Ravensthorpe Gold Project

Draft Mine Closure Plan

ACH Minerals Pty Ltd

July 2019

DOCUMENT CONTROL

Version	Description	Date	Author	Reviewer
3.1	Draft	20/11/2018	APM	
0a	Draft	17/07/2019	SW	GB
1a	Draft for DWER	30/7/2019	GB	

Approval for Release

Name	Position	File Reference
Paul Bennett	Managing Director	ACH Minerals Ravensthorpe Gold Project MCP.1a
Signature		

on behalf of P Bennett

Mine Closure Plan Checklist

No.	Mine Closure Plan (MCP) checklist	Y/N/ NA	Page No.	Comments	Changes from previous version (Y/N)	Page No.	Summary
1	Has the Checklist been endorsed by a senior representative within the tenement holder/operating company? (See bottom of checklist.)	N	-	Draft for consultation only.	Y	-	-
Public Availability							
2	Are you aware that from 2015 all MCPs will be made publicly available?	Y	-	-	-	-	-
3	Is there any information in this MCP that should not be publicly available?	N	-	-	-	-	-
4	If "Yes" to Q3, has confidential information been submitted in a separate document/section?	NA	-	-	-	-	-
Cover Page, Table of Contents							
5	Does the MCP cover page include: Project Title Company Name Contact Details (including telephone numbers and email addresses) Document ID and version number Date of submission (needs to match the date of this checklist)	Y	-	-	-	-	-
Scope and Purpose							
6	State why the MCP is submitted (e.g. as part of a Mining Proposal, a reviewed MCP or to fulfil other legal requirements)	Draft for consultation purposes, not for assessment under the *Mining Act 1978*.					
Project Overview							
7	Does the project summary include: Land ownership details (include any land management agency responsible for the land / reserve and the purpose for which the land / reserve [including surrounding land] is being managed) Location of the project; Comprehensive site plan(s);	Y	2-1	-	Y	-	-

No.	Mine Closure Plan (MCP) checklist	Y/N/ NA	Page No.	Comments	Changes from previous version (Y/N)	Page No.	Summary
	Background information on the history and status of the project.						
Legal Obligations and Commitments							
8	Does the MCP include a consolidated summary or register of closure obligations and commitments?	Y	3-1	Summary of legal obligations that will apply if project is approved under the EP Act.	Y	-	-
Stakeholder Engagement							
9	Have all stakeholders involved in closure been identified?	Y	4-1	-	-	-	-
10	Does the MCP include a summary or register of historic stakeholder engagement with details on who has been consulted and the outcomes?	Y	4-1	-	-	-	-
11	Does the MCP include a stakeholder consultation strategy to be implemented in the future?	Y	4-3	-	-	-	-
Post-mining land use(s) and Closure Objectives							
12	Does the MCP include agreed post-mining land use(s), closure objectives and conceptual landform design diagram?	Y	5-1	Post-mining land use and closure objectives are draft for consultation. See section 7-9 for landform design.	-	-	-
13	Does the MCP identify all potential (or pre-existing) environmental legacies, which may restrict the post mining land use (including contaminated sites)?	Y	2-4	Area has extensive history of small scale mining.	-	-	-
14	Has any soil or groundwater contamination that occurred, or is suspected to have occurred, during the operation of the mine, been reported to DWER as required under the *Contaminated Sites Act 2003*?	N	-	No known reports of contamination at this stage.	-	-	-
Development of Completion Criteria							
15	Does the MCP include an appropriate set of specific completion criteria and closure performance indicators?	Y	6-1	These are for consultation purposes at this stage.	-	-	-
Collection and Analysis of Closure Data							

No.	Mine Closure Plan (MCP) checklist	Y/N/ NA	Page No.	Comments	Changes from previous version (Y/N)	Page No.	Summary
16	Does the MCP include baseline data (including pre-mining studies and environmental data)?	Y	7-1+	Includes data from current assessment under the EP Act.	Y	-	-
17	Has materials characterisation been carried out consistent with applicable standards and guidelines (e.g. GARD Guide)?	Y	7-28	-	Y	--	-
18	Does the MCP identify applicable closure learnings from benchmarking against other comparable mine sites?	N	-	Limited information available from mines in the region.	-	-	-
19	Does the MCP identify all key issues impacting mine closure objectives and outcomes (including potential contamination impacts)?	Y	8-1	Risk assessment undertaken.	-	-	
20	Does the MCP include information relevant to mine closure for each domain or feature?	Y	9-6+	Program for each domain included.	Y	-	-
Identification and Management of Closure Issues							
21	Does the MCP include a gap analysis/risk assessment to determine if further information is required in relation to closure of each domain or feature?	Y	8-1	Risk assessment included.	-	-	-
22	Does the MCP include the process, methodology, and has the rationale been provided to justify identification and management of the issues?	Y	8-1	-	-	-	-
Closure Implementation							
23	Does the MCP include a summary of closure implementation strategies and activities for the proposed operations or for the whole site?	Y	9-6+	Program for each domain included.	-	-	-
24	Does the MCP include a closure work program for each domain or feature?	Y	9-6+	As above.	-	-	-
25	Does the MCP contain site layout plans to clearly show each type of disturbance as defined in Schedule 1 of the MRF Regulations?	Y	2-1, 9-3	-	-	-	-

No.	Mine Closure Plan (MCP) checklist	Y/N/ NA	Page No.	Comments	Changes from previous version (Y/N)	Page No.	Summary
26	Does the MCP contain a schedule of research and trial activities?	N	-	-	-	-	-
27	Does the MCP contain a schedule of progressive rehabilitation activities?	N	-	No schedule at this stage – project is yet to be approved under the EP Act.			
28	Does the MCP include details of how unexpected closure and care and maintenance will be handled?	Y	9-1	-	-	-	-
29	Does the MCP contain a schedule of decommissioning activities?	Y	9-1	-	-	-	-
30	Does the MCP contain a schedule of closure performance monitoring and maintenance activities?	Y	10-1	-	-	-	-
Closure Monitoring and Maintenance							
31	Does the MCP contain a framework, including methodology, quality control and remedial strategy for closure performance monitoring including post-closure monitoring and maintenance?	Y	10-1	-	-	-	-
Financial Provisioning for Closure							
32	Does the MCP include costing methodology, assumptions and financial provision to resource closure implementation and monitoring?	Y	11-1	-	-	-	-
33	Does the MCP include a process for regular review of the financial provision?	Y	11-2	-	-	-	-
Management of Information and Data							
34	Does the MCP contain a description of management strategies including systems and processes for the retention of mine records?	Y	12-1	-	-	-	-

Corporate Endorsement

I hereby certify that to the best of my knowledge, the information within this MCP and checklist is true and correct and addresses all the requirements of the Guidelines for the Preparation of a MCP approved by the Director General of Mines.

Signed: Date:

Name: Paul Bennett

Position: Managing Director

Table of Contents

List of Tables

List of Figures

List of Appendices

List of Abbreviations

Abbreviation	Meaning
AEP	Annual Exceedance Probability
AER	Annual Environmental Report
Ag	Silver
AHIS	Aboriginal Heritage Inquiry System
AMD	Acid and Metalliferous Drainage
ANZMEC	Australia and New Zealand Minerals and Energy Council
APM	Animal Plant Mineral Pty Ltd
Au	Gold
BCM	Bank cubic metres
BoM	Bureau of Meteorology
CIL	Carbon-in-Leach
Cu	Copper
DAA	Department of Aboriginal Affairs
DBCA	Department of Biodiversity Conservation and Attractions
DER	Department of Environment Regulation
DMIRS	Department of Mines, Industry Regulation and Safety
DMP	Department of Mines and Petroleum
DoIR	Department of Industry and Resources
EPA	Environmental Protection Authority of Western Australia
ERD	Environmental Review Document
FoS	Factor of safety
LOM	Life of mine
MCA	Minerals Council of Australia
MCP	Mine Closure Plan
MP	Mining Proposal
NAF	Non-Acid Forming
PAF	Potentially acid forming
PAF_{LC}	Potentially acid forming (low capacity)
Pb	Lead
ROM pad	Run of mine pad, an area where ore is stockpiled awaiting processing

1 Introduction

1.1 Scope

ACH Minerals Pty Ltd (ACH) [ABN 89 609 225 023] has developed this draft Mine Closure Plan (MCP) document for the Ravensthorpe Gold Project (the Project; the RGP) in accordance with the Government of Western Australia's (WA) *Guidelines for Preparing Mine Closure Plans* (the Guidelines) (May 2015).

MCPs require approval under the *Mining Act 1978*. The currently approved MCP was prepared by Silver Lake Resources, the previous tenement holder, and was approved in 2016. This version of the MCP addresses a revised project as proposed by ACH.

1.2 Purpose

This draft MCP has been prepared to support assessment of the proposed Ravensthorpe Gold Project under Part IV of the *Environmental Protection Act 1986* (EP Act). The document forms part of the information package to help decision making authorities and the public to contribute to the assessment. If the Project is approved under the EP Act, a revised version of the MCP will be developed that considers matters arising from the consultation process. Approval of a final MCP under the *Mining Act 1978* (Mining Act) is required prior to the commencement of mining.

2 Project Summary

2.1 Ownership

The Project is located within six tenements, comprising five mining leases and one miscellaneous lease, granted under the Mining Act. All tenements are held by ACH, and are listed in Table 2-1 and shown in Figure 2-1.

Table 2-1: Ravensthorpe Gold Project - land tenure

Tenement	Commenced	Expires	Total tenement area (ha)
M74/41	29/12/1987	28/12/2029	3.44
M74/51	25/01/1990	24/01/2032	519.65
M74/53	26/01/90	25/01/2032	82.835
M74/135	19/12/2000	18/12/2021	9.1625
M74/180	08/04/2009	07/04/2030	1.621
L74/34	03/07/2009	02/07/2030	1.70
		TOTAL	618.41

The Proponent for the Project is:

ACH Minerals Pty Ltd

ABN 89 609 225 023

ACN 609 225 023

Address: Suite 5, 11 Ventnor Avenue, West Perth, WA 6005

Postal Address: PO Box 470, West Perth, WA 6872

The key Proponent contact for the referral is:

Mr Paul Bennett

Managing Director – ACH Minerals Pty Ltd

Phone: (08) 6243 3990

Email: pbennett@achminerals.com.au

2.2 Project location

The Project is located within the Goldfields-Esperance region of Western Australia at the Kundip Mining Centre, approximately 550 km southeast of City of Perth (see Figure 2-1) and 17 km southeast of the town of Ravensthorpe. The Project can be accessed from the Hopetoun-Ravensthorpe Road.

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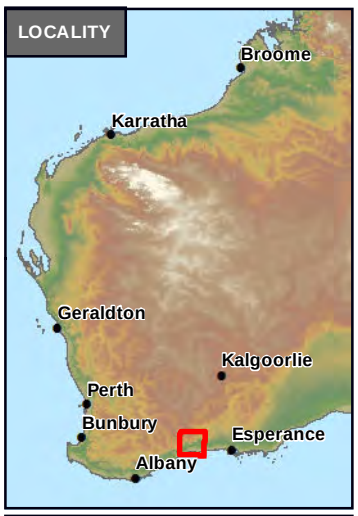
- Ravensthorpe Gold Project Area
- Local Government Area Boundary
- Mine Site
- DBCA Managed Lands
- Townsite
- Major Road



REGIONAL LOCATION
Ravensthorpe Gold Project
Mine Closure Plan
ACH Minerals Pty Ltd

N
0 5 10 15 20 Km

Coordinate System: GDA 1994 MGA Zone 51
Projection: Transverse Mercator, Datum: GDA 1994
Scale @ A3: 1:350,000

Prepared:	F Walker
Reviewed:	G Barrett
Project No:	TE19017
Revision:	A
Date:	24/07/2019

Figure 2-1

ACHMINERALS

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2.3 Project history

The Ravensthorpe-Kundip copper-gold belt stretches approximately 20 km from northern Ravensthorpe to the Kundip Mining Centre (Kundip) in the south, encompassing the existing Mt Chester, Mt Desmond and Elverdton Mines. The Kundip was first mined in 1901 with the commencement of construction at the Harbour View mine.

Between 1901 and 1906, a ten-head battery was erected. However, a slump in copper prices saw the mine and battery close in 1907. Following this the mine was let out to tributers until 1913, when the mine was purchased by Reg and Harry Dallison. Shortly afterwards a rich new reef was discovered and mined in addition to the previously discovered Main Reef, No 2 Reef, No 3 Reef, and the Pig and Whistle Reef. However, despite the discovery of this reef, mining was infrequent at Harbour View up to the 1930's. In 1932, the Beryl Gold Mining Company purchased the lease, along with several others in the Kundip. Mining sprang to life again for approximately 10-15 years. The last reported activity at Harbour View was in 1940.

Remains of the Kundip battery can be found within the Project Area approximately 600 m east of the Hopetoun-Ravensthorpe Road. Just beyond the battery extends a broad east-west arc of shallow diggings for gold, while numerous historic shafts occur for approximately 3 km towards the Ravensthorpe Range. Vegetation in these areas has been subject to great disturbance by historic mining activities; however, many areas have regained vegetative cover.

In more recent times, Tectonic Resources NL (Tectonic) and Homestake Gold Australia (Homestake) (now Barrick Gold Corporation or Barrick) entered into a joint venture in May 1996. Homestake's interest was based on the possible continuation of mineralisation under Proterozoic cover at the southern end of the field. Also of interest was a genetic relationship with porphyry-style mineralisation for the copper-gold lodes at Kundip, similar to that seen at Boddington. Homestake completed geochemical surveys and surface mapping exercises across the area which eventually led to the discovery of the Trilogy deposit, south of Kundip, in 1997. Drill programs were subsequently undertaken both at Trilogy and across other targets in the joint venture portfolio.

Tectonic took over management of the joint venture in mid-2000, and in late 2003 purchased Barrick's share, gaining 100% control of the tenements covering the Kundip – the first time that a single company held amalgamated ownership. Tectonic subsequently undertook numerous infill and resource extension drilling campaigns from early 2001 to 2010. In September 2011, Tectonic changed its name to Phillips River Mining Ltd.

Silver Lake acquired the Project from Phillips River in 2012. Due to unrelated corporate matters and subsequent competing priorities, Silver Lake completed very little additional work at the Project, and neither updated nor re-reported the resource inventory during that time. Silver Lake's work was generally limited to soil geochemistry surveys and mapping across sections of the tenure, followed by a review of the same in conjunction with data inherited from Tectonic. ACH Minerals (ACH) acquired the tenements in 2016.

2.4 Site layout

2.4.1 Existing disturbance

The Project Area has been heavily impacted by historic mining activities. Existing disturbances at the site include a Department of Biodiversity Conservation and Attractions (DBCA) fire break, costeaning and trenching, trial pits, numerous historical mine shafts (some in excess of 150 m deep), decline tunnels into mineralised targets, a historic Heap Leach Facility, a Waste Rock Landform (WRL), a Tailings Storage Facility (TSF), and water containment infrastructure.

The immediate environment has been subject to varying levels of contamination from localised rubbish scatter (e.g. building materials from the early and mid-1900s) to seepage from a historic HLF. Overburden from trial pits, shafts and costeans has been stockpiled adjacent to the workings and has not been remediated. Consequentially existing disturbance at the Project Area is high.

2.4.2 Proposed infrastructure

A layout of the proposed infrastructure at the Project is provided in Figure 2-2.

Proposed operations at the Project include the development of three open pits: Kaolin, Harbour View, and Flag. Underground operations will be established at Harbour View and Flag following the completion of open pit cutback.

Mined ore will be hauled from the pits to the ROM Pad for processing in the adjacent Processing Plant, which will comprise a Carbon-In-Leach (CIL) circuit and/or flotation circuit depending on the mineralogy of the ore. The Plant will produce gold doré (doré) and a precious metals concentrate (concentrate) containing economic quantities of gold, silver and copper.

Tailings material produced from processing will be deposited into a hillside/paddock-design TSF located in the south east of the Project Area, which has been designed to provide sufficient tailings storage capacity for the Life of Mine (LoM). Waste rock material will be transported and deposited onto one of two WRLs, North WRL or South WRL.

The following ancillary infrastructure will also be constructed within the Project Area:

- Haul and access roads, using established site roads wherever possible;
- Offices, crib room, ablutions and go-line hardstand area;
- Workshops with associated hydrocarbon management systems and wash down area;
- Laydown and storage areas;
- Diesel storage and re-fueling area;
- Water containment infrastructure;
- Vehicle washdown area;
- Powerlines;
- Explosives magazine for the storage of explosives; and
- Bioremediation facility.

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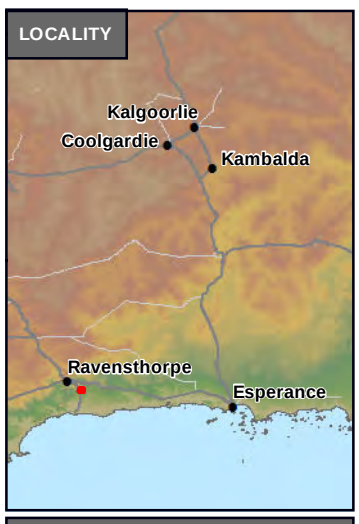
- Ravensthorpe Gold Project Area
- RGP Development Envelope

RGP Mine Activities

- Offices
- Site Support
- Magazine
- Mine Pit (Kaolin)
- Mine Pit (Harbour View)
- Mine Pit (Flag East)
- Mine Pit (Flag West)
- Waste Rock Landform (North)
- Waste Rock Landform (South)
- Topsoil Stockpile
- Fire Break
- Processing Plant Area
- Run-of-Mine
- Tailings Storage Facility
- Roads
- Water Storage Facility
- Water Transfer Facility



MINING ACT TENURE, DEVELOPMENT ENVELOPE AND DISTURBANCE FOOTPRINT

Ravensthorpe Gold Project
Mine Closure Plan
ACH Minerals Pty Ltd

N
0 150 300 450 600 m
Coordinate System: GDA 1994 MGA Zone 51
Projection: Transverse Mercator, Datum: GDA 1994
Scale @ A3: 1:12,000

Prepared:	F Walker
Reviewed:	G Barrett
Project No:	TE19017
Revision:	A
Date:	24/07/2019

Figure 2-2

ACHMINERALS

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3 Identification of Closure Obligations and Commitments

The DMIRS is the lead regulator and decision-making authority for mining projects in WA under the Mining Act. DMIRS has the role of regulating the industry to ensure the closure conditions applied and commitments made are implemented during the life of the mining project. This is undertaken through the assessment of Mining Proposals and Mine Closure Plans under the Mining Act. Once approved, these documents will form part of the tenement conditions.

The Ravensthorpe Gold Project is being assessed under Part IV of the *Environmental Protection Act 1986* (EP Act). If approved, the project will operate under conditions set by the Minister for Environment. In this case, assessment of Mining Proposals and Mine Closure Plans under the Mining Act will only take place when approval under the EP Act has been received. This draft Mine Closure Plan has been provided for consultation purposes during the EP Act process.

Should the Project proceed, there will be obligations potentially required under a range of legislation outside of the EP and Mining Acts. This legislation is listed in Table 3-1. All are Western Australian statutes except where indicated.

Table 3-1: Legislation relevant to Project closure

Type	Title
Acts	*Aboriginal Heritage Act 1972*
	Biodiversity Conservation Act 2016
	Conservation and Land Management Act 1984
	Contaminated Sites Act 2003
	Dangerous Goods Safety Act 2004
	Environmental Protection Act 1986
	Environmental Protection and Biodiversity Conservation Act 1999 (C'wealth)
	Land Administration Act 1997
	Mines Safety and Inspection Act 1994
	Mining Act 1978
	Native Title Act 1993 (C'wealth)
	Rights In Water and Irrigation Act 1914
Regulations	Aboriginal Heritage Regulations 1974
	Environmental Protection (Clearing of Native Vegetation) Regulations 2004 (WA).
	Environmental Protection (Controlled Waste) Regulations 2004 (WA)
	Environmental Protection Regulations 1987 (WA)
	Dangerous Goods Safety (Explosives) Regulations 2007
	Dangerous Goods Safety (General) Regulations 2007
	Dangerous Goods Safety (Storage and Handling of Non-explosives) Regulations 2007
	Land Administration (Land Management) Regulations 2006
	Land Administration Regulations 1998
	Mining Regulations 1981
	Mines Safety and Inspection Regulations 1995

4 Stakeholder Engagement

4.1 Historical Consultation – Phillips River Project

Extensive consultation has been previously undertaken with stakeholders for the former PRP. There was a small amount of interest in the PRP from the local community, particularly with regard to potential employment opportunities. Overall the community sentiment towards the PRP was positive.

4.2 Key Ravensthorpe Gold Project Stakeholders

Stakeholders have been identified based on an assessment of the Project location, surrounding land users, significant elements of the proposed impact area that may be of interest to non-government organisations or community groups, and potential Project environmental impacts and risks. Table 4-1 lists key stakeholders for the Project; this list is dynamic and will be updated throughout the Project life as necessary.

4.3 Stakeholder Engagement Process

ACH has established communications with key stakeholders to ensure that any potential issues and concerns are raised and appropriately addressed. ACH initiated a stakeholder consultation program for the Project in February 2016. The stakeholder engagement objectives are to:

- Identify key risks for the Project at an early stage, ensuring they are promptly addressed to enable a smoother and faster approval process, and to help promote successful rehabilitation and closure through early planning;
- Ensure that Community members or groups are informed regarding the progress of the Project and have an opportunity to comment;
- Inform surrounding land users of the Project and ensure they will not be negatively impacted by the Project activities;
- Establish the post-mining land use and confirm it is acceptable to key stakeholders and any likely post-mining land managers/ owners;
- Establish a safe environment for staff and the public through early liaison regarding subjects such as traffic management on public roads and heritage trail interaction;
- Identify significant historical sites so impacts to them can be managed appropriately and in agreement with interested parties; and
- Establish key Project Area biological attributes and mitigate impacts where practicable.

Table 4-1: Ravensthorpe Gold Project Stakeholder Register

Stakeholder Group	Specific Stakeholder
Ravensthorpe Community	Ravensthorpe Community Hopetoun Community Local Landholders – Farmers Local Residents
Community and Industry Groups and Organisations	Ravensthorpe Progress Association Hopetoun Progress Association Ravensthorpe Regional Chamber of Commerce Ravensthorpe Landcare District Committee Ravensthorpe Historical Society Hopetoun Volunteer Fire & Emergency Services Ravensthorpe Volunteer Fire & Rescue Ravensthorpe State Emergency Service St John Ambulance – Ravensthorpe Sub Centre Hopetoun Ravensthorpe Railway Heritage Trail Steering Committee Conservation Council Wildflower Society South West Aboriginal Land and Sea Council Southern Aboriginal Corporation Greening Australia Mallee Fowl Preservation Group Birds of Australia
Government Regulators	Environmental Protection Authority Department of Water and Environmental Regulation Department of Mines, Industry Regulation and Safety Department of Biodiversity, Conservation and Attractions
Local Government and Government Agencies	Shire of Ravensthorpe Department of Planning, Lands and Heritage Department of Primary Industries and Regional Development Main Roads Western Australia Heritage Council Western Australian Museum Water Corporation Shire of Esperance
Traditional Owners	Wagyl Kaip/ Southern Noongar People South West Aboriginal Land and Sea Council
Other	Southern Ports Authority Fremantle Ports Western Australia Goldfields Esperance Development Corporation

ACH has actively engaged key Project stakeholders, including government departments and the local community, to provide updates and receive feedback on proposed activities. Early engagement in this process has allowed ACH a better understanding of stakeholder expectations for the Project and post closure land use. This information has informed the mine planning process.

4.4 Ongoing Stakeholder Consultation

Stakeholder consultation will be ongoing throughout the Project life. Objectives of ongoing consultation include:

- Keeping community members, groups and nearby land users up to date on Project progress and any changes;
- Addressing any complaints or grievances that are raised during mine operations;
- Ensuring Government departments are kept up to date with any Project changes or issues that may arise, including updating approval documents if required;
- Ensuring closure planning is informed by key stakeholders and that all relevant stakeholders have agreed to the proposed end land uses;
- Identifying whether any infrastructure will be retained for end land users (e.g. bores) and ensuring appropriate approvals and transfer agreements are in place; and
- Ensuring all completion criteria have been met to the satisfaction of Government Regulators.

A stakeholder consultation schedule is outlined in Table 4-2.

Table 4-2: Ravensthorpe Gold Project – ongoing stakeholder consultation

Organisation/ Stakeholder	Issue	ACH Task	Frequency / Timeframe
Environmental Protection Authority	Compliance with Part IV approval/ Ministerial Conditions.	Submission of the Environmental Review Document and follow up consultation.	2019.
		Consultation in regard to Ministerial Statement compliance.	Annually.
		Environmental report submission and review.	Annually.
Department of Mines, Industry Regulation and Safety	Assessment of Project under Mining Act 1978. Annual Environmental Reports. Mine Closure Plans. Mining Rehabilitation Fund. Inspections and compliance. Mine Health and Safety. Mineral Titles.	Submission of updated Mining Proposal and Mine Closure Plan.	2019.
		Submission of Project Management Plan.	2019.
		Annual Environmental Report.	Annually.
		Facilitation of Regulator inspections and compliance.	Annually or as required.
Department of Water and Environmental Regulation	Works Approval and Licence for Prescribed Premises. 5C Licence for water abstraction. Compliance with Part V Licence. Compliance with Contaminated Sites Act 2003. Compliance in relation to groundwater abstraction licences and Operating Strategy.	Submission of Works Approval and Licence Applications.	2019.
		Water Licensing and Reporting.	Annually or as required.
		Management of Contaminated Sites.	As required.
		Environmental Report submission.	Annually.
		Facilitation of Regulator inspections and compliance.	Annually or as required.
Department of Biodiversity, Conservation and Attractions	Management of environmental aspects including protected flora, fauna and vegetation communities. Management of adjacent Kundip Nature Reserve. Fire Management.	Consultation regarding conservation of biological values and management of significant flora and fauna.	As required.
		Consultation regarding management of the firebreak within the Kundip Mine Site.	Ongoing throughout Project.
		Development of Completion Criteria for Vegetation Communities and biological aspects of the site to ensure the conservation value of surrounding vegetation and habitats is maintained, particularly in relation to the adjacent Nature Reserve.	Every three years (in conjunction with MCP) or as required.
Shire of Ravensthorpe	Use of roads and potential impacts to tourist sites, local heritage areas or Shire of Ravensthorpe sites or facilities.	Consultation regarding Shire of Ravensthorpe campsite and management of traffic/ other issues in vicinity.	As required.

Organisation/ Stakeholder	Issue	ACH Task	Frequency / Timeframe
Fremantle Ports Authority	Export of product from Fremantle Port.	Consultation regarding use of Fremantle Port facilities.	As required.
Main Roads Western Australia	Use of public roads to transport ore and product between mine sites and to Fremantle Port.	Consultation regarding roads, primarily between the Project and Fremantle Port.	2019.
Local Landholders/ Neighbours	Whether any infrastructure is to remain post-closure.	Establish if future land managers prefer any infrastructure to remain. Transfer agreements if required and appropriate permission from applicable Government Agencies.	Prior to final closure.
	Amenity and indirect impacts (noise, dust etc.)	Follow-up of any complaints or grievances and management of a complaints and grievances register.	As required.
		Regular consultation regarding Project updates.	Annually or as required.
South West Aboriginal Land and Sea Council	Identification and protection of Aboriginal Heritage.	Consult regarding Aboriginal Heritage and Matters.	As required.
Malleefowl Preservation Group	Malleefowl.	Consultation and updates regarding potential options for a Malleefowl Research Project.	As required.

5 Post-Mining Land Use(s) and Closure Objectives

5.1 Post-mining land use

ACH has considered the post-mining land use requirements and hierarchy set out in Section 4.8 of the current DMIRS Guidelines (DMP/EPA, 2015) in formation of the post-mining land use objectives for the Project. The DMP/EPA (2015) states that "post-mining land use(s) must be:

- Relevant to the environment in which the mine will operate or is operating;
- Achievable in the context of post-mining land capability;
- Acceptable to the key stakeholders; and
- Ecologically sustainable in the context of local and regional environment."

With these restrictions in mind, the post-mining land use must aim to (DMP/EPA, 2015):

- Reinstate the 'natural' ecosystems to be as similar as possible to the original ecosystem;
- Develop an alternative land use with higher beneficial uses than the pre-mining land use;
- Reinstate the pre-mining land use; or
- Develop and alternative land use with beneficial uses other than pre-mining land use.

Upon completion of the RGP it is anticipated that the Project Area will return to a self-sustaining ecosystem where possible and resources allow, consistent with and relevant to the surrounding flora of the Ravensthorpe Range.

Constraints to achieving the post-mining land use are discussed further in this MCP. Completion criteria aligned with achieving a self-sustaining ecosystem at the RGP have been developed and ongoing discussion with stakeholders will achieve refinement and agreement to these over further revisions of the MCP.

5.2 Closure objectives

ACH's objective is to ensure that the Project can be closed, decommissioned and rehabilitated in an ecologically sustainable manner, while avoiding the need for costly remedial earthworks late in the project lifecycle.

The broad mine closure objectives for the Project are identified in Table 5-1. Given the lifespan of the Project, it is anticipated that these objectives may evolve over time as further stakeholder consultation is conducted. However, the key focus will remain for ACH to leave the site in a safe, stable and non- polluting condition.

Where appropriate, rehabilitation will occur progressively throughout the life of the Project, commencing after the construction phase; for example areas that are no longer required will be closed to promote natural vegetation recruitment as they become available. The mining schedule will enable progressive rehabilitation and closure throughout the life of mine (LoM), however, there will be the need for continual use of many of the disturbed areas throughout the Project life.

Table 5-1: Ravensthorpe Gold Project – draft mine closure objectives

Aspect	Objective
Compliance	• All legally binding conditions and commitments relevant to rehabilitation and closure will be met.
Landforms and disturbance	• All constructed waste rock landforms will be stable and resistant to erosion. • All constructed tailings storage facilities and waste rock landforms will be non-polluting with substances potentially harmful to people or the environment permanently encapsulated or removed from site. • The site will be safe for people and animals.
Revegetation	• Revegetation is self-sustaining, is compatible with surrounding native vegetation and is not a source of weeds.
Water	• Pre-mine surface water movement patterns should be restored to the extent possible given constructed landforms have been established. • Surface and groundwater levels and quality should reflect the original levels and water chemistry.
Infrastructure	• No infrastructure to be left on site unless agreed to by regulators and the subsequent land holders.

6 Completion Criteria

6.1 Development of completion criteria

Completion criteria provide a basis for the determination of successful closure and rehabilitation. DMP and EPA (2015) guidance on closure criteria indicates that closure criteria should:

- Be specific enough to reflect unique sets of environmental, social and economic circumstances.
- Be flexible enough to adapt to changing circumstances without compromising objectives.
- Include environmental indicators suitable for demonstrating that rehabilitation trends are heading in the right direction.
- Undergo periodic review resulting in modification if required due to changed circumstances or improved knowledge.

Be based on targeted research which results in more informed decisions. Further to this, DMIRS advises that closure criteria should be:

- Specific.
- Measurable.
- Attainable.
- Relevant.
- Time specific.

Closure criteria have been formulated using closure objectives as a guide for categorisation. These criteria provide a traceable and measurable indicator of completeness of closure activities when closure takes place.

Earlier iterations of the MCP established preliminary completion criteria. This document seeks to update these. It is envisaged that the completion criteria may be further refined with reference to ongoing monitoring data, and development of more detailed closure designs, geotechnical and hydrogeological reviews as they may occur in the future.

6.2 Project specific completion criteria

Completion criteria have been developed using DMIRS guidance (Section 6.1) and closure objectives as a guide for categorisation. Completion criteria specific to the Project are presented in Table 6-1.

Table 6-1: Completion criteria with measurable standards for the Project

Closure objective	Completion criteria	Monitoring (performance indicators)
Compliance		
All legally binding conditions and commitments relevant to rehabilitation and closure will be met.	All conditions and commitments are met.	Milestone audits (degree of compliance with tenement conditions)
Landforms and disturbance		
All constructed waste rock landforms will be stable and resistant to erosion.	All landforms constructed in accordance with parameters outlined in this MCP (see Section 9.0) and are stable and erosion resistant.	Independent annual assessments or at other times at ACH's discretion (degree of compliance with tenement conditions)
All constructed tailings storage facilities and waste rock landforms will be non-polluting with substances potentially harmful to people or the environment permanently encapsulated or removed from site.	No substances potentially harmful to people or the environment are accessible.	Annual groundwater quality assessments (comparison with baseline data) Soil contamination audit at closure (comparison with baseline data) Post-decommissioning inspection and auditing (degree of compliance with tenement conditions).
The site will be safe for people and animals.	All mine voids are appropriately bunded to prevent entry (DoIR, 1997).	Post-decommissioning inspection and auditing (degree of compliance with tenement conditions).
Revegetation		
Revegetation is self-sustaining, is compatible with surrounding native vegetation and is not a source of weeds.	Foliar cover is on a positive trajectory. Flowering, fruiting and seed production is evident in a range of species. Vegetation composition is reflective of undisturbed native vegetation in the immediate area. Weeds do not inhibit establishment/out compete native vegetation in rehabilitation areas.	Annual vegetation monitoring (vegetation cover, composition and reproductive status; weed cover).
Water		
Pre-mine surface water movement patterns should be restored to the extent possible given constructed landforms have been established.	No obstructions to water flow beyond approved landforms.	Inspection and auditing (instances of water flow obstructions; compliance with tenement conditions).

Closure objective	Completion criteria	Monitoring (performance indicators)
Surface and groundwater levels and quality should reflect the original levels and water chemistry.	Water quantity and quality on a trajectory to baseline levels within two years of cessation of mining and processing[1].	Annual groundwater quality assessments (comparison with baseline data, triggers and thresholds).
Infrastructure		
No infrastructure to be left on site unless agreed to by regulators and the subsequent land holders.	Written agreement from all parties prior to closure.	Evidence of written agreement.

[1] Potentially cannot be met in the Flag West open pit.

7 Collection and Analysis of Closure Data

7.1 Regional setting

The Project is situated within the Fitzgerald (ESP01) sub-region of the Esperance Plains Bioregion according to the Interim Biogeographic Regionalisation for Australia (IBRA) classification system, which classifies the landscape into regions based on geomorphological, ecological, and biological characteristics (Thackway and Cresswell, 1995).

The Esperance Plains Bioregion is characterised by a plain broken by quartzite ranges and granite domes/ outcrops. These inselbergs provide habitat diversity and unique microclimates compared to regional conditions, supporting high species diversity and level of endemism (Hopper et al. 1997; Keppel et al. 2016). Dominant vegetation of the region is predominantly proteaceous scrub and mallee heaths on sandplain, with fields and heaths, which are rich in endemics. Eucalypt woodlands also occur in gullies and foot-slopes (Thackway and Cresswell, 1995).

The topography within ESP01 is variable, ranging from sandplains on the coast to granite and quartzite ranges on both the coastal plain and inland (Comer et al. 2003). Vegetation complexes within this subregion represent coastal dune woodlands, coastal shrublands and heathlands, mallee shrubland and heathland (rich in endemics). Herb fields and heaths can be found on granite tors, quartzite ranges and greenstone heath and shrublands (Comer et al. 2003).

The Project is situated in the foothills of the Ravensthorpe Range which comprises 40 km of low hills running north-north-west to south-south-east adjacent the town of Ravensthorpe. The topography of the Project Area is characterised by moderate slopes of 5 – 10%. Landscape elevation is highest in the north-eastern corner of the site at 228 m AHD, falling to 127 m AHD in the south-western corner.

Soil-landscape mapping delineates repeating patterns of soils and landscapes across WA's rangelands and arid interior (Tille, 2006). Mapping completed by the Department of Agriculture places the Proposal within the Ravensthorpe Zone of the Stirling Province (Government of Australia, 2016).

The Stirling Province is broadly described as a gently undulating plain in the northeast, occasionally broken by small valleys, low narrow rocky hills and ridges, and granitic tors and bosses. In the northwest a gently undulating plain occurs, dissected by short rivers. In the western half of the Stirling Province, hills and ranges are noticeable features. Soils of the Ravensthorpe Range are mostly shallow gravels and red/brown non-cracking clays. Vegetation in the Stirling Province ranges from mallee scrub and woodlands in the northeast, to mallee scrub and salmon gum- yate woodlands on the Ravensthorpe Range (Tille, 2006).

The Ravensthorpe Zone is characterised as rolling low hills on greenstone (mafic and ultramafic). South-flowing rivers moderately dissect the zone and soils are red fine-textured (Government of Australia, 2016).

7.2 Climate

The Project is located in the Goldfields-Esperance region of WA which experiences a Mediterranean climate with mild summers and cool wet winters. Climate data was sourced from the nearest Bureau of Meteorology (BoM) weather station to the Project at Ravensthorpe, Western Australia, located less than 5 km north of the Project Area (Station no. 010633).

The annual maximum daily temperature at Ravensthorpe ranges from an average of 16.3 °C in July to 29.0 °C in January, while the average minimum daily temperature ranges from 6.7 °C in August to 14.6 °C in February (Figure 7-1) (BoM, 2019).

The area receives approximately 429.6 mm of rain per annum (p/a), with an average of 112 wet days p/a occurring primarily May through to September. The average monthly rainfall for Ravensthorpe ranges from 24.0 mm in December to 47.1 mm in July (Figure 7-1). Humidity levels range from 45% to 64% in summer, increasing to between 56% and 80% in winter (BoM, 2019).

The likelihood of a 1/100 year rainfall event occurring in Ravensthorpe is depicted in Figure 7-2. There is a 1 % Annual Exceedance Probability (AEP) that Ravensthorpe will experience 39.1 mm of rainfall for a 1 hr period or 127 mm for a 24 hr period. Surface water management infrastructure at the Project is based on a 1% AEP that the area will experience 158 mm of rainfall for a 72 hr period (BoM, 2019). A maximum probable rainfall event that can be characterised as a 1 in 2000-year, 72-hour rain event peaks out at 316 mm. It is expected that pit bunds would be able to withstand this type of event, in order to prevent surface-water entering pits from outside of the safety bund.

Morning winds are dominated by north-westerly wind direction, with speeds ranging from 10.2 km/hr to 14.0 km/hr across the year. Afternoon winds are dominated by south-easterlies and north-westerlies, with wind speeds ranging from 12.2 km/hr to 16.3 km/hr (BoM, 2019).

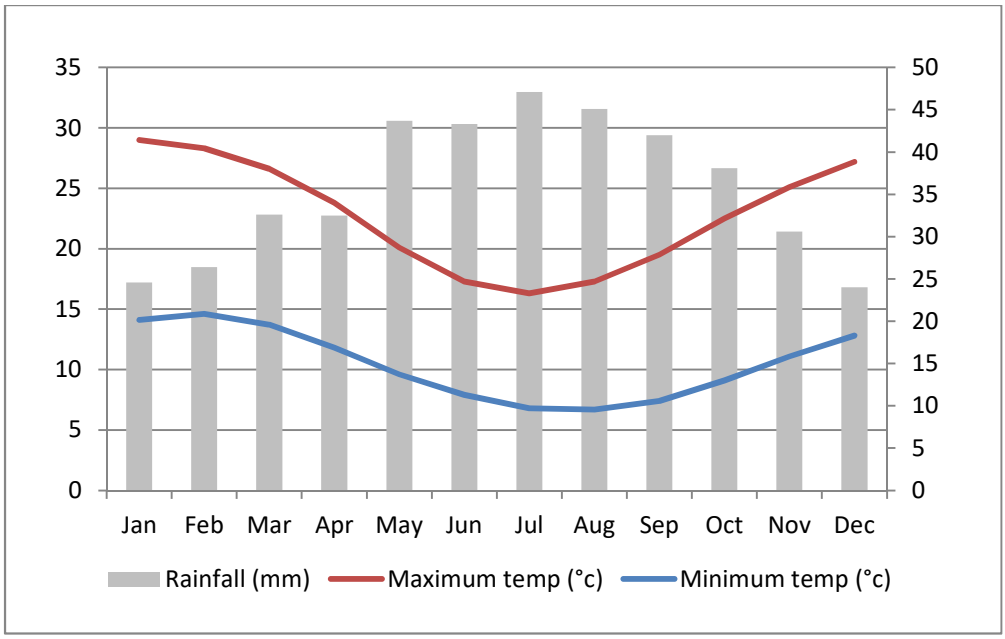

Figure 7-1: Ravensthorpe Weather Station Meteorological Data (BoM, 2019)

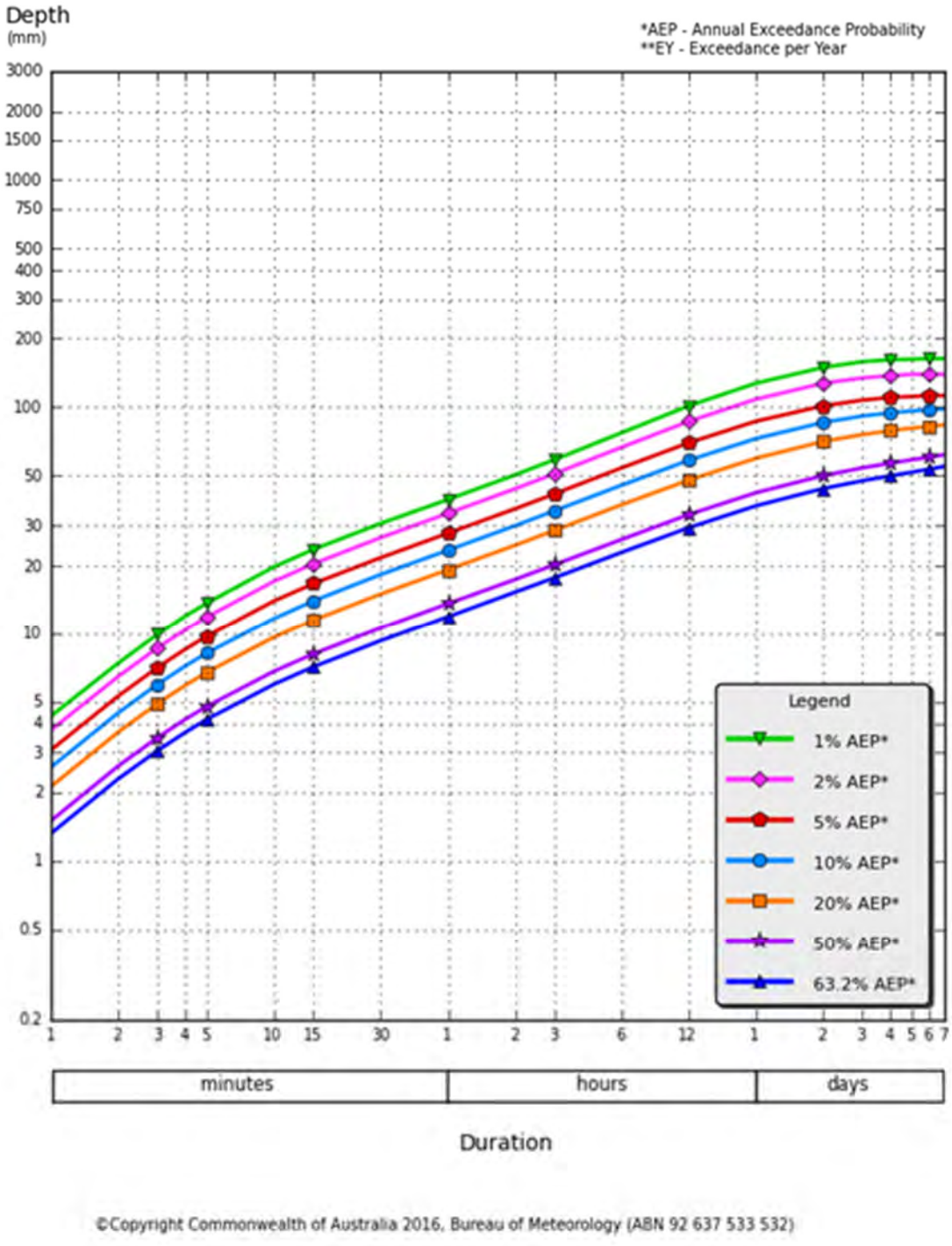

Figure 7-2: Project IFD Design Rainfall Depth (mm)

7.3 Geology

7.3.1 Regional Geology

The Archaean Ravensthorpe Greenstone Belt, hosting the Kundip Mining Centre, is located in the eastern portion of the Southern Cross Province (Tectonic, 2011). It consists of a northwest trending metamorphosed volcano-sedimentary succession of alternating mafic and felsic lavas and sediments. Volcaniclastics are associated with chert, fine-grained detrital sediments and ultramafic volcanics. Greenstone terranes are overlain in the south by the Proterozoic Mount Barren Group metasediments. Further south the Munglingup Gneiss is separated from the Mount Barren Group and Archaean terranes to the north by the east-northeast trending Jerdacuttup Fault (Tectonic, 2011).

The Project is located in a region dominated by Kybulup schist with the underlying geology predominantly Annabelle Volcanics. The Ravensthorpe Terrane, hosting the Kundip, is a calc-alkaline complex consisting of the Annabelle Volcanics and the Manyutup Tonalite. The Annabelle Volcanics consists of basalt, andesite and dacite with minor occurrences of dolerite. The proportion of dacite increases from near the Ravensthorpe Township, southeast toward Kundip, and southwest toward West River (Witt, 1997). Pervasive alteration occurs through the Annabelle Volcanics as disseminations and discontinuous veinlets. Secondary quartz, biotite, chlorite, epidote and sericite are common. The Manyutup Tonalite varies in composition from diorite to granodiorite but is mainly tonalite. Textural variations exist within the Manyutup Tonalite; micro-tonalite has been identified in drill core from the northern area of Kundip.

Host rocks for the mineral veins comprise an acid volcanic sequence of fine to medium grained dacite and andesite, feldspar porphyry (intrusive or extrusive), crystal tuffs of acid to intermediate composition and intrusive granodiorite. The tuffs range from fine-grained chloritic siltstone/sandstone to a coarse lapilli tuff with fragments to 20 cm in size. Where outcrop is sufficiently good, bedding surfaces may be preserved in the tuffs (Marjoribanks, 2003).

To the east, the volcanics are structurally overlain by steep dipping, NNW striking, outcropping Archaean sediments of the Chester Formation. To the northwest, they are intruded by the post-tectonic Archaean Ravensthorpe tonalite/diorite pluton. To the south, the rocks pass below shallow dipping conglomerate and sands of an unconformably overlying Proterozoic Basin.

The Chidnup Fault Zone bounds the Ravensthorpe Terrane in the west and the Carlingup Terrane in the east; it extends for over 40 km and is considered to have been instrumental in mineralisation within the area. The fault zone, including its associated structures, is over 2 km wide. It has been postulated that sinistral strike-slip movement across the Chidnup Fault Zone produced secondary structures in adjacent rocks into which metamorphogenic fluids moving up the major structure found favourable sites for mineral deposition. In the Kundip area, a component of reverse fault movement on the Chidnup fault zone created tension fractures that dip 30° to 60° south. Other vein orientations are thought to be related to other minor secondary structures.

7.3.2 Local Geology

Kaolin and Hillsborough Deposits

The Kaolin open pit will be the major source of waste rock in the proposed project. The Kaolin deposit is comprised of a stacked series of flat dipping quartz veins, encased within fine-medium grained dacite overlying granite or granodiorite. The deposit consists of four main series of mineralisation (Kaolin, Hillsborough, Two Boys and Beryl). Within these, there are numerous mineralised structures striking approximately 030° and dipping shallowly to the east-southeast, and which remain partially open to the southeast. Small northerly dipping faults which trend 245° have been identified that displace the lode surfaces by up to one metre. The Main Series is the most extensive group, covering over 400 m of strike, during which the strike swings from about 060° to 030° at the eastern extent of mineralisation. Dip is consistently 020° to 030° to the southeast.

The most strongly mineralised lodes are dominantly pyrite-pyrrhotite rich, and display strikes of up to 50 m of elevated width and grade in dilatational zones typical of tensional fractures. A strong plunge to mineralisation located during earlier workings, however, is interpreted to be a localised intersection of the Hillsborough and Main Series orientated structures. The Two Boys structures display a swing in strike similar to a cone shape in plan view; the dip is moderate to the west. The Hillsborough series is inferred from historic mining, as separated from the other lodes by a fault, though no evidence has been put forward to confirm this (SRK, 2011).

Harbour View Deposit

The Harbour View deposit is again predominately hosted within the Archaean Annabelle Volcanics dominated by dacite and to a lesser extent andesite and granites. The Harbour View deposit consists of steep west dipping Harbour View series lodes which trend northeast/ southwest and are cross cut by the moderately southern dipping May series lodes which trend east-west to east-northeast/ west- southwest (Tectonic, 2011).

The Harbour View North structure sits approximately 30 m in the footwall of the more significantly mineralised Harbour View structure. The May series of ore structures consist of a group of vein swarms which are located directly west of Harbour View. The lodes are typically 0.5 m to 2.0 m in thickness, reaching a maximum of 10 m where structural intersections occur. The strike length on the major shear surfaces are typically in the range of 800 m to 900 m (SRK, 2011).

Flag Deposit

The Flag deposit is predominately hosted within the Archaean Annabelle Volcanics and consists of shallow to moderate and moderate to steep south dipping lodes which roughly trend in an east-west direction. The mineralisation generally occurs within gold-copper sulphide rich shears as stacked dilatational quartz veins with associated wall rock alteration. Veins generally dip in a southerly direction at about 060o. There is a single large fault offset identified within the area (Tectonic, 2011).

Mineralisation plunges to the east in the central zone. The most common sulphide is pyrite followed by chalcopyrite and pyrrhotite. Sulphides occur as massive to semi-massive and as thin veinlets

along fractures. Vein Contacts are generally sharp. The modelled lodes are typically 1 m to 2 m thick, with the main lode extending over an 840 m strike length (SRK, 2011).

7.3.3 Soil Profile

Physical and chemical characterisation of the soil profile at the Project has previously been undertaken by Outback Ecology in 2004 and 2011.

Based on the findings of the assessments, topsoil materials were found to be slightly acidic to neutral (pH 5.5-7.3) with low salinity values (EC 3-35), and were generally found to be non-dispersive in nature (as indicated by high Emerson Class values) due to the higher content of gravel and rock fragments (Outback Ecology 2004, 2011). Plant available nutrients, native seed and soil-borne organisms were particularly concentrated within the top 15 cm of topsoil; therefore, the optimal stripping depth of topsoils to be used in rehabilitation should be no deeper than 15 cm.

While data on subsoils was limited with chemical characterisation only undertaken for samples collected from the Kaolin area, it was apparent based on the data available that subsoil materials across the Project are clay-rich, and have the potential to slake and become dispersive (as indicated by low Emerson Class values) (Outback Ecology 2004, 2011). If exposed landform surfaces these materials are considered likely to become unstable, creating risks of hard-setting and erosion.

A summary of soil characteristics within the Project Area is provided in Table 7-1 below.

Table 7-1: Ravensthorpe Gold Project – results of soil sampling at proposed mine operations

Deposit	Depth	Texture	Emerson Class	pH (H_2O)	EC (mS/m)
Kaolin	Topsoil	Loam – sandy loam	8	5.9 – 7.3	4 - 20
	Subsoil	Heavy clay –light clay	2 - 5	5.4	49
Harbour View	Topsoil	Clayey sand - loam	3 - 8	6.1 – 7.3	3 - 15
	Subsoil	Medium clay	2 - 3	-	-
Flag	Topsoil	Gravelly loam – sandy loam	8	5.5 – 6.3	6 - 35
	Subsoil	Medium clays	1 - 2	-	-

7.4 Hydrology

7.4.1 Surface water

Hydrological catchments within the region trend in a southerly direction from the Ravensthorpe Range, draining into the Southern Ocean. The Project lies predominantly within the Steere River Catchment, with a small portion intercepting the Jerdacuttup River Catchment to the east (as seen in Figure 7-3). This area will comprise the proposed TSF, magazine storage area, water containment infrastructure, and mine road infrastructure.

The Steere River and Jerdacuttup River are the primary drainage channels within the Kundip area, diverging to form an integrated network of well-defined ephemeral creeks and streams (Figure 7-4). Tributaries of the Steere River receive runoff from the Project Area as they flow west from the upper limits of the catchment, with the primary river channel crossing under the Hopetoun-Ravensthorpe Road, approximately 200 m south of the Project Area.

The divide between the Steere River sub-catchments and Jerdacuttup River Catchment to the east varies in elevation from 232 m Australian Height Datum (AHD) at the divide to 80 m AHD at the river. The primary channel of the Steere River falls from 145 m to 117 m AHD over a 2.75 km north-to-south stretch adjacent to the western extent of the site. The Steere River tributaries are interspersed with comparatively flat damp lands, displaying poorly defined drainage.

Projected flood inundation levels within the Project Area have been mapped with pre-mine flood depth modelling, which can be seen in Figure 7-4 and Appendix A. In the event of flood, inundation is concentrated to creeklines which trend laterally across the Project Area, as well as the eastern Project Area, where small pockets of inundation >2.67 m may occur.

7.4.2 Surface water quality

Baseline surface water sampling has been undertaken at two sites along the Steere River, one site at the crossing of the Steere River and Jones River, nine sites along the Jerdacuttup River, and at various surface water dam infrastructures within the Project Area. Surface water quality data of each location is provided in the section below. Surface water sampling locations have been indicated in Figure 7-5.

Steere River

Two surface water monitoring sites (STE01E and STE01W) were established by the Department of Water (now DWER) along the Steere River between 2005 and 2007, with four samples collected from each location. Water quality analysis determined the Steere River to be brackish in nature, increasing in salinity toward the lower catchment areas. Site STE01E is located downstream of the historical Elverdton tailings stockpile, with samples indicating significant enrichment in Copper (Cu) and elevations in calcium (Ca), magnesium (Mg), sulphate (SO_4), electrical conductivity (EC) and turbidity in comparison to site STE01W (Table 7-2). The results suggest that the Elverdton tailings have potentially impacted surface water quality to some degree in western tributaries of the Steere River, including a section that passes through the western Project Area.

Water quality analysed at the crossing of the Steere and Jones Rivers displayed slightly alkaline pH values, with salinity values approximately one third the salinity levels of seawater.

Table 7-2: Steere River (STE01E, STE01W) – water quality samples (2005-2007)

Source: Department of Water and Environmental Regulation.

Analyte	Units	Measured range		Recreational level trigger values ANZECC and ARMCANZ (2000)
		STE01E	STE01W	
As	mg/L	0.001 – 0.005	0.001 – 0.005	0.05
Ba	mg/L	0.004 -0.022	0.002 – 0.01	1
Ca	mg/L	85	17 - 18	
Cd	mg/L	0.0001 -0.002	0.001-0.002	0.005
Co	mg/L	0.002 - 0.42	0.008 – 0.16	
Fe	mg/L	0.65 -2.5	1.1 – 8.5	0.3
Mg	mg/L	36 - 240	28 - 45	
Pb	mg/L	0.001 – 0.01	0.001 – 0.01	0.05
SO_4	mg/L	30 - 570	51 - 100	400
Zn	mg/L	0.004 – 0.11	0.005 – 0.04	5
Cu	mg/L	0.81	0.051	1
EC	mS/cm	1.6 – 8.8	1.5 – 3.6	
pH		6.5 – 11.5	7.1 – 11.3	
DO	mg/L	4.6 - 9	6.1 – 9.4	
Turbidity	NTU	30 - 300	40 - 150	

Table 7-3: Steere River (Jones River Crossing) – water quality samples (2010)

Source: Department of Water and Environmental Regulation Water Information Reporting database.

Analyte	Units	Measured range
NH_3NH_4	mg/L	0.03-0.23
NO_2	mg/L	<0.01-0.024
N (kjel)	mg/L	0.37-1.6
N (total)	mg/L	0.39-2.3
P (total)	mg/L	0.01-0.047
TSS	mg/L	4-15
EC	mS/cm	19.2-21.9
pH	-	7.6-7.8

Jerdacuttup River

Water samples collected from the Jerdacuttup River from 2001 to 2002 indicated highly variable salinity values, with EC at one location increasing from 20 to 117.3 mS/cm within a one year period. The Jerdacuttup River is naturally saline due to transport of soil-stored salts of marine origin (Department of Environment, 2004).

Table 7-4: Jerdacuttup River – water quality samples (2001-2002)

Source: Department of Environment (2004)

Analyte	Units	Measured range
N	mg/L	0.72 – 9.3
P	mg/L	0.02 – 0.24
DO	mg/L	2.7 – 11.2
EC	mS/cm	7.82 – 117.3
pH		7.4 - 9.45
Turbidity	NTU	10-60

Surface water dams

A number of surface water collection dams located within the Project Area were analysed in January, May, August, and December of 2018. Surface water quality values were similar to or below the values of the DER (2014) fresh water assessment levels for most analytes, however, exceedances in Cu and Iron (Fe) were noted.

Table 7-5: RGP Project Area – dam water quality samples (2018)

Analyte	Units	Measured range	DER (2014) fresh water assessment level
EC	mS/cm	1.26 – 9.5	-
pH		6.8 – 7.7	6.5-8.5
Total N	mg/L	1.11 – 3.68	1 (long term) 2 (Short term)
Hg	mg/L	0.00005 – 0.00056	0.00006
Al	mg/L	0.1 - 0.54	0.055
Cu	mg/L	0.03 – 0.533	0.0014
Mn	mg/L	0.03 – 1.904	1.9
Ni	mg/L	0.003 – 0.024	0.011
Zn	mg/L	0.01 – 0.048	0.008
Bo	mg/L	0.2 – 0.48	0.37
Fe	mg/L	0.263 - 6.631	0.3
Pb	mg/L	0.001 – 1.4	0.0034
Cd	mg/L	0.0001 -0.0003	0.0002
As	mg/L	0.001 – 0.027	0.013

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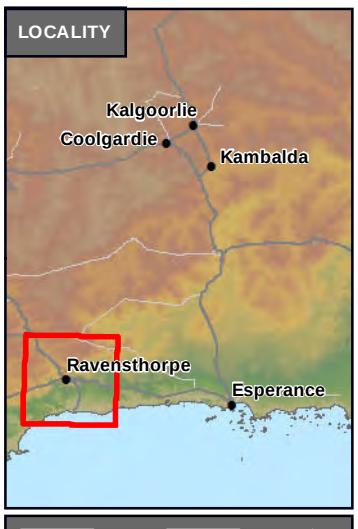
Lake King
Lake Pallarup
Stokes Inlet: Lort/Young Catchment
Young River
Oldfield River
Moolyall Creek
Coujinup Creek
Camm River
Culham Inlet / Phillips / West / Steere Catchment
Phillips River
Jerdacuttup River
Oldfield River Catchment
Ravensthorpe
Elverdton Tailings
Jerdacuttup River Catchment
Steere River
West River
Hamersley River Catchment
Hammersley River
Yallobup Creek Catchment
Culham Inlet
Jerdacuttup Lakes
Hopetoun
Hamersley Inlet
Copper Mine Creek
Dempster Inlet

200000 220000 240000 260000
6320000 6300000 6280000 6260000 6240000

Data source: Imagery: Landgate, 2016. Hydrology: DoW, 2018.

Ravensthorpe Gold Project Area
Major Drainage Line
Regional Catchment

LOCALITY



CATCHMENTS
Ravensthorpe Gold Project
Mine Closure Plan
ACH Minerals Pty Ltd

N
0 5 10 15 20 Km

Coordinate System: GDA 1994 MGA Zone 51
Projection: Transverse Mercator, Datum: GDA 1994
Scale @ A3: 1:350,000

Prepared:	F Walker
Reviewed:	G Barrett
Project No:	TE19017
Revision:	A
Date:	24/07/2019

Figure 7-3

ACHMINERALS

Document Path: \\server\talis\SECTIONS\Environment\Projects\TE2019\TE19017 - Ravensthorpe Gold Project\GIS\Maps\MCP\TE19017_7-2_Catchments_RevA.mxd

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239000 240000 241000 242000

6272000 6271000 6270000 6269000 6268000

C01 C02 C03 C04 C05 C06 C07 C08 C09 C09a C10 C11

Data source: Imagery: Landgate, 2016. Flood Modelling: Soilwater Consultants, October 2018.

Ravensthorpe Gold Project
RGP Development Envelope
Stream Paths
Regional Catchment Boundary
Catchments

Flood Depth (m)

- No Flooding
- < 0.67m
- 0.67 - 1.33m
- 1.33 - 2.00m
- 2.00 - 2.67m
- > 2.67m

LOCALITY

0 90 180 270 360 km

PRE-MINE FLOOD MODELLING

Ravensthorpe Gold Project
MCP
ACH Minerals Pty Ltd

N

0 200 400 600 800 metres

Coordinate System: GDA 1994 MGA Zone 51
Projection: Transverse Mercator, Datum: GDA 1994
Scale @ A3: 1:15,000

Prepared:	F Walker
Reviewed:	G Barrett
Checked:	A Mack
Project No:	TE19017
Revision:	A
Date:	26/07/2019

Figure 7-4

ACHMINERALS

Document Path: \\server\talis\SECTIONS\Environment\Projects\TE2019\TE19017 - Ravensthorpe Gold Project\GIS\Maps\ERD\TE19017_4-29_PreMineFloodDepth_RevA.mxd

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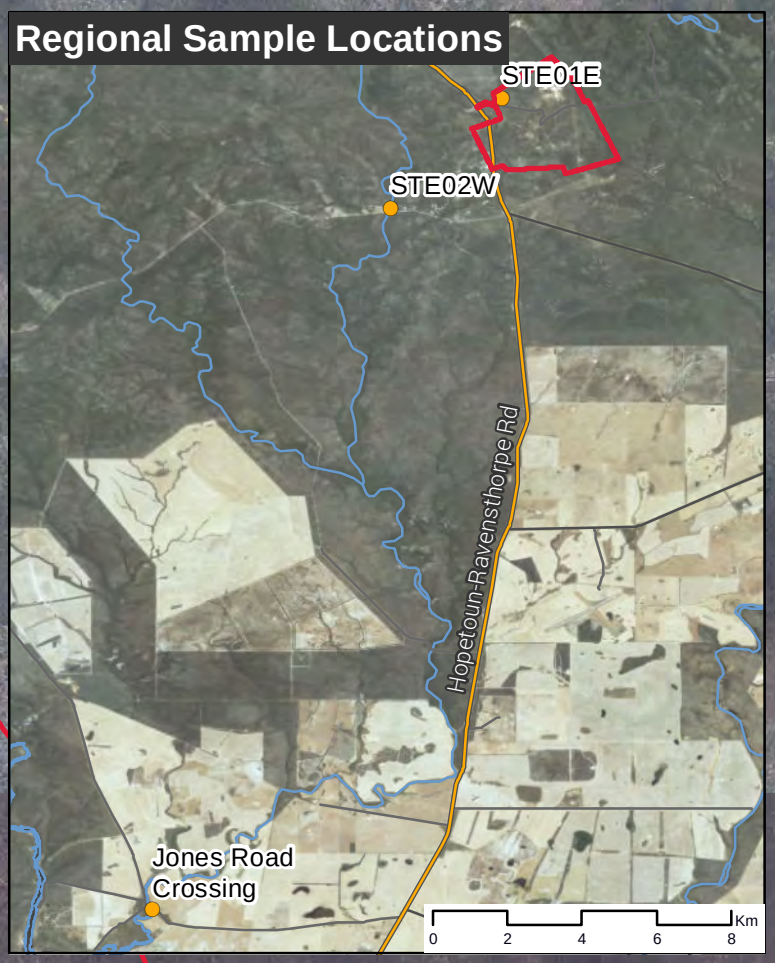
Regional Sample Locations



239000 240000 241000 242000

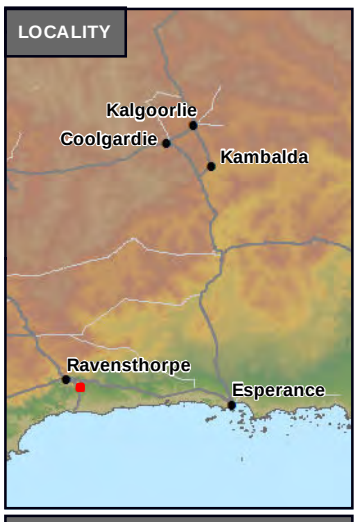
6272000 6271000 6270000 6269000

Kundip Tailings Dam
Kaolin Dam
Heritage Railway Dam
STE01E
Bore-H
KMB5
KMB2
KMB4
KMB1
Harbour View Dam
KMB6
Flag Dam 1
Flag Dam 2
KMB3
KMB7

Data source: Imagery: Landgate, 2016.

Ravensthorpe Gold Project Area
Groundwater Monitoring Location
Surface Water Monitoring Location
Rivers

LOCALITY



WATER QUALITY - MONITORING LOCATIONS FOR BASELINE DATA

Ravensthorpe Gold Project
MCP
ACH Minerals Pty Ltd

N
0 150 300 450 600 metres
Coordinate System: GDA 1994 MGA Zone 51
Projection: Transverse Mercator, Datum: GDA 1994
Scale @ A3: 1:13,000

Prepared:	F Walker
Reviewed:	G Barrett
Checked:	A Mack
Project No:	TE19017
Revision:	A
Date:	26/07/2019

Figure7-5

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7.5 Hydrogeology

7.5.1 Aquifers

Fractured rock aquifers are common within the region, often displaying low permeability and low to moderate groundwater resources. Drainage lines typically follow fractures in the underlying bedrock. Previous groundwater inflows to the old workings on site have been estimated to be up to 500 cubic metres (m^3) per day. There are no groundwater users or groundwater-dependent ecosystems within the Project Area.

Rockwater (2011) found that underlying rock at the Project is generally of low permeability, even within the Harbour View mineralised zone. A very small proportion of the rainfall, approximately 0.1%, is estimated to infiltrate the rock mass, recharging groundwater that eventually discharges to low-lying areas in the south towards Kuliba Creek. Groundwater occurs in localised fractures and the hydraulic gradient at the Project Area trends downwards to the south-south-east. The water table has been found to be irregular and does not closely reflect the topography.

Ten bores are installed across the Project Area, with all but one (Bore D) remaining fully functional with water depth readings recorded consistently from April 2004 to December 2015. Recent sampling was undertaken by Rockwater (Appendix B), conducting test pumping of old workings at the Beryl and Flag shafts. Attempts were made to test Hillsborough and Harbour View, however those shafts were blocked and unsuitable for testing. Results from Beryl indicated aquifer transmissivity rates of 10 meters squared per day (m^2/d) and hydraulic conductivity of 0.1 meters per day (m/d). Transmissivity rates at Flag were recorded at 4 m^2/d with a hydraulic conductivity rate of 0.04 m/d (Rockwater, 2018).

7.5.2 Groundwater quality

Groundwater monitoring was undertaken at a number of locations in January, May, August and December 2018, with samples collected from eight locations (KMB1 – KMB7 and Bore H). A number of analytes exceeded the DER (2014) non-potable groundwater use assessment levels, which are summarised in Table 7-6 below. Sample analysis suggested that groundwater within the Project Area is generally saline and enriched in major cations such as Ca, MG, Sodium (Na), and Potassium (K), with the exception of monitoring bore KMB3. Analysis of samples from KMB3 returned EC values between 0.6 and 0.7 mS/cm and TDS values between 300 and 600 mg/L, indicating the presence of localised fresh water. Cation enrichment was not evident within these samples.

Table 7-6: RGP Project Area - Groundwater quality results

Analyte	Units	Measured range	DER (2014) non-potable groundwater use assessment level
EC	mS/cm	16.33 – 69.7	-
pH		6.18 – 7.37	-
SO4	mg/L	1280 - 3600	1000
Cl	mg/L	4857 - 19800	250
Ammonia as N	mg/L	0.02 – 1.24	0.5
Al	mg/L	0.01 – 0.25	0.2
Fe	mg/L	0.001 – 1.647	0.3

7.6 Flora and vegetation

The Project Area has undergone a considerable amount of flora and vegetation surveying within the past two decades, with baseline assessments carried out by Craig in 2004 and 2005 within the Kundip area, followed by quadrat monitoring by Hickman in 2007. Modern vegetation mapping was conducted across the Project Area by Craig in 2008 as part of an extensive survey of the Ravensthorpe Range and Kundip area, and has been used as the basis for Section 7.6.3 (Craig et. al., 2008). As part of the current proposal, ACH commissioned further survey work within the Project Area which was undertaken by Animal Plant Mineral Pty Ltd (APM) in 2018 (Appendix C).

7.6.1 Flora

Field surveys and database searches have identified a total of 312 flora species within the Project Area, comprising 50 families, with the most dominant being Myrtaceae, Fabaceae, Proteaceae, Cyperaceae and Ericaceae.

Database searches have identified five Threatened (T) flora species listed under the BC Act within the locality of the Project, including *Acacia rhamphophylla* (CR), *Acrotriche orbicularis* (VU), *Conostylis lepidospermoides* (VU), *Daviesia megacalyx* (EN), and *Eucalyptus purpurata* (VU). None of these species are known to occur within the Project Area; however, *A. rhamphophylla* is known to occur within the Kundip area and is also listed as an Endangered (EN) species under the EPBC Act (Markey et. al., 2009).

Database searches have also identified a number of Priority-listed species within the locality of the Project, including nineteen Priority 1 (P1), eight Priority 2 (P2), thirteen Priority 3 (P3), and nineteen Priority 4 (P4) species. Fifteen of these were identified during database searches as having been previously recorded within the Project Area (Table 7-7), of which five were identified during recent surveys by APM (Table 7-7). An additional two species were also recorded which were not picked up by the database search. The locations of Priority species identified are shown in Figure 7-6.

Table 7-7: Priority flora species known to occur within the Project Area

Species	Priority listing	Database listing	Field survey
Acacia sp. Ravensthorpe Range (B.R. Maslin 5463)	1	✓	
Calothamnus roseus	1	✓	✓
Lepidosperma sp. Elverdton (R. Jasper et al. LCH 16844)	1	✓	
Lepidosperma sp. *Maydon* (S. Kern, R. Jasper, H. Hughes LCH 17844)	1		✓
Lepidosperma sp. Mt Short (S. Kern et al. LCH 17510)	1	✓	
Melaleuca sophisma	1	✓	✓
Hydrocotyle tuberculata	2	✓	✓
Thomasia sp. Hopetoun (K.R. Newbey 4896)	2	✓	
Dampiera sp. Ravensthorpe (G.F. Craig 8277)	3	✓	
Grevillea fulgens	3	✓	
Pultenaea craigiana	3	✓	✓
Acacia argutifolia	4	✓	
Eucalyptus desmondensis	4	✓	
Eucalyptus stoatei	4	✓	
Marianthus mollis	4	✓	✓
Pultenaea calycina subsp. *proxena*	4	✓	
Stachystemon vinosus	4		✓
Thysanotus parviflorus	4		✓

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239000 240000

Data source: Tenements - DMIRS, 2019. Imagery: Landgate, 2016. Flora - APM, 2016 and 2017 and DBCA, 2019.

- Calothamnus roseus (P1)
- Hibbertia hamata (P3)
- Hydrocotyle sp. Decipiens (G.J. Keighery 463) (P2)
- Marianthus mollis (P4)
- Melaleuca sophisma (P1)
- Pultenaea craigiana (P3)
- Stachystemon vinosus (P4)
- Thysanotus parviflorus (P4)
- Marianthus mollis population polygon
- Calothamnus roseus population polygon

DBCA Records of Priority Flora

P1

- Acacia sp. Ravensthorpe Range (B.R. Maslin 5463)
- Calothamnus roseus
- Lepidosperma sp. Elverdton (R. Jasper et al. LCH 16844)
- Lepidosperma sp. Mt Short (S. Kern et al. LCH 17510)
- Melaleuca sophisma

P2

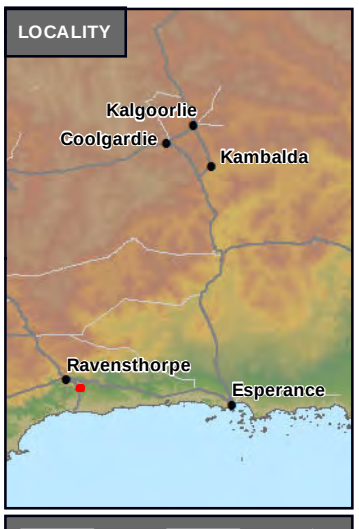
- Hydrocotyle tuberculata
- Thomasia sp. Hopetoun (K.R. Newbey 4896)

P3

- Dampiera sp. Ravensthorpe (G.F. Craig 8277)
- Grevillea fulgens
- Pultenaea craigiana

P4

- Acacia argutifolia
- Eucalyptus desmondensis
- Eucalyptus stoatei
- Marianthus mollis
- Pultenaea calycina subsp. proxena
- Thysanotus parviflorus



CONSERVATION SIGNIFICANT FLORA

Ravensthorpe Gold Project
Mine Closure Plan
ACH Minerals Pty Ltd

N

0 150 300 450 600 m

Coordinate System: GDA 1994 MGA Zone 51
Projection: Transverse Mercator, Datum: GDA 1994
Scale @ A3: 1:13,000

Prepared:	F Walker
Reviewed:	G Barrett
Project No:	TE19017
Revision:	A
Date:	24/07/2019

Figure 7-6

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7.6.2 Vegetation condition

Vegetation across the Project Area is for the most part, in Very Good to Excellent condition, with approximately 542.1 ha intact, with some areas of Pristine/almost pristine vegetation. A small portion of vegetation represents Good to Degraded condition, displaying areas of recent exploration disturbance. A 71.7 ha portion of the Project Area represents Completely Degraded vegetation, comprising access roads and historical mining disturbance (APM, 2017).

7.6.3 Vegetation communities

Pre-European vegetation mapping undertaken by Beard et. al. (2013) classified the Project Area into two natural vegetation complexes thought to have existed prior to European settlement; Mallee shrubland comprising *Eucalyptus eremophila*, *E. redunca*, and various E. spp. in the western and southern portions, and mallee heathland comprising mixed heath and scattered Eucalypts such as *E.pleurocarpa* (Beard et. al., 2013).

Modern vegetation mapping by Craig et. al. (2004; 2008) mapped 25 vegetation communities within the Project Area, which are listed below in Table 7-8. Figure 7-7 shows the extent of the vegetation communities within the Project Area.

The following two Priority Ecological Communities (PECs) have been identified as occurring within the Project Area:

- Very open Mallee over *Melaleuca sophisma* dense heath (PEC -P1); and
- Proteaceae dominated Kwongkan shrublands of the Southeast Coastal Floristic Province of WA (PEC - P3).

Table 7-8: Vegetation communities within the Project Area (Craig et. al. 2008)

Community Code	Community name	Total ha the Project Area
Dcir	*Banksia cirsioides*: Proteaceous Mallee-heaths	1.8
East	*Eucalyptus astringens*: Mallet dominated system	21.3
Ecli	*Eucalyptus clivicola*: Mallet dominated system	11.9
Efal	*Eucalyptus falcata*: Proteaceous Mallee-heath	1.8
Efal/ Eple	*Eucalyptus falcata/ E. pleurocarpa*: Proteaceous Mallee-heath	151.5
Eflo/ Espp	*Eucalyptus flocktoniae/Eucalyptus* species	57.2
Eflo/ Esug	*Eucalyptus flocktoniae/ Eucalyptus phenax*	5.1
Eflo/ Mbra	*Eucalyptus flocktoniae/ Melaleuca bracteosa: Melaleuca* dominated	13.6
Eflo/ Mcuc	*Eucalyptus flocktoniae/ Melaleuca cucullata: Melaleuca* dominated	25.9
Eflo/ Mgor	*Eucalyptus flocktoniae/ Melaleuca* sp. Gorse (ASG 7224): *Melaleuca* dominated	15.4
Elep/ Mrig	*Eucalyptus leptocalyx/ Melaleuca rigidifolia*	9.7
Eocc	*Eucalyptus occidentalis*	48.6
Eole/ Mpau	*Eucalyptus oleosa* subsp. *corvina/ Melaleuca pauperiflora*	1.6
Epil	*Eucalyptus pileata*	0.3
Epla	*Eucalyptus platypus*	3.6
Epla/ Mcuc	*Eucalyptus platypus/ Melaleuca cucullata*	0.0
Epla/ Mhap	*Eucalyptus platypus/ Melaleuca haplantha*	4.8
Eple/ Bmed	*Eucalyptus pleurocarpa/ Banksia media*	32.1
Epro/ Mspp	*Eucalyptus proxima/ Melaleuca* species	13.7
Espo	*Eucalyptus sporadica*	9.3
Macu	*Melaleuca acuminata*	0.7
Mallee/ Mspp	*Eucalyptus species/ Melaleuca species*	55.4
Mosaic_Ecer_and_Ecli	*Eucalyptus cernua/ Eucalyptus clivicola*	44.0
Mstr	*Melaleuca stramentosa*	62.5
Mx	*Melaleuca* sp. Kundip	11.0
	Disturbed	14.2
	Total	**617.2**

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Efal/Eple
Mstr
Macu
Epro/Mspp
Ecli
Efal
Eple/Bmed
Espo
Epla/Mcuc
Dcir
Mallee/Mspp
Eocc
Epla/Mhap
Mine_site/Cleared
Eflo/Mgor
Eflo/Espp
Eflo/Esug
Eflo/Mcuc
Mx
East
Mosaic_Ecer_and_Ecli
Elep/Mrig
Eole/Mpau
Epil
Epla
Epla/Mcuc
Epla/Mhap
Completely Degraded

Data source: Imagery: Landgate, 2016. Vegetation Communities - Craig et al, 2008.

LOCALITY

Kalgoorlie
Coolgardie
Kambalda
Ravensthorpe
Esperance

0 90 180 270 360 km

VEGETATION COMMUNITIES OF THE RGP AREA, CRAIG ET AL. (2008)

Ravensthorpe Gold Project
Mine Closure Plan
ACH Minerals Pty Ltd

N

0 200 400 600 800 m

Coordinate System: GDA 1994 MGA Zone 51
Projection: Transverse Mercator, Datum: GDA 1994
Scale @ A3: 1:13,000

Prepared:	F Walker
Reviewed:	G Barrett
Project No:	TE19017
Revision:	A
Date:	24/07/2019

Figure 7-7

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7.6.4 Weeds

Seventeen weed species have been recorded during previous field surveys of the Project Area. Seven of these were recorded during a recent field survey of the Project Area by APM (2016), including *Arctotheca calendula*, *Asparagus asparagoides*, *Hypochaeris glabra*, *Oxalis pes-caprae*, *Cotula coronopifolia*, *Trifolium* spp., and *Carpobrotus aequilaterus*. *A.asparagoides* (Bridal Creeper) is classified as a Weed of National Significance (WONS), and was observed within isolated areas of high disturbance, forming zonal weed patches. The species is also associated with annual weed species.

Two additional WONS were identified by APM as having the potential to occur within the Project Area, including *Lycium ferocissimum* and *Tamarix aphylla* (APM, 2016).

7.6.5 Dieback

A preliminary dieback assessment was undertaken across the Project Area by an assessor accredited by the DWER in the detection, diagnosis and mapping of dieback disease (Glevan, 2006). No infestation of *Phytophthora cinnamomi* (*P.cinnamoni*) was detected during this survey. Approximately 62% of the survey area was uninterpretable due to the low abundance of disease indicator species. Areas which were mappable were classified as 'dieback free', 'uninterpretable – conducive' and 'uninterpretable – not conducive'. Areas which are uninterpretable, but have conditions favourable to the uptake of dieback were classified as 'uninterpretable – conducive', while areas uninterpretable found to be unfavourable to the update of dieback were classified as 'uninterpretable – not conducive'. Cleared areas were delineated by Glevan (2006) as un-mappable.

In 2010, NRG Consulting undertook additional dieback mapping and sampling within the Project Area to differentiate areas previously mapped by Glevan (2006) as 'dieback free'. No infestations of dieback were recorded. In 2012 Terratree conducted further assessments and recorded two positive sample results of Phytophthora along the entrance road to the mine. Terratree also reported that Glevan (2006) also recorded one positive sample of *Phytophthora* on the same entrance road.

7.7 Fauna

Comprehensive baseline biological assessments of the PRP Project Area were originally undertaken by Biota Environmental Sciences Pty Ltd (Biota) during May and November 2004 (Biota, 2004; 2005). These surveys targeted both terrestrial vertebrate fauna and Short Range Endemic (SRE) invertebrate species and utilised methods consistent with current practices.

The current RGP Project Area was surveyed on three separate occasions by Animal Plant Mineral Pty Ltd (APM) in 2016 and 2017, in addition to a desktop database search. The consolidated APM report is provided as Appendix C. These surveys also included targeted searches for conservation significant fauna species.

A DBCA database search was undertaken in March 2019, with the findings of this search incorporated within Sections 7.7.3 and 7.7.4.

7.7.1 Regional value

The Project Area is situated in the foothills of the Ravensthorpe Range approximately 0.4 – 1 km north of the Kundip Nature Reserve (Reserve No. 31128). Large tracts of uncleared remnant bush surround the Project Area and sections of this bushland are targeted for incorporation into the proposed Ravensthorpe Range Nature Reserve.

The Project Area occurs on the periphery of the Fitzgerald Biosphere, which is one of 15 biodiversity hotspots. The most valuable ecological attributes within this biosphere are protected within the Fitzgerald River National Park (FRNP). Radiating out from the FRNP, the peripheral areas of the biosphere are 'zones of co-operation', where development can take place in an ecologically sustainable manner. The intent is that development within the biosphere zone of cooperation does not constrain or inhibit the radiation or movement of local fauna species, many of which have become threatened by fragmentation, land clearing, increased feral predation and competition from non- native species.

The Project is situated within the 'zone of co-operation'; there is no capacity for the Project Area to have impacts on local and regional fauna values beyond the direct impacts of clearing for construction and operation. The Project will not constrain or inhibit the radiation or movement of local fauna species as there are broad tracts of uncleared bushland north and south of the site, enabling movement west to east or east to west.

7.7.2 Fauna habitats

Three broad habitat types have been mapped over the Project Area based on vegetation mapping undertaken by Craig et. al. (2008). These habitat types are outlined in Table 7-9 and shown in Figure 7-8.

Table 7-9: Fauna habitats of the Project

Habitat	Description	Area (ha)	%
Damplands and Drainage Lines	Features a eucalypt overstorey over a diverse myrtaceous middle storey. Sedges, grasses and herbs are a common ground storey component.	49.1	11.5
Low Dense Forest/ Forest	Occurs on areas of sheet wash on low gradient slopes. Overstorey features mallees with *Melaleuca* and others shrubs. In areas of poor drainage the ground storey can comprise almost entirely of sedges such as *Gahnia aristata*.	33.0	7.7
Low Woodland Mallee and Heath	Features a broad variety of eucalypt species and occurs over all rises and hills. Also features a diverse proteaceous and myrtaceous shrub layer. The predominant fauna habitat within the Project Area.	280.8	65.5
Disturbed areas	Historical mining disturbance, access roads and other cleared or degraded areas.	65.5	15.3
	Total	**428.4**	**100.0**

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Spatial Extent of Habitat Mapping

Ravensthorpe

0 3 6 9 12 Km

239000 240000 24100

Data source: Imagery: Landgate, 2016. Habitat Mapping: Craig et al (2008).

Ravensgate Gold Project Area

RGP Development Envelope

Fauna Habitats

- Completely Degraded
- Damplands and Drainage Habitat
- Low Dense Forest / Forest Habitat
- Low Woodland Mallee and Heath Habitat

LOCALITY

Kalgoorlie
Coolgardie
Kambalda
Ravensthorpe
Esperance

0 90 180 270 360 km

FAUNA HABITATS

Ravensthorpe Gold Project
Mine Closure Plan
ACH Minerals Pty Ltd

N

0 200 400 600 800 m

Coordinate System: GDA 1994 MGA Zone 51
Projection: Transverse Mercator, Datum: GDA 1994
Scale @ A3: 1:15,000

Prepared:	F Walker
Reviewed:	G Barrett
Project No:	TE19017
Revision:	A
Date:	24/07/2019

Figure 7-8

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Damplands and Drainage

Few species were captured in this habitat type, which is possibly an artefact of the poor conditions during the survey, with a delayed onset of Spring and little warm weather during the survey. Surveys in drainage lines during the Biota surveys in January also would not have been particularly productive due to lack of water. Only the Motorbike Frog, Western Banjo Frog, Bobtail Lizard, Bush Rat and House Mouse were recorded.

This habitat has intrinsic value as a connective or corridor habitat to avoid fragmentation of other habitats within the Project Area.

Low Dense Forest/Forest

These landforms support a complex array of fauna. All of the four species of gecko collected during the surveys (*Underwoodisaurus milii* (Barking Gecko); *Crenodoctylus ocellatus* (Clawless Gecko); *Christinus marmoratus*; and *Diplodactylus granariensis* (Marbled Gecko) were collected in this habitat, as was a suite of fossorial skinks including *Hemiergis peronei* (Four-toed Earless Skink); *Hemiergis initialis initialis* and *Lerista distinguenda*.

Evidence of a diverse and abundant small fauna assemblage was ratified by the presence of larger predatory fauna species such as *Varanus rosenbergii* (Rosenberg's Monitor); and *Pseudonja affinis* (Dugite).

Dense and structurally diverse vegetation and floristics also provides abundant suitable habitat for smaller ground-dwelling *Sminthopsis griseoventer* (Grey-bellied Dunnart) and arboreal mammals *Tarsipes rostratus* (Honey Possum); and *Cercartetus concinnus* (Pygmy Possum).

Low Woodland Mallee and Heath

The majority of species recorded within the Project Area have been sighted within this fauna habitat. Previous records emphasise both a dominance of this vegetation type in the area and an associated sampling bias that is unavoidable in impact assessment. That is, this habitat was sampled more because it is better represented in the site and also present in more areas likely to be impacted.

This is not a short-coming of the survey design however, as more intensive sampling and a better understanding of this fauna habitat is essential when this is the fauna habitat most likely to be impacted by the development due to its representation across the entire site. Of the 440.94 ha of Low Woodland Mallee and Heath present within the Project Area, 19.59% (86.37 ha) will be disturbed by the Project Area, and 1.64% (7.25 ha) will be disturbed by the Corridor.

Within this habitat type, all four of the Pygopid (true legless lizards) were collected. Large skinks, *Teliqua rugosa* and *Egernia kingii* were located with the latter collected under building refuge near the historic heap leach facility.

This habitat was the most common habitat type from which the Bush Rat was collected. It is also the habitat within which *Lerista viduata* (Ravensthorpe Range Slider) was recorded by Biota (Biota, 2004). Chuditch were recorded on motion sensing cameras around the Kundip battery in the lower

south western section of the Project Area and Malleefowl observed foraging in the same location. In addition to the Dugite, the two small elapids, *Elapognathus coronatus* (Crown snake) and *Parasuta gouldii* (Gould's hooded snake), were collected under building material in this habitat. The mygalomorph spider *Aname mainae* was recorded in this habitat during the 2016 survey and 2004 Biota survey. Biota also recorded this species in the Low Dense Forest/Forest and Damplands and Drainage habitats.

7.7.3 Fauna assemblage

Combined database searches indicate that a total of 193 vertebrate fauna species are expected to occur within 10 km of the Project Area, comprising 127 birds, 26 mammals, seven amphibians and 33 reptiles. APM surveys recorded 101 vertebrate fauna species, including 54 birds, 12 mammals, six amphibians and 29 reptiles. This represents more than 50 % of the fauna species recorded in the broad database searches.

The most common species recorded during field surveys were:

- *Glossopsitta porphyrocephala* (Purple-crowned lorikeet) – 192 records;
- *Smicrornis brevirostris* (Weebill) – 71 records;
- *Phylidonyris novaehollandiae* New Holland honeyeater – 301 records;
- *Zosterops lateralis* (Silvereye) – 61 records;
- *Rattus fuscipes* (Bush rat) – 68 records
- *Tarsipes rostratus* (Honey possum) – 87 records; and
- *Cercartetus concinnus* (Pygmy possum) – 56 records.

7.7.4 Conservation significant fauna

A total of 38 Threatened vertebrate species occur or may occur within the Project Area, including twenty six birds, ten mammals, and two reptiles (Table 7-10). Ten of these species have previously been recorded within the Project Area.

Table 7-10: Threatened fauna potentially occurring within the Project Area

Species	Name	Cth[2]	WA[1]	Recorded?
Acanthophis antarcticus	Southern Death Adder	-	P3	No
Apus pacificus	Fork-tailed Swift	IA	IA	No
Ardea alba	White Egret	M	-	No
Ardea ibis	Cattle Egret	IA	-	No
Ardea modesta	Eastern Great Egret	IA	-	No
Botaurus poiciloptilus	Australasian Bittern	EN	EN	No
Calidris ferruginea	Curlew Sandpiper	M, MI	CR	No
Calidris ruficollis	Red-necked Stint	M, MI	MI	No
Calyptorhynchus latirostris	Carnaby's Cockatoo	EN	EN	Yes
Charadrius rubricollis	Hooded Plover	M	-	No
Cereopsis novaehollandiae grisea	Cape Barren Goose	VU, M	VU	No
Chrysococcyx lucidus	Shining Bronze Cuckoo	M	-	No
Coracina novaehollandiae	Black-faced Cuckoo-shrike	M	-	No
Dasyornis longirostris	Western Bristlebird	EN	EN	Yes[3]
Dasyurus geoffroii	Chuditch, Western Quoll	VU	VU	Yes
Falco peregrinus	Peregrine Falcon	-	OS	Yes
Grallina cyanoleuca	Magpie-lark	M	-	No
Hydromys chrysogaster	Water Rat/ Rakali	-	P4	No
Isoodon fusciventer	Quenda, Southern Brown Bandicoot	-	P4	No
Leipoa ocellata	Malleefowl	VU	VU	Yes
Lerista viduata	Ravensthorpe Range Slider	-	P1	Yes
Merops ornatus	Rainbow Bee-eater	M	-	No
Motacilla cinerea	Grey Wagtail	IA	IA	No
Myrmecobius fasciatus	Numbat, Walpurti	EN	EN	No
Notamacropus eugenii derbianus	Tammar Wallaby	-	P4	Yes
Notamacropus irma	Western Brush Wallaby	-	P4	Yes
Oxyura australis	Blue-Billed Duck	-	P4	No

[2] CR – critically endangered; EN - endangered; IA – migratory birds protected under international agreement; M - marine; MI - migratory; P1-4 – On Priority list issued by DBCA; VU - vulnerable.

[3] On the Jerdacuttup Road, south of the Project Area.

Species	Name	Cth[2]	WA[1]	Recorded?
Pandion haliaetus	Osprey	IA	IA	No
Parantechinus apicalis	Dibbler	EN	EN	No
Pezoporus occidentalis	Night Parrot	EN	CR	No
Pezoporus flaviventris	Western Ground Parrot	CR	CR	No
Phascogale calura	Red-tailed Phascogale, Kenngoor	VU	CD	No
Pseudomys occidentalis	Western Mouse	-	P4	No
Pseudomys shortridgei	Heath Mouse, Dayang	EN	VU	Yes
Psophodes nigrogularis nigrogularis	Western Whipbird (Heath)	EN	EN	No
Psophodes nigrogularis oberon	Western Whipbird (Mallee)	VU	P4	Yes
Sterna caspia	Caspian Tern	M, MI	-	No
Tringa nebularia	Common Greenshank	MI	MI	No

7.7.5 Short Range Endemic (SRE) species

Short Range Endemic (SRE) species are defined as "terrestrial and freshwater invertebrates with naturally small distributions, of less than 10,000 km^2" (EPA, 2016). SREs often display low dispersal ability with high habitat specificity and low fecundity or recruitment success (Harvey, 2002).

Only one potential SRE has been identified within the Project Area – a land snail from the genus *Bothriembryon*. Land snails are among the group of invertebrates that are considered to be SRE candidates. A single specimen was collected by Biota in Low Dense Forest/Forest habitat outside of the Development Envelope. The specimen was not known to the WA Museum.

7.7.6 Introduced fauna

There are six introduced or feral fauna species of national environmental significance that are likely to occur in the Project Area; the Domestic Dog (*Canis lupus familiaris*), Cat (*Felis catus*), House Mouse (*Mus musculus*), Goat (*Capra hircus*), Rabbit (*Oryctolagus cuniculus*) and Red Fox (*Vulpes vulpes*). Feral predators are responsible for the population decline of many native animals and they may utilise newly cleared roads as dispersal corridors to new habitat.

7.8 Materials Characterisation

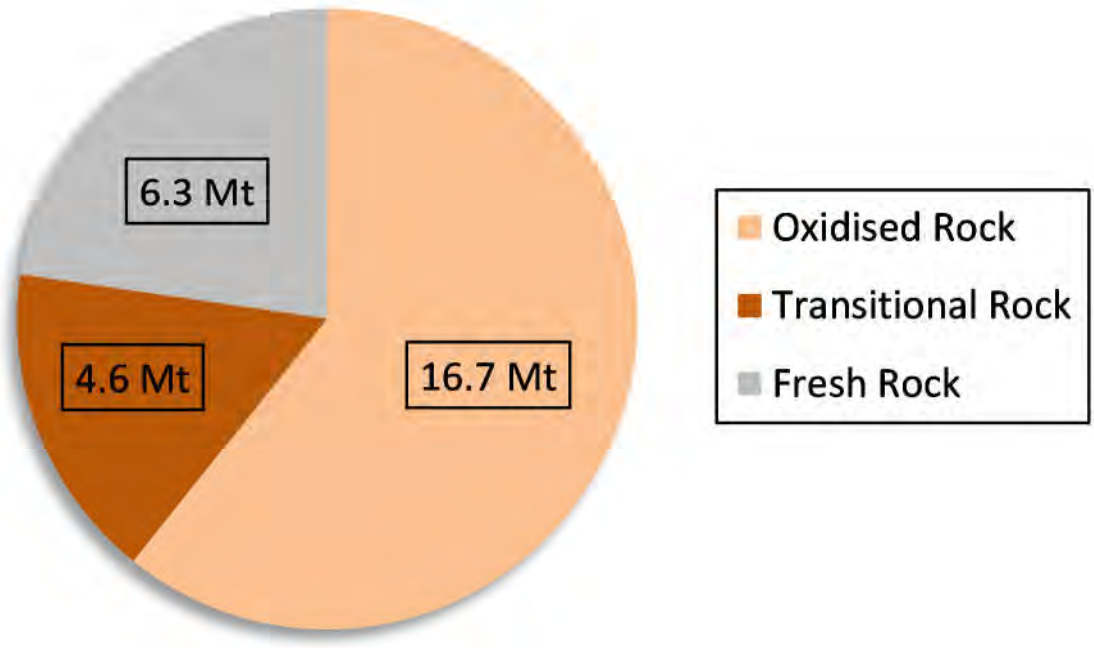
7.8.1 Waste rock

Waste rock at the RGP has been classified as:

- Oxide (fully oxidised);
- Transitional (substantially and partially oxidised); and
- Fresh (unoxidised).

The great majority of waste rock will be mined from the Kaolin pit (Figure 7-9). Most waste rock will be oxidised, originating from the overlying regolith. However, significant volumes of transitional and fresh waste rock will also be mined. A further volume of 1 Mt of primarily oxidised waste rock will be produced from other open pit operations and 0.6 Mt of fresh waste rock will be produced by the underground operations.

Figure 7-9: Waste rock – volume and type from the Kaolin open pit



Investigations have been undertaken by Graeme Campbell & Associates into the geochemical characteristics of waste rock at the RGP over a number of years, including work undertaken for the PRP, the previous mining proposal that was approved but did not proceed.

The assessments, presented in Appendix D, considered the potential for waste rock to oxidise and produce acid leachate with potential adverse environmental impacts. The assessments also considered the multi-element composition of waste rock with respect to environmentally-significant elements.

With regard to acid producing potential, the test results obtained are summarised in Table 7-11. Oxidised rock was NAF with no apparent potential to acidify. Transitional rock was predominantly NAF with some PAF_{LC} (rock that is potentially acid forming but has a low maximum acid production potential of 5-10 kg H_2SO_4/t). Fresh (unoxidised) rock contained some NAF material but was predominantly PAF or PAF_{LC}.

On the basis of these analyses, Graeme Campbell & Associates concluded that all waste rock could be classified in terms of its acid-forming potential by S content, as shown in Table 7-12.

Table 7-11: Ravensthorpe Gold Project – summary results of ABA and NAG investigations into waste rock

Waste rock type	No.	pH	EC $_{(1:2)}$ (mS/cm)	Sulphide-S (%)	ANC (kg H_2SO_4/t)	NAG-pH 7.0	AFP category
Oxide (completely oxidised)	6	4.6-6.9	1.47-2.98	<0.1	<1-1	0	NAF
Oxide (strongly oxidised)	5	6.8-7.5	0.61-4.08	<0.1	2-3	0	NAF
Transitional (partly oxidised)	4	6.3-7.9	0.15-1.35	<0.1-0.16	1-2	0-<0.5	NAF-PAF_{LC}
Fresh (not oxidised)	11	6.8-8.7	0.091-1.32	<0.1-0.82	1-37	0-6.0	NAF-PAF_{LC}-PAF

Terms: ABA – acid base analysis; ANC – Acid Neutralisation Capacity; AFP – Acid Formation Potential; EC – Electrical Conductivity; NAF – Not Acid Forming; NAG-pH7.0 – Net Acid Generation at a pH of 7; PAF – Potentially Acid Forming; PAF_{LC} – Potentially Acid Forming (low capacity); Sulphide –S – form of sulphur mineral with acidification potential.

Table 7-12: Acid-forming potential of waste rock based on S content

Acid-forming potential	S content
NAF	<0.1% S
PAF_{LC}	0.1-0.3% S
PAF	>0.3% S

Based on the material classification shown in Table 7-12, ACH used a numerical model utilising % sulphur values in drill assay data to assess the Kaolin pit (see Attachment II, Appendix D**)**. When adjusted to remove ore, the waste rock volumes were calculated to be:

- NAF (<0.1% S) – 74%;
- PAF_{LC} (0.1-0.3% S) – 8%;
- PAF (>0.3% S) – 17%.

The waste rock from the Kaolin pit accounts for over 94% of all waste rock produced by RGP. Based on drill record data and sulphur content, more than 50% of the waste rock from other pits and underground operations is NAF.

Aside from the potential acid-producing characteristics of waste rock, multi-element analyses for metals and metalloids were also undertaken (Appendix D). The results indicated 'enrichment' in some samples for Cu, As and Bi (see discussion in Table 7-13).

Table 7-13: Metal concentrations showing enrichment in waste rock compared to median soil content

Element	Comments
Arsenic (As)	As concentrations in waste rock ranged from <0.1-29.7 mg/kg. As is a naturally occurring element that occurs widely in the Earth's crust. As is often associated with gold ore bodies. Water extraction testing (Appendix D) from waste rock at RGP recorded very low solubility (all samples below level of detection at µg/L). Used in some industrial processes (e.g. as a wood preservative) or agriculture (e.g. pesticides) where it can be toxic.
Bismuth (Bi)	Bi concentrations in waste rock ranged from 0.1-0.74 mg/kg. Bi is believed to have a low toxicity relative to other metals, such as lead and arsenic, and there is very limited information available on toxicity in the environment. Water extraction testing (Appendix D) from waste rock at RGP recorded very low solubility (all samples below level of detection at µg/L). Bi has various industrial uses, usually as an alloy with lead, tin and other metals.
Copper (Cu)	Cu concentrations in waste rock ranged from 16-1,741 mg/kg. Cu readily adsorbs to minerals and organic matter. Most instances of Cu levels reaching toxic levels in the environment are related to wind and water erosion from substantial uncontained mine wastes and air emissions from smelting. No adverse response evident in vegetation surrounding the Elverdton tailings. Water extraction testing (Appendix D) from waste rock at RGP recorded low solubility (34 µg/L). Copper is widely used for electrical wiring and in construction.

Enrichment was not recorded for Hg. A separate assessment (Graeme Campbell & Associates 2018) was undertaken for the RGP which confirmed "Hg contents within the sub-mg/kg range, and often below the Hg abundance in soils, regoliths, and bedrocks removed from any mineralisation influences". ACH notes that the Trilogy deposit, about 10 km south of the proposed RGP operations, is associated with a mercury enrichment. Trilogy is in the Proterozoic Mount Barren Group, in which no mining has historically occurred. The RGP and other past operations in the Ravensthorpe area occur in the Ravensthorpe Greenstone Belt.

Finally, a further study by Outback Ecology (2011) considered physical and chemical properties of the regolith. The results indicated that regolith material could be susceptible to tunnel erosion, making it unsuitable for use on the outer surfaces of waste rock landforms. Physical properties of oxidised waste rock was also examined by Graeme Campbell & Associates (Appendix D) who also noted their erosive potential.

7.8.2 Tailings

Samples of oxide and fresh rock tailings were assessed by Graeme Campbell & Associates (Appendix E; Table 7-14). The tailings produced from oxide ore were NAF while tailings from fresh rock (unoxidised) ore were PAF.

Table 7-14: Ravensthorpe Gold Project – acid-base analysis investigations into geochemistry of tailings

Tailings type	Total S (%)	ANC (kg H_2SO_4/t)	NAG (pH 7.0) (kg H_2SO_4/t)	AFP category
Oxide ore	0.05	3	<0.5	NAF
Fresh rock ore	3.04	22	76	PAF
Terms: ANC – Acid Neutralisation Capacity; NAG – Net Acid Generation; AFP – Acid Formation Potential; NAF – Not Acid Forming; PAF – Potentially Acid Forming.				

Total tailings production for the Project is expected to be 3.0 Mt, of which approximately 1.0 Mt will comprise oxide ores (oxidised and transitional ore) and 2.0 Mt will comprise tailings produced from fresh (unoxidised) rock. Based on limited data, management options developed for tailings storage should assume some potential for acid formation in tailings derived from fresh rock.

Multi-element analyses for metals and metalloids in tailings were also undertaken and the results compared with a geochemical abundance index (GAI). Given the mineralised nature of ore, analyses of tailings recorded significant enrichment for the following wide range of elements:

- Silver (Ag);
- Arsenic (As);
- Bismuth (Bi);
- Copper (Cu);

- Lead (Pb);
- Molybdenum (Mo); and
- Selenium (Se).

Graeme Campbell & Associates also assessed weak acid dissociable cyanide (WAD-CN) levels within tailings. The results were in the sub-mg/L range, well below the industry guideline value of 50 mg/L.

7.9 Design and construction of landforms

7.9.1 Waste rock

Two landforms will be used for the permanent storage of waste rock - one north and one south of the Kaolin pit (Figure 2-2). The northern WRL will contain 7.7 Mm^3 of waste rock and the southern WRL will contain 8.5 Mm^3. Placement and design of the WRLs within the project area considered:

- Height relative to local natural features (20 m below highest local topographical feature);
- Proximity to open pits;
- Avoidance of 'line of lode' that could contain further mineralisation;
- Location of the 'zone of instability' (i.e. extent to which failure of pit walls could occur) around each pit; and
- Avoidance of the railway easement (now a walking trail).

Soilwater Consultants (2018) modelled various options for slope stabilisation after closure, taking into consideration the various characteristics of the materials discussed. Modelling over 500 years was used to determine the likely extent of erosion. Soilwater Consultants advised that "whilst modelling to longer timescales could be carried out, the nature of the inputs precludes this. As the inputs are based on adjustments calibrated to other erosion and landform evolution framework equations, the generalisations which are assumed in the parameter derivation become less acceptable as timescales grow. With this in mind a limit of 500 years has been set."

Development of the model included a review of past rainfall data on which likely future rainfall scenarios were based. This included an estimation of Potential Maximum Precipitation (PMP) which was randomly added to a single day within the 100 year rainfall data file.

The modelling considered each of the following capping and revegetation scenarios:

- Topsoil with a 30% vegetation cover;
- Topsoil with a 70% vegetation cover;
- Topsoil and fresh rock (50:50 mix) with a 30% vegetation cover; and
- Topsoil and fresh rock (50:50 mix) with a 70% vegetation cover.

In each case, erosion was significantly less when a topsoil and fresh rock mix was used and the vegetation cover achieved was greater. The fresh rock provides a matrix to contain the topsoil and a barrier to potentially less stable waste rock within the WRLs.

Based on this assessment and the waste rock characterisation discussed in the preceding section, a specification for construction, rehabilitation and closure of waste rock landforms has been developed, with the following to be undertaken:

- Vegetation to be progressively cleared;
- Topsoil and subsoil (if suitable for use in rehabilitation) will be recovered and stockpiled;
- NAF waste rock with a high clay content will be recovered from open pit excavations and stockpiled for later use;
- A low permeability (~ 10^{-6} m/s) barrier will be constructed from selected NAF waste rock near the downstream extent of the WRL;
- A basal blanket of selected NAF waste rock, 1 m in thickness will be progressively placed and machine compacted over the footprint of the WRL;
- The outer portion of the initial 10 m layer of waste rock will be constructed from NAF waste rock;
- Once the low permeability barrier, basal blanket and outer portion of the WRL have been established, co-mingled NAF, PAF_{LC} and PAF waste rock can be placed inside the WRL;
- Waste rock produced thereafter will follow a similar arrangement with each outer portion of NAF waste rock underlain by a compacted layer with high clay content.

This general arrangement is shown in a schematic in Figure 7-10.

The geochemical classification of waste rock is conservative. During operations, ACH will undertake kinetic testing of currently categorised at PAF_{LC} and PAF to further determine the extent to which acid formation can occur and the rate at which a reaction can be expected.

The WRLs will both occur on sloping ground. During construction of each WRL, surface water management measures will be used to prevent or reduce flow of water into waste rock placed within the WRL. This will be achieved by:

- Staged land clearing; and
- Drainage structures to direct any flows to the perimeter of the WRL and then to a sediment trap adjacent to the starting embankment.

Maximum heights of 58 m (northern WRL) and 46 m (southern WRL) are proposed.

The proposed design ensures PAF_{LC} and PAF waste rock is encapsulated within the overall WRL, ensuring that sulphide oxidation will be controlled by a lack of oxygen and water, preventing the potential for acidic drainage to be released from the WRL. ACH also notes that low levels of metal enrichment in NAF material also limits the potential for metalliferous (or neutral) drainage.

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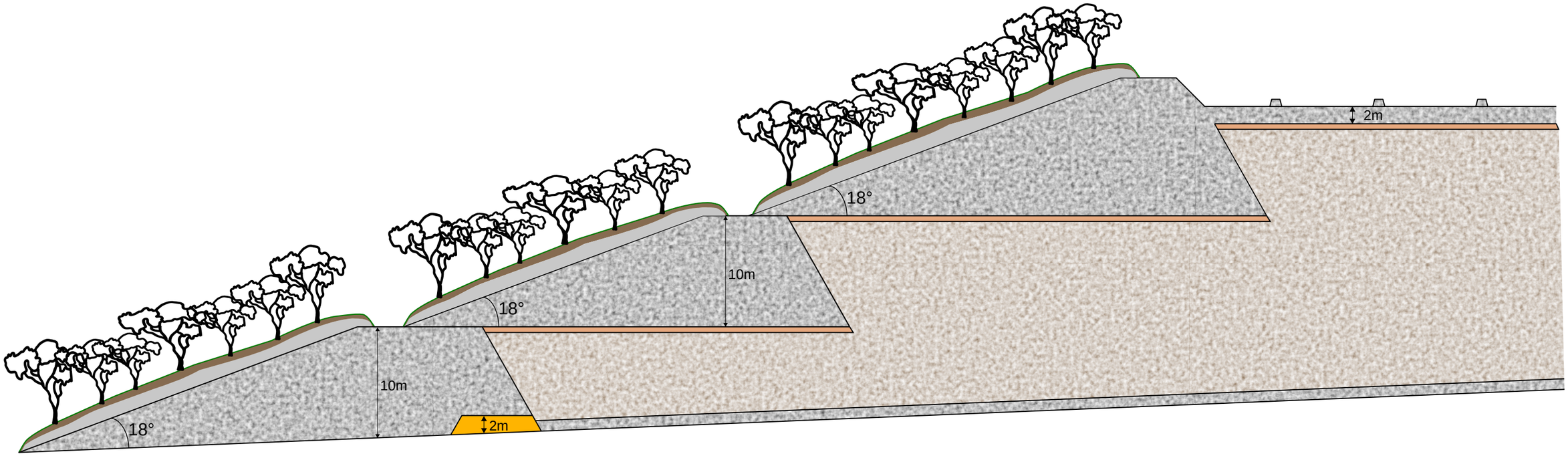
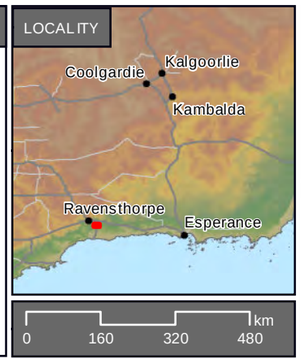


LEGEND

- Topsoil
- NAF Waste rock (Fresh, coarse, erosion-resistant)
- Low permeability barrier (10^{-6}m/s) constructed from selected NAF waste rock (clays and silts) and compacted
- NAF Waste rock
- Clay
- Co-mingled NAF, PAF_{LC} and PAF Waste rock



WASTE ROCK LANDFORM
Schematic Diagram of Structure At Closure
Ravensthorpe Gold Project ERD
ACH Minerals Pty Ltd

Date:	25/07/2019	Revision:	Rev B
Scale @ A3:	Not to Scale	Project No:	TE19017
Prepared:	F Walker		
Checked:	A Mack		Figure 7-10
Reviewed:	G Barrett		

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At closure, the following steps will be undertaken to develop landforms that are stable in the long term:

- Outer slopes angles will be reduced to 18^{o};
- Berms will be backsloping to hold water and reduce the likelihood of erosion on each batter;
- Each slope will be armoured with a 1 m layer of NAF fresh rock; and
- A layer of 0.1 m of topsoil will be added to decrease the potential for erosion.

The upper surface of each waste rock landform will be concave and capped with NAF waste with no PAF_{LC} or PAF waste to be stored within 2 m of the final surface. The edge of the upper surface will be bunded with a 1 m high NAF waste rock bund to retain storm water. Topsoil will be applied as per the slopes.

Figure 7-10 shows a visual representation of the slopes of WRLs at closure.

The data suggests waste rock can be safely and securely stored in the long term. However, a number of mitigation measures, including some further geochemical analysis, will be undertaken to reduce the risk factors associated with waste rock management and to ensure construction and closure of WRLs can proceed as planned.

If the project is approved under the EP Act, final design details will be presented when seeking subsidiary approvals under the Mining Act.

At this stage, backfilling of pit voids with waste rock or an integrated waste landform has not been considered. However, the ability to return at least some waste rock to a pit void would have a range of benefits and the material scheduling required to realise this will be examined in more detail if approval under Part IV of the EP Act is obtained and further approvals under the Mining Act are required.

7.9.2 Tailings

MHA Geotechnical (2018) was engaged by ACH to provide engineering design services as part of feasibility level design of the TSF. The preferred design is a side hill paddock-style facility, as shown in plan view in Figure 7-11. The location for the TSF was selected to minimise the upstream catchment while meeting other requirements (e.g. suitable ground conditions). An engineered embankment will provide containment on three sides (east, south and west) whilst the natural topography will provide containment on the northern side.

Design considerations for the TSF included:

- Limiting the upstream catchment reporting to the TSF (the proposed design has an upstream catchment of only 6.5 ha);
- Ability to store storm water from a 1 in 100 year 72 hour rainfall event (as per guidelines issued by ANCOLD (2012) and the DMP (2015a));
- Subsurface conditions;
- Seismic risk;

- Seepage minimisation; and
- Likely tailings volume.

The proposed TSF embankment configuration of 1:3 (~18^{o}) will help manage batter erosion. The shallow downstream batter will serve as both an operational and final closure slope, envisaged to be vegetated as part of the final closure plan. A shallow upstream batter has been adopted due to the length of time the batter will be exposed prior to being covered with tailings.

Tailings slurry (50% w/w) will be pumped from the process plant to the TSF in a HDPE pipeline. The pipeline will rest in a v-drain to contain any spillage and pumping of tailings will be telemetrically controlled. Tailings will be deposited from the main embankment in a sub-areal manner in thin lifts, beaching towards the northwest corner of the facility to form a decant pond away from the main embankment. As tailings settle and consolidate, supernatant water will be pumped back to the plant for re-use in ore processing.

The configuration and location of the decant pond provides capacity for the 1 % annual exceedance probability 72-hour storm event with freeboard.

When tailings deposition is complete and consolidation has occurred, the tailings surface will be covered with waste and topsoil to provide long term containment and erosion protection of the tailings, as well as providing a suitable medium for re-establishment and sustenance of vegetation.

The current design (MHA Geotechnical 2018) involves a cover varying from 0.5 m to 2.0 m in thickness (generally 1.0 m thick) depending on the location of the tailings surface and estimated surface water flow velocities. The tailings surface cover will make use of the tailings beach slope and grade away from the embankment towards the spillway.

Given that the final tailings surface will comprise PAF tailings, a modified approach using a minimum of 2 m of NAF waste rock as a final cover is now proposed. This will entail a review of the final surface water management measures to be implemented at closure and drainage off the facility to the north to the natural landform, with drainage subsequently directed to the east or west, appears the better option.

During operations, the TSF design includes provision for runoff from a 1 in 100 year Annual Exceedance Probability (AEP) 72 hour rainfall event while maintaining 500 mm total freeboard. Under this design, discharge from the TSF even under extreme storm conditions is considered unlikely.

Approval of the final TSF design and a final mine closure plan will be required from DMIRS under the Mining Act. Further refinement of the current design may occur as a result of the EIA process and, if the proposal is approved, further investigative work undertaken prior to and during operations. If the project is approved under the EP Act, the mine closure plan subsequently submitted for assessment under the Mining Act will include refinements arising from the current assessment process and a revised strategy for surface water management on the final TSF landform.

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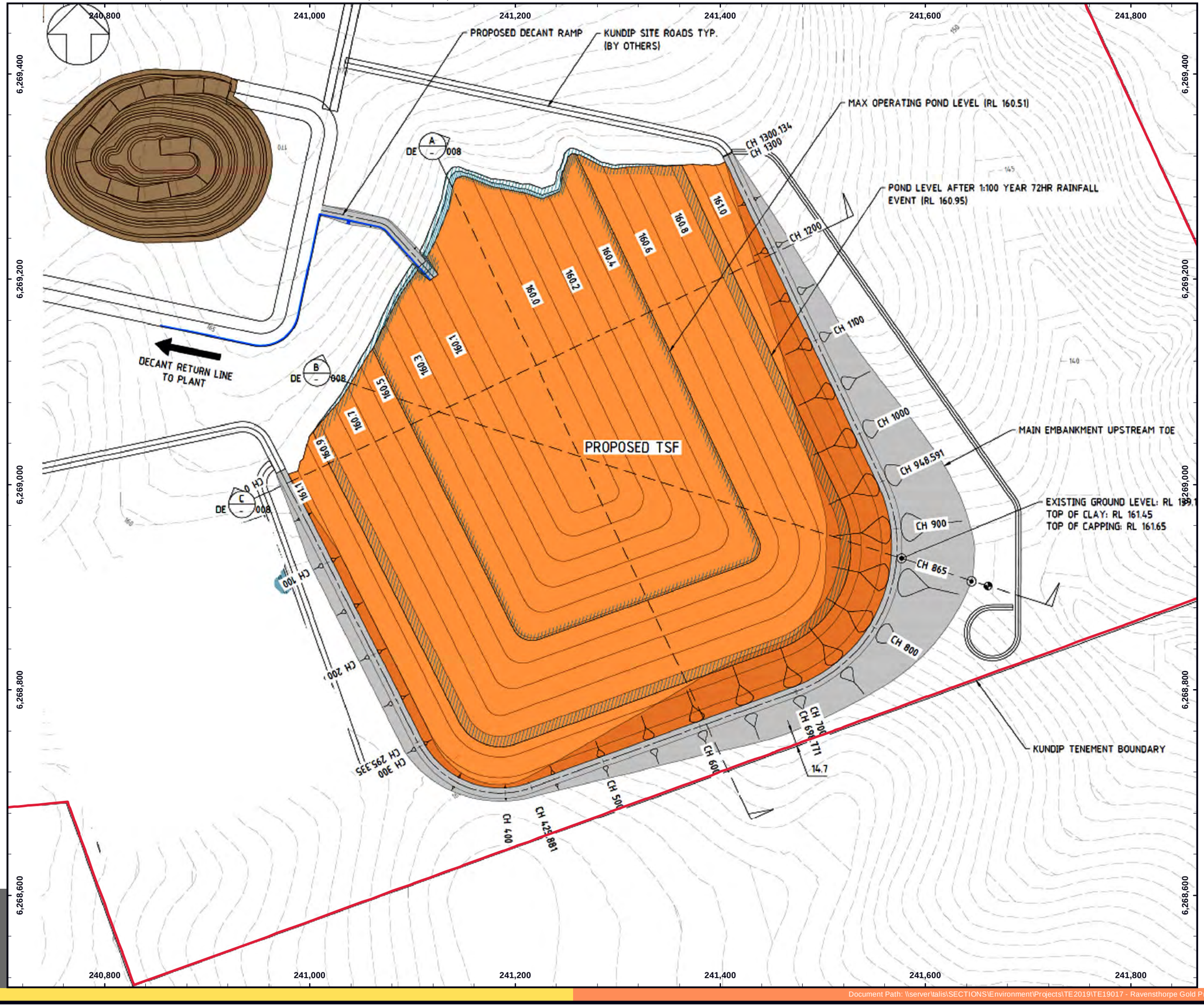
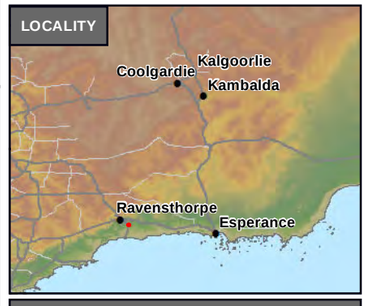


LEGEND

- Ravensthorpe Gold Project Area
- PROPOSED MAIN EMBANKMENT
- PROPOSED FINAL TAILINGS SURFACE
- POND EXTENTS
- 160.6 PROPOSED CONTOUR AND HEIGHT
- EXISTING CONTOUR AND HEIGHT
- PROPOSED VIBRATING WIRE PIEZOMETER
- PROPOSED MONITORING BORE

LOCALITY



0 75 150 300 450 600 km

TAILINGS STORAGE FACILITY GENERAL ARRANGEMENT (PLAN VIEW) (FROM MHA TECHNICAL)

Ravensthorpe Gold Project ERD
ACH Minerals Pty Ltd

N 0 50 100 150 m

Coordinate System: GDA 1994 MGA Zone 51
Projection: Transverse Mercator, Datum: GDA 1994
Scale @ A3: 1:3,500

Prepared:	F Walker	Date:	26/07/2019
Checked:	A Mack	Project No:	TE19017
Reviewed:	G Barrett	Revision:	A

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Figure 7-11

7.10 Social environment

7.10.1 Aboriginal heritage

The Project Area lies within the traditional lands of the Bibbulmun People (Southwest Nyungars) and the area around Ravensthorpe was traditionally the domain of the Wadjan tribe.

A search of the Department of Planning, Lands and Heritage (DPLH) Aboriginal Heritage Inquiry System (AHIS) noted that tenements fall within the South West Settlements Wagyl Kalp Southern Noongar People Indigenous Land Use Agreements.

The AHIS search did not identify any 'registered' Aboriginal sites or 'other heritage places' within the Project Area. ACH entered into a Noongar Standard Heritage Agreement in August 2016 over the entire Project Area.

The following Aboriginal Heritage Survey Reports were identified by the AHIS as encompassing tenements within the Project Area:

- Tamora Pty Ltd (2003) Ethnographic Survey report [22843]
    - Field and desktop assessment of relevant tenements L 74/34, L 74/35, L 74/45, M 74/41, M 74/51, M 74/53, M 74/176 and M 74/180.
    - The advisors cleared all listed tenements and survey areas for mining. A general camping area was identified at the old homestead; however, the advisor indicated that it could be disturbed.
- Brad Goode and Associates (2004) Archaeological and Ethnographic Survey report [21068]
    - Tenements L 74/45 and M 74/51 were included in this assessment; the survey focussed on the proposed haul road between the Project Area and originally proposed processing plant located at the RAV8 Mine Site on the South Coast Highway. Therefore, the outcomes of this assessment are not relevant to the new proposed Project, where processing will occur onsite within the Project Area.
- Brad Goode and Associates (2005) Archaeological and Ethnographic Survey report [23284]:
    - Tenements L 74/34 and M 74/53 were included in this assessment.

7.10.2 European heritage

A search of the Heritage Council's 'inHerit' database and the DEE's Australian Heritage Database identified five historic sites within the surrounding Project Area, none of which are state listed Heritage Places. Harbour View (Heritage Place No. 14027) is the only heritage listed site occurring within the Project Area. In 2005, this site was reconsidered as part of the Heritage Council's Assessment and Registration Program in 2005, with the Register Committee determining that it does not warrant entry in the Register of Heritage Places as it is not of State significance, however may be of local significance.

Four historic sites were identified within the Kundip townsite area and lie adjacent to the southwestern corner of the Project, on the opposite side of Hopetoun – Ravensthorpe Road:

- Kundip school site (Heritage Place No. 13983);
- Hopetoun Hall (Heritage Place No. 13999);
- Kundip townsite (Heritage Place No. 14023); and
- Kundip half-way houses (Heritage Place No. 14059).

Two sites listed under the Register of National Estate were identified by the Australian Heritage Database as occurring in the vicinity of the Project Area (DEE, 2018a):

- Jerdacuttup River Komatiites (Place ID 101329) (Register of the National Estate).
- Ravensthorpe Range Area (Place ID 9393) (Register of the National Estate).

The Jerdacuttup River Komatiites (also listed by InHerit as Heritage Place No. 18767) display exceptional exposures and sequences of ultramafic volcanic rocks (komatiites). The komatiites are located approximately 3 km northeast of the Project Area across an area of approximately 21 ha (Heritage Council, 2017).

8 Identification and Management of Closure Issues

8.1 Risk assessment approach

A risk assessment has been conducted to determine the level of risk associated with closure aspects for the Project. The risk matrix used to assess the likelihood and consequence of impacts associated with decommissioning and closure is provided in Table 8-1.

Table 8-1: Risk matrix for closure

		CONSEQUENCE				
		Insignificant	**Minor**	**Moderate**	**Major**	**Severe**
LIKELIHOOD	**Rare**	Low	Low	Low	Moderate	Moderate
	Unlikely	Low	Low	Moderate	Moderate	High
	Possible	Low	Moderate	Moderate	High	High
	Likely	Low	Moderate	High	Extreme	Extreme
	Almost Certain	Low	High	High	Extreme	Extreme

8.2 Closure risk assessment

Key environmental issues and workable management mechanisms relevant to mine closure have been identified throughout the course of the preparation of the following documents:

- Kundip Mining Centre Mine Closure Plan – Silver Lake Resources (2016); and
- Draft Environmental Review Document (July 2019).

The detail in the above documents outlines the mining process and identifies avenues for potential contamination of the receiving environment. Stakeholder consultation with the Ravensthorpe community and regulators has also provided input into identifying closure issues.

Closure issues currently identified as relevant to the Project include but are not limited to:

- Safety of open pit/underground mine voids (including historic shafts).
- Derelict infrastructure.
- Acid and metalliferous drainage.
- Contaminated sites.
- Dispersive and/or sodic materials.
- Impacts to native vegetation adjacent disturbance areas.
- Impacts on surface and ground water quality.
- Impacts on surface water hydrological processes.
- Impacts on groundwater hydrological processes.

- Hazardous materials (i.e. processing reagents and residual waste).
- Stability of constructed landforms.
- Impacts to visual amenity of the site.
- Rehabilitation failure.

In order to address potential closure risks, mining activities/ disturbances were categorised into closure domains. Closure domains group like disturbances and closure/rehabilitation tasks. The domains defined appear below, and are discussed further in Section 9.

- Mining Voids;
- Waste Rock Landforms;
- Tailings Storage Facility;
- Infrastructure;
- Run-Of-Mine Pad;
- Water Infrastructure;
- Transportation Corridors; and
- Other Cleared Areas.

Table 8-2 provides an assessment of the potential risks associated with the closure issues for each closure domain identified above. Risk treatments and management strategies have been developed and an assessment of the residual risk is provided assuming implementation of the strategies.

Any management strategy that identifies monitoring as an activity is expected to be undertaken at the frequency stated until the closure objective that it relates to is met.

Table 8-2: Key closure issues, risk treatments and management strategies

Key Closure Issue	Risk Pathways	Impacts	Likelihood	Consequence	Risk Rating	Risk Treatment/Management Strategy	Likelihood	Consequence	Residual Risk Rating
Mine Pits									
Safety regarding pit voids/ portals	• Collapse of pits/ portal. • Vehicle/ plant/ equipment encroaches within zone of instability. • Potential entry to portal.	• Potential equipment loss, human injuries/fatality, fauna death.	Possible	Severe	High	• All roads previously utilised to access pits will be closed and rehabilitated. • Abandonment bunds will be constructed in accordance with relevant DMP guidelines to deter access. • Signage alerting of dangerous area, no access permitted. • Monitoring of abandonment bund integrity through biannual inspections to ensure pit access is limited. • Underground portals to be secured with waste rock and mesh.	Rare	Severe	Moderate
Ground water quality	• Contamination of aquifer/ groundwater from contaminated pit-water or spills of hydrocarbons and chemicals. • Salinisation of groundwater from evaporation of water from open pit voids.	• Groundwater resources not suitable for post mining land use. • Increase in groundwater salinity.	Possible	Moderate	Moderate	• Model pit voids and water quality post-mining. Identify sources, sinks and flowthrough pits. • Ensure all pits have adequate surface water control at pit crests to divert water away from pits. • Monitor bunding and undertake remedial works when and if required to maintain integrity. • Ensure all hydrocarbons used and stored near pits are appropriately bunded. Spill clean-up kits made available at each hydrocarbon storage and use location. • Monitor pit water quality post mining for contaminants. Establish triggers for remediation action when contaminants exceed DER (2014) contaminated sites guidelines except where background levels from baseline sampling exceed these guideline levels.	Unlikely	Moderate	Moderate

Key Closure Issue	Risk Pathways	Impacts	Likelihood	Consequence	Risk Rating	Risk Treatment/Management Strategy	Likelihood	Consequence	Residual Risk Rating
Altered groundwater levels and disruption of groundwater flow	• Dewatering from open pits and underground mines. • Intersection of pit lakes with groundwater	• Short term decrease in groundwater levels resulting in pits/mines operating as groundwater sinks. • Localised disruption to groundwater flow	Possible	Minor	Moderate	• Progressively backfill shallow open pits, where possible, above the water table to avoid impacts to groundwater levels. • Hydrological modelling to confirm final pit lake water levels and expected recovery times for all open pits/ underground mines.	Unlikely	Minor	Low
Death of vegetation from saline mine dewater	• Use of saline mine dewater in dust suppression.	• Death of vegetation subject to saline spray. • Salinisation of soils subject to saline spray.	Possible	Minor	Moderate	• Conservative use of saline mine dewater for dust suppression. • Develop precise application techniques to minimise overspray of saline water to vegetation adjacent roads and infrastructure areas. • Monitor impacts to vegetation that may come in contact with saline water (i.e. along haul roads).	Unlikely	Minor	Low
Residual waste	• Entrapment of fauna in residual waste. • Ingestion of waste by fauna. • Waste harbouring feral fauna or pest plants. • Potential contaminants in residual waste products	• Fauna injury or death. • Weediness impacting diversity and structure of vegetation in rehabilitation areas • Soil or groundwater resources not suitable for post mining land use. Visual amenity.	Possible	Minor	Moderate	• Remove any waste and dispose within WRL or landfill. • Remove contaminated soils and remediate at bioremediation facility or contain ready for disposal. • If it is hydrocarbon waste contain and store for disposal.	Unlikely	Minor	Low
WRLs									

Key Closure Issue	Risk Pathways	Impacts	Likelihood	Consequence	Risk Rating	Risk Treatment/Management Strategy	Likelihood	Consequence	Residual Risk Rating
Stability of constructed landforms	• Failure of WRL structure due to rotational failure/ seismic event/ saturation. • Structural breakdown and/or hard-setting of WRL surface material.	• Potential vegetation destruction. • Encroachment on the Zone of Instability. • Contamination by sediment and topsoil movement.	Possible	Major	High	• Geotechnically sound design of WRLs taking into account strength, physical and geochemical characteristics of waste rock types encountered during mining. • Characterise soils prior to mining and integrate results into design of WRL. • Ensure dispersive or sodic materials are appropriately placed. • Survey of WRL landforms at completion to confirm landform design completion criteria have been met (rehabilitation batters ≤18° for the WRLs). • Geotechnical review of WRLs within 12 months of closure.	Unlikely	Major	Moderate
Erosion of WRL	• Surface water erosion from rain events. • Wind erosion removing topsoil.	• Rilling, gullying and tunnel erosion potentially leading to instability, loss of growth medium. • Removal of growth medium, nutrients.	Likely	Moderate	High	• WRLs to be re-contoured and battered. • Rehabilitation batter angles to be ≤18° for Project Area WRLs. • Batters to be ripped on the contour. • Vegetation debris and rock mulch spread over surface to complement topsoiling. Ensure that the growth medium has adequate water storage capacity. • Revegetation with local provenance species. • Audit of WRL landforms at completion to confirm landform design completion criteria have been met	Unlikely	Moderate	Moderate

Key Closure Issue	Risk Pathways	Impacts	Likelihood	Consequence	Risk Rating	Risk Treatment/Management Strategy	Likelihood	Consequence	Residual Risk Rating
Surface and ground water quality	• Acid and metalliferous drainage leaching from waste dump into surface and/or groundwater.	• Surface or groundwater resources not suitable for post mining land use.	Possible	Major	High	• Characterise waste for each deposit prior to commencement of mining and integrate results into design of WRL. • Develop routine procedures that readily identify PAF waste rock in situ and permit this material to be directed to a PAF cell in a WRL. • Undertake further assessment of the geochemical characteristics of waste rock and tailings, including kinetic testing to assess the potential for acid generation over a longer period ('long lag'). • Encapsulate PAF and construct a basal blanket of NAF waste to minimise the potential for percolation of water and therefore minimise the potential for leaching of AMD. • Include provision of material scheduling and stockpiling in the mining program to ensure there is adequate suitable material available at the end of mine life to undertaken rehabilitation as planned.	Unlikely	Major	Moderate

Key Closure Issue	Risk Pathways	Impacts	Likelihood	Consequence	Risk Rating	Risk Treatment/Management Strategy	Likelihood	Consequence	Residual Risk Rating
Contaminated sites	• Mobilisation of AMD to surrounding soils.	• Potential contamination of soils making them unsuitable for post mining land use.	Possible	Major	High	• Characterise waste for each deposit prior to commencement of mining and integrate results into design of WRL. • Undertake further assessment of the geochemical characteristics of waste rock and tailings, including kinetic testing to assess the potential for acid generation over a longer period ('long lag'). • Develop routine procedures that readily identify PAF waste rock in situ and permit this material to be encapsulated within a WRL. • Include provision of material scheduling and stockpiling in the mining program to ensure there is adequate suitable material available at the end of mine life to undertaken rehabilitation as planned. • Sample potential contaminated sites with regard to the Contaminated Sites Act 2003 and Regulations 2006. • If a contaminated site occurs as defined by the Contaminated Sites Act 2003 or Regulations 2006, treat according to required protocols.	Unlikely	Major	Moderate

Key Closure Issue	Risk Pathways	Impacts	Likelihood	Consequence	Risk Rating	Risk Treatment/Management Strategy	Likelihood	Consequence	Residual Risk Rating
Rehabilitation failure	• Inadequate volume, nutrition or water holding capacity of growth medium. • Hostile geochemical or geophysical properties of materials. • Inadequate seed viability. • Pest plant proliferation.	• Failure to restore functional ecosystem.	Possible	Major	High	• Provide appropriate growth medium with appropriate water storage capacity and adequate nutrition to enable germination and sustained growth of revegetation. • Undertake annual flora monitoring on WRL rehabilitated landforms to assess revegetation establishment. • Assist natural regeneration with additional seeding with local provenance species as required. • Establish thresholds for intervention if rehabilitation is at risk of failing to meet completion objectives. • Manage weeds as necessary to achieve completion criteria.	Unlikely	Major	Moderate
TSF									
Stability of constructed landform	• Failure of TSF structure due to rotational failure/ seismic event/ saturation. • Structural breakdown and/or hard-setting of TSF embankments.	• Potential vegetation destruction. • Sedimentation resulting from erosion of topsoil materials	Possible	Major	High	• Geotechnically sound design of the TSF taking into account strength, physical and geochemical characteristics of waste rock types encountered during mining. • Characterise soils prior to mining and integrate results into design of the TSF. • Construct WRLs in accordance with a design that minimises erosion and provides for stability in the long term. • Survey of TSF landform at completion to confirm landform design completion criteria have been met. • Geotechnical review of TSF within 12 months of closure.	Unlikely	Major	Moderate

Key Closure Issue	Risk Pathways	Impacts	Likelihood	Consequence	Risk Rating	Risk Treatment/Management Strategy	Likelihood	Consequence	Residual Risk Rating
Contaminated sites	• Wind-blown tailings from the surface. • Overtopping of the TSF. • Leaching of tailings by rainwater/ surface water inundation/ flows.	• Potential contamination of soils adversely impacting rehabilitation success and biodiversity of the post mining landscape. • Contamination of surface or groundwater resources affecting regional users.	Possible	Major	High	• When processing activities cease commence capping as soon as tailings have reached desired density and moisture content. • Maintain adequate freeboard in TSFs until capping has commenced. • Ensure TSF is capped as per approved design. • Top with an additional rock mulch and/ or topsoil and seed with local provenance taxa. • These will predominantly be relatively shallow rooted shrubs (from the rehabilitation species list) that will utilise the storage capacity of the rootzone. • Sample potential contaminated sites with regard to the Contaminated Sites Act 2003 and Regulations 2006. • If contaminated site occurs as defined by the Contaminated Sites Act 2003 or Regulations 2006, treat according to required protocols.	Unlikely	Major	Moderate
Erosion of capped TSF and surrounds	• Surface water erosion from rain events. • Wind erosion removing topsoil.	• Rilling, gullying and tunnel erosion potentially leading to instability, loss of growth medium. • Removal of growth medium, nutrients	Likely	Moderate	High	• TSF rehabilitation batter angles to be ≤18° (3H:1V). Batters to be ripped on the contour. • Vegetation debris and rock mulch spread over surface to complement topsoiling. Ensure that the growth medium has adequate water storage capacity. • Revegetation with local provenance species. • Maintain surface water diversion structures to direct flows around the rehabilitated landform where required. • Undertake a biannual inspection of the facility to identify location and extent of embankment erosion.	Possible	Moderate	Moderate

Key Closure Issue	Risk Pathways	Impacts	Likelihood	Consequence	Risk Rating	Risk Treatment/Management Strategy	Likelihood	Consequence	Residual Risk Rating
Ground water quality	• Seepage of enriched metals from the TSF. • AMD caused by seepage of acidic materials mobilising metals.	• Contamination of groundwater resources affecting regional users.	Possible	Major	High	• Undertake characterisation of process tailings. • Ensure TSF is appropriately capped to create an impervious layer minimising the potential for percolation of water and seepage. • Monitor groundwater from established monitoring bores for selected contaminants as per the DWER Operating Licence (to be obtained). Establish triggers for remediation action when contaminants exceed DER (2014) contaminated sites guidelines except where background levels from baseline sampling exceed these guideline levels	Unlikely	Major	Moderate
Residual waste	• Entrapment of fauna in residual waste such as piping, spigots, bore casings. • Waste harbouring feral fauna or pest plants. • Potential contaminants in residual waste products.	• Fauna injury or death. • Weediness impacting diversity and structure of vegetation in rehabilitation areas. • Soil or groundwater resources not suitable for post mining land use.	Possible	Minor	Moderate	• Bury all piping, spigots and other residual rubbish within the TSF rehabilitation landform or within landfill. • Manage weeds as necessary to achieve completion criteria. • Remove contaminated soils and remediate at bioremediation facility or contain ready for disposal.	Unlikely	Minor	Low

Key Closure Issue	Risk Pathways	Impacts	Likelihood	Consequence	Risk Rating	Risk Treatment/Management Strategy	Likelihood	Consequence	Residual Risk Rating
Rehabilitation failure	• Inadequate volume, nutrition or water holding capacity of growth medium. • Hostile geochemical or geophysical properties of materials. • Inadequate seed viability. • Pest plant proliferation.	• Failure to restore functional ecosystem.	Possible	Major	High	• Provide appropriate growth medium with appropriate water storage capacity to enable germination and sustained growth of revegetation. • Undertake annual flora monitoring on TSF rehabilitated landforms to assess revegetation establishment. • Assist natural regeneration with additional seeding with local provenance species as required. • Manage weeds as necessary to achieve completion criteria.	Unlikely	Major	Moderate
Visual amenity	• Rehabilitated landform not well integrated into the existing landscape.	• Visual impact to walkers utilising the Railway Heritage Walk Trail. • Visual impact to drivers utilising the Hopetoun Ravensthorpe Road.	Likely	Insignificant	Low	• TSF embankments contoured to ensure integration with the surrounding landscape. • Revegetate all surfaces of the TSF landform with local provenance species.	Possible	Insignificant	Low
Infrastructure									
Derelict infrastructure	• Refuge for feral fauna/ weeds. • Potential hazard for native fauna/ people.	• Pest plant and animal impacts on diversity and structure of native fauna and flora. • Death or injury of native fauna. • Potential human injury/fatality.	Possible	Moderate	Moderate	• Decommissioning and removal/ disposal of infrastructure at site. • Burial of all materials that are suitable for disposal in-situ, WRL or appropriate location.	Unlikely	Moderate	Moderate

Key Closure Issue	Risk Pathways	Impacts	Likelihood	Consequence	Risk Rating	Risk Treatment/Management Strategy	Likelihood	Consequence	Residual Risk Rating
Contaminated sites	• Potential for hydrocarbon contamination of soils adjacent to gensets, diesel storage and filling locations, and sediment of WSF. • Potential for contamination at chemical storage areas	• Soil or groundwater resources not suitable for post mining land use.	Possible	Moderate	Moderate	• Remove contaminated soils and remediate at bioremediation facility or contain ready for disposal. • Sample potential contaminated sites with regard to the Contaminated Sites Act 2003 and Regulations 2006. • If contaminated site occurs as defined by the Contaminated Sites Act 2003 or Regulations 2006, treat according to required protocols.	Unlikely	Moderate	Moderate
Surface water and groundwater quality	• Potential impacts from decommissioning sewage systems, remaining hydrocarbons or hazardous process chemicals.	• Surface or groundwater resources not suitable for post mining land use	Possible	Major	High	• Ensure that all septic systems and piping have been pumped out and disposed appropriately. • Remove wash-down bay and dispose of any remaining waste at an approved landfill. • Where possible use any remaining hydrocarbons in decommissioning (i.e. diesel and oils for equipment). • Ensure that any bunded containers are pumped out to avoid over-topping spills. • Remove any remaining hydrocarbons for disposal by accredited recyclers. Ensure that any hydrocarbon or hazardous waste is disposed of in compliance with Safety Data Sheets (SDS) or DWER requirements. • Ensure any hydrocarbon spills or leaks from machinery during closure operations are immediately cleaned up with a spill kit and contained in impermeable drums or containers for disposal. • Removal of any remaining process chemicals in compliance with SDS or DWER requirements. • Monitor groundwater from established monitoring bores for selected contaminants.	Unlikely	Major	Moderate
ROM									

Key Closure Issue	Risk Pathways	Impacts	Likelihood	Consequence	Risk Rating	Risk Treatment/Management Strategy	Likelihood	Consequence	Residual Risk Rating
Contaminated sites	• Contamination from hydrocarbon spills	• Soil or groundwater resources not suitable for post mining land use.	Possible	Moderate	Moderate	• Remove contaminated soils and remediate at bioremediation facility or contain for appropriate disposal. • Sample potential contaminated sites with regard to the Contaminated Sites Act 2003 and Regulations 2006. • If contaminated site occurs as defined by the Contaminated Sites Act 2003 or Regulations 2006, treat according to required protocols.	Unlikely	Moderate	Moderate
Rehabilitation failure	• Inadequate volume, nutrition or water holding capacity of growth medium. • Inadequate seed viability. • Pest plant proliferation	• Failure to restore functional ecosystem	Possible	Moderate	Moderate	• Provide appropriate growth medium with appropriate water storage capacity to enable germination and sustained growth of revegetation • Assist natural regeneration with additional seeding with local provenance species as required. • Manage weeds as necessary to achieve completion criteria.	Unlikely	Moderate	Moderate
Residual waste	• Refuge for feral fauna/ weeds. • Potential hazard for native fauna. • Potential contaminants in residual waste products.	• Pest plant and animal impacts on diversity and structure of native fauna and flora. • Native fauna injury or death. • Soil or groundwater resources not suitable for post mining land use. • Visual amenity.	Possible	Minor	Moderate	• Remove any waste and dispose within WRL or landfill facility. • If it is hydrocarbon waste contain and store for disposal.	Unlikely	Minor	Low
Water Infrastructure									
Safety associated with water infrastructure	• Fauna entrapment in WSFs or bores.	• Fauna injury or death.	Unlikely	Moderate	Moderate	• Construct a fauna proof fence around WSFs. • Ensure bore holes are capped to prevent fauna entrapment.	Rare	Moderate	Low

Key Closure Issue	Risk Pathways	Impacts	Likelihood	Consequence	Risk Rating	Risk Treatment/Management Strategy	Likelihood	Consequence	Residual Risk Rating
Stability of water infrastructure	• Failure of water diversion infrastructure. • Uncontrolled surface water flows.	• Structural integrity of constructed landforms such as WRLs, TSF and mine pits threatened.	Likely	Major	Extreme	• Water infrastructure (diversions, bunding and drainage channels) are designed and constructed to withstand water flows expected for 1 % AEP 72-hour rainfall events. These structures are expected to remain at closure and be handed over to successive land user. • Monitoring of water diversion infrastructure throughout operations and closure. • Threshold for intervention established and remediation is undertaken when structures meet this point.	Unlikely	Major	Moderate
Roads									
Surface water quality	• Sedimentation from road rehabilitation surfaces.	• Vegetation death. • Turbidity in downstream surface water bodies.	Possible	Moderate	Moderate	• Recontour the rehabilitation area to align with the topography of the site. • Reinstate natural drainage lines.	Unlikely	Moderate	Moderate
Safety	• Entry to dangerous areas (pits, TSFs)	• Potential equipment loss. • Human injuries/fatality. • Death of fauna	Unlikely	Severe	High	• All roads previously utilised to access pits will be closed and rehabilitated. • All roads no longer required will be removed. • Abandonment bunds will be constructed in accordance with relevant DMP guidelines to deter access. • Signage alerting of dangerous area, no access permitted. • Monitoring of abandonment bund integrity through biannual inspections to ensure pit access is limited.	Rare	Severe	Moderate

Key Closure Issue	Risk Pathways	Impacts	Likelihood	Consequence	Risk Rating	Risk Treatment/Management Strategy	Likelihood	Consequence	Residual Risk Rating
Rehabilitation failure	• Inadequate volume, nutrition or water holding capacity of growth medium. • Inadequate seed viability. • Pest plant proliferation.	• Failure to restore functional ecosystem.	Possible	Moderate	Moderate	• Provide appropriate growth medium with appropriate water storage capacity to enable germination and sustained growth of revegetation. • Assist natural regeneration with additional provenance species seeding if required. • Manage weeds as necessary to achieve completion criteria.	Unlikely	Moderate	Moderate
Other Cleared Areas									
Rehabilitation failure	• Inadequate volume, nutrition or water holding capacity of growth medium. • Inadequate seed viability. • Pest plant proliferation.	• Failure to restore functional ecosystem.	Possible	Moderate	Moderate	• Provide appropriate growth medium with appropriate water storage capacity to enable germination and sustained growth of revegetation. • Assist natural regeneration with additional provenance species seeding if required. • Manage weeds as necessary to achieve completion criteria.	Unlikely	Moderate	Moderate
Surface water quality	• Sedimentation from rehabilitation surfaces.	• Vegetation death. • Turbidity in downstream surface water bodies.	Possible	Moderate	Moderate	• Recontour the rehabilitation area to align with the topography of the site. • Reinstate natural drainage lines.	Unlikely	Moderate	Moderate

9 Closure Implementation

This section provides an overview of the closure strategy for the RGP, encompassing planned closure, unplanned closure, and decommissioning of the site. Closure of the Project will involve the commencement of the Closure Works Programme, which is described in further detail in Section 9.4.

9.1 Planned closure

As part of the Closure Works Programme, all features at the Project have been grouped into separate closure domains. Each closure domain has particular closure obligations that are to be fulfilled and closure tasks that are to be completed within specific timeframes. Closure domains at the Project are listed in Table 9-1 below and shown in Figure 9-1.

Table 9-1: RGP - Closure domains and associated features

Domain	Features
Mining Voids	Kaolin Pit, Harbour View Pit, Flag Pits and underground operations
Waste Rock Landforms	North WRL and South WRL
Tailings Storage Facility	TSF
Run-of-Mine Pad	ROM Pad
Infrastructure	Processing Plant, chemical storage tanks, explosives magazine, go-line, re-fuelling bay, hardstands, workshops, offices, crib rooms, bioremediation facility, septic systems, pipelines, and bores.
Water Infrastructure	Dams, ponds, drains, and pipeline infrastructure.
Transportation Corridors	Roads and access tracks.
Other cleared areas	Topsoil and vegetation stockpiles

9.2 Decommissioning

Progressively, or upon closure, ACH will dismantle and remove or dispose of any infrastructure, building structures, plant facilities, equipment, and and pipelines where not required by the future land user. All waste will be removed from site and disposed of using the appropriate measures. Any areas with potential contamination are to be reported to the relevant statutory authorities. If hydrocarbon contaminated soils are present, these will undergo remediation in a bioremediation facility.

9.3 Unplanned closure

The RGP tenements are currently under a period of 'Care and Maintenance'. Should mining activities recommence and the Project proceeds to an unplanned closure, the tasks listed in the following table will apply. Notification of the suspension of operations must be communicated to the DMIRS,

in addition to the following details in accordance with section 3.12 of the Mines Safety and Inspection Regulations 1995:

- The reason for the suspension and the planned duration of the suspension;
- Whether the closure is total or whether access to underground and/or pit workings is to be maintained;
- If underground and/or pit access is to be maintained, details of the arrangements that have been agreed to are to be communicated;
- Made for the provision of regular services and emergency services to ensure the safety of employees engaged in maintaining the mine;
- The measures that have been taken to prevent unauthorised access or entry to the mine;
- The precautions that have been taken to protect underground equipment and service installations; and
- Any plans required to be prepared under section 88 of the EP Act.

Table 9-2: Unplanned closure tasks

Key closure tasks	Priority	Timeframe
Ensure all safety obligations are met.	High	During closure.
Notify DMIRS before the mining operation is suspended or abandoned.	High	ASAP but ideally 1 month prior to unplanned closure.
For unexpected closure - immediate review of MCP to include detailed decommissioning plan.	High	Within 3 months of notification to DMIRS.
For temporary closure – prepare a detailed care and maintenance plan.	High	Within 3 months of notification to DMIRS.

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M 74/180
M 74/41
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L 74/34
Hopetoun-Ravensthorpe Rd
M 74/51
L 74/45
Data source: Tenements - DMIRS, 2019. Roads - MRWA, 2019. Imagery: Landgate, 2016.

Ravensthorpe Gold Project Area

Closure Domain

- Infrastructure
- Mine pits
- Other cleared areas
- ROM
- Roads
- TSF
- WRLs
- Water Infrastructure

LOCALITY

CLOSURE DOMAINS
Ravensthorpe Gold Project
Mine Closure Plan
ACH Minerals Pty Ltd

N
0 150 300 450 600 m
Coordinate System: GDA 1994 MGA Zone 51
Projection: Transverse Mercator, Datum: GDA 1994
Scale @ A3: 1:12,000

Prepared:	F Walker
Reviewed:	G Barrett
Project No:	TE19017
Revision:	A
Date:	24/07/2019

Figure 9-1

ACHMINERALS

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9.4 Closure Works Programme

Table 9-4 to Table 9-10 provide Closure Works Programmes for each domain, outlining the closure objectives that are to be met for each feature within the relevant domain, and the specific tasks that are to be completed within a particular timeframe.

Table 9-3: Closure Works Programme - Mining Voids

Domain: Mining Voids	
Closure Objectives	
• All legally binding conditions and commitments relevant to rehabilitation and closure will be met. • The site will be safe for people and animals. • Pre-mine surface water movement patterns should be restored to the extent possible given constructed landforms have been established. • Surface and groundwater levels and quality should reflect the original levels and water chemistry. • No infrastructure to be left on site unless agreed to by regulators and the subsequent land holders.	
Closure Tasks	**Schedule**
Model pit voids to determine their likely characteristics post-mining.	Prior to closure.
Abandonment bunds around pit voids will be designed and constructed in accordance with DMIRS guideline *Safety bund walls around abandoned open pit mines* (DOIR 1997). This will ensure that access to the zone of instability around abandoned pit is prevented.	Commencement of mining
Open pits is physically obstructed by the bund. In general, waste rock will be placed to develop the bunds with a 5 m base and up to 2 m in height with prominent signage to indicate the danger and to deter access.	Cessation of mining
Remove all infrastructure from the mine pit.	
Remove residual waste for appropriate disposal in WRL or landfill.	
Remove any hydrocarbon waste for containment and appropriate disposal, and removal of any hydrocarbon contaminated soil to the bioremediation facility for treatment.	
Remove and rehabilitate any roads that are not required.	
Install signage alerting of dangerous area, no access permitted.	
Underground portal entrances to be secured with mesh. Place waste rock at the mouth of each portal prior to the void filling. It is envisaged that portals in the Harbour View and Flag pits will below groundwater when it recovers and forms pit lakes.	
Rehabilitation of roads and other cleared areas within the mine pit domain will be undertaken as follows: • Stripping any suspected contaminated soils for treatment at the bioremediation facility. • Ripping of compacted areas to break up hardpans. • Contouring to integrate with surrounding topography. • Replacement of subsoil and topsoil. • Vegetation debris spread over surface.	Progressively
Monitor water quality post mining. Water samples will be taken, as per the monitoring schedule, to measure water quality parameters according to the DER (2014) contaminated sites guidelines.	Annually
Monitoring of abandonment bund integrity through biannual inspections to ensure pit access is limited.	Biannually

Table 9-4: Closure Works Programme – Waste Rock Landforms

Domain: Waste Landforms

Closure Objectives

- All legally binding conditions and commitments relevant to rehabilitation and closure will be met.
- All constructed waste rock landforms will be stable and resistant to erosion.
- All constructed tailings storage facilities and waste rock landforms will be non-polluting with substances potentially harmful to people or the environment permanently encapsulated or removed from site.
- The site will be safe for people and animals.
- Revegetation is self-sustaining, is compatible with surrounding native vegetation and is not a source of weeds.
- Pre-mine surface water movement patterns should be restored to the extent possible given constructed landforms have been established.
- Surface and groundwater levels and quality should reflect the original levels and water chemistry.
- No infrastructure to be left on site unless agreed to by regulators and the subsequent land holders.

Closure Tasks	Schedule
Soil characterisation and mine waste rock characterisation studies to determine properties for input into WRL design and rehabilitation.	Pre-mining
Design WRLs taking into account footprint, materials characteristics including potential for AMD and ability of soils to support revegetation and rehabilitation.	Pre-mining
Develop designs incorporating an encapsulation cell if required to contain PAF material so that conditions for development of AMD are minimised.	Pre-mining
Conduct landform evolution modelling of WRLs	Pre-mining
WRLs are to be constructed with final batters of ≤18° to assist with stability during operations.	Progressively
Any hostile materials identified as PAF to be co- mingled with appropriate volumes of NAF or contained within designed encapsulation cell and buffered with NAF or material with appropriate acid neutralising capacity.	Progressively
WRLs will have crest bunding to one 1 m to contain stormwater, and toe bunding to prevent sedimentation of surrounding vegetation.	Progressively
Remove residual non-mineral waste for appropriate disposal in WRL or off-site.	Cessation of mining
Sample potential contaminated sites with regard to the *Contaminated Sites Act 2003* and *Regulations 2006*. If contaminated site occurs as defined by the *Contaminated Sites Act 2003* or *Regulations 2006*, treat according to required protocols.	Cessation of mining
WRLs will be re-contoured and battered. Batters will be ripped on the contour and topsoil replaced to a depth of 100 mm where available.	Progressively
Where available, vegetation debris and rock mulch will be spread over surface to complement topsoiling.	Progressively
All rehabilitated surfaces will be seeded with local provenance species.	Progressively
Germination of vegetation will be monitored and where required additional seeding will take place.	Progressively
Monitoring of rehabilitation to be integrated into the Project's AER including erosion and vegetation establishment.	Annually

Table 9-5: Closure Works Programme – Tailings Storage Facility

Domain: Tailings Storage Facilities	
Closure Objectives	
• All legally binding conditions and commitments relevant to rehabilitation and closure will be met. • All constructed tailings storage facilities and waste rock landforms will be non-polluting with substances potentially harmful to people or the environment permanently encapsulated or removed from site. • The site will be safe for people and animals. • Revegetation is self-sustaining, is compatible with surrounding native vegetation and is not a source of weeds. • Pre-mine surface water movement patterns should be restored to the extent possible given constructed landforms have been established. • Surface and groundwater levels and quality should reflect the original levels and water chemistry. • No infrastructure to be left on site unless agreed to by regulators and the subsequent land holders.	
Closure Tasks	**Schedule**
Complete a TSF review report outlining including the status of the TSF and the potential implications of the physical/chemical characteristics of the tailings material. The document should also present all associated monitoring results, and any progressive/ proposed remedial works.	Prior to rehab
Flush pipeline infrastructure, and remove and dispose pipeline and spigots.	Closure
Tailings to be checked periodically for moisture level. Once dry and stable, capping will be required.	Quarterly post closure
Undertake sampling of potential contaminated sites with regard to the *Contaminated Sites Act* 2003 and *Regulations 2006*. If contaminated site occurs as defined by the *Contaminated Sites Act 2003* or Regulations *2006*, treat according to required protocols.	Following drying of tailings
Cap TSF with appropriate material to the extent determined in the decommissioning review report above.	Within 3 months of appropriate tailings moisture levels being achieved
Undertake earthworks to ensure TSF is compliant with closure commitments - Rip and contour; application of rock, mulch and seed.	
Following capping, inspection for erosion will be undertaken annually.	Annually
Revegetation monitoring will be undertaken annually for the first three years after capping and rehabilitation earth works. If required, revegetation will be undertaken to promote suitable vegetation establishment.	Annually and as required
Monitor groundwater from established monitoring bores for selected contaminants.	Monitor annually until completion criteria achieved

Table 9-6: Closure Works Programme – Run-of-Mine Pad

Domain: ROM Pads	
Closure Objectives	
• All legally binding conditions and commitments relevant to rehabilitation and closure will be met. • The site will be safe for people and animals. • Revegetation is self-sustaining, is compatible with surrounding native vegetation and is not a source of weeds. • Pre-mine surface water movement patterns should be restored to the extent possible given constructed landforms have been established. • Surface and groundwater levels and quality should reflect the original levels and water chemistry. • No infrastructure to be left on site unless agreed to by regulators and the subsequent land holders.	
Closure Tasks	**Schedule**
Remove any remaining ore for processing	Cessation of mining or progressively
Remove residual waste for disposal in landfill or containment for appropriate disposal off site.	
Ensure that any hydrocarbon or hazardous waste is disposed of in compliance with SDS or DER requirements.	
Sample potential contaminated sites with regard to the *Contaminated Sites Act* 2003 and *Regulations 2006*. If contaminated site occurs as defined by the *Contaminated Sites Act 2003* or Regulations *2006*, treat according to required protocols.	
Stripping any suspected contaminated soils for treatment at the bioremediation facility or containment prior to appropriate offsite disposal.	Closure
Ripping and contouring	
Replacement of subsoil and topsoil	
Vegetation debris spread over surface	
Monitoring of rehabilitation to be integrated into the Project's Environmental Management System.	Annually
Assist revegetation with additional provenance species seeding if required.	As required
Weed monitoring and supplementary spraying if required.	Annually or as required

Table 9-7: Closure Works Programme – Infrastructure

Domain: Infrastructure

Closure Objectives

- All legally binding conditions and commitments relevant to rehabilitation and closure will be met.
- The site will be safe for people and animals.
- Revegetation is self-sustaining, is compatible with surrounding native vegetation and is not a source of weeds.
- Pre-mine surface water movement patterns should be restored to the extent possible given constructed landforms have been established.
- Surface and groundwater levels and quality should reflect the original levels and water chemistry.
- No infrastructure to be left on site unless agreed to by regulators and the subsequent land holders.

Activity	Closure Tasks	Schedule
Go-line, Re-fuelling bays, hardstands	Dispose of storage tanks through sale or demolition. Removal of concrete bunding – broken up and disposed to landfill. Ensure that any hydrocarbon or hazardous waste is disposed of in compliance with SDS or DWER requirements.	As soon as practicable
Processing Plant, chemical storage tanks, and workshops	Ensure that any hydrocarbons or hazardous waste is disposed of in compliance with SDS or DWER requirements. Dispose of assets through sale or demolition. Removal of concrete footings and slabs – broken up and disposed to landfill. Remove residual waste for disposal in landfill.	1 year post closure
Magazine	Removal of explosives in accordance with Explosives and Dangerous Goods Act, the Dangerous Goods Safety (Explosives) Regulations 2007 and Australian Standard AS 2187.1:1998, Explosives – Storage, transport and use, Part 1. Dispose of assets through sale or demolition. Removal of concrete footings and slabs – broken up and disposed to landfill.	1 year post closure
Offices, crib rooms	Dispose of assets through sale or demolition. Removal of concrete footings and slabs – broken up and disposed to landfill. Remove residual waste for disposal in landfill or containment for appropriate disposal off site.	1 year post closure
Septic systems	Excavate, break concrete septic system up, backfill.	1 year post closure
Pipelines	Disconnect from bores. Cut up, flatten and bury *in situ*.	1 year post closure
Bioremediation facility	Sample potential contaminated sites with regard to the Contaminated Sites Act 2003 and Regulations 2006. If a contaminated site occurs as defined by the Contaminated Sites Act 2003 or Regulations 2006, treat according to required protocols. Backfill any excavations with subsoil or fill.	Remain open until all other domains are closed in case there is a requirement to treat contaminated soils
Bores	Bores to be either capped or secured below ground or backfilled in accordance with DWER requirements.	Prior to relinquishment

Domain: Infrastructure		
All remaining areas	Rehabilitation of infrastructure areas after decommissioning will be undertaken as follows: • Any suspected contaminated soils for treatment at the bioremediation facility or containment prior to appropriate offsite disposal. • Ripping of compacted area to break up hardpans. • Contouring to integrate with surrounding topography. • Replace topsoil to a depth of 100 mm where available. • Where available vegetation debris will be spread over surface to complement topsoiling. • All rehabilitated surfaces will be seeded with local provenance species.	Within 1 year of decommissioning
	Monitoring of rehabilitation to be integrated into the Project Environmental Management System.	Annually
	Germination of vegetation will be monitored and where required additional seeding with local provenance species will take place.	As required
	Weed monitoring and supplementary spraying if required.	Annually and as required

Table 9-8: Closure Works Programme - Water Infrastructure

Domain: Water Containment Infrastructure	
Closure Objectives	
• All legally binding conditions and commitments relevant to rehabilitation and closure will be met. • The site will be safe for people and animals. • Revegetation is self-sustaining, is compatible with surrounding native vegetation and is not a source of weeds. • Pre-mine surface water movement patterns should be restored to the extent possible given constructed landforms have been established. • Surface and groundwater levels and quality should reflect the original levels and water chemistry. • No infrastructure to be left on site unless agreed to by regulators and the subsequent land holders.	
Closure Tasks	**Schedule**
Any culverts or pipes installed as part or drainage infrastructure removed and disposed to appropriate location (landfill or for re-use off-site).	Closure
Remove pipeline for re-use off-site or dispose in WRL.	Cessation of pipeline use
Remove residual waste for disposal in landfill or containment for appropriate disposal off site. This is inclusive of standpipes, plumbing and pipelines.	Cessation of mining/progressively
Rehabilitation of water infrastructure areas after decommissioning will be undertaken as follows: • Backfilling of excavations (dams/channels) with oxide/laterite waste material • Ripping of compacted areas to break up hardpans • Contouring to integrate with surrounding topography • Replacement of subsoil and topsoil • Vegetation debris spread over surface	Within 1 year
Monitoring of rehabilitation to be integrated into the Project's Environmental Management System.	Annually or as required
Assist revegetation with additional local provenance species seeding if required.	

Table 9-9: Closure Works Programme - Transportation Corridors

Domain: Transportation Infrastructure	
Closure Objectives	
• All legally binding conditions and commitments relevant to rehabilitation and closure will be met. • The site will be safe for people and animals. • Revegetation is self-sustaining, is compatible with surrounding native vegetation and is not a source of weeds. • Pre-mine surface water movement patterns should be restored to the extent possible given constructed landforms have been established. • Surface and groundwater levels and quality should reflect the original levels and water chemistry. • No infrastructure to be left on site unless agreed to by regulators and the subsequent land holders.	
Closure Tasks	**Schedule**
Remove residual waste for disposal in landfill or containment for appropriate disposal off site.	Cessation of mining or progressively
Remove any signage that is no longer required.	
Rehabilitation of the road domain will be undertaken as follows: • Stripping any suspected contaminated soils for treatment at the bioremediation facility or containment prior to appropriate offsite disposal • Ripping of compacted areas to break up hardpans • Contouring to integrate with surrounding topography • Replacement of subsoil and topsoil • Vegetation debris spread over surface	Progressively
Monitoring of rehabilitation to be integrated into the Project's Environmental Management System.	Annually
Assist revegetation with additional provenance species seeding if required.	As required
Weed monitoring and supplementary spraying if required.	Annually or as required

Table 9-10: Closure Works Programme - Other cleared areas

Domain: Other cleared areas	
Closure Objectives	
• All legally binding conditions and commitments relevant to rehabilitation and closure will be met. • The site will be safe for people and animals. • Revegetation is self-sustaining, is compatible with surrounding native vegetation and is not a source of weeds. • Pre-mine surface water movement patterns should be restored to the extent possible given constructed landforms have been established. • Surface and groundwater levels and quality should reflect the original levels and water chemistry. • No infrastructure to be left on site unless agreed to by regulators and the subsequent land holders.	
Closure Tasks	**Schedule**
Remove residual waste for disposal in landfill or containment for appropriate disposal off site.	Cessation of mining or progressively
Rehabilitation of the cleared areas domain will be undertaken as follows: • Stripping any suspected contaminated soils for treatment at the bioremediation facility or containment prior to appropriate offsite disposal • Ripping of compacted areas to break up hardpans • Contouring to integrate with surrounding topography • Replacement of subsoil and topsoil where available • Vegetation debris spread over surface	Progressively
Monitoring of rehabilitation to be integratedinto the Project's Environmental Management System.	Annually
Assist revegetation with additional provenance species seeding if required.	As required
Weed monitoring and supplementary spraying if required.	Annually or as required

9.5 Research, Investigation and Trials

Revegetation trials have not yet been undertaken within the Project Area. However, it has been observed that native vegetation has successfully established across many of the historically disturbed sites. Unconstrained by temperature and rainfall, the potential for successful revegetation of disturbed sites is high where topsoil has been returned and soils are stabilised.

9.6 Progressive rehabilitation

Opportunities for progressive rehabilitation are limited until mining and processing are complete, with the following exceptions:

- Batters on the WRLs and TSF can be constructed at their final angle and capped with fresh rock and topsoil, with fresh topsoil to be utilised where possible; and
- Currently disturbed areas outside of the disturbance footprint can be rehabilitated during site establishment.

10 Closure Monitoring and Maintenance

10.1 Monitoring

The overall objective for rehabilitation and closure monitoring programs is to ensure the success of the rehabilitation program and achievement of the completion criteria. Monitoring will be carried out on a regular basis during operations and post-closure in accordance with relevant mine procedures.

A preliminary schedule for post closure monitoring is detailed in Table 10-1.

10.2 Maintenance

Maintenance will be required both during and after operations. Typical maintenance activities include:

- Installation and maintenance of signage and fencing;
- Repair of erosion damage;
- Weed control; and
- Access road repairs post-closure.

Table 10-1: Preliminary Project post-closure monitoring programme

Aspect	Objective	Completion Criteria	Monitoring (performance indicators)	Monitoring method
Compliance	All legally binding conditions and commitments relevant to rehabilitation and closure will be met.	All conditions and commitments are met.	Milestone audits (degree of compliance with tenement conditions)	Site inspected by independent auditor and a completion report produced.
Landforms and disturbance	All constructed waste rock landforms will be stable and resistant to erosion.	All landforms constructed in accordance with parameters outlined in this MCP (see Section 9.0) and are stable and erosion resistant.	Independent annual assessments or at other times at ACH's discretion (degree of compliance with tenement conditions).	Inspection.
	All constructed tailings storage facilities and waste rock landforms will be non-polluting with substances potentially harmful to people or the environment permanently encapsulated or removed from site.	No substances potentially harmful to people or the environment are accessible.	Annual groundwater quality assessments (comparison with baseline data) Soil contamination audit at closure (comparison with baseline data) Post-decommissioning inspection and auditing (degree of compliance with tenement conditions).	Water and soil sampling and analysis. Inspection by engineer and report with recommendations as required.
	The site will be safe for people and animals.	All mine voids are appropriately bunded to prevent entry (DoIR, 1997).	Assessment against DoIR guideline.	Field inspection and report.
Revegetation	Revegetation is self-sustaining, is compatible with surrounding native vegetation and is not a source of weeds.	Foliar cover is on a positive trajectory. Flowering, fruiting and seed production is evident in a range of species. Vegetation composition is reflective of undisturbed native vegetation in the immediate area. Weeds do not inhibit establishment/out compete native vegetation in rehabilitation areas.	Annual vegetation monitoring (vegetation cover, composition and reproductive status; weed cover).	Monitoring and inspection by botanist or revegetation specialist, report.
Water	Pre-mine surface water movement patterns should be restored to the extent possible given constructed landforms have been established.	No obstructions to water flow beyond approved landforms.	Inspection and auditing (instances of water flow obstructions; compliance with tenement conditions).	Inspection and report with recommendations as required.
	Surface and groundwater levels and quality should reflect the original levels and water chemistry.	Water quantity and quality on a trajectory to baseline levels within two years of cessation of mining and processing.	Annual groundwater quality assessments (comparison with baseline data, triggers and thresholds).	Water and soil sampling and analysis; SWL monitoring.
Infrastructure	No infrastructure to be left on site unless agreed to by regulators and the subsequent land holders.	Written agreement from all parties prior to closure.	Evidence of written agreement.	Third party agreement approved by DMIRS.

11 Financial provisioning for closure

11.1 Formulation of provision – general approach

ACH acknowledges it is required to decommission and rehabilitate mines and processing sites at the end of their producing lives to an agreed condition (via completion criteria approved by DMIRS). ACH will make provision for the costs associated with this work during the course of operations.

The expected cost of any approved decommissioning or rehabilitation programme, discounted to its net present value (NPV), will be provided when the related environmental disturbance occurs. Expected decommissioning and rehabilitation costs are based on the discounted value of the estimated future cost of detailed mine plans. The estimated costs of rehabilitation will be reviewed annually and adjusted as appropriate for changes in legislation, technology or other circumstances. Cost estimates are not reduced by potential proceeds from the sale of assets or from plant clean up at closure.

This approach is consistent with AASB 137[4] and guidance from the Department of Finance (2016).

11.2 Rehabilitation and closure considerations to be included in provision

Costs associated with the following items will be included in the financial provision:

- Earthmoving costs, including formation of final batters on WRLs, construction of abandonment bunds and capping of landforms with competent rock materials, subsoils and topsoil;
- Management of problematic materials;
- Post-closure management of surface water drainage;
- Decommissioning and removal of infrastructure;
- Remediation of contamination;
- Progressive and final revegetation works;
- Maintenance and monitoring in post-closure phase, including statutory reporting requirements;
- Ongoing stakeholder engagement process;
- Closure project management costs;
- Specialist and consultant fees; and
- Legal requirements.

[4] AASB (Australian Accounting Standards Board) Standard 137 – Provisions, Contingent Liabilities and Contingent Assets.

Exclusions include:

- Rehabilitation of exploration disturbance (costs to be met through operating budgets); and
- Income from sale of assets (for the purpose of provisioning this income is assumed to be zero).

11.3 Review

Financial provisioning will be reviewed annually or if there are any significant changes to activities at the Project. The provision can be expected to change more often early in the life of the operation as the site is established.

Department of Finance (2016). Accounting for decommissioning, restoration and similar provisions ('make good'). Resource Management Guide No. 114, November 2016.

12 Management of Information and Data

12.1 Systems and processes for the retention of mine records

When ACH commences operations systems will be developed to monitor activities on a real time basis and it is proposed that a records management system for environmental data maintained by ACH is based on the principles of ISO 14001 and includes the following elements:

- Planning and Approvals;
- Operations;
- Checking and Corrective Action.

The system is expected to capture all activities, products and/or services including exploration, mining, processing and maintenance that take place as part of the mining operation and also incorporates mine closure planning and implementation.

12.2 Monitoring and closure records

Monitoring results will be provided in the Project's Annual Environmental Report which is generated through the on-line EARS system of DMIRS.

Documents and data relating to closure at the Project will be stored in the system as described above. A Mine Closure Document register will be developed to ensure closure documents are stored, available and not lost over time.

The Progressive and Post Closure records to be stored in the ACH system will include, but are not limited to:

- Location of monitoring sites;
- Location of analogue sites;
- Groundwater SWL;
- Monitoring Data; and
- Calibration records.

ACH is continuing to develop a GIS database, providing a simple and effective tool for the analysis and display of rehabilitation information.

The Mine Closure Document Register and GIS database form part of a closure information system that contains details for each domain. The information that makes up the system will include, but not be limited to:

- The current status of the domain or feature;
- Information from spatial datasets and databases;
- Design and construction information;
- Operation and monitoring information;

- Other information that meets a specific purpose (e.g. maps, area statistics, species lists or modelled environmental impacts).

12.3 Updates and communication

ACH will update the Project's MCP every three years, or as new developments are proposed, to capture and store all relevant information. The MCP and related information will be managed by the Project's environmental personnel and/or consultants and the data will be stored in a central and readily accessible location on the Project's server.

ACH will communicate their progress in achieving closure planning tasks to the DMIRS via existing annual reporting channels.

ACH will progressively update the Project's MCP as knowledge gaps are filled and closure plans are refined. During the implementation of the closure program ACH will update the Project's MCP with as-built information so that records of actual closure works are maintained.

During the post closure period, ACH will undertake monitoring to measure closure performance against agreed objectives and criteria. During the post closure period, ACH will also undertake maintenance works, as required. ACH will update the Project's MCP with records and data from the post closure monitoring and maintenance period.

ACH's MCP will therefore be the primary source of closure and post closure information and data. After lease relinquishment, ACH will transfer the Project's MCP and all associated information to DMIRS for their records.

13 References

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Appendix A: Hydrological report

See Appendix Q, ERD

Appendix B: Hydrogeological report

See Appendix R, ERD

Appendix C: Biological survey

See Appendix C, ERD

Appendix D: Characterisation of mine waste and low grade ore samples for the Kaolin pit

See Appendix L, ERD

Appendix E: Geochemical testing of slurry samples of oxide ore tailings and primary ore tailings

See Appendix N, ERD

Appendix F: Tailings storage facility design

See Appendix P, ERD