Office of the Environmental Protection Authority

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A:	For Information
fa:	For Discussion
Officer:	For Action
Dir.AC	Response please:
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Dir. Strat Sup	Dir Signature (copy ...)
	Mgr D... (copy ...)

kmg

kimberley metals group

29 April 2014

Environmental Protection Authority
Level 8, The Atrium
168 St Georges Terrace
Perth WA 6000

Attn: Sally Bowman

Re: REFERRAL TO EPA OF RIDGES IRON ORE PROJECT – MATSU PROJECT

Dear Sally,

Please find attached a referral of a proposal to the Environmental Protection Authority under Section 38(1) of the *Environmental Protection Act 1986* (WA) for the Kimberley Metals Group Ridges Iron Ore Project - Matsu Project.

The following information is included:-

- EPA Referral Document including proponent information, technical aspects of the project, potential environmental impacts and environmental management strategies;
- Accompanying Appendices of consultant reports referred to in the referral document report; and
- CD containing recommended ESRI format shape-files, plus the above in digital format.

If you have any queries, please contact me on (08) 9225 3100 or via email at lhill@kmetgroup.com, or Sharon Arena on 0419 934 461 or via email at sharon@animalplantmineral.com.au (on behalf of Animal Plant Mineral Pty Ltd).

Yours sincerely,

Mr Leon Hill
Environment Manager
Kimberley Metals Group Pty Ltd

Environmental Protection Authority

GOVERNMENT OF WESTERN AUSTRALIA

EPA REFERRAL FORM

PROPONENT

Referral of a Proposal by the Proponent to the Environmental Protection Authority under Section 38(1) of the *Environmental Protection Act 1986*.

PURPOSE OF THIS FORM

Section 38(1) of the *Environmental Protection Act 1986* (EP Act) provides that where a development proposal is likely to have a significant effect on the environment, a proponent may refer the proposal to the Environmental Protection Authority (EPA) for a decision on whether or not it requires assessment under the EP Act. This form sets out the information requirements for the referral of a proposal by a proponent.

Proponents are encouraged to familiarise themselves with the EPA's *General Guide on Referral of Proposals* [see Environmental Impact Assessment/Referral of Proposals and Schemes] before completing this form.

A referral under section 38(1) of the EP Act by a proponent to the EPA must be made on this form. A request to the EPA for a declaration under section 39B (derived proposal) must be made on this form. This form will be treated as a referral provided all information required by Part A has been included and all information requested by Part B has been provided to the extent that it is pertinent to the proposal being referred. Referral documents are to be submitted in two formats – hard copy and electronic copy. The electronic copy of the referral will be provided for public comment for a period of 7 days, prior to the EPA making its decision on whether or not to assess the proposal.

CHECKLIST

Before you submit this form, please check that you have:

	Yes	No
Completed all the questions in Part A (essential).	☑	
Completed all applicable questions in Part B.	☑	
Included Attachment 1 – location maps.	☑	
Included Attachment 2 – additional document(s) the proponent wishes to provide (if applicable).	☑	
Included Attachment 3 – confidential information (if applicable).		
Enclosed an electronic copy of all referral information, including spatial data and contextual mapping but excluding confidential information.	☑	

Following a review of the information presented in this form, please consider the following question (a response is optional).

Do you consider the proposal requires formal environmental impact assessment? ☐ Yes ☑ No ☐ Not sure
If yes, what level of assessment? ☐ Assessment on Proponent Information ☐ Public Environmental Review

PROPONENT DECLARATION (to be completed by the proponent)

I, Leon Victor Hill declare that I am authorised on behalf of Kimberley Metals Group Pty Ltd (being the person responsible for the proposal) to submit this form and further declare that the information contained in this form is true and not misleading.

Signature:	Name: Leon Hill
Position: Environment Manager	Company: Kimberley Metals Group Pty Ltd
Date: 30th April 2014	

PART A - PROPONENT AND PROPOSAL INFORMATION

(All fields of Part A must be completed for this document to be treated as a referral)

1 PROPONENT AND PROPOSAL INFORMATION

1.1 Proponent

Name	Kimberley Metals Group Pty Ltd
Joint Venture parties (if applicable)	N/A
Australian Company Number (if applicable)	114 123 572
Postal Address (where the proponent is a corporation or an association of persons, whether incorporated or not, the postal address is that of the principal place of business or of the principal office in the State)	Suite 4, Ground Floor 610 Murray Street West Perth WA, 6005
Key proponent contact for the proposal: • name • address • phone • email	***Mr Leon Hill*** Environment Manager – Kimberley Metals Group *Address:* Suite 4 – Ground Floor 610 Murray Street, West Perth, WA 6005 *Phone:* (08) 9225 3100 *Mobile:* 0429 927 169 *Email:* lhill@kmetgroup.com
Consultant for the proposal (if applicable): • name • address • phone • email	***Ms Sharon Arena*** Principal HSE Adviser – Badaling Pty Ltd *Address:* 66 Leake Street Forrestdale WA 6112 *Phone:* (08) 9397 1998 *Mobile:* 0419 934 461 *Email:* sharon.arena@westnet.com.au

1.2 Proposal

Title	Ridges Iron Ore Project - Matsu Project
Description	Kimberley Metals Group Pty Ltd (**KMG**) developed the Ridges Iron Ore Project (**RIOP**) in the Kimberley region of Western Australia (WA) in late 2010, with operations commencing in 2011. The RIOP produces 1.5 to 2.0 million tonnes of iron ore fines per annum and consists of the Mine Site 165 km south of Wyndham and Barge Loading Facility (**BLF**) at Wyndham (Figure 1, Attachment 1). KMG is currently mining two ore bodies at the RIOP known as Sam and Tony. The RIOP was referred to the Office of Environmental Protection (**OEPA**) in December 2009, with a decision to not formally assess the RIOP made by the OEPA on April 21st 2010. To maintain continuous feed as the Sam and Tony deposits near completion, KMG is now proposing to develop a satellite ore body known as the Matsu deposit; located approximately 10km south-southeast of the existing RIOP. The Matsu Project will consist of an open cut (terraced mining of a ridge) operation at the Matsu deposit, waste rock dump (Matsu WRD), access track/haul road route, as well as support infrastructure (Matsu Project).

	As with the Sam and Tony deposits, the Matsu mineralisation is situated along the back slope of the Hensman Sandstone ridge and is located near the surface. The resultant open pit will therefore be very shallow with minimal overburden. Continuous mining technology and conventional drill and blast mining, which have been successful at the Sam and Tony deposits, will be utilised as the primary mining methods at Matsu. The proposed methods of mining and the shallow depth of the pit will minimise geotechnical issues, ensure that mining remains above the water table and will facilitate better rehabilitation outcomes. Ore will likely be hauled to the existing Run of Mine (ROM) stockpile at the RIOP (Figure 2, Attachment 1), although options for establishing a ROM pad and crushing facility near the Matsu deposit are being investigated. KMG may utilise the ROM pad and crushing facility at RIOP or may develop new facilities near the Matsu deposit. Waste rock material will be placed on the Matsu WRD, although backfilling of waste rock into the pit will be preferentially undertaken, as is the current practice at the existing RIOP deposits. Waste material at the RIOP mine and the Matsu deposit is relatively homogeneous and, due to the same geological characteristics, waste characterisation (Appendix 1) undertaken for the Sam and Tony pits at the RIOP is reflective of the waste material associated with the Matsu deposit. The characterisation shows that the waste materials are largely non-dispersive and non-erosive. Furthermore, the waste rock at the Matsu deposit does not contain potentially acid forming (PAF) materials. Two options for an access track/haul road route linking the Matsu deposit to the facilities at the RIOP are currently being investigated, as indicated on Figure 2, Attachment 1. At this stage, the most likely option (Access Track 1) predominantly follows a historical (1960s) four wheel drive exploration track. The track is approximately 18 km long and currently 4 m wide; the track traverses the ridge line and directly connects the RIOP with the Matsu deposit. The second access track option commences from Great Northern Highway, approximately 10km south along the highway from the existing RIOP site entrance. The track progresses east-northeast towards the Matsu deposit over a straight line distance of approximately 7.5km where it intercepts the deposit at the top of the escarpment (Access Track 2).

	Additional infrastructure will be required for the development of the Matsu Project, although the majority of necessary facilities are present at the RIOP. Infrastructure that will be required may include, but is not limited to: • Refurbishment of historical access road or establishment of a new route from Great Northern Highway to create the Matsu access track/haul road • First aid facilities • Crib Hut and ablution facilities • Site office • Communications facilities • Workshop • Hydrocarbon storage facility • Screening and crushing facility • Explosives magazine • Borefield and associated infrastructure The key characteristics for the Matsu Project are presented in Appendix 2.
Extent (area) of proposed ground disturbance.	The Matsu Project involves a total disturbance footprint of approximately 150ha, including disturbance for the pit, WRD, access track, stockpiles and associated infrastructure. This disturbance is likely to occur within three development envelopes, namely: the access route, the deposit and the processing area as shown on Figure 2, Attachment 1. More specific disturbance figures relating to operations within the development envelopes will be determined once the access track/haul road route and infrastructure footprints have been finalised. Areas that have already been disturbed will be utilised as much as possible to reduce new ground disturbance.
Timeframe in which the activity or development is proposed to occur (including start and finish dates where applicable).	Provided all relevant approvals are obtained for the Matsu Project, construction at the site is scheduled to commence at the start of 2015. The operational life of the Matsu Project is expected to be approximately 2-3 years.
Details of any staging of the proposal.	The key purpose of the Matsu Project is to allow continuation of production life at the RIOP. The Matsu Project development will coincide with the depletion of economically mineable iron ore at the RIOP Sam and Tony deposits. Operations at Matsu may initially run concurrently with those at Sam and Tony however, operations at Sam and Tony will eventually be replaced by Matsu. Production is anticipated to remain at approximately 1.5 – 2Mtpa throughout the transition phase and during mining at Matsu.

Is the proposal a strategic proposal?	No.
Is the proponent requesting a declaration that the proposal is a derived proposal? If so, provide the following information on the strategic assessment within which the referred proposal was identified: • title of the strategic assessment; and • Ministerial Statement number.	No.
Please indicate whether, and in what way, the proposal is related to other proposals in the region.	The Matsu Project is an extension of the existing RIOP to provide a continuation of production as existing resources are depleted. Development of Matsu involves mining a satellite deposit situated south-southeast of the existing RIOP. The Matsu Project is not related to any other projects or proposals in the region.
Does the proponent own the land on which the proposal is to be established? If not, what other arrangements have been established to access the land?	The Matsu Project is located on mining tenure held by KMG, specifically E80/2389, E80/4309 and P80/1750. KMG is in the process of obtaining appropriate tenure for the proposal, including a mining lease (M80/625) that will incorporate the Matsu deposit and associated infrastructure. The tenement is currently under the "right to negotiate" phase of the *Native Title Act 1993* (Cth). The most likely Matsu Project access track/haul road (Access Track 1) traverses KMG leases M80/600 and E80/2389 plus M 259SA Lease, which is held by Argyle Diamonds Limited, a subsidiary of Rio Tinto Limited. A letter of authority was obtained from Rio Tinto Limited and a Deed of Access and Indemnity was signed by the two parties, enabling access through M259SA for exploration purposes and baseline surveys. This agreement is currently being revised to encompass mining and ore haulage operations. The existing RIOP is situated on Leases M80/599, M80/600, G80/55 and Miscellaneous Licence L80/55 which are held by KMG. Although it is anticipated that support infrastructure required for the Matsu Project will predominantly be developed near the Matsu deposit, some infrastructure existing at the RIOP will also be utilised.
What is the current land use on the property, and the extent (area in hectares) of the property?	The current land use for areas to be disturbed for the Matsu Project is mineral exploration, mining and cattle grazing; the Matsu Project is located 10km south east of the existing RIOP and 5km north west of the Argyle diamond mine and is contained within the Glen Hill pastoral station.

1.3 Location

Name of the Shire in which the proposal is located.	Shire of Wyndham East Kimberley (SWEK).
For urban areas: • street address; • lot number; • suburb; and • nearest road intersection.	N/A
For remote localities: • nearest town; and • distance and direction from that town to the proposal site.	The Matsu deposit is situated approximately 10km south-southeast of the existing RIOP Mine Site within the East Kimberley region of Western Australia (WA). The RIOP is located 165 km by road south of Wyndham adjacent to the Great Northern Highway. Argyle Diamond Mine and the Doon Doon Roadhouse and community are the closest other establishments. The nearest infrastructure at the Argyle Diamond Mine is approximately 5km south east of the Matsu deposit; Doon Doon Roadhouse is approximately 45km from the Matsu Project Area.
Electronic copy of spatial data - GIS or CAD, geo-referenced and conforming to the following parameters: • GIS: polygons representing all activities and named; • CAD: simple closed polygons representing all activities and named; • datum: GDA94; • projection: Geographic (latitude/longitude) or Map Grid of Australia (MGA); • format: Arcview shapefile, Arcinfo coverages, Microstation or AutoCAD.	Enclosed?: Yes (Enclosure 1)

1.4 Confidential Information

Does the proponent wish to request the EPA to allow any part of the referral information to be treated as confidential?	No
If yes, is confidential information attached as a separate document in hard copy?	N/A

1.5 Government Approvals

Is rezoning of any land required before the proposal can be implemented? If yes, please provide details.	No
Is approval required from any Commonwealth or State Government agency or Local Authority for any part of the proposal? If yes, please complete the table below.	Yes

Agency/Authority	Approval required	Application lodged Yes / No	Agency/Local Authority contact(s) for proposal
Environmental Protection Authority (EPA)	EPA Referral	This document forms the referral	
Department of Sustainability, Environment, Water, Population and Communities (SEWPaC)	*Environment Protection and Biodiversity Conservation Act 1999* Referral	Referral document in preparation	
Department of Mines and Petroleum (DMP)	Mining Proposal	Mining Proposal	Demelza Dravnieks
	Native Vegetation Clearing Permit (VCP)	Matsu Access Track VCP submitted 02/01/2013; approved 28/02/2013 – CPS 5432/1. This VCP only covers access track within M 259SA Matsu mining area VCP in preparation. An amendment to this VCP, or a new VCP, will also be sought once the haul road/access track route and infrastructure locations are finalised.	
Department of Environment Regulation (DER)	Works Approval and Licence Amendment	In Preparation	Damian Thomas
Department of Water (DoW)	*5C Licence to Take Water*	Review of current licence allocation being undertaken. Licence amendments or a new licence will be sought as required.	

PART B - ENVIRONMENTAL IMPACTS AND PROPOSED MANAGEMENT

2. ENVIRONMENTAL IMPACTS

Describe the impacts of the proposal on the following elements of the environment, by answering the questions contained in Sections 2.1-2.11:

- 2.1 flora and vegetation;
- 2.2 fauna;
- 2.3 rivers, creeks, wetlands and estuaries;
- 2.4 significant areas and/ or land features;
- 2.5 coastal zone areas;
- 2.6 marine areas and biota;
- 2.7 water supply and drainage catchments;
- 2.8 pollution;
- 2.9 greenhouse gas emissions;
- 2.10 contamination; and
- 2.11 social surroundings.

These features should be shown on the site plan, where appropriate.

For all information, please indicate:

- (a) the source of the information; and
- (b) the currency of the information.

2.1 Flora and Vegetation

2.1.1 Do you propose to clear any native flora and vegetation as a part of this proposal?

[A proposal to clear native vegetation may require a clearing permit under Part V of the EP Act (Environmental Protection (Clearing of Native Vegetation) Regulations 2004)]. Please contact the Department of Environment and Conservation (DEC) for more information.

(please tick)	☑ Yes	**If yes**, complete the rest of this section.
	☐ No	**If no**, go to the next section

2.1.2 How much vegetation are you proposing to clear (in hectares)?

The Matsu Project involves a total disturbance footprint of approximately 150ha hectares, including disturbance for the pit, WRD, access track/haul road, stockpiles and associated infrastructure. This clearing will occur within the Matsu Project Area (Deposit Development Envelope, Processing Development Envelope and Access Track Development Envelope) shown on Figure 2, Attachment 1. More detailed disturbance figures and locations within the Matsu Project Area will be determined once the access track/haul road route, infrastructure footprint and other requirements have been finalised. Areas that have already been disturbed will be utilised as much as possible to reduce new ground disturbance requirements.

2.1.3 Have you submitted an application to clear native vegetation to the DEC (unless you are exempt from such a requirement)?

☐ Yes ☑ No

If yes, on what date and to which office was the application submitted of the DEC?

2.1.4 Are you aware of any recent flora surveys carried out over the area to be disturbed by this proposal?

☑ Yes ☐ No

If yes, please attach a copy of any related survey reports and provide the date and name of persons / companies involved in the survey(s).

If no, please do not arrange to have any biological surveys conducted prior to consulting with the DEC.

A Level 1 biological survey, the Matsu Biological Survey, (as per the EPA Guidance Statements 51 and 56) was conducted across the Matsu Project Area. The survey was conducted in 2012 with the results reported in 2014 in the Matsu Biological Survey report (Appendix 3). A level 2 floristic survey within the Matsu Project Area will be undertaken in April 2014.

2.1.5 Has a search of DEC records for known occurrences of rare or priority flora or threatened ecological communities been conducted for the site?

☑ Yes ☐ No

If you are proposing to clear native vegetation for any part of your proposal, a search of DEC records of known occurrences of rare or priority flora and threatened ecological communities will be required. Please contact DEC for more information.

A request was made for a search of the Department of Parks and Wildlife (DPaW) databases for threatened and priority flora and consideration was given to the presence of any Threatened Ecological Communities (TEC's) or Priority Ecological Communities (PEC's). This search was requested using a spot location (NW 16^{o} 41' 53"S; 128^{o} 20' 01"E), located approximately at the centre of the Matsu deposit. DPaW applied a 50 km buffer to this search which adequately encompasses the Matsu Project Area. The search results were obtained on March 17th 2014. The most recent fauna, PEC and TEC data has been included in the Matsu Biological Survey report. However, the recent priority flora data has not been included, as the proposed 2014 field flora collection work is yet to be completed.

The database searches did not detect any PEC's or TEC's within the Matsu Project Area however the searches did identify a number of priority species that could potentially occur (Table 1). Species which were not captured by the database searches but are known to occur in the Matsu Project Area as a result of previous survey work conducted by APM have also been included in Table 1.

Table1: Declared Rare and Priority Flora Potentially Occurring in the Matsu Survey area

Species	Conservation Code	DPaW Database Search of Potentially Occurring Species			Habitat
		Threatened (Declared Rare) Flora Database	Threatened & Priority Flora List	WA Herbarium Specimen Database	
Acacia repens	P1			√	-
Acacia setulifera	P1	√		√	-
Acacia sp. Cockburn Range (R. Pullen 10. 763)	P3		√		Erosion surface of plain above river, rock outcrops, shrub grassland.
Asteromyrtus arnhemica	P1			√	Banks of seasonal streams, near waterfalls, along tracks in wet areas.
Bonamia oblongifolia	P1			√	-
Brachychiton tuberculatus	P3		√		Undulating plains.
Corymbia cadophora subsp. *polychroma*	P1	√		√	Gentle sandstone slopes.
Cyperus digitatus	P1		√		Waters' edge.
Desmodium flagellare	P1		√		-
Dolichandrone filiformis	P2		√		-
Echinochloa kimberleyensis	P1		√		Swamps.
Eucalyptus costuligera	P1		√		-
Eucalyptus ordiana	P2	√		√	Steep rocky outcrops.
Ficus lilliputiana	P4		√		Rocky sites.
Fuirena incrassata	P3	√		√	Swamps, creek beds, claypans, semi-saline lakes.
Goodenia byrnesii	P1	√		√	Edge of creek.
Goodenia durackiana	P1		√		Grassland.
Goodenia malvina	P1		√		Seasonally wet areas.
Goodenia sepalosa var. *glandulosa*	P3		√		-
Grevillea minuata	P4			√	Cliffs or rocky slopes, sometimes along watercourses.
Heliotropium cupressinum	P1		√		Stony sandy soils, sandstone.
Heliotropium foveolatum	P1		√		-
Heliotropium uniflorum	P1		√	√	Stony slopes, undulating rocky plateaus.
Ipomoea gracilis	P1		√		Black cracking clay or black sand. Irrigated areas.
Jacquemontia sp. Keep River (J.L. Egan 5051)	P1		√	√	-
Olearia arguta var. glabrous narrow leaves	P3		√		-
Macrothelypteris torresiana	P1		√		Wet rock face of gorge.
Melaleuca viminalis	P2			√	-

Species	Conservation Code	DPaW Database Search of Potentially Occurring Species			Habitat
		Threatened (Declared Rare) Flora Database	Threatened & Priority Flora List	WA Herbarium Specimen Database	
Phyllanthus aridus	P3	√	√		-
Selaginella pygmaea	P2		√		Damp ground near creek.
Sorghum plumosum var. *teretifolium*	P1		√		Sand, clay, loam, alluvium. Swamps, claypans, watercourses, waterholes, valleys.
Triodia barbata	P1		√		Cliffs.
Triodia bunglensis	P2			√	Cliffs, gorges & domes, often in fissures & cracks.
Triodia cremnophila	P1			√	-
Triodia fitzgeraldii	P1		√		Sandstone hills.
Triodia fissura	P1			√	Growing in narrow fissures on steep or near vertical rock faces
Triodia pasconieana	P1		√		Limestone. Limestone ranges & gorges.
Triodia prona	P1			√	Lower slopes of sandstone mountain range.
Triodia racemigera	P1		√	√	Steep rocky slopes, crevices, cliffs & ridges.
Triodia triticoides	P1		√		Rocky sandstone & limestone hillslopes.

2.1.6 Are there any known occurrences of rare or priority flora or threatened ecological communities on the site?

☑ Yes ☐ No **If yes**, please indicate which species or communities are involved and provide copies of any correspondence with DEC regarding these matters.

Thirteen vegetation communities were identified within and in the vicinity of the Matsu Project Area during the Matsu Biological Survey; vegetation mapping is provided in the Matsu Biological Survey report (Appendix 3). Twelve of the thirteen vegetation communities were identified as occurring within the Matsu Project Area. None of the vegetation communities identified within the Matsu Project Area resemble any of the TEC's listed under the Commonwealth EPBC Act; however two communities located adjacent the Matsu Project Area, but within the Matsu Survey area are representative of PEC's listed by DPaW (Species and Communities Branch, April 2013).

The vegetation community associated with the west facing cliffs of the escarpment at the Matsu deposit (within the Deposit Development Envelope) was identified as the Priority 1 PEC 'Plant assemblages on vertical sandstone surfaces' and pockets of vegetation on steep south facing slopes to the south of the Matsu Project Area were identified from the air as the Priority 1 PEC – 'Monsoon Vine Thicket'.

It is anticipated that the PEC's will not be unduly impacted by the Matsu Project. The PEC 'Plant assemblages on vertical sandstone surfaces' is a common feature of the Hensman Sandstone topography within the Rugged Ranges and is on the escarpment at the margin of the Matsu Project Area. Although operations at Matsu will be carried out within the Matsu Project Area, which extends to the escarpment, mining will be restricted to the back slopes, not the cliff face *per se*; therefore, operations in proximity to the escarpment will be minimal and the likelihood of overburden spilling over the edge is low. Therefore, the vertical sandstone face will remain as far as practicable undisturbed.

The 'Monsoon Vine Thicket' pockets are located outside of the Matsu Project Area and therefore outside of the clearing area and direct impact footprint. To ensure that secondary impacts are minimised KMG will implement a number of management strategies including:

- Construction of appropriately designed rock gabions or other sediment trapping devices to ensure sediment laden waters do not enter the 'Monsoon Vine Thicket' areas.
- To avoid sediment laden run-off entering the adjacent environment, run-off from stockpiles will be directed to appropriately constructed sediment traps prior to entering natural drainage lines.
- Management and monitoring of rock gabions at Matsu will be incorporated into the RIOP Operational Environmental Management Plan, including procedures for cleaning out and inspection requirements.
- A monitoring programme for the 'Monsoon Vine Thicket' pockets at Matsu will be developed to ensure there are no adverse impacts from the proposed upstream mining activities.
- Dust management measures, primarily water spray, will be utilised to ensure dust remains at acceptable levels.

No Threatened Flora pursuant to the *Wildlife Conservation Act 1950* (WA) (*WC Act)*, were recorded during the ground survey work in the Deposit Development Envelope during the APM Matsu Biological Survey (Appendix 3), however, nine priority taxa as defined by DPaW were identified (Table 2). Flora and vegetation of conservation significance are mapped in the Matsu Biological Survey report (Appendix 3).

Table 2: Priority taxa recorded or has the potential to occur within the Matsu Project Area.
'*' Denotes species known to occur within described vegetation types but not recorded during APM Matsu Biological Survey due to limited access.

Priority Code	Species		Habitat	Location (WGS84/52K)
Currently under taxonomic review	*Acacia lycopodiifolia* (prostate form)		Sand, sandstone. Rocky hills & ridges	Associated with the CL community plus, E:0429813, N:8153151 E:0428933, N:8153498
P3	*Brachychiton tridentatus*		Sand, sandstone. Rocky hills & ridges	E: 430758, N: 8152924
P1	*Corymbia cadophora* subsp. *polychroma*	*	Sandstone, banded ironstone gentle slopes. Damp land, creeklines.	Occurs throughout the EB-CPP vegetation community.
P2	*Eucalyptus ordiana*	*	Steep rocky outcrops. Cliff faces and cliff margins of ironstone/sandstone geological formations	Occurs in association with the CL cliff vegetation community.
P4	*Grevillia minuata*	*	Cliffs or rocky slopes, sometimes along watercourses.	Forms scattered thickets throughout the EB-w vegetation community
P1	*Jacquemontia sp. Keep River (J.L. Egan 5051)*	*	Cliff faces and cliff margins of ironstone/sandstone geological formations	Probably occurs throughout the CL vegetation community
Currently nominated for priority status	*Kunzea* sp. Keep River		Damp shaded sand stone cliff faces.	C.379 individuals on south west facing cliffs. E: 428933, N: 8153498 E: 428750, N: 8153392
P1	*Triodia cremnophila*		Cliff faces and cliff margins of ironstone/sandstone geological formations. Drainage lines	E: 429547, N: 8153153 E: 431247, N: 8152605

Priority Code	Species		Habitat	Location (WGS84/52K)
Currently nominated for priority status	*Triodia* sp. Argyle (aff. cunninghamii)		Cliff faces and cliff margins of ironstone/sandstone geological formations	Probably occurs throughout the CL vegetation community

Triodia cremnophila was detected within the Matsu Project Area and appears to be endemic to the southern reaches of the Rugged Range. *Triodia cremnophila* is a dominant species of the PEC 'Plant assemblages on vertical sandstone surfaces' (as defined by DPaW Species and Communities Branch, April 2013). As discussed above, impact to the 'Plant assemblages on vertical sandstone surfaces' PEC is not anticipated to be significant as mining activities in proximity to the escarpment, and therefore the PEC, will be minimal. Further ground survey work, scheduled to be carried out in April/May 2014, will allow a full assessment of the distribution of this species to be undertaken.

Kunzea sp. Keep River is an important discovery for the region as it was previously only known from the Northern Territory (NT) until collected within the Matsu Biological Survey area; thus, it represents a new taxon to WA. *Kunzea sp.* Keep River also represents a significant range extension for this genus, with the nearest record for *Kunzea recurva* located near the Murchison River, 1868 km to the south west (FloraBase 2012). In 2012 KMG invested significant resources into a regional survey for *Kunzea sp.* Keep River and located a number of populations around the Rugged Range and north-west to the border of WA and NT. Although there is potential for some local impact on this taxon during mining at the Matsu deposit, there are other local and regional populations that will not be disturbed by the Matsu Project.

Triodia sp. Argyle (aff. cunninghamii), is currently under review for priority status and taxonomic description (R. Barrett. pers. comm. 2012). This species is associated with the PEC 'Plant assemblages on vertical sandstone surfaces'. As discussed above, impacts to this PEC, and therefore *Triodia* sp. Argyle (aff. cunninghamii), are not anticipated to be significant.

Rare and priority flora and the absence of TEC's are discussed in detail in the Matsu Biological Survey report (Appendix 3).

2.1.7 If located within the Perth Metropolitan Region, is the proposed development within or adjacent to a listed Bush Forever Site? (You will need to contact the Bush Forever Office, at the Department for Planning and Infrastructure)

☐ Yes ☑ No **If yes**, please indicate which Bush Forever Site is affected (site number and name of site where appropriate).

The Matsu Project is not located within the Perth Metropolitan Region.

2.1.8 What is the condition of the vegetation at the site?

In accordance with the Keighery (1994) vegetation condition scale (Appendix 4), the vegetation condition at all sites observed during the ground survey component of the Matsu Biological Survey is classified as 'excellent' (Appendix 3). 'Excellent' is defined by Keighery (1994) as: *Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species*. Further ground survey work, scheduled to be carried out in April/May 2014, will allow a full assessment of the vegetation condition of the Matsu Project Area to be undertaken.

2.2 Fauna

2.2.1 Do you expect that any fauna or fauna habitat will be impacted by the proposal?

(please tick) ☑ Yes **If yes**, complete the rest of this section.

☐ No **If no**, go to the next section.

2.2.2 Describe the nature and extent of the expected impact.

There are five main types of fauna habitat occurring within the proposed Matsu Project Area; the habitat types are summarised below and mapped in the Matsu Biological Survey report (Appendix 3):

- ***Rocky outcrops:*** On the lightly wooded stony slopes, that have an established shrub layer and a ground cover of hummock grasses the Kimberley Rock-rat *Zyzomys woodwardi*, Storr's Monitor *Varanus storri* subsp. *ocreatus* and the more woodland orientated skinks such as *Ctenotus inornatus* have been captured in abundance at nearby surveys.

  Surface expressions of sandstone boulders are a common occurrence and provide complex refuges for saxacoline reptile species, including the Panther Skink *Ctenotus pantherinus*, and small mammals, such as the Stripe-faced Dunnart *Sminthopsis macroura*.

  The rockier habitats (outcroppings) support a more unique fauna assemblage including the Spiny-tailed Monitor, *Varanus acanthurus* and the Spotted Gecko *Gehyra punctata*. The *Triodia* spp. is particularly favoured by the skink, *Ctenotus pantherinus* and the Spinifex specialist *Strophurus taeniatus*. The Long-tailed Rock Monitor *Varanus kingorum* would also occur and is known to be a rock specialist.

  During trapping for the APM Matsu Biological Survey (Appendix 3) the Common Rock-rat *Zyzomys argurus* (75 individuals) and the Ningbing False Antechinus *Pseudantechinus ningbing* (two individuals) were captured in this habitat.

- ***Open Eucalypt Woodland on Rocky Ridges***: This habitat covers much of the Matsu Project Area and represents an interzone between multiple habitats, including nearby rocky outcrops, cliffs or drainage lines.

  Widely foraging species such the Greater Black Whips Snake *Demansia papuensis*, Black-headed Python *Aspidites melanocephalus* and the Spotted Snake *Suta punctata* would utilize this habitat type and are therefore likely to be well represented in the Matsu Project Area. The diverse woodland species and mid-dense grass layer create a good cover for the swift moving Ctenotus species, such as *C. inornatus* and *C. robustus*, and the pygopid *Pygopus steelescotti*. The interspersed shrubland provides habitat for dragons, such as *Diporiphora lalliae* and *D. magna*, and the gecko *Strophurus ciliaris* that perches on shrub branches, relying on crypsis to escape predation during the day. Fossorial skink species are abundant in the dense litter and detrital layer, including the Rainbow Skink *Carlia triacantha* and the small legless lizard *Lerista borealis*.

  No amphibians are expected to occur in this habitat other than water holding species such as *Cyclorana* spp. which burrow deep within clay soils and emerging in the wet season. Bird species which favour the open woodland include the Weebil *Smicrornis brevirostris*, Brown Honeyeater *Lichmera indistincta* and Northern Rosella *Platycercus venustus*.

  Small mammals may include the Long-tailed Planigale *Planigale ingrami*, whilst Wild dogs, *Canis familiaris*, the Antilopine Wallaroo *Macropus antilopinus* and the Euro *Macropus robustus* would best represent the macro-fauna of the Matsu Project Area.

- ***Undulating Plains***: This habitat is similar in structure to the open eucalypt woodland on rocky ridges habitat, however the main difference is that this habitat is located off the escarpment and down on the undulating plains which tend to form broad valleys between ranges. The landform consists mainly of moderate slopes with scattered steep bouldery hills that are dissected by ephemeral drainages.

  The vegetation generally comprises of open eucalypt woodland over tall mixed upland grasses. Due to the flatter nature of this habitat compared to the typically more rugged and steep terrain in the area, species that prefer the plains such as the Australian Bustard and Bush Stone-curlew are more likely to be found.

  Similar widely foraging species found in the open woodland on rocky ridges habitat may also utilise the undulating plains habitat e.g. Greater Black Whips Snake *Demansia papuensis*, Black-headed Python *Aspidites melanocephalus* and the Spotted Snake *Suta punctata*. The diverse woodland species and mid-dense grass layer create a good cover for the swift moving *Ctenotus* species, such as *C. inornatus* and *C. robustus*, and the pygopod *Pygopus steelescotti*. The grasslands within this habitat provide a food source for seed eating birds and may provide useful feeding habitat for the conservation significant species; Gouldian Finch and Pictorella Manikin.

- ***Gullies and Ephemeral Drainages:*** Minor, intermittent ephemeral drainage lines are present within the Deposit Development Envelope, located primarily in the valley along the north-north eastern margin of the envelope at the bottom of the slope. Several minor ephemeral channels lead into this drainage line from the top of the escarpment. The base of many of these small gullies and ephemeral drainages sustain numerous small pools. Although mostly ephemeral, when present these pools provide an important water source for many species, notably numerous species of frog (including the invasive Cane Toad). In addition to the pools, the low-lying areas support a different suite of vegetation, being slightly denser than that of the surrounding woodland.

The ephemeral drainages cross a number of different habitats and therefore serve as dispersal corridors for a variety of fauna particularly amphibians, including the invasive Cane Toad. These drainages may also hold water for longer time periods than the surrounds and can function as vital water sources for a number of species, including the larger macropods, bats and birds.

A number of smaller mammals utilize the intermittent drainage lines where deposition of silt and sand promote the growth of very thick hummock and tussock grasses. In identical habitats, a number of Long-tailed Planigale *Planigale ingrami*, Chestnut Mice *Pseudomys nanus* and Long-haired Rats *Rattus villosisimus* have been recorded in previous nearby surveys. Kimberley Rock-rats *Zyzomys argurus* from adjacent steep rocky slopes will also utilise the habitat.

The greatest bat species richness is typically recorded around wet areas, particularly where the water occurs in close association to rock outcrops and overhangs. Species expected include the Gould's Wattled Bat *Chalinolobus gouldii*, the Beccari's Freetail Bat *Mormopterus beccarii*, the Hoary Wattled Bat *Chalinolobus nigrogriseus*, the bent-wing bat *Miniopterus schreibersii*, the Yellow-bellied Sheathtail Bat *Saccolaimus flaviventris*, the Little Broad-nosed Bat *Scotorepens greyii* and the Northern Cave Bat *Vespadelus caurinus*.

- ***Sandstone Cliffs:*** The sandstone cliffs in the Biological Survey Area encompassing the Matsu Project are quite extensive. Species likely to favour these environments are cliff dwelling reptiles such as *Varanus glauerti*, rock wallabies, bird species such as the White-quilled Rock-pigeon *Petrophassa albipennis* and bats such as the Northern Leafnosed-bat *Hipposideros stenotis*. If present the Peregrine Falcon *Falco peregrinus* will also nest on these vertical cliffs. The mining proposed as part of the Matsu Project will be restricted to the back slopes, not the cliff faces, therefore minimising potential impacts to this habitat.

Clearing will likely result in localised deaths of native non-volant fauna. However, the extent and intensity of the impact is not considered significant enough to impact species richness and diversity beyond the individual level. Moreover, very few conservation significant fauna species are likely to occur in the Matsu Project Area. Biodiversity will be maintained through the maintenance of local populations of fauna distributed beyond the Matsu Project Area.

Two bat species of conservation significance, Orange Leafnosed-bat and Ghost Bat have been recorded above the caves in the cliff face in the Matsu Biological Survey Area. The Northern Leafnosed-bat, was not recorded during the Matsu Biological Survey but has been recorded nearby in the RIOP Mine Site area in identical habitat and, therefore, has the potential to occur in the Matsu Project Area. A survey of the cliffs in the RIOP Matsu Project area is planned for April 2014. This survey will seek to further investigate any accessible caves for their potential usage as roosting habitat for the conservation significant bat species.

The construction and operation of the Matsu Project will cause limited interference with these species as mining will take place on the back slope therefore minimising disturbance to the cliff face. Noise and light disturbance is unlikely to displace the animals as experience from other locations have shown that these bats remain present in areas that have mid to high levels of human activity. Northern Leafnosed-bats have remained in large crevices on the cliff faces immediately adjunct the Sam pit in the RIOP, and after large scale open cut mining on Koolan Island. (Bullen unpublished).

The Peregrine Falcon uses steep cliffs for nesting and has the potential to use the sandstone cliffs in the Matsu Project Area for breeding. While in the nesting stage the species is extremely sensitive and might abandon their nestlings when disturbed. This species was recorded over the backslope of the Sam Deposit of the RIOP in 2009. However, no white faecal smears, characteristic of nesting sites of the Peregrine Falcon, were observed along the cliffs in the Matsu Project Area during the Matsu Biological Survey (Appendix 3).

The Fork-tailed Swift is a migratory species, which is almost exclusively aerial, only landing to breed. As this species is a non-breeding visitor to Australia the Matsu Project is not expected to impact the local population.

The Rainbow Bee-eater is protected in the *EPBC Act* as a 'Migratory' species; however, not all individuals of the species migrate. Populations that breed in the north of Australia are considered to be resident. This species is abundant in northern Australia and is regularly recorded in disturbed habitats such as roadside vegetation, quarries and mines. Although this species has been recorded in the Matsu Project Area, due to its wide distribution and abundance in disturbed habitats the Matsu Project is not expected to have a significant impact on the population of Rainbow Bee-eaters.

The Gouldian Finch is distributed throughout the Kimberley and is generally classed as moderately common in the North, Central and East Kimberley and the lower Ord drainage area, while uncommon or scarce in most of the South Kimberley (Johnstone and Storr 2004). While the Gouldian Finch was not recorded in the Matsu Project Area, it has been recorded at adjacent ridges and the RIOP mining camp. A key threatening process for the Gouldian Finch is the destruction of potential nest sites. The species is an obligate cavity-nesting species and utilises smooth barked *Eucalyptus* and *Corymbia* species on rocky hills. The Matsu Project Area represents potential suitable breeding habitat.

Habitat surveys conducted across the RIOP Mine Site area by APM in 2010 (Appendix 5) showed the density of suitable nesting hollows in the area (1.94 hollows/ha) to be lower than reported by other studies (4.6-27 hollows/ha; Gibbons and Lindenmayer 2002, Brazill-Boast *et al*. 2010). Thus the potential for nesting at the Matsu Project Area also appears to be low compared to other locations. KMG is currently undertaking an artificial nest box program to offset the loss of natural tree hollows removed during current operations at RIOP's Sam and Tony Deposits (Figure 3). To date, a total of 110 artificial nest boxes across six different sites have been established to create alternative breeding sites. Gouldian Finches were observed using the nest boxes within six weeks of placement (S. Pryke pers. comm. 2011). Artificial nest boxes are known to increase natural breeding densities and fledging success (Brazill-Boast *et al*. 2012). The current KMG artificial nest box program will be extended to the Matsu Project Area therefore the local population of Gouldian Finch is not expected to be negatively impacted as the artificial nest boxes offset the loss of natural hollows and even increases fecundity.

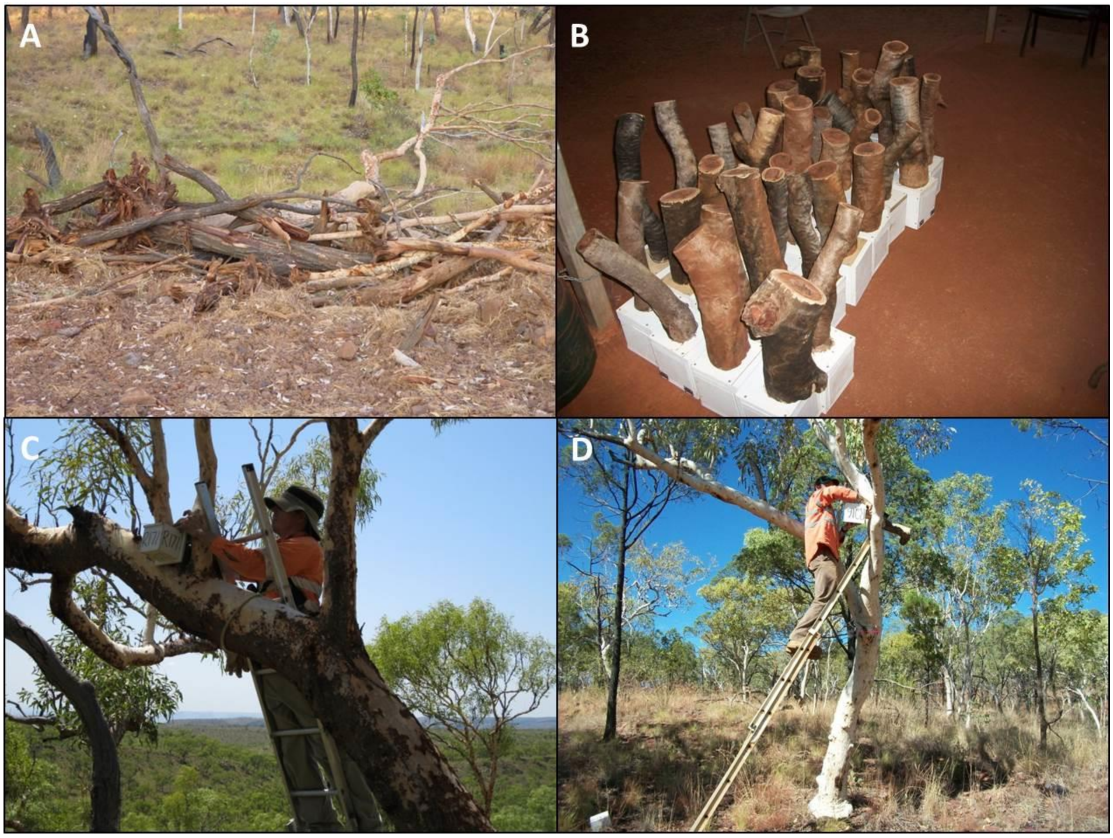

Figure 3: KMG Gouldian Finch Nest Box Program

A) During clearing vegetation is segregated and stockpiled; these stockpiles are inspected for logs containing suitable hollows. B) The logs with hollows are then used in the construction of nest boxes. C) and D) The nest boxes are installed in suitable Gouldian Finch habitat.

The Pictorella Mannikin is a partly granivorous bird that can be found feeding on grass seeds in the vicinity of water. Although this species was not recorded in the Matsu Project Area it has been recorded at the RIOP Mine Site camp and is therefore expected to occur along ephemeral drainages in the Matsu Project Area when key grasses species are seeding. The Matsu Project is expected to have only a minor effect on this species given the small amount of feeding habitat that will be removed.

2.2.3 Are you aware of any recent fauna surveys carried out over the area to be disturbed by this proposal?

☑ Yes ☐ No **If yes**, please attach a copy of any related survey reports and provide the date and name of persons / companies involved in the survey(s).

If no, please do not arrange to have any biological surveys conducted prior to consulting with the DEC.

A Level 1 biological survey, the Matsu Biological Survey, (as per the EPA Guidance Statement 51 and 56) was conducted across the Matsu Project Area. The survey was conducted in 2012 with the results reported in 2014 in the Matsu Biological Survey report (Appendix 3). Further bat acoustic recordings and searches for roost caves will be undertaken in April 2014, specifically targeting bat species of conservation significance.

DPaW was consulted in 2012 (Nick Wolfrey and Murray Baker) and again in 2014 (Sandra Thomas) to confirm survey requirements. On both occasions it was agreed that a targeted significant fauna survey was sufficient for the Matsu Project Area.

2.2.4 Has a search of DEC records for known occurrences of Specially Protected (threatened) fauna been conducted for the site?

☑ Yes ☐ No (please tick)

A request was made for a search of the DPaW databases for threatened and priority fauna. This search was conducted using a spot location (NW 16^{o} 41’ 53”S; 128^{o} 20’ 01”E), located approximately at the centre of the Matsu deposit. DPaW applied a 25 km buffer to this search which adequately encompasses the Matsu Project Area. The search results were obtained on March 17th 2014.

The database search found a number of conservation significant species that could potentially occur within the Matsu Project Area. The results, along with those from a search of the NatureMap and Protected Matters Tool, are provided in Table 3 (and Appendix 3). The table describes each species, its conservation status and the likelihood of occurrence.

Table 3: List of Conservation Significant Fauna potentially occurring in the Matsu Project Area

Species	Common Name	Conservation Status			Likelihood of Occurrence in the Survey Area
		Commonwealth Level (*EPBC Act*)	State Level (*WC Act*)	DPaW (Priority status)	
Birds					
Anseranas semipalmata	Magpie Goose	Listed Marine Species			**Unlikely to Occur.** While this species does utilise aquatic and terrestrial habitats, it is mainly found in shallow wetlands with dense growth of rushes or sedges (SEWPaC SPRAT 2013). No suitable habitat occurs in the Survey area.
Tadorna radjah	Burdekin Duck		Schedule 4		**Highly Unlikely to Occur**. The species prefers the brackish waters of mangrove flats and paperbark tree swamps, but will visit freshwater swamps, lagoons, and billabongs further inland during the wet season. It has been recorded at the sewage ponds of the Argyle Diamond Mine. No suitable habitat occurs in the Survey area.
Phaps histrionica	Flock Bronzewing			Priority 4	**Unlikely to Occur**. This species is the most nomadic of the Australian pigeons and is occasionally found in the Kimberley. Its preferred habitat is open grassland on black soil plains, salt bush and *Triodia* hummock grasslands. It has been recorded in the Lake Argyle area.
Apus pacificus	Fork-tailed Swift	Migratory Marine/ Wetland Species			**Likely to Occur.** This species is almost exclusively aerial. It occurs over cliffs, beaches, islands and settled areas (SEWPaC SPRAT 2013). This is a seasonal migrant and has been recorded in previous wet season surveys in the area.
Ardea ibis	Cattle Egret	Migratory Marine/ Wetland Species			**Unlikely to Occur.** While this species often forages away from water on low lying grasslands and improved pastures, it is mainly associated with shallow, open and freshwater wetlands (SEWPaC SPRAT 2013). No suitable habitat occurs in the Survey area.
Ardea alba	Great Egret, White Egret	Migratory Marine/ Wetland Species			**Unlikely to Occur.** This species usually frequents shallow waters of a wide range of wetlands (SEWPaC SPRAT 2013) of which there are none in the Survey area.
Ixobrychus minutus	Little Bittern			Priority 4	**Highly Unlikely to Occur**. This species is associated with wetlands fringed with dense vegetation. No suitable habitat occurs in the Survey area.
Ixobrychus flavicollis	Black Bittern			Priority 3	**Highly Unlikely to Occur**. This species is associated with wetlands fringed with dense vegetation. No suitable habitat occurs in the Survey area.
Botaurus poiciloptilus	Australasian Bittern		Schedule 1 Endangered		**Highly Unlikely to Occur**. This species occurs mainly in densely vegetated freshwater wetlands (SEWPaC SPRAT 2013), which do not occur in the Survey area.

Species	Common Name	Conservation Status			Likelihood of Occurrence in the Survey Area
		Commonwealth Level (*EPBC Act*)	State Level (*WC Act*)	DPaW (Priority status)	
Haliaeetus leucogaster	White-bellied Sea-eagle	Migratory Terrestrial/ Marine Species			**Unlikely to Occur**. Found in both coastal and terrestrial habitats such as estuaries, mangroves, woodlands, rivers and lakes. Generally forages over large expanses of water (SEWPaC SPRAT 2013) which do not occur in the Survey area.
Falco peregrinus	Peregrine Falcon		Schedule 4		**Potential to Occur**. While this species is found across Australia, it is not common anywhere. It uses a wide range of habitats and is associated with cliffs where it nests. There are suitable cliffs in the Survey area and it has been recorded at nearby Argyle Diamond Mine and north in the RIOP.
Ardeotis australis	Australian Bustard			Priority 4	**Potential to Occur.** While **t**his species has been recorded at the nearby Argyle Diamond mine, it has not been recorded on the rocky escarpment and it prefers the flat plains similar to the Low Rolling Hills habitat through which Access Track Option 3 traverses.
Burhinus grallarius	Bush Stone-curlew			Priority 4	**Potential to Occur**. While **t**his species has been recorded at the nearby Argyle Diamond mine, it has not been recorded in previous surveys on the rocky ridges and it prefers the flat plains similar to the Low Rolling Hills habitat through which Access Track Option 3 traverses.
Charadrius veredus	Oriental Plover, Oriental Dotterel	Migratory Wetland/ Marine Species			**Unlikely to Occur**. This species is a non-breeding visitor to Australia (breeds in Mongolia). Upon arrival, they utilise the coastal habitats such as estuarine mudflats and sandbanks. They then move inland where the preferred habitat is flat, open, semi-arid or arid grasslands, where the grass is short and sparse, and interspersed with hard, bare ground, such as claypans, dry paddocks, playing fields, lawns and cattle camps (SEWPaC SPRAT 2013).
Rostratula australis	Australian Painted Snipe	Endangered	Schedule 1 Endangered		**Highly Unlikely to Occur**. This species is extremely cryptic and can often be found sheltering in dense grass or under the shade of trees well away from water. However, typical habitat comprises ephemeral or permanent water, usually with muddy edges (SEWPaC SPRAT 2013). No suitable habitat occurs in the Survey area.
Glareola maldivarum	Oriental Pratincole	Migratory Wetland/ Marine Species			**Unlikely to Occur**. This species is a non-breeding visitor which hawks low over flooded grassland or on the ground where locusts are present (SEWPaC SPRAT 2013). No suitable habitat occurs in the Survey area.
Merops ornatus	Rainbow Bee-eater	Migratory Terrestrial/ Marine Species			**Likely to Occur**. This species usually occurs in open, cleared or lightly timbered areas that are often, but not always, located in close proximity to permanent water (SEWPaC SPRAT 2013). It has been recorded in the Survey area.

Species	Common Name	Conservation Status			Likelihood of Occurrence in the Survey Area
		Commonwealth Level (*EPBC Act*)	State Level (*WC Act*)	DPaW (Priority status)	
Malurus coronatus	Purple-crowned Fairy-wren	Vulnerable		Priority 4	**Unlikely to Occur**. This species prefers to occupy habitats along or very close to rivers and streams, in thick vines or pandanus but occurs less frequently in dense grasslands and mangroves (SEWPaC SPRAT 2013). No suitable habitat occurs in the Survey area.
Erythrotrirchis radiatus	Red Goshawk	Vulnerable	Schedule 1 Vulnerable		**Unlikely to Occur.** The Red Goshawk has the ability to disperse hundreds of kilometres and there is very little information available on non-breeding habitat. Suitable breeding habitat consists mainly of tall riparian vegetation supporting a high density of bird prey species. The Red Goshawk prefers to nest in the tallest available tree within 1 km of permanent water. There is no suitable nesting habitat in the Survey area and none of the numerous bird censuses conducted by APM in the area have recorded this species.
Falcunulus frontatus whitei	Northern Shrike-tit	Vulnerable		Priority 4	**Unlikely to Occur.** The Northern (Crested) Shrike-tit prefers habitat of open eucalypt woodland. Given the habitat requirements, there is potential for this species to occur however, the Northern Shrike-tit has a very fragmented distribution and none of the numerous bird censuses conducted by APM in the area have recorded this species.
Tyto novaehollandiae kimberlii	Masked Owl (northern)	Vulnerable		Priority 1	**Unlikely to Occur.** The Masked Owl inhabits forests, woodlands, timbered waterways and open country on the fringe of these areas. The main requirements are tall trees with suitable hollows for nesting and roosting and adjacent areas for foraging. Suitable hollow bearing woodlands and timbered waterways are not present in suitable structure in the Survey area and none of the numerous bird censuses conducted by APM in the area have recorded this species.
Erythrura gouldiae	Gouldian Finch	Endangered/ Migratory Terrestrial		Priority 4	**Likely to Occur**. This species has been recorded nearby in previous surveys and was also recorded at the RIOP camp during the current survey. It is expected to occur in the Survey area at various times of the year related to the seeding of food grass species.
Heteromunia pectoralis	Pictorella Mannikin			Priority 4	**Likely to Occur**. This species was recorded at the RIOP camp during a recent survey. It is expected to occur in the Survey area at various times of the year related to the seeding of food grass species.
Mammals					
Dasyurus hallucatus	Northern Quoll	Endangered	Schedule 1 Endangered		**Unlikely to Occur**. A targeted search of the Survey area and the neighbouring ridges of RIOP (from previous surveys) did not find any Northern Quolls. No quolls were recorded in surveys on the nearby Argyle Diamond Mine.

Species	Common Name	Conservation Status			Likelihood of Occurrence in the Survey Area
		Commonwealth Level (*EPBC Act*)	State Level (*WC Act*)	DPaW (Priority status)	
Macrotis lagotis	Greater Bilby	Vulnerable	Schedule 1 Vulnerable		**Unlikely to Occur**. Bilby occur in a variety of habitats, usually on landforms with level to low slope topography and light to medium soils. It occupies three major vegetation types; open tussock grassland on uplands and hills, mulga woodland/shrubland growing on ridges and rises, and hummock grassland in plains and alluvial areas. The distribution of Greater Bilbies can be limited by the availability of suitable burrowing habitat where burrow excavation is easier (SEWPaC SPRAT 2013). None of the suitable Bilby habitats occur in the Survey area and Bilby have not been recorded in numerous surveys conducted by APM.
Hydromys chrysogaster	Water-rat			Priority 4	**Unlikely to Occur**. This species prefers permanent water bodies of brackish and fresh water. They live in burrows in the bank along the water (Australian Museum 2010a). Ideal habitat does not occur in the Survey area.
Leggadina lakedownensis	Short-tailed Mouse			Priority 4	**Unlikely to Occur**. This species is known to occur on sandy soils and cracking clays in Western Australia (DEC 2012d). Ideal habitat does not occur in the Survey area.
**Rhinonicteris auriantia*	*Orange Leaf-nosed Bat		Schedule 1-Vulnerable		**Likely to Occur**. These bats prefer very humid caves. The species is known to expand to woodlands during the wet season and contract back to the caves in the dry season. This species was recorded inside the Survey area, the RIOP Mine Site area as well as 15 km north of the RIOP Mine Site.
**Hipposideros stenotis*	*Northern Leaf-nosed Bat			Priority 2	**Likely to Occur**. These bats prefer low humidity caves preferring to roost singly or in small groups close to the entrance. Experience from other locations have shown that these bats remain present in areas that have mid to high levels of human activity (Bullen unpublished) even to the extent that *H. stenotis* has remained present during and after large scale open cut mining on Koolan Island. This species has been recorded inside the RIOP as well as 15 km north. It was not recorded during this survey.
**Macroderma gigas*	*Ghost Bat			Priority 4	**Likely to Occur**. This species expands its foraging range in the wet season and contracts back to stable roost caves during the dry season. This species was recorded inside the Survey area and in the RIOP Mine Site area.
Reptiles					
Crocodylus johnstoni	Freshwater Crocodile	Listed Marine Species		Schedule 4	**Highly Unlikely to Occur**. This species inhabits various freshwater environments and will move through the inundated floodplains during the wet season (Australian Museum 2010b). No suitable habitat occurs in the Survey area.

Species	Common Name	Conservation Status			Likelihood of Occurrence in the Survey Area
		Commonwealth Level (*EPBC Act*)	State Level (*WC Act*)	DPaW (Priority status)	
Crocodylus porosus	Salt-water Crocodile	Migratory Marine Species			**Highly Unlikely to Occur**. This species mostly occurs in tidal rivers, coastal floodplains and channels, billabongs and swamps up to 150 km inland from the coast. This habitat does not occur in the Survey area (SEWPaC SPRAT 2013).
Invertebrates					
Mouldingia orientalis	Land snail			Schedule 1	**Potential to Occur.** These snails are often associated with, and restricted to, the tropical vine thickets in the Kimberley. The sandstone cliff maintains a vegetation community representative of tropical vine thicket and so this species has the potential to occur in the Survey area. However no impacts are expected as the sandstone cliffs and vine thickets will not be disturbed by mining operations.
Fish					
Pristis pristis	Freshwater Sawfish	Vulnerable			**Highly Unlikely to Occur**. There are no rivers present in the Survey area suitable for either permanent residence or migration of these fish.
Syncomistes rastellus	Drysdale Grunter			Priority 2	**Highly Unlikely to Occur**. This species prefers large streams rather than small tributaries (Fishbase 2013) of which there are none in the Survey area.

* These bat species were not listed on any government database as potentially occurring in the area, however, over the course of three surveys (APM 2009, 2010 and 2012); these bat species of conservation significance have been recorded.

2.2.5 Are there any known occurrences of Specially Protected (threatened) fauna on the site?

☑ Yes ☐ No **If yes**, please indicate which species or communities are involved and provide copies of any correspondence with DEC regarding these matters.

See Table 2.

2.3 Rivers, Creeks, Wetlands and Estuaries

2.3.1 Will the development occur within 200 metres of a river, creek, wetland or estuary?

(please tick) ☐ Yes **If yes**, complete the rest of this section.

☑ No **If no**, go to the next section.

No named rivers or creeks are present within the Matsu Project Area; however small gullies and some other minor ephemeral drainage lines are present and may therefore be impacted.

2.3.2 Will the development result in the clearing of vegetation within the 200 metre zone?

☐ Yes ☐ No **If yes**, please describe the extent of the expected impact.

2.3.3 Will the development result in the filling or excavation of a river, creek, wetland or estuary?

☐ Yes ☐ No **If yes**, please describe the extent of the expected impact.

2.3.4 Will the development result in the impoundment of a river, creek, wetland or estuary?

☐ Yes ☐ No **If yes**, please describe the extent of the expected impact.

2.3.5 Will the development result in draining to a river, creek, wetland or estuary?

☐ Yes ☐ No **If yes**, please describe the extent of the expected impact.

2.3.6 Are you aware if the proposal will impact on a river, creek, wetland or estuary (or its buffer) within one of the following categories? (please tick)

Conservation Category Wetland	☐ Yes	☐ No	☐ Unsure
Environmental Protection (South West Agricultural Zone Wetlands) Policy 1998	☐ Yes	☐ No	☐ Unsure
Perth's Bush Forever site	☐ Yes	☐ No	☐ Unsure
Environmental Protection (Swan & Canning Rivers) Policy 1998	☐ Yes	☐ No	☐ Unsure
The management area as defined in s4(1) of the *Swan River Trust Act 1988*	☐ Yes	☐ No	☐ Unsure
Which is subject to an international agreement, because of the importance of the wetland for waterbirds and waterbird habitats (e.g. Ramsar, JAMBA, CAMBA)	☐ Yes	☐ No	☐ Unsure

2.4 Significant Areas and/ or Land Features

2.4.1 Is the proposed development located within or adjacent to an existing or proposed National Park or Nature Reserve?

☐ Yes ☑ No **If yes**, please provide details.

2.4.2 Are you aware of any Environmentally Sensitive Areas (as declared by the Minister under section 51B of the EP Act) that will be impacted by the proposed development?

☐ Yes ☑ No **If yes**, please provide details.

2.4.3 Are you aware of any significant natural land features (e.g. caves, ranges etc) that will be impacted by the proposed development?

☐ Yes ☑ No **If yes**, please provide details.

2.5 Coastal Zone Areas (Coastal Dunes and Beaches)

2.5.1 Will the development occur within 300metres of a coastal area?

(please tick) ☐ Yes **If yes**, complete the rest of this section.

☑ No **If no**, go to the next section.

2.5.2 What is the expected setback of the development from the high tide level and from the primary dune?

2.5.3 Will the development impact on coastal areas with significant landforms including beach ridge plain, cuspate headland, coastal dunes or karst?

☐ Yes ☐ No **If yes**, please describe the extent of the expected impact.

2.5.4 Is the development likely to impact on mangroves?

☐ Yes ☐ No **If yes**, please describe the extent of the expected impact.

2.6 Marine Areas and Biota

2.6.1 Is the development likely to impact on an area of sensitive benthic communities, such as seagrasses, coral reefs or mangroves?

☐ Yes ☑ No **If yes**, please describe the extent of the expected impact.

2.6.2 Is the development likely to impact on marine conservation reserves or areas recommended for reservation (as described in *A Representative Marine Reserve System for Western Australia*, CALM, 1994)?

☐ Yes ☑ No **If yes**, please describe the extent of the expected impact.

2.6.3 Is the development likely to impact on marine areas used extensively for recreation or for commercial fishing activities?

☐ Yes ☑ No **If yes**, please describe the extent of the expected impact, and provide any written advice from relevant agencies (e.g. Fisheries WA).

2.7 Water Supply and Drainage Catchments

2.7.1 Are you in a proclaimed or proposed groundwater or surface water protection area?

(You may need to contact the Department of Water (DoW) for more information on the requirements for your location, including the requirement for licences for water abstraction. Also, refer to the DoW website)

☑ Yes ☐ No **If yes**, please describe what category of area.

The Matsu Project Area is within the proclaimed Ord Irrigation and Tributaries catchment and the proclaimed Canning-Kimberley groundwater area.

2.7.2 Are you in an existing or proposed Underground Water Supply and Pollution Control area?

(You may need to contact the DoW for more information on the requirements for your location, including the requirement for licences for water abstraction. Also, refer to the DoW website)

☐ Yes ☑ No **If yes**, please describe what category of area.

2.7.3 Are you in a Public Drinking Water Supply Area (PDWSA)?

(You may need to contact the DoW for more information or refer to the DoW website. A proposal to clear vegetation within a PDWSA requires approval from DoW.)

☐ Yes ☑ No **If yes**, please describe what category of area.

2.7.4 Is there sufficient water available for the proposal?

(Please consult with the DoW as to whether approvals are required to source water as you propose. Where necessary, please provide a letter of intent from the DoW)

☑ Yes ☐ No (please tick)

The RIOP is currently extracting water under a *5C Licence to Take Water* (Appendix 6); the annual water entitlement for the RIOP under this licence is 150,000 kL. The additional water requirements for the Matsu Project may be either (a) extracted from current bores and remain within this water entitlement with the licence amended to incorporate water use at the Matsu Project or (b) an additional bore/s will be installed at Matsu and a new licence obtained.

2.7.5 Will the proposal require drainage of the land?

☐ Yes ☑ No **If yes**, how is the site to be drained and will the drainage be connected to an existing Local Authority or Water Corporation drainage system? Please provide details.

2.7.6 Is there a water requirement for the construction and/ or operation of this proposal?

(please tick) ☑ Yes **If yes**, complete the rest of this section.

☐ No **If no**, go to the next section.

2.7.7 What is the water requirement for the construction and operation of this proposal, in kilolitres per year?

The water requirement for the Matsu Project is anticipated to be within the annual entitlement of 150,000 kL currently approved for extraction at the RIOP by DoW; a licence amendment will be sought to include water use at the Matsu Project. If additional water is required, a bore/s will be installed at Matsu and a new licence will be obtained.

2.7.8 What is the proposed source of water for the proposal? (e.g. dam, bore, surface water etc.)

As discussed in Sections 2.7.4 and 2.7.7, water will either be sourced from the existing bore field at the RIOP or additional groundwater bores will be established at the Matsu Project to supply the required water. If additional groundwater bores are to be established a groundwater exploration program will be undertaken to determine potential bore locations.

2.8 Pollution

2.8.1 Is there likely to be any discharge of pollutants from this development, such as noise, vibration, gaseous emissions, dust, liquid effluent, solid waste or other pollutants?

(please tick) ☑ Yes **If yes**, complete the rest of this section.

☐ No **If no**, go to the next section.

2.8.2 Is the proposal a prescribed premise, under the Environmental Protection Regulations 1987?

(Refer to the EPA's *General Guide for Referral of Proposals to the EPA under section 38(1) of the EP Act 1986* for more information)

☑ Yes ☐ No **If yes**, please describe what category of prescribed premise.

Whilst mining of the Matsu deposit does not constitute a prescribed premises under the *Environmental Protection Regulations 1987*, should crushing activities be conducted for the Matsu Project, a Prescribed Premise Licence will be required through DER. If ore from the Matsu deposit is crushed at existing facilities that have been developed for RIOP, the operating licence for that facility will be maintained.

2.8.3 Will the proposal result in gaseous emissions to air?

☑ Yes ☐ No **If yes**, please briefly describe.

Atmospheric pollutants such as dust and emissions will be negligible at the Matsu Project.

Dust will be generated during clearing and subsequent excavation of materials from the Matsu deposit and haulage to designated stockpiles. Dust management measures, primarily water spray, will be utilised. Carbon dioxide emissions will result from the burning of fossil fuels to run machinery and transport vehicles. To minimise emissions, Matsu Project equipment will be regularly maintained to ensure they operate at maximum achievable efficiency.

2.8.4 Have you done any modelling or analysis to demonstrate that air quality standards will be met, including consideration of cumulative impacts from other emission sources?

☐ Yes ☑ No **If yes**, please briefly describe.

2.8.5 Will the proposal result in liquid effluent discharge?

☐ Yes ☑ No **If yes**, please briefly describe the nature, concentrations and receiving environment.

Large quantities of liquid effluent will not be produced or discharged at the Matsu Project Area; the existing RIOP accommodation village will be utilised for employees and contractors working at Matsu. An office block/crib room will be established at the Matsu Deposit; which will incorporate ablutions and an associated septic system. This septic system will be licensed as required.

2.8.6 If there is likely to be discharges to a watercourse or marine environment, has any analysis been done to demonstrate that the State Water Quality Management Strategy or other appropriate standards will be able to be met?

☐ Yes ☑ No **If yes**, please describe.

2.8.7 Will the proposal produce or result in solid wastes?

☑ Yes ☐ No **If yes**, please briefly describe the nature, concentrations and disposal location/ method.

Domestic waste generated at the Matsu Project will be disposed of at the existing RIOP facilities, as described in the approved 2010 RIOP Mine Site Mining Proposal and 2011 RIOP Mine Site Mining Proposal Variation. There will be no putrescible or inert waste landfill established at the Matsu Project.

2.8.8 Will the proposal result in significant off-site noise emissions?

☐ Yes ☑ No **If yes**, please briefly describe.

2.8.9 Will the development be subject to the Environmental Protection (Noise) Regulations 1997?

☐ Yes ☑ No **If yes**, has any analysis been carried out to demonstrate that the proposal will comply with the Regulations?

Please attach the analysis.

2.8.10 Does the proposal have the potential to generate off-site, air quality impacts, dust, odour or another pollutant that may affect the amenity of residents and other “sensitive premises” such as schools and hospitals (proposals in this category may include intensive agriculture, aquaculture, marinas, mines and quarries etc.)?

☐ Yes ☑ No **If yes**, please describe and provide the distance to residences and other “sensitive premises”.

2.8.11 If the proposal has a residential component or involves "sensitive premises", is it located near a land use that may discharge a pollutant?

☐ Yes ☐ No ☑ Not Applicable

If yes, please describe and provide the distance to the potential pollution source

2.9 Greenhouse Gas Emissions

2.9.1 Is this proposal likely to result in substantial greenhouse gas emissions (greater than 100 000 tonnes per annum of carbon dioxide equivalent emissions)?

☐ Yes ☑ No

If yes, please provide an estimate of the annual gross emissions in absolute and in carbon dioxide equivalent figures.

2.9.2 Further, if yes, please describe proposed measures to minimise emissions, and any sink enhancement actions proposed to offset emissions.

2.10 Contamination

2.10.1 Has the property on which the proposal is to be located been used in the past for activities which may have caused soil or groundwater contamination?

☐ Yes ☑ No ☐ Unsure **If yes**, please describe.

2.10.2 Has any assessment been done for soil or groundwater contamination on the site?

☐ Yes ☑ No **If yes**, please describe.

2.10.3 Has the site been registered as a contaminated site under the *Contaminated Sites Act 2003*? (on finalisation of the CS Regulations and proclamation of the CS Act)

☐ Yes ☑ No **If yes**, please describe.

2.11 Social Surroundings

2.11.1 Is the proposal on a property which contains or is near a site of Aboriginal ethnographic or archaeological significance that may be disturbed?

☐ Yes ☐ No ☑ Unsure **If yes**, please describe.

A search of the Department of Aboriginal Affair's (DAA) Aboriginal Heritage Inquiry System for tenements M80/625, E80/2389, E80/4309 and P80/1750 identifies no registered Aboriginal heritage sites within the Matsu Project Area (Appendix 7). The historic access route proposed to be utilised intersects the boundary of the Department of Aboriginal Affairs (DAA) registered site 13749 – S. Blatchford Escarpment. KMG has sought, and received, advice from the DAA that the registered site will not be impacted by the proposed access track (Appendix 8).

Heritage surveys will be completed in the Matsu Project Area prior to any ground disturbing works with the relevant Traditional Owners, as per established Heritage Protection Agreements.

2.11.2 Is the proposal on a property which contains or is near a site of high public interest (e.g. a major recreation area or natural scenic feature)?

☐ Yes ☑ No **If yes**, please describe.

2.11.3 Will the proposal result in or require substantial transport of goods, which may affect the amenity of the local area?

☐ Yes ☑ No **If yes**, please describe.

3. PROPOSED MANAGEMENT

3.1 Principles of Environmental Protection

3.1.1 Have you considered how your project gives attention to the following Principles, as set out in section 4A of the EP Act? (For information on the Principles of Environmental Protection, please see EPA Position Statement No. 7, available on the EPA website)

1. The precautionary principle.	☑ Yes	☐ No
2. The principle of intergenerational equity.	☑ Yes	☐ No
3. The principle of the conservation of biological diversity and ecological integrity.	☑ Yes	☐ No
4. Principles relating to improved valuation, pricing and incentive mechanisms.	☑ Yes	☐ No
5. The principle of waste minimisation.	☑ Yes	☐ No

It is KMG's intention that the environmental principles and management strategies currently used at the existing RIOP operations will be applied to the Matsu Project where appropriate.

A Mine Closure Plan (MCP) for the RIOP was approved by the Department of Mines and Petroleum on 20th February 2014; the MCP is a dynamic document that will undergo development, review and continuous improvement throughout the life of the RIOP. Closure and rehabilitation of the Matsu Project will be included in the MCP and will be in line with the approved closure methodologies, obligations and commitments outlined for RIOP. This will ensure that the RIOP and Matsu Project can be closed, decommissioned and progressively rehabilitated in an ecologically sustainable manner.

As with the current operations at the Sam and Tony deposits, Matsu pit will be progressively backfilled with waste rock as mining advances. The backfilled areas will be contoured and rehabilitated when practicable.

3.1.2 Is the proposal consistent with the EPA's Environmental Protection Bulletins/Position Statements and Environmental Assessment Guidelines/Guidance Statements (available on the EPA website)?

☑ Yes ☐ No

3.2 Consultation

3.2.1 Has public consultation taken place (such as with other government agencies, community groups or neighbours), or is it intended that consultation shall take place?

☑ Yes ☐ No **If yes**, please list those consulted and attach comments or summarise response on a separate sheet.

As the holder of Mining Tenement M 259SA, KMG has informed Rio Tinto Argyle Diamonds Ltd of its intention to re-establish an existing access track across M259SA to the Matsu deposit. Rio Tinto Argyle Diamonds Ltd agreed to the refurbishment and use of this track by KMG and a Deed of Access and Indemnity was entered into between the two parties. Annual renewal of this agreement is in progress.

KMG is also in close contact with the local Miriuwung Gajerrong (MG) Corporation as the Matsu Project Area lies within the Miriuwung Gajerrong (Western Australia) Native Title Determination area. The MG Corporation Traditional Owners have previously signed a Heritage Protection Agreement for exploration purposes with KMG in November 2010. KMG has submitted a Heritage Impact Assessment (November 2012) to the MG Corporation covering exploration activities and a subsequent Work Clearance Survey was completed in July 2013 granting clearance for a drilling campaign. Ground disturbing work cannot be undertaken within the Miriuwung Gajerrong Determination Area without MG Corporation consultation, normally entailing completion of a Work Clearance Survey Program. KMG are in the process of negotiating a Mining Agreement with MG Corporation in accordance with the *Native Title Act 1993* (Cth) to allow a mining lease to be granted at the Matsu Project.

The section of the access track located in M 259SA, held by Argyle Diamonds Limited is subject to an Indigenous Land Use Agreement (ILUA) with the Traditional Owners for the mine area, Miriwoong and Gija People. KMG proposed activities within M 259SA are subject to the terms of the ILUA, specifically Management Plan 1 - Aboriginal Site Protection, in accordance with the Access Agreement KMG signed with Argyle Diamonds Limited.

Relevant government agencies have been consulted regarding the proposed development of the Matsu Project:

- Department of Mines and Petroleum (DMP)
- Department of Environment Regulation (DER), formerly the Department of Environment and Conservation (DEC)
- Department of Water (DoW)

KMG have also consulted with the Glen Hill pastoralist.

A register of stakeholder consultation for Matsu to date is included as Appendix 9.

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RIDGES IRON ORE PROJECT - MATSU PROJECT

EPA REFERRAL ATTACHMENT 1

Figure 1: Location Map

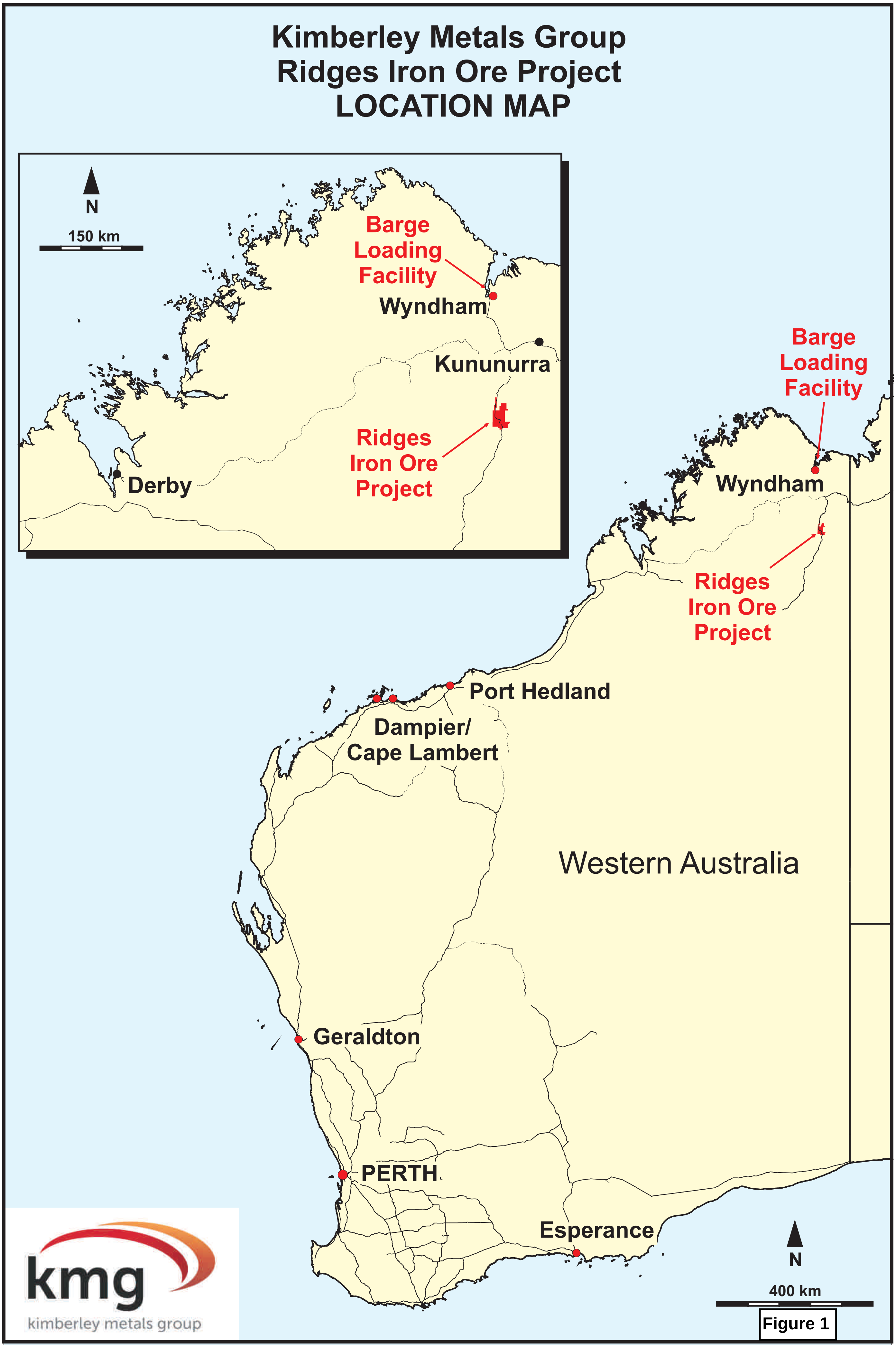
Kimberley Metals Group
Ridges Iron Ore Project
LOCATION MAP
N
150 km
Barge
Loading
Facility
Wyndham
Kununurra
Ridges
Iron Ore
Project
Derby
Barge
Loading
Facility
Wyndham
Ridges
Iron Ore
Project
Port Hedland
Dampier/
Cape Lambert
Western Australia
Geraldton
PERTH
Esperance
N
400 km
kmg
kimberley metals group
Figure 1

Figure 2: RIOP Matsu Project

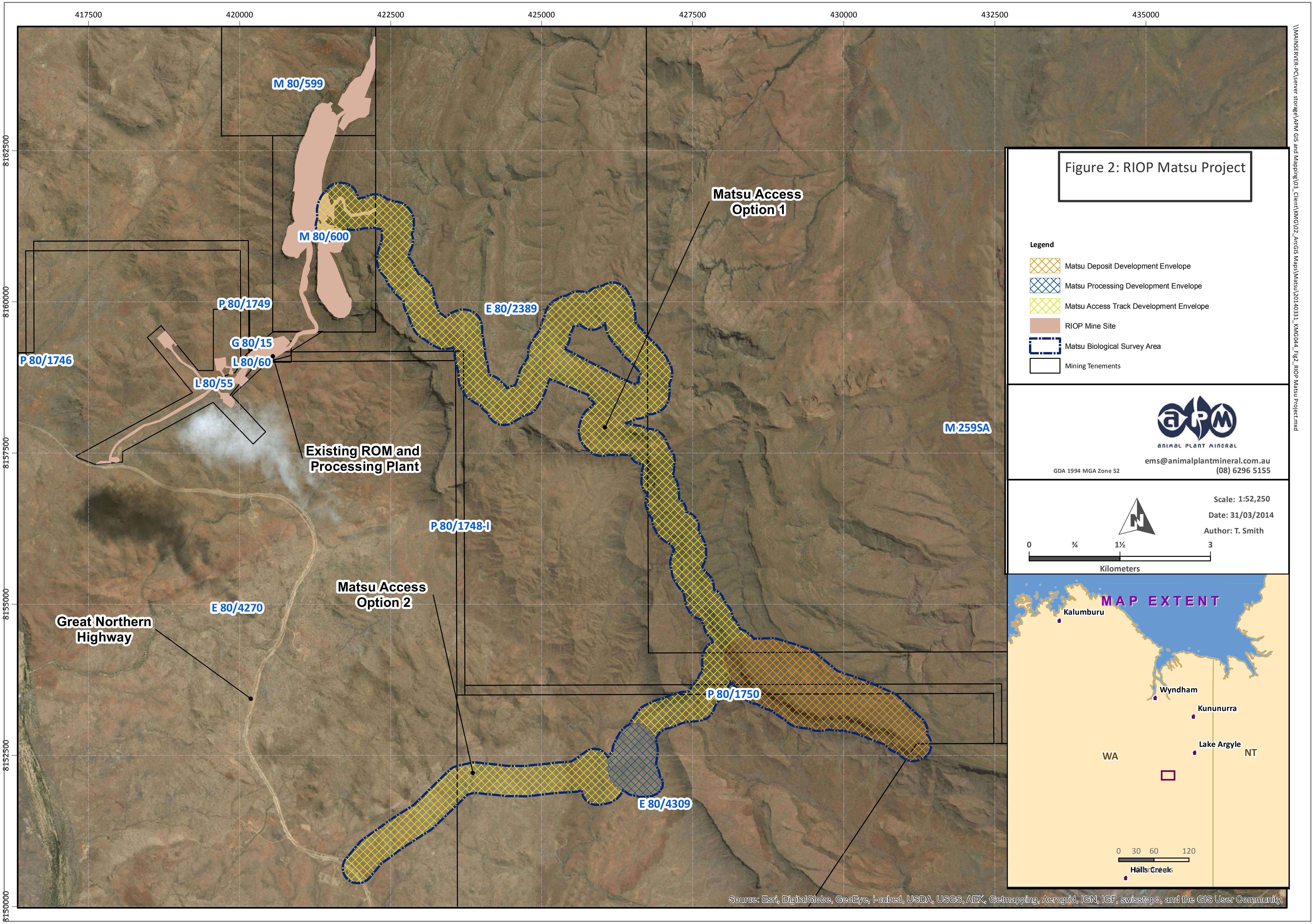

Figure 2: RIOP Matsu Project
Legend
Matsu Deposit Development Envelope
Matsu Processing Development Envelope
Matsu Access Track Development Envelope
RIOP Mine Site
Matsu Biological Survey Area
Mining Tenements
ems@animalplantmineral.com.au
(08) 6296 5155
GDA 1994 MGA Zone 52
Scale: 1:52,250
Date: 31/03/2014
Author: T. Smith
Kilometers
MAP EXTENT
Kalumburu
Wyndham
Kununurra
Lake Argyle
WA
NT
Halls Creek
M 80/599
M 80/600
P 80/1749
G 80/15
L 80/60
L 80/55
P 80/1746
E 80/2389
Matsu Access Option 1
Existing ROM and Processing Plant
P 80/1748-I
M 259SA
Matsu Access Option 2
E 80/4270
Great Northern Highway
P 80/1750
E 80/4309
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

KIMBERLEY METALS GROUP

RIDGES IRON ORE PROJECT - MATSU PROJECT

EPA REFERRAL ATTACHMENT 2

Appendix 1: Soil and Waste Characterisation

S O I L   W A T E R   C O N S U L T A N T S

RIDGES IRON ORE DEPOSIT SOIL SURVEY

Prepared for:	**Kimberley Metals Group**
Date of Issue:	27 April 2010
Project No.:	PN0149-1-1-KMG-001

A member of the SOIL WATER GROUP

SOIL WATER CONSULTANTS | SOIL WATER ANALYSIS | SOIL WATER TECHNOLOGIES

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DOCUMENT STATUS RECORD

Project Title:	**RIDGES IRON ORE DEPOSIT SOIL SURVEY**
Project No.:	PN0149-1-1-KMG-001
Client:	Kimberley Metals Group

Revision History

Revision Code*	Date Revised	Revision Comments	Signatures		
			Originator	Reviewer	Approved
A	26/04/10	Internal review of report	ASP	AJH	ASP
B	27/04/10	Draft report for review	ASP	AJH	ASP

Revision Code*

A - Report issued for internal SWC review	1 - First Revision
B - Draft report issued for client for review	2 - Second Revision
C - Final report issued to	3 - Third Revision

LIMITATIONS

The sole purpose of this report and the associated services performed by Soil Water Consultants (SWC) was to undertake a Soil and Waste Characterisation for the proposed Ridges Iron Ore Project (RIOP). This work was conducted in accordance with the Scope of Work discussed with Kimberley Metals Group ('the Client').

SWC performed the services in a manner consistent with the normal level of care and expertise exercised by members of the earth sciences profession. Subject to the Scope of Work, the soil and waste characterisation was confined solely to the Ridges Iron Ore Project. No extrapolation of the results and recommendations reported in this study should be made to areas external to this project area. In preparing this study, SWC has relied on published soil reports from various soil researchers and information provided by the Client. All information is presumed accurate and SWC has not attempted to verify the accuracy or completeness of such information. While normal assessments of data reliability have been made, SWC assumes no responsibility or liability for errors in this information. All conclusions and recommendations are the professional opinions of SWC personnel.

SWC is not engaged in reporting for the purpose of advertising, sales, promoting or endorsement of any client interests. No warranties, expressed or implied, are made with respect to the data reported or to the findings, observations and conclusions expressed in this report. All data, findings, observations and conclusions are based solely upon site conditions at the time of the investigation and information provided by the Client.

This report has been prepared on behalf of and for the exclusive use of the Client, its representatives and advisors. SWC accepts no liability or responsibility for the use of this report by any third party.

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1 INTRODUCTION

Soil Water Consultants (SWC) were commissioned by Kimberley Metals Group (KMG) to undertake a pre-mine soil and waste characterisation study for the proposed Ridges Iron Ore Project (RIOP). The purpose of this assessment was to identify and characterise all surficial soil and waste materials in the disturbance area and suggest management strategies for their handling and utilisation. This information provides baseline data that will be used to assist in the mining of these soils, restoration of the post-mining soil profile and the identification of potential environmental impacts that may occur in response to mining. Implementation of the waste management recommendations suggested in this report will ensure that only optimal materials are used in the rehabilitation of the backfilled mine pits and in the construction of the outer surface of the waste dumps, thus facilitating stability and revegetation.

1.1 STUDY OBJECTIVES

The objectives of this soil survey were to:

- Define the distribution of the soils in the Ridges Pre-Mine Soil Study Area (the study area);
- Characterise the physical and chemical properties of these soils;
- Identify soils that may develop adverse soil properties during mining and rehabilitation;
- Suggest management strategies for the handling and utilisation of these soils during mining and rehabilitation.

1.2 SCOPE OF WORK

The Scope of Work completed by SWC included:

- Obtain and review all of the existing exploration and production drilling data from KMG;
- Prepare geological cross-sections throughout the soil study area and identify provisional Soil Mapping Units (SMU) from these cross-sections;
- Excavate soil trenches to expose and examine the soil profile in each SMU;
- Using field and laboratory analysis, and the morphological descriptions, finalise the definition of SMU boundaries and characteristics for the soil study area;
- Preparation of this report.

2 SITE DESCRIPTION

2.1 STUDY LOCATION

The RIOP is located with the Shire of Wyndham - East Kimberley, approximately 78 km from the Northern Territory border and 120 km SSW of Kununurra (Figure 2.1). The deposit is located along a major north-south trending escarpment, approximately 6 km east of the Great Northern Highway (Figure 2.2).

2.2 PROJECT BACKGROUND

The RIOP consists principally of two deposits named Sam and Tony Pits (Figure 2.3). Two orebody outlines have currently been identified consisting of a high-grade hematite-rich deposit and a larger low-grade more magnetite-rich deposit. Areas of the proposed pits are provided in Table 2.1. The iron ore deposits have formed by supergene alteration and iron enrichment of the previous sandstone formation, and subsequently it is relatively shallow with a maximum depth of only 24 m. The orebody occurs close to surface over most of the area, and therefore there is minimal requirement for waste dumps, with backfilling of the mine void being considered as a possible option to further reduce the requirement of permanent waste dumps.

Additional infrastructure associated with the RIOP includes: Run-Of-Mine (ROM) Pad, crusher, workshop, laydown area, site offices and carparks. These ancillary facilities will be located on the flatter plain area to the west of the escarpment (Figure 2.3).

Table 2.1: Areas of proposed mine areas at the RIOP.

	High grade area (m^2)	Low grade area (m^2)
Sam Pit	186,295	522,691
Tony Pit	73,641	140,421

Given the shallow elongate nature of the deposits, surface miners are likely to be used. Mined ore will be excavated and trucked to the ROM Boxcut located between the two pits (Figure 2.3). From there the ore will be trucked to the ROM Pad, down the escarpment, and then crushed for transport by road to Wyndham where it will be shipped to overseas clients.

2.3 CLIMATE

The study area experiences a tropical climate with warm, dry winters and hot, wet summers. The average long-term (1889 - 2009) annual rainfall for the area is 624 mm, with 80% of the total rainfall falling between the months of December and March. During the wet season (Dec - Mar) daily rainfalls of > 100 mm have been recorded, with these associated with large cyclonic events (for example, on the 17th March 2005 a total of 209 mm of rain was recorded at the Lissadell weather station associated with Cyclone Ingrid, whilst close to 100 mm fell on the 11th December 2000, associated with Cyclone Sam).

The average long-term (1889 - 2009) annual pan evaporation is approximately 2850 mm (Table 2.2), with a monthly average of 242 mm. Potential evaporation exceeds rainfall for all months of the year, and subsequently the environment exists in a water deficit condition.

Table 2.2: Average monthly rainfall (mm) and pan evaporation data (mm) for the study area (Lissadell; Station number 2016; Bureau of Meteorology, 2009).

Month	Rainfall (mm) (1889 – 2009)	Pan Evaporation (mm) (1989 – 2009)
January	151.8	242.1
February	157.9	197.8
March	101.1	215.8
April	18.4	218.9
May	5.9	202.7
June	3.5	178.9
July	4.3	194.6
August	1.2	230.8
September	3.8	275.0
October	21.2	315.3
November	50.7	300.5
December	105.1	277.2
Annual	**624.5**	**2849.1**

2.4 GEOMORPHOLOGY

The landscape within the RIOP is dominated by the large north-south trending sandstone escarpment, which hosts the mineralised iron ore deposits (Plate 2.1; Figure 2.4). The escarpment rises approximately 300 m from the surrounding granitic plain and reaches a maximum elevation of 668 m AHD (Figure 2.5). East of the escarpment the plateau landsurface gently slopes towards Lake Argyle, located approximately 40 km east-northeast of the RIOP.

At a local-scale within the RIOP the geomorphology of the plateau surface is strongly controlled by a series of north-south trending structural surfaces or geological contacts, resulting in a steeply dipping east-west landsurface (Figures 2.6 and 2.7). Within the proposed Sam Pit area the landsurface steeply dips from a maximum elevation of 668 m on the western side of the deposit to around 580 m to the east (Figure 2.6), with slopes of between 15 - 20° over most of the deposit (Plates 2.2 and 2.4). At the base of the slope there is a broad alluvial valley, approximately 250 m wide (Plate 2.5), with a centralised drainage line. Surface water within this drainage system flows predominately to the north, becoming March Fly Creek.

In the Tony Pit area the landsurface dips from 650 m west of the proposed pit to 550 m in the east (Figure 2.7). Slopes vary from 15 - 20° (Plate 2.6), and unlike in the Sam Pit area there is no broad valley at the base of the slope (Plate 2.7). At the Tony Pit the linear slope abuts the structural contact with the adjoining unweathered Hensman Sandstone and Golden Gate Siltstone (Plate 2.8). The contact between the steep slope and the unweathered basement rocks creates a defined drainage line which flows south over the edge of the escarpment.

Plate 2.1: Dominant sandstone escarpment which hosts mineralised deposits.

Plate 2.2: Approximate location of the Sam Pit showing the considerable relief of the area.

Plate 2.3: Characteristic steep vegetated slope within the Sam Pit area.

Plate 2.4: Very steeply dipping portion (20° slope) of the landsurface in the Sam Pit area.

Plate 2.5: Broad alluvial valley at the base of the slope in the Sam Pit area.

Plate 2.6: Steep linear slope within the Tony Pit area.

Plate 2.7: Steep linear slope within the Tony Pit area looking east.

Plate 2.8: Abrupt contact between the steeply dipping landsurface of the Tony Pit area and the remnant structural surface of the Hensman Sandstone and Golden Gate Siltstone.

2.5 GEOLOGY

The regional geology covering the RIOP is shown in Figure 2.8, whilst a schematic cross-section is provided in Figure 2.9. The RIOP occurs within the metasediments of the once extensive Carr Boyd Basin, which consists of interbedded sandstone, siltstone and mudstone sequences deposited under a shallow-water environment (Xploray, 2006). These basin sediments were deposited onto the existing Proterozoic granite - gneiss terrane of the Lamboo Complex, which forms the relatively flat granitic plain area surrounding the RIOP.

The basal portion of the Carr Boyd Basin consists predominately of a sandstone end-member, labelled the Hensman Sandstone. Unconformably overlying the sandstone is the Golden Gate Siltstone, which was subsequently covered by the Lissadel Formation. Uplifting of the basin sediments and subsequent erosion during the Mesozoic - Paleozoic Periods exposed the basal Hensman Sandstone along the western edge of the basin. Extensive lateritic weathering of the exposed Hensman Sandstone during the Tertiary Period and subsequent supergene mineralisation of iron resulted in the formation of the iron-ore deposits to be mined at the RIOP. The eastern extent of the magnetite-hematite deposit is constrained by the presence of the remnant Golden Gate Siltstone overlying the Hensman Sandstone; the presence of the fine-textured siltstone would have limited the extent of lateritic weathering of the underlying sandstone and the enrichment of iron.

2.6 REGIONAL SOILS

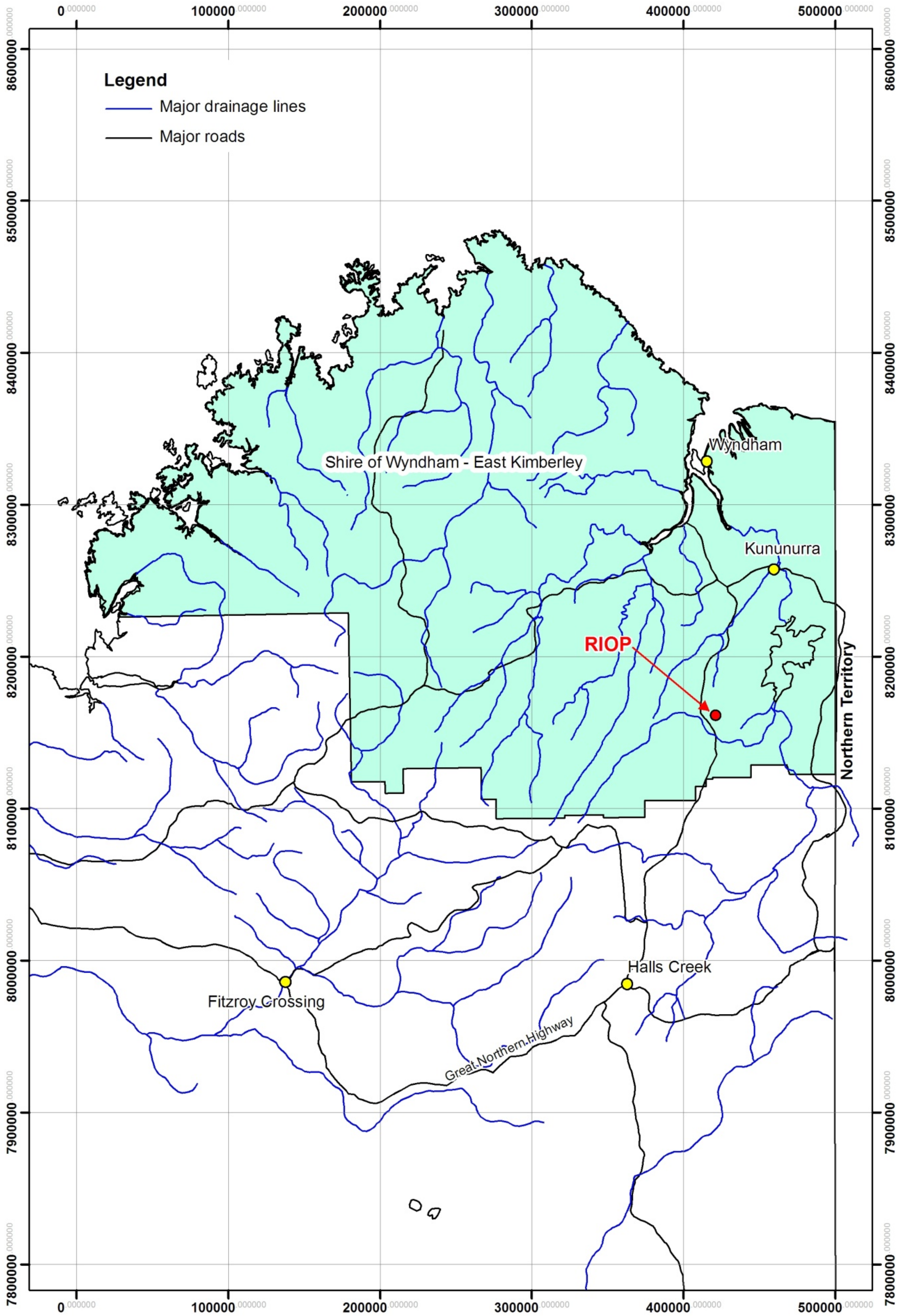
The soils within the RIOP have been mapped at a regional scale by the Department of Agriculture as part of the Rangelands and Arid Interior Soil - Landscape Survey (Tille, 2006). A map showing the regional distribution of soils is provided in Figure 2.10.

Soils on the escarpment and associated sandstone plateau consist of shallow sands, often gravelly, overlying a consolidated laterite, sandstone, siltstone or mudstone basement. The soils have formed primarily by *in situ* weathering of the parent rocks, and subsequently their properties reflect the characteristics of the parent materials. In lower slope positions the depth of the surface soil cover increases and becomes more silty with a dominated loamy texture.

Soils within the surrounding plain consist of shallow granitic detritus overlying unweathered granite (Plate 2.9). Granitic outcrops are common through the area creating a gently undulation relief, with the depth of soil cover varying according to slope position. The surface soils are primarily gritty yellow sands with neutral to alkaline pH. Drainage lines within the area consist of weathered, well rounded fragments of granite in a loss sand matrix.

Plate 2.9: Shallow, predominately sandy soils overlying unweathered granitic bedrock within the plain surrounding the escarpment.

Plate 2.10: Sandy soils within drainage lines in the granite plain area surrounding the escarpment.



Soil Water Consultants PTY LTD Perth Offices 08 9434 5836

PN	PN0149-1-1-KMG-001	
Prep. by	ASP	04/02/10
Rev'd. by	MH	04/02/10
Revision No.		0

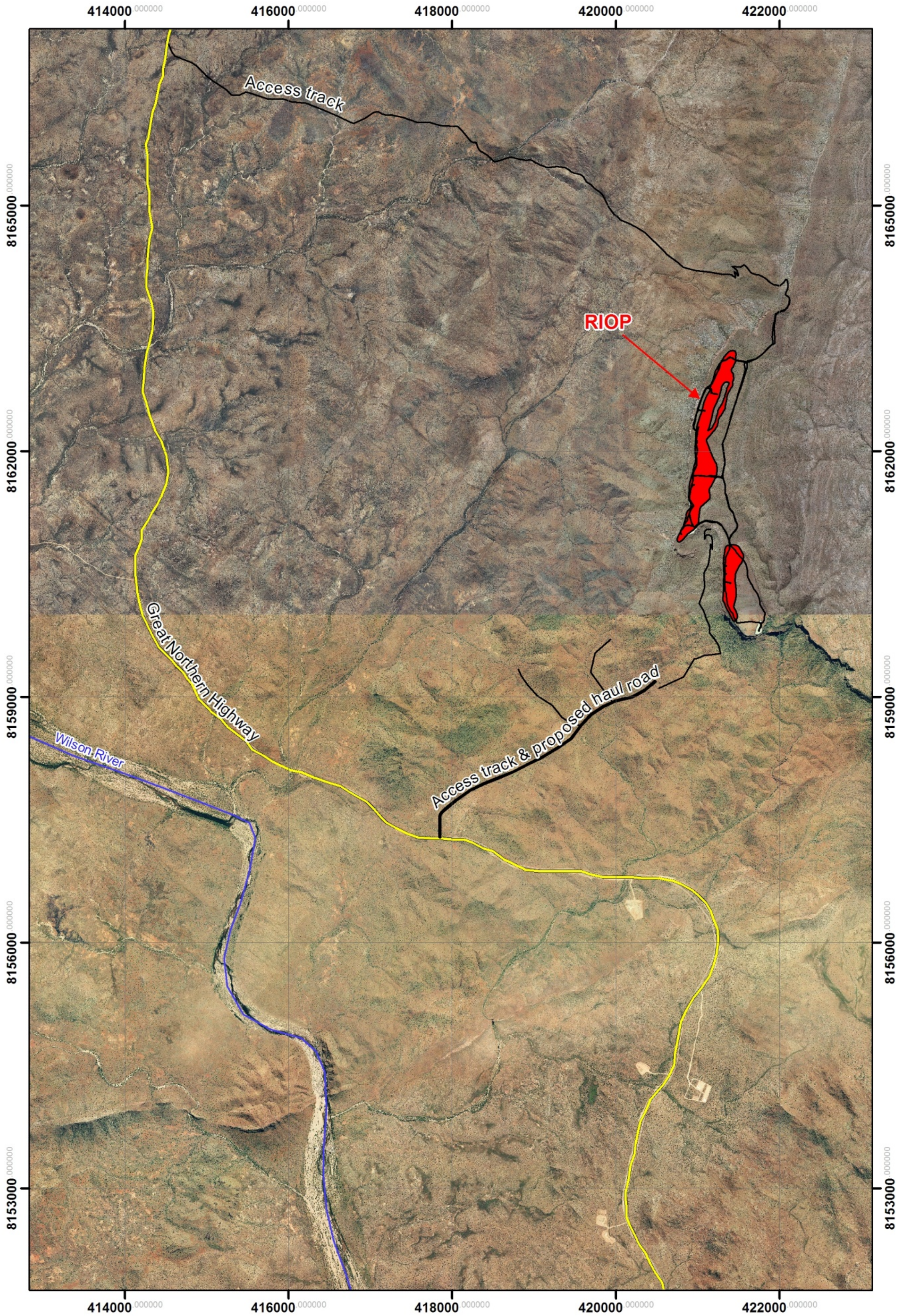
Kimberley Metals Group

RIOP SOIL AND WASTE CHARACTERISATION

REGIONAL LOCATION

Figure 2.1

soilwater



Soil Water Consultants PTY LTD Perth Offices 08 9434 5836

PN	PN0149-1-1-KMG-001	
Prep. by	ASP	04/02/10
Rev'd. by	MH	04/02/10
Revision No.		0

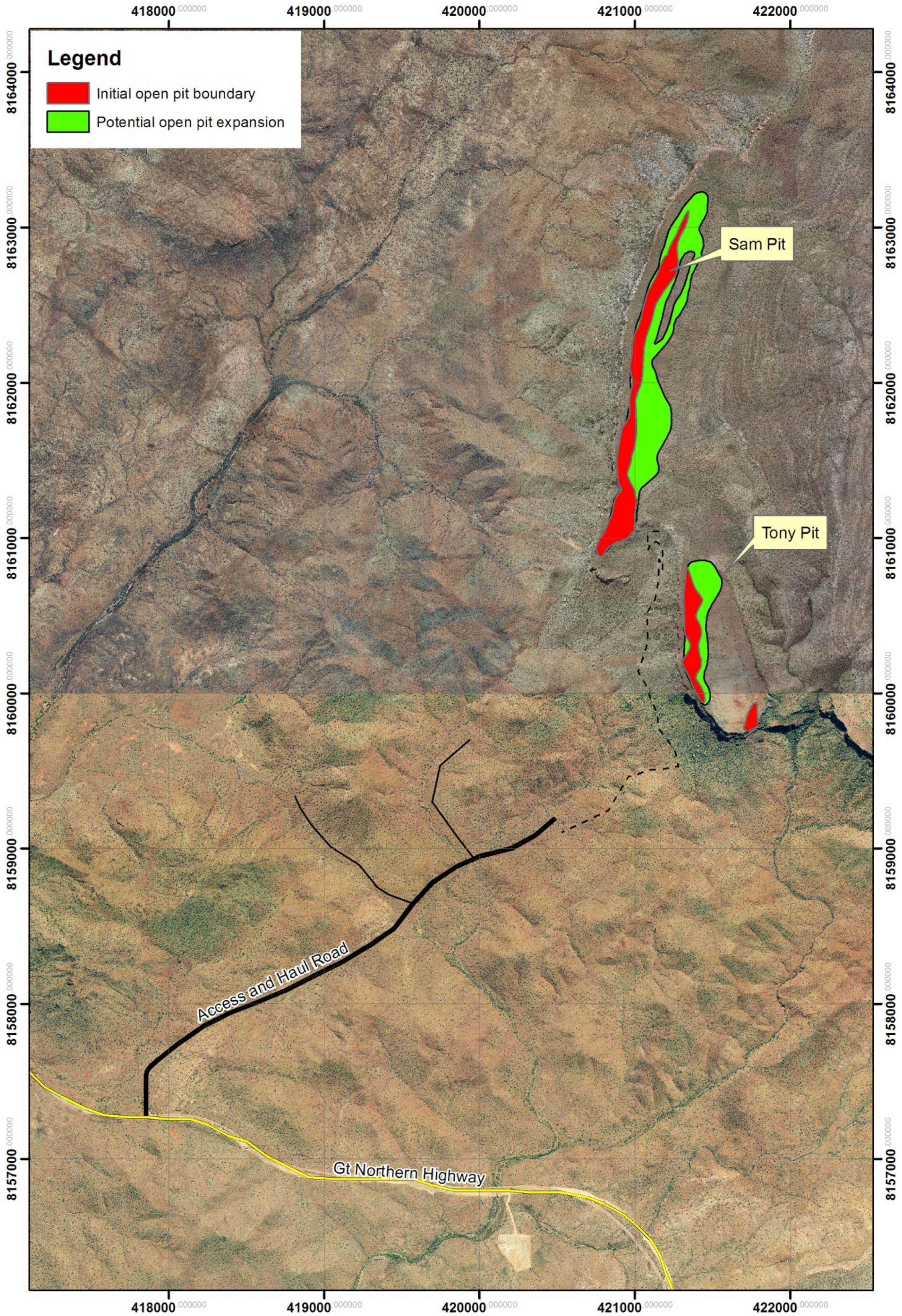
Kimberley Metals Group

RIOP SOIL AND WASTE CHARACTERISATION

LOCAL LOCATION

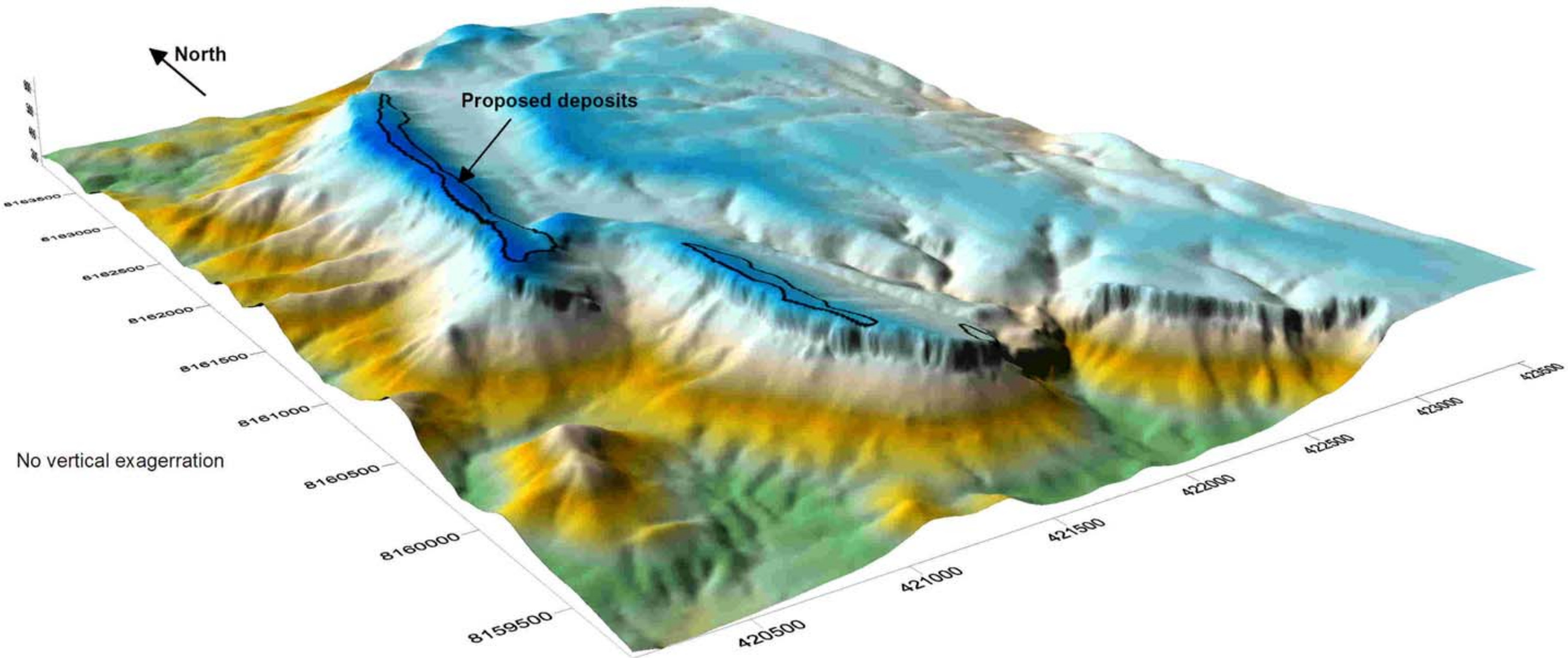
Figure 2.2

soilwater



Soil Water Consultants PTY LTD Perth Offices 08 9434 5836

PN	PN0149-1-1-KMG-001		Kimberley Metals Group RIOP SOIL AND WASTE CHARACTERISATION **SITE LAYOUT**	**Figure 2.3**
Prep. by	ASP	04/02/10		
Rev'd. by	MH	04/02/10		soilwater
Revision No.		0		



PN	PN0149-1-1-KMG-001		Kimberley Metals Group RIOP SOIL AND WASTE CHARACTERISATION **REGIONAL GEOMORPHOLOGY**	**Figure 2.4**
Prep by	ASP	15/02/10		
Rev'd by	MH	15/02/10		soilwater
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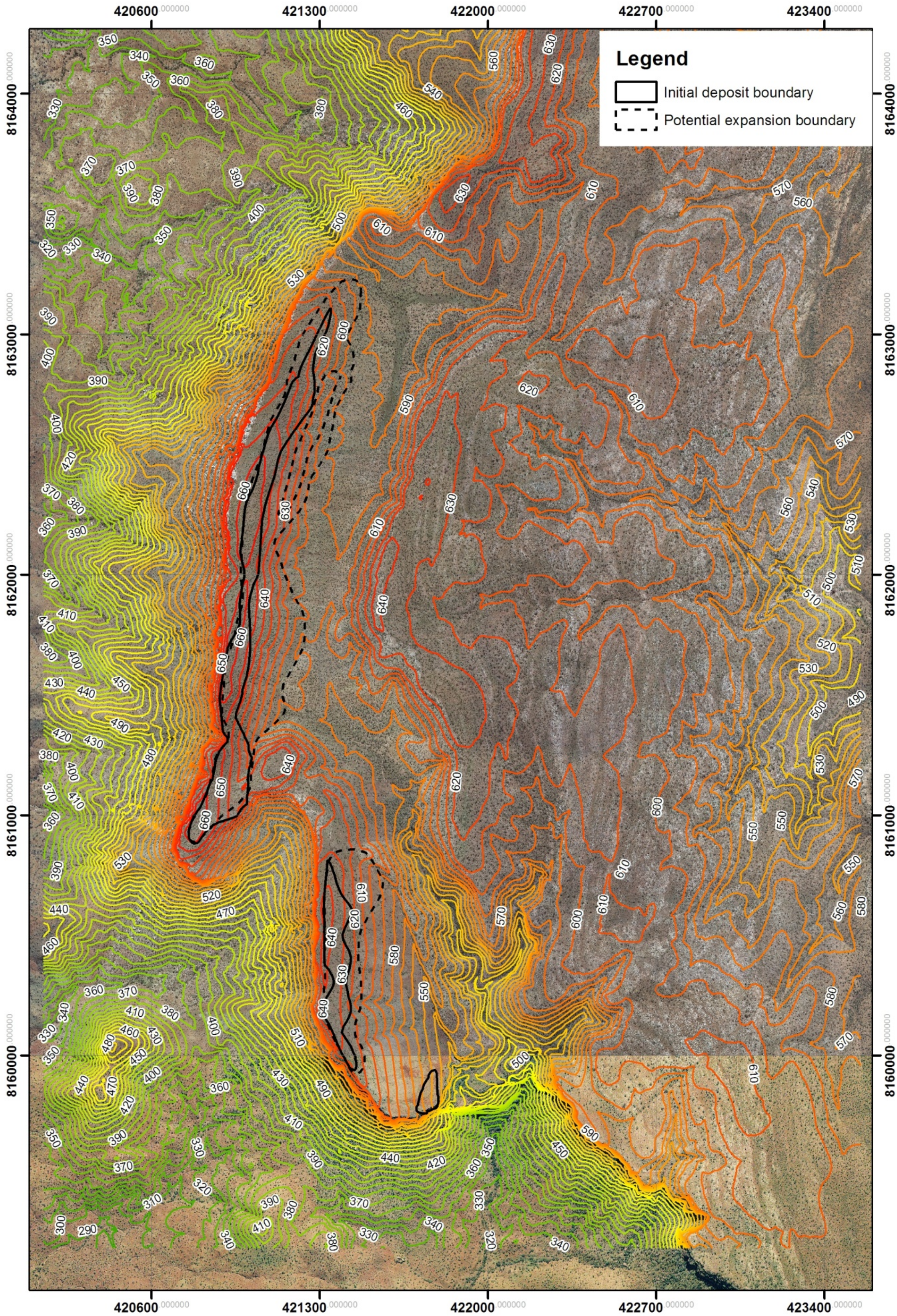

PN	PN0149-1-1-KMG-001		Kimberley Metals Group RIOP SOIL AND WASTE CHARACTERISATION **SURFACE CONTOURS**	**Figure 2.5**
Prep. by	ASP	04/02/10		soilwater
Rev'd. by	MH	04/02/10		
Revision No.		0		

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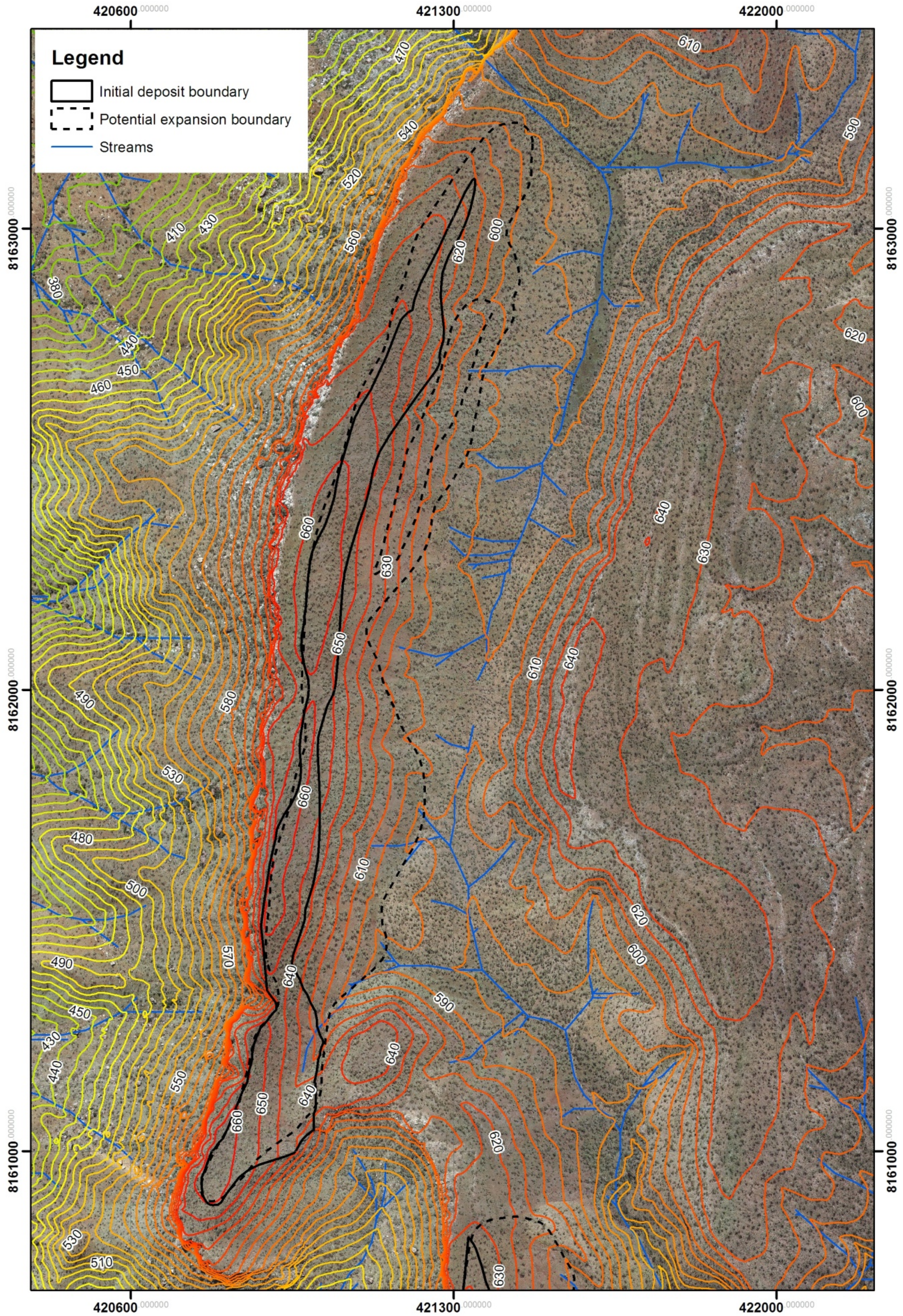
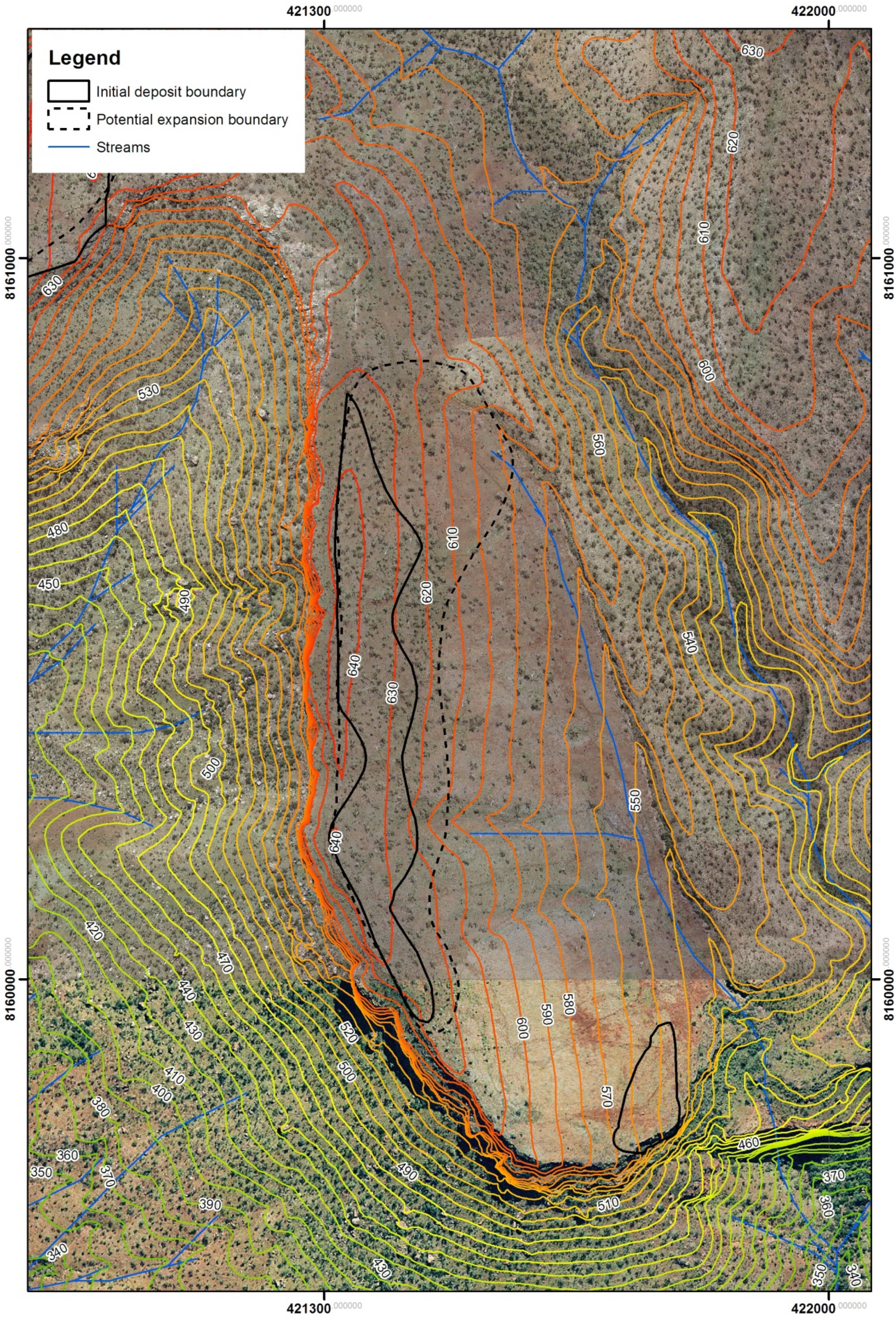
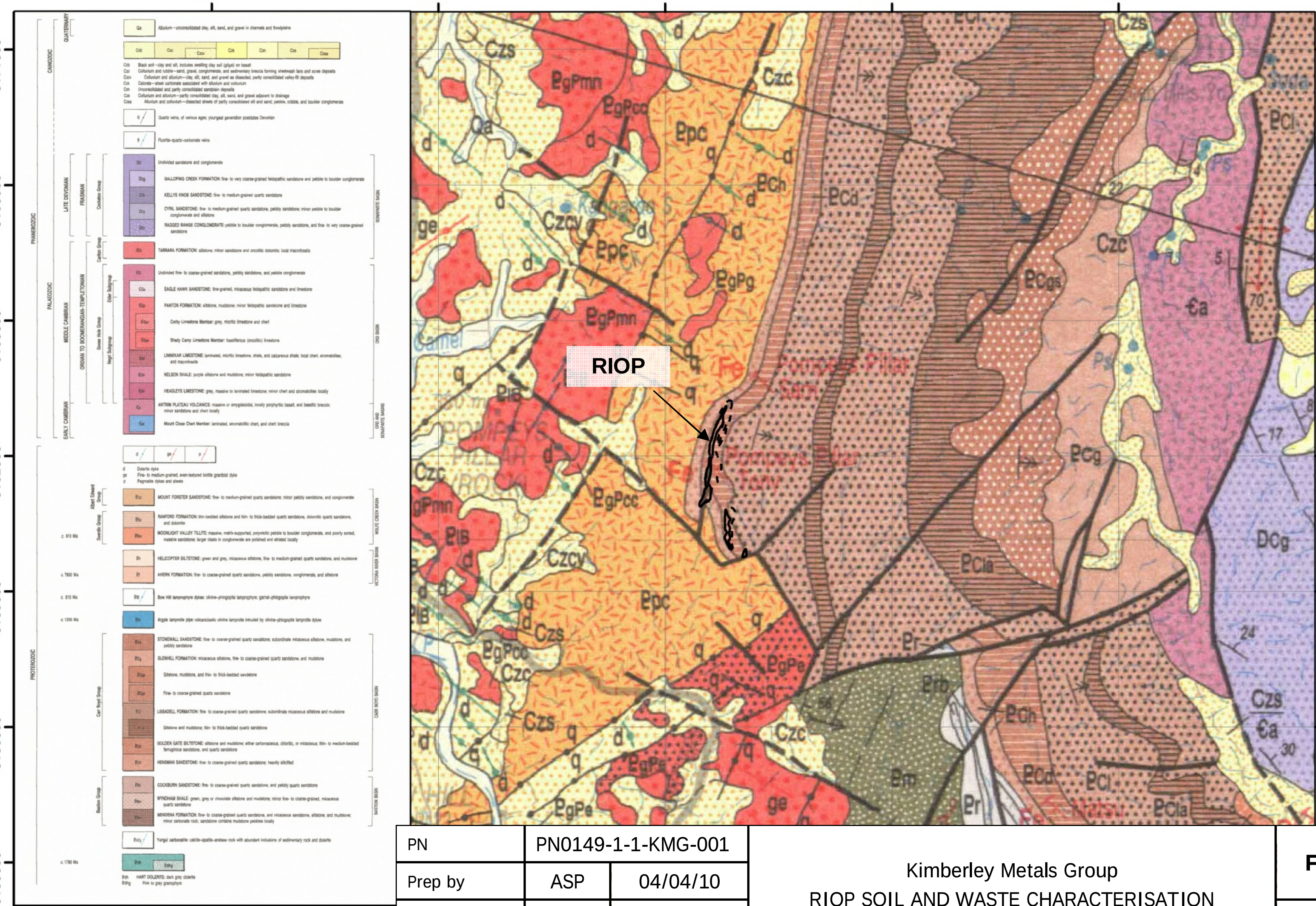


PN	PN0149-1-1-KMG-001		Kimberley Metals Group RIOP SOIL AND WASTE CHARACTERISATION **SAM PIT LANDSURFACE**	**Figure 2.6**
Prep. by	ASP	04/02/10		soilwater
Rev'd. by	MH	04/02/10		
Revision No.		0		



PN	PN0149-1-1-KMG-001		Kimberley Metals Group RIOP SOIL AND WASTE CHARACTERISATION **TONY PIT LANDSURFACE**	**Figure 2.7**
Prep. by	ASP	04/02/10		soilwater
Rev'd. by	MH	04/02/10		
Revision No.		0		



PN	PN0149-1-1-KMG-001	
Prep by	ASP	04/04/10
Rev'd by	MH	04/04/10
Revision No.	0	

Kimberley Metals Group
RIOP SOIL AND WASTE CHARACTERISATION
REGIONAL GEOLOGY

Figure 2.8

soilwater

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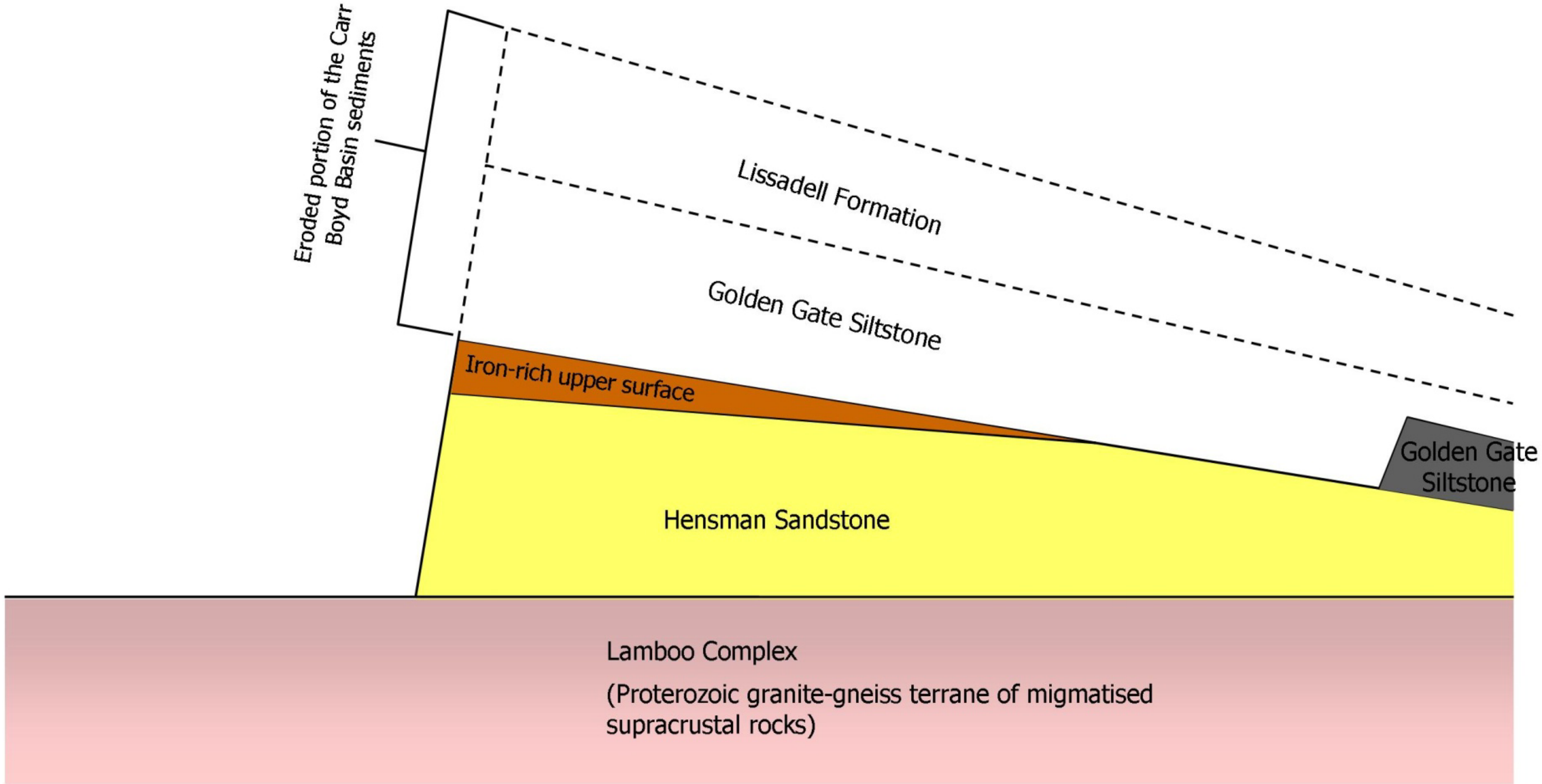

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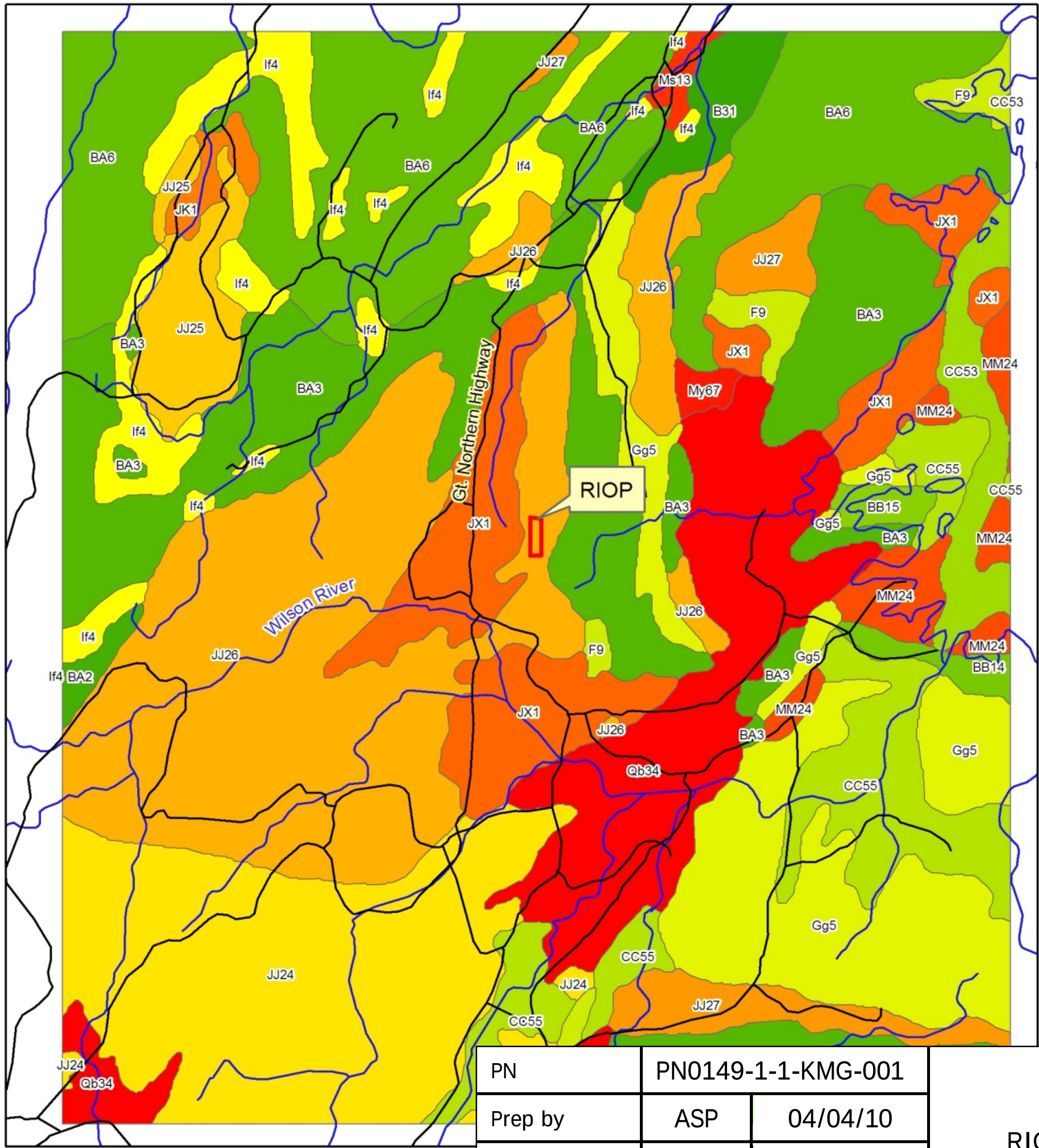
Kimberley Metals Group
RIOP SOIL AND WASTE CHARACTERISATION
SCHEMATIC GEOLOGICAL CROSS SECTION

Figure 2.9

soilwater



Legend

- Major Roads
- Major Drainage Lines

Soil - Landscape Unit

B31	Gently undulating sandy plains with small areas of low bouldery sandstone hills. Soils are typicall deep red and yellow siliceous sands.
BA2	Mountains sandstone country with narrow valleys cut into basalt. Soils are typically shallow sands with rock outcrop in elevated areas.
BA3	Rugged stony country - ridges, cuestas and plateau formed in sandstone, quartzite, shale and some limestone. Soils are typically shallow, often stony, sands and sandy loams.
BA6	Rugged stony country - ridges, cuestas and plateau with some sloping or low hilly dissected areas on sandstone, quartzite, shale and some limestone. Typical soils are shallow sands, often stony together with shallow stony loams.
BB14	Low hilly to undulating dissected limestone country with some steep low hills and ridges separated by deeply incised stream channels. Soils are typically shallow calcareous loams and shallow red loams.
BB15	Undulating to low hilly limestone country with scattered outcrops and boulders of limestone. Soils are typically shallow calcareous loams with minor grey and brown cracking clays.
CC53	Flat to gently sloping flood plains. Soils are typically grey and brown clays.
CC55	Gently sloping and undulating plains derived from intermediate and basic igneous rocks and mantled with stones. Soils are typically grey and brown clays with minor gilgai.
F9	Mountains and rocky ridges of metamorphic rocks (phyllites, schists and gneiss). Soils are typically shallow dense loamy soils and neutral red soils along valley plains.
Gg5	Remnant flat to gently undulting sandy laterite country. Soils are typically shallow leached sands, often gravelly, overlying solid laterite.
If4	Hilly country with mesas and buttes on basic igneous rocks. Soils are typically shallow dark pedal clays.
JJ24	Mountainous country developed from granitic rocks. Soils are typically shallow stony sands with considerable rock outcrop on crests and upper slopes.
JJ25	Granite domes with intervening alluvial plains. Soils are typically shallow gritty sandy soils.
JJ26	Rocky sandstone plateau and hills with minor lower slopes and deeply incised valleys. Soils are typically shallow sands with loams on lower slopes and valley floors.
JJ27	Undulating to hilly shaly country with some rock outcrops. Soils are typically shallow, often stony, sandy soils with minor shallow loams.
JK1	Rocky sandstone plateau and hills. Soils are typically shallow sands with minor shallow loams.
JX1	Valleys of undulating relief developed in granitic detritus with common granitic outcrops. Soils are typically shallow gritty yellow sands and gritty alkaline to neutral yellow mottled soils on lower slopes.
MM24	Gently undulating plain derived from limestone and shales with occasional limestone outcrops. Soils are typically brown and grey clays with gilgai microrelief.
Ms13	Low-lying alluvial plains. Soils are typically acid yellow earths with minor ironstone gravels.
My67	Gently undulating country derived from limestone and shales. Soils are typically neutral to alkaline red earths.
Qb34	Stony undulating country with scattered granitic residuals. Soils are typically neutral hard red earths and minor alkaline yellow mottled earths.

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Revision No.	0	

Kimberley Metals Group
RIOP SOIL AND WASTE CHARACTERISATION
REGIONAL SOILS

Figure 2.10

soilwater

3 STUDY METHODOLOGY

3.1 SOIL CHARACTERISATION

3.1.1 SOIL SAMPLE COLLECTION

Soil materials within the proposed Sam and Tony Pits and the waste dump areas were investigated by shallow trench excavation. Sampling was undertaken in August 2009 and the locations of the sampling sites are shown in Figure 3.1. Shallow trenches were excavated by hand to a maximum depth of 0.6 m (Plate 3.1), with 24 sites investigated across the proposed mining disturbance area.

Soil samples were collected at regular intervals down the surficial profile to ensure that any pedologic organisation or horizonation was identified and that each of the major soil materials was sampled. Approximately 3 kg of soil was collected for each material for detailed laboratory analysis (Section 3.1.2).

Plate 3.1: Sampling of the surficial soil materials in the proposed disturbance area

3.1.2 LABORATORY ANALYSIS

The physical and chemical properties of the various soil materials collected in the field were assessed in the laboratory. The properties listed in Table 3.1 were assessed for representative soil materials. Analysis of the physical properties was undertaken at Soil Water Analysis (SWA) Laboratories, whilst the chemical properties were assessed at CSBP Laboratories.

Table 3.1: Physical and chemical properties examined in the laboratory

Physical properties	Chemical properties
• Soil structure • Bulk density • Particle size distribution • Gravel content • Saturated hydraulic conductivity • Unsaturated hydraulic conductivity • Water retention properties	• Nutrients (Mineralised Nitrogen, Colwell Phosphorus and Potassium, and extractable Sulfur) • Organic carbon • pH • Electrical conductivity (salinity, EC) • Exchangeable cations (Calcium, Magnesium, Sodium and Potassium) • Cation exchange capacity (CEC) • Sodicity (Exchangeable sodium percentage – ESP)

All physical and chemical properties were assessed against standard Australian soil property criteria.

3.2 WASTE CHARACTERISATION

Waste materials at the RIOP are generally regarded as the uneconomic portion of the consolidated lateritic profile underlying the surface friable soils. Although the mine pits are planned to be backfilled with excavated waste materials, a proportion of this material will need to be stored in permanent above-ground waste dumps. In order to determine how these materials will behave during the construction and rehabilitation of the waste dumps, and whether they represent a risk to the surrounding environment, detailed laboratory investigation was undertaken to quantify the geochemical characteristics of these materials.

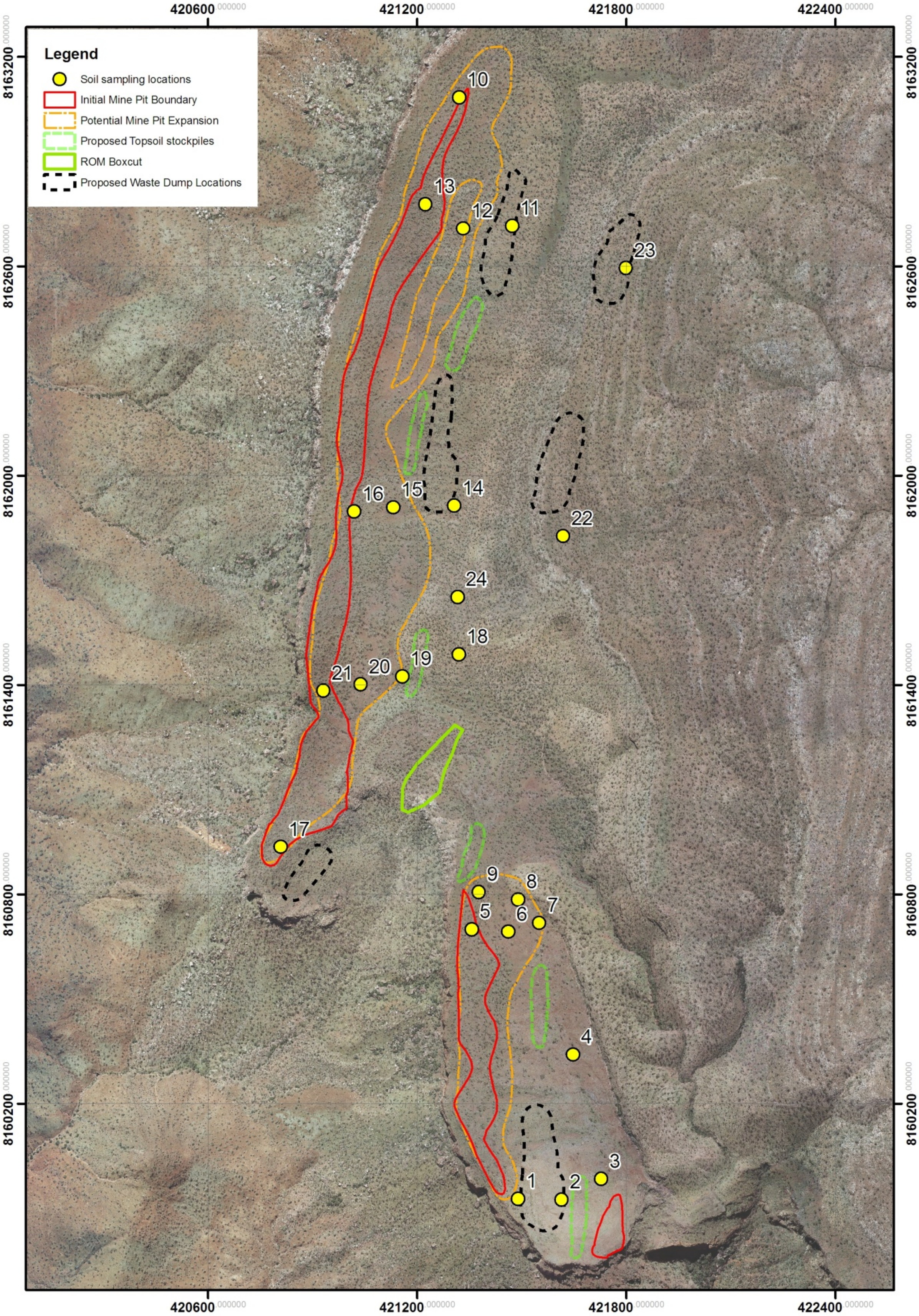
Representative samples of waste material likely to be stored in the waste dumps were selected following a review of the geological data and observation of intact drill cores. A total of 15 samples of waste material were selected for analysis (Table 3.2) and the properties assessed included:

- pH
- EC
- Dispersion (structural stability)
- Sodicity (ESP)
- Metals content (metals assessed - As, Ba, Cd, Co, Cr, Cu, Mn, Ni, Pb and Zn)
- Bioavailability or leachability of metals (using the Australian Standard Leaching Procedure - AS4439.3 - 1997, under both a neutral and a highly acidic leach environment)

The presence of potential acid forming (PAF) or acid rock drainage (ARD) materials was not tested as the redoximorphic conditions in which the waste materials exist is unlikely to facilitate sulfide formation or hosting of sulfide minerals. The lateritic profile exists in a highly weathered oxidising environment, and subsequently any PAF materials would have previously oxidised resulting in an acidic material. Measurement of the pH of the waste materials will identify if such oxidation of sulfides has occurred in the past.

Table 3.2: Waste materials selected for detailed laboratory analysis.

Drillhole ID	Depth (m)
RIDD 006	0 - 1
	1 - 2
	2 - 3
	3 - 4
	4 - 5
RIDD 007	0 - 1
	1 - 2
	2 - 3
RIDD 011	0 - 1
	1 - 2
	2 - 3
	3 - 4
RIDD 018	0 - 1
	1 - 2
	2 - 3



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PN	PN0149-1-1-KMG-001		Kimberley Metals Group RIOP SOIL AND WASTE CHARACTERISATION **SOIL SAMPLING LOCATIONS**	**Figure 3.1**
Prep. by	ASP	04/02/10		soilwater
Rev'd. by	MH	04/02/10		
Revision No.		0		

4 SOIL & WASTE CHARACTERISATION

4.1 SOILS CHARACTERISATION

4.1.1 Soil Mapping Units

Based on the evolutionary history of the project area and the morphological characteristics of the soil profiles exposed by trench excavation, three distinct Soil Mapping Units (SMU) were identified in the RIOP:

- SMU 1: Deep gravelly duplex
- SMU 2: Shallow gravel over ironstone
- SMU 3: Shallow gravel over siltstone.

The relationship between these SMU and the major soil groups of Western Australia (Schoknecht, 2001) and the Australia Soil Classification (Isbell, 1996) are presented in Table 4.1.

Table 4.1: Relationship between the SMU identified in this study and the major soil groups of Western Australian and the Australian Soil Classification.

SMU (Present study)	Major soil group, WA (Schoknecht, 2001)	Australian Soil Classification (Isbell, 1996)
1. Deep gravelly duplex	Deep sandy gravel	Ferric Chromosol
2. Shallow gravel over ironstone	Shallow gravel	Ferric - Petroferric Tenosol
3. Shallow gravel over siltstone	Shallow gravel	Ferric - Petroferric Tenosol

A detailed description of each SMU identified in this study is provided below, whilst their distribution across the study area is shown in Figure 4.1.

4.1.2 SMU 1: Deep gravelly duplex

This soil type or SMU occurs over the majority of the proposed mining disturbance area (Figure 4.1). A characteristic soil profile showing the physical and chemical properties of the soils is shown in Figure 4.2. It has negligible pedogeneic organisation and consists of 30 to 60+ cm of reddish brown gravelly loamy sand to gravelly sandy loam overlying a solid siltstone or ironstone base (Plate 4.1). The surface soils typically have gravel contents > 60 %, with the gravel fraction loosely set in the finer textured matrix. The particle size distribution within SMU 1 exhibits a defined toposequence, with the gravel fraction and gravel size decreasing with distance downslope and a corresponding increase in the silt and clay content (Table 4.2). This transition in particle size distribution with distance downslope is shown in Plate 4.2.

The high gravel fraction of the surface soils results in them having a high permeability (> 2 m/day). Subsequently, rainfall rapidly infiltrates the soil surface and recharges the soil moisture content, with minimal surface runoff. Any runoff that does occur (i.e. during high intensity storm events) is unlikely to cause significant erosion as the abundance of gravels and ironstone fragments on the surface (Plate 4.3) reduce the slope length and corresponding flow velocity; hence there is insufficient energy to detach the surface soil particles causing erosion; during the site visit no evidence of erosion of any surfaces was observed.

Plate 4.1: Typical soil profile in SMU 1.

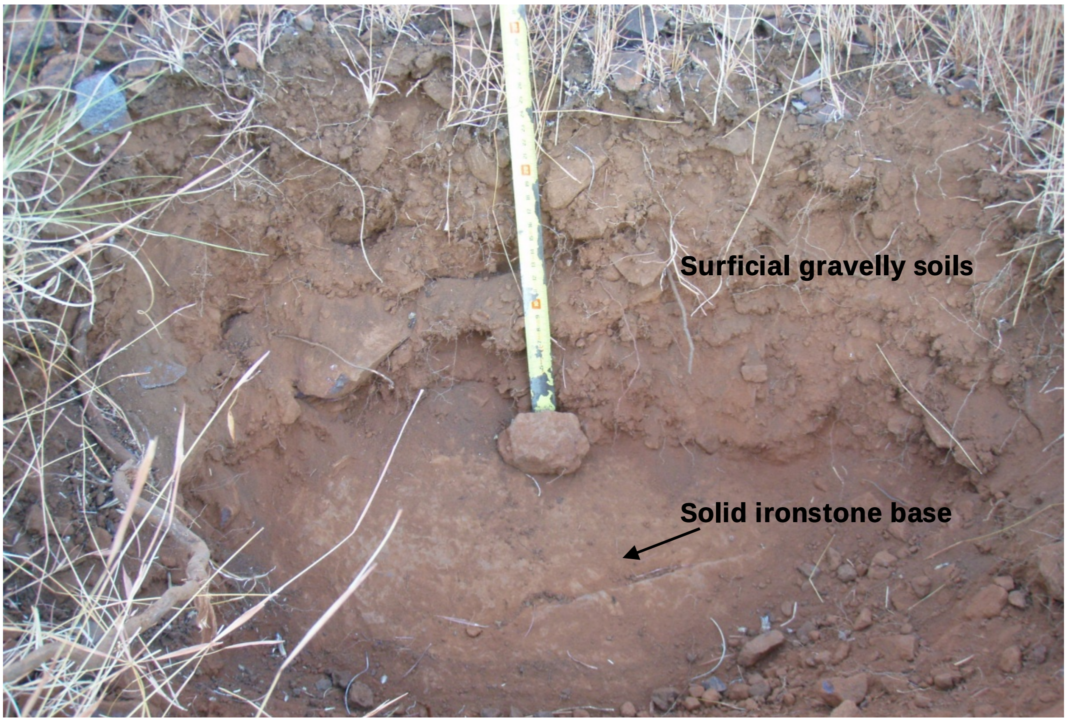


Plate 4.2: Nature of the surficial soils in SMU 1 with distance downslope.

Table 4.2: Variation in particle size distribution with distance downslope in SMU 1.

Slope location	Depth (cm)	Gravel fraction size distribution (%)				Gravel fraction (%)	Particle size distribution (< 2 mm soil fraction)		
		> 100 mm	100 - 60 mm	60 - 20 mm	20 - 2 mm		% Sand	% Silt	% Clay
Upper slope	0 - 10	10	30	40	20	80.4	77.9	10.7	11.4
	10 - 20	6	25	50	19	76.7	81.4	10.4	8.2
	20 - 30	-	-	-	-	77.3	-	-	-
	30 - 40	2	40	40	18	88.2	75.5	5.8	18.7
	40 - 50	-	-	-	-	75.9	-	-	-
Mid slope	0 - 10	1	20	18	60	71.5	64.8	16.5	18.7
	10 - 20	1	20	19	60	64.3	65.8	10.4	8.2
	20 - 30	-	-	-	-	66.2	-	-	-
	30 - 40	-	-	-	-	59.8	-	-	-
	40 - 50	1	15	44	40	53.2	64.4	9.0	26.7
Lower slope/valley floor	0 - 10	0	1	30	69	2.6	50.5	18.3	31.2
	10 - 20	0	1	20	79	2.3	45.2	21.0	33.8
	20 - 30	-	-	-	-	3.7	-	-	-
	30 - 40	0	1	25	74	4.2	40.9	25.6	33.5
	40 -50	-	-	-	-	4.6	-	-	-

The presence of the surface gravels also protects the surface soils from wind erosion. These soils, however, are highly susceptible to wind erosion once disturbed, as shown in Plate 4.4. This susceptibility is due to the relatively high fine silt and clay content in the finer fraction, which is highly mobile and easily dispersed by wind action. Dust control measures, such as spraying with non-saline water or use of chemical binding agents, will need to be applied during mining at this site to prevent the loss of this valuable soil resource and potential impact to surrounding vegetation (i.e. by coating their leaves and thus impacting on photosynthesis and transpiration).

Plate 4.3: Abundance of surface gravels protecting the soils from wind and water erosion.

The surficial gravelly soils in SMU 1 are slightly to very strongly acidic with pH values between 4 and 6 (Figures 4.3 and 4.4). This acidity is to be expected given the highly weathered nature of the soils and the dominance of iron oxides (i.e. ferrolysis results in the release of H^+ ions which cause the pH of the materials to be become acidic). All salts have been leached from the surface soils, resulting in EC values < 10 mS/m and sodicity values typically < 6 % (i.e. non-sodic soils; Figure 4.3 and 4.4). The surface soils are therefore structurally stable and non-dispersive.

As the surface soils in SMU 1 exhibit little pedogenic organisation no defined topsoil, as represented by a build-up of organic matter, is present. In the surface 10 cm of the profile there is an abundance of large to fine roots, and a slight accumulation of nutrients; although the soils generally have very low levels of mineralised N (< 8 mg/kg), plant available P (Colwell P: < 5 mg/kg), plant available K (Colwell K: 36 - 278 mg/kg) and extractable S (1.5 - 4 mg/kg).

Plate 4.4: High wind erosion potential of the surface soils in SMU 1.

4.1.3 SMU 2: Shallow gravel over ironstone

This soil type represents a truncated version of SMU 1, with the surface gravelly soils having a depth of < 30 cm (Plate 4.5). This SMU occurs in areas of considerable relief (i.e. > 20 ° slope; Plate 4.6), and subsequently the majority of the surface soil profile has been eroded.

The physical and chemical properties of the surface gravelly soils in SMU 2 are equivalent to those in SMU 1, emphasizing their common origin. The surface soils are friable, highly permeable and have a low hardsetting potential. They are also slightly to strongly acidic, non-saline, non-sodic and non-dispersive (Figure 4.5); these soils therefore exhibit optimal physical and chemical limitations for handling and utilisation.

The presence of the solid ironstone base close to the soil surface strongly influences the nature of the vegetation in SMU 2. The downward extension of roots is restricted by the ironstone and the roots of the vegetation are constrained to the shallow surface soils, developing a dominant lateral root system. This root distribution significantly limits the availability of soil moisture as the surface soils remain in a water deficit condition for the majority of the years as a result of their low water holding capacity. Consequently, the vegetation in SMU 2 is dominated by shallow-rooted, low transpiring grasses with trees only occurring in regions where the underlying ironstone is fractured, thus allowing roots to access moisture stored deeper in the soil profile.

Plate 4.5: Characteristic soil profile in SMU 2.

Plate 4.6: Location of SMU 2 on very steep slopes in SMU 1.

Plate 4.7: Transition from SMU 1 to SMU 2, marked by the change in vegetation structure from woodland to grassland.

4.1.4 SMU 3: SHALLOW GRAVEL OVER SILTSTONE

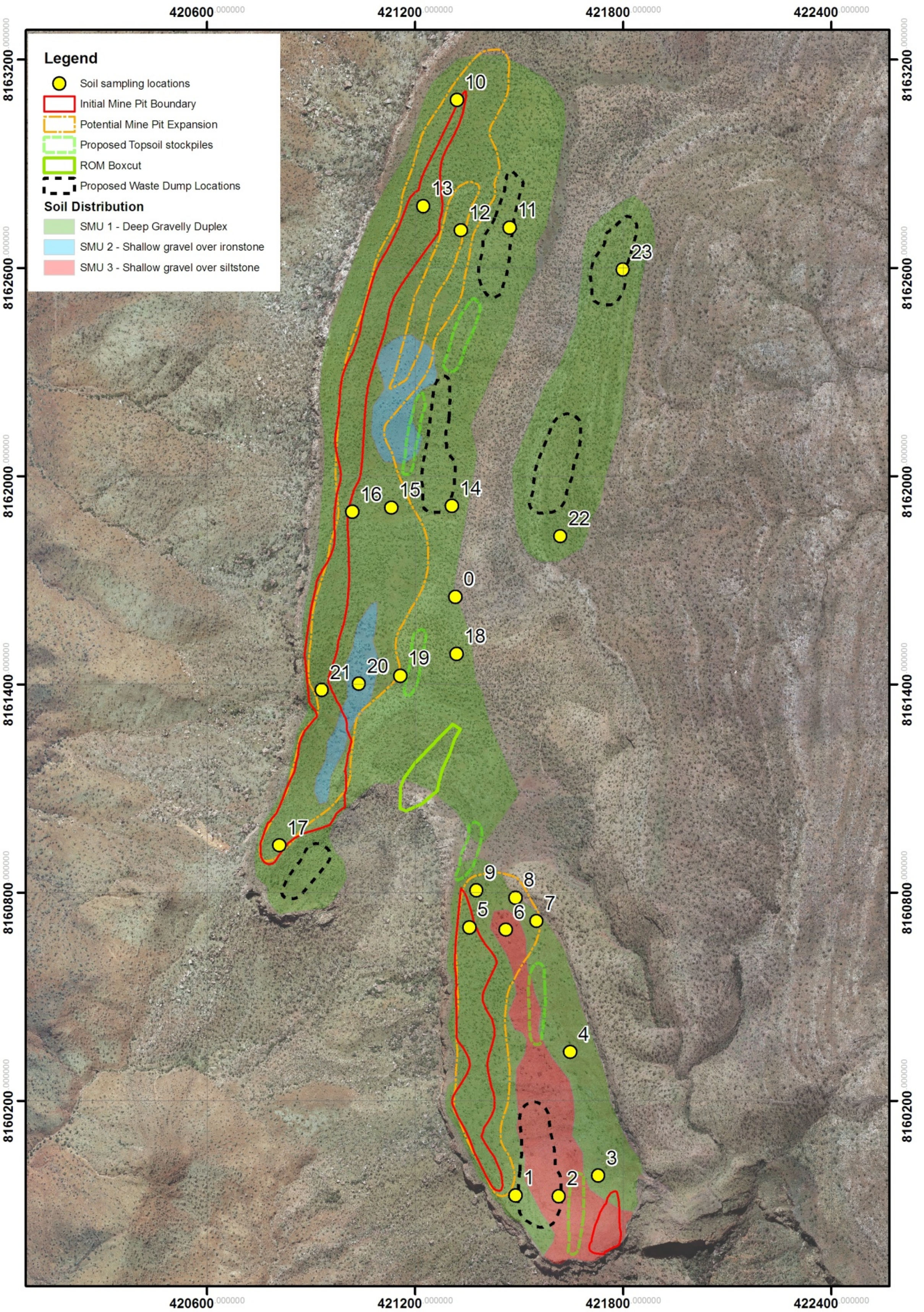
This soil type is restricted to the Tony Pit and corresponds to areas where unweathered remnant portions of the Golden Gate Siltstone (Section 2.5) occur at (Plate 4.8) or close to (i.e. < 10 cm of depth; Plate 4.9) the soil surface. The properties of the surficial gravelly soils are similar to those exhibited in SMU 1 and 2, and are slightly to strongly acidic, non-saline, non-sodic, structurally stable and non-erosive (Figure 4.5).

As with SMU 2, the thin surface soil cover restricts the distribution of trees and larger shrubs, and subsequently the vegetation in SMU 3 is dominated by grasses (Plate 4.10).

Plate 4.8: Presence of unweathered siltstone at the surface in SMU 3.

Plate 4.9: Presence of unweathered siltstone within the surface 10 cm of the profile in SMU 3.

Plate 4.10: Grass species dominating the surface in SMU 3.



PN	PN0149-1-1-KMG-001		Kimberley Metals Group RIOP SOIL AND WASTE CHARACTERISATION **SMU DISTRIBUTION**	**Figure 4.1**
Prep. by	ASP	04/02/10		soilwater
Rev'd. by	MH	04/02/10		
Revision No.		0		

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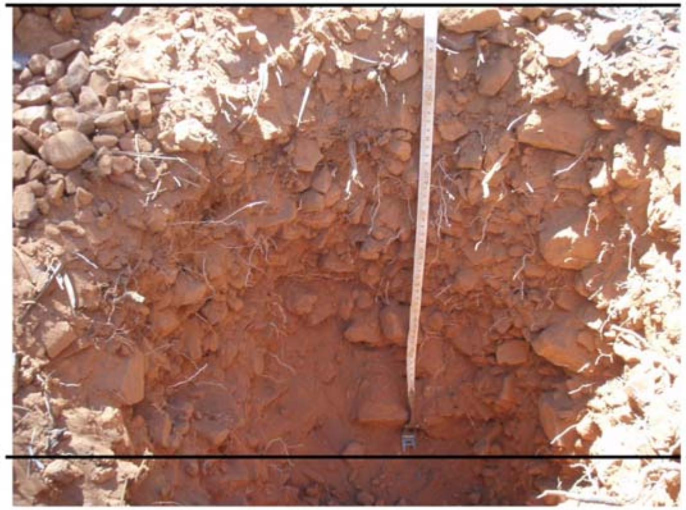
Figure #: 4.2- Characteristic soil profile for SMU 1 - Deep gravelly duplex	Easting: 421,021	Northing: 8,161,900	Trench No.: Trench 16

Morphological description:

Depth (cm)

0



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Horizon	Soil Material	Description
A	Red gravelly sandy loam	Reddish brown sandy loam with abundant (50 - 80 %) coarse (2 - 4 cm) angular gravel, single grain structured with very weak coherence, no pedologic organization, common roots growing through matrix, abrupt boundary to
B	Ironstone	Massive ironstone

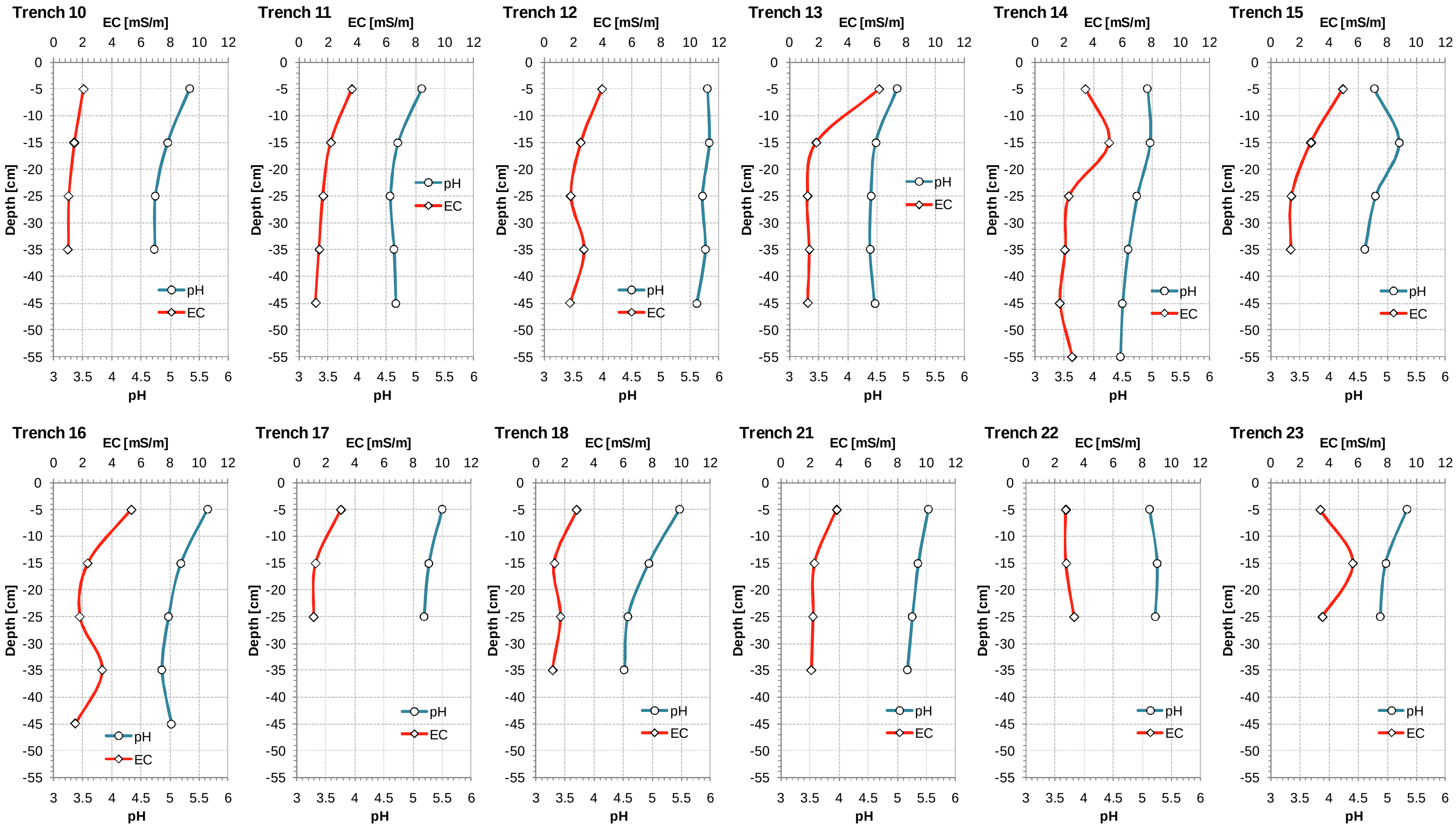
Soil properties:

Physical properties

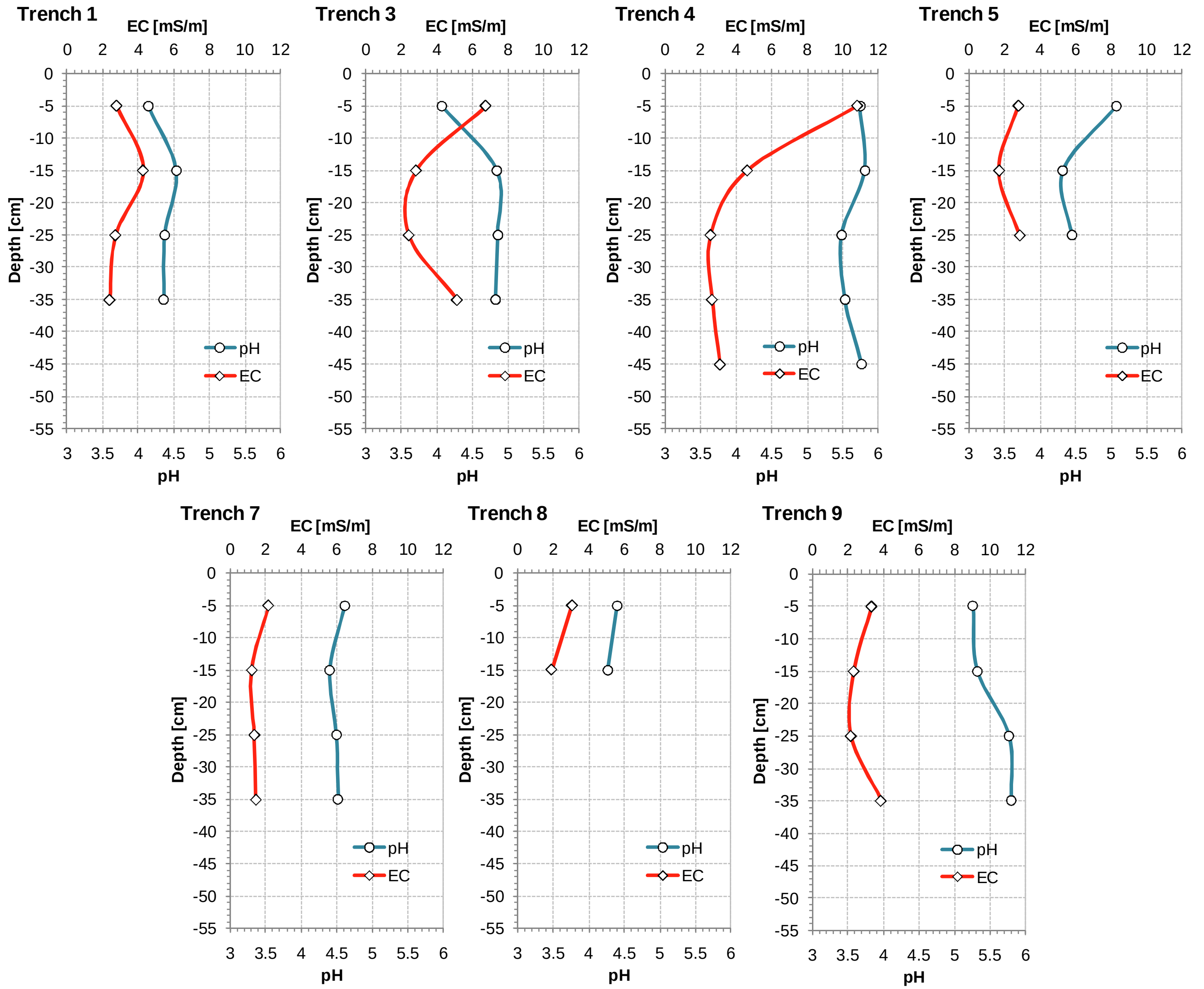
Depth (m)	Soil material	Structure	Particle size distribution				Bulk Density (g/cm^3)	Total porosity (%)	Soil Strength (MPa)	Saturated Hydraulic Conductivity (m/day)	Structural Stability		Hardsetting potential
			Sand (%)	Silt (%)	Clay (%)	Texture					Macro (slaking)	Micro (dispersive)	
0 - 10	Gravelly sandy loam	Single grain	83.57	10.79	5.64	Loamy sand	-	-	< 0.5	5.92	Very poor	Good	Very low
10 - 20		Single grain	82.25	10.94	6.81	Loamy sand	-	-	< 0.5	-	Very poor	Good	Very low
20 - 30		Single grain	79.35	7.13	13.52	Sandy loam	-	-	< 0.5	> 20	Very poor	Good	Very low
30 - 40		Single grain	77.17	7.45	15.39	Sandy loam	-	-	< 0.5	-	Very Poor	Good	Very low

Chemical Properties

Depth (m)	Soil material	Nutrients (mg/kg)					OrgC (%)	EC (mS/m)	pH_W	pH_{Ca}	PRI	Exchangeable Cations (meq/100g)					ESP
		NO_3^- -N	NH_4^+ -N	Colwell		Extr S											
				P	K							Ca	Mg	Na	K	CEC	
0 - 10	Gravelly sandy loam	1	1	2	165	3.7	1.76	1.7	5.9	4.9	-	1.87	0.44	0.06	0.35	2.72	2.21
10 - 20		1	1	3	165	10.5	1.26	1.7	5.2	4.2	-	1.33	0.29	0.07	0.29	1.98	3.54
30 - 40		1	1	4	124	11.9	0.45	2.7	5.1	4.2	-	1.73	0.34	0.11	0.21	2.39	4.60
40 - 50		1	2	2	78	14.5	0.54	3.6	5.4	4.5	-	3.70	0.51	0.15	0.16	4.52	3.32



PN	PN0149-1-1-KMG-001		Kimberley Metals Group RIOP SOIL AND WASTE CHARACTERISATION **pH AND EC DATA FOR SMU 1 SOILS - SAM PIT**	**Figure 4.3**
Prep by	ASP	04/04/10		soilwater
Rev'd by	MH	04/04/10		
Revision No.	0			



PN	PN0149-1-1-KMG-001		Kimberley Metals Group RIOP SOIL AND WASTE CHARACTERISATION **pH AND EC DATA FOR SMU 1 SOILS - TONY PIT**	**Figure 4.4**
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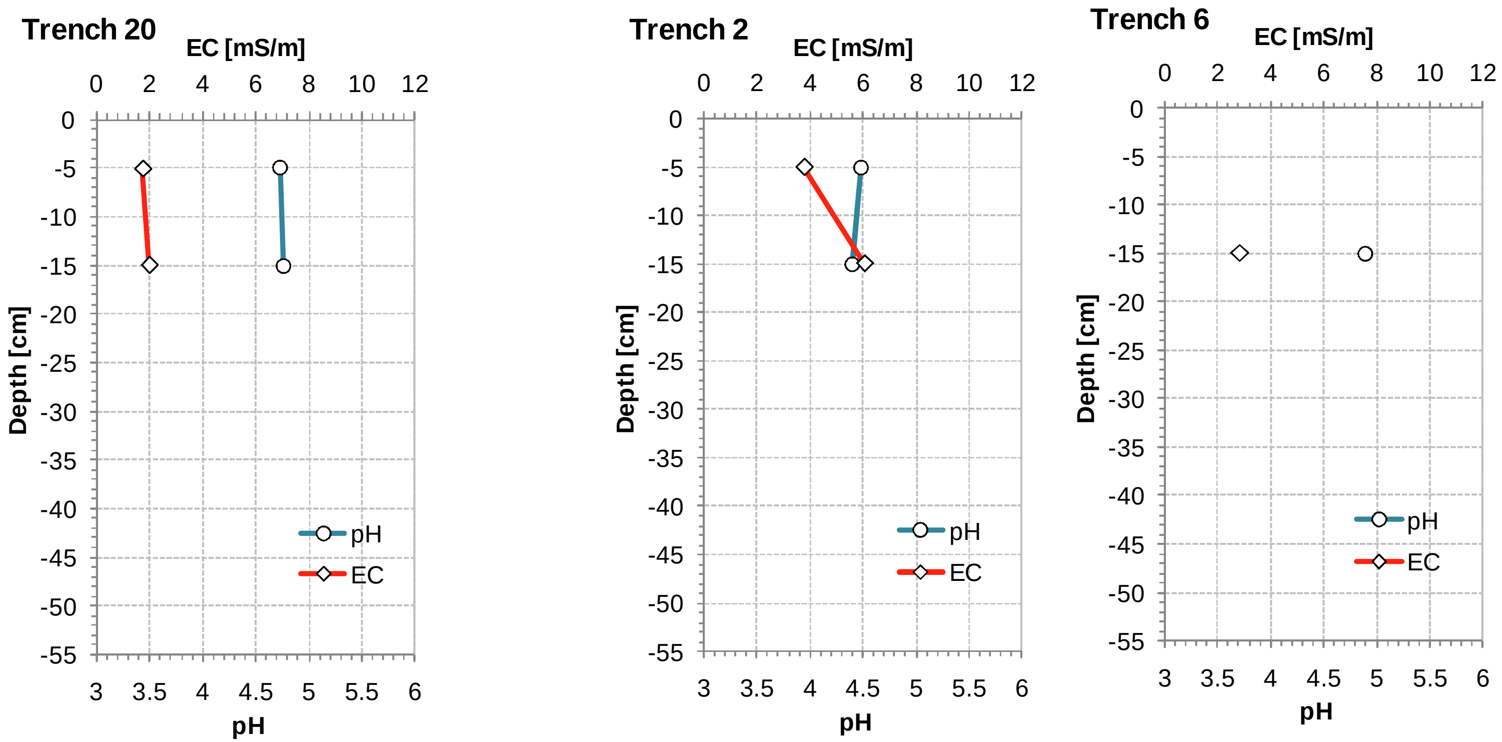
Rev'd by	MH	04/04/10		
Revision No.	0			

SMU 2 Surface Soils

SMU 3 Surface Soils



PN	PN0149-1-1-KMG-001		Kimberley Metals Group RIOP SOIL AND WASTE CHARACTERISATION **pH AND EC DATA FOR SMU 2 & 3 SOILS**	**Figure 4.5**
Prep by	ASP	04/04/10		soilwater
Rev'd by	MH	04/04/10		
Revision No.	0			

4.2 WASTE CHARACTERISATION

The results of the waste characterisation are provided in Tables 4.3 - 4.5.

The lateritic waste materials are typically slightly to strongly acidic, in response to their high iron content (i.e. ferrolysis releases H^+ into the soil solution), non-saline, non-sodic (ESP < 6 %) and non-dispersive (Emerson Dispersion Class 6). These materials are highly weathered and subsequently nearly all salts (including exchangeable Na^+) have been removed. The structural stability of these materials occurs in response to the low sodicity and aggregation by iron oxides. Even when excavated and fractured, the lateritised waste materials will remain structurally stable as negligible silt and clay contents occur; hence the < 2 mm size fraction rapidly settles out of solution, with no mobilisation or slaking of finer particles.

Table 4.3: Chemical properties of waste materials in the RIOP.

Drillhole ID	Depth (m)	pH	EC (mS/m)	Emerson Dispersion Class*	Exchangeable cation content (meg/100g)				CEC (meq/100g)	ESP (%)
					Ca	Mg	Na	K		
RIDD 006	0 - 1	6.65	30.3	Class 6	0.38	0.48	0.08	0.09	1.03	7.77
	1 - 2	6.11	4.96	Class 6	0.94	0.54	0.10	0.22	1.80	5.56
	2 - 3	5.04	1.60	Class 6	1.69	0.48	0.09	0.32	2.58	3.49
	3 - 4	4.73	1.68	Class 6	4.96	1.30	0.14	0.56	6.69	2.01
	4 - 5	5.16	57.9	Class 6	3.32	1.70	0.07	0.29	5.38	1.30
RIDD 007	0 - 1	7.23	6.59	Class 6	2.76	1.44	0.15	0.28	4.66	3.22
	1 - 2	6.73	29.7	Class 6	0.54	0.69	0.04	0.16	1.43	2.80
	2 - 3	5.69	2.15	Class 6	0.61	2.38	0.1	0.16	3.24	3.08
RIDD 011	0 - 1	5.98	2.35	Class 6	4.92	1.53	0.03	0.32	6.80	0.44
	1 - 2	6.24	3.36	Class 6	1.76	1.02	0.03	0.11	1.91	1.57
	2 - 3	6.15	2.96	Class 6	14.14	7.88	0.04	0.65	22.71	0.18
	3 - 4	6.37	2.76	Class 6	1.54	2.15	0.03	0.31	4.03	0.74
RIDD 018	0 - 1	6.86	8.21	Class 6	4.05	1.00	0.03	0.23	5.31	0.56
	1 - 2	6.27	2.98	Class 6	1.27	0.63	0.02	0.20	2.12	0.94
	2 - 3	5.62	2.35	Class 6	1.30	0.59	0.02	0.19	2.10	0.95

* Emerson Dispersion Class: Class 6 - Non dispersive (flocculated) in both a undisturbed and disturbed condition.

The metals content of the waste materials is shown in Table 4.4. In these materials only As is elevated. But although As is enriched, the bioavailability results shown in Table 4.5 indicate that it is not mobile, either under a neutral or highly acidic leaching environment. It is therefore likely that the high As concentration represents structural elements in the iron-rich materials (i.e. through isomorphic substitution), and is not readily exchangeable or released into the environment.

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Table 4.4: Metals content and relative enrichment for the various waste materials tested. Values highlighted in Red are significant enrichment, whilst those in Green represent slight enrichments.

	Element	As		Ba		Cd		Co		Cr		Cu		Mn		Ni		Pb		Zn	
	ACA*	1.5		500		0.11		20		100		50		950		130		14		75	
Sample #	Depth (m)	Metal content	GAI†	Metal content	GAI	Metal content	GAI	Metal content	GAI	Metal content	GAI	Metal content	GAI	Metal content	GAI	Metal content	GAI	Metal content	GAI	Metal content	GAI
		(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)	
RIDD 006	0 - 1	24	3	137.7	0	0.3	1	4.1	0	41	0	141	1	78	0	12	0	22	0	10	0
	1 - 2	18	3	86	0	0.4	1	3.1	0	145	0	119	1	83	0	30	0	24	0	11	0
	2 - 3	26	4	138.3	0	0.2	0	6	0	6	0	92	0	209	0	11	0	57	1	13	0
	3 - 4	27	4	31.4	0	0.2	0	20.4	0	17	0	107	1	430	0	15	0	89	2	64	0
	4 - 5	48	4	9.6	0	<0.1	0	38.7	0	7	0	85	0	1157	0	12	0	157	3	86	0
RIDD 007	0 - 1	38	4	8.4	0	<0.1	0	9.2	0	16	0	14	0	87	0	7	0	7	0	2	0
	1 - 2	36	4	16.5	0	<0.1	0	20.8	0	8	0	27	0	130	0	6	0	6	0	2	0
	2 - 3	69	5	6.2	0	<0.1	0	10.3	0	9	0	30	0	31	0	6	0	6	0	<1	0
RIDD 011	0 - 1	97	5	55.1	0	0.2	0	2.2	0	38	0	253	2	12	0	11	0	16	0	4	0
	1 - 2	93	5	55.3	0	0.2	0	2.2	0	42	0	234	2	17	0	12	0	14	0	3	0
	2 - 3	94	5	64	0	0.3	1	1.7	0	48	0	225	2	5	0	11	0	13	0	2	0
	3 - 4	92	5	5.3	0	<0.1	0	25	0	8	0	124	1	226	0	7	0	20	0	40	0
RIDD 018	0 - 1	79	5	4.6	0	<0.1	0	9.7	0	13	0	129	1	140	0	6	0	17	0	3	0
	1 - 2	212	7	6.7	0	0.2	0	5.7	0	19	0	183	1	57	0	9	0	23	0	4	0
	2 - 3	110	6	5.4	0	0.2	0	6.2	0	23	0	204	1	104	0	13	0	11	0	10	0

* ACA = Average Crustal Abundance
† GAI = Global Abundance Index

Table 4.5: Bioavailability of metals within the various materials under both a neutral (pH 5.5 - 6.5) and high acidic (pH 2.5) leaching environment.

Neutral Solution (pH 5.5 - 6.5)																					
Element		**As**		**Ba**		**Cd**		**Co**		**Cr**		**Cu**		**Mn**		**Ni**		**Pb**		**Zn**	
		Leachate concentration	Proportion leached	Leachate concentration	Proportion leached	Leachate concentration	Proportion leached	Leachate concentration	Proportion leached	Leachate concentration	Proportion leached	Leachate concentration	Proportion leached	Leachate concentration	Proportion leached	Leachate concentration	Proportion leached	Leachate concentration	Proportion leached	Leachate concentration	Proportion leached
Sample ID	Depth (m)	mg/L	%	mg/L	%	mg/L	%	mg/L	%	mg/L	%	mg/L	%	mg/L	%	mg/L	%	mg/L	%	mg/L	%
RIDD 006	0 - 1	0.0009	0.0000016	0.0528	0.000203	<0.00002	0	0.0007	0.0000008	<0.1	0.000198	<0.1	0.000168	<0.1	0.000198	<0.1	0.000198	<0.2	0.0004	<0.1	0.000124
	1 - 2	0.0008	0.0000012	0.0453	0.000173	<0.00002	0	0.0003	0	<0.1	0.000198	<0.1	0.000168	<0.1	0.000198	<0.1	0.000198	<0.2	0.0004	<0.1	0.000124
	2 - 3	<0.0005	0	0.0477	0.000183	0.00003	0	0.0005	0	<0.1	0.000198	<0.1	0.000168	<0.1	0.000198	<0.1	0.000198	<0.2	0.0004	<0.1	0.000124
	3 - 4	<0.0005	0	0.0502	0.000193	0.00004	0	0.001	0.000002	<0.1	0.000198	<0.1	0.000168	<0.1	0.000198	<0.1	0.000198	<0.2	0.0004	<0.1	0.000124
	4 - 5	<0.0005	0	0.0504	0.000194	0.00004	0	0.0014	0.0000036	<0.1	0.000198	<0.1	0.000168	<0.1	0.000198	<0.1	0.000198	<0.2	0.0004	0.2	0.000724
RIDD 007	0 - 1	<0.0005	0	0.0411	0.000156	0.00002	0	0.0018	0.0000052	<0.1	0.000198	<0.1	0.000168	0.1	0.000398	<0.1	0.000198	<0.2	0.0004	<0.1	0.000124
	1 - 2	<0.0005	0	0.0349	0.000132	0.00003	0	0.0009	0.0000016	<0.1	0.000198	<0.1	0.000168	<0.1	0.000198	<0.1	0.000198	<0.2	0.0004	<0.1	0.000124
	2 - 3	<0.0005	0	0.0245	0.00009	<0.00002	0	0.0003	0	<0.1	0.000198	<0.1	0.000168	<0.1	0.000198	<0.1	0.000198	<0.2	0.0004	<0.1	0.000124
RIDD 011	0 - 1	<0.0005	0	0.0375	0.000142	<0.00002	0	0.0001	0	<0.1	0.000198	<0.1	0.000168	<0.1	0.000198	<0.1	0.000198	<0.2	0.0004	<0.1	0.000124
	1 - 2	0.0006	0.0000004	0.0489	0.000188	<0.00002	0	0.0002	0	<0.1	0.000198	<0.1	0.000168	<0.1	0.000198	<0.1	0.000198	<0.2	0.0004	<0.1	0.000124
	2 - 3	0.0008	0.0000012	0.0415	0.000158	<0.00002	0	0.0001	0	<0.1	0.000198	<0.1	0.000168	<0.1	0.000198	<0.1	0.000198	<0.2	0.0004	<0.1	0.000124
	3 - 4	<0.0005	0	0.0331	0.000124	<0.00002	0	<0.0001	0	<0.1	0.000198	<0.1	0.000168	<0.1	0.000198	<0.1	0.000198	<0.2	0.0004	<0.1	0.000124
RIDD 018	0 - 1	<0.0005	0	0.0193	6.92E-05	<0.00002	0	0.0002	0	<0.1	0.000198	<0.1	0.000168	<0.1	0.000198	<0.1	0.000198	<0.2	0.0004	<0.1	0.000124
	1 - 2	<0.0005	0	0.0324	0.000122	<0.00002	0	<0.0001	0	<0.1	0.000198	<0.1	0.000168	<0.1	0.000198	<0.1	0.000198	<0.2	0.0004	<0.1	0.000124
	2 - 3	<0.0005	0	0.0309	0.000116	<0.00002	0	<0.0001	0	<0.1	0.000198	<0.1	0.000168	<0.1	0.000198	<0.1	0.000198	<0.2	0.0004	<0.1	0.000124

Table 4.5 continued...

Acidic solution (pH 2.5)																					
Element		**As**		**Ba**		**Cd**		**Co**		**Cr**		**Cu**		**Mn**		**Ni**		**Pb**		**Zn**	
		Leachate concentration	Proportion leached	Leachate concentration	Proportion leached	Leachate concentration	Proportion leached	Leachate concentration	Proportion leached	Leachate concentration	Proportion leached	Leachate concentration	Proportion leached	Leachate concentration	Proportion leached	Leachate concentration	Proportion leached	Leachate concentration	Proportion leached	Leachate concentration	Proportion leached
Sample #	Depth (m)	mg/L	%	mg/L	%	mg/L	%	mg/L	%	mg/L	%	mg/L	%	mg/L	%	mg/L	%	mg/L	%	mg/L	%
RIDD 006	0 - 1	0.0005	0	0.1537	0.000603	0.00004	0	0.0153	0.0000592	<0.1	0.000198	<0.1	0.00014	0.5	0.001988	<0.1	0.000198	<0.2	0.0004	<0.1	0.000112
	1 - 2	0.0007	0.0000008	0.0936	0.000362	0.00004	0	0.0009	0.0000016	<0.1	0.000198	<0.1	0.00014	0.2	0.000788	<0.1	0.000198	<0.2	0.0004	<0.1	0.000112
	2 - 3	<0.0005	0	0.0461	0.000172	0.00003	0	0.0009	0.0000016	<0.1	0.000198	<0.1	0.00014	0.1	0.000388	<0.1	0.000198	<0.2	0.0004	<0.1	0.000112
	3 - 4	0.0011	0.0000024	0.0636	0.000242	0.00002	0	0.0013	0.0000032	<0.1	0.000198	<0.1	0.00014	<0.1	0.000188	<0.1	0.000198	<0.2	0.0004	<0.1	0.000112
	4 - 5	0.0005	0	0.0501	0.000188	0.00003	0	0.002	0.000006	<0.1	0.000198	<0.1	0.00014	<0.1	0.000188	<0.1	0.000198	<0.2	0.0004	0.2	0.000712
RIDD 007	0 - 1	<0.0005	0	0.0755	0.00029	0.00003	0	0.0065	0.000024	<0.1	0.000198	<0.1	0.00014	0.3	0.001188	<0.1	0.000198	<0.2	0.0004	0.2	0.000712
	1 - 2	<0.0005	0	0.0648	0.000247	0.00003	0	0.0026	0.0000084	<0.1	0.000198	<0.1	0.00014	0.2	0.000788	<0.1	0.000198	<0.2	0.0004	0.1	0.000312
	2 - 3	0.0007	0.0000008	0.0345	0.000126	0.00003	0	0.0005	0	<0.1	0.000198	<0.1	0.00014	<0.1	0.000188	<0.1	0.000198	<0.2	0.0004	<0.1	0.000112
RIDD 011	0 - 1	<0.0005	0	0.0589	0.000224	0.00033	0.0000011	0.0029	0.0000096	<0.1	0.000198	<0.1	0.00014	<0.1	0.000188	<0.1	0.000198	<0.2	0.0004	<0.1	0.000112
	1 - 2	0.0008	0.0000012	0.0852	0.000329	0.00002	0	0.0031	0.0000104	<0.1	0.000198	<0.1	0.00014	<0.1	0.000188	<0.1	0.000198	<0.2	0.0004	<0.1	0.000112
	2 - 3	<0.0005	0	0.0623	0.000237	0.00002	0	0.0006	0.0000004	<0.1	0.000198	<0.1	0.00014	<0.1	0.000188	<0.1	0.000198	<0.2	0.0004	<0.1	0.000112
	3 - 4	<0.0005	0	0.0371	0.000136	<0.00002	0	0.0014	0.0000036	<0.1	0.000198	<0.1	0.00014	<0.1	0.000188	<0.1	0.000198	<0.2	0.0004	<0.1	0.000112
RIDD 018	0 - 1	0.001	0.000002	0.0347	0.000127	0.00003	0	0.0014	0.0000036	<0.1	0.000198	<0.1	0.00014	<0.1	0.000188	<0.1	0.000198	<0.2	0.0004	<0.1	0.000112
	1 - 2	<0.0005	0	0.0671	0.000256	0.00004	0	0.0019	0.0000056	<0.1	0.000198	<0.1	0.00014	<0.1	0.000188	<0.1	0.000198	<0.2	0.0004	<0.1	0.000112
	2 - 3	0.0006	0.0000004	0.0495	0.000186	0.00004	0	0.0008	0.0000012	<0.1	0.000198	<0.1	0.00014	<0.1	0.000188	<0.1	0.000198	<0.2	0.0004	<0.1	0.000112

5 SOIL AND WASTE MATERIAL MANAGEMENT

From the results presented in Section 4 the following soil material management units (SMMU) were identified:

- Topsoil
- Subsoil
- Waste material

Each of these materials exhibits specific physical and chemical properties that may either benefit or limit their handling and utilisation during mining, rehabilitation and closure. Careful management of these soils is therefore required to ensure rehabilitation success and subsequent closure is not impacted, and that the environmental risks to the surrounding environment are kept to a minimum.

5.1 TOPSOIL

Although there is negligible profile differentiation in surface soils across the site, topsoil has been delineated as the the surface 0 - 10 cm of the profile. This soil layer has slightly elevated nutrient and organic matter levels, compared to the deeper soil materials, and it is likely that the majority of the soil stored native vegetation seed occurs in this layer. It is therefore recommended that this soil layer be preferentially stripped and stockpiled separately from the deeper soil materials for use in rehabilitation.

Topsoils within the proposed mining area consist of a friable gravelly loamy sand to sandy loam that is non-saline, non-sodic, and structurally stable with a high permeability in response to its high gravel fraction. They therefore have optimal soil properties for use in rehabilitation and can be easily handled and utilised. All temporary topsoil stockpiles should not exceed 2 m in height to maintain the soils biological activity and native seed viability.

5.2 SUBSOIL

The morphological, physical and chemical properties of the subsoil materials are very similar to the overlying topsoils consisting of a friable, non-saline, non-sodic and structurally stable gravelly loamy sand to sandy loam. The subsoil represents a critical soil layer that facilitates the establishment of vegetation on the escarpment. The friable nature of the subsoil materials enables roots of the vegetation to expand laterally and access fracture surfaces in the underlying consolidated ironstone or siltstone. A strong correlation between depth of subsoil and vegetation composition and structure is clearly evident at this site. It is therefore recommended that all friable gravelly material beneath the topsoil (0 - 10 cm soil layer) and overlying the ironstone/siltstone basement is stripped and stockpiled as a subsoil for later use in rehabilitation. For volume calculations a subsoil depth of 10 - 40 cm can be used within SMU 1. In SMU 2 and 3 the thickness of subsoil will generally be < 10 cm.

Subsoil materials in all soil types are unlikely to contain an appreciable biological component or native seed store and subsequently there is no restriction to the height in which they can be stockpiled. Given their friable gravelly nature, these materials can easily be handled and utilised.

5.3 WASTE MATERIAL

Waste materials represent all consolidated soils below the surficial gravels, corresponding to the highly weathered ironstone and siltstone. These materials are non-saline, non-sodic, structurally stable and non-dispersive. Although these materials contain considerable enrichment of As, it is not readily available or mobile under a range of leaching environments; hence it has a very low bioavailability and represent a low risk to the surrounding environment.

Excavation of the lateritic waste materials to access the underlying orebody will result in fracturing of this material and a subsequent reduction in particle/aggregate size (diameter). A gravel-rich material, with a minor < 2 mm soil fraction, will likely be produced and based on the testwork undertaken during this study these gravels will be structurally stable, non-dispersive and non-erosion. There is therefore no restriction on the utilisation of this material in the construction of the permanent waste dumps.

5.4 MINE PIT REHABILITATION

To reduce the volume of material to be stored in waste dumps onsite, KMG have proposed to backfill and rehabilitate the mine voids. A progressive backfill strategy will be implemented whereby excavated waste material is continuously backfilled into the advancing mined-out void. Topsoil and Subsoil materials will then be placed over the waste to rehabilitate the soil profile. To facilitate post-mine revegetation of the mine voids it is recommended that the following profile is reconstructed:

- Topsoil (0 - 10 cm): the presence of the native seed store should facilitate rapid revegetation establishment and growth. Direct seeding may be required to supplement or return recalcitrant species and to improve the species richness, plant density and foliage cover so that the closure objectives can be achieved in a timely manner.
- Subsoil (10 - 40 cm): a minimum of 30 cm of subsoil should be spread over areas where trees are to be re-established. The thickness of returned subsoil should be recorded so that areas that receive < 30 cm can easily be identified and revegetated with shallow-rooted, low transpiring revegetation species (i.e. grasses).
- Waste material (> 40 cm).

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6 REFERENCES

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Appendix 2: Matsu Key Characteristics

Key Project Characteristics

Summary of the Proposal	
Proposal Title	Ridges Iron Ore Project (RIOP) – Matsu Project
Proponent Name	Kimberley Metals Group Proprietary Limited (KMG)
Short Description	KMG developed the RIOP in the Kimberley region of Western Australia (WA) in late 2010, with operations commencing in 2011. The RIOP produces 1.5 to 2.0 million tonnes of iron ore fines per annum and consists of the Mine Site 165 km south of Wyndham and Barge Loading Facility (BLF) at Wyndham. KMG is currently mining two ore bodies at the RIOP known as Sam and Tony. To maintain continuous feed as the Sam and Tony deposits near completion, KMG is now proposing to develop a satellite ore body known as the Matsu deposit; located approximately 10km south-southeast of the existing RIOP. The Matsu Project will consist of an open cut (terraced mining of a ridge) operation at the Matsu deposit, waste rock dump (Matsu WRD), access track/haul road route, as well as support infrastructure (Matsu Project). The Matsu mineralisation is located near the surface; the resultant open pit will therefore be very shallow with minimal overburden. Continuous mining technology and conventional drill and blast mining, which have been successful at the Sam and Tony deposits, will be utilised as the primary mining methods at Matsu. Ore will likely be hauled to the existing Run of Mine (ROM) stockpile at the RIOP, although options for establishing a ROM pad and crushing facility near the Matsu deposit are being investigated. Waste rock material will be placed on the Matsu WRD, although backfilling of waste rock into the pit will be preferentially undertaken, as is the current practice at the existing RIOP deposits.

Physical Elements		
Element	***Location***	***Extent***
Ground Disturbance	EPA Referral Figure 2, Attachment 1	The Matsu Project involves a total disturbance footprint of approximately 150ha, including disturbance for the pit, WRD, access track, stockpiles and associated infrastructure. This disturbance is likely to occur within three development envelopes, namely: the access route, the deposit and the processing area. More specific disturbance figures relating to operations within the development envelopes will be determined once the access track/haul road route and infrastructure footprints have been finalised. Areas that have already been disturbed will be utilised as much as possible to reduce new ground disturbance.

Operational Elements		
Element	***Location***	***Extent***
Mining		
Depth of Mine	-	Up to 10 m
Ore (Maximum)	EPA Referral Figure 2, Attachment 1	3.37 Mt total ore will be hauled to the existing Run of Mine (RoM) stockpile at the RIOP Mine Site for blending and crushing. The product will then be stockpiled to await haulage to the RIOP Barge Loading Facility (BLF) at Wyndham.
Mineralised Waste Materials (Maximum)	EPA Referral Figure 2, Attachment 1	0.8 Mt total. Waste rock will be placed on the Matsu WRD.
Transportation		
Transport Method	-	110 tonne capacity quad road trains.
Truck Movements	-	The RIOP requires an average of 37 trucks per day to haul to the BLF.
Export	-	One ship is currently loaded every two weeks over a period of five days.
Water		
Dewatering	-	N/A. Mining will remain above the water table.
Requirements	-	The RIOP is currently extracting water under a *5C Licence to Take Water*; the annual water entitlement for the RIOP under this licence is 150,000 kL. The additional water requirements for the Matsu Project may be either (a) extracted from current bores and remain within this water entitlement with the licence amended to incorporate water use at the Matsu Project or (b) an additional bore/s will be installed at Matsu and a new licence obtained.

Appendix 3: Matsu Biological Survey

PROVISIONAL LEVEL 1 BIOLOGICAL SURVEY

RIOP MATSU PROJECT

EAST KIMBERLEY, WESTERN AUSTRALIA

March 2014

BIOLOGICAL SURVEY OF THE RIGDES IRON ORE PROJECT
MATSU PROJECT

animal plant mineral

Prepared by Animal Plant Mineral Pty Ltd for Kimberley Metals Group Ltd

KMG032 – Kimberley Metals Group Ltd. Level 1 Biological Survey for the RIOP Matsu Project

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EXECUTIVE SUMMARY

Kimberley Metals Group Ltd commissioned Animal Plant Mineral Pty Ltd to provide a Level 1 flora and vegetation survey and a Level 1 fauna survey of the RIOP Matsu Project located approximately 10 km south east of the current Ridges Iron Ore Project mine site which is located approximately 165 km south of Wyndham in the East Kimberley region of Western Australia.

The RIOP Matsu Project consists of three Development Envelopes; 1) Deposit Development Envelope, 2) Access Track Development Envelope, 3) Processing Development Envelope. These Development Envelopes were delineated and known as the Survey area and the subject of the Level 1 biological survey

The Level 1 flora and vegetation assessment comprised a desktop assessment of all relevant information of value in describing the floristic attributes of the Survey area. The desktop assessment was augmented with some ground-truthing field survey work done by helicopter and foot traverses in May 2012. During the field survey significant effort was focussed on the search for Rare / Priority Flora and Priority / Threatened Ecological Communities.

The Survey area is situated within the Ord Victoria Plain bioregion, lies with four Landsystems; Wickham, MacPhee, Pompey and Dockrell and does not include any lands considered as Environmentally Sensitive areas under Section 51B of the *EP Act.*

The desktop assessment and ground survey identified the occurrence of 13 plant communities within the Survey area. Two of these communities are listed as Priority Ecological Communities by the Department of Environment and Conservation. Plant Assemblages on Vertical Sandstone Surfaces were located within the boundaries of the Matsu Deposit and near to the Access Track. Monsoon Vine Thickets were not found within the boundaries of the Survey area, however, they were found in close proximity.

A total of 197 taxa (species, subspecies and varieties) from 53 families and 115 genera were recorded in the course of the field survey of the Deposit Development Envelope. No flora of conservation significance, pursuant to subsection 2 of section 23F of the *Wildlife Conservation Act 1950* (WA) and no plant taxa pursuant to section 179 of the *Environment Protection Biodiversity Conservation Act 1999* (Cth) were located in the Survey area.

The database searches showed a potential of 40 Priority taxa, as defined by the Department of Parks and Wildlife, with the potential to occur in the Survey area. Nine priority taxa were located during the field survey. These were Priority 1 species *Corymbia cadophora* subsp. *polychroma, Jacquemontia* sp. Keep River (J.L. Egan 5051) and *Triodia cremnophila*, Priority 2 species *Eucalyptus ordiana*, Priority 3 species *Brachychiton tridentatus*, Priority 4 species *Grevillia minuata, Kunzea* sp. Keep River and *Triodia* sp. Argyle (aff. cunninghamii) which is currently being nominated for priority status and *Acacia lycopodiifolia* (prostate form) which is currently under taxonomic review.

Of the 197 taxa recorded in the Matsu Deposit four were introduced (weed) species. These were **Calotropis procera, *Cenchrus americanus, *Melinis repens* and **Passiflora foetida*. Both **Calotropis procera* and **Passiflora foetida* are classified as 'invasive' under the Invasive Plant Prioritisation Process (DEC 2012b) with medium and high ecological impact respectively.

The Level 1 terrestrial fauna assessment comprised a desktop assessment of all relevant information of value in describing the fauna and fauna habitat values of Survey area. In addition, a targeted field survey of the Matsu Development Envelope was undertaken that recorded bird and bat species richness and assessed the potential presence of Northern Quoll *Dasyurus hallucatus* using an Elliot trapping array for 467 trap nights.

The desktop survey produced a list of 244 vertebrate fauna species (118 birds, 34 mammals, 74 reptiles and 18 amphibians) that could potentially occur in the Survey area, eight of which are protected under the *Environment Protection and Biodiversity Conservation Act*, the *Wildlife Conservation Act* or are a declared

Priority species by the Department of Environment and Conservation. The field survey of the Matsu Deposit identified 44 bird species, 10 bat species and four non-volant mammal species. No Northern Quoll were recorded during the targeted survey. Three conservation significant species were recorded during the field surveys (Rainbow Bee-eater, Orange Leafnosed-bat and Ghost Bat) and a further five are likely to occur in the project area (Fork-tailed Swift, Gouldian Finch, Pictorella Mannikin, Peregrine Falcon and Northern Leafnosed-bat).

Using the APM database from fauna surveys conducted across the Ridges Iron Ore Project and neighbouring Argyle Diamond Mine are taken into account a total of 96.5% of the expected fauna species have been recorded in the local area surrounding the RIOP Matsu Project.

Five distinct fauna habitats were identified in the Survey area; Undulating Plains habitat, Gullies and Ephemeral Drainages habitat, Open Eucalypt Woodland on Rocky Ridges habitat, Rocky Outcrops habitat and Sandstone Cliffs habitat. The fauna habitats that were identified in the Survey area represent common features of the encompassing Land Systems. The clearing of the Survey area represents a potential loss of habitat equating to less than 0.5% of any one of the four Land Systems. Therefore the Project is expected to only have a minor impact on the fauna habitat available in the region.

Due to the relatively small clearing areas, the Matsu Project is expected to have only a minor impact on the regional population of common species in the area. Conservation significant species like the Rainbow Bee-eater, Fork-tailed Swift and Pictorella Mannikin may use the Survey area as foraging habitat but will suffer negligible to minor impact due to limited habitat loss.

The Survey area was identified as possible Gouldian Finch breeding habitat (and feeding habitat) there are areas of smooth-barked *Corymbia* and *Eucalyptus* species on rocky hills with a grassy understorey. The clearing of the Survey area would therefore result in a small decrease in potential breeding habitat for this species. Kimberley Metals Group Ltd is currently undertaking an artificial nest box program to offset the loss of natural tree hollows removed during current mining operations. Artificial nest boxes are readily used by Gouldian Finches and are known to increase breeding density and fecundity. Therefore, the local population of Gouldian Finches is not expected to be negatively impacted by the Matsu Project.

The Peregrine Falcon, Orange Leaf-nosed-bat, Northern Leaf-nosed-bat and Ghost Bat all potentially utilise the cliff faces in the Matsu Deposit as nesting or roosting habitat. The construction and operations of the Matsu Project should not interfere with these species as mining will occur on the back slope, leaving the cliff face untouched. Additionally, any noise and light disturbance created by the Matsu Project is unlikely to displace the bats as experience from other locations have shown that they remain present in areas that have mid to high levels of human activity.

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PROJECT DEFINITIONS

Project Terminology	Meaning
Matsu Deposit	Matsu Iron Ore Deposit
Deposit Development Envelope	The area encompassing the Matsu iron ore deposit which will be subjected to mining operations
Access Tracks	Two access track options with their encompassing 500 m corridor (Access Track option 1 and Access Track option 3), under consideration for accessing the Deposit Development Envelope and Processing Development Envelope
Access Track Development Envelope	The area encompassing the two access track options and their associated 500 m corridors
Processing Development Envelope	Encompasses the approximately 10 ha area proposed for processing infrastructure with a surrounding 250 m buffer.
Survey area	A defined area encompassing the Deposit Development Envelope, the Access Track Development envelope and the Processing Development Envelope which was subjected to biological desktop and field surveys
RIOP	Ridges Iron Ore Project

ABBREVIATIONS

Abbreviation	Meaning
Aff.	Affiliated
APM	Animal Plant Mineral Pty Ltd
CAMBA	China and Australian Migratory Bird Agreement 1986
Cth	Commonwealth
DPaW	Department of Parks and Wildlife
DRF	Declared Rare Flora
SEWPaC	Department of Sustainability, Environment, Water, Population and Communities
EP Act	*Environmental Protection Act 1986* (WA)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
GPS	Global Positioning System
IBRA	Interim Biogeographic Regionalisation for Australia
JAMBA	Japan and Australian Migratory Bird Agreement 1974
KMG	Kimberley Metals Group Pty Ltd
MNES	Matters of National Environmental Significance
N:	Northing
NVIS	National Vegetation Information System
NW	North West
P1-4	Priority Species
PEC	Priority Ecological Community
S	South
RIOP	Ridges Iron Ore Project
sp.	Species (Unspecified)
subsp.	Sub-species
SW	South West
TEC	Threatened Ecological Community
var.	Variety
W	West
WA	Western Australia

Abbreviation	Meaning
WC Act	*Wildlife Conservation Act 1950* (WA)

SYMBOLS AND UNITS

Symbols and Units	Meaning
*	Introduced plant species
+	Plus
%	Percentage
° ' "	Degrees, Minutes, Seconds
>	More than
C.	Circa
ha	Hectare
km	Kilometre
km^2	Square Kilometre
m	Metre
mm	Millimetre

1 INTRODUCTION

1.1 LOCATION AND SCOPE OF WORK

The Ridges Iron Ore Project (RIOP) Mine Site is located approximately 165 km south of Wyndham adjacent to the Great Northern Highway in the East Kimberley Region of Western Australia (WA) (Figure 1-1).

Animal Plant Mineral Pty Ltd (APM) was engaged by Kimberley Metals Group Pty Ltd (KMG) to provide a provisional biological survey consisting of a Level 1 flora, vegetation survey and Level 1 terrestrial vertebrate fauna survey of a Survey area (Figure 1-2) consisting of; the Matsu Iron Ore Deposit (Deposit Development Envelope), two associated access track options, (Access Track Development Envelope) and the currently proposed ore processing area (Processing Development Envelope); hereafter collectively referred as the RIOP Matsu Project. Further field work involving a level 2 floristic survey will be conducted in April 2014, however field work regarding the two (and possibly a third) access track options may occur in 2015, depending on logistics. The April 2014 floristic survey will provide relevant data for the final report intended to supersede this document.

The Matsu Deposit is located on a ridge approximately 10 km south east of the current RIOP mine site. The iron ore deposit is situated inside the Deposit Development Envelope and covers approximately 112.6 hectares (ha) and is located in KMG Lease areas E80/2389, P80/1750 and E80/4309.

The two access track options included in the Access Track Development Envelope lie within a 500 m wide corridor, shown in Figure 1-2 and described below (using the preferred terminology supplied by KMG):

- **Access Track Option 1)** This track is approximately 18 kilometres (km) long and following the alignment of a historical track linking the current mining operations at Tony pit, running in a southerly direction along the ridgeline, to the Deposit Development Envelope.

- **Access Track Option 3)** This proposed track option would be approximately 8 km long and links the Great Northern Highway with the Deposit Development Envelope running through the Processing Development Envelope in an east to west direction.

The current proposed location of the Processing Development footprint is situated along Access Track Option 3 and consists of approximately 16 ha with a surrounding 250 m buffer (Figure 1-2). The area will be used to crush and screen the iron ore produced from mining operations in the Deposit Development Envelope.

The biological survey included:

- A regional desktop assessment that considers extensive previous APM work conducted for the RIOP and all relevant information of value in describing the flora, vegetation, terrestrial vertebrate fauna and fauna habitat values of the RIOP Matsu Project and the immediate surrounds.

- Searches of the following on-line databases:

    - The *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) Protected Matters database to identify Matters of National Environmental Significance (MNES)

    - The Department of Parks and Wildlife (DPaW) :
      - Threatened Ecological Communities (TECs) database
      - Priority Ecological Communities (PECs) database
      - Threatened (Declared Rare) and Priority Flora database

- Threatened and Priority Flora List
- Threatened and Priority Fauna List

- A Level 1 flora and vegetation survey of the Deposit Development Envelope (conducted in May 2012)
- A Level 1 terrestrial vertebrate fauna survey of the Deposit Development Envelope, including a census for birds, acoustic recording for bats and targeted trapping for Northern Quoll (conducted in May 2012)

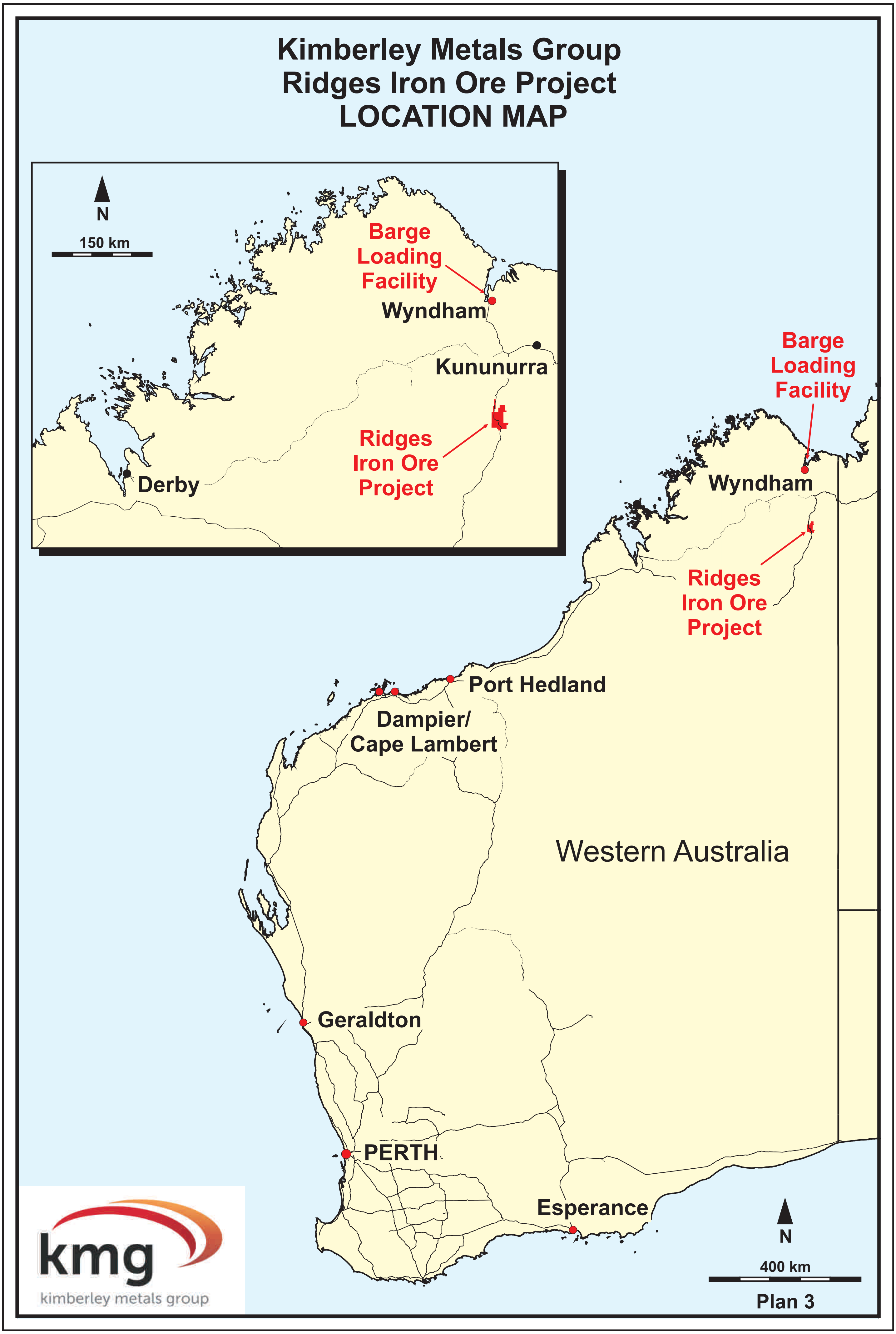


Figure 1-1: General Location Map

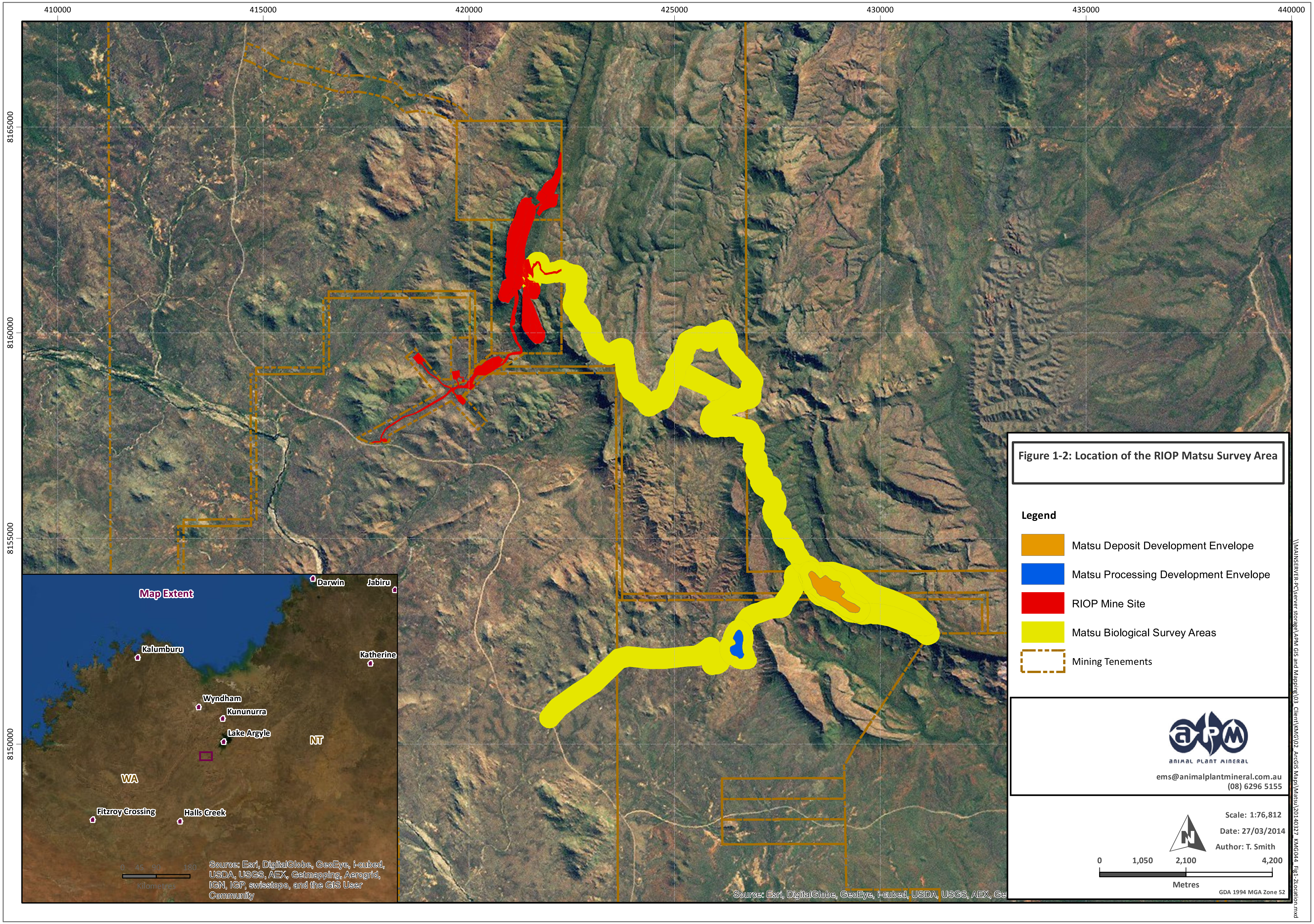


Figure 1-2: Location of the RIOP Matsu Survey Area

1.2 SUPPORTING INFORMATION

Species considered to be of national conservation significance are protected under the *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 Sustainability, Environment, Water, Population and Communities (SEWPaC) for assessment. In WA, all native fauna species are protected under the *WC Act*; 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 other fauna under five different priority codes (Appendix 1).

In addition, some species of fauna are covered under the 1991 *Australian and New Zealand Environment Conservation Council* (*ANZECC*) *Convention* (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 MNES under the *EPBC Act*.

Flora may be afforded rare or priority status when they are known only from a small number of populations, and when at least some of those populations are deemed to be under threat. Threatened Flora (T) are protected under section 23F of the *WC Act,* and it is an offence to "take" Rare Flora without ministerial permission. Section 23F defines "to take" as "…to gather, pick, cut, pull up, destroy, dig up, remove or injure the flora or to cause or permit the same to be done by any means." Flora and Threatened Ecological Communities (TEC's) considered to have national conservation significance are also listed under the *EPBC Act,* and may not be damaged or destroyed without the permission of the Federal Minister for the Environment. Possible TEC's that do not meet survey criteria or that are not adequately defined, are added to DPaW's Priority Ecological Community (PEC) list, so that consideration can be given to their declaration as TEC's. Definitions of conservation codes are provided in Appendix 1.

2 EXISTING ENVIRONMENT

2.1 PHYSICAL ENVIRONMENT

2.1.1 Climate

The climate for the Survey area is described as dry, hot tropical and semi-arid with a mean annual precipitation of > 590mm during a summer wet season from December to March inclusive. Meteorological data from the Argyle Aerodrome weather station, which is approximately 14 km south east of the Survey area, is presented in Figure 2-1 and is indicative of the climatic conditions experienced on the site.

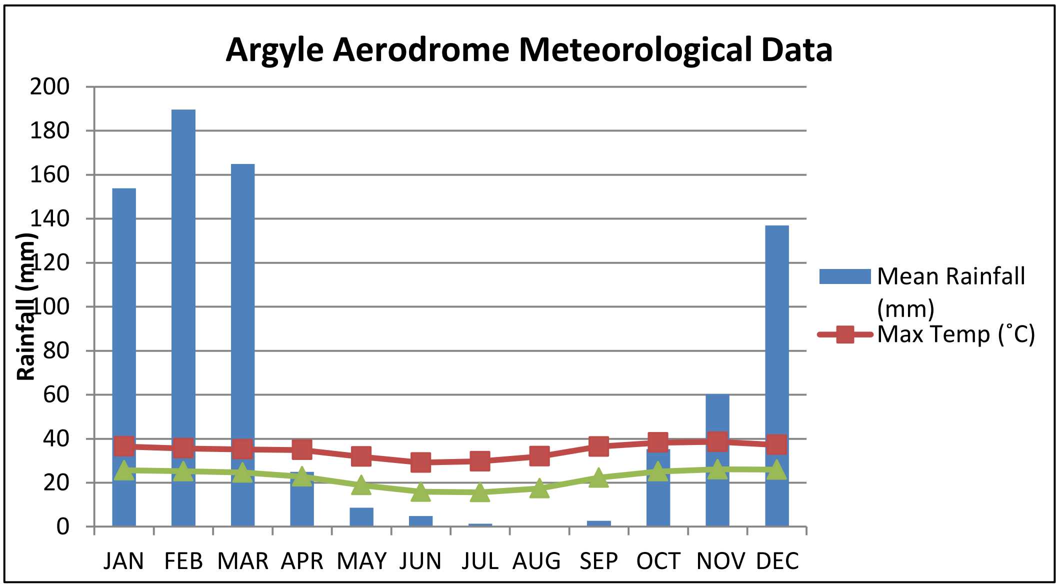


Figure 2-1: Mean Monthly Rainfall and Temperature from the Argyle Aerodrome Weather Station (Australian Bureau of Meteorology 2012)

2.1.2 Geology and Soils

The iron ore mineralisation, which is the focus of the RIOP, is located within Proterozoic rocks (ca: 1.2 billion years old) of the Carr Boyd Ranges, forming part of the Carr Boyd Group, which is a complex package of sandstone, ferruginous sandstone, siltstone and mudstone. The Carr Boyd Ranges extend in a north to north-easterly direction from the Argyle Diamond Mine to Kununurra, a total distance of approximately 115 km within the Kimberley region of WA (100 km North of the RIOP and 15 km South), and cover an area of approximately 3000 square km.

Soils consist of shallow stony sand and loam soils on harder siliceous rocks and neutral red earths and red loams or grey and brown cracking clays on volcanics and limestone (Beard 1990).

2.1.3 Bioregions and Systems

The Interim Biogeographic Regionalisation for Australia (IBRA) divides Australia into bioregions on the basis of climate, geology, landforms, vegetation and fauna (Thackway and Cresswell 1995). The mapping completed by Beard (1975) provides the basis for the IBRA bioregions. IBRA (version 6.1) mapping places the Survey area within the Ord Victoria Plain bioregion.

The Ord Victoria Plain is found in northern WA and the Northern Territory (NT) and covers much of the upper catchments of the Ord and Victoria River systems. It includes ridges, plateaus and undulating plains with scattered mesas and buttes. Vegetation consists mainly of *Eucalyptus* woodlands over hard/soft spinifex and annual grasslands (SEWPaC 2012a). The region includes Purnululu (Bungle Bungle) National Park in WA, part of the Gregory National Park in the NT and the Argyle Diamond Mine (Australian Government 2012).

The Rangeland Land System Mapping for Western Australia dataset (Department of Agriculture and Food, 2009) was consulted to further facilitate a broad assessment of the regional representation of vegetation that occurs in the Survey area. A land system is defined as 'an area or group of areas, throughout which there is a recurring pattern of topography, soils and vegetation'. The Wickham, MacPhee, Dockrell and Pompey land systems were mapped within the Survey area. Approximately half of the Access Track Option 1 and the Deposit Development Envelope lie within the Wickham Land System with the other half of the Access Track Option 1 lying within the Pompey Land System. Approximately three quarters of Access Track Option 3 and the Processing Development Envelope lies within the MacPhee land system with the remaining section of Access Track Option 3 lying within the Dockrell land system. These four land systems are characterised by Payne and Schoknecht (2011) as:

Wickham: Rugged plateaux, ridges and hills formed on sedimentary rocks supporting snappy gum low woodland over soft or curly spinifex.

Pompey: Rugged, boulder hill, granite country with sandy soils supporting sparse low eucalypt woodlands and spinifex.

MacPhee: Undulating plains of sandy granite country with eucalypt woodlands and mixed grasses.

Dockrell: Rocky, mountain ridges on metamorphic rocks, skeletal soils, open stunted woodlands with spinifex.

3 METHODOLOGY

3.1 CONTRIBUTING AUTHORS

The flora and vegetation field work and taxonomic component of this survey was undertaken by Kimberley Botanist and Taxonomist Dr Russell Barrett and Dr Chris Hancock. The associated reporting was undertaken by APM Senior Botanist Mr Brian Vincent.

The bird survey was undertaken by Kimberley expert ornithologist Mr George Swann with the assistance of APM Senior Ecologist Dr Margot Oorebeek, whom also conducted the Northern Quoll survey. R. D. Bullen of Bat Call WA completed analysis of echolocation recordings to determine bat species present. The associated reporting was undertaken by Dr Margot Oorebeek and Mr Shane McAdam.

3.2 PREVIOUS BIOLOGICAL SURVEYS

Several previous biological surveys have been undertaken in the East Kimberley region. Surveys in the vicinity of the RIOP Matsu Project from which data have been reviewed and included in this report include:

- APM (2012) Baseline Fauna Survey for area north of Sam deposit (unpublished)
- APM (2011) Baseline Fauna Survey of the Argyle Diamond Mine and Proposed Conservation Reserve. Environmental Impact Assessment survey undertaken for Argyle Diamonds.
- APM (2010) Ridges Iron Ore Flora and Vegetation Survey of Proposed Mine and Infrastructure Impact areas. Environmental Impact Assessment survey undertaken for Kimberley Metals Group.
- APM (2010) Ridges Iron Ore Wet Season Echolocation Survey of Bat Activity. Environmental Impact Assessment survey undertaken for Kimberley Metals Group.
- APM (2009) Ridges Iron Ore Mine Site Fauna Assessment Survey. Environmental Impact Assessment survey undertaken for Kimberley Metals Group.
- APM (2009) Ridges Iron Ore Gouldian Finch Nest Assessment. Environmental Impact Assessment survey undertaken for Kimberley Metals Group.
- Ecologia (2005) Argyle Iron Ore Project. Flora and Fauna survey undertaken for Resource Mining Corporation

Other relevant surveys that have occurred at nearby sites include:

- APM (2010) Speewah Vanadium Project Biological Survey. Environmental Impact Assessment Survey undertaken for Speewah Metals Limited. Approximately 50km north west of RIOP
- Harold 1981 – Argyle Diamond Mine approximately 20 km south east of RIOP
- Biostat 2001 – Argyle Diamond Mine approximately 20 km south east of RIOP
- Biostat 2002– Argyle Diamond Mine approximately 20 km south east of RIOP
- Frank O'Connor's (previous Argyle employee and birdwatcher) records– Argyle Diamond Mine approximately 20 km south east of RIOP

3.3 DESKTOP METHODOLOGY

3.3.1 Flora and Vegetation

Prior to commencing the flora and vegetation field survey of the Matsu Project area, a number of desktop searches were undertaken for both the Project area.

A search of MNES protected under the *EPBC Act* was undertaken using the Protected Matters Search Tool (SEWPaC 2012b). This search covered the Project area using a polygon including a 10 km buffer (coordinates: -16.60564, 128.23663; -16.59255, 128.3104; -16.71747, 128.4408; -16.73651, 128.33657; -16.6681, 128.26281; -16.60564, 128.23723; -16.60564, 128.23663). The report produced details listed threatened flora and TEC's, wetlands of international importance, world heritage properties and national heritage places and is presented in Appendix 2.

A request was made for a search of the DEC databases for threatened and priority flora and consideration was given to the presence of any TEC's or PEC's. This search was conducted using a spot location (NW 16^{o} 18' 30"S; 128^{o} 14' 55"E; SW 16^{o} 48' 0.6"S; 128^{o} 34' 44"E) approximately 10 km from the Matsu Project area. A 20 km buffer area was used for this search which adequately encompasses the Project area; the results are presented in Table 4-1.

The Project area and was also assessed in the context of regional and national vegetation mapping programs carried out by Beard (1975) and the IBRA Program (Australian Government 2012).

A search for environmentally sensitive areas, as declared by a Notice under section 51B of the *Environmental Protection Act 1986* (WA) (*EP Act*), and areas where low impact mineral and petroleum activities cannot occur, as defined under Schedule 1 of the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*, was undertaken using the Native Vegetation Map Viewer (DEC 2012a).

3.3.2 Fauna

A search of terrestrial vertebrate fauna MNES protected under the *EPBC Act* was undertaken using the Protected Matters Search Tool (SEWPaC 2012b). This search covered the Survey area using a polygon including a 10 km buffer (coordinates: -16.60564, 128.23663; -16.59255, 128.3104; -16.71747, 128.4408; -16.73651, 128.33657; -16.6681, 128.26281; -16.60564, 128.23723; -16.60564, 128.23663). The report is presented in Appendix 2.

A request was made for a search of the DPaW databases for threatened and priority fauna. This search was requested using a spot location (NW 16^{o} 41' 53"S; 128^{o} 20' 01"E), located approximately at the centre of the Matsu Deposit. DPaW applied a 25 km buffer for this search which adequately encompasses the Survey area.

In addition, a search of APM's in-house database, containing records from the most recent and nearby fauna surveys, was used to identify fauna most likely to occur in the rocky ridge habitat of the Survey area. The species list generated using this selective approach is considered to contain the fauna most likely to occur in the Survey area.

Other more general texts were also used to provide supplementary information on vertebrates in the bioregion, including Storr *et al*. (1983, 1990, 1999, 2002) for reptiles, Johnstone and Storr (1998, 2004) for birds and Van Dyck and Strahan (2008) for mammals.

3.4 FIELD SURVEY

3.4.1 Flora and Vegetation

The flora and vegetation field survey of the Deposit Development Envelope was undertaken from the 17th to the 18th of May 2012. Leading up to the survey period, January and February received below average rainfall, while March and April received slightly above average rainfall as evidenced by meteorological data from the Warmun weather station (Figure 3-1) which is situated 35 km from the Survey area.

Additionally, a follow up Level 2 flora and vegetation survey is planned for April 2014.

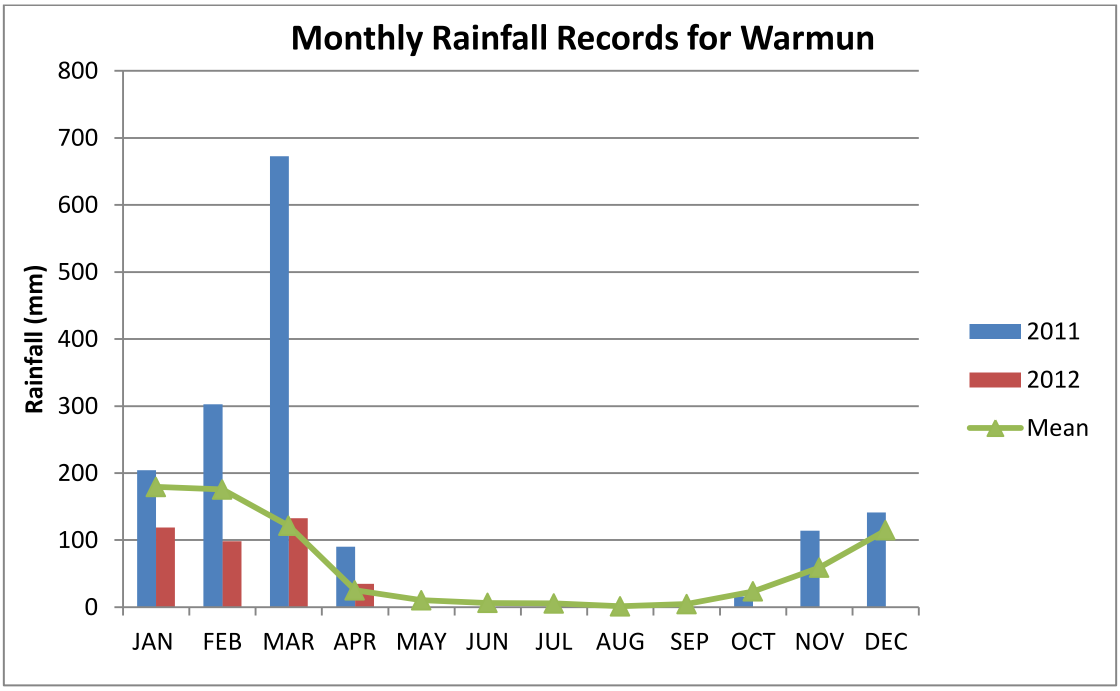


Figure 3-1: Monthly Rainfall Records from Warmun Weather Station (Australian Bureau of Meteorology 2012)

The Deposit Development Envelope field survey involved the verification of vegetation communities using aerial photography and direct observation from a helicopter. Where necessary, and practical, aerial observations were confirmed by ground survey work. The survey area covers parts of the M 259SA Lease which is situated immediately to the north of the Matsu Deposit (Figure 1-2).

The first 5.6km, of the of Access Track option 1, were surveyed as above, the remainder of the track plus Access Tracks option 3, were mapped using data from a previous survey of the current KMG camp and haul road, conducted by APM (2009). This data was compared to the aerial photography of the Camp, Haul road areas and the proposed Access Track alignments. The proposed Access Tracks will be subject to a level 2 survey in 2014/2015, in order to confirm the identity of the vegetation communities impacted and investigate the presence of any priority or rare/ threatened species and/or ecological communities.

Vegetation was described and identified using methods based on the National Vegetation Information System (NVIS). The NVIS is a collaborative initiative between the Australian Commonwealth, State and Territory governments to enable the compilation of a nationally consistent vegetation dataset from data collected by the states and territories. The NVIS hierarchy is presented in Appendix 3.

In this report vegetation is described at its broadest level at hierarchical Level III (Broad Floristic Formation) defined as '*Dominant growth form, cover and height of the ecologically dominant stratum'* and at its most detailed level at Level V (Association Level) defined as *'Dominant growth form, height, cover and species (three species) of the three traditional strata (i.e. Upper, mid and ground)'.* Colour aerial photography was used to assist with the vegetation mapping.

Threatened flora, Declared Rare and Priority flora and TEC's were searched for on foot. All Identification of plant species was carried in the field, no specimens were collected.

3.4.2 Fauna

In May 2012 a bird, bat and targeted Northern Quoll survey of the Deposit Development Envelope was conducted. Access was limited as there are no serviceable access tracks to the Matsu Deposit. All work was conducted within walking distance of small open areas along the ridgeline on which the helicopter could land.

Bird surveys were conducted from 17th May – 20st May 2012. Intensive opportunistic sampling was considered to be the most appropriate method to reveal the presence of *EPBC Act* listed bird species and also the most appropriate method to increase the general species count and obtain a reasonable assessment of the total species richness of the relatively small area able to be surveyed. Opportunistic sampling commenced at 0600 and proceeded throughout the day until 1600. As the surveys were opportunistic, and limited by helicopter access, it was difficult to approximate the area and locations covered. As a general rule, ornithologists rarely move more than 1 – 1.5 km in a one hour census, and remain within a particular habitat type for the duration of the census. A total of 50 hours were spent conducting opportunistic surveys.

A targeted survey for the Northern Quoll was undertaken over five nights in the Deposit Development Envelope, from 16th May till 21st May. Two areas with suitable habitat were targeted for trapping; one on the north side of the range and one on the south side. Up to 114 large box traps were deployed along the rocky ridge and sandstone boulder outcrops. This resulted in a total of 467 trap nights. Traps were baited with a moist mixture of rolled oats, peanut butter and sardines and checked daily within three hours of sunrise.

An echolocation survey was conducted to establish the presence of bats in the Deposit Development Envelope. The survey was conducted over four nights between the 17th May and the 21st May 2012. Two SM2BAT detectors (Wildlife Acoustics, USA) were placed on a cliff top site above a cave entrance where bat presence was expected. The jumper and audio settings used for the SM2BAT followed the manufacturer's recommendations for bat detection contained in the user manual (Wildlife Acoustics 2010). Selectable filters and triggers were also set using the manufacturer's recommendations. For all recordings, once reformatted as .wav files, COOL EDIT 2000 was used to display each "continuous call" sequence (EPA and DEC 2010) for identification. Only good quality call sequences were used.

Descriptions of fauna habitats were based on the vegetation associations, soils and landforms observed during the fauna field survey. Habitat maps were constructed using the botanists' vegetation mapping in order to reflect the landscape scale of the areas under investigation.

4 RESULTS

4.1 FLORA AND VEGETATION

4.1.1 Flora

A total of 197 taxa (species, subspecies and varieties) from 53 families and 115 genera were recorded in the course of the field survey of the Deposit Development Envelope (Appendix 4). Fabaceae (32 taxa) was the most specious genera, followed by Poaceae (25 taxa). The high number of genera compared to species is typical for a subtropical monsoonal region.

4.1.2 Vegetation Communities

A total of 13 plant communities were identified during the course of the field and desktop surveys of the Survey area. The plant communities are described below and mapped in **Figure** 4-1. The communities may be further divided into subsets, largely driven by topographic effects within the landscape. While generally the plant communities and dominant species are shared between nearby iron ore deposits, each area also contains a subset of species not found on the other sites. The number and definition of plant communities may differ in the final report once extensive filed work has been carried out.

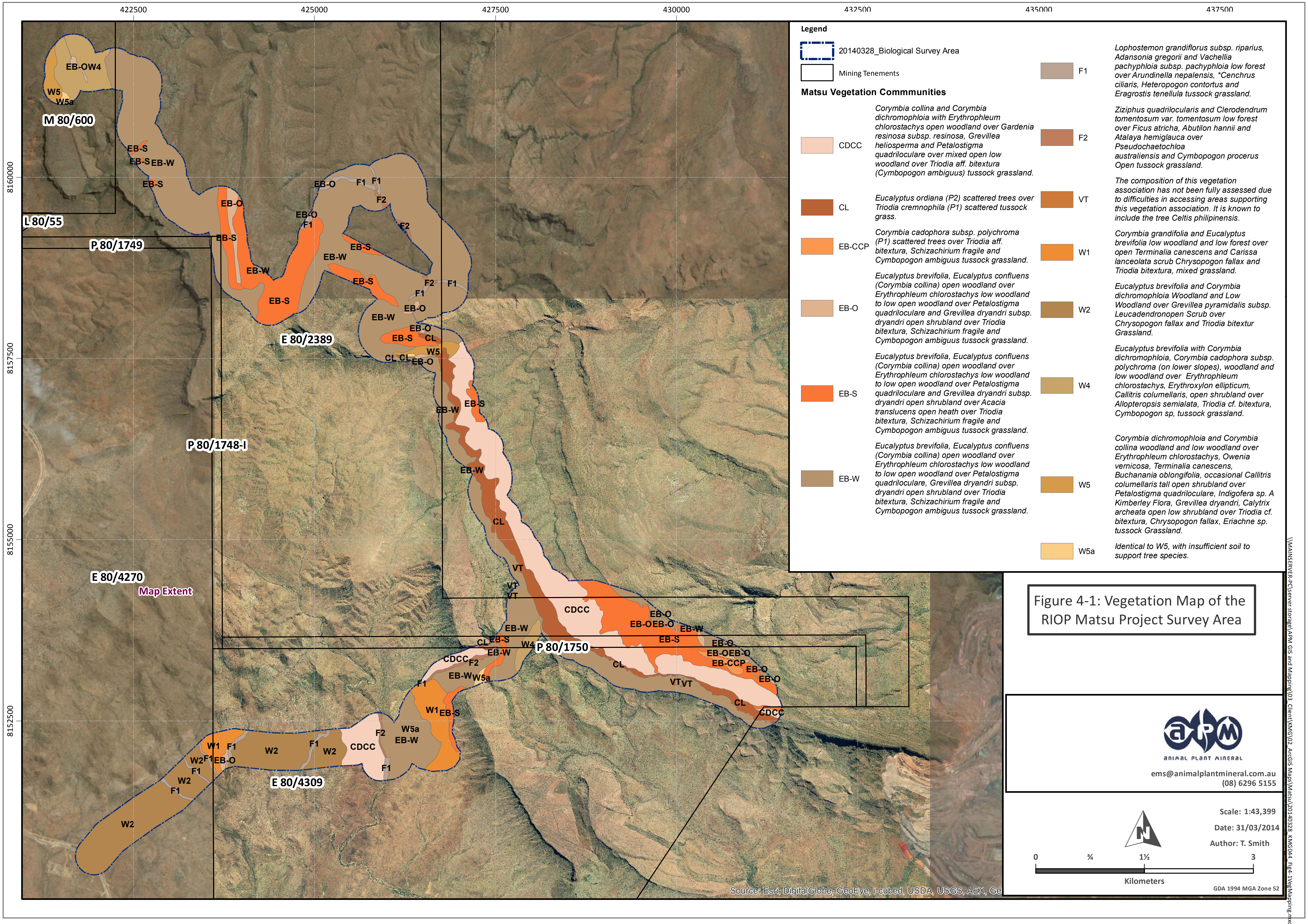


Figure 4-1: Vegetation Map of the RIOP Matsu Project Survey Area

Vegetation Community: CCDC

CDCC: *Corymbia collina* and *Corymbia dichromophloia* with *Erythrophleum chlorostachys* open woodland over *Gardenia resinosa* subsp. *resinosa, Grevillea heliosperma* and *Petalostigma quadriloculare* over mixed open low woodland over *Triodia* aff. *bitextura* (*Cymbopogon ambiguus*) tussock grassland.

Occurrence: Ironstone formations, slopes with medium to gentle relief.

Associated species: *Eriachne ciliata*, *Eriachne* aff. *mucronata*, *Heteropogon contortus*, *Schizachirium fragile* .

Land System: Wickham

Plate A: Vegetation Community – CCDC

Vegetation Community: EB-s

EB-s: *Eucalyptus brevifolia*, *Eucalyptus confluens* (*Corymbia collina*) open woodland over *Erythrophleum chlorostachys* low woodland to low open woodland over *Petalostigma quadriloculare* and *Grevillea dryandri* subsp. *dryandri* open shrubland over *Acacia translucens* open heath over *Triodia bitextura*, *Schizachirium fragile* and *Cymbopogon ambiguus* tussock grassland.

Occurrence: Sandstone slopes.

Associated species: *Callitris columellaris*, *Erythroxylum ellipticum* .

Land System: Wickham

Plate B : Vegetation Community – EB-s

Vegetation Community: EB-o

EB-o: *Eucalyptus brevifolia*, *Eucalyptus confluens* (*Corymbia collina*) open woodland over *Erythrophleum chlorostachys* low woodland to low open woodland over *Petalostigma quadriloculare* and *Grevillea dryandri* subsp. *dryandri* open shrubland over *Triodia bitextura*, *Schizachirium fragile* and *Cymbopogon ambiguus* tussock grassland.

Occurrence: Sandstone outcrops and ridge crests.

Associated species: *Acacia* aff. *asperulacea, Callitris columellaris, Comesperma secundum, Erythroxylum ellipticum, Mirbelia viminalis.*

Land System: Wickham

Plate C: Vegetation Community EB-o

Vegetation Community: EB-w

EB-w: *Eucalyptus brevifolia, Eucalyptus confluens (Corymbia collina)* open woodland over *Erythrophleum chlorostachys* low woodland to low open woodland over *Petalostigma quadriloculare, Grevillea dryandri* subsp. *dryandri* open *shrubland* over *Triodia bitextura, Schizachirium fragile* and *Cymbopogon ambiguus* tussock grassland.

Occurrence: Woodlands on plains, valleys and gently undulating terrain.

Associated species: *Callitris columellaris, Erythroxylum ellipticum.*

Land System: Wickham

Plate D: Vegetation Community – EB-w

Vegetation Community: EB-CCP

EB-CCP: *Corymbia cadophora* subsp. *polychroma* (P1) scattered trees over *Triodia* aff. *bitextura*, *Schizachirium fragile* and *Cymbopogon ambiguus* tussock grassland.

Occurrence: Sandstone outcrops and ridge crests.

Associated species: Not ground trothed.

Land System: Wickham

(No Image available)

Vegetation Community: CL

CL: *Eucalyptus ordiana* (P2) scattered trees over *Triodia cremnophila* (P1) scattered tussock grass.

Occurrence: Steep slopes and precipitous rock faces. In areas of lower relief this vegetation community can form a mosaic with small patches of CDCC. This vegetation Community is representative of the Priority 1 PEC 'Plant assemblages on vertical sandstone surfaces' listed by DPaW (Appendix 5)

Associated species: *Acacia lamprocarpa*, *Acacia multisiliqua*, *Acacia retivenea* subsp. *retivenea*, *Acacia thomsonii*, *Achyranthes aspera*, *Adansonia gregori*, *Atalaya salicifolia*, *Brachychiton viscidulus*, *Buchanania oblongifolia*, *Callitris columellaris*, **Calotropis procera*, *Calytrix extipulata* (shrub form), *Calytrix extipulata* (rock form), *Capparis lasiantha*, *Capparis umbonata*, *Celtis philippensis*, **Cenchrus americanus*, *Cheilanthes brownii*, *Christia australasica*, *Clerodendrum floribundum* var. *floribundum*, *Clerodendrum tomentosum* var. *tomentosum*, *Cochlospermum fraseri*, *Comesperma secundum*, *Corchorus sidoides*, *Corymbia aspera*, *Corymbia collina*, *Corymbia dichromophloia*, *Corymbia disjuncta*, *Cyanthillium cinereum*, *Cyperus cunninghamii* subsp. *uniflorus*, *Denhamia obscura*, *Dicliptera armata*, *Dodonaea hispidula* var. *arida*, *Dolichandrone heterophila*, *Eriachne ciliata*, *Erythrophleum chlorostachys*, *Eucalyptus ordiana* (P2), *Euphorbia schultzii*, *Evolvulus alsinoides* var. *decumbens*, *Ficus aculeata* var. *indecora*, *Ficus atricha*, *Ficus brachypoda*, *Flueggea virosa* subsp. *melanthesioides*, *Galactia tenuiflora*, *Gardenia resinosa* subsp. *resinosa*, *Gossypium australe*, *Grevilea refracta*, *Grevillea heliosperma*, *Grevillea velutinella*, *Heteropogon contortus*, *Hypoestes floribunda*, *Indigofera* sp. A Kimberley Flora, *Jacquemontia* sp. Keep River (P1), *Melhania oblongifolia*, *Oldenlandia kochiae*, *Opilia amentacea*, *Owenia vernicosa*, *Panicum decompositum*, **Passiflora foetida*, *Psydrax attenuata*, *Persoonia falcata*, *Petalostigma quadriloculare*, *Phyllanthus exilis*, *Phyllanthus grandisepala*, *Pittosporum spinescens*, *Polycarpaea involucrata*, *Santalum lanceolatum*, *Schizachyrium fragile*, *Scleria* aff. *brownii*, *Sida rohlenae*, *Sida* sp. A Kimberley Flora, *Solanum cunninghamii*, *Stemodia lythrifolia*, *Stenocarpus acacioides*, *Terminalia canescens*, *Terminalia ferdinandiana*, *Triodia cremnophila* (P1), *Triodia* sp. Argyle (currently nominated for priority status), *Triumfetta triandra*, *Triumfetta clivorum*, *Uraria lagopodioides*, *Wrightia saligna*, *Xenostegia tridentata*, *Yakirra australasica*, *Zornia muriculata.*

Land System: Wickham

Plate E: Vegetation Community – CL

Vegetation Community: VT

VT:	The composition of this vegetation association has not been fully assessed due to difficulties in accessing areas supporting this vegetation association. It is known to include *Celtis philipinensis.*
Occurrence:	Occasionally in pockets at the base of the cliffs but these have not been visited to determine their composition. This vegetation Community is representative of the Priority 1 PEC 'Monsoon Vine Thicket' listed by DPaW in Appendix 5.
Associated species:	Not available as the areas representing this vegetation community were not ground trothed.
Land System:	Wickham

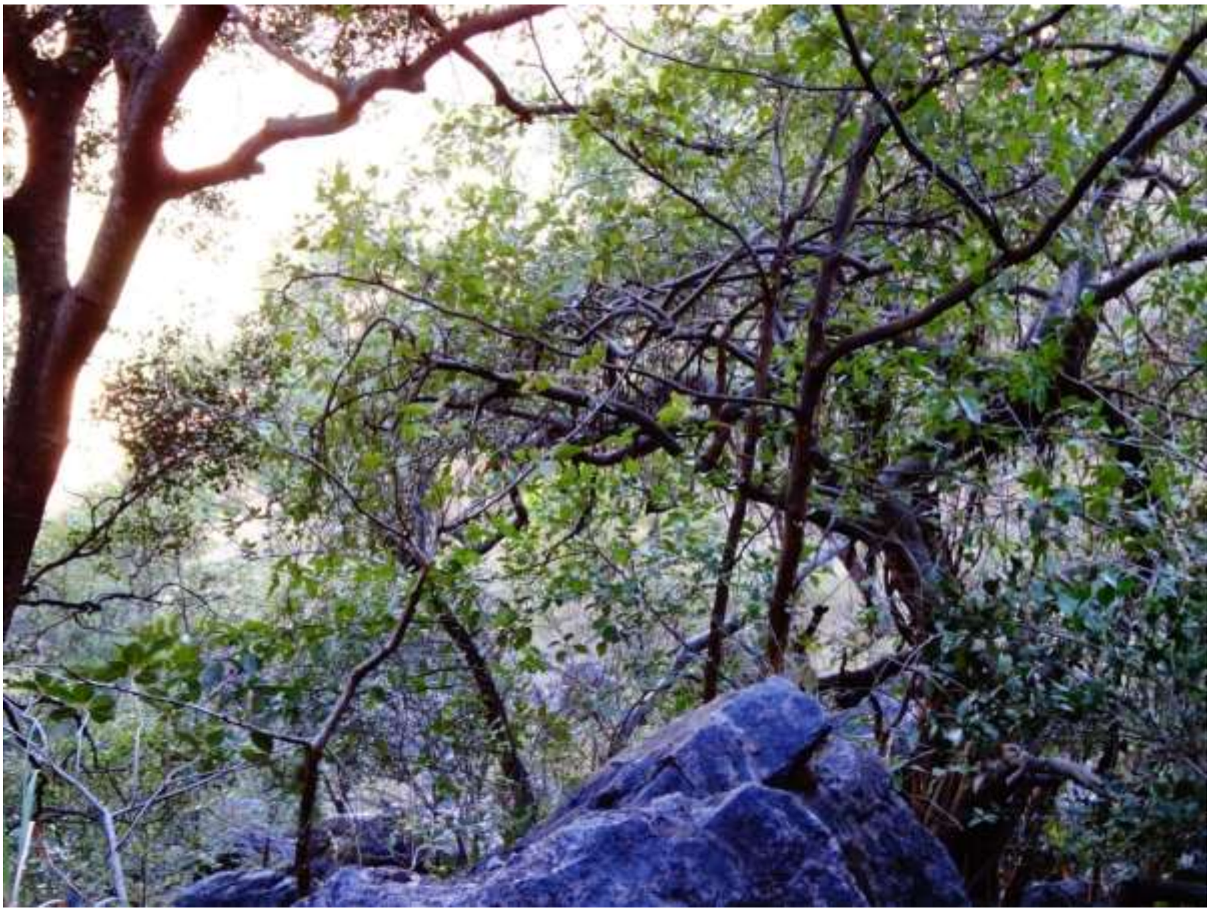


Plate F: Vegetation Community – VT

Vegetation Community W1:

W1: *Corymbia grandifolia* and *Eucalyptus brevifolia* low woodland and low forest over open *Terminalia canescens* and *Carissa lanceolata* scrub *Chrysopogon fallax* and *Triodia bitextura,* mixed grassland.

Associated species: *Aristida holathera* var*. holathera, Bauhinia cunninghamii, Carissa lanceolata, Corymbia dichromophloia, Eriachne obtusa, Grevillea pyramidalis* subsp. *Leucadendron, Indigofera hirsute, Indigofera linifolia, Polycarpaea spirostylis* subsp. *Glabra, Pseudochaetochloa australiensis, Ptilotus capitatus, Tephrosia stipuligera, Terminalia canescens* and *Triodia bitextura.*

Occurrence: This community was found along minor drainage lines and across the valley floors.

Land System: Dockrell

Plate G: Vegetation Community – W1

Vegetation Community: W2

W2: *Eucalyptus brevifolia* and *Corymbia dichromophloia* Woodland and Low Woodland over *Grevillea pyramidalis* subsp. *Leucadendron*open Scrub over *Chrysopogon fallax* and *Triodia bitextur* Grassland.

Occurrence: This vegetation occupied the hills and slopes.

Associated species: *Aristida holathera* var. *holathera, Bauhinia cunninghamii, Callitris columellaris, Cheilanthes sieberi, Cochlospermum fraseri, Cymbopogon procerus, Euphorbia coghlanii, Indigofera linifolia, Polycarpaea longiflora* and *Tephrosia stipuligera.*

Land System: Pompey

Plate H: Vegetation Community – W2

Vegetation Community W4:

W4: *Eucalyptus brevifolia* with *Corymbia dichromophloia*, *Corymbia cadophora* subsp. *polychroma* (on lower slopes), woodland and low woodland over *Erythrophleum chlorostachys*, *Erythroxylon ellipticum*, *Callitris columellaris*, open shrubland over *Allopteropsis semialata*, *Triodia* cf. *bitextura*, *Cymbopogon* sp, tussock grassland.

Associated species: *Acacia orthocarpa, Acacia cf. lycopodiifolia, Brachychiton diversifolius Clerodendrum floribundum, Cochlospermum fraseri Evolvulus alsinoides, Gardenia* sp., *Eucalyptus jensenii*, *Grevillea pyramidalis*, *Grevillea dryandra, Goodenia odonnellii,Hybanthus enneaspermus, Indigofera* sp. A Kimberley Flora*, Ipomoea gracilis, Jacquemontia sp. Beverley Springs Jasminum didymium, Petalostigma quadriloculare, Phyllanthus exilis Polygala longifolia, Terminalia canescens*, *Uraria lagopodioides*, *Wrightia saligna*, *Zornia muriculata.*

Occurrence: This community is common on slopes on sandstone substrates.

Land System: Pompey

Plate I: Vegetation Community – W4

Vegetation Community W5:

W5: *Corymbia dichromophloia* and *Corymbia collina* woodland and low woodland over Erythrophleum *chlorostachys*, *Owenia vernicosa*, *Terminalia canescens*, *Buchanania oblongifolia*, occasional *Callitris columellaris* tall open shrubland over *Petalostigma quadriloculare*, *Indigofera* sp. A Kimberley Flora, *Grevillea dryandri*, *Calytrix archeata open low shrubland over Triodia* cf. *bitextura*, *Chrysopogon fallax*, *Eriachne* sp. tussock Grassland.

Associated Species: *Amyema ? eburnea, Calytrix exstipulata***,** *Cheilanthes caudate, Clerodendrum floribundum, Cochlospermum fraseri*, *Chamaechrista mimosoides Cheilanthes brownii*, *Cymbidium canaliculatum*. *Evolvulus alsinoides, Gompholobium subulatum, Grevillea pyramidalis, Grevillea heliosperm Haemodorum ensifolium, Hybanthus enneaspermus, Marsdenia angustata, Mirbelia spinosa, Persoonia falcata*, *Phyllanthus exili, Santalum lanceolatum*, *Sida* sp. A Kimberley Flora, *Stenocarpus acacioides*, *Tinospora smilacina*, *Zornia muriculata.*

Occurrence: Sand stone Scarps and plateaus.

Land System: Pompey

Plate J: Vegetation Community – W5

Vegetation Comunity W5a: as above with insufficient soil to support tree species.

Landsystem: Pompey

Vegetation Community F1:

F1: *Lophostemon grandiflorus* subsp. *riparius, Adansonia gregorii* and *Vachellia pachyphloia* subsp. *pachyphloia* low forest over *Arundinella nepalensis, *Cenchrus ciliaris, Heteropogon contortus* and *Eragrostis tenellula* tussock grassland.

Occurrence: This vegetation community lined sections of some creeks where the channel is more pronounced.

Associated Species: *Adansonia gregorii, holathera , Arundinella nepalensis, Atalaya hemiglauca, Cenchrus ciliaris, Eragrostis tenellula, Eriachne ciliate, Exocarpos latifolius, Indigofera hirsute, Lophostemon grandiflorus* subsp. *Riparius, Vachellia pachyphloia* subsp. *Pachyphloia.*

Land System: MacPhee

Plate K: Vegetation Community – F1

Vegetation Community F2:

F2:	*Ziziphus quadrilocularis* and *Clerodendrum tomentosum* var. *tomentosum* low forest over *Ficus atricha, Abutilon hannii* and *Atalaya hemiglauca* over *Pseudochaetochloa australiensis* and *Cymbopogon procerus* Open tussock grassland.
Occurrence:	This community was found on the scree slope and occupies shaded niches between large boulders.
Associated Species:	*Cochlospermum fraseri, Cymbopogon procerus, Exocarpos latifolius, Flueggea virosa* subsp. *melanthesoides, Pseudochaetochloa australiensis Ziziphus quadrilocularis*.
Land system:	Wickham and Dockrell

Plate L: Vegetation Community – F2

4.1.3 Vegetation Condition

In accordance with the Keighery (1994) vegetation condition scale, all ground survey sites observed in this survey were classified as 'excellent'. 'Excellent' is defined by Keighery as: *Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.* The full vegetation condition scale is provided in Appendix 6.

4.1.4 Introduced Flora

The Protected Matters search tool did not return any botanical or geographical MNES or Other Matters protected by the *EPBC Act*. However, five invasive plant taxa listed as MNES were identified as being likely to occur in the vicinity of the Survey area. These were **Cryptostegia grandiflora*,**Cenchrus ciliaris*, **Jatropha gossypifolia,* **Parkinsonia aculeata* and **Urochloa mutica* (formerly *Brachiaria mutica*). The Protected Matters Search Tool report itemising the results is provided in Appendix 2.

Of the 197 taxa recorded in the project area, four were introduced (weed) species (Table 4-1), with an additional unconfirmed record for **Eragrostis* ? *cilianensis*, this record is unconfirmed due to insufficient, plant material available at the time of survey . Images of the weed species are provided in Appendix 7 and their locations are mapped in Figure 4-2.

**Calotropis procera* and **Passiflora foetida* are classified as 'invasive' under the Invasive Plant Prioritisation Process (DEC 2012b) with medium and high ecological impact respectively.

Table 4-1: Introduced Species Recorded in the Survey area

Species	Common Name	Family	Sites Recorded	Habitats Recorded	Vegetation Associations	Location (WGS84/52K)	
						Easting	Northing
**Calotropis procera*	Calotrope / Rubber bush	Apocynaceae	Opportunistic Recording	Cliff faces and cliff margins	CI	429547	8153153
**Cenchrus americanus*	Pearl Millet	Poaceae	Relevé and Opportunistic Recordings	Ironstone slopes, ridges and gullies	CI	430758	8152924
**Melinis repens*	Natal Red Top	Poaceae	Opportunistic Recording	Sandy areas, cliffs	CDCC	429547 430638	8153153 8152955
**Passiflora foetida*	Stinking Passion Flower	Passifloraceae	Opportunistic Recording	Cliff faces and Cliff Margins	CI	430758	8152924

4.1.5 Flora and Vegetation of Conservation Significance

The Protected Matters search tool did not return any botanical or geographical MNES or Other Matters protected by the *EPBC Act*. The Protected Matters Search Tool report itemising the results is provided in Appendix 2.

The Native Vegetation Map Viewer search revealed that the Survey area does not include any lands considered as Environmentally Sensitive areas under Section 51B of the *EP Act.*

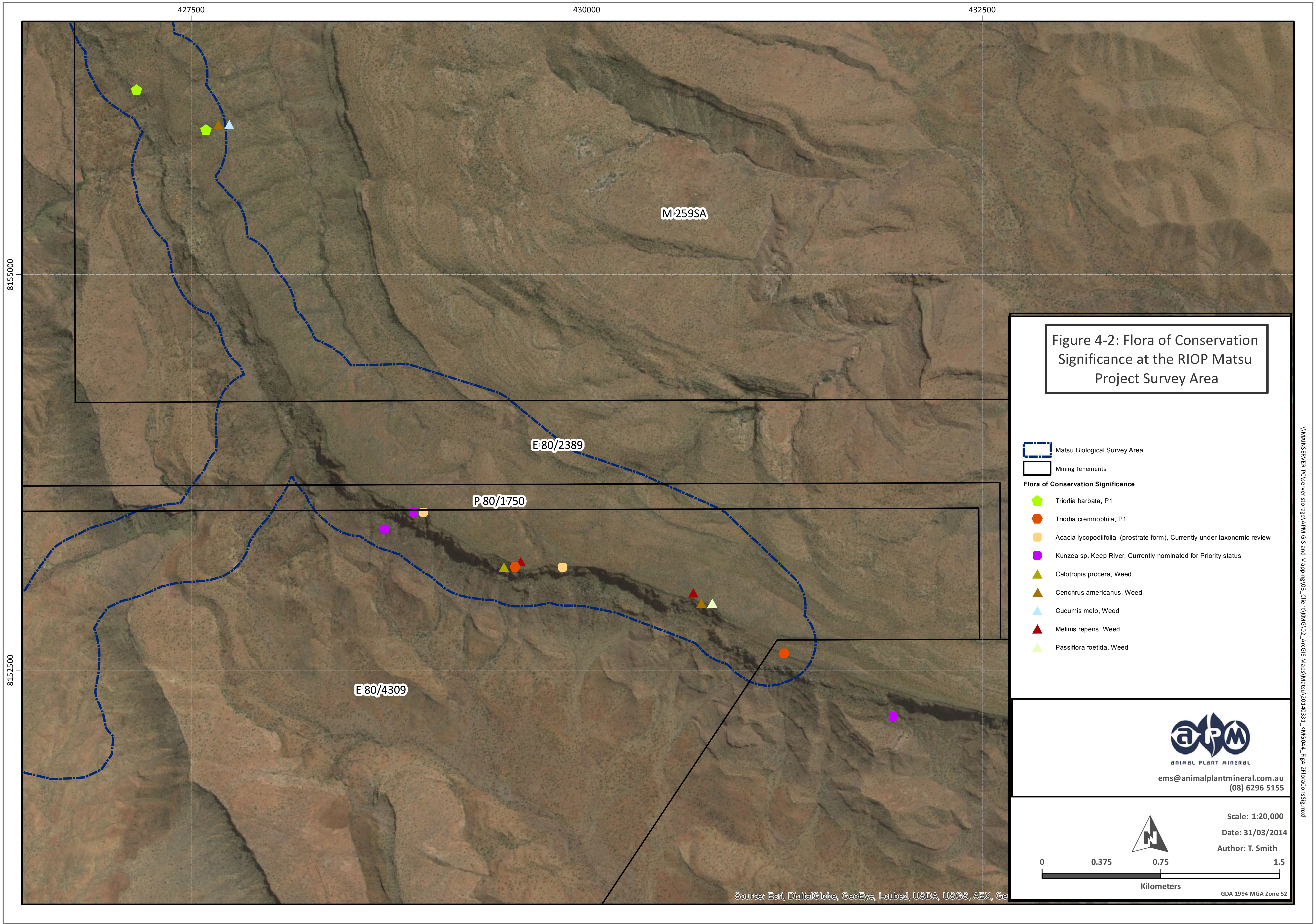
Database searches undertaken by DPaW did not detect any PEC's or TEC's within the Survey area. The DPaW's Threatened (Declared Rare) and Priority Flora Database, Threatened and Priority Flora List and the WA Herbarium Specimen Database found 40 priority species that could potentially occur within the Survey area (Table 4-2).

Table 4-2: Declared Rare and Priority Flora Potentially Occurring in the Survey area

Species	Conservation Code	DPaW Database Search of Potentially Occurring Species			Habitat
		Threatened (Declared Rare) Flora Database	Threatened & Priority Flora List	WA Herbarium Specimen Database	
Acacia repens	P1			√	-
Acacia setulifera	P1	√		√	-
Acacia sp. Cockburn Range (R. Pullen 10. 763)	P3		√		Erosion surface of plain above river, rock outcrops, shrub grassland.
Asteromyrtus arnhemica	P1			√	Banks of seasonal streams, near waterfalls, along tracks in wet areas.
Bonamia oblongifolia	P1			√	-
Brachychiton tuberculatus	P3		√		Undulating plains.
Corymbia cadophora subsp. *polychroma*	P1	√		√	Gentle sandstone slopes.
Cyperus digitatus	P1		√		Waters' edge.
Desmodium flagellare	P1		√		-
Dolichandrone filiformis	P2		√		-
Echinochloa kimberleyensis	P1		√		Swamps.
Eucalyptus costuligera	P1		√		-
Eucalyptus ordiana	P2	√		√	Steep rocky outcrops.
Ficus lilliputiana	P4		√		Rocky sites.
Fuirena incrassata	P3	√		√	Swamps, creek beds, claypans, semi-saline lakes.
Goodenia byrnesii	P1	√		√	Edge of creek.
Goodenia durackiana	P1		√		Grassland.
Goodenia malvina	P1		√		Seasonally wet areas.
Goodenia sepalosa var. *glandulosa*	P3		√		-

Species	Conservation Code	DPaW Database Search of Potentially Occurring Species			Habitat
		Threatened (Declared Rare) Flora Database	Threatened & Priority Flora List	WA Herbarium Specimen Database	
Grevillea minuata	P4			√	Cliffs or rocky slopes, sometimes along watercourses.
Heliotropium cupressinum	P1		√		Stony sandy soils, sandstone.
Heliotropium foveolatum	P1		√		-
Heliotropium uniflorum	P1		√	√	Stony slopes, undulating rocky plateaus.
Ipomoea gracilis	P1		√		Black cracking clay or black sand. Irrigated areas.
Jacquemontia sp. Keep River (J.L. Egan 5051)	P1		√	√	-
Olearia arguta var. glabrous narrow leaves	P3		√		-
Macrothelypteris torresiana	P1		√		Wet rock face of gorge.
Melaleuca viminalis	P2			√	-
Phyllanthus aridus	P3	√	√		-
Selaginella pygmaea	P2		√		Damp ground near creek.
Sorghum plumosum var. *teretifolium*	P1		√		Sand, clay, loam, alluvium. Swamps, claypans, watercourses, waterholes, valleys.
Triodia barbata	P1		√		Cliffs.
Triodia bunglensis	P2			√	Cliffs, gorges & domes, often in fissures & cracks.
Triodia cremnophila	P1			√	-
Triodia fitzgeraldii	P1		√		Sandstone hills.
Triodia fissura	P1			√	Growing in narrow fissures on steep or near vertical rock faces
Triodia pasconieana	P1		√		Limestone. Limestone ranges & gorges.
Triodia prona	P1			√	Lower slopes of sandstone mountain range.
Triodia racemigera	P1		√	√	Steep rocky slopes, crevices, cliffs & ridges.
Triodia triticoides	P1		√		Rocky sandstone & limestone hillslopes.

No Threatened Flora pursuant to the *WC Act*, were recorded during the ground survey work in the Deposit Development Envelope, however, nine priority taxa as defined by the DPaW were recorded (Table 4-3), images are provided in Appendix 8. Flora and vegetation of conservation significance are mapped in Figure 4-2.


427500
430000
432500
8155000
8152500
M 259SA
E 80/2389
P 80/1750
E 80/4309
Figure 4-2: Flora of Conservation Significance at the RIOP Matsu Project Survey Area
Matsu Biological Survey Area
Mining Tenements
Flora of Conservation Significance
Triodia barbata, P1
Triodia cremnophila, P1
Acacia lycopodiifolia (prostrate form), Currently under taxonomic review
Kunzea sp. Keep River, Currently nominated for Priority status
Calotropis procera, Weed
Cenchrus americanus, Weed
Cucumis melo, Weed
Melinis repens, Weed
Passiflora foetida, Weed
animal plant mineral
ems@animalplantmineral.com.au
(08) 6296 5155
Scale: 1:20,000
Date: 31/03/2014
Author: T. Smith
N
0
0.375
0.75
1.5
Kilometers
GDA 1994 MGA Zone 52
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Ge
\\MAINSERVER-PC\server storage\APM GIS and Mapping\03_Client\KMG\02_ArcGIS Maps\Matsu\20140331_KMG044_Fig4-2FloraConsSig.mxd

Currently *Triodia cremnophila* is only known to occur in WA along cliffs that are located along the southern reaches of the Rugged Range. *Triodia cremnophila* is a dominant species of the PEC 'Plant assemblages on vertical sandstone surfaces

Kunzea sp. Keep River is a significant discovery for the region as it was previously only known from the NT and thus represents a new taxon to WA. *Kunzea* sp. Keep River also represents a significant range extension for this genus, with the nearest record for *Kunzea recurva* located near the Murchison River, 1868 km to the south west (FloraBase 2012). A regional survey was carried out for *Kunzea* sp. Keep River in July 2012 (APM 2013); the locations of those recorded are presented in Figure 4-3.

Triodia sp. Argyle (aff. cunninghamii), is currently under review for priority status and taxonomic description (R. Barrett. pers. comm. 2012).

A prostrate dwarf Acacia shrub thought to be related to the common species *Acacia lycopodiifolia* was discovered at several locations within the Deposit Development Envelope, (Table 4-3). Multiple specimens of this individual were collected and are currently under taxonomic review, by taxonomists Russell Barrett and Bruce Maslin, at the West Australian Herbarium. This taxa will be referred to in this document as *Acacia lycopodiifolia* (prostrate form).

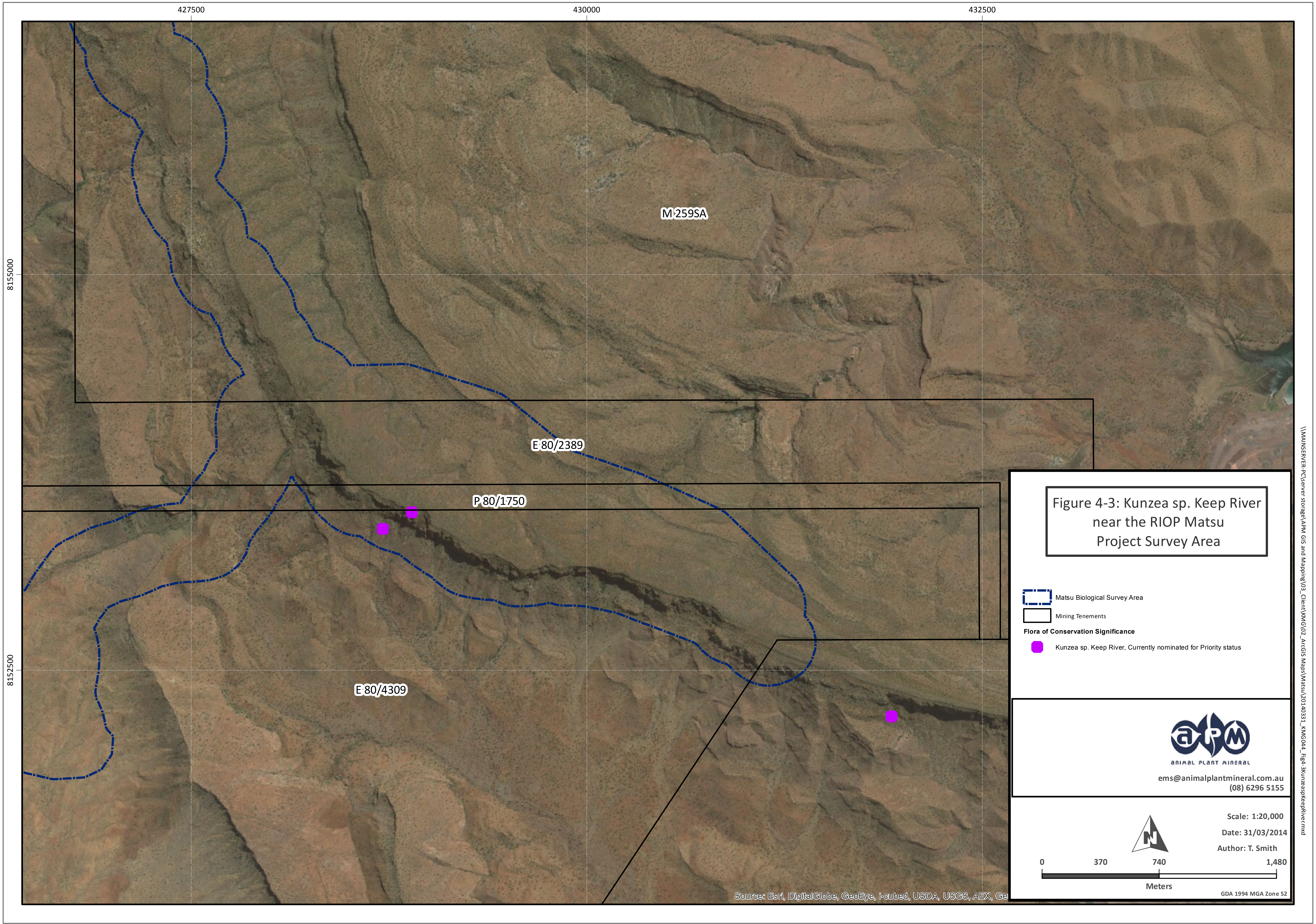
The 12 vegetation communities described in Section 4.1.1 do not resemble any of the TEC's listed under the Commonwealth *EPBC Act.* However two communities are representative of PEC's listed by the DPaW (Appendix 5). The vegetation community associated with cliff surfaces (CL) was identified as the Priority 1 PEC 'Plant assemblages on vertical sandstone surfaces' and pockets of vegetation on steep south facing slopes to the south of the Survey area were identified from the air as the Priority 1 PEC –'Monsoon Vine Thicket' (VT). Both priority communities are mapped in Figure 4-1.

Table 4-3: Priority and conservation significant taxa recorded within the Survey area.

***Species known to occur within described vegetation types but not recorded due to limited access.**

Priority Code	Species	Habitat	Location (WGS84/52K)
Curently under taxanomic review	*Acacia lycopodiifolia* (prostate form)	Sand, sandstone. Rocky hills & ridges	Associated with the CL community plus, E:0429813, N:8153151 E:0428933, N:8153498
P3	*Brachychiton tridentatus*	Sand, sandstone. Rocky hills & ridges	E: 430758, N: 8152924
P1	*Corymbia cadophora* subsp. *polychroma*	Sandstone, banded ironstone gentle slopes. Damp land, creeklines.	*Occurs throughout the EB-CPP vegetation community.
P2	*Eucalyptus ordiana*	Steep rocky outcrops. Cliff faces and cliff margins of ironstone/sandstone geological formations	*Occurs in association with the CL cliff vegetation community.
P4	*Grevillia minuata*	Cliffs or rocky slopes, sometimes along watercourses.	*Forms scattered thickets throughout the EB-w vegetation community
P1	*Jacquemontia* sp. Keep River (J.L. Egan 5051)	Cliff faces and cliff margins of ironstone/sandstone geological formations	*Probably occurs throughout the CL vegetation community
Currently nominated for	*Kunzea* sp. Keep River	Damp shaded sand stone cliff faces.	C.379 individuals on south west facing cliffs.

Priority Code	Species	Habitat	Location (WGS84/52K)
priority status			E: 428933, N: 8153498 E: 428750, N: 8153392
P1	*Triodia cremnophila*	Cliff faces and cliff margins of ironstone/sandstone geological formations. Drainage lines	E: 429547, N: 8153153 E: 431247, N: 8152605
Currently nominated for priority status	*Triodia* sp. Argyle (aff. cunninghamii)	Cliff faces and cliff margins of ironstone/sandstone geological formations	Probably occurs throughout the CL vegetation community


427500
430000
432500
8155000
8152500
M 259SA
E 80/2389
P 80/1750
E 80/4309
Figure 4-3: Kunzea sp. Keep River near the RIOP Matsu Project Survey Area
Matsu Biological Survey Area
Mining Tenements
Flora of Conservation Significance
Kunzea sp. Keep River, Currently nominated for Priority status
animal plant mineral
ems@animalplantmineral.com.au
(08) 6296 5155
Scale: 1:20,000
Date: 31/03/2014
Author: T. Smith
N
0
370
740
1,480
Meters
GDA 1994 MGA Zone 52
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Ge
\\MAINSERVER-PC\server storage\APM GIS and Mapping\03_Client\KMG\02_ArcGIS Maps\Matsu\20140331_KMG044_Fig4-3KunzeaspKeepRiver.mxd

4.2 FAUNA SURVEY RESULTS

4.2.1 Survey Adequacy

General database searches indicate that 222 bird species, 84 reptile species, 26 amphibian species and 39 mammal species have been located in the area. Recent studies in the local area undertaken on the RIOP and Argyle Diamond Mine have recorded 99.1 % of the expected birds, 95.2 % of the expected reptiles, 80.8 % of the expected amphibians and 94.9 % of the expected mammals for the area (Table 4-4). Based on the quality of the data in surrounding areas we have almost complete certainty of the species assemblages of the area and can accurately describe the species assemblages of the Survey area based on a desktop assessment.

Table 4-4: Survey Adequacy across the Local RIOP Area

	Expected	RIOP area	Argyle and RIOP combined
Birds	222	36.0%	99.1%
Reptiles	84	48.8%	95.2%
Amphibians	26	42.3%	80.8%
Mammals	39	69.2%	94.9%

4.2.2 Fauna of Conservation Significance

Based on searches of the *EPBC Act*, DPaW list of Threatened and Priority Fauna and NatureMap 35 species of conservation significance have previously been recorded or have the potential to occur within 20km of the Project. These species comprise 23 birds, seven mammals, two reptiles, one invertebrate and two fish

The list of potentially occurring species of conservation significance was then validated using APM's in-house fauna capture data base for previous KMG fauna surveys and the fauna habitat map produced for the Survey area. Table 4-5 lists the fauna species of conservation significance with potential to occur in the Survey area, their conservation status, and their likelihood of occurrence.

Of the 35 species of conservation significance that may occur in the Survey area, 10 species are considered likely to occur, and are shaded in blue in Table 4-5.

Table 4-5: List of Conservation Significant Fauna potentially occurring in the Survey area

Species	Common Name	Conservation Status			Likelihood of Occurrence in the Survey Area
		Commonwealth Level (*EPBC Act*)	State Level (*WC Act*)	DPaW (Priority status)	
Birds					
Anseranas semipalmata	Magpie Goose	Listed Marine Species			**Unlikely to Occur.** While this species does utilise aquatic and terrestrial habitats, it is mainly found in shallow wetlands with dense growth of rushes or sedges (SEWPaC SPRAT 2013). No suitable habitat occurs in the Survey area.
Tadorna radjah	Burdekin Duck		Schedule 4		**Highly Unlikely to Occur**. The species prefers the brackish waters of mangrove flats and paperbark tree swamps, but will visit freshwater swamps, lagoons, and billabongs further inland during the wet season. It has been recorded at the sewage ponds of the Argyle Diamond Mine. No suitable habitat occurs in the Survey area.
Phaps histrionica	Flock Bronzewing			Priority 4	**Unlikely to Occur**. This species is the most nomadic of the Australian pigeons and is occasionally found in the Kimberley. Its preferred habitat is open grassland on black soil plains, salt bush and *Triodia* hummock grasslands. It has been recorded in the Lake Argyle area.
Apus pacificus	Fork-tailed Swift	Migratory Marine/ Wetland Species			**Likely to Occur.** This species is almost exclusively aerial. It occurs over cliffs, beaches, islands and settled areas (SEWPaC SPRAT 2013). This is a seasonal migrant and has been recorded in previous wet season surveys in the area.
Ardea ibis	Cattle Egret	Migratory Marine/ Wetland Species			**Unlikely to Occur.** While this species often forages away from water on low lying grasslands and improved pastures, it is mainly associated with shallow, open and freshwater wetlands (SEWPaC SPRAT 2013). No suitable habitat occurs in the Survey area.

Species	Common Name	Conservation Status			Likelihood of Occurrence in the Survey Area
		Commonwealth Level (*EPBC Act*)	State Level (*WC Act*)	DPaW (Priority status)	
Ardea alba	Great Egret, White Egret	Migratory Marine/ Wetland Species			**Unlikely to Occur.** This species usually frequents shallow waters of a wide range of wetlands (SEWPaC SPRAT 2013) of which there are none in the Survey area.
Ixobrychus minutus	Little Bittern			Priority 4	**Highly Unlikely to Occur**. This species is associated with wetlands fringed with dense vegetation. No suitable habitat occurs in the Survey area.
Ixobrychus flavicollis	Black Bittern			Priority 3	**Highly Unlikely to Occur**. This species is associated with wetlands fringed with dense vegetation. No suitable habitat occurs in the Survey area.
Botaurus poiciloptilus	Australasian Bittern		Schedule 1 Endangered		**Highly Unlikely to Occur**. This species occurs mainly in densely vegetated freshwater wetlands (SEWPaC SPRAT 2013), which do not occur in the Survey area.
Haliaeetus leucogaster	White-bellied Sea-eagle	Migratory Terrestrial/ Marine Species			**Unlikely to Occur**. Found in both coastal and terrestrial habitats such as estuaries, mangroves, woodlands, rivers and lakes. Generally forages over large expanses of water (SEWPaC SPRAT 2013) which do not occur in the Survey area.
Falco peregrinus	Peregrine Falcon		Schedule 4		**Potential to Occur**. While this species is found across Australia, it is not common anywhere. It uses a wide range of habitats and is associated with cliffs where it nests. There are suitable cliffs in the Survey area and it has been recorded at nearby Argyle Diamond Mine and north in the RIOP.

Species	Common Name	Conservation Status			Likelihood of Occurrence in the Survey Area
		Commonwealth Level (*EPBC Act*)	State Level (*WC Act*)	DPaW (Priority status)	
Ardeotis australis	Australian Bustard			Priority 4	**Potential to Occur.** While **t**his species has been recorded at the nearby Argyle Diamond mine, it has not been recorded on the rocky escarpment and it prefers the flat plains similar to the Low Rolling Hills habitat through which Access Track Option 3 traverses.
Burhinus grallarius	Bush Stone-curlew			Priority 4	**Potential to Occur**. While **t**his species has been recorded at the nearby Argyle Diamond mine, it has not been recorded in previous surveys on the rocky ridges and it prefers the flat plains similar to the Low Rolling Hills habitat through which Access Track Option 3 traverses.
Charadrius veredus	Oriental Plover, Oriental Dotterel	Migratory Wetland/ Marine Species			**Unlikely to Occur**. This species is a non-breeding visitor to Australia (breeds in Mongolia). Upon arrival, they utilise the coastal habitats such as estuarine mudflats and sandbanks. They then move inland where the preferred habitat is flat, open, semi-arid or arid grasslands, where the grass is short and sparse, and interspersed with hard, bare ground, such as claypans, dry paddocks, playing fields, lawns and cattle camps (SEWPaC SPRAT 2013).
Rostratula australis	Australian Painted Snipe	Endangered	Schedule 1 Endangered		**Highly Unlikely to Occur**. This species is extremely cryptic and can often be found sheltering in dense grass or under the shade of trees well away from water. However, typical habitat comprises ephemeral or permanent water, usually with muddy edges (SEWPaC SPRAT 2013). No suitable habitat occurs in the Survey area.
Glareola maldivarum	Oriental Pratincole	Migratory Wetland/ Marine Species			**Unlikely to Occur**. This species is a non-breeding visitor which hawks low over flooded grassland or on the ground where locusts are present (SEWPaC SPRAT 2013). No suitable habitat occurs in the Survey area.

Species	Common Name	Conservation Status			Likelihood of Occurrence in the Survey Area
		Commonwealth Level (*EPBC Act*)	State Level (*WC Act*)	DPaW (Priority status)	
Merops ornatus	Rainbow Bee-eater	Migratory Terrestrial/ Marine Species			**Likely to Occur**. This species usually occurs in open, cleared or lightly timbered areas that are often, but not always, located in close proximity to permanent water (SEWPaC SPRAT 2013). It has been recorded in the Survey area.
Malurus coronatus	Purple-crowned Fairy-wren	Vulnerable		Priority 4	**Unlikely to Occur**. This species prefers to occupy habitats along or very close to rivers and streams, in thick vines or pandanus but occurs less frequently in dense grasslands and mangroves (SEWPaC SPRAT 2013). No suitable habitat occurs in the Survey area.
Erythrotrirchis radiatus	Red Goshawk	Vulnerable	Schedule 1 Vulnerable		**Unlikely to Occur.** The Red Goshawk has the ability to disperse hundreds of kilometres and there is very little information available on non breeding habitat. Suitable breeding habitat consists mainly of tall riparian vegetation supporting a high density of bird prey species. The Red Goshawk prefers to nest in the tallest available tree within 1 km of permanent water. There is no suitable nesting habitat in the Survey area and none of the numerous bird censuses conducted by APM in the area have recorded this species.
Falcunulus frontatus whitei	Northern Shrike-tit	Vulnerable		Priority 4	**Unlikely to Occur.** The Northern (Crested) Shrike-tit prefers habitat of open eucalypt woodland. Given the habitat requirements, there is potential for this species to occur however, the Northern Shrike-tit has a very fragmented distribution and none of the numerous bird censuses conducted by APM in the area have recorded this species.
Tyto novaehollandiae kimberlii	Masked Owl (northern)	Vulnerable		Priority 1	**Unlikely to Occur.** The Masked Owl inhabits forests, woodlands, timbered waterways and open country on the fringe of these areas. The main requirements are tall trees with suitable hollows for nesting and roosting and adjacent areas for foraging. Suitable hollow bearing woodlands and timbered waterways are not present in suitable structure in the Survey area and none of the numerous bird censuses conducted by APM in the area have recorded this species.

Species	Common Name	Conservation Status			Likelihood of Occurrence in the Survey Area
		Commonwealth Level (*EPBC Act*)	State Level (*WC Act*)	DPaW (Priority status)	
Erythrura gouldiae	Gouldian Finch	Endangered/ Migratory Terrestrial		Priority 4	**Likely to Occur**. This species has been recorded nearby in previous surveys and was also recorded at the RIOP camp during the current survey. It is expected to occur in the Survey area at various times of the year related to the seeding of food grass species.
Heteromunia pectoralis	Pictorella Mannikin			Priority 4	**Likely to Occur**. This species was recorded at the RIOP camp during a recent survey. It is expected to occur in the Survey area at various times of the year related to the seeding of food grass species.
Mammals					
Dasyurus hallucatus	Northern Quoll	Endangered	Schedule 1 Endangered		**Unlikely to Occur**. A targeted search of the Survey area and the neighbouring ridges of RIOP (from previous surveys) did not find any Northern Quolls. No quolls were recorded in surveys on the nearby Argyle Diamond Mine.
Macrotis lagotis	Greater Bilby	Vulnerable	Schedule 1 Vulnerable		**Unlikely to Occur**. Bilby occur in a variety of habitats, usually on landforms with level to low slope topography and light to medium soils. It occupies three major vegetation types; open tussock grassland on uplands and hills, mulga woodland/shrubland growing on ridges and rises, and hummock grassland in plains and alluvial areas. The distribution of Greater Bilbies can be limited by the availability of suitable burrowing habitat where burrow excavation is easier (SEWPaC SPRAT 2013). None of the suitable Bilby habitats occur in the Survey area and Bilby have not been recorded in numerous surveys conducted by APM.
Hydromys chrysogaster	Water-rat			Priority 4	**Unlikely to Occur**. This species prefers permanent water bodies of brackish and fresh water. They live in burrows in the bank along the water (Australian Museum 2010a). Ideal habitat does not occur in the Survey area.
Leggadina lakedownensis	Short-tailed Mouse			Priority 4	**Unlikely to Occur**. This species is known to occur on sandy soils and cracking clays in Western Australia (DEC 2012d). Ideal habitat does not occur in the Survey area.

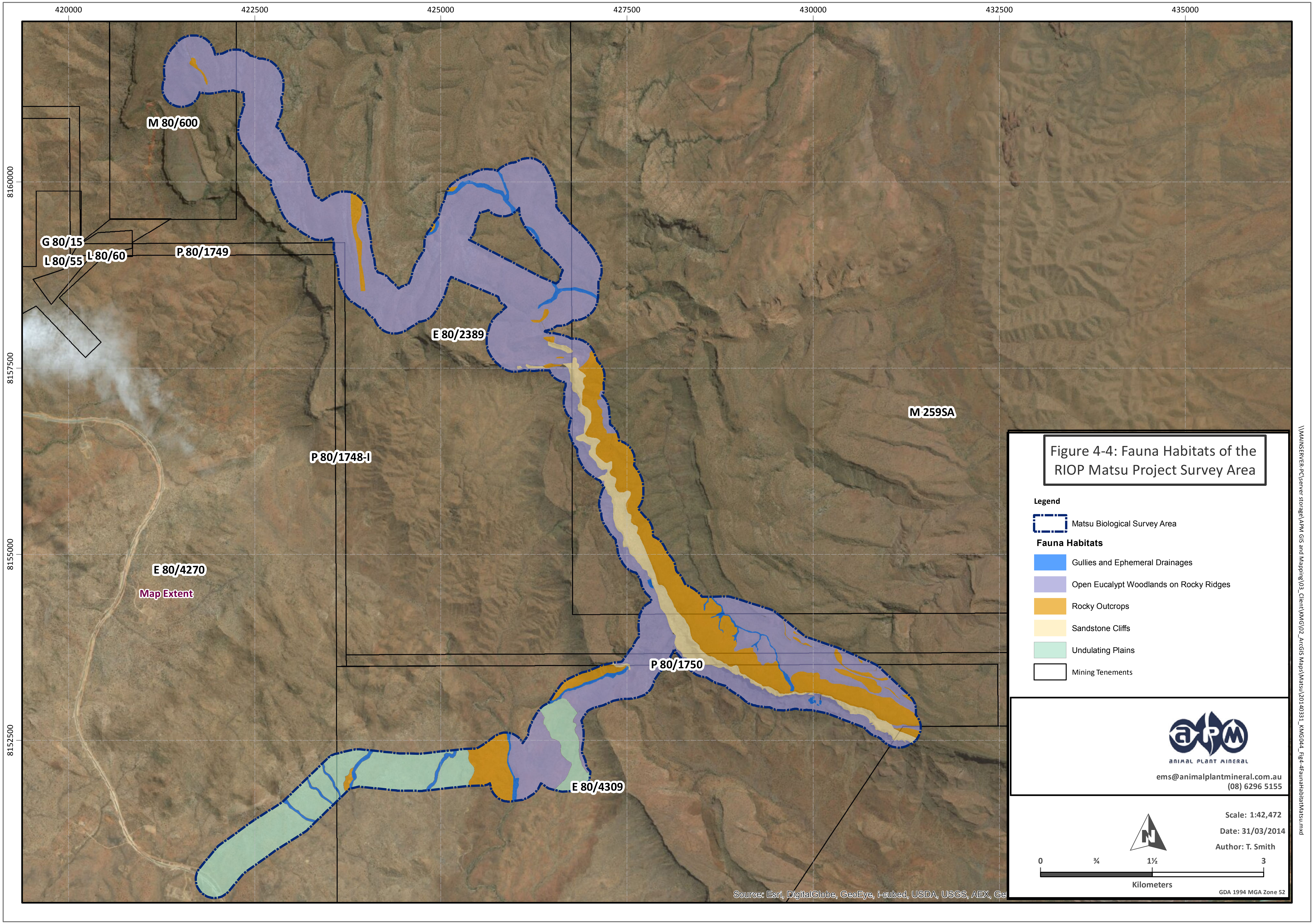
Species	Common Name	Conservation Status			Likelihood of Occurrence in the Survey Area
		Commonwealth Level (*EPBC Act*)	State Level (*WC Act*)	DPaW (Priority status)	
******Rhinonicteris auriantia*	*Orange Leaf-nosed Bat		Schedule 1-Vulnerable		**Likely to Occur**. These bats prefer very humid caves. The species is known to expand to woodlands during the wet season and contract back to the caves in the dry season. This species was recorded inside the Survey area, the RIOP Mine Site area as well as 15 km north of the RIOP Mine Site.
**Hipposideros stenotis*	*Northern Leaf-nosed Bat			Priority 2	**Likely to Occur**. These bats prefer low humidity caves preferring to roost singly or in small groups close to the entrance. Experience from other locations have shown that these bats remain present in areas that have mid to high levels of human activity (Bullen unpublished) even to the extent that *H. stenotis* has remained present during and after large scale open cut mining on Koolan Island. This species has been recorded inside the RIOP as well as 15 km north. It was not recorded during this survey.
**Macroderma gigas*	*Ghost Bat			Priority 4	**Likely to Occur**. This species expands its foraging range in the wet season and contracts back to stable roost caves during the dry season. This species was recorded inside the Survey area and in the RIOP Mine Site area.
Reptiles					
Crocodylus johnstoni	Freshwater Crocodile	Listed Marine Species		Schedule 4	**Highly Unlikely to Occur**. This species inhabits various freshwater environments and will move through the inundated floodplains during the wet season (Australian Museum 2010b). No suitable habitat occurs in the Survey area.
Crocodylus porosus	Salt-water Crocodile	Migratory Marine Species			**Highly Unlikely to Occur**. This species mostly occurs in tidal rivers, coastal floodplains and channels, billabongs and swamps up to 150 km inland from the coast. This habitat does not occur in the Survey area (SEWPaC SPRAT 2013).
Invertebrates					
Mouldingia orientalis	Land snail			Schedule 1	**Potential to Occur.** These snails are often associated with, and restricted to, the tropical vine thickets in the Kimberley. The sandstone cliff maintains a vegetation community representative of tropical vine thicket and so this species has the potential to occur in the Survey area. However no impacts are expected as the sandstone cliffs

Species	Common Name	Conservation Status			Likelihood of Occurrence in the Survey Area
		Commonwealth Level (*EPBC Act*)	State Level (*WC Act*)	DPaW (Priority status)	
					and vine thickets will not be disturbed by mining operations.
Fish					
Pristis pristis	Freshwater Sawfish	Vulnerable			**Highly Unlikely to Occur**. There are no rivers present in the Survey area suitable for either permanent residence or migration of these fish.
Syncomistes rastellus	Drysdale Grunter			Priority 2	**Highly Unlikely to Occur**. This species prefers large streams rather than small tributaries (Fishbase 2013) of which there are none in the Survey area.

* These bat species were not listed on any government database as potentially occurring in the area, however, over the course of three surveys (APM 2009, 2010 and 2012); these bat species of conservation significance have been recorded.

4.2.3 Fauna Habitats

Fauna assemblages are closely aligned with available habitats. The habitat types chosen for this project represent a scale based on the size of the Survey area in relation to the surrounding landscape and largely reflect landform, soil type and vegetation communities. Five types of fauna habitats have been classified as occurring within the Survey area and are summarised below and shown in Figure 4-4.



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Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Ge
Figure 4-4: Fauna Habitats of the RIOP Matsu Project Survey Area
Legend
Matsu Biological Survey Area
Fauna Habitats
Gullies and Ephemeral Drainages
Open Eucalypt Woodlands on Rocky Ridges
Rocky Outcrops
Sandstone Cliffs
Undulating Plains
Mining Tenements
animal plant mineral
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Rocky Outcrops

On the lightly wooded stony slopes, that have an established shrub layer and a ground cover of hummock grasses the Kimberley Rock-rat *Zyzomys woodwardi*, Storr's Monitor *Varanus storri* subsp. *ocreatus* and the more woodland orientated skinks such as *Ctenotus inornatus* have been captured in abundance at nearby surveys.

Surface expressions of sandstone boulders are a common occurrence and provide complex refuges for saxacoline reptile species, including the Panther Skink *Ctenotus pantherinus*, and small mammals, such as the Stripe-faced Dunnart *Sminthopsis macroura*.

The rockier habitats (outcroppings) support a more unique fauna assemblage including the Spiny-tailed Monitor, *Varanus acanthurus* and the Spotted Gecko *Gehyra punctata*. The *Triodia* spp. is particularly favoured by the skink, *Ctenotus pantherinus* and the Spinifex specialist *Strophurus taeniatus*. The Long-tailed Rock Monitor *Varanus kingorum* would also occur and is known to be a rock specialist.

During trapping the Common Rock-rat *Zyzomys argurus* (75 individuals) and the Ningbing False Antechinus *Pseudantechinus ningbing* (two individuals) were captured in this habitat.

Plate M: Rocky Outcrops

Open Eucalypt Woodland on Rocky Ridges

This habitat covers much of the Survey area and represents an interzone between multiple habitats, including nearby rocky outcrops, cliffs or drainage lines.

Widely foraging species such the Greater Black Whips Snake *Demansia papuensis*, Black-headed Python *Aspidites melanocephalus* and the Spotted Snake *Suta punctata* would utilize this habitat and be well represented in the project area. The diverse woodland species and mid-dense grass layer create a good cover for the swift moving Ctenotus species, such as *C. inornatus* and *C. robustus*, and the pygopid *Pygopus steelescotti*. The interspersed shrubland provides habitat for dragons, such as *Diporiphora lalliae* and *D. magna*, and the gecko *Strophurus ciliaris* that perches on shrub branches, relying on crypsis to escape predation during the day. Fossorial skink species are abundant in the dense litter and detrital layer, including the Rainbow Skink *Carlia triacantha* and the small legless lizard *Lerista borealis*.

No amphibians are expected to occur in this habitat other than water holding species such as *Cyclorana* spp. which burrow deep within clay soils and emerging in the wet season. Bird species which favour the open woodland include the Weebil *Smicrornis brevirostris*, Brown Honeyeater *Lichmera indistincta* and Northern Rosella *Platycercus venustus*.

Small mammals may include the Long-tailed Planigale Planigale ingrami, whilst Wild dogs, *Canis familiaris*, the Antilopine Wallaroo *Macropus antilopinus* and the Euro *Macropus robustus* would best represent the macro-fauna of the Survey area.

Plate N: Open Eucalypt Woodland on Rocky Ridges

Undulating Plains:

This habitat is similar in structure to the open eucalypt woodland on rocky ridges habitat, however the main difference is that this habitat is located off the escarpment and down on the undulating plains which tend to form broad valleys between ranges. The landform consists mainly of moderate slopes with scattered steep bouldery hills and which is crossed by ephemeral drainages.

The vegetation generally comprises of open eucalypt woodland over tall mixed upland grasses. Due to the flatter nature of this habitat compared to the typically more rugged and steep terrain in the area, species that prefer the plains such as the Australian Bustard and Bush Stone-curlew are more likely to be found in this habitat.

Similar widely foraging species found in the open woodland on rocky ridges habitat may also utilise the undulating plains habitat e.g. Greater Black Whips Snake *Demansia papuensis*, Black-headed Python *Aspidites melanocephalus* and the Spotted Snake *Suta punctata*. The diverse woodland species and mid-dense grass layer create a good cover for the swift moving Ctenotus species, such as *C. inornatus* and *C. robustus*, and the pygopod *Pygopus steelescotti*. The grasslands within this habitat provide a food source for seed eating birds and may provide useful feeding habitat for the conservation significant species; Gouldian Finch and Pictorella Manikin.

Plate O: Undulating Plains

Gullies and Ephemeral Drainages

Minor, intermittent ephemeral drainage within the Deposit Development Envelope consists of a small drainage line at the bottom of the slope and several gullies leading into it from the top of the escarpment. The base of many of these small gullies and ephemeral drainages sustain numerous small pools. Although mostly ephemeral, when present these pools provide an important water source for many species, notably numerous species of frog (including the invasive Cane Toad). In addition to the pools, the low-lying areas support a different suite of vegetation, being slightly denser than that of the surrounding woodland.

The ephemeral drainages cross a number of different habitats and therefore serve as dispersal corridors for a variety of fauna particularly amphibians, including the invasive Cane Toad. These drainages may also hold water for longer time periods than the surrounds and can function as vital water sources for a number of species, including the larger macropods, bats and birds.

A number of smaller mammals utilize the intermittent drainage lines where deposition of silt and sand promote the growth of very thick hummock and tussock grasses. In identical habitats, a number of Long-tailed Planigale *Planigale ingrami*, Chestnut Mice *Pseudomys nanus* and Long-haired Rats *Rattus villosisimus* have been recorded in previous surveys. Kimberley Rock-rats *Zyzomys argurus* from adjacent steep rocky slopes will also utilise the habitat.

The greatest bat species richness is typically recorded around wet areas, particularly where the water occurs in close association to rock outcrops and overhangs. Species expected include the Gould's Wattled Bat *Chalinolobus gouldii*, the Beccari's Freetail Bat *Mormopterus beccarii*, the Hoary Wattled Bat *Chalinolobus nigrogriseus*, the bent-wing bat *Miniopterus schreibersii*, the Yellow-bellied Sheathtail Bat *Saccolaimus flaviventris*, the Little Broad-nosed Bat *Scotorepens greyii* and the Northern Cave Bat *Vespadelus caurinus*.

Plate P: Gullies and Ephemeral Drainages

Sandstone Cliffs

The sandstone cliffs in the area encompassing the RIOP Matsu Project, are quite extensive. Species likely to favour these environments are cliff dwelling reptiles such as *Varanus glauerti*, rock wallabies, bird species such as the White-quilled Rock-pigeon *Petrophassa albipennis* and bats such as the Northern Leaf-nosed-bat *Hipposideros stenotis*. If present the Peregrine Falcon *Falco peregrinus* will also nest on these vertical cliffs. The sandstone cliffs are unlikely to be impacted by activities at the Deposit Development Envelope as mining operations will be restricted to the back slopes.

Plate I: Sandstone Cliffs

4.2.4 General Fauna

As described in Section 4.2.3, the Survey area only contains four distinct fauna habitats. Based on known distributions and habitat preferences, the expected fauna list for the Survey area comprises 118 bird, 34 mammal, 74 reptile and 18 amphibian species (Appendix 9).

Birds

A total of 44 bird species were recorded during the field survey (Appendix 10). The Rainbow Bee-eater *Merops ornatus* was the only species of conservation significance to be recorded. Two bird species, Tree Martin *Petrochelidon nigricans* and Masked Woodswallow *Artamus personatus*, were observed within the RIOP area for the first time during this survey. The Tree Martins were observed feeding along the cliff face; while a group of 50+ Masked Woodswallows was seen flying over the Deposit Development Envelope migrating in a north-easterly direction.

Mammals

While no Northern Quoll were recorded during the trapping survey, two other mammals were trapped; the Common Rock-rat *Zyzomys argurus* (75 individuals) and the Ningbing False Antechinus *Pseudantechinus ningbing* (two individuals). The trapping of the Ningbing False Antechinus is the first record for the RIOP area and neighbouring Argyle Diamond Mine. Additionally, two species were observed opportunistically during the bird surveys; the Euro *Macropus robustus* and Short-eared Rock-wallaby *Petrogale brachyotis*.

The echolocation survey revealed the presence of ten bat species in the Deposit Development Envelope (Appendix 10). Two of these species are of conservation significance; the Ghost Bat *Macroderma gigas* (Priority 4) and Orange Leaf-nosed-bat *Rhinonicteris aurantia* (Vulnerable under the *WC Act*). Both are species that roost in caves and as the bat-detectors were positioned above two cave entrances, it is reasonable to assume these species utilize the caves in the cliff face of the Survey area for roosting. Previous surveys have also recorded the Northern Leaf-nosed-bat *Hipposideros stenotis* (Priority 2) in the RIOP area. This species utilizes similar habitat to the Orange Leaf-nosed-bat and as such has the potential to occur in the Survey area.

Reptiles

Based on literature and previous surveys of the region a total of 74 reptiles have the potential to occur in the Survey area. While the field survey did not include a reptile component two species were observed opportunistically while conducting bird surveys. These were the Spiny-tailed Monitor *Varanus acanthurus* and Green Tree Snake *Dendrelaphis punctulata*. No species of conservation significance are expected to occur in the Survey area.

Amphibians

The field survey opportunistically recorded two of the potential 18 amphibian species in the Survey area, the Rockhole Frog *Litoria meiriana* and the introduced Cane Toad *Rhinella marina*. The creek at the bottom of the slope in the Deposit Development Envelope contained high numbers of Cane Toads at various stages of development. The Cane Toad is an invasive poisonous species that has caused the population decline of many native predators; its progress through Australia has been documented and it was recorded entering WA in March 2009. No Cane Toads were observed during the August 2010 survey of the RIOP area. However, at the Argyle Diamond Mine the first Cane Toads were recorded in 2011 and it appears that Cane Toads reached the RIOP area sometime between 2010 and 2012 and are now firmly established in the area. Other than the Cane Toad, which is listed as invasive in the *EPBC Act*, no species of conservation significance are expected to occur in the Survey area.

5 DISCUSSION AND CONCLUSION

5.1 FLORA AND VEGETATION

The upper strata (canopy layer) of the vegetation communities occurring within the RIOP Matsu Project are relatively uniform and, by and large, represent *Eucalyptus/Corymbia* woodland and open woodland, typical of the sandstone and ironstone ridges and plateaus found throughout the Rugged Range (APM 2010, APM 2009, Ecologia 2005).

Of the vegetation communities observed during ground truthing, a higher degree of heterogeneity was found throughout the mid and ground stratum (shrub/grass and herb layer) within vegetation communities associated with the Deposit Development Envelope. These two strata can often form sub communities which are too small to map at a practical scale. This is particularly relevant to vegetation community EB-w, which contains thickets of *Grevillea minuata*, a Priority 4 shrub species. To accurately determine the potential for direct impact from the RIOP Matsu Project on stands of this species, further comprehensive ground survey work would be required.

However *Grevillea minuata* has previously been recorded throughout the Sam, North of Sam and Tony iron ore deposits of the RIOP to the north (Ecologia 2005) and throughout the southern reaches of the Ragged Range. Therefore it could be said the species is relatively well represented in the local area and the areas proposed for disturbance comprise a small portion of its potential distribution.

The PEC's will not likely be impacted by the development of the RIOP Matsu Project. The vertical sandstone surfaces will remain as undisturbed as possible with mining operations structured to minimise any impacts to the priority P1 vegetation community as much as is possible and practical. The Monsoon Vine Thicket pockets are located outside the development envelopes and are not traversed by any of the access track options.

The vegetation community CL runs virtually unbroken along the western and south western edges of the Survey area and is representative of a Priority 1 PEC. The CL community is associated with three Priority taxa *Eucalyptus ordiana* (P2), *Triodia cremnophila* (P1) as definitive dominants, plus the creeping perennial herb *Jacquemontia* sp. Keep River (P1) as an occasional associated taxon. Individuals of *Eucalyptus ordiana* (P2) and *Jacquemontia* sp. Keep River (P1) were not detected within the Survey area but are known to occur within the CL community further north (APM 2012). Potential impacts to *Eucalyptus ordiana* and *Jacquemontia* sp. Keep River resulting from development of the RIOP Matsu Project will require management. *Triodia cremnophila* was detected within the Survey area and appears to be endemic to the southern reaches of the Rugged Range. Further ground survey work scheduled to be carried out in April/May 2014 will be highly beneficial and allow a full assessment of the distribution and conservation status of these taxa to be undertaken.

Although the VT vegetation community will not be directly impacted by the development of the Survey area it is anticipated that this vegetation community is dependent on drainage from the Survey area. If the Project has the potential to disrupt drainage patterns, the health of this community may require monitoring as the Project progresses. At present, the composition of the Vine Thicket vegetation community (VT), which is representative of a Priority 1 PEC, is currently unknown and will require further assessment.

The four introduced (weed) species, **Calotropis procera* **Cenchrus americanus* **Melinis repens* and **Passiflora foetida,* were found in vegetation communities that are traversed by Access Track Option 1 (Figure 4-2). Therefore all four species are susceptible to spreading as a result of vehicle or mobile plant movement, related to the re-establishment of the Access Tracks and clearing within the development envelopes..

5.2 FAUNA

The development of the RIOP Matsu Project may have a negative impact on fauna in several ways. Some of the impacts are short-term and will only be experienced during the construction phase of the Project, while others will be long-term impacts on the biodiversity of the area.

5.2.1 Habitat Loss

The local impact of the clearing will be minor as the clearing area is relatively small and the fauna habitat that will be affected is common in the local region. The fauna habitats that were identified in the Survey area represent common features of the four identified Land Systems; MacPhee, Dockrell, Wickham and Pompey.

As the land systems provide a regional representation of vegetation and soil associations they can be used to calculate a very broad impact, using the large 500 m corridor of the access tracks, on the regional fauna habitat. The portion of Wickham Land System within the Survey area is 956 ha of a total area of 520000 ha representing a 0.18 % of the total Wickham Land System that may be impacted. The portion of Pompey Land System within the Survey area is 337 ha of a total area of 164800 ha, representing a 0.18 % of the total Pompey Land System that may be impacted. The portion of MacPhee Land System within the Survey area is 321 ha of a total area of 110600 ha, representing a 0.29 % of the total Macphee Land System that may be impacted. The portion of Dockrell Land System within the Survey area is 98 ha of a total area of 603800 ha, representing a 0.02 % of the total Dockrell Land System that may be impacted.

The above workings assume the entire Survey area will be impacted when development actually occurs. This is not the case and the reality is that the size of the area that will be impacted will be significantly less. For example the 500m access track corridor will only be 20 m. Additionally, only 1 of the two access track options will actually be chosen for use, thus further reducing the estimates of area to be impacted mentioned above.

Given the size and regional representation of the Wickham, Dockrell, MacPhee and Pompey Land Systems, the Project is expected to only have a minor impact on the fauna habitat available in the region.

The sandstone cliff face and the ephemeral drainages support unique or diversity rich fauna assemblages. In general a cliff face habitat supports a fauna assemblage with a high percentage of habitat specialists. This is shown by the presence of Short-eared Rock-wallabies, Sandstone Shrike-thrush, White-quilled Rock-pigeon and two bat species of conservation significance, within the Survey area.

As mining at Deposit Development Envelope is to take place on the back slope, this should protect the cliff face habitat, which is potential habitat for the conservation significant bats and Peregrine Falcon, from disturbance.

The ephemeral drainages have the potential to be indirectly impacted by the mining operation. Mining operations may result in the diversion of rainfall runoff from the surrounding south-eastern slopes away from the drainage. However, due to the high amount of rain that falls during the wet season (> 590 mm) the effect is likely to be minimal, with the drainage still being saturated and flowing in the wet season.

The clearing of vegetation along a linear area, such as the access tracks, has the potential to lead to fragmentation of the surrounding habitat. While fragmentation is expected to be minimal, it has the potential to impact species that are transient between two habitats, such as small mammals that refuge in the sandstone cliff and forage in the stony slopes.

5.2.2 Mortality

Clearing will likely result in localised deaths of native non-volant fauna. However, the extent and intensity of the impact is not considered significant enough to impact species richness and diversity beyond the individual level. Moreover, very few conservation significant fauna species are likely to occur in the areas proposed to be cleared. Biodiversity will be maintained through the maintenance of local populations of fauna distributed beyond the clearing area for the Survey area.

5.2.3 Conservation Significant Species

Two bat species of conservation significance, Orange Leaf-nosed-bat and Ghost Bat have been recorded above the caves in the cliff face in the Survey area and another species, the Northern Leaf-nosed-bat, has been recorded in the RIOP area in identical habitat and, therefore, has the potential to occur in the Survey area, however it was not recorded during this survey.

A survey of the cliffs in the RIOP Matsu Project area is planned for March/April 2014. This survey will seek to further investigate any accessible caves for their potential usage as roosting habitat for the conservation significant bat species.

The construction and operation of the RIOP Matsu Project should not interfere with these species as mining will take place on the back slope, leaving the cliff face largely untouched. Noise and light disturbance is unlikely to displace the animals as experience from other locations have shown that these bats remain present in areas that have mid to high levels of human activity. Northern Leaf-nosed-bats have remained in large crevices on the cliff faces immediately adjacent to the Sam pit in the RIOP, and after large scale open cut mining on Koolan Island. (Bullen unpublished).

The Peregrine Falcon uses steep cliffs for nesting and has the potential to use the sandstone cliffs in the Survey area for breeding. While in the nesting stage the species is extremely sensitive and might abandon their nestlings when disturbed. This species was recorded over the backslope of the Sam Deposit of the RIOP in 2009. However, no white faecal smears, characteristic of nesting sites of the Peregrine Falcon, were observed along the cliffs.

The Fork-tailed Swift is a migratory species, which is almost exclusively aerial, only landing to breed. As this species is a non-breeding visitor to Australia the Survey area is not expected to impact the local population.

The Rainbow Bee-eater is protected in the *EPBC Act* as a 'Migratory' species; however, not all individuals of the species migrate. Populations that breed in the north of Australia are considered to be resident. This species is abundant in northern Australia and is regularly recorded in disturbed habitats such as roadside vegetation, quarries and mines. Due to its wide distribution and abundance in disturbed habitats the RIOP Matsu Project is not expected to have a significant impact on the population of Rainbow Bee-eaters.

The Gouldian Finch is distributed throughout the Kimberley and is generally classed as moderately common in the North, Central and East Kimberley and the lower Ord drainage area, while uncommon or scarce in most of the South Kimberley (Johnstone and Storr 2004). While the Gouldian Finch was not recorded in the Survey area, it has been recorded from adjacent ridges and the RIOP mining camp. A key threatening process for the Gouldian Finch is the destruction of potential nest sites. The species is an obligate cavity-nesting species and utilises smooth barked *Eucalyptus* and *Corymbia* species on rocky hills. The Survey area represents potential suitable breeding habitat.

Habitat surveys conducted across the RIOP area by APM in 2010 (Appendix 11) showed the density of suitable nesting hollows at RIOP (1.94 hollows/ha) to be lower than reported by other studies (4.6-27 hollows/ha; Gibbons and Lindenmayer 2002, Brazill-Boast *et al*. 2010). Thus the potential for nesting on the RIOP mine site appears to be low compared to other locations. KMG is currently undertaking an artificial nest box program to offset the loss of natural tree hollows removed during current operations. To date, a total of 110 artificial nest boxes across six different sites have been established to create alternative breeding sites. Gouldian Finches were observed using the nest boxes within six weeks of placement (S. Pryke pers. comm. 2011). Artificial nest boxes are known to increase natural breeding densities and fledging success (Brazill-Boast *et al*. 2012).

Consequently the RIOP Gouldian Finch artificial nestbox program appears to be successful at reducing impact on the local population resulting from any hollow bearing tree removal during clearing.

The Pictorella Mannikin is a partly granivorous bird that can be found feeding on grass seeds in the vicinity of water. It is expected to occur along ephemeral drainages in the Survey area when key grasses species are seeding. The RIOP Matsu Project is expected to have only a minor effect on this species given the small amount of feeding habitat that will be removed.

5.2.4 Short Range Endemics

Short Range Endemics are species with a naturally small range of less than 10,000 km^2 that occupy unique habitats that are broadly separated from each other. They are further characterised by poor dispersal capabilities and low fecundity. These animals would be impacted by the RIOP Matsu Project if suitable disjunct habitats are destroyed or if these habitats become further isolated.

However, the habitat present in the Survey area is common and continuous throughout the area and the area proposed for clearing is relatively small. Consequently, the RIOP Matsu Project is not expected to have an adverse impact on populations of short range endemics.

5.2.5 Feral Animals

Project development often leads to an increase in feral predators as new roads create corridors to new habitats. Cats are listed under the *EPBC Act* as invasive species and are of conservation significance due to the negative impact they have on native wildlife. Cats have not been observed in the RIOP, but have been observed at Argyle and are therefore expected to infiltrate the RIOP Matsu Project once operational.

Cane Toads are also ubiquitous throughout the RIOP and Argyle mine site areas. The development at the RIOP Matsu Project is not expected to significantly increase populations of this species.

6 CLEARING PRINCIPLES

Land clearing activities associated with the RIOP Matsu Project are considered below against the ten clearing principles outlined in Schedule 5 of the *Environmental Protection Amendment Act 2003*.

1) Native vegetation should not be cleared if it comprises a high level of biological diversity.

No Threatened Flora pursuant to the *WC Act*, were recorded in the Survey area. There were no TEC's recorded within or adjacent to the Survey area. A vegetation community associated with the cliff surfaces (CL) was identified as the Priority 1 PEC 'Plant assemblages on vertical sandstone surfaces'. Additionally, a plant community occurring just outside the Survey area was mapped as VT (Figure 4-1) and described to be similar to the Priority 1 PEC 'Monsoon Vine Thicket'.

The CL PEC is unlikely to be significantly impacted as the Matsu Deposit mining operations will occur on the back slope and any clearing of the cliff face will be as minimal as is practical. There is potential for minimal impact resulting from re-establishment of the Access Track Option 1 where it follows the cliff edges near the southern boundary of the alignment (Figure 4-2). However, the CL community is locally widespread and continues north of the Survey area and further south toward Argyle Diamond Mine.

The RIOP Matsu Project will impact the EB-w community which includes thickets of *Grevillea minuata* (P4) with scattered individuals of *Brachychiton tridentatus* and *Corymbia cadophora* subsp. *polychroma* however these species are known to occur throughout the North of Sam and Tony iron ore deposits to the north (Ecologia 2005).

It is recommended that a suitably trained person traverse the access track routes to identify and flag Priority species. The flagged individuals or populations can then be avoided by redirecting the track, where possible.

Additionally a regional survey of *Triodia cremnophila* would enable a better assessment of the extent of impact upon this species. If these precautions are carried out, the proposed developments will not be at variance with Principle 1.

2) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia.

Broad and general database searches identified 35 fauna species of conservation significance potentially occurring within the Survey area. After a critical assessment of habitat availability and analysis of relevant baseline surveys immediately adjacent the Survey area (within 20km), only 10 species of conservation significance were considered likely to occur.

Cats and Cane Toads are listed under the *EPBC Act* (1999) as invasive species and are of conservation significance due to the negative impact they have on native wildlife. Cats have not been observed in the area, but are expected to occur. Cane Toads were recorded in high numbers during the field survey and are common in the local area. Given the presence of existing populations of Cats and Cane toads and the nature of the operations forecast for the Matsu Deposit (mining without a requirement for accommodation camps), the clearing for the RIOP Matsu Project is not expected to enhance the populations of either species.

Two bat species of conservation significance, Orange Leafnosed-bat and Ghost Bat have been recorded above the caves in the cliff face in the Survey area and another species, Northern Leafnosed-bat, has been recorded in the RIOP area in identical habitat and, therefore, has the potential to occur in the Survey area. The Peregrine Falcon uses steep cliffs for nesting and has the potential to use the sandstone cliffs in the Survey area, having previously been recorded south at Argyle Diamond Mine and north in the RIOP.

The construction and operation of the RIOP Matsu Project should not interfere with these species as mining will take place on the back slope, leaving the cliff face untouched.

The RIOP Matsu Project will not decrease habitat availability for the aerial Fork-tailed Swift and the development may create nesting habitat for the Rainbow Bee-eater which is regularly recorded in disturbed habitats such as roadside vegetation, quarries and mines.

Clearing of potential nesting sites for the Gouldian Finch that may arise out of clearing will be offset by an extension of the ongoing Gouldian Finch Nest Box installation program first implemented at the RIOP in 2010. Artificial nest boxes are known to increase natural breeding densities and fledging success (Brazill-Boast *et al*. 2012); therefore the local population of Gouldian Finch is not expected to be negatively impacted as the artificial nest boxes offset the loss of natural hollows and even increases fecundity.

The Pictorella Mannikin may lose feeding habitat as grasslands are cleared. However, this habitat is well represented in the project area.

Provided that suitable management measures are implemented for the relevant conservation significant fauna, clearing for the RIOP Matsu Project is not at variance with Principle 2.

3) Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora.

None of the flora surveys undertaken in the vicinity of the Survey area, nor the ground survey work undertaken for the current report have ever recorded any Threatened Flora. The RIOP Matsu Project Area is therefore considered not likely to contain DRF or to be at variance with Principle 3.

4) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a threatened ecological community.

There are no known occurrences of TECs within the RIOP Matsu Project Area of in adjacent areas. The proposed developments are not considered to be at variance with Principle 4.

5) Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.

The Survey area does not comprise an isolated remnant of intact vegetation. Therefore, the proposed developments are not likely to be at variance with Principle 5.

6) Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.

The degree to which the P1 Vine thicket community is dependent upon drainage from the Survey area is not yet known. Although this community will not be impacted directly, it may be dependent on drainage, in the form of surface water channels or rock seepage, from the Survey area. Therefore health monitoring of Vine Thicket Community is recommended to remain compliant with this clearing principle.

7) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.

No appreciable land degradation is likely to arise as a result of clearing activities for the Survey area. The surface soils consist of gravelly loamy sands that are structurally stable and non-dispersive. Negligible surface water flow and sediment loss occurs in response to the high infiltration capacity of the soils and the presence of substantial gravels and rock fragments on the surface, which reduces the flow velocity of overland flow, minimizes the potential for sediment detachment and erosion. In addition, extensive rock armouring occurs over most surfaces which further protect the land surface from erosion and subsequent degradation. Additionally Access Track Option 1 follows a previously established historical track, therefore minimal land degradation will occur as a result re-establishing this track. Therefore land clearing will not be at variance to principle 7.

Four weeds species are present within the Survey area, of these, **Calotropis procera and *Passiflora foetida* are classified as 'invasive' under the Invasive Plant Prioritisation Process (DEC 2012b). Therefore APM recommends developing weed management measures prior to any vehicle movement or clearing to ensure weed species do not spread from infested to non-infested areas. If the weed management measures are implemented, the proposed developments are not likely to be at variance with Principle 7.

8) Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.

The Survey area is not located within or adjacent to any conservation reserves. The proposed developments are not considered to be at variance with Principle 8.

9) Native vegetation should not be cleared if the clearing of native vegetation is likely to cause deterioration in the quality of surface or underground water.

The anticipated clearing is not expected to have a detrimental impact on surface or groundwater quality. However management measures will be implemented to reduce sediment impacts and monitor water quality.

Creeks and drainage lines will be avoided during the development of site infrastructure and pits where possible. If creeks or drainage lines will be impacted a *Permit to Interfere with Bed and Banks* will be obtained through the Department of Water (DoW) under the *Rights in Water and Irrigation Act 1914* prior to any ground disturbance occurring. Adequate culverts will be installed to avoid impeding natural drainage lines and appropriately designed and located surface water diversion bunds and sediment trapping devices will be installed to ensure that potentially sediment laden waters do not enter the adjacent environment.

Upon cessation of mining the pits will be backfilled to minimise the potential for water ponding. The rehabilitated backfilled mine surface and post-mine landforms will be designed such that they do not impede or impact on surface water hydrology along the escarpment, and thus no impacts to surface water flows are expected to occur.

No impact on groundwater resources is expected as the water requirements for the proposed mine site are predicted to be relatively small and any abstraction will be undertaken in a sustainable manner. If the above precautions and operating procedures are adhered to, land clearing and ground disturbance will not be at variance to principle 9.

10) Native vegetation should not be cleared if the clearing of native vegetation is likely to cause, or exacerbate, the incidence or intensity of flooding.

Land clearing is not expected to increase the incidence or intensity of flooding as the properties of the surface soils (i.e. high infiltration rates and gravelly and rocky surface cover materials) will promote vertical infiltration of rainfall and deep recharge of the soil profile. It is therefore not expected that land clearing will significantly increase surface water runoff and subsequent flooding of low-lying areas. In addition, groundwater generally occurs at considerable depths below the surface and any increase in recharge in response to land clearing is not expected to cause an appreciable rise in groundwater levels.

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8 APPENDICES

APPENDIX 1: DEFINITIONS OF CONSERVATION CODES

EPBC ACT AND WA WILDLIFE CONSERVATION ACT DEFINITIONS

Schedule 1: Fauna that are rare or likely to become extinct.
Schedule 2: Fauna presumed to be extinct.
Schedule 3: Migratory birds that are listed under JAMBA.
Schedule 4: Other specially protected fauna.

Extinct: Taxa not definitely located in the wild during the past 50 years.
Extinct in the wild: Taxa known to survive only in captivity.
Critically Endangered: Taxa facing an extremely high risk of extinction in the wild in the immediate future.
Endangered: Taxa facing a very high risk of extinction in the wild in the near future.
Vulnerable: Taxa facing a very high risk of extinction in the wild in the medium-term future.
Near Threatened: Taxa that risk becoming Vulnerable in the wild.
Conservation Dependent: Taxa whose survival depends upon ongoing conservation measures. Without these measures, a conservation dependent taxon would be classed as Vulnerable or more severely threatened.
Data Deficient: Taxa suspected of being Rare, Vulnerable or Endangered, but whose true status cannot be determined without more information.
Least Concern: Taxa that are not Threatened.

Priority 1: Taxa with few, poorly known populations on threatened lands.
Taxa which are known from few specimens or sight records from one or a few localities on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, active mineral leases. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.

Priority 2: Taxa with few, poorly known populations on conservation lands.
Taxa which are known from few specimens or sight records from one or a few localities on lands not under immediate threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown land, water reserves, etc. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.

Priority 3: Taxa with several, poorly known populations, some on conservation lands.
Taxa which are known from few specimens or sight records from several localities, some of which are on lands not under immediate threat of habitat destruction or degradation. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.

Priority 4: Taxa in need of monitoring.
Taxa which are considered to have been adequately surveyed, or for which sufficient knowledge is available, and which are considered not currently threatened or in need of special protection, but could be if present circumstances change. These taxa are usually represented on conservation lands.

Priority 5: Taxa in need of monitoring.
Taxa which are not considered threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years.

APPENDIX 2: EPBC ACT PROTECTED MATTERS REPORT

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information about the EPBC Act including significance guidelines, forms and application process details can be found at http://www.environment.gov.au/epbc/assessmentsapprovals/index.html

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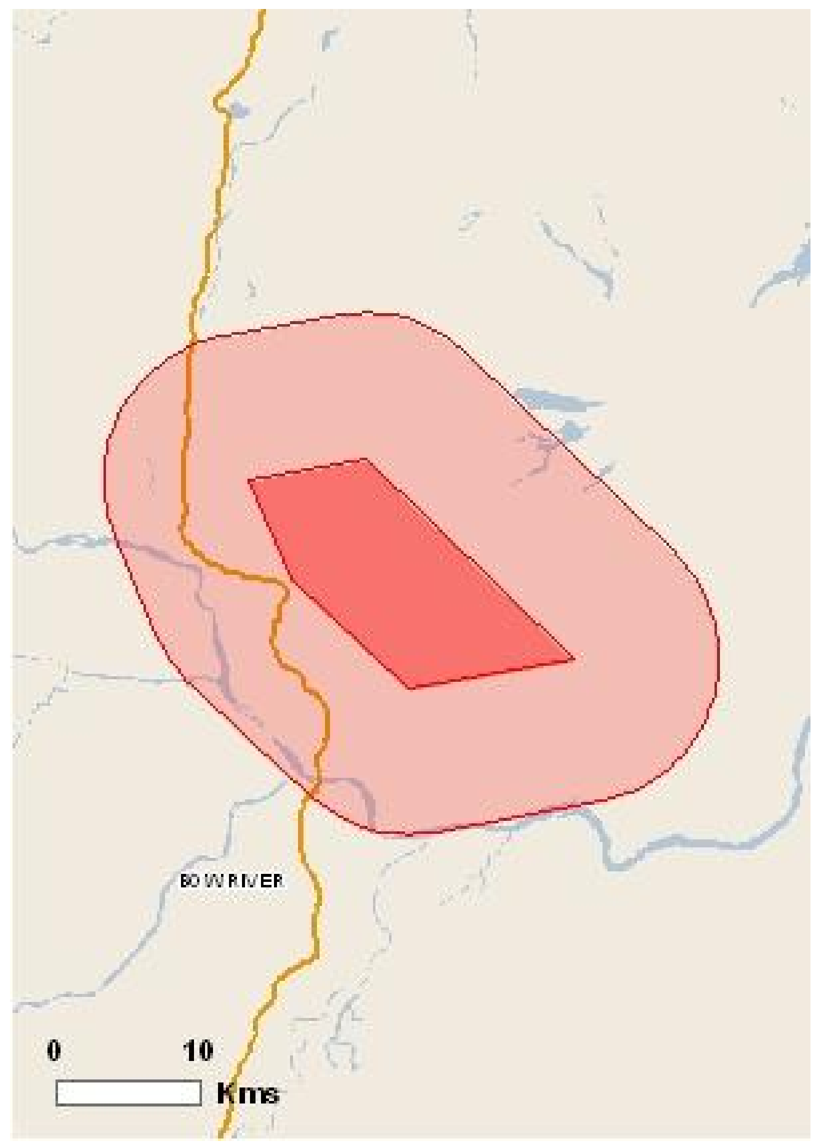

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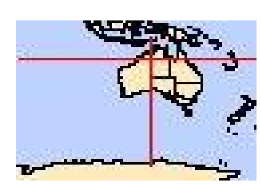

Summary

Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance - see http://www.environment.gov.au/epbc/assessmentsapprovals/guidelines/index.html

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International	2
Great Barrier Reef Marine Park:	None
Commonwealth Marine Areas:	None
Threatened Ecological Communities:	None
Threatened Species:	5
Migratory Species:	12

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place and the heritage values of a place on the Register of the National Estate. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage/index.html

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species. Information on EPBC Act permit requirements and application forms can be found at http://www.environment.gov.

Commonwealth Lands:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	11
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have

Place on the RNE:	1
State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	7
Nationally Important Wetlands:	None

Details

Matters of National Environmental Significance

Wetlands of International Significance (RAMSAR) [Resource Information]

Name	Proximity
Lake argyle and lake kununurra	Within 10km of Ramsar
Ord river floodplain	Upstream from Ramsar

Threatened Species [Resource Information]

Name	Status	Type of Presence
BIRDS		

Name	Status	Type of Presence
Erythrura gouldiae		
Gouldian Finch [413]	Endangered	Species or species habitat known to occur within area
Malurus coronatus coronatus		
Purple-crowned Fairy-wren (western) [64442]	Vulnerable	Species or species habitat likely to occur within area
Rostratula australis		
Australian Painted Snipe [77037]	Vulnerable	Species or species habitat likely to occur within area
MAMMALS		
Dasyurus hallucatus		
Northern Quoll [331]	Endangered	Species or species habitat likely to occur within area
SHARKS		
Pristis microdon		
Freshwater Sawfish [66182]	Vulnerable	Species or species habitat likely to occur within area

Migratory Species

[Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat may occur within area
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Migratory Marine Species		
Crocodylus porosus		
Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Erythrura gouldiae		
Gouldian Finch [413]	Endangered	Species or species habitat known to occur within area
Haliaeetus leucogaster		
White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Merops ornatus		
Rainbow Bee-eater [670]		Species or species habitat may occur within area
Migratory Wetlands Species		
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Charadrius veredus		
Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Glareola maldivarum		
Oriental Pratincole [840]		Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
[Rostratula benghalensis s. lat.](#) Painted Snipe [889]	Vulnerable*	Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Anseranas semipalmata Magpie Goose [978]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat may occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Rostratula benghalensis s. lat. Painted Snipe [889]	Vulnerable*	Species or species habitat likely to occur within area
Reptiles		
Crocodylus johnstoni Freshwater Crocodile, Johnston's Crocodile, Johnston's River Crocodile [1773]		Species or species habitat may occur within area
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area

Extra Information

Places on the RNE		[Resource Information]

Note that not all Indigenous sites may be listed.

Name	State	Status
Natural		
Parts of the Kimberley	WA	Indicative Place

Invasive Species		[Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit,

Name	Status	Type of Presence
Frogs		
Bufo marinus		
Cane Toad [1772]		Species or species habitat likely to occur within area
Mammals		
Felis catus		
Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Sus scrofa		
Pig [6]		Species or species habitat likely to occur within area
Plants		
Brachiaria mutica		
Para Grass [5879]		Species or species habitat may occur within area
Cenchrus ciliaris		
Buffel-grass, Black Buffel-grass [20213]		Species or species habitat likely to occur within area
Cryptostegia grandiflora		
Rubber Vine, Rubbervine, India Rubber Vine, India Rubbervine, Palay Rubbervine, Purple Allamanda [18913]		Species or species habitat likely to occur within area
Parkinsonia aculeata		
Parkinsonia, Jerusalem Thorn, Jelly Bean Tree, Horse Bean [12301]		Species or species habitat likely to occur within area

Coordinates

-16.60564 128.23663,-16.59255 128.3104,-16.71747 128.44008,-16.73651 128.33657, -16.6681 128.26281,-16.60564 128.23723,-16.60564 128.23663

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World Heritage and Register of National Estate properties, Wetlands of International Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Department of Environment, Climate Change and Water, New South Wales
-Department of Sustainability and Environment, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment and Natural Resources, South Australia
-Parks and Wildlife Service NT, NT Dept of Natural Resources, Environment and the Arts
-Environmental and Resource Management, Queensland
-Department of Environment and Conservation, Western Australia
-Department of the Environment, Climate Change, Energy and Water
-Birds Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-SA Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Atherton and Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
-State Forests of NSW
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

Department of Sustainability, Environment, Water, Population and Communities
GPO Box 787

APPENDIX 3: NVIS HIERARCHY FOR VEGETATION MAPPING

NVIS Hierarchy Vegetation Mapping

Hierarchical Level	Description	NVIS structural/floristic components required
I	**Class***	Dominant growth form for the ecologically or structurally dominant stratum
II	**Structural Formation***	Dominant growth form, cover and height for the ecologically or structurally dominant stratum.
III	**Broad Floristic Formation****	Dominant growth form, cover, height and dominant land cover genus for the upper most or the ecologically or structurally dominant stratum.
IV	**Sub-Formation****	Dominant growth form, cover, height and dominant genus for each of the three traditional strata. (i.e. Upper, Mid and Ground)
V	**Association****	Dominant growth form, height, cover and species (3 species) for the three traditional strata. (i.e. Upper, Mid and Ground)
VI	**Sub-Association****	Dominant growth form, height, cover and species (5 species) for all layers/sub-strata.
* Walker & Hopkins 1990 ** NVIS (defined for the NVIS Information Hierarchy)		

APPENDIX 4: FULL FLORA SPECIES LIST

Flora Species list

Family / Species

Acanthaceae

Dicliptera armata

Hypoestes floribunda

Adiantaceae

Cheilanthes sieberi

Aizoaceae

Trianthema ufoensis

Amaranthaceae

Achyranthes aspera

Gomphrena leptoclada

Ptilotus capitatus

Ptilotus fusiformis

Anacardiaceae

Buchanania oblongifolia

Apocynaceae

Carissa lanceolata

Marsdenia angustata

Wrightia saligna

Buchanania oblongifolia

Apocynaceae

**Calotropis procera*

Tylophora flexuosa

Wrightia saligna

Asteraceae

Cyanthillium cinereum

Bignoniaceae

Dolichandrone heterophylla

Bixaceae

Cochlospermum fraseri

Boraginaceae

Ehretia saligna

Heliotropium aff. tenuifolium

Cannabaceae

Celtis philippensis

Trema tomentose var. aspera

Capparaceae

Capparis lasiantha

Capparis umbonata

Caryophyllaceae

Polycarpaea longiflora

Polycarpaea spirostylis subsp. glabra

Polycarpaea involucrata

Celastraceae
Denhamia obscura
Stackhousia intermedia
Cleomaceae
Cleome viscosa
Combretaceae
Terminalia canescens
Terminalia ferdinandiana
Convolvulaceae
Evolvulus alsinoides var. decumbens
Evolvulus alsinoides
Ipomoea gracilis
Ipomoea eriocarpa
Jacquemontia sp. Keep River (J.L. Egan 5051) (P1)
Xenostegia tridentata
Cupressaceae
Callitris columellaris
Cyperaceae
Bulbostylis barbata
Cyperus ?bifax
Cyperus aquatilis
Cyperus cunninghamii subsp. uniflorus
Scleria aff. brownii
Erythroxylaceae
Erythroxylum ellipticum
Euphorbiaceae
Euphorbia alsiniflora
Euphorbia coghlanii
Euphorbia drummondii
Euphorbia schultzii
Excoecaria ? ovalis
Fabaceae
Acacia aff. asperulacea
Acacia lamprocarpa
Acacia cf. lycopodiifolia
Acacia multisiliqua
Acacia orthocarpa
Acacia retivenea subsp. retivenea
Acacia thomsonii
Acacia translucens
Canavalia papuana
Caesalpiniaceae Bauhinia cunninghamii
Chamaecrista absus
Chamaecrista mimosoides
Christia australasica
Crotalaria retusa

Crotalaria novae-hollandiae subsp. novae-hollandiae
Desmodium brownii
Erythrophleum chlorostachys
Galactia tenuiflora
Gompholobium subulatum
Indigofera hirsuta
Indigofera linifolia
Indigofera linnaei
Indigofera sp. A Kimberley Flora (G.J. Keighery & N. Gibson 70)
Lophostemon grandiflorus subsp. riparius
Mirbelia viminalis
Mirbelia spinosa
Rhynchosia minima
Tephrosia phaeosperma
Tephrosia stipuligera
Tephrosia virens
Uraria lagopodioides
Zornia muriculata
Goodeniaceae
Goodenia odonnellii
Goodenia sepalosa var. sepalosa
Haematommaceae
Haemodorum ensifolium
Lamiaceae
Clerodendrum floribundum
Clerodendrum floribundum var. floribundum
Clerodendrum tomentosum var. tomentosum
Loranthaceae
Amyema eburna
Amyema sp.
Malvaceae
Abutilon otocarpum
Abutilon hannii
Adansonia gregorii
Brachychiton tridentatus (P3)
Brachychiton diversifolius
Brachychiton viscidulus
Corchorus sidoides subsp. sidoides
Corchorus sidoides subsp. vermicularis
Corchorus sidoides
Gossypium australe
Melhania oblongifolia
Sida rohlenae
Sida sp. A Kimberley Flora (P.A. Fryxell & L.A. Craven 3900)
Triumfetta clivorum
Triumfetta plumigera

Triumfetta triandra
Meliaceae
Owenia vernicosa
Menispermaceae
Tinospora smilacina
Moraceae
Ficus aculeata var. indecora
Ficus atricha
Ficus brachypoda
Myrtaceae
Calytrix archeata
Calytrix exstipulata (rock form)
Calytrix exstipulata (shrub form)
Corymbia aspera
Corymbia cadophora subsp. polychroma
Corymbia collina
Corymbia dichromophloia
Corymbia disjuncta
Corymbia grandifolia
Eucalyptus brevifolia
Eucalyptus confluens
Eucalyptus jensenii
Eucalyptus ?lirata
Eucalyptus ordiana (P2)
Kunzea sp. Keep River (Currently nominated for priority status)
Oleaceae
Jasminum didymium
Jasminum molle
Opiliaceae
Opilia amentacea
Orchidaceae
Cymbidium canaliculatum
Orobanchaceae
Buchnera ramosissima
Passifloraceae
**Passiflora foetida*
Phyllanthaceae
Flueggea virosa subsp. melanthesoides
Phyllanthus exilis
Phyllanthus grandisepalus
Picrodendraceae
Petalostigma quadriloculare
Pittosporaceae
Pittosporum spinescens
Plantaginaceae
Stemodia lythrifolia

Poaceae

Allopteropsis semialata

Aristida holathera var. holathera

Arundinella nepalensis

**Cenchrus americanus*

Chrysopogon fallax

Chrysopogon setifolius

Cymbopogon procerus

Cymbopogon ambiguus

** Eragrostis ?cilianensis*

Eragrostis tenellula

Eriachne ciliata

Eriachne aff. mucronata

Eriachne obtusa

Heteropogon contortus

**Melinis repens*

Panicum decompositum

Panicum seminudum var. cairnsianum

Pseudochaetochloa australiensis

Sehima nervosum

Schizachyrium fragile

Themeda triandra

Triodia aff. bitextura

Triodia cremnophila (P1)

Triodia sp. Argyle (aff. cunninghamii) (Currently nominated for priority status)

Triodia wiseana

Yakirra australiensis

Polygalaceae

Comesperma secundum

Polygala longifolia

Portulacaceae

Portulaca bicolor

Proteaceae

Grevillea agrifolia

Grevillea dryandri subsp. dryandri

Grevillea dryandri

Grevillea heliosperma

Grevillea mimosoides

Grevillea miniata (P4)

Grevillea parallela

Grevillea pyramidalis

Grevillea pyramidalis subsp. leucadendron

Grevillea refracta

Grevillea velutinella

Persoonia falcata

Stenocarpus acacioides

Pteridaceae

Cheilanthes brownii

Cheilanthes caudate

Rhamnaceae

Ziziphus quadrilocularis

Rubiaceae

Gardenia resinosa subsp. resinosa

Oldenlandia kochiae

Psydrax attenuata

Rubiaceae Spermacoce ?laevigata

Spermacoce phaeosperma

Spermacoce sp.

Santalaceae

Exocarpos latifolius

Santalum lanceolatum

Sapindaceae

Atalaya salicifolia

Dodonaea hispidula var. arida

Scrophulariaceae

Stemodia tephropelina

Ulmaceae

Celtis philippensis

Violaceae

Hybanthus enneaspermus

APPENDIX 5: PRIORITY ECOLOGICAL COMMUNITY LIST

PRIORITY ECOLOGICAL COMMUNITIES FOR WESTERN AUSTRALIA Version 19

Species & Communities Branch, Department of Parks and Wildlife

20 September 2013

Possible threatened ecological communities that do not meet survey criteria or that are not adequately defined are added to the Priority ecological community list under Priorities 1, 2 and 3. These three categories are ranked in order of priority for survey and/or definition of the community, and evaluation of conservation status, so that consideration can be given to their declaration as threatened ecological communities. Ecological communities that are adequately known, and are rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list, are placed in Priority 4. These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5.

Note:
i) Nothing in this table may be construed as a nomination for listing under the Commonwealth EPBC Act 1999.
ii) The inclusion in this table of a community type does not necessarily imply any status as a threatened ecological community.
iii) Regions eg Pilbara are based on Department of Parks and Wildlife regional boundaries.
iv) For definitions of categories (Priority 1 etc.) refer to document entitled 'Definitions and Categories'

	Community name	Category
	Pilbara	
1	**West Angelas Cracking-Clays** Open tussock grasslands of *Astrebla pectinata, A. elymoides, Aristida latifolia*, in combination with *Astrebla squarrosa* and low scattered shrubs of *Sida fibulifera*, on basalt derived cracking-clay loam depressions and flowlines. Threats: Disturbance footprints increasing from mine, future infrastructure development, possible weed invasion and changes in fire regime.	Priority 1
2	**Weeli Wolli Spring community** Weeli Wolli Spring's riparian woodland and forest associations are unusual as a consequence of the composition of the understorey. The sedge and herbfield communities that fringe many of the pools and associated water bodies along the main channels of Weeli Wolli Creek have not been recorded from any other wetland site in the Pilbara. The spring and creekline are also noted for their relatively high diversity of stygofauna and this is probably attributed to the large-scale calcrete and alluvial aquifer system associated with the creek. The valley of Weeli Wolli Spring also supports a very rich microbat assemblage including a threatened species. Threats: dewatering and re-watering altering patterns of inundation, weed invasion	Priority 1
3	**Burrup Peninsula rock pool communities** Calcareous tufa deposits. Interesting aquatic snails. Threats: recreational impacts, and potential development; possibly NOX and SOX emissions.	Priority 1
4	**Burrup Peninsula rock pile communities** Comprise a mixture of Pilbara and Kimberley species, communities are different from those of the Hamersley and Chichester Ranges. Short-range endemic land snails. Threats: industrial development.	Priority 1
5	**Roebourne Plains coastal grasslands with gilgai microrelief on deep cracking clays** (Roebourne Plains gilgai grasslands) The Roebourne Plains coastal grasslands with gilgai micro-relief occur on deep cracking clays that are self mulching and emerge on depositional surfaces. The Roebourne Plains gilgai grasslands occur on microrelief of deep cracking clays, surrounded by clay plains/flats and sandy coastal and alluvial plains. The gilgai depressions supports ephemeral and perennial tussock grasslands dominated by *Sorghum* sp. and *Eragrostis xerophila* (Roebourne Plains grass) along with other native species including *Astrebla pectinata* (barley mitchell grass), *Eriachne benthamii* (swamp wanderrie grass), *Chrysopogon fallax* (golden beard grass) and *Panicum decompositum* (native millet). Restricted to the Karratha area, this community differs from the surrounding clay flats of the Horseflat land system which are dominated by *Eragrostis xerophila* and other perennial tussock grass species (*Eragrostis* mostly).	Priority 1

	Threats: Grazing, clearing for mining and infrastructure and urban development, weed invasion, basic raw material extraction.	
6	**Stony Chenopod association of the Roebourne Plains area** The community is dominated by *Eragrostis xerophila* and chenopods growing in saline clay soils with dense surface strew of pebbles and cobbles. The association appears to be uncommon and is likely to be linked with the Cheerawarra land system (Unit 3 - Saline clay plains). Only one occurrence has been located to date (Roebourne Airport), however it is likely some other small areas remain. Threats: grazing, clearing, and weeds especially buffel grass	Priority 1
7	**Barrow Island subterranean fauna** Barrow Island stygofauna and troglofauna. Threats: Mining and industrial development.	Priority 1
8	**Subterranean invertebrate communities of mesas in the Robe Valley region** A series of isolated mesas occur in the Robe Valley in the state's Pilbara Region. The mesas are remnants of old valley infill deposits of the palaeo Robe River. The troglobitic faunal communities occur in an extremely specialised habitat and appear to require the particular structure and hydrogeology associated with mesas to provide a suitable humid habitat. Short range endemism is common in the fauna. The habitat is the humidified pisolitic strata. Threats: Mining	Priority 1
9	**Subterranean invertebrate community of pisolitic hills in the Pilbara** A series of isolated low undulating hills occur in the state's Pilbara region. The troglofauna are being identified as having very short range distributions. Threats: mining	Priority 1
10	**Peedamulla Marsh vegetation complex** Peedamulla (Cane River) Swamp Cyperaceae community, near mouth of Cane River. Plants are unusual. Threats: grazing, weed invasion, altered surface hydrologic flows.	Priority 1
11	***Triodia angusta* dominated creekline vegetation (Barrow Island)** General cover of *Triodia angusta* with shrubs principally *Hakea suberea*, *Petalostylis labicheoides, Acacia bivenosa*, and *Gossypium robinsonii*. Threats: basic raw material extraction for island infrastructure.	Priority 1
12	**Brockman Iron cracking clay communities of the Hamersley Range** Rare tussock grassland dominated by *Astrebla lappacea* in the Hamersley Range, on the Newman land system. Tussock grassland on cracking clays- derived in valley floors, depositional floors. This is a rare community and the landform is rare. Known from near West Angeles, Newman, Tom Price and boundary of Hamersley and Brockman Stations. Threats: Heavily grazed, mining and infrastructure developments.	Priority 1
13	**Sand Sheet vegetation (Robe Valley)** *Corymbia zygophylla* scattered low trees over *Acacia tumida* var. *pilbarensis*, *Grevillea eriostachya* high shrubland over *Triodia schinzii* hummock grassland. Other associated species include *Cleome uncifera*, *Heliotropium transforme*, *Indigofera boviperda* subsp. *boviperda*, and *Ptilotus arthrolasius*. Most northern example/expression of vegetation of Carnarvon Basin. Community is poorly represented type in the Pilbara Region, and not represented in the reserve system. Community contains many plant species that are at their northern limits or exist as disjunct populations. Vulnerable to invasion by weeds. Threats: mining, basic raw material extraction, weed invasion especially buffel grass.	Priority 1
14	**Mingah Springs calcrete groundwater assemblage type on Gascoyne palaeodrainage on Mingah Spring Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
15	**Coastal dune native tussock grassland dominated by *Whiteochloa airoides*** Tussock grassland of *Whiteochloa airoides* occurs on the landward side of foredunes, hind dunes or remnant dunes with white or pinkish white medium sands with marine fragments. There may be occasional *Spinifex longifolius* tussock or *Triodia epactia* hummock grasses and scattered low shrubs of *Olearia dampierii* subsp. *dampierii*, *Scaevola spinescens*, *S. cunninghamii*, *Trianthema turgidifolia* and *Corchorus* species (*C. walcottii*, *C. laniflorus*). Occurs on Barrow Island and possibly some unaffected littoral areas in west Pilbara. **Threats:** weed invasion especially buffel grass and kapok, basic raw material extraction.	Priority 3
16	**Freshwater claypans of the Fortescue Valley** Freshwater claypans downstream of the Fortescue Marsh - Goodiadarrie Hills on Mulga Downs Station.	Priority 1

	Important for waterbirds, invertebrates and some poorly collected plants. *Eriachne* spp., *Eragrostis* spp. grasslands. Unique community, has few Coolibah. **Threats:** weed invasion, infrastructure corridors, altered hydrological flows, inappropriate fire regimes.	
17	**Fortescue Marsh (Marsh Land System)** Fortescue Marsh is an extensive, episodically inundated samphire marsh at the upper terminus of the Fortescue River and the western end of Goodiadarrie Hills. It is regarded as the largest ephemeral wetland in the Pilbara. It is a highly diverse ecosystem with fringing mulga woodlands (on the northern side), samphire shrublands and groundwater dependant riparian ecosystems. It is an arid wetland utilized by waterbirds and supports a rich diversity of restricted aquatic and terrestrial invertebrates. Recorded locality for night parrot and bilby and several other threatened vertebrate fauna. Endemic *Eremophila* species, populations of priority flora and several near endemic and new to science samphires. **Threats:** mining, altered hydrology (watering with fresh water), grazing and weed invasion.	Priority 1
18	**Tanpool land system** A highly restricted land system that occurs between Pannawonica and Onslow. Consists of stony plains and low ridges of sandstone and other sedimentary rocks supporting hard spinifex grasslands and snakewood shrublands. Threats: grazing	Priority 1
19	**Stygofaunal community of the Bungaroo Aquifer** A unique assemblage of aquatic subterranean fauna including eels, snails and other stygofauna. Threats: groundwater drawdown, mining.	Priority 1
20	**Coolibah-lignum flats**: ***Eucalyptus victrix* over *Muehlenbeckia* community** Woodland or forest of *Eucalyptus victrix* (coolibah) over thicket of *Muehlenbeckia florulenta* (lignum) on red clays in run-on zones. Associated species include *Eriachne benthamii, Themeda triandra, Aristida latifolia, Eulalia aurea* and *Acacia aneura*. A series of sub-types have been identified: • Coolibah and mulga (*Acacia aneura*) woodland over lignum and tussock grasses on clay plains (Coondewanna Flats and Wanna Munna Flats) • Coolibah woodlands over lignum (*Muehlenbeckia florulenta***)** over swamp wandiree (Lake Robinson is the only known occurrence) • Coolibah woodland over lignum and silky browntop (*Eulalia aurea)* (two occurrences known on Mt Bruce Flats) Threats: dewatering and grazing, clearing associated with infrastructure corridors.	 Priority 3(i) Priority 1 Priority 1
21	**Four plant assemblages of the Wona Land System** **(previously 'Cracking clays of the Chichester and Mungaroona Range')** A system of basalt upland gilgai plains with tussock grasslands occurs throughout the Chichester Range in the Chichester-Millstream National Park, Mungaroona Range Nature Reserve and on adjacent pastoral leases. There are a series of community types identified within the Wona Land System gilgai plains that are considered susceptible to known threats such as grazing or have constituent rare/restricted species, as follows: • Cracking clays of the Chichester and Mungaroona Range. This grassless plain of stony gibber community occurs on the tablelands with very little vegetative cover during the dry season, however during the wet a suite of ephemerals/annuals and short-lived perennials emerge, many of which are poorly known and range-end taxa. • Annual Sorghum grasslands on self mulching clays. This community appears very rare and restricted to the Pannawonica-Robe valley end of Chichester Range. • Mitchell grass plains (*Astrebela* spp.) on gilgai • Mitchell grass and Roebourne Plain grass (*Eragrostis xerophila*) plain on gilgai (typical type, heavily grazed	 Priority 1 Priority 1 Priority 3(iii) Priority 3(iii)
22	**Tussock grasslands or grassy tall or low shrublands of the Yarcowie Land System (Carnarvon Basin)** Gilgaied soils derived from lower cretaceous benthonitic siltstone on nearly flat plains that support tussock grasslands or grassy tall or low shrublands. Land system has very restricted distribution. Threats: over grazing	Priority 1
23	***Triodia* sp. Robe River assemblages of mesas of the West Pilbara** (previously named *'Triodia* sp. Robe River assemblages of mesas of the Robe Valley') This community is typically restricted to mesas and cordillo landforms where the plant assemblages are dominated by or contain *Triodia* sp. Robe River and are indicative of inverted landscapes; that is, where *Triodia* sp. Robe River occurs in combination with species that are considered 'out-of-context' from their normal habitat. The community is a combination of *Triodia* sp. Robe River with *Acacia pruinocarpa, A. citrinoviridis* on slopes or peaks of mesas. These two *Acacias* are generally found associated with Pilbara creeklines, and their occurrence is probably indicative of the genesis of the mesa surfaces in wetlands, then erosion of the landscape and 'inversion of the landscape' such that the mesa slopes and peaks that were previously low in the landscape become high points. Threats: Mining and associated infrastructure	Priority 3(iii)

24	**Stony saline plains of the Mosquito Land System** Described as saltbush community of the duplex plains - Mosquito Creek series (Nullagine). Known to contain two endemic Acacias. One occurrence known on stony plains, and one on rocky ground. Threats: preferential grazing, prospecting and mining, increasing erosion	Priority 3(iii)
25	**Fortescue Valley Sand Dunes** (known previously as 'Sand dune communities of the Fortescue Botanical District') These red linear sand dune communities lie on the Divide Land system at the junction of the Hamersley Range and Fortescue Valley, between Weeli Wolli Creek and the low hills to the west. A small number are vegetated with *Acacia dictyophleba* scattered tall shrubs over *Crotalaria cunninghamii, Trichodesma zeylanicum* var. *grandiflorum* open shrubland. They are regionally rare, small and fragile and highly susceptible to threatening processes. Threats: weed invasion especially buffel grass, and erosion.	Priority 3(iii)
26	**Riparian vegetation including phreatophytic species associated with creek lines and watercourses of Rudall River** Semi permanent pools along courses of Rudall River. Threats**:** weed invasion, altered hydrological flows, inappropriate fire regimes.	Priority 3(ii)
27	**Horseflat land system of the Roebourne Plains** (Does not include priority ecological communities 'Roebourne Plains gilgai grasslands' and the 'Chenopod association of the Roebourne Plains area') The Horseflat Land System of the Roebourne Plains are extensive, weakly gilgaied clay plains dominated by tussock grasslands on mostly alluvial non-gilgaied, red clay loams or heavy clay loams. Perennial tussock grasses include *Eragrostis xerophila* (Roebourne Plains grass) and other *Eragrostis* spp., *Eriachne* spp. and *Dichanthium* spp. The community also supports a suite of annual grasses including *Sorghum* spp. and rare *Astrebela* spp. The community extends from Cape Preston to Balla Balla surrounding the towns of Karratha and Roebourne. This community incorporates Unit 3 (Gilgai plains), Unit 5 (Alluvial Plains) with some Unit 7 (Drainage Depressions) described in Van Vreeswyk *et al*. 2004. Threats: grazing, weed invasion, fragmentation	Priority 3(iii)
28	**Invertebrate assemblages (Errawallana Spring type) Coolawanya Station** Geologically distinct. Sherlock River system. Permanent spring-fed creek. Has atypical invertebrate community. Threats: grazing.	Priority 4(ii)
29	**Invertebrate assemblages (Nyeetberry Pool type)** Jimmawurrada Creek. Nyeetberry pool, Robe River. Permanent River Pool in the Pilbara (groundwater fed). Blind isopod collected from this site. Threats: mining and feral animals	Priority 4(ii)
30	**Stygofaunal communities of the Western Fortescue Plains freshwater aquifer** (Previously named 'Stygofaunal communities of the Millstream freshwater aquifer') A unique assemblage of subterranean invertebrate fauna. Threats: Groundwater drawdown and salinisation.	Priority 4(ii)
	KIMBERLEY	
1	**Perched spring-fed peat-based swamps on hillslopes of the Durack Range area** Assemblages of spring-fed wetlands on organic substrates perched on sandstone hill-slopes in the Central Kimberley bioregion. Drainage lines are vegetated with a forest of *Corymbia ptychocarpa* (swamp bloodwood), *Grevillea pteridifolia, Melaleuca* spp, *Pandanus spiralis*, and some *Livistona* spp. over the fern *Cyclosorus interruptus* and the climbing fern *Lygodium microphyllum*. Sedges occur in the understorey and clumps of Reed Grass *Arundinella nepalensis* are dominant in the understorey where the canopy is more open. Also associated with the drainage lines are swamps vegetated by dense sedgelands with grasses and herbs. Threats: Cattle grazing and weeds.	Priority 1
2	**Assemblages of Point Spring rainforest swamp** Closed canopy rainforest on freshwater swamps on alluvial floodplain soils in the east Kimberley. At Point Spring the canopy is 17m high and the dominant tree species include *Canarium australianum, Carallia brachiata, Euodia elleryana, Ficus racemosa, F. virens* and *Terminalia sericocarpa*. Threats: Invasion by feral fish, impacts of stock, climate change and rising sea levels.	Priority 1
3	**Assemblages of the wetlands associated with the organic mound springs on the tidal mudflats of the Victoria-Bonaparte Bioregion**	Priority 1

	East Kimberley (i.e. Brolga Spring, King Gordon Spring, Attack Spring, Long Swamp etc on Carlton Hill Station). Large wetlands with Melaleuca forest with small patches of rainforest on central mounds. Rainforest and paperbark forest associated with mound springs and seepage areas of the Victoria Bonaparte coastal lands.	
4	**Monsoon vine thickets and Camaenid land snails of limestone ranges (Napier Range)** Unusual vine thicket community and Camaenid land snails assemblage located on Napier Range. Threats: frequent fires leading to vegetation changes; loss of vine thickets and leaf litter	Priority 1
5	***Oryza australiensis* (wild rice) grasslands on alluvial flats of the Ord River** West side of Weaber Hills, Weaber Plain, Mantini Flats, Knox Creek.	Priority 1
6	**Inland Mangrove (*Avicennia marina*) community of Salt Creek** Anna Plains Station, Mandora.	Priority 1
7	**Plant assemblages on vertical sandstone surfaces** Eg. Two undescribed spinifex spp. at Bungles and Molly Spring, foxtail spinifex at Cathedral Gorge and Thompsons Spring. Fire sensitive plants, fire regimes a threat.	Priority 1
8	**Invertebrate community of Napier Range Cave** On Old Napier Downs, Karst No. KNI. Threats: Mine close by and tourist visitation.	Priority 1
9	**Invertebrate assemblages of the cliff foot springs around Devonian reef system** Black soils. Threats: Springs drying up due to dewatering of karst systems.	Priority 1
10	**Dwarf pindan heath community of Broome coast** Occurs between the racecourse and Gantheame Point lighthouse. Insufficient survey outside of Broome townsite area to determine full extent. Threats: clearing, trampling, weed invasion, inappropriate fire regimes	Priority 1
11	***Corymbia paractia* dominated community on dunes** *Corymbia paractia* behind dunes, Broome township area, Dampier Peninsula. Transition zone where coastal dunes (with vine thickets) merge with Pindan (desert) vegetation. Also, port north of Broome. Threats: clearing, trampling, weed invasion, inappropriate fire regimes	Priority 1
12	**Relict dune system dominated by extensive stands of Mangarr *Sersalisia* (formerly *Pouteria*) *sericea*** Contains frequent mature (100 years +) *Sersalisia* (formerly *Pouteria) sericea* or otherwise known as Mangarr. Mangarr is a culturally important and renowned local bushtucker species and does not occur in such frequency and longevity in other locations. The community is recorded as a *Eucalyptus, Sersalisia* low woodland unit that occurs on parallel dunes in the area south east of Gantheaume Point. The community also contains numerous woodland species such as: *Erythropleum chlorostachys* (ironwood), *Eucalyptus (Corymbia) zygophylla* (Broome bloodwood), *Hakea macrocarpa* and *Corynotheca micrantha* (zig-zag Lilly). Some species are more reminiscent of desert and aridlands country including: *Solanum cunninghammii* (bush tomato), *Scaevola parvifolia, Goodenia sepalosa, Senna costata, Gyrostemon tepperi* and *Triodia* sp. (spinifex). The extensive stands of Mangarr occur in association with species more often found within the nearby threatened ecological community- Monsoon vine thicket. Threats: weed invasion, grazing, inappropriate fire regime, proposed developments	Priority 1
13	**Invertebrate community of Tunnel Creek** Has unique fauna and has high visitation but not enough data available yet to describe - currently only has one sample site (neighbouring sample areas eg Windjana Gorge have different genera)	Priority 2
14	**Camaenid land snail and vine thicket assemblage of limestone hills (Jeremiah and Ningbing Ranges)** A suite of species of land snail belonging to the family Camaenidae are only recorded from limestone ranges and outcrops of the East Kimberley. They occur in areas of limited Devonian reef with unusual vine thickets with a boab overstorey. All the Camaenid snails are short-range endemics, with known geographic ranges ranging from 0.01 ha to 5.6 km^2. Twenty critically endangered, four endangered and one vulnerable species occur in the Ningbing Ranges and Jeramiah Hills north of Kununurra. Threats: frequent fires leading to vegetation changes (loss of vine thickets) and leaf litter and grazing impacts, especially on flat-lying fringing limestone pavement areas; mining.	Priority 3(iii)
15	**Assemblages of Disaster Bay organic mound springs** Organic mound springs on tidal flat with *Melaleuca acacioides, Timonius timon, Pandanus spiralis, Melaleuca viridiflora, Acacia neurocarpa* and *Lumnitzera racemosa* (mangrove) woodland with *Typha domingensis* and sedges, including *Schoenoplectus litoralis*. Threats: soil compaction by cattle; potential changes in sea level due to climate change	Priority 3(iii)
16	**Assemblages of Lolly Well Springs wetland complex**	Priority 3(ii)

	Wetland complex containing numerous low organic mound springs with moats. Threats: Recreational use, potential tourism developments, weed invasion, rubbish dumping, grazing and trampling (cattle)	
17	**Nimalaica clay pan community**. Nimalaica claypan is a unique, almost permanent, freshwater lake inland from Willie Creek, Broome Threats: groundwater extraction, causeway construction, feral animals, expansion of township	Priority 4(ii)
	MIDWEST	
1	**Mount Gibson Range vegetation complexes (banded ironstone formation)** Threats: mining	Priority 1
2	**Blue Hills (Mount Karara/Mungada Ridge/Blue Hills) vegetation complexes (banded ironstone formation)** Threats: mining	Priority 1
3	**Jack Hills vegetation complexes (banded ironstone formation)** Threats: mining	Priority 1
4	**Mount Gould vegetation complexes (banded ironstone formation)** Threats: mining	Priority 1
5	**Lake Austin vegetation complexes (banded ironstone formation)** Threats: mining	Priority 1
6	**New Forest (Including Twin Peaks and Barloweerie Range) vegetation complexes (banded ironstone formation)** Threats: mining	Priority 1
7	**Robinson Range vegetation complexes (banded ironstone formation)** Threats: mining	Priority 1
8	**Weld Range vegetation complexes (banded ironstone formation)** Threats: mining	Priority 1
9	**Gullewa vegetation complexes (banded ironstone formation)** Includes Buddadoo Range, Edamura Range, Mugga Mugga Hill and Murdaburia Hill. Threats: mining	Priority 1
10	**Yalgoo vegetation complexes (banded ironstone formation)** Includes Gnows Nest Range, Wolla Wolla and Woolgah-Wadgingarra Hills. Threats: mining	Priority 1
11	**Plant assemblages of the Moresby Range system** Includes the *Melaleuca megacephala* and *Hakea pycnoneura* thicket on stony slopes, *Verticordia* dominated low heath, and *Allocasuarina campestris* and *Melaleuca uncinata* thicket on superficial laterite, on Morseby Range. Threats: clearing for infrastructure	Priority 1
12	**Mount Dugel/Mount Nairn vegetation complexes (banded ironstone formation)** Threats: mining	Priority 1
13	**Minjar and Chulaar Hills vegetation complex (banded ironstone formation)** Threats: mining	Priority 1
14	**Warriedar Hill/Pinyalling vegetation complexes (banded ironstone formation)** Threats: mining	Priority 1
15	**Mount Magnet vegetation complexes (banded ironstone formation)** Threats: mining	Priority 1
16	**Tallering Peak vegetation complexes** Tallering Peak in the northwest is a massif of banded ironstone and jaspilite, with outcropping masses or rock along the spine. Vegetation is sparse and includes shrubs of only 1.2m of *Acacia quadrimarginea, A ?coolgardiensis, Eremophila leucophylla, Thryptomene johnsonii,* a smaller Baeckea or Thryptomene sp. and *Ptilotus obovatus*. Threats: mining	Priority 1
17	**Lesueur-Coomallo Floristic Community M2 (*Melaleuca preissiana* woodland)**	Priority 1

	Woodland dominated by *Melaleuca preissiana* along sandy drainage lines, with faithful species of *Anigozanthos pulcherrimus* and constant species of *Chamaescilla corymbosa, Petrophile brevifolia* and *Xanthorrhoea reflexa.*	
18	**Lesueur-Coomallo Floristic Community DFGH** Mixed species-rich heath on lateritic gravel with *Hakea erinacea, Melaleuca platycalyx* and *Petrophile seminuda:* a fine scale mixture of four floristically-defined communities occurring on lateritic slopes.	Priority 1
19	**Kalbarri ironstone community** Winter wet, mallee/Melaleuca over herbs. Dense shrubland when burnt. Surrounded by sandplain. Yerina springs and north Eurardy Station. Z-bend loop, Junga Dam. The taxon *Eremophila microtheca* (previously declared rare flora) occurs in community.	Priority 1
20	**Frankenia pauciflora low open shrublands in swales** Community occurs on Tamala South grey-brown sand, on mid to lower slopes of Tamala Limestone ridges and some isolated rises on calcareous deep and shallow sands. Taxa include *Acacia rostellifera, Stylobasium spathulatum, Frankenia pauciflora, Tetragonia implexicoma, Threlkeldia diffusa, Zygophyllum fruticulosum.* Threats: grazing, land clearing	Priority 1
21	**Shrublands of the Northampton area, dominated by Melaleuca species over exposed Kockatea Shale** Heath on breakaways located in Port Gregory, west of Northampton. Community includes priority taxa; *Ptilotus chortophytum* (P1), *Leucopogon* sp. Port Gregory, *Ozothamnus* sp. Northampton, *Gastrolobium propinquum* (P1), outlier of *Ptilotus helichrysoides*. Unusual geology (Kockatea Shale) outcropping at surface.	Priority 1
22	**Badja calcrete groundwater assemblage type on Moore palaeodrainage on Badja Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
23	**Belele calcrete groundwater assemblage type on Murchison palaeodrainage on Belele Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
24	**Black Range South and Windsor groundwater calcrete assemblage type on Raeside and Murchison palaeodrainage on Lake Mason and Windsor Stations** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
25	**Bunnawarra calcrete groundwater assemblage type on Moore palaeodrainage on Bunnawarra Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
26	**Byro Central and Byro HS calcrete groundwater assemblage types on Murchison palaeodrainage on Byro Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
27	**Challa, Challa North and Wondinong calcrete groundwater assemblage type on Murchison palaeodrainage on Challa and Wondinong Stations** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
28	**Cogla Downs calcrete groundwater assemblage type on Murchison palaeodrainage on Yarrabubba Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
29	**Dalgety and Landor calcrete groundwater assemblage type on Gascoyne palaeodrainage on Dalgety Downs and Landor Stations** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
30	**Doolgunna calcrete groundwater assemblage type on Gascoyne palaeodrainage on Doolgunna Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
31	**Gabyon calcrete groundwater assemblage type on Moore palaeodrainage on Gabyon Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes.	Priority 1

	Threats: mining	
32	**Gifford Creek, Mangaroon, Wanna calcrete groundwater assemblage type on Lyons palaeodrainage on Gifford Creek, Lyons and Wanna Stations** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
33	**Hillview calcrete groundwater assemblage type on Murchison palaeodrainage on Hillview Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
34	**Innouendy calcrete groundwater assemblage type on Murchison palaeodrainage on Innouendy Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
35	**Karalundi calcrete groundwater assemblage type on Murchison palaeodrainage on Karalundi Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
36	**Killara calcrete groundwater assemblage types on Murchison palaeodrainage on Killara Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
37	**Killara North calcrete groundwater assemblage types on Murchison palaeodrainage on Killara Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
38	**Lake Austin calcrete groundwater assemblage type on Murchison palaeodrainage on Austin Downs Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
39	**Maranalgo west calcrete assemblage type on Moore palaeodrainage on Maranalgo Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
40	**Meeberrie calcrete groundwater assemblage type on Murchison palaeodrainage on Meeberrie Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
41	**Meka calcrete groundwater assemblage type on Murchison palaeodrainage on Meka Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
42	**Milgun central calcrete groundwater assemblage types on Gascoyne palaeodrainage on Milgun Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
43	**Milgun south calcrete groundwater assemblage types on Gascoyne palaeodrainage on Milgun Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
44	**Mount Augustus calcrete groundwater assemblage type on Lyons palaeodrainage on Mount Augustus Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
45	**Mount Narryer calcrete groundwater assemblage type on Murchison palaeodrainage on Mount Narryer Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
46	**Mount Padbury calcrete groundwater assemblage type on Murchison palaeodrainage on Mount**	Priority 1

	Padbury Station Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	
47	**Muralgarra calcrete groundwater assemblage type on Murchison palaeodrainage on Muralgarra Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
48	**Murchison Downs calcrete groundwater assemblage type on Murchison palaeodrainage on Murchison Downs Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
49	**Ninghan calcrete groundwater assemblage type on Moore palaeodrainage on Ninghan Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
50	**Nowthanna Hill calcrete groundwater assemblage type on Murchison palaeodrainage on Yarrabubba Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
51	**Paroo calcrete groundwater assemblage type on Carey palaeodrainage on Paroo Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
52	**Polelle calcrete groundwater assemblage type on Murchison palaeodrainage on Polelle Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
53	**Taincrow calcrete groundwater assemblage type on Murchison palaeodrainage on Taincrow Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
54	**Three Rivers calcrete groundwater assemblage types on Gascoyne palaeodrainage on Three Rivers Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
55	**Three Rivers Plutonic calcrete groundwater assemblage types on Gascoyne palaeodrainage on Three Rivers Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
56	**Wagga Wagga and Yalgoo calcrete groundwater assemblage type on Yalgoo and Moore palaeodrainage on Wagga Wagga and Bunnawarra Stations** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
57	**Windimurra calcrete groundwater assemblage type on Murchison palaeodrainage on Windimurra Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
58	**Yarrabubba east calcrete groundwater assemblage types on Murchison palaeodrainage on Yarrabubba Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining.	Priority 1
59	**Yarrabubba west calcrete groundwater assemblage types on Murchison palaeodrainage on Yarrabubba Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining.	Priority 1
60	**Yoweragabbie calcrete groundwater assemblage type on Moore palaeodrainage on Yoweragabbie Station**	Priority 1

	Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	
61	***Claypans with mid dense shrublands of *Melaleuca lateritia* over herbs** Claypans (predominantly basins) usually dominated by a shrubland of *Melaleuca lateritia* occurring both on the coastal plain and the adjacent plateau. These claypans are characterized by aquatic (*Hydrocotyle lemnoides* – Priority 4) and amphibious taxa (e.g. *Glossostigma diandrum, Villarsia capitata* and *Eleocharis keigheryi* - DRF)	Priority 1
62	**Coastal sands dominated by *Acacia rostellifera, Eucalyptus oraria* and *Eucalyptus obtusiflora*.** Floristically, this community is similar to other *Acacia rostellifera* communities but is differentiated on structure, being dominated by mallee eucalypts. The community occurs on limestone ridges, in some swales in the coastal dunes between Cape Burney and Dongara, on the Greenough Alluvial Flats on limestone soil and near Tarcoola Beach. Some very small occurrences have also been recorded on the limestone scarp north of the Buller River. Threats: Clearing	Priority 1
63	**Hypersaline community number 2 (Stromatolites of Hamelin Pool)** Hypersaline tidal stromatolite aragonite community formed by trapping and binding by a variety of cyanobacteria and eukaryotes.	Priority 1
64	***Petrophile chrysantha* low heath on Lesueur dissected uplands (Gp200-170)** Low heath dominated by *Petrophile chrysantha* on Lesueur Dissected Uplands. Associated species include *Dryandra armata* and *Hakea undulata.*	Priority 2
65	**Fairy Shrimp communities of rock outcrops** Invertebrate communities are unusual, some species known from relatively few outcrops but not under imminent threat. Mining could be an issue with regards to dust accumulation as it could affect pool chemistry, and especially with regard to flatter rocks at landscape level.	Priority 3(i)
66	***Granite outcrop pools with endemic aquatic fauna** Freshwater pools formed on granite outcrops that may persist for several months and house a variety of aquatic invertebrates, some of which are endemic to south-west WA. Some examples include cladocerans, ostracods, copepods, rotifers, oligochaetes and molluscs.	Priority 3(i)
67	**Coolibah-lignum swamps** Widely distributed, would need to clarify composition of herbs and extent of specific plant assemblage. Similar assemblage occurs in the Pilbara.	Priority 3(iii)
68	***Subtropical and Temperate Saltmarsh** Consists of the assemblage of plants, animals and micro-organisms associated with saltmarsh in coastal regions of sub-tropical and temperate Australia (south of 23°S latitude). The habitat is coastal areas under tidal influence. In southern latitudes saltmarsh are the dominant habitat in the intertidal zone and often occur in association with estuaries. It is typically restricted to the upper intertidal environment, generally between the elevation of the mean high tide, and the mean spring tide. The community consists mainly of salt-tolerant vegetation (halophytes) including: grasses, herbs, reeds, sedges and shrubs. Succulent herbs and grasses generally dominate and vegetation is generally <0.5m tall with the exception of some reeds and sedges. Many species of non-vascular plants are also found in saltmarsh, including epiphytic algae, diatoms and cyanobacterial mats. Saltmarsh consists of many vascular plant species but is dominated by relatively few families. There is also typically a high degree of endemism at the species level. The two most widely represented coastal saltmarsh plant families are the Chenopodiaceae and Poaceae. Four structural saltmarsh forms are currently recognised based on dominance of a particular vegetation type: • dominance by succulent shrubs (e.g. *Tecticornia*) • dominance by grasses (e.g. *Sporobolus virginicus*) • dominance by sedges and grasses (e.g. *Juncus kraussii, Gahnia trifida*) • dominance by herbs (e.g. low-growing creeping plants such as *Wilsonia backhousei, Samolus repens, Schoenus nitens*).	Priority 3(iii)
69	**Plant assemblages (spinifex dominated) of sand dune mesa topping the Kennedy Range National Park**	Priority 4 (i)
70	**Invertebrate assemblages of Edithana Pool** High quality river pool on the Lyons River. High invertebrate diversity. Threats: cattle and Tilapia	Priority 4 (ii)
71	**Springs of the Western Kennedy Ranges** Spring in the Kennedy Range. Has rich representative invertebrate community. Threats: feral goats and mining.	Priority 4 (ii)
72	**Invertebrate assemblages of Cattle Pool** High quality river pool on the Lyons River adjacent to Mt Augustus National Park. High invertebrate diversity. Threats: cattle and Tilapia	Priority 4 (ii)
73	**Invertebrate assemblages of Yinnetharra Cattle Pool**	Priority 4 (ii)

	Permanent freshwater pool on the middle Gascoyne. Threats: cattle	
74	**Invertebrate assemblages of Mibbley pool** Large relatively undisturbed freshwater pool on the upper Gascoyne River (therefore unusual). Until recently protected from stock by thick riparian vegetation. A track has been cleared to the pool which has allowed stock access.	Priority 4 (ii)
75	**Invertebrate assemblages of Erong Springs** High aquatic invertebrate diversity site in the Gascoyne area. Threats: stock and goats.	Priority 4 (ii)
76	**Invertebrate assemblages of Callytharra Spring, Wooramel River** Permanent Spring on the Wooramel river. High aquatic invertebrate diversity Threats: cattle.	Priority 4 (ii)
77	**Lake Macleod invertebrate assemblages** Saline aquatic community with strong marine affinities with particularly rich copepod elements - is effectively a well developed, very rich birrida community with strong marine and terrestrial components with especially rich hypactacoid community. Distinctive but lacks threats.	Priority 4 (ii)
	GOLDFIELDS	
1	**Koolyanobbing vegetation complexes (banded ironstone formation)** Threats: Subject to mining	Priority 1
2	**Die Hardy Range/Diemels vegetation complex (banded ironstone formation)** Threats: iron ore mining.	Priority 1
3	**Mount Jackson Range vegetation complex (banded ironstone formation)** Threats: iron ore mining.	Priority 1
4	**Mount Dimer vegetation complexes (banded ironstone formation).** Threats: mining	Priority 1
5	**Windarling Ranges vegetation complex (banded ironstone formation)** Threats: mining	Priority 1
6	**Booylgoo Range vegetation complexes (banded ironstone formation)** Threats: mining	Priority 1
7	**Mt Forrest - Mt Richardson (Bulga Downs) vegetation complex (banded ironstone formation)** Threats: mining	Priority 1
8	**Perrinvale/Walling vegetation complexes (banded ironstone formation)** Threats: mining	Priority 1
9	**Cashmere Downs vegetation complexes (banded ironstone formation)** Threats: mining	Priority 1
10	**Finnerty Range vegetation complexes (banded ironstone formation)** Threats: mining	Priority 1
11	**Lake Giles vegetation complexes (banded ironstone formation)** Threats: mining	Priority 1
12	**Lake Mason vegetation complexes (banded ironstone formation)** Threats: mining	Priority 1
13	**Montague Range vegetation complexes (banded ironstone formation)** Threats: mining	Priority 1
14	**Lee Steere Range vegetation complexes (banded ironstone formation)** Threats: mining	Priority 1
15	**Violet Range (Perseverance Greenstone Belt) vegetation complexes (banded ironstone formation)** Threats: mining	Priority 1
16	**Wiluna West vegetation complexes (banded ironstone formation)**	Priority 1

	Threats: mining	
17	**Albion Downs calcrete groundwater assemblage type on Carey palaeodrainage on Albion Downs Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
18	**Banjawarn and Melrose (Lake Darlot) calcrete groundwater assemblage type on Carey palaeodrainage on Banjawarn and Melrose Stations** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
19	**Barwidgee calcrete groundwater assemblage type on Carey palaeodrainage on Barwidgee Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
20	**Black Range North calcrete groundwater assemblage type on Raeside palaeodrainage on Lake Mason Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
21	**Cunyu SBF and Cunyu Sweetwater calcrete groundwater assemblage types on Nabberu palaeodrainage on Cunyu Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
22	**Dandaraga calcrete groundwater assemblage type on Raeside palaeodrainage on Dandaraga Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
23	**Depot Springs calcrete groundwater assemblage type on Raeside palaeodrainage on Depot Springs Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
24	**Glenayle and Carnegie Downs calcrete groundwater assemblage type on Burnside palaeodrainage on Glenayle Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
25	**Hinkler Well calcrete groundwater assemblage type on Carey palaeodrainage on Lake Way Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
26	**Lake Way South calcrete groundwater assemblage type on Carey palaeodrainage on Lake Way Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
27	**Johnston Range vegetation complexes (banded ironstone formation)** Threats: mining	Priority 1
28	**Jundee Homestead calcrete groundwater assemblage type on Carnegie palaeodrainage on Jundee Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
29	**Jundee South Hill calcrete groundwater assemblage type on Carnegie palaeodrainage on Jundee Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
30	**Kaluwiri calcrete groundwater assemblage type on Raeside palaeodrainage on Kaluwiri Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
31	**Lake Mason calcrete groundwater assemblage type on Raeside palaeodrainage on Lake Mason Station**	Priority 1

	Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	
32	**Lake Miranda east calcrete groundwater assemblage types on Carey palaeodrainage on Yakabindie Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
33	**Lake Miranda west calcrete groundwater assemblage types on Carey palaeodrainage on Yakabindie Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
34	**Lake Violet south and Lake Violet calcrete groundwater assemblage types on Carey palaeodrainage on Millbillillie Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
35	**Laverton Downs calcrete groundwater assemblage type on Carey palaeodrainage on Laverton Downs Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
36	**Lorna Glen calcrete groundwater assemblage type on Carnegie palaeodrainage on Lorna Glen Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
37	**Melita calcrete groundwater assemblage type on Raeside palaeodrainage on Melita Station (Sons of Gwalia)** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
38	**Millbillillie: Bubble calcrete groundwater assemblage type on Carey palaeodrainage on Millbillillie Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
39	**Mount Morgan calcrete groundwater assemblage type on Carey palaeodrainage on Mount Weld Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
40	**Nambi calcrete groundwater assemblage type on Carey palaeodrainage on Nambi Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
41	**Old Cunya calcrete groundwater assemblage type on Nabberu palaeodrainage on Cunyu Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
42	**Perrinvale (Pine Well) calcrete groundwater assemblage type on Raeside palaeodrainage on Perrinvale Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
43	**Pinnacles calcrete groundwater assemblage type on Raeside palaeodrainage on Pinnacles Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
44	**Sturt Meadows calcrete groundwater assemblage type on Raeside palaeodrainage on Sturt Meadows Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
45	**Uramurdah Lake calcrete groundwater assemblage type on Carey palaeodrainage on Millbillillie Station**	Priority 1

	Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	
46	**Wiluna BF calcrete groundwater assemblage type on Carey palaeodrainage on Millbillillie Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
47	**Windidda calcrete groundwater assemblage type on Carnegie palaeodrainage on Windidda Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
48	**Yakabindie calcrete groundwater assemblage type on Carey palaeodrainage on Yakabindie Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
49	**Yandal calcrete groundwater assemblage type on Carey palaeodrainage on Yandal Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
50	**Yeelirrie calcrete groundwater assemblage type on Carey palaeodrainage on Yeelirrie Stration** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
51	**Yuinmery calcrete groundwater assemblage types on Raeside palaeodrainage on Yuinmery Station** Unique assemblages of invertebrates have been identified in the groundwater calcretes. Threats: mining	Priority 1
52	**Helena and Aurora Range vegetation complexes (banded ironstone formation)** Threats: iron ore mining.	Priority 1
53	**Mount Manning Range vegetation complex (banded ironstone formation)** Threats: iron ore mining.	Priority 1
54	**Banded Ironstone Hills with *Dryandra arborea*** On Unallocated Crown Land in excellent condition north-west Menzies area. Threats: mining	Priority 1
55	**Yellow sandplain communities of the Great Victoria Desert** Very diverse mammalian and reptile fauna, distinctive plant communities. Threats: mining	Priority 3(ii)
56	**Yilgarn Hills vegetation complex** Threats: mining	Priority 3(iii)
57	**Mount Belches *Acacia quadrimarginea* / *Ptilotus obovatus* banded ironstone community** On Randall Timber Reserve. Threats: Has grazing coexistence with the reserve.	Priority 3(iii)
58	**Duladgin Ridge vegetation complex**	Priority 3(iii)
59	**Mount Jumbo Range vegetation complex** Laverton area, northeast goldfields	Priority 3(iii)
60	**Mount Linden Range banded ironstone ridge vegetation complex**	Priority 3(iii)
SOUTH WEST		
1	***Reedia spathacea - Empodisma gracillimum – Sporadanthus rivularis* dominated floodplains and paluslopes of the Blackwood Plateau** Diverse closed sedges and rushes to 1.5 m in height of *Reedia spathacea/Empodisma gracillimum/Sporadanthus rivularis* with open low shrubs to open scrub of *Taxandria linearifolia*.	Priority 1
2	**Granite community dominated by the shrubs *Calothamnus graniticus* subsp. *graniticus*, *Acacia cyclops, A. saligna, Hakea oleifolia, H. prostrata and Jacksonia furcellata* (Sugar Loaf Rock)**	Priority 1

	Shrubland (0.5-2 m) growing on shallow soils derived from granite gneiss on the Cowaramup and Gracetown (Willyabrup Exposed Rocky Slopes land unit) soil landscape systems. The dominant species include: *Allocasuarina humilis, Acacia cyclops, A. littorea, A. pulchella, A. rostellifera, Calothamnus graniticus, Darwinia citriodora, Corymbia calophylla, Daviesia horrida, D. preissii, Dryandra lindleyana, D. erinacea, Hakea prostrata, H. trifurcata, Spyridium globulosum, Pimelea ferruginea,* and *Xanthorrhoea preissi.*	
3	***Corymbia calophylla, Melaleuca rhaphiophylla, Banksia littoralis, Eucalyptus rudis, Agonis flexuosa* low open forest with seasonal subsoil moisture of the Dunsborough area** *Corymbia calophylla, Agonis flexuosa, Banksia littoralis, Melaleuca rhaphiophylla* low open forest over *Viminea juncea, Jacksonia furcellata* tall open shrubland over *Xanthorrhoea preissii, Pericalymma elliptica shrubland* over *Hibbertia* spp*, Astroloma pallidum, Leucopogon australia* open low heath over *Hypolaena pubescens, Mesomelaena tetragona, Lepidosperma* spp. dense sedges over *Amphipogon* and *Thysanotus* spp. open herbs. The community occurs on sandy loam soils at the southern tip of the Swan Coastal Plain. Threats: urban development, weeds and recreation impacts, fire and changes in hydrology	Priority 1
4	**Tall closed sedgeland on shallow soils derived from granite gneiss on the Leeuwin Naturaliste Ridge ('Sedgelands of the Cape Leeuwin Spring')** Tall closed sedgeland of *Juncus krausii, Baumea juncea, and Schoenoplectus validus;* tall closed sedgeland of *Typha orientalis,* over *S. validus, Lepidosperma gladiatum* and *Muehlenbeckia adpressa;* low closed sedgeland of *Ficina nodosa and Baumea juncea* on shallow soils derived from granite gneiss on the Leeuwin Naturaliste Ridge.	Priority 1
5	***Eucalyptus cornuta, Agonis flexuosa* and *Eucalyptus decipiens* forest on deep yellow-brown siliceous sands over limestone ('Busselton Yate community')**	Priority 1
6	***Eucalyptus rudis, Corymbia calophylla, Agonis flexuosa* Closed Low Forest (near Busselton)** A low lying Spearwood Dune plant community associated with shallow sandy soils over Tamala limestone that in places is exposed at the surface. The plant community on these soils supports a unique mixture of wetland and upland flora. Typically low forest dominated by *Eucalyptus rudis, Eucalyptus calophylla, Agonis flexuosa* over a diverse understorey including *Hibbertia hypericoides, Logania vaginalis, Conospermum caeruleum, Agrostocrinum hirsutum* and *Lomandra micrantha.* Other associated species include *Eucalyptus decipiens, Melaleuca rhaphiophylla, Banksia littoralis, Hakea varia* and the sedge species *Baumea juncea* and *Gahnia trifida.*	Priority 1
7	***Eucalyptus patens, Corymbia calophylla, Agonis flexuosa* Closed Low Forest (near Busselton)** *Eucalyptus patens* on loamy brown sands over limestone. Species present include *Eucalyptus patens, Corymbia calophylla* and *Agonis flexuosa* over understorey species including *Bossiaea linophylla, Hibbertia hypericoides, Gastrolobium praemorsum, Leucopogon propinquus, Phyllanthus calycinus, Lomandra micrantha, Lepidosperma longitudinale, Mesomelaena tetragona, Cyathochaeta avenacea* and *Tetraria octandra.* The community is likely to have similarities to community type 1b 'Southern *Corymbia calophylla* woodlands on heavy soils'.	Priority 1
8	**Central Whicher Scarp Mountain Marri woodland (Whicher Scarp woodlands of grey/white sands community A1)** Located on Whicher Scarp mid slopes. The taxa that identify the group include: *Ricinocarpus* aff. *cyanescens, Hibbertia ferruginea, Platysace filiformis, Conospermum capitatum* subsp. *glabratum, Thysanotus arbuscular, Schoenus brevisetis, Phlebocarya filifolia, Leucopogon glabellus, Pimelea rosea* subsp. *rosea, Adenanthos obovatus, Stylidium carnosum* and *Gompholobium capitatum*. Note: This community should be cross-referenced with '*Eucalyptus haematoxylon - Eucalyptus marginata* woodlands on Whicher foothills ('community type 1a')', see below.	Priority 1
9	**West Whicher Scarp *Banksia attenuata* woodland (Swan Coastal Plain centred woodlands of grey/white sands community B2)** This community type occurs in grey sand in the West Whicher Scarp. It is similar to the open *Banksia attenuata* woodlands with Peppermint (*Agonis flexuosa*) from the grey sands of the West Whicher Scarp. The type is species poor. Taxa include: *Allocasuarina fraseriana, Banksia attenuata, Xylomellum occidentale, Bossiaea praetermissa, Calytrix flavescens, Gompholobium tomentosum, Hibbertia hypericoides, Hovea stricta, Hypocalymma robustum, Kunzea rostrata, Petrophile linearis* and a suite of grasses, herbs and sedges.	Priority 1
10	**Central Whicher Scarp Jarrah woodland (Whicher Scarp woodlands of coloured sands and laterites community C1)** Occurs on coloured sands on moderate to gentle slopes of the Central Whicher Scarp. The community has strong representation of a less common group of southern taxa including: *Podocarpus drouyianus, Loxocarya cinerea, Allocasuarina fraseriana, Drosera stolonifera, Amperea ericoides, Thysanotus triandrus, Cyathochaeta equitans, Hibbertia quadricolor, Comesperma calymega, Lepidosperma pubisquameum, Conospermum paniculatum, Acacia preissiana* and *Hybanthus debissimus*. Note: This community should be cross-referenced with '*Eucalyptus haematoxylon - Eucalyptus marginata* woodlands on Whicher foothills ('community type 1a')', see below.	Priority 1
11	**Whicher Scarp Jarrah woodland of deep coloured sands (Whicher Scarp woodlands of coloured sands and laterites community C2)** Community is found scattered through the Central and North Whicher Scarp on midslopes on deep, generally coloured sands rarely associated with laterites. Community has a strongest representation of common sand taxa especially *Hypolaena exsulca, Dasypogon bromeliifolius, Stirlingia latifolia, Petrophile linearis, Melaleuca thymoides* and *Adenanthos meisneri*. Note: This community should be cross-referenced with '*Eucalyptus haematoxylon - Eucalyptus marginata*	Priority 1

	woodlands on Whicher foothills ('community type 1a')', see below.	
12	**Dardanup Jarrah and Mountain Marri woodland on laterite (Whicher Scarp woodlands of coloured sands and laterites community C5)** Community located on unusual surface of quartzite and laterite in Dardanup forest which is an area where the Whicher Scarp, Blackwood Plateau and Darling Scarp interface. It is notable in the presence of uncommonly encountered laterite taxa including: *Lomandra* sp. Dardanup, *Lomandra spartea, Olax benthamiana, Andersonia heterophylla, Hemigenia incana, Acacia varia* var. *varia, Daviesia angulata, Pimelea preissii,* and also *Lomandra brittanii, Xanthorrhoea acanthostachya, Dryandra armata* var. *armata, Hakea stenocarpa, Stachystemon vermicularis, Lambertia multiflora* var *darlingensis, Petrophile striata* and *Pimelea sulphurea.* Note: This community should be cross-referenced with '*Eucalyptus haematoxylon - Eucalyptus marginata* woodlands on Whicher foothills ('community type 1a')', see below.	Priority 1
13	**Sabina River Jarrah and Marri woodland (Whicher Scarp community F1)** Community in Sabina River alluvial fan where the Sabina River meets the Swan Coastal Plain. It is characterised by a suite of wetland taxa of restricted occurrence in the Whicher Scarp: *Mirbelia dilatata, Lomandra pauciflora, Tremandra diffusa, Tremandra stelligera, Trymalium floribundum* subsp. *trifidum* and *Clematis aristata* var. *occidentalis*. Other significant taxa in the community are: *Hovea elliptica, Leucopogon verticillatus,* and *Darwinia citriodora*.	Priority 1
14	**Shrublands of near permanent wetlands in creeklines of the Whicher Scarp (Whicher Scarp community G2)** Community is species poor and included the following taxa: *Astartea scoparia, Homalospermum firmum, Taxandria fragrans* MS, **Anthoxanthum odoratum, Baumea rubingosa, Cyathochaeta teretifolia, Isolepis cernua, Taraxis grossa*.	Priority 1
15	**Swan Coastal Plain Paluslope Wetlands** These wetlands are very wet all year round and are associated with areas of groundwater seepage from the sandy low hills at the base of the Whicher Scarp. At times these wetlands are contiguous with areas of Pinjarra Plain wetlands, and the wetlands of the two landforms merge. Combinations of the following species are typically found in the type: *Melaleuca preissiana, Taxandria linearifolia, Taxandria fragrans, Melaleuca incana,* and *Cyathochaeta teretifolia*. Other species include: *Eucalyptus patens, Homalospermum firmum, Gahnia decomposita, Callistachys lanceolata, Hakea linearis, Melanostachya ustulata, Evandra aristata, Beaufortia sparsa, Calistemon glaucus* and *Pultenaea pinifolia*.	Priority 1
16	**Relictual White Mangrove Community (Leschenault Inlet)** May not be considered a separate community type as is possibly a geographic outlier.	Priority 1
17	***Melaleuca lanceolata* forests, Leeuwin Naturaliste Ridge** Low Closed Forest to Closed Forest of *Melaleuca lanceolata* ("moonah") occurring near the coastline of the Leeuwin-Naturaliste Ridge adjacent to limestone cliffs and down steeply sloping rock slopes on dark-grey, brown or, less commonly, pale-grey sands, often with outcropping limestone. The Moonah varies from 2 to 15 metres, reflecting depth of soil and wind pruning. Typical understorey shrubs are *Tetragonia implexicoma, Rhagodia baccata, Leucopogon propinquus*, and *Suaeda australis*.	Priority 2
18	**Blackwood Alluvial Flats** Woodlands and shrublands of the alluvial soils of the upper Blackwood River (Condinup and Darkan 5f soil-landscape sub-systems). Vegetation associations identified to date: Wet shrublands on alluvial clay flats, Jarrah-Marri woodlands on alluvial grey-brown loams, Wandoo woodlands on alluvial grey-brown clay-loams (includes vernal pools), Flooded Gum-Wandoo woodland on alluvial grey clays (includes vernal pools), Wandoo woodlands on grey sandy loams	Priority 2
19	**Low shrublands on acidic grey-brown sands of the Gracetown soil-landscape system** A low shrubland or heath occurring on grey brown sand with a bleached surface derived from granite gneiss near the west coast of the Leeuwin-Naturaliste Ridge. Dominant or characteristic shrub species include; *Calothamnus sanguineus, Darwinia citriodora, Hakea prostrata, Hakea trifurcata, Jacksonia horrida, Kunzea ciliata, Pimelea ferruginea, Pimelea rosea, Spyridium globulosum, Verticordia plumosa* var. *plumosa, Xanthorrhoea brunonis*. Common herbs, grasses and sedges include; *Asteridea pulverulenta, Austrodanthonia setacea, Austrostipa compressa, Brachyscome iberidifolia, Lepidosperma squamatum, Platysace haplosciadia, Trichocline spathulata* and *Velleia trinervis*.	Priority 2
20	***Southern Swan Coastal Plain *Eucalyptus gomphocephala - Agonis flexuosa* woodlands (type 25)** Woodlands of *Eucalyptus gomphocephala - Agonis flexuosa* south of Woodman Point. Recorded from the Karrakatta, Cottesloe and Vasse units. Dominants other than tuart were occasionally recorded, including *Corymbia calophylla* at Paganoni block and *Eucalyptus decipiens* at Kemerton. Tuart formed the overstorey nearby however.	Priority 3(iii)
21	**Quindalup *Eucalyptus gomphocephala* and / or *Agonis flexuosa* woodlands ('community type 30b')** This community is dominated by either Tuart or *Agonis flexuosa*. The presence of *Hibbertia cuneiformis, Geranium retrorsum* and *Dichondra repens* differentiate this group from other Quindalup community types. The type is found from the Leschenault Peninsular south to Busselton.	Priority 3(i)
22	***Eucalyptus haematoxylon - Eucalyptus marginata* woodlands on Whicher foothills ('community type 1a')**	Priority 3(i)

	Community occurs along the northern edge of State Forest along the base of the Whicher Range and is composed of *Eucalyptus haematoxylon – Corymbia calophylla - Eucalyptus marginata* forests and woodlands. Taxa virtually restricted to the type include *Acacia varia* subsp. *varia*, *Agonis grandiflora* and *Xanthosia pusilla*.	
23	***Low lying *Banksia attenuata* woodlands or shrublands ('community type 21c')** This type occurs sporadically between Gingin and Bunbury, and is largely restricted to the Bassendean system. The type tends to occupy lower lying wetter sites and is variously dominated by *Melaleuca preissiana*, *Banksia attenuata*, *B. menziesii*, *Regelia ciliata*, *Eucalyptus marginata* or *Corymbia calophylla*. Structurally, this community type may be either a woodland or occasionally shrubland.	Priority 3(i)
24	***Subtropical and Temperate Saltmarsh** Consists of the assemblage of plants, animals and micro-organisms associated with saltmarsh in coastal regions of sub-tropical and temperate Australia (south of 23^{o}S latitude). The habitat is coastal areas under tidal influence. In southern latitudes saltmarsh are the dominant habitat in the intertidal zone and often occur in association with estuaries. It is typically restricted to the upper intertidal environment, generally between the elevation of the mean high tide, and the mean spring tide. The community consists mainly of salt-tolerant vegetation (halophytes) including: grasses, herbs, reeds, sedges and shrubs. Succulent herbs and grasses generally dominate and vegetation is generally <0.5m tall with the exception of some reeds and sedges. Many species of non-vascular plants are also found in saltmarsh, including epiphytic algae, diatoms and cyanobacterial mats. Saltmarsh consists of many vascular plant species but is dominated by relatively few families. There is also typically a high degree of endemism at the species level. The two most widely represented coastal saltmarsh plant families are the Chenopodiaceae and Poaceae. Four structural saltmarsh forms are currently recognised based on dominance of a particular vegetation type: • dominance by succulent shrubs (e.g. Tecticornia) • dominance by grasses (e.g. Sporobolus virginicus) • dominance by sedges and grasses (e.g. Juncus kraussii, Gahnia trifida) • dominance by herbs (e.g. low-growing creeping plants such as Wilsonia backhousei, Samolus repens, Schoenus nitens).	Priority 3(iii)
25	**Southern *Banksia attenuata* woodlands ('community type 21b')** This community is restricted to sand sheets at the base of the Whicher Scarp, the sand sheets on elevated ridges or the sand plain south of Bunbury. Structurally, this community type is normally *Banksia attenuata* or *Eucalyptus marginata – B. attenuata* woodlands. Common taxa include *Acacia extensa*, *Jacksonia* sp. Busselton, *Laxmannia sessiliflora, Lysinema ciliatum* and *Johnsonia acaulis*.	Priority 3(i)
	SWAN	
1	*** Pools of the Avon and Dale Rivers** Deep pools and natural braided sections of the fresh to brackish Avon and Dale Rivers.	Priority 1
2	**Fairbridge Ironstone community** (Cemetery – Fairbridge Farm).	Priority 1
3	**Mount Saddleback heath communities**	Priority 1
4	***Casuarina obesa* association** Thomas Rd to Serpentine River, Swan Coastal Plain. No detailed information to assess if distinct community.	Priority 1
5	**Elongate fluviatile delta system** Peel Harvey system, the site appears to contain common vegetation types on an unusual substrate, may not meet the criteria for TECs.	Priority 1
6	***Claypans with mid dense shrublands of *Melaleuca lateritia* over herbs** Claypans (predominantly basins) usually dominated by a shrubland of *Melaleuca lateritia* occurring both on the coastal plain and the adjacent plateau. These claypans are characterized by aquatic (*Hydrocotyle lemnoides* – Priority 4) and amphibious taxa (e.g. *Glossostigma diandrum*, *Villarsia capitata* and *Eleocharis keigheryi* - DRF).	Priority 1
7	**Brackish microbial community number 1 (Lake Walyungup)** Microbial community formed in Lake Walyungup, Rockingham. Data required about status and composition. Threats: altered water levels and quality, damage from illegal access to lake bed.	Priority 1
8	**Microbialites and microbial mats of coastal hypersaline lakes (Rottnest lakes)** Extant coastal hypersaline lakes microbialite communities (Rottnest).	Priority 1
9	**Wandoo woodland over dense low sedges of *Mesomelaena preisii* on clay flats** Wandoo woodland on clay flats in valleys over dense low sedges of *Mesomelaena preisii.*	Priority 2
10	**Banksia woodland of the Gingin area restricted to soils dominated by yellow to orange sands**	Priority 2

	Species-rich Banksia woodlands on deep yellow-red sands that appear restricted to the western Dandaragan Plateau. The vegetation is described as scattered *Eucalyptus todtiana* and *Eucalyptus calophylla* over *Banksia menziesii* and *Banksia attenuata* low open woodland over *Jacksonia sternbergiana* and *Adenanthos cygnorum* high open shrubland over *Allocasuarina humilis* and *Chamelaucium lullfitzii* (DRF) open shrubland over *Eremaea pauciflora* and *Astroloma xerophyllum* low shrubland over *Mesomelaena pseudostygia* open sedgeland.	
11	**Living microbial mats in hypersaline ponds** Extant hypersaline pond stromatolitic 'Conophyton' like unlithified communities formed with little sediment incorporation by (?) *Phormidium hypersalinum* (Pamelup Pond, Lake Preston, Yalgorup).	Priority 2
12	**Wooded wetlands that support colonial waterbird nesting areas** Chandala, Booragoon Lake, unnamed wetland near Pinjarra, McCarleys Swamp. This type differs from the listed 'Perched wetlands of the Wheatbelt region with extensive stands of *Casuarina obesa* and *Melaleuca strobophylla'* ('Toolibin-type' wetlands) in that the Wheatbelt type is Casuarina, rather than Melaleuca dominated. Also, Toolobin Lake type is now brackish-saline (formerly fresh-brackish), whereas this type are currently fresh-brackish.	Priority 2
13	**Litter Dependent Invertebrate Community of the northern Jarrah Forest** Chandler Block, Northern Jarrah Forest, insufficient evidence that this is a discrete community type.	Priority 2
14	***Banksia ilicifolia* woodlands, southern Swan Coastal Plain ('community type 22')** Low lying sites generally consisting of *Banksia ilicifolia – B. attenuata* woodlands, but *Melaleuca preissiana* woodlands and scrubs are also recorded. Occurs on Bassendean and Spearwood systems in the central Swan Coastal Plain north of Rockingham. Typically has very open understorey, and sites are likely to be seasonally waterlogged.	Priority 2
15	**Coastal shrublands on shallow sands, southern Swan Coastal Plain ('community type 29a')** Mostly heaths on shallow sands over limestone close to the coast. No single dominant but important species include *Spyridium globulosum, Rhagodia baccata*, and *Olearia axillaris*.	Priority 3(ii)
16	**Granite communities of the northern Jarrah Forest** Jarrahdale area - Monadnocks, Blue Rock; insufficient information to distinguish discrete community type/s.	Priority 3(i)
17	**Swan Coastal Plain *Banksia attenuata* - *Banksia menziesii* woodlands ('community type 23b')** These woodlands occur in the Bassendean system, from Melaleuca Park to Gingin. Occurs in reasonably extensive Banksia woodlands north of Perth.	Priority 3(i)
18	***Southern Swan Coastal Plain *Eucalyptus gomphocephala* - *Agonis flexuosa* woodlands (type 25)** Woodlands of *Eucalyptus gomphocephala - Agonis flexuosa* south of Woodman Point. Recorded from the Karrakatta, Cottesloe and Vasse units. Dominants other than tuart were occasionally recorded, including *Corymbia calophylla* at Paganoni block and *Eucalyptus decipiens* at Kemerton. Tuart formed the overstorey nearby however.	Priority 3(i)
19	***Low lying *Banksia attenuata* woodlands or shrublands ('community type 21c')** This type occurs sporadically between Gingin and Bunbury, and is largely restricted to the Bassendean system. The type tends to occupy lower lying wetter sites and is variously dominated by *Melaleuca preissiana, Banksia attenuata*, *B. menziesii, Regelia ciliata, Eucalyptus marginata* or *Corymbia calophylla*. Structurally, this community type may be either a woodland or occasionally shrubland.	Priority 3(i)
20	**Northern Spearwood shrublands and woodlands ('community type 24')** Heaths with scattered *Eucalyptus gomphocephala* occurring on deeper soils north from Woodman Point. Most sites occur on the Cottesloe unit of the Spearwood system. The heathlands in this group typically include *Dryandra sessilis, Calothamnus quadrifidus*, and *Schoenus grandiflorus*.	Priority 3(i)
21	**Acacia shrublands on taller dunes**, **southern Swan Coastal Plain ('community type 29b')** Community is dominated by Acacia shrublands or mixed heaths on the larger dunes. This community stretches from Seabird to south of Mandurah. No consistent dominant but species such as *Acacia rostellifera, Acacia lasiocarpa,* and *Melaleuca acerosa* were important.	Priority 3(i)
22	***Subtropical and Temperate Saltmarsh** Consists of the assemblage of plants, animals and micro-organisms associated with saltmarsh in coastal regions of sub-tropical and temperate Australia (south of 23^{o} S latitude). The habitat is coastal areas under tidal influence. In southern latitudes saltmarsh are the dominant habitat in the intertidal zone and often occur in association with estuaries. It is typically restricted to the upper intertidal environment, generally between the elevation of the mean high tide, and the mean spring tide. The community consists mainly of salt-tolerant vegetation (halophytes) including: grasses, herbs, reeds, sedges and shrubs. Succulent herbs and grasses generally dominate and vegetation is generally <0.5m tall with the exception of some reeds and sedges. Many species of non-vascular plants are also found in saltmarsh, including epiphytic algae, diatoms and cyanobacterial mats. Saltmarsh consists of many vascular plant species but is dominated by relatively few families. There is also typically a high degree of endemism at the species level. The two most widely represented coastal saltmarsh plant families are the Chenopodiaceae and Poaceae. Four structural saltmarsh forms are currently recognised based on dominance of a particular vegetation type: • dominance by succulent shrubs (e.g. Tecticornia)	Priority 3(iii)

	• dominance by grasses (e.g. Sporobolus virginicus) • dominance by sedges and grasses (e.g. Juncus kraussii, Gahnia trifida) • dominance by herbs (e.g. low-growing creeping plants such as Wilsonia backhousei, Samolus repens, Schoenus nitens).	
23	**Central Northern Darling Scarp Granite Shrubland Community** Shrublands and heath on deeper loams and red earths on fragmented granite/quartzite. Heath species typically consist of the taller shrubs *Xanthorrhoea acanthostachya* and *Allocasuarina humilis* over smaller proteaceous and myrtaceous shrubs, namely *Melaleuca* aff. *scabra*, *Baeckea camphorosmae* and to a lesser extent, the proteaceous shrubs *Dryandra armata, Hakea incrassata and Hakea undulata*. Located in central region of the Northern Darling Scarp near Perth.	Priority 4 (i)
	WARREN	
1	***Reedia spathacea - Empodisma gracillimum - Schoenus multiglumis* dominated peat paluslopes and sandy mud floodplains of the Warren Biogeographical Region** Sedges/ rushes to about 1.5m in height of *Reedia spathacea/Empodisma gracillimum/Schoenus multiglumis* with *Homalospermum firmum* low open shrubs to scrub.	Priority 1
2	**Relictual peat community** Lake Surprise.	Priority 1
3	**Southwest Coastal Grassland** Southwest coastal grassland occuring over calcareous sand dune and dominated by a dense covering of a diverse array of perennial grasses including *Austrostipa flavescens*, and *Poa porphyroclados*, as well as a high density of the restiad *Desmocladus flexuosus*.	Priority 1
4	**Dense heath B of *Spyridium glosulosum, Banksia occidentalis, Olearia axillaris, Melaleuca pauciflora, Pericalymma spongiocaule* and *Jacksonia horrida* with tall open sedges of *Ficinia nodosa*** Typical species may include *Anarthria prolifera, Ficinia nodosa, Baumea juncea, Hibbertia stellaris, Patersonia occidentalis, Cassytha racemosa, Melaleuca pauciflora, Melaleuca* sp., *Pericalymma spongiocaule, Banksia occidentalis, Hakea varia, Spyridium globulosum, Dodonaea ceratocarpa.* Found at Black point, D'Entrecasteaux National Park Threats: Uncontrolled vehicle access, trampling, grazing, altered hydrology, *Phytophthora* and acid sulphate soils.	Priority 1
5	**Low forest B of *Melaleuca cuticularis* with *Banksia occidentalis*** Typical species include *Melaleuca cuticularis, Banksia occidentalis, Acacia saligna, Rhadinothamnus anceps, Cassytha racemosa, Spyridium globulosum, Olearia axillaris, Olax phyllanthii, Agonis flexuosa, Xanthorrhoea preissii, Muehlenbeckia adpressa.* Found at Black point, D'Entrecasteaux National Park Threats: Uncontrolled vehicle access, trampling, grazing, altered hydrology, *Phytophthora* and acid sulphate soils.	Priority 1
6	**Sphagnum communities of the Tingle Forest** Only 4 known occurrences - Walpole area.	Priority 2
7	**Basalt association of the Warren Region** Black Point - near Augusta. Dwarf Scrub D *Leucophyta brownii*, *Sarcocornia quinquefolia* and *Olearia axillaris* with Open Low Sedges of *Juncus pauciflorus* and Herbs of *Sarcocornia quinquefolia*, *Isolepis* sp., *Samolus repens* and Very Open Low Grass of *Sporobolus virginicus*. Bunbury Basalt outcrops, flats over Bunbury Basalt with reddish brown sandy clay loam basaltic soils and basaltic saprolite outcrops with light yellowish brown clays. Threats: Uncontrolled vehicle access, trampling, grazing, altered hydrology, *Phytophthora* and acid sulphate soils erosion	Priority 2
9	**Aquatic invertebrate assemblages of granite outcrops associated with Burnside Batholith** (formerly Southern Granite community (Muirillup Rock, Northcliffe)) Subset of wheatbelt granites; insufficient information to distinguish discrete community type/s.	Priority 2
10	**Aquatic invertebrate communities of peat swamps**	Priority 2
11	**Microbial tufa community (Black Point type)** A comparison of the species composition of the microbial tufa at Black Point with the TEC 'Rimstone pools and caves structures formed by microbial activity on marine shorelines', at Augusta needs to be completed to determine if the communities should be considered as separate types. Threats: Recreational activity has the potential to impact on some of the occurrences through physical disturbance and altered hydrology.	Priority 3 (i)
12	***Subtropical and Temperate Saltmarsh**	Priority 3(iii)

	Consists of the assemblage of plants, animals and micro-organisms associated with saltmarsh in coastal regions of sub-tropical and temperate Australia (south of 23°S latitude). The physical environment for the ecological community is coastal areas under tidal influence. In southern latitudes saltmarsh are the dominant habitat in the intertidal zone and often occur in association with estuaries. It is typically restricted to the upper intertidal environment, generally between the elevation of the mean high tide, and the mean spring tide. The community consists mainly of salt-tolerant vegetation (halophytes) including: grasses, herbs, reeds, sedges and shrubs. Succulent herbs and grasses generally dominate and vegetation is generally less than half of a metre tall with the exception of some reeds and sedges. Many species of non-vascular plants are also found in saltmarsh, including epiphytic algae, diatoms and cyanobacterial mats. Saltmarsh consists of many vascular plant species but is dominated by relatively few families. There is also typically a high degree of endemism at the species level. The two most widely represented coastal saltmarsh plant families are the Chenopodiaceae and Poaceae. Four structural saltmarsh forms are currently recognised based on dominance of a particular vegetation type: • dominance by succulent shrubs (e.g. *Tecticornia*) • dominance by grasses (e.g. *Sporobolus virginicus, Austrostipa stipoides*) • dominance by sedges and grasses (e.g. *Juncus kraussii, Gahnia trifida*) • dominance by herbs (e.g. low-growing creeping plants such as *Wilsonia backhousei, Samolus repens, Schoenus nitens*).	
13	**Epiphytic Cryptogams of the karri forest** Cryptogams associated with *Trymalium odoratissimum* subsp. *odoratissimum* and *Chorilaena quercifolia* in the karri forests of south-west WA. Comprises liverworts, mosses and lichens found on the bark of mature (plants greater than 15 years old and prior to senescence at about age 50) of *Trymalium odoratissimum* subsp. *odoratissimum* and *Chorilaena quercifolia* in the karri forest of south-west Western Australia.	Priority 3 (iii)
	WHEATBELT	
1	**Highclere Hills (Mayfield) vegetation complex (banded ironstone formation)** Threats: iron ore mining.	Priority 1
2	**Red Morrel Woodland of the Wheatbelt** Tall open woodlands of *Eucalyptus longicornis* (red morrell) found in the Wheatbelt on lateritic, ironstone or granitic soil types. Sometimes found with *Eucalyptus salmonophloia* (Salmon Gum), or *E. loxophleba* (York Gum) woodlands and has very little understorey. It is also found directly above lake systems in the central and eastern Wheatbelt. The landscape unit in which it is found is valley floors, usually adjacent to saline areas.	Priority 1
3	*** Pools of the Avon and Dale Rivers** Deep pools and natural braided sections of the fresh to brackish Avon and Dale Rivers.	Priority 1
4	**Canegrass perched clay wetlands of the wheatbelt dominated by *Eragrostis australasica* and *Melaleuca strobophylla* across the lake floor**	Priority 1
5	**Mottlecah dominated heathland on deep white sands** Wheatbelt Mottlecah *(Eucalyptus macrocarpa* subsp. *macrocarpa)* dominated heathland on deep white sands. *Eucalyptus macrocarpa* over proteaceous sandplain community.	Priority 1
6	**Natural organic saline seeps of the Avon Botanical District** The known occurrence of this community is characterised by vegetation in a series of bands from the upland to the saline seep. 1) Dunes and sandplain, 2) Saline seep and 3) Adjacent flats and flow lines.	Priority 1
7	**Dense Melaleuca thickets with emergent mallee *Eucalyptus erythronema* var. *marginata* and *Eucalyptus transcontinentalis* of the Wheatbelt Region**	Priority 1
8	**Tamma-Dryandra-Eremaea shrubland** Tamma-Dryandra-Eremaea shrubland on cream sands of the Ulva Landform Unit. *Acacia lasiocalyx* and *Allocasuarina campestris* over *Eremaea pauciflora, Dryandra armata, Hakea aculeata* and *Dryandra erythrocephala* open heath over *Neurachne alopecuroidea* very open grassland over cream sands of the Ulva Landform Unit.	Priority 1
9	***Banksia prionotes* and *Xylomelum angustifolium* low woodlands on transported yellow sand** *Banksia prionotes* and *Xylomelum angustifolium* Low Woodlands on large yellow sands dunes (formed from sheets of transported sand in the valleys) on the Ulva Landform Unit. The community has a species rich understorey of *Grevillea eriostachya, Melaleuca leptospermoides, Verticordia roei, Calytrix leschenaultii, Dampiera* spp., *Baeckea preissiana* and *Borya constricta.*	Priority 1
10	**Salt Flats Plant Assemblages of the Mortlock River (East Branch)** The habitat comprises braided channels (up to 2 km wide), flats, wash-lines and sandy rises (up to 2m high) stretching 39 km along the Mortlock River (East) from Meckering eastwards to 8 km west of Tammin. A mosaic of plant communities assorted by elevation occurs on the river flats. The area represents the most extensive braided saline drainage line in this part of the SW agricultural zone. The plant community comprises mixed shrubs (*Scholtzia capitata*, *Melaleuca* aff. *uncinata*) over species rich herbs on sandy rises, with *Melaleuca thyoides* on margins, dwarf scrub and species rich herbs on washlines and saline wetlands.	Priority 1
11	**Brown mallet *Eucalyptus astringens* communities in the western Wheatbelt on alluvial flats (previously 'Beaufort River Flats')**	Priority 1

	Near York and on the Arthur River on grey clays the understorey is dominated by *Melaleuca viminea* over sedges (*Gahnia trifida*) and bunch grasses. At Kojunup and near Tambellup on brown clays sparse shrubs and succulent shrubs (*Disphyma crassifolium*) dominate the understorey.	
12	**Yate (*Eucalyptus occidentalis*) dominated alluvial claypans of the Jingalup Soil System**	Priority 2
13	**Gypsum Dunes (Lake Chinocup)** *Eucalyptus* aff. *incrassata* mallee over low scrub on gypsum dunes.	Priority 2
14	**Wheatbelt *Allocasuarina huegeliana* over *Pteridium esculentum* fernland community** Tall emergent *Eucalyptus salmonophloia* over *Allocasuarina huegeliana* tall closed forest over *Acacia acuminata* mid-high isolated trees over *Alyxia buxifolia* tall sparse shrubland over *Pteridium esculentum* very tall closed fernland over various sparse forbland. Occurs in a drainage line near the base of a granite inselberg.	Priority 2
15	***Claypans with mid dense shrublands of *Melaleuca lateritia* over herbs** Claypans (predominantly basins) usually dominated by a shrubland of *Melaleuca lateritia* occurring both on the coastal plain and the adjacent plateau. These claypans are characterized by aquatic (*Hydrocotyle lemnoides* – Priority 4) and amphibious taxa (e.g. *Glossostigma diandrum*, *Villarsia capitata* and *Eleocharis keigheryi* - DRF).	Priority 1
16	***Allocasuarina huegeliana* and *Lepidosperma tuberculatum* growing on the south-western side of granite outcrops adjacent to laterite on the eastern slopes of the Darling Scarp**	Priority 2
17	***Ironcap Hills vegetation complexes** (Mt Holland, Middle, North and South Ironcap Hills, Digger Rock and Hatter Hill) Threats: mining	Priority 3(iii)
18	**Parker Range vegetation complexes** *Hakea pendula* Tall Shrubland is of particular significance. *Eucalyptus sheathiana* with *E. transcontinentalis* and/or *E. eremophila* woodland on sandy soils at the base of ridges and low rises; *E. longicornis* with *E. corrugata* and *E. salubris* or *E. myriadena* woodland on broad flats; *E. salmonophloia* and *E. salubris* woodland on broad flats; *Allocasuarina acutivalvis* and *A. corniculata* on deeper sandy soils of lateritic ridges; *E. capillosa* subsp. *polyclada* and/or *E. loxophleba* over *Hakea pendens* thicket on skeletal soils on ridges (laterites, breakaways and massive gossanous caps); and *Callitris glaucophylla* low open woodland on massive greenstone ridges. Threats: exploration and mining	Priority 3(iii)
19	***Granite outcrop pools with endemic aquatic fauna** Freshwater pools formed on granite outcrops that may persist for several months and house a variety of aquatic invertebrates, some of which are endemic to south-west WA. Some examples include cladocerans, ostracods, copepods, rotifers, oligochaetes and molluscs.	Priority 3(i)
20	**Eucalypt woodlands of the Western Australian Wheatbelt** Eucalypt-dominated woodlands in the Western Australian Wheatbelt region as defined by the IBRA Avon Wheatbelt 1 and 2 and Western Mallee subregions with the specific exceptions of: woodlands and forests dominated by Jarrah (*E. marginata*) or Marri (*Corymbia calophylla*) where they occur without York Gum present; and non-woodland communities dominated by eucalypts, specifically those dominated by eucalypts with a mallee growth form. Community is defined primarily by its structure as a woodland. The presence in the canopy layer of eucalypt trees - most commonly salmon gum (*Eucalyptus salmonophloia*), York gum (*Eucalyptus loxophleba*), red morrel (*Eucalyptus longicornis*) or gimlet (*Eucalyptus salubris*) defines the Wheatbelt woodlands. Several of the other emergent eucalypt species which may be present as a defining species (e.g. Kondinin blackbutt (*E. kondinensis*), *E. myriadena*, salt river gum (*E. sargentii*), silver mallet (*E. ornata*) and mallet (*E. singularis*) are found only in the Western Australian Wheatbelt. Threats: altered hydrology, grazing, altered fire regimes, vegetation clearing, exotic species, soil cultivation and fertilization	Priority 3(iii)
21	**Plant assemblages of the Wongan Hills System** Mallee over *Petrophile shuttleworthiana/Allocasuarina campestris* thicket on shallow gravely soils over ironstone on summit and slopes; Shrub mallee on slopes of lateritic hills; Mallee over *Allocasuarina campestris* thicket on the slopes of the laterite plateaus; Mallee over Melaleuca thicket on red brown loam over gravel on slopes below the plateau; Mallee over *Melaleuca coronicarpa* heath on shallow red soil on scarp slopes; *A. campestris/Calothamnus asper* thicket over red-brown clay/ironstone/greenstone on scree slopes; and in lower areas: *Eucalyptus longicornis/ E. salubris* woodland, *E. salmonophloia* and *E. loxophleba* woodlands; *Acacia acuminata* low forest; *E. ebbanoensis* mallee over scrub; and open mallee of *E. drummondii.*	Priority 4(i)
	SOUTH COAST	
1	**Stromatolite-like microbialite community of a Coastal Hypersaline Lake (Pink Lake)** Microbial, invertebrate and plant assemblages of natural saline seeps. Well-laminated stromatolites consisting of alternations of egg-shell-like layers of inorganic aragonite precipitate and calcified microbial layers dominated by coccoid cyanobacteria and photosynthetic bacteria. These structures probably record seasonal alternations of the growth of a benthic microbial community and aragonite precipitation.	Priority 1
2	**Ridge Road Quartzite community**	Priority 1

	Open Jarrah forest and woodland developed on young exposed quartzite with an understorey dominated by *Taxandria parviceps* on the western interface of the Yilgarn craton and the Albany-Frazer orogen.	
3	***Allocasuarina globosa* assemblages on greenstone rock (Esperance District)** Assemblage only known from near Norseman and in the Bremer Range (see below). Threats: mining and exploration	Priority 1
4	**Bremer Range vegetation complexes** Mt Day, Round Top Hill, Honman Ridge. *Eucalyptus rhomboidea* ms and *E. eremophila* woodland on the side slopes of low ridges; *E. flocktoniae* woodland (with *E. salubris*, *E. salmonophloia*, *E. dundasii* and *E. tenuis*) on broad flat ridges and side slopes; *E. flocktoniae* and/or *E. longicornis* woodland on saline soils on ridges and flats adjacent to large salt lake systems; *E. longicornis* and/or *E. salmonophloia* or, *E. georgei* subsp *georgei* or, *E. dundasii* woodland, on low areas; *E. livida* woodland on lateritic tops or Allocasuarina thickets on greenstone ridges of lateritic breakaways; *Acacia duriuscula*, *Allocasuarina globosa*, *E. georgei* subsp. *georgei* and *E. oleosa* thickets on greenstone ridges with skeletal soils. Proposed Nature Reserve. Threats: exploration and mining	Priority 1
5	**Fraser Range vegetation complex** Plant assemblages of the Fraser Range Vegetation Complex: *Allocasuarina huegeliana* and *Pittosporum phylliraeoides* open woodland over *Beyeria lechenaultia* and *Dodonaea microzyga* Scrub and *Aristida contorta* bunch grasses (granite complex), on the slopes and summits of hills; *Acacia acuminata* Tall Shrubland dominated by *Melaleuca uncinata* and *Triodia scariosa* on uplands with shallow loamy sands; *Eucalyptus* aff. *uncinata* (KRN 7854) over *Senna artemisioides* subsp. *helmsii*, *Cryptandra miliaris*, *Dodonaea boroniifolia*, *D. stenozyga* and *Triodia scariosa* (*Eucalyptus effusa* Mallee) on colluvial flats with loamy clay sands, and; *E. oleosa*, *E. transcontinentalis*, *E. flocktoniae* Woodland on flats.	Priority 1
6	**Plant assemblages of the Southern Hills Vegetation Complex** Complex of woodland *(Eucalyptus oleosa, E. transcontinentalis, E. flocktoniae)* on flats with open stony ridges carrying mainly mallee and spinifex *(Eucalyptus effusa* mallee: *Eucalyptus rigidula* over *Cassia helmsii, Cryptandra miliaris, Dodonaea boroniifolia, D. stenozyga* and *Triodia scariosa).* Includes patches of grassland, wattle thicket and mallee.	Priority 1
7	**Green Range granite hill heath and woodland community** Heath and woodland dominated by *Acacia heteroclita, Anthocercis viscosa, Thryptomene saxicola, Darwinia citriodora, Prostanthera verticillata, Platysace compressa, Gastrolobium bilobum, Hakea oleifolia, Leucopogon verticillaris, Agonis flexuosa, Eucalyptus cornuta*, and *Acacia drummondii* ssp. *elegans* on red clay-loam over granite.	Priority 1
8	**Wet ironstone heath community (Albany District)** The habitat for the community is winter-wet ironstone in valley floors. The heath community is dominated by *Kunzea recurva, K. preissiana, K. micrantha, Hakea lasiocarpha, H. tuberculata, H. oldfieldii, H. cucullata, H. sulcata, Petrophile squamata, Dryandra tenuifolia* ssp. *tenuifolia, Adenanthos apiculatus, Melaleuca suberosa, M. violacea, Gastrolobium spinosum*. North Porongurup.	Priority 1
9	**Porongurup Range Karri Forest** Occurs on granite, red clay-loam on the mid-upper slopes of the Porongurup Range. Dominants include *Eucalyptus diversicolor, Corymbia calophylla, Trymalium floribundum, Hydrocotyle ?hirta, Tetrarrhena laevis, Clematis pubescens, Lepidosperma effusum* and *Pteridium esculentum*. Other associated species include; *Apium prostratum* subsp. *phillipii* (DRF), *Ranunculus colonorum, Adiantum aethiopicum, Asplenium flabellifolium, A. aethiopicum* (P4), *Veronica plebeia, Poa porphyroclados* and *Oxalis corniculata*.	Priority 1
10	**Cheynes 1 Tree Mallee** *Eucalyptus acies, E. lehmanii, E. goniantha* Tree Mallee Tall Open Shrubland and Open Sedgeland on loam on steep slopes of spongelite breakaway. Common shrub species include *Gastrolobium bilobum, Rhadinothamnus rudis, Melaleuca blaeriifolia, Hakea elliptica, Spyridium majoranifolium* and *Agonis theiformis*. Common sedges include *Desmocladus flexuosus* and *Tetraria capillaris*. Priority taxa other than *E. acies* (P4) and *E. goniantha* (P4) include *Dryandra serra* (P4, at the eastern limit of its range) and *Calothamnus robustus* (P3).	Priority 1
11	**Cheynes 2 Open Tree Mallee** *Eucalyptus acies* (P4), *E. doratoxylon* Tree Mallee over Mixed Tall Open Shrubland, Open Shrubland and Open Sedgeland on loam on gentle to moderate slopes and crests of spongelite outcropping. Common tall shrub species include *Allocasuarina trichodon, Hakea cucullata* and *H. lasiantha*; however the tall shrub stratum may be absent. Common shrubs include *Calothamnus robustus* (P3), *Beaufortia empetrifolia, Dryandra mucronulata, Melaleuca striata* and *Taxandria spathulata*. Common sedges include *Mesomelaena stygia, M. tetragona, Cyathochaeta avenacea, Anarthria scabra* and *Chordifex leucoblepharus*.	Priority 1
12	***Ironcap Hills vegetation complexes** (Mt Holland, Middle, North and South Ironcap Hills, Digger Rock and Hatter Hill) Threats: mining	Priority 3(iii)

13	**Heath on Komatiite of the Raventhorpe 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 occurrence. Dominant species: *Beyeria* sp. Bandalup, *Acacia ophiolithica, Hakea verrucosa, Grevillea fastigiata, Melaleuca* sp. Gorse, *Allocasuarina* sp. Bandalup, *Verticordia oxylepis, Grevillea oligantha, Hybanthus floribundus, Pomaderris brevifolia* ssp. *brevifolia, Pultenaea wudjariensis, Melaleuca pomphostoma, Nematolepis phebalioides, Philotheca gardneri* Bandalup form, *Gyrostemon* sp. Ravensthorpe, *Calothamnus quadrifidus, Calytrix tetragona, Halgania anagalloides, Coleanthera myrtoides*. *Beyeria* sp., *Pultenaea wudjariensis, Grevillea fastigiata* and *Gyrostemon* sp. Ravensthorpe are narrow range endemics.	Priority 3(iii)
14	***Melaleuca* sp. Kundip 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.	Priority 1
15	**Montane mallee of the Stirling Ranges** Thicket, mallee-thicket and heath community on mid to upper slopes of Stirling Range mountains and hills east of Red Gum Pass.	Priority 1
16	**Coyanarup Wetland Suite** Microscale paluslopes associated with seepage and creeks in the area between Coyanarup Peak and Bluff Knoll in the Stirling Ranges.	Priority 1
17	***Eucalyptus purpurata* woodlands (Bandalup Hill**) *Eucalyptus purpurata* woodlands on magnesite soils of the ridge-tops and upper slopes of Bandalup Hill	Priority 1
18	***Banksia coccinea* Shrubland/*Eucalyptus staeri*/Sheoak Open Woodland ('Community type 14a')** Found on deep white/light grey sand on the lower slopes and valleys, usually occurring just upslope of seasonally wet drainage lines. The community is floristically very diverse and structurally quite variable. Typically *Allocasuarina fraseriana, Eucalyptus staeri, Banksia attenuata and Banksia ilicifolia* are present as emergents or as low open woodland above a *Banksia coccinea* tall open scrub, mixed open/closed heath, mixed low open heath, mixed sedgeland and open herbland. *Jacksonia spinosa* often forms a distinct stratum above the heathland, dominant heath species are *Melaleuca thymoides, Adenanthos cuneatus, Leucopogon rubricaulis, Phyllota barbata, Hypocalymma strictum* and *Leucopogon glabellus*. Common sedges and herbs include *Anarthria scabra, Lyginia barbata, Schoenus caespititius, Anarthria prolifera, Anarthria gracilis* and *Cyathochaeta equitans*. The community is highly susceptible to *Phytophthora* dieback with infestations resulting in greatly reduced floristic and structural diversity. Appears to be restricted to the Albany region.	Priority 1
19	***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*.	Priority 1
20	***Eucalyptus megacornuta* mallet woodland** Associated species include the shrubs *Hovea acanthoclada, Lasiopetalum compactum, Melaleuca thapsina*. This community typically grows on rock piles and breakaways of laterised banded ironstone and pyrite formations. A vegetation study noted that *E. megacornuta* is almost confined to the Ravensthorpe Range and was considered rare (less than 1,000 plants known in conservation reserves, or few populations).	Priority 1
21	**Microbial mantles of Nullarbor caves (especially Weebubbie Cave)** Significant microbial communities in underwater sections of caves. Threats: uncontrolled access	Priority 1
22	**Mosaic of Albany Blackbutt (*Eucalyptus staeri*) mallee-heath found on lateritic ridges and Chittick (*Lambertia inermis* subsp. *inermis*) scrub-heath on seasonally-waterlogged laterite** Regionally very restricted and very poorly reserved. Threats: dieback	Priority 1
23	***Banksia littoralis* woodland / *Melaleuca incana* Shrubland (South Coast Region)** Threats: fragmentation, dieback disease, hydrological change, too frequent fire, weed invasion	Priority 1
24	***Banksia occidentalis/Kunzea clavata* Shrubland (South Coast Region)** Threats: dieback disease, too frequent fire, weed invasion	Priority 1
25	***Astartea scoparia* Swamp Thicket (South Coast Region)** Threats: fragmentation, too frequent fire, hydrological change, weed invasion, dieback disease	Priority 1

26	**Coastal *Melaleuca incana* / *Taxandria juniperina* Shrubland/ Closed Forest (South Coast Region)** Threats: fragmentation, too frequent fire, hydrological change, weed invasion, dieback disease	Priority 1
27	**Tallerack (*Eucalyptus pleurocarpa*) mallee-heath on seasonally inundated soils** May have been common prior to clearing for agriculture, and the remaining occurrences of this vegetation are of high conservation significance.	Priority 2
28	***Melaleuca striata /Banksia* spp. Coastal Heath** Community occurs on light grey deep sand on coastal slopes and valleys. *Melaleuca striata, Banksia attenuata* and *Banksia coccinea* dominate the closed to open heath/low heath with exposure to salt laden winds restricting the growth of the latter two species. This unit is typically dense being a closed to open heath/low heath over a dense sedgeland dominated by *Anarthria scabra*. Other common species include *Isopogon cuneatus, Adenanthos cuneatus, Astroloma baxteri, Hypocalymma strictum, Petrophile rigida, Melaleuca thymoides, Lyginia barbata* and *Hypolaena exsulca.* The community is restricted to an area in Gull Rock National Park east of Albany. Threats: All known occurrences are affected by *Phytophthora* dieback and/or aerial canker. Also vulnerable to inappropriate fire regimes as the community contains serotinous obligate seeders.	Priority 1
29	***Melaleuca spathulata/Melaleuca viminea* Swamp Heath** Seasonally wet heath dominated by *Melaleuca spathulata and Melaleuca viminea* in the upper stratum over an open sedgeland characterised by *Meeboldina roycei;* occurs on brown to orange brown loam overlying clay in winter-wet sumplands. Threats: As a wetland community may be considered vulnerable to inappropriate fire regimes i.e. intense fire while the dominant species *Melaleuca viminea* is a serotinous obligate seeder and vulnerable to too frequent fire.	Priority 1
30	***Banksia coccinea* Shrubland */Melaleuca striata / Leucopogon flavescens* Heath** Community occurs on light grey or grey deep sand on lower slopes and valleys. Structurally this unit is a diverse heathland over a diverse sedgeland dominated by *Anarthria scabra* and a very open herbland dominated by *Dasypogon bromeliifolius.* Emergent trees (*Allocasuarina fraseriana, E. marginata*) may be present along with the shrub *Taxandria angustifolia.* The community is restricted to an area in the Angove-Two-Peoples Bay - Bettys Beach area east of Albany. Threats: dieback disease caused by *Phytophthora* spp., inappropriate fire regimes.	Priority 1
31	**Albany Blackbutt (*Eucalyptus staeri*) mallee-heath on deep sand** The structure of the vegetation is mallee heath. *Eucalyptus staeri* to about 4-5 m in height is the most common mallee within a tall open shrub layer consistently dominated by *Agonis theiformis* and *Banksia baxteri*. *Banksia attenuata, Banksia coccinea, Hakea pandanicarpa* subsp.*crassifolia* and *Lambertia inermis* are also dominant in some occurrences. *Banksia attenuata* dominates this assemblage at occurrences with the deepest sand. *Hakea baxteri* and *Nuytsia floribunda* are other common species in the tall shrub layer. *Banksia baxteri* in the tall shrubs layer is a conspicuous indicator species of this unit. Requires further survey to confirm distribution. Threats: appears to have been very extensive and common throughout the region but has been comprehensively cleared and degraded (mainly through grazing).	Priority 2
32	**Subterranean faunal ecosystems of Nullarbor caves (known from Nurina Cave, Olwolgin Cave, Burnabbie Cave, N327, N1327)** The caves contain communities of invertebrates, other fauna and sensitive habitats including tree roots. Caves included in this community contain at least four troglobitic taxa. Threats: uncontrolled access	Priority 3(i)
33	**Swamp Yate (*Eucalyptus occidentalis*) woodlands in seasonally inundated clay basins (South Coast)** Yate woodlands with intact understorey and fringing vegetation are poorly conserved in the region.	Priority 3(iii)
34	**Scrub heath on deep sand with Banksia and Lambertia, and Banksia scrub heath on Esperance Sandplain** The scrub heath forms part of Beard's Esperance System and comprises two very closely related vegetation units (bSZc & blSZc) on sand of varying depths overlying clay: Scrub heath dominated by *Banksia speciosa* and *Lambertia inermis* and other proteaceous species such as *B. media* and *Hakea* spp. (with occasional *Nuytsia floribunda* and mallee species) over herbs on deep sand (to 1m) over clay over ironstone. The scrub heath may share a number of species in common with the Mallee heath vegetation unit (e26SZc) of the Esperance System: *Eucalyptus tetragona* and. *E decipiens* with occasional *E. incrassata, E. redunca* over *Lambertia inermis* and *Hakea* spp. on lateritic soil over ironstone.	Priority 3(iii)
35	***Subtropical and Temperate Saltmarsh**	Priority 3(iii)

	Consists of the assemblage of plants, animals and micro-organisms associated with saltmarsh in coastal regions of sub-tropical and temperate Australia (south of 23° S latitude). The habitat is coastal areas under tidal influence. In southern latitudes saltmarsh are the dominant habitat in the intertidal zone and often occur in association with estuaries. It is typically restricted to the upper intertidal environment, generally between the elevation of the mean high tide, and the mean spring tide. The community consists mainly of salt-tolerant vegetation (halophytes) including: grasses, herbs, reeds, sedges and shrubs. Succulent herbs and grasses generally dominate and vegetation is generally <0.5m tall with the exception of some reeds and sedges. Many species of non-vascular plants are also found in saltmarsh, including epiphytic algae, diatoms and cyanobacterial mats. Saltmarsh consists of many vascular plant species but is dominated by relatively few families. There is also typically a high degree of endemism at the species level. The two most widely represented coastal saltmarsh plant families are the Chenopodiaceae and Poaceae. Four structural saltmarsh forms are currently recognised based on dominance of a particular vegetation type: • dominance by succulent shrubs (e.g. Tecticornia) • dominance by grasses (e.g. Sporobolus virginicus) • dominance by sedges and grasses (e.g. Juncus kraussii, Gahnia trifida) • dominance by herbs (e.g. low-growing creeping plants such as Wilsonia backhousei, Samolus repens, Schoenus nitens).	
36	***Granite outcrop pools with endemic aquatic fauna** Freshwater pools formed on granite outcrops that may persist for several months and house a variety of aquatic invertebrates, some of which are endemic to south-west WA. Some examples include cladocerans, ostracods, copepods, rotifers, oligochaetes and molluscs.	Priority 3(i)
37	***Taxandria spathulata* Heath** Community is an open heath dominated by *Taxandria spathulata*, with a sedgeland that includes *Schoenus* sp. Cape Riche Cushion and *Mesomelaena stygia* on clay loam overlying spongelite plains. Threats*:* The community is vulnerable to inappropriate fire regimes with *Taxandria spathulata* being a serotinous obligate seeder.	Priority 4(i)
38	**Dense, obligate seeding Proteaceae dominated shrublands and kwongan of the Esperance Sandplains** Consists of predominantly obligate seeding proteaceous shrubland and heath (kwongan) 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. Threats: Past threats have principally been fragmentation from land clearing, current threats are plant disease *Phytophthora cinnamomi*, increased fire frequencies, invasive weeds and feral animals.	Priority 3(iii)
39	**Woodline Hills vegetation complexes (*Baeckea* sp. Barbalin previously known as B. recurva) surubland** Ridge communities unique but unless a mine is proposed are currently not threatened.	Priority 4(i)
40	**Stirling Range Upland Yate community** Low woodland of *Eucalyptus cornuta* over a sparse shrub layer of *Gastrolobium velutinum*, *Chamelaucium pauciflorum* and *Thomasia foliosa* over open herbs of *Tetrarrhena laevis*, *Poa porphyroclados*, *Billardiera heterophylla*, *Clematis pubescens*, *Senecio* sp., *Hydrocotyle hirta*, *Cheilanthes austrotenuifolia* and *Asplenium flabellifolium.*	Priority 4(ii)

***Community type occurs in more than one region**

Total 301 (community types and sub-types)

APPENDIX 6: VEGETATION CONDITION SCALE

Vegetation Condition Scale – adapted from Keighery (1994) and Kaesehagen (1995).

VEGETATION CONDITION SCALE		
Rating	**Condition**	**Descriptive Features**
1	Excellent	• >80% Native Flora Composition • Vegetation structure intact or nearly so • Minor signs of disturbance • Weeds are non-aggressive species (cover <5%)
2	Good	• 60 - 80% Native Flora Composition • Vegetation structure altered in places • Obvious signs of disturbance • Weed cover/abundance 5 -20%
3	Fair	• 40 - 60% Native Flora Composition • Vegetation structure significantly altered yet retains basic vegetation structure or ability to regenerate to it • Very obvious signs of multiple disturbance • Weed cover/abundance 20 -50%
4	Poor/Partially Degraded	• 20 - 40% Native Flora Composition • Vegetation structure severely impacted by disturbance • Scope for regeneration but not to state approaching good condition without intensive management • Weed cover/abundance 50 -80%
5	Completely Degraded	• <20% Native Flora Composition • Vegetation structure no longer intact • Extensive disturbance/modification present • Weeds are highly invasive (cover/abundance >80%)

Fire:

No fire evident/0-2 years/2-5 years/5-10 years/> 10 years

Disturbance Types:

Grazing, Clearing, Flooding, Vehicular, Machinery

APPENDIX 7: IMAGES OF INTRODUCED FLORA

Introduced Flora Images

Plate H: ****Calotropis procera* **(FloraBase 2012)**

Plate I: ****Cucumis melo* **(United States Department of Agriculture 2012)**

Plate J: **Melinis repens* (Sharp and Simon 2012)

Plate K: **Passiflora foetida* (FloraBase 2012)

APPENDIX 8: IMAGES OF FLORA OF CONSERVATION SIGNIFICANCE

Priority Flora Images

Plate E: ***Eucalyptus ordiana*** **(P2) (Centre for Plant Biodiversity Research 2012)**

Plate F: ***Grevillea miniata*** **(P4) (FloraBase 2012)**

Plate G: *Jacquemontia* sp. Keep River (P1) (Scanned image of specimen collected during the survey)

* There are no images available of *Triodia cremnophila* (P1) or *Triodia* sp. Argyle (aff. cunninghamii) (currently nominated for priority status)

APPENDIX 9: FAUNA SPECIES POTENTIALLY OCCURRING IN THE RIOP MATSU SURVEY AREA

Fauna species potentially occurring in the Matsu Project Area and associated access track

Birds

Scientific Name	Common Name
Phasianidae	
Coturnix ypsilophora	Brown Quail
Columbidae	
Phaps chalcoptera	Common Bronzewing
Phaps histrionica	Flock Bronzewing
Ocyphaps lophotes	Crested Pigeon
Geophaps plumifera	Spinifex Pigeon
Petrophassa albipennis	White-quilled Rock-Pigeon
Geopelia cuneata	Diamond Dove
Geopelia striata	Peaceful Dove
Geopelia humeralis	Bar-shouldered Dove
Podargidae	
Podargus strigoides	Tawny Frogmouth
Eurostopodidae	
Eurostopodes argus	Spotted Nightjar
Aegothelidae	
Aegotheles cristatus	Australian Owlet-nightjar
Apodidae	
Apus pacificus	Fork-tailed Swift
Accipitridae	
Elanus axillaris	Black-shouldered Kite
Lophoictinia isura	Square-tailed Kite
Hamirostra melanosternon	Black-breasted Buzzard
Haliastur sphenurus	Whistling Kite
Milvus migrans	Black Kite
Accipiter fasciatus	Brown Goshawk
Accipiter cirrocephalus	Collared Sparrowhawk
Accipiter novaehollandiae	Grey Goshawk
Aquila audax	Wedge-tailed Eagle
Hieraaetus morphnoides	Little Eagle
Falconidae	
Falco cenchroides	Nankeen Kestrel
Falco berigora	Brown Falcon
Falco longipennis	Australian Hobby
Falco subniger	Black Falcon
Falco peregrinus	Peregrine Falcon
Turnicidae	
Turnix maculosus	Red-backed Button-quail
Turnix pyrrhothorax	Red-chested Button-quail
Turnix velox	Little Button-quail
Cacatuidae	

Scientific Name	Common Name
Calyptorhynchus banksii	Red-tailed Black-Cockatoo
Eolophus roseicapillus	Galah
Cacatua sanguinea	Little Corella
Cacatua galerita	Sulphur-crested Cockatoo
Nymphicus hollandicus	Cockatiel
Psittacidae	
Trichoglossus haematodus	Rainbow Lorikeet
Psitteuteles versicolor	Varied Lorikeet
Aprosmictus erythropterus	Red-winged Parrot
Platycercus venustus	Northern Rosella
Melopsittacus undulatus	Budgerigar
Cuculidae	
Centropus phasianinus	Pheasant Coucal
Eudynamys scolopaceus	Asian Koel
Scythrops novaehollandiae	Channel-billed Cuckoo
Chalcites basalis	Horsfield’s Bronze-cuckoo
Chalcites osculans	Black-eared Cuckoo
Cacomantis pallidus	Pallid Cuckoo
Cacomantis variolosus	Brush Cuckoo
Strigidae	
Ninox connivens	Barking Owl
Ninox novaeseelandiae	Southern Boobook
Halcyonidae	
Dacelo leachii	Blue-winged Kookaburra
Todiramphus pyrrhopygius	Red-backed Kingfisher
Todiramphus sanctus	Sacred Kingfisher
Meropidae	
Merops ornatus	Rainbow Bee-eater
Coraciidae	
Eurystomus orientalis	Dollarbird
Climacteridae	
Climacteris melanura	Black-tailed Treecreeper
Ptilonorhynchidae	
Ptilonorhynchus nuchalis	Great Bowerbird
Maluridae	
Malurus melanocephalus	Red-backed Fairy-wren
Acanthizidae	
Smicrornis brevirostris	Weebill
Pardalotidae	
Pardalotus rubricatus	Red-browed Pardalote
Pardalotus striatus	Striated Pardalote
Meliphagidae	
Lichenostomus virescens	Singing Honeyeater
Lichenostomus unicolor	White-gaped Honeyeater
Lichenostomus plumulus	Grey-fronted Honeyeater
Lichenostomus flavescens	Yellow-tinted Honeyeater

Scientific Name	Common Name
Manorina flavigula	Yellow-throated Miner
Conopophila rufogularis	Rufous-throated Honeyeater
Cissomela pectoralis	Banded Honeyeater
Lichmera indistincta	Brown Honeyeater
Melithreptus gularis	Black-chinned Honeyeater
Melithreptus albogularis	White-throated Honeyeater
Entomyzon cyanotis	Blue-faced Honeyeater
Philemon argenticeps	Silver-crowned Friarbird
Philemon citreogularis	Little Friarbird
Pomatostomidae	
Pomatostomus temporalis	Grey-crowned Babbler
Neosittidae	
Daphoenositta chrysoptera	Varied Sittella
Campephagidae	
Coracina novaehollandiae	Black-faced Cuckoo-shrike
Coracina papuensis	White-bellied Cuckoo-shrike
Lalage sueurii	White-winged Triller
Pachycephalidae	
Pachycephala rufiventris	Rufous Whistler
Colluricincla woodwardi	Sandstone Shrike-thrush
Colluricincla harmonica	Grey Shrike-thrush
Oriolidae	
Oriolus sagittatus	Olive-backed Oriole
Artamidae	
Artamus leucorynchus	White-breasted Woodswallow
Artamus personatus	Masked Woodswallow
Artamus cinereus	Black-faced Woodswallow
Artamus minor	Little Woodswallow
Cracticus torquatus	Grey Butcherbird
Cracticus nigrogularis	Pied Butcherbird
Cracticus tibicen	Australian Magpie
Rhipiduridae	
Rhipidura albiscapa	Grey Fantail
Rhipidura rufiventris	Northern Fantail
Rhipidura leucophrys	Willie Wagtail
Corvidae	
Corvus bennetti	Little Crow
Corvus orru	Torresian Crow
Monarchidae	
Grallina cyanoleuca	Magpie-lark
Myiagra inquieta	Restless Flycatcher
Myiagra rubecula	Leaden Flycatcher
Petroicidae	
Microeca fascinans	Jacky Winter
Alaudidae	
Mirafra javanica	Horsfield’s Bushlark

Scientific Name	Common Name
Cisticolidae	
Cisticola exilis	Golden-headed Cisticola
Megaluridae	
Cincloramphus mathewsi	Rufous Songlark
Hirundinidae	
Hirundo rustica	Barn Swallow
Petrochelidon ariel	Fairy Martin
Petrochelidon nigricans	Tree Martin
Dicaeidae	
Dicaeum hirundinaceum	Mistletoebird
Estrildidae	
Taeniopygia guttata	Zebra Finch
Taeniopygia bichenovii	Double-barred Finch
Poephila acuticauda	Long-tailed Finch
Poephila personata	Masked Finch
Erythrura gouldiae	Gouldian Finch
Lonchura castaneothorax	Chestnut-breasted Mannikin
Heteromunia pectoralis	Pictorella Mannikin
Motacillidae	
Anthus novaeseelandiae	Australasian Pipit

Mammals

Scientific Name	Common Name
Tachyglossidae	
Tachyglossus aculeatus	Short-beaked Echidna
Dasyuridae	
Planigale ingrami	Long-tailed Planigale
Planigale maculata	Common Planigale
Pseudantechinus ningbing	Ningbing False Antechinus
Sminthopsis macroura	Stripe-faced Dunnart
Macropodidae	
Macropus robustus	Euro
Petrogale brachyotis	Short-eared Rock-wallaby
Petropodidae	
Pteropus alecto	Black Flying-fox
Megadermatidae	
Macroderma gigas	Ghost Bat
Hipposideridae	
Hipposideros stenotis	Northern leaf-nosed bat
Rhinonicteris aurantia	Orange leaf-nosed bat
Emballonuridae	
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat

Scientific Name	Common Name
Taphozous georgianus	Common Sheathtail-bat
Molossidae	
Chaerephon jobensis	Northern Freetail-bat
Mormopterus beccarrii	Beccarri's Freetail-bat
Vespertilionidae	
Chalinolobus gouldii	Gould's Wattled Bat
Chalinolobus nigrogriseus	Hoary Wattled Bat
Miniopterus schreibersii orianae	Common Bentwing-bat
Scotorepens greyii	Little Broad-nosed Bat
Scotorepens sanborni	Northern Broad-nosed Bat
Vespadelus caurinus	Western Cave Bat
Muridae	
Leggadina lakedownensis	Short-tailed Mouse
Melomys burtoni	Grassland Melomys
Mus musculus	House Mouse
Pseudomys laborifex	Kimberley Mouse
Pseudomys nanus	Western Chestnut Mouse
Rattus tunneyi	Pale Field-rat
Rattus villosissimus	Long-haired Rat
Zyzomys argurus	Common Rock-rat
Zyzomys woodwardi	Kimberley Rock-rat
Canidae	
Canis lupus dingo	Dingo
Canis lupus familiaris	Dog
Felidae	
Felis catus	Cat
Bovidae	
Bos taurus	Cattle

Reptiles

Scientific Name	Common Name
Agamidae	
Amphibolurus gilberti	Gilbert's Dragon
Chlamydosaurus kingii	Frilled Neck Lizard
Ctenophorus nuchalis	Central Netted Dragon
Diporiphora arnhemica	
Diporiphora bennettii	
Diporiphora lalliae	
Diporiphora magna	
Diplodacylidae	
Amalosia rhombifer	
Diplodactylus conspicillatus	Fat-tailed Gecko
Lucasium stenodactylum	
Rhynchoedura sexapora	Northern Beaked Gecko

Strophurus ciliaris subsp. *aberrans*	
Strophurus ciliaris subsp. *ciliaris* *Strophurus taeniatus*	
Carphodactylidae *Nephrurus sheai*	
Gekkonidae *Gehyra australis* *Gehyra nana* *Gehyra punctate* *Heteronotia bynoei* *Heteronotia planiceps*	 Bynoe's Gecko
Pygopodidae *Delma borea* *Delma tincta* *Lialis burtonis* *Pygopus steelescotti*	
Scincidae *Carlia amax* *Carlia gracilis* *Carlia munda* *Carlia tricantha* *Cryptoblepharus metallicus* *Cryptoblepharus ruber* *Ctenotus alacer* *Ctenotus burbidgei* *Ctenotus decaneurus* *Ctenotus inornatus* *Ctenotus pantherinus* subsp. *calx* *Ctenotus piankai* *Ctenotus robustus* *Ctenotus saxatilis* *Ctenotus schomburgkii* *Eremiascincus richardsonii* *Menetia greyii* *Menetia maini* *Morethia ruficauda* subsp. *ruficauda* *Proablepharus tenuis* *Tiliqua multifasciata* *Tiliqua scincoides* subsp. *intermedia*	 Ten-lined Ctenotus Rock Ctenotus Broad-banded Sand Swimmer Central Blue-tongue Eastern Blue-tongue
Varanidae *Varanus acanthurus* *Varanus glauerti* *Varanus glebopalma* *Varanus gouldii* *Varanus kingorum* *Varanus mertensi* *Varanus mitchelli* *Varanus panoptes* subsp. *panoptes*	 Spiny-tailed Monitor Kimberley Rock Monitor Black-palmed Rock Monitor Sand Monitor Mertens' Water Monitor Mitchell's Water Monitor Yellow-spotted Monitor

Varanus scalaris	Spotted Tree Monitor
Varanus storri subsp. *ocreatus* *Varanus tristis* subsp. *tristis*	 Racehorse Monitor
Typholpidae *Ramphotyphlops guentheri* *Ramphotyphlops ligatus*	
Boidae *Antaresia childrenii* *Aspidites melanocephalus* *Liasis olivaceus* subsp. *olivaceus*	 Children's Python Black-headed Python Olive Python
Colubridae *Boiga irregularis* *Dendrelaphis punctulatus*	 Brown Tree Snake Green Tree Snake
Elapidae *Acanthophis praelongus* *Brachyurophis roperi* *Demansia papuensis* *Demansia vestigiata* *Furina ornata* *Pseudechis australis* *Pseudonaja modesta* *Pseudonaja mengdeni* *Suta punctata* *Vermicella multifasciata*	 Northern Death Adder Great Black Whipsnake Lesser Black Whipsnake Moon Snake Mulga Snake Ringed Brown Snake Gwardar Spotted Snake

Amphibians

Scientific Name	Common Name
Hylidae *Cyclorana australis* *Cyclorana cultripes* *Cyclorana longipes* *Litoria bicolor* *Litoria caerulea* *Litoria coplandi* *Litoria inermis* *Litoria meiriana* *Litoria nasuta* *Litoria rothii* *Litoria rubella* *Litoria splendida* *Litoria tornieri*	 Giant Frog Knife-footed Frog Long-footed Frog Northern Dwarf Tree Frog Green Tree Frog Rock Frog Bumpy Rocket Frog Rockhole Frog Striped Rocket Frog Northern Laughing Tree Frog Little Red Tree Frog Splendid Tree Frog Black-shinned Rocket Frog
Myobatrachidae *Uperoleia borealis* *Uperoleia trachyderma*	 Northern Toadlet Blacksoil Toadlet

Limnodynastidae	
Limnodynastes lignarius	Carpenter Frog
Platyplectrum ornatum	Ornate Burrowing Frog
Bufonidae	
Rhinella marina	Cane Toad

APPENDIX 10: FAUNA SPECIES RECORDED DURING THE 2012 FIELD SURVEY

Fauna species Recorded During the 2012 Field Survey

Birds

Scientific Name	Common Name
Phasianidae	
Coturnix ypsilophora	Brown Quail
Columbidae	
Petrophassa albipennis	White-quilled Rock-Pigeon
Geopelia cuneata	Diamond Dove
Geopelia striata	Peaceful Dove
Podargidae	
Podargus strigoides	Tawny Frogmouth
Aegothelidae	
Aegotheles cristatus	Australian Owlet-nightjar
Accipitridae	
Lophoictinia isura	Square-tailed Kite
Milvus migrans	Black Kite
Accipiter cirrocephalus	Collared Sparrowhawk
Aquila audax	Wedge-tailed Eagle
Falconidae	
Falco berigora	Brown Falcon
Falco cenchroides	Nankeen Kestrel
Psittacidae	
Platycercus venustus	Northern Rosella
Melopsittacus undulatus	Budgerigar
Cuculidae	
Centropus phasianinus	Pheasant Coucal
Halcyonidae	
Todiramphus pyrrhopygius	Red-backed Kingfisher
Meropidae	
Merops ornatus	Rainbow Bee-eater
Ptilonorhynchidae	
Ptilonorhynchus nuchalis	Great Bowerbird
Maluridae	
Malurus melanocephalus	Red-backed Fairy-wren
Acanthizidae	
Smicrornis brevirostris	Weebill
Pardalotidae	
Pardalotus striatus	Striated Pardalote
Meliphagidae	
Lichenostomus plumulus	Grey-fronted Honeyeater
Manorina flavigula	Yellow-throated Miner
Conopophila rufogularis	Rufous-throated Honeyeater
Lichmera indistincta	Brown Honeyeater
Melithreptus albogularis	White-throated Honeyeater
Philemon argenticeps	Silver-crowned Friarbird

Scientific Name	Common Name
Neosittidae	
Daphoenositta chrysoptera	Varied Sittella
Campephagidae	
Coracina novaehollandiae	Black-faced Cuckoo-shrike
Coracina papuensis	White-bellied Cuckoo-shrike
Lalage sueurii	White-winged Triller
Pachycephalidae	
Pachycephala rufiventris	Rufous Whistler
Colluricincla woodwardi	Sandstone Shrike-thrush
Artamidae	
Artamus personatus	Masked Woodswallow
Artamus minor	Little Woodswallow
Cracticus torquatus	Grey Butcherbird
Cracticus nigrogularis	Pied Butcherbird
Rhipiduridae	
Rhipidura rufiventris	Northern Fantail
Rhipidura leucophrys	Willie Wagtail
Monarchidae	
Myiagra rubecula	Leaden Flycatcher
Megaluridae	
Cincloramphus mathewsi	Rufous Songlark
Hirundinidae	
Hirundo nigricans	Tree Martin
Dicaeidae	
Dicaeum hirundinaceum	Mistletoebird
Estrildidae	
Taeniopygia bichenovii	Double-barred Finch

Bats

Scientific Name	Common Name
Megadermatidae	
Macroderma gigas	Ghost Bat
Hipposideridae	
Rhinonicteris aurantius	Orange Leafnosed-bat
Emballonuridae	
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat
Taphozous georgianus	Common Sheathtail-bat
Vespertilionidae	
Chalinolobus gouldii	Gould's Wattled Bat
Chalinolobus nigrogriseus	Hoary Wattled Bat
Miniopterus schreibersi	Common Bentwing-bat
Scotorepens greyii	Little Broad-nosed Bat
Vespadelus caurinus	Western Cave Bat
Molossidae	
Chaerephon jobensis	Northern Freetail-bat

APPENDIX 11: APM RIOP GOULDIAN FINCH NEST ASSESSMENT

Kimberley Metals Group Pty Ltd
Ridges Iron Ore Project:
Gouldian Finch Nest Assessment

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Summary

This paper describes an assessment of the potential impact of the Ridges Iron Ore Project on breeding habitat of the Gouldian Finch, *Erythrura gouldiae*.

A total of 24 trees, supporting 33 potentially suitable nesting hollows were located in 17 quadrats surveyed across areas targeted for impact from ore extraction, the creation of waste dumps and the movement of vehicles.

An average of 1.41 trees supporting hollows occur per hectare within the mine impact footprint, supporting 1.94 potential nesting hollows per hectare. The potential for nesting on the RIOP mine site area appears to be low in comparison to other studies.

Based on nest density calculations of previous authors from other locations, between 62 and 170 nests could occur in 750 hollow-bearing trees located with the 125ha impact area.

Based on the ecology, including longevity and behaviour related to nest-site selection, Gouldian Finches readily utilise artificial nest hollows. Therefore, where there are disturbances to potential nest sites from clearing, breeding in an area can continue successfully provided that key resources, such as nest hollows, proximity to feeding grounds and water are maintained.

Based on the outcomes of this survey Kimberley Metals Group will commit to the establishment of a suitable number of artificial nesting hollows to compensate for clearing during the RIOP. It is anticipated that nest boxes will be established in the 2010 dry season in preparation for the 2011 breeding season. It is anticipated that the first artificial nest box study site would be located north of March Fly creek and commence with the establishment of 100 nest boxes.

The utilisation of these next boxes will be monitored bi-annually in April and July as part of the ongoing management of the RIOP. Data will be exchanged with research groups at Macquarie University associated with the Save the Gouldian Fund.

Contents

1 Introduction

As part of the overall environmental impact assessment for the Ridges Iron Ore Project (RIOP), the RIOP mine site, located approximately 165 south of Wyndham, has been specifically assessed to determine potential impacts on the Gouldian Finch, *Erythrura gouldiae*. The Gouldian Finch is currently listed as Endangered and Migratory under the Environment Protection and Biodiversity Conservation Act 1999 (cth) and listed as "rare or likely to become extinct" under the Wildlife Conservation Act 1950.

1.1 Distribution

Gouldian Finches, *Erythrura gouldiae*, are distributed throughout Western Australia in the North Kimberley, south to Beagle Bay, Oobagooma, King Leopold Ranges, middle of the Durack River, Dunham River and Lake Argyle. They can also be found further south, for example in Derby and Louisa Downs. Gouldian Finches are also distributed throughout the north of the Northern Territory and the north of Queensland. They are generally classed as moderately common in the northern, central and eastern Kimberley and the lower Ord drainage area, but are uncommon or scarce in most of the southern Kimberley (Johnstone and Storr 2004).

1.2 General Habitat and Behaviour

The ecology and breeding biology of the Gouldian Finch is relatively well known and many aspects of the biology of the species have been published in peer reviewed journals (Brazill-Boast et al. In press; Tidemann and Woinarski 1994; Tidemann et al. 1992; Tidemann et al. 1999).

Gouldian Finches prefer a habitat of grassy open forests and woodlands that are near to drinkable water. When breeding they like rough country with stony hills and Eucalyptus brevifolia, snappy gum. Gouldian Finches feed on ripe and unripe small seeds of *Sorghum plumosum*, *Eriachne obtusa*, *Eragrostis* sp. and Spinifex. They also feed on insects such as flying termites and small spiders.

Gouldian Finches usually nest in small tree hollows, from February to August depending on the region and seasonal rainfall, and occasionally the hollow is lined on the bottom forming a frail cup. They sometimes breed in small colonies with several breeding pairs in close proximity. Up to 5 (average 4) eggs are laid in April, May and June. Incubation period is 12 – 14 days, while the fledging period is 20 – 21 days. Courtship displays are obvious and well documented (Johnstone and Storr 2004).

Gouldian Finches have very specific nesting requirements and require robust hollows of a finite diameter in *Eucalyptus brevifolia* (Tidemann et al. 1992; 1999) and *Corymbia* *dichromophloia* (Brazill-Boast et al. In press.). These trees are used throughout the breeding season, as Gouldian Finches can breed on multiple occasions from late February to late July (Tidemann and Woinarski 1994). There appears to be a heavy reliance on feeding habitat located immediately adjacent to breeding habitat. Therefore, the presence of Sorghum and Triodia grass species in close proximity to nesting hollows is essential. O'Malley (2006) states that breeding habitat is characterised by rocky hills with hollow-bearing smooth barked gums within two to four kilometres of small waterholes or springs that persist through the dry season, although there are records of breeding in several other habitats (Ron Johnstone and George Swann pers comm.). Those authors who have data on nest site density report nest site density of 1.36 per hectare (Brazill-Boast et al. In press.). Tidemman et al. (1999) reports nesting density at one site of 0.5 per hectare.

1.3 Ridges Iron Ore Project

The Ridges Iron Ore Project (RIOP) mine site includes two shallow open pits (known as the Sam and Tony deposits), crushing facilities, offices and workshop, camp facilities and support infrastructure such as production bores, bulk diesel storage, a small powerhouse, access roads and haul roads. The total area proposed for disturbance is 125 ha, comprising a larger area on the ridge top where the mine pits are located (the focus of this study), and a smaller area on the surrounding plains.

1.4 Gouldian Finches and the Ridges Iron Ore Project

Historically, local populations of the Gouldian Finch have been located at Argyle Diamond Mine (O'Connor unpub.). Individuals were also sighted approximately 5km north of the RIOP mine pit area (ecologia 2005). The recording at RIOP was made during the 2005 wet season survey undertaken by ecologia Environment for the then proponent, Resource Mining Corporation. During that survey three individuals, including two males and one female, were recorded

Recent survey work at RIOP by expert Kimberley ornithologist George Swann, in August 2009, failed to reveal further records of individuals in the area. This is despite six person days of survey work across the ridge top of the RIOP mine site. Moreover, targeted monitoring of perennial water sources near to the impact area achieved no records, despite it being the peak of the dry season. There are three major perennial water sources within 3km of the RIOP mine impact footprint.

1.5 Purpose of the Current Survey

The current survey was designed to assess the possible impact of the RIOP mine site on Gouldian Finch breeding habitat.

Relevant to the current proposal and the potential impacts of the RIOP, it is important to identify the current threatening processes for Gouldian Finch, before making an assessment on the additional potential impacts from the proposed RIOP mine site. O'Malley (2006), in the National Recovery Plan for the Gouldian Finch (*Erythrura gouldiae*), identifies that the primary threat for this species is vegetation change through inappropriate fire regimes and grazing impacts of stock and feral herbivores. These factors have contributed to ongoing declines and absence of recovery in populations. The recovery plan also cites air sac mites (*Sternostoma tracheacolum*) and possible climate change as other factors. However, in the appendix to O'Malley (2006), the authors do refer to impacts at the local scale through loss of nesting hollows due to wildfire.

Despite the fact that loss of nesting hollows may not be the major impact on decline in numbers of Gouldian Finch, it is inherently obvious that maintenance of nesting hollows in what is considered to be ideal habitat for breeding finches, is an appropriate way to assist in the recovery of the species (Brazill-Boast et al. in press.). This is primarily due to the fact that nest success for Gouldian Finches is constrained by their specialised niche requirements and overlap with more competitive species, such as the Long-tailed finch (*Poephila acuticauda*).

There are potential impacts arising from the proposed project and these impacts need to be specifically addressed and managed to minimise potential disturbance to the Gouldian Finch. At the RIOP mine site the primary impacts will be clearing of potential nest site hollows within the mine impact footprint (ore body and overburden dumps). Secondary impacts may include the influence of dust, noise and vibration on habitat use by the Gouldian Finch and potential contamination of local water sources.

The primary impact of loss of hollow-bearing trees that may be used for nesting by Gouldian Finches may be offset by the provision of artificial nest hollows, the success of which is reported in Brazill-Boast et al. In prep.). It is the objective of this study to quantify the potential requirement for artificial nest boxes to offset disturbance associated with clearing, dust and noise from the proposed RIOP.

2 Methods

2.1 Study Site

The RIOP is situated within the East Kimberley region of Western Australia. The Mine Site is located 165km by road south of Wyndham adjacent to the Great Northern Highway. Argyle Diamond Mine and the Doon Doon roadhouse and community are the closest other establishments being 20km and 35km away respectively (Figure 1).

2.2 Tree Density

Individual trees, discernable on a detailed aerial photograph of the site with the mine impact footprint and waste dump boundaries superimposed over the aerial, were counted to provide an approximation of tree density across the RIOP mine site.

2.3 Sampling

A total of 17 sites were randomly chosen across one of the two deposits (Figure 2a-c). The intent was to use the data collected from each of the sites to extrapolate the number of potential nest sites across the RIOP mine area. As the site selection was random, no specific habitat was favoured for assessment that may lead to a positive bias in nest hollow calculations. Sites were sampled in low lying alluvial gullies, and low, moderate and steep slopes. All sites supported various Eucalyptus and Corymbia species. The majority of sites were on stony or rocky substrates (see Plates 1 - 3). Appendix 1 includes all field notes and Appendix 2 shows each of the 17 sites sampled.

Plate 1: Flat gravel site.

Plate 2: Low stony slopes


Plate 3: Steep stony slope

Ornithologists George Swann and Adrian Boyle searched each 50 x 50m quadrat and assessed the potential of hollows using binoculars. All trees that supported hollows in any condition between 35mm and 100mm diameter were marked with flagging tape. A ladder was ascended to closely assess all hollows that were reasonable accessible. The ladder utilised was 4.5m in length, enabling close assessment of nest hollows at that height (Plate 4). Where accessible tree hollows were at a greater height than the ladder, the tree was climbed (Plate 5).

Plat 5: Ascending beyond ladder height

Plate 4: Ascending to ladder height

Where a suitable nest hollow was found the diameter of the aperture, the direction the aperture faced, the species of tree and the height of the hollow above the ground was recorded.

3 Results

A total of approximately 5040 trees were discernable from aerial photography within the mine impact footprint. Approximately 3410 were located in the mine site ore body impact footprint and a further 1630 were located in the overburden or waste dump areas.

Table 1 presents a summary of the sites assessed, including the number of trees, the number of potential nesting hollows and the heights of potential nesting hollows in each quadrant. Raw data are presented in Appendix 1.

Table 1: Summary of data from each of the 17 quadrats assessed.

Site	Number of Potential Nest Trees	Number of Potential Nest Sites	Height
Site 1	0	0	
Site 2	1	1	3.7
	1	1	4.7
		1	4.5
	1	1	9.8
Site 3	1	1	4
		1	4.2
		1	
Site 4	1	1	
	1	1	
		1	2.4
Site 5	1	1	3.8
	1	1	4.3
Site 6	1	1	3.6
	1	1	3.1
	1	1	3.3
		1	3.8
		1	2.7
		1	5.1
Site 7	1	1	
Site 8	1	1	2.2
	1	1	3.4
	1	1	2.5
		1	3.1
			4.9
Site 9	1	1	2.2
	1	1	3.9
	1	1	2.1
	1	1	2.5

Site	Number of Potential Nest Trees	Number of Potential Nest Sites	Height
	1	1	3.3
		1	3.4
Site 10	1	1	3
Site 11	1	1	5.5
Site 12	1	1	
Site 13	0	0	
Site 14	0	0	
Site 15	0	0	
Site 17	0	0	
Site 18	1	1	3.1
Total	**24**	**33**	
Average per site	**1.41**	**1.94**	**3.72**
Average per Ha	**6**	**8.25**	

Using the results from Table 1 and the number of trees counted from aerial photography it was possible to approximate the total number of hollow bearing trees, or trees that have the potential to support nests, in the RIOP mine site. Based on the results of the 17 quadrats surveyed, six trees per hectare were found to support hollows suitable for nesting. Within each hectare there were approximately 8.25 potential nest hollows. Table 2 shows that 14.88% of the trees within each hectare support hollows. Based on the number of trees in the 125ha impact footprint, approximately 750 trees are likely to support 1031 nests.

Furthermore, knowing the size of the total lease areas held by Kimberley Metals Group Pty Ltd, it was possible to count the number of hollow bearing trees across the total lease area. Approximately, 415 200 supporting 570 900 hollows are likely to occur across the impact area.

The potential clearing from RIOP will result in the loss of 0.2% of the trees on the total lease area.

Table 2: Extrapolations based on number of trees counted from aerial photography

	Number of Trees	Number of Hollows
Total trees in impact zone	5040	
Total Ha in impact zone	125 Ha	
Trees per Ha in impact zone	40.32	
% Trees likely to support nests	14.88%	20.46%
Number of trees likely to support nests	750	1031.25
Total Ha of mine lease	69200 Ha	
Extrapolated number of trees on lease	2790144	
Number of trees likely to support nests	415200	570900

4 Discussion

A total of 24 trees, supporting 33 potentially suitable nesting hollows were located in 17 quadrats. Many more hollows were recorded in trees within quadrats, however these were full of detrital material or termites. An average of 1.41 trees supporting hollows occur per hectare within the mine impact footprint, supporting 1.94 nesting hollows per hectare. Brazill-Boast et al. (in press) reports that potential nest sites occur at density of 4.6 per hectare and Gibbons and Lindenmayer (2002) report up to 27 nesting hollows per hectare. Thus the potential for nesting on the RIOP mine site area appears to be low in comparison to other studies. It is anticipated that, based on the dynamic formation and destruction of potential nesting hollows over time calculated by other authors (Tidemann et al. 1999, Brazill-Boast et al. In press) and the number of trees likely to support nesting hollows in the future, that this number may remain fairly consistent over time.

Direct impacts from RIOP mine on potential nesting sites for Gouldian Finch could impact 1031 nest hollows, or 0.2% of hollow-bearing trees in the area. It is important to note that within all trees investigated no nesting material was found. However, this is not unusual given that Gouldian Finches nest using very little material and nest deep within hollows.

Based on nest density calculations of Brazill-Boast et al. (In press.) and Tidemman et al. (1999), between 62 and 170 nests could occur in 750 hollow-bearing trees located with the 125ha impact area. Furthermore, 94 112 nests could occur in the 69, 200 ha of the greater lease area.

These calculations of potential nesting density would exceed actual numbers of breeding finches in the area by several orders of magnitude. However, the data do suggest that the RIOP lease sites may be suitable to assist in regional management of this species, particularly given that breeding habitat attributes such as slope, proximity to feeding areas and water contribute to the potential value of the area.

Gouldian Finches are highly fecund birds and more fecund than 14 other multi-brooded Australian passerines (Rowley and Russell 1991). Despite this, studies elsewhere have shown that only a few banded adults found breeding in one year returned to the study are in subsequent years and far fewer nestlings and juveniles (Tidemann et al. 1999). This is most likely due to high dispersal and low survival rates, post-breeding (S. Pryke pers comm.). Therefore nest fidelity must be limited to a single year. No pair bonds are maintained across seasons and repeat nesting pairs are equally likely to select a few hollows in which to breed, as they were to re-use the same hollow (Tidemann et al. 1999). Gouldian Finches will use the same hollow a number of times if the hollow is not destroyed by fire or sealed by termites. It is for these reasons that this species utilise artificial nest hollows. Even pairs that are successfully breeding, continue to investigate other hollows.

Low fidelity of Gouldian Finches may be a result of high post breeding mortality, but it could also be due to the attrition of nest sites. Whatever the case there is very good evidence to suggest that breeding in an area can continue successfully in spite of disturbance, provided that key resources, such as nest hollows, proximity to feeding grounds and water are maintained as is the case on the RIOP leases outside of the impact area.

Many studies have demonstrated that the provision of artificial nest-boxes can stimulate reproduction and increase fledging in wild populations. Brazill-Boast et al. (in prep) shows that the provision of nest boxes for Gouldian finches leads to earlier nesting, larger clutches and a greater fledgling rate. Increase in breeding densities can be up to 240% greater than natural hollow nesting populations, with 338% increased fledging. Thus nest boxes are an important part of management and recovery of this species, are custom built to satisfy the niche requirements of Gouldian Finches and are readily available for purchase through the Save the Gouldian Fund (the Fund).

Based on the outcomes of this survey Kimberley Metals Group will commit to the establishment of a suitable number of artificial nesting hollows to compensate for clearing during the RIOP. It is anticipated that nest boxes will be established in the 2010 dry season in preparation for the 2011 breeding season. The outer entrance tunnels for the nest boxes will be constructed from hollow timber sourced from clearing on site or from existing fallen trees, and provided to the Save the Gouldian Fund to be fitted to the nesting chamber. Completed nest boxes will be purchased from the Fund and established on site beyond the periphery of the impact area, but within the same habitat type and proximity to water. It is anticipated that the first artificial nest box study site would be located north of March Fly creek and commence with the establishment of 100 nest boxes.

The utilisation of these next boxes will be monitored bi-annually in April and July as part of the ongoing management of the RIOP. Data will be exchanged with research groups at Macquarie University associated with the Save the Gouldian Fund.

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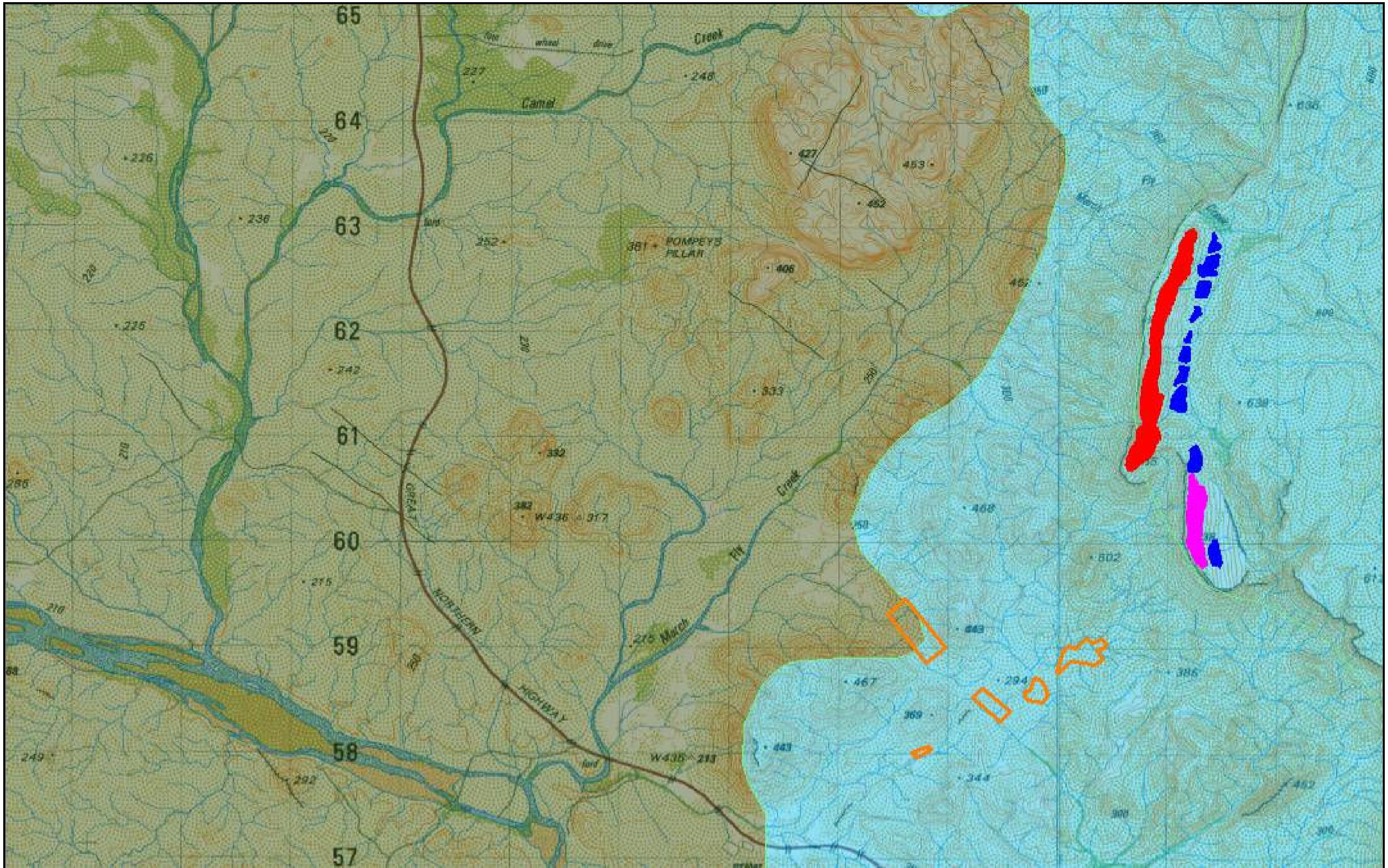
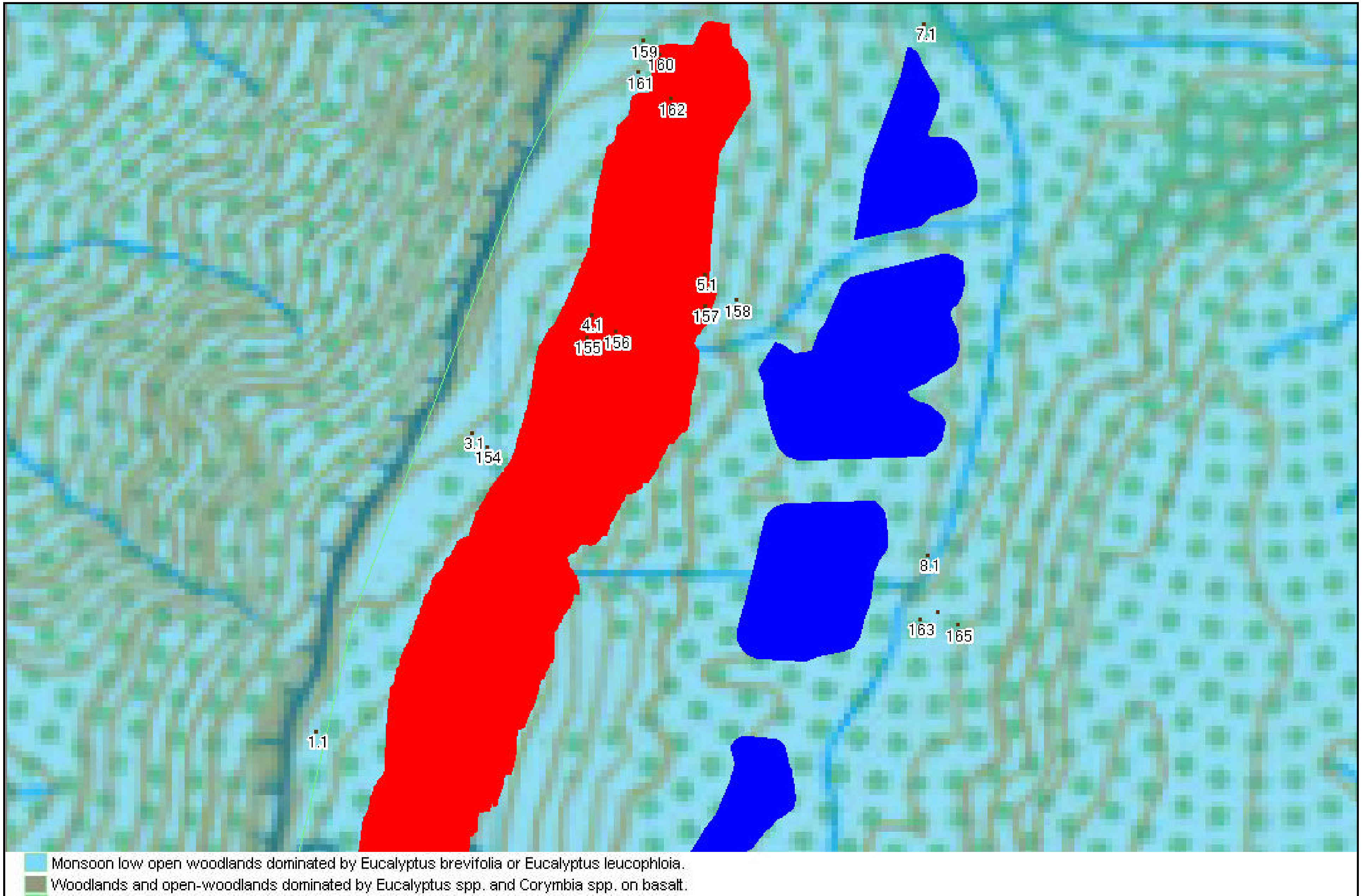
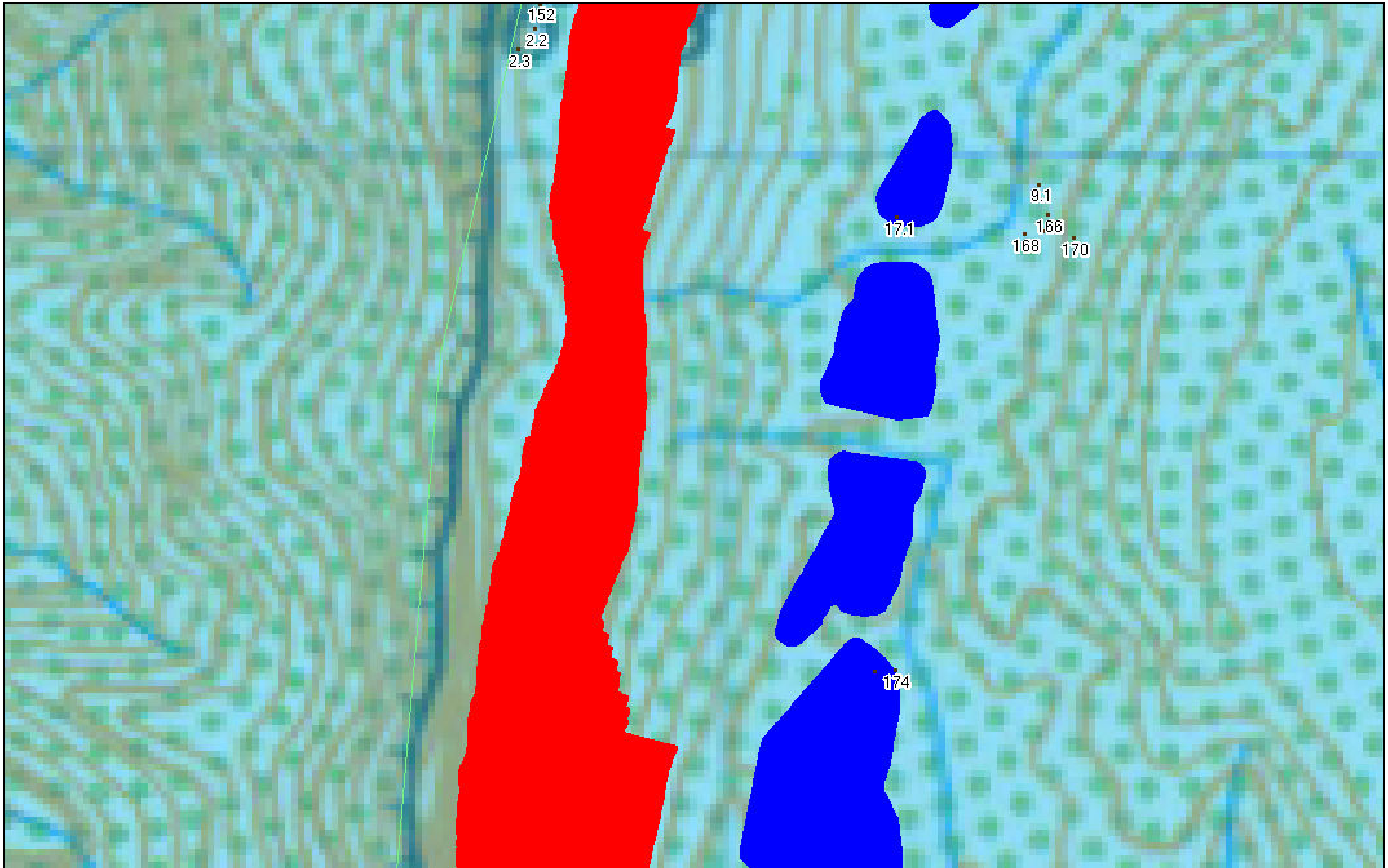


Monsoon low open woodlands dominated by Eucalyptus brevifolia or Eucalyptus leucophloia.
Woodlands and open-woodlands dominated by Eucalyptus spp. and Corymbia spp. on basalt.

Auth: Mitch Ladyman	Project: Kimberley Metals Group RIOP	ANIMAL PLANT MINERAL — NORTH	**Figure 1** **Tropical Savanna CRC Vegetation Mapping and RIOP Site in a Regional Setting** KMG RIOP
Date: April 2010	Datum: GDA94 (MGA Zone50)		

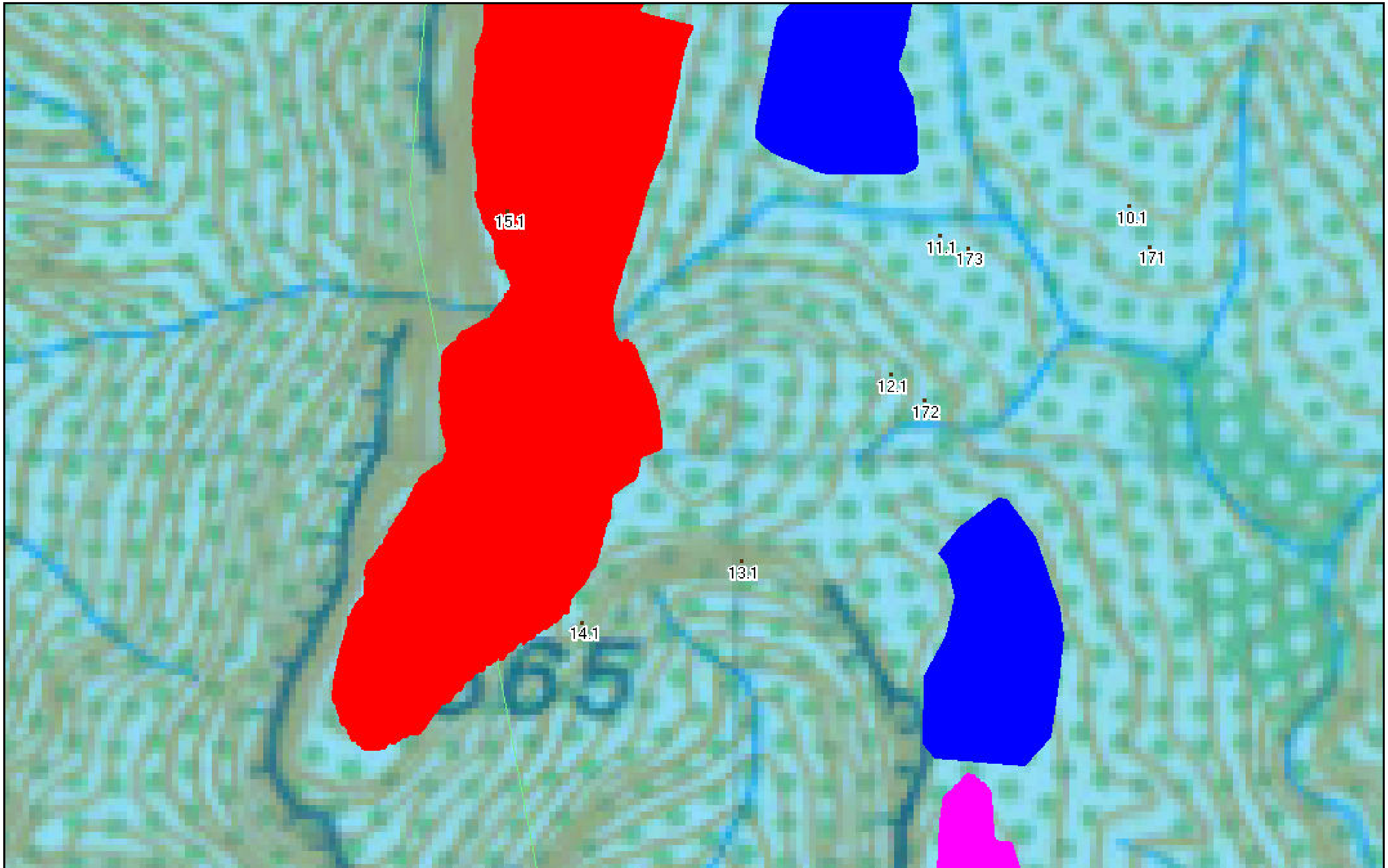


Auth: Mitch Ladyman	Project: Kimberley Metals Group RIOP	**Figure 2a**
Date: April 2010	Datum: GDA94 (MGA Zone50)	**Tropical Savanna CRC Vegetation Mapping and Gouldian Finch Monitoring Sites** KMG RIOP



Monsoon low open woodlands dominated by Eucalyptus brevifolia or Eucalyptus leucophloia.
Woodlands and open-woodlands dominated by Eucalyptus spp. and Corymbia spp. on basalt.

Auth: Mitch Ladyman	Project: Kimberley Metals Group RIOP	animal plant mineral; NORTH	**Figure 2b** **Tropical Savanna CRC Vegetation Mapping and Gouldian Finch Monitoring Sites** KMG RIOP
Date: April 2010	Datum: GDA94 (MGA Zone50)		



Monsoon low open woodlands dominated by Eucalyptus brevifolia or Eucalyptus leucophloia.
Woodlands and open-woodlands dominated by Eucalyptus spp. and Corymbia spp. on basalt.

Auth: Mitch Ladyman	Project: Kimberley Metals Group RIOP	NORTH
Date: April 2010	Datum: GDA94 (MGA Zone50)	

Figure 2c
Tropical Savanna CRC Vegetation Mapping and Gouldian Finch Monitoring Sites
KMG RIOP

Appendix 1 Survey field data

Site	WPs	Dominant Species	Number of Potential Nest Trees	Number of Potential Nest Sites	Measurements	Comments
Site 1	Riogou001		0	0		No suitable nest hollows found
Site 2	Riogou002 1stnesttree 2nd nesttree	 *Eucalyptus tectifica* *Corymbia greeniana* *Corymbia dichromophloia*	3	4	1st nest hollow found in *Eucalyptus tectifica* 3.7m high from the ground Hollow 70mm in diameter North facing 2nd nest hollow in same tree 4.7m from ground 100mm in diameter North facing 3rd nest hollow in same tree 4.5m from ground 80mm in diameter North facing 4th nest hollow found in *Corymbia greeniana* 9.8m high from ground 60mm in diameter South facing	*Corymbia dichromophloia* - Smooth barked. This tree has two potential nest hollows but they are filled with termites. If the termites leave or get washed out the hollows could be used.

Site 3	Riogou003 WP 154	*Corymbia collina*	1	3	1st nest hollow found in *Corymbia collina* WP 154 4m from ground 50mm in diameter Hollow faces North West 2nd nest hollow in same tree 4.2m from ground 50mm in diameter Faces south 3rd potential nest hollow same tree Faces South East	The 3rd potential nest hollow in the same tree *Corymbia collina* faces South East. This hollow is unreachable as it is too high to get to, so there were no measurements were obtained
Site 4	Riogou004 WP 155 WP 156	*Corymbia collina*	2	3	*Corymbia collina* has two potential nest sites WP 155 *Corymbia collina* has one potential nest site WP 156 2.4m from ground 70mm in diameter North facing	The two potential nest hollows in the first *Corymbia collina* tree has two hollows unreachable as they are too high to get to, so no measurements were obtained
Site 5	Riogou005 WP 157 WP 158	*Corymbia collina*			*Corymbia collina* WP 157 Perfect nest hollow found 3.8m from the ground 45mm in diameter Facing east	Another *Corymbia collina* has potential future nest hollows if the termites leave and rain washes them out

					Corymbia collina WP 158 4.30meters from ground 35mm in diameter West facing	
Site 6	Riogou006 WP 159 WP 160 WP 161 WP 162	*Corymbia collina*			*Corymbia collina* WP 159 3.65m high 30mm in diameter Facing SSE 2nd nest hollow same tree 3.10m high 45mm in diameter North facing 3rd nest hollow same tree 3.31m high 30mm in diameter Facing east *Corymbia collina* WP 160 3.8m high 50mm in diameter Facing North *Corymbia collina* WP 161 2.7m high 40mm in diameter Facing South West	

					Corymbia collina WP 162 5.10 m high 50mm in diameter Facing SE	
Site 7	Riogou007	*Corymbia collina*				*Corymbia collina* has potential nest sites in hollows if the blockage clears. The hollows are blocked with termitaria – termite mounds.
Site 8	Riogou008 WP 163 WP 164 WP 165	*Eucalyptus brevifolia*			*Eucalyptus brevifolia* WP 163 2.20meters high 45mm in diameter South facing *Eucalyptus brevifolia* WP 164 3.40meters high 35mm in diameter South facing 2nd nest hollow same tree 2.50meters high from ground 35mm in diameter SW facing 3rd nest hollow same tree 3.10meters high 35mm in diameter East facing *Eucalyptus brevifolia* WP 165	This site has a lot of snappy gums – *Eucalyptus brevifolia*

					4.9 meters high 35mm in diameter North east facing	
Site 9	Riogou009 WP 166 WP 167 WP 168 WP 169 WP 170	*Eucalyptus brevifolia*	5	6	*Eucalyptus brevifolia* WP 166 2.2meters high 35mm in diameter NW facing *Eucalyptus brevifolia* WP 167 3.9meters high 60mm in diameter South facing *Eucalyptus brevifolia* WP 168 2.10meters high 50mm in diameter North facing 2nd nest hollow same tree 2.55meters high from the ground 30mm in diameter NW facing *Eucalyptus brevifolia* WP 169 3.35meters high 40mm in diameter East facing	

					Eucalyptus brevifolia WP 170 3.40meters high 35mm in diameter West facing	
Site 10	Riogou010 WP 171	*Eucalyptus jensenii* – Wandi ironbark			*Eucalyptus jensenii* WP 171 3.05meters from ground 50mm in diameter ENE facing	
Site 11	Riogou011 WP 173	*Eucalyptus brevifolia* – snappy gum			*Eucalyptus brevifolia* WP 173 Nest hollow 5.50meters high from ground 40mm in diameter North east facing	
Site 12	Riogou012	*Corymbia dichromophloia*	1	1	*Corymbia dichromophloia* WP 172 Unreachable nest hollow Approx 7meters high from ground Approx 60mm in diameter	*Corymbia dichromophloia* has an unreachable nest hollow that looks perfect with binoculars so we approximated the measurements
Site 13	Riogou013	*Eucalyptus jensenii* *Corymbia dichromophloia* *Corymbia collina*	0	0		All possible nest hollows found were blocked and not suitable. They may be suitable in the future if the blockage clears
Site 14	Riogou014		0	0		No suitable nest hollows found – some hollows were chocked with termites, others were bees nests

Site 15	Riogou015		0	0		No suitable nest sites found
Site 17	Riogou017		0	0		No suitable nest hollows were found – they were all blocked
Site 18	Riogou018 WP 174	*Eucalyptus brevifolia* – snappy gum	1	1	*Eucalyptus brevifolia* WP 174 Hollow 3.10 m high from ground 45mm in diameter North east facing	There were other possible nest sites in *Eucalyptus brevifolia* at this site that were full of termitaria and/or ants and the hollows from the tree limbs were quite split

Appendix 2: Survey site photos


Site 1


Site 2


Site 3


Site 4


Site 5


Site 6


Site 7


Site 8


Site 9


Site 10


Site 11


Site 12


Site 13


Site 14


Site 15

 Site 17	 Site18	

Appendix 4: Vegetation Condition Scale

Vegetation Condition Scale – adapted from Keighery (1994) and Kaesehagen (1995).

VEGETATION CONDITION SCALE		
Rating	**Condition**	**Descriptive Features**
1	Excellent	• >80% Native Flora Composition • Vegetation structure intact or nearly so • Minor signs of disturbance • Weeds are non-aggressive species (cover <5%)
2	Good	• 60 - 80% Native Flora Composition • Vegetation structure altered in places • Obvious signs of disturbance • Weed cover/abundance 5 -20%
3	Fair	• 40 - 60% Native Flora Composition • Vegetation structure significantly altered yet retains basic vegetation structure or ability to regenerate to it • Very obvious signs of multiple disturbance • Weed cover/abundance 20 -50%
4	Poor/Partially Degraded	• 20 - 40% Native Flora Composition • Vegetation structure severely impacted by disturbance • Scope for regeneration but not to state approaching good condition without intensive management • Weed cover/abundance 50 -80%
5	Completely Degraded	• <20% Native Flora Composition • Vegetation structure no longer intact • Extensive disturbance/modification present • Weeds are highly invasive (cover/abundance >80%)

Fire:

No fire evident/0-2 years/2-5 years/5-10 years/> 10 years

Disturbance Types:

Grazing, Clearing, Flooding, Vehicular, Machinery

Appendix 5: RIOP Gouldian Finch Nest Assessment

Kimberley Metals Group Pty Ltd
Ridges Iron Ore Project:
Gouldian Finch Nest Assessment

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Summary

This paper describes an assessment of the potential impact of the Ridges Iron Ore Project on breeding habitat of the Gouldian Finch, *Erythrura gouldiae*.

A total of 24 trees, supporting 33 potentially suitable nesting hollows were located in 17 quadrats surveyed across areas targeted for impact from ore extraction, the creation of waste dumps and the movement of vehicles.

An average of 1.41 trees supporting hollows occur per hectare within the mine impact footprint, supporting 1.94 potential nesting hollows per hectare. The potential for nesting on the RIOP mine site area appears to be low in comparison to other studies.

Based on nest density calculations of previous authors from other locations, between 62 and 170 nests could occur in 750 hollow-bearing trees located with the 125ha impact area.

Based on the ecology, including longevity and behaviour related to nest-site selection, Gouldian Finches readily utilise artificial nest hollows. Therefore, where there are disturbances to potential nest sites from clearing, breeding in an area can continue successfully provided that key resources, such as nest hollows, proximity to feeding grounds and water are maintained.

Based on the outcomes of this survey Kimberley Metals Group will commit to the establishment of a suitable number of artificial nesting hollows to compensate for clearing during the RIOP. It is anticipated that nest boxes will be established in the 2010 dry season in preparation for the 2011 breeding season. It is anticipated that the first artificial nest box study site would be located north of March Fly creek and commence with the establishment of 100 nest boxes.

The utilisation of these next boxes will be monitored bi-annually in April and July as part of the ongoing management of the RIOP. Data will be exchanged with research groups at Macquarie University associated with the Save the Gouldian Fund.

Contents

1 Introduction

As part of the overall environmental impact assessment for the Ridges Iron Ore Project (RIOP), the RIOP mine site, located approximately 165 south of Wyndham, has been specifically assessed to determine potential impacts on the Gouldian Finch, *Erythrura gouldiae*. The Gouldian Finch is currently listed as Endangered and Migratory under the Environment Protection and Biodiversity Conservation Act 1999 (cth) and listed as "rare or likely to become extinct" under the Wildlife Conservation Act 1950.

1.1 Distribution

Gouldian Finches, *Erythrura gouldiae*, are distributed throughout Western Australia in the North Kimberley, south to Beagle Bay, Oobagooma, King Leopold Ranges, middle of the Durack River, Dunham River and Lake Argyle. They can also be found further south, for example in Derby and Louisa Downs. Gouldian Finches are also distributed throughout the north of the Northern Territory and the north of Queensland. They are generally classed as moderately common in the northern, central and eastern Kimberley and the lower Ord drainage area, but are uncommon or scarce in most of the southern Kimberley (Johnstone and Storr 2004).

1.2 General Habitat and Behaviour

The ecology and breeding biology of the Gouldian Finch is relatively well known and many aspects of the biology of the species have been published in peer reviewed journals (Brazill-Boast et al. In press; Tidemann and Woinarski 1994; Tidemann et al. 1992; Tidemann et al. 1999).

Gouldian Finches prefer a habitat of grassy open forests and woodlands that are near to drinkable water. When breeding they like rough country with stony hills and Eucalyptus brevifolia, snappy gum. Gouldian Finches feed on ripe and unripe small seeds of *Sorghum plumosum*, *Eriachne obtusa*, *Eragrostis* sp. and Spinifex. They also feed on insects such as flying termites and small spiders.

Gouldian Finches usually nest in small tree hollows, from February to August depending on the region and seasonal rainfall, and occasionally the hollow is lined on the bottom forming a frail cup. They sometimes breed in small colonies with several breeding pairs in close proximity. Up to 5 (average 4) eggs are laid in April, May and June. Incubation period is 12 – 14 days, while the fledging period is 20 – 21 days. Courtship displays are obvious and well documented (Johnstone and Storr 2004).

Gouldian Finches have very specific nesting requirements and require robust hollows of a finite diameter in *Eucalyptus brevifolia* (Tidemann et al. 1992; 1999) and *Corymbia* *dichromophloia* (Brazill-Boast et al. In press.). These trees are used throughout the breeding season, as Gouldian Finches can breed on multiple occasions from late February to late July (Tidemann and Woinarski 1994). There appears to be a heavy reliance on feeding habitat located immediately adjacent to breeding habitat. Therefore, the presence of Sorghum and Triodia grass species in close proximity to nesting hollows is essential. O'Malley (2006) states that breeding habitat is characterised by rocky hills with hollow-bearing smooth barked gums within two to four kilometres of small waterholes or springs that persist through the dry season, although there are records of breeding in several other habitats (Ron Johnstone and George Swann pers comm.). Those authors who have data on nest site density report nest site density of 1.36 per hectare (Brazill-Boast et al. In press.). Tidemman et al. (1999) reports nesting density at one site of 0.5 per hectare.

1.3 Ridges Iron Ore Project

The Ridges Iron Ore Project (RIOP) mine site includes two shallow open pits (known as the Sam and Tony deposits), crushing facilities, offices and workshop, camp facilities and support infrastructure such as production bores, bulk diesel storage, a small powerhouse, access roads and haul roads. The total area proposed for disturbance is 125 ha, comprising a larger area on the ridge top where the mine pits are located (the focus of this study), and a smaller area on the surrounding plains.

1.4 Gouldian Finches and the Ridges Iron Ore Project

Historically, local populations of the Gouldian Finch have been located at Argyle Diamond Mine (O'Connor unpub.). Individuals were also sighted approximately 5km north of the RIOP mine pit area (ecologia 2005). The recording at RIOP was made during the 2005 wet season survey undertaken by ecologia Environment for the then proponent, Resource Mining Corporation. During that survey three individuals, including two males and one female, were recorded

Recent survey work at RIOP by expert Kimberley ornithologist George Swann, in August 2009, failed to reveal further records of individuals in the area. This is despite six person days of survey work across the ridge top of the RIOP mine site. Moreover, targeted monitoring of perennial water sources near to the impact area achieved no records, despite it being the peak of the dry season. There are three major perennial water sources within 3km of the RIOP mine impact footprint.

1.5 Purpose of the Current Survey

The current survey was designed to assess the possible impact of the RIOP mine site on Gouldian Finch breeding habitat.

Relevant to the current proposal and the potential impacts of the RIOP, it is important to identify the current threatening processes for Gouldian Finch, before making an assessment on the additional potential impacts from the proposed RIOP mine site. O'Malley (2006), in the National Recovery Plan for the Gouldian Finch (*Erythrura gouldiae*), identifies that the primary threat for this species is vegetation change through inappropriate fire regimes and grazing impacts of stock and feral herbivores. These factors have contributed to ongoing declines and absence of recovery in populations. The recovery plan also cites air sac mites (*Sternostoma tracheacolum*) and possible climate change as other factors. However, in the appendix to O'Malley (2006), the authors do refer to impacts at the local scale through loss of nesting hollows due to wildfire.

Despite the fact that loss of nesting hollows may not be the major impact on decline in numbers of Gouldian Finch, it is inherently obvious that maintenance of nesting hollows in what is considered to be ideal habitat for breeding finches, is an appropriate way to assist in the recovery of the species (Brazill-Boast et al. in press.). This is primarily due to the fact that nest success for Gouldian Finches is constrained by their specialised niche requirements and overlap with more competitive species, such as the Long-tailed finch (*Poephila acuticauda*).

There are potential impacts arising from the proposed project and these impacts need to be specifically addressed and managed to minimise potential disturbance to the Gouldian Finch. At the RIOP mine site the primary impacts will be clearing of potential nest site hollows within the mine impact footprint (ore body and overburden dumps). Secondary impacts may include the influence of dust, noise and vibration on habitat use by the Gouldian Finch and potential contamination of local water sources.

The primary impact of loss of hollow-bearing trees that may be used for nesting by Gouldian Finches may be offset by the provision of artificial nest hollows, the success of which is reported in Brazill-Boast et al. In prep.). It is the objective of this study to quantify the potential requirement for artificial nest boxes to offset disturbance associated with clearing, dust and noise from the proposed RIOP.

2 Methods

2.1 Study Site

The RIOP is situated within the East Kimberley region of Western Australia. The Mine Site is located 165km by road south of Wyndham adjacent to the Great Northern Highway. Argyle Diamond Mine and the Doon Doon roadhouse and community are the closest other establishments being 20km and 35km away respectively (Figure 1).

2.2 Tree Density

Individual trees, discernable on a detailed aerial photograph of the site with the mine impact footprint and waste dump boundaries superimposed over the aerial, were counted to provide an approximation of tree density across the RIOP mine site.

2.3 Sampling

A total of 17 sites were randomly chosen across one of the two deposits (Figure 2a-c). The intent was to use the data collected from each of the sites to extrapolate the number of potential nest sites across the RIOP mine area. As the site selection was random, no specific habitat was favoured for assessment that may lead to a positive bias in nest hollow calculations. Sites were sampled in low lying alluvial gullies, and low, moderate and steep slopes. All sites supported various Eucalyptus and Corymbia species. The majority of sites were on stony or rocky substrates (see Plates 1 - 3). Appendix 1 includes all field notes and Appendix 2 shows each of the 17 sites sampled.

animal plant mineral

Plate 1: Flat gravel site.

Plate 2: Low stony slopes

Plate 3: Steep stony slope

Ornithologists George Swann and Adrian Boyle searched each 50 x 50m quadrat and assessed the potential of hollows using binoculars. All trees that supported hollows in any condition between 35mm and 100mm diameter were marked with flagging tape. A ladder was ascended to closely assess all hollows that were reasonable accessible. The ladder utilised was 4.5m in length, enabling close assessment of nest hollows at that height (Plate 4). Where accessible tree hollows were at a greater height than the ladder, the tree was climbed (Plate 5).

Plat 5: Ascending beyond ladder height

Plate 4: Ascending to ladder height

Where a suitable nest hollow was found the diameter of the aperture, the direction the aperture faced, the species of tree and the height of the hollow above the ground was recorded.

3 Results

A total of approximately 5040 trees were discernable from aerial photography within the mine impact footprint. Approximately 3410 were located in the mine site ore body impact footprint and a further 1630 were located in the overburden or waste dump areas.

Table 1 presents a summary of the sites assessed, including the number of trees, the number of potential nesting hollows and the heights of potential nesting hollows in each quadrant. Raw data are presented in Appendix 1.

Table 1: Summary of data from each of the 17 quadrats assessed.

Site	Number of Potential Nest Trees	Number of Potential Nest Sites	Height
Site 1	0	0	
Site 2	1	1	3.7
	1	1	4.7
		1	4.5
	1	1	9.8
Site 3	1	1	4
		1	4.2
		1	
Site 4	1	1	
	1	1	
		1	2.4
Site 5	1	1	3.8
	1	1	4.3
Site 6	1	1	3.6
	1	1	3.1
	1	1	3.3
		1	3.8
		1	2.7
		1	5.1
Site 7	1	1	
Site 8	1	1	2.2
	1	1	3.4
	1	1	2.5
		1	3.1
			4.9
Site 9	1	1	2.2
	1	1	3.9
	1	1	2.1
	1	1	2.5

Site	Number of Potential Nest Trees	Number of Potential Nest Sites	Height
	1	1	3.3
		1	3.4
Site 10	1	1	3
Site 11	1	1	5.5
Site 12	1	1	
Site 13	0	0	
Site 14	0	0	
Site 15	0	0	
Site 17	0	0	
Site 18	1	1	3.1
Total	**24**	**33**	
Average per site	**1.41**	**1.94**	**3.72**
Average per Ha	**6**	**8.25**	

Using the results from Table 1 and the number of trees counted from aerial photography it was possible to approximate the total number of hollow bearing trees, or trees that have the potential to support nests, in the RIOP mine site. Based on the results of the 17 quadrats surveyed, six trees per hectare were found to support hollows suitable for nesting. Within each hectare there were approximately 8.25 potential nest hollows. Table 2 shows that 14.88% of the trees within each hectare support hollows. Based on the number of trees in the 125ha impact footprint, approximately 750 trees are likely to support 1031 nests.

Furthermore, knowing the size of the total lease areas held by Kimberley Metals Group Pty Ltd, it was possible to count the number of hollow bearing trees across the total lease area. Approximately, 415 200 supporting 570 900 hollows are likely to occur across the impact area.

The potential clearing from RIOP will result in the loss of 0.2% of the trees on the total lease area.

Table 2: Extrapolations based on number of trees counted from aerial photography

	Number of Trees	Number of Hollows
Total trees in impact zone	5040	
Total Ha in impact zone	125 Ha	
Trees per Ha in impact zone	40.32	
% Trees likely to support nests	14.88%	20.46%
Number of trees likely to support nests	750	1031.25
Total Ha of mine lease	69200 Ha	
Extrapolated number of trees on lease	2790144	
Number of trees likely to support nests	415200	570900

4 Discussion

A total of 24 trees, supporting 33 potentially suitable nesting hollows were located in 17 quadrats. Many more hollows were recorded in trees within quadrats, however these were full of detrital material or termites. An average of 1.41 trees supporting hollows occur per hectare within the mine impact footprint, supporting 1.94 nesting hollows per hectare. Brazill-Boast et al. (in press) reports that potential nest sites occur at density of 4.6 per hectare and Gibbons and Lindenmayer (2002) report up to 27 nesting hollows per hectare. Thus the potential for nesting on the RIOP mine site area appears to be low in comparison to other studies. It is anticipated that, based on the dynamic formation and destruction of potential nesting hollows over time calculated by other authors (Tidemann et al. 1999, Brazill-Boast et al. In press) and the number of trees likely to support nesting hollows in the future, that this number may remain fairly consistent over time.

Direct impacts from RIOP mine on potential nesting sites for Gouldian Finch could impact 1031 nest hollows, or 0.2% of hollow-bearing trees in the area. It is important to note that within all trees investigated no nesting material was found. However, this is not unusual given that Gouldian Finches nest using very little material and nest deep within hollows.

Based on nest density calculations of Brazill-Boast et al. (In press.) and Tidemman et al. (1999), between 62 and 170 nests could occur in 750 hollow-bearing trees located with the 125ha impact area. Furthermore, 94 112 nests could occur in the 69, 200 ha of the greater lease area.

These calculations of potential nesting density would exceed actual numbers of breeding finches in the area by several orders of magnitude. However, the data do suggest that the RIOP lease sites may be suitable to assist in regional management of this species, particularly given that breeding habitat attributes such as slope, proximity to feeding areas and water contribute to the potential value of the area.

Gouldian Finches are highly fecund birds and more fecund than 14 other multi-brooded Australian passerines (Rowley and Russell 1991). Despite this, studies elsewhere have shown that only a few banded adults found breeding in one year returned to the study are in subsequent years and far fewer nestlings and juveniles (Tidemann et al. 1999). This is most likely due to high dispersal and low survival rates, post-breeding (S. Pryke pers comm.). Therefore nest fidelity must be limited to a single year. No pair bonds are maintained across seasons and repeat nesting pairs are equally likely to select a few hollows in which to breed, as they were to re-use the same hollow (Tidemann et al. 1999). Gouldian Finches will use the same hollow a number of times if the hollow is not destroyed by fire or sealed by termites. It is for these reasons that this species utilise artificial nest hollows. Even pairs that are successfully breeding, continue to investigate other hollows.

Low fidelity of Gouldian Finches may be a result of high post breeding mortality, but it could also be due to the attrition of nest sites. Whatever the case there is very good evidence to suggest that breeding in an area can continue successfully in spite of disturbance, provided that key resources, such as nest hollows, proximity to feeding grounds and water are maintained as is the case on the RIOP leases outside of the impact area.

Many studies have demonstrated that the provision of artificial nest-boxes can stimulate reproduction and increase fledging in wild populations. Brazill-Boast et al. (in prep) shows that the provision of nest boxes for Gouldian finches leads to earlier nesting, larger clutches and a greater fledgling rate. Increase in breeding densities can be up to 240% greater than natural hollow nesting populations, with 338% increased fledging. Thus nest boxes are an important part of management and recovery of this species, are custom built to satisfy the niche requirements of Gouldian Finches and are readily available for purchase through the Save the Gouldian Fund (the Fund).

Based on the outcomes of this survey Kimberley Metals Group will commit to the establishment of a suitable number of artificial nesting hollows to compensate for clearing during the RIOP. It is anticipated that nest boxes will be established in the 2010 dry season in preparation for the 2011 breeding season. The outer entrance tunnels for the nest boxes will be constructed from hollow timber sourced from clearing on site or from existing fallen trees, and provided to the Save the Gouldian Fund to be fitted to the nesting chamber. Completed nest boxes will be purchased from the Fund and established on site beyond the periphery of the impact area, but within the same habitat type and proximity to water. It is anticipated that the first artificial nest box study site would be located north of March Fly creek and commence with the establishment of 100 nest boxes.

The utilisation of these next boxes will be monitored bi-annually in April and July as part of the ongoing management of the RIOP. Data will be exchanged with research groups at Macquarie University associated with the Save the Gouldian Fund.

5 References

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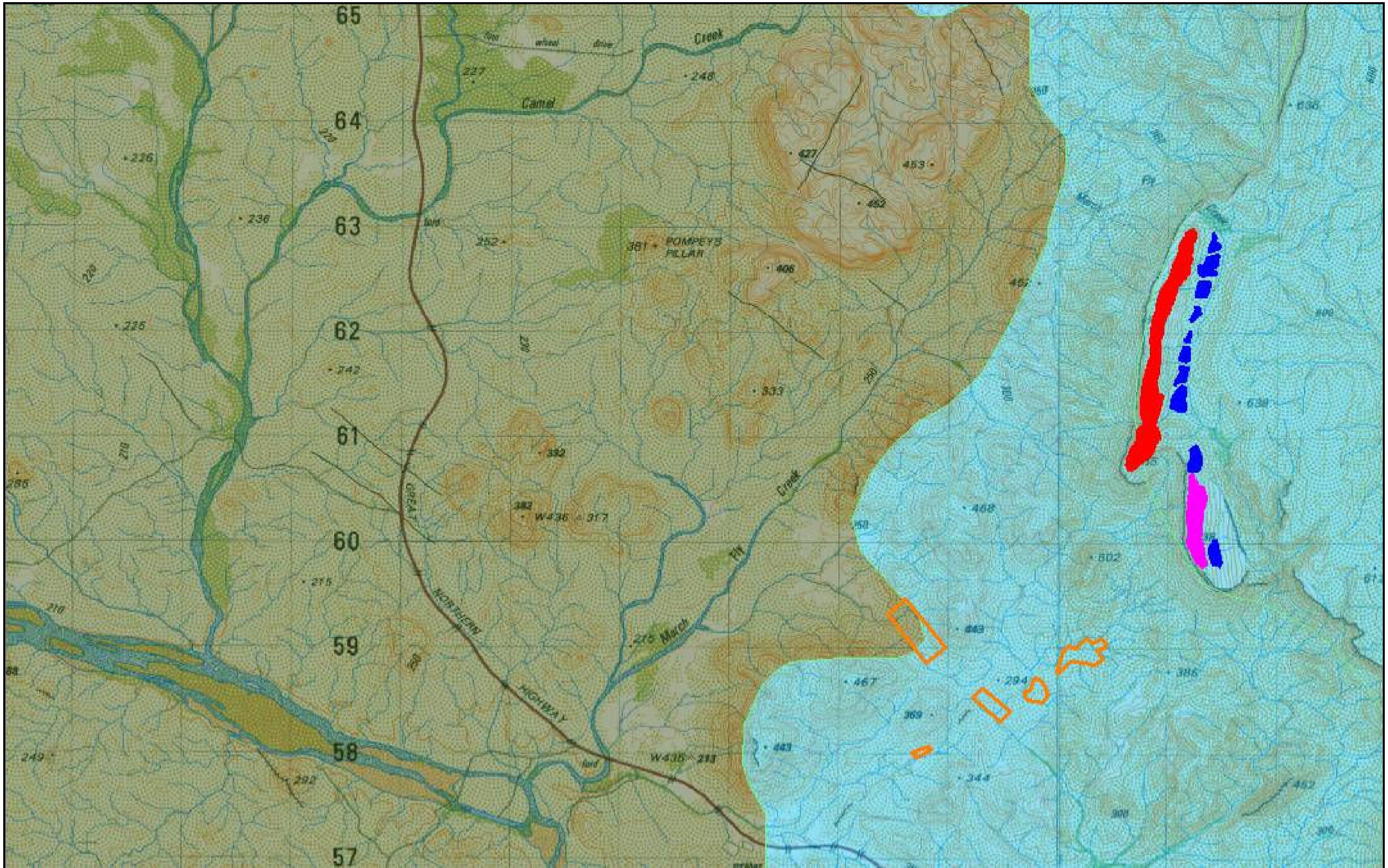
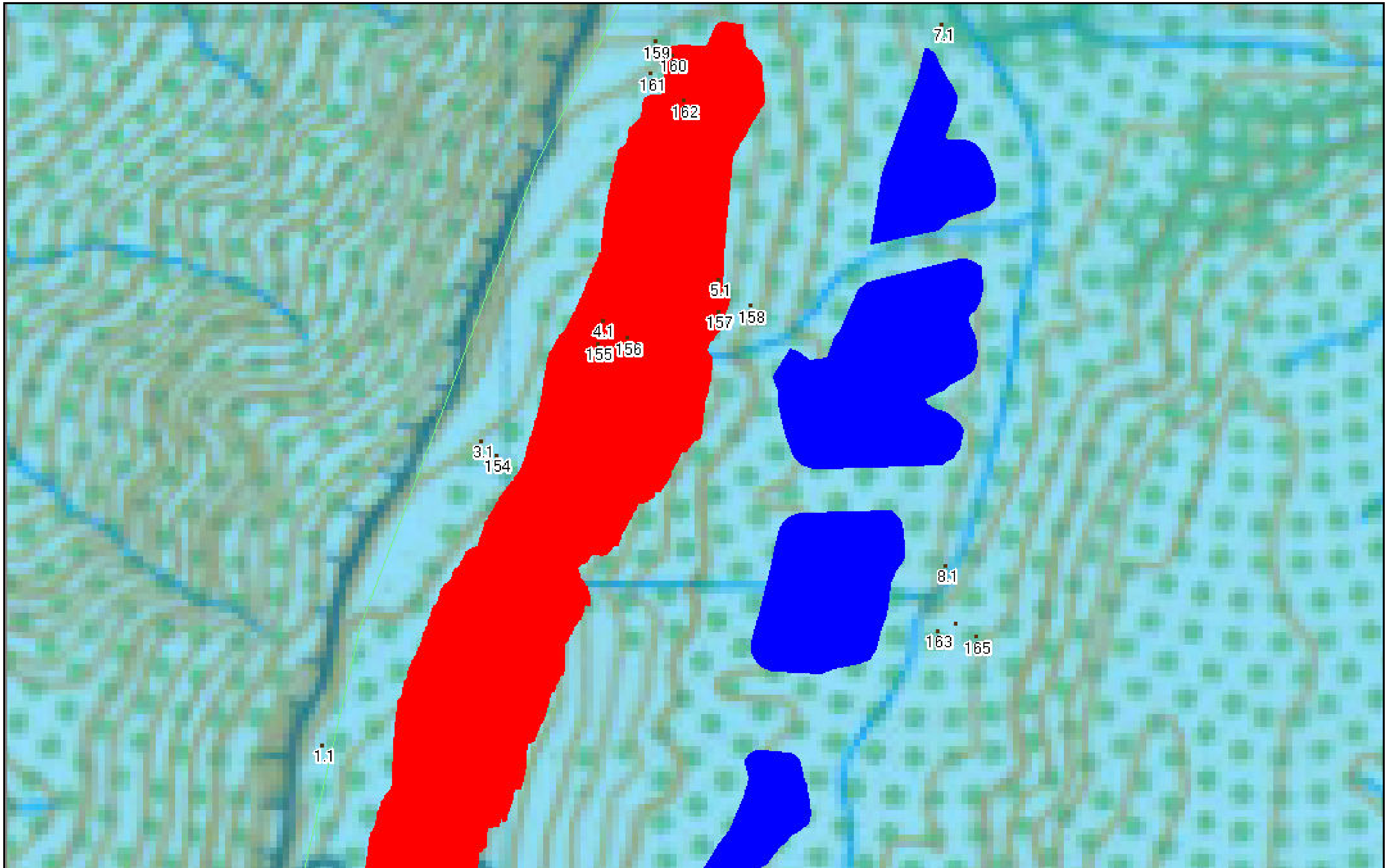


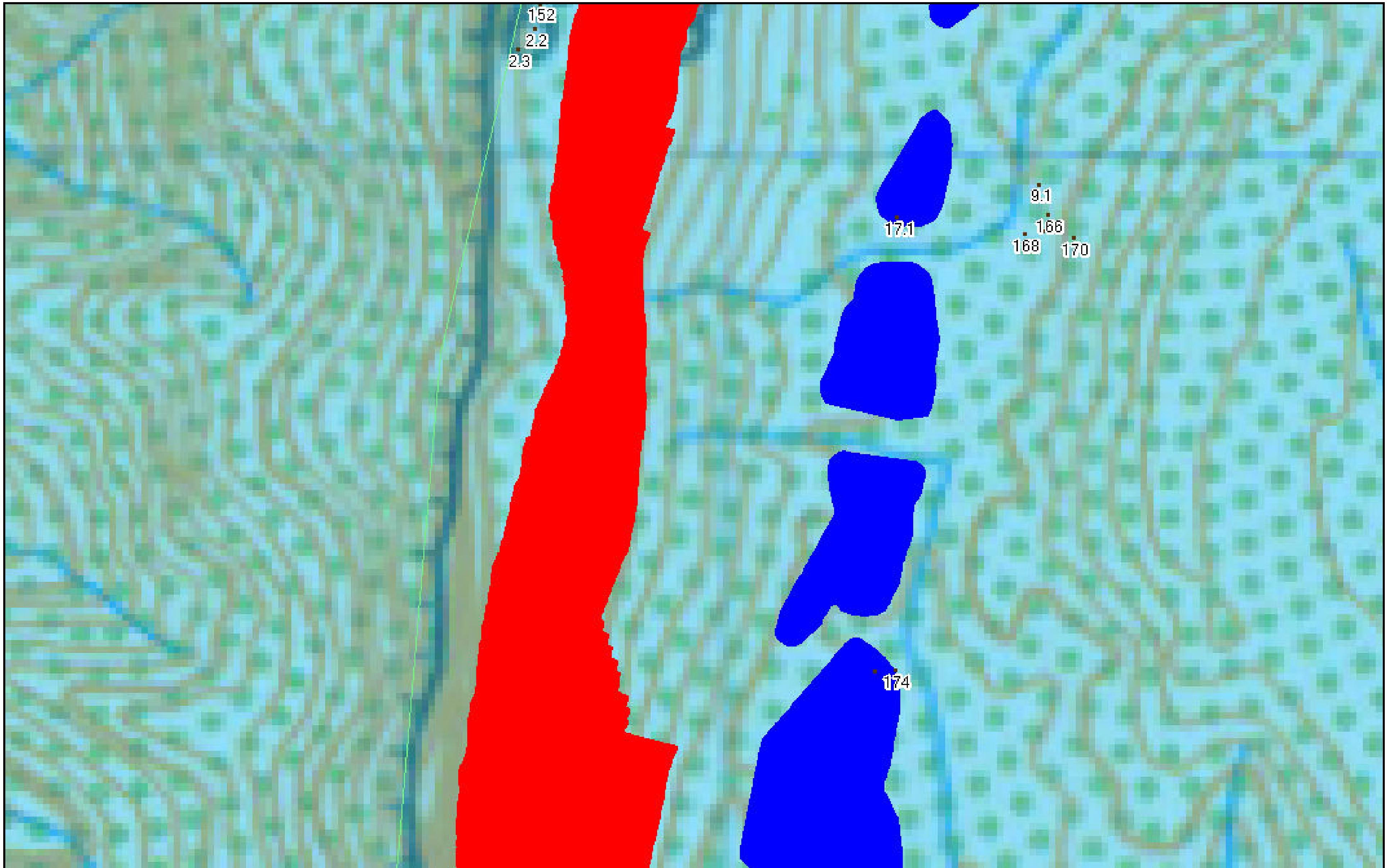
Monsoon low open woodlands dominated by Eucalyptus brevifolia or Eucalyptus leucophloia.
Woodlands and open-woodlands dominated by Eucalyptus spp. and Corymbia spp. on basalt.

Auth: Mitch Ladyman	Project: Kimberley Metals Group RIOP	animal plant mineral	NORTH	**Figure 1** **Tropical Savanna CRC Vegetation Mapping and RIOP Site in a Regional Setting** KMG RIOP
Date: April 2010	Datum: GDA94 (MGA Zone50)			



Monsoon low open woodlands dominated by Eucalyptus brevifolia or Eucalyptus leucophloia.
Woodlands and open-woodlands dominated by Eucalyptus spp. and Corymbia spp. on basalt.

Auth: Mitch Ladyman	Project: Kimberley Metals Group RIOP	NORTH	**Figure 2a** **Tropical Savanna CRC Vegetation Mapping and Gouldian Finch Monitoring Sites** KMG RIOP
Date: April 2010	Datum: GDA94 (MGA Zone50)		



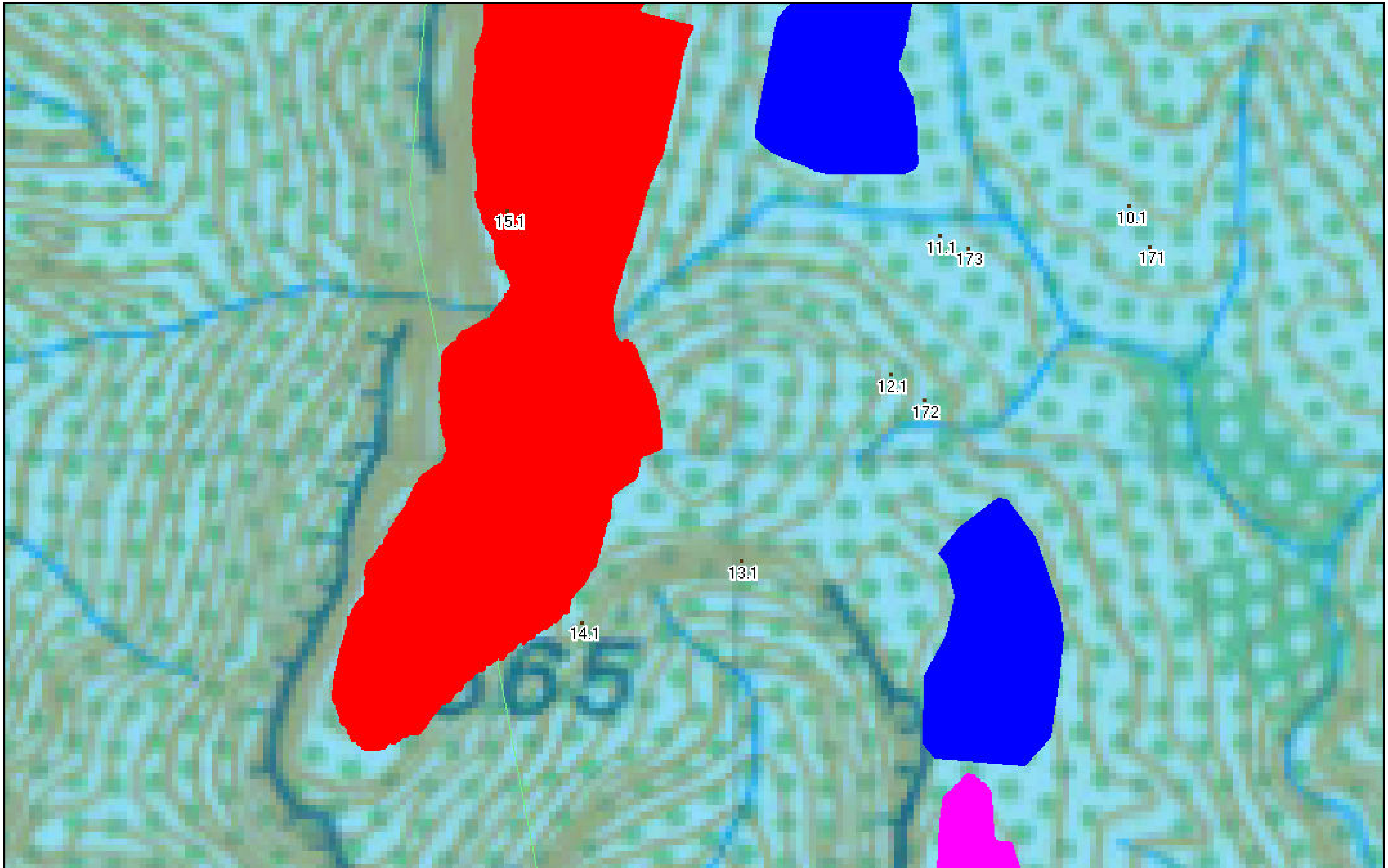
Monsoon low open woodlands dominated by Eucalyptus brevifolia or Eucalyptus leucophloia.

Woodlands and open-woodlands dominated by Eucalyptus spp. and Corymbia spp. on basalt.

Auth: Mitch Ladyman	Project: Kimberley Metals Group RIOP	**Figure 2b** **Tropical Savanna CRC Vegetation Mapping and Gouldian Finch Monitoring Sites** KMG RIOP
Date: April 2010	Datum: GDA94 (MGA Zone50)	

animal plant mineral

NORTH



Monsoon low open woodlands dominated by Eucalyptus brevifolia or Eucalyptus leucophloia.
Woodlands and open-woodlands dominated by Eucalyptus spp. and Corymbia spp. on basalt.

Auth: Mitch Ladyman	Project: Kimberley Metals Group RIOP	**Figure 2c**
Date: April 2010	Datum: GDA94 (MGA Zone50)	**Tropical Savanna CRC Vegetation Mapping and Gouldian Finch Monitoring Sites**

animal plant mineral

NORTH

KMG RIOP

Appendix 1 Survey field data

Site	WPs	Dominant Species	Number of Potential Nest Trees	Number of Potential Nest Sites	Measurements	Comments
Site 1	Riogou001		0	0		No suitable nest hollows found
Site 2	Riogou002 1stnesttree 2ndnesttree	 *Eucalyptus tectifica* *Corymbia greeniana* *Corymbia dichromophloia*	3	4	1st nest hollow found in *Eucalyptus tectifica* 3.7m high from the ground Hollow 70mm in diameter North facing 2nd nest hollow in same tree 4.7m from ground 100mm in diameter North facing 3rd nest hollow in same tree 4.5m from ground 80mm in diameter North facing 4th nest hollow found in *Corymbia greeniana* 9.8m high from ground 60mm in diameter South facing	*Corymbia dichromophloia* - Smooth barked. This tree has two potential nest hollows but they are filled with termites. If the termites leave or get washed out the hollows could be used.

Site 3	Riogou003 WP 154	*Corymbia collina*	1	3	1st nest hollow found in *Corymbia collina* WP 154 4m from ground 50mm in diameter Hollow faces North West 2nd nest hollow in same tree 4.2m from ground 50mm in diameter Faces south 3rd potential nest hollow same tree Faces South East	The 3rd potential nest hollow in the same tree *Corymbia collina* faces South East. This hollow is unreachable as it is too high to get to, so there were no measurements were obtained
Site 4	Riogou004 WP 155 WP 156	*Corymbia collina*	2	3	*Corymbia collina* has two potential nest sites WP 155 *Corymbia collina* has one potential nest site WP 156 2.4m from ground 70mm in diameter North facing	The two potential nest hollows in the first *Corymbia collina* tree has two hollows unreachable as they are too high to get to, so no measurements were obtained
Site 5	Riogou005 WP 157 WP 158	*Corymbia collina*			*Corymbia collina* WP 157 Perfect nest hollow found 3.8m from the ground 45mm in diameter Facing east	Another *Corymbia collina* has potential future nest hollows if the termites leave and rain washes them out

					Corymbia collina WP 158 4.30meters from ground 35mm in diameter West facing	
Site 6	Riogou006 WP 159 WP 160 WP 161 WP 162	*Corymbia collina*			*Corymbia collina* WP 159 3.65m high 30mm in diameter Facing SSE 2nd nest hollow same tree 3.10m high 45mm in diameter North facing 3rd nest hollow same tree 3.31m high 30mm in diameter Facing east *Corymbia collina* WP 160 3.8m high 50mm in diameter Facing North *Corymbia collina* WP 161 2.7m high 40mm in diameter Facing South West	

					Corymbia collina WP 162 5.10 m high 50mm in diameter Facing SE	
Site 7	Riogou007	*Corymbia collina*				*Corymbia collina* has potential nest sites in hollows if the blockage clears. The hollows are blocked with termitaria – termite mounds.
Site 8	Riogou008 WP 163 WP 164 WP 165	*Eucalyptus brevifolia*			*Eucalyptus brevifolia* WP 163 2.20meters high 45mm in diameter South facing *Eucalyptus brevifolia* WP 164 3.40meters high 35mm in diameter South facing 2nd nest hollow same tree 2.50meters high from ground 35mm in diameter SW facing 3rd nest hollow same tree 3.10meters high 35mm in diameter East facing *Eucalyptus brevifolia* WP 165	This site has a lot of snappy gums – *Eucalyptus brevifolia*

					4.9 meters high 35mm in diameter North east facing	
Site 9	Riogou009 WP 166 WP 167 WP 168 WP 169 WP 170	*Eucalyptus brevifolia*	5	6	*Eucalyptus brevifolia* WP 166 2.2meters high 35mm in diameter NW facing *Eucalyptus brevifolia* WP 167 3.9meters high 60mm in diameter South facing *Eucalyptus brevifolia* WP 168 2.10meters high 50mm in diameter North facing 2nd nest hollow same tree 2.55meters high from the ground 30mm in diameter NW facing *Eucalyptus brevifolia* WP 169 3.35meters high 40mm in diameter East facing	

					Eucalyptus brevifolia WP 170 3.40meters high 35mm in diameter West facing	
Site 10	Riogou010 WP 171	*Eucalyptus jensenii* – Wandi ironbark			*Eucalyptus jensenii* WP 171 3.05meters from ground 50mm in diameter ENE facing	
Site 11	Riogou011 WP 173	*Eucalyptus brevifolia* – snappy gum			*Eucalyptus brevifolia* WP 173 Nest hollow 5.50meters high from ground 40mm in diameter North east facing	
Site 12	Riogou012	*Corymbia dichromophloia*	1	1	*Corymbia dichromophloia* WP 172 Unreachable nest hollow Approx 7meters high from ground Approx 60mm in diameter	*Corymbia dichromophloia* has an unreachable nest hollow that looks perfect with binoculars so we approximated the measurements
Site 13	Riogou013	*Eucalyptus jensenii* *Corymbia dichromophloia* *Corymbia collina*	0	0		All possible nest hollows found were blocked and not suitable. They may be suitable in the future if the blockage clears
Site 14	Riogou014		0	0		No suitable nest hollows found – some hollows were chocked with termites, others were bees nests

Site 15	Riogou015		0	0		No suitable nest sites found
Site 17	Riogou017		0	0		No suitable nest hollows were found – they were all blocked
Site 18	Riogou018 WP 174	*Eucalyptus brevifolia* – snappy gum	1	1	*Eucalyptus brevifolia* WP 174 Hollow 3.10 m high from ground 45mm in diameter North east facing	There were other possible nest sites in *Eucalyptus brevifolia* at this site that were full of termitaria and/or ants and the hollows from the tree limbs were quite split

Appendix 2: Survey site photos

 Site 1	 Site 2	 Site 3
 Site 4	 Site 5	 Site 6


Site 7


Site 8


Site 9


Site 10


Site 11


Site 12


Site 13


Site 14


Site 15

 Site 17	 Site18	

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Appendix 6: RIOP *5C Licence to Take Water*

Government of **Western Australia**
Department of **Water**

Looking after all our water needs

Our ref RF5869
CAW171726 & GWL172778
Enquiries Kate Gole (9166 4117)

RECEIVED
13 JAN 2011

BY: ....

Ian Junk
Managing Director
Kimberley Metals Group
Suite C5, 1 The Esplanade
MOUNT PLEASANT WA 6153

Dear Ian

Re: Issue of a Licence to Take Water & a Licence to Construct or Alter Well
Property: Mining tenements M80/599, M80/600, L80/55, Ridges Iron Ore project

Please find enclosed your *Licence to Take Water*, issued under section 5C of the *Rights in Water and Irrigation Act 1914*. This licence entitles you to take water, subject to certain terms, conditions or restrictions. It does not absolve the licensee from responsibility for compliance with the requirements of all Commonwealth and State legislation.

Your *Licence to Construct or Alter a Well* is also enclosed.

It is important that you read the conditions of your licence carefully. If you do not understand your licence, please contact the Department as soon as possible, as there are penalties for failing to comply with all of your licence conditions.

Under Section 26GG(2) and 26GI of the *Rights in Water and Irrigation Act 1914*, you have a right to apply to the State Administrative Tribunal for a review of the decision to issue a *Licence to Take Water* and *Licence to Construct or Alter a Well*. You have 28 days from the date you received this letter to request that the decision be reviewed.

For further information please contact the State Administrative Tribunal:

State Administrative Tribunal
12 St Georges Terrace
PERTH WA 6000

GPO Box U1991
PERTH WA 6845

Telephone (08) 9219 3111
Toll-free 1300 306 017
Facsimile: (08) 9325 5099
www.sat.justice.wa.gov.au

Under section 21 of the *State Administrative Tribunal Act 2004*, you have a right to request a written statement of reasons for the decision to issue a *Licence to Take Water* and *Licence to Construct or Alter a Well*. This request must be made, in writing, to Department of Water within 28 days after the day on which you received this letter.

This licence is due to expire on **8 January 2016**. If you wish to continue taking water after the *Licence to Take Water* expires, it is your responsibility to apply to the Department of Water for its renewal. If this licence expires and you have not applied to renew it, then the taking of water must cease, or you will be in breach of *the Rights in Water and Irrigation Act 1914*. It is suggested that an application for renewal be made at least one month in advance of the *Licence to Take Water* expiry date.

You may apply to amend or transfer the *Licence to Take Water* at any time. The Department may also amend, suspend or cancel this licence in certain circumstances.

An extract of this licence has been placed in the public register and is available for viewing by appointment at Department of Water offices.

Please find enclosed a *Form 2: Information to be provided on completion of a non-artesian well*. Under *Section 26E* of the *Rights in Water and Irrigation Act 1914* Form 2 is to be completed and submitted by your driller to the Department of Water's Kununurra office within one month of completion of the well.

Metering conditions

Please note that metering conditions have been placed on your licence. Please read these conditions carefully and contact us if you have any questions. These conditions require you to:

- Install a flow meter on all production bores in accordance with the *Guidelines for water meter installation 2009* (a copy of which is included with this letter)
- Take meter readings each month to measure your water use
- Return the water use card to Department of Water's Kununurra office by **8 January** each year (excluding 8 January 2011).

In accordance with the *Guidelines for water meter installation 2009* (attached), within 30 days of installing a water meter you need to submit the following information:

- The exact location of the meter (in Global Positioning System coordinates)
- The date the meter was installed
- The make, size, type and serial number of the meter
- A photograph, and/or a diagram of the meter fitted on the pipe-work, including the dimensions, and showing lengths of clear pipe before and after the water meter up to the first off-take.

A ***water meter use card*** for recording and submitting your meter readings can be found by visiting our website www.water.wa.gov.au and following the links >doing business with us>water licensing>licensing publications and forms>meter water use card-Kununurra.

If you have any queries relating to the above matters, please contact Kate Gole on telephone number 9166 4117.

Yours faithfully

JThompson

Jacinta Thompson

Program Manager – Water Resource Use
Kimberley Region

29 December 2010

Government of **Western Australia**
Department of **Water**

Instrument No. CAW171726(1)

LICENCE TO CONSTRUCT OR ALTER WELL

Granted by the Minister under section 26D of the Rights in Water and Irrigation Act 1914

Licensee(s)	Kimberley Metals Group Pty Ltd	
Description of Water Resource	Canning-Kimberley Combined - Fractured Rock Central	
Location of Well(s)	Mining tenement M80/599 Mining tenement M80/600 Mining tenement L80/55	
Authorised Activities	**Activity**	**Location of Activity**
	Construct 1 non-artesian well(s).	Mining tenement L80/55
	Construct 1 non-artesian well(s).	Mining tenement M80/599
	Construct up to 5 non-artesian well(s).	Mining tenement M80/600
Duration of Licence	From 29 December 2010 to 8 January 2012	

This Licence is subject to the following terms, conditions and restrictions:

1 The well must be constructed by a driller having a current class 1 water well drillers certificate issued by the Western Australian branch of the Australian Drilling Industry Association or other certification approved by the Department of Water as equivalent.

2 Approval by the Department of Water is to be obtained prior to the construction of additional and replacement wells and the modification or refurbishment of existing wells.

3 The licensee is to provide a completed 'Form 2: Information to be provided on completion of a non-artesian well' for each bore drilled under this licence to the Department of Water with one month of the completion of the drilling program.

4 That water discharged during the pump test, is to be disposed of in such a manner as to cause no undesirable environmental impact.

End of terms, conditions and restrictions

This Licence is granted subject to the Rights in Water and Irrigation Regulations 2000.

File No: RF5869

Government of **Western Australia**
Department of **Water**

Instrument No. GWL172778(1)

LICENCE TO TAKE WATER

Granted by the Minister under section 5C of the Rights in Water and Irrigation Act 1914

Licensee(s)	Kimberley Metals Group Pty Ltd		
Description of Water Resource	Canning-Kimberley Combined - Fractured Rock Central	**Annual Water Entitlement**	150000 kL
Location of Water Source	Mining tenement M80/600 Mining tenement L80/55		

Authorised Activities	**Taking of water for**	**Location of Activity**
	Mining camp purposes	Mining tenement L80/55
	Dust Suppression for mining purposes	Mining tenement M80/599
	Dust Suppression for mining purposes	Mining tenement M80/600
Duration of Licence	From 5 January 2011 to 8 January 2016	

This Licence is subject to the following terms, conditions and restrictions:

1 That the licensee shall utilise efficient irrigation systems that are satisfactory to the Department of Water, so that water is not used in a wasteful manner.

2 That should the licensee's draw adversely affect the aquifer or other users in the area, the Department of Water may reduce the amount that may be drawn.

3 That the licensee shall allow access, in an agreed manner, by Department of Water personnel for the purposes of inspection at any time.

4 Approval by the Department of Water is to be obtained prior to the construction of additional and replacement wells and the modification or refurbishment of existing wells.

5 The licensee must install a cumulative water meter of a type approved under the Rights in Water and Irrigation (Approved Meters) Order 2009 to each water draw point under this licence.

6 The meter(s) must be installed in accordance with the provisions of the document entitled "Guidelines for Water Meter Installation 2009" before any water is taken under this licence.

7 The licensee must ensure the installed meter(s) accuracy is maintained to within plus or minus 5% of the volume metered, in field conditions.

8 The annual water year for water taken under this licence is defined as 12:00 pm at 1 January to 12:00 pm at 1 January twelve months later.

9 The licensee must not, in any water year, take more water than the annual water entitlement specified in this licence.

This Licence is granted subject to the Rights in Water and Irrigation Regulations 2000

Government of **Western Australia**
Department of **Water**

LICENCE TO TAKE WATER

Granted by the Minister under section 5C of the Rights in Water and Irrigation Act 1914

This Licence is subject to the following terms, conditions and restrictions:

10 The licensee must take and record the reading from each meter required under this licence at the beginning and another at the end of the water year defined on this licence.

11 In addition to taking and recording the reading(s) at the beginning and the end of the water year, the licensee must, as close as practicable to the end of each month (other than the month in which the water year ends), take and record the reading from each meter required under this licence.

12 The licensee must notify the Department of Water in writing of any water meter malfunction within seven days of the malfunction being noticed.

13 The licensee must obtain authorisation from the Department of Water before removing, replacing or interfering with any meter required under this licence.

14 The licensee must submit to the Department of Water the recorded meter readings and the volume of water taken within the water year by 8 January.

End of terms, conditions and restrictions

Appendix 7: Department of Aboriginal Affairs Database Search Results

Aboriginal Heritage Inquiry System

Aboriginal Sites Database

Search Criteria

No Registered Aboriginal Sites in Mining Tenement - M 80/625

Disclaimer

The *Aboriginal Heritage Act 1972* preserves all Aboriginal sites in Western Australia whether or not they are registered. Aboriginal sites exist that are not recorded on the Register of Aboriginal Sites, and some registered sites may no longer exist.

Copyright

Coordinate Accuracy

Accuracy is shown as a code in brackets following the site coordinates.

Terminology (NB that some terminology has varied over the life of the legislation)

ID/Site ID: This a unique ID assigned by the Department of Aboriginal Affairs to the place
Status:

- **Registered Site**: The place has been assessed as meeting Section 5 of the *Aboriginal Heritage Act 1972*
- **Other Heritage Place which includes:**
  - **Stored Data:** The place has been assessed as not meeting Section 5 of the *Aboriginal Heritage Act 1972*
  - **Insufficient Information:** There is not enough information presented to determine if the place meets Section 5 of the *Aboriginal Heritage Act 1972*
  - **Lodged:** Information has been received in relation to the place, but an assessment has not been completed at this stage to determine if it meets Section 5 of the *Aboriginal Heritage Act 1972*

Access and Restrictions:

- **Open:** Availability of information that the Department of Aboriginal Affairs holds in relation to the place is not restricted in any way.
- **Closed:** Some of the information that the Department of Aboriginal Affairs holds in relation to the place is restricted if it is considered culturally sensitive.
  This information will only be made available if the Department of Aboriginal Affairs receives written approval from the informants who provided the information. Download the Request to Access Restricted Information letter and form.
  The Department of Aboriginal Affairs maps the locations of all sites and heritage places, including Closed sites, as accurately as the information lodged with the Registrar allows. However, to preserve the confidentiality of Closed sites their locations are published in reports from the Register and displayed on the Aboriginal Heritage Inquiry System within one or more two-kilometre-square boxes. These 2 km boxes act as indicators for the presence of sites or heritage places rather than the exact location of the place.
- **Restriction:**
  - **No Restrictions:** Anyone can view the information.
  - **Male Access Only:** Only males can view restricted information.
  - **Female Access Only:** Only females can view restricted information

Reliability:

- **Reliable:** The spatial information recorded about the place is deemed to be reliable, due to methods of capture.
- **Unreliable:** The spatial information recorded about the place is deemed to be unreliable due to errors of spatial data capture and/or quality of spatial information recorded.

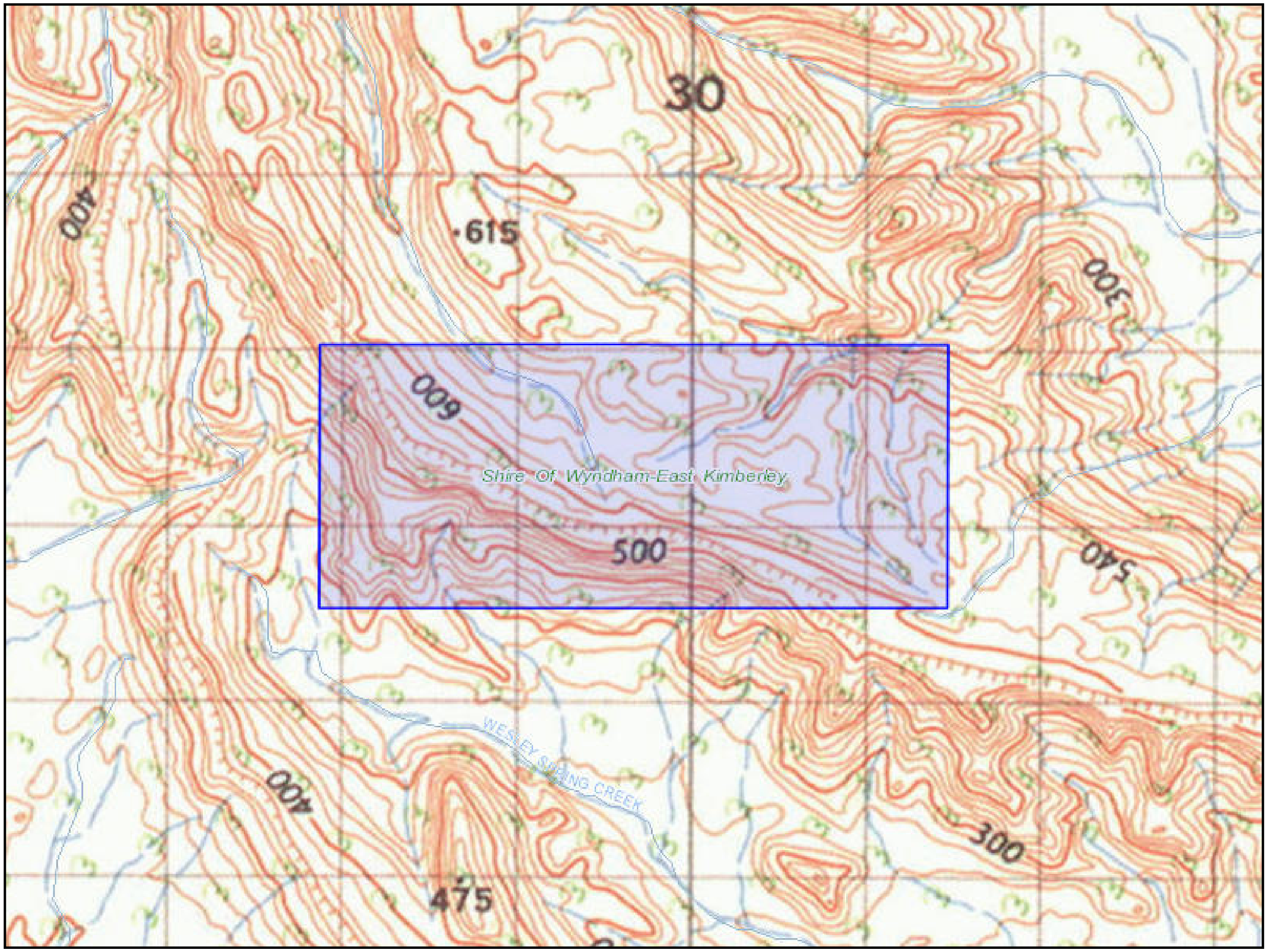
Number/No./Site No: This is the former unique number that the former Department of Aboriginal Sites assigned to the place. This has been replaced by the ID/SiteID

List of Registered Aboriginal Sites with Map

No Results

Aboriginal Heritage Inquiry System

Aboriginal Sites Database



Legend

Selected Heritage Sites

- Registered Sites
- Aboriginal Community Occupied
- Aboriginal Community Unoccupied
- Town
- Search Area

Aboriginal Heritage Inquiry System

Aboriginal Sites Database

Search Criteria

9 Registered Aboriginal Sites in Mining Tenement - E 80/2389

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Number/No./Site No: This is the former unique number that the former Department of Aboriginal Sites assigned to the place. This has been replaced by the ID/SiteID

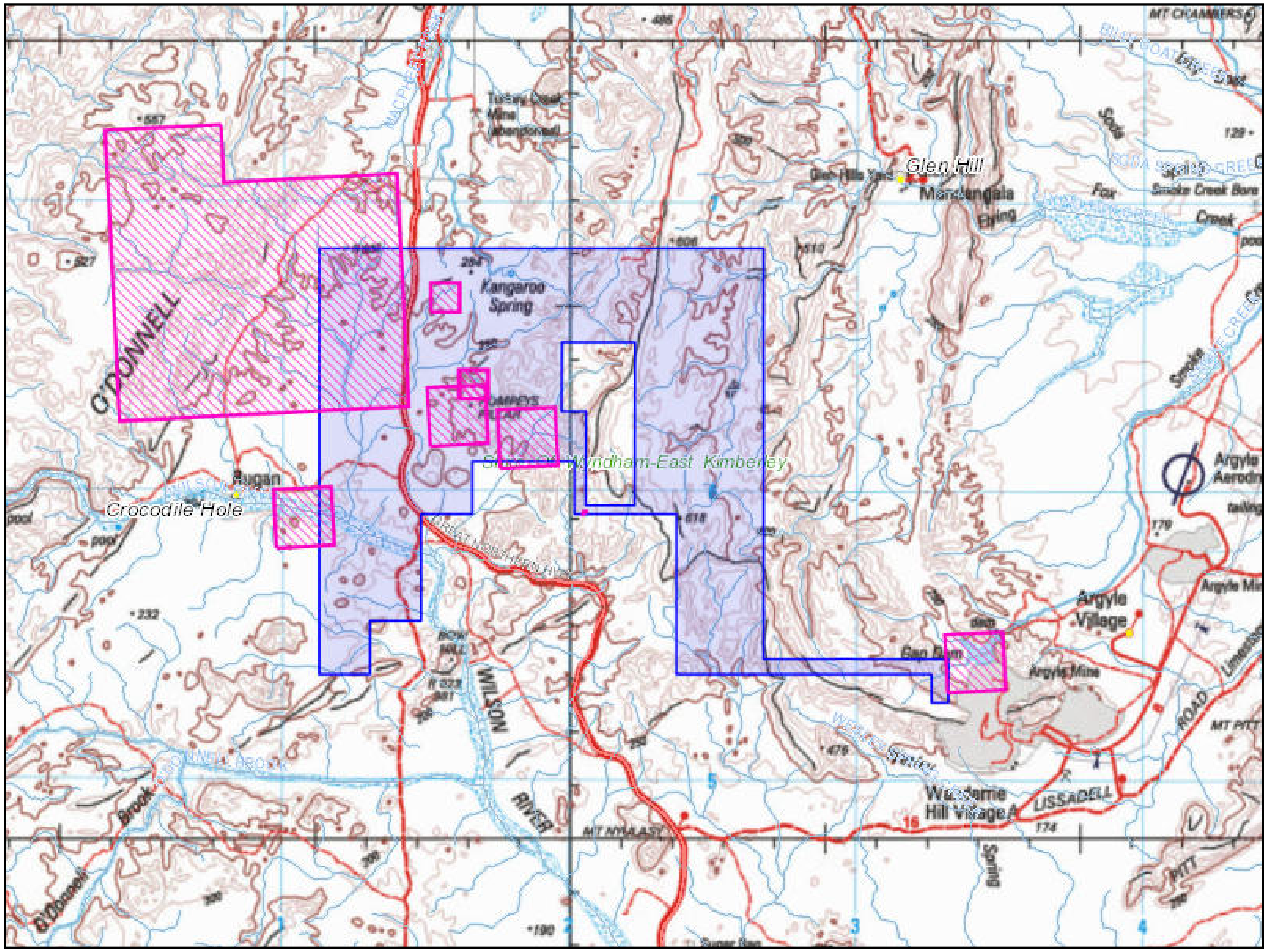
List of Registered Aboriginal Sites with Map

Site ID	Status	Access	Restriction	Site Name	Site Type	Additional Info	Informants	Coordinates	Site No.
13064	Registered Site	Open	No Gender Restrictions	MARK HILL	Artefacts / Scatter			416634mE 8163665mN Zone 52 [Unreliable]	K02152
13065	Registered Site	Open	No Gender Restrictions	WALT HILL	Artefacts / Scatter			416634mE 8163665mN Zone 52 [Unreliable]	K02153
14002	Registered Site	Closed	No Gender Restrictions	DEVIL DEVIL SPRING.	Mythological, Artefacts / Scatter	[Other: PA 69]	*Registered Informant names available from DAA	Not available for closed Sites	K01100
14006	Registered Site	Closed	No Gender Restrictions	PANGKALTJI	Mythological			Not available for closed Sites	K01104
14007	Registered Site	Closed	No Gender Restrictions	WULANGKU	Mythological			Not available for closed Sites	K01105
14013	Registered Site	Closed	No Gender Restrictions	HILL, CASTLEREAGH CREEK	Mythological			Not available for closed Sites	K01111
14017	Registered Site	Closed	No Gender Restrictions	TJAMINDIN/NGOAKUL	Mythological, Quarry			Not available for closed Sites	K01115
14351	Registered Site	Open	No Gender Restrictions	DUNHAM STATION	Painting, Artefacts / Scatter			415634mE 8166665mN Zone 52 [Unreliable]	K00727
30208	Registered Site	Open	No Gender Restrictions	KMG 09-05	Artefacts / Scatter		*Registered Informant names available from DAA	420531mE 8159252mN Zone 52 [Reliable]	

Government of **Western Australia**
Department of **Aboriginal Affairs**

Aboriginal Heritage Inquiry System

Aboriginal Sites Database



Legend

Selected Heritage Sites

- Registered Sites
- Aboriginal Community Occupied
- Aboriginal Community Unoccupied
- Town
- Search Area

Aboriginal Heritage Inquiry System

Aboriginal Sites Database

Search Criteria

9 Registered Aboriginal Sites in Mining Tenement - E 80/4309

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Reliability:

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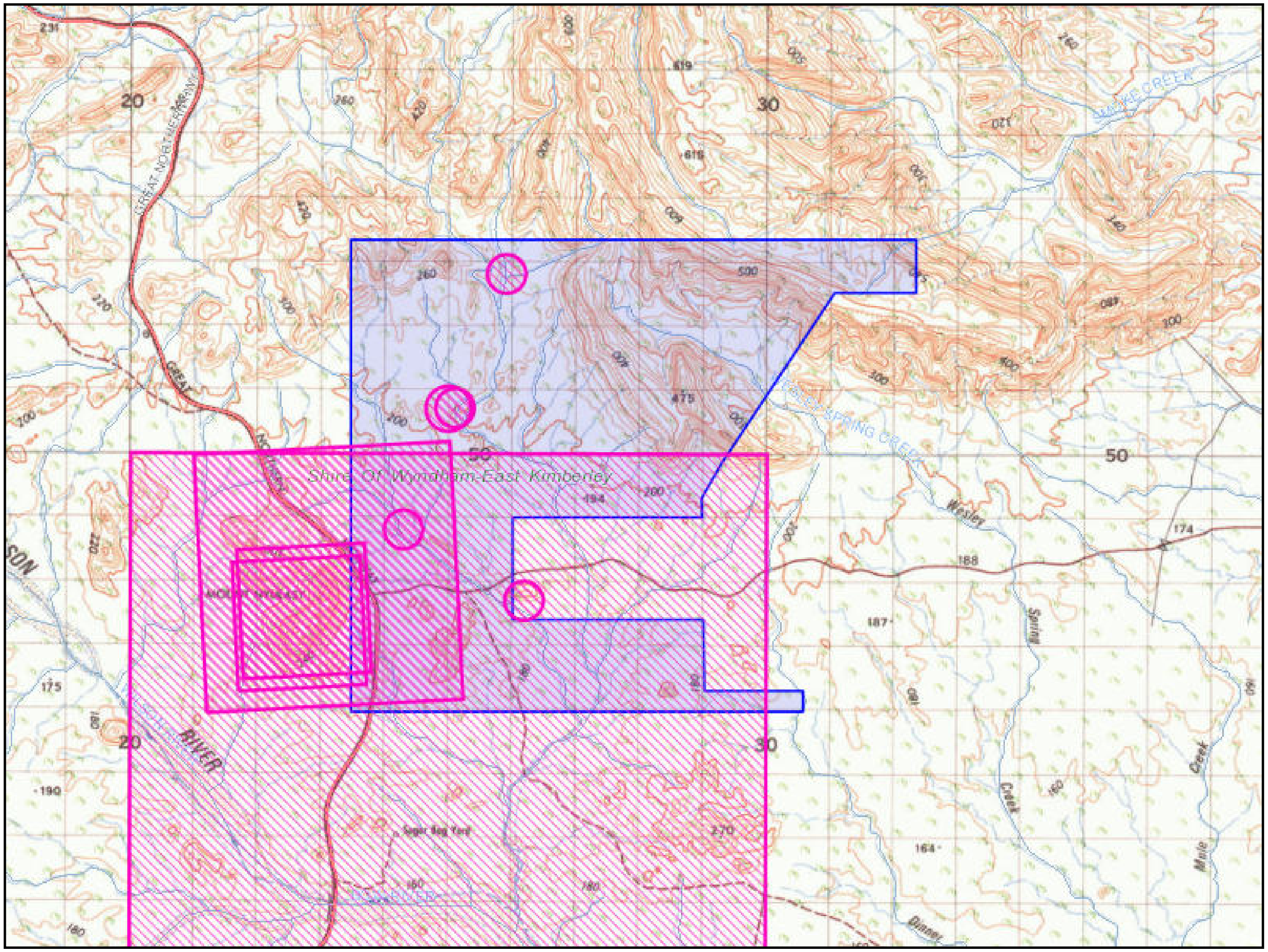
List of Registered Aboriginal Sites with Map

Site ID	Status	Access	Restriction	Site Name	Site Type	Additional Info	Informants	Coordinates	Site No.
13083	Registered Site	Closed	Male Access Only	MARGUMBARREN	Mythological			Not available for closed Sites	K02117
13717	Registered Site	Open	No Gender Restrictions	ARGYLE 7.	Artefacts / Scatter	Rockshelter		424434mE 8148965mN Zone 52 [Unreliable]	K01422
13718	Registered Site	Open	No Gender Restrictions	ARGYLE 8	Quarry, Artefacts / Scatter			425134mE 8150865mN Zone 52 [Unreliable]	K01423
13719	Registered Site	Open	No Gender Restrictions	ARGYLE 9	Artefacts / Scatter			425234mE 8150865mN Zone 52 [Unreliable]	K01424
13720	Registered Site	Open	No Gender Restrictions	ARGYLE 10	Artefacts / Scatter			426034mE 8152965mN Zone 52 [Reliable]	K01425
13725	Registered Site	Open	No Gender Restrictions	ARGYLE 15	Artefacts / Scatter			426334mE 8147865mN Zone 52 [Unreliable]	K01430
14010	Registered Site	Closed	No Gender Restrictions	YULITJ	Mythological			Not available for closed Sites	K01108
14011	Registered Site	Closed	No Gender Restrictions	STANDING ROCK	Mythological, Man-Made Structure			Not available for closed Sites	K01109
14019	Registered Site	Closed	Female Access Only	WITIKARA	Mythological			Not available for closed Sites	K01117

Government of **Western Australia**
Department of **Aboriginal Affairs**

Aboriginal Heritage Inquiry System

Aboriginal Sites Database



Legend

Selected Heritage Sites

Registered Sites

Aboriginal Community Occupied

Aboriginal Community Unoccupied

Town

Search Area

For further important information on using this information please see the Department of Aboriginal Affairs' Terms of Use statement at http://www.daa.wa.gov.au/Terms-Of-Use/

Aboriginal Heritage Inquiry System

Aboriginal Sites Database

Search Criteria

No Registered Aboriginal Sites in Mining Tenement - P 80/1750

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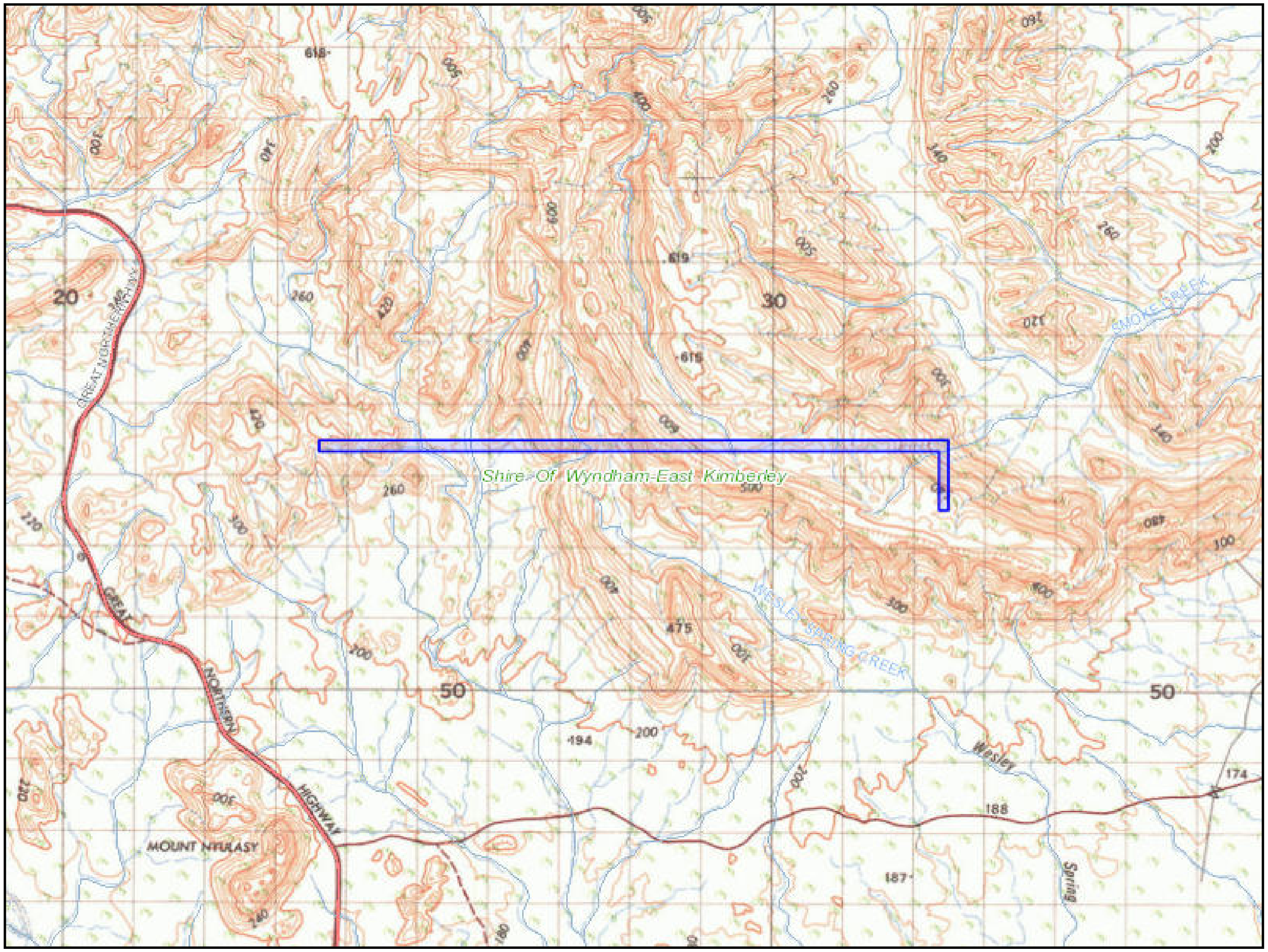
Number/No./Site No: This is the former unique number that the former Department of Aboriginal Sites assigned to the place. This has been replaced by the ID/SiteID

List of Registered Aboriginal Sites with Map

No Results



Legend

Selected Heritage Sites

- Registered Sites
- Aboriginal Community Occupied
- Aboriginal Community Unoccupied
- Town
- Search Area

For further important information on using this information please see the Department of Aboriginal Affairs' Terms of Use statement at http://www.daa.wa.gov.au/Terms-Of-Use/

Appendix 8: Department of Aboriginal Affairs Advice

Government of Western Australia
Department of Indigenous Affairs

ENQUIRIES : Rebecca Bairnsfather-Scott - Ph 65518050

OUR REF: 13/0034-02

YOUR REF:

Mr Brett Phyland
Exploration Manager
Kimberley Metals Group Pty Ltd
Suite C5 1 The Esplanade
MOUNT PLEASANT WA 6153

Dear Mr Phyland

DIA ADVICE - SITE 13749 WITHIN MINING LEASE M 259SA

Thank you for your information regarding the Programme of Works (PoW) received 26 March 2013. I have reviewed all the relevant information and I can confirm that the proposed work is within the dithered boundary of one closed registered site but not within the actual boundary of the site. The registered site is confirmed as:

DIA 13749 – S. Blatchford Escarpment

The dithered boundary is used by the Department of Indigenous Affairs (DIA) for protection of closed heritage places therefore Proponents are advised by DIA that if there is a closed Aboriginal heritage site within their proposed work area to have a Registered Aboriginal site search conducted by DIA for clarification.

The Registered site will not be impacted by the current proposed work as detailed in the shape file provided by Kimberley Metals Group Pty Ltd.

If you have any questions regarding the above, please contact Rebecca Bairnsfather-Scott on 6551 8050.

Kind Regards

Cesar Rodriguez
A/Manager Heritage Advice and Approvals - Government
28 March 2013

Ground Floor, 151 Royal Street, East Perth, Western Australia, 6004
PO box 3153, East Perth, Western Australia, 6892
Telephone 1300 651 077 Facsimile (08) 6551 8088
www.dia.wa.gov.au

Appendix 9: Matsu Stakeholder Consultation Register

Stakeholder Consultation Register

As part of the broad consultation programme for the Matsu Project the Kimberley Metals Group (KMG) consults with identified stakeholders on project development, operation and closure to ensure that legal requirements, risks and internal and external stakeholder expectations for the Project are taken into account at an appropriate time and as far as practicable. The list of stakeholders who have been consulted (to date) during the Matsu Project feasibility stage/planning process includes:

Date	Federal/State/Local Government Department or Company	Person(s)	Consultation Process	Topics Covered	Issues Raised	KMG Response
STATUTORY						
12 February 2014	Department of Environment DoE Office (Federal) – Level 15, 37 St Georges Tce (Citibank Building)	In person: Nicole Mathews (WA) Phone in: Michael Ward and Felicity Mclean (Canberra)	Meeting	Matsu referral (significant flora, fauna, habitat)	• Protection and management of Gouldian Finch, Rainbow Bee eater • Management through Federal and State Bilateral Agreement • Need to submit referral	• KMG has implemented a Gouldian Finch Management Plan • Flora (opportunistic fauna) survey planned for early April 2014 • KMG will submit proposal for assessment
11 March 2014	Office of the Environmental protection Authority (WA). Atrium, 168 St Georges Tce	Sally Bowman and Peter Tapsell	Meeting	Matsu referral (significant flora, fauna, habitat)	• Protection and management of Gouldian Finch, Rainbow Bee eater • Environmental management currently undertaken at RIOP; • Mine Closure Plan (MCP) • Need to submit referral	• KMG has implemented a Gouldian Finch Management Plan • KMG to include environmental management practices at RIOP in referral • DMP has approved RIOP MCP • KMG will submit proposal for assessment
8 April 2014	Department of State Development (DSD)	Courtney Draper (General Manager, Project Facilitation) & Luke Rees (Project Manager) & Brett Phyland	Email & Phone	Securing Matsu haul road access across the Argyle Diamond State Agreement land	• KMG & Matsu Project introductory email sent requesting DSD assistance to secure haul road access • CD called 14 Apr & meeting scheduled for 17 Apr at the DSD office	• Giles Nunis (Deputy Director General, Resources & Industry Development) initially sought but contact with his PA Amanda Taylor only possible and referred to CD
17 April 2014	DSD	Courtney Draper & Luke Rees (DSD), Brett Phyland & Glenn Jardine (DSD)	Meeting	Matsu Project briefing & access issue outlined (written brief & plans supplied)	• Project background including resource, employment, royalties • Haulage route options • Native Title considerations • Discussions with ADL to date • KMG legal advice to potential suitable State Leases	• DSD to review and respond, week of 21st April 2013
8 March 2013	Dept. of Mines and Petroleum (DMPR)			Mining Lease Application & Approval Process	• Mining Lease marked out 8 Mar 2013 • Application including Mineralisation Report & Mining Statement received by DMP 13 Mar 2013 • Revised Mineralisation Report supplied to DMP 22 Mar 2013, modified as per instructions by Roger Cooper (DMP)	
17 March 2014	Dept of Mines and Petroleum	Demelza Dravnieks and Leah Ilkiw	Meeting	Matsu Project - Overview	• Submission of Mining Proposal – will not be formally assessed until KMG can show land tenure (ownership) • 10ha Rule to access land under *Mining Act 1978* (WA) • Clearing Permit application	• KMG to discuss draft/s with DMP and to receive comments/commitments table • KMG to confirm land ownership • KMG to contact DoW

Date	Federal/State/Local Government Department or Company	Person(s)	Consultation Process	Topics Covered	Issues Raised	KMG Response
					• Need to contact the DoW regarding Bed and Banks permit	
	Department of Parks and Wildlife	Sandra Thomas: Area Manager - North	Meeting	Overview of Matsu Previous and Planned surveys	• Flora and vegetation community mapping (Level 2 survey). • Status of Gouldian finch. • SREs. • Escarpment Buffer	• Undertake a level 2 flora programme – scheduled for April 2014 • Submit copy of flora report to DPaW • APM to make comment on SRE status. • KMG to undertake risk assessment approach rather than propose a set buffer distance.
3 April	Shire of Wyndham and East Kimberley (SWEK)	Gary Gaffney – CEO	Meeting	Matsu Project	• Existing Ridges mine life • Matsu development and production timing to ensure production continuity with Ridges • Wyndham accommodation options • Potential Matsu development roadblocks	• Existing Ridges mine life is mid 2015 • Matsu attempting to be developed by mid-2015 to avoid loss of local jobs, contracts and commerce.
INDIGENOUS						
31 July 2013	MG Corporation & Gelganyem Trust	Traditional Owners, 2x Anthropologist & Brett Phyland	Work Clearance Survey	Combined MG Corp & Gelganyem work clearance survey for Matsu access track works and drilling program	• Work program clearance granted • TOs raised concerns about impact on groundwater and cultural awareness training at KMG.	• Track construction and drilling completed during Sept – Oct 2013.
24 September 2013	MG Corporation	John Hughes (CEO) & Dominque Reeves (Senior Lawyer) – MG Corp; Duncan Coutts & Brett Phyland (KMG)	Meeting	Matsu Project briefing (hard & digital copies of presentation supplied to MG Corp)	• KMG company background & existing operations • Matsu Project summary to date, including 2011 Inferred Resource details based on 1960s drilling, and planned work • Mining Lease application pegged in Mar13 • Project development timeline • KMG keen to commence Mine Agreement negotiations	
21 – 22 November 2013	MG Corporation	KMG represented by Duncan Coutts & Graham Castledine (Anthropologists Kim Doohan & Joh Borman present for MG Corp); Dominique Reeves (MG Corp)	Meeting	Matsu Mining Agreement	• Opening negotiation meeting • First day TOs & MG Corp executive only, second day KMG representation	• Draft agreement supplied to MG Corp by KMG 17 Jan 2014 • Alison Ross (MG Corp – Legal Officer) requested Matsu exploration results 21 Feb 2014 to inform negotiations, results (resource figure) supplied 28 Feb 2014 with KMG requesting a further negotiation meeting

Date	Federal/State/Local Government Department or Company	Person(s)	Consultation Process	Topics Covered	Issues Raised	KMG Response
PARTIES						
10 February 2014	Argyle Diamond Limited (ADL) – Rio Tinto Managed JV	John Graham & Jodie Hawley (ADL) & Brett Phyland (KMG)	Email & Letter	Renewal of RIOP to Matsu access road agreement	• Access Deed renewal request in accordance with the Deed (annual renewal required by 23 Feb) • BP email 27 Feb to JH as no response to date, JH to follow up • JG called 4 Mar, renewal of Deed to be discussed at ADL Community Liaison Meeting 6th Mar • BP email 10 Mar to JH & JH re. status of Deed; JG response in email that Traditional Owners had denied Deed renewal • Rio will not approval until track access until Agreement renewal signed by TLOs	• ADL will not renew the exploration Access Deed until consent from the Traditional Owners (TO) is given. • KMG is responsible for seeking the TO approval. No involvement from ADL. • Seeking this approval has been the subject of meetings, phone calls and emails between Gelganyem Trust, MG Corporation and KMG (primarily Glenn Jardine and Dave Gallagher). • Consent still not given as at 14 April 2014
4 April 2014	Argyle Diamond Limited (ADL) – Rio Tinto Managed JV	John Graham – Manager Environment & Communities ADL & Brett Phyland	Phone & Email	Haul Road Access on Argyle Lease M 259SA	• Conversation surrounding options for haul construction and access across the ADL lease. JG requested email to document discussion so he could follow up internally. Also discussed TO refusal to renew existing access Deed. BP sent email 4/4. • BP email 11 Apr to JG as no response to 4 Apr correspondence. • 14 Apr JG called. ADL position is that haul road will not be considered until TO consent given in relation to existing exploration access Deed. ADL open to considering options once this achieved. BP acknowledged ADL position & advised KMG seeking DSD advice in parallel.	• Topic of haul road first raised at Matsu Exploration Access Deed meeting 29 Oct 2013; JG, Jodie Hawley, Sarah Althorpe (ADL) & BP present • BP has advised JG of KMG position and options for haul road access being considered including State involvement. • No further progress will be achieved with ADL until TO consent given. • BP will keep JG informed of DSD discussions.
1 April	MG Corporation	John Hughes - CEO	Meeting	Matsu Project and KMG status with traditional owner processes	• Status	• Existing Ridges mine life is mid 2015 • Matsu attempting to be developed by mid-2015 to avoid loss of local indigenous jobs, indigenous contracts and indigenous royalties. • KMG would appreciate any assistance MG Corporation can provide to enabling a timely and positive negotiation process.

Stakeholder	Relationship
Miriuwung & Gajerrong #1 NTD	Matsu resource contained within the MG #1 NTD, represented by MG Corporation
Glen Hill Pastoral Lease	Matsu falls within this pastoral lease. Aboriginal pastoral lease, Mandangala community located 17km north
Argyle Diamonds Limited	Operators of the Argyle Diamond Mine and hold M 259SA
Mandangala and Tiltuwum Dawangs (M 259SA)	Signatories to the Argyle Participation Agreement ILUA, represented by Gelganyem Trust. NT clearance required from this group activity within M 259SA
Yurriyangem Taam NT Claim	Native title claimants unlikely to be impacted, claim area west of probable haul routes
Doon Doon Pastoral Lease	Unlikely to be impacted, boundaries west of probable haul routes
Main Roads Western Australia	Extending haulage route south on highway? Use of Lissadell Road?
Department of Water	Within Ord Irrigation District & Dunham River Catchment
Any Environmental Groups	Local groups only (Save the Kimberley?)
Lissadell Pastoral Lease	Homestead accessed via Lissadell Road