December 2016

RAVENSTHORPE GOLD/COPPER PROJECT EPA REFERRAL SUPPORTING DOCUMENT

Ravensthorpe, WA

Prepared on behalf of ACH Minerals Pty Ltd by:

Animal Plant Mineral Pty Ltd

Kundip Mine Site:

M74/41, M74/51, M74/53, M74/135, M74/180, L74/34, L74/45

Myamba Mine Site:

M74/176, L74/35

Completed by: Animal Plant Mineral Pty Ltd

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EXECUTIVE SUMMARY

The Ravensthorpe Gold/Copper Project (RGCP) (the Project) is located in the Goldfields-Esperance region of Western Australia (WA) approximately 550 km southeast of Perth near Ravensthorpe. The RGCP will occur in two distinct locations, Kundip Mine Site and Myamba Mine Site. Kundip Mine Site will host open pits and underground mining coupled with a processing plant, office and primary workshop facilities, water storage facilities, run-of-mine (ROM) pad, waste rock landforms (WRL's) and a tailings storage facility (TSF). Myamba Mine Site, located approximately 7 km to the south of Kundip, will host a single open pit (Trilogy oxide pit) and an associated evaporation pond, WRL, ROM pad and support office/crib and minor workshop facilities. The existing exploration offices at the site will host additional support facilities.

ACH Minerals Pty Ltd (ACH) is the owner of all tenements associated with the RGCP. This referral relates specifically to Kundip Mine Site tenements M74/41, M74/51, M74/53, M74/135, M74/180, L74/34, and L74/45; and Myamba Mine Site tenements M74/176, L74/35 and L74/45.

Originally titled the Phillips River Project, the Project was referred to the WA Environmental Protection Authority (EPA) and the Commonwealth Department of Environment (DoE) in 2005. The DoE determined the Project to be "Not a Controlled Action". The State Minister for the Environment approved the Project in 2006 (Ministerial Statement (MS0716)), however, that approval lapsed in 2011 after the proponents failed to make a substantiative commencement on the project and declined to request an extension to the approval. As a consequence, a modified version of the Project is now being referred by new proponents ACH to the EPA for consideration.

The RGCP is smaller in scale than the previously approved Phillips River Project. In the first instance, mining and processing of gold bearing ore will be focussed on proposed open-pits at Kundip Mine Site and a single, shallower open-pit within cleared pasture at Myamba Mine Site. Mining will later progress towards underground mining at the Kundip Mine Site. Processing will also be contained within the Kundip Mine Site, negating the requirement for a haul road to traverse the adjacent proposed Nature Reserve, as was previously proposed in the Phillips River Proposal.

ACH aims to have substantially commenced mining within one year of the date of this referral. The resource identified within the Kundip Mine Site is sufficient to undertake open pit mining of the Kaolin, May and Flag deposits for an initial duration of seven years. Underground mining of Harbour View and Flag deposits will commence concurrently from the second year of mine life and will continue for a duration of five-to-six years. Sufficient resource has been identified within the Myamba Mine Site to undertake open pit mining of oxide components of the Trilogy deposit for an initial duration of 1 year.

Activities proposed to occur within the Kundip Mine Site include:

- Clearing of soil and vegetation over relevant areas, and storage of this material in segregated stockpiles;
- Construction of office, workshop and processing plant facilities;
- Establishment of a six megawatt diesel power generation plant;
- Establishment of the surface ROM pad;
- Construction and operation of a processing facility;
- Construction of diversion structures where required to intercept and redirect surface water flows around constructed landforms;
- Dewatering of open pits and underground mines;
- Open pit mining of the Kaolin, Harbour View/May and Flag deposits;

- Subsequent underground mining of the Harbour View and Flag deposits;
- Transport of waste rock from open pits and underground mines to construct surface WRL's, embankments for the TSF and other surface infrastructure;
- Tailings deposition in the TSF, including bunded tailings pipelines and return water lines to and from the processing plant;
- Backfilling or partial backfilling of available open pits in the latter stages of the Project where possible.

It is proposed that approximately 252 ha of land will be disturbed to accommodate the proposed activities at the Kundip Mine Site within a 366 ha development envelope.

Activities proposed to occur within the Myamba Mine Site include:

- clearing of soil and vegetation over relevant areas, and storage of this material in segregated stockpiles;
- construction of support office and workshop facilities;
- construction of an evaporation pond to accommodate dewatering ahead of open pit mining;
- open pit mining of the Trilogy oxide deposit;
- transport of waste rock from the open pit to a surface WRL; and
- transport of ore to a surface ROM pad ready for haulage via road trains to the Kundip Mine Site.

It is proposed that approximately 64 ha of land will be disturbed to accommodate the proposed activities at the Myamba Mine Site within a 150 ha development envelope.

Key impacts of the RGCP are expected to be associated with impacts to:

- **Flora and vegetation**
  Localised clearing will be undertaken, however, no direct impacts will occur to known conservation significant flora. With the implementation of comprehensive mitigation measures, impacts to conservation significant flora will be minimised and impact upon regional flora diversity is expected to be negligible.

- **Terrestrial fauna**
  The identification and protection of a Conservation Area, the establishment of a vegetation corridor and an increase in the net amount of vegetative cover within the RGCP area following rehabilitation will ensure that the impact on fauna distribution will be negligible. Contribution to regional fox control will aid in minimising predation from foxes due to fragmentation of the landscape. Current and future monitoring of conservation significant fauna will increase awareness and data available to assist with the conservation of these species into the future.

- **Terrestrial environmental quality**
  Potential contamination of groundwater and the terrestrial environment by hydrocarbons, dangerous goods, general domestic waste and metalliferous drainage will be mitigated through effective management. A network of monitoring bores will ensure early detection of contaminants in groundwater. Based line data will be established for comparison.

- **Landforms**
  Targeted mitigation measures will ensure local impacts from constructed landforms (i.e. open pits, underground mines, WRL's, TSF, ROM pads, water storage facilities and an evaporation pond) are minimised. All final landforms will be stable, non-polluting and integrated appropriately into the surrounding landscape.

- **Hydrological processes – surface water**
  Minor local disruption to surface water flow will occur within the RGCP area, however, appropriate placement of diversion structures will ensure flows are diverted around mining landforms and back into natural drainage lines. Mitigation measures combined with a water quality monitoring program will ensure the quality of downstream surface water bodies is maintained to an acceptable standard.

- **Hydrological processes – ground water**
  Although mine pits will disrupt local groundwater flows, there are no groundwater users or groundwater dependent ecosystems close enough to the RGCP that could be impacted by the changes to the groundwater flow system. Reduced groundwater levels during and post mining will not have a negative impact upon the health of local flora due to frequent reliable rainfall in the Ravensthorpe region. Furthermore, groundwater levels are anticipated to recover to natural levels post-mining.

- **Air quality and atmospheric gasses**
  The total Greenhouse Gas (GHG) emissions are not expected to exceed trigger values established by the Commonwealth & State GHG emission policies. Vegetation impacted by dust is expected to recover via natural regeneration. The overall impact to vegetation by dust will be minor at a local scale and insignificant at a regional scale.

- **Amenity**
  Activities proposed to occur within the Kundip Mine Site are not expected to increase impacts on amenity above the level of current impact from historical mining activities at the site.

- **Indigenous heritage**
  No impact to indigenous heritage is expected as no 'registered' Aboriginal sites or 'other heritage places' have been identified in the RGCP area.

- **Environmental heritage**
  Kundip Mine Site is expected to have an insignificant impact upon the Environmental Heritage value of the 30,000 ha Ravensthorpe Range Area. Particularly given vegetation units within the site are represented across 6,183.82 ha in the wider Ravensthorpe Range area.

- **Rehabilitation and closure**
  With the implementation of comprehensive mitigation measures and a mine closure plan (MCP), the post-mining landscape of the RGCP area is expected to support the same land uses and functions to that which existed pre-mining. Although minor localised impacts may result from the proposed activities, there is not expected to be any significant residual impacts to the environment from the RGCP.

This document has been prepared to support the referral in accordance with EAG 1 (EPA 2012), EAG 8 (EPA 2015), EAG 9 (EPA 2015a) and EAG 16 (EPA 2015b). This document is intended to inform and assist in determining the appropriate environmental assessment and approval pathway for the

proposed RGCP under Part IV of the *Environmental Protection Act 1986* (*EP Act*). The information provided within it is consistent with the Environmental Impact Assessment (Part IV Division 1 and 2) Administrative Procedures 2012.

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PROJECT TERMS

Abbreviation	Meaning
ACH	ACH Minerals Pty Ltd
RGCP	Ravensthorpe Gold/Copper Project
the Project	Includes the Kundip Mine Site and the Myamba Mine Site.

UNITS OF MEASURE

Unit	Measure
%	Percentage
°	Degree
°C	Degrees Celsius
a	Annum
bcm	Bank cubic metres
cm	Centimetre
GL	Gigalitre
g/L	Grams per litre
ha	Hectare
kg	Kilogram
kL	Kilo-litre
km	Kilometre
kVA	Kilovolt-amps
kW	Kilowatt
L	Litre
L/s	Litres per second
m	Metre
m^2	Metres squared
m^3	Metres cubed
m^3/d	Metres cubed per day
m/s	Metres per second
Mbcm	Million bank cubic metres
mbs	Metres below surface
mg/L	Milligram per litre
mg/m^3	Milligram per metres cubed
mm	Millimetre
MPa	Megapascal
Mt	Million tonnes
MVA	Megavolt-amps
MW	Megawatt
t	Tonnes

Unit	Measure
t/d	Tonnes per day
t/m^3	Tonnes per metres cubed
t/y	Tonnes per year
w/v	Weight per volume
w/w	Weight per weight (weight fraction)
µm	Micrometre
µg/L	Micrograms per litre
µS/cm	Microseconds per centimetre

LIST OF ABBREVIATIONS

Abbreviation	Meaning
AS/NZS	Australian Standard/New Zealand Standard
BoM	Bureau of Meteorology
CIL	Carbon-in-Leach
DMP	Department of Mines and Petroleum
DoE	Department of Environment
DPaW	Department of Parks and Wildlife
EGA	Environmental Assessment Guideline
EP Act	*Environmental Protection Act 1986*
AHIS	Aboriginal Heritage Inquiry System
AMD	Acid metalliferous drainage
ANC	Acid neutralising capacity
APM	Animal Plant Mineral
ARI	Average rainfall incidence
AS	Australian Standard
CEO	Chief Executive Officer
DAA	Department of Aboriginal Affairs
EC	Electrical conductivity
EIL	Ecological Investigation Level
EOP	Environmental Operations Procedure
EPA	Environmental Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
FRNP	Fitzgerald River National Park
Golder	Golder Associates
GCA	Graeme Campbell and Associates
GDP	Ground Disturbance Permit
GHG	Greenhouse Gas
GR	GR Engineering Services
GWLs	Ground water levels

Abbreviation	Meaning
ISRM	International Society of Rock Mechanics
IBCs	Intermediate Bulk Containers
ILUA	Indigenous Land Use Agreement
LFA	Landscape Function Analysis
MCP	Mine Closure Plan
MS	Ministerial Statement
MWH	MWH Global
NAF	Non-acid forming
NGER Act	*National Greenhouse and Energy Reporting Act 2007*
OEPA	Office of the Environmental Protection Authority
PAF	Potentially acid forming
PAW	Plant-available water
PEC	Priority Ecological Communities
PDWS	Public Drinking Water Source
PMST	Protected Matters Search Tool
RIWI Act	*Rights in Water and Irrigation Act 1914*
RO	Reverse Osmosis
Rockwater	Rockwater Pty Ltd
ROM	Run-of-Mine
SCNRMG	South Coast Natural Resource Management Group
Silver Lake	Silver Lake Resources Ltd
TDS	Total-Dissolved Solids
TEC	Threatened Ecological Communities
TOFR	Top of fresh rock
TSF	Tailings Storage Facility
WRL	Waste Rock Landform
WA	Western Australia

LIST OF ELEMENTS

Element/Compound	Meaning
Ag	Silver
As	Arsenic
Au	Gold
B	Boron
Bi	Bismuth
C	Carbon
Ca	Calcium
$CaCl_2$	Calcium chloride
Cd	Cadmium

Element/Compound	Meaning
Cr	Chromium
Cu	Copper
CO_3	Carbonate
H_2O	Water
H_2SO_4	Sulfuric acid
Mg	Magnesium
Mo	Molybdenum
Ni	Nickel
NaCl	Sodium chloride
Pb	Lead
S	Sulfur
Sb	Antimony
Se	Selenium
SO_4	Sulphate
Zn	Zinc

1 INTRODUCTION

1.1 BACKGROUND

The Kundip Mine Site and Myamba Mine Site form part of the Ravensthorpe Gold/Copper Project (RGCP) (the Project) located approximately 550 km southeast of Perth near Ravensthorpe. ACH Minerals Pty Ltd (ACH) purchased the Project from Silver Lake Resources Ltd (Silver Lake) on 15 July 2016. The former farm-in and joint-venture agreement held between the two parties allowed for ACH to acquire the project at any time during the earn in period.

Originally titled the Phillips River Project, the RGCP was referred to the WA Environmental Protection Authority (EPA) and the Commonwealth Department of Environment (DoE) in 2005. The DoE determined the Project to be "Not a Controlled Action". The State Minister for the Environment approved the Project in 2006 (Ministerial Statement (MS0716)), however, that approval lapsed in 2011 after the proponents failed to make a substantiative commencement on the project and declined to request an extension to the approval. As a consequence, a modified version of the Project is now being referred by new proponents ACH to the EPA for consideration.

This document has been prepared to support the referral in accordance with Environmental Assessment Guideline (EAG) 1 (EPA 2012), EAG 8 (EPA 2015), EAG 9 (EPA 2015a) and EAG 16 (EPA 2015b). This document is intended to inform and assist in determining the appropriate environmental assessment and approval pathway for the proposed RGCP under Part IV of the *Environmental Protection Act 1986* (*EP Act*). The information provided within it is consistent with the *Environmental Impact Assessment (Part IV Division 1 and 2) Administrative Procedures 2012*.

The RGCP is smaller in scale than the previously approved Phillips River Project. In the first instance, mining and processing of gold bearing ore will be focussed on proposed open-pits at Kundip Mine Site and a single, shallower open-pit within cleared pasture at Myamba Mine Site. Mining will also progress towards underground operations at the Kundip Mine Site. Processing will be contained within the Kundip Mine Site, negating the requirement for a haul road to traverse the adjacent proposed Nature Reserve, as was previously proposed in the Phillips River Proposal.

The scope of this EPA referral includes:

- Open pit mining of the Kaolin, Harbour View/May and Flag deposits and subsequent underground mining of the Harbour View and Flag deposits at Kundip Mine Site;
- Open pit mining of the Trilogy oxide deposit at Myamba Mine Site;
- Construction of processing facilities and processing at Kundip Mine Site;
- Construction of a Tailings Storage Facility (TSF) at Kundip Mine Site;
- Construction of an evaporation pond at Myamba Mine Site, incorporating water pipelines between Kundip and Myamba Mine Sites;
- Construction of surface water storage facilities and diversion structures at Kundip Mine Site;
- Construction of Waste Rock Landforms (WRL's) and Run-of-Mine (ROM) pads at both Kundip and Myamba Mine Sites; and
- Construction of support facilities (offices, workshops) at both Kundip and Myamba Mine Sites.

1.2 PROPONENT DETAILS AND LAND TENURE

ACH Minerals Pty Ltd is the owner of all tenements associated with the RGCP. The tenements to which this referral relates specifically are provided in Table 1-1, with company details provided below.

Project Owner/Operator: ACH Minerals Pty Ltd

Physical Address: Suite 15, 11 Ventnor Avenue, West Perth, WA 6005

Postal Address 1: PO Box 470, West Perth, WA 6872

Table 1-1: Tenements of the RGCP

Mine Site	Tenement	Commenced	Expiry	Area (ha)
Kundip	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	82.84
	M74/135	19/12/2000	18/12/2021	9.16
	M74/180	08/04/2009	07/04/2030	1.62
	L74/34	03/07/2009	02/07/2030	1.70
	L74/45	16/04/2009	15/04/2030	15.62
			TOTAL	634.03
Myamba	M74/176	03/08/2005	02/08/2026	936.15
	L74/35	23/11/2005	22/11/2026	2.87
			TOTAL	939.02

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Sharon Arena

Principal Environmental Adviser - Animal Plant Mineral

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1.3 LOCATION

The RGCP is located in the Goldfields-Esperance region of Western Australia (WA) approximately 550 km southeast of Perth (see Figure 1-1). The Kundip Mine Site is situated approximately 17 km southeast of the town of Ravensthorpe and can be accessed from the Hopetoun-Ravensthorpe Road. The Myamba Mine Site is a further 9 km south of the Kundip Mine Site and is also accessed *via* the Hopetoun-Ravensthorpe Road. The southern boundary of the Myamba Mine Site adjoins the Jerdacuttup Road, which runs eastwards from the Hopetoun-Ravensthorpe Road.

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Ravensthorpe

Kundip

Myamba

Kalumburu
Wyndham
Kununurra
Lake Argyle
Derby
Broome
Fitzroy Crossing
Halls Creek
NT
Port Hedland
Barrow Island
Karratha
Roebourne
Marble Bar
Onslow
Exmouth
Nullagine
Tom Price
Paraburdoo
Newman
Carnarvon
Giles
Denham
Meekatharra
WA
Kalbarri
Leinster
Geraldton
Morawa
Leonora
SA
Moôra
Kalgoorlie-Boulder
Mundrabilla
Forrest
Merredin
Wanneroo
Perth
Eucla
Madura
Norseman
Caiguna
Border Village
Mandurah
Narrogin
Lake Grace
Bunbury
Collie
Katanning
Ravensthorpe
Busselton
Esperance
Margaret River
Augusta
Manjimup
Albany

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Figure 1-1: Ravensthorpe Gold/Copper Project Location Plan

Legend

Ravensthorpe Gold/Copper Project Tenements

Major roads

animal plant mineral

ACH

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ems@animalplantmineral.com.au

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1.4 IMPLEMENTATION SCHEDULE

ACH aims to have substantially commenced mining within one year of the date of this referral. The resource identified within the Kundip Mine Site is sufficient to undertake open pit mining of the Kaolin, May and Flag deposits for an initial duration of seven years. Underground mining of Harbour View and Flag deposits will commence concurrently from the second year of mine life and will continue for a duration of five-to-six years. Sufficient resource has been identified within the Myamba Mine Site to undertake open pit mining of oxide components of the Trilogy deposit for an initial duration of 1 year.

There exists potential to further develop resources within the RGCP area following additional exploration drilling. It is predicted there would be sufficient resource to extend the Project life to in excess of ten years.

2 THE PROPOSAL

2.1 KEY PROPOSAL CHARACTERISTICS

The RGCP will occur in two distinct locations, Kundip Mine Site and Myamba Mine Site. A summary of the proposal is provided in Table 2-1.

Mining activities (elements) proposed for Kundip Mine Site and Myamba Mine Site are provided as Figure 2-1 and Figure 2-2 respectively.

Areas of estimated disturbance are provided in Table 2-2 for physical elements of the Project; Table 2-3 details operational elements of the Project.

Table 2-1: Summary of the Proposal

Proposal Title	Ravensthorpe Gold/Copper Project
Proponent Name	ACH Minerals Pty Ltd
Short Description	The RGCP was referred to the EPA for assessment as the Phillips River Project in 2005. The proposal was approved by the EPA on 22 March 2006. The approval (MS0716) lapsed in 2011 after the proponents (Silver Lake) failed to make substantiative progress on the Project and declined to request an extension to the approval. As a consequence the Project, which is now smaller in scale than previously proposed, is being referred by new proponents (ACH) to the EPA for consideration. *Background* The RGCP will occur in two distinct locations: Kundip Mine Site and Myamba Mine Site. Kundip Mine Site will host open pits and underground mining coupled with a processing plant, office and workshop facilities, water storage facilities, ROM pad, waste rock landforms (WRL's) and a TSF. Myamba Mine Site, located approximately 7 km to the south of Kundip, will host a single open pit (Trilogy oxide pit) to extract the gold-silver-oxide cap; the pit will be of a low-strip-ratio. An associated evaporation pond, WRL, ROM pad, support office/workshop and designated magazine, will also be established at the site. The existing exploration offices will provide additional support facilities. *Overview of Kundip Mine Site* Mining of ore at Kundip will be by conventional open pit and underground mining methods. Open pit mining, and to a lesser degree underground mining, will generate waste rock which will be contained in the proposed WRL's within the Kundip Mine Site. Treatment of ore will take place at a processing facility to be located within the Kundip Mine Site. Waste product generated from the processing of ore (tailings) will be contained within the proposed TSF landform at the Kundip Mine Site. Development within the Kundip Mine Site will comprise the following: - clearing of soil and vegetation over relevant areas, and storage of this material in segregated stockpiles; - construction of office, workshop and processing plant facilities; - establishment of a six megawatt (MW) diesel power generation plant; - establishment of the surface ROM pad; - construction and operation of a processing facility comprising crushing and grinding

circuits, gravity concentration, gravity separation, concentrate dewatering and storage, processed depending on ore type via (a) A carbon-in-leach (CIL) plant involving gold leaching, an elution circuit and a gold room for electro winning and smelting of gold; and (b) A flotation circuit involving copper flotation, followed by cleaning, concentrating and filtering of copper concentrate.
- construction of diversion structures where required to intercept and redirect surface water flows around constructed landforms;
- dewatering of open pits and underground mines;
- open pit mining of the Kaolin, Harbour View/May and Flag deposits;
- subsequent underground mining of the Harbour View and Flag deposits;
- transport of waste rock from open pits and underground mines to construct surface WRL's, embankments for the TSF and other surface infrastructure;
- Tailings deposition in the TSF, including bunded tailings pipelines and return water lines to and from the processing plant;
- backfilling or partial backfilling of available open pits in the latter stages of the Project where possible.

The existing plans have been based on technical studies and assessment of the currently known resources. Whilst the extent of the existing open pit mineable ore is constrained by both drilling and the economic limits of the relevant input parameters, especially commodity price levels, the sources of underground ore are not closed off at depth or along strike. As such there is the potential for these workings to extend beyond the current envisaged timeline. Any changes to the constraining parameters for open pit footprints, in particular commodity price levels, could also result in future expanded open pit mining, which would be subject to further environmental assessment at that time.

Overview of Myamba Mine Site

At the Myamba Mine Site, oxide ore will be mined by open pit methods at the Trilogy oxide deposit only. Waste rock generated will be contained in a surface WRL. Ore will be trucked by road trains *via* the Hopetoun-Ravensthorpe Road to the processing facility at Kundip Mine Site.

Development within the Myamba Mine Site will comprise the following:

- clearing of soil and vegetation over relevant areas, and storage of this material in segregated stockpiles;
- construction of support office and minor workshop facilities;
- construction of an evaporation pond to accommodate dewatering ahead of open pit mining;
- open pit mining of the Trilogy oxide deposit;
- transport of waste rock from the open pit to a surface WRL; and
- transport of ore to a surface ROM pad ready for haulage via road trains to the Kundip Mine Site.

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M 74/53

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Kundip Mine Site		
ID	**Element**	**Proposed Extent**
1	Open pit mine - Kaolin deposit	Clearing approximately 66 ha within the 366 ha Kundip development envelope.
2	Open pit mine and underground mine - Harbour View/ May deposits	
3	Open pit mine and underground mine - Flag deposit	
4	Process plant	Clearing approximately 13 ha within the 366 ha Kundip development envelope.
5	Waste Rock Landform - North-West	Clearing approximately 75 ha within the 366 ha Kundip development envelope.
6	Waste Rock Landform - South-East	
7	Tailings Storage Facility	Clearing approximately 39 ha within the 366 ha Kundip development envelope.
8	ROM pad	Clearing approximately 7 ha within the 366 ha Kundip development envelope.
9	Workshop	Clearing approximately 1 ha within the 366 ha Kundip development envelope.
10	Offices	Clearing approximately 1 ha within the 366 ha Kundip development envelope.
11	Water Storage/Transfer Facilities	Clearing approximately 29 ha within the 366 ha Kundip development envelope.
12	Magazine	Clearing approximately 1 ha within the 366 ha Kundip development envelope.
13	Haul/Internal roads	Clearing approximately 16 ha within the 366 ha Kundip development envelope.
14	Water and power corridor	Clearing approximately 4 ha within the 366 ha Kundip development envelope.

Figure 2-1: Kundip Mine Site proposed physical and operational elements

Legend

- *Development Envelope*
- *Proposed Conservation Reserve*
- Tenements

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ems@animalplantmineral.com.au

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Existing support infrastructure

Myamba Mine Site		
ID	**Element**	**Proposed Extent**
1	Evaporation pond	Clearing approximately 24 ha within the 150 ha Myamba development envelope.
2	Open pit mine - Trilogy oxide deposit	Clearing approximately 7 ha within the 150 ha Myamba development envelope.
3	Waste Rock Landform - Trilogy	Clearing approximately 15 ha within the 150 ha Myamba development envelope.
4	ROM pad	Clearing approximately 3 ha within the 150 ha Myamba development envelope.
5	Office and minor workshop	Clearing approximately 1 ha within the 150 ha Myamba development envelope.
6	Internal site roads	Clearing approximately 6 ha within the 150 ha Myamba development envelope.
7	Haul roads	Clearing approximately 7 ha within the 150 ha Myamba development envelope.
8	Magazine	Clearing approximately 1 ha within the 150 ha Myamba development envelope.

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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Figure 2-2: Myamba Mine Site proposed physical and operational elements

Legend

Development Envelope

Tenements

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Table 2-2: Physical Elements of the Proposal

Element	Reference Name	Location	Proposed Extent
KUNDIP MINE SITE			
Open pit mine – Kaolin deposit	1	Figure 2-1	Clearing of approximately 66 ha for proposed open pit mines within the 366 ha Kundip development envelope. No clearing required for underground mines, access from existing open pit related disturbance area.
Open pit mine and underground mine - Harbour View/May deposit	2	Figure 2-1	
Open pit mine and underground mine - Flag deposit	3	Figure 2-1	
Process Plant	4	Figure 2-1	Clearing of approximately 13 ha within the 366 ha Kundip development envelope.
WRL – North-West	5	Figure 2-1	Clearing of approximately 75 ha within the 366 ha Kundip development envelope.
WRL – South-East	6	Figure 2-1	
TSF	7	Figure 2-1	Clearing of approximately 39 ha within the 366 ha Kundip development envelope.
ROM pad	8	Figure 2-1	Clearing of approximately 7 ha within the 366 ha Kundip development envelope.
Primary Workshop	9	Figure 2-1	Clearing of approximately 1 ha within the 366 ha Kundip development envelope.
Primary Offices	10	Figure 2-1	Clearing of approximately 1 ha within the 366 ha Kundip development envelope.
Water Storage/Transfer Facilities	11	Figure 2-1	Clearing of less than 29 ha within the 366 ha Kundip development envelope. The water storage facility to the west will incorporate an existing dam, therefore, the area to be cleared will be less than 29 ha (the total area of the two water storage facilities and transfer facilities).
Magazine	12	Figure 2-1	Clearing of approximately 1 ha within the 366 ha Kundip development envelope.
Haul/Internal roads	13	Figure 2-1	Clearing of approximately 16 ha within the

Element	Reference Name	Location	Proposed Extent
			366 ha Kundip development envelope.
Water and power corridor	14	Figure 2-1	Clearing of approximately 4 ha within the 366 ha Kundip development envelope.
MYAMBA MINE SITE			
Evaporation pond	1	Figure 2-2	Clearing of approximately 24 ha within the 150 ha Myamba development envelope.
Open pit mine – Trilogy oxide deposit	2	Figure 2-2	Clearing of approximately 7 ha within the 150 ha Myamba development envelope.
WRL	3	Figure 2-2	Clearing of approximately 15 ha within the 150 ha Myamba development envelope.
ROM pad	4	Figure 2-2	Clearing of approximately 3 ha within the 150 ha Myamba development envelope.
Office and minor workshop	5	Figure 2-2	Clearing of approximately 1 ha within the 150 ha Myamba development envelope.
Internal site roads	6	Figure 2-2	Clearing of approximately 6 ha within the 150 ha Myamba development envelope.
Haul roads	7	Figure 2-2	Clearing of approximately 7 ha within the 150 ha Myamba development envelope.
Magazine	8	Figure 2-2	Clearing of approximately 1 ha within the 150 ha Myamba development envelope.

Table 2-3: Operational Elements of the RGCP

Element	Reference No.	Location	Proposed Extent
KUNDIP MINE SITE			
Open Pits		Open Pits Figure 2-1	Kaolin Pit - Approximately 900 m long with a NE-SW axis, up 400 m wide at its max with a typical average width of 300 m and 115 m deep. Harbour View Pit - Approximately 260 m long, 135 m wide and 52.50 m deep. May Pit - Approximately 140 m long, 120 m wide and 52.50 m deep. Flag Pit

Element	Reference No.	Location	Proposed Extent
			- Approximately 550 m long, 80-105 m wide and 46 m deep.
Dewatering		Open Pits Figure 2-1	Dewatering rates will vary between pits: Kaolin pit - 0.011 GL/a Harbour View/May pit – 0.009 GL/a Flag pit - 0.037 GL/a All mine dewater will be used in processing or discharged via the evaporation pond at Myamba Mine Site.
Mining Waste		WRL Figure 2-1	12.30 Mbcm.
Ore Processing		Processing Plant Figure 2-1	3.20 Mt of ore.
Ore Processing Waste		TSF Figure 2-1	Total storage capacity of 2.30 Mbcm.
Power Supply		Processing Plant Figure 2-1	Six 1.0 MW diesel generators.
Underground Mine		Underground Mine Figure 2-1	Harbour View Mine - Shoots developed over an approximate 750 m strike length, 2 - 10 m wide and up to 200 m deep down plunge. Flag Mine - Shoots developed over an approximate 500 m strike length, 2 – 5 m wide and up to 200 m deep down plunge.
MYAMBA MINE SITE			
Open Pit		Open Pit Figure 2-2	Trilogy oxide pit - Approximately 155 m long, 155 m wide and 45 m deep.
Dewatering		Open Pit Figure 2-2	Extraction of approximately 0.0018 GL/a. Mine dewater to be directed to a designated evaporation pond. Stored water will be pumped via a return pipeline to the Kundip Mine Site as required, for use in processing.
Mining Waste		WRL Figure 2-2	0.23 Mbcm

2.2 PROJECT OVERVIEW

2.2.1 Mining

2.2.1.1 Kundip Mine Site

The Kundip Mine Site is host to a number of different deposits all similar in style and structural setting, but arranged in a variety of orientations from vertical, to gently dipping at around 15 degrees. Initially mining will occur via conventional drill and blast open pit methods. Mining at Kundip Mine Site will generate three open pits: Kaolin, Flag and Harbour View/May. Flag will also be mined via underground mining methods, as will the Harbour View deposits.

Access to the northern end of the Harbour View line is intended to be via the final wall of the southeast portion of the Kaolin open pit. The southern and central portions of the Harbour View system will be accessed from the May portion of the Harbour View/May open pit. Flag will be accessed from the small Flag open pit.

Underground mines will be entered *via* a decline gradient of approximately 1:7. Ore bodies will be mined *via* a combination of long-hole stoping and handheld stoping. Pillars will be left to support the mined areas. The existing Flag shaft and select examples of the historic Harbour View shafts will be intersected with mine development and may be used for ventilation and emergency egress.

Open pit and underground mining will be carried out on a labour and equipment hire basis. There is sufficient resource identified within the Kundip Mine Site to undertake open pit mining for an initial duration of seven years. Underground mining will commence concurrently from the second year of mine life and will continue for a duration of five-to-six years.

Ore will be trucked to the designated ROM Pad at the processing facility. Where viable, pits will be preferentially backfilled; however, the current mining schedule does not allow many opportunities for backfilling and the majority of waste rock is expected to be trucked and deposited at the proposed WRL's or TSF for use in embankment construction.

The proposed pit shells for the Harbour View/May and Flag deposits are smaller than the initially proposed Phillips River Project and reflect a scaled back open pit/boxcut approach to accessing the fresh sulphide material. It is estimated there will be approximately 4.5 - 5.0 Mbcm less waste volume, approximately 460 kt less ore, and 0.3 Mbcm less tailings to store.

2.2.1.2 Myamba Mine Site

Myamba Mine Site currently hosts two deposits, Trilogy and Queen Sheba. The Trilogy deposit is a combination of a gold-silver oxide cap above a polymetallic Cu-Au-Ag-Pb-Zn deposit, hosted within fresh Proterozoic rock below. The Queen Sheba deposit is a gold-silver structural lode deposit. Currently ACH are not intending to mine Queen Sheba or the Pb-Zn elements of the Trilogy deposit.

The satellite Trilogy deposit will be mined to form a small, low strip ratio pit. The gold-silver cap will be removed using a hydraulic excavator and rear dump trucks. Although Cu-Au-Ag ore is known to occur within fresh rock at the Trilogy deposit, extraction of this combination ore is not currently proposed. ACH have no plans to mine Pb-Zn ore from the Trilogy deposit.

Dewatering from the Trilogy oxide pit will occur at a rate of 5 m^3/d. An evaporation pond will be constructed to accommodate dewater from the Trilogy oxide pit, as well as Kundip Mine Site, prior to commencement of mining. Transport of mine pit water will be via an overland bunded pipeline

connecting between the Kundip Mine Site and the Myamba Mine Site evaporation pond. Once processing commences all mine dewater from Kundip pits will be used in processing operations, with top-up water provided from the Myamba evaporation pond as required. Transport of water from Myamba Mine Site to Kundip Mine Site will be via a return pipeline along L74/45. The evaporation pond at Myamba will be available to discharge water from Kundip Mine Site should the need arise. Consultation will be undertaken with Main Roads WA to seek approval for the construction of the pipelines adjacent to the Hopetoun-Ravensthorpe Road.

All ore extracted from the Trilogy oxide pit will be placed at a short term ROM pad at Myamba Mine Site prior to haulage to the processing facility at Kundip Mine Site. Ore will be transported via road trains on the public Hopetoun-Ravensthorpe Road.

2.2.2 Waste Rock Landform Design/Location

Golder Associates (Golder), in conjunction with Dump Solver, have prepared a concept design for the construction of the proposed WRL's and TSF within the Kundip Mine Site (see Appendix 1).

2.2.2.1 Kundip Mine Site

The feasibility level technical assessment by Golder/Dump Solver (2016) provides a concept for the design and location of the two proposed WRL's to manage waste rock. The following constraints were considered when selecting a suitable location.

- Waste must not be placed within 40 m of main pit shells for proposed Kaolin, Harbour View/May and Flag open pits; except for shallow excavations northeast and south of Harbour View/May pit, which will be available for dumping. An evaluation was conducted into the potential for backfilling of the Kaolin pit and it was concluded that this is unlikely to be technically viable due to current scheduling constraints on ore and waste mining.
- The conservation area to the north of Kaolin pit must not be impacted.
- Waste must be placed within the Project area (i.e. leases currently owned by ACH).
- Waste deposition must not impact directly upon the Railway Heritage Walk Trail or the historic Kundip Battery (both situated to the west of the proposed pits).
- Waste must not be placed further south or west of the proposed Harbour View/May pit.
- Waste generated from the Harbour View/May and Flag pits must be placed into a single WRL to minimise the overall disturbance footprint.
- The location of water storage facilities previously proposed by Coffey (2011) and incorporated into the conceptual mine layout must be maintained.

Given the constraints outlined above Golder/Dump Solver (2016) recommended two separate WRL's be established, one to the west of Kaolin pit and one to the east of Harbour View/May pit (see Figure 2-3).

The proposed WRL's will together have an estimated disturbance footprint of 75 ha. The northern WRL will have a maximum height of 1020 m RL, and the eastern WRL a maximum height of 1030 m RL, consistent with the surrounding topography. The WRL's will be developed with 10 m lifts, with material placed at the angle of repose, and a berm width of approximately 22 m. The design is based upon a conservative post rehabilitation slope of 16˚. The relatively flat batters will improve

the stability of the landforms; construction materials and the strength of the foundation will also have an effect on stability. The overall stability of the landforms will be further investigated.

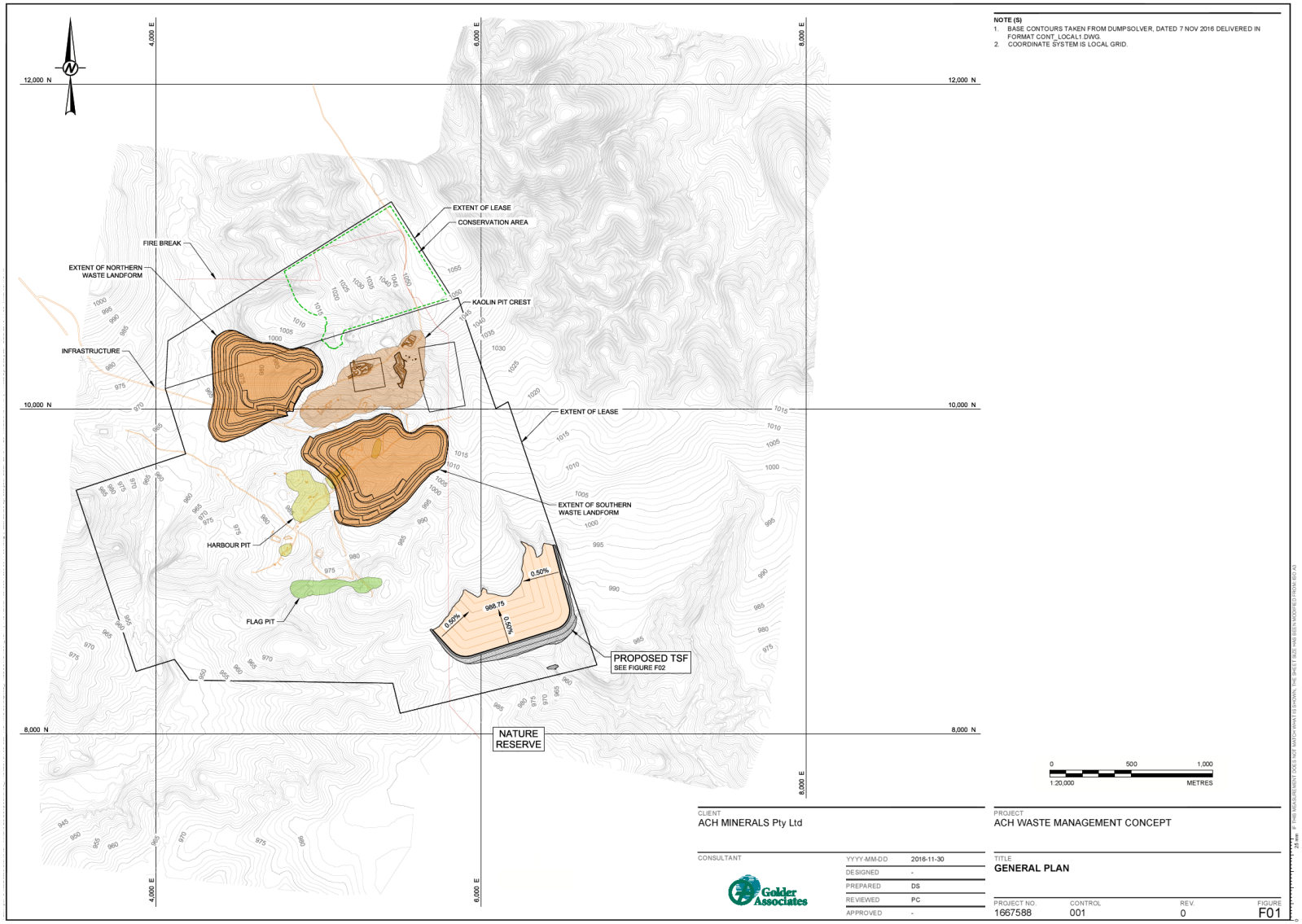

Figure 2-3: Proposed WRL and TSF locations (copy of Figure 1 in Golder/Dump Solver (2016) report, see Appendix 1)

2.2.2.2 Myamba Mine Site

One WRL will be established at the Myamba Mine Site (see Figure 2-2). The WRL will be situated west of the Trilogy oxide pit, outside of known ore resources to prevent potential sterilisation of these resources. The proposed WRL will be developed with 10 m lifts, with material placed at the angle of repose, and a berm width of approximately 5 m. The design is based upon a post rehabilitation slope of 18˚. WRL embankments will not exceed a maximum height of 30 m.

2.2.3 Ore Processing

The RGCP processing facility will be designed to process ore from the Kundip deposits and the satellite Trilogy deposit at Myamba Mine Site. The RGCP deposits consist of ore types amenable to industry standard conventional processing routes. The Kundip deposits host Au-Cu ore with varying levels and oxidisation states of Cu, while the Trilogy satellite deposit hosts a precious metal oxide ore cap containing low Cu grades.

The processing plant will be designed with two distinct operating modes. The mode used will depend on the type of ore being treated. Oxide ore with a low Cu content will be treated at a nominal throughput of 500,000 t/y using a conventional CIL plant to recover Au as bullion. Sulphide ores will be treated at a nominal throughput of 250,000 t/y through a conventional froth flotation plant to produce a Cu-Au concentrate.

Ore will be delivered to a ROM pad and fed into a 50 t ROM bin by a front end loader. The ore will then be crushed to 100% passing 12 mm by a conventional three stage crushing circuit. The circuit will compromise the following:

- A 1000 mm x 760 mm jaw crusher as the primary crusher;
- A 940 mm diameter standard head cone crusher as the secondary crusher; and
- A 940 mm short head cone crusher as the tertiary crusher.

The cone crushers will be closed circuit with a 2.4 m x 6.1 m double deck vibrating screen.

Dust suppression sprays and enclosed transfer chutes will be used through the crushing circuit to minimise dust emissions.

Product from the crushing circuit will be conveyed to the 1500 t fine ore bin. The fine ore bin will be fitted with an open door rill to provide a means to empty the bin for maintenance purposes. This will also provide a means to feed the grinding circuit during an extended shut down of the crushing circuit.

Ore will be reclaimed from the fine ore bin by a belt feeder and delivered to the single stage 3.4 m diameter (inside shell) x 5.2 long (effective grinding length) ball mill that will be fitted with a 900 kW motor. The ball mill will be in closed circuit with 250 mm diameter cyclones. The ball mill will grind the ore to 80% passing 75 um. A portion of the cyclone underflow will be directed to a gravity circuit to recover gravity recoverable gold. The gravity circuit concentrate will be treated by intensive cyanidation and electrowinning to produce gold bullion after smelting. Cyclone overflow will be screened by trash screen and the undersize will be directed to either the CIL plant or the flotation plant depending on the ore type.

2.2.3.1 Carbon-in-Leach Circuit

For low Cu oxide ores the cyclone overflow will be approximately 40% solids and will be directed to a leaching circuit comprising three 300 m^3 agitated leach tanks in series. The ore will be dosed with sodium cyanide and lime to leach the cyanide soluble gold. To assist the leaching kinetics oxygen will be injected into each leach tank. After leaching the pulp will pass through six 300 m^3 CIL tanks. Each CIL tank will have approximately 10 g/L of carbon. The carbon will be advanced counter-current to the pulp by air lifts. Loaded carbon from the first tank will be recovered over a loaded carbon screen and directed to the elution circuit. The pulp from the last CIL tank will be directed to cyanide detoxification.

The elution circuit will be a split AARL circuit with a 2 t acid wash and a 2 t elution column. Gold in the pregnant solution from the elution circuit will be recovered by electrowinning and will then be smelted to produce gold bullion. The barren carbon from the elution circuit will be thermally regenerated by a kiln prior returning it to the last tank in the CIL circuit.

Tailings from the CIL circuit will undergo cyanide detoxification using the air – sulphur dioxide process. This will consist of two 150 m^3 agitated tanks, in which the slurry will be dosed with sodium metabisulphite and lime to break down the WAD cyanide. After cyanide detoxification the slurry will be directed to a 13 m diameter high rate thickener. Tailings will be thickened to approximately 60% solids prior to pumping to the TSF, located in the south eastern corner of the Kundip Mine Site. Water recovered from the tailings thickener will be recycled to the process water pond. Water in the supernatant pond at the TSF will be returned to the process water pond by a pump.

2.2.3.2 Flotation Circuit

For Cu sulphide ores the cyclone overflow will be approximately 30% solids and will be directed to a rougher flotation circuit consisting of five 20 m^3 tank cells. Flotation reagents will be added to recover the Cu minerals to the concentrate. The concentrate from the roughing circuit will be directed to the cleaning circuit. The cleaning circuit will consist of five 1.5 m^3 conventional cells. Both the tailings from the rougher and the cleaner flotation cells will be directed to the tailings thickener for thickening to approximately 60% solids prior to being pumped to the TSF. The concentrate from the Cu cleaners will be re-ground in a 132 kW stirred bead mill to further liberate the Cu minerals. The regrind mill product will be directed to the Cu re-cleaners for a final stage of cleaning. The re-cleaning circuit will consist of five 1.5 m^3 conventional cells. Concentrate from the re-cleaners will be directed to the 5 m diameter high-rate thickener. The tailings from the re-cleaning circuit will be recycled to the Cu cleaning circuit.

Cu concentrate will be thickened to approximately 65% solids in the concentrate thickener. The overflow from the concentrate thickener will be recycled to the process water pond. The thickened Cu concentrate will be pumped to a 50 m^3 agitated concentrate storage tank. The Cu concentrate will then be filtered using an 18 chamber recessed plate filter with 1,500 mm x 1,500 mm plates. The filter cake will be discharged into a concentrate storage shed for shipment off site in bulk. The filtrate from the filter will be returned to the concentrate thickener.

2.2.3.3 Reagents

Reagents proposed to be used in processing are described below:

Sodium cyanide - *gold leaching reagent and elution reagent*

Will be delivered to site in 1000 kg bulk boxes and will be mixed as a 10% w/v solution in a 20 m^3 agitated mixing tank and transferred to a 40 m^3 storage tank as required for use in the process.

Quick lime - *pH modifier and cyanide detoxification reagent*

Will be delivered to site in bulk (70 t) and will be stored in a 100 t silo. A 20 t/d lime slaking plant will convert this to a hydrated lime slurry at 20% w/w. This slurry will be stored in a 20 m^3 agitated tank for use in the process.

Oxygen - *gold leaching agent and cyanide detoxification agent*

Will be delivered to site in bulk and will be stored in a 42 kL vessel on site for use in the process.

Carbon - *gold adsorption agent*

Will be delivered to site in 500 kg bulk bags. These will be added to the CIL circuit as required.

Sodium hydroxide (50% w/w) - *intensive cyanidation and elution reagent*

Will be delivered to site in bulk (20 t) and stored in a 30 m^3 storage tank for use in the process.

Hydrochloric acid (30% w/w) - *carbon acid washing*

Will be delivered to site in bulk (20 t) and stored in a 30 m^3 storage tank for use in the process.

Nitric acid (70% w/w) - *acid washing step in the intensive cyanidation process*

Will be delivered to site in 1000 L Intermediate Bulk Containers (IBCs). These will be transferred into a 1.5 m^3 storage tank as required for use in the process.

LPG - *fuel for the elution heater, carbon regeneration kiln and smelting furnace*

Will be delivered to site in bulk and will be stored in a 7.5 kL gas bullet for use in the process.

Sodium metabisulphite - *cyanide detoxification reagent and flotation reagent*

Will be delivered in bulk (20 t) as a 35% w/v solution. It will be stored in a 50 m^3 storage for use in the process.

Potassium amyl xanthate - *flotation reagent*

Will be delivered to site in 850 kg bulk bags and will be mixed as a 10% w/v solution in a 10 m^3 agitated mixing tank and transferred to a 20 m^3 storage tank as required for use in the process.

Cytec 9810 - *flotation reagent - dithiophoshate*

Will be delivered to site in 1000L IBCs. These will be transferred into a 1.5 m^3 storage tank as required for use in the process.

Sodium hydrosulphide - *flotation reagent*

Will be delivered to site in 1200 kg bulk bags and will be mixed as a 10% w/v solution in a 12 m^3 agitated mixing tank and transferred to a 24 m^3 storage tank as required for use in the process.

MIBC - *flotation reagent*

Will be delivered to site in 1000L IBCs. These will be transferred into a 1.5 m^3 storage tank as required for use in the process.

Flocculant - *settling agent for thickening*

Will be delivered to site in 25 kg bags. It will be mixed as a 0.25% w/v solution for use in the process.

Figure 2-4 provides a process flow diagram for the RGCP prepared by GR Engineering Services (GR) (2016). The full report by GR (2016) which contains capital and operating cost estimates for the RGCP, as well as additional detail on proposed ore processing, is provided as Appendix 2.

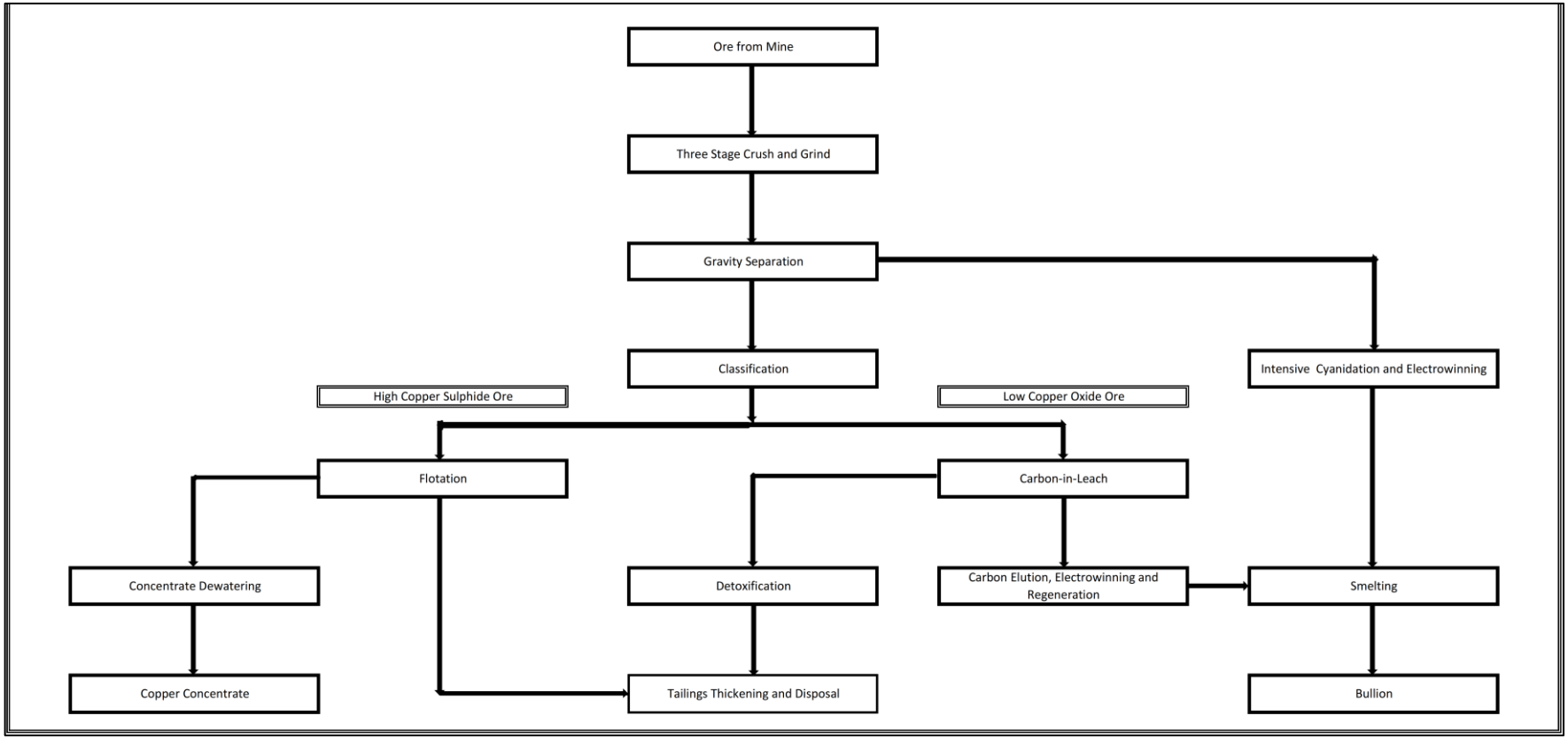

Figure 2-4: Ravensthorpe Gold/Copper Project process flow diagram

2.2.4 Tailing Storage Facility

The feasibility level technical assessment by Golder/Dump Solver (2016) provides a concept for the design and location of the proposed TSF within the Kundip Mine Site to manage tailings waste.

When choosing an appropriate location and design for the TSF to minimised potential impacts to the environment, Golder/Dump Solver (2016) took into consideration the following factors:

- Suitable geotechnical conditions;
- Avoidance of potentially mineralised areas;
- Integration with the surrounding topography to reduce the potential for erosion;
- The requirement of surface water diversion structures to direct flows around constructed landforms;
- Avoidance of areas of cultural importance; and
- Avoidance of impact to known conservation significant flora and fauna.

With these factors in mind, as well as the constraints outlined in Section 2.2.2.1 above, it is proposed a cross-valley TSF be constructed south of Flag pit, in the south eastern corner of the Kundip Mine Site (see Figure 2-3). Locally borrowed material will be used to provide sufficient capacity to retain process tailings for the anticipated LOM. The TSF will provide storage capacity for 2.3 Mm^3 of tailings waste (see Figure 2-5 for the proposed TSF layout).

Tailings slurry will be deposited at an estimated beach slope of 0.5%[2] or 1V:200H, allowing a 300 mm operational freeboard, with deposition occurring primarily from the confining embankment constructed across the valley. Deposition from the embankment is expected to result in the supernatant pond being located at the head of the two valleys, as indicated in Figure 2-5, providing sufficient freeboard to contain the 1 in 100-year, 72-hour rainfall event in line with DMP guidance (see Appendix 1 for further information). The concept assumes that the embankment would be constructed using the downstream raise approach, or constructed as a single embankment prior to commencement of operations, depending on availability of local materials and therefore waste scheduling from the pits.

Deposition from the embankment will result in the supernatant pond being remote from the embankment. Such placement will reduce risks associated with embankment instability, overtopping and seepage; and also provide the opportunity to raise the TSF upstream should this be viable at a later date.

Water will be collected from the TSF, by pumps located on the supernatant ponds or on fixed towers, and returned to the processing plant for reuse in the circuit. The TSF will be unlined and hence a seepage collection facility has been incorporated downstream of the main embankment to mitigate against the risk of seepage. The seepage collection facility can also be utilised as a temporary decant pond if required.

The confining embankment will be conservatively constructed with a slope of 1V:3H at approximately 18˚. The relatively flat batters will allow the slopes to be trafficked during closure, and are likely to provide a satisfactory factor of safety against instability, depending on the available construction materials and the strength of the foundation. Stability analysis will be undertaken as part of future studies to confirm this.

The proposed 10 m crest width will provide sufficient room for a tailings delivery pipe (safety barrier) on the upstream crest margin, a safety windrow on the downstream crest margin, and vehicle traffic

along the crest. A cross section of the proposed TSF design is provided as Figure 3 in Appendix 1. Refinements to the geometry of the confining embankment and hence the volume of fill required, will be made during the final stages of design.

The maximum embankment height will be approximately 23 m, resulting in the TSF being classified as a Category 1 facility under the Department of Mines and Petroleum (DMP) *Code of Practice: Tailings Storage Facilities in Western Australia* (2013). It is anticipated the TSF will have a low to medium hazard rating.

Tailings characterisation is described in Section 3.5 below.

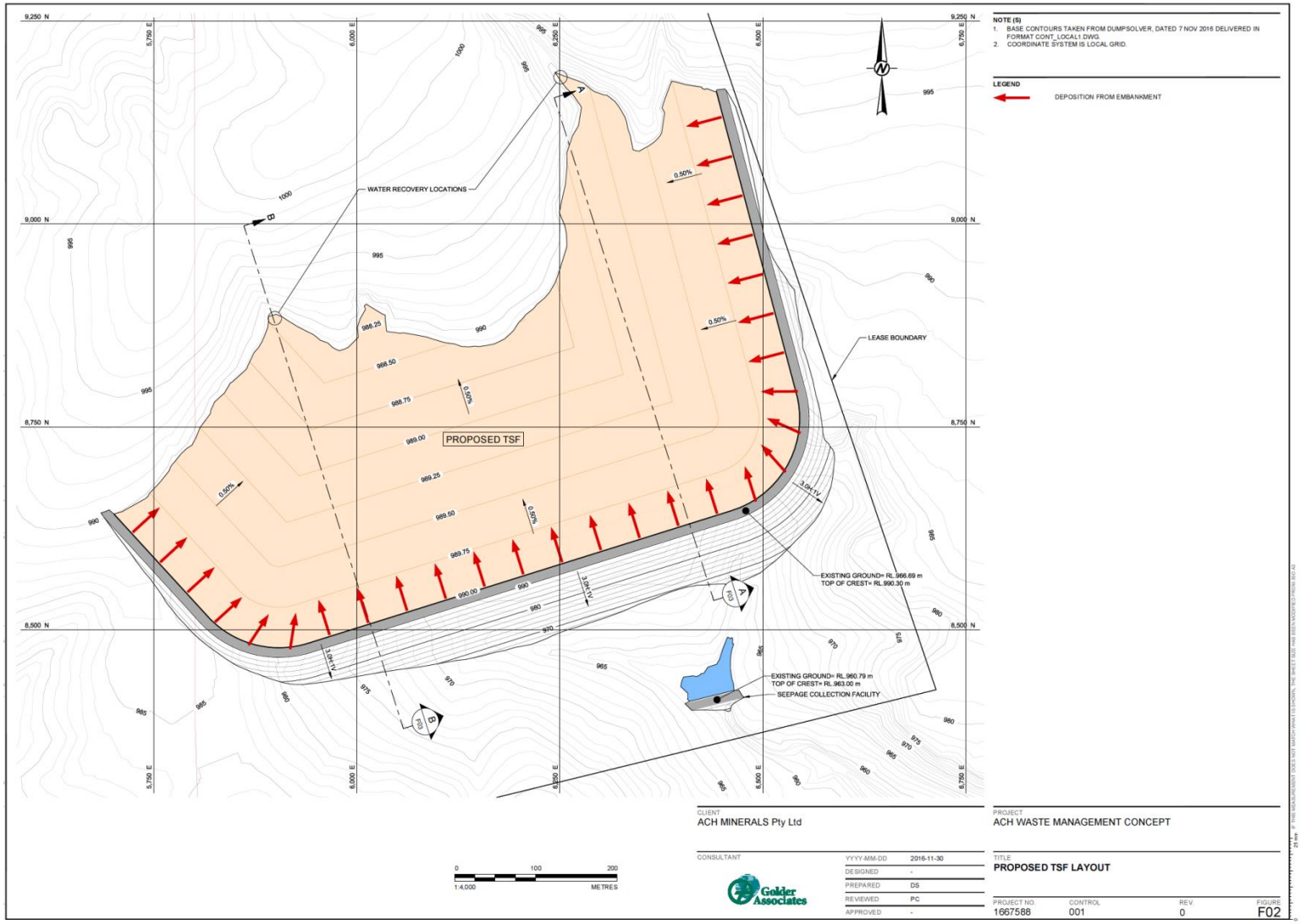

Figure 2-5: Proposed TSF layout (copy of Figure 02 in Golders/Dump Solver (2016) report, see Appendix 1)

2.3 PROPOSED LAND DISTURBANCE

Estimated total land disturbance required for development of the RGCP is approximately 316 ha. Indicative disturbance for key components of the RGCP within the Kundip and Myamba Mine Sites are provided in Table 2-4.

Table 2-4: Estimated Disturbance for Key Project Components

Project Component	Estimated Disturbance Area (ha)
KUNDIP MINE SITE	
Open pit mines – Kaolin, Harbour View/May and Flag	66
Underground mines – Harbour View/May and Flag	Nil – access from existing open pit related disturbance area.
Process Plant	13
WRLs (North-West and South-East)	75
TSF	39
ROM pad	7
Primary workshops	1
Primary offices	1
Water storage/transfer facilities	29
Haul/Internal site roads	16
Water and power corridor	4
Total (Kundip Mine Site)	252
MYAMBA MINE SITE	
Evaporation pond	24
Open pit mine – Trilogy oxide deposit	7
WRL	15
ROM pad	3
Office and minor workshop	1
Internal site roads	6
Haul roads	7
Magazine	1
Total (Myamba Mine Site)	64
***TOTAL:**	~316 ha

*The alignment of existing fire breaks will be re-established by ACH upon finalisation of the RGCP disturbance footprint area. Following construction, the fire breaks will revert back to the responsibility of DPaW for ongoing management.

2.4 SUPPORT FACILITIES

2.4.1 Mine Water Disposal

All open pits and underground mines proposed for the RGCP will intersect groundwater, therefore, water containment facilities needed to be considered as part of the Project design. It is proposed that mine dewater from both the Kundip and Myamba Mine Sites will be preferentially used in processing and dust suppression. The Kundip Mine Site will have a designated water storage facility where mine dewater can be temporarily stored until needed. Where mine dewater exceeds the capacity of the facility, particularly prior to commencement of processing, this water will be transported via an overland bunded pipeline to the designated evaporation pond at Myamba Mine Site. Mine dewater from the Trilogy oxide pit (at Myamba Mine Site) will also be temporarily stored in the nearby evaporation pond. Water in this pond will be available for use at Kundip Mine Site as required and can be pumped to the site via a return pipeline.

Water Storage Facilities - Kundip Mine Site

Dewatering operations will be required to facilitate the development and mining of all Kundip ore deposits. Coffey (2011) previously undertook an impact assessment and recommended suitable locations and design specifications for two water storage facilities at the Kundip Mine Site. The full report is provided as Appendix 3. Rockwater Pty Ltd (Rockwater) (2011) undertook a groundwater assessment of the Kundip Mine Site (see Appendix 4), providing background to groundwater patterns and characteristics of the site, as well as predicted inflow rates based on the former proposed pits. A review of inflow rates predicted in the 2011 report was undertaken in November of 2016, to determine expected inflow rates for the reduced pit depths and crest area proposed for the RGCP. The reviewed maximum inflow rates are estimated to be 30 m^3/d at Kaolin pit, 25 m^3/d at Harbour View/May pit, and 100 m^3/d at Flag pit.

Evaporation Pond - Myamba Mine Site

Groundwater encountered during the development of the proposed Trilogy oxide pit will be stored within a purpose built evaporation pond within the Myamba Mine Site. It is proposed the facility be constructed in the north western corner of the site, close to L74/45, where the water pipelines will traverse between the Kundip and Myamba Mine Sites.

The static water levels in test bores vary between 51 -55 m AHD (approximately 32 metres below surface (mbs)). Therefore, with the maximum depth of the Trilogy oxide pit proposed to be 39 mbs, groundwater will be intersected as mining progresses. Groundwater may be intersected above 32 mbs if the water table rises in the vicinity of the pit area, as ground pressure eases due to mining. Predicted inflow rates for the Trilogy oxide pit are estimated to be 5 m^3/d.

Soil and Rock Engineering (2004) undertook a geotechnical assessment for the construction of an evaporation pond at the Myamba Mine Site. The report (attached as Appendix 5) contains advice for embankment design, stability analysis, seepage analysis and additional construction considerations. Findings from the report are summarised below.

The design concept for the Myamba evaporation pond incorporates perimeter embankments (to a maximum height of 4 m) constructed with sandy-clay material sourced insitu, or from the surface of the Trilogy oxide pit. The pond area will be stripped, scarified and watered. The clay liner will then be proof compacted using a heavy roller to form a solid base. Fill material shall be compacted to achieve a dry density not less than 95% of the standard maximum dry density, with the materials placed at optimum moisture content +/-2%. Given the underlying sandy-clay is of medium plasticity, the hydraulic conductivity of the base will be approximately 1.0 x 10^{-9}m/sec with a mine dewater overburden of 500 mm.

Based on the low embankment height batter of 4 m, slopes will be battered to 1:2 (vertical:horizontal) upstream and 1:2.75 (vertical:horizontal) downstream for maximum stability.

2.4.2 Offices and Workshop Facilities

The primary office and workshop facilities for the RGCP will be located at the Kundip Mine Site. Support infrastructure will include the following:

- 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 refuelling area;
- Explosives magazine for the storage of explosive in compliance with the *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;*
- Water storage and bore infrastructure;
- Landfill facility; and
- Bioremediation facility.

The support infrastructure at the Myamba Mine Site may include:

- Offices;
- Crib room;
- Ablutions;
- Minor support workshop; and
- Go-line hardstand area including heavy vehicle maintenance bay.

Servicing will be undertaken within the Myamba Mine Site for general, preventative and emergency/breakdown maintenance as required. Limited diesel storage will be undertaken at Myamba within self-bunded tanks on the support infrastructure area.

Basic support office and minor workshop facilities will also be located within the support infrastructure area. The existing exploration office in the south western corner of the Myamba Mine Site (see Figure 2-2) will provide additional facilities to support the Project. All other facilities will be provided from the Kundip Mine Site.

The existing ACH accommodation facility located within the Ravensthorpe township will be utilised for site personnel. There is no requirement for additional accommodation provisions at either Kundip or Myamba Mine Sites.

2.5 POWER SUPPLY

Kundip Mine Site

Diesel generators will likely be used to supply power for proposed operations within the Kundip Mine Site. The power station will continuously generate up to 6 MW of power at 3,300 V AC. Power from generators will be reticulated to buildings or plant as per *Australian Standard/New Zealand Standard (AS/NZS) 3000-2007: Electrical Installations*, with all installations meeting the required standard. Power will be reticulated to the underground mines using overhead power lines.

Myamba Mine Site

The Hopetoun grid currently powers the Myamba homestead, machinery sheds and other support facilities. No upgrade of power will be required to support the running of these facilities. A small generator will be utilised to power the pumps stationed within the Trilogy oxide pit.

2.6 WATER SUPPLY

Kundip Mine Site

Two potential sources are being considered to supply water for processing (up to 1,500 m^3/d), dust suppression and ablutions, these include:

A. Dewatering at Kundip Mine Site,– up to 100 m^3/d;
B. Transfer of mine dewatering and bore water from Trilogy oxide pit at Myamba Mine Site – range from an initial 1,100 m^3/d up to 2,800 m^3/d subject to final pit depth.

Utilisation of mine dewater (Option A) is preferred, however, where dewatering is insufficient to meet water requirements additional water will be sourced as per option B.

A purpose built water storage facility will be required nearby the processing plant at Kundip Mine Site for retention of processing water and will include a 2000 m^3 earthen raw water pond with a HDPE liner. At Myamba Mine Site dewater produced throughout mining will be stored in the designated evaporation pond, with the option of transferring via overland 180 mm OD class 12.5 HDPE polypipe to the Kundip Mine Site along a designated pipeline corridor within L74/45.

Process water recovered from the tailings thickener, concentrate thickener and the TSF will also be recycled to the process water pond for re-use in processing to reduce the amount of water which must be sourced via alternative means as outlined above.

Potable water will be provided through capture of rainfall runoff from the roof of the support workshop and offices or from site water treated through a Reverse Osmosis (RO) Plant.

Myamba Mine Site

Key water uses at Myamba Mine Site will be dust suppression and potable water. Dewater from Trilogy deposit will be utilised for dust suppression purposes, whilst potable water will be sourced from rainwater harvesting. Dedicated holding tanks will be established on site for water storage purposes.

2.7 HIGH PRESSURE AIR

High pressure air (required for the site) will be supplied by rotary screw compressors and will be stored in air receivers prior to use. Low pressure air (required for flotation in the processing plant) will be supplied by centrifugal blowers.

2.8 ACCESS ROADS

Established site roads will be utilised for the RGCP, with roads to be widened and upgraded where necessary. Some additional internal roads may also be required to access site infrastructure.

Existing access to both the Kundip Mine Site and the Myamba Mine Site is via the Hopetoun-Ravensthorpe Road. Entry into the Kundip Mine Site is approximately 17 km southeast of the town of Ravensthorpe, while entry into Myamba Mine Site is a further 9 km south (Figure 1-1).

The southern boundary of the Myamba Mine Site adjoins the Jerdacuttup Road. ACH are considering constructing an access point along this road to provide alternative access/egress to the site for smaller vehicles, thereby improving traffic management processes.

Ore mined at Kundip will be transported directly to the processing plant located onsite. Ore mined at Myamba Mine Site will be trucked by road trains via the Hopetoun-Ravensthorpe Road to the Kundip Mine Site for processing.

2.9 CLOSURE AND REHABILITATION

A Mine Closure Plan (MCP) for the former Phillips River Project, now the RGCP, was submitted to DMP in January of 2016. The MCP focussed on rehabilitation of existing landforms within the Kundip Mine Site, which has been historically mined. No mining has been undertaken at the Myamba Mine Site to date. Mining is proposed to recommence at both Mine Sites following environmental assessment and subject to approval of the RGCP. An updated MCP will be developed in conjunction with Mining Proposal documents; the existing MCP will be updated accordingly.

Preliminary closure objectives have been developed for the RGCP and include:

1. **Safety and public health**
   - Site closure activities undertaken safely.
   - Public access to closed areas deterred.
2. **Final landforms**
   - All constructed landforms are non-polluting and are stable with a low risk of erosion.
3. **Infrastructure**

- Assets are disposed or retained in accordance with agreements with stakeholders and regulatory agencies.

4. **Soils**
   - Contaminated soils do not remain in-situ at levels above those acceptable for the agreed post-closure land use.
5. **Groundwater**
   - Alteration to groundwater from the Project (from extraction or contamination) not affecting existing or future users.
6. **Surface Water**
   - Controlled surface water flows on rehabilitated landforms.
   - Surrounding surface water flows are not interrupted.
7. **Revegetation**
   - Establish local provenance self-sustaining, resilient and stable vegetation.
8. **Waste**
   - All non-mineral waste is appropriately disposed or removed from site.

The Kundip Mine Site will return to Vacant Crown Land following cessation of mining operations; Myamba Mine Site will remain freehold land and will be returned to an agricultural land use to the extent possible. Key existing and proposed landforms of the RGCP to be closed and rehabilitated include:

- Open Pits (existing and proposed);
- Underground Mines (proposed);
- WRL's (existing and proposed);
- TSF (proposed);
- Evaporation pond (proposed); and
- Historic heap leach facility (existing).

Landforms of the RGCP will be progressively rehabilitated where possible, with final closure and rehabilitation occurring upon cessation of mining activities. In particular, the outer faces of the WRL's and TSF will be built in advance to facilitate early revegetation of these slopes prior to closure. During rehabilitation the battered WRL and TSF faces will be re-contoured, ripped, topsoil replace where available and seeded with native species. This will ensure these landforms are continuous with the surrounding environment as much as practicable. Post rehabilitation batters will be 16˚ and 18˚ for the Kundip and Myamba Mine Sites WRL's respectively, and 18˚ for the Kundip Mine Site TSF batter.

Early testing of subsoils will be undertaken to categorise soils as suitable or unsuitable for use as a subsurface layer during rehabilitation of landforms. Those subsoils more structurally stable and suitable for use as a subsurface layer will be stockpiled separately. Those subsoils most prone to hardsetting and erosion will be contained either within landforms, or away from external slopes of landforms. Contours and rock mulching may be used to slow the flow of surface water across rehabilitated landforms and improve infiltration of water into the upper soil profile where it can be taken up by vegetation. The depth of rocky topsoils used to rehabilitate landforms will be maximised as much as possible, but will be dependent upon availability of such materials.

Open pits will be preferentially backfilled above the water table where possible, to avoid impacts to groundwater levels and flows. Where open pits are not backfilled, suitable waste rock will be used to construct abandonment bunds around the outer perimeter of the open pits upon closure.

All final landforms will be geo-technically and geo-chemically stable, designed with appropriate batters and berms. Completion criteria for the RGCP have been considered and are provided in Table 2-5. ACH recognise the criteria are at a preliminary stage and will be further developed throughout the approvals process. It is proposed the criteria be incorporated into the next MCP submission.

Table 2-5: Preliminary Completion Criteria for the Ravensthorpe Gold/Copper Project

Aspect	Objectives	Completion Criteria	Measurable Standards to Meet Completion Criteria
Safety and Public Health	• Site closure activities undertaken safely. • Public access to closed areas deterred.	• All excavations backfilled or have a perimeter safety bund • Underground portals secured to prevent access • Signage where appropriate • Roads no longer required will be rehabilitated • Ensure areas are left in a safe manner	• Site inspected by independent auditor and completion report produced.
Final Landforms	• All constructed landforms are non-polluting and are stable with a low risk of erosion	• Constructed landforms to have final batters of: - ~18˚ WRL (Myamba Mine Site) - ~16˚ WRL's (Kundip Mine Site) - ~18˚ TSF (Kundip Mine Site)	• Audit to confirm compliance with closure design specifications, including placement of waste materials. Rehabilitated landforms surveyed at completion of rehabilitation earthworks to ensure landform design completion criteria are met. • Geotechnical review of landforms within 12 months of closure.
		• Erosion levels on constructed landforms stabilised	• Annual inspection and monitoring for AER data sheets to collect erosion data on WRL's and the TSF. Review of erosion levels to be undertaken annually. Erosion to be considered stabilised when occurring within 30% of analogue site for three consecutive monitoring periods, as determined by LFA which will be prepared. • Geotechnical review of landforms within 12 months of closure.
		• Waste materials are appropriately placed in landforms so as to be non-polluting	• Monitoring bores at defined landforms remain within parameters determined by DER licencing, biannually for three years post closure. • Geotechnical review of landforms within 12 months of closure.
		• TSF to have an effective 'store and release' cover system	• Geotechnical review of landforms within 12 months of closure.

Aspect	Objectives	Completion Criteria	Measurable Standards to Meet Completion Criteria
Infrastructure	• Assets are disposed or retained in accordance with agreements with stakeholders and regulatory agencies.	• Infrastructure decommissioned and removed unless retention is agreed upon during discussions with stakeholders and regulatory agencies. • Any remaining buried infrastructure to be defined and markers maintained if required. • A transfer agreement is in place for all residual assets.	• No infrastructure remaining at closure unless transfer agreement in place; to be confirmed by post closure inspection.
Soils	• Contaminated soils do not remain in-situ at levels above those acceptable for the agreed post-closure land use.	• Contaminated soils are remediated. • Any remaining contaminated sites are identified and contaminated sites classification does not impact on suitability of the Project area for proposed post-mining land use.	• Any sites requiring investigation under *Contamination Sites Act* are completed at closure in accordance with DER Guidelines and *National Environment Protection (Assessment of Site Contamination) Measure 1999*.
Groundwater	• Alteration to groundwater from the Project (from extraction or contamination) not affecting existing or future users.	• Ground water quality from TSF monitoring bores within DER licence target parameters.	• Post mining groundwater quality from TSF monitoring bores monitored biannually for three years post closure with results remaining within DER licence target parameters.
		• Groundwater levels within borefields comparable to baseline data.	• Groundwater levels comparable to baseline data in three consecutive monitoring periods post closure.
Surface Water	• Controlled surface water flows on rehabilitated landforms. • Surrounding surface water flows are not interrupted.	• At a catchment and local scale, natural surface water drainage flow functionality is reinstated.	• Assessment at closure of connectivity of surface water flow against those established in baseline reports.
		• Surface water diversion infrastructure, where retained by agreement with stakeholders, to be functional, effective, remain stable and resist erosion.	• Audit of surface drainage infrastructure upon closure.
Revegetation	• Establish local provenance self-sustaining, resilient and stable vegetation.	• Final landform to include representative local provenance endemic flora that contributes to slope stability, rainfall infiltration/run-off and nutrient cycling. • Canopy volume and density at	• LFA conducted annually at selected sites to measure slope stability, rainfall infiltration/run-off and nutrient cycling indices – to meet a target of within 30% of comparable analogue. • LFA conducted annually at selected sites to measure canopy volume and density – to meet a target within 30% of appropriate

Aspect	Objectives	Completion Criteria	Measurable Standards to Meet Completion Criteria
		rehabilitation areas approaching that of appropriate analogues.	analogue sites.
		• Weed species richness and diversity shall not exceed applicable analogue site.	• Area of weed infestation recorded post closure is less than or equal to, infestation prior to commencement of mining, for three consecutive monitoring periods following closure.
		• All available topsoil is respread over disturbance areas.	• Site inspection after rehabilitation works to survey previous soil stockpile locations.
Waste	• All non-mineral waste is appropriately disposed or removed from site.	• All non-mineral waste disposed in accordance with regulations. • Recycling opportunities maximised for appropriate materials.	• Completion report upon closure.

3 EXISTING ENVIRONMENT

3.1 SURVEYS AND INVESTIGATIONS

A number of surveys and investigations have been previously undertaken in and near the Project area. A summary of relevant surveys is provided in Table 3-1 below.

Table 3-1: Existing surveys and investigations of the RGCP area and surrounds

Aspect	Survey	Consultant	Year	Purpose
Flora and Vegetation	Kundip Mining Leases M74/41, 51, 53, & 135 and P74/153 – Vegetation and Flora Survey.	G.F Craig	2004	Flora and vegetation survey.
	Kundip Mining Leases – *Pultenaea* and *Melaleuca*.	G.F Craig	2004	Targeted flora survey.
	Kundip Haul Road – Declared Rare and Priority Flora Survey.	G.F Craig	2004	Targeted flora survey.
	Kundip Mining Leases – Waste Dumps and Haul Road – Declared Rare and Priority Flora Surveys.	G.F Craig	2005	Targeted flora survey.
	Kundip Mining Leases Monitoring Quadrat Survey	Ellen Hickman	2007	Establishment of 25 vegetation monitoring quadrats
	Vegetation of the Ravensthorpe Range: Mt Short to South Coast Highway.	Craig *et al*.	2007	Vegetation assessment of the Ravensthorpe Range between Mt Short and South Coast Highway.
	Floristic Survey of the Ravensthorpe Range, Western Australia	Markey *et al.*	2007	Flora survey of the Ravensthorpe Range
	Vegetation of the Ravensthorpe Range, Western Australia: Mt Short to Kundip, 1:10,000 scale	Craig *et al*.	2008	Vegetation mapping of the Ravensthorpe Range between Mt Short and Kundip. The survey was undertaken by Department of Environment and Conservation as part of the Biodiversity Inventory Program.
	Power and Water Easement, Trilogy to Kundip Mine Site. Declared Rare and Priority Flora Survey	Ellen Hickman	2008	Targeted flora survey.
	Kundip Mining Leases Additional Monitoring Quadrat Survey	Ellen Hickman	2009	Establishment of an additional nine vegetation monitoring quadrats.

Aspect	Survey	Consultant	Year	Purpose
	Targeted and Regional Survey for *Melaleuca* sp. Kundip and *Melaleuca stramentosa*.	N. McQuoid	2009	Targeted flora survey
	Survey for Declared Rare and Priority Flora, and Exotic Weeds of Proposed Drill Grids at the Lonestar and the Gift Prospects, Kundip Mining Centre	N. McQuoid	2009	Targeted flora and weed survey
	Priority 1 "Gem Restored" Flora and Fauna Reconnaissance Survey	MWH Global	2013	Level 1 Flora and Fauna Assessment of the Gem Restored Study Area (located within the proposed Kundip Mine Site).
	Ravensthorpe Gold/Copper Project (Kundip and Myamba Mine Sites) Level 1 Biological Assessment	APM	2016	Reassess and remap (where required) the vegetation boundaries identified by the South Coast Natural Resource Management Group. Declared Rare Flora and Priority Flora search across the Project impact footprint.
Terrestrial Fauna	Fauna and Fauna Assemblages of the Kundip and Trilogy Study Sites	Biota Environmental Sciences Pty Ltd.	2004	Two Phase (two season) baseline Level 2 fauna survey as per EAG56.
	Kundip Phase II Fauna Survey – Summary of Findings.	Biota Environmental Sciences Pty Ltd	2004	Summary of the outcomes of the targeted components of Phase II in context with Phase 1.
	Subterranean fauna desktop risk assessment	Outback Ecology	2010	Desktop assessment of the risk to subterranean fauna from the Phillips River Project.
	Gem Restored Flora and Fauna Reconnaissance Survey	Outback Ecology	2013	Priority 1 "Gem Restored" Flora and Fauna Reconnaissance Survey
	Ravensthorpe Gold/Copper Project (Kundip and Myamba Mine Sites) Level 1 Biological Assessment	Animal Plant Mineral	2016	Survey included a targeted survey of conservation significant fauna previously recorded or highly likely to occur within the RGCP area.
Dieback	Kundip Mining Centre and Proposed Kundip – Rav 8 Haul Road. *Phytophthora* Dieback Assessment	Terratree Pty Ltd.	2012	Phytophthora Dieback assessment.
	Survey for Dieback Disease caused by *Phytophthora cinnamomi* on Mining Leases within the Southern Ravensthorpe Range known as	NRG Consultancy	2011	Phytophthora Dieback assessment.

Aspect	Survey	Consultant	Year	Purpose
	the Kundip Mining Centre Spring 2010 for Tectonic Resources N.L.			
	Dieback Assessment of Kundip, Trilogy and RAV8 Sites	Glevan Consulting	2006	Phytophthora Dieback assessment.
Geotechnical	Trilogy Water Storage Facility Geotechnical Assessment	Soil and Rock Engineering	2004	Geotechnical Assessment
	Feasibility Geotechnical Assessment of Kundip Deposits	Peter O'Bryan and Associates	2010	Geotechnical Assessment
	Feasibility Geotechnical Assessment of the Trilogy Deposit	Peter O'Bryan and Associates	2010	Geotechnical Assessment
	Concept design for waste landform and tailings storage facility	Golder Associates/Dump Solver	2016	Geotechnical Assessment
Soil and Landform	Topsoil Characterisation at Kundip and Trilogy and Recommendations for Rehabilitation	Outback Ecology	2004	Topsoil Characterisation Report.
Waste Characterisation	Characterisation of soils from the Trilogy Deposit and waste material from the Kundip Deposit	Outback Ecology	2011	Soil and Waste Characterisation Report.
	Geochemical Characterisation of Waste-regolith Samples (Trilogy Deposit) - Implications for Mine-Waste Management	Graeme Campbell and Associates	Nov 2010	Soil and Waste Characterisation Report.
	Mine-Waste-Characterisation Study of the Trilogy Deposit – Implications for Mine-Waste Management	Graeme Campbell and Associates	Jul 2010	Waste Characterisation Report.
	Geochemical Characterisation of Mine Waste Samples from the Trilogy and Kundip Deposits	Graeme Campbell and Associates	2004	Waste Characterisation Report.
	Geochemical Characterisation Test Work on Process-Tailings-Slurry Samples	Graeme Campbell and Associates	2005	Tailings Characterisation Report.
Water	Trilogy Hydrogeological Investigation	Rockwater	2011	Groundwater Assessment of the Myamba Mine Site
	Impact of Final Mine Voids on Groundwater Flow System.	Rockwater	2011	Groundwater Assessment of the Kundip Mine Site.
	Trilogy Surface Hydrology Assessment	Coffey	2011	Surface Water Assessment.
	Kundip Surface Hydrology Assessment	Coffey	2011	Surface Water Assessment.
	Kundip Water Storage Facility	Coffey	2011	Kundip Water Storage Facility

Aspect	Survey	Consultant	Year	Purpose
	Design			Impact Assessment and Design
Air	Baseline Dust Monitoring at Kundip Mine Site	WestSafe	2005	Dust Monitoring
Heritage	Aboriginal Heritage Survey of M74/51, M74/53, M74/41, M74/135, P74/153 and M74/176	Tamora Pty Ltd - Machin & Barrie	2003	Ethnographic Survey

3.2 CLIMATE

The Project is located in the Goldfields-Esperance region of WA which experiences a Mediterranean climate with mild summers and cool wet winters.

The nearest Bureau of Meteorology (BoM) weather station is at Ravensthorpe (BoM Site Number: 010633), less than 5km north of the Kundip mine site. The Ravensthorpe station has been recording rainfall and temperature since 1901. Average monthly and annual rainfall and temperature is presented in Table 3-2.

Table 3-2: Rainfall and Temperature Averages for Ravensthorpe Weather Station (BoM 2016)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Mean Rainfall (mm)	25.0	24.6	33.0	33.0	44.2	43.4	47.3	44.5	42.1	38.2	30.6	24.2	427.2
Mean Max Temp (°C)	29.0	28.4	26.6	23.7	20.0	17.3	16.3	17.3	19.5	22.5	25.1	27.2	22.8
Mean Min Temp (°C)	14.1	14.6	13.6	11.8	9.6	7.9	6.8	6.7	7.4	9.1	11.1	12.8	10.5

Recorded data suggests that the Project area is likely to receive close to 427mm of rain on an annual basis and experience temperatures ranging between 2.2°C and 43°C (the lowest and highest monthly averages recorded) (BoM, 2016). January is the hottest month with a mean maximum temperature of 29.0 °C and mean minimum of 14.1°C. July is the coolest month with a mean maximum temperature of 16.3 °C and mean minimum of 6.8°C (BoM, 2016) (Table 3-2). Figure 3-1 illustrates the Project area is subject to climate typical of the region, with mild summers and wet winters.

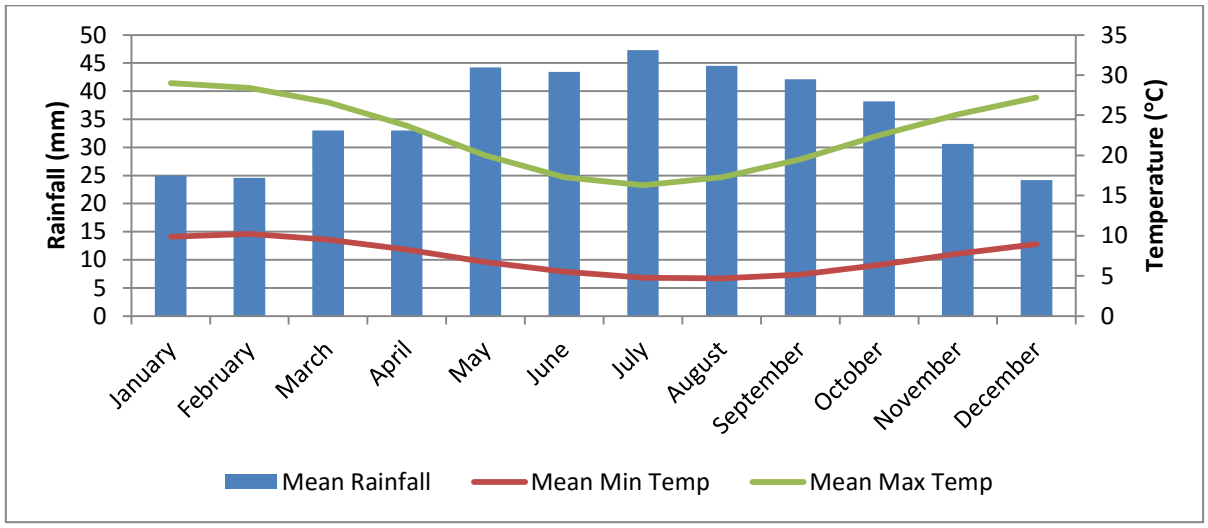

Figure 3-1: Ravensthorpe Weather Station Meteorological Data (BoM 2016)

3.3 FLORA AND VEGETATION

Local and regional environmental values

The Kundip Mine Site is situated in the foothills of the Ravensthorpe Range. The southern boundary of the Kundip Mine Site lies in close proximity (0.4 - 1 km) and just north of the Kundip Nature Reserve (No. 31128). Large tracts of uncleared remnant bush, which are currently proposed for vesting as nature reserves, surround the tenements. The Kundip Mine Site is bounded on the north, east and south by an area recommended by the EPA Red Book (Recommendation 3.8) to become Nature Reserve (No. 56).

The Myamba Mine Site is located on cleared farmland approximately 1.5 km south of the Kundip Nature Reserve. The site is predominately flat, with little remaining perennial vegetation except for a narrow strip along a drainage line on the eastern extent of the site.

Current Status

The Kundip Mine Site has been heavily impacted by historic mining activities. Existing disturbances within the site include costeaning and trenching, trial pits, numerous shafts (some in excess of 150 m deep), decline tunnels into mineralised targets, a historic heap leach facility, WRL, TSF, and water storage facilities. 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 heap leach facility. Overburden from trial pits, shafts and costeans has been stockpiled adjacent to the workings and has not been remediated. Consequentially existing disturbance at the Kundip Mine Site is high.

The Myamba Mine Site has not been subject to mining activities in the past. However, the site has been completely cleared for agricultural use, and there has been minor localised disturbance associated with existing exploration office facilities.

Desktop Assessment

Flora and vegetation reports were assessed to determine changes in the status of flora recorded or expected to occur in the RGCP area since survey work commenced in 2004. Table 3-3 outlines the status of conservation significant flora identified during the surveys and their current status.

A desktop search of the *Environment Protection and Biodiversity Conservation Act 1999* (*EPBC Act)* Protected Matters Search Tool (PMST) and NatureMap database was undertaken in June 2016.

The PMST returned 13 species protected under the *EPBC Act* recorded within 10 km of the RGCP area. The NatureMap and DPaW database searches listed 62 Priority taxa and 11 threatened species recorded within 10 km of the RGCP area.

A request was also made for a search of the Department of Parks and Wildlife (DPaW) databases for Threatened and Priority flora and the presence of Threatened Ecological Communities (TEC) or Priority Ecological Communities (PEC).

Searches of the *EPBC* PMST and DPaW database identified the following TECs and PECs:

- 'Kwongan shrublands of the southeast coastal floristic province of Western Australia' (TEC - *EPBC Act*; Priority 3 PEC – *Wildlife Conservation Act 1950* (*WC Act)*);
- '*Banksia laevigata – Banksia lemanniana proteaceous* thicket' (TEC – *EPBC Act*);
- 'Very open Mallee over *Melaleuca sp. Kundip* dense heath' (Priority 1 PEC – *WC Act*); and
- 'Heath on Komatiite of the Ravensthorpe area' (Priority 3 PEC – *WC Act*).

Table 3-4 outlines the conservation significant flora identified by the desktop searches that may occur in the RGCP area, including species which have previously been recorded in the RGCP area.

Table 3-3: Changes in Status of Conservation Significant Flora

Taxa	Survey	Conservation Status at Time of Survey	Current Conservation Status
Acacia disticha	Craig, 2004a; Craig, 2005	P2	-
Acacia durabilis	Craig, 2004a; Craig; 2005; Hickman, 2007	P3	-
Acacia laricina var. *crassifolia*	Craig, 2004a; Craig, 2004b; Craig, 2005; Hickman, 2007	P2	-
Acacia ophiolithica	Craig, 2004b	P3	-
Acacia pinguiculosa	Craig, 2004a	P4	-
Acrotriche pariflora	Hickman, 2009	P4	-
Allocasuarina hystricosa	MWH, 2013	P4	P4
Allocasuarina scleroclada subsp. *echinata*	Craig, 2004b	DRF	-
Banksia corvijuga	MWH, 2013	P3	P3
Banksia laevigata subsp. *laevigata*	MWH, 2013	P4	P4
Beyeria sp. A Ravensthorpe	Craig, 2004b	P1	-
Boronia oxyantha var. *brevicalyx*	Craig, 2004a; Craig, 2005	P3	-
Dampiera deltoidea	MWH Global (MWH), 2013	P4	P4
Daviesia megacalyx	MWH, 2013	DRF	DRF
Dodonaea trifida	Craig, 2004a; Craig, 2005; Hickman, 2007	P3	-
Eucalyptus desmondensis	MWH, 2013	P4	P4
Eucalyptus proxima	Hickman, 2009	P4	-
Grevillea sulcate	MWH, 2013	P1	-
Grevillea fulgens	MWH, 2013	P3	P3
Grevillea punctate	MWH, 2013	P3	P3
Guichenotia apetala	MWH, 2013	P1	P1
Marianthus mollis	Hickman, 2007; MWH, 2013	DRF; P4	P4
Marianthus villosus (now M. tenuis)	Craig, 2004a; Craig, 2004b; 2005	DRF	-

Taxa	Survey	Conservation Status at Time of Survey	Current Conservation Status
Melaleuca penicula	MWH, 2013	P4	P4
Melaleuca stramentosa	Craig, 2004a; Craig, 2004b; Craig, 2005; Hickman, 2007	P1	-
Melaleuca sp. Kundip	Craig, 2004a; Hickman, 2007	P1	-
Micromyrtus navicularis	MWH, 2013	P3	P3
Pultenaea calycina subsp. *proxena*	Craig, 2004b	P1	P4
Pultenaea craigiana	Hickman, 2009	P1	P3
Pultenaea sp. Kundip	Craig, 2004a; Hickman, 2007	P1	-
Siegfriedia darwinoides	Craig, 2004a; Craig, 2005; Hickman, 2007	P4	-
Spyridium glaucum	Craig, 2004a; Craig, 2004b; Hickman, 2007	P3; P4	-
Stachystemon vinosus	Hickman, 2007	DRF	P4
Thomasia sp. Hopetoun	MWH, 2013	P2	P2

Table 3-4: Conservation Significant Flora Potentially Occurring in the Ravensthorpe Gold/Copper Project Area

Species	Description & Habitat	Likelihood of Detection if Present	Previously Recorded on Site	Conservation Status	
				Cth	State
Acacia argutifolia	Low spreading shrub. Shallow sand over quartzite, rocky hills & ridges	High, flowering in spring	Recorded in 1985 & 2010 (DPaW & WA herbarium database searches)	-	P4
Acacia besleyi	Resinous shrub with stringy and fibrous bark.	High, flowering in spring	Not recorded	-	P1
Acacia bifaria	Prostrate or semi-prostrate shrub. Rocky loam, sandy soils. Plains, roadsides, low lying areas	High, flowering in spring	Not recorded	-	P3
Acacia dictyoneura	Shrub. Loamy soils, River banks, gentle slopes.	High, flowering in spring	Not recorded	-	P4
Acacia errabunda	Dense, bushy, spreading shrub. Clay loam, gravelly loam, sand. Plans, clay flats.	High, flowering in spring	Not recorded	-	P3
Acacia grisea	Spreading or compact shrub. Lateritic gravelly loamy soils. Plains & slopes.	Medium, flowering in winter	Not recorded	-	P4
Acacia improcera	Spreading, spiny shrub. Sand, loamy clay, clay. Undulating plaints, flats	High, flowering in spring	Not recorded	-	P3
Acacia nitidula	Spreading shrub. Granitic sandy gravelly soils. Amongst granite boulders.	Low, few, if any granite protruding granite boulders.	Not recorded	-	P2
Acacia papulosa	Bushy shrub. Spongolitic loam.	High, flowering in spring	Not recorded	-	P2
Acacia rhamphophylla	Low spreading shrub. Rocky or sandy clay. Upper sloped of low ranges.	High, flowering in spring	Not recorded	EN	T
Acacia sp. Ravensthorpe Range (B.R. Maslin 5463)	Low spreading shrub. Rocky clay, clayey loam.	High, flowering in spring	Recorded in 1980 (WA herbarium record)	-	P1
Allocasuarina hystricosa	Dioecious tree. Orange, red or brown loam with limestone or granite outcropping. Plains, lower slopes, hilltops.	Flowers in summer	Not recorded	-	P4
Anigozanthos bicolor subsp. minor	Rhizomatous, perennial herb. Sand.	High, flowering in	Not recorded	EN	T

Species	Description & Habitat	Likelihood of Detection if Present	Previously Recorded on Site	Conservation Status	
				Cth	State
	Well-watered sites.	spring			
Anticoryne ovalifolia	Shrub. Quartzite rocky slopes & granite.	High, flowering in spring	Not recorded	-	P2
Banksia corvijuga	Dense, rounded shrub. Gravelly lateritic soils. Hillslopes.	High, flowering in spring	Not recorded	-	P3
Banksia corvijuga x heliantha	Dense, rounded shrub. Gravelly lateritic soils. Hillslopes.	High, flowering in spring	Not recorded	-	P3
Banksia foliosissima	Dense erect, non-lignotuberous shrub. Gravelly sand or sandy clay over laterite. Hill top & upper slopes.	High, summer flowerer with distinctive perennial morphology.	Not recorded		P4
Banksia laevigata subsp. laevigata	Shrub. Rocky soils. Hill, top of breakaways.	High, flowering in spring	Not recorded	-	P4
Beyeria sulcata var. truncata	Shrub.		Not recorded	-	P3
Beyeria villosa	Upright spreading perennial shrub	Medium, flowering in winter	Not recorded	-	P4
Calothamnus roseus	Dense shrub. Sandy loam, quartzite soil. Upper-slopes and hilltops.	High, flowering in spring	Recorded in 2004, 2007-2010 (WA herbarium record)	-	P1
Conostylis lepidospermoides	Rhizomatous, tufted perennial, grass-like or herb. Grey or yellow-brown sand over laterite.	High, flowering in spring	Not recorded	EN	T
Cryptandra craigiae	Erect to spreading shrub. Sand. Low-lying sand dunes, low rises between or adjacent to swampy areas, gutter on disturbed road verge.	Medium, flowering in winter	Not recorded	-	P1
Dampiera deltoidea	Erect perennial herb. Sand, sandy clay, loam. Sandplains around quartzite rocks	High, flowering in spring	Not recorded	-	P4
Dampiera sp. Ravensthorpe (G.F. Craig 8277)	Erect perennial herb. Orange loam, rocky outcrops & hillcrest.	High, flowering in spring	Recorded in 2009 (WA herbarium record)	-	P3
Darwinia oxylepis	Upright, dense shrub. Occurs on stony, peaty sand and rocky gullies.	High, flowering in spring	Not recorded	EN	T
Daviesia megacalyx	Erect shrub. Gravelly laterite. Ridges.	High, flowering in	Not recorded	EN	T

Species	Description & Habitat	Likelihood of Detection if Present	Previously Recorded on Site	Conservation Status	
				Cth	State
	Hillslopes.	spring			
Daviesia newbeyi	Bushy, multi-stemmed, broom-like shrub. Sand or sandy clay over granite. Rocky slopes.	High, flowering in spring	Not recorded	-	P2
Eremophila chamaephila	Low, dome-shaped shrub. White sand, clay. Sandplains, disturbed road verges.	High, flowering in spring	Not recorded	-	P3
Eremophila denticulata subsp. denticulata	Erect, open shrub. Alluvium, sand, sandy clay loam. River beds & plains, laterite breakaways.	High, flowering in spring	Not recorded	VU	T
Eucalyptus desmondensis	Mallee. Stony loam or sand, clay, granitic soils. Rocky hillsides, sandplains.	High, flowering in spring	Recorded in 1952 (WA herbarium record)	-	P4
Eucalyptus famelica	Mallee. White/grey sand. Wet areas, sometimes slightly brackish.	High, flowering in winter - long lived perennial structures can be used for identification	Not recorded	-	P3
Eucaltyptus merrickiae	Mallee. Sandy clay, grey sand. Near salt lakes.	High, flowering in spring.	Not recorded	VU	T
Eucalyptus preissiana subsp. lobata	Mallee. Coastal limestone rises & sand dunes.	High, flowering in spring	Not recorded, limestone rises or large sand dunes not in survey area.	-	P4
Eucalyptus purpurata	Tree (mallette). White powdery loam, magnesite.	High, flowering in spring	Not recorded, soil profile not found in survey area.	-	T
Eucalyptus stoatei	Slender tree. Gravelly sand or clay, sandy loam. Flats, rises.	High, flowering in spring	Recorded (WA herbarium record; no date supplied)	-	P4
Eucalyptus x bennettiae	Mallee. Red quartzite rubble, red loam. Slopes.	High, flowering in spring	Not recorded	-	P4
Goodenia phillipsiae	Low shrub. Sandy soils.	High, flowering in spring	Not recorded	-	P4
Goodenia stenophylla	Erect shrub. Rocky soils. Granite or quartzite rocks. Steep slopes.	High, flowering in spring	Not recorded, few slopes 'steep', study area is close to Ravensthorpe Range - southern & lower elevation areas.	-	P4

Species	Description & Habitat	Likelihood of Detection if Present	Previously Recorded on Site	Conservation Status	
				Cth	State
Grevillea fastigiata	Shrub. Red clay, granite.	High, flowering in summer - long lived perennial structures can be used for identification.	Not recorded	-	P4
Grevillea fulgens	Spreading to straggling, shrub. Gravel over laterite. Hillsides.	High, flowering in spring	Recorded in 1976 (WA herbarium record)	-	P3
Grevillea punctata	Shrub. Stony red loam, red clay.	High, flowering in spring	Not recorded	-	P3
Guichenotia apetala	Compact, much branched shrub. Gravel, laterite.	High, flowering in spring	Not recorded	-	P1
Gyrostemon sp. Ravensthorpe (G. Cockerton & N. Evelegh 9467)	Not available	-	Recorded in 2008 (WA herbarium record)	-	P1
Hakea acuminata	Shrub. Deep white sand, grey sand over granite, loam. Undulating plain.	Flowers in winter	Not recorded	-	P2
Hydrocotyle sp. Decipiens (G.J. Keighery 463)	Prostrate annual herb. Clay / loam soils. Riverbeds & banks.	Medium, flowering in spring	Recorded in 2005 & 2016 (WA herbarium record & APM survey)	-	P2
Kunzea ericifolia subsp. subulata	Shrub. Course grey sand over quartzite. Amongst rocks on summit.	High, flowering in spring	Not detected	-	P2
Lasiopetalum sp. Desmond (N. McQuoid 653)	Not available	-	Not recorded	-	P1
Lepidosperma sp. Archer Drive (S. Kern & R. Jasper LCH 18300)	Not available	-	Not recorded	-	P1
Lepidosperma sp. Elverdton (R. Jasper et al. LCH 16844)	Not available	Underlying geology matches the site	Recorded in 2007 (WA herbarium record)	-	P1
Lepidosperma sp. Hopetoun Road (S. Kern et al. LCH 16552)	Not available	-	Not recorded	-	P1
Lepidosperma sp. Maydon (S. Kern, R. Jasper, H. Hughes LCH 17844)	Not available	-	Not recorded	-	P1
Lepidosperma sp. Mt Chester (S. Kern et al. LCH 16596)	Not available	-	Not recorded	-	P1

Species	Description & Habitat	Likelihood of Detection if Present	Previously Recorded on Site	Conservation Status	
				Cth	State
Lepidosperma sp. Mt Short (S. Kern et al. LCH 17510)	Not available	Underlying geology matches the site	Recorded in 2007 (WA herbarium record)		P1
Lepidosperma sp. Shoemaker Levy (L. Ang & O. Davies 10815)	Not available	-	Not recorded	-	P3
Lepidosperma sp. Steere River (S. Kern, R. Jasper, H. Hughes LCH 17764)	Not available	-	Not recorded	-	P1
Marianthus mollis	Low branching, spreading, silky hariy shrub. Laterite soils. Hills and ridges.	High, flowering in spring	Recorded in 2003, 2004, 2007, 2016 (WA herbarium record & APM survey)	EN	P4
Melaleuca penicula	Spreading shrub. Red, brown loamy sand or red sandy clay. Granite outcrops, valley slopes.	Medium, perennial summer flowerer. Some structures would be intact for identification.	Not recorded	-	P4
Melaleuca similis	Shrub. Grey sand. Margins of saline drainage lines.	High, flowering in spring	Not recorded	--	P1
Melaleuca sophisma	Short, dense/compact shrub.	High, flowering in spring	Recorded in 2003, 2004 (WA herbarium record)	-	P1
Micromyrtus navicularis	Spindly, erect shrub. Sand with gravel, laterite, granite. Hill slopes.	High, flowering all year	Not recorded	-	P3
Pultenaea brachyphylla	Erect shrub. Pale brown sandy loam, sandy clay, gravel, granite, quartz, laterite.	High, flowering in spring	Recorded in 2008 (WA herbarium record)	-	P2
Pultenaea calycina subsp. proxena	Many-branched, compact shrub. Sand, clay, sandy clay or loam with gravel, over magnesite. Moderate slopes, adjacent to creek beds.	High, flowering in spring	Recorded in 2004 (WA herbarium record)	-	P4
Pultenaea craigiana	Branching, erect shrub.	High, flowering in spring	Recorded in 2003 & 2004 (WA herbarium record)	-	P3
Pultenaea vestita	Erect or procumbent shrub. Sandy soils. Coastal cliffs, granite.	High, flowering in spring	Not recorded, suspected habitat 'coastal cliffs' not found within survey area	-	P3

Species	Description & Habitat	Likelihood of Detection if Present	Previously Recorded on Site	Conservation Status	
				Cth	State
Ricinocarpos trichophorus	Erect, openly branching shrub. Occurs on sandy clay and loam on breakaways and among sandstone rocks	-	Not recorded	EN	T
Roycea pycnophylloides	Many-branched short shrub.	High, flowering in spring	Not recorded	EN	T
Stachystemon vinosus	Compact shrub. Fine loamy sand, stony soils. Sandplains, rock crevices on breakaways.	High, flowering in spring	Not recorded	-	P4
Thelymitra psammophila	Perennial herb. Sandy clay, loam.	High, flowering in spring	Not recorded	VU	T
Thomasia sp. Hopetoun (K.R. Newbey 4896)	Erect slender shrub	High, flowering in spring	Recorded in 1974 (WA herbarium record)	-	P2
Thysanotus parviflorus	Perennial herb. Grey sand	High, flowering in spring	Not recorded	-	P4
Xanthoparmelia subimitatrix	Lichen. Granite. Sheltered/exposed outcrops.	High, flowering in spring	Not recorded	-	P1
Xanthoparmelia xanthomelanoides	Lichen. Granite. Sheltered/exposed outcrops.	High, flowering in spring	Not recorded	-	P2

Site Investigations

The most recent flora and vegetation survey of the RGCP was undertaken by Animal Plant Mineral (APM) in 2016, the full report is included as Appendix 6.

The objective of the APM (2016) survey was to ground truth the vegetation community boundaries mapped by Craig (2003), and local vegetation mapping completed for the Ravensthorpe Ranges by the South Coast Natural Resource Management Group (SCNRMG) (Craig et al. 2008). The Ravensthorpe Range vegetation mapping and associated report is a comprehensive resource that enables current and future potential impacts on flora and vegetation at the RGCP to be measured and assessed relative to consistent mapping across a much larger local area, much of which is proposed for conservation. Spatially explicit data for the Ravensthorpe Range provided the baseline from which the relative extents of proposed disturbance were calculated.

The field survey was carried out over 6 days between the 17/08/2016 and 22/08/2016. Ground truthing of this mapping confirmed no change to mapped vegetation associations was required other than to update areas disturbed by mining.

Two conservation significant flora taxa, *Hydrocotyle* sp. *Decipiens* and *Marianthus mollis,* were identified during the survey. *H. Decipiens* is listed as Priority 2 under the *WC Act.* Three historical records from the WA herbarium (DPaW, 2016) located north-north-west of the Western Gem pit

were confirmed still present during the 2016 survey. *Marianthus mollis* is listed as Endangered under the *EPBC Act* and Priority 4 under the *WC Act*. The populations of *M. mollis* were located directly north and east of the proposed disturbance footprint. Approximately 192 plants were recorded.

Of the 16 vegetation associations assessed within the RGCP proposed disturbance area, four communities potentially represent one or more of the TECs or PECs identified from the *EPBC* PMST and DPaW database searches. A summary of outcomes from the impact assessment are provided in Table 3-5.

The RGCP area has also been surveyed for Phytopthora Dieback (see Appendix 7). Approximately 62% of the Kundip mining area was uninterpretable due to the low abundance of disease indicator species. Three positive sample results of Phytopthora have been recorded along the entrance road to the mine. Two of these were recorded by Terratree during their assessment (2012); the other was recorded in 2006 by Glevan Consulting (as cited in Terratree, 2012). A study undertaken in 2010 had recorded no infestations of dieback (NRG Consulting, 2011).

Table 3-5: Threatened and Priority Ecological Communities Impact Assessment

Vegetation Code	Summary Description	TEC/PEC Representation	Amount in the Ravensthorpe Range (ha)	Amount in the Project Area (ha)	Amount in Proposed Disturbance Footprint (ha)	Disturbance to TEC/ PEC in the Ravensthorpe Range (%)	Disturbance to TEC / PEC within the Project Area (%)
Dcir	Dryandra cirsioides: Proteaceous mallee-heaths	TEC - Proteaceae Dominated Kwongkan Shrublands of the Southeast Coastal Floristic Province of Western Australia	521.11	1.76	NIL[1]	0[1]	0[1]
Efal/Eple	Eucalyptus falcata / E. pleurocarpa: Proteaceous mallee-heath	TEC - Proteaceae Dominated Kwongkan Shrublands of the Southeast Coastal Floristic Province of Western Australia	2932.99	150.99	31.75	1.08	21.02
Eple/Bmed	Eucalyptus pleurocarpa/ Banksia media	TEC - Proteaceae Dominated Kwongkan Shrublands of the Southeast Coastal Floristic Province of Western Australia	332.81	31.20	3.91	1.17	12.53
Mx	Melaleuca sp. Kundip	PEC (P1): Very open mallee over Melaleuca sp. Kundip dense heath	11.26	11.01	NIL	0	0

[1] Relocating the waste rock dump will result in no impact to this vegetation community

3.4 FAUNA AND HABITAT

3.4.1 Terrestrial Fauna

Local and regional environmental values

The Kundip Mine Site occurs on the periphery of the Fitzgerald Biosphere and one of 15 biodiversity hotspots, where the most valuable ecological attributes 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 sensitive manner. The intent is that development 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 RGCP is situated within the 'zone of co-operation'; there is no capacity for the Kundip Mine Site to have impacts on local and regional fauna values beyond the direct impacts of clearing for construction and operation. Therefore, the Project will not degrade the local and regional fauna conservation values.

The Myamba Mine Site is situated approximately 1.5 km south of the Kundip Nature Reserve and is located on land cleared for agricultural use. Consequently, there are no fauna assemblages within the site.

Current Status

In the early 1900s much of the original vegetation at the Kundip Mine Site was cleared, with larger trees being felled and used for bracing mine shafts and the construction of gantries. Tall hollow bearing eucalypt and corymbia species would have provided essential nesting and roosting habitat for a number of arboreal and semi arboreal non-volant (non-flying) species, and a number of predatory volant (flying) species. The current over-story vegetation does not accurately reflect the vegetation that would have been present had these small scale mining operations not proliferated. There is little doubt that this major shift in vegetation attributes would have had a major impact on the faunal assemblages. In addition to the changes in vegetation structure, the small scale mines of the early and mid-1900s and the subsequent larger scale activities in more recent times, has resulted in the clearing of all vegetation strata across approximately 30 ha within the Kundip Mine Site.

Nevertheless, the area still has intrinsic value to fauna. Recent fauna trapping showed that the small patch (<1 ha) of remnant vegetation between Kaolin Pit, Western Gem Pit and the former TSF, continues to support a diverse array of mammals and reptiles. The innumerable mine shafts distributed across the site provide refuge for species such as the Chuditch and small Microchiropteran bats which would, under normal circumstances, take refuge in standing and fallen hollow limbs.

Native vegetation has re-established across most of the site, though the structure is not the same.

Surveys and Investigations

Desktop Assessment

A search of the *EPBC Act* list for MNES indicated 15 fauna species of conservation significance have the potential to occur in habitats that may be present within 10 km of the RGCP area. The 15 species comprise 11 birds and 4 mammals.

A search of NatureMap carried out in June 2016 indicated up to 117 fauna species have the potential to occur, comprising of 5 Amphibians, 29 Reptiles, 15 mammals, and 68 Birds.

A search of DPaW's Threatened and Priority Fauna database identified 34 conservation significant fauna have previously been recorded within a 30 km radius of the RGCP area.

Seventeen conservation significant fauna species, including 6 migratory species, have previously been recorded in or near the RGCP area.

A level 2 fauna assessment and supplementary fauna assessment were undertaken by Biota Environmental Sciences Pty Ltd in 2004 (see Appendix 2 and Appendix 3 of Appendix 6). These surveys recorded five fauna taxa of conservation significance including *Calyptorhynchus latirostris* (Carnaby's Cockatoo)*, Leipoa ocellata* (Malleefowl), *Lerista viduata* (Ravensthorpe Range Slider)*, Psophodes nigrogularis oberon* (Western Whipbird) and *Macropus irma* (Western Brush Wallaby). Two species of mygalomorph spiders, *Aname mainae* and *Chenistonia tepperi,* were recorded in the RGCP area.

Site Investigations

The most recent fauna survey undertaken within the RGCP area was undertaken by APM in 2016, the full report is included as Appendix 6.

The field survey targeted the conservation significant fauna previously recorded by Biota or having a high likelihood of occurrence based on the vegetation and habitats present. The survey was carried out in two parts; 6 days from 17/08/2016 to 22/08/2016 and 6 days from 20/09/2016 to 26/09/2016. Opportunistic collecting was also undertaken at locations likely to support fauna of conservation significance including Short Range Endemics. The survey identified five conservation significant fauna species listed under the *EPBC Act* and *WC Act*:

- *Calyptorhynchus latirostris*, Carnaby's Black Cockatoo (Endangered, *EPBC Act*; Threatened, *WC Act*);
- *Dasyurus geoffroii*, Chuditch (Vulnerable, *EPBC Act*; Threatened, *WA Act*);
- *Leipoa ocellata,* Malleefowl (Endangered, *EPBC Act*; Threatened, *WC Act*);
- *Falco peregrinus*, Peregrine Falcon (Schedule 7, *WC Act*); and
- *Pseudomys shortridgei*, Heath Rat (Vulnerable, *EPBC Act*).

3.4.2 Subterranean Fauna

Local and regional environmental values

Of the stygofauna surveys known to have been conducted in the south west and surrounds, particularly in fractured rock aquifers, stygofauna have generally been absent or of low diversity. The few troglofauna surveys carried out have also typically yielded few taxa (Outback Ecology 2010).

Current Status

A subterranean fauna desktop risk assessment was undertaken by Outback Ecology in 2010. Findings of the assessment are summarised below and further information is provided in the 2016 Biological Survey Report (Appendix 6).

Kundip Mine Site

The Kundip Mine Site is considered unlikely to contain rich stygofauna or troglofauna communities. Stygofauna presence is considered unlikely due to the low permeability of the rocks in the area and low inflows, potentially limiting energy inputs.

Presence of troglofauna is also considered unlikely within the site as the geology of the area is mostly unsuitable, with only limited potential habitat noted. Therefore, the likelihood of significant troglofauna values in the Kundip Mine Site is considered low.

Myamba Mine Site

Based on the geology and hydrogeology of the Myamba Mine Site, the probability of significant stygofauna values within the site is considered low. In particular the low pH of the groundwater associated with the main water bearing zone (the mineralised zone) does not provide a suitable environment for stygofauna. An additional factor is the low level of recharge to the aquifer (potentially <1 % of rainfall), which is likely to result in low inputs of energy and nutrients as organic matter, and limit the ability of the groundwater, all of which are needed to support diverse stygal communities.

Potential habitat for troglofauna in the Myamba Mine Site is limited, suggesting that the area is unlikely to have significant troglofauna values. Lack of habitat suitability is mostly attributed to the lack of vuggs above the water table in the subsurface geology of the proposed Trilogy oxide pit area.

Based on the findings of the Outback Ecology 2010 desktop assessment, the risk to stygofauna and troglofauna in the RGCP area is considered to be low. Additional pilot surveys to investigate subterranean fauna were not recommended.

3.5 TERRESTRIAL ENVIRONMENTAL QUALITY

Local and regional environmental values

The RGCP lies within the eastern sector of the Fitzgerald Biosphere Reserve in the ‘zone of cooperation’. The 130,000 ha buffer zone includes the upper catchments of all the river systems that pass through or around the core FRNP. The Biosphere Reserve is a part-tenured management concept recognised by UNSECO as well as State and Commonwealth governments.

There are no World Heritage sites or Ramsar wetlands within the RGCP area or the wider Ravensthorpe shire. Further, mining of the Kundip deposits (Kaolin, Harbour View/May and Flag) and Myamba oxide deposit (Trilogy) will not impact on any Commonwealth marine areas, Commonwealth land or conservation reserves or parks.

Current Status

At a regional scale, a TSF breach at Elverdton Mines (approximately 6 km north of the Kundip Mine Site) has resulted in tailings being discharged into the Steere River. The active sediment plume can be seen from aerial photography and extends as far downstream as the Kundip Mine Site.

At a localised scale, seepage from a historic heap leach facility at Kundip Mine Site has caused death of local vegetation. It is unknown if cyanide is still leaching from the facility however this is unlikely given the number of frogs noted as calling in the water bodies associated with the heap leach facility. Further investigation is needed to determine the current severity and extent of cyanide contamination, to determine if remediation works are required. Investigation may include sampling for free, total or Weak Acid Dissociable (WAD) cyanide content in surrounding soils. WAD cyanide refers to metal cyanide complexes that dissociate under week acid conditions pH 4.5 to pH 6.

Existing Surveys

Geochemical characterisation test work was undertaken by Graeme Campbell and Associates (GCA) on waste bedrock material from Kundip and Trilogy deposits (2004), and process-tailings-slurry (2005). These reports are attached as Appendix 8 and Appendix 9 respectively. In 2010 GCA undertook additional characterisation test work on samples from the Trilogy deposit. The first report investigated the characteristics of mine waste (see Appendix 10); the second report the geochemical characterisation of waste regolith (see Appendix 11). Characterisation of waste regolith material from the Kundip deposit was undertaken by Outback Ecology in 2011 and this report is included as Appendix 12.

Regolith material referred to hereafter is defined as the layer of unconsolidated rock and weathered material above bedrock, including weathered sediments, scapolites, organic accumulations, soil, colluvium, alluvium and aeolian deposits.

3.5.1 Waste Rock Characterisation

3.5.1.1 Kundip Deposits (Kundip Mine Site)

GCA (2004) described mineralisation of the Kundip mining field as consisting of quartz veins ranging from a few centimetres to several metres thick. The veins carry several percent coarse Fe and Cu sulphide (pyrite, pyrrhotite and chalcopyrite) with associated Au and Ag values.

As described by GCA (2004), the Kundip deposit is characterised by Low-Grade-Oxide-Ores which are non-acid forming (NAF) and reflect groundmasses devoid of both sulphide and carbonate materials. The samples of Low-Grade-Transition Ore and Low-Grade-Primary-Ore were classified as potentially acid forming (PAF) and reflect 'trace/accessory sulphides' in a groundmass devoid of carbonate minerals. The samples were variously enriched in Cu, and in the case of the Low-Grade-primary-Ore samples, also in Ag, Zn, Cd and Pb. The Cu contents range from approximately 0.3 to 0.4 %.

Characterisation of waste regolith materials generated from the Kundip deposit was undertaken in 2011 by Outback Ecology. The results of the assessment indicated that pH of waste regolith materials ranged from strongly acidic (pH 5.3) to neutral (pH 7.3). The electrical conductivity (EC) of the material ranged from non-saline to moderately saline, with all waste samples being classified as either sodic (6 to 15 % ESP) or highly sodic (> 15 % ESP). The majority of material sampled was found

to have a low to moderate organic carbon content and low levels of plant-available nutrients. Investigation undertaken by GCA (2004) classified the waste regolith materials as NAF with a low capacity to consume acid.

All waste regolith and bedrock materials characterised during the 2004 assessments were found to have low contents of environmentally significant elements.

3.5.1.2 Trilogy Deposit (Myamba Mine Site)

Mining strategy for Myamba Mine Site

The satellite Trilogy deposit at the Myamba Mine Site is a combination of Au-Ag oxide cap above a polymetallic Cu-Au-Ag-Pb-Zn deposit. Only the Au-Ag oxide cap is proposed to be mined as part of the Project. Although Cu-Au-Ag ore is known to occur within fresh rock at the Trilogy deposit, extraction of this combination ore is not proposed for the current RGCP. ACH have no plans to mine Pb-Zn ore from the Trilogy deposit. The base of the proposed Trilogy oxide pit will not extend below 39 m.

Geochemical characterisation results

At the Trilogy deposit the base of oxidation occurs at approximately 38 m to 40 m vertical depth. Mining will not occur below this level. Above this level Au and Ag mineralisation predominates, with depletion of the base metals except for some Cu carbonate minerals close to the base of oxidation. GCA (2010) found the upper 10 m of the regolith profile to be moderately enriched in As, Bi, Sb, Se, and B. The extent of enrichment, however, was not marked and the solubility of these minor elements (in water) was considered to be modest (see Appendix 11).

A distinct zone of higher-grade supergene enrichment exists between 40 m and about 60 m vertical depth. The sulphide resource continues from approximately 40 m below surface to a maximum currently defined depth of 150 vertical metres. Significant Au and Ag credits occur throughout the sulphide zone; however, these will not be mined as part of the RGCP.

The Trilogy deposit is characterised by a regolith profile approximately 30-40 m thick, comprising a Clay-Rich-Zone (approximately 3-5 m thick) overlying a Weathered-Shale-Zone. The geochemical analysis results indicate that the waste material generated from the regolith profile is NAF, contains negligible amounts of sulphide minerals, and is mildly alkaline (viz. pH 8-9), with moderate contents of soluble-salts. A sample of light-brown-clay had a high capacity to consume acid and likely reflects the occurrence of ‘pedogenic-calcite’ in the soil profile. The samples of the regolith materials from depth had a negligible capacity to consume acid.

The test work results from representative samples of the low grade ore from the Trilogy deposit indicate that the samples of the Low-Grade-Oxide-Ore and Low-Grade-Transition-Ore are NAF, and reflect groundmasses devoid of both sulphide and carbonate materials. Low grade ore samples were enriched in Cu and Pb and contained soluble Cu and Pb forms that have the potential to be released at circum-neutral pH.

Additional waste characterisation will be undertaken to validate characteristics of the proposed RGCP deposits.

A summary of waste rock characterisation results for the Kundip deposits and the Trilogy oxide deposit are provided in Table 3-6.

Table 3-6: Summary of waste rock characterisation results

Material	Depth of Materials	pH	Soluble Salts (Low/Moderate/High)	Sulphide Minerals (%)	Acid forming capacity (NAF/PAF)	Estimated timeframe for acidification if exposed (Short Lag/Long Lag)	Acid consuming capacity (Low/Moderate /High)	Carbonate Minerals (Present/Absent)	Environmentally significant elements
KUNDIP DEPOSITS (KUNDIP MINE SITE)									
Waste Regolith	~0 – 40m	Mildly alkaline (pH 8-9)	Moderate	Negligible (<0.1%)	NAF	N/A	Low	Absent	Low
Waste Bedrock	The depth of these materials will vary between pits. Kaolin pit, the deepest pit, has an estimated max pit depth of 69.85m AHD. Flag and Harbour View/May pits, slightly more shallow, have estimated max pit depths of 98.35m and 99.85m/102.35m AHD respectively.	Mildly alkaline (pH 8-9)	Low - Moderate	Minute - Trace (0.2-0.3%)	Mostly NAF (one PAF)	Long Lag	Moderate - High	Present	Low
Low Grade Oxide Ore		Mildly alkaline (pH 8-9)	Moderate	Negligible	NAF	N/A	Low	Absent	Low
Low Grade Transitional & Primary Ore		Mildly alkaline (pH 8-9)	Low - Moderate	Minute - Trace	PAF	Long Lag	Moderate - High	Present	Enriched: Cu
TRILOGY DEPOSIT (MYAMBA MINE SITE)									
Waste Regolith	0 - 40m	Mildly alkaline (pH 8-9)	Moderate	Negligible (<0.1%)	NAF	N/A	Shallow soils – High Deep regolith - Low	Shallow soils – Present Deep regolith - Absent	Low *Moderately enriched in As, Bi, Sb, Se, and B.*

Material	Depth of Materials	pH	Soluble Salts (Low/Moderate/High)	Sulphide Minerals (%)	Acid forming capacity (NAF/PAF)	Estimated timeframe for acidification if exposed (Short Lag/Long Lag)	Acid consuming capacity (Low/Moderate /High)	Carbonate Minerals (Present/Absent)	Environmentally significant elements
									Saprolitic-phyllite at depth may be enriched in Pb
Low Grade Oxide/Transitional Ore	Oxide 0 - 40m Transitional 40 – 60m	Mildly alkaline (pH 8-9)	Moderate	Absent	NAF	N/A	Low	Absent	Significantly Enriched: Cu & Pb *(contains soluble form released at circum-neutral-pH)*

3.5.2 Tailings Characterisation

Geochemical characterisation of process-tailings-slurry was undertaken by GCA (2005). The results of test work undertaken are an indication only of potential characteristics of RGCP process-tailings-slurry. Materials proposed to be processed for the RGCP are expected to contain a greater proportion of NAF materials, and a smaller proportion of PAF materials, than original test work materials. Thus the results detailed below represent a 'worst case scenario' for potential tailings characterisation. Further, characterisation of process-tailings-slurry will be completed in association with new metallurgical test work prior to commencement of the Project.

Table 3-7 provides a summary of the GCA (2005) tailings characterisation results.

3.5.2.1 Oxide-Ore-Tailings – Kundip and Trilogy

The tailings solids from Kundip and Trilogy oxide ores were found to have Total-S and SO_4-S values of 0.10 - 0.31% and 0.08 - 0.11% respectively, and contained minute/trace amounts of sulphide-minerals (viz. Sulphide-S contents less than 0.2-0.3%). The material was found to have a low capacity to consume acid, a reflection of the paucity of carbonate-minerals. Oxide-ore-tailings were classified as NAF with an NAG-pH value of 6.8 - 7.1 and an NAG value less than 0.5 kg H_2SO_4 per tonne.

3.5.2.2 Primary-Ore-Tailings – Kundip

The tailings solids from Kundip primary ores were found to have Total-S and SO_4-S values of 9.1% and 0.03% respectively. The sulphide-mineral suite was co-dominated by pyrite and pyrrhotite as minor components (viz. Sulphide-S content of 9 - 10%). The sample was found to have a high capacity to consume acid and buffer pH due to presence of reactive carbonate-minerals (i.e. calcite). The acid neutralising capacity (ANC) was 64 kg H_2SO_4 per tonne and the CO_3-C value 0.54%. The pH-buffering curve exhibited an "inflection-point" near pH 6 to 7. Primary-ore-tailings were classified as PAF with a NAG-pH value of 2.7 - 3.0, a NAG value of 37 – 76 kg H_2SO_4 per tonne, and a NAPP value of 220 kg H_2SO_4 per tonne.

3.5.2.3 Multi-element composition and mineralogy of ore tailings

All samples of tailings solids were variously enriched in chalcophyles (Ag, Cu, Pb, As, Bi, Se, Mo, and B). The Kundip-Oxide-Ore-Tailings-Solids were particularly enriched with Cu (0.28%), while the Trilogy-Oxide-Ore-Tailings-Solids were particularly enriched with Pb (0.13%). Of the Primary-Ore-Tailings, Kundip tailings were most enriched with chalcophyles due to the high Sulphide-S content.

3.5.2.4 Tailings Slurry Water Samples

Tailings-slurry-water was found to be mildly-alkaline (viz. pH 8-9) and saline with Total-Dissolved Solids (TDS) of 25,000 - 29,000mg/L. The salts in the samples comprised NaCl (viz. "halite"), together with sulphates, Mg and Ca. Concentrations of most minor-elements were less than or close to the respective detection-limits, with the exception of cyanide-complexing metals, especially Cu.

GCA (2005) reported tailings-slurry-water samples had total-cyanide (CNtot) and weak-acid-dissociable-cyanide (CNwad) concentrations of 210 - 640 mg/L and 200 - 480 mg/L respectively, although GR Engineering, the consultants currently engaged by ACH to address metallurgical aspects of the project, have indicated that levels are likely to be sub 50 mg/L . The SCN concentrations were 3.4 - 250 mg/L. The main cyanide-complexing-metal in solution was Cu (120 - 410 mg/L). Lead

concentrations were comparatively lower at 0.017 - 2.2 mg/L. Further testing of cyanide forms in tailings-slurry-water will be undertaken.

Table 3-7: Summary of tailings characterisation results

Material	Depth of Materials	pH	Soluble Salts (Low/Moderate/High)	Sulphide Minerals (%)	Acid forming capacity (NAF/PAF)	Estimated timeframe for acidification if exposed (Months/Years /Decades)	Acid consuming capacity (Low/Moderate /High)	Carbonate Minerals (Present/Absent)	Environmentally significant elements
KUNDIP/TRILOGY OXIDE ORE TAILINGS									
Oxide Ore Tailings	Oxide 0 - 40m	Neutral (pH 6.8 – 7.1)	Moderate	Minute – Trace (<0.2-0.3%)	NAF	N/A	Low	Absent	Variously enriched in Ag, Cu, Pb, As, Bi, Se, Mo, and B. Particularly enriched with Pb.
Primary Ore Tailings	Primary 60 – 150m	Neutral (pH 6 – 7)	Low-Moderate	Accessory (9-10 %).	PAF	Kundip – Long Lag Trilogy – Short Lag	High	Present	Variously enriched in Ag, Cu, Pb, As, Bi, Se, Mo, and B. Particularly enriched with chalcophyles.
Tailings Slurry Water Samples	N/A	Mildly-Alkaline (pH 8.4-8.8)	High	N/A	N/A	N/A	N/A	N/A	Concentrations of most minor-elements less than, or close to, the respective detection-limits. Exceptions are cyanide-complexing metals, especially Cu.

3.6 LANDFORMS

3.6.1 Existing and Proposed Landforms

Kundip Mine Site

The current landform of the Kundip Mine Site has been somewhat altered by historic mining activities. Existing landforms within the site include:

- Open pits;
- WRL;
- TSF (historic);
- Heap leach facility (historic); and
- Water storage facilities.

Surface water runoff from these landforms has caused sediment erosion across areas of the Kundip Mine Site. Subsoils in particular are clay rich and therefore have the potential to slake and are dispersive. Topsoils across the site are more physically stable due to the greater gravel and rock content. Nutrients, seeds of native plant species and beneficial soil micro-organisms are considered to be concentrated within the top 15 cm of topsoil.

Existing landforms proposed to be altered and new landforms proposed to be constructed within the Kundip Mine Site include:

- Expansion of existing open pit mines (Kaolin, Harbour View/May, and Flag);
- Development of underground mines (Harbour View and Flag);
- Expansion of the existing WRL;
- Construction of an additional WRL;
- Construction of a TSF;
- Construction of two water storage facilities;
- Construction of diversion structures; and
- Construction of a process plant and ROM pad.

Golders/Dump Solver (2016) provides a concept design for the construction of WRL's and a TSF within the Kundip Mine Site and is included as Appendix 1.

Myamba Mine Site

No mining has occurred within the Myamba Mine Site; consequently, the current landform of the site remains unaltered. Landforms proposed to be constructed within the Myamba Mine Site as part of the RGCP include:

- Construction of a single open pit mine (Trilogy);
- Construction of an evaporation pond;
- Construction of a WRL; and
- Construction of ROM pad.

3.6.2 Surface Soil Characteristics Assessment

Kundip Mine Site

Outback Ecology (2004) undertook an assessment of the physical and chemical characteristics of regolith materials at Kundip Mine Site (see Appendix 15). Topsoil materials were found to be more physically stable than their associated subsoils, as they contain a greater content of gravel and rock fragments. Nutrients, seeds of native plant species and beneficial soil micro-organisms were particularly concentrated within the top 15 cm of topsoil. Therefore, the optimal stripping depth of topsoils to be used in rehabilitation is no deeper than 15 cm. Subsoil materials were generally described as clay rich with the potential to slake and be dispersive. If exposed on landform surfaces these materials are considered likely to become unstable, creating risks of hard-setting and erosion.

Further information is provided below on regolith characteristics, specific to proposed open pits at the Kundip Mine Site; the full report is contained within Appendix 15.

Flag Deposit

Surface soils at Flag were described as gravelly loams overlying medium clays. The topsoils were found to be relatively stable with little tendency for slaking or dispersion. By contrast, the clay subsoils (below 15cm depth) were unstable, with a tendency to slake and become dispersive.

Topsoils had characteristic gravel 'lag' on the surface, acting to protect the soil from raindrop splash and erosion. Towards the northern side of the deposit topsoils were found to have a substantial content of rock fragments. These soils are considered valuable for use in erosion protection on constructed landforms, particularly given the susceptibility of subsoil clays to erosion.

The topsoils contained low levels of salinity/ EC and were slightly acidic (pH 4.5 to 5.4). The soils were low in plant-available nitrogen, but were found to have moderate levels of extractable phosphorous. Organic matter content was moderate with the percentage content of organic carbon found to range from 2% to 4%.

Harbour View/May

The fertility of topsoils from the Harbour View/May deposit were found to be similar to those from the Flag deposit; however, the level of organic carbon was generally greater (by 2.5% - 5%) and the soil pH slightly higher (5.0 - 6.1 ($CaCl_2$)). The physical properties of the gravelly-loam topsoils and clay subsoils were also very similar to those from the Flag deposit.

Surface soils, particularly in well-vegetated areas, were physically well-protected with gravel lag, cryptogamic crusts and plant litter. The undisturbed soil crust was typically very firm, providing a barrier against raindrops and erosion and regulating the flow of water and nutrients through the soil.

Kaolin

Soils from the Kaolin deposit were similar to all other areas, predominately loamy topsoils over clay subsoils. The topsoils from around Kaolin were stable in terms of the Emerson test, but subsoils slaked and had some potential to disperse.

The existing Kaolin pit face contained soils of brown-yellow mottled medium clay (0.3 - 1 m) overlying red-grey heavy clay (1 - 2 m), with powdery light, white-yellow pink clays to depth. Soils from the uppermost pit face profile (0.3 - 1 m) were acidic (pH 4.2, 1:5 $CaCl_2$), had low organic carbon and extractable K, but substantially higher extractable S than was typical of topsoils at Kaolin. Both this medium clay (0.3 – 1 m) and red-grey heavy clays (1 – 2 m) from the upper sections of this

exposed profile had a tendency to slake but were not dispersive. The deeper light clays were unable to be tested by Outback Ecology (2004) due to lack of aggregates.

Myamba Mine Site

Outback Ecology (2011) undertook an assessment of the physical and chemical characteristics of 'surface' soils (to approximately 0.5 m depth) within the Myamba Mine Site (see Appendix 12). Soils from the site were categorised into five different soil associations, namely red clay dominant soil, phyllite outcrop, sand-dominant soil, gravel-dominant soil and calcrete-dominant soil.

Soil Physical Characteristics

Soil texture was found to range from sandy loam (approximately 10 to 20 % clay) to heavy clay (> 50% clay). The majority of soil materials were classed as sandy loams, sandy clays or light to medium clays. Sites from the red clay-dominant soils had the highest clay contents and were classed as sandy clays to medium clays.

A high proportion of the sub-surface soil samples from below the 0 – 10 cm sampling interval were described as partially or completely dispersive. There was no relationship observed between soil association and soil structural stability. Sub-surface soils from all soil associations were observed to be completely or partially dispersive. Gravel-dominant soils were found to be the most stable. Soils exhibited a capacity for hard-setting, in particular those dominated by red clay or gravel.

The drainage class (hydraulic conductivity) ranged from 'extremely slow' to 'very rapid'. The plant-available water (PAW), (% volume) values measured within the site were considered to be 'moderate', and typical for the soils of the region. There was substantial variation in the water retention characteristics measured for the < 2 mm soil fraction of most soils, with PAW values ranging from 14.3 to 35.7%.

Soil Chemical Characteristics

Soil pH values (H_2O) were found to vary between pH 5.1 (very strongly acidic) to 9.3 (strongly alkaline). The majority of soil materials sampled were classed as neutral to moderately alkaline. Soils from the red clay-dominant, phyllite outcrop, sand-dominant and calcrete-dominant materials were generally moderately alkaline, while the gravel-dominant sites were generally classed as neutral. The EC of the surface soils ranged from non-saline to very saline. EC values within the soil profile were found to increase with depth.

The majority of soils sampled contained moderate to high organic carbon content and typically had low levels of plant-available nutrients. The majority of the soils were classified as non-sodic, with ESP values less than 6%; however, highly sodic ESP values were measured in sites from the red-clay dominant soils and phyllite outcrop below the surface 0 – 10 cm.

The concentration of Cd and Hg within Myamba soils was not measured within detectable limits; however, As, Cr, Cu, Pb, Ni and Zn were regularly detected at a reportable level. There was an observed trend between multi-element concentrations and the sand-dominant soils, which also had levels of As above the Ecological Investigation Level (EIL) guidelines (DEC, 2010).

3.6.3 Geotechnical Assessment

Two feasibility level geotechnical assessments have been undertaken by Peter O'Byran and Associates (2010) for the Kundip and Myamba Mine Sites. Each report provides an indication of ground conditions within the relevant site, with the potential to influence the stability of proposed open pits, as well as proposed underground mines at the Kundip Mine Site. Additional geotechnical test work will be undertaken to confirm the stability of proposed landforms. Appendix 13 includes the geotechnical assessment of proposed Kundip Mine Site open pits (Kaolin, Harbour View/May and Flag) and underground mines (Flag and Harbour View). While Appendix 14 includes the geotechnical assessment of proposed Myamba Mine Site Trilogy open pit.

3.6.3.1 Open Pits

Kundip Mine Site - Kaolin, Harbour View/May and Flag pits

Rock Weathering

The Kaolin rock mass can be generally described as highly weathered to a depth of ~50 mbs (ranging from ~ 42 to 55 mbs). From this depth the rock mass weathering rapidly transitions from slightly weathered to fresh. At the southern pit wall, however, the rock mass becomes reasonably fresh (slightly weathered) at a depth of ~15 mbs.

The Harbour View/May rock mass is described as highly weathered to a depth of ~ 35 mbs (ranging from ~ 30 m to 40 mbs). From this depth the rock mass weathering grades gradually from slightly weathered to fresh. The top of fresh rock (TOFR) generally occurs within the interval of 40 m to 60 mbs.

The Flag open pit weathering profile is described as highly variable. The southern wall of the pit will occur within weathered rock to ~24-27 mbs, where the rock then grades into slightly weathered rock. The TOFR occurs between ~41-51 mbs. Along the western half of the pits north wall the weathering profile is relatively shallow with slightly weathered rock occurring from 6 mbs – 38 mbs (TOFR). At the eastern end of the north wall the rock mass is weathered to ~60 mbs. The TOFR is estimated to occur just below ~85 mbs.

Rock Strength

Manual index testing was undertaken in accordance with the International Society of Rock Mechanics (ISRM) guidelines, to estimate intact rock strength. Granite rocks at the Flag and Harbour View/May deposits were classified as extremely strong, while rocks at Kaolin were found to be even stronger.

A summary of base case wall design parameters for the Kaolin, Harbour View/May, and Flag open pits recommended by Peter O'Byran and Associates (2010) is provided in Table 3-8.

Myamba Mine Site – Trilogy oxide pit

Rock Weathering

The depth of rock weathering is reasonably uniform over the deposit, with the TOFR located at a depth of ~ 40 mbs.

With the exception of the siliceous siltstones, the rock mass within the proposed open pit mining domain is characterised by strong fracturing, which will be detrimental for berm and batter stability. Fracturing within the laminated siltstones significantly decrease as the rock becomes fresher with depth below surface. The siliceous siltstones are moderately fractured within the open pit domain.

Rock Strength

The compressive strengths of weathered laminated siltstones were found to range from approximately 1 MPa to 25 MPa. It is expected weathered siliceous siltstones will have a similar compressive strength.

Table 3-8: Base case wall design parameters for the Ravensthorpe Gold/Copper Project open pits

Mine Site	Pit	Wall Location	Rock Mass Description	Depth Below Surface	Batter Angle (°)	Berm Width (m)	Bench Height (m)	Inter-ramp angle (°)
Kundip Mine Site	Kaolin	North wall	Completely weathered to moderately weathered	0 – 60 m	65	4.2	5	37
			Slightly weathered to fresh	60 – 100 m	60	7.0	15	44
		South, east & west walls	Completely weathered to moderately weathered	0 – 30 m	50	7.0	10	33
				30 – 60 m	60	7.0	10	38
			Slightly weathered to fresh	60 – 90 m	60	7.0	15	44
				90 – 100 m	75	-	10	75
	Flag	North	Completely to slightly weathered	0 – 60 m	60	7.0	15	44
		South, east & west walls	Slightly weathered to fresh	0 – 30 m	60	7.0	15	44
				30 – 60 m	65	7.0	15	47
	Harbour View/May	North, south and east walls	Completely to Moderately Weathered	0 – 45 m	55	8	15	39
			Slightly Weathered to Fresh	45 – 60 m	65		15	65
		West wall (follow footwall)	Completely to Moderately Weathered	0 – 45 m	55	8	15	39
			Slightly Weathered	45 – 60 m	60		15	60

Mine Site	Pit	Wall Location	Rock Mass Description	Depth Below Surface	Batter Angle (°)	Berm Width (m)	Bench Height (m)	Inter-ramp angle (°)
			to Fresh					
Myamba Mine Site	Trilogy	Handingwall & Endwall	Weathered laminated siltstones	0 – 40m	60	4	5	36
			Slightly weathered to fresh laminated siltstones	40 – ~150m	60	4	15	42
		Footwall (wall striking sub-parallel to bedding)	Weathered laminated siltstones and siliceous siltstones	0 – 40m	60	4	5	36
			Slightly weathered to fresh laminated siltstones	35 – ~150m	60	8	15	42
			Slightly weathered to fresh siliceous siltstones	35 – ~150m	64	6	15	48

3.6.3.2 Underground Mines – Flag and Harbour View

Rock Quality

The Harbour View/May weathered and fresh rock mass within the anticipated pit walls are expected to be strongly fractured which will be unfavourable for batter and berm crest stability. However, within the proposed underground mining area rock mass fracturing tends to decrease with increasing depth below surface.

Rock mass fracturing at the Flag deposit was found to be less than that occurring at Harbour View/May deposits. It is expected the granitic rock mass will be moderately blocky and extremely strong.

Mining methods

Two stoping methods have been identified by Peter O'Bryan and Associates (2010) for the extraction of Harbour View lodes. The first method, LHOS with pillars, is geotechnically feasible based on known ground conditions. If conditions are less favourable than expected, Bench Stoping with rock fill could be readily implemented.

Similarly the Flag main lodes will also be preferentially extracted using LHOS with pillars. Cut and fill mining proposed for the bottom potion of the western ore block will add further conservatism to the mine design. If ground conditions are less favourable in LHOS areas than expected, Bench Stoping with rock fill will be the preferred alternative mining method. Peter O'Bryan and Associates (2010) recommend that a conservative HR value of 6.7 m (20 m high x 40 m long) be adopted for Flag main lode stopes.

Decline and Accesses

Decline and lode access to the Harbour View deposit will predominately occur within Good to Very Good quality rock. The proposed location of the decline and accesses opposite an uneconomic sector of the lodes means that this development is unlikely to be affected by stope instability.

Decline and lode access to the Flag deposit will be positioned in a mine footwall sequence of Good to Very Good quality rock. Within this favourable rock mass it is recommended the decline be positioned at least 25 m from potential stope voids.

All underground openings within the Kundip Mine Site will be at a minimum meshed from grade line to grade line at least 1.5 m off the floor.

Ground support and reinforcement

The minimum ground support design specifications for proposed Harbour View and Flag underground mines are provided in Table 3-9.

Table 3-9: Ground support specifications for Harbour View and Flag underground mines at the Kundip Mine Site

Development Type	Dimensions	Ground Conditions	Minimum Ground Support Specification
Decline and ore accesses	5 mW x 5 mH	Weakly to moderately structured rock mass (Fair to Good)	≥ 2.4 m long friction bolts and mesh (3 m x 2.4 m) installed over the backs and shoulders to within ~3 m of floor level.
		Highly structured (Blocky) rock mass (Very Poor to Poor)	2.4 m long friction bolts and mesh (3 m x 2.4 m) installed over the backs and shoulders to within ~1.5 m of floor level.
Ore drives	3 mW x 3.5 mH	Weakly to moderately structured rock mass (Fair to Good)	1.8 m long friction bolts and mesh (3 m x 2.4 m) installed over the backs and shoulders to within ~3 m of floor level.
		Highly structured (Blocky) rock mass (Very Poor to Poor)	1.8 m long friction bolts and mesh (3 m x 2.4 m) installed over the backs and shoulders to within ~1.5 m of floor level.
Intersection spans	≥ 6 m wide spans	All conditions	≥ 6 m long twin strand cable bolts installed on a 2 m x 2 m pattern throughout wide span.
	4 - 6 m wide spans	All conditions	≥ 3 m long, 20 mm diameter full column grouted gewie bars installed on a 1.5 m x 1.5 m pattern throughout wide span.
Stope spans	NA	Highly structured (Blocky) rock mass and/or unfavourably orientated structures.	≥ 4 m long twin strand cable bolts installed in 2-2.5 m spaced rings with each ring containing two (2) plated and tensioned cable bolts.

3.7 HYDROLOGICAL PROCESSES

3.7.1 Surface Water

Surface hydrology assessments of the Kundip and Myamba Mine Sites were undertaken by Coffey in 2011 and are provided as Appendix 16 and Appendix 17 respectively. An impact assessment and design for water storage facilities at Kundip Mine Site was also prepared by Coffey (2011), the report is provided as Appendix 3.

Regional environmental values

Surface drainage in the region trends north to south from the Ravensthorpe Range towards the Southern Ocean. Main drainage channels in the Kundip area are the Phillips River, Steere River and Jerdacuttup River.

The RGCP is not in any proclaimed surface water areas, or rivers protected under the *Rights in Water and Irrigation Act 1914 (RIWI Act)*. The RGCP is within the Esperance Coast surface water allocation area and the Phillips River sub-area. The closest Public Drinking Water Source (PDWS) protection areas (both Priority 1 and 2) are located approximately 15 km south of the Myamba Mine Site nearby Hopetoun. The Ravensthorpe catchment area is located approximately 10 km north-west of the Kundip Mine Site. The closest surface water allocation area protected under the *RIWI Act* is located approximately 15 km north-west of the Kundip Mine Site beyond the Ravensthorpe catchment area.

The RGCP is not within a 100 year Average Recurrence Interval (ARI) floodplain development control area.

A TSF breach at Elverdton Mine (approximately 6 km north of the Kundip Mine Site) has resulted in tailings being discharged into the Steere River. The active sediment plume extends downstream to the Kundip Mine Site and may impact surface water quality within the region.

Local environmental values

Kundip Mine Site

The Kundip Mine Site is bound by the Steere River to the west (which intersects the site) and the Jerdacuttup River approximately 6 km to the east. Drainage across the Kundip Mine Site predominately occurs from north-east to south-west along a 100 m declining gradient across the site. Historical mining at Kundip has resulted in numerous disturbances which create local drainage anomalies; however, the majority of surface water is channelled towards the Steere River, which crosses under the Hopetoun-Ravensthorpe Road approximately 200 m south of Kundip Mine Site. The site falls predominately within the Steere River Catchment, with parts of the eastern extent (outside of the proposed development envelope) falling within the Jerdacuttup River Catchment. There are 11 sub-catchments of approximately 494.4 ha which feed into the Steere River (see Figure 6 of Appendix 3).

Myamba Mine Site

The Myamba Mine Site is situated between Kuliba Creek, approximately 1.5 km to the west, and the Jerdacuttup River, approximately 4 km to the east. Drainage across the Myamba Mine Site occurs along a gentle gradient from 90 m AHD in the north to 80 m AHD in the south. Surface water flows

converge at Kuliba Creek, a tributary which feeds into the Steere River on the west side of the Hopetoun-Ravensthorpe Road, approximately 8 km south-west of the site. The site is situated within the greater Steere River Catchment; however, the site itself contains two sub-catchments of Kuliba Creek. The estimated area of sub-catchment A is 345 ha and for sub-catchment B is 432 ha.

Flood Estimations

Flood estimations for the Kundip and Myamba Mine Sites were determined using the Australian Rainfall and Runnoff guidelines (2000) for *Rational Method Flood Estimation* (Coffey 2011). Peak flow estimates for all sub-catchments of the Project area were determined for 50-year and 100-year ARI and are provided in Table 3-10.

Table 3-10: Peak Flow Estimates for the Ravensthorpe Gold/Copper Project Area

Mine Site	Sub-Catchment / Creek	Flow Peaks (m^3/s)	
		50 year ARI	100 year ARI
Kundip Mine Site	1	0.9	1.2
	2	1.1	1.5
	3	2.0	2.7
	4	0.8	1.0
	5	2.1	2.9
	6	0.6	0.9
	7	6.1	8.3
	8	0.2	0.3
	9	0.7	1.0
	10	0.2	0.3
	11	1.7	2.4
	Steere River*	19.8	28.0
Myamba Mine Site	A	16.9	22.9
	B	21.2	28.7

*Steere River flow was calculated by Coffey (2011) at the downstream end of the Kundip Mine Site where the catchment 11 tributary meets the Steere River.

Current Status

Kundip Mine Site

The Kundip Mine Site contains four artificially constructed water storage facilities. These facilities currently capture excess surface water flows across the site, minimising sediment erosion and transport from historically disturbed areas. There are three water storage facilities nearby Kaolin pit. The two facilities north of Kaolin pit will remain undisturbed, while the smaller facility south of Kaolin pit will be incorporated as the pit expands. The larger water storage facility nearby the historic Harbour View mine, will form part of the proposed water storage facility south of the proposed Harbour View/May pit.

The location of the larger water storage facilities proposed by Coffey in 2011 remains uncompromised by the proposed activities, and thus the location of these facilities remain valid and

applicable to the current proposal (see Figure 2-1). Further detail on the construction of these facilities, the location of diversion channels, plus cross section diagrams, can be found in the attached report (Appendix 3). Together the two water storage facilities will have a disturbance area of approximately 29 ha.

Some adjustment of the drainage flow to the immediate south of the Kaolin pit (as shown in Figure 4 of Appendix 3) may be required as the slightly bigger shell proposed on the south-eastern flank of the Kaolin pit encompasses this drainage line. Furthermore, the current design requires the main southern rock dump to be placed at stand off to this south eastern wall pit crest line. For further information refer to Section 2.2.2 of this support document.

Myamba Mine Site

Given the Myamba Mine Site has been heavily cleared for agriculture; additional runoff generated by the construction of the mine infrastructure is expected to be minor.

3.7.2 Groundwater

Hydrogeological investigations of the Kundip and Myamba Mine Sites were undertaken by Rockwater in 2011, these reports are provided as Appendix 4 and Appendix 18 respectively.

Local and regional environmental values

The RGCP area has minor local aquifers with Archaean volcanic rocks that are generally of low permeability. However, fractures and joints in rocks and mineralised zones can be moderately permeable. Drainage lines typically follow fractures in the underlying rocks.

Rockwater (2011) found that rocks in the Kundip Mine Site area are of low permeability, even within the Harbour View/May 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 Kundip Mine Site trends downwards to the south-south-east. The water table has been found to be irregular and does not closely reflect the topography.

The main water-bearing zone within the Myamba Mine Site is the silicified mineralised zone. Static water levels ranged from approximately 51.34 m AHD in the north-west to 55.24 m AHD in the east, indicating that the groundwater flows northwest towards tributaries of the Steere River. The hydraulic gradient is contrary to local and regional topography, however, the direction of groundwater flow will not affect mine pit dewatering as the aquifer is interpreted to be isolated within rocks of very low permeability, and so any groundwater flow will be very slow and of low volume.

The RGCP is not in any proclaimed or *RIWI* protected groundwater areas.

3.7.2.1 Groundwater Monitoring

There are 10 bores installed at the Kundip Mine Site, and eight monitoring bores and one production bore installed at the Myamba Mine Site. All bores except Bore D at the Kundip Mine Site remain fully functional and water depth readings have been recorded consistently from April 2004 to December 2015. Average readings for each bore over this time period are included in Table 3-11.

Table 3-11: Static Water Levels for Ravensthorpe Gold/Copper Project Monitoring and Production Bores

Mine Site	Bore ID	Static Water Level (mbs)
Myamba Mine Site	A	31.64
	B	30.57
	C	29.95
	D	31.23
	E	38.04
	F	36.01
	G	31.16
	H	26.80
	Production Bore	31.36
Kundip Mine Site	A (RC03KP_067)	24.86
	B (RC04KP_112)	52.72
	C (RC04KP_113)	19.85
	D (RC04KP_115)	*Destroyed (last reading March 2013)
	E (RC04KP_116)	21.77
	F (RC04KP_111)	34.61
	G (RC04KP_114)	39.22
	H (RC04KP_271)	51.70
	Beryl Shaft	31.34
	Flag Shaft	39.62

Test drilling by Rockwater (2011) indicated rocks in the area are generally of low permeability even within the mineralised zone. Old mine workings were reported to have intersected water bearing fractures, and there are moderate volumes of water stored in the workings. Previous groundwater inflows to the old workings have been estimated to be up to 500 m^3 per day.

Groundwater of the RGCP area is generally saline, ranging from 22,000mg/L TDS to 38,000 mg/LTDS within the Kundip Mine Site, and from 15,200 mg/L TDS to 25,400 mg/L TDS within the Myamba Mine Site. Field pH of Kundip Mine Site groundwater is approximately 6.8, while field pH of groundwater at Myamba Mine Site was approximately 8.0 in the higher mineralised zone (i.e. within the zone of oxidation 0 - 40 mbs).

Groundwater quality monitoring was undertaken at the Kundip Mine Site twice in 2006. The results of the water quality analysis are provided in Table 3-12. The results were compared against the Department of Health (DoH) (2006) *Contaminated Sites Reporting Guideline for Chemicals in Groundwater*. The limits represent acceptable concentrations of contaminants in groundwater for domestic non-potable use. Exceedance of the assessment levels does not necessarily imply that

adverse effects will occur to the terrestrial groundwater ecosystem and surrounding environment, but rather represents a baseline assessment of existing water quality in the RGCP area. The only parameters detected in greater concentrations than the limits set by DoH (2006) were metals Cd, Fe and Ni. Bore C was the only monitoring bore to detect elevated concentrations of Cd. Ni was detected in elevated concentrations at four bore sites; however, Bore C again contained the highest concentration overall. Fe only just exceeded the limits at bores B and C; levels were slightly higher again in Bore G, while Bore D contained Fe concentrations more than 300 times greater than the DoH (2006) limit of 3 mg/L.

Table 3-12: Groundwater monitoring at Kundip Mine Site bores in 2006

Parameter Units mg/L except for EC	DoH (2006) Domestic non-potable groundwater use (mg/L)	Sample Date	Bore									
			A (B67)	B (B112)	C (B113)	D (B115)	E (B116)	F (B111)	G (B114)	H (B271)	BERYL	FLAG
EC (mS/m)	N/A	20-Apr-2006	2370	1540	1490	2610	2200	1750	2580	2880	-	-
		15-Jun-2006	1720	2320	3690	1160	138	3690	4490	2990	2360	1380
TDS_180C	N/A	20-Apr-2006	15000	9400	8900	17000	14000	17000	18000	22000	-	-
		15-Jun-2006	14000	19000	32000	7400	1000	25000	40000	25000	19000	9900
pH	N/A	20-Apr-2006	6.50	5.80	6.40	6.20	6.50	7.30	6.20	6.60	-	-
		15-Jun-2006	7.40	7.40	6.90	8.20	6.50	7.80	7.30	7.10	7.40	7.00
Al	2	20-Apr-2006	0.13	0.13	0.14	1.90	0.04	0.50	0.24	0.11	-	-
		15-Jun-2006	0.01	0.04	0.01	0.01	0.01	0.01	0.01	<0.005	0.01	<0.005
B	40	20-Apr-2006	3.40	2.50	1.70	3.50	2.80	2.40	3.70	3.00	-	-
		15-Jun-2006	2.00	2.90	4.30	0.96	0.62	3.90	6.30	4.30	3.30	1.60
Ca	N/A	20-Apr-2006	45.70	33.10	75.70	40.40	88.20	47.80	87.70	78.40	-	-
		15-Jun-2006	189.00	194.00	333.00	205.00	10.80	284.00	345.00	225.00	201.00	80.70
Cd	0.02	20-Apr-2006	0.00	0.02	0.03	0.00	0.00	0.00	<0.001	0.01	-	-
		15-Jun-2006	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Parameter Units mg/L except for EC	DoH (2006) Domestic non-potable groundwater use (mg/L)	Sample Date	Bore									
			A (B67)	B (B112)	C (B113)	D (B115)	E (B116)	F (B111)	G (B114)	H (B271)	BERYL	FLAG
Co	-	20-Apr-2006	0.07	0.56	0.21	<0.005	<0.005	<0.005	<0.005	0.23	-	-
		15-Jun-2006	<0.005	<0.005	0.02	0.02	0.03	<0.005	<0.005	<0.005	0.06	<0.005
Cu	20	20-Apr-2006	0.24	1.90	0.34	<0.005	0.01	<0.005	<0.005	2.00	-	-
		15-Jun-2006	<0.005	<0.005	<0.005	<0.005	0.12	<0.005	0.01	<0.005	<0.005	<0.005
Fe	3	20-Apr-2006	2.60	4.60	3.30	1000.00	1.40	0.31	14.00	0.27	-	-
		15-Jun-2006	0.05	0.17	3.00	0.03	0.02	0.04	0.23	0.17	0.08	0.03
K	N/A	20-Apr-2006	101.0	61.3	67.5	116.0	96.1	76.0	142.0	101.0	-	-
		15-Jun-2006	86.2	124.0	210.0	34.7	10.4	203.0	235.0	149.0	126.0	75.0
Mg	N/A	20-Apr-2006	354.0	289.0	275.0	468.0	417.0	296.0	550.0	620.0	-	-
		15-Jun-2006	365.0	857.0	1660.0	352.0	31.5	1390.0	1830.0	1080.0	769.0	417.0
Na	N/A	20-Apr-2006	4610.0	2620.0	2480.0	4610.0	4040.0	2690.0	4460.0	5350.0	-	-
		15-Jun-2006	3900.0	5150.0	8330.0	2080.0	247.0	9070.0	11400.0	7030.0	5400.0	3060.0
Ni	0.2	20-Apr-2006	0.63	0.65	2.90	<0.01	0.05	0.10	0.08	0.82	-	-
		15-Jun-2006	0.01	0.01	0.04	0.19	0.09	0.02	0.02	0.02	0.03	0.11
Pb	0.1	20-Apr-2006	0.04	0.00	0.05	0.01	<0.0005	0.00	<0.001	0.01	-	-
		15-Jun-2006	<0.0005	<0.0005	<0.001	0.00	0.00	<0.001	0.00	<0.001	0.00	0.00

Parameter Units mg/L except for EC	DoH (2006) Domestic non-potable groundwater use (mg/L)	Sample Date	Bore									
			A (B67)	B (B112)	C (B113)	D (B115)	E (B116)	F (B111)	G (B114)	H (B271)	BERYL	FLAG
Zn	30	20-Apr-2006	1.40	15.00	15.00	0.04	0.05	0.19	0.01	6.10	-	-
		15-Jun-2006	0.03	<0.005	0.03	0.06	0.16	0.01	0.01	0.02	0.01	0.02

3.7.2.2 Impact of Final Mine Voids

Kundip Mine Site

Rockwater (2011) investigated the impact to groundwater from final mine voids within the Kundip Mine Site (see Appendix 4). Findings of the investigation are summarised below with key pit depths and estimated groundwater levels provided in Table 3-13.

The Kundip Mine Site is characterised by Archaean volcanic rock of low permeability. The proposed Kaolin, Harbour View/May, and Flag open-pits will extend below the water table. However, reducing the size of Harbour View/May and Flag pit shells, as proposed, will result in reduced inflow (via rainfall) and reduced outflow (via evaporation). The existing groundwater levels are expected to remain approximately neutral with inflows balancing outflows. All three pits will remain below current static groundwater levels as last measured acting predominately as groundwater sinks. However, with the estimated final pit depth at Harbour View/May only 3 m below the static groundwater level, it is possible that in times of high rainfall the pit lake may act as a groundwater source or throughflow lake.

Table 3-13: Predicted inflow rates for Kundip Mine Site pits

Pit	Pit area at crest (m^2)	Est. Static Water level (m AHD)	Max Pit Depth (m AHD)	Est. Max Inflow (m^3/d)	Est. Post mining pit water level (m AHD)	Sink/ source
Kaolin	244,657	146.70	69.85	30	110	Sink
Harbour View/May	57,000	124.10	99.85 / 102.35	25	~124	Sink (source in times of high rainfall)
Flag	76,452	122.20	98.35	100	120	Sink

**allows for net effect of groundwater inflow, rainfall inflow and evaporation.*

Bores used to monitor groundwater levels of Kundip Mine Site open pits are provided in Table 3-14, with the location of these bores indicated in Figure 3-2. The figure also provides ground water levels (GWLs) in metres AHD, and proposed pit shell designs as a location reference.

Groundwater of the Kundip Mine Site measures salinity levels in the range of 22,000 mg/L to 38,000 mg/L TDS, and a near neutral pH. The occurrence of carbonate minerals within the 'fresh dacite' waste rock ore material suggests that the pit water will also have approximately a circum-neutral pH due to buffering by submerged rocks in the pit walls. Evaporation from the pits may cause increases in salinity in the pit lakes. However, the water will not move into the groundwater flow system if the pits remain as groundwater sinks, as indicated from the Rockwater (2011) assessment.

Table 3-14: Key groundwater monitoring bores for the Kundip Mine Site

Borehole ID	Representative of pit	Static Water level (m AHD – Dec '10)	Static Water level (m AHD – Jan '04)
Beryl	Kaolin	146.70	No measure
KMB 1	Harbour View	124.10	121.65
KMB 3	Flag	122.20	120.90

A 'cone of depression' or localised lowering of groundwater levels will occur around the Kaolin, Harbour View/May, and Flag open pits. Changes in groundwater levels are not expected to be detected approximately 500 m or further down-gradient of the pits. This is mostly due to the low permeability of rocks in the Kundip Mine Site area. There are no groundwater users or groundwater dependent ecosystems near the Kundip Mine Site that could be impacted by any changes to the groundwater flow system (Rockwater 2011).

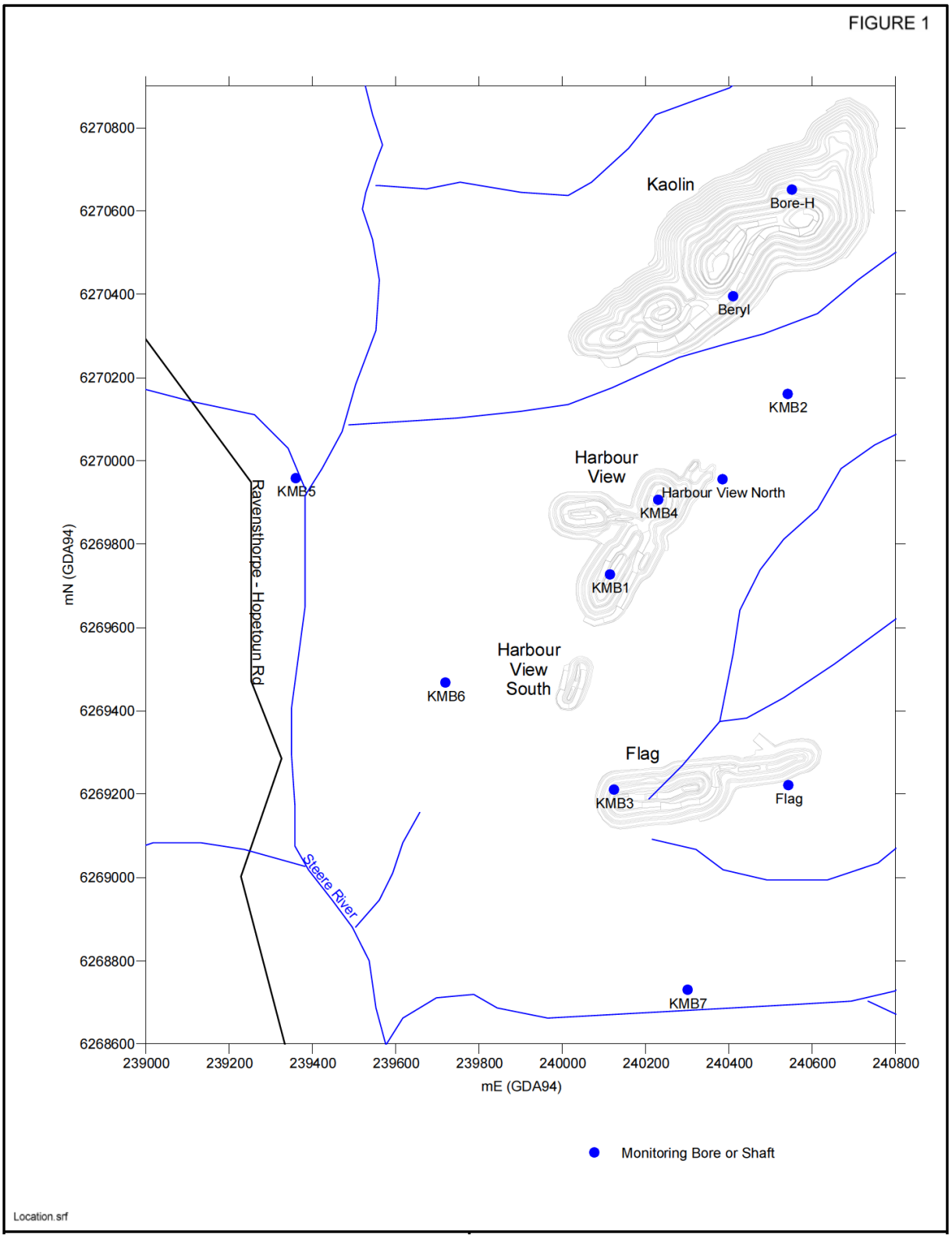

Figure 3-2: Location of Kundip Mine Site bores (Figure 1 of Rockwater 2011 report, Appendix 4)

Myamba Mine Site

Rockwater (2011) undertook a hydrogeological investigation of the Myamba Mine Site (see Appendix 18). The report is an update of the Rockwater (2004) report and a draft report prepared in December 2009. Findings of the investigation are summarised below.

The Trilogy satellite deposit at the Myamba Mine Site is characterised by carbonaceous shale host rock and fractured/mineralised zones. Of the eight groundwater exploration holes drilled during an initial site visit in 2004, airlift yields ranged from < 20 m^3/d to 240 m^3/d, with only two holes having airlift yields of more than 50 m^3/d. The groundwater is contained within fractures, joints and vugs in the silicified shales of the mineralized zone and overlying supergene zone.

The groundwater has a salinity of approximately 18,000 mg/L TDS. Groundwater outside of the mineralised zone (i.e. within the zone of oxidation 0 - 40 mbs) is circum-neutral, therefore, acid metalliferous drainage from the evaporation pond is considered highly unlikely.

Hydraulic conductivities ranged from 0.8 to 17.4 m/d averaging 8 m/d; while storage coefficients ranged from 0.0008 to 0.001. Variable hydraulic conductivity is characteristic of a fractured rock aquifer; however, some of the higher values may be due to restricted hydraulic connection with the pumping bore and are therefore considered by Rockwater (2011) to be higher than true values.

It is suggested an average pumping rate of up to 60 m^3/d, may be required to lower the groundwater levels ahead of mining, however, a dewatering rate of 5 m^3/d is considered more likely. In-pit bores and/or sumps will be needed to achieve the required dewatering. These bores could be suitably installed on the south-western and north-eastern sectors of the proposed pit perimeter.

Groundwater seepage from the proposed evaporation pond is predicted to flow towards the pit rather than off-site, as the final Trilogy oxide pit void will act as a groundwater sink. If the pond is not lined with material of low permeability initial seepage of water from the pond is expected to occur.

The final water level of the Trilogy oxide pit is predicted to be approximately 8.5 m below the present static water level (see Table 3-15).

Table 3-15: Predicted inflow rate for the Trilogy oxide pit

Pit	Pit area at crest (m^2)	Base of pit (RL of the bottom bench in m AHD)	Initial GWL (m AHD est)	Estimated max inflow (m^3/d)	Post mining pit water level (m AHD)*
Trilogy Oxide	21,285	43.10	52.45	60	61

**Allows for net effect of groundwater inflow, rainfall inflow and evaporation.*

3.8 AIR QUALITY AND ATMOSPHERIC GASSES

3.8.1 Air Quality

A major source of atmospheric pollution from the RGCP is dust emissions. Dust is an issue associated with many mining developments and may have the potential to be generated by activities occurring within the RGCP area during construction and ongoing operations. Potential emission sources include:

- Earthworks;
- Wind erosion of stockpiles of waste and topsoil material;
- Wheel generated dust from travelling on unsealed roads; and
- Road side dust mobilisation from ore haulage trucks.

Dust is not considered likely to cause health or amenity issues to neighbouring residents due to the relatively remote location of the RGCP. The nearest residence and sensitive receptor to the Project area is a farming homestead located approximately 6.5 km south of the proposed processing plant and workshop facilities.

WestSafe (2005) conducted baseline dust monitoring within the Kundip Mine Site. The full report and results of sampling undertaken are provided in Appendix 19. Fifty dust collection sites were established across the site and were subsequently analysed for inhalable dust and heavy metals. All monitoring was undertaken in accordance with *Australian Standard (AS) 3640 (2004) – Workplace Atmospheres – Method for sampling and gravimetric determination of inhalable dust.* Filters were set a minimum of 1.2 m above the ground and were collected at approximately 4 pm each afternoon.

No measurable amount of Cu, As or Ni was found in any of the samples. The minimum measurable amount of dust collected was 0.1 mg/m^3 with a maximum of 0.9 mg/m^3, less than 10% of the national exposure standard.

The nearby Elverdton tailings breach material that has migrated along the Steere River to the Kundip Mine Site was identified as having the potential to spread dust across the site during unfavourable wind conditions. The Elverdton mine ceased operation in 1971; the discharged tailings material has been an issue for many years and is in close proximity to the Kundip site.

3.8.2 Atmospheric Gasses

Major sources of Greenhouse Gas (GHG) emissions from the RGCP include:

- Consumption of electricity for processing;
- Combustion of fuel in mining equipment and vehicles; and
- Land use change.

GHG emissions will be monitored and reported if and when required, in accordance with the *National Greenhouse and Energy Reporting Act 2007* (*NGER Act*), and the *National Pollutant Inventory Guidelines (Version 6.1)* (Department of Environment, 2015).

3.9 SOCIAL ENVIRONMENT

3.9.1 Indigenous Heritage

The RGCP 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 Aboriginal Affairs (DAA) Aboriginal Heritage Inquiry System (AHIS) identified tenements - M74/135, L74/45, L74/34, M74/180, M74/41, M74/51, M74/53, L74/35 and M74/176 – of the RGCP area fall within the South West Settlements Wagyl Kalp Southern Noongar People Indigenous Land Use Agreements (ILUA). The results are presented as Appendix 20.

The DAA AHIS search did not identify any 'registered' Aboriginal sites or 'other heritage places' within the RGCP area.

The following Aboriginal Heritage Survey Reports were identified by the DAA AHIS as encompassing tenements within the RGCP area:

- Tamora Pty Ltd (2003) *Ethnographic Survey Report* [22843]
  - Field and desktop assessment of relevant tenements M74/176, M74/135, L74/35, L74/45, L74/34, M74/180, M74/41, M74/51 and M74/53.
  - The informants cleared all listed tenements and survey areas for mining. A general camping area was identified at the old homestead; however, the informants indicated that it could be disturbed.
  - Further detail is provided in the full report attached as Appendix 21.
- Brad Goode & Associates (2004) Archaeological & Ethnographic Survey Report [21068]
  - Tenements L74/45 and M74/51 were included in this assessment; the survey focussed on the proposed haul road between the Kundip Mine Site and originally proposed processing plant located on the South Coast Highway. Therefore, the outcomes of this assessment are not as relevant to the new proposed RGCP, where processing will occur onsite within the Kundip Mine Site.
- Brad Goode & Associates (2005) Archaeological & Ethnographic Survey Report [23284]
  - Tenements L74/34 and M74/53 were included in this assessment; however, the outcomes of the survey are not as relevant to the new proposed RGCP.

3.9.2 Environmental Heritage

A search of the Department of the Environment's Australian Heritage Database was undertaken in July 2016. The search returned two results in the vicinity of the RGCP area:

1. Jerdacuttup River komatiites [Place ID 101329] (Register of the National Estate).

The site displays exceptional exposures and sequences of ultramafic volcanic rocks (komatiites). The komatiites occur across an area of approximately 21 ha. They are situated approximately 6 km north-east of Kundip and 19 km south-east of Ravensthorpe, outside of the RGCP area.

2. Ravensthorpe Range Area [Place ID 9393] (Register of the National Estate).

The Ravensthorpe Range Area is a biological niche within WA containing many rare and endemic plant species. The area is approximately 30,000 ha in size extending from the Hopetoun-Ravensthorpe Road along the Ravensthorpe Range and the Jerdacuttup River, between Mount Short and Moolyal Creek in the north-west, and the Jerdacuttup North Road in the south-east. The Ravensthorpe Range Area is currently protected as Reserve 3.8. The Kundip Mine Site falls within the bounds of the Ravensthorpe Range; however, the proposed disturbance of approximately 252 ha within the site, will only impact approximately 0.84% of the wider Ravensthorpe Range Area.

3.9.3 Amenity

Local and regional environmental values

The Kundip Mine Site is situated in the foothills of the Ravensthorpe Range. The site is undulating with approximately 90 m relief between the highest and lowest points of the site. The Hopetoun-Ravensthorpe Railway Heritage Walk Trail extends along the western boundary of the site. The southern boundary of the Kundip Mine Site lies in close proximity (0.4 - 1 km) north of the Kundip Nature Reserve (No. 31128). Although the Kundip Mine Site is not within the nature reserve, large tracts of uncleared remnant bush, which are currently proposed for vesting as nature reserves, surround the site.

The Myamba Mine Site is located approximately 1.5 km south of the Kundip Nature Reserve. The site is predominately flat with very gentle slopes of 2-3%. Freehold farmlands directly adjoin the site boundary.

Current Status

The Kundip Mine Site is scattered with remnants of historical mining activities, including mine pits and waste dumps, which have the potential to impact on the visual amenity of the site. Due to the site being covered with relatively dense vegetation however, existing disturbances are not easily visible from the Hopetoun-Ravensthorpe Road.

The Myamba Mine Site is comparatively more exposed than Kundip. The site is mostly cleared with only a narrow strip of perennial vegetation remaining along the eastern extent of the site. Consequently, the site is visible from the Hopetoun-Ravensthorpe Road, which borders the site to the west.

3.10 HISTORIC MINING

The Ravensthorpe-Kundip Cu-Au belt stretches 20 km in a north-south direction. It starts just north of Ravensthorpe and incorporates the Mt Chester, Mt Desmond and Elverdton Mines, finishing with Kundip at the southern end. Kundip refers to the general area at the southern end of the belt rather than an individual mine.

The Kundip area was first mined just after the turn of the twentieth century. Harbour View mine, named after its view of the distant Hopetoun harbour in the south, was one of the larger mines on the Kundip field. Located at the western end of the Kundip field, approximately 500 m from the historic railway line, Harbour View mine adjoined the former Flag mine to the east.

Mining commenced at Harbour View in 1901 and was worked on and off for 40 years. Between 1901 and 1906 a ten head battery was erected, however, a slump in Cu 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 area. 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 Kundip Mine Site 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 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 mining field – the first time that a single company held amalgamated ownership. Tectonic subsequently undertook numerous infill and resource extension drilling campaigns at Myamba and Kundip from early 2001 to 2010. In September 2011, Tectonic changed its name to Phillips River Mining Ltd (Phillips River).

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.

3.11 CURRENT LEVEL OF CUMULATIVE IMPACT

The RGCP is situated within the Fitzgerald Biosphere reserve. The reserve has a core area, the FRNP, a buffer zone and a 'zone of cooperation' (DEC 2012). The RGCP falls within the 895,000 ha 'zone of cooperation' which includes the upper catchments of all the river systems (i.e. Steere and Jerdacuttup Rivers) that pass through or around the core FRNP (DEC 2012). This area is primarily privately owned and modified farmland, with localised mining areas scattered throughout (DEC 2012). Remnant vegetation of the Ravensthorpe region has become highly fragmented by agriculture and mining related activities (DEC 2012).

The Ravensthorpe Range Area provides a valuable habitat linkage for fauna between the FRNP and the Southern Goldfields region. Vegetation across the area also contains many rare and endemic plant species. Although the Ravensthorpe Range is recognised for its value to both flora and fauna, it

covers an area of approximately 30,000 ha in size and small scale clearing is not expected to impact upon the overall value of the area.

Activities proposed for Kundip Mine Site will result in the disturbance of approximately 252 ha, which accounts for approximately 0.84% of the wider Ravensthorpe Range Area. Furthermore, of the 252 ha proposed for disturbance within the Kundip Mine Site 28.09 ha has been previously disturbed, therefore, only 223.90 ha will be new disturbance. Impact upon the regional value of the Ravensthorpe Range area will be negligible.

Given the Myamba Mine Site has been previously cleared for agriculture no additional clearing will be required for the proposed activities, and there will be no impact to vegetation of the Ravensthorpe Range Area.

Disturbance by mining in the Ravensthorpe region is still considered minor when compared to larger scale disturbance from broad-acre agriculture occurring throughout the region.

4 STAKEHOLDER CONSULTATION

ACH is committed to an open and transparent approach to stakeholder consultation. The term 'stakeholders' refers to both internal and external parties that are likely to affect, be affected by, or have an interest in the proposed RGCP. ACH has established communications with key stakeholders to ensure that any potential issues and concerns are raised and appropriately addressed.

4.1 STAKEHOLDER IDENTIFICATION

Stakeholder identification and on-going consultation are key components of the mine development process. Early engagement in this process has allowed ACH a better understanding of stakeholders' expectations for the Project and land use post-closure. Consultation with key stakeholders will continue throughout all phases of the Project, from project planning through to decommissioning and closure. A list of stakeholders and their primary interest in the Project are identified in the Stakeholder Identification Register (Table 4-1).

Table 4-1: Stakeholder Identification Register for the Ravensthorpe Gold/Copper Project

Stakeholder Group	Specific Stakeholder
Ravensthorpe Community	Burton family: owner of Oldfield location 62
	Daw family: owner of Oldfield location 56
	Hughes Family: lessees of Myamba farmland
	Ravensthorpe Community
	Hopetoun Community
Community and Industry Groups and Organisations	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	EPA
	DER
	DMP
	DPaW
	DoW
Local Government and Government Agencies	Shire of Ravensthorpe
	DAA

Stakeholder Group	Specific Stakeholder
	Department of Agriculture
	Main Roads WA
	Heritage Council
	WA Museum
	Water Corporation

4.2 PREVIOUS CONSULTATION

Extensive consultation has been previously undertaken with stakeholders for the former Phillips River Gold Project. Appendix 22 provides a summary table of consultation undertaken in 2004 and 2005 prior to referral of the Phillips River Gold Project to the EPA, as well as a comprehensive *Stakeholder Consultation Report* encompassing all consultation undertaken between 2004 and 2011. There was a small amount of interest in the Phillips River Gold Project from the local community, particularly with regard to potential employment opportunities the project may create. Overall the community appeared to be positive about the project.

4.3 RECENT CONSULTATION

ACH has actively engaged key stakeholders of the RGCP, including government regulators, to provide updates and receive feedback on proposed activities. A register of consultation undertaken with key stakeholders in 2016 is provided in Table 4-2.

Table 4-2: Ravensthorpe Gold/Copper Project - Stakeholder Engagement Register 2016

Date	Description of Engagement	Stakeholders	Stakeholder type	ACH representatives	Stakeholder Comments / Issue	ACH Response and /or Resolution	Stakeholder Response
23/02/16	Introductory meeting	Ian Fitzgerald (JP)	Ravensthorpe Shire CEO	Ian Junk, Ed Ainscough, John Wang	Happy to meet us and keep in the loop of how ACH progresses	n/a	
23/02/16	Introductory meeting	Garry Walker	Local resident	Ian Junk, Ed Ainscough, John Wang	As above		
12/04/16	Telephone call - introduction	Peter O'Loughlin	Senior Inspector, DMP Resources Safety Division, Collie District	Ed Ainscough	Happy to receive update	ACH to continue to update DMP as required by formal and informal means	
??/02/2016	Telephone call	Helen Burton	Landholder - farmer	Ed Ainscough	Wished to discuss E application that overlapped their land	Introduced company and our objectives, emphasised the involvement of Ian Junk and his background in regard empathy with landholders	Agreed to keep in touch
18/06/16	Radio interview	Tara De Landgrafft	ABC Radio Rural and Resources Reporter, Goldfields Esperance	Ed Ainscough	Interested to update local listeners with who ACH was and potential plans	Gave overview of company and our goals	n/a
25/07/2016	A pre-referral discussion with OEPA.	Office of the Environmental Protection Authority (OEPA) *OEPA representatives:* Richard Southerland	Regulator	*ACH representative:* Edmund Ainscough *APM representatives:* Dr Mitchell Ladyman & Sharon Arena	Happy to meet and be provided an overview of the Project	n/a	n/a

Date	Description of Engagement	Stakeholders	Stakeholder type	ACH representatives	Stakeholder Comments / Issue	ACH Response and /or Resolution	Stakeholder Response
		& Stephen Danti					
10/08/16	Meeting	DPaW Environmental Management Branch *DPaW Representatives* Dan Coffey and Justin Baker	Regulator	*APM representative on behalf of ACH:* Dr Mitchell Ladyman	Happy to meet and discuss fauna survey alternatives.	Discussed alternatives for undertaking a fauna survey for the Project.	The most suitable survey approach was recommended.
4/10/16	Telephone call	Jay Francis – Land hosting Meridian prospect next to Galaxy	Landholder - farmer	David Groombridge	Happy to receive update.	Invited to ACH Minerals presentation in Ravensthorpe on 6th October	Came to presentation on the 6th. Arranged to meet again in March to detail exploration on land.
4/10/16	Telephone call	Ray Edwards – Land hosts the Mumbles prospect.	Landholder - farmer	David Groombridge	Happy to receive update	Invited to ACH Minerals presentation in Ravensthorpe on 6th October. Agreed to contact by end of October to arrange a face to face meeting regarding exploration activities on land.	Agreed to keep in touch. Noted that Harvest was coming up and they would be busy Nov-Jan
4/10/16	Telephone call	Luke Webster – Land hosts the Bridgetown-Mumbles prospects	Landholder - farmer	David Groombridge	Happy to receive update	As Above	As Above
4/10/16	Telephone call	Kyle Forsyth – Landmark Manager for Ravensthorpe	Landholder - farmer	David Groombridge	Land access agreement – Has recently brought land at Old Gregg prospect. Was surprised that land access agreement had not been disclosed when purchasing	Arranged a meeting at 8:30am regarding land access agreement.	Agreed to meeting on following day (5th October)

Date	Description of Engagement	Stakeholders	Stakeholder type	ACH representatives	Stakeholder Comments / Issue	ACH Response and /or Resolution	Stakeholder Response
					property.		
4/10/16	Telephone call	Greg Belli –Land hosts the Old Gregg prospect	Landholder - farmer	David Groombridge	Happy to receive update	Invited to ACH Minerals presentation in Hopetoun on 5th October	Came to presentation on the 5th.
4/10/16	Telephone call	Phil Townsend – Land hosts historic Mt. McMahon/FED mines	Landholder - farmer	David Groombridge	Happy to receive update	Invited to ACH Minerals presentation in Ravensthorpe on 6th October	Phil's son attended the presentation on the 6th. Agreed to keep in touch.
5/10/16	Meeting Land Access/ Farm lease tender	Kyle Forsyth –	Landholder/ Landmark Manager for Ravensthorpe	Ed Ainscough, David Groombridge	Discuss tenements and land access agreement that overlapped their land	Advised of ACH current situation and potential of exploration in the future at the Old Gregg prospect.	Kyle also advised that Landmark could facilitate the lease letting process for the farm. Agreed to keep in touch.
5/10/16	Meeting	Ian Fitzgerald (JP)	Ravensthorpe Shire CEO	Ed Ainscough, David Groombridge	Ravensthorpe camp, timing of exploration/mining	Advised of ACH current situation including upgrades at the camp. Stressed that sewage would be fixed promptly.	
5/10/16	Presentation	Hopetoun community – 20 people in attendance	Local community	Ed Ainscough, David Groombridge	Flora/Fauna at Kundip Heritage trail Workforce at Kundip	ACH overview of background, people, philosophy and objectives and challenges that ACH face at Kundip to get it into production.	Positive on the project and wishing ACH well in our endeavours
6/10/16	Presentation	Ravensthorpe community – 5 people in attendance	Local community	Ed Ainscough, David Groombridge	Ravensthorpe camp Workforce at Kundip	ACH overview of background, people, philosophy and objectives and challenges that ACH face at Kundip to get it into production.	Happy to get feedback from ACH. Generally positive about the
8/10/16	Meeting	Greg Belli –	Land Holder	David Groombridge	Clarification on timeline for	Review of previous work by	Was happy to have an

Date	Description of Engagement	Stakeholders	Stakeholder type	ACH representatives	Stakeholder Comments / Issue	ACH Response and /or Resolution	Stakeholder Response
		dropped in to the office when driving past.			exploration at Old Gregg prospect	SLR and discussed an approximate time for drilling. Will contact again in 6 months for an update	update.
8/10/16	Meeting	Michael Hughes	Myamba Lease farmer	David Groombridge	Notification that Myamba Farm lease will be put out to tender. Farm to be vacated by 1 February 2017.	Open tender and welcome to submit a bid.	Understood the notification and its implications.
15/11/16	Meeting	Michael Palmer	Owner of Grand Hotel in Ravensthorpe and current sub-lessee of the Ravensthorpe Camp	Paul Bennett		ACH initiated the meeting by way of introduction and in order to check on the status of the Camp sub-lease.	Sub-lease is going well. Camp numbers continue to increase. Numerous maintenance issues that need to be dealt with.
16/11/16	Meeting	Kyle Forsyth	Manager Landmark Ravensthorpe	Paul Bennett & David Groombridge	Status of draft Farm lease.	Drafting ongoing, will submit for review before the end of the following week.	Market is buoyant for leasing, expect good result. Subject to finalising the lease agreement, begin marketing 1 December.
30/11/16	Meeting	Kyle Forsyth	Manager Landmark Ravensthorpe	Paul Bennett	Execution of authorities to lease Myamba Farm on behalf of ACH Minerals.	ACH has agreed terms with Landmark and has authorised the marketing to commence.	First interested parties inspected the property on 1 December.

5 ASSESSMENT OF ENVIRONMENTAL FACTORS

5.1 EPA PRINCIPLES OF ENVIRONMENTAL PROTECTION

There are five principles which guide the overall application of the powers of the *EP Act*. The EPA has also adopted two additional principles to help guide policy development and environmental impact assessment. ACH has considered these principles during planning and feasibility studies for the RGCP with details provided in Table 5-1.

Table 5-1: Principles of Environmental Management

Principle	Proposal Application
1. Precautionary principle *Where there are threats of serious or irreversible damage, lack of scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.* *In the application of the precautionary principle, decision should be guided by:* *(a) Careful evaluation to avoid, where practicable, serious or irreversible damage to the environment; and* *(b) An assessment of the risk-weighted consequences of various options.*	ACH has made use of existing environmental surveys and investigations to identify likely impacts and assess potential risks to the environment that may result from activities proposed for the RGCP. Identified risks will be considered when finalising mine site plans and landform designs. Already, as a function of the recent botanical survey work the waste dump designs have been reconsidered and re-positioned to reduce impacts on conservation significant flora and fauna known to occur. ACH will develop and implement site-specific management measures to mitigate potential impacts to the environment, including the development of species specific fauna conservation management plans.
2. Intergenerational equity *The present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.*	ACH will implement suitable management measures for all environmental factors which may be impacted by the proposed activities, such that future adverse impacts are minimised and wherever possible the quality of the environment is maintained or enhanced. The RGCP occurs across a landscape punctuated with frequent evidence of recent and more historical disturbance. The number of open shafts in the area are too numerous to count and much of the site is a mosaic of abandoned pits and neglected waste dumps. Nevertheless, these disturbed areas are surrounded by vegetation representative of the Fitzgerald Biosphere and in good to pristine condition. Development of the RGCP can proceed in such a way that the disturbed areas are partitioned off and the vast majority of the natural vegetation beyond the impact footprint is preserved and managed proactively. A MCP will be prepared for the RGCP in consultation with regulatory bodies and traditional owners of the land, to ensure that post mining land use is consistent with agreed stakeholder objectives. Rehabilitation will be undertaken progressively where possible.
3. Conservation of biological diversity and ecological integrity	Existing biological studies, as well as recent surveys targeting flora and fauna of conservation significance (APM 2016), have assisted with identifying the value of vegetation within the Project area compared

Conservation of biological diversity and ecological integrity should be a fundamental consideration.	with the greater Ravensthorpe Range area. The records of conservation significant flora taxa *H. Decipiens* (Priority 2, *WC Act*) have the potential to be disturbed by the proposed activities as they are within the proposed disturbance footprint. This species is distributed from the FRNP to north of Esperance in a number of isolated populations. The proposal will result in fragmentation of these contiguous known populations. However, based on the east west distribution of the species it is likely that individuals recorded at Kundip were recorded due to the intensity of the survey work in the area, not because this is the only area in which they occur. There is little doubt that individuals of the same species would occur elsewhere in the Ravensthorpe Range, though this cannot be confirmed in the absence of further survey work. Very few individuals (less than 5) of the conservation significant flora *M. mollis* (Endangered – EPBC Act; Priority 4, WC Act) have the potential to be disturbed indirectly by proposed activities. All of the *M. mollis* individuals recorded during the 2016 survey were outside of the impact footprint but within the tenement boundary. There is some potential for impact on local vegetation communities that are representative of TEC's and PEC's. This impact is not significant and is quantified elsewhere in this document. Nevertheless, comprehensive mitigation measures will ensure impacts to conservation significant flora, TEC's and PEC's are minimised or avoided. Although conservation significant fauna have been identified in the Project area, the impacts from the proposed projects are not likely to be significant. There is substantial vegetation surrounding the site and vegetation corridors will be maintained across the Kundip Mine Site to facilitate movement of fauna across the site. Control of feral predators and fire management that will develop in accordance with environmental management systems will increase the overall security of many of these fauna species. With these measures in place ACH are confident that the current level of biological diversity and ecological integrity is maintained. ACH has also instigated a process of commencement of ecological research focussed on the RGCP, with negotiations underway with Edith Cowan University to commence two Masters projects in 2017 on Chuditch and Malleefowl.
4. Improved valuation, pricing and incentive mechanisms • *Environment factors should be included in the valuation of assets and services.* • *The polluter pays principle – those who generate pollution and waste should bear the cost of containment, avoidance or abatement.* • *The users of goods and services should pay prices based on the full life cycle costs of providing*	The efficiency of proposed processing and mining activities will be continuously evaluated and areas for potential improvement identified. Improving efficiencies across the RGCP will reduce ongoing costs, as well as the overall impact on the environment. *Energy/Power* Environmental impact and costs associated with power generation and energy use options have been considered. ACH is currently undertaking the following measures: • Assessing the advantages of using diesel compared with natural gas or LNG, in particular a comparison of the potential environmental footprint, expected life cycle, and economic advantages of each. • Discussing with Bolong the potential for construction of a 1MW solar to vanadium flow battery (solar-VFB) renewable power

goods and services, including the use of natural resources and assets and the ultimate disposal of any wastes. • *Environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, which enable those best placed to maximise benefits and/or minimise costs to develop their own solutions and responses to environmental problems.*	station to supplement the diesel generators. Investigating solar energy pumps as a form of backup power for groundwater abstraction bores within the RGCP area. • Designing the RGCP layout to minimise transport distances of ore, tailings and sewerage where possible. *Cost Minimisation* When selecting an appropriate location for the processing plant and key landforms both costs and environmental footprint were considered. The decision to locate the processing plant at the Kundip Mine Site, as opposed to the Rav 8 Mine Site location that was proposed as part of the previous Phillips River Project, has resulted in greater efficiency, particularly for ore haulage. By reducing the transport requirements, the overall contribution to GHG emissions will also be reduced. Costs associated with reagents and other major consumables required for the RGCP have been considered. Where possible requirements for consumables will be minimised and materials will be recycled. ACH have considered potential closure costs associated with the RGCP. More detailed closure cost estimates will be calculated as part of the approvals process prior to commencement of mining.
5. Waste minimisation *All reasonable and practicable measures should be taken to minimise the generation of waste and its discharge into the environment.*	Waste minimisation principles have been considered in the design of the RGCP and key landforms. Measures of waste minimisation and management include but are not limited to the following: • Disposal of general domestic waste at the Kundip Mine Site landfill facility; • Minimise chemicals and chemical packaging products by importing in bulk and returning to suppliers if possible, or triple rinsing before deposition to the Kundip Mine Site landfill facility; • Establish waste recycling programs to reduce the volume of materials disposed; • Recycle dewater for use in processing and dust suppression; • Recycling waste water from the TSF for re-use in the processing plant; • Contain excess dewater in a designated evaporation pond at Myamba Mine Site; • All PAF material will be selectively handled and encapsulated within WRL's or the TSF embankment such that these materials are isolated from oxygen and rainfall; • Storage of hydrocarbons on site in suitably bunded areas; • Servicing and maintenance of vehicles, plant and equipment will occur preferentially within designated service and wash down bays at the Kundip Mine Site workshop area. A comprehensive list of proposed mitigation measures is provided in Table 5-4.
6. Best practice *When designing proposals and implementing environmental mitigation and management actions, the contemporary best practice measures available at the time of*	ACH will endeavour to prepare best practice measures during the approvals process, and ensure they are implemented throughout the LOM.

implementation should be applied.	
7. Continuous improvement *The implementation of environmental practices should aim for continuous improvement in environmental performance.*	An environmental performance review will be undertaken annually and will form an essential component of the RGCP Environmental Improvement Plan. Areas of potential improvement will be identified, performance targets established and timelines for review set. ACH aim to continuously improve the environmental performance of proposed activities. A general overview of the continuous improvement process is outlined below: 1. Evaluate and identify areas where environmental performance could be improved. 2. Adjust existing, or develop new, management strategies and processes for improvement. 3. Implement these strategies or processes. 4. Set a timeline to review performance. 5. Review environmental performance.

5.2 ASSESSMENT OF RELEVANT ENVIRONMENTAL FACTORS

Assessment of environmental factors relevant to the RGCP and proposed activities is provided in Table 5-2. Environmental statements and bulletins used to guide the significance assessment are also listed. An assessment of potential impacts follows in Table 5-3, with targeted management measures to mitigate these impacts provided in Table 5-4 and proposed offsets provided in Table 5-5. Lastly an assessment of residual impacts from the RGCP and the significance of these impacts is provided in Table 5-6.

Table 5-2: Environmental factors relevant to the RGCP and guidance used for the significance assessment

Theme	Factor	EPA Objective	Environmental Guidance
Land	Flora and Vegetation	To maintain representation, diversity, viability and ecological function at the species, population and community level.	Guidance Statement No. 51: *Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* Position Statement No. 2: *Environmental Protection of Native Vegetation in Western Australia* Position Statement No. 3: *Terrestrial Biological Surveys as an Element of Biodiversity Protection* Environmental Protection Bulletin No. 20: *Protection of Naturally Vegetated Areas Through Planning and Development* Environmental Protection Bulletin No. 21: *Guidance for Wind Farm Developments* Technical Guide – Flora and Vegetation Surveys for Environmental Impact Assessment
	Terrestrial Fauna	To maintain representation, diversity, viability and ecological function at the species, population and assemblage level.	Guidance Statement No. 20: *Sampling of Short Range Endemic Invertebrate Fauna for Environmental Impact Assessment in WA.* Guidance Statement No. 56: *Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia* Position Statement 3: *Terrestrial Biological Surveys as an Element of Biodiversity Protection* *Technical Guide on Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* Environmental Protection Bulletin No. 20: *Protection of Naturally Vegetated Areas Through Planning and Development*
	Terrestrial Environmental Quality	To maintain the quality of land and soils so that the environment values, both ecological and social, are protected.	Guidance Statement No. 6: *Rehabilitation of Terrestrial Ecosystems*.
	Landforms	To maintain the variety, integrity, ecological functions and environmental values of landforms.	Guidance Statement No. 6: *Rehabilitation of Terrestrial Ecosystems* Environmental Protection Bulletin No. 23: *Guidance on the EPA's Landforms factor*

Theme	Factor	EPA Objective	Environmental Guidance
Water	Hydrological Processes – Surface Water	To maintain the hydrological regimes of surface water so that existing and potential uses, including ecosystem maintenance, are protected.	DoW: *Western Australian water in mining guideline.*
	Hydrological Processes – Ground Water	To maintain the hydrological regimes of groundwater so that existing and potential uses, including ecosystem maintenance, are protected.	Operational Policy 5.08: *Use of operating strategies in the water licensing process.* *Western Australian water in mining guideline*.
Air	Air Quality and Atmospheric Gasses	To maintain air quality for the protection of the environment and human health and amenity, and to minimise the emission of greenhouse and other atmospheric gases through the application of best practice.	Guidance Statement No. 3: *Separation Distance between Industrial and Sensitive Land Uses.* Environmental Protection Bulletin No. 24: *Greenhouse Gas Emissions and Consideration of Projected Climate Change Impacts in the EIA Process.*
People	Amenity	To ensure that impacts to amenity are reduced as low as reasonably practicable.	Environmental Assessment Guideline No. 13: *Consideration of Environmental Impacts from Noise* Guidance Statement No. 3: *Separation Distance between Industrial and Sensitive Land Uses*
	Indigenous Heritage	To ensure that cultural associations are not adversely affected.	Guidance Statement No. 41: *Assessment of Aboriginal Heritage.*
	Environmental Heritage	To ensure that historical associations and natural heritage are not adversely affected.	N/A
Integrating Factor	Rehabilitation and Closure	To ensure that premises are decommissioned and rehabilitated in an ecologically sustainable manner.	Environmental Assessment Guideline: *Joint Guidelines for Preparing Mine Closure Guidelines*. Guidance Statement No. 6: *Rehabilitation of Terrestrial Ecosystems*. Environmental Protection Bulletin No. 19: *EPA Involvement in Mine Closure*.

Table 5-3: Assessment of potential impacts upon relevant environmental factors by the RGCP

Environmental Factor	Potential Impact
Flora and Vegetation	Of the 252 ha proposed disturbance envelope for the Kundip Mine Site, approximately 223.90 ha will be new disturbance. The vegetation mapping completed during the 2016 survey shows that approximately 28.09 ha within the Kundip Mine Site development envelope is already significantly disturbed following historical mining, or is rehabilitating naturally *via* succession from the surrounding undisturbed vegetation. Within the project area there is longstanding legacy of mining practice stemming from the early 19th century to present day exploration projects. Subsequently, the vegetation reflects a mosaic of conditions. Specifically, recently disturbed areas (i.e. clearing for exploration drill lines [50 - 25 m resolution] and support infrastructure) are of Good to Degraded condition; historically disturbed areas (i.e. clearing for construction of mine shafts, former infrastructure and historic dwellings) are of Very Good condition; and the remaining undisturbed vegetation is of Excellent condition. Vegetation condition assessments are based on Keighery (1994). The conservation value of the Kundip project site must be considered in the context of a disturbed site set amongst undisturbed mallee heath and woodland. **Potential impacts from proposed activities to flora and vegetation are likely to include the following:** 1. *Disturbance of Individual Plants* During the 2016 APM survey Priority flora *Hydrocotyle sp. Decipiens (G.J. Keighery 463)* and *Marianthus mollis* were recorded. *Hydrocotyle sp. Decipiens (G.J. Keighery 463)* was recorded (three individuals) within the proposed disturbance footprint north-north west of Western Gem pit. These three individuals have the potential to be lost due to the secondary impacts of dust and sediment movement. Under the current proposed site layout the population will not be directly impacted This species occurs in isolated populations from the FRNP to Esperance. Given the contiguous nature of the species across the southern coast, it is highly likely that other populations exist but they have remained, as yet, undiscovered. Loss of these three individuals will have local impacts on the species but regionally the species will remain secure. *Marianthus mollis* was recorded north and east of the disturbance area boundary. Potential impact to this species had been reduced to nil with the movement of the proposed waste dump. 2. *Spread of Weeds* The Ravensthorpe Range vegetation survey recorded minimal invasion by weeds in the region (Craig *et al*., 2008). The invasive plant *Asparagus asparagoides* has previously been recorded in the RGCP area. This species can spread approximately 5 km per year. Other weeds in the region

Environmental Factor	Potential Impact
	include *Lycium ferocissimum* and *Tamarix aphyll,* both of which are easily spread. However, *L. ferocissimum* plants take at least two years to flower. *Tamarix aphyll* seeds are easily dispersed by wind and water and a single tree can produce thousands of seed each year. In the absence of universal controls across the site, which can only be achieved on an active mine site and not on vacant crown land, weeds will continue to spread across the site propelled by wind and water. The spread will be augmented by transient campers accessing the site and moving across the range using the myriad of mine exploration and fire management tracks. If the mine is allowed to proceed, the construction environmental management plans and subsequent operational environmental management plans will incorporate weed management such as active control and quarantine, which will benefit the region. *3. Spread of Phytopthora Dieback* Numerous records of dieback exist in the Goldfields-Esperance region, particularly along coastal areas. Occurrences of *Phytopthora cinnamomi* have been previously recorded approximately 46 km to the west and 21 km to the east of the RGCP area. Both records are along the South Coast Highway (Natural Resource Management WA, 2016). Dieback has also been identified in the RGCP area along the entrance road to the mine. A new species of *Phytopthora* was recorded by Glevan Consulting 2006 (Terratree, 2012) and two spot infestations of *Phytopthora* were recorded in 2012 (Terratree, 2012). The previous project proponents implemented strict vehicle washdown protocols for vehicles involved in ground disturbance and these controls have abated the spread of dieback in recent years. Dieback management controls will be enhanced and refined if the Project proceeds to construction. *4. Increased Frequency and Intensity of Fire Events* Based on BOM 2015 *Climate Overview*, the Ravensthorpe region experienced 'average rainfall' and 'very much above average' temperatures in 2015. The Landgate *My Fire Watch* mapping tool indicates the occurrence of small scattered fires (<10) within 50 km of Ravensthorpe within the last two years. No fires are reported to have occurred within the RGCP area. The closest fire occurred at the southern point of the Kundip Nature Reserve this year. Proposed operations are considered unlikely to increase the risk of fire with the implementation of strict fire management measures. Better constructed and managed access roads around site will also better enable the control of wild fires in summer months, both inside the tenement and into the adjacent Ravensthorpe Range proposed conservation reserve. *5. Degradation of native vegetation within the RGCP area* The proposed disturbance of approximately 252 ha within the Kundip Mine Site will impact 16 vegetation associations of the RGCP area. Previous disturbance of the Myamba Mine Site by agriculture mean the 64 ha proposed to be disturbed within the site has already been previously disturbed, therefore no clearing will be required. An estimate of disturbance to vegetation associations within the Kundip Mine Site,

Environmental Factor	Potential Impact
	and a comparison of this disturbance in the context of the wider Ravensthorpe Range is provided as Appendix 23. Of the 16 vegetation associations four communities present in the Project area potentially represent one or more of the TECs or PECs identified by the database searches. Three vegetation associations are considered representative of the 'Proteaceae Dominated Kwongkan Shrublands of the Southeast Coastal Floristic Province of WA' TEC/PEC. Approximately 4.8 % (182.19 ha) of this TEC/PEC in the Ravensthorpe range will be impacted by the proposed development. One vegetation association is representative of the 'Very open mallee over *Melaleuca* sp. Kundip dense heath' PEC (Priority 1). This vegetation association will not be impacted by the proposed development. Native vegetation may also be impacted by dust from movement of overburden and topsoil material, blasting and loading waste rock and ore, and from vehicles on the haul road. Although the proposed disturbance will directly and indirectly impact vegetation through clearing and dust respectively, the impacts are likely to be minimal considering the varying condition of vegetation within the Kundip Mine Site and that the proposed total disturbance for the site (252 ha) will only impact 0.84% of the greater 30,000 ha Ravensthorpe Range area.

<table>
<tr><th>Environmental Factor</th><th>Potential Impact</th></tr>
<tr><td>Terrestrial Fauna</td><td>

Potential impacts from proposed activities to fauna are likely to include the following:

1. *Clearing of Fauna Habitat*

Up to 252 ha is proposed to be disturbed within the Kundip Mine Site, of this 28.09 ha has been previously disturbed, therefore, only 223.9 ha is likely to require clearing.

2. *Direct and Indirect Loss of Individuals, Populations and Species Including Short Range Endemics*

Clearing fauna habitat and mining associated activities may impact fauna. DPaW and APM records of conservation significant fauna in the area indicate the following fauna have been recorded within and outside of the RGCP area (Table 6a).

Table 6a – Conservation Significant Fauna Records

Fauna	APM / Biota records in the Project Area	DPaW records in Development Footprint	DPaW records in the Project Area Outside Development Footprint	DPaW records in the Region (Outside Project Area)
Chuditch	1	0	1	7
Carnaby's Cockatoo	2	2	1	22
Dibbler	0	0	0	6
Heath Rat	2	0	0	16
Malleefowl	2	0	1	26
Ravensthorpe Range Slider	1	0	4	14
Western Brush Wallaby	0	1	0	11
Western Bristlebird	0	0	0	2
Western Whipbird	6	0	0	6

Given the higher habitat value of vegetation outside of the RGCP area and the number of conservation significant fauna recorded,

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	it is unlikely the Project will have a significant impact on populations of these species. However, ACH are committed to facilitating research projects on both the Malleefowl and the Chuditch through Edith Cowan University based on conservation specific management plans developed specifically for the RGCP. 3. *Increased Death by Predation Due to Fragmentation of Habitat* At the whole of project scale, the RGCP will not contribute to the fragmentation of habitat. Within the project impact footprint the project design proposes to unite a number of smaller, sporadic areas of historic disturbance into a larger mining landform. Overall there will be an increase in cleared land but little impact on current local levels of fragmentation. 4. *Changed Fire Regimes* Mining activities have the potential to increase spot fires from heavy machinery and equipment operation. Changed fire regimes at the RGCP can reduce the amount of habitat available to fauna. Strict fire management measures, including training employees in fire-fighting and the use of emergency response equipment, will however improve overall fire management at the site. 5. *Impacts to Fauna from Dust* Dust impacting upon vegetation adjacent to unsealed roads and mining operations can have a secondary impact upon fauna by reducing the value of habitat in these areas. Dust management strategies will be implemented to reduce the impact of dust generation. 6. *Impacts to Fauna from 24/hour Light (i.e. processing activities)* Constant light emitted from 24/hour mining operations, has the potential to impact upon nocturnal fauna species by deterring them from using habitats adjacent to such operations that would normally be available to them. 7. *Impacts to Fauna from 24/hour Noise (i.e. drill and blast activities)* The greatest impacts from noise are sudden, sharp and stochastic noise events (i.e. blasting), rather than constant noise (i.e. processing plant operations). These noise events may have a short, but potentially measurable, impact on fauna activity.

Terrestrial Environmental Quality	**Potential impacts from proposed activities to the existing quality of the terrestrial environment are likely to include the following:** *1. <u>Contamination by Hydrocarbons and Dangerous Goods</u>* Diesel fuel, oil, lubricants, explosives and miscellaneous cleaning product will be required for RGCP mine site operations. The potential impacts that may arise from inappropriate storage and management of hydrocarbons and other dangerous goods at the Kundip Mine Site include: • Contamination of soils, surface water or groundwater. • Adverse effects to faunal habitats. Strict management measures will be implemented to ensure that impacts from hydrocarbons and dangerous goods are minimised throughout the life of the RGCP. *2. <u>Metalliferous Drainage from PAF and Mineralised Materials</u>* Waste characterisation testing has indicated there is potential for PAF materials to occur within transitional and primary ore extracted from Kundip open pits and underground mines. If these materials are not appropriately contained acid metalliferous drainage (AMD) and consequential leaching of bioavailable forms of Cu and Pb may occur. Regular testing of waste rock materials (in particular fresh-phyllite waste) will ensure PAF materials are identified early and contained appropriately in the WRL's or TSF embankments. Low grade ore stockpiles will also be bunded to ensure runoff that may comprise liberated minerals is appropriately contained. Mining of the satellite Trilogy oxide pit at the Myamba Mine Site will not extend below 39 m, the estimated base of oxidation. Waste material generated from this oxidised zone has been classified as NAF, therefore AMD is highly unlikely. *3. <u>Seepage of Tailings Materials</u>* There is potential for seepage of enriched metals from the Kundip Mine Site TSF. These metals may cause contamination of underlying groundwater. Furthermore, as seepage occurs, acidic materials may also promote AMD if present in underlying waste rock. Landform design measures will minimise seepage occurring, whilst groundwater monitoring will ensure seepage is detected and contaminated water returned to the TSF. The proposed TSF has a maximum embankment > 15 m (at 23 m) and is therefore classified as a Category 1 facility, with a Low to

	Medium hazard rating (DMP Code of Practice: *Tailings Storage Facilities in Western Australia* 2013). *4. Contamination by General Domestic Waste* Various forms of non-mining wastes will be produced by all phases (construction, operation and closure) of the operation. Wastes include: • Putrescibles, plastics, glass and aluminium from the office and crib room facilities. • General litter from human presence. • Paper and cardboard from office and crib activities. • Incidental tyres. • Hydrocarbon wastes, in particularly waste oil. • Laboratory wastes. • Packaging wastes. • Sewage related wastes. Inappropriate handling and disposal of waste products can impact the receiving environment.
Landforms	**Potential impacts from proposed activities to landforms are likely to include the following:** *1. Alteration of Existing Landform* The landform at Kundip Mine Site will be further altered through the construction of open pits, underground mines, a ROM pad, surface water diversion structures, water storage facilities, a WRL and a TSF. The landform at Myamba Mine Site will be altered by the construction of a single open pit, evaporation pond, WRL and ROM pad. Constructed landforms are expected to generate greater runoff, which will increase the potential for erosion and transport of sediments. Mitigation measures will divert and capture surface water flows or steady the flow of water across the surface of constructed landforms. *2. Interruption of Natural Drainage Patterns* Construction of the proposed landforms will interrupt drainage patterns at a localised scale. Surface water flows will be directed around landforms during mining, with natural drainage patterns reinstated where possible upon closure.

	3. Erosion of Sediment Sub-surface soils within the Kundip Mine Site were observed to be relatively stable in terms of dispersive qualities, while those at Myamba Mine Site were observed to be completely or partially dispersive. At both Mine Sites the sub-surface soils exhibited a capacity for hard-setting, in particular those soils dominated by red clay or gravel. If exposed on landform surfaces, sub-surface soils from both Kundip and Myamba Mine Sites are considered likely to become unstable with an increased risk of structural breakdown, hardsetting and erosion. Consequently, these materials would need to be appropriately placed if used to rehabilitate proposed landforms. *4. Unstable Constructed Landforms* Constructed landforms have the potential to become unstable. However, construction of landforms to geotechnical specifications will ensure stability is maximised and the potential for erosion is minimised.
Hydrological Processes – Surface Water	**RGCP proposed activities are considered likely to have a localised impact upon surface water hydrological processes in the following ways:** *1. Altered Drainage Patterns* Constructed landforms such as mine pits, WRL's, ROM pads, a TSF, and an evaporation pond, may alter drainage patterns at a localised scale. However, the use of diversion structures to redirect surface water flows around constructed landforms will enable flows to re-join natural drainage lines, minimising the overall impact. *2. Sediment Erosion and Transport* Clearing and construction of landforms will reduce the stability of soils, increasing the potential erosion and transport of unstable sediments with surface water flows. Artificially constructed water storage facilities will assist with containing surface water flows across the Kundip Mine Site. The existing water storage facility south of Harbour View mine was constructed during the mid-1900's as evidence by the recovery of surrounding perennial vegetation. This facility will be incorporated into one of the two additional proposed water storage facilities (see Figure 2-1). The three existing water storage facilities nearby Kaolin pit were constructed more recently and still have clearly defined dam walls which do not yet support vegetation. The two facilities north of Kaolin pit will remain undisturbed, while the smaller facility south of Kaolin pit will be incorporated as the pit expands.

	3. Impacts to Surface Water Quality There is potential for surface water quality within downstream waterways to be impacted by the proposed activities. In particular clearing and construction of landforms may reduce the stability of soils and increase susceptibility of erosion and transport of these sediments into tributaries feeding into the Steere River. Management measures will ensure the risk of impact to surface water quality of downstream waterways is minimised.
Hydrological Processes – Ground Water	**Potential impacts to groundwater are caused by construction of pits, pit dewatering and contamination from mining operations. Potential impacts include the following:** *1. Altered groundwater levels* Dewatering from open pits (Kaolin, Harbour View/May and Flag) and underground mines (Harbour View, Flag) at the Kundip Mine Site, plus dewatering from the Trilogy oxide pit (Myamba Mine Site) will results in a short term decrease in groundwater levels or a 'cone of depression' surrounding open pits, which operate as groundwater sinks. Impacts to groundwater levels will be localised and restricted to no more than a 500m down-gradient due to low permeability of rocks and mineralised zones in the RGCP area. *2. Salinisation of groundwater* There is potential for saline groundwater to have an adverse effect on the surrounding environment. If, however, mine dewater is used preferentially in processing, conservatively for dust suppression, and any excess water is stored in the Kundip Mine Site water storage facility, or the Myamba Mine Site evaporation pond, impacts from salinity are expected to be negligible. Evaporation from open pit voids filled with groundwater may cause small increases in salinity in the pit lakes. However, the water will not move into the groundwater flow system (aquifer) if the pits remain as groundwater sinks as indicated from the Rockwater (2011) assessment. Furthermore, rainfall captured by the pits will introduce fresh water to the pits, which is expected to negate any increase in salinity from evaporation. *3. Contamination of groundwater* There is potential for adverse impacts to groundwater quality from spillage of hydrocarbons and chemicals during mine operation and subsequent seepage to the groundwater table. There is also potential for AMD and mobilisation of metals to groundwater if PAF and other mineralised materials are not contained appropriately. Impact to groundwater quality has the potential to occur through seepage of tailings from the Kundip Mine Site TSF. *4. Disruption of groundwater flow*

	Open mine pits (that intersect groundwater) will disrupt local groundwater flows, however, these impacts are considered to be insignificant at a regional scale due to the low permeability of the surrounding country rock (see Appendix 4 and Appendix 18).
Air Quality and Atmospheric Gasses	**Emissions such as dust and GHG's resulting from the proposed RGCP have the potential to impact in the following ways:** 1. *Adverse health impacts to employees by dust* Dust monitoring undertaken in 2005 confirmed dust samples collected from Kundip Mine Site did not contain any heavy metals. Therefore dust as a health risk to employees is considered negligible. 2. *Death of vegetation by dust* The major impact of dust will be to local vegetation. Whereby smothering of vegetation can result in death of individual plants. Major sources of dust include: • Dust generation on unsealed haul roads. • Dust generation during movement of topsoil and overburden material. • Dust generation during blasting and loading of waste rock and ore. • Potential dust generation from WRL's and the TSF. 3. *Contribution to global GHG emissions* GHG emissions will be generated from electricity consumption and combustion of fossil fuels, with effects slightly compounded by clearing of vegetation capable of removing carbon dioxide from the atmosphere. Given the scale of the RGCP and the size of the proposed RGCP disturbance footprint (316 ha), the overall contribution to global GHG emissions will be insignificant.
Amenity	There are a number of activities associated with the RGCP that have the potential to impact upon amenity. The major impacts would be to visual amenity and the nearby Railway Heritage Walk Trail. Whilst noise, odour and dust may occur from mining, processing and transportation of ore within the RGCP, these factors are not expected to have a significant impact on amenity of the site. 1. *Impacts to visual amenity* There is potential for visual impacts to occur from the following activities: • Light emissions from 24 hour operations.

	• Visual impact of dust emissions (i.e. on vegetation). • Landforms at Kundip Mine Site - open mine pits, WRL's, TSF, ROM pad, and water storage facilities. • Support facilities at Kundip Mine Site - processing, office and workshop facilities. • Landforms at Myamba Mine Site - open mine pit, evaporation pond, WRL and ROM pad. *2. <u>Impacts to the Railway Heritage Walk Trail</u>* The greatest impact to the Railway Heritage Walk Trail will be visual impacts from proposed activities within the Kundip Mine Site. In the distance the proposed mine pits, WRL's and the TSF positioned on slopes may be visible to walkers. Walkers will need to be aware of haulage trucks passing over the trail between the Kundip Mine Site and the Hopetoun-Ravensthorpe Road.
Indigenous Heritage	No 'registered' Aboriginal sites or 'other heritage places' have been identified in the RGCP area and therefore no impact to Aboriginal heritage is expected.
Environmental Heritage	The Jerdacuttup River komatiites are not within the RGCP area, therefore, no impact will occur to the National Estate from proposed activities. The RGCP does however fall within the Ravensthorpe Range Area. Given Myamba Mine Site has been previously cleared for agriculture, only disturbance proposed for Kundip Mine Site will impact vegetation of the Ravensthorpe Range Area. The Kundip Mine Site is known to contain 16 vegetation units covering an area of 667.88 ha, of which 525.57 ha may be impacted within the proposed Kundip development envelope. These same units are represented across 6,183.82 ha in the wider Ravensthorpe Range Area. The overall impact from the proposed disturbance to the value of this National Estate is therefore considered to be minor.
Rehabilitation and Closure	At the Kundip Mine Site the development of open pits (Kaolin, Harbour View/May and Flag), underground mines (Flag and Harbour View), offices, workshops and processing plant facilities, WRL's, TSF, ROM pad, surface water diversion structures, internal roads and haul roads, will result in added disturbance at the site. Similarly, the development of Trilogy oxide pit at Myamba Mine Site, an associated evaporation pond, WRL, ROM pad, support infrastructure area, internal roads and haul roads, will cause new disturbance at the site. Upon closure, the abovementioned landforms will be rehabilitated in accordance with an approved MCP. The Kundip Mine Site will be returned to the former land use as vacant crown land, whilst Myamba Mine Site will be rehabilitated to facilitate

	agricultural activities.

Table 5-4: Mitigation measures to minimise impacts to relevant environmental factors

Environmental Factor	Mitigation Measures		
	Avoidance	Minimisation	Rehabilitate
Flora and Vegetation	Avoidance of impact to flora and vegetation of the RGCP will not be possible; however, comprehensive minimisation and rehabilitation measures have been developed to reduce the overall impact.	**Degradation of Native Vegetation within the RGCP Area** • Existing disturbance areas within the RGCP (28.09 ha at Kundip Mine Site and 939 ha at the Myamba Mine Site) will be preferentially utilised in the construction of mine infrastructure to reduce the amount of clearing required. • Existing Haul Roads will be utilised where possible to reduce the amount of clearing required for the RGCP and reduce impacts from dust. • A Ground Disturbance Permit (GDP) will be utilised prior to the commencement of clearing works; GDP records will be maintained. • Areas to be cleared will be clearly delineated. Delineation of clearing boundaries shall involve: - Boundaries of areas approved for clearing shall be identified using survey pegs and/or photo degradable flagging tape. - Survey pegs/tape shall be placed on the approved boundary and shall remain in place once clearing has occurred so that over clearing can be identified. - Where practicable, survey pegs/tape shall be located at intervals not exceeding 25 m. - Survey pegs/tape shall be positioned so as to be clearly visible from one marker to the next. • An Environmental Representative, or Delegate, shall be present at all times where practicable during clearing works to guide operators around clearing boundaries and	**Degradation of Native Vegetation within the RGCP Area** • Topsoil will be stockpiled for as short a time as possible and used for progressive rehabilitation works throughout the LOM. • Surface water drainage patterns will be reinstated to reduce risk of water ponding and/or erosion. • Indigenous seed from local provenance species will be used in rehabilitation activities in order to facilitate preservation of local genetic diversity within the re-established vegetation. • Rehabilitation and revegetation will be incorporated into the Mine Closure Plan (MCP). **Disturbance of Individual Plants** • Rehabilitate all disturbed areas within the RGCP area utilising the return of stockpiled vegetation and topsoil, to facilitate plant establishment and growth. • Indigenous seed from local

Environmental Factor	Mitigation Measures		
	Avoidance	Minimisation	Rehabilitate
		ensure over clearing does not occur. • Sites for stockpiling topsoil and vegetation are to be clearly defined prior to clearing. • Vegetation shall be progressively cleared to prevent soil erosion, dust generation and weed introduction/colonisation. • Cleared vegetation shall be directly placed on areas to be rehabilitated, or, stockpiled in such a manner to avoid interference to the north-east to south-west surface drainage flows across the RGCP. • Prior to commencement of mining, topsoil will be stripped and stockpiled for use in rehabilitation works. **Degradation of Native Vegetation within the RGCP Area** • Visual monitoring of vegetation along the haul road to determine dust impacts. • Dust suppression measures will be implemented as required. **Disturbance of Individual Plants** • Identified TECs, PECs and Priority flora within the RGCP area will be clearly demarcated on project drawings and, where it is possible to do so, avoided. • A Conservation Significant Flora Management Plan shall be developed and implemented to avoid impacts to conservation significant flora, including *H. Decipiens* (Priority 2) *M. mollis* (Priority 4).	provenance species representative of the local vegetation will be used in rehabilitation activities in order to facilitate preservation of local genetic diversity within the re-established vegetation. • Rehabilitation and revegetation will be incorporated into the MCP.

Environmental Factor	Mitigation Measures		
	Avoidance	Minimisation	Rehabilitate
		Spread of Weeds • Vegetation shall be progressively cleared to prevent weed introduction and colonisation. • Any equipment or vehicle considered to have been working in a weed risk area will be cleaned down before mobilising to site. • All earthmoving, drilling and construction equipment or machinery that could potentially have collected weed seeds or matter will be cleaned of soil and vegetation matter and be inspected prior to mobilisation for works. • All vehicles and equipment will be restricted to designated mine areas and roads. • The Existing Environmental Operations Procedure (EOP) for management and eradication of the weeds within the lease area will be revised and updated. • All employees and contractors will be required to participate in the site induction which will provide an awareness of weeds including risk species such as Bridal Creeper, and response to weed infestation. All vehicles, plant and equipment will be restricted to within clearing limits. **Spread of *Phytopthora* Dieback** • Install a vehicle and machinery wash-down facility to minimise the risk of spreading or transporting weeds or dieback within the RGCP area. • The existing Dieback Management Plan shall be revised	

Environmental Factor	Mitigation Measures		
	Avoidance	Minimisation	Rehabilitate
		and updated. • All employees and contractors will be required to participate in the site induction which will provide an awareness of dieback. All vehicles, plant and equipment will be restricted to within clearing limits. **Increased Frequency and Intensity of Fire Events** • The existing Fire Contingency Plan shall be revised and updated, detailing measures to preserve undisturbed habitat and to prevent loss of leaf litter in bush greater than 15 years old.	
Terrestrial Fauna	**Direct and Indirect Loss of Individuals, Populations and Species Including Short Range Endemics** • In conjunction with the Malleefowl Preservation Group, vegetation units considered likely to host Malleefowl will be searched on foot prior to commencement of clearing • ACH is proposing to expand the existing WRL to the west, rather than to the north as originally proposed. This will reduce the impact of the development on the Heath Rat. The area to the north is now going to form part of the proposed Conservation Reserve.	**General management measures which apply to all identified impacts to fauna** • Develop and implement Conservation Significant Reptile/Bird/Mammal Management Plans. • Initiate Masters research projects on Chuditch and Malleefowl. • Monitoring will be undertaken as detailed within the Conservation Significant Reptile/Bird/Mammal Management Plans, to measure impacts of proposed activities on the behaviour of Chuditch, Carnaby's Cockatoo, Heath Rat, Malleefowl, Quenda, Ravensthorpe Range Slider, Tammar Wallaby, Water Rat, Western Brush Wallaby, Western Bristlebird, Western Mouse and the Western Whipbird. • Collaboratively assist Mallefowl Preservation Groups in long term species preservation of the Malleefowl.	**Clearing of Fauna Habitat** • Stockpile habitat logs and branches from clearing and replace during rehabilitation to provide fauna habitat. • Retain fresh water dams for avifauna, aquatic invertebrates, amphibians and turtles within the region. **Direct and Indirect Loss of Individuals, Populations and Species Including Short Range Endemics** • Minimise clearing where ever practical. • Retain fresh water dams for avifauna within the region.

Environmental Factor	Mitigation Measures		
	Avoidance	Minimisation	Rehabilitate
		• All employees will be encouraged to complete a sighting form for the recording of Malleefowl. A requirement of the Malleefowl Preservation Group. • All employees will be encouraged to complete a sighting form for the recording of Chuditch as this species is most frequently seen on road verges at night and is very distinct. **Clearing of Fauna Habitat** • Vegetation clearing will be kept to a minimum and infrastructure located to preserve habitat for Chuditch, Carnaby's Cockatoo, Malleefowl, Ravensthorpe Range Slider, Western Brush Wallaby, Western Bristlebird and the Western Whipbird. • Where possible, activities will be undertaken in previously disturbed areas to reduce the amount of clearing required. • All areas to be cleared will be assessed by qualified biological consultants. • Any Chuditch, Carnaby's Cockatoo, Malleefowl, Ravensthorpe Range Slider, Western Brush Wallaby, Western Bristlebird or Western Whipbird habitat identified during surveys will be clearly demarcated and, where it is possible to do so, avoided. • Preferentialise the clearing of well represented vegetation communities that make up the Mallee Heath and Woodlands fauna habitat, which covers the majority of the site (see Figure 4.3 of Appendix 6, the 2016 Biological Survey Report). • Barriers to native fauna movement will be kept to a	• Incorporate fauna mosaics in the construction and rehabilitation of waste dumps to increase potential refuge for fauna species of conservation significance. To be included in the MCP.

Environmental Factor	Mitigation Measures		
	Avoidance	Minimisation	Rehabilitate
		minimum. • Habitat trees will be retained for Carnaby's Cockatoo and Chuditch where possible. **Direct and Indirect Loss of Individuals, Populations and Species Including Short Range Endemics** • Any Chuditch, Carnaby's Cockatoo, Malleefowl, Ravensthorpe Range Slider, Western Brush Wallaby, Western Bristlebird or Western Whipbird habitat identified during surveys will be clearly demarcated and, where it is possible to do so, avoided. • Where possible, activities will be undertaken in previously disturbed areas to reduce the amount of clearing required to reduce impacts to Chuditch, Carnaby's Cockatoo, Malleefowl, Ravensthorpe Range Slider, Western Brush Wallaby, Western Bristlebird and the Western Whipbird. • Increase employee and community awareness of Chuditch, Carnaby's Cockatoo, Malleefowl, Ravensthorpe Range Slider, Western Brush Wallaby, Western Bristlebird and Western Whipbird found within the RGCP area. • Other than formal monitoring and fauna relocation undertaken by specialist consultants, native fauna will not be captured or intentionally handled. • Where fauna handling is deemed necessary by employees, individuals will be appropriately trained and licensed for fauna handling. • Employees are to understand native fauna have right of way, where possible and safe to do so.	

Environmental Factor	Mitigation Measures		
	Avoidance	Minimisation	Rehabilitate
		• Firearms and pets will be prohibited within the RGCP area. • Foodstuffs will be stored and disposed of appropriately to avoid scavenging. Native or feral animals are not to be fed foodstuffs. • Road kills will be removed from the road to a minimum of 10m into the adjoining vegetation to avoid further impacts to fauna feeding on carcasses. • Fauna egress ramps will be installed on all excavations i.e. sumps and trenches. **Increased Death by Predation Due to Fragmentation of Habitat** • A vegetation corridor ("wildlife corridor") will be retained within the Kundip Mine Site to provide a linkage between vegetation units and ensure safe movement of Chuditch, Malleefowl and Western Brush Wallaby across the site. The corridor is easily identifiable in the Dampland and Drainage fauna habitat figure (Section 4.2.2, Figure 4.2) in the Biological survey report (Appendix 6). • Where there is unavoidable fragmentation of vegetation units, the 'area to perimeter' ratio of remnant vegetation will be maximised. • Barriers to native fauna movement will be kept to a minimum. • Feral animal eradication and control programs will be implemented to protect Chuditch, Malleefowl and Western Brush Wallaby by reducing predation.	

Environmental Factor	Mitigation Measures		
	Avoidance	Minimisation	Rehabilitate
		Impacts to Fauna from Dust / 24-hour Light / 24-hour Noise • Manage dust/light/noise according to acceptable standards as detailed within the Conservation Significant Reptile/Bird/Mammal Management Plans. • Light emissions will also be managed in accordance with Australian Standard AS 4282-1997 *Control of Obtrusive Effects of Outdoor Lighting*.	
Terrestrial Environmental Quality	**Contamination by Hydrocarbons and Dangerous Goods** • All hydrocarbons will be stored on site in suitably bunded areas in accordance with AS/NZS 1940:2004. • Storage vessels will be fit for purpose, waterproof and display clear labelling specific to their contents. • Drip trays or alternative spill capture devices will be installed at refuelling points. • Waste hydrocarbons will be stored in bunded storage containers and/or holding tanks until collection and disposal offsite by a licenced contractor. **Changed Soil Structure and Soil Chemistry**	**Contamination by Hydrocarbons and Dangerous Goods** • Servicing and maintenance of vehicles, plant and equipment will occur preferentially within designated service and wash down bays at the Kundip Mine Site workshop area. • Field servicing will be undertaken in a manner that meets best practice guidelines. • Spill kits will be provided and personnel are to be familiar with their use. Absorbent and other spill response materials will be available in the field for quick response. • Storage and transport of chemicals throughout the RGCP area will be undertaken in accordance with the *Dangerous Goods Regulations*. • Waste oil filters, rags, contaminated absorbent, containers and soil will be disposed in designated bins. • A bioremediation facility at Kundip Mine Site will be utilised to treat contaminated soil. • Chemicals and chemical packaging products will be return to the supplier if possible, or triple rinsed before deposition to the Kundip Mine Site landfill facility.	As part of closure contaminated sites will be identified and remediated where required in consultation with regulatory authorities.

Environmental Factor	Mitigation Measures		
	Avoidance	Minimisation	Rehabilitate
	• Stockpiles shall not be located in water ponding areas. **Metalliferous Drainage from PAF and Mineralised Materials** • Low grade ore stockpiles will be bunded to contain runoff and avoid impacts which could result from solubilisation and mobilisation of enriched metals potentially present in low grade ore materials.	• The tailings and return water pipelines will be frequently inspected for leaks and will be bunded to avoid an unexpected spill entering the surrounding environment. **Metalliferous Drainage from PAF Materials** • Analyse waste rock for PAF material during grade control sampling. • All PAF material will be selectively handled and encapsulated within the WRL's or TSF embankment such that it is isolated from oxygen and rainfall. • High risk PAF materials will be contained within a constructed containment cell within a nominated WRL or TSF location so as to minimise potential for oxidation and AMD, in accordance with the PAF management plan. • Alternatively PAF materials may be intermingled with NAF materials at the dump face of the WRL's to minimise the risk of AMD. • Oxidised material will be stockpiled and processed at completion of mining for use as a capping if necessary. **Seepage of Tailings Materials** • Tailings slurry will be deposited from the embankment so that the supernatant pond is located at the head of the two valleys, away from the embankment. This will reduce risks associated with embankment instability, overtopping and seepage. • A seepage collection facility will be positioned downstream of the main embankment to mitigate against	

Environmental Factor	Mitigation Measures		
	Avoidance	Minimisation	Rehabilitate
		the risk of seepage. • The confining embankment will be conservatively constructed with a slope of 1V:3H at approximately 18˚. The relatively flat batters will provide a satisfactory factor of safety against instability. • Ensure pond size is kept to a minimum. • Install a network of groundwater monitoring bores downstream of the TSF embankment to monitor water levels and water quality. **Contamination by General Domestic Waste** • General domestic waste (i.e. food scraps and non-recyclable crib room and office rubbish), as well as wood from pallets and packaging will be disposed at the Kundip Mine Site landfill facility. **Changed Soil Structure and Soil Chemistry** • Topsoil will be stripped to a minimum depth of 100mm. • Topsoil will not be stripped when wet as this can lead to compaction and loss of soil structure when stockpiling. • Topsoil stockpiles will be truck dumped no higher than 2m in height and not compacted. • Where practicable, topsoil will be directly placed on rehabilitation areas. Where this is not possible storage time will be minimised to prevent decline in soil structure, seed and nutrient viability. • Stockpiled topsoil will be monitored for weed germination	

Environmental Factor	Mitigation Measures		
	Avoidance	Minimisation	Rehabilitate
		and weed control undertaken as necessary. Topsoil will be stockpiled to avoid any interference to the flow of surface water; channels will be cut in topsoil where ponding is evident.	
Landforms	**Erosion of Sediment** • Subsoils from the RGCP area considered likely to become unstable will not be left exposed on landform surfaces. Containment of such materials will ensure structural breakdown, hardsetting and erosion are avoided.	**Alteration of Existing Landform** • The waste landform locations at Kundip Mine Site have been selected based on areas of greatest pre-existing disturbance and integration into the surrounding topography. • It is proposed the TSF be established south of Flag pit, in a natural valley towards the south eastern corner of the Kundip Mine Site. The TSF will integrate with the surrounding topography to reduce the potential for erosion. The existing WRL west of Kaolin pit will continue to be utilised, and a new WRL will be established east of Harbour View/May pit. The final disturbance footprint for the WRL's and TSF combined is expected to be smaller than originally proposed. • Ore tailings will be contained in the TSF at Kundip Mine Site. The landform will be integrated with the surrounding landscape as much as practicable. **Interruption of Natural Drainage Patterns** • Surface water diversion structures will be used to direct flows around constructed landforms. **Unstable Constructed Landforms**	**Erosion of Sediment** • Early testing of subsoils will be undertaken to categorise soils as suitable or unsuitable for use as a subsurface layer during rehabilitation of landforms. - Those subsoils more structurally stable and suitable for use as a subsurface layer will be stockpiled separately. - Those subsoils most prone to hardsetting and erosion will be contained either within landforms, or away from external slopes of landforms. - Contours and rock mulching may be used to slow the flow of surface water across rehabilitated landforms and improve infiltration of water into the upper soil profile where it can be taken up by vegetation. - The depth of rocky topsoils used to rehabilitate landforms will be maximised as much as possible,

Environmental Factor	Mitigation Measures		
	Avoidance	Minimisation	Rehabilitate
		• All constructed landforms will be designed to geotechnical specification. **Instability of TSF** • Tailings slurry will be deposited from the embankment so that the supernatant pond is located at the head of the two valleys, away from the embankment. This will reduce risks associated with embankment instability, overtopping and seepage. • The confining embankment will be conservatively constructed with a slope of 1V:3H at approximately 18˚. The relatively flat batters will provide a satisfactory factor of safety against instability. • Inspection protocols will be developed for the TSF, incorporating stability and erosion considerations.	but will be dependent upon availability of such materials. **Unstable Constructed Landforms** • Bare, compacted soils and previously disturbed areas that are not required shall be progressively rehabilitated to provide a safe, stable, non-polluting landform. • All landforms will be geo-technically and geo-chemically stable, designed with appropriate batters and berms. • During rehabilitation the battered WRL's will be re-contoured, ripped, topsoil replaced where available and seeded with native species. This will ensure the landform is continuous with the surrounding environment as much as practicable. • Suitable waste rock will be used to construct abandonment bunds around the outer perimeter of the open pits upon closure. • Where possible the outer faces of the WRL's and TSF will be built in advance to facilitate early revegetation of these slopes prior to closure.

Environmental Factor	Mitigation Measures		
	Avoidance	Minimisation	Rehabilitate
Hydrological Processes – Surface Water	**Altered Drainage Patterns** • Stockpiles will be located to avoid impeding on critical surface drainage lines.	**Altered Drainage Patterns** • Diversion structures will be constructed around pits, WRL's and the TSF such that surface water flows can be diverted and maintained within the same creek system. • Road crossings which ensure minimal flow disruption will be constructed where the Kundip-Myamba haul road crosses the Steere River. **Sediment Erosion and Transport** • Waste Dumps will be located to prevent damming or ponding of surface water runoff. • Erosion and sediment transport from operational areas will be minimised through the construction of surface water diversion bunds and sediment settling ponds. • Runoff and erosion control measures will be installed for all cleared areas. **Impacts to Surface Water Quality** • Hydrocarbon and dangerous goods management measures will be implemented to avoid contamination of surface water. • Downstream impacts of sediment erosion and transport will be monitored. • Permanent water bodies at Kundip Mine Site will be	**Altered Drainage Patterns** • At the end of the mine life, all natural drainage processes will be reinstated. **Sediment Erosion and Transport** • Bare, compacted soils and previously disturbed areas that are not required will be progressively rehabilitated to minimise erosion. • Surface flows from the rehabilitated land surface will be integrated with flows from the adjacent native (undisturbed) land surface to ensure continuity of surface hydrology across the disturbance. **Impacts to Surface Water Quality** • Zones of riparian vegetation will be enhanced during post-mining rehabilitation. • Water quality monitoring will continue to be undertaken post closure until acceptable levels are reached.

Environmental Factor	Mitigation Measures		
	Avoidance	Minimisation	Rehabilitate
		monitored to ensure acceptable surface water quality is maintained.	
Hydrological Processes – Ground Water	**Salinisation of groundwater** • Mine dewater will be preferentially used in processing and dust suppression on haul roads. • Excess saline groundwater (mine dewater) will be contained in the Myamba evaporation pond to avoid impacts to vegetation.	**Altered groundwater levels and flow** • Shallow open pits will be progressively backfilled above the water table where possible to avoid impacts to groundwater levels and flows. **Salinisation of groundwater** • Saline groundwater will be used in mining operations as service water (specifically underground drilling water) and in processing. • Saline groundwater will also be conservatively used for dust suppression. Application techniques will be developed to ensure adjacent vegetation does not receive overspray from saline water. Impacts to vegetation that may come in contact with this water (i.e. along haul roads) will be monitored. **Contamination of groundwater** • Hydrocarbons will be stored on site in suitably bunded areas in accordance with AS/NZS 1940:2004. • Equipment servicing will take place in the Kundip Mine Site workshop areas where practicable. • If field servicing is require, it will be undertaken in a manner that meets best practice guidelines. • Chemicals will be stored and transported in the mining area in accordance with *Dangerous Goods Regulations*.	

Environmental Factor	Mitigation Measures		
	Avoidance	Minimisation	Rehabilitate
		• The Myamba Mine Site evaporation pond will be constructed with a clay liner to minimise potential seepage to groundwater. • All PAF and metal-enriched materials will be encapsulated within the designated WRL's, TSF embankment or appropriately bunded. • The size of the supernatant pond in the TSF will be minimised. • A network of groundwater monitoring bores will be installed downstream of the TSF embankment to monitor water levels and water quality. • Groundwater quality across the project area will be monitored throughout the mine life and continue post mining until results are consistently at or below target levels.	
Air Quality and Atmospheric Gases		**Death of vegetation by dust** • Progressive clearing will be undertaken to minimise dust generation from exposed surfaces. • Water carts and other methods will be utilised for dust suppression. • Water, or where appropriate dust suppressants, will be used to minimise dust generation from cleared areas where fugitive dust is recognised as a problem. • Vehicle speeds on site will be controlled to minimise dust generated. • Product stockpiles will be monitored to determine whether there is significant dust being generated;	**Death of vegetation by dust** • Bare surfaces no longer required will be progressivity rehabilitated as soon as possible. **Increased GHG emissions** • Post mining landscape of the RGCP to have a net increase in the amount of vegetation cover to partially offset GHG emissions.

Environmental Factor	Mitigation Measures		
	Avoidance	Minimisation	Rehabilitate
		stockpiles will be stabilised if necessary. • A comprehensive dust monitoring programme will be developed. • Visual monitoring of dust will be regularly conducted and activities will be halted if adverse conditions result in excessive dust generation that cannot be suppressed; the event will be recorded. • Baseline monitoring of atmospheric dust. • Monitoring of vegetation in areas likely to be impacted by dust (i.e. beside haul roads and unsealed tracks). • Drop heights between excavators and trucks will be reduced to minimise dust creation. • Weather conditions will be assessed prior to blasting and blasting will not be undertaken during unfavourable conditions. **Increased GHG emissions** • All employees will be educated about different means to reducing electricity consumption. • Transport options will be assessed to reduce fuel usage requirements where possible. **Adverse health impacts to employees by dust** • Regular housekeeping will be undertaken to collect and remove earth material that may contribute to airborne dust. • Baseline and periodic monitoring of atmospheric dust levels and presence of heavy metals in dust.	

Environmental Factor	Mitigation Measures		
	Avoidance	Minimisation	Rehabilitate
		• Appropriate PPE available and utilised by ACH staff and contractors.	
Amenity	**Impacts to Visual Amenity** • Impacts to visual amenity at Myamba Mine Site will be avoided by locating processing facilities at Kundip Mine Site, which is less exposed and not as visible from the Hopetoun-Ravensthorpe road as Myamba Mine Site. **Impact to the Railway Heritage Walk Trail** • A fence will be erected along the length of the Railway Heritage Walk Trail within the lease boundary to separate the trail from disturbed areas and nearby processing, workshop and office facilities. • Where the Kundip Mine Site access track crosses the walk trail signage will be used to warn walkers of the danger of passing vehicles.	**Impacts to Visual Amenity** Kundip Mine Site • It is proposed the TSF be established south of Flag pit, in a natural valley towards the south eastern corner of the Kundip Mine Site. The TSF will integrate with the surrounding topography and will expand eastwards into the valley. Consequently the landform will be less visible from the Hopetoun-Ravensthorpe road. • The existing WRL west of Kaolin pit will be expanded and a new WRL will be constructed to the east of Harbour View/May pit. Despite this, the final disturbance footprint for the WRL and TSF combined is expected to be smaller than originally proposed. • Water carts will be used to reduce dust emissions and therefore visual impacts to vegetation adjacent to haul roads. • Light emissions will be managed in accordance with Australian Standard AS 4282-1997 *Control of Obtrusive Effects of Outdoor Lighting*. Myamba Mine Site • Activities proposed for Myamba Mine Site will be limited to a single open pit, evaporation pond, WRL, and ROM pad. The size of the proposed Trilogy oxide pit has been significantly reduced compared with the Phillips River Proposal.	**Impacts to Visual Amenity** • Upon cessation of mining activities, rehabilitation will be undertaken to restore areas within the RGCP where visual amenity was compromised. Rehabilitation will be undertaken in accordance with the MCP.

Environmental Factor	Mitigation Measures		
	Avoidance	Minimisation	Rehabilitate
		• A band of vegetation along the western edge of Myamba Mine Site will be developed to reduce visibility of the proposed activities from the Hopetoun-Ravensthorpe Road. **Impact to the Railway Heritage Walk Trail** • It is proposed the second WRL will expand eastwards from Harbour View/May pit into a valley; this will improve integration with the surrounding topography and reduced visibility of this landform from the Railway Heritage Walk Trail. • It is proposed the TSF be established south of Flag pit, in a natural valley towards the south eastern corner of the Kundip Mine Site. The TSF will integrate with the surrounding topography and will expand eastwards into the valley. Consequently the landform will be less visible from the Railway Heritage Walk Trail.	
Indigenous Heritage	• No 'registered' Aboriginal sites or 'other heritage places' have been identified in the RGCP area. • However, if a suspected site is identified it will be cordoned off to avoid disturbance and site infrastructure re-aligned to avoid impacts wherever possible. The location will be recorded with a GPS and the DAA notified of its location.	• Ensure clearing only occurs once the site has been considered for Aboriginal heritage significance. • All actions will be undertaken in accordance with the *Aboriginal Heritage Act 1972*.	

Environmental Factor	Mitigation Measures		
	Avoidance	Minimisation	Rehabilitate
Environmental Heritage	• There is no potential for impact to Jerdacuttup River komatiites, given the location proximal to the RGCP.	The proposed activities will have a minor impact upon the Environmental Heritage value of the larger Ravensthorpe Range Area (National Estate). Any potential for impact will be further minimised by adhering to the following minimisation measures. • The existing disturbance footprint will be utilised as much as possible to reduce the amount of clearing required. • Vegetation clearing will be kept to a minimum and infrastructure located to preserve fauna habitat. • Any significant fauna habitat identified during surveys will be clearly demarcated and, where it is possible to do so, avoided. • Two vegetation corridors ("wildlife corridors") will be retained within the Kundip Mine Site to provide linkages between vegetation units and ensure safe movement of fauna across the site. • Conservation Significant Flora/Reptile/Bird/Mammal Management Plans shall be developed and implemented.	• Rehabilitation will be undertaken in accordance with the MCP to reduce long term impacts on the value of the Ravensthorpe Range Area.
Rehabilitation and Closure		• Rehabilitation will be consistent with long term land uses and conservation values, in accordance with the MCP. • A Landscape Function Analysis (LFA) of the RGCP area will be used to inform the MCP and establish a basis for measuring rehabilitation success following mine closure.	• Application of rehabilitation procedures in disturbed areas will be consistent with long term land uses and conservation values, in accordance with the rehabilitation plans. Rehabilitation will be carried out to industry standards.

Table 5-5: Measures to offset impacts to relevant environmental factors

Environmental Factor	Offsets
Flora and Vegetation	ACH has committed to setting aside 50.69 ha of the Kundip Mining Lease Area as conservation reserve.
Terrestrial Fauna	• ACH has committed to setting aside 50.69 ha of the Kundip Mining Lease Area as conservation reserve. • Offset clearing of Carnaby's Black Cockatoo foraging habitat within the Kundip Mine Site with the planting of pines and native vegetation within the Myamba Mine Site. **Increased Death by Predation Due to Fragmentation of Habitat** • Collaborative control of feral animals within the proposed nature reserve with CALM through sponsorship arrangement with project Western Shield. • Contribution of funds to allow fox control of the Ravensthorpe Range for five years (approximately $10,000/yr). **Research** • ACH propose to fund two Masters projects to be run through Edith Cowan University. • The utilisation of artificial habitat as a consequence of historic clearing in the Kundip mining area. • The creation of Malleefowl nesting material from land clearing from construction of the RCGP.
Air Quality and Atmospheric Gases	ACH has committed to setting aside 50.69 ha of the Kundip Mining Lease Area as conservation reserve. Post mining landscape of the RGCP to have a net increase in the amount of vegetation cover to partially offset GHG emissions.
Amenity	The railway was built to connect mines in the Ravensthorpe area to the Hopetoun port and operated from 1909 – 1935. The trail is open in four sections: The Ravensthorpe to Hopetoun Heritage Railway Walk Trail covers approximately 39 km with the old Kundip Town Site located at approximately the halfway mark. Currently there are ablution amenities at the old Kundip Town Site.

Environmental Factor	Offsets
	ACH could contribute to the cost of constructing a communal shelter at the old Kundip Town Site. The provision of accommodation, clean water and ablutions would make this an ideal stop over for cyclists or trail walkers using the trail moving between Ravensthorpe and Hopetoun. This would significantly promote tourism in the area.
Indigenous Heritage	The RGCP 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. The passing of the Ravensthorpe to Kundip Railway line through the RGCP presents an ideal opportunity to integrate a cultural perspective on the area using signage along the Heritage trail which represents a passage through the landscape. Topographically the project area descends from an elevated area into a lowland or dampland and then rises back up to a rocky breakaway, providing a variable cross section of landforms to describe from the perspective of the Wadjan people.

Table 5-6: Significance of impact to environmental factors from the RGCP

Factor	EPA Objective	Estimated Residual Impact	Does the Proposal Meet the EPA's objective?
Flora and Vegetation	To maintain representation, diversity, viability and ecological function at the species, population and community level.	***Cumulative impacts from a regional perspective*** The proposed activities will require the disturbance of up to 252 ha of native vegetation within the Kundip Mine Site, in addition to the 28.09 ha previously disturbed. The additional disturbance will contribute little to the cumulative impacts of mining, which has occurred over an extended period along the 20 km Cu-Au belt from Ravensthorpe in the north to Kundip in the south. This belt incorporates the Mt Chester, Mt Desmond, Elverdton and Kundip Mines. The proposed disturbance footprint at Myamba Mine Site (64 ha, approximately 6.82% of the site) will not result in cumulative impacts as no native vegetation will be cleared within the site. Some clearing may be required along L74/45 to make way for two water pipelines running between the Myamba evaporation pond and the Kundip Mine Site. ***Potential Impacts from a local context*** During the 2016 APM survey *H. decipiens* was recorded north-north west of the Western Gem pit within the proposed disturbance footprint and *M. mollis* was recorded north and east of the disturbance area boundary. No direct impacts to will occur to either species from the proposed activities. However, secondary impacts are possible given the location of individuals relative to the disturbance areas within the RGCP area. At a localised scale disturbed areas, such as those areas surrounding constructed landforms, have been found to provide habitat for Priority flora *M. mollis*, providing evidence that disturbed landscapes can still offer valuable habitat for flora. Table 1 of Appendix 23 outlines the disturbance to each vegetation type. ***Expected residual impact*** With the implementation of the above mitigation measures (Table 5-4), impacts to known conservation significant flora will be minimised and impact upon regional flora diversity is	Yes. With the implementation of the above mitigation measures, impacts to flora and vegetation are expected to be negligible.

Factor	EPA Objective	Estimated Residual Impact	Does the Proposal Meet the EPA's objective?
		expected to be negligible. Current and future survey work and seed collection will expand existing knowledge of conservation significant flora species range/habitats and recruitment ability. Donations to the CALM Threatened Flora Seed Centre will ensure the likelihood of long term species survival and enhancement.	
Terrestrial Fauna	To maintain representation, diversity, viability and ecological function at the species, population and assemblage level.	The disturbed mining landscape and early post-rehabilitation landscape can offer highly suitable habitat for fauna. Buildings and old mine shafts provide an excellent refuge for fauna. Water storage facilities are a valuable habitat for water rat and water source for birds, while excess soil material pushed up during construction of roads, is highly suitable for use in the construction of nests (mounds) by Malleefowl. These are just some examples of niche environments for fauna resulting from mining related activities. The identification and protection of a Conservation Area, the establishment of a vegetation corridor and an increase in the net amount of vegetative cover within the RGCP area following rehabilitation will ensure that the impact on fauna distribution will be negligible. Contribution to regional fox control will aid in minimising predation from foxes due to fragmentation of the landscape. Current and future monitoring of conservation significant fauna will increase awareness and data available to assist with the conservation of these species into the future. ***Expected residual impact*** With the implementation of these offsets and the above mitigation measures, the residual impact on fauna is considered to be minimal at a local scale and negligible at a regional scale.	Yes. Implementation of the above mitigation measures will ensure the residual impact on fauna from proposed mining activities is negligible.
Terrestrial Environmental Quality	To maintain the quality of land and soils so that the environment values, both ecological and social, are protected.	Potential impacts from contamination by hydrocarbons, dangerous goods, general domestic waste and AMD will be mitigated through effective management as detailed above. Early detection of contamination (in particular from seepage of enriched metals in tailings) will be possible through comprehensive monitoring and having comprehensive baseline data in place.	Yes.

Factor	EPA Objective	Estimated Residual Impact	Does the Proposal Meet the EPA's objective?
		There will be localised changes to soil structure and soil chemistry from proposed activities, however, management measures (particularly for the preservation of topsoil) will enable rehabilitated areas to regain their former soil structure and stability post closure. ***Expected residual impact*** Following completion of mining there are not expected to be significant residual impacts to terrestrial environmental quality.	
Landforms	To maintain the variety, integrity, ecological functions and environmental values of landforms.	Implementation of the above mitigation measures will ensure local impacts from constructed landforms (i.e. open pits, underground mines, WRL's, TSF, ROM pads, water storage facilities and an evaporation pond) are minimised. All final landforms will be stable, non-polluting and integrated appropriately into the surrounding landscape. All natural drainage lines will be reinstated. ***Expected residual impact*** Following completion of mining, the residual impact of altered landforms from proposed activities is anticipated to be minor at a local scale and insignificant at a regional scale.	Yes. All final landforms will be stable, non-polluting and integrated appropriately into the surrounding landscape.
Hydrological Processes – Surface Water	To maintain the hydrological regimes of surface water so that existing and potential uses, including ecosystem maintenance, are protected.	Minor local disruption to surface water flow will occur within the RGCP area, however, appropriate placement of diversion structures will ensure flows are diverted around mining landforms and back into natural drainage lines. Implementation of the above mitigation measures will minimise impacts from erosion and transport of sediment by surface water flows. Surface water diversion structures and water storage facilities will be closely monitored to ensure they are effectively controlling flows and sediment erosion. Mitigation measures combined with a water quality monitoring program will ensure the quality of downstream surface water bodies is maintained to an acceptable standard. ***Expected residual impact*** Following completion of mining residual impacts from changed surface water patterns to	Yes.

Factor	EPA Objective	Estimated Residual Impact	Does the Proposal Meet the EPA's objective?
		downstream rivers and water bodies is not expected to be significant, particularly in a regional context.	
Hydrological Processes – Ground Water	To maintain the hydrological regimes of groundwater so that existing and potential uses, including ecosystem maintenance, are protected.	**Altered groundwater levels** Flora of the RGCP area are not reliant upon groundwater for survival due to frequent reliable rainfall in the Ravensthorpe region. Therefore, reduced groundwater levels during and post mining will not have a negative impact upon the health of local flora. Groundwater levels are anticipated to recover to natural levels post-mining. **Salinisation of groundwater** Four pit lakes will be formed as a result of mining for the RGCP. Rainfall captured by the pits is expected to introduce sufficient fresh water to the aquifer to negate the small increase in salinity due to evaporation from the pits. **Contamination of groundwater** Potential impacts from hydrocarbon/chemical contamination and AMD can be mitigated through effective management as described above. Early detection of contamination will be possible through comprehensive monitoring and the establishment of baseline groundwater quality data for comparison. **Disruption of groundwater flow** Although mine pits will disrupt local groundwater flows, there are no groundwater users or groundwater dependent ecosystems close enough to the RGCP that could be impacted by the changes to the groundwater flow system.	Yes. Assuming groundwater quality and depth returns to pre-mining levels, impacts to groundwater are expected to be negligible.
Air Quality and Atmospheric Gasses	To maintain air quality for the protection of the environment and human health and amenity, and to minimise the emission of	***Expected residual impact*** Following completion of mining it is expected there will be local evidence of impact to vegetation by dust, especially along unsealed roads. However, with the above management measures in place to minimise dust generation and reduce atmospheric dust if present, impacts will be greatly reduced. Vegetation impacted by dust is expected to recover via natural regeneration, with native seed provided to areas if required. The overall impact to vegetation by dust will be minor at	Yes. With the implementation of the above mitigation measures, changes to air quality and estimated contribution to global GHG emissions is expected to

Factor	EPA Objective	Estimated Residual Impact	Does the Proposal Meet the EPA's objective?
	greenhouse and other atmospheric gases through the application of best practice.	a local scale and insignificant at a regional scale. The total GHG emissions are not expected to exceed trigger values established by the Commonwealth & State GHG emission policies. Therefore the RGCP is expected to have negligible impact on global GHG emissions.	be negligible.
Amenity	To ensure that impacts to amenity are reduced as low as reasonably practicable.	***Expected residual impact*** Activities proposed to occur within the Kundip Mine Site are not expected to increase impacts on amenity above the level of current impact from historical mining activities at the site. Following completion of mining, impacts to visual amenity are expected to be greater at Myamba Mine Site because the site is cleared of vegetation and highly visible from the Hopetoun-Ravensthorpe Road. Proposed activities such as open pit mining, an evaporation pond, WRL and ROM pad will impact upon the visual amenity of the site. However, activities expected to have a greater impact on visual amenity (i.e. TSF, processing plant, workshop and office facilities) will be located at Kundip Mine Site. Through these measures and additional mitigation measures detailed in the previous section, the relative impact to visual amenity of the RGCP area resulting from mining activities will be reduced as much as practicable. There will be no direct or lasting impact upon the Railway Heritage Walk Trail.	Yes.
Indigenous Heritage	To ensure that cultural associations are not adversely affected.	***Expected residual impact*** No residual impact is expected as no 'registered' Aboriginal sites or 'other heritage places' have been identified in the RGCP area.	Yes. There are no 'registered' Aboriginal sites or 'other heritage places' within the RGCP area. All actions will be undertaken in accordance with the *Aboriginal Heritage Act 1972*.

Factor	EPA Objective	Estimated Residual Impact	Does the Proposal Meet the EPA's objective?
Environmental Heritage	To ensure that historical associations and natural heritage are not adversely affected.	***Expected residual impact*** Following completion of mining, disturbance of up to 252 ha of vegetation within the Kundip Mine Site is expected to have an insignificant impact upon the Environmental Heritage value of the 30,000 ha Ravensthorpe Range Area. Particularly given these same units of vegetation are represented across 6,183.82 ha in the wider Ravensthorpe Range area. To further reduce the potential for impact, clearing will be minimised within the proposed disturbance area and impacts to conservation significant flora and fauna avoided where possible.	Yes.
Rehabilitation and Closure	To ensure that premises are decommissioned and rehabilitated in an ecologically sustainable manner.	***Expected residual impact*** Given the existing disturbance of 28.09 ha within the Kundip Mine Site, the proposed additional disturbance of approximately 223.9 ha will add to cumulative impacts of the site at a localised scale. However, when considered within the wider context of the entire Ravensthorpe Range the proposed impacts will be proportionally small. Proposed activities at Myamba Mine Site are estimated to disturb up to 64 ha which will have localised impacts not considered significant at a regional scale. With the implementation of the above mitigation measures and the MCP, the post-mining landscape of the RGCP area is expected to support the same land uses and functions to that which existed pre-mining.	Yes. Rehabilitation will be undertaken in accordance with the MCP. The post-mining landscape will support the same uses and functions to that which existed pre-mining.

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7 APPENDICES

APPENDIX 1: KUNDIP WASTE LANDFORM AND TSF DESIGN CONCEPT – GOLDER ASSOCIATES/DUMPSOLVER (2016)

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APPENDIX 2: CAPITAL AND OPERATING COST ESTIMATE – GR ENGINEERING SERVICES (2016)

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APPENDIX 3: WATER STORAGE FACILITY DESIGN – KUNDIP – COFFEY (2011)

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APPENDIX 5: GEOTECHNICAL ASSESSMENT FOR AN EVAPORATION POND - MYAMBA - SOIL AND ROCK ENGINEERING (2004)

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APPENDIX 6: BIOLOGICAL SURVEY OF THE RGCP – ANIMAL PLANT MINERAL (2016)

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APPENDIX 7: PHYTOPHTHORA DIEBACK ASSESSMENT – KUNDIP – TERRATREE (2013)

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APPENDIX 8: GEOCHEMICAL CHARACTERISATION OF MINE WASTE – GRAEME CAMPBELL & ASSOCIATES (2004)

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APPENDIX 10: CHARACTERISATION OF MINE WASTE – TRILOGY DEPOSIT - GRAEME CAMPBELL & ASSOCIATES (2010)

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APPENDIX 12: CHARACTERISATION OF REGOLITH MATERIALS – OUTBACK (2011)

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APPENDIX 13: GEOTECHNICAL ASSESSMENT OF THE KUNDIP MINE SITE – PETER O'BYRAN & ASSOCIATES (2010)

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APPENDIX 14: GEOTECHNICAL ASSESSMENT OF THE MYAMBA MINE SITE – PETER O'BYRAN & ASSOCIATES (2010)

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APPENDIX 15: CHARACTERISATION OF TOPSOILS – OUTBACK (2004)

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APPENDIX 16: SURFACE WATER ASSESSMENT – KUNDIP MINE SITE – COFFEY (2011)

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APPENDIX 18: GROUNDWATER ASSESSMENT – MYAMBA – ROCKWATER PTY. LTD. (2011)

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APPENDIX 19: DUST MONITORING – KUNDIP MINE SITE – WESTSAFE (2005)

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APPENDIX 20: ABORIGINAL HERITAGE INQUIRY SYSTEM SEARCH OF THE RGCP AREA (2016)

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APPENDIX 21: ETHNOGRAPHIC SURVEY REPORT – TAMORA PTY. LTD. (2003)

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APPENDIX 22: STAKEHOLDER ENGAGEMENT 2004 TO 2011

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APPENDIX 23: PROPOSED DISTURBANCE TO VEGETATION ASSOCIATIONS OF THE RGCP AREA

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