# Goschen Rare Earths and Mineral Sands Project

## Environment Effects Statement – Draft Rehabilitation Plan

Prepared for
**VHM Limited**

Client representative

Date
**27 October 2023**

Rev03

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**Revision History**

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| B | Draft for client review | Adam Bishop | Sven Rand | Adam Bishop | 28 July 2022 |
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| 02 | Final addressing second round TRG comments | Adam Bishop | Sven Rand | Adam Bishop | 19 May 2023 |
| 03 | Final | Adam Bishop | Sven Rand | Adam Bishop | 27 Oct 2023 |

# 1. Introduction

## 1.1 Requirement for an EES

The Goschen Project is a rare earth and mineral sands mine and processing facility, proposed to be operational for approximately 20 years. VHM has been developing the Goschen Project in the context of a rapidly growing global demand for rare earths. One of the world's largest, highest grade zircon, rutile and rare earth mineral deposits is in the Loddon Mallee region of Victoria in Australia. VHM intends to establish the Goschen Project to mine these deposits and process to produce and market a range of products to national and international consumers.

The Goschen Project was referred to the Minister for Planning to seek advice on the need for an EES under the Environment Effects Act 1978 (Vic) (EE Act). On 10 October 2018, the Minister for Planning decided that an EES was required on the basis that the Project has the potential for a range of significant environmental effects.

On 19 December 2018 under delegated authority from the Minister for the Environment, the Department of the Environment and Energy (now the Department of Climate Change, Energy, the Environment and Water (DCCEEW)) made a decision that the Project is a controlled action under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) and would require assessment and a decision about whether approval should be given under the EPBC Act. DCCEEW also confirmed the Victorian Government's advice that the Project will be assessed under a bilateral agreement under the EE Act.

The EES allows stakeholders to understand the likely environmental impacts of the Goschen Project and how they are proposed to be managed. The Minister's assessment of the EES will also inform statutory decisions that need to be made on the Project.

## 1.2 Purpose and structure of this Draft Rehabilitation Plan

This Draft Rehabilitation Plan has been prepared to inform preparation of the EES Closure Chapter and addresses the scoping requirements (DELWP, 2018) related to mine rehabilitation. Specifically, it has been prepared to outline the key rehabilitation objectives, methodologies and goals to be achieved by VHM in achieving the proposed final land use that is safe, stable and sustainable. It aims to be in line with the *Mineral Resources (Sustainable Development) Act 1990* and Mineral Resources (Sustainable Development) (Mineral Industries) Regulations 2019. This Draft Rehabilitation Plan is prepared with reference to the guideline *Preparation of Draft Rehabilitation Plans: Guideline for Mining & Prospecting Projects* (Earth Resources Regulation, 2020) and largely follows the structure of the guideline.

In accordance with the *Mineral Resources (Sustainable Development) Act 1990 (MRSDA)* and Mineral Resources (Sustainable Development) (Mineral Industries) Regulations 2019, this Draft Rehabilitation Plan provides the required site-specific information. An overview of these requirements and where they are addressed, is provided in Table 1.

*Table 1 Information requirements from the Mineral Resources (Sustainable Development) Act 1990*

| Information requirement | Where addressed in this report |
|---|---|
| project summary | Chapter 3 |
| checklist | This table |
| site information and setting | Section 3.6 |
| community engagement details | Chapter 4 |

| | |
|---|---|
| post-quarrying land uses and landform | Chapter 5 |
| rehabilitation domains | Chapter 6 |
| objectives | Chapter 7 |
| criteria for measuring whether objectives are met | Section 7.2 |
| schedule for rehabilitation milestones | Chapter 8 |
| post-rehabilitation risks. | Chapter 9 |

This Draft Rehabilitation Plan will be updated prior to operations commencing to include additional details such as relevant conditions of approval.

## 1.3 EES evaluation objectives and scoping requirements

The scoping requirements for the Goschen Mineral Sands and Rare Earths Project Environment Effects Statement ('scoping requirements') by the Minister for Planning, set out the specific environmental matters the project must address in order to satisfy the Victorian assessment and approval requirements.

The scoping requirements include a set of evaluation objectives. These objectives identify the desired outcomes to be achieved in managing the potential impacts of constructing and operating the project in accordance with the *Ministerial guidelines for assessment of environmental effects* under the EE Act.

The EES is to document the proponent's approach to progressive rehabilitation and closure to ensure stable rehabilitated landforms capable of supporting future use of the project site. The description of rehabilitation and closure should canvass changes in topography, groundwater conditions, drainage and vegetation cover during mining operations and at the end of the mine life. Rehabilitation and closure planning in the EES should be informed by the outcomes and adopted recommendations of the specialist studies within the EES (e.g. water, soils, landscape and visual, social, biodiversity, cultural heritage, etc.). Specific matters to be addressed in the EIS and a reference to where these matters are addressed in this Draft Rehabilitation Plan, are provided in Table 2.

*Table 2 EES scoping requirements for rehabilitation*

| **Aspect** | **Detail** | **Relevant Section of this report** |
|---|---|---|
| Soil management | • proposed depth of topsoil to be extracted, storage and management of stockpiled topsoil and subsoils and treatment measures | Section 3.4<br>Section 6.2 |
| Rehabilitation methods | • proposed methods for restoring soil profiles, drainage and productivity, as well as landscape rehabilitation in the context of the mine path and decommissioning of structures/facilities | Section 6.2 |
| Geotechnical risk | • assessment of residual geotechnical risk of rehabilitated areas | Section 5.2.2 |

| | | |
|---|---|---|
| Water management | • proposed management of surface water and groundwater flows, including erosion and flood risks, and consideration of site drainage and water quality | Section 3.6.7<br>EES stormwater management plan |
| Rehabilitation design and closure criteria | • proposed design criteria relating to landform and geology<br>• proposed design criteria for landscape and visual values<br>• proposed rehabilitation and closure criteria for all environmental, geophysical and structural elements of the rehabilitation framework | Section 5<br>Section 6 |
| Final land use | • approach to identifying potential end land uses of the project site (including potential for return of agricultural land-uses post mining) including consultation with landholders and local communities | Section 4<br>Section 5 |
| Revegetation | • approach for establishing sustainable vegetation cover (consistent with end land uses) | Section 6.2.6 |
| Stakeholder engagement | • approach to community and stakeholder engagement | Section 5 |
| Emergency management | • proposed fire and emergency management measures | Section 9 |
| Monitoring and maintenance and contingency | • proposed rehabilitation monitoring and maintenance methods including contingency measures for unplanned/forced closure<br>• proposed program for monitoring and maintenance of rehabilitation and closure activities including contingency measures for where proposed rehabilitation and closure criteria are not achieved | Section 6.2.9<br>Section 6.2.10<br>Section 9 |
| Progressive Draft Rehabilitation Planning | • planning for progressive rehabilitation and mine closure | Section 3.4<br>Section 6.2 |
| | | |

## 1.4 Linkages to other technical reports

This Draft Rehabilitation Plan has interdependencies with and was informed by many other technical assessment reports in relation to knowledge of existing site conditions, potential impacts and management measures, and formulation of rehabilitation goals. Key technical report references include:

- Geology – Geotechnical Impact Assessment. (Pitt&sherry, 2023a).
- Surface water – Mine Site Surface Water. (Pitt&sherry, 2023b).
- Groundwater – Groundwater Impact Assessment (CDM Smith, 2023). (CDM Smith. 2022).

- Soils – Soil and Land Resource Assessment. (SLR Consulting 2022).
- Flora – Native Vegetation and Flora Assessment (Nature Advisory, 2023)
- Tailings – Process Material Characterisation (Right Solutions Australia, 2022)

# 2. Regulatory Context

## 2.1 Key legislation

The two key pieces of legislation governing the rehabilitation requirements for mining operations in Victoria are as follows:

***Mineral Resources (Sustainable Development) Act 1990 (MRSDA)***

The MRSDA is the principal legislation governing the mining industry in Victoria and encourages the exploration and development of minerals in a manner that is 'compatible with the economic, social and environmental objectives of the state'. The MRSDA establishes a legal framework to ensure mined land is rehabilitated and requires:

- A Draft Rehabilitation Plan to be prepared that considers any special characteristics of the land, the surrounding environment, land stability, agreed end uses, and any potential for long term degradation of the environment. The plan must include proposals for the progressive rehabilitation, stabilisation and revegetation of extraction areas, waste disposal areas, stockpile areas, dams and other land affected by the operation. Landscaping to minimise visual impacts and details of final rehabilitation and closure of the site must also be included in the plan; and
- A rehabilitation bond to be lodged by the proponent to cover rehabilitation costs should the operator default on its obligations to complete rehabilitation. The method used to calculate the bond needs to be approved by the Victorian Minister for Resources. Compensation agreements with landholders, severance or redundancy payments to employees or contractors, and shire rates, royalties or taxes do not form part of the bond.

***Mineral Resources (Sustainable Development) (Mineral Industries) Regulations 2019***

The objectives of these Regulations as outlined in section 1 are:

*a) to prescribe various procedures, details, royalties, fees, forms, rents, information required in documents and other matters authorised by the Mineral Resources (Sustainable Development) Act 1990*
*b) to prescribe certain offences as infringement offences*
*c) to set out requirements relating to declared mines; and*
*d) to set out the requirements for persons who are required, under the Mineral Resources (Sustainable Development) Act 1990, to disclose any interests.*

Both the MRSDA and the Regulations include requirements for a rehabilitation plan. Section 79 of the MRSDA sets out what a rehabilitation plan must take into account:

A rehabilitation plan must –

*a) take into account –*
  *i) any special characteristics of the land*
  *ii) the surrounding environment*
  *iii) the need to stabilise the land*
  *iv) the desirability or otherwise of returning agricultural land to a state that is as close as is reasonably possible to its state before the mining licence, prospecting licence or extractive industry work authority was granted; and*
  *v) any potential long-term degradation of the environment.*

The Regulations further specify what information must be included in a Draft Rehabilitation Plan, at Regulation 43(2):

a) *proposed land uses for the affected land after it has been rehabilitated, that considers community views expressed during consultation*
b) *a land form that will be achieved to complete rehabilitation, which must—*
   *i) be safe, stable and sustainable*
   *ii) be capable of supporting the proposed land uses referred to in paragraph (a)*
c) *objectives that set out distinct rehabilitation domains that collectively amount to the land form described in paragraph (b)*
d) *criteria for measuring whether the objectives described in paragraph (c) have been met*
e) *a description of, and schedule for, rehabilitation milestones*
f) *an identification and assessment of relevant risks that the rehabilitated land may pose to the environment, to any member of the public or to land, property or infrastructure in the vicinity of the rehabilitated land, including—*
   i) *the type, likelihood and consequence of the risks*
   ii) *the activities required to manage the risks*
   iii) *the projected costs to manage the risks; and*
   iv) *any other matter that may be relevant to risks arising from the rehabilitated land.*

Relevant risk is defined thus at Regulation 43(5):

*"relevant risks" means risks that may require monitoring, maintenance, treatment or other ongoing land management activities after rehabilitation is complete.*

## 2.2 Relevant guidelines for rehabilitation

The main policy and guideline documents relevant to mine rehabilitation and closure include the following.

- *Preparation of Draft Rehabilitation Plans: Guideline for Mining & Prospecting Projects* (Earth Resources Regulation, 2020). This guideline provides information to assist licensees for mining and prospecting licences to develop Draft Rehabilitation Plans that meet regulatory requirements in Victoria and achieve sustainable rehabilitation outcomes. It sets out what the regulator, Earth Resources Regulation, expects to be included in a Draft Rehabilitation Plan, and how the safe, stable and sustainable requirement in the Mineral Resources (Sustainable Development) (Mineral Industries) Regulations 2019 (Regulations) is interpreted. This guideline aims to enhance regulatory certainty and minimise regulatory burden through its adoption of an outcomes-based and proportionate approach. This Draft Rehabilitation Plan is prepared in accordance with and follows the structure of this guideline.
- The Australian and New Zealand Minerals and Energy Council (ANZMEC) and Minerals Council of Australia (MCA) *Strategic Framework for Mine Closure* (ANZMEC/MCA, 2000) aims to provide a consistent approach for mine closure across all Australian jurisdictions, and focuses, wherever practicable, on self-sustaining ecosystems. The framework also promotes involvement of stakeholders in the mine closure process, and that processes and indicators be in place to demonstrate the successful completion of the closure process. The *Mine rehabilitation in the Australian minerals industry* (MCA, 2016) report provides case studies of successful rehabilitation programs in different resource sectors.
- The *Mine Closure and Mine Rehabilitation Leading Practice Handbooks* (LPSDP, 2016a; LPSDP, 2016b) are publications of the Commonwealth's Leading Practice Sustainable Development Program in the Mining Industry. They are two of 17 handbooks addressing key issues of sustainable mining development, developed by the Australian Government in consultation with the mining industry and other stakeholders. These handbooks outline the key principles and procedures of leading practice for closure planning, and implementing and monitoring mine rehabilitation.

The following are among several additional guidelines developed by the Commonwealth and Victorian Governments, industry organisations and independent bodies, which are relevant in planning for mine rehabilitation, decommissioning and closure:

- *Guidelines for the Assessment of Geotechnical Risks in Open Pit Mines* (ERR, 2021);
- The Victorian Environment Protection Authority's *Industrial Waste Resource Guidelines* for wastes and resources regulated under the Environment Protection (Industrial Waste Resource) Regulations 2009.
- Guidelines on Tailings Dams: Planning, Design, Construction, Operation and Closure, Rev 1 (ANCOLD, 2019)

## 2.3 Agency Review of the Draft Rehabilitation Plan

This Draft Rehabilitation Plan has been prepared to accompany the EES and would be included with the Work Plan application. During the EES process, VHM presented an overview of the planned mine rehabilitation to the technical reference group (TRG) established for the project. TRG review comments were received from the following Victorian Agencies:

- Earth Resources Regulation (ERR);
- Environment Protection Authority (EPA);
- Department of Environment, Land, Water and Planning (DELWP); and
- Department of Energy, Environment and Climate Action (DEECA).

In response to Agency comments the Draft Rehabilitation Plan was updated prior to finalisation for submission with the EES. Some key themes of the TRG comments which have been addressed in the finalised document include:

- Updates to sections on legislation and Agency/stakeholder involvement
- Rehabilitation themes and closure criteria
- Clarification of final landform and final land use goals
- Tailings and overburden backfill approach and control to ensure final landform objectives are achieved
- Groundwater impact assessment and risk management
- Soils description and management
- Updating the rehabilitation risk assessment to focus on post-closure risks
- Rehabilitation milestones
- General layout and formatting of the document

## 2.4 Earth Resources Regulation

There are several government regulators involved in the rehabilitation of a mine. Each regulator has the power to impose conditions that may affect operations and rehabilitation.

Earth Resources Regulation (ERR) is Victoria's regulator of exploration, mining, quarrying, petroleum, recreational prospecting and other earth resource activities. ERR's role is to ensure earth resources activities are conducted safely to protect people, property, infrastructure and the environment. In fulfilling its role ERR considers the advice of, and any standards or other regulatory requirements developed by, these other regulators.

ERR has been involved in review of the Draft Rehabilitation Plan and would approve the Work Plan, of which the Draft Rehabilitation Plan is a part, prior to mining operations commencing.

## 2.5 Environment Protection Authority Victoria

The Environment Protection Authority Victoria (EPA) administers the *Environment Protection Act 2017* (EP Act), which creates a legislative framework for environmental protection in Victoria. The EPA issues development licences, operating licences and various types of permits. The EPA is a statutory referral agency for mining work plans and also regulates mine sites that need an EPA development approval and/or operating licence as their activities are likely to generate 'offsite discharges' during construction, operation and/or closure. The EPA has been consulted during the course of Draft Rehabilitation Plan development.

As required by the EP Act, the Environmental Reference Standard (ERS) 2021 outlines the environmental values of the environment that the community wishes to protect. Environmental values are defined as a use of the environment or any element or segment of the environment which:

- is conducive to public benefit, welfare, safety, health or aesthetic enjoyment and which requires protection from the effects of waste discharges, emissions or deposits or of the emission of noise.

Relevant to mine site rehabilitation are the environmental quality indicators and objectives for rivers and streams (Water Quality Objectives or WQOs) outlined in the ERS 2021 for defined segments of landscapes/catchments to protect these environmental values (Victorian Government 2021). The specific WQOs are outlined in the Surface Water Impact Assessment (Water Technology, 2022) submitted with the EES.

The proposed activities involve discharge of tailings into mine voids and it is expected they will require an A18 permit for activities involving releasing of waste into an aquifer. As identified in the Groundwater Impact Assessment (CDM Smith, 2023), an A18 application will need to be made through the EPA Victoria for permission and approval. The application will need to include a summary of the proposal, characteristics of the waste discharge, characteristics of the aquifer and consideration of risk of harm to human health or the environment. The permit may embed additional monitoring or other regulatory requirements on the operator and is expected to include requirements for closing out the permit on the cessation of the impact of the activities.

# 3. Project Description

## 3.1 Project overview

The Goschen Project is a rare earth and mineral sands mine and processing facility, proposed to be operational for approximately 20-25 years. VHM has been developing the Project in the context of a rapidly growing global demand for rare earths. One of the world's largest, highest grade zircon, rutile and rare earth mineral deposits is in the Loddon Mallee region of Victoria in Australia. VHM intends to establish the Project to mine these deposits and process to produce and market a range of products to national and international consumers.

The mine footprint has been restricted to avoid intersection with groundwater and significant areas of remnant native vegetation. VHM will implement a staged development approach. Initially developing Phase 1 consisting of a mining unit plant (MUP), wet concentrator plant (WCP), rare earth mineral concentrate (REMC) flotation plant and a hydrometallurgical circuit that will further refine the REMC that is produced at Goschen. The product suite for phase 1 consists of a zircon/titania heavy mineral concentrate (HMC) and mixed rare earth carbonate (MREC).

Phase 2 will consist of an additional mineral separation plant (MSP) and, subject to prevailing market circumstances at that time, hot acid leach (HAL) and chrome removal circuit, that will produce additional products such as premium zircon, zircon concentrate, HiTi rutile, HiTi leucoxene, LoTi leucoxene, low chromium ilmenite.

Goschen Project is located approximately 4 hours' drive (275 kilometres) northwest of Melbourne and 30 minutes (35 km) south of Swan Hill within Gannawarra Shire (Figure 1).

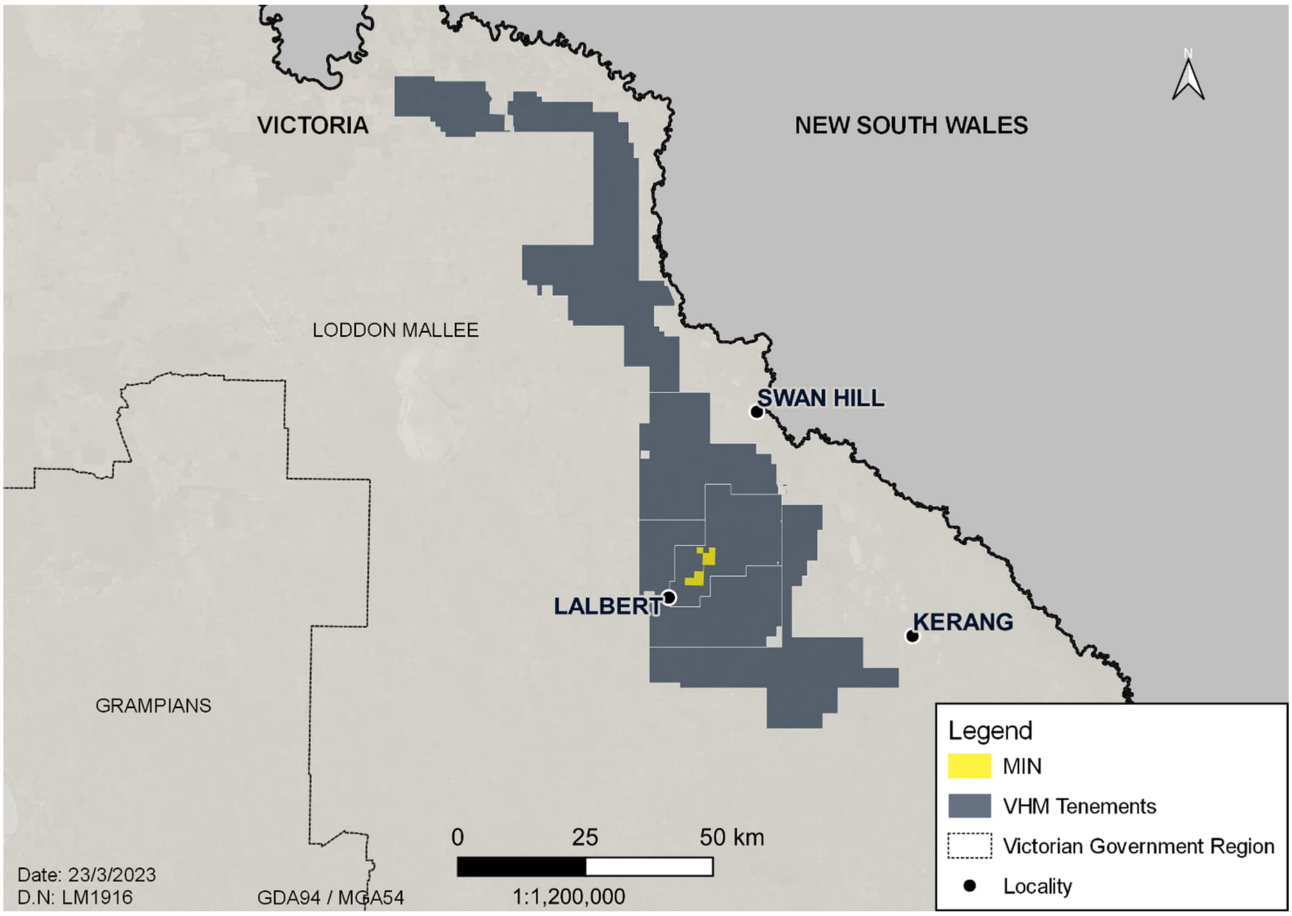


*Figure 1 Goschen Project Location*

## 3.2 Project development

It is recognised that there are opportunities to avoid and minimise environmental impacts during the many stages of project development. During project inception and early design development stages of the project, decisions on the location of the project, its design and construction techniques have enabled impacts to be significantly avoided and minimised in accordance with the hierarchy presented in Figure 2.

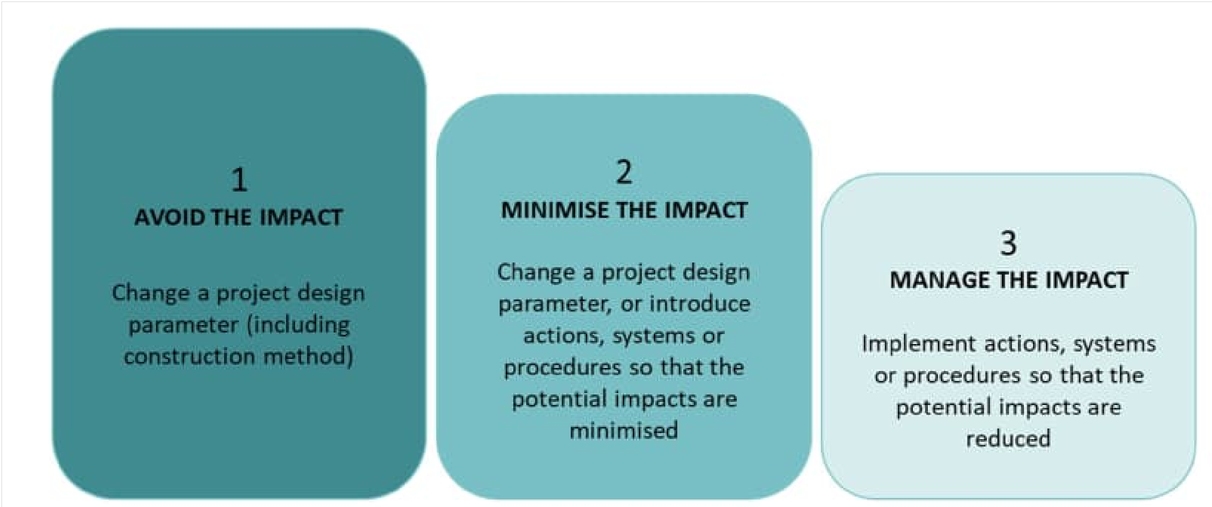


*Figure 2 Mitigation hierarchy*

Avoidance and minimisation of social and environmental impacts is central to the project's decision making and as such, the project will continue to be refined in response to technical requirements and potential environmental and social impacts identified during the development phase.

Examples of this include the decision to create vegetation protection zones within the project (mining area), restricting mining operations to daylight hours only to avoid noise related impacts to certain receptors, and restricting mining to depths above the water table to avoid impacts to the groundwater table. Consideration has been given to potential surface and subsurface impacts with the most significant outcomes aimed at avoiding or minimising effects through the use of subsurface storage and progressive rehabilitation. Multiple design iterations have been implemented to avoid or minimise the extent of the potential environmental effects through exposure to geotechnical risks.

Detailed subsidence modelling was undertaken to understand the likely rate and depth of subsidence during dewatering and settlement of wet tailings, which is a core component of the rehabilitation strategy. This information contributed to the development of the overburden backfilling plans and final landform design.

## 3.3 Key Project Components

The Project site consists of a heavy mineral sand mining and processing operation that will produce several heavy mineral concentrates (HMC) and a range of critical rare earth minerals across two defined mining areas known as Area 1 and Area 3 (Figure 3 and Figure 4).

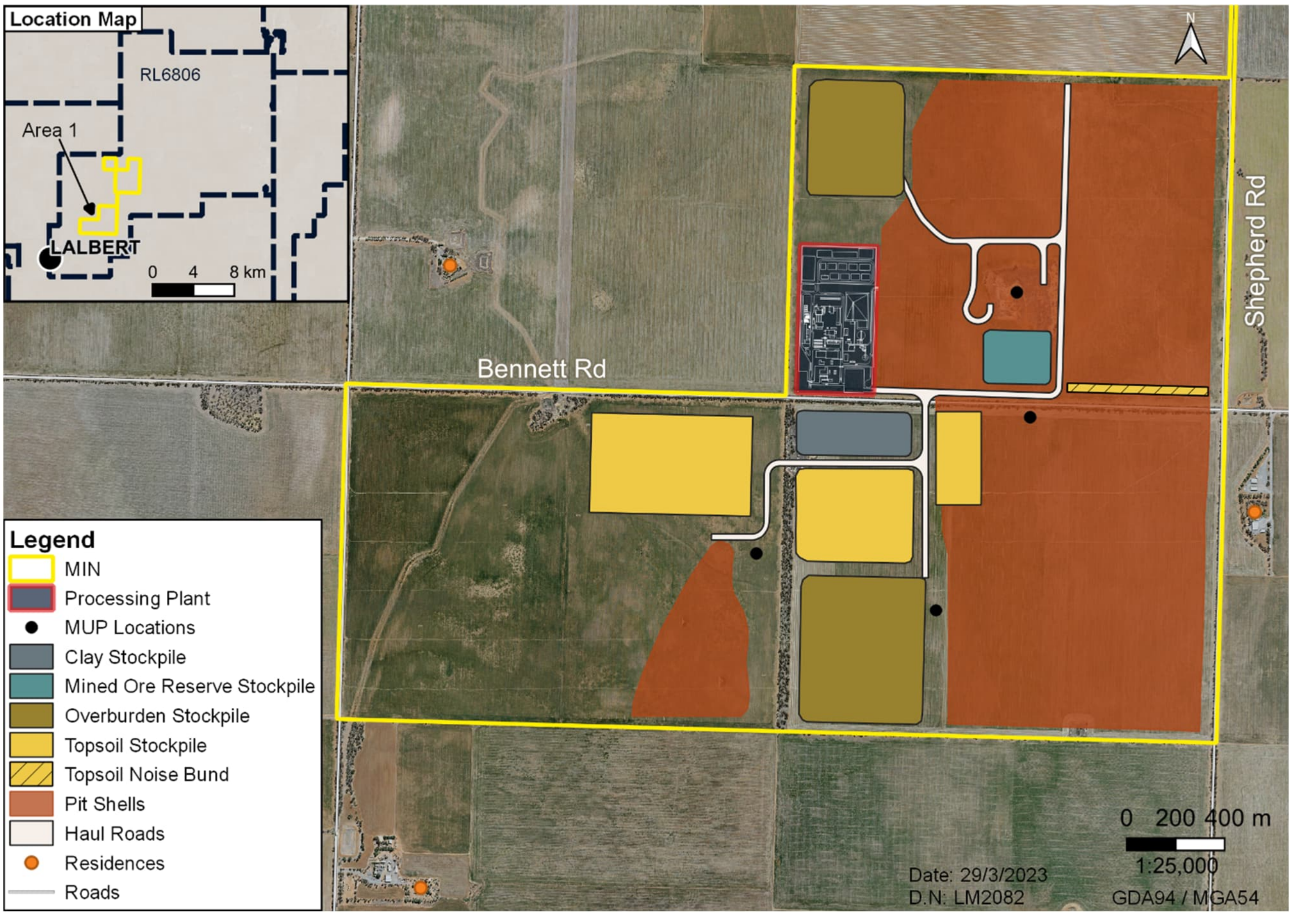


*Figure 3 Area 1 Goschen Project*

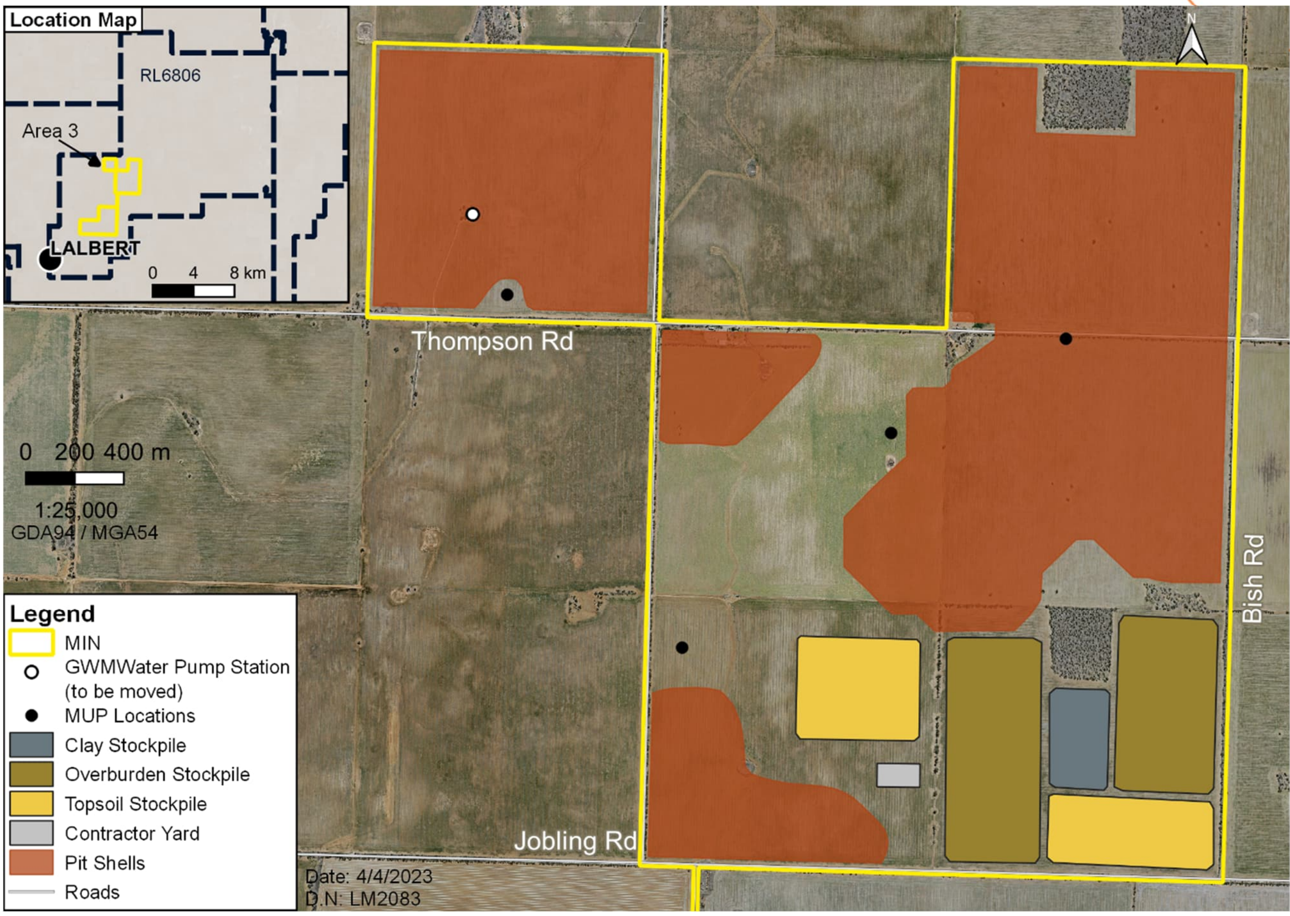


*Figure 4 Area 3 Goschen Project*

The key components that make up the project are described below.

**Mining** – Mining will take approximately 20-25 years at 5M tonnes of ore produced per year and will occur only above groundwater (no dewatering) across approximately 1,479 hectares of farmland using conventional open cut mining methods of excavation, load, and haul.

**Processing** – Heavy mineral sands and rare earths ore will be separated via an on-site WCP and MSP to generate a Rare Earth Mineral Concentrate (REMC). Refining of the REMC on-site is limited to hydrometallurgical extraction to produce a mixed rare earth carbonate (MREC). Tailings from the various mineral processes will be homogenised and placed back into the ore zone earlier mined.

**Rehabilitation** – The mined areas will be progressively backfilled in a staged manner, with tailings dewatered in-pit to allow overburden and topsoil placement in a profile that reinstates the background soil structure. This will result in the ability for a return to the current agricultural land uses within approximately 3 years within each mining block. The final landform is proposed to be very similar to present, that is, a gently undulating low gradient plain conducive to a wide range of agricultural land uses.

**Power** – Electrical power needed for mining and processing will be produced on-site from dual fuel diesel/LNG fired power generators, with a gradual evolution over the life of mine to renewables, hydrogen and/or battery as technologies and commercial viability increase. Heat energy for the on-site gas fired appliances shall be provided from an extension of the distribution network from the main LNG storage and regasification system.

**Transport** – Final products will be containerised in 20ft sealed sea containers on site and exported via Melbourne Port using road and/or rail-based land logistics solutions. Ultima will provide intermodal rail solution, to reach the shipping export ports.

**Water** – Water will be required for construction earthworks, processing, dust suppression and rehabilitation. 4.5 Gigalitres per year (GL/y) will be needed for the start-up of the Project, and then reduced to 3.1 GL/year during operations. Water will be sourced from Goulburn-Murray Water (GMW) from a new pumpstation at Kangaroo Lake via the open water market. A 38 km underground pipeline is proposed beneath existing local road easements as shown in Figure 5, noting the section of pipeline labelled 'alternative route' is not proposed to be constructed.

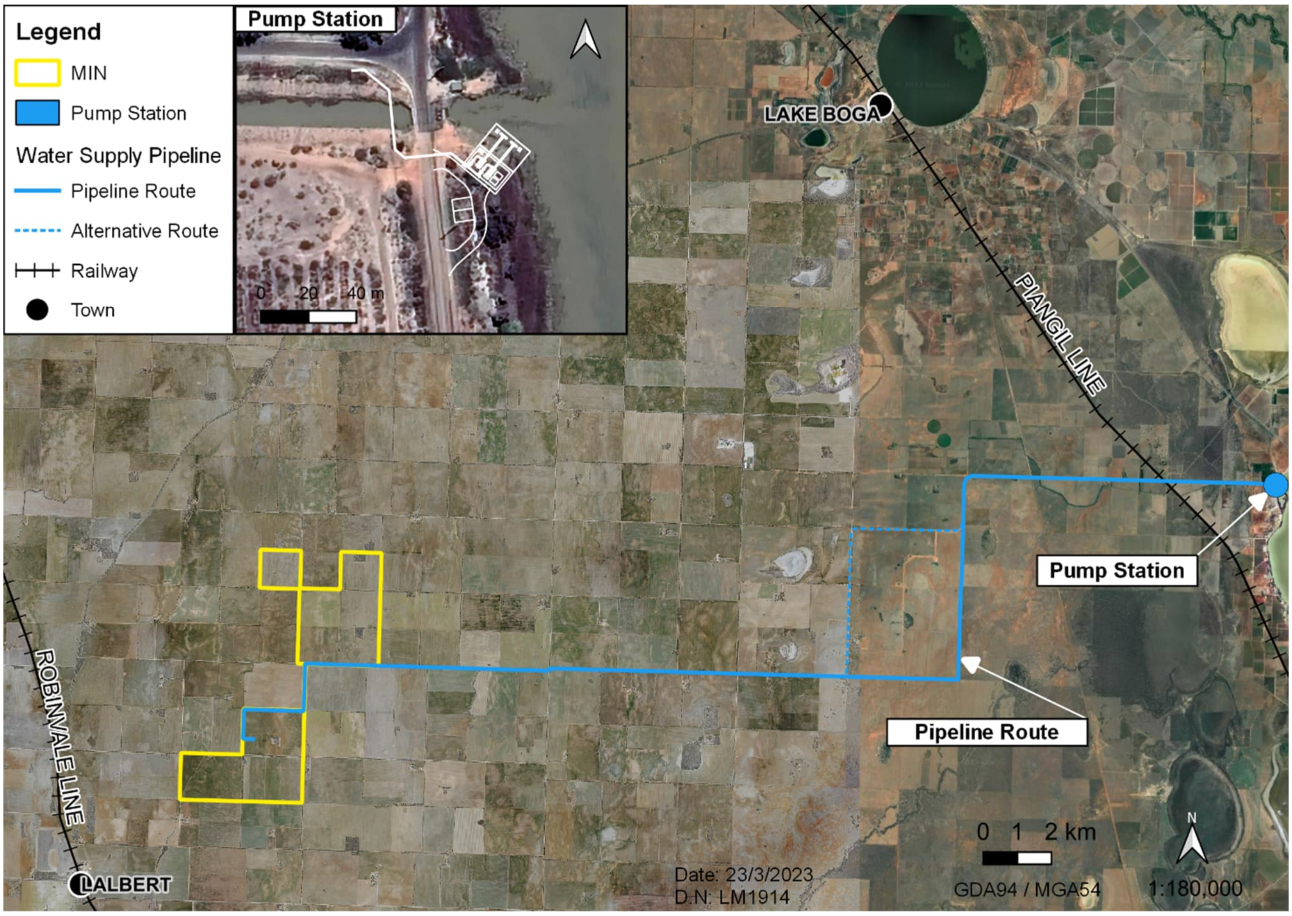


*Figure 5 Proposed water supply pipeline route*

## 3.4 Overview of mining sequence and backfill strategy

### 3.4.1 Mining sequence

The mining sequence is a conventional open cut operation comprising removal of topsoil and overburden to expose the ore which extends from a depth of approximately 20m to 50m below present ground. Mined out voids would be used to dispose tailings from processing operations and so avoid the need for construction of dedicated above-ground tailings storage facilities. Tailings would be deposited in voids to backfill to about the depth of the top of the orebody, allowing space for subsequent replacement of overburden, subsoil and topsoil to restore the upper subsurface and landscape to as close as possible to the original landform and levels.

The time for the full mining sequence within each mine cell, from initial excavation of overburden, extraction of ore and replacement of tailings and subsequent rehabilitation is expected to be approximately two to four years. This will depend on factors such as weather.

A set of conceptual staged tailings disposal and backfill plans are provided in Figure 6 to Figure 9. These describe the core features of the backfill operations and use of major and minor tailings bunds to assist in tailings containment and consolidation.

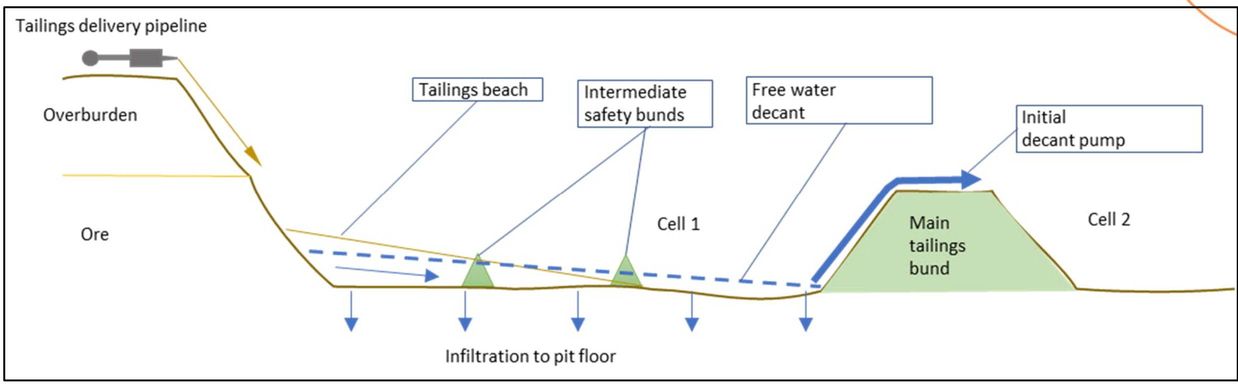


*Figure 6 Backfill stage 1 – Tailings disposal*

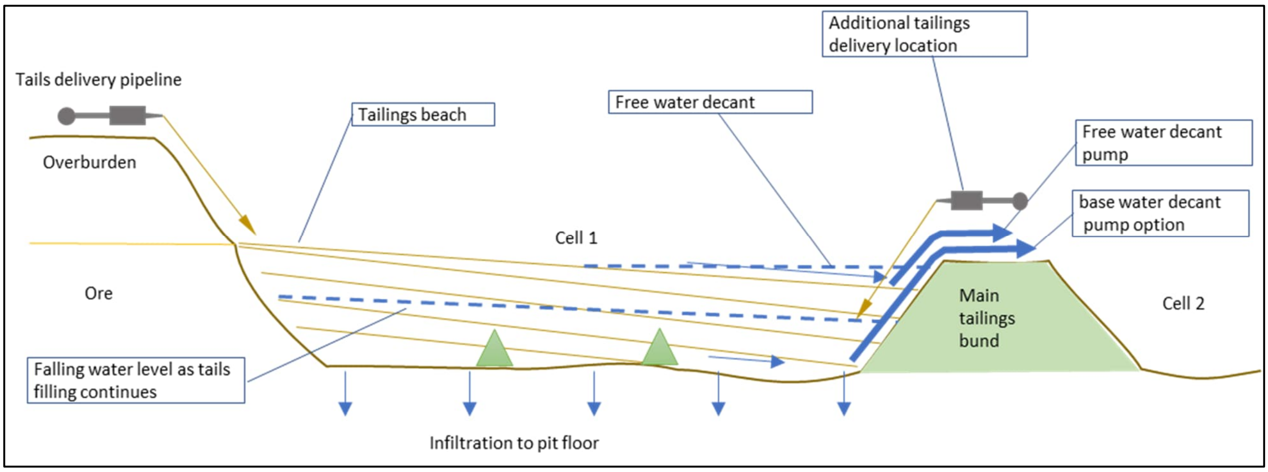


*Figure 7 Stage 2 – Tailings fill complete and in process of consolidation*

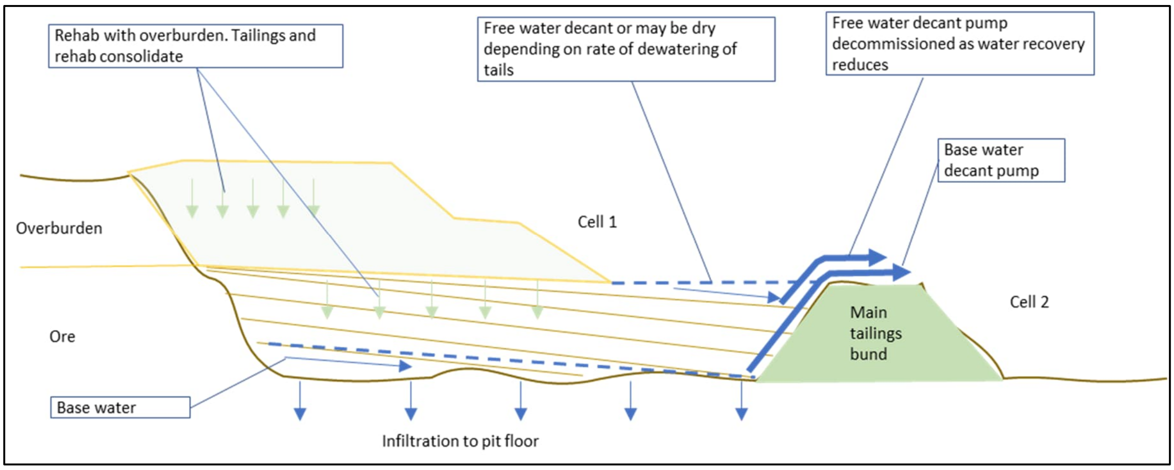


*Figure 8 Stage 3 – Overburden backfill and further tailings consolidation*

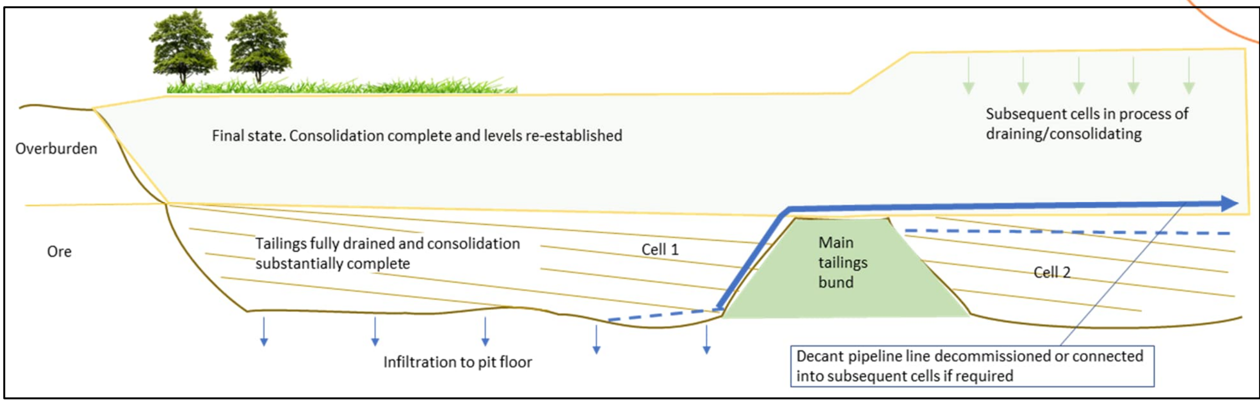


*Figure 9 Stage 4 – Final levels established for rehabilitation*

This sequence of backfill activity is further described conceptually in plan and cross-section view, in Figure 10.

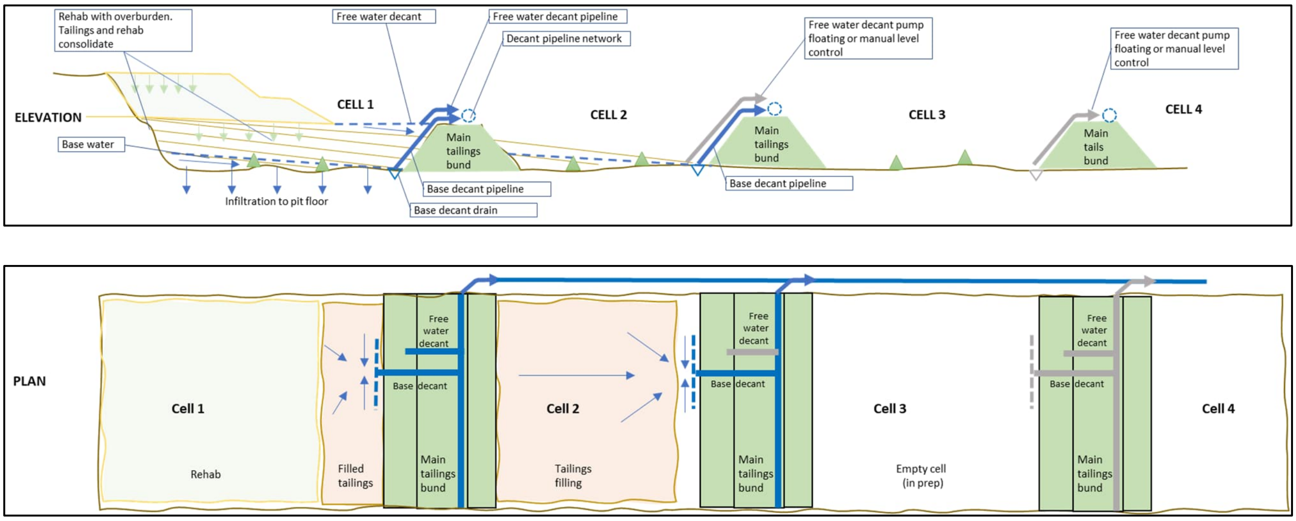


*Figure 10 Plan and Cross-section view of staged backfill over 4 consecutive pit cells*

### 3.4.2 Topsoil Management

Topsoil will be collected and transported to stockpiles as close to the operating pit crest as possible. Recommended topsoil stripping depth is 20cm.

A key aspect of the progressive rehabilitation process will be direct transfer of topsoil from new mine cells to adjacent cells undergoing rehabilitation, avoiding double handling and stockpiling as far as practicable. Not only does this offer substantial material handling efficiency it will also maximise the topsoil quality by minimising potential degradation during stockpiling.

Some stockpiling of topsoil will however be unavoidable. For example, an initial topsoil stockpile will be established for material removed during construction of processing and operational areas during mine establishment as well as the initial mine cells.

These stockpiles would be established and managed following advice of the soils specialist (refer SLR, 2022) as outlined in Section 6.2.2. This includes mixing gypsum with stripped and stockpiled soils to maintain soil structure and reduce the effects of sodicity.

### 3.4.3 Subsoil management

Beneath the topsoil is a clayey subsoil (B-horizon) and beneath this, a clayey overburden above the thick layer of more sandy overburden. The soil profile will be stripped to a depth of 1.0m and preserved strictly for use within the reinstated soil profile. The stripped soil profile includes the nominal 20cm thick topsoil and 80cm thick subsoil. This subsoil material will not be used for any civil purposes like construction of hardstands, sealing of dams or construction of in-pit bunds. It will be preserved exclusively for rehabilitation purposes. The existing subsoil is important to the rehabilitated soil profile as it provides moisture and nutrient retention among other things. Dedicated stockpiles will be created for all topsoil and subsoil material to ensure its preservation for rehabilitation purposes.

Section 6.2 describes the stripping and management of topsoil and subsoil as part of the recreated soil profile. The subsoil is a vital resource for rehabilitation and will be managed similarly to topsoil in terms of stockpiling, tracking and reuse. Similar to the progressive replacement of topsoil as described in section 3.4.2, as mining progresses, subsoil will be deposited back in sequence to recreate the subsoil profile. The focus will be on direct transfer of subsoil from stripping operations into rehabilitation areas as far as possible. However, despite the goal of avoiding double-handling there will be a need to stockpile some subsoil material preserved for rehabilitation, from time to time, depending on the mine sequence. For example, during stripping of the initial mine cell, subsoil will need to put aside for later rehabilitation.. Stockpiles may also be used to manage the differential of material supply and demand during the course of operations.

The clayey overburden comprising material deeper than 1m below surface has material properties that may make it suitable for use as lining of water storage facilities on site and for creation of in-pit tailings bunds. Overburden material collected from deeper than 1m may be used for such ancillary purposes. It is important to reiterate that to ensure integrity and success of the rehabilitation program the priority will always be to retain sufficient subsoil for use in the reinstated soil profile, and only surplus clayey overburden material would be used for ancillary purposes. Current investigations suggest there is ample material for this. The soil resource assessment (SLR, 2022) found all soil profiles within planned mining areas have a depth of at least 1.2 metres of soil indicating a surplus of soil resource for the proposed reinstatement of a 1 metre soil profile.

### 3.4.4 Overburden

Overburden is defined as material underlying the topsoil and subsoil but overlying the target ore – essentially material deeper than 1m and above the orebody. The overburden produced from mining will be placed in one of three general locations:

- Directly emplaced over consolidated tailings to return the mining areas under rehabilitation to as close to the original landform as possible;
- Used for ancillary purposes such as in-pit bunding to form tailings cells, or lining of dams; or
- in surface stockpiles.

It is expected that at least some overburden material from the initial 10 mining blocks will need to be stored in a surface overburden stockpile. Subsequent overburden will be directly trucked to create in-pit bunds or to overlay deposited tails. At the conclusion of mining in any one specific area, the material in the surface overburden stockpiles will be rehandled back to the final mine void.

Proposed locations for the surface overburden stockpiles have been selected to ensure haulage distances and costs (both during initial overburden removal and then subsequent rehandling) are kept to a minimum. Topsoil would be stripped from stockpiling locations prior to use, and topsoil would be respread over these locations during rehabilitation post use.

### 3.4.5 Ore

Ore mined from the first mining block will be stockpiled on surface adjacent to the first MUP location. Processing this ore will begin when the first in-pit tailings cell is ready to receive tailings (approximately at the completion of ore mining from block 1). This stockpile will gradually be fed to the MUP over the first ~12 months of processing, at which point no ore stockpile will be required (beyond the run of mine ore stockpile used to handle any daily fluctuations or downtime). Ore slurry produced from the MUP will be pumped to the processing facility located in Area 1.

### 3.4.6 Interburden

Interburden will generally be mined separately from the mineralised sheets. Interburden material will be treated as any other overburden and deposited in the surface overburden stockpile or mined void or transferred directly to rehabilitation cells as backfill. Where the distance between mineralised sheets is too small to economically separate interburden in the pit, it will be mined with the ore and processed through MUP.

### 3.4.7 Tailings disposal and mine cell backfilling

By stockpiling ore on surface and processing only when an in-pit tailings cell is available, the need for a surface tailings storage facility has been removed with all tailings to be deposited in-pit. Sand and fines tailings will be combined and disposed of together in the in-pit tailings cells. A flocculant will be added to improve handling and consolidation time of the tailings.

Tailings cells will be created in two adjacent mining blocks with the next mining block void partially filled with overburden to create an in-pit, engineered 'bulk' tailings bund wall. This will reduce complexity, costs and time compared to constructing fully engineered tailings bunds. Figure 11 provides a schematic representation of the mining blocks and bund walls. These major bund walls permit mining to proceed in successive blocks while tailings emplacement and overburden backfill occur sequentially in mined out areas. The configuration of mining blocks and bund walls is conceptual only and subject to further mine plan development.

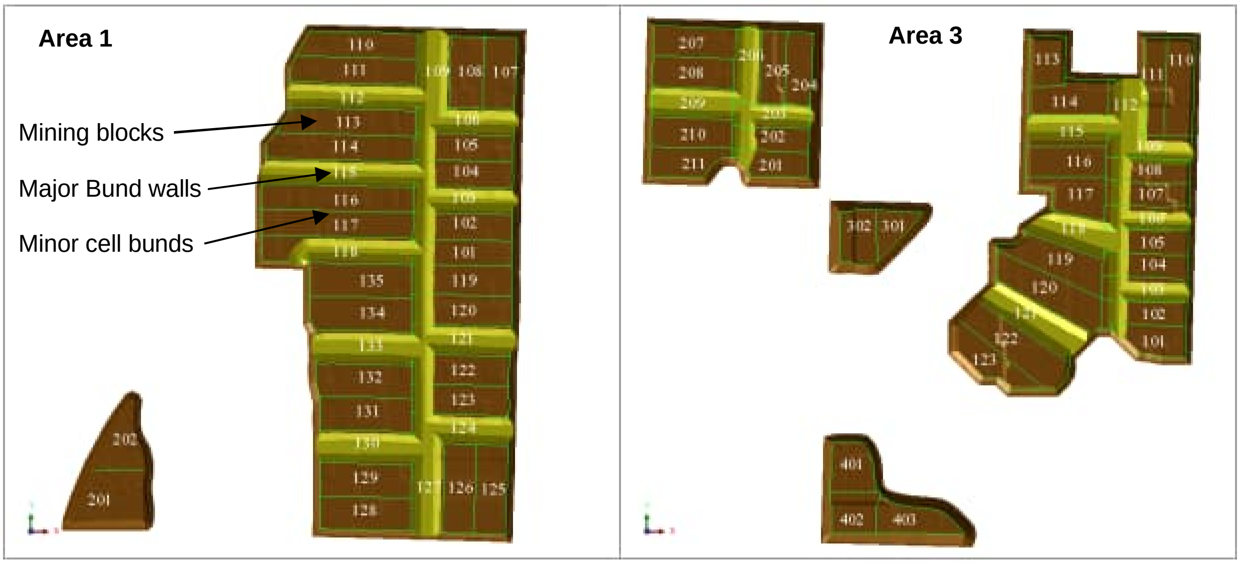


*Figure 11 Bund walls constructed to form in-pit tailings cells.*

It is proposed that bund walls for in-pit tailings cells will be predominately constructed from the site's clayey overburden material due to its low permeability. The use of this material will provide an additional level of safety when mining is undertaken adjacent to these bund walls later in the project's life. If there is insufficient clay material to build an entire bund wall, a barrier of clay material on the upstream side of the bund will be included as a minimum.

Within each tailings cell will be some minor bunds (two to three, approximately 5m high and built of clay material) to reduce the distance between ore mining and tailings deposition while maintaining safe working conditions. The fill depth for the first few tailings' cells will be significantly higher than the mined ore thickness due to reduced footprint (because of bund walls and overburden barriers) and the volume of ore/tails from the additional mining block. Tailings generated from the processed ore from the first four mining blocks will be deposited in the first tailings cell; subsequent tailings cells will hold the tailings from only three mining blocks.

Once deposited tailings are suitably consolidated, overburden will be deposited on top. To reduce potential hazards, it is proposed that trucks will paddock dump with dozers to push the material out over the consolidated tailings.

The tailings filling cycle is predicted to take approximately 3-4 months in each cell before the filling cycle for the subsequent cell is initiated. The time taken for tailings to sufficiently consolidate is still being determined and would be outlined in the Ground Control Management Plan, including a process for monitoring consolidation. Further consolidation will occur during overburden placement. Acceptance criteria for consolidated tailings is subject to further testing and would be outlined in the Ground Control Management Plan. The Ground Control Management Plan would also detail and inspection and test plan to verify that tails are adequately consolidated prior to overburden backfill.

Given the progressive nature of mine backfilling, factors like the time taken to consolidation, consolidation testing, and design of overburden placement lift thickness will be monitored and adapted through the course of mining operations to optimise performance and address any concerns about achievement of the final rehabilitation goals.

### 3.4.8 Tailings characterisation

An investigation of the geochemical characteristics of process material (ore) and waste streams produced by ore processing (tailings) was undertaken by Right Solutions Australia[1] (2022). This investigation assessed whether there is potential that mining waste may contain elevated concentrations of elements or ions that exceed natural concentrations, and so may be considered a potential source of contamination. Tailings streams from metallurgical testing conducted on ore from Areas 1 and 3 were assessed for acid generating, salinity and metal leaching potential.

The investigation found that:

- Tailings streams are slightly acidic with no significant or long-term acid drainage likely to occur from tailings material.
- Salinity in various ratios of solid to water leachates were relatively low, particularly when compared to groundwater. Tailings is not considered to be a potential source of saline drainage.
- The tailings material tested show the potential to be a source of dissolved metals including aluminium, arsenic, cerium, chromium, hexavalent chromium, fluoride, phosphorus (as reactive phosphorus), nickel, titanium, vanadium, selenium, tin, thorium, thallium, uranium, yttrium, and zircon.
- There appears to be a marked difference in total elements between the two mining areas, with Area 3 containing higher total concentrations than the tailings from Area 1. However, this difference does not appear to be reflected as a significant difference in the leachability of the tailings (Right Solutions, 2022).

In general, tailings appear to show no potential for acid or saline drainage and a slight to moderate potential for metalliferous drainage. There is a moderate to high risk that tailings leachate may constitute a source of aluminium, arsenic, hexavalent chromium and vanadium as compared to natural background levels. The impacts to groundwater quality from this seepage have been assessed in the Groundwater Impact Assessment (CDMSmith, 2023).

## 3.5 Rehabilitation obligations and commitments

The overall objectives of rehabilitation are to ensure that the final landform and land use is safe, stable and non-polluting, and capable of supporting the final land use which is broadacre agriculture. With reference to the *Preparation of Draft Rehabilitation Plans* (ERR, 2021a) guideline, the specific whole-of-site rehabilitation objective is:

> "To restore land disturbed by mining to an equivalent (or better) agricultural land capability to enable a variety of productive agricultural uses."

The following aspects of the Draft Rehabilitation Plan will help to achieve this objective:

- Pits will be backfilled to reinstate levels and gradients similar to present conditions;
- No stockpiles will remain at surface following closure;
- Land area will be graded to achieve gradients and topography similar to pre-mining conditions;

[1] Report in Appendix C of Groundwater Impact Assessment report (CDMSmith, 2023).

- Soil profile will be re-established to a minimum depth of 1.0m including topsoil and subsoil;
- Topsoil will be rehabilitated to pre-mining fertility or better;
- Crop yields will be returned to pre-mining levels of production or better;
- Crops and soils will not contain any pollution or increase in elements associated with mining above pre-mining levels;
- Where desirable, infrastructure utilised during mining will remain for use of landholders: such as upgraded roads, water storage ponds, upgraded electricity connections, water pipeline, fences, etc. This will be determined in conjunction with the local government authority and landholders. If infrastructure is not required, it will be decommissioned and rehabilitated as per the previous commitments; and
- Public roads disturbed or removed by mining would be reinstated to the satisfaction of the roads authority. Roadside native vegetation would be restored consistent with the EVC present and boundary fencing replaced.

With regard to safety, the post-mining landform presents a very low risk to public health and safety into the future. The landform is proposed to be similar to present, without any sharp relief and the backfill plans have been designed to minimise risk of ground movement or differential settlement which could affect productive future agricultural use of the land. Tailings from mineral processing would be buried deep beneath overburden backfill and a reinstated soil profile comprising topsoil and subsoil. Soil condition, productivity and valuable ecosystem services would be re-established such that no further, ongoing, intervention is required. The existing soil properties would be maintained as far as possible through careful handling and amelioration as necessary to address existing constraints such as sodicity.

The potential for impacts on groundwater systems has been comprehensively assessed and documented in the Groundwater Impact Assessment (CDM Smith, 2023), which estimates the nature and extent of groundwater mounding and extent of changes to groundwater quality as a result of mining activity. The assessment found that there is expected to be a zone of altered groundwater quality, and this affected zone may be less saline (due to introduction of fresh water in process tails) and will contain increase in some dissolved metals. The assessment indicated that groundwater changes are not expected to impact on sensitive receptors (for example GDEs and groundwater bores). Tailings would be buried deep within the backfilled mine voids (typically >20m below surface) and are not predicted to cause pollution to land and surface waters based on the assessments undertaken by CDM Smith (2023).

## 3.6 Environmental and social setting

### 3.6.1 Climate

The area experiences a relatively dry climate where average monthly rates of rainfall are exceeded by evaporation in all months of the year. Climate data was obtained from the Bureau of Meteorology Station at Lake Boga (Kunat), ID 77021, located approximately 10 kilometres north-east of the Study Area. Mean minimum and maximum temperatures range between 9.7°C to 23°C. Average annual rainfall is 327 millimetres (Table 3) and evaporation 1,620 millimetres.

The area is classed as a low rainfall cropping zone, being less than 350 millimetres per annum. The growing season rainfall for winter cropping in the area falls between April and October, with rainfall spread reasonably evenly across all months (GRDC, 2022). There is a net moisture deficit annually and the moisture deficit is most significant over the warmer summer months. This moisture deficit presents a risk for rehabilitation during vegetation establishment.

*Table 3 Annual average rainfall data*

| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 23.9 | 21.0 | 20.4 | 21.4 | 31.3 | 26.9 | 33.8 | 33.2 | 31.0 | 34.9 | 27.8 | 20.7 | 327.3 |

(Source: Data taken from BoM, Lake Broga (Kunat) station, referenced in CDM Smith, 2023)

### 3.6.2 Landform and topography

The Project area is characterised by a gently undulating topography, with small depressions in the landscape. The Cannie Ridge is located on the east side of the Project area, trending from north to south, and represents a peak in the regional topography at 125 metres AHD. The lowest point in the region topographically is 53 metres AHD, which is characterised by Lake Lalbert, located 4 kilometres west from the Project area.

Within the Project area the topography ranges from approximately 90 m to 125 m Australian Height Datum (AHD) and is characterised by the north–south-orientated Cannie Ridge that can be seen transecting the proposed pit areas as shown in Figure 12. Surface gradients are typically less than 2%. There are no outstanding landscape features located within or near the Project area.

Surrounding the Project area, the main landform is a wide flat alluvial plain with minor features such swamps, shallow lakes, lunettes, sand sheets and minor drainage features. The main water features near the Project area are Lake Boga to the northeast and the Kerang wetlands 15 kilometres to the east.

The gentle landform gradients with limited relief and absence of natural watercourses, suggest the landform poses minimal constraints to the proposed mining and rehabilitation operations.

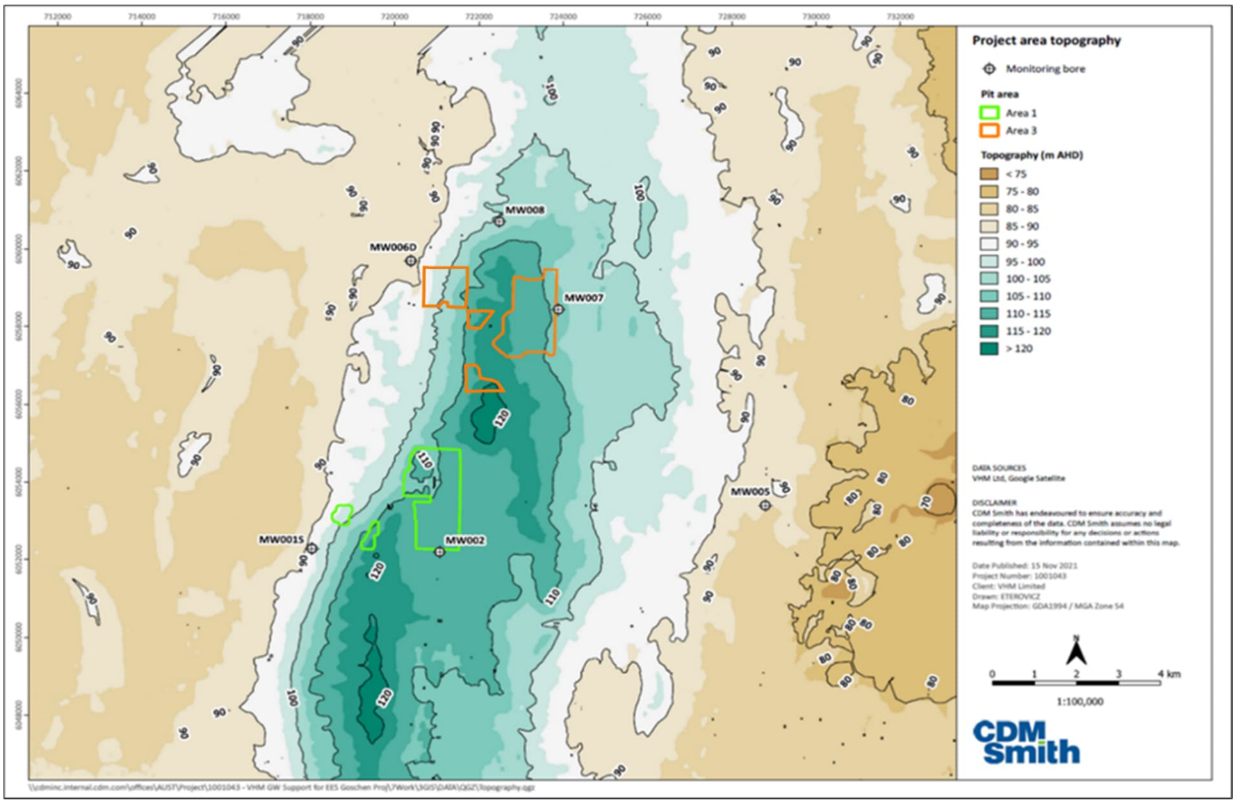


*Figure 12 Project area topography (reproduced from CDM Smith)*

### 3.6.3 Regional Land use

SLR (2022) provides a good summary of the regional and local land use within the Project area. Agriculture is the main employer and economic driver within the Gannawarra Shire (the Shire) with a value of around $284 million per annum, employing around 1,058 people. The Shire has a diverse agricultural economy comprised of dairy, cereal and legume cropping, livestock including beef, lamb and pork, viticulture and horticulture comprising walnuts, olives, tomatoes, apples, peaches and citrus along with small plantings of vegetables and herbs (Gannawarra Shire Council, 2022).

A variety of soil types combined with a suitable climate can support a range of enterprises across both irrigated and dryland properties. The Shire is split distinctively between the riverine plain to the east and the Mallee to the west. Soils in the Mallee are dominated by Calcarosols, Chromosols and Sodosols, which are suited to dryland winter cropping. Cropping comprises approximately 30% of agricultural land use in the Gannawarra Shire.

Irrigation plays an important role in agricultural production within the Shire. Water is supplied from the Murray River and Goulburn River systems via a network of automated channels and natural lakes and creeks. Lake Charm, Kangaroo Lake and the Gunbower Creek are natural assets that play a key role in the distribution of irrigation water from the Murray River.

Irrigation farms have undergone an efficiency transformation with laser grading and re use systems developed for flood irrigation farms. The implementation of subsurface irrigation, centre pivot irrigators, pipes and risers and automation has assisted in further efficiency gains for irrigation farmers.

Crops grown with irrigation include:

- Wheat, barley, canola, cotton, corn, peas, beans, sorghum, vetch and oats;
- Tree crops including walnuts, olives, stonefruit, citrus and apples;
- Tomatoes, onions, broccoli and pumpkin;
- Wine grapes; and
- Hay including oaten, vetch, lucerne, clover and pasture.

The majority of the Study Area has been cleared of native vegetation, with only remnant areas left along road reserves and isolated patches within paddocks.

The predominant land use within and surrounding the Project area is dryland winter cereal cropping, with wheat, barley, oats and canola the most commonly sown crops. Crops are sown using minimum or zero tillage techniques with an emphasis on minimal ground disturbance and stubble retention to protect the topsoil from wind and water erosion. Grazing of sheep and cattle is undertaken opportunistically, however dryland winter cereal cropping is the predominant land use. There is no irrigation within or in the vicinity of the mine.

The proposed final land use has been developed to be consistent with the existing and surrounding agricultural land uses and there is some opportunity to improve productivity and diversity of agricultural pursuits on the land if the water pipeline is retained.  This is yet to be determined and would form part of a future variation to the Draft Rehabilitation Plan if it is retained.

### 3.6.4 Geology

The outcropping geology at the Project site is comprised of a thin quaternary cover of sandy clay and ranges from approximately 5–10 m. The quaternary material overlays tertiary sediments including the Loxton Sand (formerly ‘Loxton–Parilla Sand/s’), which hosts the target mineralisation zone. This unit consists of a typically well sorted, fine to medium grained, quartz rich sand) and has an average thickness of 50m across the basin. The deposit has both sheet-style and strandline mineralisation within original fluvial, marginal marine and marine environments.

The site stratigraphy is summarised as follows:

- Topsoil/Quaternary - Loam and sandy clay – 5-10m thick;
- Loxton-Parilla Sand - Coarse-grained to gravelly quarts-rich sand – 35-55m thick;
- Geera Clay - Dark grey/black clay of low plasticity – 32-46m thick;
- Olney Formation - Dark grey/black silty clay of low plasticity – 13-25m thick; and
- Warina Sand - Coarse-grained sand with clayey interbeds, minor shale.

The Goschen site has a relatively simple lithology. From the geotechnical perspective the site lithology is relatively simple and can be described as topsoil over clays and silty sands with discontinuous areas of cemented sands which in places represent as weak and very weak sandstones. These layers have been considered as overburden and overly the mineralised fine to medium sand which is the layer that is of primary interest to the mining operation.

Additional information on site geology is provided in the Geotechnical Impact Assessment (pitt&sherry, 2023).

### 3.6.5 Soils

The Project's Soil & Land Resource Assessment (SLR, 2022) identified one soil map unit (SMU), a Calcic Red-Brown Calcarosol, in the Study Area, having been mapped according to the dominant Australian Soil Classification (ASC) soil type (Table 3). The Calcic Red Calcarosol and Calcic Brown Calcarosol soil types are dominant across the Study Area.

*Table 4 Soil types within the Study Area*

<table>
<tr><th>ASC Soil Type</th><th>Soil Type Group</th><th>Hectares</th></tr>
<tr><td>Calcic Red Calcarosol</td><td rowspan="2">Dominant</td><td rowspan="4">1,479</td></tr>
<tr><td>Calcic Brown Calcarosol</td></tr>
<tr><td>Eutrophic Red Chromosol</td><td rowspan="2">Sub-Dominant</td></tr>
<tr><td>Subnatric Brown Sodosol</td></tr>
</table>

It is possible that the "original" soil type across the entire Study Area was a Calcarosol, with the actual physical textural characteristics of the topsoil (A horizon) having changed through loss of fine clay particles due to wind erosion, resulting from the rabbit plagues of the late 1880's and 150 years of cultivation in the Mallee region, with minimum and zero tillage methods only adopted in the early 1980's.

The characteristics of the identified soil types are:

- Calcarosols are soils which are calcareous throughout the solum, or calcareous at least directly below the A1 horizon, or within a depth of 0.2 metres. Carbonate accumulations must be judged to be pedogenic. Calcarosols do not have a clear or abrupt texture contrast between the A and B horizons;
- Chromosols are soils with a strong texture contrast between the A horizon and B horizon where the B horizon is not strongly acidic or sodic; and
- Sodosols are soils with a strong texture contrast between the A horizon and a sodic B horizon which is not strongly acidic.

SLR (2022) undertook sampling and analysis of topsoil and subsoil materials from 14 detailed soil description sites. Soil physical and chemical attributes were analysed. A generalised summary of soils attributes in the topsoils and upper part of the subsoil profile, is as follows:

- pH ranges from neutral to very strongly alkaline in topsoils; and strongly alkaline to very strongly alkaline in subsoils;
- salinity (measured as $EC_e$) ranges from non-saline to slightly saline in topsoils; and non-saline to moderately saline in subsoils;
- texture ranges from sandy loam to clay loam in topsoils; and light clay to medium clay in subsoils;
- exchangeable sodium percentage (ESP) indicates non-sodic properties in topsoils; and non-sodic to sodic properties in subsoils. Deeper subsoils (nominally >50 cm depth) commonly have high ESP and high field

dispersion properties;

- dispersion rating as estimated by the Emerson Aggregate class is typically moderate in topsoils; and moderate-high in subsoils; and
- Ca:Mg ratios indicate predominantly balanced conditions in topsoils, tending to calcium deficient in subsoils. magnesium is not deficient.

The site backfilling plan intends to restore to as similar as possible the existing site geology and soil conditions. The plan identifies three discrete horizons of overburden, subsoils and topsoils that would be independently managed, separated and replaced in reverse order as part of the backfilling plan. Specific geotechnical and chemical/fertility aspects of each material have been acknowledged in developing the proposed soil amelioration plan.

A key management issue for operational stockpile management and rehabilitation is the soils dispersibility particularly associated with the subsoils. A comprehensive program of amelioration with gypsum is proposed to help minimise the impacts of dispersion and soil structural decline and optimise soil properties on return to rehabilitation areas.

### 3.6.6 Groundwater

Four regional hydrogeological units have been identified and are described in the Groundwater Impact Assessment (CDM Smith, 2023):

- Loxton Parilla Sands, which forms the main aquifer in the Study Area, with aquifer thickness ranging from 35 to 55 metres
- Geera Clay, which acts as an aquitard in the region, separating the Loxton-Parilla Sands and the underlying Renmark Group aquifer, with aquitard thickness ranging from 32 to 46 metres; and
- Renmark Group, consisting of the Olney Formation underlying the Geera Clay and the Warina Sand which forms an aquifer underlying the Olney Formation.

There are no licenced or stock and domestic bores domestic within 10 kilometres of the Study Area. All monitoring bores have recorded electrical conductivity (EC) of over 19,000 uS/cm (up to 44,100) and TDS of over 13,000 mg/L (up to 29,500) (CDM Smith, 2023), making the groundwater unsuitable for any agricultural or domestic use. The Project has been designed to minimise impact to groundwater, specifically by limiting extraction depths to above the watertable.

The Groundwater Impact Assessment does identify some groundwater mounding is likely due to tailings dewatering, but the mounding effects are generally localised around the mine pits. Potenital groundwater contaminants have been identified. Forward particle tracking shows that for a pre-defined period of 10,000 years the approximate zone of potential contamination in groundwater travels at a distance of 2 km. Leachability testing is still ongoing and testing and modelling to date is conservative. Potential impacts associated with groundwater dependent ecosystems (GDEs) were assessed, and it was concluded that the proposed mine is not expected to impact GDEs associated with nearby wetlands and water features such as Lake Lalbert, Avoca Marshes and other unnamed wetlands in closer proximity.

The assessment also considered groundwater fauna. Groundwater fauna are found in aquifers across Australia, predominantly in aquifers with large pore spaces, especially alluvial, karstic and some fractured rock aquifers. The size of the pore spaces is a key determinant of the suitability of an aquifer as stygofauna habitat. The assessment found that the aquifer environment beneath and surrounding the site is highly unlikely suitable for groundwater for reasons including the high groundwater salinity, small pore spaces and low permeability.

For additional details on the groundwater assessment refer to the Groundwater Impact Assessment (CDM Smith, 2023).

### 3.6.7 Surface water

The Project area has relatively low rainfall and is not in direct proximity to any waterways. CDM Smith (2023) describes the surface water drainage patterns of the Project area, indicating that surface water runoff within the Project area flows predominantly to the west. While there are more defined flow paths across Area 1 than Area 3, the runoff from both areas largely forms isolated pools in depressions and quickly infiltrates or evaporates.

Nearby waterways include:

- Murray River – North of the Project area; forms part of the Murray–Darling basin river system which drains most of the inland waterways in Victoria and New South Wales;
- Avoca River – Has a history of flooding. Significant events occurred in September 2010 and January 2011 which filled the Avoca Marshes and flowed through to Lake Boga. In 2016-17 flooding occurred in the region, flooded the Avoca Marshes, up to Second Marsh. In 2022-23 flood waters filled the Avoca Marshes and flowed through to Lake Boga, similar to the 2010-11 event. The river is an anabranching system, with the majority of floodwater leaving the river downstream of Charlton and spreading across the floodplain and through various anabranching waterways;
- Back Creek – Part of the Avoca floodplain and is one of its anabranching waterways. It also drains a large local catchment to the west of the Avoca River and flows back into the Avoca River system at the Avoca Marshes; and
- Lalbert Creek – An effluent stream of the Avoca River, carrying flood flows to the terminal lake systems of Lake Lalbert and Lake Timboram. Lalbert Creek also drains a large local catchment.

Lalbert Creek and Back Creek catchments intersect the Project area. Lalbert Creek catchment intersects the south western corner of Area 1. Back Creek originates on the eastern boundary and flows in an easterly direction into Avoca River system. The local catchment is gently undulating, with a large, raised dune running north–south through the middle of the tenement areas. Due to the low rainfall, sandy soils with high infiltration and gradually sloping land surface, the formation of natural waterways appears to be inhibited.

There were once many stock and domestic channels that bisected the retention area delivering water to the region. These channels were fed from the GWM Water storages, as well as runoff from the nearby tributaries during flooding events. They were typically distribution channels and, although they cover a large area, do not have their own catchments. The larger of them included the Wychitella, Harpers, Nullawil, Kings and Kalpienung channels, all with small spur channels which were used to connect to farm dams. Most of these have been decommissioned, with water supplied to the area via pipelines (as part of the Northern Mallee Pipeline). Within the mine site all former drainage channels have been filled in.

The site does not possess complex or challenging drainage conditions for consideration in the final landform. The goal is to restore sheet flow conditions for all parts of the rehabilitated landform. This is represented in Figure 13 and Figure 14 which indicate the proposed final landform contours, which are similar to the pre-existing contours.

With reference to the Environmental Reference Standard under the Environment Protection Act 2017, the goal is to ensure that the development and rehabilitated landscape do not adversely impact areas external to the mine area. This includes ensuring the mine construction, operation or decommissioning does not:

- Cause a reduction in water quality at any sensitive receptors/beneficial uses/environmental values. i.e. decreased water quality in waterways;
- Cause a decrease in water quantity at sensitive receptors/beneficial uses/environmental values. i.e. decreased water availability for native vegetation/dams;
- Cause an increase in water quantity at sensitive receptors/beneficial uses/environmental values. i.e. increased inundation depth in cropped paddocks, roads, houses, sheds etc.

### 3.6.8 Vegetation

The study area largely supported red brown sandy soils, across a landscape of undulating inland jumbled dunes (Nature Advisory, 2022). The vast majority of the study area comprises private farmland, most of which supports extensive areas of cereal cropping, namely wheat. Linear stretches of remnant native vegetation existed commonly along public roads, as well as along farm lanes and fences separating farm properties. Few large remnants of native mallee vegetation occurred in private land, ranging in size from 5 and 20 hectares. Numerous scattered trees dotted farmed paddocks, most of which were old multi-stemmed mallee eucalypts, although Buloke and Slender Cypress Pine were occasionally recorded.

Mallee comprised the vast majority of the native vegetation recorded in the study area, occurring on red sands throughout the central and eastern parts of the site. The western portion of the study area was on the edge of a floodplain and supported a healthy canopy of large Black Box trees over a chenopod dominated understorey. Small, scattered occurrences of Buloke Woodlands existed in the western and northern parts of the study area.

Pre–European EVC mapping (DELWP 2021a) indicated that the study area and surrounds would have supported Ridged Plains Mallee (EVC 96), Woorinen Mallee (EVC 824), Plains Savannah (EVC 826), Riverine Chenopod Woodland (EVC 103) and Semi-arid Woodland (EVC 97) prior to European settlement based on modelling of factors including rainfall, aspect, soils and remaining vegetation. Based on site surveys undertaken by Nature Advisory (2022) as part of detailed flora and fauna assessments of the site, it is evident that Woorinen Mallee (EVC 824) was considered to be the most dominant remnant vegetation type in the study area. This EVC was largely distinguished by the occurrence on red-brown sandy soils and where chenopods formed the dominant life form in the ground layer.

# 4. Stakeholder identification and community engagement

Consultation and stakeholder engagement has been undertaken for the project with a broad range of community participants and stakeholders. Consultation is ongoing and has in the past involved community information sessions at Lalbert, Kerang and Swan Hill. Rehabilitation and closure have been topics of interest raised by stakeholders and community members at various events over the last 18 months.

Issues raised include:

- Concerns over the ability to successfully rehabilitate the land to restore productive agriculture, including requests for examples of where this has been achieved successfully;
- Concerns over final landform linked to differential settlement, and impacts on agricultural potential and drainage;
- Soil management and topsoil restoration; and
- Legal obligations to rehabilitate the land and adequacy of government-held bonds.

The Draft Rehabilitation Plan considers the matters raised by stakeholders and outlines the rehabilitation procedures, monitoring and quality assurance processes that will ensure the desired final land use is achieved. The Draft Rehabilitation Plan will be exhibited for stakeholder review and feedback. Any queries or concerns raised will be addressed with subsequent documentation and engagement.

# 5. Proposed post-mining land uses and post-mining landform

## 5.1 Proposed post-mining land use

The proposed post mining land use is agriculture, and this occurs across the area to be disturbed by mining with the exclusion of areas of retained native vegetation, and public infrastructure such as roads that would be restored. The exact nature of the agricultural use is not prescribed and would be open to decisions by future land owner or occupiers. Fundamentally, the goal of rehabilitation is to restore land disturbed by mining to an equivalent (or better) agricultural land capability to enable a broad range of future agricultural uses. Existing public roadways that would be temporarily closed by mining would be reconstructed and recommissioned for public use within 2 years of conclusion of mining.

A post mining agricultural land use has been identified as an appropriate and desirable outcome and has been insisted on based on feedback from community and stakeholder engagement. VHM is committed to achieving this objective and this Draft Rehabilitation Plan demonstrates the rehabilitation procedures, monitoring practices and closure obligations that will ensure these objectives are met.

The site landform, soils and hydrology present relatively limited constraints to achievement of this final land use. The site landform is very flat; therefore, the final landform and topography is well understood and relatively simple to recreate. The Site contains no watercourses and hence the proposed mining and final landform present minimal drainage and water quality risks. Soils have been thoroughly investigated and though soils constraints do exist with respect to alkalinity, structure, sodicity and salinity, mitigation methodologies are available and are readily implementable. Specific topsoil and subsoil handling procedures have been developed to ensure preservation of the site's valuable soils resources.

## 5.2 Post-mining landform

### 5.2.1 Landform description

The post-mining landform is to be a gently undulating plain which is consistent with the existing landform. The goal is to restore final landform levels and local relief similar to current conditions, avoiding sharp relief between the existing and rehabilitated landscapes. The landform element that best represents the existing landscape is a plain, based on the definitions in the *Australian Soil and Land Survey Field Handbook* (National Committee on Soil and Terrain, 2009).

Key design criteria for the final landform are:

- Final levels are within +/- 0.5 m of existing levels when averaged across the mining blocks;
- Landform gradients will be typically less than 3% across agricultural areas and avoid sharp relief between rehabilitated landscapes and surrounding lands;
- Drainage will be predominantly as sheet flow mirroring present conditions; and
- Topsoil and subsoil profile restored to minimum 1m deep comprising at least 20cm of topsoil and 80 cm of clayey subsoil material.

This proposed final landform is readily achievable and has been comprehensively assessed within the *Goschen Mineral Sands and Rare Earth Project Geotechnical Impact Assessment* (pitt&sherry, 2022), which addresses factors including settleability of tailings and overburden, and provides a backfill sequence to achieve the desired final levels. Design of the mining methodology and sequencing of operations has been developed with a core focus on achieving a backfilled landform consistent with current conditions.

The proposed final landform is safe, stable and sustainable. It presents a very low relief environment with no steep gradients or unstable slopes, no watercourses and no complex landforms to reinstate. The very low site gradients and low erosion hazard of the region indicates a very low risk of instability of the final reconstructed landscape. The final landform would support a range of potential agricultural uses consistent with the agricultural activities that occur throughout the region.

Figure 13 and Figure 14 represent the proposed final landform with topographic contours describing the very gentle slopes and absence of sharp relief or incised drainage lines.

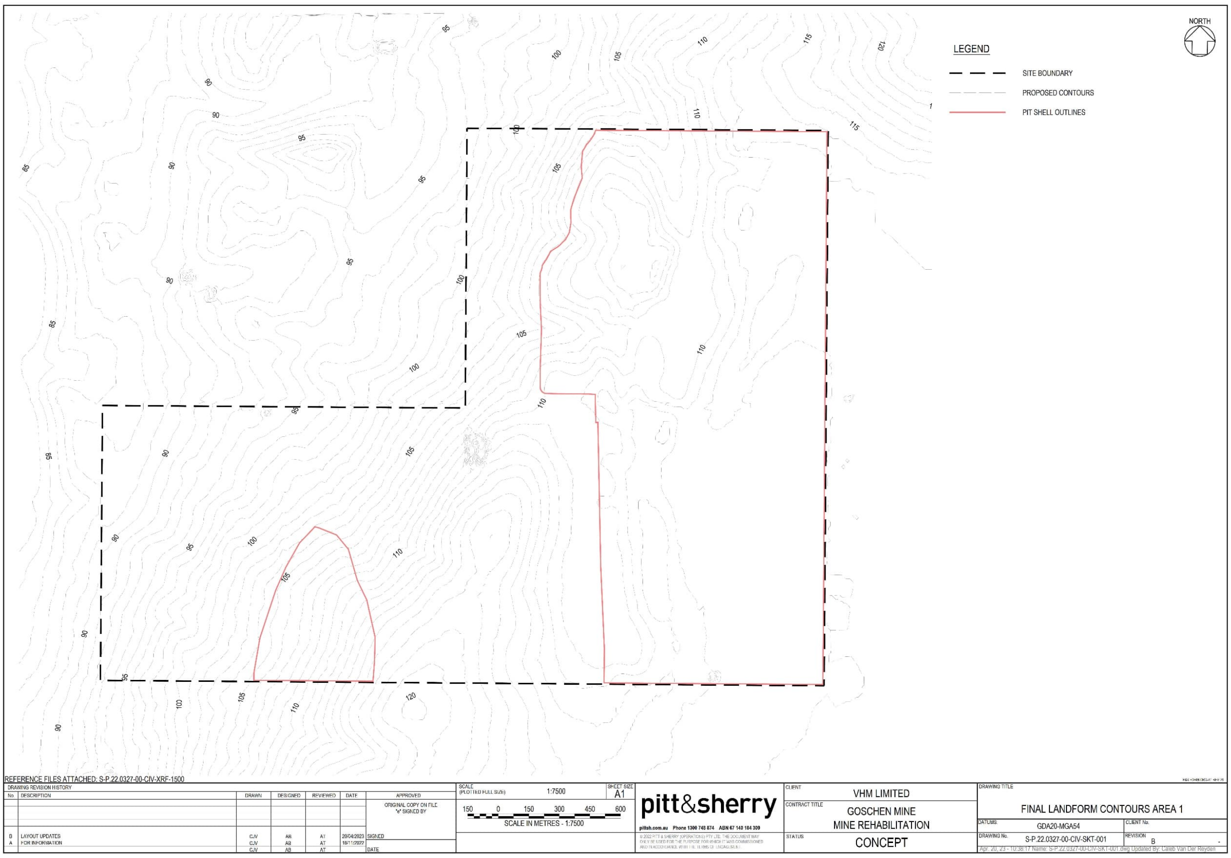


*Figure 13 Area 1 Final Landform Contours*

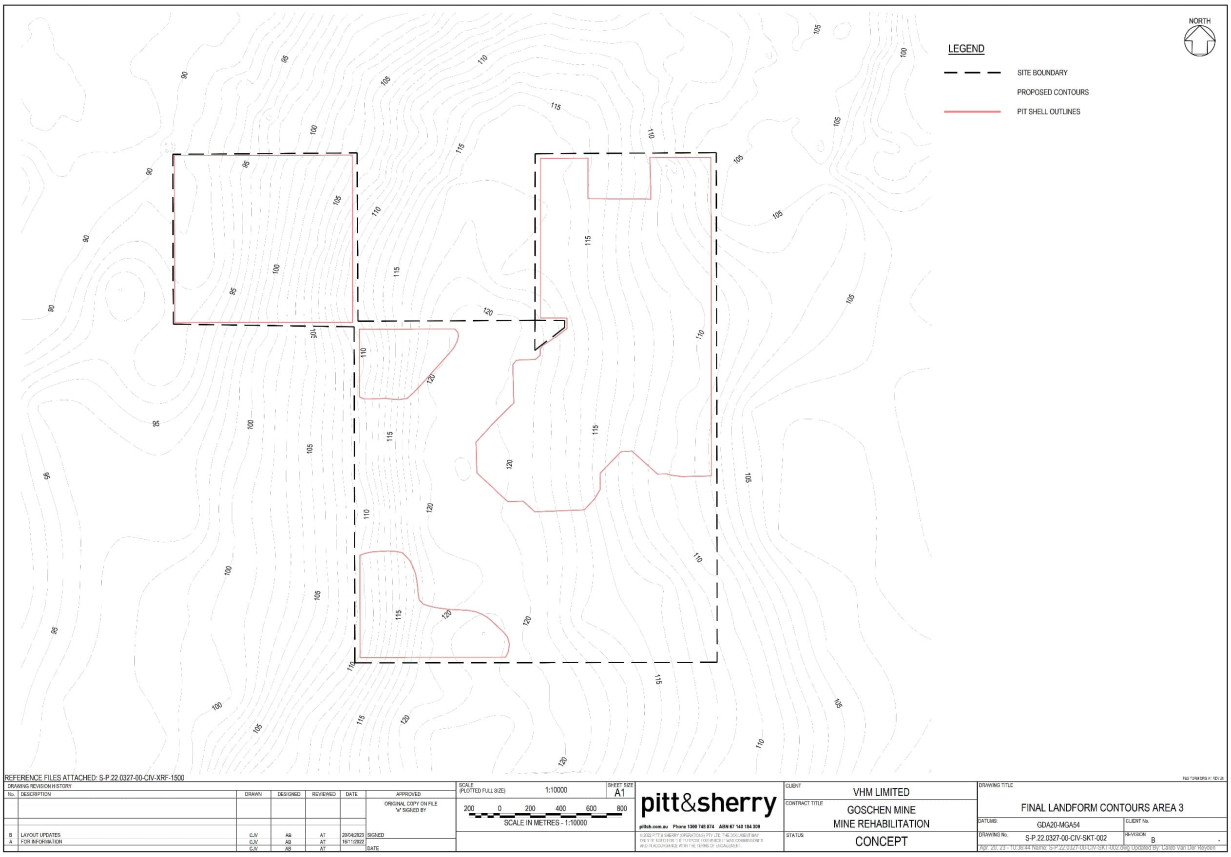


*Figure 14 Area 3 Final Landform Contours*

### 5.2.2 Risks to achieving final landform

The main risks to achieving the final landform relate to uncertainty over settlement and deformation during tailings and overburden emplacement within mine cells. Differential settlement in the backfilled mining cells could result in a landscape with hummocky or irregular topographic features including poorly drained or closed depressions, or deformation features such as tension cracks.

The geotechnical modelling and analysis undertaken by Pitt & Sherry (2022) included assessment of potential impacts due to deformation and settlement with mitigation measures to reduce the risk to as low as practicable. A summary of the geotechnical approach and findings is as follows:

- The assumption is that rehabilitated areas will be returned to the original landform as broad acre farming. Ground movement of the rehabilitated area may result in harm of the landform through settlement of the underlying replaced material;
- The Goschen mine has adopted a cyclic approach to mining. As mining advances and an area of the pit is excavated it is then prepared as tailings containment cells. Each tailings containment cell is filled with tailings over a period of months until it reaches its design capacity. During filling the tailing settles, and as more tailings are deposited it continues to settle as the water content is either decanted off for reuse or seeps into the pit floor. Once the tailings reach sufficient strength overburden is placed on the tailings as part of the rehabilitation process. The load of the overburden on the tailings continues to compress the tailings;
- The risk of soil /ore extraction and loss impacting the proposed final landform was considered from a mass balance perspective and determined to be negligible. As a rough estimate, approximately 3% of the ore zone would be taken through ore processing to produce the mineral concentrate. This is a very small proportion (<1.5%) of the overall profile depth and this loss would be offset by bulking of the tailings and overburden during backfilling. The likelihood is there will be an excess of material resulting in a slightly elevated landscape relative to present.

- The settlement of the tailings and overburden reduces over time and is negligible after about 1 year from initial placement; and
- The tailings are more compressible than the material used to construct the tailings bund and where the overburden crosses from the tailings to the tailings bund there is a risk of differential settlement. Analysis of the settlement over time in the zone of tailings and overburden and of overburden and tailing bund indicate that differential settlement will be low, less than 100 mm and that the transition will have a gradient of 1 in 500. This is less of a gradient change than is observed in the pre mining landscape (refer Figure 15).

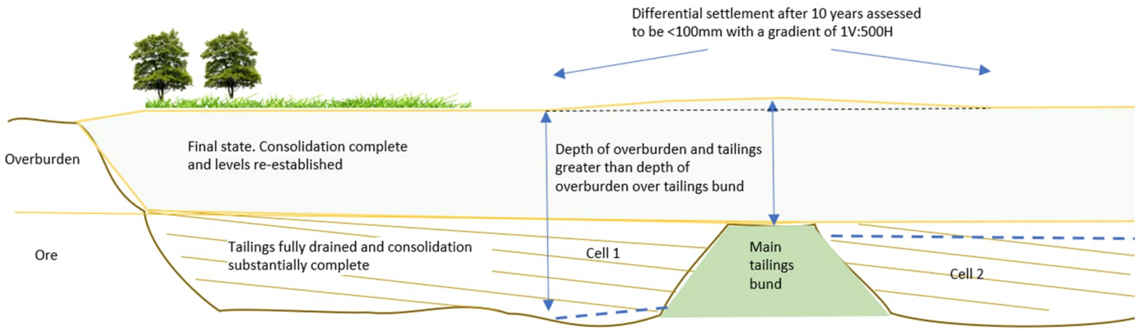


*Figure 15 Schematic cross section of the rehabilitated landform at closure*

- The severity of the differential settlement is assessed as minor. Normal soil cultivation for cropping is likely to obscure the actual affect. There is not expected to be any risk of harm to people or environmental harm. Land use harm is expected to be minor and manageable;
- Possible impacts could be minor impact on overland flow paths leading to minor impacts of the broad acre farming. The large scale cell size and existing site cross fall will assist in mitigation;
- The mine life is in the order of 20 years. During this time for most cells the majority of the consolidation cycle will have occurred, and the mine will review the final landform as part of its Draft Rehabilitation Plan; and
- For limited areas where settlement is likely to continue post closure the mine would maintain a monitoring program and undertake limited regrading of the final landform (if required) and in accordance with the Draft Rehabilitation Plan. Any regrading would need to be carefully planned and implemented to avoid loss of topsoil.

Another risk considered is that there will be an excess of backfill material resulting in a final landform that is higher than present. This could occur due to bulking of backfill material causing an increase in volume and reduction in bulk density of the material. Geotechnical investigations have considered this and suggest this is unlikely. If there is a small excess of overburden towards the end of mining, a reasonable management approach would be to spread the overburden uniformly within the final backfill cells to create an area of slightly elevated land. This would not compromise achievement of final land use goals.

Given the progressive nature of mine backfilling, factors like the time taken to consolidation, consolidation testing, and design of overburden placement lift thickness will be monitored. There is ample opportunity to monitor, adapt and change backfilling methods through the course of mining operations to optimise performance and address any concerns about achievement of the final rehabilitation goals.

# 6. Rehabilitation domains

## 6.1 Domain identification

Four (4) rehabilitation domains have been identified which group mining areas based on similar mine-related impacts and subsequent rehabilitation requirements. The domains are Processing and Infrastructure areas, Active Mining Areas, Stockpiles, and Services and Transport Corridors. Each has different rehabilitation requirements based on the nature of mining activities and disturbance, with a final land use of agriculture except for those areas that would be reinstated as public roads.

A summary of these domains and key rehabilitation tasks is provided in Table 5. The rehabilitation domains are presented in Figure 16 and Figure 17.

*Table 5 Rehabilitation domains*

| Domain | Coverage | Key rehabilitation activities |
|---|---|---|
| 1 | **Processing and Infrastructure Areas:**<br>• Process Plant – MUPs etc<br>• ROM stockpile<br>• Workshop/Admin/Lab<br>• Water Treatment<br>• Haul Roads<br>• Hardstands; and<br>• Water Storage Dams. | • Decommissioning and removal of infrastructure and utilities<br>• Waste removal, contamination assessment and remediation<br>• Backfill excavations (eg dams) and rip hardstands<br>• Removal of temporary environmental and drainage controls<br>• Soil replacement and revegetation<br>• Reinstatement of public roads and other infrastructure (eg fences); and<br>• Retention of infrastructure (eg roads, dams, hardstands, water supply infrastructure, electrical / telecommunication services) where agreed for the final land use. |
| 2 | **Active mining (pit) areas:**<br>All mine cells (pits) which also service as tailing storage/disposal. | • Removal of infrastructure and services<br>• Controlled backfill with tailings, overburden, subsoil and topsoil<br>• Soil preparation and revegetation<br>• Removal of temporary environmental and drainage controls. |
| 3 | **Stockpiles:**<br>• Overburden<br>• Subsoil; and<br>• Topsoil. | • Stockpile removal<br>• Soil replacement and revegetation<br>• Reinstatement of public roads and other infrastructure (eg fences); and<br>• Removal of temporary environmental and drainage controls. |
| 4 | **Services and Transport Corridors:**<br>• External water supply line from Kangaroo Lake<br>• Public roads | • Rehabilitation of areas disturbed during installation of water supply pipeline (construction stage)<br>• Removal of underground water supply lines except where agreed to be retained (decommissioning stage)<br>• Soil preparation and revegetation as appropriate<br>• Reinstatement of public roads and other infrastructure (eg fences) subject to any required further design and local authority approval |

| | | |
|---|---|---|
| | | • Reinstate roadside native vegetation in accordance with relevant Ecological Vegetation Class (EVC)<br>• Replace boundary fencing |

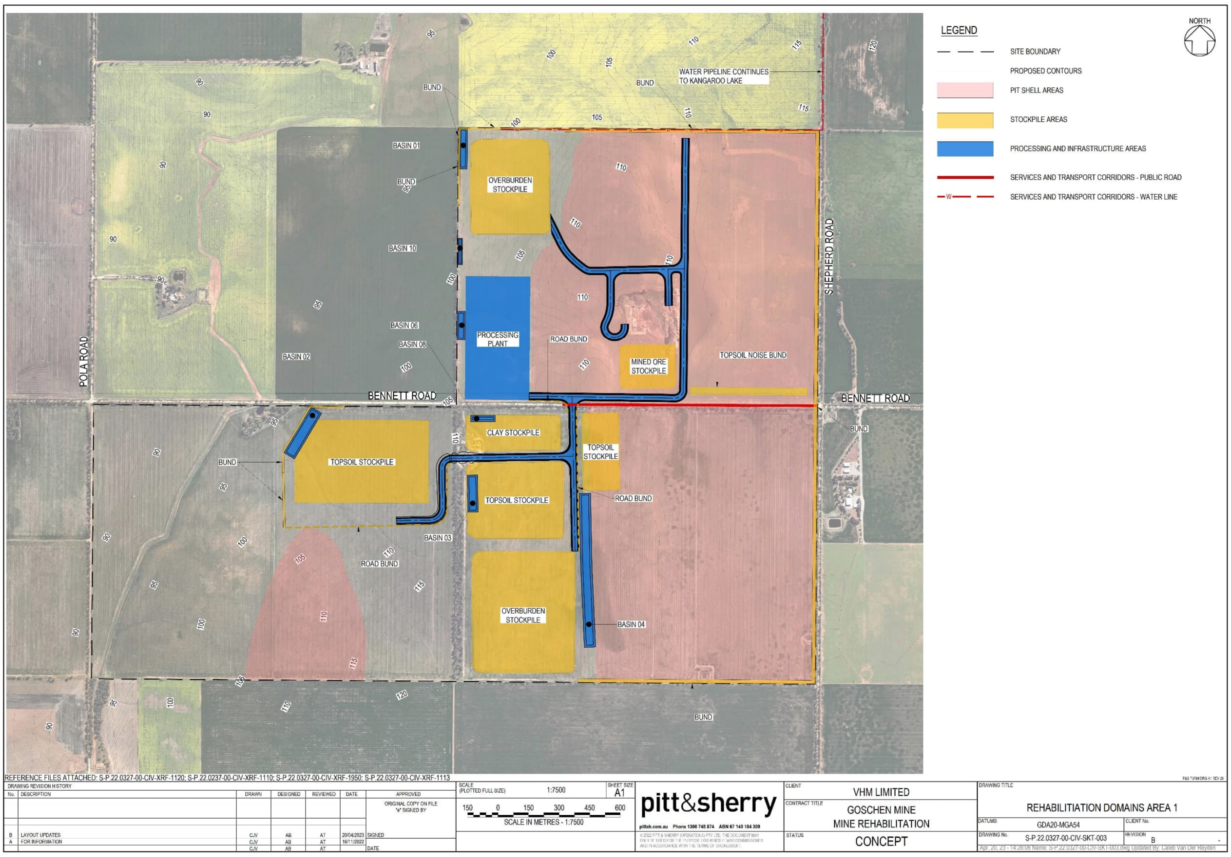


*Figure 16 Area 1 Rehabilitation Domains*

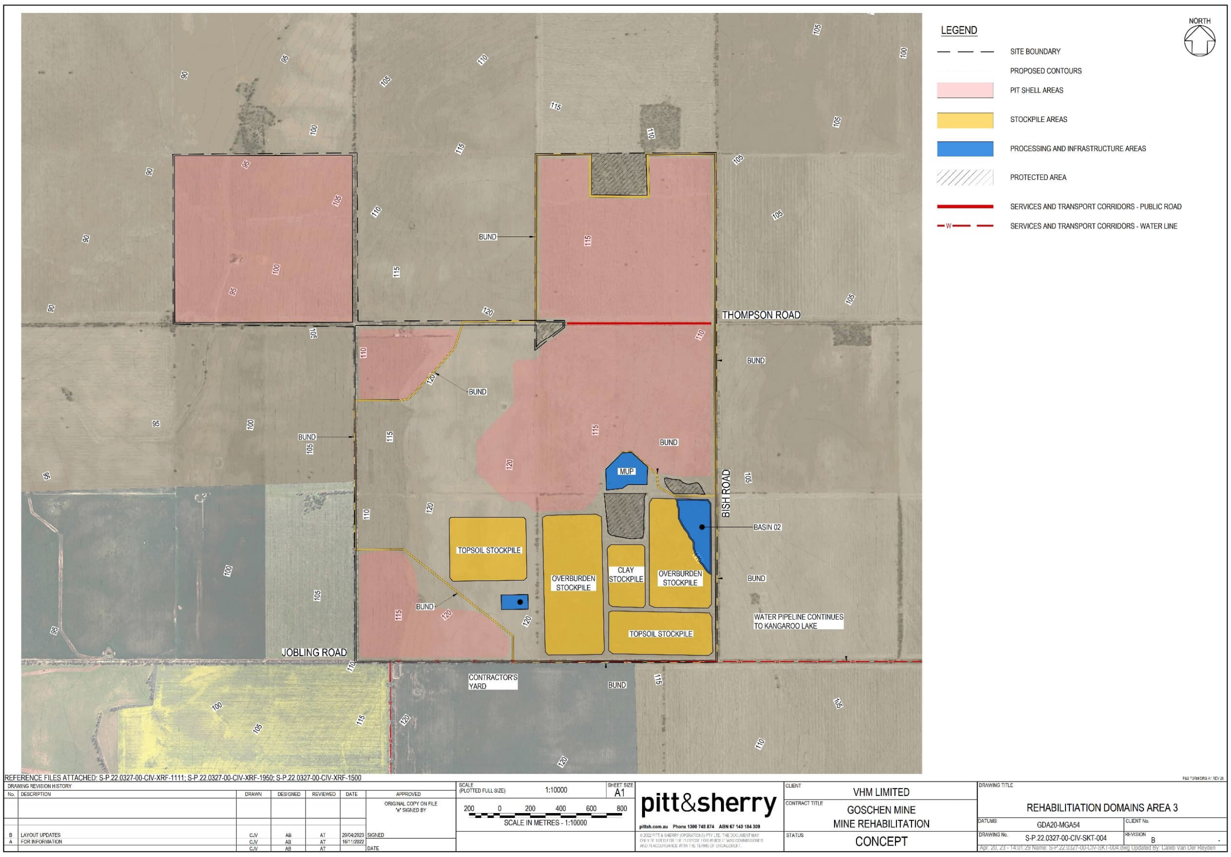


*Figure 17 Area 3 Rehabilitation Domains*

## 6.2 Rehabilitation methodology overview

This section provides an overview of the approach to rehabilitation including the sequence and methodology for key processes. Key risks identified through the environmental impact assessment process are addressed, in particular those related to geotechnical aspects, soils and weeds. Detailed rehabilitation methods would be developed and refined during mining operations and this plan updated accordingly.

### 6.2.1 Decommissioning

Decommissioning for the VHM Goschen Site will include activities associated with removing mining infrastructure and the removal and/or remediation of contaminants and hazardous materials if required. It is assumed that all fixed plant, buildings, mine roads and water storage infrastructure will be completely decommissioned and removed prior to, or during the mine closure process. If desired certain infrastructure such as water supply lines and electrical infrastructure may be retained to assist the future land use where agreed with future land owners.

A Decommissioning and Closure Management Plan will be developed to guide activities at the end of the mine operations and detail the resources needed to undertake those activities. The plan will include the process for undertaking decommissioning and closure activities, complying with all legal obligations and communicating to minimise the risk of safety and environmental incidents. In addition, the Decommissioning and Closure Management plan will outline how any infrastructure remaining at the end of the mining lease is to be managed and financed into the future, and provide opportunity for the community and other stakeholders to provide input.

Generally, the Decommissioning and Closure Management Plan will address the following:

- Before demolition, all infrastructure should be evaluated in terms of the presence of hazardous substances and land contamination, and appropriate management strategies developed to protect employees, the public and minimise potential environmental harm. This includes the identification of the various waste streams and development of management strategies in accordance with the appropriate waste legislation;

- Decommissioning risk assessment;
- Inventory of all salvageable equipment and resources;
- Waste management strategy identifying waste types, indicative quantities, disposal and recycling practices for all materials, and suitable disposal locations;
- Decommissioning and demolition plans with costings;
- Telecommunications, water supply and other services to be disconnected and removed unless agreed to remain. Services removal to adopt techniques that minimise additional land disturbance and ensure prompt stabilisation and restoration of final landforms to support the desired land use;
- A plan for reconstruction of local roads closed by mining. This would address matter such as collecting and storing materials useful in future rehabilitation (e.g. pavement material, roadside habitat such as logs, stumps and vegetation, collection of local seeds and raising of tubestock for native vegetation replanting), and replacement of fencing. Detailed design of roadways and approvals required from local roads authority;
- Where services are buried (e.g. pipelines, cables) and their retrieval may lead to further unacceptable disturbance, the infrastructure may be left in situ if agreed with the relevant authority (subject to any necessary approvals or agreements) if they don't pose constraints to the final land use. In this situation, the location of the services will be surveyed and marked on the site plan and a suitable caveat developed to provide that they are readily identifiable for future land holders;
- Fuel and other hazardous materials stores to be decommissioned and removed, and contamination assessments undertaken to identify remediation requirements for any contaminated soil or water resources; and
- All buildings, fixed plant and other infrastructure that are not required as part of the final land use will be demolished and removed. Demolition will be carried out in accordance with the AS 2601—2001, *The demolition of structures*; and
- A closure plan for tailings storage facilities is a requirement under the ANCOLD guidelines and would be prepared in an updated version of this document for submission with the final Work Plan to ERR, and prior to commencement of construction. Aspects of the tailings closure plan are expected to overlap significantly with and utilise information from this Draft Rehabilitation Plan.

### 6.2.2 Soil stripping and handling

For infrastructure areas only topsoil would generally be stripped. Development of the mine cells involves stripping of nominally 20 m depth of overburden including an upper soil profile comprising clay subsoils and topsoil. Overburden, clay subsoil and topsoil will be directly emplaced in rehabilitation cells as a general rule to minimise double handling and minimise potential for material decline during extended stockpiling. When stockpiling is required, materials will be separated into their respective layers and stockpiled in dedicated areas with a focus on preserving quality of the clay subsoil and topsoil material for future rehabilitation. The mine plans for Area 1 and Area 3 depict the proposed stockpile locations though this may vary during detailed mine planning.

Consistent with advice provided in the Soils and Land Resource Assessment (SLR, 2022) the following process would be applied to topsoil and subsoil stripping and handling. Soil should be stripped in a slightly moist to moist condition, whereby soil is pliable when hand texturing (15-30% soil moisture) wherever possible. Material should not be stripped in either an excessively dry, powdery or very friable when hand texturing (<15% moisture), or wet condition, loses integrity when hand texturing or leaves mud on hands (>30% moisture). Stripping operations should not be undertaken during excessive dry periods to prevent pulverisation of the natural soil aggregates. Similarly, stripping during wet periods should not be undertaken to prevent damage of the resource through compaction by equipment. Given the normally dry climate, consideration should be given to stripping and stockpiling large areas of topsoil when soil moisture conditions are favourable. This is primarily applicable to the upper 1 m or so of the profile that will be utilised for future soil restoration.

To reduce soil degradation during stripping operations preference should be given to using equipment which can grade or push soil into windrows such as graders or dozers for later collection by open bowl scrapers or for loading into rear dump trucks by front-end loaders or excavators. This will minimise compaction impacts of heavy equipment that is often necessary for economical transport of soil material. These techniques are examples of preferential, less aggressive soil handling systems which may be adopted.

All soils removed should be placed in designated stockpile areas if they cannot be directly applied to rehabilitation areas. Freshly stripped and placed topsoil retains seed that is more viable and a greater number of micro-organisms and nutrients, than does stockpiled soil. Vegetation establishment is generally improved by the direct return of topsoil and is considered 'best practice' topsoil management. Should long term storage stockpiles be proposed accurate records are required, indicating stockpile volumes and areas to be covered by each stockpile upon rehabilitation and final decommissioning. Where possible soil stockpiles could be utilised as long-term batters or bunds to facilitate noise, visual screening and surface water diversion where required. If sodic soils are used for this purpose they would be first ameliorated (with gypsum) and vegetated to minimise the risk of dispersion, erosion and turbid stormwater runoff.

Based on the soil survey (SLR, 2022) the following stripping depths are recommended:

- Strip topsoil to a depth of 20 cm. Topsoil would be stripped from all disturbance areas, including haul roads, infrastructure areas and subsoil stockpile locations. Stripping to 20 cm is deeper than some of the existing topsoils and will collect some of the heavier (clay textured) and more sodic subsoils. The benefit is an increase in clay content and water and nutrient holding capacity of the existing lighter sandy loams and loam topsoils. Although there will be a slight increase in sodicity this can be mitigated by the application of gypsum prior to stripping works being undertaken; and
- Strip subsoil from mining areas only to a depth of 1.0 m (80 cm thick layer). Subsoil clay would be stockpiled separately to topsoil and used to restore a rehabilitated soil profile depth at least 1.0 m thick.

Management and mitigation strategies recommended for implementation as appropriate to reduce degradation during stripping and stockpiling operations include:

- Prior to stripping, topsoils should be treated with gypsum as described in Table 6;
- Where possible, freshly stripped subsoil and topsoil should be re-spread directly onto rehabilitation areas. Topsoil to be spread, treated with fertiliser and seeded using equipment that will minimise the potential for compaction and also topsoil loss to wind and water erosion;
- Locations and nature of material in stockpiles recorded using GPS along with data relating to the soil type and volume and any soil treatment/amelioration. An inventory of available soil maintained and updated regularly to ensure adequate topsoil and subsoil materials are available for planned rehabilitation activities;
- Develop a soil model that can be used with GPS guided stripping equipment (e.g. grader/dozer) to accurately strip the precious resource and assist with recording soil volumes and storage locations;
- The surface of soil stockpiles should be left in as coarsely structured condition as possible to promote rainfall infiltration and minimise erosion prior to cover vegetation becoming established. The coarse structure will also prevent anaerobic zones forming;
- Maintain a maximum stockpile height for subsoil and topsoils of two metres with shallow batter angle (<1:5) for ease of access and management;
- Topsoil and subsoil stockpiles are to be stored separately;
- Storage time should be minimised, where possible. If long-term stockpiling is planned (greater than 12 months), stockpiles should be seeded with an annual cover crop species. A rapid growing and healthy annual pasture sward provides sufficient competition to minimise the emergence of undesirable weed species. The annual pasture species will not persist in the rehabilitation areas but will provide sufficient competition for emerging weed species, enhance the desirable micro-organism activity in the soil and minimise the erosivity potential of the stockpile;
- Subsoil and topsoil are spread to depths according to target requirements;
- Stockpiles should not be disturbed until required for rehabilitation, weed management, erosion control or for seeding and fertilising purposes;
- The surface of all stockpiles should be treated with the ameliorants shown in Table 6, which will create the most

suitable growth medium for the chosen rehabilitation pasture species. Topsoil that is treated with gypsum prior to stripping will not require additional treatment of stockpile surfaces; and

- Gypsum rates of 10 tonnes per hectare are recommended where ESP is greater than 14 (i.e. strongly sodic) which will apply to the majority of stripped and stockpiled subsoil. The gypsum sourced should have a minimum 19% calcium and 15% sulfur (SLR, 2022).

### 6.2.3 Soil amelioration

The Soil and Land Resource Assessment (SLR, 2022) provides recommendations for soil amelioration to counter the effects of sodicity. Accordingly, to maximise soil fertility and address sodicity constraints, it is recommended that soil amelioration be undertaken during stripping, stockpiling and material spreading as detailed in Table 6.

*Table 6 Soil amelioration by rehabilitation phase*

| Ameliorant | Topsoil | Subsoil |
|---|---|---|
| **Soil stripping:** | | |
| Gypsum | 5 T/ha<br>(10 T/ha if ESP>14) | n/a |
| **Stockpile surface:** | | |
| Gypsum | n/a | 10 T/ha |
| Granulock 15 (or similar) | 80 kg/ha | 80 kg/ha |
| **Re-spread materials:** | | |
| Gypsum | n/a | 10 T/ha |
| Granulock 15 (or similar) | 120 kg/ha | 120 kg/ha |

### 6.2.4 Soil replacement

In infrastructure areas affected by creation of hardstands (roads, building pads etc), it is recommended that hardstand material be deep ripped and ameliorated prior to topsoil placement to a minimum depth of 20cm. Mining areas would be finished with a reinstated soil profile comprising 80 cm of subsoil and 20 cm of topsoil as described previously. Soils would be ameliorated during re-spread in accordance with the guidance provided in Table 6.

Subsoils may need to be ripped or scarified during amelioration and prior to topsoil replacement to key the topsoil in and prevent a hardpan developing at the topsoil/subsoil interface. This would be assessed in practice and if necessary incorporated into the rehabilitation methodology.

Contour scarification of topsoil is suggested to incorporate soil ameliorants into the plant rooting zone (to a depth of 100 mm) and to provide a suitable seedbed for direct seeding. A roughened soil surface also increases rainfall infiltration, reduces run-off and provides a micro-habitat allowing plants to germinate and establish. Where possible ripping and scarification will be undertaken when the soil is moist to minimise structural decline and immediately prior to sowing.

Soils will be tested, and additional fertilisers or ameliorants added as necessary to address any deficiencies.

### 6.2.5 Erosion control

The water erosion hazard in rehabilitation areas is expected to be very low due to the low rainfall conditions and flat site gradients. Conventional erosion control techniques would be appropriate and include:

- amelioration of dispersive soil with gypsum as outlined earlier to minimise the risk of dispersion and hardpan creation, and so maximise opportunity for surface infiltration of rainfall. This in turn will reduce the amount and velocity of surface water runoff;
- leaving the topsoil surface in a loose, roughened condition (e.g. by scarification) to increase infiltration and reduce runoff; and
- establishing ground cover vegetation promptly following completion of rehabilitation works to prevent raindrop and sheet erosion of the overburden emplacements. This would include a sterile cover crop for temporary stabilisation, even if that species will not form part of the final, permanent vegetation. Cover crops may need to be resown where there is a delay in handing areas back for farming

### 6.2.6 Revegetation of agricultural areas

Revegetation for the purpose of rehabilitation and closure prior to hand-back would be aimed at achieving a desirable surface cover of annual and perennial grasses to protect the soil surface and restore the land to productive agriculture. Revegetation methodologies would be developed and would include revegetation trials undertaken within the earliest mining rehabilitation areas. The trials would test different revegetation species, seeding times and rates, and application methods. Success and failure factors would be investigated and fed into an adaptive management program to develop preferred revegetation methodologies.

Revegetation methods would be developed based on first-hand knowledge of local landholders and agronomists. The methodology would need to address the significant revegetation challenges posed by the site's dry climate with a short growing season during autumn and winter. Revegetation during summer would generally not be prudent except during unseasonal wet conditions or where supplemental watering can be provided. Watering may be required at any time of year.

Initial advice suggests that revegetation of rehabilitated landforms and temporary stockpiles could be achieved using a suitable winter active cover crop such as ryegrass sown in autumn. Sterile cover crops may be needed to avoid seed set where the cover crop species is not desirable in the final vegetation mix. Within final rehabilitation areas legumes would also be sown to provide nitrogen fixing to improve the health of pasture. Perennial pastures may be provided to provide longer term stability. Once rehabilitated, VHM would seek to restore active agriculture over former mining areas through appropriate arrangements and would ensure the revegetation program is targeted to achieving this end.

### 6.2.7 Roadside restoration and revegetation

Although relatively small in area, mining would impact some existing public roads and adjacent roadside native vegetation. VHM commits to reinstating public roads post mine closure to the satisfaction of the local roads authority. This would include replacing boundary fencing. A Decommissioning and Closure Management Plan will be developed to guide activities at the end of the mine operations and detail the resources needed to undertake those activities. This plan would detail the activities required to reinstate the public roads.

Revegetation to restore native vegetation disturbed by the project, will be limited in extent mainly to the woodland and grassland communities adjacent public roads closed by mining, and along the corridor disturbed by water pipeline installation. In these areas VHM commits to restoring native vegetation consistent with the representative ecological vegetation classes (EVC) as agreed through the EES process.

During removal of the roads in preparation for mining it is important to preserve materials that will be useful in future rehabilitation. This could include pavement material, roadside habitat such as logs, stumps and brush, collection of local seeds and raising of tubestock for native vegetation replanting, and even fencing materials for reuse. Where appropriate, weed free topsoil from the roadway reserves should be stored separately for reuse in rehabilitation of these areas. Weed infested topsoil may not be appropriate for reuse and should be segregated.

### 6.2.8 Weed and pest management

Weeds present a risk to rehabilitation through competition with target species. A targeted weed control program will reduce the long term cost of weed control and help ensure successful rehabilitation. The *Invasive Plants and Animals*

*Policy Framework* is the Victorian Government's approach to the management of existing and potential invasive species and will be incorporated into the Project's relevant weed and pest management plan.

Weed control is necessary at various stages of mining and rehabilitation:

- **Prior to topsoil stripping**. Weed control will occur in areas that are yet to be mined if they are not under agricultural production to prevent seed set prior to topsoil stripping;
- **On stockpiles**. Weed control on stockpiles should occur biannually as required, during autumn/winter and spring/summer. Sowing of suitable pasture species or cover crop on stockpiles will provide competition for weed species and help minimise weed invasion. Develop a revegetation plan that allows for weed management. For example, Sow only grass species (monocotyledons) or legumes (dicots) on stockpiles to allow use of selective herbicides; and
- **Rehabilitation establishment**. Weed control to be undertaken as required during rehabilitation including soil replacement and revegetation.

Herbicide use for weed control would be in accordance with a weed management plan and agronomist advice, which would be reviewed and adapted as necessary during operations.

Weed surveys would be undertaken at least annually. An inventory should be maintained of weed inspections, target weed species and weed control actions.

Weed management should be addressed within a broader Vegetation Management Plan prepared as part of the operational management plans for the site post approval. The Vegetation Management Plan would address protection of remnant native vegetation, weed management and revegetation with pasture and/or crop species.

All equipment or machinery particularly from interstate or overseas will follow the standard procurement safeguards and quarantine procedures as per Victorian and Australian requirements from the Biosecurity Act 2015. Once on site the vast majority of equipment to be used for the Project will be site-dedicated and pose no biosecurity risk.

Pest animals such as kangaroos and rabbits can have a significant determinantal impact on revegetation areas. There may be a need to manage birds such as cockatoos and corellas, that can predate seed and impact on revegetation performance. Permits may be required if native animals are being managed as pests. Pest control should be addressed in a Pest Animal Management Plan prepared as part of the Work Plan.

### 6.2.9 Rehabilitation Monitoring

VHM would implement a formalised rehabilitation monitoring and review process to monitor rehabilitation performance, identify emerging risks and enable early intervention. Rehabilitation monitoring would include surveys to be undertaken routinely within each discrete rehabilitation area. The recommended frequency of survey will vary depending on the stage of rehabilitation and progress towards completion, but also depending on the presence or otherwise of active rehabilitation threats. A typical monitoring frequency might include:

- Monthly for the first three months during initial vegetation establishment, then
- Quarterly for the first year following commencement of rehabilitation, then
- Annually until completion and achievement of closure criteria.

Rehabilitation monitoring will continue for at least 2 years post meeting closure criteria to ensure rehabilitation progress remains acceptable with a positive trend towards achieving the final land use, and no longer requires active intervention. This would be when:

- the final landform is achieved
- drainage is stable and in accordance with final landform design
- soil fertility and erosion hazard are equivalent or better than pre-existing conditions

- vegetation and weed cover are acceptable

Rehabilitation surveys will record key details of rehabilitation progress, including identification of any emerging risks, activation of triggers for mitigation controls, and noting any corrective actions that may be required. Any identified deficiencies or failures shall be noted and follow-up actions identified. Success factors will be noted for future reference and to assist in continuing improvement.

Details to be recorded during the rehabilitation survey include:

- Area inspected
- Date and time of inspection
- Person undertaking the inspection
- Photographic record
- Landform stability / functionality
    - Settlement/subsidence in line with design goals; and
    - Continuity with surrounding lands.
- Surface water drainage. Note factors including:
    - Free draining or ponding
    - Sheet flow stability
    - Presence and stability of any concentrated flows including berms and batter drains; and
    - Stability and adequacy of discharge control and discharge locations.
- Soil surface cover and erosion risk:
    - Ground cover %; and
    - Presence and severity of sheet, rill and gully erosion.
- Assess vegetation cover, health, abundance, type and structure (qualitative assessment)
- Weeds, type and abundance; and
- Record specific repair/maintenance actions, with timelines and responsibilities for completion. Include an audit process to follow up and close out corrective actions.

Monitoring of settlement and final landform topography would be undertaken by Drone / LiDAR and compared against the design final landform plan. Any irregularities would be reviewed and actioned.

#### 6.2.10 Record Keeping

Good record keeping will assist VHM track Draft Rehabilitation Planning and progress and improve success. Important rehabilitation records include:

- Draft Rehabilitation Plan (this document). The plan will be reviewed and updated as necessary through the course of mine operations and closure planning;
- Rehabilitation Risk Assessment. Maintain and update a risk assessment (refer Section 9);
- Register of soil materials for use in rehabilitation. The register will identify material type, locations, quantity and treatment/amelioration history;
- Rehabilitation Survey results, included as part of a Rehabilitation Register;
- Rehabilitation Register to record rehabilitation activity and monitoring. This will detail the current rehabilitation status and outline in detail the rehabilitation methodologies undertaken (including landform preparation, drainage goals, growth media development, surface preparation techniques, and revegetation processes, and any follow up corrective actions). The register shall highlight success factors and lessons learned from previous reviews to assist future rehab planning and improve outcomes. The register would include quality assurance records such

as as-built drawings. A photographic log would be kept as part of the rehabilitation register; and

- Additional quality assurance documentation as described in Section 6.2.11 of this plan.

### 6.2.11 Rehabilitation Quality assurance

A Rehabilitation Quality Assurance Process (RQAP) will be implemented through the life of the mine and each phase of rehabilitation. The RQAP will ensure that:

- Persons responsible for rehabilitation implementation are identified;
- Rehabilitation is being implemented consistent with the nominated methodologies;
- Rehabilitation records are updated; and
- Identified rehabilitation risks are adequately addressed at each phase of rehabilitation.

The RQAP will include inspections, monitoring and documentation to ensure that each phase of decommissioning and rehabilitation has been completed according to the nominated methodologies before proceeding to the next rehabilitation phase. The rehabilitation risk assessment is part of the quality assurance process as it is a live document that would be updated to address any emerging risks.

As part of the RQAP, a rehabilitation register will be developed and maintained. The register aims to record success factors and lessons learned from previous reviews to assist future Draft Rehabilitation Planning and improve outcomes. This register will detail the current rehabilitation status within each mining domain and outline the rehabilitation works undertaken.

Key elements of the rehabilitation quality assurance process and how they would be applied at each rehabilitation phase are summarised in Table 7.

*Table 7 Rehabilitation phases*

| Mining / rehabilitation phase | Quality assurance elements |
|---|---|
| Active mining | • Mine and Draft Rehabilitation Plans, updated to reflect current status and future planning<br>• Topsoil and subsoil inventory to document stripped, stockpiled and re-spread resources and soil amelioration<br>• Scheduled rehabilitation surveys to identify soil and land erosion and adequacy of soil, erosion and drainage controls; and<br>• Weed inspections and maintenance. |
| Decommissioning | • Inspections and demolition reports to confirm all infrastructure has been removed<br>• Contamination assessment, remedial action plans and validation reports post site clean-up; and<br>• Waste tracking documentation to demonstrate that all wastes are disposed legally. |
| Landform establishment / post-mine backfill | • Survey and preparation of as constructed drawings of final constructed landforms and water drainage structures; and<br>• Inspection to record the progression of the intended landform. |
| Soil preparation | • Registers of topsoil and subsoil stockpiles including management records (such as stripping/stockpiling dates, weed control, amelioration)<br>• Records of soil replacement including source and destination of soil resources, soil replacement depths and methodologies, and soil amelioration (eg gypsum application fertilisers)<br>• Soil testing results to confirm appropriate soil physical and chemical parameters for plant establishment<br>• Soil surface preparation (eg ripping, scarification); and<br>• Implementation of any necessary erosion and sediment controls. |
| Vegetation establishment | Records of revegetation activities including:<br>• Date/season of revegetation actions<br>• Weather conditions<br>• Seed mix and seeding rate (kg/ha) and/or planting rate (tubestock/ha)<br>• Scheduled rehabilitation surveys to allow early identification of any emerging threats to rehabilitation, assess stability and revegetation success; and<br>• Regular inspections to identify weed and feral animal impacts and controls. |

# 7. Rehabilitation Objectives and completion criteria

## 7.1 Whole of site objectives

The whole of site objective for rehabilitation is: “to restore land disturbed by mining to an equivalent (or better) agricultural land capability to enable a variety of productive agricultural uses.”

This overall objective is supported by a set of domain specific objectives as described in section 7.2.

## 7.2 Rehabilitation domain specific objectives and criteria

*Table 8: Domain objectives and completion criteria*

| Mining domain | Rehabilitation Objective | Completion criteria |
|---|---|---|
| Domain 1<br>Processing and Infrastructure | All infrastructure that is not to be used as part of the final land use will be decommissioned and removed to ensure the site is safe, stable and free of hazardous materials. Infrastructure to be removed within 2 years of operations completion. | All infrastructure and underground services removed in accordance with a Decommissioning and Closure Plan, including:<br>• Fuel and chemical tanks and drums are removed in accordance with departmental guidelines.<br>• Mining roads are ripped and revegetated.<br>• Water pumps and pipelines are removed.<br>• Ground water piezometers and any temporary supply bores are sealed, except as required for long term monitoring post closure<br>• Hazardous and contaminated materials are removed<br>• Offices/ laboratory, stores and workshops are demolished and removed;<br>• Processing plant and MUPs are dismantled and materials salvaged and recycled where possible, but otherwise removed; and<br>• Waste tracking documentation verifies legal disposal of all wastes. |
| | Water storages that are not retained as part of the final land use, are to be drained and backfilled | • Water quality in storages is tested prior to dewatering.<br>• Dewatering avoids release of contaminants to land or waters.<br>• Sediments accumulated in sediment dams are tested, removed and emplaced in the final landform if suitable.<br>• Contaminated sediments deemed unsuitable for emplacement in the voids are disposed offsite at a facility licensed to accept contaminated waste, or emplaced onsite subject to further assessment.<br>• All ancillary equipment including pumps and pipelines are removed and services terminated.<br>• Dams are backfilled in a controlled way consistent with geotechnical advice to minimise post closure settling.<br>• Water storages are removed and land regraded so final land surface is contiguous with surrounding landscape in preparation for return to agricultural practices. |

| Mining domain | Rehabilitation Objective | Completion criteria |
|---|---|---|
| | Water storages to be retained as part of the final landform will be for a clear and agreed purpose, and be safe, stable and sustainable. | • Sediments tested and any contaminated materials removed from water storages ensuring no residual contaminants exist that would compromise future water use goals.<br>• Retained dams will be assessed and verified as structurally sound by a suitably qualified person.<br>• Water quality is tested and fit for the final use (eg agriculture, stock and domestic). consistent with relevant water quality guidelines.<br>• Dams are licensed (if required) in accordance with relevant state legislation. |
| | Infrastructure is only to be retained where it is sympathetic to and supports the final land use, has a clear purpose and is in a condition that does not present undue risk to safety or the environment. | • Any retained infrastructure is to have a clear purpose and agreement from relevant stakeholders that the purpose is supported and the retained infrastructure is safe, stable and sustainable.<br>• Condition assessments and certification are completed as required.<br>• Hardstands and tracks retained in a fit for purpose condition that is safe and stable and supports the final land use. |
| | Land free of contamination:<br>Land, water and soils are free from contamination, safe, compatible with the final land use and pose no unacceptable threat of ongoing environmental harm or risk to people, | • Hazardous materials are removed from site and any wastes and visible indicators of contamination are cleaned up.<br>• Soils (and where required water) tested and site validated as fit for final land use in accordance with applicable guidelines including the National Environment Protection (Assessment of Site Contamination) Measure (1999).<br>• Water quality monitored with respect to the relevant Environmental Reference Standard and fit for final land use.<br>• Water quality and quantity are not impacted at any sensitive receptors/ environmental values. |
| Domain 2<br>Active mining areas | Infrastructure decommissioning:<br>All mobile and fixed plant and infrastructure from mining areas is to be decommissioned and removed | • All temporary infrastructure is removed.<br>• Mining roads ripped and revegetated. |
| | Mine backfill and landform establishment:<br>Mine cells are backfilled and rehabilitated progressively on completion of resource | • Mine cells are backfilled to design levels allowing for any final consolidation. Confirmed through geotechnical inspection and testing. |

| Mining domain | Rehabilitation Objective | Completion criteria |
|---|---|---|
| | extraction to reinstate a final landform that is contiguous with the surrounding natural landscape and is fit for future agricultural land use | • Final levels are within +/- 0.5 m of existing (pre-disturbance) levels when averaged across the mining blocks.<br>• Landform gradients will be typically less than 3% across agricultural areas and avoid sharp relief between rehabilitated landscapes and surrounding lands. Verified through survey.<br>• Landforms are shaped to blend with the natural environment and maximise sheet flow drainage. |
| | Landform drainage:<br>Rehabilitated landform is to be free draining with sheet flow conditions and avoiding poorly drained depressions and flow concentration | • Drainage conditions are stable with no active gully heads or tunnel erosion. Verified through rehabilitation inspections.<br>• Drainage is predominantly as sheet flow mirroring present conditions.<br>• Site topography is a gently undulating and free draining plain, verified through topographic survey as within acceptable tolerances. |
| | Soil preparation:<br>Soils reinstated to create a productive soil profile with topsoil and subsoil depths, physical and chemical characteristics in line with agronomist's advice and similar to pre-mining conditions | • Topsoil and subsoil profile restored to minimum 1m deep comprising at least 20cm of topsoil and 80 cm of clayey subsoil material.<br>• Restored soil profile contains similar physical, chemical and fertility characteristics to surrounding natural soils and is suitable for agricultural land use,. Verified through soil survey and testing.<br>• Soil surfaces do not possess problematic dispersive or hardsetting surfaces. |
| | Vegetation cover:<br>Establish a vegetation cover crop across rehabilitation areas to stabilise the soil, restore soil health and minimise sediment loss subject to agronomist's advice. | • A vegetative surface cover is established for long term erosion control and consistent with achieving the final agricultural land use. Target 70% groundcover. Erosion control and cover verified through rehabilitation inspections.<br>• Weeds managed to ensure weed types and density within rehabilitation areas are no worse than on surrounding agricultural lands, Verified through weed survey. |
| | Hazards including bushfire:<br>Management measures are implemented to minimise bushfire risks in rehabilitation areas | • Bushfire risk managed to the satisfaction of local rural fire service and consistent with management approaches on adjoining agricultural land. |
| Domain 3 | Stockpiles removal and landform establishment: | • Stockpiles removed and surface rehabilitated to design levels. |

| Mining domain | Rehabilitation Objective | Completion criteria |
|---|---|---|
| Stockpiles | Stockpiles are removed and surface revegetated consistent with objectives for mining domains | • Subsoil ripped and topsoil replaced.<br>• A vegetative surface cover is established for long term erosion control and consistent with achieving the final agricultural land use. Target 70% groundcover. Erosion control and cover verified through rehabilitation inspections.<br>• Weeds managed to ensure weed types and density within rehabilitation areas are no worse than on surrounding agricultural lands, |
| Domain 4<br>Services and Transport Corridors | Telecommunications, water supply and other services to be disconnected and removed unless agreed to be retained. | • Telecommunications, water supply and other services are disconnected and removed unless agreement is reached with relevant stakeholders to retain services infrastructure to benefit future land use.<br>• Services removal to adopt techniques that minimise additional land disturbance and ensure prompt stabilisation and restoration of final landforms to support the desired land use; |
| | Public roads:<br>Public roads reinstated to the satisfaction of local roads authority | • A plan is prepared and implemented for reconstruction of local roads closed by mining, to the satisfaction of the roads authority.<br>• Roadside revegetation is undertaken to restore representative ecological vegetation classes (EVC) as agreed through the EES process.<br>• Roadside boundary fencing is replaced in a condition acceptable to the landowners. |

# 8. Schedule for rehabilitation milestones

The mine is expected to have a life of approximately 20 years. Much of the infrastructure area cannot be progressively rehabilitated but will be subject to a decommissioning program at the conclusion of mining. This is expected to take approximately 5 years to complete.

A schedule of key rehabilitation milestones focused on the mining cells is provided in Table 9. Driving the progressive rehabilitation program is the intention to commence backfilling of mine cells as soon as practicable following mining completion within each cell. Satisfactory achievement of this goal will mean there are never more than about 3 or 4 mine cells open at a time. Forward stripping will be minimised as far as possible. The timing of the backfill and rehabilitation sequence is an estimate only and subject to refinement once in operation.

*Table 9 Indicative milestones for mine rehabilitation*

| Mining phase and milestone | Timing |
|---|---|
| **Pre mining commencement (planning):** | |
| Pre-existing site conditions documented including dilapidation survey of relevant infrastructure | Pre-mining |
| Environmental controls established | Pre-mining |
| Topsoil stripped progressively from infrastructure areas, planned stockpile areas, and first mine cell | Pre-mining and as close as practicable to mine commencement (minimise forward stripping prior to mining) |
| **During and post mining:** | |
| Topsoil and subsoil progressively stripped and preserved for later use in rehabilitation | Pre-mining |
| Soil ameliorants applied during stripping and stockpiling in accordance with the Draft Rehabilitation Plan | During topsoil stripping<br>On surface of stockpiles – within 60 days from establishment and final shaping<br>Respreading in rehabilitation cells – within 30 days of respreading |
| Completed mine cells progressively backfilled with tailings to design levels and allowed to dry sufficiently to meet desired geotechnical parameters | Commence as soon as practicable on completion of mining. Tailings fill is expected to take around 180 days allowing time for sufficient dewatering and consolidation prior to overburden fill. |
| Mine cells backfilled with overburden following tailings consolidation. Overburden backfill to be done in nominally 3m lifts with a consolidation period allowed between each lift. | Overburden filling could take up to 12 months allowing for consolidation period between each lift. |
| Mine cells capped with subsoil and topsoil to establish final levels | Final soil profile reinstated as soon as practicable from completion of overburden settling and to ensure placed topsoil and subsoil has optimal moisture levels, |
| Final surface prepared in readiness for revegetation, including application of soil ameliorants, fertilisers and surface roughening | As soon as practicable from completion of overburden filling to ensure placed topsoil and subsoil has optimal moisture levels |

| | |
|---|---|
| Rehabilitation surface is sown with desired vegetation mix | Cover crop established ideally within 30 days following topsoil placement, but dependent on season |
| Revegetated surface achieves desired vegetation mix and cover, and can be treated as a “clean” catchment for the purpose of stormwater management | Expected within 60 days from sowing |
| Reinstatement of public roads and lands removed by mining | Within 2 years of conclusion of mining |
| Final hand back to post-mining land use (agriculture) | Relinquishment of mining areas expected after about 6 years from conclusion of all mining |
| Infrastructure removed from infrastructure domains and land remediated (if required) and rehabilitated | Within 2 years of conclusion of mining |
| Water storages decommissioned, backfilled and rehabilitated | Within 2 years of conclusion of mining |

# 9. Post-rehabilitation risk identification and assessment

The Mineral Resources (Sustainable Development) (Mineral Industries) Regulation 2019 identifies the requirement for a risk assessment to be undertaken and included in the Work Plan, that assesses the risks that the rehabilitated land may pose to the environment, to any member of the public or to land, property or infrastructure in the vicinity of the rehabilitated land, including:

(i) the type, likelihood and consequence of the risks; and

(ii) the activities required to manage the risks; and

(iii) the projected costs to manage the risks; and

(iv) any other matter that may be relevant to risks arising from the rehabilitated land.

The regulations define "relevant risks" as risks that may require monitoring, maintenance, treatment or other ongoing land management activities after rehabilitation is complete.

In identifying what (if any) “relevant risks” may exist, the following factors are relevant:

- Landform: the backfilled, rehabilitated landform would be very similar to the existing landform, being a flat plain without precipitous voids or sharp relief. Closure would be achieved following demonstration that final landform levels and gradients are achieved and within stated criteria, and only once sufficient monitoring has demonstrated the landform is not affected by differential or ongoing settlement. Consequently, there would be no ongoing landform related risks to the public such as falling rocks, unstable slopes or unsafe landforms that require ongoing monitoring or management to protect public health;
- Soils: The backfill plan includes reinstatement of a minimum 1.0m soil profile comprising topsoil and subsoil. The existing soil properties would be maintained as far as possible through careful handling and amelioration as necessary. Tailings from mineral processing would be buried deep beneath overburden and the reinstated soil profile. Soil condition, productivity and valuable ecosystem services would be re-established. Closure would be achieve upon demonstration of successful soil restoration. No further intervention or ongoing monitoring would be required;
- Vegetation: the rehabilitated landform is to be returned to a predominantly agricultural land use. Closure criteria includes goals for establishment of a vegetation cover consistent with future agricultural use and aimed mainly at providing stability and soil protection. Upon closure signoff there are no residual risks relating to vegetation, or to native flora or fauna, that may require monitoring or maintenance. The only exception to this is in the reinstated road corridors, where native vegetation reestablishment may be undertaken. This would be undertaken well in advance of final closure being achieved, and signoff would occur once vegetation is trending towards final criteria;
- Drainage: the final landform involves a simple, sheet flow drainage pattern. Closure would be achieved upon demonstration of stable drainage patterns. No ongoing monitoring or management would be required; and
- Water quality: the potential for impacts on groundwater systems has been comprehensively assessed and while there is expected to be a zone of altered groundwater quality (may be less saline and may contain dissolved metals), the changes are not expected to impact on sensitive receptors. The rehabilitated land is not predicted to cause pollution to land and surface waters that may require ongoing monitoring or management.

The overall objectives of rehabilitation are to ensure that the final landform and land use is safe, stable and non-polluting, and capable of supporting the final land use which is broadacre agriculture. Closure would be met upon demonstrating achievement of these goals, by which time the land would be expected to be back in agricultural production. Based on the above, it is reasonable to assume the rehabilitated land poses little if any residual risk to the environment, public, land or property.

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# Important information about your report



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Environment Effects Statement –DRAFT Rehabilitation Plan

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