as those who have the potential to be impacted by the project (irrespective of their level of interest or involvement in – or influence over – the project). These are represented by Groups 1 and 3 in Figure 10-1. Secondary stakeholders are defined as those who are unlikely to be impacted by project implementation, but who nonetheless have an interest in – or influence over - the project. These are represented by Groups 2 and 4 in Figure 10-1.



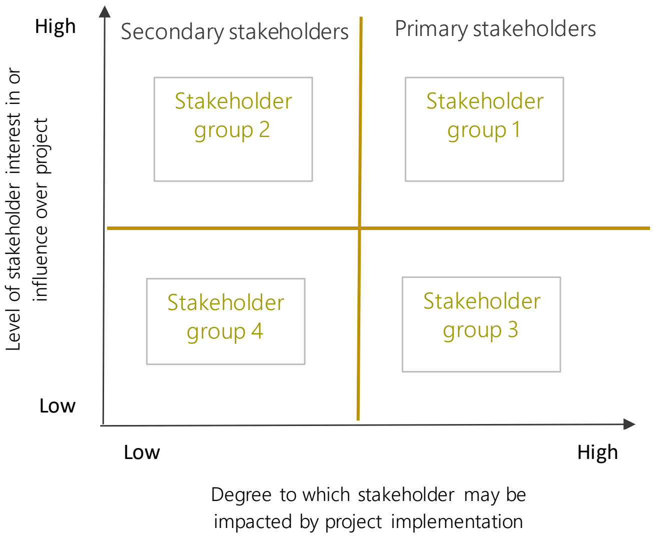


Figure 10-1: Stakeholder groupings

Primary stakeholders identified in the Community Engagement Plan include:

- Traditional owners and their representative bodies: Gunaikurnai Land and Waters Aboriginal Corporation; Gunaikurnai Traditional Owners Land Management Board
- landholders and residents within the proposed mining licence area

- landholders and residents adjacent to and near the proposed mining licence area
- community members within the local communities of Glenaladale, Lindenow, Fernbank, Lindenow South, Walpa and Flaggy Creek
- East Gippsland, Wellington and South Gippsland Shire Councils
- relevant State government agencies
- Kalbar investors, staff and contractors.

10.2 Information contained in the Community Engagement Plan

The Fingerboards Community Engagement Plan includes detailed information on the engagement process for primary and other stakeholders, including methods of consultation and records of consultation undertaken. As recommended in ERR guidelines, the Community Engagement Plan includes:

- a description of how community attitudes and expectations have been identified and documented
- a description of likely community and stakeholder attitudes and expectations related to the mining operations
- the potential impacts of project implementation on each of the identified community members/stakeholders

The Community Engagement Plan also provides information on:

- how each of the identified community members/stakeholders have been engaged to date (and at what level)
- information channels/types used for communication with the community
- how Kalbar receives / collects community feedback about the Fingerboards operations.

Kalbar maintains a detailed register of responses to issues raised by various stakeholders and these are available to ERR on request.

Timeframes for further consultation and engagement are provided in the Community Engagement Plan. An updated schedule for ongoing community engagement will be prepared at the completion of the EES process.

Kalbar's approach to complaints management is outlined in Section 9.4 of the Community Engagement Plan.

10.3 Community engagement during operational phase of project

If the project proceeds, Kalbar is committed to undertaking the following on-going stakeholder engagement during project construction and operation:

- Establish a community forum group to provide a point of liaison and communication with the local community. Prior to establishing the group, Kalbar would engage stakeholders and community members to discuss the preferred scope, membership and activities of the group. Meeting minutes would be made available through the project website.
- Maintain avenues for community members to submit any complaints, issues or questions directly to Kalbar. The existing free-call number and feedback form on the project website would continue, with a response time of 14 days for all enquiries and complaints.

- Establish an environment review committee to review the environmental performance of the project during construction and operation. Members of the committee would include a range of stakeholders including representatives from the local community, community groups, local and state government, Indigenous groups and small businesses. The committee would be chaired by an independent stakeholder to promote openness and transparency.
- Continue to hold community information sessions quarterly
- Participating in, and providing support for, community events such as East Gippsland Field Days.
- Provide dust, noise and water monitoring results on the project website to inform community members of environmental conditions within and adjacent to the mine site. Dust and noise data will be collected by monitoring equipment placed at selected locations throughout the project life to ensure that the project complies with relevant health and amenity guidelines. Water monitoring will be conducted in accordance with authorisations granted pursuant to the *Water Act 1989* and the *Environment Protection Act 1970*.
- Maintain regular communications with stakeholders through media releases and advertisements in local newspapers and project updates through the email database.

During decommissioning and rehabilitation of the project – or in the event of unplanned closure - Kalbar is committed to the following stakeholder engagement activities:

- Holding personal meetings with directly affected landholders and other key stakeholders prior to commencement of rehabilitation to determine the preferred final land use.
- Engaging with all relevant stakeholders (e.g., landholders and local council) prior to the removal of project infrastructure, such as water storages, fencing, groundwater bores, haul roads and powerlines, to determine whether these assets could be used in the future (subject to regulatory approval).
- Consulting with landholders, traditional owners and community groups (e.g., Wildlife Victoria) to determine preferred vegetation for rehabilitation of the site to ensure compatibility with future stocking requirements.
- Regularly communicating with stakeholders through media releases and advertisements in local newspapers and project updates through the email database.
- Providing annual environmental and rehabilitation performance reports in plain language to provide information in an accessible format to stakeholders. These reports would be made available through the project and Kalbar's website.
- Conducting post-closure monitoring for at least five years after project completion, unless otherwise agreed with Earth Resources Regulation and other stakeholders.

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