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

Figure 1-3: Proposed and Current Disturbance at Myamba Mine Site

Legend

- *Proposed disturbance footprint*
- *Current disturbance*
- *Ravensthorpe Gold/Copper Project Tenement*
- *Major roads*

Date: 12/12/2016

Scale: 1:13,096

N

0 0.55 1.1

Kilometres

ems@animalplantmineral.com.au

GDA 1994 MGA Zone 51

\\MAINSERVER-PC\server storage\APM GIS and Mapping\03_Client\ACH\02_GIS Maps\20161212_ACH_Kundip Gold Project_Fig 1-3 Bio Report.mxd

1.3 BACKGROUND AND SUPPORTING INFORMATION

Species considered to be of national conservation significance are protected under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act). Under this Act, activities that may have a significant impact on a species of national conservation significance must be referred to the Department of Environment (DoE) for assessment. In WA, all native flora and fauna species are protected under the *Wildlife Conservation Act 1950* (WC Act). Flora and Fauna species that are considered rare, threatened with extinction or have high conservation value are specially protected by four schedules in this Act (see Appendix 1). The DPaW also classifies some flora under four different Priority codes and fauna under five different Priority codes (Appendix 1).

Some species of fauna are covered under the 1991 Australian and New Zealand Environment Conservation Council (ANZECC) Convention (Commonwealth (Cth)), while certain birds are listed under the 1974 Japan and Australian Migratory Bird Agreement (JAMBA) (Cth) and the 1986 China and Australian Migratory Bird Agreement (CAMBA) (Cth). More recently Australia and the Republic of Korea agreed to develop a bilateral migratory bird agreement similar to the JAMBA and CAMBA. The Republic of Korea-Australian Migratory Bird Agreement (ROKAMBA) was entered into force in 2007. All migratory bird species listed in the annexes to these bilateral agreements are protected in Australia as Matters of National Environmental Significance (MNES) under the EPBC Act.

1.4 EXISTING ENVIRONMENT

The Project lies within the Shire of Ravensthorpe. Land use in the area is predominantly pastoralism, in particular grazing and cultivation. Some conservation areas are present along with unallocated crown land, crown reserves and forestry plantations (Comer, Gilfillan and Grant et *al*., 2003).

1.4.1 Climate

The Project is located in the Goldfields-Esperance region of WA which experiences a Mediterranean climate with mild summers and cool wet winters (Figure 1-4).

The nearest Bureau of Meteorology (BoM) weather station is at Ravensthorpe (BoM Site Number: 010633), less than 15 km 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 1-2.

Recorded data suggests that the Project area is likely to receive close to 427 millimetres (mm) of rain on an annual basis and experience temperatures ranging between 2.2 degrees Celsius (°C) and 43°C (the lowest and highest monthly records) (BoM, 2016a). 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, 2016a) (Table 1-2).

Table 1-2: Rainfall and temperature averages for Ravensthorpe Weather Station (010633)

	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

Source: BoM, 2016

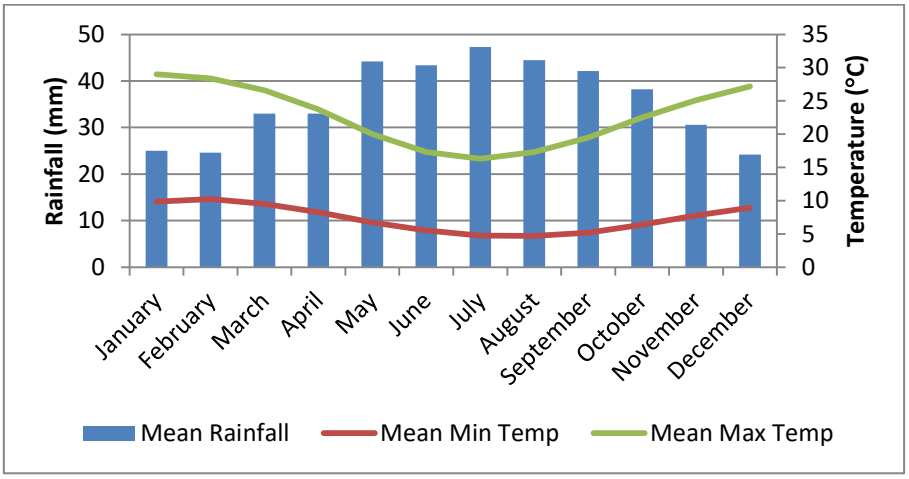

Figure 1-4: Ravensthorpe Weather Station meteorological data (BoM 2016)

1.4.2 Biogeographic Regionalisation

The Interim Biogeographic Regionalisation for Australia (IBRA) (version 7.1) classifies the Australian continent into regions (bioregions) of similar geology, landform, vegetation, fauna and climate characteristics (Thackway and Cresswell, 1995). The mapping completed by Beard (1975) provides the basis for the IBRA bioregions. IBRA mapping (Version 7.1), places the Project within the Esperance Plains Bioregion.

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

The Esperance Plains Bioregion is further subdivided into the Fitzgerald (ESP01) and Recherche (ESP02) sub-regions. The Project lies entirely within the Fitzgerald (ESP01) sub-region. Topography of the Fitzgerald subregion is variable, ranging from sandplains on the coast to granite and quartzite ranges on both the coastal plain and inland (Comer, Gilfillan, Grant et *al.*, 2003). Soils are predominantly duplex, deep and yellow sands on the plains with shallow sandy soils on mountain ranges (Comer, Gilfillan, Grant et *al.*, 2003). Vegetation types are diverse and Eucalypts dominate most systems. These include coastal dune woodlands, coastal shrublands and heathlands, mallee shrubland and heath (rich in endemics). Herbfields and heaths can be

found on granite tors, quartzite ranges and greenstone heath and shrublands (Comer, Gilfillan, Grant et *al*., 2003).

1.4.3 Land Systems

The land system approach to the management of rangelands results from the identification of recurring patterns of topography, soil and vegetation and involves their use in land use and catchment planning.

The Project area falls into an area which has not been surveyed in the context of land systems. For this reason information for this report is limited to IBRA and soil-landscape characterisation. Soil-landscape mapping delineates repeating patterns of soils and landscapes across WA's rangelands and arid interior (Tille, 2006). Mapping completed by the Department of Agriculture places the Project within the Ravensthorpe Zone of the Stirling Province (Government of Australia, 2016).

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

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

1.4.4 Surface Water

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 (JDA, 2005). The Project area is situated between the Steere River to the west and Jerdacuttup River to the East. There are no perennial drainage lines or rivers in the Project area.

Drainage across the Project is generally south-west towards the Steere River, with the main river channel crossing under the Ravensthorpe Hopetoun Road approximately 200 metres (m) south of the Kundip mine site (JDA, 2005). Some of the Kundip mining leases fall within the Jerdacuttup River catchment, which drains to the Jerdacuttup Lakes. Stream channels at the Project are spaced such that they form a network of convergent creeks (JDA, 2005). Historical mining at Kundip has resulted in numerous disturbances which create local drainage anomalies (JDA, 2005).

1.4.5 Wetlands

The Project area does not include and is not in close proximity to any wetlands listed as Ramsar sites (Landgate, 2016). Towards the western boundary of the Project there are patches of habitat dominated by myrtaceous species strongly associated with natural drainage lines.

1.4.6 Previous Surveys

The Phillips River Gold Project (PRGP) was referred to the Federal Department of Environment (DoE) for assessment in 2005 where it was determined to be "Not a Controlled Action".

The PRGP was also assessed based on proponent information by the EPA in 2006. Following the recommendations of the EPA, the Minister for Environment approved the project (Ministerial Statement (MS) 0716). This approval is no longer valid due to the time that has elapsed without substantial commencement on the Project.

A great deal of survey work was done to underpin the environmental approvals at the time of assessment. The Kundip site specific vegetation survey work done by G.F Craig in 2003 and local vegetation mapping completed for the Ravensthorpe Ranges by the South Coast Natural Resource Management Group provides a wealth of background information to give context to the 2016 flora survey work. In 2004 a fauna survey consultant executed a comprehensive baseline biological assessment over two seasons. The first survey was done at a sub-optimal time of the year, but the second survey was done in ideal conditions in spring (Biota 2004). This work provides a valuable baseline for the 2016 fauna survey work and the data are included herein as capture records for the Project.

A summary of the surveys previously undertaken is provided in Table 1-3 below.

Table 1-3: Existing surveys and investigations of the Ravensthorpe Gold Copper Project 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	Markey *et al.*	2007	Flora survey of the Ravensthorpe Range

Aspect	Survey	Consultant	Year	Purpose
	Australia			
	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.
	Targeted and Regional Survey for *Melaleuca* sp.[1] 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
	Level 1 Flora Assessment of the Kundip Exploration Leases – Targeted Search of Tenements P74/352, 349, 350, 351, E74/537, E74/311, P74/290, E74/486, P74/259 and E74/392	MWH Global	2013	Level 1 flora survey of prospecting and exploration leases at the Kundip Mining Centre.
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.

[1] Species unspecified

2 METHODOLOGY

2.1 CONTRIBUTING AUTHORS

The Project survey scope was designed by APM Principal Biologist Dr Mitch Ladyman. The flora and vegetation survey was refined and executed by APM Senior Botanist James Tsakalos, with field assistance by environmental biologists Loren Kavanagh and Sarah Isbister. The field fauna survey work was executed by Dr Mitch Ladyman.

Data captured by Biota Environmental Sciences Pty Ltd (Biota) in May and November 2004 are incorporated into the results of this report. Those data are the property of ACH Minerals and, as such, can be utilised herein. Credit is given to Roy Teale and the team at Biota Environmental Sciences Pty Ltd who undertook the field surveys and collected the data. The Biota reports are provided in Appendix 2 and 3.

2.2 DESKTOP METHODOLOGY

2.2.1 Database Searches

A search of the EPBC Act list of protected species was undertaken using the Protected Matters Search Tool (PMST) (DoE, 2016a) to identify flora, fauna and threatened ecological communities considered to be Matters of National Environmental Significance (MNES). This search covered an area within 10 km of the centre of the Project area (-33.67 S, 120.20 E). The results of the database search are presented in Appendix 4.

The NatureMap database (DPaW, 2016) was searched to produce a list of potentially occurring species within 10 km of the Project area using coordinates (-33.67° S, 120.20° E). This database has the most up to date species list based on flora and fauna licence returns from numerous surveys conducted in the area. The results of the database search are presented in Appendix 5.

A search of the Atlas of Living Australia (AoLA) (AoLA, 2016) was also undertaken to produce a list of fauna potentially occurring within a 10 km buffer of the Project area using coordinates -33.67° S, 120.20° E. The results of the database search are presented in Appendix 6.

A request was made for a search of the DPaW databases for Threatened and Priority flora and fauna and the presence of Threatened Ecological Communities (TEC) or Priority Ecological Communities (PEC). This search was conducted based on a single point approximately centrally located in the Project area at -33.67° S, 120.20° E and included a 10 km buffer for flora and communities and a 30 km buffer for fauna. The results of the DPaW flora database searches are presented in Appendix 7, results of the fauna database search are presented in Appendix 8.

Additional searches for fauna focussing more intensively on the Kundip Mine Site and immediate area, including the Kundip nature reserve, were undertaken to enable a comparison of the results of an extensive field survey undertaken by Biota Environmental Sciences Pty Ltd (Biota) in 2004 (Biota, 2004a; Biota, 2005). The searches comprised the PMST, NatureMap and AoLA and included a 6 km buffer, with the exception of the AoLA search which included a predefined buffer of 5 km. The results of the database searches are presented in Appendix 9 and Appendix 10.

Forming part of both flora and fauna database searches, previous reports (Table-1-3) were reviewed. Species previously noted as priority or of conservation concern were considered in terms of spatial occurrence (proximity to or within the Project area) and current conservation status reviewed.

2.2.2 Refining Field Searches

Due to the high number of potential Priority flora taxa in the area (n = 72) it was necessary to eliminate taxa of the lowest conservation significance and all taxa unlikely to occur based in the Project area. Species occurrence is known to be a product of long term evolutionary and short term biological processes which act as filters (e.g specific life history is responsive to local habitat conditions) on species pool (Diaz et al 2016). These ideas are not only theoretical but can be practically applied to assist in taxa reduction. Specifically APM used (1) Maximum entropy modelling of species geographic distribution (See Phillips, Anderson & Schapire 2006), a broadly implemented tool (~6000 citations) which makes use of species occurrence and environmental data to predict potential occurrence (Soil data – collected freely from Commonwealth Scientific and Industrial Research Organisation (CSIRO) Terrestrial Ecosystem Research Network, including; Total Nitrogen, Total Phosphorus, Bulk density, Clay, Sand, Organic carbon, pH CaCl2, Available water, Effective Cation Exchange Capacity) and (2) tacit and published habitat specific information (e.g. florabase and published descriptions).

The primary objective was to identify and eliminate from the field survey all of those species that were more likely to occur on the Ravensthorpe Rangeland and associated habitats (well defined permanent drainage lines in valleys) rather than in the Project area. The modelling information was used in the accompaniment of the species habitat information (determined through florabase collections records, published descriptions and tacit knowledge) and the final decision on taxa to be searched for in the field was made based on conservation significance; that is, a Priority 1 or Threatened taxa was still searched for in the field even if the predictive model suggested it may not be present based on landforms or soil types. Conversely, Priority 2, 3 or 4 taxa that were modelled as not present were not searched for. Both tools used in conjunction provide robust means of taxa reduction to more practicable number applied in field survey.

Taxa of low conservation status were also eliminated from the field targeted survey if their broad distribution and collection records in the region determined that Project specific impacts would not significantly impact the reginal population. Results of the Maximum entropy modelling are provided in Appendix 11.

2.3 FIELD SURVEY

2.3.1 Flora and Vegetation Survey Methodology

The flora and vegetation field survey was undertaken from 17-22 of August 2016. Field personnel included Botanist James Tsakalos, Environmental Scientists Sarah Isbister and Loren Kavanagh. The survey was designed in accordance with Environmental Protection Authority (EPA) Guidance Statement No. 51 (EPA, 2004a) and EPA Position Statement No. 3 (EPA, 2002) with specific liaison and guidance from DPaW.

Prior to the survey field personnel familiarised themselves with conservation significant flora that were to be the focus of the field survey. A field herbarium containing habitat requirements and photos (scans of the actual specimens lodged with the State herbarium) was produced for each of the field staff.

The survey area was traversed on foot, with transects covering areas likely to be cleared for mine construction. Transects walked were approximately 5 m apart, with two people holding a handheld global positioning system (GPS) unit. Track logs were recorded on the GPS to ensure maximum coverage of the areas and minimum overlap of search effort. The locations of conservation significant flora identified were recorded with the GPS unit. Plants with unknown or uncertain identities were recorded with the GPS, collected and later identified to species level.

Vegetation units mapped by DEC (Craig *et al.*, 2008) were used and their mapping boundaries reviewed during the survey. These units and associated habitats were used as tool to assist in searching for habitat specific

taxa. Disturbance areas were mapped with a GPS unit to update the total disturbance footprint of the Project area.

2.3.2 Terrestrial Vertebrate Fauna Survey Methodology

The field survey was undertaken by Dr Mitch Ladyman (Principal Biologist) in two stages; 17 - 21 August and 20 – 26 September 2016. The survey was designed in accordance with EPA Guidance Statement No. 56 on terrestrial fauna surveys for environmental impact assessment (EPA, 2004b) and Position Statement No. 3 (EPA, 2002), followed up with Project specific liaison with DPaW.

The survey targeted conservation significant fauna with a high likelihood of occurrence in the area based on the habitat present and previous historical records (Biota 2004, 2005). The targeted survey utilised Aluminium box traps, cage traps, pit traps, funnel traps, turtle traps and camera traps and acoustic recording devices. All opportunistic observations of other species were recorded. Table 2-1 outlines the target fauna species and the method of trapping employed to determine presence absence. The location of traps is illustrated in Figure 2-1.

Table 2-1: Target fauna species and method of trapping

Fauna Species	Transect Observation	Funnel and Pit Trapping	Call Play-back	Thermal Trigger Fauna Cameras	Aluminium Box Traps	Cage traps	Opportunistic Hand Searching
Calyptorhynchus latirostris (Carnaby's Cockatoo (short-billed black-cockatoo) Carnaby's Cockatoo)	×		×				
Dasyornis longirostris (Western Bristlebird)	×		×				
Dasyurus geoffroii (Chuditch Western Quoll)				×		×	
Falco peregrinus (Peregrine Falcon)	×		×				
Hydromys chrysogaster (Water-rat)	×			×	×	×	
Isoodon obesulus subsp.[1] *fusciventer* (Quenda Southern Brown Bandicoot)	×			×	×	×	
Leipoa ocellata (Malleefowl)	×			×			
Lerista viduata (Ravensthorpe Range Slider skink)		×					×
Macropus eugenii subsp. *derbianus* (Tammar Wallaby (WA subsp))	×			×			
Macropus irma (Western Brush Wallaby)	×			×			
Merops ornatus (Rainbow Bee-eater)	×						
Myrmecobius fasciatus (Numbat Walpurti)	×			×	×	×	
Parantechinus apicalis (Dibbler)	×			×	×		
Phascogale calura (Red-tailed Phascogale Kenngoor)	×			×	×		
Pseudomys occidentalis (Western Mouse)	×			×	×		
Pseudomys shortridgei (Heath Mouse Dayang)	×			×	×		
Psophodes nigrogularis subsp. *oberon* (Western Whipbird (Mallee))	×		×				

[1] Sub-species

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

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

Legend

- *Aluminium box trap*
- *Acoustic recorder*
- *Cage trap*
- *Funnel trap*
- *Pit trap*
- *Camera*
- *Bat detector*
- *Turtle trap*
- *Proposed disturbance footprint*
- *Ravensthorpe Gold/Copper Project Tenements*
- *Major roads*

Figure 2-1: Fauna Trap Locations

Date: 12/12/2016

Scale: 1:24,000

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0 1 2

Kilometres

ACH

APM animal plant mineral

ems@animalplantmineral.com.au

GDA 1994 MGA Zone 51

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Document Name: 20161212_ACH_Kundip Gold Project_Fig 2-1 Bio Report

2.3.2.1 Transect Observation

Transect Observations were made in a number of different ways with each increasing the likelihood of encounter of a particular species or suite of species.

Nocturnal Transects

Nocturnal searching comprised vehicle-based searches of all roads and tracks throughout the project area. Searches commenced after sunset (approximately 7pm) and typically lasted for more than one hour. On all occasions hand held spotlights were used to detect arboreal or volant nocturnal fauna, including possums and owls, and vehicle headlights and spotlights were used to detect ground dwelling reptiles and amphibians and hawking nocturnal birds that are often found roosting on the track.

Diurnal Transects

As a function of the botanical survey protocol biologists were able to actively search for Malleefowl nests during grid searches for Priority flora species. Over the course of the botanical survey five persons walked a total of more than 35 km searching a 10 m swath width for Malleefowl mounds.

Movement between traps and sites on foot increases the likelihood of detection of scats and secondary evidence of fauna. All evidence observed during daily systematic trap clearing was recorded.

2.3.2.2 Funnel and Pit Trapping

A total of 40 funnel traps were set in two different habitats. The first was the sandy gentle slopes in the *Eucalyptus falcata* / *E. pleurocarpa*: Proteaceous mallee-heath vegetation unit. The object was to sample for the Ravensthorpe Slider and funnel traps were augmented by small cup pit traps with four funnel traps and four cups set up per 10 m drift fence.

The second site was set up in a small patch of *Eucalyptus clivicola* Mallee /*Melaleuca stramentosa* to sample species that had persisted in this remnant patch of vegetation between Western Gem, Two Boys and Kaolin Pit and the Tailings Storage Facility. Funnel traps were set up in conjunction with deep 20 L bucket pit traps with three way traversing wire drift fences (Table 2-2 and Table 2-3).

Table 2-2: Funnel trap survey effort

Trap Location	No. of Traps	No. of Trap Nights	Total
F29	20	4	80
F30	20	4	80
Total	**40**	**4**	**160**

Table 2-3: Pit trap survey effort

Trap Location	No. of Traps	No. of Trap Nights	Total
P30	5	5	25
Total	**5**	**5**	**25**

2.3.2.3 Call Play-back

A Marantz acoustic recorder was set up over a number of nights adjacent a small permanent water body at the foot of an historic heap leach pit at the point of out flow (Table 2-4).

The objective here was to establish a list of common frog species that give an indication of overall water quality and environmental health.

Table 2-4: Acoustic monitoring survey effort

Trap Location	No. of Traps	No. of Trap Nights	Total
ACHS8Ac Outflow	1	1	1
ACHS8Ac Heap leach dam	1	1	1
ACHS8Ac Two boys	1	1	1
Total	**3**	**3**	**3**

2.3.2.4 Acoustic Monitoring

A total of four full spectrum lossless WAC0 format with Wildlife Acoustics SM2BAT bat detectors (sampling rate 384 kHz, trigger 6 dB above background; 48 dB gain) were set to record the acoustic signatures of the microbats bats across the project area. Detectors were set up in strategic locations where the likelihood of detecting bats was significantly increased, in particular water bodies and mine shafts. Detectors were set to turn on automatically at sunset and off at sunrise (Table 2-5).

Table 2-5: Bat acoustic monitoring survey effort

Trap Location	No. of Traps	No. of Trap Nights	Total
A23 - 7014	1	5	5
A24 - 8066	1	5	5
A31 - 6066	1	4	4
A33 - 8048	1	3	3
Total	**4**	**17**	**17**

2.3.2.5 Thermal Trigger Fauna Cameras

Scout Guard SG560K-14mHD white light and Reconyx HC500 HyperFire™ Semi-Covert IR were set up at several locations across the Project area (Table 2-6). The principal focus was on mine shafts set at angles that would encourage occupation by both native and feral fauna of various sizes from small dasyurids and rodents to larger animals such as fox, cats and Chuditch.

Table 2-6: Thermal trigger camera survey effort

Trap Location	No. of Traps	No. of Trap Nights	Total
ACHS3TC004	1	3	**3**
ACHS5TC003	1	3	**3**
ACHS5TC004	1	3	**3**
ACHS6 - Camera 005 & 006	2	3	**6**
ACHS7TC001	1	3	**3**
ACHS7TC002	1	3	**3**
C25 - Camera 25	1	4	**4**
E34 - Camera 29	1	4	**4**
E35 - Camera 30	1	4	**4**
DpaW10 - bridge	1	4	**4**
DPaW21 - NW hill	1	4	**4**
DPaW24 - NW creek	1	4	**4**
DPaW25	1	4	**4**
DPaW25	1	4	**4**
DPaW26	1	4	**4**
DPaW27	1	4	**4**
DPaW35	1	4	**4**
Total	**18**	**62**	**65**

2.3.2.6 Aluminium Box Traps

A total of 80 aluminium box traps were set up in linear transects at close proximity to concentrate trapping in limited habitats (Table 2-7). Trap spacing was =/< 10 m, with the standard spacing typically closer to 20 m. The majority of the box traps were set in habitats likely to support the conservation significant mammalian fauna of the Project area. In particular, a number of grids were set up along drainage lines starting at or perpendicular to artificially constructed dam walls. Saturation trapping of 20 traps around one shaft was employed after potential detection of a *Parantechinus apicalis* Dibbler on a remote sensing camera.

Table 2-7: Aluminium box trap survey effort

Trap Location	No. of Traps	No. of Trap Nights	Total
ACHS1	12	3	36
ACHS2	8	3	24
ACHS3	20	3	60
ACHS4	20	3	60
C25	20	5	100
E22	12	5	60
E26	20	4	80
E28	8	4	32
E32	40	3	120
E34	9	3	27
E35	9	3	27
Total	**98**	**22**	**346**

2.3.2.7 Cage Traps

Twelve cage traps were set in sets of four in association with the Aluminium box traps (Table 2-8). The primary focus was on habitat likely to support *Dasyurus geoffroii* Chuditch or *Hydromys chrysogaster* Water Rats. Though water rats are capable of capture in the larger aluminium box traps used in this survey, cage traps have a higher capture success rate. Cage traps are the only traps of a sufficient size to catch Chuditch.

Table 2-8: Cage trap survey effort

Trap Location	No. of Traps	No. of Trap Nights	Total
ACHS1	4	3	12
ACHS2	4	3	12
ACHS3	4	3	12
C20	5	5	25
C25	2	5	10
C27	5	4	20
Total	**12**	**14**	**55**

2.3.2.8 Turtle traps

Seven turtle traps were set along the banks of more established rehabilitated water bodies.

Table 2-9: Turtle trap survey effort

Trap Location	No. of Traps	No. of Trap Nights	Total
T21	7	4	28
Total	**7**	**4**	**28**

2.3.2.9 Opportunistic Hand Searching

Historic mine workings, processing areas and settlement sites provided an array of material such as sheets of tin, concrete slabs and timber within which to search for small fossorial reptiles. In addition, roadside vegetation spoil heaps were searched, and micro-refuges in standing and fallen timber were investigated. More than 30 person hours was invested in opportunistic searching across the site, the majority of which was undertaken by Principal Biologist Dr Mitch Ladyman.

2.3.2.10 Short Range Endemics Methodology

Short-range endemics (SRE) were searched for opportunistically during the survey and all invertebrates captured in pits that were representative of the main SRE fauna groups were collected for verification.

3 FLORA AND VEGETATION RESULTS

3.1 DESKTOP SURVEY

3.1.1.1 Climate

Leading up to the survey period, monthly total rainfall was above average for February, March, May and June, particularly in March when the average was exceeded by 130 mm (BoM, 2016a; BoM, 2016b). Figure 3-1 illustrates total and mean monthly rainfall at Ravensthorpe in the six months prior to the survey.

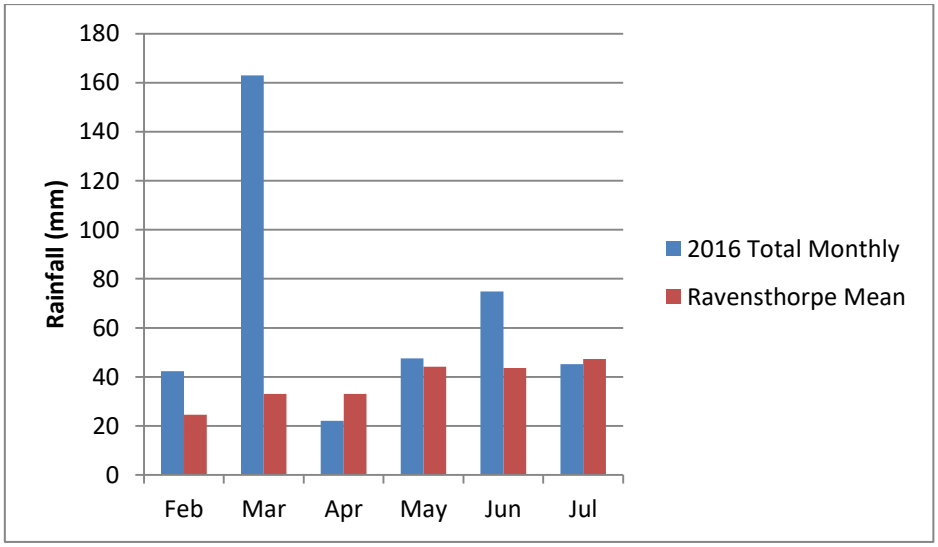

Figure 3-1: Monthly Ravensthorpe mean rainfall leading up to the survey

3.1.1.2 Previous Surveys

The vegetation survey of the Ravensthorpe Range undertaken by the Department of Environment and Conservation (DEC) in 2008 identified 26 vegetation units within the Kundip survey area, many of which (63%) are dominated by obligate seeder species (Craig *et al*., 2008). The vegetation was in excellent condition and weed invasion was minimal (Craig *et al*., 2008). Within the Project area, vegetation is extremely old, possibly 100 years or more (Craig, 2004a).

Flora surveys of the area have previously identified 34 conservation significant flora species. However, the status of many taxa have since been downgraded. Table 3-1 outlines the status of flora taxa previously detected in the Project area and their current status.

3.1.1.3 Conservation Significant Flora

The DPaW's Threatened (Declared Rare) and Priority Flora Database, Threatened and Priority Flora List and the WA Herbarium Specimen Database found 11 Threatened flora and a number of priority species that could potentially occur within the Project area. The Protected Matters Search Tool returned 13 botanical MNES. Conservation significant flora identified by the searches are shown in Table 3-1.

Table 3-1: Conservation significant flora potentially occurring in the Ravensthorpe Gold Copper Project Area

Species	Description & Habitat	Likelihood of Detection if Present	Survey Records on Site	DPaW Records on Site	Conservation Status at time of Survey	Current 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 disticha			Craig, 2004a; Craig, 2005	Not recorded	P2	-	-
Acacia durabilis			Craig, 2004a; Craig; 2005; Hickman, 2007	Not recorded	P3	-	-
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 laricina var.[1] *crassifolia*			Craig, 2004a; Craig, 2004b; Craig, 2005; Hickman, 2007	Not recorded	P2	-	-
Acacia nitidula	Spreading shrub. Granitic sandy gravelly soils. Amongst granite	Low, few, if any granite protruding granite	-	Not recorded	-	-	P2

Species	Description & Habitat	Likelihood of Detection if Present	Survey Records on Site	DPaW Records on Site	Conservation Status at time of Survey	Current Conservation Status	
						Cth	State
	boulders.	boulders.					
Acacia ophiolithica			Craig, 2004b	Not recorded	P3	-	-
Acacia papulosa	Bushy shrub. Spongolitic loam.	High, flowering in spring	-	Not recorded		-	P2
Acacia pinguiculosa			Craig, 2004a	Not recorded	P4	-	-
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
Acrotriche pariflora			Hickman, 2009	Not recorded	P4		
Allocasuarina hystricosa	Dioecious tree. Orange, red or brown loam with limestone or granite outcropping. Plains, lower slopes, hilltops.	Flowers in summer	MWH Global (MWH), 2013	Not recorded	P4	-	P4
Allocasuarina scleroclada subsp. *echinata*			Craig, 2004b	Not recorded	T	-	-
Anigozanthos bicolor subsp. minor	Rhizomatous, perennial herb. Sand. Well-watered sites.	High, flowering in spring	-	Not recorded	-	EN	T
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	MWH, 2013	Not recorded	T	-	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	High, flowering in	MWH, 2013	Not recorded	P4	-	P4

Species	Description & Habitat	Likelihood of Detection if Present	Survey Records on Site	DPaW Records on Site	Conservation Status at time of Survey	Current Conservation Status	
						Cth	State
	breakaways.	spring					
Beyeria sulcata var. truncata	Shrub.		-	Not recorded	-	-	P3
Beyeria villosa (Previously *Beyeria* sp. A Ravensthorpe)	Upright spreading perennial shrub	Medium, flowering in winter	Craig, 2004b	Not recorded	P1	-	P4
Boronia oxyantha var. *brevicalyx*			Craig, 2004a; Craig, 2005	Not recorded	P3	-	-
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	MWH, 2013	Not recorded	P4	-	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. Hillslopes.	High, flowering in spring	MWH, 2013	Not recorded	T	EN	T
Daviesia newbeyi	Bushy, multi-stemmed, broom-like shrub. Sand or sandy clay over granite. Rocky slopes.	High, flowering in spring	-	Not recorded	-	-	P2

Species	Description & Habitat	Likelihood of Detection if Present	Survey Records on Site	DPaW Records on Site	Conservation Status at time of Survey	Current Conservation Status	
						Cth	State
Dodonaea trifida			Craig, 2004a; Craig, 2005; Hickman, 2007	Not recorded	P3	-	-
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	MWH, 2013	Recorded in 1952 (WA herbarium record)	P4	-	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 proxima			Hickman, 2009	Not recorded	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

Species	Description & Habitat	Likelihood of Detection if Present	Survey Records on Site	DPaW Records on Site	Conservation Status at time of Survey	Current Conservation Status	
						Cth	State
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
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	MWH, 2013	Recorded in 1976 (WA herbarium record)	P3	-	P3
Grevillea punctata	Shrub. Stony red loam, red clay.	High, flowering in spring	MWH, 2013	Not recorded	P3	-	P3
Grevillea sulcata			MWH, 2013	Not recorded	P1	-	-
Guichenotia apetala	Compact, much branched shrub. Gravel, laterite.	High, flowering in spring	MWH, 2013	Not recorded	P1	-	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	Not available	-	-	Not recorded	-	-	P1

Species	Description & Habitat	Likelihood of Detection if Present	Survey Records on Site	DPaW Records on Site	Conservation Status at time of Survey	Current Conservation Status	
						Cth	State
LCH 18300)							
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
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	Hickman, 2007; MWH, 2013	Recorded in 2003, 2004, 2007, 2016 (WA herbarium record & APM survey)	T; P4	EN	P4
Marianthus villosus (now M. tenuis)			Craig, 2004a; Craig, 2004b; 2005	Not recorded	T	-	-
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.	MWH, 2013-	Not recorded	P4	-	P4
Melaleuca similis	Shrub. Grey sand. Margins of saline drainage lines.	High, flowering in spring	-	Not recorded	-	--	P1

Species	Description & Habitat	Likelihood of Detection if Present	Survey Records on Site	DPaW Records on Site	Conservation Status at time of Survey	Current Conservation Status	
						Cth	State
Melaleuca stramentosa			Craig, 2004a; Craig, 2004b; Craig, 2005; Hickman, 2007	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	MWH, 2013	Not recorded	P3	-	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	Craig, 2004b	Recorded in 2004 (WA herbarium record)	P1	-	P4
Pultenaea craigiana	Branching, erect shrub.	High, flowering in spring	Hickman, 2009	Recorded in 2003 & 2004 (WA herbarium record)	P1	-	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
Pultenaea sp. Kundip (now Pultenaea craigiana)			Craig, 2004a; Hickman, 2007	Not recorded	P1	-	P3
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

Species	Description & Habitat	Likelihood of Detection if Present	Survey Records on Site	DPaW Records on Site	Conservation Status at time of Survey	Current Conservation Status	
						Cth	State
Siegfriedia darwinoides			Craig, 2004a; Craig, 2005; Hickman, 2007	Not recorded	P4	-	-
Spyridium glaucum			Craig, 2004a; Craig, 2004b; Hickman, 2007	Not recorded	P3; P4	-	-
Stachystemon vinosus	Compact shrub. Fine loamy sand, stony soils. Sandplains, rock crevices on breakaways.	High, flowering in spring	Hickman, 2007	Not recorded	T	-	P4
Thelymitra psammophila	Perennial herb. Sandy clay, loam.	High, flowering in spring	-	Not recorded	P4	VU	T
Thomasia sp. Hopetoun (K.R. Newbey 4896)	Erect slender shrub	High, flowering in spring	MWH, 2013	Recorded in 1974 (WA herbarium record)	P2	-	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

[1] Variety

3.1.1.4 Conservation Significant Vegetation Communities

Two TECs listed under the EPBC Act were identified as potentially occurring in the Project area:

- Proteaceae dominated Kwongan shrublands of the Southeast Coastal Floristic Province of WA; and
- *Banksia laevigata – Banksia lemanniana* proteaceous thicket.

Three PECs listed under the WC Act were also identified as potentially occurring in the Project area:

- Proteaceae dominated Kwongan shrublands of the Southeast Coastal Floristic Province of WA (P3);
- Very open mallee over *Melaleuca* sp. Kundip dense heath (P1); and
- Heath on Komatiite of the Ravensthorpe area (P3).

Descriptions for these communities are provided in Table 3-2 overleaf.

Table 3-2: Priority and Threatened Ecological Communities potentially in the Ravensthorpe Gold Copper Project Area

Community	Description	Conservation Status
Proteaceae dominated Kwongan shrublands of the Southeast Coastal Floristic Province of WA	Consists of predominantly obligate seeding **proteaceous** shrubland and heath (kwongkan) and mallee heath on sandplain, duplex sand/clay and gravels overlying Eocene sediments, quartzite, schist, Yilgarn and Albany Fraser granite and greenstone ranges. Its flora is characterised by high species diversity and a high degree of endemism, particularly in the Stirling Range, Fitzgerald River National Park, Ravensthorpe Range and Russell Ranges. Due to the high levels of endemism, there are few species that exist across the entire range of the dense, obligate seeding **Proteaceae dominated shrublands** and kwongan of the Esperance Sandplains, however particular species have been identified as common dominant species in each of its ecodistricts.	TEC, EPBC Act; PEC (Priority 3), WC Act
Banksia laevigata – Banksia lemanniana proteaceous thicket	This community occurs on laterised ridges and breakaways. Associated species generally include *Eucalyptus pleurocarpa*, *Adenanthos oreophilus*, *Leptospermum maxwellii*, *Beaufortia orbifolia, Taxandria spathulata* and *Stylidium albomontis*.	TEC, EPBC Act
Very open mallee over *Melaleuca* sp. Kundip dense heath	Very open mallee over Melaleuca sp. Kundip (Collection number GF Craig 6020) dense heath. Open mallee over dense shrub heath (1.0-1.5) dominated by *Melaleuca* sp. Kundip on pale grey loamy sand with quartz rubble, occupies hill slopes. Associated species include *Melaleuca* sp. Kundip (GF Craig 6020) (P1) (dominant), *M. haplantha, M. stramentosa* (P1), *M rigidifolia, M. bracteosa, Melaleuca* sp. Gorse, *Pultenaea* sp. Kundip (GF Craig 6008) (P1), *Eucalyptus cernua, E. phaenophylla, E. pileata, Dodonaea trifida* (P3), *Acacia durabilis* (P3), *Leucopogon infuscatus* and *Hibbertia psilocarpa* ms. On its eastern boundary, the community abuts *Eucalyptus astringens* open low woodland and in this area there is an intergrade community.	PEC (Priority 1), WC Act
Heath on Komatiite of the Ravensthorpe area	Dense heath on alkaline red clay over komatiite (ultra-mafic rock) and associated carbonates. Note: very open tree mallee over heath B in Hale Bopp orebody area. Dominant species: *Beyeria cockertonii* (DRF), *Acacia ophiolithica, Hakea verrucosa, Grevillea fastigiata, Melaleuca ulicoides , Allocasuarina hystricosa* (P3), *Verticordia oxylepis, Grevillea oligantha, Hybanthus floribundus, Pomaderris brevifolia* ssp. *brevifolia*, *Pultenaea wudjariensis* (P1), *Melaleuca pomphostoma, Nematolepis phebalioides, Philotheca gardneri* subsp. *gardneri, Gyrostemon sessilis, Calothamnus quadrifidus, Calytrix tetragona, Halgania anagalloides, Coleanthera myrtoides, Beyeria cockertonii, Pultenaea wudjariensis*, *Grevillea fastigiata* and *Gyrostemon sessilis* are narrow range endemics.	PEC (Priority 3), WC Act

3.1.1.5 Introduced Flora

Three invasive plant taxa listed as MNES were identified as likely to occur in the vicinity of the Project area; **Asparagus asparagoides*, **Lycium ferocissimum* and **Tamarix aphylla*.

Bridal creeper **Asparagus asparagoides* is classified as a Weed of National Significance (WONS) under the *Biosecurity and Agriculture Management Act 2007* (BAM Act) and may be determined to require active management.

African Boxthorn **Lycium ferocissimum* is broadly distributed over the Eremaean Province and South-West Botanical Provinces. Often introduced on islands and near-coastal areas as a wind break this species is highly invasive and, once established, is difficult to control. Broken stem and root pieces can remain alive for several months before flowering, fruiting or taking root. Disturbance results in mass seed germination within one year. Over the life of the Project the spread of this species must be curtailed and provisions for active removal should be put in place.

Athel Pine *Tamarix aphylla* is a Weed of National Significance. It is regarded as one of the worst weeds in Australia because of its invasiveness, potential for spread, and economic and environmental impacts. This species, if detected, will require active management.

3.2 FIELD SURVEY

3.2.1 Flora and Vegetation Associations

The DEC (Craig, 2008) vegetation communities were ground-truthed during the survey and disturbed areas were subsequently updated. There were no changes to vegetation unit mapping – with exception of new disturbance areas produced from exploration works. A description of each vegetation community is presented in Table 3-3 and Figure 3-2 shows where those vegetation communities occur within the Project area.

Table 3-3: Summary of vegetation communities in the Kundip Mine Site

Vegetation Code	Summary Description
Dcir	Dryandra cirsioides: Proteaceous mallee-heaths
East	Eucalyptus astringens: Mallet dominated system
Ecli	Eucalyptus clivicola: Mallet dominated system
Efal	Eucalyptus falcata: Proteaceous mallee-heath
Efal/Eple	Eucalyptus falcata / E. pleurocarpa: Proteaceous mallee-heath
Eflo/Espp	Eucalyptus flocktoniae/ Eucalyptus species
Eflo/Esug	Eucalyptus flocktoniae/ E. phenax
Eflo/Mbra	Eucalyptus flocktoniae/ Melaleuca bracteosa: Melaleuca dominated
Eflo/Mcuc	Eucalyptus flocktoniae/ Melaleuca cucullata: Melaleuca dominated
Elep/Mgor	Eucalyptus flocktoniae/ Melaleuca sp. Gorse (ASG 7224): Melaleuca dominated
Elep/Mrig	Eucalyptus leptocalyx/ Melaleuca rigidifolia
Eocc	Eucalyptus occidentalis
Eole/Mpau	Eucalyptus oleosa subsp. corvina/ Melaleuca pauperiflora
Epil	Eucalyptus pileata
Epla	Eucalyptus platypus
Epla/Mcuc	Eucalyptus platypus/ Melaleuca cucullata
Epla/Mhap	Eucalyptus platypus/ Melaleuca haplantha
Eple/Bmed	Eucalyptus pleurocarpa/ Banksia media
Epro/Mspp	Eucalyptus proxima/ Melaleuca species
Espo	Eucalyptus sporadica
Macu	Melaleuca acuminata
Mallee/Msp	Eucalyptus species/ Melaleuca species
Ecer[1]	Eucalyptus cernua
Mosiac_Ecer_and_Ecli	-
Mstr	Melaleuca stramentosa
Mx	Melaleuca sp. Kundip

[1] Ecer is not found at the Kundip Mine Site. It has been included only to determine the status of Mosaic_Ecer_and_Ecli