

**A REVISED AND UPDATED REPORT ON THE HERPETOFAUNA  
OF THE PROPOSED MULGA ROCK PROJECT AREA,  
GREAT VICTORIA DESERT, WESTERN AUSTRALIA**



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## SUMMARY

This report has been prepared for Vimy Resources Limited (Vimy) and documents the reptile fauna recorded in the Mulga Rock Uranium Project area (MRUP). The study area lies approximately 240km east-north-east of Kalgoorlie on the western sector of the Great Victoria Desert (GVD). It is situated 55 km north-east of Queen Victoria Spring, a Nature Reserve within the GVD. In order to complete the assessment of the herpetofauna of the MRUP, this current report has been prepared using a substantial amount of data that is available from the greater part of the GVD both north and east of Mulga Rock. The main objective of the report was to review all of the available herpetofauna data resulting from an intensive field survey conducted in October 2009; this was combined with the historical data from a 1985 survey, and trail camera results obtained between 2009 and 2014. Secondly, the aim was to compare the historical and current results from the MRUP with other survey results from the GVD, to put the area into a regional context.

Ten sites were chosen for systematic sampling during October 2009, representing the range of plant community types and soil variations within the current study area. Traplines in each site consisted of pitfall, funnel, Elliott and cage traps. Hand-foraging for cryptic species was conducted in each site, as was head-torching for nocturnal species. Spotlight runs from slow-moving vehicles were also conducted. Specific searches were undertaken for species considered endangered, rare or threatened under Federal and/or State legislation.

No amphibians were recorded during either the October 2009 or 1985 survey, although the literature review shows that a small number of burrowing species known from the GVD could occur. However, a single specimen of the Shoemaker Frog (*Neobatrachus sutor*) was reported by Vimy staff following heavy rainfall in January 2014, along with opportunistic sighting of tadpoles to the east of the MRUP.

A total of 42 species of reptile was recorded during October 2009. While this total is relatively high for a single season survey such as this, the highest number of species captured in any one site was 16 and the lowest was eight. Fifteen reptile species, mainly legless lizards and snakes, were represented by single individuals. The most common reptile was the small skink, *Ctenotus schomburkii*, which was represented by 58 individuals and was the only species to be represented in all 10 sites. While the number of species recorded is relatively high, it is clear from accumulation graphs that the number was likely to continue to rise given further sampling as neither graph reached an asymptote. Three species were recorded during 1985 that were not recorded during 2009; these were one gecko, one legless lizard and one dragon. In addition, three of the 14 reptile species subsequently recorded by the trail cameras were not recorded during the 2009 survey; these were the dragon *Ctenophorus nuchalis* (recorded in 1985); the Woma (*Aspidites ramsayi*) and the Gwardar (*Pseudonaja mengdeni*). In addition, four species were recorded during a survey in 1999 that were not known previously from the Mulga Rock area. This brings the total number of reptile species known from the MRUP to 53. One reptile listed as Vulnerable under both Federal and State legislation, the Great Desert skink (*Liopholis kintorei*), could occur within the MRUP but was not recorded despite targeted searches. One reptile of conservation significance, the Woma (*Aspidites ramsayi*), which is listed under State legislation, has been recorded within the MRUP by trail cameras and by Vimy staff.

A literature review was conducted for the greater GVD area including: a review of long-term studies of lizard assemblages in arid environments; surveys conducted for mining projects; and a search of the Department of Parks and Wildlife database for the area encompassing the MRUP. The results of these studies and database search are shown, along with the results from the 1985, 2009 general surveys, and opportunistic reptile results from a 1999 targeted Sandhill Dunnart (*Sminthopsis psammophila*) survey within the Mulga Rock area. The size of the various study areas, number of field surveys and range of habitats varied considerably, precluding any direct comparisons with the MRUP. However, the results of these studies indicate that the list of herpetofauna of the MRUP is, as yet, incomplete.

A series of potential impacts of mine development on reptiles has been provided in this report, as have a number of impact reduction strategies.

## **1 PROJECT DESCRIPTION**

The Mulga Rock Uranium Project (MRUP) lies approximately 240km east-north-east of Kalgoorlie-Boulder in the Shire of Menzies (Figure 1). The area is remote, located on the western flank of the Great Victoria Desert, and is comprised of a series of large, generally parallel sand dunes, with interdunal swales and broad flat plains.

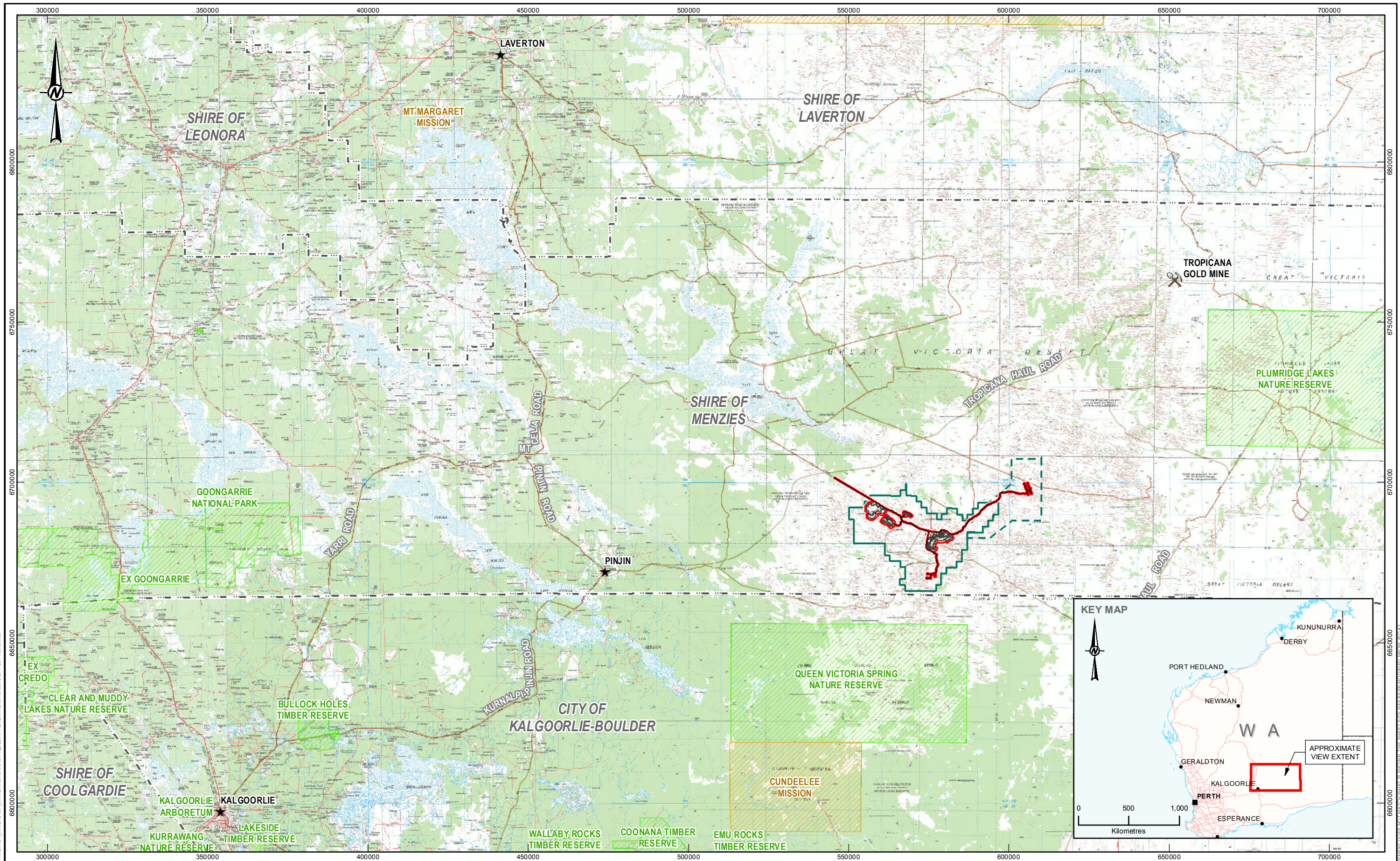
Access to the Project area is limited and is only possible using four-wheel-drive vehicles. The nearest residential town to the Project is Laverton which lies approximately 200km to the north-west. Other regional residential communities include Pinjin Station homestead located approximately 100km to the west, Coonana Aboriginal community situated approximately 130km to the south-south-west, Kanandah Station homestead positioned approximately 150km to the south-east, and the Tropicana Gold Mine lying approximately 110km to the north-east of the Project.

The MRUP covers approximately 102,000 hectares on granted mining tenure (primarily M39/1080 and M39/1081) within Unallocated Crown Land (UCL). It includes two distinct mining centres, Mulga Rock East (MRE) comprising the Princess and Ambassador resources, and Mulga Rock West (MRW) comprising the Emperor and Shogun resources; MRE and MRW are approximately 20km apart. MRE contains over 65% of the total recoverable uranium and is of a higher grade than MRW. Mining will commence at MRE which will include the location of the processing plant. Up to 4.5 Million tonnes per annum (Mtpa) of ore will be mined using traditional open cut techniques, crushed, beneficiated and then processed at an acid leach and precipitation treatment plant to produce, on average, 1,360 tonnes of uranium oxide concentrate (UOC) per year over the life of the Project. The anticipated Life-of-Mine (LOM) is up to 16 years, based on the currently identified resource.

Other metal concentrates will be extracted using sulphide precipitation after the uranium has been removed and sold separately. These metal concentrates will not be classified as radioactive. The UOC product will be sealed in drums and transported by road from the mine site in sealed sea-containers to a suitable port (expected to be Port Adelaide) which is approved to receive and ship Class 7 materials for export.

The MRUP will require the clearing of vegetation, borefield abstraction, mine dewatering and reinjection, the creation of above-ground and in-pit overburden (non-mineralised) and tailings landforms, and the construction of on-site processing facilities and associated infrastructure. Key Project infrastructure will include mine administration and workshop facilities, fuel and chemical storage depots, a diesel-fired power plant of up to 20 megawatt (MW) capacity and distribution network, a saline abstraction borefield and a saline mine water reinjection borefield with associated pipelines and power supply units, an accommodation village servicing a fly-in / fly-out workforce, an airstrip, laydown areas and other supporting ancillary infrastructure including communications systems, roads, a waste water treatment plant and solid waste landfill facilities. Transport to site for consumables, bulk materials and general supply items will be via existing public road systems linked to dedicated Project site roads, branching off the Tropicana Gold Mine access road.

At the completion of operations, the Project site will be decommissioned and rehabilitated in accordance with an approved Mine Closure Plan.



**LEGEND**

	TROPICANA GOLD MINE		PROJECT BOUNDARY (MINING TENURE)
	TOWN		PROJECT BOUNDARY (MISCELLANEOUS TENURE)
	ROAD		CONSERVATION RESERVE
	INFRASTRUCTURE		ABORIGINAL LAND TRUST ESTATE
	MRP DEVELOPMENT ENVELOPE		LOCAL GOVERNMENT AUTHORITY (LGA) BOUNDARY

**NOTES**  
 1. COORDINATE SYSTEM: GDA 1994 MGA ZONE 51

**REFERENCE**  
 INFRASTRUCTURE DATA PROVIDED BY CLIENT  
 BASE DATA © WESTERN AUSTRALIAN LAND INFORMATION AUTHORITY TRADING AS LANDGATE (2015)  
 IMAGE SOURCED FROM GEOSCIENCE AUSTRALIA 250K TOPO  
 INSET BASE DATA/ROADS SOURCED FROM STREET PRO DATA 2009

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 1:1,100,000 KILOMETRES

CLIENT  
**VIMY RESOURCES LIMITED**

CONSULTANT

YYYY-MM-DD	2015-10-21
DESIGNED	MS
PREPARED	MS
REVIEWED	GB
APPROVED	GB

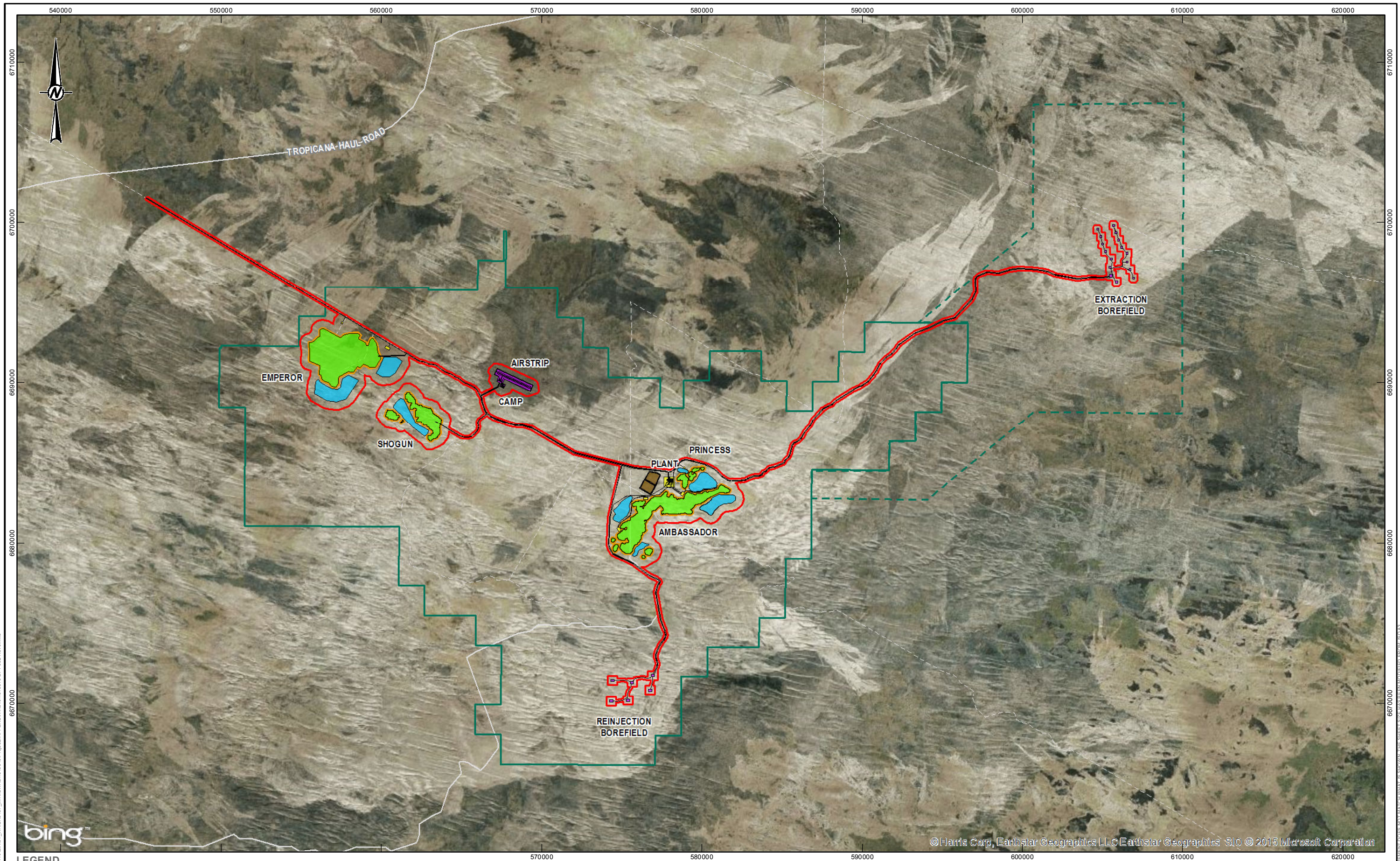
PROJECT  
**MULGA ROCK URANIUM PROJECT**

TITLE  
**REGIONAL LOCATION**

PROJECT NO. 1540340 CONTROL B7 REV. 0

FIGURE 1

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**LEGEND**

	MINOR ROAD/TRACK		PIT
	ROAD		OVERBURDEN LANDFORM
	MRUP DEVELOPMENT ENVELOPE		PROCESSING INFRASTRUCTURE
	PROJECT BOUNDARY (MINING TENURE)		ABOVE GROUND TSF
	PROJECT BOUNDARY (MISCELLANEOUS TENURE)		SUPPORTING INFRASTRUCTURE
			PIT CLEARING (50 m BUFFER)

**NOTES**  
 1. COORDINATE SYSTEM: GDA 1994 MGA ZONE 51

**REFERENCE**  
 INFRASTRUCTURE DATA PROVIDED BY CLIENT  
 AERIAL IMAGERY SOURCED FROM ESRI ONLINE  
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 FROM GEOSCIENCE AUSTRALIA

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CLIENT  
**VIMY RESOURCES LIMITED**

CONSULTANT

YYYY-MM-DD	2015-10-16
DESIGNED	MS
PREPARED	MS
REVIEWED	GB
APPROVED	GB

PROJECT  
**MULGA ROCK URANIUM PROJECT**

TITLE  
**PROJECT TENURE AND DEVELOPMENT ENVELOPE**

PROJECT NO. 1540340	CONTROL B7	REV. 0	FIGURE <b>2</b>
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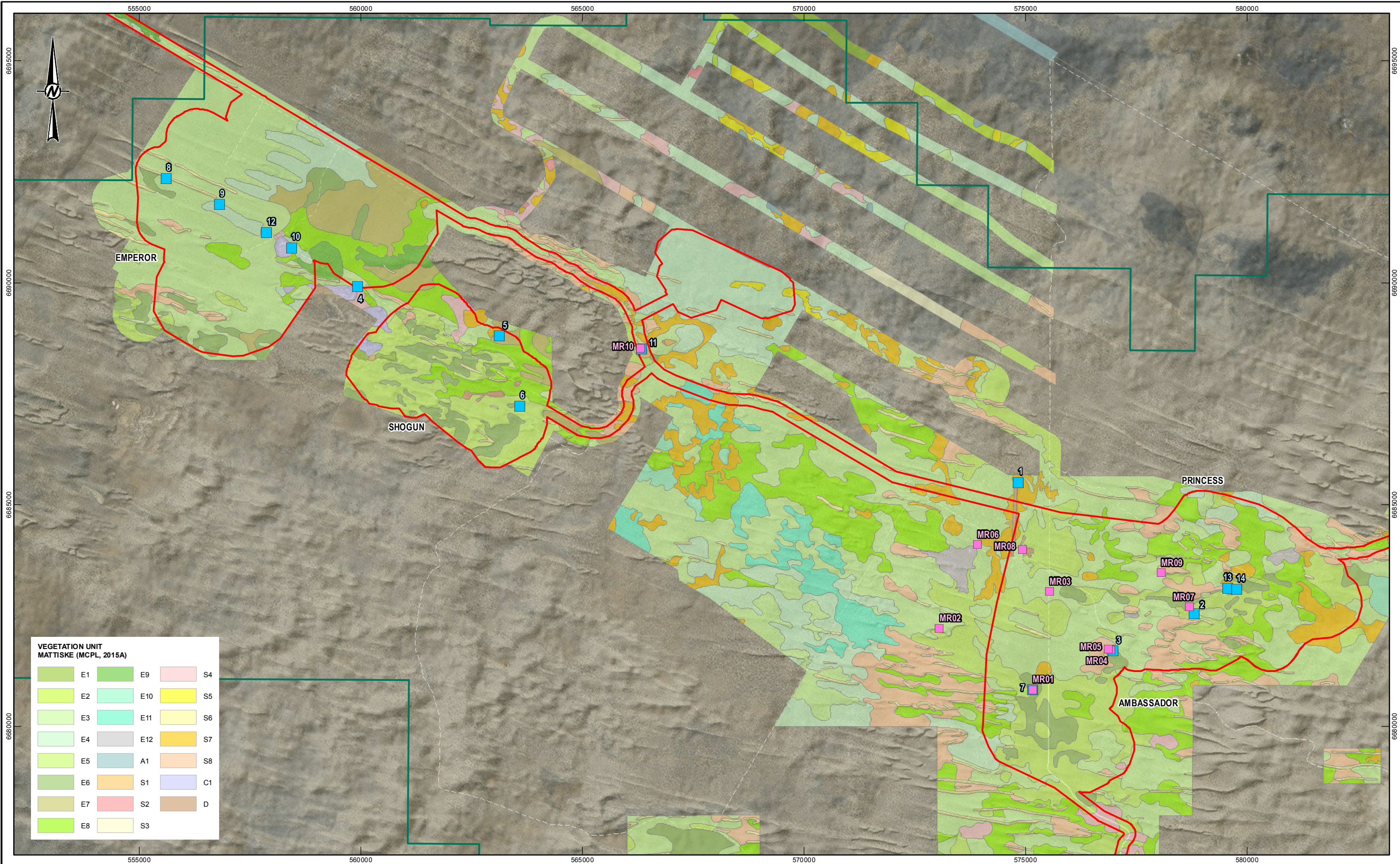
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**VEGETATION UNIT  
MATTISKE (MCPL, 2015A)**

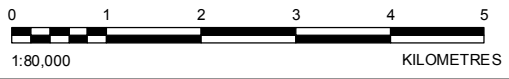
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E2	E10	S5
E3	E11	S6
E4	E12	S7
E5	A1	S8
E6	S1	C1
E7	S2	D
E8	S3	

**LEGEND**

	NINOX (2009) TRAP SITE		MRUP DEVELOPMENT ENVELOPE
	MARTINICK & HART (1985) TRAP SITE		PROJECT BOUNDARY (MINING TENURE)
	MINOR ROAD/TRACK		
	ROAD		

**NOTES**  
1. COORDINATE SYSTEM: GDA 1994 MGA ZONE 51

**REFERENCE**  
INFRASTRUCTURE DATA PROVIDED BY CLIENT  
AERIAL IMAGERY SOURCED FROM ESRI ONLINE  
TOPOGRAPHY BASED ON NATIONAL DEM 1 S SOURCED FROM GEOSCIENCE AUSTRALIA



CLIENT  
**VIMY RESOURCES LIMITED**



PROJECT  
**MULGA ROCK URANIUM PROJECT**

CONSULTANT

YYYY-MM-DD	2015-10-23
DESIGNED	MS
PREPARED	MS
REVIEWED	GB
APPROVED	GB

TITLE  
**1985 AND 2009 VERTEBRATE FAUNA SAMPLING LOCATIONS**

PROJECT NO. 1540340	CONTROL B7	REV. 0	FIGURE <b>3A</b>
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**Eucalypt Woodlands**

- E1** Low Woodland to Low Open Woodland of *Eucalyptus concinna* with *Callitris preissii* over *Westringia cephalantha*, *Melaleuca hamata*, *Acacia colletioides*, *Acacia hemiteles* and *Scaevola spinescens* over *Triodia desertorum*. This community occurs on red-orange sandy loams on flats.
- E2** Low Woodland to Open Scrub Mallee of *Eucalyptus trivalva* and *Eucalyptus platycorys* with *Callitris preissii* and *Hakea francisiana* over *Acacia colletioides*, *Acacia hemiteles*, *Melaleuca hamata*, *Westringia cephalantha*, *Bertya dimerostigma* and mixed shrubs over *Triodia desertorum* with occasional emergent *Eucalyptus gongylocarpa*. This community occurs on red-orange sandy loams on flats.
- E3** Low Open Woodland of *Eucalyptus gongylocarpa* over *Eucalyptus youngiana*, *Eucalyptus ceratocorys*, *Grevillea juncifolia*, *Hakea francisiana* and *Callitris preissii* over *Acacia helmsiana*, *Cryptandra distigma* and mixed low shrubs over *Triodia desertorum*, *Chrysitrix distigmata* and *Lepidobolus deserti*. This community occurs on yellow and yellow-orange sands on flats, slopes and between dunes.
- E4** Low Open Woodland of *Eucalyptus gongylocarpa* over *Callitris preissii* with *Hakea francisiana* and *Grevillea juncifolia* over *Bertya dimerostigma*, *Westringia cephalantha* and mixed shrubs over *Triodia rigidissima* and *Triodia desertorum*. This community occurs on orange sands on flats and slopes.
- E5** Low Open Woodland of *Eucalyptus gongylocarpa* over *Eucalyptus rigidula* and *Eucalyptus* sp. Mulga Rock with *Hakea francisiana* and *Grevillea juncifolia* over *Westringia cephalantha*, *Acacia helmsiana*, *Acacia rigens*, *Eremophila platythamnus* subsp. *platythamnus*, *Cryptandra distigma* and mixed low shrubs over *Triodia desertorum*, *Triodia rigidissima* and *Chrysitrix distigmata*. This community occurs on yellow and orange sands on flats and slopes.
- E6** Open Scrub Mallee to Very Open Scrub Mallee of *Eucalyptus rigidula* and/or *Eucalyptus* sp. Mulga Rock over *Acacia hemiteles*, *Hakea francisiana*, *Westringia rigida*, *Cryptandra distigma*, *Grevillea acuaria* and mixed low shrubs over *Triodia rigidissima* with *Halgania cyanea*. This community occurs on red-orange sandy loams on flats and low lying swales.
- E7** Open Scrub Mallee to Very Open Scrub Mallee of varying *Eucalyptus* spp. over *Grevillea acuaria*, *Acacia hemiteles*, *Cryptandra distigma*, *Westringia cephalantha* and mixed shrubs over *Triodia desertorum*. This community occurs on red-orange sandy loams in low lying swales.
- E8** Open Scrub Mallee to Very Open Scrub Mallee of *Eucalyptus ceratocorys* and *Eucalyptus mammensis* subsp. *mammensis* with *Eucalyptus youngiana*, *Hakea francisiana* and *Grevillea juncifolia* over *Acacia fragilis*, *Acacia helmsiana* and mixed low shrubs over *Triodia desertorum*, *Chrysitrix distigmata* and *Lepidobolus deserti* with emergent *Eucalyptus gongylocarpa*. This community occurs on yellow sands on flats and slopes.
- E9** Very Open Scrub Mallee of *Eucalyptus mammensis* subsp. *mammensis* with *Grevillea juncifolia* and *Hakea francisiana* over *Cryptandra distigma*, *Acacia ligulata* and mixed low shrubs over *Triodia desertorum* with emergent *Eucalyptus gongylocarpa*. This community occurs on yellow sand on slopes and flats.
- E10** Open Scrub Mallee to Very Open Scrub Mallee of *Eucalyptus concinna* with *Eucalyptus platycorys* over *Hakea francisiana*, *Cryptandra distigma*, *Acacia rigens* and mixed shrubs over *Triodia rigidissima* and *Chrysitrix distigmata* with *Leptosema chambersii*. This community occurs on orange-red sandy loams on slopes and flats.
- E11** Open Scrub Mallee to Very Open Scrub Mallee of *Eucalyptus platycorys* with *Eucalyptus concinna* over *Acacia helmsiana*, *Grevillea juncifolia*, *Hakea francisiana* and mixed shrubs over *Triodia desertorum* and *Chrysitrix distigmata*. This community occurs on orange-yellow sandy loams on slopes and flats.
- E12** Open Scrub Mallee to Very Open Scrub Mallee of *Eucalyptus trivalva* with *Eucalyptus rigidula* over *Hakea francisiana*, *Bertya dimerostigma*, *Acacia helmsiana*, *Cryptandra distigma* and *Grevillea juncifolia* over *Triodia rigidissima*, *Triodia desertorum*, *Chrysitrix distigmata* and *Halgania cyanea*. This community occurs on orange and red-orange sandy loams on flats and swales.

- E13:** Low open mallee woodland of *Eucalyptus youngiana* over low shrubland of *Grevillea didymobotrya* subsp. *didymobotrya*, *Cryptandra distigma*, *Banksia elderiana*, *Calothamnus gilesii*, *Acacia desertorum* var. *desertorum* and other *Acacia* spp. over open *Triodia* spp. hummock grassland with *Chrysitrix distigmata* and some low myrtaceous shrubs (and occasional emergent *Eucalyptus gongylocarpa*). This community occurs on orange-yellow sandy loams on lower slopes and flats.
- E14:** Low open mallee woodland of *Eucalyptus leptophylla* or *Eucalyptus horistes* over open low shrubland of *Daviesia ulicifolia* subsp. *aridicola*, *Callitris verrucosa* and mixed *Acacia* spp., over *Triodia* spp., *Androcalva melanopetala*, *Dysphania kalpari* and other short-lived perennial or annual herbs. This community occurs on highly leached red-brown-white sandy-clayey soils in swales and drainage areas.

**Acacia Woodland**

- A1** Low Woodland to Tall Shrubland of *Acacia aneura* over *Aluta maisonneuvei* subsp. *auriculata*, *Eremophila latrobei*, *Phebalium canaliculatum*, *Prostanthera* spp. and mixed shrubs. This community occurs on orange sandy loams or clay loams with some laterite pebbles on flats.

**Mixed Shrublands**

- S1** Shrubland of *Melaleuca hamata* with *Hakea francisiana* and mixed shrubs over *Triodia desertorum* with emergent *Eucalyptus* spp. This community occurs on yellow and orange sand on slopes and flats.
- S2** Shrubland of *Acacia sibina* with *Grevillea juncifolia* and *Eucalyptus youngiana* over *Phebalium canaliculatum*, *Grevillea acuaria* and mixed shrubs over *Triodia desertorum*. This community occurs on red clay loams in seasonally wet areas.
- S3** Shrubland of *Allocasuarina spinosissima* and *Allocasuarina acutivalvis* subsp. *acutivalvis* with *Grevillea juncifolia* and *Hakea francisiana* over *Triodia desertorum* with emergent *Eucalyptus youngiana* and *Eucalyptus gongylocarpa*. This community occurs on yellow sand on slopes.
- S4** Shrubland to Open Shrubland of *Acacia desertorum* var. *desertorum* and mixed low shrubs over *Triodia desertorum* with occasional emergent mallee *Eucalyptus* species. This community occurs on yellow or orange sands on mid-slopes.

- S5** Shrubland to Open Shrubland of *Acacia sibina* with *Phebalium tuberculatum* over *Enekbatus eremaeus*, *Bertya dimerostigma*, *Homalocalyx thryptomenoides*, *Baeckea* sp. Great Victoria Desert (A.S. Weston 14813), *Melaleuca hamata* and mixed low shrubs over *Triodia desertorum* and *Chrysitrix distigmata* with occasional emergent *Eucalyptus gongylocarpa* and *Eucalyptus youngiana*. This community occurs on yellow-orange sands on flats and lower slopes.
- S6** Low Shrubland of *Thryptomene biseriata*, *Allocasuarina spinosissima*, *Allocasuarina acutivalvis* subsp. *acutivalvis*, *Jacksonia arida*, *Calothamnus gilesii*, *Acacia fragilis*, *Conospermum toddii* (P4), *Pityrodia lepidota*, *Lomandra leucocephala*, *Anthotroche pannosa* and mixed low shrubs over *Triodia desertorum* with *Lepidobolus deserti* with emergent *Eucalyptus gongylocarpa*, *Eucalyptus youngiana*, *Eucalyptus ceratocorys* and *Eucalyptus mammensis* subsp. *mammensis*. This community occurs on yellow sand dunes.
- S7** Low Shrubland to Low Open Shrubland of *Enekbatus eremaeus*, *Acacia desertorum* var. *desertorum*, *Verticordia helmsii*, *Homalocalyx thryptomenoides*, *Leptospermum fastigiatum*, *Allocasuarina spinosissima*, *Baeckea* sp. Great Victoria Desert (A.S. Weston 14813), *Leptosema chambersii* and mixed low shrubs over *Triodia desertorum* and *Chrysitrix distigmata* with occasional emergent mallee *Eucalyptus* species, *Grevillea juncifolia* and *Hakea francisiana*. This community occurs on yellow and orange sands on lower slopes, undulating plains and swales.
- S8** Low Open Shrubland of *Calothamnus gilesii*, *Persoonia pertinax*, *Thryptomene biseriata*, and *Leptospermum fastigiatum* with *Anthotroche pannosa*, *Acacia helmsiana*, *Microcorys macredieana*, *Micromyrtus stenocalyx* and mixed low shrubs over *Triodia desertorum* with *Lepidobolus deserti*, *Chrysitrix distigmata* and *Caustis dioica* with emergent *Eucalyptus youngiana*, *Eucalyptus gongylocarpa* and *Eucalyptus ceratocorys*. This community occurs on yellow sands flats adjacent to yellow sand dunes and undulating sandplains.
- S9:** Low open shrubland of *Melaleuca hamata* and mixed *Acacia* species (including *Acacia fragilis*, *Acacia ligulata* and *Acacia sibina*) with *Hannafordia bissillii* subsp. *bissillii*, *Grevillea didymobotrya* subsp. *didymobotrya*, *Mirbelia seorsifolia* over *Triodia* spp. hummock grassland with *Leptosema chambersii*, *Chrysitrix distigmata*, *Aristida contorta* and *Goodenia xanthosperma*, with emergent eucalypt mallees. This community occurs on orange-red sandy-clay loam, in swales and on flats.
- S10:** Low open shrubland of *Banksia elderiana*, *Calothamnus gilesii*, *Grevillea didymobotrya* subsp. *didymobotrya*, *Acacia desertorum* var. *desertorum* and *Grevillea secunda* (P4) with *Leptospermum fastigiatum* and emergent *Eucalyptus youngiana* (and *Eucalyptus rosacea*) over *Triodia* spp. hummock grassland with *Chrysitrix distigmata*. This community occurs on orange-yellow undulating sandplains and flats.

**Chenopod Shrublands**

- C1** Low Chenopod Shrubland of *Atriplex ?vesicaria* with *Eremophila decipiens* subsp. *decipiens* and *Acacia colletioides*. This community occurs on red-brown clay loams on clay pans. *Callitris preissii* with *Eucalyptus* spp. over mixed shrubs are found in adjacent pockets.

**D** Disturbed

**Priority Species**

Code	Species	Status
Aen	Acacia eremophila numerous-nerved variant (A.S. George 11924)	P3
Aev	Acacia eremophila var. variabilis	P3
As	Acacia aff. sorophylla	Other
Bs	Baeckea ?sp. Sandstone (C.A. Gardner s.n. 26 Oct. 1963)	P3
Ct	Conospermum toddii	P4
Cta	Caesia talingka ms	P2
Cv	Comesperma viscidulum	P4
Dc	Dicrastylis cundeeleensis	P4
De	Dampiera eriantha	P1
E?u	Eremophila ?undulata	P2
Gs	Grevillea secunda	P4
Hc	Hibbertia crispula	P1 & Vulnerable
Hs139	Hakea sp. (LAC 139 13/04/14)	Other
Hs140	Hakea sp. (LAC 140 13/04/14)	Other
Ic	Isotropis canescens	P2
Le	Labichea eremaea	P3
Lp	Leucopogon aff. planifolius	Other
Mo	Malleostemon sp. Officer Basin (D. Pearson 350)	P2
Nl	Neurachne lanigera	P1
Oa	Olearia arida	P4
Pb	Ptilotus ?blackii	P3
Pc	Physopsis chrysotricha	P2
Sb	Schoenus sp. A1 Boorabbin (K.L. Wilson 2581)	Other
Sg	Styphelia sp. Great Victoria Desert (N. Murdock 44)	P2

**REFERENCE**

VEGETATION MAPPING - MATTISKE (MCPL, 2015A)

CLIENT  
VIMY RESOURCES LIMITED



PROJECT  
MULGA ROCK URANIUM PROJECT

CONSULTANT



YYYY-MM-DD	2015-10-23
DESIGNED	MS
PREPARED	MS
REVIEWED	GB
APPROVED	GB

TITLE

**VEGETATION UNIT DISTRIBUTION - LEGEND**

PROJECT NO.	CONTROL	REV.	FIGURE
1540340	B7	0	3B

25mm

## 2 INTRODUCTION

This report has been prepared for Vimy Resources Limited (Vimy) previously known as Energy and Minerals Australia Ltd (EAMA), and documents the reptile fauna recorded in the MRUP area. An interim report on the total vertebrate fauna was prepared in 2010 (Ninox Wildlife Consulting 2010), which included a description of the reptile fauna of the area. The study area is situated approximately 240km east-north-east of Kalgoorlie in dune fields on the western sector of the Great Victoria Desert (GVD), and 55 km north-east of Queen Victoria Spring, a Nature Reserve within the GVD.

A report by W.G. Martinick & Associates Pty Ltd (1986) provided historical data on a larger study area, which encompassed the current study area. This early report documented the flora, vegetation and vertebrate fauna of three survey areas: Emperor, Shogun and Ambassador. These three areas are shown in Figure 2. The 2009 Ninox survey concentrated on an area within Ambassador, with one trapline located within Shogun (Figure 3). This latter site was chosen specifically to sample for the endangered Sandhill Dunnart (*Sminthopsis psammophila*), which had been captured in this site in 1985.

In order to complete the assessment of the herpetofauna of the MRUP, this current report has been prepared using a substantial amount of data that is now available from the greater part of the GVD to the north-east of MRUP. These reports include several from the Tropicana Project Area (both the Mine and Exploration II/III Group) and are noted and referenced in text.

## 3 NOMENCLATURE, TAXONOMY AND DISTRIBUTION PATTERNS

The following literature sources have been used to discuss nomenclature, taxonomy and amphibian and reptile distribution patterns in this report: Tyler and Doughty (2009) and Wilson & Swann (2013).

Other, more recent, taxonomic revisions have been used when applicable. These are noted in text and are listed in References. In particular, the recent revision of two skink species (*Lerista* and *Cryptoblepharus*) has resulted in a large number of new skinks being added to the State's list (Smith and Adams 2007; Horner 2007).

## 4 STUDY OBJECTIVES

Prior to commencing this current report, Ninox was supplied with the results of motion-activated camera traps that had been placed within the MRUP between 2009 and 2014. The objectives were to:

1. review all reptile data captured on the motion-activated cameras and through opportunistic sightings by on-site personnel since 2009;
2. identify as many reptiles to species level as possible; and
3. add the results to the existing database and incorporate these results into this current document.

Secondly, Ninox was commissioned to review additional available data from the GVD with the objectives of:

1. reviewing all available herpetofauna data from the region, in particular, the results of the work conducted by E.R. Pianka, S. Churchill, G. Gaikhorst and C. Lambert, information from the Tropicana Gold Project, Department of Parks and Wildlife (DPaW) and the WA Museum;

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2. comparing the results of these data with the results from both Martinick and Ninox surveys within the MRUP;
3. updating the previous herpetofauna section of the 2009 Ninox report to produce a stand-alone document on the herpetofauna of the MRUP, with comparisons with all other available data from the region; and
4. including in the updated herpetofauna document a risk assessment of potential long-term changes to reptile habitats within the MRUP area.

The original study objectives were fulfilled by means of a spring field investigation (7<sup>th</sup> to 14<sup>th</sup> October 2009). The results of the survey plus an extensive literature review will provide adequate information to satisfy a Level 2 Detailed Survey as defined in the Environmental Protection Authority's Guidance Statement No. 56 (EPA 2004).

## 5 FAUNA HABITATS

Mattiske Consulting Pty Ltd (MCPL) provided a brief description of each of the 10 sites chosen for sampling during October 2009 (Plates 1-10). These sites represented the range of plant community types and soil variations present within the current sampling area, with three overlapping with the original 1985 sampling locations. Table 1 lists these sites, the plant community code, a brief description, and the coordinates taken at trap one in each location. Also shown are the original site codes for three sampling locations (PNC) documented in Martinick and Associates (1986). Figure 3 shows the 1985 and 2009 trapline locations within the MRUP. Full descriptions of the vegetation communities are provided in MCPL (2015).

**Table 1 List of systematic vertebrate fauna sampling sites within the MRUP.**

Fauna Site Code	PNC Site Code	Mattiske Plant Community Code	Description	Easting Northing GDA94
MR01	7	E6 with influence E5 species	Open Scrub Mallee to Very Open Scrub Mallee of <i>Eucalyptus rigidula</i> over <i>Westringia rigida</i> , <i>Grevillea acuaria</i> and mixed low shrubs over <i>Triodia desertorum</i> with <i>Halgania cyanea</i> . Low Open Woodland of <i>Eucalyptus gongylocarpa</i> over <i>Eucalyptus rigidula</i> with <i>Hakea francisiana</i> and <i>Grevillea juncifolia</i> over <i>Westringia cephalantha</i> , <i>Eremophila platythamnus</i> subsp. <i>platythamnus</i> and mixed low shrubs over <i>Triodia desertorum</i> .	575 160 6 680 830
MR02		E8	Open Scrub Mallee to Very Open Scrub Mallee of varying <i>Eucalyptus</i> spp. with <i>Hakea francisiana</i> and <i>Grevillea juncifolia</i> over <i>Westringia cephalantha</i> , <i>Acacia hemiteles</i> , <i>Acacia fragilis</i> , <i>Acacia helmsiana</i> and mixed low shrubs over <i>Triodia desertorum</i> with emergent <i>Eucalyptus gongylocarpa</i> .	573 052 6 682 213
MR03		E3	Low Open Woodland of <i>Eucalyptus gongylocarpa</i> over <i>Eucalyptus youngiana</i> , <i>Grevillea juncifolia</i> , <i>Callitris preissii</i> and <i>Hakea francisiana</i> over mixed low shrubs over <i>Triodia desertorum</i> with <i>Chrysitrix distigmata</i> and <i>Lepidobolus deserti</i> (P4).	575 537 6 683 050
MR04	3	E6	Open Scrub Mallee to Very Open Scrub Mallee of <i>Eucalyptus rigidula</i> over <i>Westringia rigida</i> , <i>Grevillea acuaria</i> and mixed low shrubs over <i>Triodia desertorum</i> with <i>Halgania cyanea</i> .	576 919 6 681 716
MR05		S6	Low Shrubland of <i>Thryptomene biseriata</i> , <i>Allocasuarina spinosissima</i> , <i>Jacksonia arida</i> (ms), <i>Calothamnus gilesii</i> , <i>Acacia fragilis</i> , <i>Conospermum toddii</i> (R), <i>Pityrodia lepidota</i> , <i>Lomandra leucocephala</i> , <i>Anthotroche pannosa</i> and mixed low shrubs over <i>Triodia desertorum</i> with <i>Lepidobolus deserti</i> (P4) and occasional emergent <i>Eucalyptus</i> spp. This community occurs on yellow sand dunes.	576 869 6 681 745

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Fauna Site Code	PNC Site Code	Mattiske Plant Community Code	Description	Easting Northing GDA94
MR06		Near ecotone of E5 and E3	Low Open Woodland of <i>Eucalyptus gongylocarpa</i> over <i>Eucalyptus youngiana</i> , <i>Grevillea juncifolia</i> , <i>Callitris preissii</i> and <i>Hakea francisiana</i> over mixed low shrubs over <i>Triodia desertorum</i> with <i>Chrysitrix distigmata</i> and <i>Lepidobolus deserti</i> (P4). Low Open Woodland of <i>Eucalyptus gongylocarpa</i> over <i>Eucalyptus rigidula</i> with <i>Hakea francisiana</i> and <i>Grevillea juncifolia</i> over <i>Westringia cephalantha</i> , <i>Eremophila platythamnus</i> subsp. <i>platythamnus</i> and mixed low shrubs over <i>Triodia desertorum</i> .	573 908 6 684 097
MR07		E5	Low Open Woodland of <i>Eucalyptus gongylocarpa</i> over <i>Eucalyptus rigidula</i> with <i>Hakea francisiana</i> and <i>Grevillea juncifolia</i> over <i>Westringia cephalantha</i> , <i>Eremophila platythamnus</i> subsp. <i>platythamnus</i> and mixed low shrubs over <i>Triodia desertorum</i> .	578 700 6 682 698
MR08		S7 next to track, then moves into E3	Low Shrubland to Low Open Shrubland of <i>Enekbatus eremaeus</i> , <i>Acacia desertorum</i> var. <i>desertorum</i> , <i>Verticordia helmsii</i> , <i>Homalocalyx thryptomenoides</i> , <i>Leptospermum fastigiatum</i> , <i>Baeckea</i> sp. Great Victoria Desert (A.S. Weston 14813) (P2), <i>Leptosema chambersii</i> and mixed low shrubs over <i>Triodia desertorum</i> and <i>Chrysitrix distigmata</i> with occasional emergent mallee <i>Eucalyptus</i> species, <i>Grevillea juncifolia</i> and <i>Hakea francisiana</i> . Low Open Woodland of <i>Eucalyptus gongylocarpa</i> over <i>Eucalyptus youngiana</i> , <i>Grevillea juncifolia</i> , <i>Callitris preissii</i> and <i>Hakea francisiana</i> over mixed low shrubs over <i>Triodia desertorum</i> with <i>Chrysitrix distigmata</i> and <i>Lepidobolus deserti</i> (P4).	574 930 6 683 986
MR09		S8 at top of slope, E3 at bottom	Low Open Shrubland of <i>Calothamnus gilesii</i> , <i>Persoonia pertinax</i> and mixed low shrubs with occasional emergent <i>Eucalyptus youngiana</i> and <i>Eucalyptus gongylocarpa</i> . Low Open Woodland of <i>Eucalyptus gongylocarpa</i> over <i>Eucalyptus youngiana</i> , <i>Grevillea juncifolia</i> , <i>Callitris preissii</i> and <i>Hakea francisiana</i> over mixed low shrubs over <i>Triodia desertorum</i> with <i>Chrysitrix distigmata</i> and <i>Lepidobolus deserti</i> (P4).	578 057 6 683 470
MR10	11	S1	Shrubland of <i>Melaleuca hamata</i> with <i>Hakea francisiana</i> and mixed shrubs over <i>Triodia desertorum</i> with emergent <i>Eucalyptus</i> spp.	566 315 6 688 517



**Plate 1 Fauna sampling site MR01 (PNC site 7).**



**Plate 2 Fauna sampling site MR02.**



**Plate 3 Fauna sampling site MR03.**



**Plate 4 Fauna sampling site MR04 (PNC site 3).**



**Plate 5 Fauna sampling site MR05.**



**Plate 6 Fauna sampling site MR06.**



**Plate 7 Fauna sampling site MR07.**





**Plate 8 Fauna sampling site MR08.**



**Plate 9 Fauna sampling site MR09.**



**Plate 10 Fauna sampling site MR10 (PNC site 11).**

## **6 METHODOLOGY**

The Ninox team members were:

Ninox Principal	Jan Henry	Survey leader and senior zoologist
Team members	Greg Harold	Assisting zoologist
	Maureen Francesconi	Senior ornithologist
	Kevin Fairbairn	Assisting ornithologist

The survey was carried out between 5<sup>th</sup> and 14<sup>th</sup> October 2009, under Department of Environment and Conservation (DEC) License Number SF007091. DEC has subsequently been renamed Department of Parks and Wildlife (DPaW).

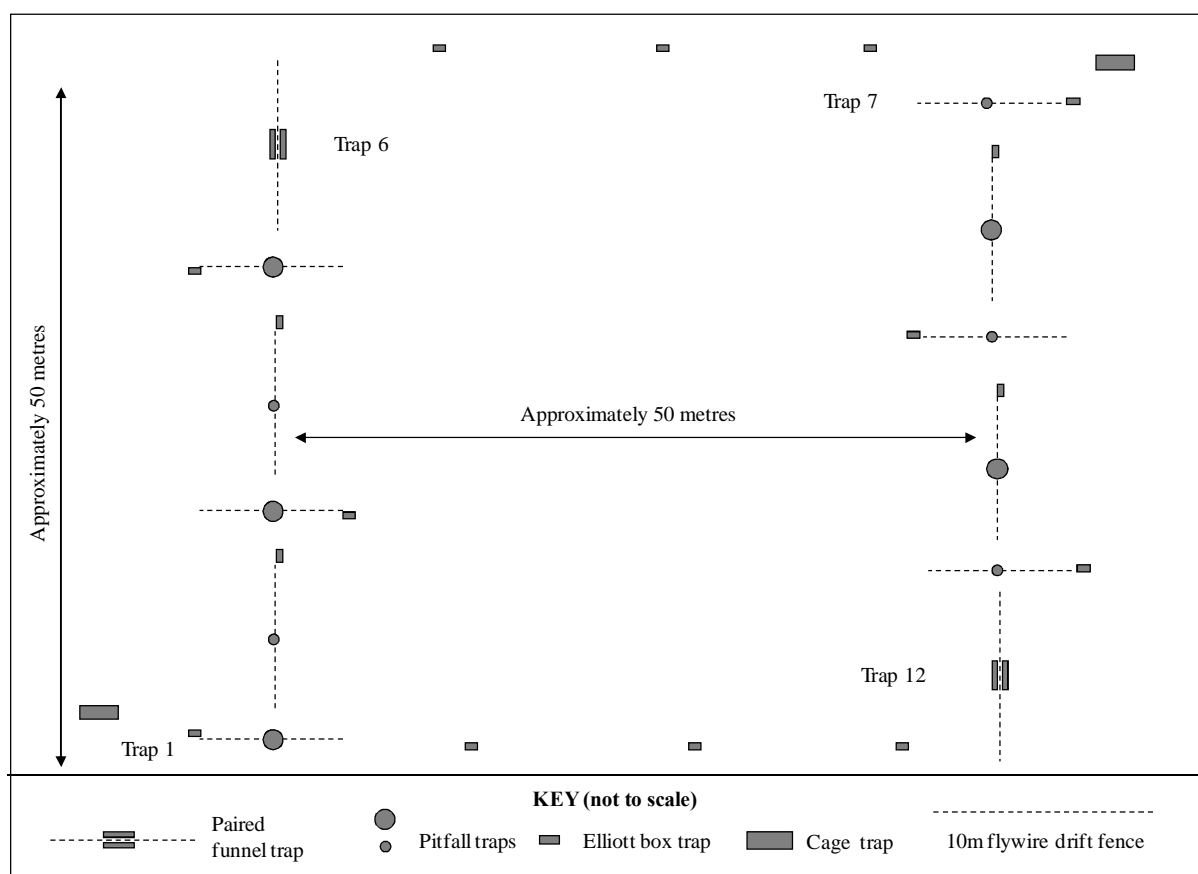
### **6.1 General Sampling**

Systematic sampling was conducted within 10 individual sites established in the dominant plant communities (as shown in Plates 1-10) within the MRUP in order to sample as many species of vertebrate fauna as possible. Two Ninox personnel were responsible for clearing traplines, identification and safe release of animals while concurrently, two additional personnel carried out systematic bird sampling. Once all traplines had been cleared and all systematic bird sampling had been completed, all four personnel conducted systematic sampling by hand-foraging for a set time period in each of the 10 sites. Opportunistic sampling by hand-foraging, nocturnal head-torching and vehicle spotlight runs was conducted throughout the MRUP.

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The ten traplines consisted of ten pitfall traps bisected across the top by 10 metres of flywire drift fence 300mm high. Five of the pitfall traps consisted of 15 litre plastic drums with custom-made plastic inserts to ensure that small vertebrates could not escape, and which gave shade during hot conditions. The lid of each plastic drum was also used to provide additional shade. The remaining five pitfall traps consisted of PVC pipe 160mm in diameter and 600mm deep. These deeper and narrower pitfall traps were specifically requested by the DEC to target the Sandhill Dunnart (*Sminthopsis psammophila*), which is listed at both a Federal and State level as endangered (Figure 4 shows a diagram of the trapline layout).

Surface traps in each site consisted of 16 medium Elliott box traps and two cage traps that were placed in association with the pitfall traps. Two additional 10 metre fence lines in each sampling location included two flywire funnel traps each. Traplines were monitored over eight consecutive nights during the survey (6<sup>th</sup> to 14<sup>th</sup> October 2009 inclusive) and were checked each morning. A grid reference (GDA94) was recorded at trap one in each sampling location (Table 1) to enable trapline positions to be accurately mapped. In addition to the trapping effort, nocturnal sampling consisted of spotlight runs from a vehicle and foot transects by all personnel using head-torches working within each sampling site and along tracks. Two camera traps were set on dune crests for three nights. Opportunistic sampling was carried out in locations away from the trapline sites, mainly adjacent to tracks and grid lines throughout the study area. A summary of trapping effort is provided in Table 2.



**Figure 4** *Diagrammatic layout of vertebrate fauna trapline used in the survey of the MRUP during October 2009.*

**Table 2 Summary of sampling effort used in the October 2009 survey within the MRUP (herptiles only).**

Trap Type	No. of Trapnights	Other Sampling	
Bucket pitfalls/fences	305	Spotlight runs	24.5 km / 6 hours
Tube pitfalls/fences	305	Head-torching	12 personnel hours
Elliott Traps	1058	Camera trap nights	6
Funnel Traps	244	Systematic hand-foraging	60 personnel hours
Cage Traps	124	Opportunistic hand-foraging	60 personnel hours
<b>Total</b>	<b>2036</b>		

Hand-foraging for cryptic reptiles consisted of searching through leaf-litter, under loose bark on dead trees, and under logs. Particular attention was paid to foraging through spoil heaps and under dead spinifex as both of these micro-habitats tends to support a wide range of species. Identifiable signs of reptiles such as scats, tracks and diggings were also noted.

Captured animals were identified and details of trapping location and method, sex, age and reproductive status (where possible) were recorded on field data sheets. The animals were released near their point of capture as soon as practicable.

## 6.2 Species Specific Sampling

### 6.2.1 Great Desert Skink (*Liopholis kintorei*)

The Great Desert Skink (*Liopholis kintorei*, previously known as *Egernia kintorei*) is listed as Vulnerable under both the Australian Environment Protection and Biodiversity Conservation Act (EPBC) 1999 and Schedule 1 the Western Australian Wildlife Conservation Act (WCA) 1950; therefore, particular effort was undertaken during the 2009 field survey to locate this species, or signs of its presence.

During all other activities by Ninox team members, special attention was given to searching for and identifying burrow systems and latrine piles that would indicate the presence of this reptile. In particular, the wide-ranging foot transects undertaken by the ornithologists surrounding each trapline increased the potential of finding large burrow systems within these locations. Afternoon hand-foraging by all team members focused on searching for signs of this species.

### 6.2.2 Woma (*Aspidites ramsayi*)

The Woma (*Aspidites ramsayi*) is listed on Schedule 4 (Specially Protected Fauna) of the Western Australian Wildlife Conservation Act (WCA) 1950 and, as such, was the focus of particular attention during the 2009 survey.

The Woma is rarely captured but may be seen opportunistically, particularly at dusk and during the early evening. Vehicle spotlight runs and foot transects using head-torches conducted by Ninox personnel during these time periods during the 2009 survey increased the chance of locating this snake.

### 6.2.3 Dotty-tailed Robust Slider (*Lerista puncticauda*)

The small skink *Lerista puncticauda* is listed as P2 on DPaWø's Priority Fauna listing. It has been recorded in arid shrublands in the vicinity of Queen Victoria Spring on the south-western edge of the GVD. Hand-foraging by the Ninox team was undertaken throughout the study area in an attempt to locate cryptic species such as this skink.

### 6.3 Weather Conditions

The following table shows the daily temperatures and rainfall in the region during the course of the October 2009 sampling session.

**Table 3** Minimum, maximum temperatures and rainfall experienced during the fauna survey within the MRUP in October 2009. Data extracted from Vimy resources environmental database, for the Emperor, Shogun and Ambassador weather stations

Date	6 Oct.	7 Oct.	8 Oct.	9 Oct.	10 Oct.	11 Oct.	12 Oct.	13 Oct.	14 Oct.
<b>Emperor</b>									
Min	8.7	13.3	12.7	10.5	15.5	14.6	6.9	8.5	8.5
Max	29.8	33.5	33.3	33.4	32.6	34.8	23.7	22.5	26.2
Rainfall	0	0	1.0	1.4	0	0	0	0	0
<b>Shogun</b>									
Min	9.8	14.8	11.7	8.7	13.2	10.5	2.7	6.1	7.8
Max	30.2	34.1	34.5	31.2	33.3	35.6	24.3	23.3	26.8
Rainfall	0	0	0	0.4	2.8	0	0	0	0
<b>Ambassador</b>									
Min	12.6	15.2	12.0	9.9	14.0	12.3	2.9	6.4	8.7
Max	29.6	34.3	34.3	31.1	33.2	34.7	24.5	23.5	27.1
Rainfall	0	0	0	2.4	0.6	0	0	0	0

## 7 RESULTS

### 7.1 Amphibians

No amphibians were recorded during the October 2009 survey or in the 1985 survey, although a small number of burrowing species and opportunistic breeders could occur in the MRUP; these would only be observed following sufficient rainfall. Only one amphibian, the Shoemaker Frog (*Neobatrachus sutor*) was listed in the updated review of DPaW's NatureMap for the general area (Appendix 1).

A single specimen of the Shoemaker Frog (*Neobatrachus sutor*) was recorded by Vimy staff near the Mulga Rock camp following heavy rainfall in January 2014, along with opportunistic sighting of tadpoles to the east of the MRUP.

### 7.2 Reptiles

A total of 42 species of reptile was recorded during October 2009. This consisted of six dragons, eight geckos, four legless lizards, 15 skinks, three monitors, two blind snakes and four elapid (venomous) snakes (Table 4). Although the total of 42 species was high for a single season survey such as this, the greatest number of species in any one location was 16 in sites MR05 and MR08. The lowest number of species in a site was recorded in MR10, with eight and MR03, with nine.

**Table 4** List of reptile species recorded during the October 2009 survey of the MRUP. (OP – results from opportunistic sampling.)

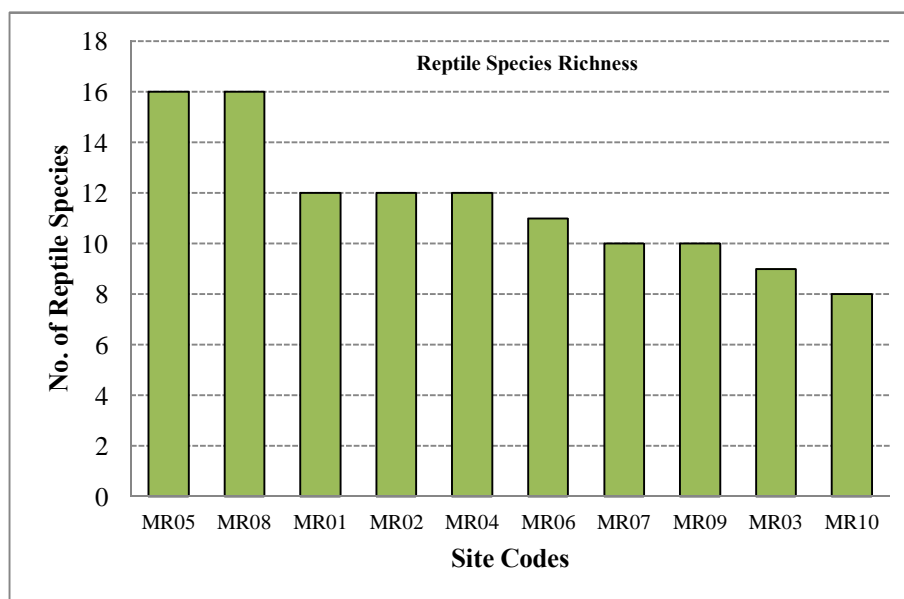
REPTILE SPECIES	Site Codes										
	MR 01	MR 02	MR 03	MR 04	MR 05	MR 06	MR 07	MR 08	MR 09	MR 10	OP
<b>CARPHODACTYLIDAE</b>	<b>Geckos</b>										
<i>Nephrurus laevis</i>	1	2	2		4	1	1	1	2		
<b>DIPLODACTYLIDAE</b>	<b>Geckos</b>										
<i>Diplodactylus conspicillatus</i>				9							
<i>Diplodactylus damaeus</i>					1	7		3	2	2	

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REPTILE SPECIES	Site Codes											OP
	MR 01	MR 02	MR 03	MR 04	MR 05	MR 06	MR 07	MR 08	MR 09	MR 10		
<i>Diplodactylus wiru</i>				1		2		2				
<i>Rhynchoedura ornata</i>								2				
<i>Strophurus assimilis</i>								1				
<b>GEKKONIDAE</b>	<b>Geckos</b>											
<i>Gehyra purpurascens</i>								1				1
<i>Gehyra variegata</i>							1					
<b>PYGOPODIDAE</b>	<b>Legless Lizards</b>											
<i>Delma australis</i>				1								
<i>Delma butleri</i>					1							
<i>Lialis burtonis</i>									1			
<i>Pygopus n. nigriceps</i>											1	
<b>SCINCIDAE</b>	<b>Skinks</b>											
<i>Ctenotus atlas</i>			1		2	1					1	
<i>Ctenotus brooksi</i>	2				2							
<i>Ctenotus pantherinus</i>				3				2				
<i>Ctenotus quattuordecimlineatus</i>	5			1				4				
<i>Ctenotus schomburgkii</i>	6	2	7	10	1	10	9	8	2	3		
<i>Cyclodomorphus melanops</i>			1									
<i>Egernia inornata</i>	1	2				2	2	1	1			3
<i>Lerista bipes</i>		3			2	1			3			
<i>Lerista desertorum</i>		1			1							
<i>Lerista rhodonoides</i>		1		1	1		2					
<i>Menetia greyii</i>	1	2	3	1	2	3	7		2			
<i>Morethia butleri</i>		1	2		5						1	
<i>Morethia obscura</i>	1											
<i>Proablepharus reginae</i>				2								
<i>Tiliqua occipitalis</i>	1										2	
<b>AGAMIDAE</b>	<b>Dragons</b>											
<i>Ctenophorus clayi</i>	1						1	1				
<i>Ctenophorus cristatus</i>								3				
<i>Ctenophorus fordi</i>		2	1		3							
<i>Ctenophorus isolepis</i>		1	3	10		1	3	2	1	2	6	
<i>Moloch horridus</i>	3	1	2	1	3	1	1	5	2		6	
<i>Pogona m. minor</i>	2							1	1		3	
<b>VARANIDAE</b>	<b>Monitors</b>											
<i>Varanus eremius</i>											1	
<i>Varanus gouldii</i>		1						1			3	
<i>Varanus tristis</i>					1	1						
<b>TYPHLOPIDAE</b>	<b>Blind Snakes</b>											
<i>Ramphotyphlops bituberculatus</i>				1								
<i>Ramphotyphlops bicolor</i>							1					
<b>ELAPIDAE</b>	<b>Venomous Snakes</b>											
<i>Brachyuropsis semifasciata</i>					1							
<i>Demansia psammophis</i>	1											
<i>Parasuta spectabilis</i>					1							
<i>Pseudonaja modesta</i>												1
<b>Number of Species (42)</b>	<b>12</b>	<b>12</b>	<b>9</b>	<b>12</b>	<b>16</b>	<b>11</b>	<b>10</b>	<b>16</b>	<b>10</b>	<b>8</b>	<b>7</b>	
<b>Number of Individuals</b>	<b>25</b>	<b>19</b>	<b>22</b>	<b>39</b>	<b>31</b>	<b>30</b>	<b>28</b>	<b>38</b>	<b>17</b>	<b>13</b>	<b>23</b>	

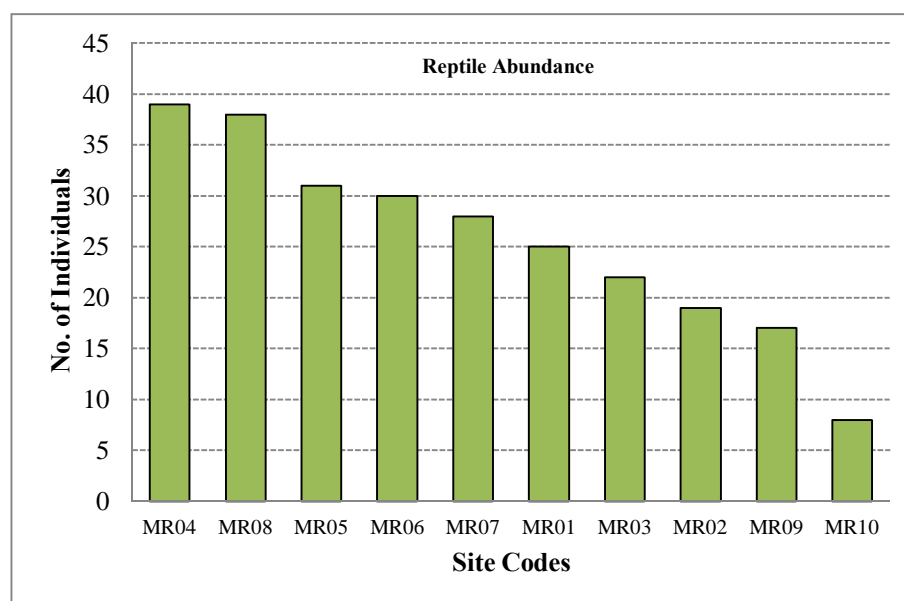
### *Mulga Rock Project Area – Herpetofauna 2015*

Table 4 and Figure 5 show that sites MR05 and MR08 had the highest number of species with 16 out of the possible 42. Three sites had 12 species: MR01, MR02 and MR04. Site MR06 had 11 species, MR07 and MR09 had 10 species. The remaining two sites, MR03 and MR10 had only nine and eight species, respectively.



**Figure 5** *Number of reptile species recorded in each site within the MRUP during October 2009.*

Table 4 and Figure 5 show that the greatest abundance of individuals was recorded in sites MR04 and MR08 with 39 and 38 reptiles respectively. Site MR05 also had relatively high numbers with 31 individuals. Four sites had between 20 and 30 individuals: MR01, MR03, MR06 and MR07. The lowest abundance was recorded in sites MR02, MR09 and MR10 with only 19, 17 and 13 individuals, respectively.



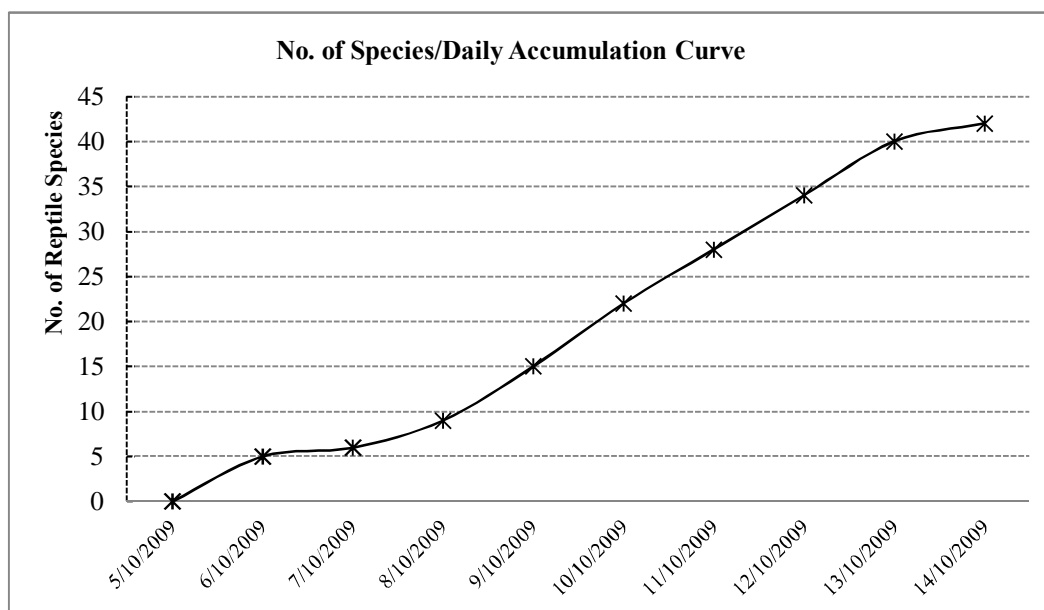
**Figure 6** *Number of individual reptiles recorded in each site within the MRUP during October 2009.*

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Table 4 shows that 15 reptile species were represented by single individuals; these were mainly legless lizards and snakes (blind and elapid). The most common reptile was the small skink, *Ctenotus schomburkii*, which was represented by 58 individuals. This was the only reptile species to be represented in all 10 sites. The small dragon, *Ctenophorus isolepis gularis*, was also relatively common, represented by 26 individuals through eight of the 10 sites. However, it must be acknowledged that some of these individual captures may be recaptures because reptiles are not marked during single field surveys such as this.

### 7.2.1 Sampling Efficacy

The following graphs are based on the daily accumulation of reptile species during systematic sampling between 6<sup>th</sup> and 14<sup>th</sup> October 2009 (opportunistic [OP] sampling results not used in this analysis).



**Figure 7** *Accumulation of reptile species over nine trap days/nights during 2009 within the MRUP.*

Figure 7 shows that after an initial capture of five species on the first day of sampling, only four additional species were recorded over the next two days. However, six species were added on the 9<sup>th</sup> October, with a further seven species on the following day. Six species were also added over each day for the next three days, with a final two species being added on the last day of sampling, bringing the total number of species to 42. Figure 11 shows this rapid addition of new species between 9<sup>th</sup> and 13<sup>th</sup> October, with only two species added to the area total on the final day of trapping. This indicates that there would continue to be a slow accumulation of species in the study area if sampling was continued but that the majority of common species had been recorded.

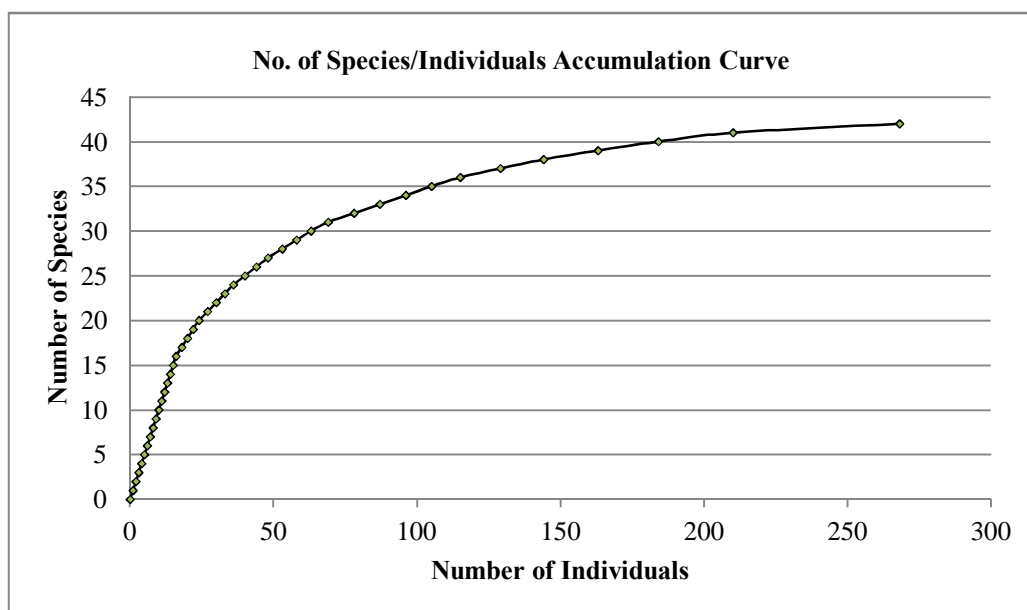
Similarly, Figure 8 also shows that there was a rapid rise in the number of species recorded for the first 150 individual reptiles captured (1 to 37 species), but only five additional species were added for the remaining 112 individuals. This also indicates that the majority of species that could occur within the MRUP had been recorded in this October 2009 field survey. As discussed earlier, it is likely that there would still be a slow accumulation of species as the number of individual captures increased.

While the number of species recorded is relatively high, it is clear from Figure 7 and Figure 8 that the number of reptile species was likely to continue to rise, given further sampling as neither graph



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reached an asymptote. This is further indicated in the following section when 1985, trail camera results and recent opportunistic sightings are discussed.



**Figure 8** Accumulation of reptile species graphed against number of individuals recorded during the October 2009 survey of the MRUP.

#### 7.2.2 Comparisons with 1985 and Camera Trapping 2009-14

Table 5 shows the number of species recorded in both 1985 and 2009. However, the 1985 survey was conducted in winter when reptiles are least active and, therefore, they were not commonly recorded. In addition, it is not possible to differentiate the opportunistic results between the three study areas (Emperor, Shogun and Ambassador) surveyed during 1985 from the Martinick and Associates (1986) report; the majority of the species recorded appear to have been hand-foraged and these captures are not shown relative to the sites sampled. Actual trapping results from the sampling sites within Ambassador show that only four species were recorded by trapping during winter 1985. Therefore, the 1985 list of reptile species does not represent those recorded only within the current 2009 survey area.

**Table 5** List of reptile species recorded during June/July 1985 and October 2009 within the MRUP. The 2009-14 records are species identified from trail camera photos and opportunistic sightings.

REPTILE SPECIES		1985	2009	2009-14
<b>CARPHODACTYLIDAE</b>	<b>Geckos</b>			
<i>Nephurus laevissimus</i>		X	X	
<b>DIPODACTYLIDAE</b>	<b>Geckos</b>			
<i>Diplodactylus conspicillatus</i>			X	
<i>Diplodactylus wiru</i>			X	
<i>Lucasium damaeum</i>			X	X
<i>Rhynchoedura ornata</i>			X	
<i>Strophurus assimilis</i>			X	
<i>Strophurus elderi</i>		X		
<b>GEKKONIDAE</b>	<b>Geckos</b>			
<i>Gehyra purpurascens</i>		X	X	
<i>Gehyra variegata</i>		X	X	

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REPTILE SPECIES		1985	2009	2009-14
<b>PYGOPODIDAE</b>	<b>Legless Lizards</b>			
<i>Delma australis</i>			X	
<i>Delma butleri</i>			X	
<i>Delma petersoni</i>		X		
<i>Lialis burtonis</i>			X	
<i>Pygopus n. nigriceps</i>			X	X
<b>SCINCIDAE</b>	<b>Skinks</b>			
<i>Ctenotus atlas</i>		X	X	
<i>Ctenotus brooksi</i>		X	X	
<i>Ctenotus leae</i>		X		
<i>Ctenotus pantherinus</i>			X	
<i>Ctenotus quattuordecimlineatus</i>		X	X	
<i>Ctenotus schomburgkii</i>		X	X	
<i>Cyclodomorphus melanops</i>		X	X	
<i>Lerista bipes</i>		X	X	
<i>Lerista desertorum</i>			X	
<i>Lerista timida</i>		X	X	
<i>Liopholis inornata</i>		X	X	
<i>Menetia greyii</i>		X	X	
<i>Morethia butleri</i>		X	X	
<i>Morethia obscura</i>			X	
<i>Proablepharus reginae</i>			X	
<i>Tiliqua occipitalis</i>			X	
<b>AGAMIDAE</b>	<b>Dragons</b>			
<i>Ctenophorus clayi</i>			X	
<i>Ctenophorus cristatus</i>			X	X
<i>Ctenophorus fordi</i>			X	X
<i>Ctenophorus isolepis</i>		X	X	X
<i>Ctenophorus nuchalis</i>		X		X
<i>Moloch horridus</i>		X	X	X
<i>Pogona minor</i>			X	X
<b>VARANIDAE</b>	<b>Monitors</b>			
<i>Varanus eremius</i>		X	X	X
<i>Varanus gouldii</i>		X	X	X
<i>Varanus tristis</i>			X	X
<b>TYPHLOPIDAE</b>	<b>Blind Snakes</b>			
<i>Ramphotyphlops bituberculatus</i>			X	
<i>Ramphotyphlops bicolor</i>			X	
<b>BOIDAE</b>	<b>Pythons</b>			
<i>Aspidites ramsayi</i>				X
<b>ELAPIDAE</b>	<b>Venomous Snakes</b>			
<i>Brachyuropsis semifasciata</i>			X	
<i>Demansia psammophis</i>			X	
<i>Parasuta spectabilis</i>			X	
<i>Pseudonaja mengdeni</i>				X
<i>Pseudonaja modesta</i>			X	X
<b>Number of species (48)</b>		<b>21</b>	<b>42</b>	<b>14</b>

Table 5 shows that three species were recorded during 1985 that were not recorded during October 2009; these were one gecko, one legless lizard and one dragon. In addition, three of the 14 reptile species recorded by Vimy staff (opportunistic sightings), or by the trail cameras since 2009 were not

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recorded during the 2009 survey; these were the dragon *Ctenophorus nuchalis* (recorded in 1985); the Woma (*Aspidites ramsayi*) and the Gwardar (*Pseudonaja mengdeni*).

A total of 48 species of reptile are known to be present in, or in the vicinity of, the MRUP. These reptiles are comprised of nine geckos, five legless lizards, 16 skinks, seven dragons, three monitors, two blind snakes, one python and five elapid snakes. Twenty-one species were recorded in 1985, 42 in 2009, and 14 species have been identified from the opportunistic photographs taken by Vimy staff or by the trail cameras. It can be seen from these photographs that dragon and monitor species are particularly well represented in the photos. The photographs provided below show three monitor species, *Varanus eremius*, *Varanus gouldii* and *Varanus tristis* taken with the same trail camera on 20<sup>th</sup>, 23<sup>rd</sup> and 24<sup>th</sup> November 2014 respectively.



Plate 11 Pigmy Desert Monitor (*Varanus eremius*)



Plate 12 Gould's or Sand Goanna (*Varanus gouldii*)



**Plate 13 Black-headed or Freckled Monitor (*Varanus tristis*)**

Four species were recorded in 1985 that were not captured in 2009: the gecko *Strophurus elderi*; the legless lizard *Delma fraseri*; the skink *Ctenotus leae*; and the dragon *Ctenophorus nuchalis*. These species were uncommon during 1985; with three, one and one individuals captured, respectively. None of these species were trapped; all being recorded during hand-foraging; therefore, no habitat information is available for these species.

## 8 DISCUSSION

### 8.1 Study Limitations

The herpetofauna survey described in this report was based on an intensive field investigation by highly experienced personnel. Table 6 lists the potential constraints to the adequacy of fauna survey work as detailed in the Environmental Protection Authority Guidance Statement 56 (EPA 2004) and addresses each of the points.

**Table 6 Statement of study limitations.**

Possible Limitations	Constraints (Yes/No): Significant, Moderate or Negligible	Comment
Competency/experience of the consultant conducting the survey	No Constraint	All field survey team members have extensive experience in fauna surveys and species identification over all fauna assemblages.
Scope	No Constraint	While the survey was conducted in order to sample all vertebrate faunal groups, this report discusses only the amphibian and reptile fauna of the MRUP area. Survey methods were discussed with DEC (now DPaW) prior to the survey. Methods included all of the current sampling techniques; followed by extensive trail camera use by Vimy. Access to all habitat types was unconstrained. Database searches and a literature review provided adequate information for habitat assessment.

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Possible Limitations	Constraints (Yes/No): Significant, Moderate or Negligible	Comment
Proportion of fauna identified, recorded and/or collected.	No constraint	All reptiles captured were identified to species level. No animals were collected. All field personnel have extensive experience in the identification of each faunal group, with particular expertise in reptile identification by G. Harold.
Sources of information	No Constraint	Vertebrate fauna information was available using the NatureMap database (Department of Parks and Wildlife). Detailed information was available from surveys conducted within GVD area. These are noted in text and listed in References.
Proportion of the task achieved and further work that may need to be undertaken	Potential Constraint	Within Ambassador, the study area was sufficiently sampled to satisfy a Level 2 Comprehensive Survey, obtain habitat values and to assess the potential for fauna of conservation significance to be present. Other sections of the MRUP area have not been surveyed to this level.
Timing/weather/season/cycle	No Constraint	Weather conditions during the field work were suitable for sampling of all vertebrate groups.
Disturbances which affected results of the survey	No constraint	There was no disturbance to the survey area.
Intensity	No constraint	Survey intensity was adequate to define major fauna habitats within the Ambassador study area and the potential for these habitats to support faunal assemblages.
Completeness (e.g. Was relevant area fully surveyed?)	Potential Constraint	The scope of work at the time of the survey included only the Ambassador area, with one trapline located within Shogun specifically in order to sample for the Sandhill Dunnart.
Remoteness and/or access problems	No constraint	Existing tracks provided excellent access to all fauna habitats within the survey area.
Availability of contextual (e.g biogeographic) information on the region.	Potential Constraint	There is a substantial amount of information available on the herpetofauna data from the region, in particular, the results of the work conducted by E.R. Pianka, S. Churchill, G. Gaikhorst and C. Lambert, information from the Tropicana Gold Project, Department of Parks and Wildlife (DPaW) and the WA Museum. All of this regional data was used in this current report.

## 8.2 Amphibians

The lack of amphibian records from either 1985 or 2009 sampling is not surprising given the lack of substantial rainfall which would initiate breeding by this group of species. Only one species of frog is listed on Appendix 1 indicating that this is a largely under-sampled group of animals. However, only four species of frog are listed in Tyler and Doughty (2009) as occurring in the Kalgoorlie area and these mainly require areas subject to seasonal flooding such as claypans for breeding. This habitat does not occur in the current MRUP study area; therefore it is unlikely that frogs form a significant component of the fauna of the area.

Two amphibian specimens from the genus *Neobatrachus* were lodged in the WA Museum from the survey of the operational area at Tropicana (*ecologia* Environment 2009) but could not be identified to species level. No frogs have been documented in the scientific papers resulting from the many years of

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surveys conducted by Pianka in the GVD. A total of five specimens of the Shoemaker Frog (*Neobatrachus sutor*) were recorded in the GVD section of the 2014 Fauna survey for the Sunrise to Tropicana gas pipeline (Kingfisher, 2014).

### 8.3 Reptiles

The inventory of reptile species recorded from the MRUP is extensive with 42 being captured or observed during 2009. Twenty-one species of reptile were recorded during the 1985 survey by Martinick and Associates (1986), four of which were not recorded in 2009 (Table 5). Nineteen species were recorded by Churchill in the Mulga Rock area in 1999 (Churchill 2001), four of which had not been recorded in other studies. In addition, the results from trail cameras show 14 identifiable species, three of which were not recorded during 2009. As a result of all of these studies, a total of 53 species are known to occur in the immediate vicinity of the MRUP.

Table 6 has been constructed from a range of sources, the majority of which have consisted of long-term studies within the GVD. For example, Pianka has published results from many surveys conducted between 1966 and 1992 (lizards only) from a wide range of locations and habitats within the GVD (Pianka 1989, 1996). Pianka's main study area was 38 km east of Laverton, some 170 km north-west of Mulga Rock. Also included in Table 6 are the results from the Churchill (2001) survey within the Mulga Rock area, and the Tropicana Project Area, which lies some 100 km north-east of Mulga Rock, (*ecologia* 2009, Gaikhorst and Lambert 2008). A search of DPaW's NatureMap database was also conducted for this report (Appendix 1) and the results of this search, while containing many of the records from these previously listed surveys (Fauna Licence returns), also shows historical and more recent records from the general area.

**Table 7** *List of amphibian and reptile species known to occur in the vicinity of the MRUP. (\*Date – see Reference list at end of Table.)*

Reference Date *	Mulga Rock				Great Victoria Desert				
	1985	1999	2009	2009-14	1966-1992	2000-2008	2009	2014	2015
<b>AMPHIBIAN SPECIES</b>									
<b>MYOBATRACHIDAE - Frogs</b>									
<i>Neobatrachus sutor</i>								X	X
<i>Neobatrachus</i> sp.							X		
<b>REPTILE SPECIES</b>									
<b>CARPHOACTYLIDAE - Geckos</b>									
<i>Nephrurus laevis</i>	X		X			X	X	X	X
<i>Nephrurus levis</i>					X	X	X	X	
<b>DIPODACTYLIDAE - Geckos</b>									
<i>Diplodactylus conspicillatus</i>			X		X	X	X	X	X
<i>Diplodactylus granariensis</i>		X				X	X		X
<i>Diplodactylus pulcher</i>						X			
<i>Diplodactylus wiru</i>			X						X
<i>Lucasium damaeum</i>		X	X	X		X	X	X	X
<i>Lucasium squarrosus</i>						X			
<i>Lucasium bungabinna</i>					X	X			
<i>Rhynchoedura ornata</i>			X		X	X	X	X	X
<i>Strophurus assimilis</i>			X			X		X	X
<i>Strophurus elderi</i>	X				X	X	X	X	X
<i>Strophurus strophurus</i>						X	X		
<i>Strophurus wellingtonae</i>						X			
<b>GEKKONIDAE - Geckos</b>									
<i>Gehyra purpurascens</i>	X	X	X		X	X	X	X	X

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Reference Date *	Mulga Rock				Great Victoria Desert				
	1985	1999	2009	2009-14	1966-1992	2000-2008	2009	2014	2015
<i>Gehyra variegata</i>	X		X		X	X	X	X	X
<i>Heteronotia binoei</i>					X	X	X	X	
<b>PYGOPODIDAE - Legless Lizards</b>									
<i>Delma australis</i>			X			X			X
<i>Delma butleri</i>		X	X		X	X	X		X
<i>Delma nasuta</i>					X		X	X	
<i>Delma petersoni</i>	X				X	X	X	X	X
<i>Lialis burtonis</i>			X		X	X	X		X
<i>Pygopus n. nigriceps</i>		X	X	X	X	X	X	X	X
<b>SCINCIDAE - Skinks</b>									
<i>Cryptoblepharus plagiocephalus</i>					X				
<i>Cryptoblepharus australis</i>							X		
<i>Ctenotus ariadnae</i>					X		X		
<i>Ctenotus atlas</i>	X	X	X			X			X
<i>Ctenotus brooksi</i>	X		X			X	X	X	X
<i>Ctenotus calurus</i>					X	X	X	X	
<i>Ctenotus dux</i>						X	X	X	
<i>Ctenotus grandis</i>					X	X	X		
<i>Ctenotus greeri</i>							X	X	
<i>Ctenotus helenae</i>		X			X	X	X	X	X
<i>Ctenotus leae</i>	X					X			X
<i>Ctenotus leonhardii</i>							X	X	
<i>Ctenotus pantherinus ocellifer</i>			X		X	X	X	X	X
<i>Ctenotus piankai</i>					X				
<i>Ctenotus quattuordecimlineatus</i>	X	X	X		X	X	X	X	X
<i>Ctenotus schomburgkii</i>	X	X	X		X	X	X	X	X
<i>Cyclodomorphus melanops</i>	?X		X		X	X	X		X
<i>Egernia depressa</i>								X	
<i>Egernia kintorei</i>					X				
<i>Eremiascincus richardsonii</i>		X				X	X	X	X
<i>Lerista bipes</i>	X	X	X		X	X	X	X	X
<i>Lerista desertorum</i>			X			X	X	X	X
<i>Lerista labialis</i>						X	X		
<i>Lerista puncticauda</i>									X
<i>Lerista taeniata</i>							X		X
<i>Lerista timida</i>	X		X		X	X	X	X	X
<i>Lerista tridactyla</i>						X			
<i>Liopholis inornata</i>	X		X		X	X	X	X	X
<i>Liopholis striata</i>					X	X	X		X
<i>Menetia greyii</i>	X		X		X	X	X	X	X
<i>Morethia butleri</i>	X		X		X	X	X	X	X
<i>Morethia obscura</i>		X	X						X
<i>Proablepharus reginae</i>			X			X	X	X	X
<i>Tiliqua multifasciata</i>							X		
<i>Tiliqua occipitalis</i>			X	X	X	X	X	X	X
<i>Tiliqua rugosa</i>						X			
<b>AGAMIDAE - Dragons</b>									
<i>Ctenophorus clayi</i>			X			X	X		X
<i>Ctenophorus cristatus</i>			X	X		X	X	X	X
<i>Ctenophorus fordi</i>			X	X?		X	X	X	X

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Reference Date *	Mulga Rock				Great Victoria Desert				
	1985	1999	2009	2009-14	1966-1992	2000-2008	2009	2014	2015
<i>Ctenophorus isolepis</i>	X	X	X	X	X	X	X	X	X
<i>Ctenophorus nuchalis</i>	X			X	X	X	X		X
<i>Ctenophorus reticulatus</i>							X		
<i>Ctenophorus scutulatus</i>						X		X	
<i>Diporiphora amphiboluroides</i>							X		
<i>Diporiphora lingua</i>						X			X
<i>Diporiphora reginae</i>						X	X	X	X
<i>Gowidon longirostris</i>							X		
<i>Moloch horridus</i>	X	X	X	X	X	X	X	X	X
<i>Pogona minor</i>		X	X	X	X	X	X	X	X
<b>VARANIDAE - Monitors</b>									
<i>Varanus brevicauda</i>							X		
<i>Varanus eremius</i>	X	X	X	X	X	X	X		X
<i>Varanus giganteus</i>					X		X	X	
<i>Varanus gilleni</i>							X		
<i>Varanus gouldii</i>	X	X	X	X	X	X	X	X	X
<i>Varanus panoptes</i>								X	
<i>Varanus tristis</i>			X	X	X	X	X	X	X
<b>TYPHLOPIDAE - Blind Snakes</b>									
<i>Ramphotyphlops australis</i>						X			
<i>Ramphotyphlops bicolor</i>			X			X			
<i>Ramphotyphlops bituberculatus</i>			X			X			
<i>Ramphotyphlops endoterus</i>							X		
<b>BOIDAE - Pythons</b>									
<i>Aspidites ramsayi</i>				X		X	X		
<i>Morelia spilota imbricata</i>						X			
<b>ELAPIDAE - Venomous Snakes</b>									
<i>Acanthophis pyrrhus</i>							X		
<i>Brachyuropis fasciolatus</i>		X				X	X	X	X
<i>Brachyuropis semifasciatus</i>		X	X			X	X	X	
<i>Demansia psammophis</i>			X			X	X	X	X
<i>Neelaps bimaculatus</i>							X		
<i>Parasuta monachus</i>						X	X	X	X
<i>Parasuta spectabilis</i>			X						X
<i>Pseudechis australis</i>						X	X		X
<i>Pseudechis butleri</i>						X			
<i>Pseudonaja mengdeni</i>				X		X	X		
<i>Pseudonaja modesta</i>			X	X		X	X		X
<i>Simoselaps bertholdi</i>						X	X	X	X
<b>Number of species - 98</b>	<b>21</b>	<b>19</b>	<b>42</b>	<b>15</b>	<b>39</b>	<b>72</b>	<b>1+73</b>	<b>49</b>	<b>1+55</b>

\*

**Mulga Rock**

1985 - Martinick and Associates 1986  
 1999 - Churchill 2001  
 2009 - Ninnox Wildlife Consulting 2010  
 2009-14 - Camera trap results

**Great Victoria Desert**

1966-1992 - Pianka 1996  
 2000-2008 - Gaikhorst and Lambert 2009  
 2009 - *ecologia* 2009  
 2014 - Kingfisher 2013-2014  
 2015 - NatureMap search results

Table 7 shows that a total 97 species of reptile are known from the GVD as listed in the documents referenced above. Table 7 summarises these into the various groups; the 97 species are made up of 17



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geckos, six legless lizards, 36 skinks, 13 dragons, 7 monitors, 4 blind snakes, 2 pythons and 12 venomous (elapid) snakes.

**Table 8 Summary of reptile groups known to occur within the GVD.**

Species recorded & known to occur in the vicinity of MRUP	1985	1999	2009	Photos	Total for MRUP	1966-1992	2008	2009	2014	2015
Geckos (17)	4	3	8	1	10	8	16	11	10	10
Legless Lizards (6)	1	2	4	1	5	5	5	6	3	5
Skinks (35)	11	7	15	1	19	18	24	25	19	21
Dragons (13)	3	3	6	6	7	4	10	12	7	9
Monitors (6)	2	2	3	3	3	4	3	6	4	3
Blind Snakes (4)	0	0	2	0	2	N/A	3	1	0	0
Pythons (2)	0	0	0	1	1	N/A	2	1	0	0
Venomous Snakes (12)	0	2	4	2	6	N/A	9	10	5	7
<b>Total (95)</b>	<b>21</b>	<b>19</b>	<b>42</b>	<b>15</b>	<b>53</b>	<b>39</b>	<b>72</b>	<b>72</b>	<b>48</b>	<b>55</b>

A number of species listed in Table 7 occur mainly within Mulga or other woodland and shrubland vegetation communities on hard stony soils, habitats not present within the MRUP study area under discussion (Mulga Rock East, previously Ambassador). As a result, some of the species known to occur in other locations within the GVD are unlikely to be present in the current study area. These include geckos such as *Lucasium squarrosus* and *Strophurus wellingtonae*, skinks such as *Ctenotus leonhardii* and *Lerista tridactyla*, and dragons such as *Ctenophorus reticulatus*, *Ctenophorus scutulatus* and *Diporiphora amphiboluroides*. Some snakes such as *Parasuta monachus* and *Pseudechis butleri* are also generally found to occur on hard soils. Other species known to occur within the Tropicana Project Area are at the limits of their distribution and may not occur in the MRUP. This includes skinks such as *Ctenotus dux*, *Ctenotus grandis*, *Ctenotus greeri* and *Lerista labialis*. Given the limitations mentioned above (lack of woodlands/shrublands on heavy soils), it can be seen from Tables 6 and 7 that most groups of reptiles are moderately well represented although the number of skink species in particular would almost certainly rise with additional sampling. In particular, as shown in Section 7.2, many species were represented by single individuals and it is likely that these species would be shown to be more common and widespread through the habitats of the MRUP given further sampling.

Several authors including Thompson and Thompson (2002) and How (1998) discuss the need for extensive sampling in both temporal and spatial scales in order to more fully document the biodiversity of the fauna of an area. In addition, Cowan and How (2004) conclude that short-term studies infrequently encounter threatened and/or rare ground-dwelling vertebrate fauna species and, therefore, do not provide adequate information to assist land managers.

## 9 REPTILE SPECIES OF CONSERVATION SIGNIFICANCE

Descriptions of the various fauna conservation acts, both Federal (Department of the Environment [DotE [www.environment.gov.au](http://www.environment.gov.au)]), and Western Australian (administered by the DPaW) are provided in Appendix 2.

Three species of conservation significance that are known to occur in the GVD are discussed in the following sections.

### 9.1 Great Desert Skink (*Liopholis kintorei*)

The Great Desert Skink (*Liopholis kintorei*, previously known as *Egernia kintorei*), is listed as Vulnerable under both the EPBC Act 1999 and WCA 1950. The type specimen of this species was collected in 1891 from the northern Great Victoria Desert, about 150km SE of Warburton (McAlpin 2001). The preferred habitat of this species appears to consist of arid sand flats and clay-based or loamy soils vegetated with spinifex (Wilson and Swan 2013).

The Great Desert Skink Recovery Plan (McAlpin 2001) states that:

*“The Great Desert Skink constructs large burrow systems to a depth of over 1m and 10m in diameter. The burrow may start as a simple single tunnel with one entrance. New tunnels are added progressively and over a period of two summers a complex with 5-10 entrances and a network of connected tunnels five or six metres across may develop. A burrow system that is inhabited for many years may become very large. On the surface the burrow system of the Great Desert Skink is identifiable by at least one large external latrine. Scats are deposited in the latrine by the occupants of the burrow system and a large number of scats may accumulate over an area of one to three square metres.”*

The Great Desert Skink is a large, burrowing reptile that has declined throughout its range with many sites no longer supporting populations (McAlpin 1997). DotE states that three populations occur in WA at Patjarr (population estimated to be less than 2500 individuals), near the Kiwirrkura community, including the vicinity of Lake Mackay (<500 individuals), and in Rudall River National Park (unknown population size).

One specimen of this species was recorded by Pianka in the GVD (Area L ó 24 miles east of Laverton, WA) in 1967 (Pianka 1969) but has not been recorded by him subsequently.

While not recorded in 1985, 1999 or 2009, specific searches for the latrine piles described above were undertaken during October 2009 but none was found.

### 9.2 Woma (*Aspidites ramsayi*)

The Woma (*Aspidites ramsayi*) is listed on Schedule 4 of the WCA 1950; it is also listed as P1 on DPaW’s Priority Fauna listing. It occurs in woodlands, shrublands and heaths often associated with spinifex in the subhumid to arid interior and south western arid areas of WA (Wilson and Swan 2013).



**Plate 14 Woma (*Aspidites ramsayi*) photographed at MRUP.**

The Woma was not recorded in 1985, 1999 or 2009 although a fresh road kill specimen was retrieved by Vimy personnel on 26<sup>th</sup> November 2008 at 1700 hrs just north of Ninox site MR03 on the Nippon Highway. There have been several additional recordings and photographs of this python between 2009 and 2014 by Vimy personnel; the photograph of the Woma shown in Plate 14 was taken in February 2011.

### 9.3 Dotty-tailed Robust Slider (*Lerista puncticauda*)

The small skink *Lerista puncticauda* is listed as P2 on DPaW's Priority Fauna listing. It has been recorded in arid shrublands in the vicinity of Queen Victoria Spring on the south-west edge of the GVD. First recorded in 1988, approximately 25 km NNE of Queen Victoria Spring and described as a new species in 1991 (Storr 1991). This small skink has not been recorded elsewhere in the GVD or environs. It was not recorded during the 2009 Ninox survey of the MRUP.

## 10 POTENTIAL IMPACT (RISK ASSESSMENT)

The effect of mine development on fauna in arid areas can be divided into three primary areas of impact. These are:

- ◆ removal of vegetation for exploration, construction of infrastructure, and mining;
- ◆ changes to fire regimes and subsequent effects on vegetation and fauna habitats; and,
- ◆ provision of permanent water supplies.

While larger reptiles such as monitors may be able to avoid the impact of clearing for exploration, mining and construction of infrastructure, most burrowing frogs and small reptiles, being more sessile/less mobile, will be at greater risk to impact from the large machinery used for vegetation removal and ground preparation, or by exposure to predators. While the local impact on individual animals is high, the clearing will have very little impact on the majority of species overall.

The following sections describe the potential impact of mining activities on vertebrate fauna and suggested impact reduction methods.

### 10.1 Vegetation Clearing

Vegetation clearing and soil disturbance result in an impact on fauna as follows:

- ◆ death and/or injury to individual frogs and reptiles, particularly smaller species that cannot escape from large machinery;
- ◆ displacement of larger, more active reptiles into adjacent areas causing increased stress on existing populations;
- ◆ increased risk of predation by both native and introduced predators as individuals move through cleared areas to undisturbed habitat;
- ◆ fragmentation of existing habitat;
- ◆ loss of habitat.

Table 8 lists the proposed disturbance area for the MRUP.

**Table 9** MRUP development envelope / disturbance footprint figures.

MRUP	Area (ha)
Development Envelope	9,998
Open cut pits and dewatering infrastructure	2,374
Reinjection infrastructure ó borefield and pipelines	45
Overburden landforms and soil stockpiles	937
Roads, borrow pits and services including corridor for slurry pipelines	143
Processing plant, ROM stockpiles and administration buildings	41
Accommodation village	7
Above ground TSF	106
Miscellaneous disturbance area (including power generation and reticulation and laydown associated with construction)	18
Airstrip	116
Disturbance footprint	3,787

These impacts can be reduced by:

- ♦ avoidance of unnecessary clearing of vegetation beyond that strictly required;
- ♦ windrows of topsoil, log debris and leaf litter formed during clearing should be retained as they create extremely good habitat for a large range of fauna, particularly reptiles;
- ♦ rapid rehabilitation of cleared areas such as laydown sites, access tracks and grid lines when these are no longer required.

## 10.2 Changes to Fire Regimes

The increase in human activity in arid areas may lead to an increase in fire through adjacent areas. Haydon *et al.* (2000) state that:

*“Lightning sets hundreds of wildfires annually in inland arid Australia, generating an ever changing spatial-temporal patchwork of habitats that differ in their state of post-fire recovery. The spatial configuration of this patchwork is determined by the size, shape, frequency and inter-spatial relationships of fires, and is likely to play a vital role in the maintenance of the desert biota.”*

Haydon *et al.* (2000) also state that habitat-specialised species can go extinct within a localised habitat but remain within the overall system. These species may then reinvade an area when regrowth permits. The analysis of fire frequency by Haydon *et al.* (2000) suggested that between 2 - 5% of the GVD landscape burns each year, with an average fire return of not less than 20 years. However, they also discuss the need for longer term modeling to distinguish between *quasi-periodic phenomenon, functions of climate change and aberrant fire activity*

This is supported by data on bushfire in the south-west GVD compiled by Vimy showing only about 2 major burn episodes over the MRUP since the late 1960s (primarily late 1960s, early 1990s and November 2014 for the majority of the MRUP). Data available from the W.A. Landgate Firewatch service shows that all bushfire in that area are associated with lightning strikes starts but not necessarily to the lightning strike frequency.

Similarly to the impacts of vegetation clearing, fire results in an impact on fauna as follows:

- ◆ death and/or injury to individual frogs and reptiles;
- ◆ displacement of larger, more active reptiles into adjacent habitat causing increased stress on existing populations;
- ◆ increased risk of predation by both native and introduced predators as individuals move to unburnt habitat;
- ◆ temporary loss of habitat;
- ◆ major and widespread habitat change if fire frequency increases or decreases.

While the incidence of wildfires cannot be controlled, the impacts on fauna from human-induced fire can be reduced by:

- ◆ vigilance during exploration and mining activities to prevent accidental fire from vehicle movement or hot work;
- ◆ development of fire management strategies to account for any increase in human activity, particularly during construction of mine infrastructure.
- ◆ Adaptive management of bushfire refugia.

### **10.3 Provision of Permanent Water Supplies**

The provision of permanent water from supply dams, sewage ponds and tailings storage facilities can increase populations of introduced predators into an area where existing impact on small to medium-sized reptiles from these animals currently exists. The trail cameras positioned within the MRUP area have shown that feral cats appear to be abundant in the general area, and the potential influx of prey species, particularly birds that are attracted to these facilities, has the potential to increase the population of these exotic predators, putting additional pressure on the herpetofauna of the area.

### **10.4 Other Impacts**

There is a range of other possible impacts on reptiles and/or their habitats that may require particular attention during development of a mine, these include:

- ◆ the introduction and spread of weeds reducing the quality of fauna habitats;
- ◆ a potential increase in feral animals, particularly foxes and cats, through the presence of a mine camp and inadequate disposal of food waste;
- ◆ increased risk of collisions with vehicles;
- ◆ an increase in light, noise and dust in areas in the vicinity of a mine camp, production facilities and other infrastructure.

These potential impacts may be minimised by:

- ◆ removal of weed infestations as soon as they are observed to ensure outbreaks are kept to a minimum and spread, particularly by wind, is avoided;
- ◆ development of a feral animal management strategy to reduce any increase in activity;
- ◆ reducing and containing all food waste to discourage scavenging by monitor lizards, crows, foxes and cats, and to reduce the potential for a rapid increase in population of the introduced House Mouse (*Mus musculus*);

- ♦ reducing vehicular activity at dawn and dusk, and ensuring low speed limits are adhered to on all roads and tracks;
- ♦ development of procedures for reporting road kill or managing animal injuries and to maximise awareness of the significance of fauna in the region;
- ♦ reducing light, noise and dust as far as possible, acknowledging that these particular issues are generally dealt with as part of good management of mine development and production.

## 11 CONCLUSIONS

The GVD supports a wide range of reptile species with many occupying the habitats present within the MRUP. Analysis of the results of the 2009 Ninox survey and literature review show that the majority of reptile species that could occur within the MRUP study area have probably been recorded during the 1985 and 2009 sampling, and subsequent camera trapping between 2009 and 2014. A total of 48 reptile species were recorded from these samples. However, the abundance of individuals in many of the sites sampled in 2009 was low, indicating that there could be an increase in species in several of these trapping locations should sampling be continued. Specifically, some species may be more common and widespread within the MRUP study area than currently shown in the data.

While there is potential for the list of species known to occur within the MRUP to increase, the lack of Mulga shrublands and woodlands on heavy soils will reduce the potential for some reptile species recorded in areas such as the Tropicana Project Area to occur within the current MRUP study area.

Three reptile species of conservation significance are known to be present or potentially occur within the MRUP development area. The Woma (*Aspidites ramsayi*) has been confirmed by both sightings and images taken by motion-activated cameras. Neither the Great Desert Skink (*Liopholis kintorei*) nor Dotty-tailed Robust Slider (*Lerista puncticauda*) has been recorded in the current MRUP study area although specific searches for them, or signs of their presence, were undertaken in 2009.

While the list of potential impacts discussed in Section 10 is relatively comprehensive, other issues may arise as development proceeds; these may require specialist attention as mine management becomes aware of the possible risk to vertebrate fauna. In particular, the provision of permanent water sources such as sewage treatment plants, water treatment plants, dewatering of mine pits (if required), and other water storage facilities, is likely to lead to a change in the vertebrate fauna composition of an area, particularly in an incursion of waterbirds and shorebirds to an area. The availability of water may also lead to changes in breeding habits by larger animals such as kangaroos. While not directly affecting reptiles, the availability of water may also lead to an increase in feral animals, potentially increasing both direct predation on reptiles and additional impact on the reptile habitats surrounding the MRUP disturbance footprint area from large herbivores, both feral and native.

The development envelope encompasses 9,998ha and the proposed area of impact from mining and infrastructure covers approximately 40% of this total. MCPL (2015) considers that most of the vegetation communities (fauna habitats) are adequately represented in the wider GVD region and overall impacts are low within the context of the surrounding areas. This conclusion in MCPL (2015) is likely to mirror the herpetofauna of the MRUP area and the GVD bioregion.

## 12 ACKNOWLEDGEMENTS

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### Appendix 1 Results of the search of the DPaW's NatureMap.

Method=By Polygon; Vertices=29° 46' 52" S, 123° 38' 35" E 29° 46' 45" S, 123° 38' 35" E 29° 46' 45" S, 123° 38' 35" E 29° 46' 45" S, 123° 38' 35" E 29° 46' 37" S, 124° 22' 59" E 29° 46' 37" S, 124° 22' 59" E 30° 19' 26" S, 124° 23' 07" E 30° 19' 26" S, 124° 23' 07" E 30° 19' 18" S, 123° 39' 06" E 30° 19' 18" S, 123° 39' 06" E 29° 46' 52" S, 123° 38' 35" E 29° 46' 52" S, 123° 38' 35" E ; Kingdom=Animalia; Current Names Only=Yes; Core Datasets Only=Yes; Species Group= **Amphibians**; Group By=Species Group;

Method=By Polygon; Vertices=29° 47' 00" S, 123° 38' 43" E 29° 47' 08" S, 123° 38' 35" E 29° 47' 08" S, 123° 38' 35" E 29° 47' 08" S, 123° 38' 35" E 29° 46' 06" S, 124° 23' 07" E 29° 46' 06" S, 124° 23' 07" E 30° 19' 26" S, 124° 22' 59" E 30° 19' 26" S, 124° 22' 59" E 30° 19' 26" S, 123° 40' 00" E 30° 19' 26" S, 123° 40' 00" E 29° 47' 00" S, 123° 38' 43" E 29° 47' 00" S, 123° 38' 43" E ; Kingdom=Animalia; Current Names Only=Yes; Core Datasets Only=Yes; Species Group= **Reptiles**; Group By=Species Group;

Species Group	Species Records
Amphibian	1 1
TOTAL	1 1

#### Amphibian

[Neobatrachus sutor](#) Shoemaker Frog  
1 species, 1 records

Species Group	Species Records
Reptile	57 448
TOTAL	57 448

#### Reptile

[Brachyuropsis semifasciatus](#) Southern Shovel-nosed Snake  
[Ctenophorus clayi](#) Collared Dragon  
[Ctenophorus cristatus](#) Bicycle Dragon  
[Ctenophorus fordj](#) Mallee Sand Dragon  
[Ctenophorus isolepis subsp. citrinus](#) Crested Dragon, Military Dragon  
[Ctenophorus isolepis subsp. ularis](#) Central Military Dragon  
[Ctenophorus nuchalis](#) Central Netted Dragon  
[Ctenotus atlas](#)  
[Ctenotus brooksii](#)  
[Ctenotus helena](#)  
[Ctenotus leae](#)  
[Ctenotus pantherinus subsp. ocellifer](#) Leopard Ctenotus  
[Ctenotus quattuordecimlineatus](#)  
[Ctenotus schomburgkii](#)  
[Cyclodomorphus melanops subsp. elongatus](#) Slender Blue-tongue  
[Delma australis](#)  
[Delma butleri](#)  
[Delma petersoni](#)  
[Demansia psammophis subsp. cupreiceps](#) Yellow-faced Whipsnake  
[Demansia psammophis subsp. psammophis](#) Yellow-faced Whipsnake  
[Diplodactylus conspicillatus](#) Fat-tailed Gecko  
[Diplodactylus granariensis subsp. granariensis](#)  
[Diplodactylus wiru](#) Desert Wood Gecko  
[Diporiphora lingua](#)  
[Diporiphora reginae](#)  
[Eremiascincus richardsonii](#) Broad-banded Sand Swimmer  
[Gehyra purpurascens](#)  
[Gehyra variegata](#)  
[Lerista bipes](#)  
[Lerista desertorum](#)  
[Lerista puncticauda](#) Dotty-tailed Robust Slider, skink **P2**  
[Lerista taeniata](#)  
[Lerista timida](#)  
[Lialis burtonis](#)  
[Liopholis inornata](#) Desert Skink  
[Liopholis striata](#) Night Skink  
[Lucasium damaeum](#)  
[Menetia greyii](#)  
[Moloch horridus](#) Thorny Devil  
[Morethia butleri](#)  
[Morethia obscura](#)  
[Nephurus laevisissimus](#)  
[Parasuta monachus](#)  
[Parasuta spectabilis subsp. nullarbor](#)  
[Pogona minor subsp. minor](#) Dwarf Bearded Dragon  
[Proablepharus reginae](#)  
[Pseudechis australis](#) Mulga Snake  
[Pseudonaja modesta](#) Ringed Brown Snake  
[Pygopus nigriceps](#)  
[Rhynchoedura ornata](#) Western Beaked Gecko  
[Simoselaps bertholdi](#) Jan's Banded Snake  
[Strophurus assimilis](#) Goldfields Spiny-tailed Gecko  
[Strophurus elderi](#)  
[Tiliqua occipitalis](#) Western Bluetongue  
[Varanus eremius](#) Pygmy Desert Monitor  
[Varanus gouldii](#) Bungarra or Sand Monitor  
[Varanus tristis subsp. tristis](#) Racehorse Monitor  
 57 species, 448 records

#### Conservation Status

TRare or likely to become extinct  
 SOther specially protected fauna  
 1 Priority 1  
 2 Priority 2  
 3 Priority 3  
 4 Priority 4  
 5 Priority 5

**Appendix 2 Fauna of Conservation Significance: Statutory and Other Requirements**

This Appendix describes the various Australian and State Government Acts that cover rare, threatened and vulnerable vertebrate fauna species and was correct at the time of the preparation of this document.

Additionally, in any discussion of rare, threatened or vulnerable species, several aspects require clarification before the significance of these species can be considered in context of the development of the proposed infrastructure.

- Resident, habitat-specific rare fauna are much more susceptible to the influences of disturbance than nomadic or migratory species.
- Not all rare species are equally susceptible to disturbance; some rare species such as the Peregrine Falcon can accommodate high levels of disturbance.
- The concept of species rarity is a dynamic process considerably influenced by the level of survey work carried out in a particular location, for example, the Sandhill Dunnart (*Sminthopsis psammophila*) was unknown in Western Australia until the 1985 survey within Mulga Rock (Martinick & Associates 1986).

Australian Government Legislation

In 1974, Australia signed the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). As a result, an official list of endangered, vulnerable or presumed extinct species was constructed (Schedule 1) and is regularly updated (*Endangered Species Protection Act 1992*).

In July 2000 this Act was replaced by *The Environment Protection and Biodiversity Conservation Act 1999 (EPBC 1999)*, which retained the schedule of threatened species of the Act it replaced. There are six parts to the EPBC Act covering species that are:

- extinct;
- extinct in the wild;
- critically endangered;
- endangered;
- vulnerable; and
- conservation dependent.

International Agreements

Australia has entered into international agreements for the protection of migratory birds. These agreements are between Japan-Australia (JAMBA), China-Australia (CAMBA), and the Republic of Korea (ROKAMBA). However, the JAMBA list differs to the Schedule 3 list discussed in Section 5.2.

State Legislation

Currently in Western Australia, rare or endangered species are protected by the *Wildlife Conservation Act 1950 (WCA 1950)*. The various schedules defined under this act are:

- **Schedule 1:** A native species that is rare or likely to become extinct, are declared to be fauna that is in need of special protection.
- **Schedule 2:** A native species that is presumed to be extinct, are declared to be fauna that is in need of special protection.

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- ♦ **Schedule 3:** Birds that are subject to an agreement between the governments of Australia and Japan relating to the protection of migratory birds and birds in danger of extinction are declared to be fauna that is in need of special protection. This list differs from JAMBA.
- ♦ **Schedule 4:** A native species that is in need of special protection, otherwise than for the reasons specified in Schedules 1, 2 and 3.

This Act is periodically reviewed and the current list of protected fauna can be viewed on DPaW's website.

### DPaW Priority Species

While not covered under any government legislation, the species listed under the DPaW Priority Fauna List require some discussion as to their potential or actual presence within the Survey Area. These species are generally listed to indicate that they require either monitoring at a species or population level. They are classified as:

- ♦ 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.*

***Mulga Rock Project Area – Herpetofauna 2015***

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The Priority Fauna List does not confer any additional legal protection to the species listed apart from the normal protection afforded to most native animals. It does, however, indicate the need for vigilance during the construction and commissioning of development projects to manage native vegetation and rehabilitation so that Priority species, should they occur, do not meet the criteria for listing on the Threatened Species List as a result of that development.