Mineral Resources (Sustainable Development) Act 1990

Tenement Number: MIN4644

Plan Number: PLN-001702

Work Plan Variation Statutorily Endorsed

Signed: _____

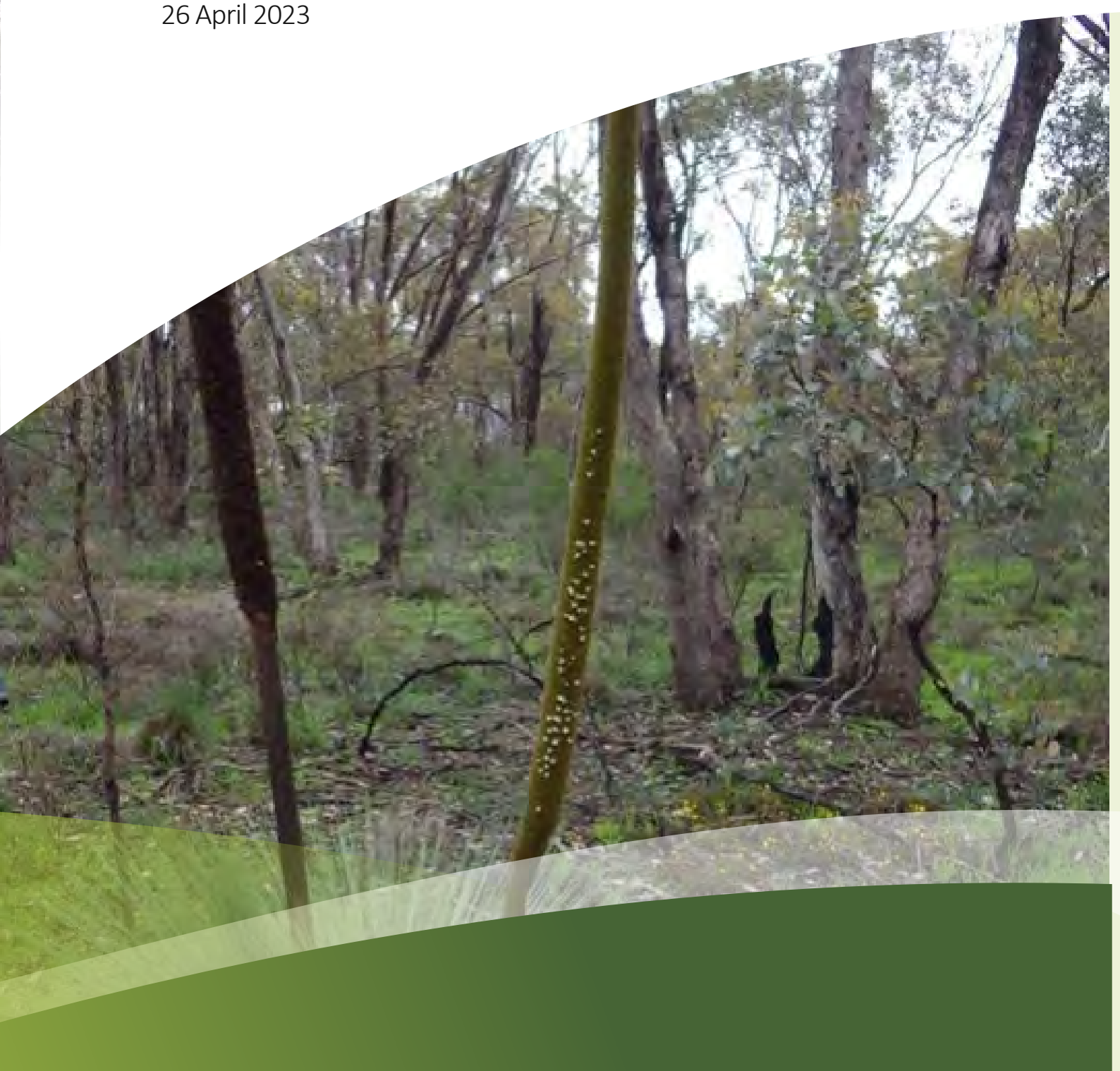
Delegate of the Department Head

Date: 28/09/2023

Risk Management Plan

Costerfield Operations

26 April 2023



Risk Management Plan

Costerfield Operations

AE1046.9_RMP

April 2023

Version 7			
Issued to			
Ross Laity, Sustainability Manager, Mandalay Resources Costerfield Operations			
Prepared by		Reviewed by	Approved by
Neil Wines (Principal Environmental Consultant)		Michael Cramer (Director - Accent)	 Michael Cramer - Director -
Previous versions			
Version:	1	12/7/2017	Draft
	2	21/7/2017	Draft
	3	8/9/2017	Draft
	4	21/12/2017	Finalised for Consolidated Work Plan
	5	6/11/2018	Updated for WPV
	6	17/04/2019	Updated for WPV

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Contents

Abbreviations

ANCOLD	Australian National Committee on Large Dams
ARD	acid rock drainage
dB(A)	A-weighted decibels
CEP	Community Engagement Plan
DEECA	Department of Energy, Environment and Climate Action
DELWP	former Department of Environment, Land, Water and Planning (now DEECA)
DJPR	former Department of Jobs, Precincts and Regions (now DEECA)
EPA	Environment Protection Authority (Victoria)
ERC	Environmental Review Committee
ERR	Earth Resources Regulation
G-MW	Goulburn-Murray Water
GBCMA	Goulburn-Broken Catchment Management Authority
ha	hectares
Mandalay	Mandalay Resources Australia Pty Ltd
km	kilometre
M	million
MCP	mine closure plan
m	metres
m^2	square metres
m^3	cubic metres
mm	millimetre
mm/s	millimeter per second
MRSD Act	*Mineral Resources (Sustainable Development) Act 1990*
MRSD (MI) Regulations	Mineral Resources (Sustainable Development) (Mineral Industries) Regulations 2019
RRAM	Resource Rights Allocation and Management
RMP	Risk Management Plan
RO	reverse osmosis
ROM	run-of-mine
TSF	tailings storage facility
WPV	work plan variation

Guidelines	Preparation of Work Plans and Work Plan Variations Guideline for Mining Projects

1 Introduction

1.1 Background

Mandalay Resources (Mandalay) owns and operates the Costerfield Operations in central Victoria. The project is located approximately 100 km north of Melbourne and 10 km from the regional town of Heathcote. The site is comprised of the Augusta and Cuffley underground gold and antimony mining operations (MIN4644), the Brunswick processing plant and tailings storage facilities (MIN4644), and the Splitters Creek evaporation facility (MIN5576). Figure 1.1 shows the location of these operations and facilities.

This Risk Management Plan (RMP) refers only to the operations on MIN4644.

1.2 Purpose

This Risk Management Plan (RMP) has been jointly prepared to meet the requirements of:

- The *Mineral Resources (Sustainable Development) Act 1990* (MRSD Act)
- The Mineral Resources (Sustainable Development) (Mineral Industries) Regulations 2019 (MRSD (MI) Regulations).

The Costerfield RMP was first prepared in 2017 to support the Consolidated Work Plan for the Costerfield Operations (PLN001247). The plan was created following a review of existing management plans and procedures at the Costerfield Operations, and integrates this information to fully describe the risk management process. The RMP was last updated in 2019 to support WPV (PLN001290).

This RMP V7 has been reviewed to consider the addition of the Brunswick West TSF WPV (PLN001702). This RMP document updates the operation details and mining risks associated with the approved Work Plan. The document has been prepared in accordance with the requirements *Preparation of Work Plans and Work Plan Variations Guideline for Mining Projects* (ERR 2020a) (the Guidelines).

1.3 Objectives of report

The objectives of this RMP are to:

- describe the mining hazards associated with the Costerfield Operations and the sensitive receptors that may be impacted
- identify, evaluate and manage the risks associated with the potential mining hazard impacts
- provide additional detail in support of the risk management component of the Consolidated Work Plan for the Costerfield Operations.

1.4 Scope and structure

The Augusta underground mine and Brunswick processing plant facilities are located on mining licence MIN4644. The Splitters Creek Evaporation Facility is located on a separate mining licence, MIN5567 (see Figure 1). This RMP covers the mining operations within MIN4644.

Mandalay also holds a number of exploration licences; however, these are not covered by the RMP.

The plan includes information under the following headings:

- overview of Costerfield operations
- the risk assessment process
- the hazards identified
- sensitive receptor identification
- risk identification, assessment and management.

2 Overview of Costerfield Operations

2.1 Locality

The Costerfield Operations are located within the Costerfield mining district of Central Victoria, approximately 10 km northeast of the township of Heathcote (see Figure 2.1), 50 km east of the City of Greater Bendigo and 100 km north of Melbourne.

2.2 Land ownership and tenure

Land property descriptions for the Costerfield Operations sites are presented Table 2.1.

Table 2-1 Operational sites and land tenure

Site	Lot/Plan	Tenure	Ownership/ land manager
Augusta Infrastructure, Boxcut and waste rock storage	(AB3, AB3G, AB3A) Lot 1 TP246611	Freehold	Tobin Family
Augusta Storage Dams/Evaporation Facility	Allot 8 Sec1 Parish of Costerfield	Freehold	Mandalay Resources
Cuffley Ventilation Shaft and facilities	Allot 34 Sec1 Parish of Costerfield	Freehold	Mandalay Resources
Mine dewatering rising main and pipeline	Allot 39 Sec1 Parish of Costerfield	Crown Land	DEECA
Brunswick Processing Plant, Brunswick TSF and Bombay TSF	Allot 37 Sec1 Parish of Costerfield	Crown Land	DEECA
Youle ventilation shaft and rising main	Allot 13 Sec6 Parish of Costerfield	Freehold	Mandalay Resources
Brunswick Open Pit and core storage area	Lot 1 PS404811	Freehold	Mandalay Resources
Brunswick West TSF	Lot 2 PS404811	Freehold	Harris Family

295000 300000 305000 310000 315000

5925000 5920000 5915000 5910000

10 km radius
5 km radius
2 km radius

Redcastle-Greytown State Forest
Strathbogie Shire Council
Moormbool Road
Corralla Creek
Ladys Pass
Tuncliffs Lane
EL3110
EL6487
Dargile State Forest
Heathcote-Graytown National Park
Northern Highway
Pavey's Road
Costerfield State Forest
Heathcote-Nagambie Road
Spitters Creek
C10 Track
Mears Track
Reef Track
Costerfield
Costerfield State Forest
Puckapunyal Military Area
EL6482
MIN 4644
Dargile State Forest
ADVERTISED PLAN
MIN 5567
Bradleys Lane
Phillips Lane
Wappemuke Creek
Major Creek
McIvor Highway
Ylands Lane
Anthony Creek
Bendigo City Council
Peels Track
Heathcote
Heathcote-Graytown National Park
Heathcote-Nagambie Road
EL5519
One Eye State Forest
Plain Springs N.C.R
Northern Highway
Mitchell Shire Council

Scale: 1:75,000
0 2 4 km
N

NSW
Horsham
Bendigo
VIC
Site
Melbourne
Traralgon
0 100 200 km
Scale 1:12,000,000

Rock Garden Waste Stockpile
Bombay TSF
Costerfield
Youle Shaft
Brunswick TSF
Brunswick West TSF
Augusta Evaporation Ponds
Brunswick Shaft
Cuffley Shaft
Augusta Shaft
Augusta Mine Site
Newtons Lane

Scale: 1:50,000
0 0.5 1 km

AE1046.9 Mandalay Resou
- Costerfield Operation
Figure 1.1. Regional plan a
tenements

Created 3/11/2022 and revised 21/04/2023
CRS: GDA 20 MGA 55
Scale: 1:75,000 @ A3 (main n
Page size: A3

- Vent shaft (inset ma
- Town
- Road
- Railway
- Main watercourse
- Watercourse - tribut
- Existing power transmission line
- Power transmission to be relocated
- Relocated power transmission line
- Exploration Licence
- Mineral Licence
- Mine site domain
- Offset area
- Lot 2 PS404811
- Private land lot bour
- LGA boundary
- Radius circle
- Water body

Crown Land

- Commonwealth Lan
- Community Use Are
- Earth Resources
- Historic and Cultural Features Reserve
- National Park
- Natural Features Res
- Nature Conservation Reserve
- Services and Utilities
- State Forest
- Uncategorised Crow
- Other Crown Land

Additional data, main map: VIC_TR TRANSPORT (Road, Rail), VIC_locali point, VIC_PLM25, VIC_MINTEN, VI HY_WATERCOURSE, VIC_HY_WATE VIC_LGA_POLYGON, VIC_TOWNSHI POLYGON, VIC_POWERLINE, VM_PA
Inset map (upper): STE_2021_AUST_GDA2020

ACCENT ENVIRONMENTAL

MANDALAY RESOURCES

AE1046.9 Mandalay Resources - Costerfield Operation

Figure 2.1. Surface layout

Created 3/11/2022 and revised 2/04/2023
CRS: GDA 20 MGA 55
Scale: 1:27,500 @ A3
Page size: A3

Dargile State Forest
Costerfield N.C.R
Costerfield State Forest
Mears Track
Reef Track
C10 Track
Splitters Creek
Splitters Creek Evaporation Facility
MIN5567
Costerfield
Heathcote-North Costerfield Road
Youle shaft
Rock Garden Waste Stockpile
Bombay TSF
Brunswick West TSF
Brunswick West RWP
Brunswick Waste Rock Stockpile
Brunswick Shaft
Brunswick TSF
Core Yard
Brunswick Pit
Brunswick Plant Site
Heathcote - Nagambie Road
South Costerfield-Graytown Road
Reef Track
Augusta Evaporation Ponds
Wappenbike Creek
Cochranes Road
Browns Lane
Bradleys Lane
PhillipsLane
Newtons Lane
Cuffley Shaft
Augusta Shaft
Augusta Site
MIN4644
Tobins Lane
Peels Track
Peels Lane
Heathcote-Nagambie Road
Doolan Crescent
Puckapunyal Military Area
Lot 1 TP163903
0 0.5 1 km
Scale: 1:27,250

- Owned by Mandalay Resources
- Sensitive receptor (residence)
- Town
- Existing clean water diversion drain
- Brunswick West TSF clean water diversion drain
- Injection site
- Splitters Creek pipeline
- RO discharge pipeline
- Process water return pipeline
- Process water delivery pipeline
- Existing power transmission line
- Road
- Main watercourse
- Watercourse - tributary
- Exploration Licence
- Mining Licence
- Mine site domain
- Vegetation offset area
- Private land lot boundary
- Costerfield township
- Water body
- Radius circle - 2km

Crown Land

- Commonwealth Land
- Community Use Area
- Earth Resources
- Natural Features Reserve
- Nature Conservation Reserve
- Services and Utilities
- State Forest
- Uncategorised Crown Land
- Other Crown Land

Additional data: VIC_TR_ROAD, VIC_MINTEN, VIC_HY_WATERCOURSE, VIC_HY_WATER_AREA_POLYGON, V_PARCEL_MP_POLYGON, VIC_TOWNSHIP-POLYGON, VIC_POWER_LINE, PLM25_Vic_Crown_Land.

ACCENT ENVIRONMENTAL
MANDALAY RESOURCES

ADVERTISED PLAN

2.2.1 Historic context

Gold and antimony were first discovered at Costerfield in 1860 and underground mining has taken place periodically since this time. Historic mining of the Costerfield–Bombay–Minerva complex occurred between surface level and 300 m below ground level, initially via shaft, and later in some areas as open cut mining.

The current mining operations at the site commenced in 2006. Mandalay purchased the operations on December 1, 2009, from AGD Operations Pty Ltd.

2.3 Overview of operations

Costerfield operates a continuous mining operation 24 hours a day 365 days per year with a workforce of approximately 220 employees.

Mining at Costerfield targets several individual lodes (including the Youle and Shepherd lodes). Mining is currently not active at Augusta, Cuffley or Brunswick. Access to the lodes is either via the Augusta Portal or Brunswick Portal and associated declines.

Ore extraction is achieved through three different mining methods: full face development, uphole stoping and predominantly longhole cemented rock fill (CRF) stoping.

Mining at Youle follows a bottom-up sequence mining from the northern and southern extents retreating towards the central access. The practice of placing CRF in stope voids has been undertaken at Youle to improve local ground stability using waste rock from development with the addition of a cement slurry mix. Mobile equipment includes underground haulage trucks, loaders, jumbos, integrated tool carriers, cement agitator trucks, fork lifts and light vehicles.

Underground ore from the Youle and Shepherd lodes is trucked to the surface via the Brunswick Portal and placed on the a Run of Mine (ROM) ore pad located adjacent to the Brunswick Processing Plant.

The ore is transferred to the Brunswick ROM pad where it is stockpiled, screened and blended prior to being fed into the Brunswick Processing Plant. The Brunswick Processing Plant throughput is typically around 13,000 tonnes/month.

The surface crushing and screening system processes underground ore down to a particle size suitable for milling through a two-stage closed circuit ball milling circuit. Centrifugal style gravity concentrators are used on the combined primary milling product and secondary mill discharge, to recover a gold rich gravity concentrate that is sold as a separate gold concentrate and sent to a local refinery.

Secondary milled products are classified by size and processed through a simple floatation circuit comprising a single stage of rougher, scavenger and cleaning. The concentrate is thickened through dewatering and filtration to produce a final antimony/gold concentrate product that is then bagged and transported to Melbourne Port for packing into shipping containers for shipment to overseas customers. The tailings is thickened before being sent to a TSF.

Tailings have been stored in the Bombay TSF and the Brunswick TSF. Once the currently active Bombay TSF is at capacity, both these facilities will be closed. The Brunswick West TSF to be constructed so that it can receive tailings once existing TSF capacity has been reached.

Mine ventilation comprises fresh air being sourced from surface intakes including the Brunswick Portal, Augusta Portal, Augusta ladderway, Brunswick Fresh Air Rise and Augusta Fresh Air Rise.

Exhaust ventilation flows exit the active mine workings via two airways comprising the Youle Return Air Rise and Cuffley Return Air Rise.

Groundwater is pumped to the surface via the Cuffley rising main. Water is pumped to the Augusta Mine Dam before being distributed for re-use in mining operations as well as feed to the Reverse Osmosis (RO) Plant located at Brunswick. Permeate from the RO plant meets applicable water quality criteria and is discharged under licence to a local waterway (Wappentake Creek).

Excess water and RO brine is sent to the Splitters Creek Evaporation Facility.

2.4 Costerfield Operations components

The surface components of the Costerfield Operations are located at the following three main locations:

- Augusta site;
- Brunswick site; and
- Splitters Creek (MIN5576).

The current components of the site are shown in Figure 2.1. Approximate areas for the facilities are shown in Table 2.2.

Table 2-2 Disturbance areas and features

Disturbance site	Area (ha)	Details
Augusta site	21.2	Boxcut, portal pads, offices, workshop, waste rock storage evaporation ponds, water storage and shafts
Brunswick site	49.15	Open pit, portal, ROM, process plant, TSFs, offices, core storage, waste rock storage and shafts
Splitters Creek site	30	Evaporation facilities
Cuffley shaft	0.5	Ventilation shaft
Youle shaft	<0.01	Ventilation shaft

2.4.1 Augusta site

The Augusta site comprises the following components (see Figure 2.2):

- underground mine

- boxcut (including the access portal to the mine, mine workshop and refuelling bay)
- mine administration area
- crib rooms
- evaporation dams
- mine dam
- waste rock stockpile
- noise bund and bund around administration area
- switch room and compressor shed
- laydown yard and stores building
- Augusta fresh air rise ventilation shafts
- Phillips Lane (i.e. Cuffley) return air rise ventilation shaft
- Phillips Lane (i.e. Cuffley) electrical substation and infrastructure
- rising main mine dewatering pipeline
- site access roads
- pipeline to Splitters Creek
- pipeline to injection bores on Peels Lane.

The Augusta mine also provides access to the Cuffley underground workings. The only surface expression of the Cuffley workings is the Cuffley vent shaft and rising main collar.

2.4.2 Brunswick site

The Brunswick site comprises the following components (see Figure 2.3):

- processing plant
- mill workshop and administration buildings
- ROM pad and crushing plant
- Brunswick Waste Rock Stockpile
- Brunswick Pit
- Brunswick Portal
- Brunswick Return Air Raise
- Youle Return Air Raise
- Brunswick TSF
- Brunswick West TSF
- Bombay TSF

- reverse osmosis water treatment plant and pipelines
- cement storage hopper
- laydown area
- exploration core shed and storage yard
- Mill Stormwater Dam
- Rock Garden Waste Stockpile.

2.4.3 Splitters Creek site

The Splitters Creek Evaporation Facility (MIN5567) is located approximately 2.5 km northeast of the Augusta mine and comprises a series of clay-lined evaporation terraces following the sloping contour of the land and an HDPE lined storage dam. Groundwater extracted from the mine and brine from the RO plant is pumped to the evaporation facility for disposal by evaporation via an above-ground pipeline on an as-needs basis.

MIN5567 is not covered by this RMP.

AE1046.9 Mandalay Resources - Costerfield Operation
Figure 2.2. Site layout - Augusta site
Created 3/11/2022, revised 21/04/2023
CRS: GDA 20 MGA 55
Scale: 1:15,000 @ A3 (main map)
Page size: A3

ADVERTISED PLAN

Costerfield State Forest
Cuffley Shaft
Augusta Evaporation Ponds
Augusta Shaft
Augusta Site
Newtons Lane
Cochranes Road
Heathcote-Nagambie Road
Wappenlarke Creek
Puckapunyal Military Area
MIN4644
Peels Lane
Doolan Crescent
Lot 1 TP163903
Scale: 1: 15,000
0 250 500 m
N

Administration
Laydown area
Electrical workshop
22 kV
UG Portal
Boxcut
Mine dam
Fuel storage tank
Waste rock stockpile
Drainage diversion
RO discharge point
0 100 200 m
Scale: 1: 3,500
Google Satellite [Apr 2023]

304000 305000 306000 307000 308000
5914000 5913000 5912000

- Owned by Mandalay Resources
- Sensitive receptor (residence)
- Vent shaft
- Injection site
- Splitters Creek pipeline
- RO discharge pipeline
- Rising main pipeline
- Existing power transmission line
- Power transmission line to be disconnected (inset map)
- Road
- Main watercourse
- Watercourse - tributary
- Exploration Licence
- Mining Licence
- Mine site domain (main map)
- Vegetation offset area
- Private land lot boundary
- Water body
- Aboriginal Cultural Overlay

Crown land (main map)

- Commonwealth Land
- Natural Features Reserve
- State Forest
- Uncategorised Crown Land

Additional data: VIC_TR_ROAD, VIC_MINTEN, VIC_HY_WATERCOURSE, VIC_HY_WATER_AREA_POLYGON, V_PARCEL_MP_POLYGON, VIC_POWER_LINE, PLM25_Vic_Crown_Lands.

ACCENT ENVIRONMENTAL
MANDALAY RESOURCES

ADVERTISED PLAN

AE1046.9 Mandalay Resources - Costerfield Operation
Figure 2.3. Site layout - Brunswick site
Created 3/11/2022, revised 21/04/2023
CRS: GDA 20 MGA 55
Scale: 1:22,250 @ A3 (main map)
Page size: A3

303000 304000 305000 306000 307000 308000 309000

5916000 5915000 5914000 5913000 5912000 5911000

Youle Shaft
South Costerfield-Graytown Road
Costerfield State Forest
Brunswick Site
Heathcote - Nagambie Road
Reef Track
Phillips Lane
Augusta Evaporation Ponds
Cuffley Shaft
Newtons Lane
Augusta Shaft
Wappentake Creek
Augusta Site
Cochranes Road
Bombay TSF
MIN4644
Peels Trail
Heathcote-Nagambie Road
Peels Lane
Puckapunyal Military Area
Doolan Crescent
Lot 1 TP163903
N
Scale: 1: 15,000
0 250 500 m

Youle Shaft
Rock Garden Waste Stockpile
Heathcote - Nagambie Road
12.7 kV
Bombay TSF
Brunswick West TSF
Crushing plant
RO plant
Administration office
Brunswick West RWP
22 kV
Brunswick TSF
Brunswick Waste Rock Stockpile
Brunswick Pit
Brunswick Shaft
Drainage diversion channel
Core Yard
PhillipsLane
Scale: 1: 7,000
0 100 200 m
Google Satellite [Apr 2023]

- Owned by Mandalay Resources
- Sensitive receptor (residence)
- Vent shaft
- Injection site
- Splitters Creek pipeline
- RO discharge pipeline
- Process water return pipeline
- Process water delivery pipeline
- Rising main pipeline
- Existing power transmission line
- Power transmission line to be disconnected (inset map)
- Road
- Main watercourse
- Watercourse - tributary
- Exploration Licence
- Mining Licence
- Mine site domain (main map)
- Vegetation offset area
- Private land lot boundary
- Water body

Crown land (main map)

- Commonwealth Land
- Natural Features Reserve
- State Forest
- Uncategorised Crown Land

Additional data: VIC_TR_ROAD, VIC_MINTEN, VIC_HY_WATERCOURSE, VIC_HY_WATER_AREA_POLYGON, V_PARCEL_MP_POLYGON, VIC_POWER_LINE, PLM25_Vic_Crown_Lands.

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MANDALAY RESOURCES

2.5 Obligations and commitments

Mandalay has identified the legal and other requirements listed below to be relevant to environmental risks associated with the Costerfield Operations. The list encompasses Acts, Regulations and Codes of Practice, some of which are legal obligations and others which are obligations to which the Company subscribes. This is not an exhaustive list of all legal obligations for the operations.

The primary legislative instruments that regulates the operation of a mine in Victoria are the *Mineral Resources (Sustainable Development) Act 1990* (MRSD Act) and the Mineral Resources (Sustainable Development) (Mineral Industries) Regulations 2019 (MRSD (MI) Regulations).

Acts

- *Environment Protection and Biodiversity Conservation Act 1999 (Cwlth)*
- *Flora and Fauna Guarantee Act 1988 (Cwlth)*
- *Native Title Act 1993 (Cwlth)*
- *Mineral Resources (Sustainable Development) Act 1990*
- *Environment Protection Act 2017*
- *Planning and Environment Act 1987*
- *Catchment and Land Protection Act 1994*
- *Dangerous Goods Act 1985*
- *Aboriginal Heritage Act 2006*
- *Water Act 1989*
- *Heritage Act 2017*

Regulations

- Mineral Resources (Sustainable Development) (Mineral Industries) Regulations 2019
- Environment Protection Regulations 2021
- Aboriginal Heritage Regulations 2018

Planning

- City of Greater Bendigo Planning Scheme

Codes of practice and guidelines

- Leading Practice Sustainable Development Program for the Mining Industry Handbooks. Mine Closure. Department of Industry, Tourism and Resources (DITR 2016)
- Strategic Framework for Mine Closure - Australian and New Zealand Minerals and Energy Council and Minerals Council of Australia (MCA 2000)
- Ministerial Guidelines for Description of a Mineral Resource (ERR 2013)
- Imported-Materials-Management-Guideline-Earth-Resources-Regulation (ERR 2017)
- Ministerial Guidelines for notices and injunctions relating to the Regulation of Earth Resources in Victoria (ERR 2013)
- Technical Guideline Design and Management of Tailings Storage Facilities ERR (2017)
- Preparation of Rehabilitation Plans Guideline for Mining & Prospecting Projects. Version 1.0. (ERR 2020)

- Preparation of Work Plans and Work Plan Variations Guideline for Mining Projects. Version 1.3. (ERR 2020)
- Mining Licence Guidelines [#]
- Reportable events and reportable incidents [#]
- Rehabilitation and Other Environmental Aspects of Work Plans [#]
- Rehabilitation bonds - minerals exploration, mines and quarries [#]
- Guidelines for the management of water in mines and quarries [#]
- Groundwater Licensing and Trading [#]
- Community Engagement Guidelines for Mining and Mineral Exploration in Victoria [#]
- Mineral tenements and the Native Title Act 1993 [#]
- Ground Vibration and Airblast Limits for Blasting in Mines and Quarries [#]
- Guidance Material for the Assessment of Geotechnical Risks in Open Pit Mines [#]
- Rehabilitation Bond Guidelines [#]
- Rehabilitation Liability Calculator for Mining and Extractive Operations [#]
- GeoVic interactive map website. Accessed online 16/03/2023 at https://earthresources.vic.gov.au/geology-exploration/maps-reports-data/geovic
- Victorian Heritage Database. Heritage Council Victoria. Accessed 16/03/2023 http://vhd.heritagecouncil.vic.gov.au/places/10180

[#] Accessed online 16/03/2023 at https://earthresources.vic.gov.au/legislation-and-regulations/guidelines-and-codes-of-practice (ERR 2023)

Other guidelines and policies

- Australia Standard AS 1940-2004 - The storage and handling of flammable and combustible liquids (Standards Australia 2004)
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia. Available at www.waterquality.gov.au/anz-guidelines (ANZG 2018)
- Environment Reference Standard (EPA Victoria 2021)
- Guidelines for Landscape and Visual Impact Assessment (The Landscape Institute with the Institute of Environmental Management and Assessment 2013)
- Guidelines for the removal, destruction or lopping of native vegetation (DELWP 2017)
- National Environment Protection (Assessment of Site Contamination) Amendment Measure (NEPM) (National Environmental Protection Council 2013)
- Publication 275 Construction Techniques for Sediment Pollution Control (EPA Victoria 1991)
- Publication 1834 Civil construction building and demolition guide (EPA Victoria 2020)
- Publication 1698 Liquid storage and handling guidelines (EPA Victoria 2018)
- Publication 1823.1: Mining and quarrying - guide to preventing harm to people and the environment (EPA Victoria 2021)
- Publication 1827.1 Waste classification assessment protocol (EPA Victoria 2021)
- Publication 1828 Waste Disposal Categories – Characteristics and Thresholds (EPA Victoria 2020)
- Publication 1961 - Guideline For Assessing and Minimising Air Pollution (EPA Victoria 2022)
- Publication 2048 – Guideline for minimising greenhouse gas emissions (EPA Victoria 2022).

3 Risk assessment process

The MRSD (MI) Regulations require operators to identify and assess all risks that the new or changing works may pose to the environment, to the public, or to nearby land, property or infrastructure (known as mining hazards). The identified risks are to be eliminated or minimised as far as reasonably practicable with risk treatments that specify the measures to be used to eliminate or minimise those risks and monitor performance.

3.1 Regulatory requirements

In relation to risk assessment, under the MRSD (MI) Regulations (ERR 2020a):

> *Regulation 45 Information required in work plans—risk management plan*
>
> *For the purposes of regulation 40(c), the specified information is a risk management plan that sets out the following information relating to the requirement in section 40(3)(c) of the Act to specify what the licensee will do to eliminate or minimise the identified risks as far as reasonably practicable—*
>
> - *measures to be applied to eliminate or minimise the risks as far as reasonably practicable;*
> - *the performance standards to be achieved by either individual measures or some combination of measures;*
> - *management systems, practices and procedures that are to be applied to monitor and manage risks and compliance with performance standards;*
> - *an outline of the roles and responsibilities of personnel accountable for the implementation, management and review of the risk management plan.*

3.2 Risk process

The risk assessment process adopted for this report follows the risk identification and assessment framework detailed in the Guidelines (ERR 2020a).

The aim of the process is to identify and assess the risk that the development may pose to the environment, to any member of the public, or to land, property or infrastructure in its vicinity. The assessment is to identify site-specific issues, constraints or characteristics requiring specific management to eliminate or minimise those mining hazards.

The risk assessment process can be summarised as follows:

- Step 1. Identify the risk hazards and risk sources that are applicable to the Costerfield Operations. The applicability of the risk hazard categories listed in the RRAM online system have been considered (see Section 4).
- Step 2. Identify the sensitive receptors. The sensitive receptors that have been considered are the ‘at risk’ components of the environment listed in the RRAM online system (see Section 5).
- Step 3 Apply a risk rating to the risk sources identified within each category of risk hazard, using the risk matrix from the Guidelines (ERR 2020a). Risk ratings are applied both before (inherent risk) and after (controlled risk) the application of standard controls, by assigning a likelihood and consequence of the event occurring. Likelihoods and consequences have been defined using the definitions within the RRAM online system.

- Step 4. Assess whether the controlled risk is acceptable or whether a risk treatment plan is required to further reduce the risk. If the risk rating taking standard controls into account is low or medium, a risk treatment plan not considered necessary. However, if the risk rating taking standard controls into account is significant or high, a risk treatment plan is required.

3.3 Risk assessment

Likelihood, consequence, and risk rating tables are provided in, Table 3-1, Table 3-2 and Table 3-3 following the criteria outlined in the Guidelines (ERR 2020a). In the Guidelines, the consequence categories are further defined in relation to the potential consequences of impacts on 'public health and safety', 'land, property and infrastructure', and 'the environment' (air, water, soil, vegetation, flora and fauna).

Table 3-1 Consequence categories and definition (ERR 2020a)

Category	Definition
Critical	*Hazard has critical impact, in terms of severity and/or duration.* *Treatment or remediation effort is required, although some effects may be irreversible.* *Remediation of environmental contamination would require significant private and public resources.* *Hazard event would be the subject of widespread community outrage.*
Major	*Hazard has major impact, in terms of severity, duration and/or frequency of occurrence. Treatment or remediation effort is required. Some effects may be irreversible.* *Remediation of environmental contamination would require significant private and public resources.* *Hazard event would be the subject of widespread community concern.*
Moderate	*Hazard has moderate, noticeable impact, in terms of severity, duration and/or frequency of occurrence. Moderate treatment or remediation effort may be required.* *Hazard event would be the subject of limited community concern.*
Minor	*Hazard is perceived but has minor and typically temporary effects. Some remediation may be required.*
Insignificant	*Impacts are barely recognised and/or quickly recovered from. No specific remediation required.*

Table 3-2 Likelihood categories and description (ERR 2020a)

Category	Definition
Rare	*Highly unlikely, but the risk event may occur in exceptional circumstances. (likelihood <5%).*
Unlikely	*The risk event could occur at some time. (likelihood 5% to 30%).*
Possible	*The risk event might occur at some time. (likelihood >30% to 70%).*
Likely	*The risk event will probably occur in most circumstances. (likelihood >70% to 90%).*
Almost certain	*The risk event is expected to occur in most circumstances. (likelihood >90%).*

Table 3-3 Risk matrix showing classification of risk ratings (ERR 2020a)

Likelihood	Insignificant	Minor	Moderate	Major	Critical
Almost Certain	Medium	High	Very High	Very High	Very High
Likely	Medium	Medium	High	Very High	Very High
Possible	Low	Medium	Medium	High	Very High
Unlikely	Low	Low	Medium	High	High
Rare	Low	Low	Medium	Medium	High

Consequence

Once the risk rating has been established some risks will need to have controls in place to reduce them to an acceptable level. Higher risk levels should take priority. Table 3-4 provides guidance on what steps need to be taken depending on the risk rating.

Table 3-4 Risk Rating Acceptability (ERR 2020a)

Category	Definition
Very High	*Totally unacceptable level of risk. Controls must be put in place to reduce the risk to lower levels.*
High	*Generally unacceptable level of risk. Controls must be put in place to reduce the risk to lower levels or seek specific guidance from ERR.*
Medium	*May be acceptable provided the risk has been minimised as far as reasonably practicable.*
Low	*Acceptable level of risk provided the risk cannot be eliminated.*

For mining operations, the following key terms are defined:

- **Mining hazards** are any mining activities and circumstances that may pose a risk to the environment, to any member of the public, or to land, property or infrastructure in the vicinity of work carried out at a mine.
- **Sensitive receptors** are those aspects of the natural or human environment that may be impacted by mining operations.
- **Risk** is the potential for a hazard to impact on a sensitive receptor.
- **Consequence** is the consequence of the event occurring and is applied to public safety, property and infrastructure, and land and environment (see Table 3-1).
- **Likelihood** is the likelihood of the event occurring and is a judgment based on the history of similar incidents occurring in the mining industry in Victoria (see Table 3-2).
- **Standard control** mechanism is considered to be accepted practice in the mining industry for addressing a potential impact on a sensitive receptor. Standard controls are recognised procedures, guidelines, methods, and codes of practice that can be sourced from regulations, policies, guidelines and leading practice references.
- **Additional treatment (control)** is a non-standard control used as part of a Risk Treatment Plan to reduce the residual risk to an acceptable level.

4 Risk hazards identified

An essential component of the risk management process is to identify the hazards created by the mining operations. Potential mining hazards as listed within the RRAM system are shown in Table 4-1, along with their applicability to the Costerfield Operations. Each hazard is further discussed in the following subsections.

Table 4-1. Potential mining hazards and applicability to the Costerfield operations

Potential mining hazard	Construction	Operation	Closure	Post Closure
Air blast	Yes	Underground only	No	No
Altered visual amenity	Yes	Yes	Yes	Yes
Dust/air emissions	Yes	Yes	Yes	No
Erosion and sedimentation	Yes	Yes	Yes	Yes
Fire	Yes	Yes	Yes	No
Flood	Yes	Yes	Yes	No
Fly rock	No	No	No	No
Ground disturbance	Yes	Yes	Yes	Yes
Ground instability	Yes	Yes	Yes	Yes
Ground vibration	Yes	Yes	Yes	No
Hazardous waste	No	Yes	Yes	Yes
Light emissions	No	Yes	No	No
Noise pollution	Yes	Yes	Yes	No
Security breach	Yes	Yes	Yes	Yes

4.1 Air blast

Air blast is a hazard created when explosive charges associated with mining create high-pressure air waves which can impact the environment. As mining activity involving air blast is contained entirely underground, there is no potential for this hazard to impact on any sensitive receptors.

This hazard is present during the construction and operation phases of the mine. However, there is potential for air blasts to generate ground vibration and these potential impacts are considered in Section 4.10 and 4.13 below.

4.2 Altered visual amenity

The altered visual amenity of an area is a hazard created when activities associated with mining impact the visual environment to the detriment of those people using the environment. Mining activities associated with the work plan that may result in visual amenity impacts on potential sensitive receptors include:

- presence and operation of plant and equipment
- presence and operation of facilities such as TSFs, waste and ore stockpiles, vent shafts, dams and evaporation ponds
- presence and operation of infrastructure such as access roads, power generators and transmission lines, water management pipelines, and water treatment facilities
- permanent landforms such as the decommissioned TSFs.

This hazard is present during all phases of the mine-life. Following the successful revegetation and rehabilitation of disturbed areas this risk should be minimised post closure.

4.3 Ground disturbance

Ground disturbance of an area is a hazard created when activities associated with mining impacts the land. For the purposes of this RMP it is also considered to include impacts on groundwater or surface water. Mining activities associated with the work plan that may impact on potential sensitive receptors include:

- disturbance associated with the operation of plant and equipment – for example potential impacts associated with any additional ground disturbance outside the current footprint of project facilities
- operation of processing facilities
- mine dewatering activities
- operation of dams and use of waterways – overtopping, breach of containment or seepage may result in environmental impacts
- operation of TSFs – overtopping, breach of containment or seepage may result in environmental impacts.

This hazard is present during the construction, operation and closure phases of the mine life. Following the revegetation and rehabilitation of disturbed areas this risk does not exist post closure.

4.4 Dust/air emissions

Emissions of dust and/or gaseous substances can have an adverse impact on air quality

The most likely sources of dust generation are:

- operation of plant and equipment – this includes crushing/screening of mined material, use of the cement silo
- vehicle movements – the hazard is generated when vehicles (particularly heavy vehicles) drive on unsealed roads (such as those on and around the mine site)

- blasting and underground workings – as these activities occur underground, the hazard is generated when particulates from blasting, or exhaust gasses/fumes from blasting or diesel vehicles, is potentially released through the ventilation shafts
- construction and operation of waste rock and ore stockpiles – the hazard is generated when material is placed onto stockpiles/dumps or excavated from those areas
- operation of TSFs – the hazard is generated when material in the TSF dries and is entrained by wind
- construction and rehabilitation activities cause dust emissions.

This hazard is present during all phases of the mine-life. Following the successful revegetation and rehabilitation of disturbed areas this risk should not exist post closure.

Emissions of other substances such as engine exhausts (particularly from combustion of diesel) can have an adversity impact on air quality. The most likely sources of engine exhaust generation are:

- operation of plant and equipment
- vehicles.

This hazard is present during the construction, operation and closure phases of the mine life. Following the decommissioning and rehabilitation of the site this risk does not exist post closure.

4.5 Erosion and sedimentation

Erosion and sedimentation can adversely impact on the environment, particularly downstream waterways. The most likely sources of erosion and sedimentation are:

- disturbance associated with the operation of plant and equipment
- operation of processing facilities
- construction and operation of waste rock and ore stockpiles
- operation of dams and use of waterways
- operation of TSFs
- discharge of treated water from RO plant to waterways
- land clearance during the construction of new facilities or infrastructure
- presence of disturbed, un-rehabilitated ground
- construction and rehabilitation activities also cause dust emissions.

This hazard is present during all phases of the mine-life. Following the successful revegetation and rehabilitation of disturbed areas this risk should not exist post closure.

4.6 Fire

Fire ignited as a result of project activities has the potential to impact on many aspects of the mine and its surrounds. Potential sources of fire include:

- operation of plant and equipment – such as vehicle exhausts, un-enclosed engines, rotating equipment
- use of spark or flame generating equipment – such as cutting and welding equipment

- personal use of cigarettes and matches
- explosives – these are securely stored underground and are not considered likely to be a source of fire
- fuel/additive storage (fuel source) – use of flammable fuels and chemicals.

There is also the potential for a bushfire to reach project facilities causing damage and associated environmental risk.

This hazard is present during construction, operation and closure phases of the mine life. Following the decommissioning and closure of the site this risk does not exist post closure.

4.7 Flood

Flood risk (including engulfment) is a hazard that mining activity (particularly underground mining) must be aware of. The most likely sources of flooding are:

- operation of dams and TSFs – the uncontrolled discharge of water contained in water storage facilities and TSFs could present a local flood risk
- the uncontrolled discharge of other waters stored or used on site could present a local flood risk
- inundation from TSF flooding into current underground workings.

There is also the potential for a natural flood to reach project facilities (such as facilities located within a flood plain) causing damage and associated environmental risk.

This hazard is present during operation until the closure phase of the mine life. Following the decommissioning and closure of each dam or TSF facility this risk does not exist.

4.8 Fly rock

Fly rock is a hazard generated by blasting and, as blasting at Costerfield is confined to underground operations, this hazard is very unlikely to impact any sensitive receptors. Therefore, this risk is not considered present at the Costerfield Operations and is not discussed further.

4.9 Ground instability

The stability of the ground in the vicinity of mining operations can be compromised by:

- pits, underground workings and voids – failures in open pit walls, underground workings, or other voids such as the boxcut can result in ground movement or subsidence and consequent impacts on the surrounding environment including private property and public infrastructure
- blasting – vibration caused by blasting can impact on built structures
- waste and ore stockpiles – slumping of these can impact on the surrounding environment
- dams and TSFs – failure of embankments can impact on the surrounding environment.

This hazard is present during the construction, operation, closure and post closure phases of the mine life. Following the successful revegetation and rehabilitation of disturbed areas this risk should be minimised post closure.

4.10 Ground vibration

As with ground stability the ground vibrations in the vicinity of mining operations can be caused by:

- blasting – vibration caused by blasting can impact on built structures
- during the construction of new facilities or infrastructure
- vibration from machinery, equipment and vehicles (e.g. drill rigs, crushers, haul trucks) can also affect built structures.

This hazard is present during the construction, operation and closure phases of the mine life. Following the decommissioning and rehabilitation of the site this risk does not exist post closure.

4.11 Hazardous materials and waste

Hazardous materials such as fuels and processing chemicals are stored and used on site, and hazardous waste is generated as part of the mining operations. When these materials are either not managed appropriately or structures used to contain them are compromised, they can present a hazard to the environment. These hazards include:

- fuel/additive storage and use, potentially resulting in unplanned spills, discharges and leaks from compromised tanks
- explosives storage and use, potentially resulting in contamination
- waste from the use of fuels and chemicals such as waste oils or empty drums/containers pose an environmental hazard and require appropriate handling and disposal
- leaching of metals from waste rock or ROM stockpiles into the environment (in particular, acid rock drainage) has the potential to impact on soil, groundwater and surface water.

This hazard is only present during the operation phases of the mine. Following the cessation of mining operations this risk does not exist during rehabilitation or post closure.

4.12 Light emissions

Light (particularly at night) can impact on the environment, principally causing amenity impacts to residents in the vicinity of the site. As the Costerfield Operations are a 24-hour per day operation, light emission is a potential hazard, predominantly:

- flood lights associated with night work operation of the Brunswick processing plant and the Augusta mine site (including mine workshop and car park)
- headlights associated with vehicle movement.

This hazard is only present during the operation phases of the mine. Following the cessation of mining operations this risk does not exist during rehabilitation or post closure.

4.13 Noise pollution

As with light, noise can impact on the environment, particularly the amenity of residents in the vicinity of the site. Processes as the Costerfield Operations that have the potential to generate noise at levels high enough to cause offsite amenity impacts include:

- operation of plant and equipment – this includes crushing/screening of mined material, use of the cement silo
- vehicle movement – vehicles (particularly heavy vehicles) on roads on and around the mine site
- blasting – as this is conducted underground, the impact of this is less than would be expected from surface blasting works
- the construction, decommissioning or rehabilitation of facilities or infrastructure
- nightworks – night-time mining activities are less intensive than those that occur during the day. However, even with restricted vehicle movements and surface activities, some night-time activities may result in noise impacts.

This hazard is present during the construction, operation and closure phases of the mine life. Following the decommissioning and rehabilitation of the site this risk does not exist post closure.

4.14 Security breach

Unauthorized entry to the site in general and/or to particular areas/processes at the site has the potential to be hazardous. Unless invited onto site and accompanied by site personnel, public entry to the site is forbidden and can cause a danger to the unauthorised entrant or to others. Additionally, some restrictions are placed on site personnel having access to particular areas/uses of equipment or materials (such as explosives). As such, unauthorised entry to or use of the following, are considered security breaches:

- entry into pit and underground mine workings
- entry into site buildings
- entry to mine dams
- use of site plant and equipment
- use of site vehicles
- use of explosives
- access to fuel or hazardous materials storages.

This hazard is present during the construction, operation, closure and post closure phases of the mine life. Following the decommissioning and rehabilitation the site this risk should be minimised post closure.

5 Sensitive receptor identification

Sensitive receptors are those aspects of the natural or human environment that may be impacted by mining operations. Under the MRSD Act, ERR has a duty when determining the consequence of a risk event to consider the potential impacts to (ERR 2020a):

- *Members of the public:*
  - *Public health, safety, amenity and Aboriginal heritage*
- *Land, property and infrastructure:*
  - *Neighbouring property, land use and nearby infrastructure such as highways, transmission lines, pipelines, schools and hospitals*
- *Environment:*
  - *Air, water, soil, vegetation, and flora and fauna species.*

The guidance for a risk based approach to the submission of Work Plans that requires the identification of sensitive receptors and the risk of the project creating a hazard to (or impact on) these receptors.

Mandalay has identified the following potential sensitive receptors at risk that need to be considered. The particular aspects of these sensitive receptors are described below.

For certain aspects of the environment (surface water, groundwater and built environment) Mandalay has produced an environmental monitoring figure which shows the main Costerfield Operations, distances to residences, waterways and the road network and monitoring locations for noise, dust, surface water and groundwater. The Sensitive Receptors and Environmental Monitoring Plan shown in Figure 5.1.

5.1 Aboriginal heritage

The Taungurung Clan Aboriginal Corporation is the Registered Aboriginal Party designated as the traditional owners of the land on which mining licence MIN4644 is located (SRK 2017).

Certain areas within MIN4644 and close to current operational areas are designated as Areas of Cultural Heritage Sensitivity. These include:

- Wappentake Creek (a waterway that traverses the southern portion of the eastern half of the mining licence) and 200 m either side of the drainage line
- Mountain Creek South (a waterway that traverses the southern portion of the eastern half of the mining licence) and 200 m either side of the drainage line
- Tin Pot Gully Creek (a waterway that traverses the eastern portion of the western half of the mining licence) and 200 m either side of the drainage line

There is the potential to disturb Aboriginal Cultural Heritage (where present) if vegetation clearance or ground disturbance activities take place outside of current disturbance areas without appropriate checks and approvals.

ADVERTISED PLAN

AE1046.9 Mandalay Resources - Costerfield Operation
Figure 5.1. Sensitive receptors - Brunswick and Augusta sites
Created 3/11/2022 and revised 21/04/2023
CRS: GDA 20 MGA 55
Scale: 1:27,250 @ A3
Page size: A3

Dargile State Forest
Costerfield N.C.R
Costerfield State Forest
Costerfield State Forest
Mears Track
Reef Track
C10 Track
Splitters Creek
Splitters Creek Evaporation Facility
MIN5567
HO722
HO745
HO333
Costerfield
HO333
Heathcote-North Costerfield Road
South Costerfield-Graytown Road
South Costerfield-Graytown Road
Youle shaft
Rock Garden Waste Stockpile
Bombay TSF
Brunswick West TSF
Brunswick West RWP
Brunswick Waste Rock Stockpile
Brunswick Shaft
Heathcote - Nagambie Road
Reef Track
2 km radius
Brunswick TSF
Bradleys Lane
HO744
Phillips Lane
Augusta Evaporation Ponds
Wappenbie Creek
Cochranes Road
Browns Lane
Lot 2 PS404811
Core Yard
Newtons Lane
Cuffley Shaft
Augusta Shaft
Augusta Site
Cochranes Road
Tobins Lane
Peels Track
Peels Track
2 km radius
MIN4644
Puckapunyal Military Area
Heathcote-Nagambie Road
Peels Lane
Doolan Crescent
Lot 1 TP163903
0 0.5 1 km
Scale: 1:27,250
Additional data: VIC_TR_ROAD, VIC_MINTEN, VIC_HY_WATERCOURSE, VIC_HY_WATER_AREA_POLYGON, V_PARCEL_MP_POLYGON, VIC_TOWNSHIP_POLYGON, VIC_POWER_LINE, PLM25_Vic_Crown_Lands and VIC_Planning_Overlay_polygon.
ACCENT ENVIRONMENTAL
MANDALAY RESOURCES

300000 301000 302000 303000 304000 305000 306000 307000 308000
5918000 5917000 5916000 5915000 5914000 5913000 5912000

- Owned by Mandalay Resources
- Sensitive receptor (residence)
- Vent shaft
- Dust monitoring site
- Groundwater monitoring site
- Injection site
- Noise monitoring site
- Seepage detection bore
- Surfacewater monitoring
- Existing clean water diversion drain
- Brunswick West TSF clean water diversion drain
- Injection site
- Splitters Creek pipeline
- RO discharge pipeline
- Rising main pipeline
- Process water return pipeline
- Process water delivery pipeline
- Relocated power transmission line
- Existing power transmission line
- Road
- Main watercourse
- Watercourse - tributary
- Exploration Licence
- Mining Licence
- Mine site domain
- Vegetation offset area
- Private land lot boundary
- Costerfield township
- Water body
- Site radius - 2 km

Crown Land
- Commonwealth Land
- Community Use Area
- Earth Resources
- Natural Features Reserve
- Nature Conservation Reserve
- Services and Utilities
- State Forest
- Uncategorised Crown Land
- Other Crown Land

Planning Overlay
- Heritage Overlay (HO)

5.2 Historic heritage

The Costerfield Gold and Antimony Mining Precinct consists of three sites (Bombay Mine and Cyanide Works, Minerva Mine and Costerfield Main shaft) that are located within MIN4644 to the northwest of the Brunswick TSF. The precinct is considered to be of historical, archaeological and scientific importance to the State of Victoria (HCV 2005).

In addition, the following features of local cultural heritage significance associated with historic mining have been identified within MIN4644 between the Augusta and Brunswick sites:

- South Costerfield Mine Shaft
- Old Alison Mine Shaft
- New Alison Mine Shaft.

The current mine operations do not disturb any historic mine workings. However, there is the potential to impact historic heritage by ground disturbance outside of current disturbance areas or the movement of equipment or vehicles through heritage areas.

The current underground operations do not disturb any historic mine workings. However, the proposed Youle Ventilation Shaft and Rising Main are located within 500m of the 3 sites. There is also the potential to impact historic heritage by ground disturbance outside of current disturbance areas during construction, operation or rehabilitation, or the movement of equipment or vehicles through heritage areas.

The Youle Ventilation Shaft and Rising Main are located on a site where an old Miner's Cottage stands, identified as a 'Contributory Place' number 32610 within the Costerfield Precinct (HO722) A contributory place contributes to the significance of a heritage precinct, note due to the limitations of the Eaglehawk and Bendigo Heritage Study, 1993 all buildings located within a heritage precinct in this study which were constructed prior to 1960 are considered contributory. (E+ Architecture CA13 Section 6 Heritage Assessment).

Costerfield Precinct (HO722)

Significant place				
Costerfield gold and antimony mining precinct	Heathcote-Nagambie Road	Costerfield	32611	HO333
Uniting Methodist Church (former)	66 Donnellys Lane	Costerfield	32607	
Contributory places				
House	3 Costerfield Redcastle Road	Costerfield	32603	
School (former)	8 Crossley Road	Costerfield	32605	
House	9 Donnellys Lane	Costerfield	32606	
House	74 Donnellys Lane	Costerfield	32608	
Post office (former) and residence	1133 Heathcote Nagambie Road	Costerfield	32613	
Hall	1136 Heathcote Nagambie Road	Costerfield	32614	
House	CA 10 Cnr Heathcote Nagambie and Reservoir Road	Costerfield	32616	
House	1 Ward Lane	Costerfield	32621	
House	CA 13 Heathcote North Costerfield Road	Costerfield	32610	

5.3 Groundwater

Groundwater extraction in the Costerfield area is regulated by Goulburn-Murray Water (G-MW). In the vicinity of the mine operations, groundwater is at approximately 20 metres below ground level (SRK 2017). Depending on quality, groundwater can be suitable for a number of uses, which in Victoria are protected by EPA Victoria's Environmental Reference Standard.

The regional groundwater aquifer is confined to semi-confined and consists of Silurian siltstones and mudstones. Groundwater flow within this regional aquifer is through fractures and fissures within the rock. This is overlain by a perched alluvial aquifer comprising recent gravels, sands and silt. The perched alluvial aquifer is connected to the surface water system.

Mining activities have the potential to impact on groundwater quality, levels, seepage from TSFs or water dams or hydrology such as by the release of contaminants or from mine dewatering.

5.4 Surface water

Surface water includes dams and waterways, including drains, streams and ponds. Regulation of surface water comes under the jurisdiction of rural water authorities and catchment management authorities.

The Costerfield gold mine lies within the G-MW and the Goulburn-Broken Catchment Management Authority (GBCMA) areas. As a delegated authority under the Water Act 1989, the GBCMA is able to declare designated waterways in the Costerfield area. Designated waterways can be named or un-named, permanent or seasonal, and can range in size from a natural depression to a river. Water quality in Victoria is protected by EPA Victoria's Environmental Reference Standard.

The waterways that may be impacted by the Costerfield Operations, particularly during construction and operation, are shown in Figure 5.1, above, and include:

- Wappentake Creek and anabranch, which are the main waterways downstream of the project area
- Mountain Creek, which runs north of the open pits and southwest of the evaporation ponds before joining Wappentake Creek
- Mountain Creek South, which traverses the southern portion of the eastern half of the mining licence and has been diverted around the Brunswick site
- Tin Pot Gully Creek, which starts just to the northwest of the Brunswick TSF and then runs east and south towards the evaporation pond.

In addition to those named waterways, there are other smaller creeks and channels that are potentially impacted by mining activities and these activities have the potential to impact on the quality and hydrology of surface waters such as by the release of contaminants or from the physical disruption or diversion of waterways.

5.5 Biodiversity and ecosystems

In the RRAM system 'biodiversity' and 'ecosystems' are categorised as separate sensitive receptors but for the purposes of this risk management plan, they have been considered together. The receptors include those ecosystems (flora and fauna) that exist on land, in surface water and in groundwater and the associated variety or plant and animal life (biodiversity) associated with them.

The Costerfield Operations are partly located within the Costerfield State Forest and in a Public Conservation and Resource Zone (PCRZ). The Department of Environment, Land, Water and Planning (DELWP) maps the following Ecological Vegetation Classes (EVCs) as potentially occurring in the vicinity of the Costerfield Operations site: EVC 175 Low Rises Grassy Woodland (conservation status: vulnerable); and 61 Box Ironbark (conservation status: depleted). For EVC evaluation purposes, Costerfield mining operations lies within the Goldfields Bioregion.

Activities during construction, operation and rehabilitation have the potential to impact on terrestrial and aquatic biodiversity and ecosystems such as by vegetation clearance, erosion and sedimentation, the release of contaminants, changes to hydrology or ignition of fires.

5.6 Significant landscape

Significant landscape is landscape which is be deemed significant for a combination of historic, aesthetic, scientific, religious or social reasons – or where vegetation is deemed integral to the amenity of the area.

This sensitive receptor is not impacted as there are no such designated areas in or near MIN4644.

5.7 Crown land

Crown land is land that is held by the Crown in right of the State of Victoria.

The following components of the Costerfield Operations are located on Crown land (see Table 2-1) – the mine dewatering rising main and pipeline, and the Brunswick processing plant and TSF.

Figure 5.1 shows the crown land affected or potentially affected by the operations described in this work plan.

Mining activities, particularly during construction, operation and rehabilitation, have the potential to impact on Crown land such as by vegetation clearance, erosion and sedimentation, breaches of containment facilities, changes to hydrology or ignition of fires.

5.8 National Park

A National Park is crown land is land that has been reserved because it is characterised by its predominantly unspoilt landscape, and its flora, fauna or other features.

The Heathcote-Graytown National Park is approximately to 1.5 km to 3 km to the north, northeast and northwest of the Costerfield Operations.

Figure 5.1 shows the location of the Heathcote-Graytown National Park in relation to MIN4644.

There is the potential for mining activities during construction, operation or rehabilitation, to impact on the National Park by ignition of fire.

5.9 Public safety

Public safety is the protection from injury and disease of persons other than employees of an employer, from risks arising from the workplace or the conduct of the employer at the workplace. There is the potential for mining activities during construction, operation or rehabilitation, to impact on public safety by the movement of vehicles on public roads, blasting, dust generation, ground

instability, operation of plant and equipment, transport and handling of mined materials, and use of hazardous materials.

5.10 Private property

Private land is that land that has been alienated from the Crown by a grant of freehold or by leasing. Private land includes residential structures and other buildings, farmed animals and crops.

Figure 5.1 shows the extent of private land and crown land covered by MIN4644 and the location of residences with respect to the Augusta and Brunswick sites. The plan shows:

- six residences within 500 m of Youle Ventilation Shaft/Rising Main site
- fifteen residences within 1000 m of Youle Ventilation Shaft/Rising Main site
- six residences within 1000 m of the Augusta site
- four residences within 1000 m of the Brunswick site.

There are a number of residences located within 300 and 500 m of the Bombay TSF and three residences located between 150 and 500 m of the Augusta evaporation ponds.

Mining activities potentially may impact on private property during construction, operation or rehabilitation, by vegetation clearance, erosion and sedimentation, breaches of containment facilities, changes to hydrology or ignition of fires.

In addition, mining activities may result in amenity impacts on residences on private land such as by altered visual amenity, dust, noise and vibration.

5.11 Public infrastructure

Public infrastructure includes public roads and public buildings.

Figure 5.1 above, shows public roads and public buildings with respect to the Augusta and Brunswick sites. The plan shows:

- Heathcote-Nagambie Road is within 500 m of the Augusta site
- Heathcote-Nagambie Road is within 1000 m of the Brunswick site
- McNicholls Lane is within 500 m of the Augusta site
- Cochranes Road, Newtons Lane, Peels Lane, Tobins Lane are within 1000 m of the Augusta site
- Bradleys Lane is within 1000 m of the Brunswick Plant site
- Bradleys Lane is within 50m of the Brunswick West TSF site
- Bradleys Lane is within 20m of the Youle Ventilation Shaft site

An investigation of infrastructure in the vicinity of the mining operations revealed:

- no railways are within 10 km
- no power transmission lines are within 10 km
- no gas pipelines are within 10 km
- no flood spillways are within 10 km.

Mining activities potentially may impact on public infrastructure during construction, operation or rehabilitation, by the movement of vehicles on public roads, erosion and sedimentation, breaches of containment facilities, blasting, ground instability or ignition of fires.

5.12 Community facility

Community facilities are similar to public infrastructure and are used by the community for events. Such facilities include recreational parks and ovals (and associated infrastructure), libraries and halls, etc.

The Costerfield Public Hall (located at 1136 Heathcote-Nagambie Road) is approximately 1.3 km northeast of the Brunswick processing plant. Figure 5.1 shows the Costerfield Public Hall in relation to the mining operations. Apart from the public hall, there are no community facilities in the vicinity of the mining operations. The Costerfield Public Hall is within 300m of the Youle Ventilation Shaft/Rising Main site.

Mining activities potentially may impact on the public hall by ignition of fires.

5.13 Visual amenity

Visual amenity, in its usual meaning is the pleasant or normally satisfactory aspects of a location which contribute to its overall character and the enjoyment of residents or visitors. It can have a physical component such as the character and appearance of building and works, proximity to facilities, quality infrastructure and absence of noise, unsightliness or offensive odours.

The Costerfield Operations are located within a relatively flat, undulating plain and the facilities are located adjacent to or within State Forest. In general, therefore, the site is not visually prominent from vantage points such as nearby landholders or public roads. In addition, as an underground operation, it has a smaller footprint than an equivalent open cut operation.

However, project facilities and activities do result in visual amenity impacts during construction, operation or rehabilitation. Condensation plumes from the warm air being emitted from the ventilation shafts may create visible clouds immediately above the shafts.

5.14 Air quality

Air quality is the quality of ambient air that may be adversely impacted by work processes and practices. At the Costerfield Operations, background air quality would be expected to be typical of a relatively remote rural location, distant from other large-scale industry.

Mining activities during construction, operation or rehabilitation, have the potential to impact on air quality by generating dust or releasing other gaseous emissions and particulates such as from diesel exhaust or blasting activities.

6 Risk assessment and management

6.1 Risk identification and assessment

A risk assessment has been undertaken for the Mandalay and processing operations by using the process described in Section 3 and applying it to each of the risk hazards identified in Section 4, taking into account potential impacts on the sensitive receptors identified in Section 5.

The risk assessment is tabulated in the sections below for the following risk hazard categories:

- altered visual amenity
- dust/air emissions
- erosion and sedimentation
- fire
- flood
- ground disturbance
- ground instability
- ground vibration
- hazardous materials and waste
- light emissions
- noise pollution
- security breach.

Where new activities are assessed to require the preparation of a new risk treatment plan these will be included and uploaded to RRAM.

6.1.1 Altered visual amenity

Table 6-1 Risk assessment: altered visual amenity

Objectives or outcomes to be met	
In terms of altered visual amenity, the goal of the Costerfield Operations is to acceptably minimise impacts on visual amenity from mining and processing. To achieve this, the following objectives shall be met: • No significant impact on the amenity of neighbouring residences by the height of TSF or waste rock and ROM pad stockpiles above natural ground level • Height of TSF to be kept to a minimum to meet short-term operational needs	
Risk source	**Possible consequence**
Plant and equipment - Cuffley vent shaft	Visible plume of steam from Phillips Lane vent shaft on cold mornings on neighbouring landowners or residences
Plant and equipment Heathcote North-Costerfield rd Vent shaft and Rising Main	Visible plume of steam from Heathcote North-Costerfield Rd vent shaft on cold mornings on neighbouring landowners or residences
Plant and equipment Bradleys Lane Youle vent shaft	Visible plume of steam from Youle vent shaft on cold mornings on neighbouring landowners or residences Visual impact of Youle vent shaft on the Miner's Cottage.
Overburden dumps and stockpiles - waste rock and ROM pad stockpiles	Visual impact of waste rock and ROM pad stockpiles on neighbouring landowners or residences
TSF	Visual impact of height of TSFs above natural ground level on neighbouring landowners or residences
Standard controls	
Consult with stakeholders regarding presence of plume and respond to concerns.	
Consult with stakeholders regarding height of stockpiles and respond to concerns.	
Limit stockpile heights to ensure comparable to surrounding tree heights.	

Minimise TSF heights as far as reasonably practical - height kept to a minimum to meet short term operational needs.
Revegetation of embankments and disturbed areas as soon as practicable.
Maintain screening vegetation, where present, between residences and TSFs.
Decommissioning and rehabilitation to agreed post-mining landuse and landforms
Relevant associated procedures
Community Engagement Plan (uploaded to RRAM)
Tailings Storage Facility Management/Operation Plan (uploaded to RRAM)
Traffic Management Procedure (uploaded to RRAM)
Rehabilitation Plan (uploaded to RRAM)
CA13 Section 6 Heritage Assessment (uploaded to RRAM)

Risk source, receptor and frequency of exposure			**Risk assessment**					
			Inherent risk			**Residual risk**		
Risk source	**Receptor**	**Frequency of exposure**	**Consequence**	**Likelihood**	**Risk**	**Consequence**	**Likelihood**	**Risk**
Cuffley / Heathcote North-Costerfield rd/ Youle vent shafts	Private Property	Cold mornings	Insignificant	Unlikely	Low	Insignificant	Unlikely	Low
Waste rock/ROM stockpiles	Private Property	Daily	Minor	Possible	Medium	Minor	Unlikely	Low
TSF	Private Property	Daily	Minor	Possible	Medium	Minor	Unlikely	Low
Outcome of risk assessment								

The maximum inherent risks are rated **medium**. The preparation of risk treatment plans is therefore not considered necessary. However, in accordance with current regulations and industry best practice, a number of standard risk control measures (as described above) are existing practices included as part of the Costerfield Mine management system to further reduce risks.

6.1.2 Dust

Table 6-2 Risk assessment: dust

Objectives or outcomes to be met	
In terms of dust emissions, the requirements to be met by the Costerfield Operations are set out in the *Environment Reference Standard*. The goal of the Costerfield Operations is to comply with applicable guidelines for particulate emissions from mining and processing, and to acceptably minimise community amenity impacts. To achieve this, using the applicable guidelines, the following objectives shall be met: • For a 24 hr average: particles with mean aerodynamic diameter less than 10 microns (PM_{10}) must not exceed 50 µg /m^3 or particles with mean aerodynamic diameter less than 2.5 microns ($PM_{2.5}$) must not exceed 25 µg /m^3.	
Risk source	**Possible consequence**
Vehicle movement	Vehicle movements on un-sealed roads creating dust that may impact on amenity, air quality and/or public health
Plant and equipment	Plant such as crushers generating fine dust or filling of cement from silo creating dust that may impact on amenity, air quality and/or public health Screening operations, heavy vehicle and loader movements creating dust that may impact on amenity, air quality and/or public health Mobile crusher, screening plant at the Brunswick mine creating dust that may impact on amenity, air quality and/or public health
Overburden dumps and stockpiles	Movement of mined materials, such as the recovery of waste rock for beneficial re-use, creating dust that may impact on amenity, air quality and/or public health
TSF	Dust emissions created by winds blowing across dried out tailings surface creating dust that may impact on amenity, air quality and/or public health

Standard controls
Deploy portable DustTrak monitoring unit as an early warning, proactive dust monitoring tool.
Reduce vehicle speed.
Water exposed areas during dry periods and restrict site traffic to areas serviced by water tankers.
Add dust suppression agent to water tankers to aid in dust suppression.
Minimise vehicle movement.
Minimise exposed areas.
Wheel washes installed at the entrances of both the Augusta and Brunswick mines.
Seal access roads after the wheel washes at both the Augusta and Brunswick mines prevent offsite road dust.
Use fixed and mobile sprinkler systems.
Use water cart on roads within the site.
Use dust covers for dust generating equipment (e.g. the crusher).
Fit a dust filter to cement silo.
Implement a cement silo maintenance program.
Control moisture level in stockpiles.
Limit stockpile heights to ensure comparable to surrounding tree heights (provides protection from wind).
Orientation and position equipment appropriately.
Moisture control of tailings surface through use of spigots and supplementary water if required.
Maintain supernatant on TSFs.

Overall shape of the Brunswick West TSF (narrow at the deposition point, and widening out towards the tail end will result in tailings being continually deposited over the same general area, limiting the potential for evaporation to completely dry the tailings beach out.
Speed limit of no more than 10km/hr on TSF embankment crest and site access roads.
Decommissioning and rehabilitation of TSF with appropriately designed cover system and vegetation.
Relevant associated procedures
Ambient Air Quality Management Plan (uploaded to RRAM)
Rehabilitation Plan (uploaded to RRAM)
Community Engagement Plan (uploaded to RRAM)

Risk source, receptor and frequency of exposure			**Risk assessment**					
			Inherent risk			**Residual risk**		
Risk source	**Receptor**	**Frequency of exposure**	**Consequence**	**Likelihood**	**Risk**	**Consequence**	**Likelihood**	**Risk**
Vehicle movement	Air quality / Public safety	Daily	Moderate	Almost certain	Very High	Moderate	Possible	Medium
Plant and equipment	Air quality / Public safety	Daily	Moderate	Almost certain	Very High	Moderate	Possible	Medium
Filling and use of cement silo	Air quality / Public safety	Daily	Moderate	Possible	Very High	Insignificant	Unlikely	Low
Screening operations, heavy vehicle and loader movements	Air quality / Public safety	Daily	Moderate	Almost certain	Very High	Moderate	Possible	Medium
Mobile crusher operations	Air quality / Public safety	Daily	Moderate	Almost certain	Very High	Moderate	Possible	Medium

Movement and stockpiling of mined materials	Air quality / Public safety	Daily	Moderate	Almost certain	Very High	Moderate	Possible	Medium
Tailings stored in TSF	Air quality / Public safety	Daily	Minor	Unlikely	Low	Minor	Rare	Low

Outcome of risk assessment
The maximum inherent risks are rated **Very High**. In accordance with current regulations and industry best practice, a number of standard risk control measures (as described above) are existing practices included as part of the Costerfield Mine management system to further reduce risks. When these standard controls are taken into account, the maximum residual risk does not exceed the **Medium** rating. The preparation of risk treatment plans is therefore not considered necessary.

6.1.3 Air emissions

Table 6-3 Risk assessment: air emissions

Objectives or outcomes to be met	
In terms of emissions from plant and machinery, the requirements to be met by the Costerfield Operations are set out in the *Environment Reference Standard*. The goal of the Costerfield Operations is to comply with applicable guidelines and General Duty of Care. The current EPA licence does not impose any specific conditions for emissions to air but requires that offensive odours are not discharged beyond the boundaries of the premises for amenity reasons.	
Risk source	**Possible consequence**
Vehicle movement	Emissions of carbon dioxide and particulates from mobile plant that may impact on amenity, air quality and/or public health
Machinery	Emissions of carbon dioxide and particulates from mobile plant that may impact on amenity, air quality and/or public health
Process Plant	Emissions of carbon dioxide and particulates from mobile plant that may impact on amenity, air quality and/or public health
Blast fume from vent shafts	Blast fumes from vent shafts that may impact on amenity, air quality and/or public health
Standard controls	
Maintain plant/equipment and follow procedures	

Implement preventative maintenance work on mobile diesel equipment
Ensure adequate underground ventilation and implement air quality monitoring program
Meet OHS standards for work force and undertake monitoring (spot tests)
Initial modelling was undertaken to show levels are significantly below limits
Undertake ongoing modelling of underground vent network
Relevant associated procedures
Ambient Air Quality Management Plan (uploaded to RRAM)
Traffic Management Procedure (uploaded to RRAM)
Equipment maintenance schedules

Risk source, receptor and frequency of exposure			**Risk assessment**					
			Inherent risk			**Residual risk**		
Risk source	**Receptor**	**Frequency of exposure**	**Consequence**	**Likelihood**	**Risk**	**Consequence**	**Likelihood**	**Risk**
Vehicle movement	Air quality / Public safety	Daily	Minor	Almost certain	High	Minor	Possible	Medium
Machinery	Air quality / Public safety	Daily	Minor	Almost certain	High	Minor	Possible	Medium
Process Plant	Air quality / Public safety	Daily	Minor	Almost certain	High	Minor	Possible	Medium
Blast fume from vent shafts	Air quality / Public safety	Daily	Minor	Unlikely	Low	Minor	Rare	Low
Outcome of risk assessment								

The maximum inherent risks are rated **High**. In accordance with current regulations and industry best practice, a number of standard risk control measures (as described above) are existing practices included as part of the Costerfield Mine management system to further reduce risks. When these standard controls are taken into account, the maximum residual risk does not exceed the **Medium** rating. The preparation of risk treatment plans is therefore not considered necessary.

6.1.4 Erosion and sedimentation

Table 6-4 Risk assessment: erosion and sedimentation

Objectives or outcomes to be met	
In terms of erosion and sedimentation, the requirements to be met by the Costerfield Operations are set out in *Environment Reference Standard* and supported by EPA Publication 1834: *Civil construction, building and demolition guide*. The goal of Costerfield Operations is to minimise impacts on downstream water quality as a result of mining-related erosion and sedimentation, and to comply with EPA licence conditions. To achieve this, using the applicable guidelines, the following objectives shall be met: • No significant deviation in water quality from background (non-mine affected) conditions • Surface water discharged from the premises is not contaminated with waste as per EPA licence conditions, where applicable, including turbidity with a 75th percentile limit of 10 Nephelometric Turbidity Units	
Risk source	**Possible consequence**
Dams and waterways	Impact on private property, crown land, surface water and aquatic ecosystems from unplanned, sediment-bearing or erosive discharge from the: • Augusta Mine dam • Augusta Mine evaporation ponds • Brunswick Mill stormwater dam • Brunswick Mill process water dam • Brunswick West Process water dam
TSF	Unplanned, sediment-bearing or erosive discharge from the TSFs resulting in impacts on private property, crown land, surface water and aquatic ecosystems

Activity – plant and equipment	Erosion and sedimentation caused by the use of plant and equipment resulting in impacts on surface water and aquatic ecosystems
Activity – overburden dumps and stockpiles	Erosion and sedimentation caused by runoff from waste dumps and stockpiles resulting in impacts on surface water and aquatic ecosystems
Disturbed, unrehabilitated ground	Erosion and sedimentation caused by rainfall runoff from disturbed, unrehabilitated land or material stockpiles resulting in impacts on surface water and aquatic ecosystems
Standard controls	
Appropriately designed, constructed and maintained water and tailings structures with adequate freeboard capacity and controlled discharge capacity	
Drainage control works to divert surface water away from disturbance areas	
Drainage collection system at Brunswick Process Plant site to direct stormwater into settling pond for re-use or for pumping into the disused tailings dam	
Culvert and channel capacity that can convey the relevant flood event design criteria (i.e. 1:100 AEP, Critical Duration)	
Minimise disturbance areas	
Rehabilitation of areas of exposed soil	
Create and implement a sediment and erosion control plan for the construction and rehabilitation phases	
Control drainage in areas where activities are being undertaken to ensure captured rainfall is directed to a sediment retention basin	
Use of appropriately sized sediment retention basin	
For erosion control of TSF embankments, final slopes of 1V:4H will be adopted. Topsoil will be placed and vegetation established to further stabilize the embankment slope.	
Heavy vehicles to be cleaned and be free of soil prior to leaving construction/rehabilitation site	
Re-use of captured water for construction purposes	
Standard controls as documented in the Costerfield Surface Water Management Plan and Tailings Management Plan	
Relevant associated procedures	

Surface Water Management Plan (uploaded to RRAM)
Rehabilitation Plan (uploaded to RRAM)
Community Engagement Plan (uploaded to RRAM)
Tailings Storage Facility Management/ Operation Plan (uploaded to RRAM)

Risk source, receptor and frequency of exposure			Risk assessment					
			Inherent risk			Residual risk		
Risk source	**Receptor**	**Frequency of exposure**	**Consequence**	**Likelihood**	**Risk**	**Consequence**	**Likelihood**	**Risk**
Dams and waterways	Private property / crown land / surface water / aquatic ecosystems	Rarely	Moderate	Unlikely	Medium	Moderate	Rare	Medium
TSFs	Private property / crown land / surface water / aquatic ecosystems	Rarely	Moderate	Unlikely	Medium	Moderate	Rare	Medium
Activity – plant and equipment	Surface water / aquatic ecosystems	Rarely	Minor	Likely	Medium	Minor	Unlikely	Low
Activity – overburden dumps and stockpiles	Surface water / aquatic ecosystems	Rarely	Minor	Likely	Medium	Minor	Unlikely	Low
Disturbed, unrehabilitated ground	Surface water / aquatic ecosystems	Rarely	Minor	Likely	Medium	Minor	Unlikely	Low

Outcome of risk assessment
The maximum inherent risks are rated **medium**. The preparation of risk treatment plans is therefore not considered necessary. However, in accordance with current regulations and industry best practice, a number of standard risk control measures (as described above) are existing practices included as part of the Costerfield Mine management system to further reduce risks.

6.1.5 Fire

Table 6-5 Risk assessment: Fire

Objectives or outcomes to be met	
In terms of fire, the responsible authorities are the Police and the Country Fire Authority. The objective of the Costerfield Operations is no impact to public safety, private property, community facilities or crown land as a result of mine-related fire ignition.	
Risk source	**Possible consequence**
Plant and equipment - fire generating activity (ignition source)	Fire ignited as a result of mining activities may impact on air quality and/or public health, as well as causing damage to private property, community facilities, crown land, public land or the Heathcote-Graytown National Park.
Fuel/additive storage – above-ground storage tanks	Fire ignited as a result of mining activities or a bushfire in the vicinity of the operation may pose a risk to the integrity of above-ground storage tanks or other hazardous goods storage areas, potentially causing flammable materials to ignite.
Standard controls	
Maintenance of firebreaks	
Preventative maintenance program on mobile equipment and fixed plant to ensure the risk of spark generation is minimised	
Maintenance of adequate on-site water storages for fire-fighting purposes	
Inclusion of bushfire authority in community engagement plan and emergency risk management plan	
Trained Emergency Response Team personnel across the mining workforce	

Employee induction								
Ensuring fire management plans (including fire extinguisher maintenance) are up to date								
Safe storage of flammable materials in accordance with applicable Australian Standards								
Relevant associated procedures								
Site Emergency Plan								
Community Engagement Plan (uploaded to RRAM)								
Tailings Storage Facility Management/ Operation Plan (uploaded to RRAM)								
Risk source, receptor and frequency of exposure			**Risk assessment**					
			Inherent risk			**Residual risk**		
Risk source	**Receptor**	**Frequency of exposure**	**Consequence**	**Likelihood**	**Risk**	**Consequence**	**Likelihood**	**Risk**
Plant and equipment - fire generating activity (ignition source)	Air quality / public safety / private property / community facility / crown land / National Park	Very rarely	Critical	Unlikely	High	Critical	Rare	High
Fuel/additive storage – above-ground storage tanks	Air quality / public safety / private property / community facility / crown land / National Park	Very rarely	Critical	Unlikely	High	Critical	Rare	High
Outcome of risk assessment								

The maximum inherent risks are rated **High**. In accordance with current regulations and industry best practice, a number of standard risk control measures (as described above) are existing practices included as part of the Costerfield Mine management system to further reduce risks. When these standard controls are taken into account, the maximum residual risk is rated as **High**. The preparation of risk treatment plan is therefore considered necessary and can be found in RRAM.

6.1.6 Flood

Table 6-6 Risk assessment: flood

Objectives or outcomes to be met	
In terms of mitigating the risk of mining-related flood impact, specifications are set out in *Guidelines on Tailings Dams* (ANCOLD 2019) and *Guideline for the design and management of tailings storage facilities* (ERR 2017). Guidance is also provided in EPA Publication 1834: *Civil construction, building and demolition guide*. The goal of the Costerfield Operations is to minimise any flood risks associated with TSF or associated activities. To achieve this, water holding structures be designed, constructed, operated and decommissioned in strict accordance with applicable engineering standards and practice.	
Risk source	**Possible consequence**
Dams and waterways	Impacts on public safety, private property, crown land, water quality and aquatic ecosystems from flooding due to unplanned discharge from the: • Augusta Mine dam • Augusta Mine evaporation ponds • Brunswick Mill stormwater dam • Brunswick Mill process water dam
	Flooding of local waterways reaching mine facilities and causing the erosion of mined materials or release of mining-related contaminants impacts on water quality and aquatic ecosystems
TSFs	Impact on public safety, private property, crown land, water quality and aquatic ecosystems from unplanned discharge from the TSFs.
Standard controls	

Appropriately designed, constructed and maintained water and tailings structures with adequate freeboard capacity and controlled discharge capacity
Inclusion of relevant authority in the community engagement plan and emergency risk management plan (i.e. Dam Safety Emergency Plan)
Employee induction
Location of at-risk project facilities away from floodplains
Standard controls as documented in the Costerfield Surface Water Management Plan and Tailings Management Plan
Augusta mine noise bund has been designed to withstand a 1:100-year flood level event
Appropriately designed, constructed and maintained clean water diversion drains
TSF and Return Water Pond to be constructed as turkeys nest facilities to minimize catchment area
Construction of external Return Water Pond to aid the removal of water that may accumulate on the Brunswick West TSF post a rainfall event
Post closure monitoring to include key aspects of current operational monitoring programs including surface water monitoring and groundwater monitoring
Relevant associated procedures
Surface Water Management Plan (uploaded to RRAM)
Brunswick West TSF Dam Safety Emergency Plan
Tailings Storage Facility Management/Operation Plan (uploaded to RRAM)
Rehabilitation Plan (uploaded to RRAM)

Risk source, receptor and frequency of exposure			**Risk assessment**					
			Inherent risk			**Residual risk**		
Risk source	**Receptor**	**Frequency of exposure**	**Consequence**	**Likelihood**	**Risk**	**Consequence**	**Likelihood**	**Risk**
Dams and waterways	Public safety / private	Yearly	Major	Unlikely	High	Major	Rare	Medium

	property / crown land							
TSFs	Public safety / private property / crown land	Very rarely	Major	Unlikely	High	Major	Rare	Medium
Dams and waterways	Water quality / aquatic ecosystems	Yearly	Moderate	Unlikely	Medium	Moderate	Rare	Medium
TSFs	Water quality / aquatic ecosystems	Very rarely	Moderate	Unlikely	Medium	Moderate	Rare	Medium

Outcome of risk assessment

The maximum inherent risks are rated **High**. In accordance with current regulations and industry best practice, a number of standard risk control measures (as described above) are existing practices included as part of the Costerfield Mine management system to further reduce risks. When these standard controls are taken into account, the maximum residual risk does not exceed the **Medium** rating. The preparation of risk treatment plans is therefore not considered necessary.

6.1.7 Ground disturbance

Table 6-7 Risk assessment: ground disturbance (including water quality)

Objectives or outcomes to be met

In terms of surface water impact, the requirements to be met by the Costerfield Operations are set out in *Environment Reference Standard* and *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZG 2018) (as referenced in the ERS). The goal of the Costerfield Operations is to minimise impacts on downstream water quality as a result of mining-related activities, and to comply with EPA licence conditions. To achieve this, using the applicable guidelines, the following objectives shall be met:

- No significant deviation in water quality from background (non-mine affected) conditions

- No significant elevated antimony levels in downstream surface waters (taking into account ANZG/ Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ 2000) trigger levels and background concentrations)
- No impact on designated beneficial uses of water as measured by the appropriate environmental quality objectives and indicators specified in the *Environment Reference Standard*
- Discharge of waste to surface water must comply with EPA licence conditions, where applicable, including:
  - stormwater diverted around the premises must not be contaminated with waste
  - discharge of waste to surface waters must be in accordance with the limits specified in the licence

In terms of land impact, the requirements are set out in *Environment Reference Standard*, the *National Environment Protection Measures (NEPM*) and the EPA licence. The following objective shall be met, as outlined in the EPA licence:

- No contamination of land

In terms of groundwater impact, the requirements are set out in the *Environment Reference Standard* and the EPA licence. The following objective shall be met, as outlined in the EPA licence:

- No contamination of groundwater

For historic heritage impacts, requirements for protection are set out at the local government level in Heritage Overlays and at a state level under the *Heritage Act 2017*. The objective at the Costerfield mine is to avoid harm or disturbance to historic heritage places.

For aboriginal cultural heritage impacts, requirements for protection are set out under the Aboriginal Heritage Regulations 2018. The objective at the Costerfield mine is to avoid harm or disturbance to aboriginal cultural heritage places.

No establishment or spread of weeds and pest species.

Additionally, during the closure phase of the mine, the following criteria shall be met (see Rehabilitation Plan):

- site is safe for final land use
- site is non-polluting
- vegetation is self-sustaining
- site rehabilitation supports future land use
- site does not require long-term monitoring and maintenance.

Risk source	Possible consequence
Dams and waterways	Potential seepage from Augusta Evaporation Dams resulting in impacts on groundwater and surface waters (affecting terrestrial or aquatic ecosystems, private land or crown land)

	Discharge of surface drains (containing salinity and metals) potentially resulting in impacts on surface waters and soil (affecting terrestrial or aquatic ecosystems, private land or crown land) Discharge of treated water from RO Water Treatment Plant potentially resulting in impacts on surface waters or hydrology (affecting aquatic ecosystems) Potential leakage of brine from RO Water Treatment Plant from pipelines to surface waters and soil (affecting terrestrial or aquatic ecosystems, private land or crown land) Potential for discharges to impact on designated Areas of Cultural Heritage Sensitivity (e.g. creek lines), requiring approvals for certain surface disturbing works
TSFs	Potential impact on groundwater and surface water quality associated with seepage or discharge from the TSFs, affecting terrestrial or aquatic ecosystems, private land or crown land Potential for TSF earthworks (construction/rehabilitation) to affect terrestrial ecosystems, private land or crown land
Activity – plant and equipment	Potential impact on groundwater aquifer levels or quality associated with mine dewatering program, affecting beneficial uses or surface water quality or hydrology Potential for land clearance activities to affect terrestrial ecosystems Potential for activities from mobile equipment to impact heritage listed 'Bombay Mine and Cyanide Works' northwest of the TSF Potential for activities from mobile equipment to impact on certain areas designated as Areas of Cultural Heritage Sensitivity (e.g. creek lines), requiring approvals for certain surface disturbing works
Disturbed and rehabilitated ground	Potential for weed and pest to establish and spread on disturbed ground from mobile equipment, seeding or wind blown sources
Standard controls	
Appropriately designed, constructed and maintained water and tailings structures with adequate retention and controlled discharge capacity	
HDPE liner in Augusta evaporation dams	
Freeboard and water level management in Augusta evaporation dams and TSFs	
Seepage detection trenches	
Bunding placed around processing facilities to contain any water or hazardous substance spillage (e.g. hydrocarbons)	
Pipelines inspected regularly to ensure structural integrity and no leakages	

Controlled discharge of RO-treated water to Wappentake Creek in accordance with monitoring requirements and compliance limits in EPA licence
Drainage control works to divert water away from extraction areas and culvert and channel capacity able to convey the relevant flood event design criteria (e.g. 1 in 20 years)
Ongoing sampling and monitoring of surface water and groundwater to ensure no contamination
TSF liner constructed with low permeability (as per ERR 2017)
Apply high standards in design, construction, operation, maintenance and decommissioning of TSF groundwater monitoring bores
Planning to ensure that sufficient material (rock, clay, sand and soil) is available for covering of tailings in final rehabilitation
Remove direct pathway to groundwater of any seepage from Brunswick TSF by lowering groundwater levels below the pit
Provision of adequate surface water drainage control along TSF embankment
Rip-rap protection for TSF bench toes and use of erosion matting
Planning to ensure that sufficient material (rock, clay, sand and soil) is available for covering of tailings in final rehabilitation (as per Mandalay Mine Closure Plan)
For erosion control of waste dump stockpiles, final slopes of 1V:3H or shallower will be adopted, with benches to break long slopes
Independent hydrogeological review and advice
Erosion and sedimentation management as outlined in Section 4.4
Hazardous materials and waste management as outlined in Section 4.11
Procedures requiring regulatory approval to carry out surface disturbing works in areas of Cultural Heritage Sensitivity
Procedures describing contingency measures in the event of the discovery of new archaeological relics (s.24 of Aboriginal Heritage Act 2006)
Site inspections to include observations to confirm that the heritage site remains undisturbed
Fencing installed to delineate and prevent disturbance of 'Bombay Mine and Cyanide Works' heritage site
When engaging contractors for activities that may impact on cultural heritage, Mandalay requests contracts to include mandatory reporting by contractors of any minerals, fossils or relics. All personnel are made aware as part of the site induction to stop works, barricade and inform supervisor and relevant authorities

Heritage Victoria will be contacted if any archaeological relics are discovered during excavation. Where works are near known historical sites, Mandalay will contact Heritage Victoria to seek approval prior to the commencement of works
Additional control measures are detailed in the Cultural Heritage Report.
Annual independent hydrogeological review and advice
Vehicle and equipment hygiene checks
Native vegetation removal will be offset at the Mandalay Peels Lane Native vegetation offset site
Brunswick West TSF embankments, built to final slope and rehabilitated after construction
Revegetation program to follow after final earthworks as per Rehabilitation Plan
Monitor disturbed areas to allow early treatment of identified weed species will reduce weed species seedbanks and assist in controlling emergent weeds prior to the commencement of decommissioning. During decommissioning works and any rehabilitation of disturbed areas, weeds will be treated and removed as appropriate.
Relevant associated procedures
Surface Water Management Plan (uploaded to RRAM)
Groundwater Management Plan (uploaded to RRAM)
Tailings Storage Facility Management/Operation Plan (uploaded to RRAM)
Chemical and Waste Management Procedure (uploaded to RRAM)
Traffic Management Procedure (uploaded to RRAM)
EPA Victoria Operating Licence 109992 (uploaded to RRAM)
Rehabilitation Plan (uploaded to RRAM)
Cultural Heritage Report (uploaded to RRAM)

Risk source, receptor and frequency of exposure			Risk assessment					
			Inherent risk			Residual risk		
Risk source	**Receptor**	**Frequency of exposure**	**Consequence**	**Likelihood**	**Risk**	**Consequence**	**Likelihood**	**Risk**
Dams and waterways	Groundwater / surface water / ecosystems	Rarely	Moderate	Possible	Medium	Moderate	Rare	Medium
Dams and waterways	Private land / crown land	Rarely	Moderate	Possible	Medium	Minor	Rare	Low
Dams and waterways	Areas of cultural heritage sensitivity	Unlikely	Moderate	Possible	Medium	Moderate	Rare	Medium
TSF	Groundwater / surface water / ecosystems	Rarely	Moderate	Possible	Medium	Moderate	Rare	Medium
TSF earthworks	Ecosystems Private land / crown land	Daily	Minor	Almost certain	High	Insignificant	Almost certain	Medium
Activity – plant and equipment	Groundwater levels and hydrology	Daily	Minor	Almost certain	High	Insignificant	Almost certain	Medium
Activity – plant and equipment	Groundwater / surface water quality	Rarely	Moderate	Possible	Medium	Moderate	Rare	Medium
Activity – plant and equipment	Ecosystems	Rarely	Moderate	Possible	Medium	Moderate	Unlikely	Medium

Activity – plant and equipment	Areas of historic or cultural heritage sensitivity	Unlikely	Moderate	Possible	Medium	Moderate	Rare	Medium
Construction/ Rehabilitation Activity – plant and equipment	Public infrastructure	Rarely	Moderate	Possible	Medium	Minor	Rare	Low
Disturbed and rehabilitated ground (weeds and pests)	Private land / crown land / ecosystems	Daily	Minor	Likely	Medium	Minor	Possible	Medium

Outcome of risk assessment
The maximum inherent risks are rated **High**. In accordance with current regulations and industry best practice, a number of standard risk control measures (as described above) are existing practices included as part of the Costerfield Mine management system to further reduce risks. When these standard controls are taken into account, the maximum residual risk does not exceed the **Medium** rating. The preparation of risk treatment plans is therefore not considered necessary.

6.1.8 Ground instability

Table 6-8 Risk assessment: ground instability

Objectives or outcomes to be met	
In terms of ground instability, the requirements applicable to the Costerfield Operations are set out by *Geotechnical guideline for terminal and rehabilitated slopes* (ERR 2020) *Assessment of Geotechnical Risks in Open Pit Mines* and *Technical Guideline for Design and Management of Tailings Storage Facilities* (ERR 2017). Requirements are also set out in applicable ANCOLD guidelines for the planning, design, construction, operation and closure of TSFs. The goal of the Costerfield Operations is to have no impact on public safety, private property or crown land due to ground disturbance associated with TSFs. To achieve this, structures will be designed, constructed, operated and closed in strict accordance with the above geotechnical and engineering standards and practice.	
Risk source	**Possible consequence**

Mine voids and underground workings, including ventilation and egress shafts	Possible subsidence of land in the vicinity of underground mine voids may impact on public safety, private property, crown land and public infrastructure
Mine voids	Failure of pit walls may impact on public safety
Activity – overburden dumps and stockpiles	Possible slumping of waste stockpiles, or constructed landforms may impact on public safety, private property, crown land and public infrastructure
TSF	Possible failure of TSF embankments may impact on public safety, private property, crown land and public infrastructure
Standard controls	
Pre-calculations on the blasting effect to ensure that the charge load is correct	
Blasting techniques that include consideration of geology, face heights and orientation of geological structures, stemming heights, blast hole to burden ratios, etc.	
Appropriately designed, constructed and maintained water and tailings structures with adequate retention and controlled discharge capacity	
Geotechnical assessments of the stability of existing and proposed underground workings, pit walls, TSF embankments and other constructed landforms	
Regular facility inspections by operator staff to confirm safety and absence of stability issues	
Standard controls as documented in the Costerfield Tailings Storage Facility Management/Operation Plan	
Earthen safety bunds established around the perimeter of pits at closure	
The Augusta mine decline will be backfilled with waste rock at closure (down to 4 level)	
Potential stability issues associated with raise boring, including those associated with fault intersections, are considered prior to commencement of works. Works are planned with reference to the document Bored Reinforced Piles for Raisebore Support – Four Case Studies, and Guidelines Developed from Lessons Learnt	
Appropriately designed, constructed and maintained water and tailings structures with adequate freeboard capacity and controlled discharge capacity	
Geotechnical assessments of the stability of the proposed Brunswick West TSF and RWP embankments taking into account the proximity of the Brunswick Pit and underground workings	
Regular facility inspections by operator staff to confirm no abnormal conditions or circumstances that could affect the stability of the TSFs or RWP	

Independent surveillance of TSFs and dams as specified by ANCOLD									
Closure and rehabilitation of TSFs with appropriately designed cover system and vegetation									
Relevant associated procedures									
Tailings Storage Facility Management/Operation Plan (uploaded to RRAM)									
Rehabilitation Plan (uploaded to RRAM)									
Bored Reinforced Piles for Raisebore Support – Four Case Studies, and Guidelines Developed from Lessons Learnt (uploaded to RRAM)									
Risk source, receptor and frequency of exposure			**Risk assessment**						
			Inherent risk			**Residual risk**			
Risk source	**Receptor**	**Frequency of exposure**	**Consequence**	**Likelihood**	**Risk**	**Consequence**	**Likelihood**	**Risk**
Mine voids and underground workings, including ventilation and egress shafts	Public safety / private property / crown land/ public infrastructure	Daily	Major	Rare	Medium	Major	Rare	Medium
Mine voids	Public safety	Daily	Critical	Rare	High	Critical	Rare	High
Activity – overburden dumps and stockpiles	Public safety / private property / crown land/ public infrastructure	Daily	Moderate	Rare	Medium	Moderate	Rare	Medium
TSF	Public safety	Daily	Critical	Unlikely	High	Critical	Rare	High
TSF	Private property / crown land/	Daily	Moderate	Rare	Medium	Moderate	Rare	Rare

	public infrastructure
Outcome of risk assessment	
The maximum inherent risks are rated **High**. In accordance with current regulations and industry best practice, a number of standard risk control measures (as described above) are existing practices included as part of the Costerfield Mine management system to further reduce risks. When these standard controls are taken into account, the maximum residual risk is rated as **High**. The preparation of risk treatment plan is therefore considered necessary and can be found in RRAM.	

6.1.9 Ground vibration

Table 6-9 Risk assessment: Ground vibration

Objectives or outcomes to be met	
In terms of ground vibration, the requirements applicable to the Costerfield Operations are set out by ERR in the document *Ground Vibration and Airblast Limits for Blasting in Mines and Quarries*. The goal of the Costerfield Operations is to have no impact on private property or public infrastructure due to ground vibration associated with mining and processing activities. To achieve this, using the applicable guidelines, the following objectives shall be met: • Ground vibration at sensitive sites should be below 10 mm/s peak particle velocity (ppv) at all times • For ERR-approved night time blasting, it is considered appropriate to apply more stringent limits to ground vibration during the hours usually devoted to sleep. In these circumstances, the ground vibration level at sensitive sites should not exceed 3 mm/s and airblast should not exceed 115 dB (Lin Peak) between the hours 10:00 pm and 7:00 am	
Risk source	**Possible consequence**
Blasting (underground)	Vibration impacts on neighbouring landowners, private property or public infrastructure
Standard controls	
Pre-calculations on the blasting effect to ensure that the charge load is correct	
Blasting techniques that include consideration of geology, face heights and orientation of geological structures, stemming heights, blast hole to burden ratios etc.	
Relevant associated procedures	

Covered by mine operational and safety procedures								
Risk source, receptor and frequency of exposure			**Risk assessment**					
			Inherent risk			**Residual risk**		
Risk source	**Receptor**	**Frequency of exposure**	**Consequence**	**Likelihood**	**Risk**	**Consequence**	**Likelihood**	**Risk**
Blasting (underground)	Private property / public infrastructure	Daily	Moderate	Possible	Medium	Moderate	Rare	Medium
Outcome of risk assessment								
The maximum inherent risks are rated **Medium**. The preparation of risk treatment plans is therefore not considered necessary. However, in accordance with current regulations and industry best practice, a number of standard risk control measures (as described above) are existing practices included as part of the Costerfield Mine management system to further reduce risks.								

6.1.10 Hazardous materials and waste

Table 6-10 Risk assessment: Hazardous materials and waste

Objectives or outcomes to be met	
In terms of hazardous materials and waste, the objectives are set out in *Environment Reference Standard*, EPA publication IWRG701, *Sampling and analysis of waters, wastewaters, soils and wastes*, EPA Industrial Waste Resource Guidelines, EPA's Bunding Guidelines and AS1940-2004. The goals of the Costerfield Operations are to: • Minimise impacts on land, surface water or groundwater as a result of the management and use of hazardous materials and the generation and management of waste • Avoidance of contamination of land and groundwater, as required by the EPA licence • Ensuring stormwater diverted around the premises is not contaminated with waste, as required by the EPA licence	
Risk source	**Possible consequence**

Fuel / additive storage	Spills, uncontrolled discharges or leaks from compromised containment structures (such as storage tanks and bunded areas) have the potential to impact on soil and/or groundwater quality on-site and / or off-site (private property and crown land)
Activity – overburden dumps and stockpiles	Leaching of metals from waste rock or ROM stockpiles into the environment (in particular, acid rock drainage) has the potential to impact on soil, groundwater and surface water
Activity – Tailings storage	Leaching of metals from TSF into the environment (in particular, acid rock drainage) or spill from tailings delivery pipeline has the potential to impact on soil, groundwater and surface water
Standard controls	
Minimise chemical use and use environmentally benign alternatives where practical	
Quantities of chemicals stored on site kept to a minimum	
Chemicals stored away from surface waters, drainage lines or floodplains, unless the storage facilities prevent them from coming into contact with surface waters	
Bunding of oil and fuel storage areas	
Bunding placed around processing facilities to contain any water or hazardous substance spillage (e.g. hydrocarbons)	
Electronic tagging system in place to ensure fuel is dispensed to authorised vehicles only	
Any major servicing/repairs conducted in a contained facility	
Oil/water separator for collection of runoff water in workshop	
Spill kits available where hazardous materials stored or used	
Contaminants spill kit is available at all times when mobile equipment is being refuelled near waterways or when any minor servicing and/or simple maintenance tasks are undertaken on site	
Procedures for the storage and handling of chemicals	
Procedures for managing and remediating chemical spills	
Staff induction and training	
Ongoing sampling and monitoring of surface water and groundwater to ensure no contamination	

Closure plan contains an allowance for offsite removal and remediation of hydrocarbon contaminated soils	
TSFs located away from surface waters, drainage lines and floodplains	
Waste rock located away from surface waters, drainage lines or floodplains, unless the storage facilities prevent them from coming into contact with surface waters	
Ongoing geochemical testing of tailings (confirm Arsenic levels are low and tailings are non-acid forming)	
Brunswick West TSF liner constructed with low permeability (as per ERR 2017)	
Appropriately designed, constructed and maintained tailings structures with adequate freeboard capacity and controlled discharge capacity	
TSF decant contaminants of concern (antimony and arsenic) are known to naturally occur at elevation concentrations, with respect to environmental values, within the regional groundwater system	
The siltstone bedrock, which is host to the regional aquifer system is also understood to have a strong attenuation capacity for elevated metals (antimony and arsenic)	
At closure, the TSF will be capped and rehabilitated to reduce mounding recharge	
Post closure monitoring to include key aspects of current operational monitoring programs including surface water monitoring and groundwater monitoring	
Relevant associated procedures	
Groundwater Management Plan (uploaded to RRAM)	
Surface Water Management Plan (uploaded to RRAM)	
Capture, Storage and Disposal of Waste Hydrocarbons Procedure	
Hazardous Chemical Management Procedure	
Rehabilitation Plan (uploaded to RRAM)	

Risk source, receptor and frequency of exposure	**Risk assessment**	
	Inherent risk	**Residual risk**

Risk source	Receptor	Consequence	Likelihood	Risk	Consequence	Likelihood	Risk
Fuel / additive storage	Private property / crown land – soil / ecosystems	Minor	Almost certain	High	Minor	Possible	Medium
Fuel / additive storage	Private property / crown land – groundwater / surface water / ecosystems	Minor	Possible	Medium	Minor	Possible	Medium
Activity – overburden dumps and stockpiles	Private property / crown land – soil / ecosystems	Moderate	Possible	Medium	Moderate	Rare	Medium
Activity – overburden dumps and stockpiles	Private property / crown land – groundwater / surface water / ecosystems	Moderate	Possible	Medium	Moderate	Rare	Medium
Activity – Tailings storage	Private property / crown land – soil / ecosystems	Moderate	Possible	Medium	Moderate	Rare	Medium
Activity – Tailings storage	Private property – Groundwater / surface water / ecosystems	Moderate	Possible	Medium	Moderate	Rare	Medium

Outcome of risk assessment

The maximum inherent risks are rated **High**. In accordance with current regulations and industry best practice, a number of standard risk control measures (as described above) are existing practices included as part of the Costerfield Mine management system to further reduce risks. When these standard controls are taken into account, the maximum residual risk does not exceed the **Medium** rating. The preparation of risk treatment plans is therefore not considered necessary.

6.1.11 Light emissions

Table 6-11 Risk assessment: light emissions

Objectives or outcomes to be met								
In terms of light emissions, the goal of the Costerfield Operations is to acceptably minimise amenity impacts from mining-related light emissions and to protect the safety of road users who may be adversely affected by lightspill.								
Risk source	**Possible consequence**							
Night works	Light emissions (lightspill) associated with night time mining and processing activities may impact on neighbouring landowners or residences and/or public safety (road users)							
Standard controls								
Keep lights off when not needed								
Mount lights low down, with lowest intensity for the job								
Prevent light from escaping upwards and outwards								
Relevant associated procedures								
Covered by mine operational procedures								
Risk source, receptor and frequency of exposure			**Risk assessment**					
			Inherent risk			**Residual risk**		
Risk source	**Receptor**	**Frequency of exposure**	**Consequence**	**Likelihood**	**Risk**	**Consequence**	**Likelihood**	**Risk**
Night works	Amenity	Nightly	Minor	Possible	Medium	Minor	Unlikely	Low
Night works	Public safety	Nightly	Minor	Unlikely	Low	Minor	Unlikely	Low

Outcome of risk assessment
The maximum inherent risks are rated **Medium**. The preparation of risk treatment plans is therefore not considered necessary. However, in accordance with current regulations and industry best practice, a number of standard risk control measures (as described above) are existing practices included as part of the Costerfield Mine management system to further reduce risks.

6.1.12 Noise pollution

Table 6-12 Risk assessment: noise pollution

Objectives or outcomes to be met	
In terms of noise emissions, the aim of the Costerfield Operations is to not exceed the noise emission levels that are set out in Planning Permit (AM/2248/1997/C) and *Environment Reference Standard* and EPA Publication 1834: *Civil construction, building and demolition guide*. The goal of the Costerfield Operations is to comply with requirements for noise emissions from mining and processing activities, and to acceptably minimise community amenity impacts. To achieve this, using the applicable planning permit limits, the maximum noise levels at adjoining residences during operations shall be: • Monday-Friday (Day) – 0700 to 1800 hours 45 A-weighted decibels (dB(A)) • Saturday (Day) – 0700 to 1300 hours 45 dB(A) • Saturday (Day) – 1300 to 1800 hours 42 dB(A) • Sunday and Public holidays (Day) – 0700 to 1800 hours 42 dB(A) • Monday-Sunday (Evening) – 1800 to 2200 hours 42 dB(A) • Monday-Sunday (Night) – 2200 to 0700 hours 36 dB(A) Additionally, during the construction (and rehabilitation) phase, the Planning Permit states : • noise levels to be 10 dB(A) above maximum day period limit In terms of blasting, the requirements applicable to the Costerfield Operations are set out by ERR in the document *Ground Vibration and Airblast Limits for Blasting in Mines and Quarries*. • Air blast should be below 120 dB(Linear) peak at all times at sensitive receptors	
Risk source	**Possible consequence**

Activity - blasting	Noise from underground blasting (and surface) may impact on amenity, neighbouring landowners or residences.
Activity – plant and equipment	Noise from: mobile crusher; screening plant; loader; process plant equipment; equipment accessing and being serviced in the workshop in the boxcut; and screening of cemented rock fill in the boxcut; may impact on amenity, neighbouring landowners or residences. Noise from: filling and discharging cement silo; and use of agitator trucks sourcing cement from silo; may impact on amenity, neighbouring landowners or residences. Noise from: construction or rehabilitation activities may impact on amenity, neighbouring landowners or residences
Activity – ventilation shaft operation	Noise from ventilation fans may impact on amenity, neighbouring landowners or residences
Activity – overburden dumps and stockpiles	Noise from: operation of excavators and trucks; placement of rock in boxcut; ore truck movements and placement of ore on ROM pad; placement of rock on waste rock stockpiles; and recovery of waste rock for beneficial re-use; may impact on amenity, neighbouring landowners or residences.
Night works	Noise during night works may impact on amenity, neighbouring landowners or residences.
Standard controls	
Blast design plan	
Equipment orientation and position	
Equipment maintenance regime in accordance with manufacturer specifications	
Engineering attenuation controls i.e. mufflers, acoustic screens and enclosures	
Restricted operation of noise generating equipment	
Heavy vehicles restricted from travel at night (i.e. no heavy vehicles outside of the Augusta boxcut at night)	
Vehicle speed limits restricted at Costerfield Operations entrance (i.e. reduced speed limit on McNicholls Lane near the Augusta mine site)	
Overburden stockpiles located to reduce noise emissions at sensitive receptors	
Noise / acoustic barriers or bunds to be considered if required	

Engineered noise abatement of crushers, mills grizzlies, pumps, conveyors, trommels and vibrating screens									
Filling of cement silo by supplier restricted to day period									
Placement of the crusher in the recessed lower level of the ROM to reduce noise emissions and exposure to wind									
Establishment of noise bund/wind protection around three sides of the screening plant									
Ventilation fans will be situated underground to minimise the impact.									
Relevant associated procedures									
Noise Management Plan (uploaded to RRAM)									
Traffic Management Procedure (uploaded to RRAM) Community Engagement Plan (uploaded to RRAM)									
Community Engagement Plan (uploaded to RRAM)									
Risk source, receptor and frequency of exposure			**Risk assessment**						
			Inherent risk			**Residual risk**			
Risk source	**Receptor**	**Frequency of exposure**	**Consequence**	**Likelihood**	**Risk**	**Consequence**	**Likelihood**	**Risk**	
Activity – blasting	Private property	Daily	Minor	Unlikely	Low	Minor	Rare	Low	
Activity – plant and equipment	Private property	Daily	Minor	Likely	Medium	Minor	Possible	Medium	
Activity – plant and equipment (Cement silo)	Private property	Daily	Minor	Likely	Medium	Minor	Possible	Medium	
Activity – plant and equipment (construction, decommissioning or rehabilitation)	Private property	Daily	Minor	Likely	Medium	Minor	Possible	Medium	

Activity – ventilation shaft operation	Private property	Daily	Minor	Likely	Medium	Minor	Possible	Medium
Activity – overburden dumps and stockpiles	Private property	Daily	Minor	Likely	Medium	Minor	Possible	Medium
Night works	Private property	Nightly	Minor	Likely	Medium	Minor	Possible	Medium

Outcome of risk assessment
The maximum inherent risks are rated **Medium**. The preparation of risk treatment plans is therefore not considered necessary. However, in accordance with current regulations and industry best practice, a number of standard risk control measures (as described above) are existing practices included as part of the Costerfield Mine management system to further reduce risks.

6.1.13 Security breach.

Table 6-13 Risk assessment: security breach

Objectives or outcomes to be met	
In terms of site security, Costerfield Operations is targeting zero security breaches.	
Risk source	**Possible consequence**
Mined voids and underground workings – open mine portals and shafts	Harm to unauthorised persons entering into open cut or underground workings
TSF	Harm to unauthorised persons or animals entering TSF and becoming trapped in tailings that appears to be a solid surface
Surface water – dams and waterways	Harm to unauthorised persons or animals entering into dams and waterways
Activity – plant and equipment	Harm to unauthorised persons using explosives and associated public safety and environmental risks Harm to unauthorised persons using site vehicles and equipment and associated public safety risks

	Harm to unauthorised persons entering into site buildings and associated public safety risks
Fuel / additive storage	Harm to persons due to unauthorised use of fuel or hazardous materials and associated public safety and environmental risks
Standard controls	
Augusta mine site entrance surrounded by a fence with lockable gates	
Brunswick processing plant is surrounded by a fence with lockable gates	
Underground workings where current access is required, including the Youle ventilation shaft site, are secured by lockable gates	
Underground workings where future access may be required are secured by fencing	
Underground workings where no access is required are secured by permanent closure	
Water storages such as TSFs are enclosed by chain-link fence with lockable gates	
Buildings are secured by lockable doors/gates and locked at the completion of working shifts	
Plant and equipment (including vehicles) are kept in gated and locked enclosures and/or individually locked at the completion of working shifts	
Explosives are kept underground in a designated secure explosives repository	
Fuel storage tanks are secured with an electronic tagging system for dispensing fuel	
TSFs and water storages are enclosed by chain-link fence with lockable gates that are to be locked when site is unattended	
No-unauthorized signage to be erected	
Regular inspections by operating personnel	
Control access to site when site is attended	
Site is rehabilitated to a safe landform	
Relevant associated procedures	
Tailings Management Plan (uploaded to RRAM)	

Chemical and Waste Management Procedure (uploaded to RRAM)								
Site Access Procedure								
Rehabilitation Plan (uploaded to RRAM)								
Risk source, receptor and frequency of exposure			**Risk assessment**					
			Inherent risk			**Residual risk**		
Risk source	**Receptor**	**Frequency of exposure**	**Consequence**	**Likelihood**	**Risk**	**Consequence**	**Likelihood**	**Risk**
Mined voids and underground workings – open mine portals and shafts	Public safety	Daily	Critical	Unlikely	High	Critical	Rare	High
TSF	Public safety	Daily	Critical	Unlikely	High	Critical	Rare	High
Surface water – dams and waterways	Public safety	Daily	Critical	Unlikely	High	Critical	Rare	High
Activity – plant and equipment (explosives)	Public safety	Daily	Critical	Unlikely	High	Critical	Rare	High
Activity – plant and equipment (explosives)	Air quality / surface water / ecosystem	Daily	Major	Unlikely	High	Major	Rare	Medium
Activity – plant and equipment (vehicles and plant)	Public safety	Daily	Critical	Unlikely	High	Critical	Rare	High
Activity – plant and equipment (buildings)	Public safety	Daily	Critical	Unlikely	High	Critical	Rare	High

Fuel / additive storage	Public safety	Daily	Critical	Unlikely	High	Critical	Rare	High
Fuel / additive storage	Air quality / surface water / ecosystem	Daily	Major	Unlikely	High	Major	Rare	Medium

Outcome of risk assessment

The maximum inherent risks are rated **High**. In accordance with current regulations and industry best practice, a number of standard risk control measures (as described above) are existing practices included as part of the Costerfield Mine management system to further reduce risks. When these standard controls are taken into account, the maximum residual risk is rated as **High**. The preparation of risk treatment plan is therefore considered necessary and can be found in RRAM.

7 Risk monitoring and reporting

Risk monitoring and reporting are key components of risk management and are required under the MRSD (MI) Regulations, which state that a monitoring program must include a program to measure performance against all the specified objectives, standards and acceptance criteria and which specifies arrangements for reporting against those specified objectives, standards and acceptance criteria.

7.1 Risk monitoring

At Costerfield risk management performance is monitored in a program that is described in the following documents, which have been uploaded to RRAM:

- Ambient Air Quality Management Plan
- Chemical and Waste Management Procedure
- Community Engagement Plan
- Environmental Monitoring Plan _ Schedule
- Groundwater Management Plan
- Native Vegetation Offset Management Strategy
- Noise Management Plan
- Sensitive Receptor Plan
- Surface Water Management Plan
- Tailings Management Plan
- Traffic Management Procedure.

Additionally, the document Costerfield Mine – Environmental Monitoring Plan summarises information including monitoring locations, monitoring frequency, parameters measured and regulatory limits for each of the different aspects of the environment that is monitored. Figure 5.1 shows the location of the monitoring points in relation to the mining operations and sensitive receptors.

Each of the individual management plans and the Environmental Monitoring Plan have been uploaded to RRAM. The monitoring program for each of the identified risks is described in more detail in the subsections below and these should be considered in conjunction with the individual management plan documents and the Environmental Monitoring Plan.

All environmental monitoring results are communicated to the Costerfield Environment Review Committee (ERC), who meet quarterly.

Table 7-1 summarises Mandalay risk monitoring for each of risk hazard.

Table 7-1 Summary of risk monitoring

Risk hazard	Comment	Parameters Measured	Sample Frequency	Regulatory Limit	Monitoring Location ID	Responsible Persons	Relevant Management Plans/Procedures
Altered visual amenity	Altered visual amenity is monitored by responding to stakeholder concerns if and when required	Visual amenity (subjective)	Dependent on stakeholder complaint	Not applicable	Dependent on stakeholder complaint	Environmental Officer	Community Engagement Plan Tailings Storage Facility Management/ Operation Plan Traffic Management Procedure Rehabilitation Plan
Dust emissions/ emissions from plant and machinery	Dust emissions are monitored monthly and as-required basis. Emissions from plant and machinery are monitored on an as- required basis. Emissions from the Augusta Mine vents are monitored on an annual basis.	Dust levels; Carbon dioxide levels	As per EPA Victoria-approved monitoring program	As per EPA Victoria-approved monitoring program or WorkSafe Victoria's regulations for vehicle emissions	See Figure 5.1 A per Mandalay's Environmental Monitoring Plan As per Ambient Air Quality Management Plan	Environmental Officer	Ambient Air Quality Management Plan Community Engagement Plan Traffic Management Procedure
Erosion and sedimentation	Erosion and sedimentation impacts are monitored on an annual basis by visual inspections of diversion and containment structures for potential weaknesses that may lead to structure failure.	Potential containment structure weakness	Annually	Not applicable	Containment structures and monitoring points as per Mandalay's Environmental Monitoring Plan (see Figure 5.1) and the Surface Water Management Plan	Structural engineer	Environmental Monitoring Plan Surface Water Management Plan Tailings Storage Facility Management/ Operation Plan Rehabilitation Plan
Fire impacts	Fire impacts are monitored by periodic maintenance of firebreaks, yearly maintenance of firefighting equipment, site inductions for site personnel on first site engagement, as required.	Visual evidence	Annually	Not applicable	Equipment, firebreaks	Site manager/ all site personnel	Community Engagement Plan Tailings Storage Facility Management/ Operation Plan
Flood impacts	Flood impacts are monitored by visual inspections of diversion and containment structures for potential weaknesses that may lead to structure failure.	Visual evidence	Annually	Not applicable	Containment structure	Structural engineer	Surface Water Management Plan Tailings Storage Facility Management/ Operation Plan Rehabilitation Plan
Ground disturbance impacts	Ground disturbance is monitored by groundwater and surface water and heritage impact monitoring programs.	Surface water and groundwater: As per Mandalay's monitoring plan Historic heritage: Visual inspection	Surface water and groundwater: As per Mandalay's monitoring plan Historic heritage: Ongoing	Surface water and groundwater: EPA Victoria-approved monitoring program and compliance limits Historic heritage: Site inspections to include observations that heritage sites remain undisturbed	See Figure 5.1 Surface water and groundwater: As per Mandalay's Environmental Monitoring Plan Historic heritage: Bombay TSF and Cyanide Works, other sites as required	Surface water and groundwater: Environmental Officer Historic heritage: Environmental Officer	Groundwater Management Plan Surface Water Management Plan Tailings Storage Facility Management/ Operation Plan Chemical and Waste Management Procedure Traffic Management Procedure Rehabilitation Plan

Risk hazard	Comment	Parameters Measured	Sample Frequency	Regulatory Limit	Monitoring Location ID	Responsible Persons	Relevant Management Plans/Procedures
Ground instability impacts	Ground instability impacts are monitored by an inspection and survey program in place for the TSF's and at Heathcote-Nagambie Road to detect any potential movement.	Visual evidence	Annually	Not applicable	Heathcote- Nagambie Road	Structural engineer	Tailings Storage Facility Management/ Operation Plan Rehabilitation Plan
Ground vibration impacts	Ground vibration impacts are monitored by temporary blast vibration monitoring to be implemented in the event of complaint or request from legitimate receptor.	Peak particle velocity	As required	Ground vibration (peak particle velocity) below 5 mm/s in at least 95 per cent of cases in a 12- month period, and not exceeding 10 mm/s at any time	As required	Shift supervisors responsible for ensuring appropriate charging of headings in accordance with approved design.	Covered by mine operational and safety procedures
Hazardous materials and waste impacts	A preventative maintenance program is in place to ensure on- going integrity of fuel and lube storage facilities at the Costerfield Operations.	Integrity of fuel and lube storage structures measured by visual inspection. Spill impact parameters are dependent on the nature of the spill. ARD impacts are measured as per the monitoring plan.	Integrity of fuel and lube storage structures are inspected annually. Spill impact sampling frequency is on an as-required basis. ARD sampling frequency is annually, as per the monitoring plan.	Fuel and lube waste impact is dependent on type of waste. ARD impact assessment is as per Mandalay's monitoring plan.	Integrity of fuel and lube storage structures at source. ARD impact monitoring locations are as per Mandalay's monitoring plan.	.	Groundwater Management Plan Surface Water Management Plan Tailings Storage Facility Management/ Operation Plan Chemical and Waste Management Procedure Rehabilitation Plan
Light emissions impacts	Light emissions impacts are monitored by responding to stakeholder concerns if and when required.	Light intensity (lumina)	As required	Not applicable	As required	Environmental Officer	Covered by mine operational procedures
Noise emissions impacts	Noise emissions are monitored as per Mandalay's monitoring plan. However, specific impacts are monitored by responding to stakeholder concerns if and when required.	Sound levels (dB)	As per Mandalay's monitoring plan	As per Mandalay's monitoring plan	As per Mandalay's Environmental Monitoring Plan and Noise Management Plan	Environmental Officer	Noise Management Plan Traffic Management Procedure Community Engagement Plan
Security breach impact	Security breach is monitored by daily checking of perimeter fence gates, building locks, portal gate and explosive container.	Visual integrity	Daily	Not applicable	Site gates, site fences, internal site gates and doors, secure explosives repository locks, vehicle locks	The general manager, all site personnel.	Tailings Management Plan Chemical and Waste Management Procedure Rehabilitation Plan

7.2 Risk reporting

All environmental monitoring results are communicated to the Costerfield Environment Review Committee (ERC), who meet quarterly. Risk reporting procedures are summarised in Table 7-2.

Table 7-2 Summary of risk reporting

Risk hazard	Reported To	Reporting Frequency	Responsible Person
Altered visual amenity **Altered visual amenity impacts are reported to the Costerfield ERC. A complaints register and reporting program is in place.**	Costerfield ERC	As required	Environmental Officer
Dust emissions/ emissions from plant and machinery **Dust emissions and emissions from plant and machinery are reported as part of the annual vent shaft emission testing to the Costerfield ERC. A complaints register and reporting program is in place and any dust-related complaints are reported to the Costerfield ERC. Particulate levels are also reported, as required, under National Pollutant Inventory (NPI) reporting requirements.**	Costerfield ERC	Monthly to internal management; Quarterly to ERC	Environmental Officer
Erosion and sedimentation **Erosion and sedimentation impacts are reported by Mandalay incident report system. Any significant, off-licence, erosion or sedimentation events are reported to the Costerfield ERC and EPA Victoria.**	Costerfield ERC EPA Victoria	As required	Structural engineer
Fire impacts **Fire impacts are reported to appropriate emergency services and regulatory agencies.**	Police Country Fire Authority Costerfield ERC ERR	As required	Site manager/ all site personnel

Risk hazard	Reported To	Reporting Frequency	Responsible Person
Flood impacts **Flood impacts are reported by Mandalay incident report system. Any significant flooding impacts are reported to the Costerfield ERC and EPA Victoria.**	Costerfield ERC EPA Victoria	As required	Structural engineer
Ground disturbance impacts **Erosion and sedimentation impacts are reported by Mandalay incident report system. Any significant, off-licence, disturbance events are reported to the Costerfield ERC, EPA Victoria and ERR.**	Costerfield ERC EPA Victoria ERR	Surface water quality is reported to the Costerfield ERC and included in the EPA Victoria Annual Performance Report. Groundwater quality is reported to the Costerfield ERC on a quarterly basis and included in the EPA Victoria Annual Performance Report. The procedure for reporting any pipework and/or dam liner leaks to the Costerfield ERC on a quarterly basis and included in the and included in the EPA Victoria Annual Performance Report. The procedure to describe reporting requirements in the event of discovery of aboriginal archaeological relics. Annual independent hydrogeological review and recommendations Facility inspections by operations personnel each shift.	Environmental Officer
Ground instability impacts	Costerfield ERC ERR	Quarterly	Structural engineer

Risk hazard	Reported To	Reporting Frequency	Responsible Person
Ground vibration impacts	Costerfield ERC	Annually	Shift supervisors responsible for ensuring appropriate charging of headings in accordance with approved design.
Hazardous materials and waste impacts **Incident reporting system is in place for the management of spills. Results of annual testing of waste rock to confirm non-acid generating properties are reported to the Costerfield ERC.**	Costerfield ERC	Annually (waste rock)	.
Light emissions impacts	Costerfield ERC	Quarterly	Environmental Officer
Noise emissions impacts	Costerfield ERC	Quarterly	Environmental Officer
Security breach impact	Police Costerfield ERC	As required Quarterly	The general manager, all site personnel.

8 Roles and responsibilities

The following Table 8-1 provides an outline of the roles and responsibilities of personnel accountable for the implementation, management and review of the risk management plan.

The Manager Sustainability or their delegate is responsible for ensuring all reports are completed within the prescribed timeframe and is responsible for maintain this RMP, the risk register and specific risk treatment plans.

Table 8-1 Roles and responsibilities

Personnel	Roles and Responsibilities
General manager	Ensure operation complies with relevant regulatory
Manager Sustainability	Ensure the RMP is implemented and maintain the RMP, risk register and risk treatment plans Review RMP and provide support to the Site team to enable them to meet their commitments Review compliance with all relevant statutes, regulations, rules, procedures, standards and policies Address complaints and maintain the complaint register Report monitoring to ERC Report environmental incidents to the Council and/or State Agencies
Technical Services Manager	Ensure that design, monitoring and audit of built features comply with relevant regulations, codes and guidelines
Shift supervisors	Ensure that personnel comply with relevant regulations, codes and guidelines
Structural engineer	Prepare design, monitoring and audit of built features complying with relevant regulations, codes and guidelines
Environmental officer	Undertake monitoring and reporting of conformance and non-conformances

9 Plan review

The RMP will undergo routine internal revision, as required, in response to:

- changes in legislation or WPV approval requirements
- changes in site activities, operations, facilities or footprint (e.g. see Section 2.1.4)
- the findings of rehabilitation studies and trials
- the results of environmental monitoring
- completion of progressive rehabilitation activities
- the outcomes of stakeholder consultation
- improvements in the knowledge of rehabilitation practice or technologies
- opportunities for improvements to the plan being identified.

Notwithstanding the above, the RMP will be fully updated every three years or as required following consultation with ERR.

10 References

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