West Musgrave Copper and Nickel Project

September 2021

Terrestrial Fauna Management Plan

VERSION CONTROL

Revision	Version	Authorisation	Position	Signature	Date
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NOTE ON CURRENCY

Where possible, information contained in this Document is up to date as at September 2021. This was not possible for all supporting appendices, and information based on those appendices, which were prepared by third parties (as discussed in the second paragraph in the Disclaimer above) prior to the Document being finalised.

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SUMMARY

A summary of the key Environmental Management Plan (EMP) information is presented in Table 1.

Table 1: Summary of Key EMP Information

Project Information	Description
Proposal Name	West Musgrave Copper and Nickel Project
Proponent Name	OZ Minerals
Ministerial Statement No/s and Condition/Clauses	The Proposal is currently being assessed by the Government of Western Australia's Environmental Protection Authority (EPA). The EPA has proposed that a Terrestrial Fauna Management Plan (TFMP) will be a condition of approval of the proposed project. A Ministerial Statement and associated conditions are yet to be issued.
Purpose of the EMP	To provide a management framework for terrestrial fauna and their habitats to avoid, minimise and mitigate potential adverse impacts associated with implementation of the West Musgrave Project.
Key Environmental Factor	Terrestrial Fauna
Objective	*To protect terrestrial fauna so that biological diversity and ecological integrity are maintained*
Key Provisions of the EMP	See Section 2
Proposed Construction Timing	Commencing 2022, progressing to 2024
EMP Required Pre-construction?	Yes, prior to issuing of Ministerial Statement
Proposed Operations Timing	26 years from date of commissioning

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1 CONTEXT, SCOPE AND RATIONALE

This Terrestrial Fauna Management Plan (TFMP) has been prepared by OZ Minerals to support the assessment, approval and implementation of the Proposal under Part IV of the *Environmental Protection Act, 1986* (WA) (EP Act). Terrestrial fauna is protected under Commonwealth and State legislation, primarily governed by three Acts:

- *Environment Protection and Biodiversity Conservation Act, 1999* (Cth)
- *Environmental Protection Act, 1986* (WA)
- *Biodiversity Conservation Act, 2016* (WA).

In addition to Commonwealth and State legislation, the following policy and guidance statements were considered in the development of this TFMP:

- EPA Statement of Environmental Principles, Factors and Objectives (EPA, 2020b)
- EPA Environmental Factor Guideline – Terrestrial Fauna (EPA, 2016a)
- EPA Technical Guidance – Terrestrial Fauna Surveys (EPA, 2016b)
- EPA Technical Guidance – Sampling methods for Terrestrial vertebrate fauna (EPA, 2016c)
- EPA Technical Guidance – Sampling of short-range endemic invertebrate fauna (EPA, 2016d)
- Interim guideline for preliminary surveys of Night Parrot (*Pezoporus occidentalis*) in Western Australia (DBCA, 2017)
- Conservation advice *Liopholis kintorei* (Great Desert Skink) (TSSC, 2016)
- National recovery plan for the Great Desert Skink (*Liopholis kintorei*) (McAlpin, 2001).

This TFMP addresses the Notice Requiring Information for Assessment, received from the EPA on 14 April 2021 (the Notice). The Notice requires OZ Minerals to:

> *Provide a Terrestrial Fauna Management Plan detailing the application of the mitigation hierarchy concerning avoidance and minimisation of direct and indirect impacts to significant terrestrial fauna species, including but not limited to the scheduled species. The Plan should be prepared in accordance with the Instructions on how to prepare Environmental Protection Act 1986 Part IV Environmental Management Plans (EPA, 2020a). The Plan should incorporate as an appendix the updated Short Range Endemic habitat connectivity assessment and review of the Night Parrot methodology, and detail how this information has informed management practices.*

As defined by EPA (2016a and 2016b) terrestrial fauna may be significant for a range of reasons, including:

- Being identified as a threatened or priority species
- Species with restricted distribution
- Species that have declining populations or declining distributions
- Species at the extremes of their range
- Isolated outlying species populations
- Species which may be undescribed
- Degree of historical impact from threatening processes
- Providing an important function required to maintain the ecological integrity of a significant ecosystem.

Note that although the focus of this TFMP is on significant fauna as defined by the EPA, the overarching management approach and the specific management objectives, actions and targets (Section 2.1) are considered adequate to provide for the minimisation of impacts to all terrestrial fauna in order to ensure that the EPA Objective for Terrestrial Fauna (Section 1.2) is met. This includes potential impacts to those species of significance to the Ngaanyatjarra People, including the Australian Bustard (*Ardeotis australis*), goanna (all the *Varanus* genus) and macropods including Western Grey Kangaroo (*Macropus fuliginosus*), Euro (*Osphranter robustus*) and Red Kangaroo (*Osphranter rufus*).

1.1 Proposal

The West Musgrave Copper and Nickel Project (WMP) is located in the West Musgrave Ranges of Western Australia. The WMP is located approximately 1,300 km north-east of Perth near to the border of South Australia and the Northern Territory. The WMP is within the Ngaanyatjarra Native Title determination, and Class A Reserve No. 17614 (for the Use and Benefit of Aboriginal Inhabitants). The nearest towns include the Indigenous Communities of Jameson (Mantamaru) 26 km north, Blackstone (Papulankutja) 50 km east, and Warburton (Milyirrtjarra) 110 km west of the project (Figure 1).

The project, with a current expected life of approximately 26 years, will consist of:

- Mining of copper and nickel ore from two open cut mine pits using conventional blast, load and haul methods
- Placement of mine waste into permanent waste rock dumps (WRDs) and dedicated tailings storage facility (TSF) adjacent to mine pit voids
- Milling and processing of ore using floatation to produce two separate copper and nickel concentrates

- On-site power supply using a combination of renewable power infrastructure (photovoltaic solar panels, wind turbines and battery storage) supported by backup thermal power generation
- Development of a process/potable water supply borefield that may include a combination of overland and/or underground pipelines for use during construction and operations
- Miscellaneous infrastructure, including stormwater management infrastructure (bunds and drains), internal roads and service tracks, a dedicated site access road, accommodation village (approximately 450 beds during operations and 1,200 during construction), airstrip, wastewater treatment, landfill and other supporting infrastructure including offices, warehouses and workshops
- Concentrate will be transported via existing roads and rail networks.

A summary of the key project characteristics is presented in Table 2.

Table 2: Key Project Characteristics

Elements	Location	Proposed Extent Authorised
Physical Element		
Mine and associated infrastructure	Figure 2	Clearing of up to 3,830 ha of native vegetation within a Development Envelope of 20,852 ha
Operational Element		
Mining voids	Figure 2	Below water table mining Nebo pit void to be backfilled above water table post-closure Babel pit void to be a permanent and episodic pit lake post-closure
Mining waste (waste rock)	Figure 2	Placement of waste rock into permanent WRDs
Ore processing waste (tailings)	Figure 2	Disposal of tailings into a TSF and/or Nebo pit void
Power supply	Figure 2	Up to 60 MW (instantaneous load requirement) of fossil fuel electricity generation Up to 100 MW of photovoltaic solar electricity generation Up to 100 MW of wind electricity generation
Water supply	Figure 2	Abstraction of up to 7.5 GL/a of groundwater from the Borefield and through mine pit dewatering

Figure 1: Site Location

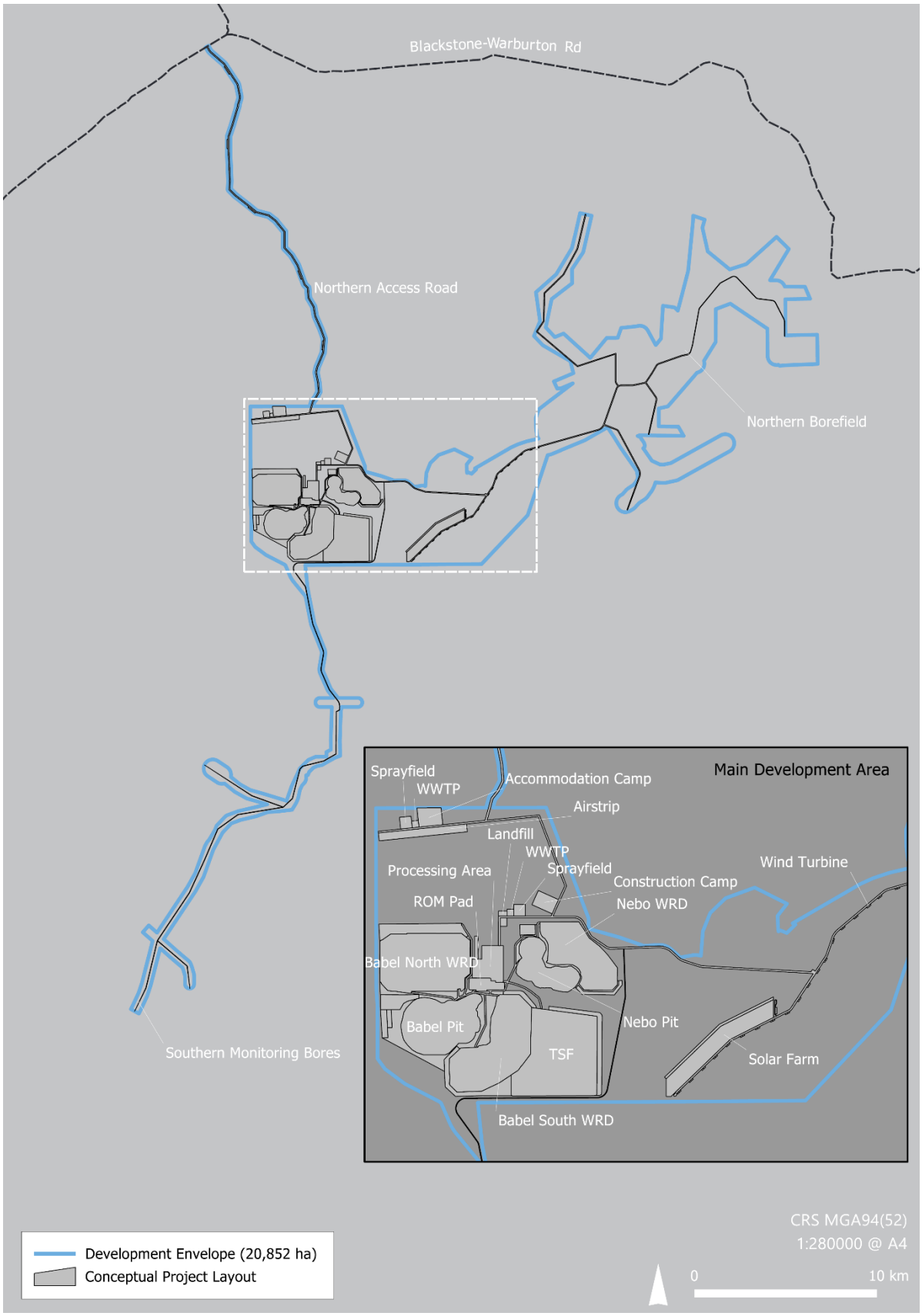

Figure 2: Location of Key Physical and Operational Elements

1.2 Key Environmental Factor

This TFMP specifically relates to the Terrestrial Fauna factor guidelines. The EPA's Statement of Environmental Principles, Factors and Objectives (EPA, 2020b) lists the following as their objective for Terrestrial Fauna:

> *To protect terrestrial fauna so that biological diversity and ecological integrity are maintained*

1.2.1 Proposal Activities that May Affect the Key Environmental Factor

In compliance with the Notice provided by the EPA, this management plan applies only to the management of significant terrestrial fauna species, including but not limited to the scheduled species, to the extent that the interaction of the project may negatively impact these terrestrial fauna such that the EPA objective may not be achieved. To this end the following credible events have been identified with the potential to result in negative impacts to significant terrestrial fauna species, including but not limited to scheduled species, specifically:

- Decrease in poorly represented fauna habitat as a result of project-related land clearing
- Significant decrease in richness and abundance of fauna, including of significant fauna, as a result of interactions with project-related vehicles and machinery or entrapment
- Increase richness and abundance of predator species resulting from project-related attractants (water and food sources) result in high levels of predation of native fauna
- Decrease in the richness and abundance of poorly represented fauna habitat and significant fauna species as a result of project-related altered fire regimes.

Other impact events identified in the EPA Section 38 Referral (OZ Minerals, 2021) were assessed as not having an impact on significant terrestrial fauna such that EPA's environmental objective for terrestrial fauna would not be met, and as such have not been considered further in this management plan.

1.2.1.1 Site Specific Environmental Values

The EPA Section 38 Referral (OZ Minerals, 2021) noted that one Threatened fauna species as defined in the *Environment Protection and Biodiversity Conservation Act, 1999* (Cth) (EPBC Act) and *Biodiversity Conservation Act, 2016* (WA) (BC Act) and three priority species designated by the Government of Western Australia's Department of Biodiversity, Conservation and Attractions (DBCA) were recorded within the survey area during project specific studies. These include:

- Great Desert Skink (*Liopholis kintorei*) – Vulnerable
- Brush-tailed Mulgara (*Dasycercus blythi*) – P4
- Southern Marsupial Mole (*Notoryctes typhlops*) – P4
- Striated Grasswren (*Amytornis striatus striatus*) – P4.

Further descriptions of these species, threatening processes and project-related impacts relevant to these species are provided in the following sections.

Consultation with the Ngaanyatjarra Council and Traditional Owners has identified several species of cultural significance that inhabit the WMP area. These species are described in Section 1.2.1.7, together with a summary of the potential impact significance.

1.2.1.2 Night Parrot (*Pezoporus occidentalis*)

A review of findings relating to the potential presence of the critically endangered Night Parrot (*Pezoporus occidentalis*) at WMP can be found in Appendix A. The review was undertaken by notable Night Parrot experts, Nigel Jackett and Nick Leseberg of Adaptive NRM, who have extensive experience identifying potential Night Parrot habitat and detecting Night Parrots using remotely deployed acoustic recording units (ARUs). The review concluded that methodological shortcomings employed in the initial WMP Night Parrot surveys (OZ Minerals, 2021; Appendix G3) presented limitations to detection of Night Parrots, and that conclusions pertaining to Night Parrot occupancy in the original study were not supported. The review recommended the following actions to increase certainty relating to potential Night Parrot occupancy at the WMP:

1. Conduct a desktop analysis of potential roosting and foraging sites using available products and hi-resolution satellite imagery, a process that the authors have used successfully to identify the presence of Night Parrot throughout Australia
2. Where the desktop analysis indicates potential roost habitat is extant, a comprehensive acoustic survey plan for these sites could be developed that would require a limited number of very brief acoustic surveys, and analysing the recordings from these surveys, with a recogniser known to be capable of detecting a higher percentage of Night Parrot calls.

In May 2021, following the review described above, Nigel Jackett, Nick Leseberg and Steve Murphy of Adaptive NRM, undertook the first of the above listed recommendations. This Night Parrot Habitat Analysis can be found in Appendix A, the study concluded:

> *Night Parrot roosting habitat is unlikely to occur within the Development Envelope, reducing uncertainties in previous assessment…. Therefore, additional acoustic surveys (or re-analysis of sound data collected by Donato Environmental Services (2019)) are unlikely to detect the presence of roosting Night Parrots within the Development Envelope. Acoustic surveys within potential foraging habitat are unlikely to detect Night Parrots, due to the small and fragmented extent of potentially suitable habitat available, and the relatively large distance Night Parrots would need to travel to access potential foraging habitat within the Development Envelope.*

This analysis provides a strong conclusion of the low likelihood of Night Parrot occurrence at the WMP and surrounds. Based on these combined studies and findings relating to the likely absence of Night Parrot, no specific consideration has been made for the specific management of Night Parrots at the project beyond the general management measures detailed in this plan.

1.2.1.3 Great Desert Skink (*Liopholis kintorei*)

The Great Desert Skink is a large burrowing lizard restricted to sandy habitats in the western desert region of Central Australia (Plate 1). Listed as Vulnerable under both the EPBC Act and the BC Act, the Great Desert Skink has a scattered distribution across its range, and is known to have disappeared from former habitats, particularly in the Gibson Desert, Great Victoria Desert and Great Sandy Desert Regions.

The Great Desert Skink is endemic to Australian arid areas within the western desert region and occurs across a broad area covering the south-western and western areas of the Northern Territory, the north-western extent of South Australia, and a central expanse of inland Western Australia.

Known population extents include seven main populations (McAlpin, 2001 and DoEE, 2020), with the greatest concentration of historic records occurring in the Northern Territory (ALA, 2020). Table 3 and Figure 3 provide known locations of Great Desert Skink (McAlpin, 2001 and TSSC, 2016).

A recent discovery of Great Desert Skink as part of the Lake Well Potash Project confirmed a range extension for the species of 480 km west of the WMP in similar sandplain spinifex habitats (Western Wildlife, 2019).

A summary of Great Desert Skink status, threats and potential impacts is provided in Table 4.

Table 3: Known Populations of the Great Desert Skink

Location of Known Population	State/Territory	Tenure	Estimated Population	Habitat	Distance from Project
Patjarr (Karilywara) and proposed Gibson Desert Indigenous Protected Area (IPA)	WA	Ngaanyatjarra Council	<2,500	Gravelly undulating plain with scattered *Acacia pruinocarpa* or *A. aneura* over *Triodia basedowii* and low shrubs	200 km
Kiwirrkurra community and surrounds including vicinity of Lake Mackay	WA	Ngaanyatjarra Council	<500	Sandplain with spinifex and scattered shrubs (*Acacia spp., Eucalyptus spp., Hakea spp., Grevillea spp.*)	350 km
Karlamilyi National Park	WA	DBCA	Unknown	Unknown	630 km
Lake Wells Potash Project	WA	Lake Wells Potash Project	<50	Sandplain spinifex	480 km
Tanami Desert including Rabbit Flat-Sangster's Bore, The Granites, and near Kintore	NT	Various Aboriginal Lands Trusts	<2,250	Sandplain with spinifex and scattered shrubs and occasional trees (*Acacia spp., Eucalyptus spp., Hakea spp., Grevillea spp.)*	700 km
Uluru-Kata Tjuta National Park (includes part of the Yulara borefields area)	NT	Uluru-Kata Tjuta Land Trust leased to Parks Australia	<500	Sandplain with spinifex (*Triodia basedowii and T. pungens*.) and scattered shrubs and occasional trees (*Acacia spp., Allocasuarina decaisneana., Hakea spp., Grevillea spp*.)	325 km
Yulara lease lands and surrounding Land Trust lands (includes part of the borefields area)		Ayers Rock Resort Corporation and Katiti Land Trust	<350		325 km
Anangu-Pitjantjatjara Lands	SA	Anangu-Pitjantjatjara Council	<50	Sandplain with mulga and minyura over woollybutt grass (*Eragrostis eriopoda*) and spinifex	280 km

Table 4: Great Desert Skink – Summary of Status, Threats and Potential Impacts

Legal conservation status	Listed as Vulnerable under the EPBC Act and the BC Act
Status at WMP and region	Studies undertaken to support the West Musgrave Project (WMP) included both site-specific (within and near to the Development Envelope) and regional (within 200 km of the West Musgrave Development Envelope). The regional study (within 200 km of the Development Envelope) identified 80 warrens representing 10 to 12 new sub-populations (Figure 3 and Figure 5). The site-specific study, covering 46,262.3 ha, identified four groups of warrens throughout the study area. All Great Desert Skink signs both regionally and locally were found in similar deep sand spinifex areas. Following the site-specific surveys, the project Development Envelope was amended to exclude deep sand spinifex habitat that contained three of the four identified groups of Great Desert Skink burrows. As such, 82% of deep sand spinifex has been excluded from the Development Envelope, with the remaining deep sand spinifex being isolated to the northern borefield area. The project proposes to clear up to 0.1% of the deep sand spinifex habitat for the purpose of low impact borefield infrastructure (e.g. buried pipe, service track and pumping infrastructure).
Threats	Moore et al. (2015) reported that Great Desert Skink is adversely affected by fire and predation (including by dingoes, foxes and cats). The recovery plan (McAlpin, 2001) for the Great Desert Skink indicated the following potential threats: • Cessation of traditional land management practices, and particularly the creation of new fire regimes • Predation by foxes and feral cats • Rabbits destroying and occupying burrow systems.
Potential impacts as a result of the WMP	• Direct loss of individuals during vegetation clearing for the borefield pipeline and associated borefield infrastructure (service tracks and pumping infrastructure) • Direct loss of individuals as a result of vehicle strikes either during construction, or while using service tracks to access other areas of the borefield • Direct loss of individuals post-wildfires due to predation by foxes, dogs and cats • Direct loss of individuals due to predation by feral animals, including foxes, dogs and cats as a result of the creation of new tracks and cleared areas.

GREAT DESERT SKINK
(*Liopholis kintorei*)

BURROW

SCAT LATRINE

HABITAT
Spinifex Sandplain

Images courtesy of Western Wildlife

Plate 1: Great Desert Skink (*Liopholis kintorei*)

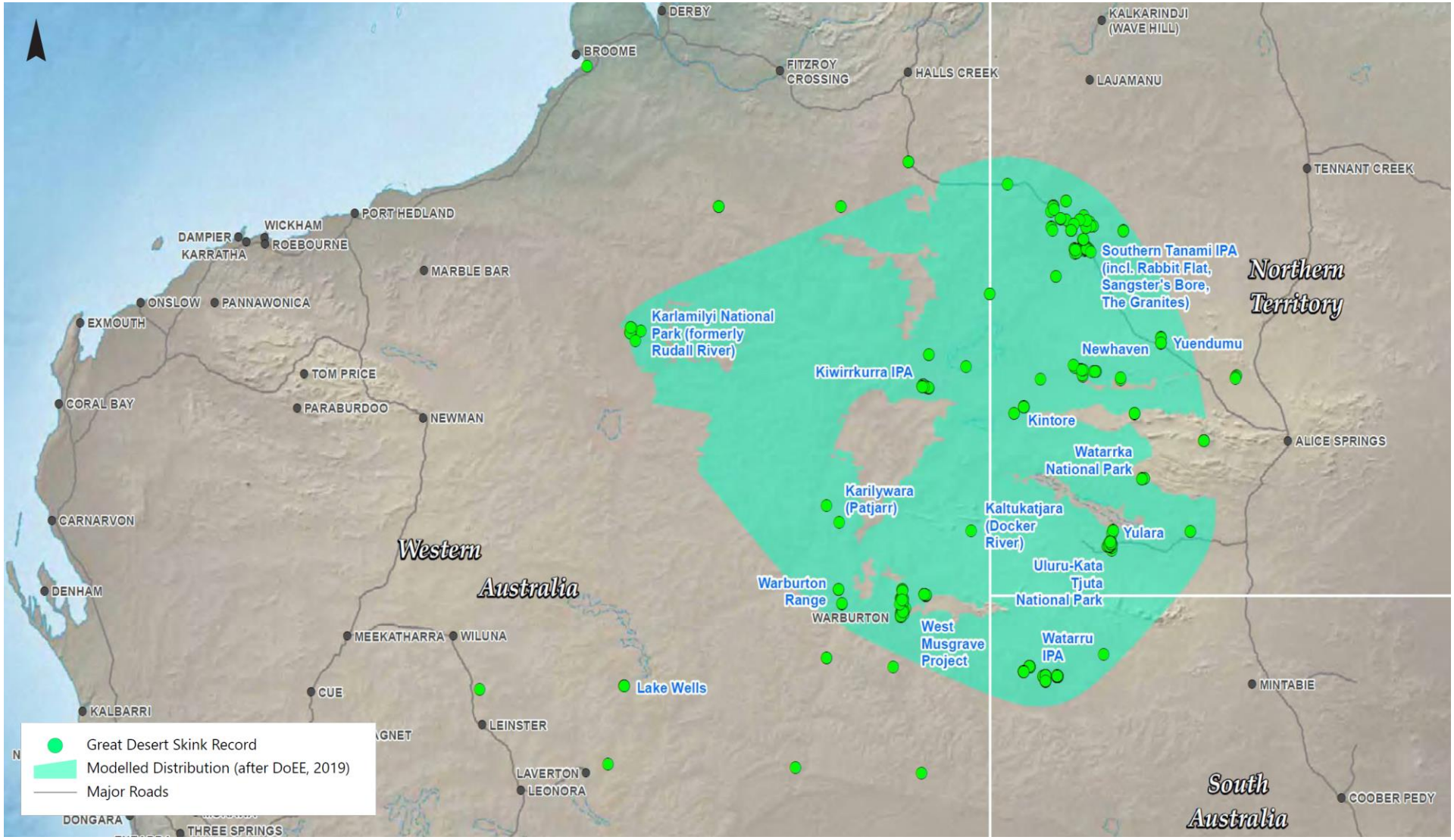

Figure 3: Known Populations of the Great Desert Skink in a Regional Context

1.2.1.4 Southern Marsupial Mole (*Notoryctes typhlops*)

The Southern Marsupial Mole is widespread across the deserts of central Australia, occurring where its sand dune habitat is present (Woinarski et al., 2014). Although there are no robust estimates of population size, given the inherent challenges of sampling for this species, there is no evidence of on-going population decline and it is listed as of 'Least Concern' in the Action Plan for Australian Mammals 2012 (Woinarski et al., 2014).

The Southern Marsupial Mole spends most of its time underground, where it 'swims' through the sand. Its underground lifestyle means that it may be less vulnerable to predation by feral cats and foxes (Woinarski et al., 2014). A summary of Southern Marsupial Mole status, threats and potential impacts is provided in Table 5.

Table 5: Southern Marsupial Mole – Summary of Status, Threats and Potential Impacts

Legal conservation status	Listed as Priority 4 by DBCA
Status at WMP and region	Evidence of its presence was found opportunistically in dune cuttings in the Northern Borefield where numerous back-filled tunnels were observed. Signs of this species was also identified in a mole trench dug in the proposed Main Development Area. Several records were identified in an extensive area of sand dunes and spinifex sandplain immediately south-west of the proposed Development Envelope. This habitat, near to, but outside of the Development Envelope is extensive and totals over 20,000 ha. The Southern Marsupial Mole is considered likely to occur throughout the Development Envelope and region where sand dunes are present.
Threats	Project-related vegetation clearing and excavation activities are likely to be the most significant threats to this small fossorial marsupial. Its underground lifestyle means that it may be less vulnerable to predation by feral cats and foxes (Woinarski et al., 2014).
Potential impacts as a result of the WMP	• Direct loss of individuals during project-related vegetation clearing in dunes and adjacent swales • Direct loss of individuals during project-related earthworks in sand dunes and adjacent swales.

1.2.1.5 Brush-tailed Mulgara (*Dasycercus blythi*)

Brush-tailed Mulgara is widely distributed across arid Australia, and though its population has declined in the past, it is currently thought to be stable or only slowly declining (Woinarski et al., 2014). It is thought that its ability to use a variety of food resources, tolerate severe declines in bodyweight, enter torpor and dig deep burrows has buffered the species from the impacts of feral predators and a variable climate and resource availability (Masters and Dickman, 2012). It is therefore listed as of 'Least Concern' in the Action Plan for Australian Mammals 2012 (Woinarski et al., 2014).

The Brush-tailed Mulgara occurs mostly on Spinifex grasslands, sheltering during the day in burrows which have been constructed on the flats between sand dunes. A summary of Brush-tailed Mulgara status, threats and potential impacts is provided in Table 6.

Table 6: Brush-tailed Mulgara – Summary of Status, Threats and Potential Impacts

Legal conservation status	Listed as Priority 4 by DBCA
Status at WMP and region	Tracks, burrows and diggings of this species were recorded extensively across the fauna survey area, records were obtained with remote cameras within Spinifex Sandplain on the Western Access Road and Southern Monitoring Bore area, with a single individual trapped in each survey period along the Western Access Road. The primary locations where these species were identified were the Western Access Road and Southern Borefield area. These locations have subsequently been excluded from the Development Envelope.
Threats	Cattle grazing, altered fire regimes and predation by cats and foxes are said to have contributed to the population decline of this species (Van Dyck and Strahan, 2008).
Potential impacts as a result of the WMP	• Direct loss of individuals during project-related vegetation clearing • Direct loss of individuals from predation by foxes, dogs and cats following wildfires as a result of project-related altered fire regimes • Increased feral animal predation (foxes, dogs and cats) along project-related service tracks and in newly created cleared areas.

1.2.1.6 Striated Grassweren (*Amytornis striatus striatus*)

The Striated Grasswren's preferred habitat is spinifex meadows with or without low shrubs (*Thryptomene sp.*) or Acacia sp. on sandy or loamy substrate. *Amytornis s. striatus* known distribution is the sandy deserts (i.e. Great Victoria, Gibson and Great Sandy) in central and eastern Western Australia (Johnstone and Storr, 2004). A summary of Striated Grasswren status, threats and potential impacts is provided in Table 7.

Table 7: Striated Grasswren – Summary of Status, Threats and Potential Impacts

Legal conservation status	Listed as Priority 4 by DBCA
Status at WMP and region	The Striated Grasswren was recorded on the Western Access Road, Northern Borefield, Southern Borefield Area and Main Development Area in a range of habitats. It is likely to occur in suitable habitats throughout the region but may be absent from areas that have been subject to extensive fires. Many of the areas where this species was extensively recorded, such as the Western Access Road and Southern Borefield, have subsequently been excluded from the Development Envelope.
Threats	The two most significant threats to this species are predation, particularly of eggs and chicks by foxes, feral cats, wild dogs and raptors, and extensive wildfires that burn mature spinifex.
Potential impacts as a result of the WMP	• Direct loss of individuals during project-related vegetation clearing • Direct loss of individuals, nesting sites or eggs from wildfires as a result of project-related altered fire regimes • Direct loss of individuals from predation by foxes, dogs and cats following wildfires as a result of project-related altered fire regimes • Increased feral animal predation (foxes, dogs and cats) along project-related service tracks and in newly cleared areas.

1.2.1.7 Culturally Significant Terrestrial Fauna

Through consultation with Ngaanyatjarra People, several fauna species of cultural importance were identified, these included totem species representative of story lines or dreamtime stories or those used as food resources. These animals included bardi grubs (witchetty grub) which are generally associated with *Acacia kempeana*, Australian Bustard (*Ardeotis australis*), goanna (all the *Varanus* genus), Emus (*Dromaius novaehollandiae*) and macropods including the Western Grey Kangaroo (*Macropus fuliginosus*), Euro (*Osphranter robustus*) and Red Kangaroo (*Osphranter rufus*).

A summary of the potential impacts to these species is presented in Table 8. No significant adverse impacts to these species are predicted. Although not specifically described any further in this TFMP, the management targets and actions described in Table 14 are also considered suitable for the minimisation of impacts to species of cultural heritage significance.

Table 8: Potential Impacts to Terrestrial Fauna Species of Cultural Significance

Species	Description	Potential Impacts
Bardi Grubs and *Acacia kemeana*	Bardi grubs are commonly found in the roots of *Acacia kempeana* which commonly occur within the fauna survey area and region. *Acacia kempeana* is a spreading shrub or tree of between 1 and 6 m in height. The species is common throughout inland Australia and has no conservation status.	The project is unlikely to impact these species on either a local or regional scale, and as such is unlikely to result in any change of access or abundance of bardi grubs to Ngaanyatjarra People.
Goanna (*Varanus* species)	Seven goanna species comprising 67 individuals were identified in the fauna survey area. Of these, the majority were represented by the sand goanna, *Varanus gouldii* (45 records). This species represented one of the most numerous reptile species identified in the fauna survey area. *Varanus* species are particularly widespread in inland arid Australia and have no conservation status. *Varanus* species are found in a wide variety of habitats including open woodland and sand plains which are particularly prevalent in the region.	While there may be a very localised decline in the abundance of this species near to the Main Development Area, the large range of habitats occupied by this species and the abundance of available regional habitat makes it unlikely that the project would have an impact on the abundance or ability of Ngaanyatjarra People to access this species.
Australian Bustard (*Ardeotis australis*)	The Australian Bustard is a large ground dwelling bird up to 1.2 m tall, which is common in grasslands and open woodlands throughout mainland Australia. This species remains relatively common and widespread across most of northern Australia; however, its range appears to have contracted in the south-east of Australia over the past century. While the Australian Bustard has no Commonwealth or WA State conservation listing, the assessment of IUCN in 2016 noted a declining population trajectory. The total population is thought to exceed 10,000 and be no greater than 100,000 individuals. Forty-nine records of the Australian Bustard were made during field surveys from throughout the fauna survey area in a range of habitat types.	Given the range of habitats this species occupies and the abundance of available regional habitat, it is considered unlikely that the project would have an impact on this species. Targeted hunting of this species is likely to present a greater pressure to this species than the project activities.

Species	Description	Potential Impacts
Macropods, including Western Grey Kangaroo (*Macropus fuliginosus*), Euro (*Osphranter robustus*) and Red Kangaroo (*Osphranter rufus*)	Macropods are a relatively rare visitor to the project area. Ngaanyatjarra People have anecdotally noted that macropods are more plentiful in the area during sustained wet periods, and during dry periods are more prevalent in specific areas such as nearby to some of the larger rocky ranges such as Jameson Range. Six records of Grey Kangaroo were identified from a single camera trap in the southern most extent of the fauna survey area. No other macropod species were identified in the fauna survey area. Macropods are uncommon in the area likely due to the limited number of water points and hunting pressure.	Implementation of the project is considered unlikely to change the already uncommon occurrence of macropods in the Development Envelope. If anything, the increasing number of water points may result in some increased incidence of macropods into the project area.
Emus (*Dromaius novaehollandiae*)	Emus are known to occupy most of mainland Australia and are known from a range of habitats including woodlands and open plains. Emus do not have any Commonwealth or WA state conservation listing. Two sightings of Emus and four indications of their presence were identified during field surveys of the West Musgrave area indicating that they are relatively uncommon to the project area. Similarly, to macropods, Emus are said to be more common during sustained periods of good conditions and are more commonly known from areas with available surface water.	The project is considered unlikely to change the already uncommon occurrence of Emus in the Development Envelope. If anything, the increasing number of water points may result in some increased incidence of Emus into the project area.

1.3 Condition Requirements

A Ministerial Statement and associated conditions are yet to be issued.

1.4 Rationale and Approach

This TFMP outlines how significant species will be managed, and where relevant monitored, to verify the effectiveness of the management measures and to ensure potential impacts associated with the proposed construction and operation of the WMP are minimised.

OZ Minerals' approach is to give significant focus during project design to avoid and minimise impacts by carefully designing the Development Envelope and siting infrastructure to avoid habitats known to support significant terrestrial fauna. It is recognised, however, that there are further mitigations available to reduce risks to those identified significant fauna species.

Although outside of the EPA's Notice for the scope of this TFMP, consideration has also been given in the development of the management approach to the potential project-related impacts on all terrestrial fauna species, including those of significance to the Ngaanyatjarra People, and the subsequent development of management and mitigation measures.

1.4.1 Survey and Study Findings

Since 2018 there have been multiple fauna surveys and assessments associated with characterising the fauna of the WMP project area, these include:

- Level 2 vertebrate fauna survey, including targeted survey of conservation significant fauna conducted by Western Wildlife (OZ Minerals, 2021; Appendix G1). Two levels of fauna survey were undertaken across the fauna survey area including a Level 2 fauna survey within the Main Development Area and proposed Western Access Road and a targeted survey for conservation significant species across the whole fauna survey area (including areas of proposed linear infrastructure). These surveys were undertaken as part of three survey events in three seasons. The fauna survey area covered a total area of 46,263.3 ha.
- Targeted Great Desert Skink survey conducted by Western Wildlife (OZ Minerals, 2021; Appendix G2). The surveys included targeted walking transects, of 767.7 km, within the immediate fauna survey area to identify signs of the Great Desert Skink, primarily burrows in association with a scat latrine (OZ Minerals, 2021; Appendix G2). Transects focused on habitats considered most likely to support the species, based on the literature, i.e. sandplains and dune swales. Other habitats, such as Calcrete – Spinifex Sandplain mosaic, were also surveyed, as these presented as superficially similar and it was unknown whether these had the potential to support the species.

- Avian fauna and microbat baseline characterisation conducted by Donato Environmental Services (OZ Minerals, 2021; Appendix G3). A detailed assessment of the aerial fauna (birds and bats) within the project area, concentrating on the proposed wind turbine electricity generator site and main infrastructure area. The study targeted the potential presence or absence of the Night Parrot (*Pezoporus occidentalis*). Specifically, this survey collected four months of audio recordings, using remotely deployed song meters and Anabats.
- A targeted Night Parrot habitat analysis (using a combination of vegetation survey results and remotely sensed imagery) was undertaken by leading Night Parrot experts over the entire Development Envelope (an area of 20,851.9 ha) and within a 10 km buffer distance around the entire Development Envelope (an area of 125,887.2 ha) (Appendix A and OZ Minerals, 2021; Appendix G3, Addendum 1). The habitat analysis concluded that Night Parrot roosting habitat is unlikely to occur within the Development Envelope, and that acoustic surveys within potential foraging habitat are also unlikely to detect Night Parrots, due to the small and fragmented extent of potentially suitable habitat available, and the relatively large distance Night Parrots would need to travel to access potential foraging habitat within the Development Envelope.
- Targeted and regional surveys for the McDonnell Ranges Black-Footed Rock-Wallaby and Great Desert Skink undertaken by the Ngaanyatjarra Council (OZ Minerals, 2021; Appendix G5). The Ngaanyatjarra Ranger Team, coordinated by the Ngaanyatjarra Council, undertook a regional study investigating the presence of both Great Desert Skink (*Liopholis kintorei*) and McDonnell Ranges Black-Footed Rock-Wallaby (*Petrogalis lateralis*) within 200 km of the project's fauna survey area. The survey had two study aims, the first to confirm the presence of further populations of Great Desert Skink from a regional perspective, and the second to confirm the presence or absence of Black-Footed Rock-Wallaby, both inside the fauna survey area, and regionally.
- Short Range Endemic (SRE) survey conducted by Alacran (OZ Minerals, 2021; Appendix G6). A targeted survey consisting of three sampling events to identify SRE habitat, identify potential SRE species and determine if the fauna survey area supports a known SRE. A summary of the updated Short Range Endemic habitat connectivity assessment is provided here as Appendix B and also discussed in Section 7.6.3.8 of the EPA Section 38 Referral (OZ Minerals, 2021).
- An independent peer review of project-related impacts on EPBC-listed Threatened species and migratory species was undertaken by Jacobs. Jacobs concluded that the project would not have a significant impact on Matters of National Environmental Significance (MNES) based on the Australian Government's Department of the Environment's (DoE) Significant Impact Guidelines 1.1 (DoE, 2013).

A summary of survey effort as applicable to Terrestrial Fauna is summarised in Table 9. The results of these studies have contributed to a comprehensive understanding of the abundance and distribution of the vertebrate fauna, specifically significant fauna, in the project area and region. Study outcomes specific to the Great Desert Skink are summarised in Table 10.

Table 9: Local and Regional Terrestrial Fauna and Habitat Surveys of the WMP Region

Survey	Sampling Effort	Dates
Level 2 vertebrate fauna survey, including targeted survey of conservation significant fauna over 46,263.3 (OZ Minerals, 2021; Appendix G1)	• Identification of fauna habitats • 1,580 pitfall trap nights • 1,570 Elliot trap nights • 870 funnel trap nights • 314 cage trap nights • 39 hours of active bird surveys • 30 nights of 2 x Anabat Swift call detection • 795 km of walking transects looking for signs of conservation significant species • Deployment of 57 camera traps (of which 30 were left deployed for 3.5 months targeting conservation significant species habitat) • Mist netting • Spotlighting • Marsupial mole trenching	20 June to 4 July 2018 17 to 31 October 2018 24 April to 6 May 2019
Targeted Great Desert Skink Survey (OZ Minerals, 2021; Appendix G2)	• 767.3 km of walking transects	20 June to 4 July 2018 17 to 31 October 2018 24 April to 5 May 2019
Avian fauna and microbat baseline characterisation (OZ Minerals 2021; Appendix G3)	• 3,455 hours of acoustic recordings using 4 x SM2 and 4 x SM4; comprising 10,366 20-minute recording sessions • 308 hours of microbats recordings using 4 x SD2 Anabat™	Four-month deployment of SM Song Meters, and Anabats between 7 October 2018 and 24 January 2019
Targeted habitat analysis for potential Night Parrot habitat (OZ Minerals 2021; Appendix G3 Addendum 1)	Systematic grid searches of the Development Envelope (20,851.9 ha) and a 10 km buffer distance around the entire Development Envelope (an area of 125,887.2 ha) using a combination of vegetation and habitat survey data and remote sensing data to identify the potential presence of Night Parrot roosting, foraging and flyaway habitats	May 2021
Targeted survey and habitat assessment for the McDonnell ranges Black Footed Rock Wallaby and the Great Desert Skink (OZ Minerals, 2021; Appendix G5)	• Walking transects at six Great Desert Skink Regional Zones • Field inspections of six near mine and regional rocky-outcrops and rangelands • Deployment of six camera traps at near mine rocky outcrops	Multiple field visits between 23 September 2019 and 22 November 2019

Survey	Sampling Effort	Dates
Short Range Endemic Survey (OZ Minerals, 2021; Appendix G6)	• 47 foraging sites • 22 dry pitfall trapping sites • 19 wet pitfall trapping sites	20 June to 4 July 2018 17 to 31 October 2018 8 to 15 October 2019

Table 10: Survey Effort for the Great Desert Skink per Habitat Type

Habitat Type	Total Transects (km)
Sand dunes	47.5
Spinifex sandplains	166.3
Calcrete – Spinifex sandplain mosaic	137.1
Mallee sandplains	74.8
Calcrete – Mallee sandplain mosaic	25.7
Mulga sandplains	24.5
Calcrete plains	51.0
Mulga woodlands	72.3
Stony hills and plains	-
Chenopod shrublands	-
Claypans	0.4
Outside fauna survey area (primarily Spinifex Sandplain)	165.1
Total	**767.3**

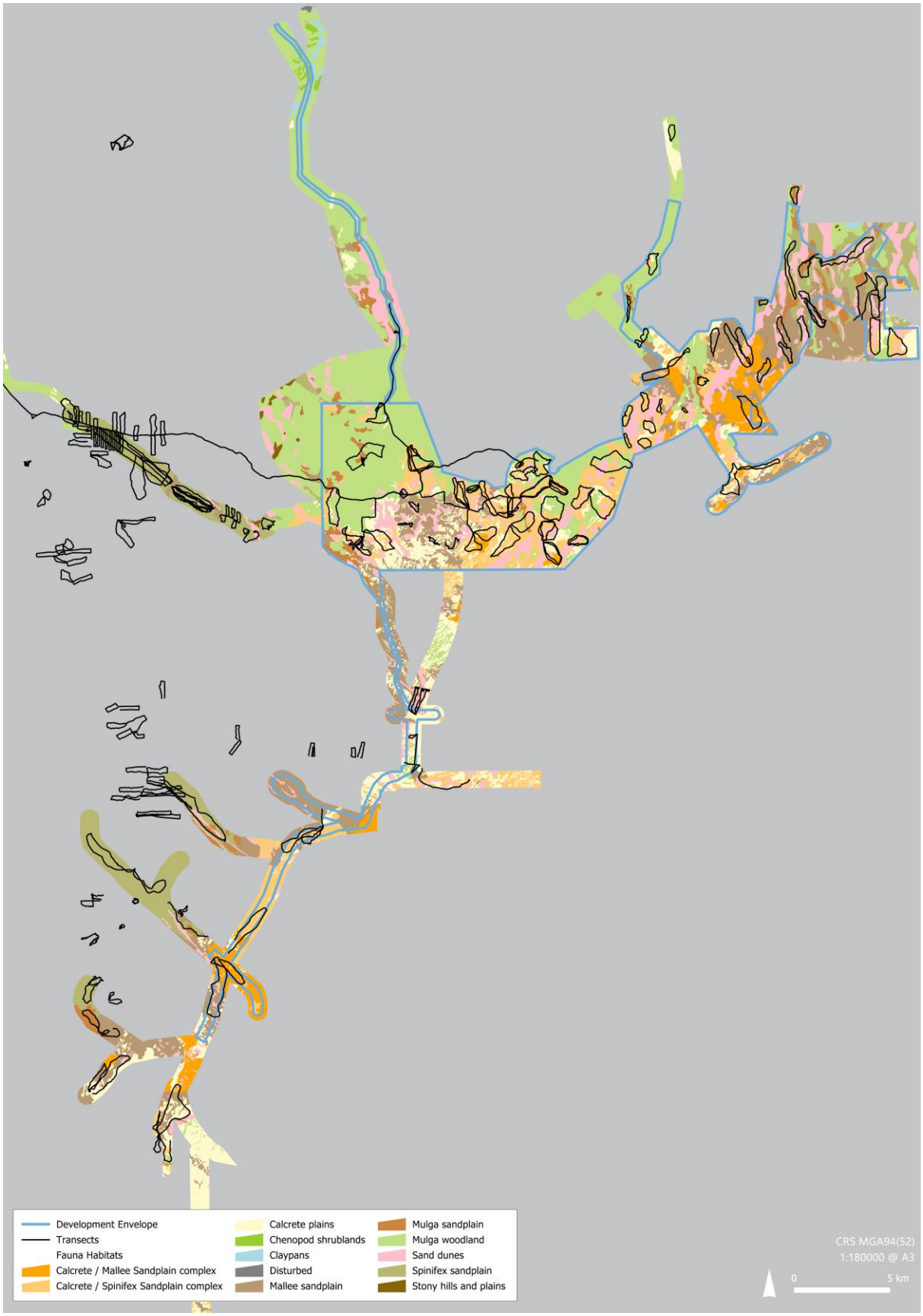

Figure 4: Great Desert Skink Survey Effort (Transects)

The targeted regional study undertaken by the Ngaanyatjarra Ranger Team identified 80 new warrens (groups of burrows), representing 10 to 12 previously undocumented clusters or sub-populations (e.g. populations separated by 10 km or more). Sixty-nine of these records were classified as active, having latrines with fresh scats (Figure 7). It is noted that the newly recorded burrows in the regional study were predominantly in relatively close proximity to vehicle access tracks (0.5 to 1 km) and do not represent an exhaustive inventory of the species area of occupancy throughout the landscape.

Within the project-specific fauna survey area (46,263.3 ha), a total of 106 Great Desert Skink burrows were recorded in four distinct areas or sub-populations (Figure 5 and Plate 1). Thirteen of these 106 records were located inside the Development Envelope, in the northern borefield area. For all sub-populations identified, it is considered likely that more burrows were present within deep sand spinifex, however as the purpose of the surveys was to investigate the extent of the population rather than document every burrow a full population estimates were not confirmed.

Based on interrogation of aerial imagery, Western Wildlife have indicated it is reasonable to assume that the area of occupancy of the species is far larger than just those locations where Great Desert Skink were identified. An indicative area of occupancy based on habitat mapping has been identified, as shown in Figure 9. Great Desert Skink burrows were found exclusively in Spinifex Sandplain, with a few burrows on the saddles of low dunes adjacent to these sandplain (Plate 1). Figure 6 shows the distribution of the burrows found within the fauna survey area. Burrows were often located in areas with patches of *Leptosema chambersii*, a widespread low shrub of the arid region. Great Desert Skink were not identified in any other habitat type within the project specific survey area, or in the Ngaanyatjarra Council Ranger study area.

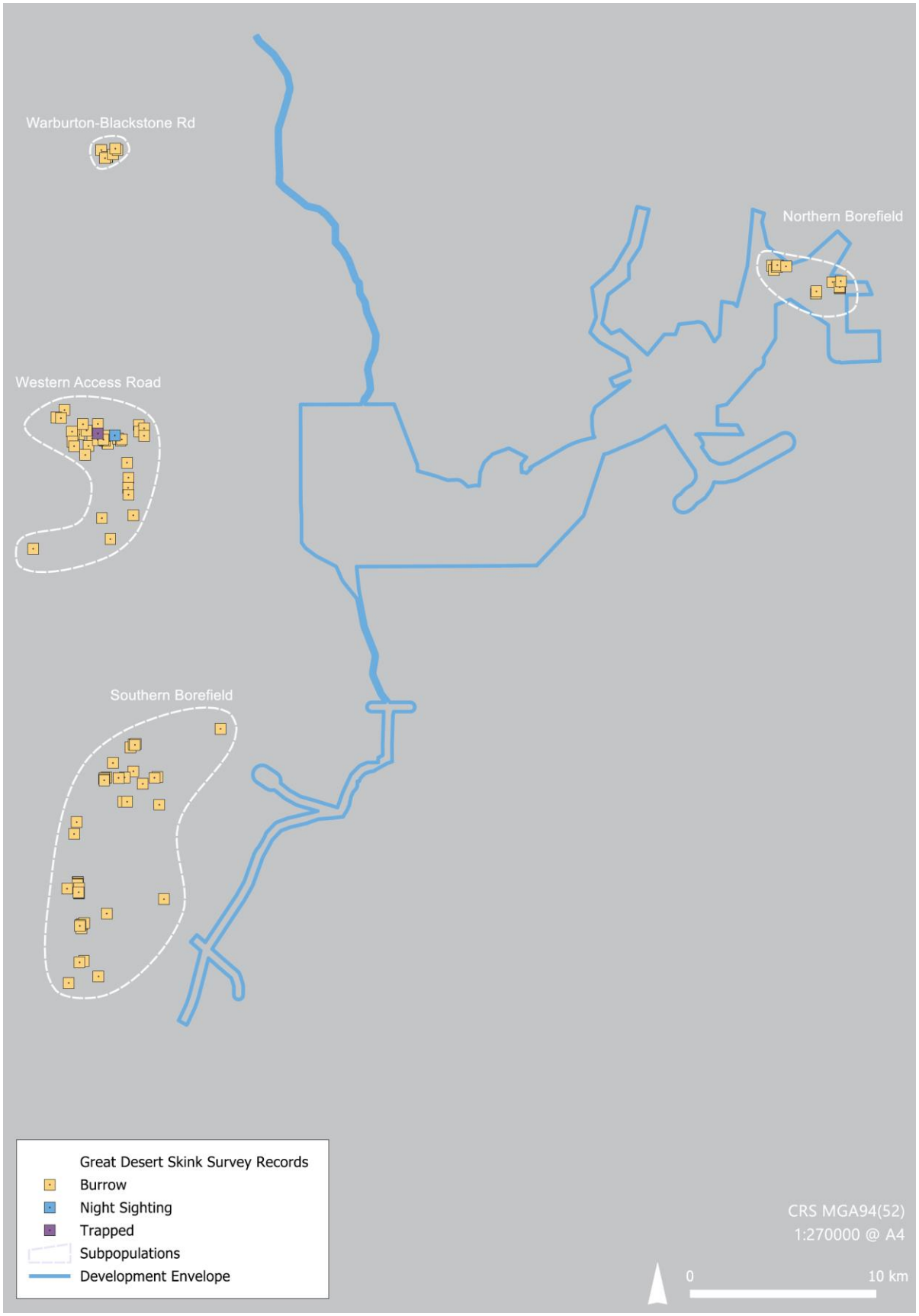

Figure 5: Great Desert Skink Survey Records Within the Survey Area

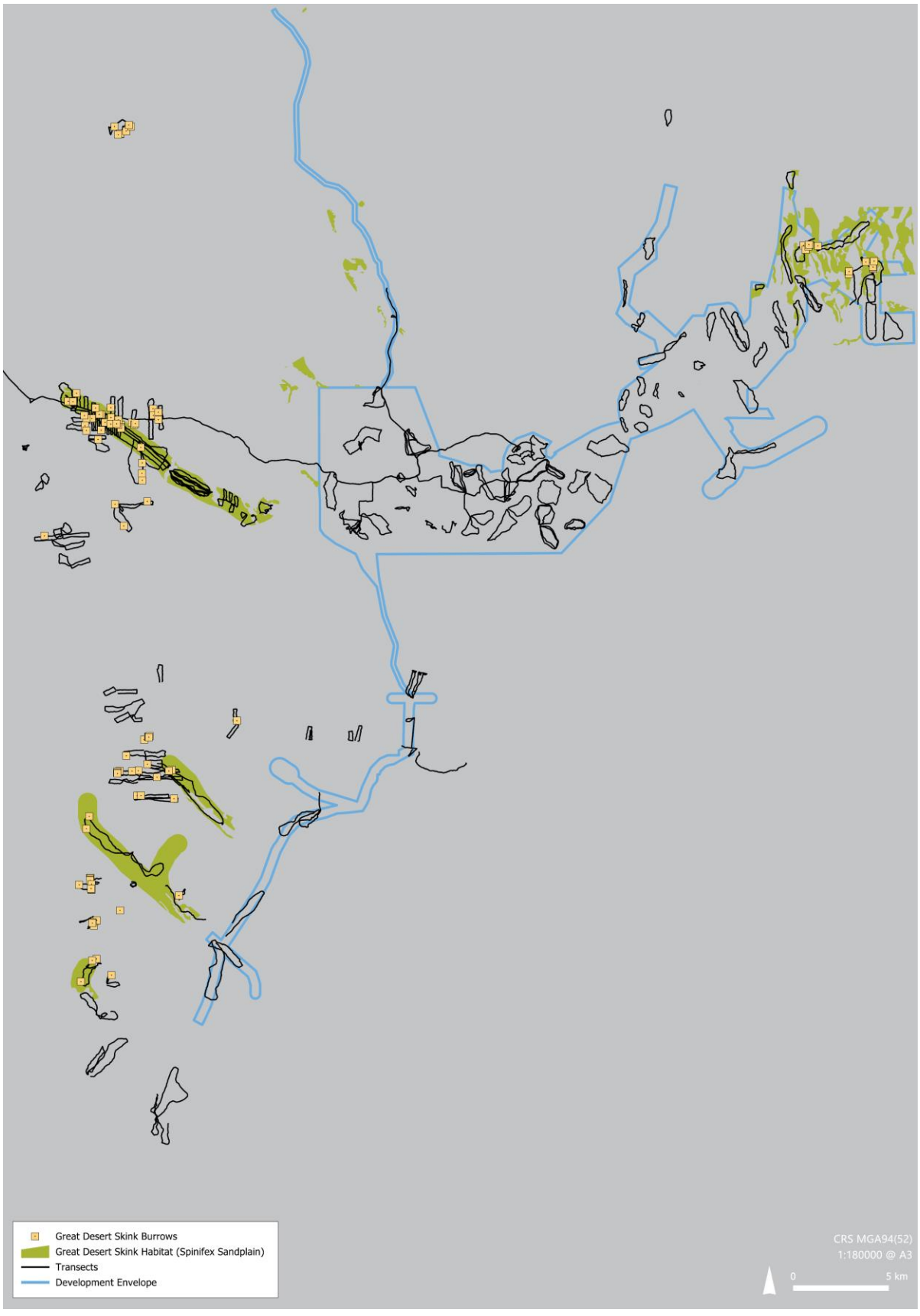

Figure 6: Observed Great Desert Skink Burrows in the Project Area

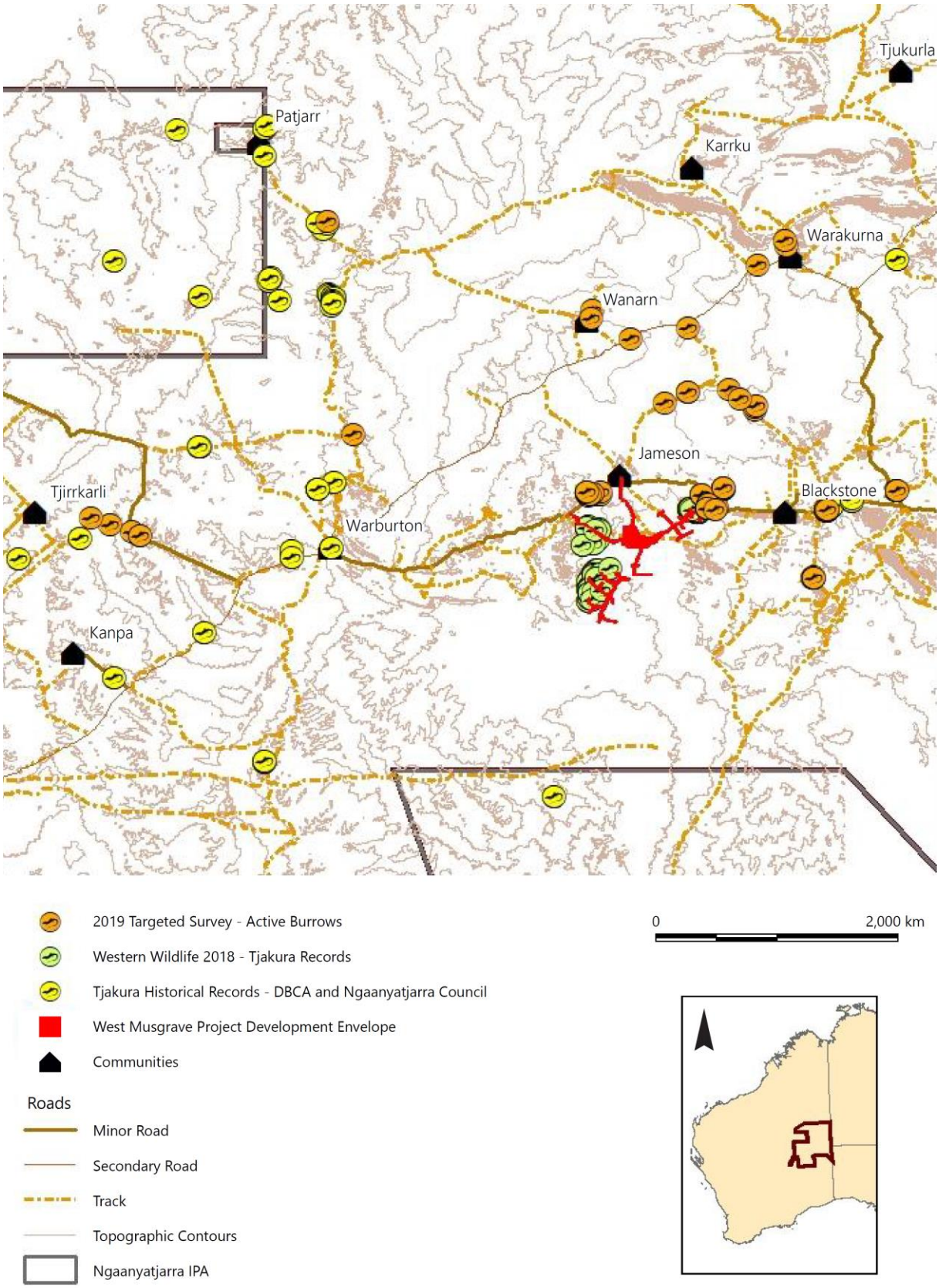

Figure 7: Regional Records for the Great Desert Skink Active Burrows

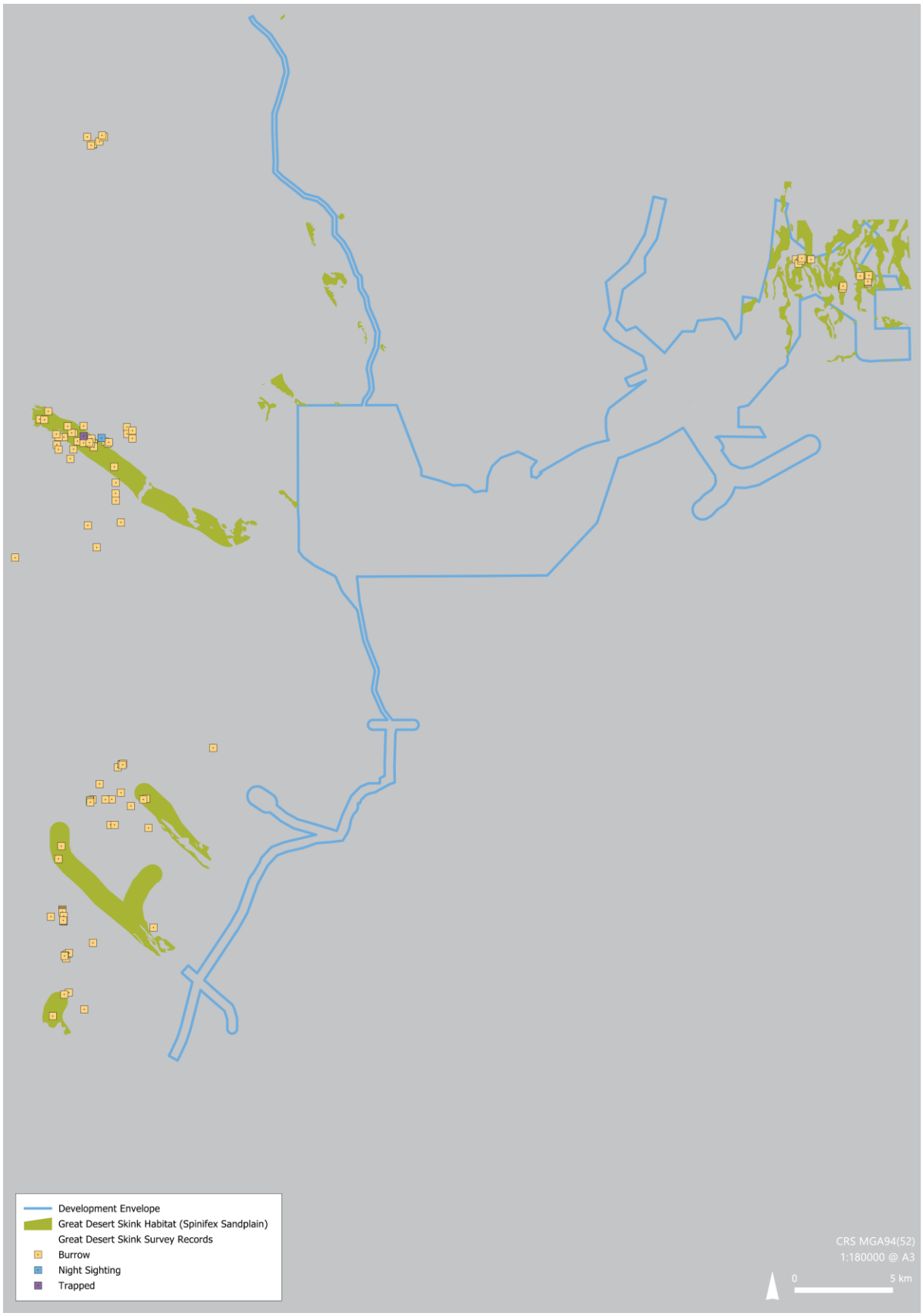

Figure 8: Great Desert Skink Habitat Within the Project Area

Figure 9: Assumed Area of GDS Occupancy in and Adjacent to the Development Envelope

1.4.2 Key Assumptions and Uncertainties

This TFMP has been developed using all relevant and available information at the time of preparation. As the understanding of terrestrial fauna management improves over time, this TFMP may require updating.

The key assumptions and uncertainties associated with this current TFMP are described in Table 11.

Table 11: Key Assumptions and Uncertainties Associated with Terrestrial Fauna Management

ID	Assumption/ Uncertainty	Description
A1	Survey effort	The fauna surveys undertaken to date accurately report the distribution and status of significant fauna and their preferred habitats in the project area. The competency and experience of the consultants carrying out Terrestrial Fauna surveys was sufficient to ensure qualified results.
A2	Species habitat	Based on the level of targeted survey effort for Great Desert Skink, the habitat preferences of this species are well known and limited to deep sand spinifex habitat, and occasionally on dune crests and swales adjacent to deep sand spinifex sandplains. No signs of Great Desert Skink have been found outside of these habitat types. Clearing of deep sand spinifex sandplain habitat in the Development Envelope is limited to an area of 6.7 ha within the Northern Borefield. This represents 0.1% of all Great Desert Skink habitat recorded and mapped in the project specific fauna survey area.
A3	Species distribution	Based on interrogation of aerial imagery, Western Wildlife have indicated it is reasonable to assume that the area of occupancy of the species is far larger than just those locations where Great Desert Skink were identified in the current survey.
A4	Threatening processes	Significant fauna are susceptible to a range of threatening processes, including predation / competition from introduced species and inappropriate fire regimes. Active management of these factors has the potential to result in a net positive outcome for fauna beyond current levels.
A5	Effectiveness of management actions	Protection of fauna habitat will result in the protection of significant fauna. The management actions proposed (Section 2) in this TFMP are appropriate and sufficient to protect significant fauna species from significant direct and indirect impacts.
A6	Protection of all native fauna	Measures to protect significant fauna habitat will also protect other native fauna species supported by that habitat. Measures to protect significant fauna will also protect all other native fauna, including those species of significance to Ngaanyatjarra People.
U1	Regional knowledge	It is considered likely that scheduled species including priority fauna populations found to date also occur more widely in the project region, outside of those areas associated with the Development Envelope. While interrogation of aerial imagery has identified significant areas of deep sand spinifex outside of the Development Envelope, the full extent of appropriate habitats and population areas outside of the Development Envelope for each listed fauna species is generally unknown.

1.4.3 Management Approach

While OZ Minerals has identified a number of avoidance, minimisation and mitigation measure that would be implemented to protect terrestrial fauna in the EPA Section 38 Referral (OZ Minerals, 2021) the management approach, and management actions detailed in this TFMP are specifically designed to ensure the project meets the EPA's objective for Terrestrial Fauna (Section 1.2) as it pertains to significant fauna, with a focus on the mitigation hierarchy; this includes avoidance and minimisation of direct impacts (Table 12) and the mitigation of indirect impacts (Table 13).

Table 12: Minimisation Measures for Direct Impacts to Significant Fauna

Mitigation
Measures to Avoid
• A considerable effort has been made to reorient and reduce the size of Development Envelope to avoid impacts to environmental values. This has included a reduction of the Development Envelope from 25,200 ha to 20,852 ha (17% reduction), and of the disturbance footprint from 3,961 ha to 3,830 ha resulting in the exclusion of some areas known to support significant fauna (such as the formally proposed Western Access Road and parts of the Southern Monitoring Area where deep sand spinifex occur) • Adjustment of the Development Envelope to exclude habitat known to support significant species (excluded 82% of Spinifex Sandplain habitat) • Avoidance through informed design by minimising clearing to the smallest area possible and placing waste in-pit where practicable • Avoidance or minimisation through informed design by avoiding clearing of habitat for conservation-significant species and, where practicable, micro-sighting infrastructure during construction to avoid significant habitats • Siting of turbines outside of habitats known to support significant fauna species • Consideration of the swept height of wind turbine blades above the vegetation canopy for wind farm design and development • Exclusion of the use of barbed wire fencing to minimise impacts to bats and avian fauna
Measures to Minimise

• Development and implementation of a site-specific internal clearing/disturbance procedure and associated permit to prevent clearing outside approved boundaries, and to minimise disturbance to only that required
• The site induction program would provide information on protection of significant fauna habitats and ground disturbance authorisation procedures
• A pre-clearance survey would be undertaken in Spinifex Sandplain to ensure that proposed clearing is aligned away from signs of Great Desert Skink
• Implementation of a Feral Animal Monitoring and Control Program, an example of which is provided in Appendix C.
• Various aspects of the conceptual and detailed design of the wind farm and individual turbines would take into account the following design features to reduce the risk of avian fauna and bat mortalities:
  ○ Design of turbine towers with solid structure turbines, as opposed to lattice style structures to prevent birds, particularly raptors, using the turbines as perching and/or nesting locations, increasing the likelihood of rotor collision
  ○ Size of turbines would be as large as practicable to allow the turbines to be more visible to avian fauna species and have lower blade rotational speeds than smaller turbines
  ○ Turbines would be designed to create less edges where possible
  ○ Provision of visibility enhancement devices

Mitigation
Measures to Rehabilitate
• Progressive rehabilitation would be undertaken on disturbed areas as they become available • Monitoring of analogue and rehabilitated areas would be undertaken to ensure short, medium and long-term rehabilitation objectives are achieved • Ongoing development of monitoring methodology and rehabilitation techniques would occur during the life of the project. Further assessments over time would plot the development of rehabilitated areas against analogue sites and progression towards completion targets • Preparation and regular update of a Mine Closure Plan consistent with DMIRS and EPA Guidelines for Preparing Mine Closure Plans (DMIRS, 2020)

Table 13: Mitigation Measures for Indirect Impacts to Significant Fauna

Mitigation
Altered fire regimes
• Fire breaks would be maintained around fixed plant areas • Fire management infrastructure would be maintained on site and in vehicles, along with competent persons for the management of bushfires • A Hot Works procedure would be put in place to ensure adequate controls are put in place for activities that have the potential to result in bushfire • Fire management protocols and land management would be consulted with the Ngaanyatjarra Council to ensure that aligned fire management outcomes are achieved

1.4.4 Rationale for Choice of Management Targets

The provisions included in this TFMP are objective-based as they relate to specific management actions.

2 EMP COMPONENTS

2.1 Management Objectives, Actions and Targets

Management objectives, actions and targets focused on achieving the EPA objective for Terrestrial Fauna (Section 1.2) as it relates to significant flora species are presented in Table 14. These focus the greatest management effort on project activities that have the highest likelihood of causing adverse impact on significant fauna species. The order of management objectives and the resultant management actions and targets is from highest to lowest management effort to achieve the EPA's objective.

Table 14: Objective-based EMP for Terrestrial Fauna

EPA Factor: Terrestrial Fauna

Key Environmental Values: Significant fauna and associated habitat

Key Impacts and Risks:

- **Decrease in poorly represented fauna habitat as a result of land clearing for the pipeline and service corridor alignment**
- **Significant decrease in richness and abundance of fauna, including significant fauna, as a result of interactions with project-related vehicles and machinery or entrapment**
- **Increase richness and abundance of predator species resulting from project-related attractants (water and food sources) result in higher levels of predation of native fauna**
- **Decrease in the richness and abundance of poorly represented fauna habitat and significant fauna species as a result of project-related altered fire regimes**

Management Action	Management Target(s)	Monitoring	Reporting
Management Objective: Minimise loss of significant fauna habitat and fragmentation as a result of project-related land clearing			
• Clearing in accordance with internal land clearing procedure • Minimise amount of active cleared land	• Total project-related land disturbance is to be within the approved Development Envelope and not to exceed the approved area	• Annual reconciliation of land disturbance-related survey data with the respective year's aerial imagery • Annual review of internal project-related land disturbance register relative to actual project-related land disturbance and LDPs	• Internal project-related Land Disturbance Register and LDPs • Mining Rehabilitation Fund (MRF) annual reporting • Annual WMP Compliance Assessment Report
Management Objective: Minimise death or injury to significant fauna in the Development Envelope as a result of project-related land clearing			
• Undertake pre-disturbance surveys: ○ in Spinifex Sandplain habitat to map all active Great Desert Skink burrows ○ prior to proposed project-related land disturbance with adequate lead time (two months is recommended) to allow for design amendment to ensure avoidance of all active Great Desert Skink burrows ○ to undertake designation/demarcation as 'fauna exclusion zones' prior to project-related land disturbance • Fauna spotter present during all project-related land disturbance in Spinifex Sandplain habitat • Where relocation of burrows is required, this will be discussed/agreed with the Department of Biodiversity Conservation and Attractions prior to any relocation being undertaken	• No death or injury to significant fauna attributable to project-related land disturbance activities • No loss of active Great Desert Skink burrows due to project-related land disturbance • The Ngaanyatjarra Ranger Teams will be invited to participate in pre-disturbance monitoring activities (subject to fair and reasonable commercial terms)	• Great Desert Skink burrow location and status data collected during pre-disturbance surveys • Fauna spotter to record observations of significant fauna and burrows during project-related land disturbance in Spinifex Sandplain habitat, including written records and photographs, where appropriate • Records of engagement with the Ngaanyatjarra Council relating to participation in pre-disturbance survey work • Opportunistic identification of fauna mortalities	• Pre-disturbance survey records including significant fauna observations and fauna mortality records • Fauna spotter recorded significant fauna observations including fauna mortality • GIS records of pre-disturbance survey records, fauna exclusion zones and locations of significant fauna recorded by fauna spotter • Annual WMP Compliance Assessment Report
Management Objective: Minimise death or injury to significant fauna as a result of interactions with project-related vehicles or machinery			
• Speed limits restricted to a maximum of 20 km/hr in close vicinity of Deep Sand Spinifex habitat, 60 km/hr in all other project areas, 80 km/hr on the main northern access road; with appropriate speed limit signage in place • Off-road driving not permitted outside of cleared areas • All fauna-vehicle interactions to be reported with time and location to allow investigation and data collection • Personnel inductions include discussion of speed limit restrictions, requirements to report fauna-vehicle interactions and the non-compliance process	• No death or injury to Great Desert Skink, Brush-tail Mulgara, Southern Marsupial Mole or Striated Grasswren as a result of vehicle strike attributable to the project	• Quarterly review of records of speed limit non-compliances • Identification of traffic related fauna mortalities through incident report data collection and investigation	• Annual WMP Compliance Assessment Report • Internal incident reporting and non-compliance reporting • Fauna mortality records • Induction records • Regulatory agency notification of incident for significant fauna

Management Action	Management Target(s)	Monitoring	Reporting
Management Objective: Minimise adverse impacts on significant fauna as a result of project-related pipeline construction			

• Undertake pre-disturbance surveys:
  ○ in Spinifex Sandplain habitat to map all active Great Desert Skink burrows
  ○ Prior to project-related land disturbance with adequate lead time (two months is recommended) to allow for design amendment to ensure a minimum buffer distance of 50 m between active Great Desert Skink burrows and pipelines
  ○ to undertake designation/demarcation as 'fauna exclusion zones' prior to project-related land disturbance
• Fauna spotter present during all project-related land disturbance in Spinifex Sandplain habitat
• Daily fauna removal from trenches during pipeline construction
• Fauna egress installed in open trenches during construction
• Pipelines in Spinifex Sandplain habitat to be buried or elevated ≥100 mm above the ground at least every 100 m
	• No death or injury to significant fauna attributable to project pipeline construction
	• No loss of active Great Desert Skink burrows due to land disturbance for project-related pipelines
	The Ngaanyatjarra Ranger Teams will be invited to participate in pre-disturbance monitoring activities (subject to fair and reasonable commercial terms)
		• Great Desert Skink burrow location and status data collected during pre-disturbance surveys
		• Fauna spotter to record observations of significant fauna and burrows during project-related land disturbance in Spinifex Sandplain habitat, including written records and photographs, where appropriate
		• Records of engagement with the Ngaanyatjarra Council relating to participation in pre-disturbance survey work
		• Daily trench inspections with records of fauna removal during pipeline trenching activities
			• Pre-disturbance survey records including significant fauna observations
			• Fauna spotter recorded significant fauna observations including fauna mortality
			• GIS records of pre-disturbance survey records, fauna exclusion zones and locations of significant fauna recorded by fauna spotter
			• Annual WMP Compliance Assessment Report

Management Objective: Minimise adverse impacts to significant fauna as a result of project-related increase in feral animal abundance			

• Install fencing around domestic waste facilities minimise access to waste
• Construct and rehabilitate project borrow pits and all other constructed landforms to minimise permanent or long-term water holding
• Develop, implement and update a Feral Animal Monitoring and Control Program within the Development Envelope for the operational phase in response to construction phase and ongoing monitoring results
	• Minimise feral fauna species access to attractants (e.g. water sources and uncovered waste)
	• Minimise feral fauna species access to ponded water in constructed landforms, including borrow pits
	• Reduced observations of feral fauna species in project attractant areas (landfill, WWTP, water storage ponds, accommodation village)
		• Quarterly feral animal monitoring and recording at attractant locations, including:
		  ○ presence/absence
		  ○ species
		  ○ status of fencing
		  ○ status of attractants (water storage, waste management)
		• Post-rehabilitation earthwork inspections
		• Post-rainfall inspections
		• Workplace inspections (WWTP, landfill, water storages)
		• Opportunistic fauna observations
			• Internal incident reports
			• Annual MRF reports
			• Feral fauna species monitoring and control program records
			• Annual WMP Compliance Assessment Report

Management Objective: Minimise adverse impacts to significant fauna as a result of project-related altered fire regime			
• Develop and maintain a Fire Mitigation Plan and incorporate into the Asset Emergency Management Plan • Install and maintain fire extinguishers and firefighting equipment in the project area and on site to relevant Australian Standards • Install and maintain firefighting equipment in machinery and vehicles undertaking land disturbance activities • Project emergency response personnel trained in fire and bushfire response • Vehicles kept to access tracks or cleared areas • Develop and implement a Hot Work Permit system • Fire management practices developed in consultation with WA Department of Fire and Emergency Services (DFES) and the Ngaanyatjarra Council, including installation and maintenance of firebreaks if required • Site induction to include information on prevention, management and response to fires	• No unplanned fires attributable to project-related activities • Minimise the potential environmental damage from project-related extreme or out-of-control wildfires attributed to project-related activities	• Emergency response equipment inspections relative to relevant Australian Standards • Annual fire response training exercise including wildlife response • Annual review of fire break development for evidence of adequate installation and maintenance	• Internal incident reports • Internal project-related Land Disturbance Register and LDPs • Hot Work Permit register • Induction and training records • Annual WMP Compliance Assessment Report

2.2 Monitoring

Internal monitoring procedures and processes will be developed to support the delivery of the monitoring commitments described in Table 14 to ensure a consistent monitoring approach and methodology is applied over the life of the project. Where relevant and appropriate, the Ngaanyatjarra Council and relevant Ngaanyatjarra People would be consulted during the development of the monitoring procedures.

2.3 Reporting

2.3.1 Ngaanyatjarra Council and Ngaanyatjarra People

All reporting discussed in this section will be made specifically available to the Ngaanyatjarra People through the Ngaanyatjarra Council, including where necessary periodic face-to-face meetings to discuss the results and outcomes of monitoring.

Where necessary training and support of relevant members of the Ngaanyatjarra People will be supported by OZ Minerals to ensure an understanding of monitoring results and their relevance. Further, opportunities for the involvement of Ngaanyatjarra People in the monitoring activities will continue to be explored as the project is developed.

2.3.2 Annual Reporting

OZ Minerals will prepare Annual Environmental Reports (AERs) to be submitted to regulatory authorities. The format of these reports will be consistent with requirements stipulated by individual regulatory authorities.

A Compliance Assessment Report (CAR) will be submitted to the Compliance Branch at Government of Western Australia's Department of Water and Environmental Regulation (DWER) at an agreed date. The CAR will document compliance with conditions of approval including assessment of compliance with management plan requirements where management plans form part of approval conditions.

2.3.3 Incident Reporting

In recognition of the conservation status of the four species of significant fauna described in this FVMP, OZ Minerals will report deaths directly attributable to the project. Relevant regulatory authorities (EPA, DBCA and Department of Mines, Industry Regulation and Safety (DMIRS)) will be notified within seven days of the death being recorded.

2.3.4 Reporting to the Ngaanyatjarra Council

In addition to the regulatory reporting requirements outlined in Table 14, OZ Minerals would report key data from this TFMP to the Ngaanyatjarra Council, including:

- Fauna deaths attributable to the WMP, including mortalities of species considered significant to the Ngaanyatjarra people
- Feral animal monitoring outcomes.

These would be reported and/or presented in accordance with consultation and/or reporting schedules nominated within the Mining Agreement.

3 ADAPTIVE MANAGEMENT

Adaptive management is a systematic approach to improving environmental results and management practices during project implementation through the application of learning from monitoring of management actions. Specifically, adaptive management in relation to this MP includes:

- Defining the issue and objectives, and developing the TFMP to address these (i.e. this document)
- Implementing the management actions described in this TFMP (Table 14)
- Monitoring and evaluating the applied management and mitigation against the outcomes and objectives, as per the monitoring program outlined in Table 14
- Adjusting the management actions and monitoring (if required) to meet the outcome or objective, based on what is learnt from:
    - evaluation of the effectiveness of applied mitigation measures
    - review of assumptions and uncertainties
    - re-evaluation of risk assessment
    - external changes during the life of the project (e.g. technical advances or innovation, changes to priority or threatened fauna listings).

It is recognised that there is a level of scientific uncertainty surrounding the Great Desert Skink, particularly in relation to abundance and distribution. This makes determination of residual impacts of implementing the project on local or regional scales difficult with any degree of certainty. Given the long life of the project, it is reasonable to expect that additional information will be gained on the species that may influence future management. For this reason, it is important that the management approach for the Great Desert Skink is adaptive.

3.1 Management Plan Review

Review processes for the TFMP will be based on formalised dates after project commencement and triggers such as:

- Monitoring results: If site-specific monitoring program results indicate that management targets are not being achieved.
- Changes in knowledge: If new information about a species' use of the Development Envelope or region is received which would better inform management approaches.
- Significant changes to project design: The relevance and effectiveness of existing management measures would be considered and amended as appropriate.

This management plan will also be reviewed and revised following any significant changes to the project from that described within the EPA Section 38 Referral (OZ Minerals, 2021). OZ Minerals will also review this plan within one year following implementation of the project, including a review of the management actions, monitoring methods and reporting requirements. Following any significant changes, the updated plan will be submitted to DWER for approval.

4 STAKEHOLDER CONSULTATION

Consultation has been undertaken as part of the Section 38 Referral under Part IV of the EP Act, and as part of ongoing discussions relating to a Mining Agreement with the Ngaanyatjarra People. Details of these consultations are provided in Section 3, Section 6.1.3, Appendix A4 and Appendix A5 of the EPA Section 38 Referral (OZ Minerals 2021).

Through consultation with Traditional Owners the following areas were identified as areas of concern to Ngaanyatjarra People relating to terrestrial fauna, these matters have been specifically considered in this TFMP:

- Potential impacts to food resources such as goanna, bush turkey (Australian Bustard), macropods and grubs or to species that are considered iconic in dreamtime stories or representative of dreaming trails. These iconic and totem species comprised the same suite of species as those listed as species that are regularly hunted.

Consultation specific to this TFMP includes internal peer review with subject-matter experts (MBS Environmental, Western Wildlife, Donato Environmental Services and Adaptive NRM) and meetings with the Government of Western Australia's DWER and EPA.

A review of a draft TFMP has been undertaken by the Ngaanyatjarra Council (environmental consultant). All relevant feedback has been considered in the development of this management plan.

5 UPDATES TO THE EMP

This section is not applicable to the first version of the Terrestrial Fauna Management Plan, and will be updated in future revisions.

6 REFERENCES

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APPENDICES

Appendix A. Night Parrot Peer Review and Habitat Analysis

NIGHT PARROT PEER REVIEW AND HABITAT ANALYSIS

As part of the Government of Western Australia's Environmental Protection Authority's (EPA) S40(2)(a) Notice Requiring Information for Assessment for the West Musgrave Copper and Nickel Project, the EPA requested a 'review of the Night Parrot methodology'.

The review, which can be found at ANRM 1, was undertaken by notable Night Parrot experts, Nigel Jackett and Nick Leseberg of Adaptive NRM, who have extensive experience identifying potential Night Parrot habitat and detecting Night Parrots using remotely deployed acoustic recording units (ARUs). The review concluded that methodological shortcomings employed in the initial WMP Night Parrot surveys presented limitations to detection of Night Parrots, and that conclusions pertaining to Night Parrot occupancy were not supported. The review recommended the following actions to increase certainty relating to potential Night Parrot occupancy at the WMP:

1. Conduct a desktop analysis of potential roosting and foraging sites using available products and hi-resolution satellite imagery, a process that the authors have used successfully to identify the presence of Night Parrot throughout Australia
2. Where the desktop analysis indicates potential roost habitat is extant, a comprehensive acoustic survey plan for these sites could be developed that would require a limited number of very brief acoustic surveys, and analysing the recordings from these surveys, with a recogniser known to be capable of detecting a higher percentage of Night Parrot calls.

In May 2021, following the review described above, Nigel Jackett, Nick Leseberg and Steve Murphy of Adaptive NRM, undertook the first of the above listed recommendations. This Night Parrot Habitat Analysis can be found at ANRM 2, and concluded:

> *Night Parrot roosting habitat is unlikely to occur within the Development Envelope, reducing uncertainties in previous assessments…. Therefore, additional acoustic surveys (or re-analysis of sound data collected by Donato Environmental Services (2019)) are unlikely to detect the presence of roosting Night Parrots within the Development Envelope. Acoustic surveys within potential foraging habitat are unlikely to detect Night Parrots, due to the small and fragmented extent of potentially suitable habitat available, and the relatively large distance Night Parrots would need to travel to access potential foraging habitat within the Development Envelope.*

This analysis provides a strong conclusion of the low likelihood of Night Parrot occurrence at the WMP.

Details of the above listed Night Parrot habitat study and review are provided below.

ANRM 1. Night Parrot Peer Review

OZ Minerals Ltd
West Musgrave Copper and Nickel Project

Peer Review of Night Parrot assessments

31 May 2021

Adaptive nrm

Recommended citation: Jackett, N.A. and Leseberg, N.P. (2021). *OZ Minerals Ltd West Musgrave Copper and Nickel Project – Peer Review of Night Parrot assessments.* Report to OZ Minerals. Adaptive NRM, Malanda, QLD.

1. Introduction

In April 2021, MBS Environmental (on behalf of OZ Minerals Ltd) engaged Adaptive Natural Resource Management Pty Ltd (ANRM) to peer review reports relating to the assessment of the Night Parrot for the OZ Minerals Ltd West Musgrave Copper and Nickel Project (WMP). The predominant report assessing the Night Parrot, '*Avian and microbat baseline characterisation associated with the proposed wind turbine electricity generators*' (Donato Environmental Services 2019), prepared by Donato Environmental Services (DES), examined the likelihood of the Night Parrot occurring within WMP area.

The specific scope of the Peer Review was to examine whether:

- Methods (habitat assessment and acoustic analysis) were reasonable;
- Locations of acoustic monitoring were reasonable;
- Survey effort was reasonable; and
- Conclusions were justifiable.

Additionally, it was requested that the Peer Review provide any advice or information relating to the flight heights of Night Parrots, for which there are no previously published data.

2. Peer Review

To assist the Peer Review, OZ Minerals Ltd provided core review documents and associated reference material relevant to the WMP. This material was reviewed by ANRM. ANRM also consulted David Donato of DES who conducted the acoustic analysis, to better understand the procedures used to analyse the recordings collected during the field survey. Under the main headings below we address each of the issues within the defined scope of the Peer Review.

Methods

Habitat assessment

All currently known Night Parrot populations occur at sites where there is a matrix of both suitable roosting and breeding habitat, and suitable foraging habitat. These habitats are typically structurally and floristically quite different (Murphy *et al.* 2017b). At sites where Night Parrots are known to occur, roosting habitat is provided by patches of relatively open, long unburnt, and structurally complex *Triodia*. Feeding habitat is characterised by relatively productive areas with a high diversity of perennial and annual grasses and herbs, typically found on run-on or floodplain areas (Murphy *et al*. 2017b).

Areas of open, long unburnt and structurally complex *Triodia* suitable for Night Parrot roosting habitat can be isolated and relatively small within the landscape. They are typically found in areas where natural fire breaks protect them from wildfires (Jackett *et al.* 2017; Murphy *et al.* 2017b). Palaeodrainage, open stony pavement, and rocky hills are likely to provide such protection.

DES (2019) stated (p. 4) "Roosting habitat for Night Parrot (*Pezoporus occidentalis*) is described as long unburnt *Triodia* [12], again a habitat of limited extent in the WMP [6]" citing Western Botanical (2019) who described and mapped the vegetation associations of the survey area. Yet, Western Botanical (2019) describes the 'SAWS' vegetation community as: "characterised by a composite hummock grassland (in a mature, long unburnt state)…The hummock grassland is dominated by the Spinifex species *Triodia basedowii* from 0.4 - 0.5 m and/or *Triodia schinzii* 0.5 - 0.8 m, with a PFC of 30 - 40%". The SAWS vegetation community comprises – at minimum based on this vegetation community being a component of other vegetation communities – 5,723.7 ha (13.8%) of the vegetation mapped by Western Botanical (2019). Contrary to the assessment by DES, based on the available habitat mapping, the presence of mature, long unburnt hummock grassland is not of limited extent in the WMP.

Western Wildlife (2020) noted potential roosting or breeding habitat for Night Parrot did occur at some sites, where spinifex hummocks occurred on shallow sands surrounding calcrete outcroppings. It was suggested that increased water run-off promoted spinifex growth, giving the *Triodia* the size and structural complexity required by Night Parrots. The extent of potential roosting and breeding habitat was considered too patchy and small to map as part of their survey, so further details are unknown. Given the extent of this habitat, it would likely be a relatively simple exercise for it to be mapped using available products, or publicly accessible hi-resolution satellite imagery.

Based on the descriptions and representative images of the *Calcrete Plain Landform System* and *Hardpan Plain and Drainage Landform System* (Western Botanical 2019), it is considered likely that some suitable foraging habitat for Night Parrot exists within these systems, albeit only a small amount. The associations with vegetation structure and flora assemblages that are similar to known Night Parrot foraging habitat (Jackett *et al.* 2017; Murphy *et al.* 2017c) include:

- Calcrete Open Grassland;
- Calcrete Platform Hummock Grassland with *Acacia eremophila* var. Numerous-nerved variant (A.S. George 11924);
- *Maireana triptera - Atriplex vesicaria* Chenopod Shrubland;
- Claypan Playa;
- Claypan Grassland.

When attempting to establish whether likely foraging habitat occurred in the WMP, DES stated (p. 4) "[c]henopods usually in association with edges of watercourses or salt lakes [15], [are] not typically vegetation that is represented within the WMP area". We concur that this vegetation is not well-represented within in WMP. However, Western Botanical (2019) described several vegetation associations, including the chenopod-dominated '*Maireana triptera - Atriplex vesicaria* Chenopod Shrubland', which we believe DES should have acknowledged as being potential foraging habitat for the Night Parrot.

Further, on page 5, DES uses a lack of the following: gibber, water sources, bare ground, and sparse vegetation, as justification for foraging habitat not being present in the WMP. None of

these properties characterise Night Parrot foraging habitat. Rather, Night Parrot feeding habitat is more correctly characterised as the presence of relatively productive areas with a high diversity of perennial and annual grasses and herbs. These are typically found on run-on or floodplain areas (Murphy *et al.* 2017b).

Because DES did not use available mapping to correctly assess the presence of potentially suitable *Triodia*, did not identify the presence of some vegetation associations that reflect potential foraging habitat, and incorrectly concluded that some potential foraging habitat was not suitable based on erroneous interpretations of the available literature, we conclude that DES' assessment of the extent of suitable Night Parrot habitat within the Development Envelope was incorrect.

Acoustic analysis

DES used Kaleidoscope Pro (Kaleidoscope) software to conduct the acoustic analysis of field recordings from the WMP. Kaleidoscope provides a method of automated detection of vocalisations within bioacoustic recordings. It is widely used in acoustic analysis, including for Night Parrots (Biologic Environmental Survey 2020; Phoenix Environmental Sciences 2020). Kaleidoscope clusters similar signals (e.g. a particular call type of a bird) into groups, to be later classified or analysed. Once classified, new data can be analysed and matched to previously annotated clusters.

DES used Kaleidoscope cluster analysis to search for calls of the Night Parrot, as well as other arid bird species. The parameter settings used to run the Kaleidoscope cluster analyses targeting the Night Parrot are listed in Table 2 (pg. 13) of DES (2019). DES stated that the selected frequency ranges for the two cluster runs targeting the Night Parrot were 1600 – 2400 Hz, and 1600 – 2600 Hz.

DES (2019) attempted to assess the performance of the selected Kaleidoscope parameters through the insertion of Night Parrot reference calls into field recordings. The reference calls were sourced from the Night Parrot website: https://nightparrot.com.au/index.php/resources/night-parrot-calls/ (D. Donato pers. comm.).

It is well-established in the acoustic analysis literature, that an accurate acoustic analysis requires: a detailed knowledge of the calls of the species of interest; access to a comprehensive library of the calls which have been recorded in the field on which to test the method of analysis; and, familiarity with the calling biology of the target species (Potamitis *et al*. 2014, Priyadasharni *et al*. 2018).

The cluster parameters employed by DES did not correspond with publicly available, peer-reviewed literature (Jackett *et al*. 2017, Leseberg *et al*. 2019), which give details of several Night Parrot call types with frequencies approaching 4000 Hz. *Didit* calls from the Great Sandy Desert, a frequent call type in that region (N. Jackett pers. obs.), are typically recorded between 2500 – 3100 Hz (Leseberg *et al.* 2019). DES did not cite either Jackett *et al*. (2017) or Leseberg *et al*. (2019), and we conclude DES was not familiar with either of these two references, otherwise cluster parameters incorporating the complete range of Night Parrot call frequencies would have been employed. DES was apparently familiar only with the nine publicly available calls at the time, which do not represent the Night Parrot's entire repertoire, nor the possible variation in the call types which are represented in that very small sample of calls. We conclude

that DES did not have a detailed knowledge of the calls of the species of interest. In fact, given that DES was apparently not familiar with the two primary references describing Night Parrot calls, and had access to a library of only nine Night Parrot calls, it is reasonable to conclude that DES had a very poor knowledge of Night Parrot calls.

It is recommended that before using a call recogniser to make conclusions about the presence or absence of a species, that recogniser is tested on field recordings with a known number of target vocalisations, so that performance can be assessed (Potamitis *et al*. 2014, Priyadarsharni *et al.* 2018). Publicly available reference calls, including those available for download on the Night Parrot website, are typically examples of unobstructed calls that are clearly audible and have been edited for listening purposes. The use of such calls when testing the performance of a recogniser is known to inflate performance, and the significant gap in performance between recognisers trained and tested on curated reference data, and those trained and tested on field data is well-established (Potamitis *et al*. 2014). This is particularly the case for Night Parrot calls. In field recordings, Night Parrot calls are often faint and obscured by insect noise, other bird calls, machinery noise, and/or wind noise. They also show much variation in frequency and structure. We acknowledge that the recogniser created by DES would have detected some Night Parrot calls, but for these reasons, the tests performed by DES which demonstrated good recogniser performance using the available reference calls inserted into field recordings cannot be used to predict the performance of the recogniser on field recordings containing Night Parrot calls.

In an attempt to recreate the performance of the cluster parameters used by DES on field recordings containing Night Parrot calls, we used Kaleidoscope 5.2.1 to test these same parameter settings on a batch of field recordings from the East Murchison and Great Sandy Desert known to contain 130 Night Parrot calls. The known Night Parrot call types within the test batch included *hollow whistle, three-note whistle, one-note trill,* and *didit,* and included variations of each. These call types are shared between Night Parrot populations (Leseberg *et al.* 2019) and are therefore considered call types likely to be detected during analyses in the WMP, if Night Parrots were in fact present. The number of true positive calls detected was compared against the known number of calls within the test batch. Both cluster runs described by DES were demonstrated of being capable of detecting 55.4 – 59.2 % of available Night Parrot calls within the test batch, with 'Night Parrot frequency specific' detecting the greatest proportion. All detections from 'Night Parrot cluster run' were detected during the 'Night Parrot frequency specific' cluster run, and as such, 59.2% of available calls were detected across both cluster runs. This assumes the analysis was conducted by an analyst experienced at identifying Night Parrot calls; it has been established DES had limited knowledge of Night Parrot calls, and was not experienced at identifying Night Parrot calls, so this is likely to be an overestimate. The results of the tests are shown in Table 1. By comparison, the Kaleidoscope cluster parameters developed by ANRM detected 117/130 (90.0%) of the calls in this test dataset.

Based on this assessment, we conclude that the analyst's limited knowledge of Night Parrot calls, plus the relatively poor performance of the cluster parameter settings used to analyse this acoustic data were not satisfactory for detecting the range of Night Parrot call types that could have been present in this data.

Table 1. Testing of Kaleidoscope parameters used during the acoustic analysis in DES (2019)

Kaleidoscope results	Night Parrot cluster run (1600 – 2400 Hz)	Night Parrot frequency specific (1600 – 2600 Hz)
Kaleidoscope detections	315	408
Night Parrot detections (True positives)	72	77
Night Parrot calls available for detection	130	130
Proportion of available calls detected (%)	55.4	59.2

Locations of acoustic monitoring

A total of eight sites were selected for ARU deployment within the Development Envelope, four of which were deployed within the wind turbine footprint, and four located westward within 10 kms of the footprint (DES 2019). DES did not visit the WMP area to assess habitat in the field or deploy ARU units (D. Donato pers. comm.), the latter of which was conducted by OZ Minerals Ltd (J. Rowntree pers. comm.). ARUs were deployed at locations 'deemed most relevant to be Night Parrot habitat', after reviewing e.g. Murphy *et al.* (2017c) (D. Donato pers. comm.). As concluded earlier, the assessment of what constituted suitable and unsuitable Night Parrot habitat was unsatisfactory. It is not clear whether these sites represented all potentially suitable habitat within the Development Envelope, or a sample of potential habitat. Sites were not separated based on potential foraging or roosting attributes.

ANRM aligned the locations of the eight acoustic monitoring sites with vegetation associations mapped by Western Botanical (2019). ARUs were deployed in:

- CPHG – Calcrete Platform Hummock Grassland (n = 2);
- HPMW – Hard pan Mulga Woodland (n = 1);
- SAMU – Sandplain Mulga (n = 1);
- SAWS – Sandplains with Wattles other than Mulga (n = 3); and
- SDAGS – Sand Dune *Acacia* – *Grevillea* shrubland (n = 1).

ANRM acknowledge that some ARUs were deployed close to vegetation association boundaries, and therefore the vegetation at the site may have better reflected the adjacent association, as per observations by OZ Minerals (J. Rowntree pers. comm.). However, sampling within the 'SAWS – Sandplains with Wattles other than Mulga' was limited to ~3 sites, despite this association comprising mature, long-unburnt *Triodia* hummock grassland, and totalling 5,723.7 ha of mapped vegetation (Western Botanical 2019). As the sampling radius of an SM4 is ~200m (or ~3ha), and the sampling radius of an SM2 is ~100m or ~1ha) (see Survey Effort below), ANRM consider it unlikely this vegetation association was adequately sampled to draw conclusions on the presence (or absence) of Night Parrots roosting within the Development Envelope.

Additionally, deployments did not target the most likely foraging habitats for Night Parrots within the Development Envelope, as listed in the 'Habitat Assessment' section above. Consequently, the likelihood of detecting a Night Parrot away from potential roost or foraging habitat is considered very low.

Survey effort

Two approaches can be used to detect Night Parrots using acoustic surveys: short, methodical surveys can be employed to target potential roosting habitat, or longer duration surveys can be used to try and detect Night Parrots in the wider landscape.

Night Parrots are relatively easy to detect at potential roosting sites, as these sites are easy to identify, and they call very predictably within specific timeframes at these sites (Murphy *et al.* 2017a). This permits the presence or absence of Night Parrots at roost locations to be determined reliably by deploying ARUs systematically within an area of prospective roosting habitat so that the entire area is sampled, and only requires ARUs to be left in place for a relatively short survey period of around four still (non-windy) nights. Recorders should be set to record from sunset to sunrise, as per DBCA guidelines (DPaW 2017). If Night Parrots are not detected at a site within this period, it is very unlikely that the site is a roost site. There is very little benefit in targeting a roost area for more than a week, as the likelihood of birds moving into a new area to roost is considered remote (N. Leseberg unpubl. data).

Night Parrots can also be detected while moving throughout the landscape at night, including at prospective roosting and foraging sites. However, as they can range widely at night (Murphy *et al.* 2017b), a greater amount of search effort (i.e. number of nights and sampling locations) is required to determine if they are present within an area, and should ideally include wet periods when Night Parrots are known to be more vocal (Murphy *et al.* 2017a). Rainfall during the survey period was considered average overall. Slightly above average rainfall recorded at Giles in December 2018, but was average at Warburton during this same month (Western Wildlife 2020). While the parameters required to detect Night Parrots in these circumstances are not entirely clear, it is known that detections in these circumstances are likely to be very infrequent. This approach requires recorders to be left in place for extended periods (up to several months), while recording nightly between sunrise and sunset. If adopting this approach, ARU locations should target potential foraging sites, or roosting sites within a matrix of potential roosting and feeding habitat.

For this survey, ARUs recorded from 03:00 – 09:00, and 16:00 – 22:00 each day between 7 October 2018 and 24 January 2019. The ARUs recorded calls for 20 minutes every hour on the nominated hour. Estimations of sunset and sunrise times for the start and finish of the acoustic survey, as well as the number of hours recorded post-sunset and pre-sunrise are shown in Table 2.

The decision to not record between 22:00 and 03:00 each night, and to only record for 20 minutes every hour when recording was occurring, greatly reduced the probability of detecting a Night Parrot call. ANRM tested the sampling schedule used for this survey against field recordings from a Night Parrot population from an undisclosed Western Australian location. This dataset comprised 2,468 Night Parrot calls recorded at 51 unique ARU locations. The ARUs were not stationed at known Night Parrot roost sites but were spread out randomly through potential Night Parrot roosting and foraging habitat, with a similar objective to that of

the WMP assessment. The combined dataset included different seasons within the year. The times of each call were assessed against the ARU sampling schedule described in DES (2019) to determine what proportion of calls would have been *available* for detection (i.e. the ARU was recording at the time of call) using this schedule (Figure 1). We conclude that 88.1% of the calls were unavailable for detection from the complete dataset using the DES (2019) sampling schedule.

Table 2. Calculations of sunset and sunrise times at a centralised WMP location 26° 6 'S, 127° 45' E.

Sunset/Sunrise	Start (7 October 2018)	Finish (24 January 2019)
Sunset	17:32	18:24
Sunrise	05:03	04:54
Estimated total recording post-sunset*	1 hour 20 minutes	1 hour
Estimated total recording pre-sunrise*	40 minutes	40 minutes
Proportion of night (sunset – sunrise) recorded (%)	17.4	15.9

*based on 20-min recordings commencing on the first hour post-sunset and finishing on the last hour pre-sunrise. Calculated using Geodetic Calculators (ga.gov.au).

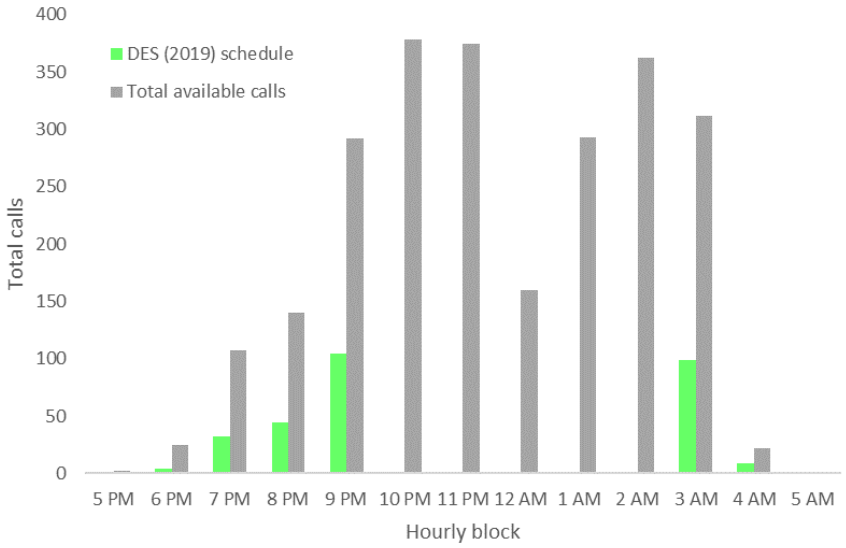

Figure 1. Number of calls available for detection using the DES (2019) sampling schedule at at a site where ARUs were used to detect Night Parrots in a suitable habitat matrix.

ANRM also tested DES' sampling schedule against the smaller dataset (i.e. 4 x 12-hour recordings) described in Jackett *et al.* (2017) from a single ARU located in the vicinity of confirmed Night Parrot roost and nesting habitat. A total of 94 *hollow whistle* and *didit* calls were contained within this dataset, of which 98.9% were unavailable for detection using DES' sampling schedule (Figure 2).

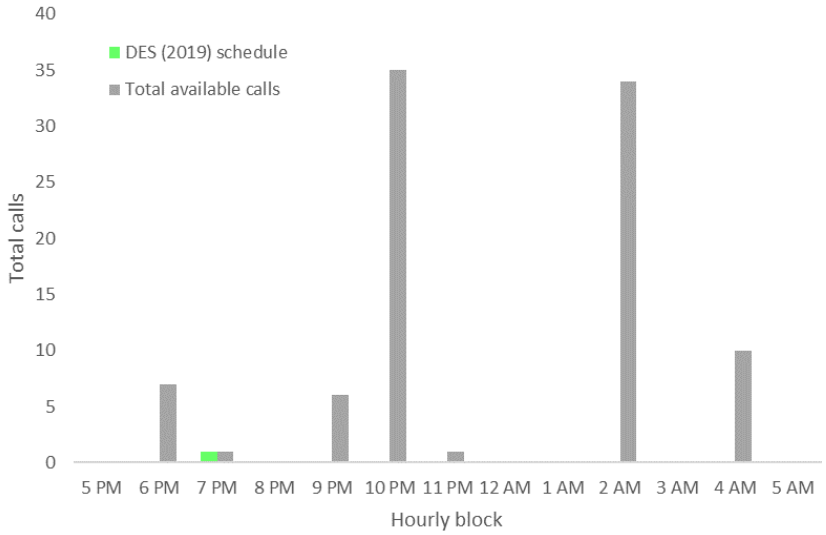

Figure 2. Number of calls available for detection using the DES (2019) sampling schedule at a Night Parrot location using a single ARU for four consecutive nights (Jackett *et al.* 2017).

These results suggest that the sampling schedule applied during this survey meant a high proportion of calls were likely unavailable for detection if Night Parrots were present within the WMP. It is important to note that when sampling in marginal habitat, as was potentially the case for this survey, the likelihood of there being a significant number of calls to detect is very small. It is more likely only a very small number of calls could be available for detection, probably fewer than 5-10. If this were the case, and Night Parrots were present in the WMP, the sampling schedule used by DES had an approximately 13% chance of recording those 5-10 calls, and as has been established previously, only a 59.2% chance of then extracting each of those calls from the dataset.

ANRM conclude that the combination of a) the analyst's limited knowledge of Night Parrot calls, b) the limitations of the Kaleidoscope parameter settings used, and c) the abbreviated sampling schedule employed resulted in a very low detection probability for any Night Parrot calls in the acoustic dataset.

We also note that both SM4 and SM2 units were used. There is a significant amount of literature (see e.g. Thomas *et al.* 2020, Yip *et al.* 2017, Stewart *et al.* 2020), supported by our own research (Leseberg *et al.* in review), which suggests the detection radius of an SM3 is around half that of an SM4 when used to detect Night Parrot calls, even when gain settings are matched as was done by DES during this survey (Donato Environmental Services 2019). SM3 has been shown to outperform SM2, so it follows that SM4 significantly outperforms SM2, and the detection radius of the SM2 will be around half that of an SM4. DES mistakenly concludes that using the equivalent gain settings on the ARUs means detection radius will be equivalent. This is not the case, as it does not account for the improved microphone sensitivity of the newer SM4 microphones.

Additionally, DES (2019) states that the effort expended at WMP was comparable to that implemented at Pullen Pullen. At Pullen Pullen, and when ANRM is conducting surveys for Night Parrots elsewhere, SM4s are set to record nightly, from sunset to sunrise, collecting

around 12 hours of data each night. This is significantly greater survey effort than occurred here.

We conclude that the survey effort used in this survey was insufficient to detect Night Parrots. Consequently, conclusions drawn about occupancy are not supported.

Conclusions and recommendations

DES (2019, p. 6) concluded that "Night Parrot (*Pezoporus occidentalis*) habitat probably doesn't occur within the WMP" and that (p. 51) "the [acoustic survey and analysis] effort and technique (hardware and software) employed here is not deemed a limitation for the detection of Night Parrots".

ANRM's assessment is that neither conclusion is justified.

Based on the results of the vegetation assessments, there is the potential for both roosting and foraging habitat to exist within the Development Envelope. It is likely a desktop analysis of potential roosting and foraging sites could be conducted accurately using available products and hi-resolution satellite imagery.

ANRM recommends conducting a desktop assessment to determine the extent of Night Parrot habitat within the Development Envelope.

If the desktop analysis indicates potential roost habitat is extant, a comprehensive acoustic survey plan for these sites could be developed that would probably require a limited number of very brief acoustic surveys. Analysing the recordings from these surveys with a recogniser known to be capable of detecting a high percentage of Night Parrot calls would determine whether Night Parrots are present or absent within the Development Envelope with a high degree of certainty.

ANRM recommends that if suitable habitat is identified within the Development Envelope, a schedule of acoustic surveys targeting those sites is implemented, with the results analysed using a recogniser capable of detecting a high percentage of Night Parrot calls.

ANRM acknowledges that the DES (2019) sound dataset is available for reanalysis. However, ANRM consider there to be limited value in re-examining this dataset, due to the sampling schedule limitations identified during the peer review.

3. Night Parrot flight heights

DES (2019) described the flight behaviour and turbine risk collision of the Eastern Ground Parrot (*Pezoporus wallicus*) as a potential surrogate for the Night Parrot, for which data is lacking. With the exception that Night Parrots are known to cover large distances at night when travelling to foraging and drinking sites, the two species do share some behavioural attributes, so drawing similarities is valid. We concur with DES that although many Night Parrot movements are likely to be relatively close to the ground, Night Parrots should not be excluded from being a species with collision risk.

Night Parrots are most typically observed flying at levels less than 10 m above the ground (N. Leseberg & N. Jackett pers. obs.). Because most observations occur around roosting sites, where the birds are typically flying short distances, this is expected. However, two Night Parrots tagged at Pullen Pullen Reserve (Murphy *et al.* 2017c) were shown to travel considerable distances to reach foraging and drinking sites. On one occasion, a VHF tagged bird was actively tracked passing by the receiver operator at an estimated height of >40 m (Murphy unpubl. data). This included travelling over low range country, as well as over the canopy of woodland, to reach open, low-lying foraging areas. These long-distance commuting movements occur at much greater heights than movements within roosting or breeding habitats. Additionally, a Night Parrot has been observed via a thermal scope climbing in flight, to heights in excess of 30 m before disappearing from sight (N. Leseberg pers. obs.). Given these known and observed behaviours, it is likely that Night Parrots fly at heights which put them at risk of collision with turbine blades.

Despite being nocturnal, Night Parrots have been modelled as having relatively poor adaptations for nocturnal behaviour, with less visual acuity than Eastern Ground Parrot (Iwaniuk *et al.* 2020). Therefore, the potential for Night Parrots to be susceptible to collision is increased. As Night Parrots occur in very low densities in the areas they are known from, the mortality of one or more individuals is considered significant.

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ANRM 2. Night Parrot Habitat Analysis

OZ Minerals Ltd
West Musgrave Copper and Nickel Project:

Night Parrot
Desktop Habitat Analysis

26th May 2021

Adaptive nrm

Summary

The West Musgrave Copper and Nickel Project (WMP) is located in the Musgrave Province of Western Australia and includes the Nebo-Babel nickel-copper and Succoth copper deposits. OZ Minerals is proposing to establish the WMP as a scaleable, low cost, long life, open pit mining operation.

OZ Minerals engaged Adaptive Natural Resource Management Pty Ltd to undertake a desktop analysis of potential Night Parrot habitat within the WMP Development Envelope (herein the Development Envelope. The aim of the desktop analysis was to determine if habitats suitable for the Night Parrot are extant within the Development Envelope.

The habitat analysis consisted of four steps:

(1) identification of areas of open, long unburnt *Triodia* in the Development Envelope that could support long-term stable roost sites;
(2) identification of productive patches that could represent suitable foraging habitat within the Development Envelope;
(3) identification of habitats or landforms located between potential roost and foraging that could represent potential flyway habitat within the Development Envelope; and,
(4) combining the results of steps (1), (2) and (3) to determine where within the Development Envelope Night Parrots are most likely to occur.

A total of 20,851.9 ha was assessed for potential roost habitat within the Development Envelope. No habitat deemed suitable for roosting for Night Parrots was identified from the available aerial or satellite imagery. Four vegetation associations totalling 70.9 ha (0.3 % of Development Envelope) were determined to comprise potential foraging habitat for the Night Parrot. No flyway habitat was considered to occur within the Development Envelope. A total of 125,887.2 ha was assessed for potential roost habitat outside of the Development Envelope within a 10 km buffer of potential foraging habitat. No potential roost habitat deemed suitable for Night Parrots was identified within the buffer area.

Although potential foraging habitat was identified within the Development Envelope, it was determined that Night Parrots are unlikely to have suitable roosting opportunities within 10 km of these potential foraging sites.

The results of the desktop habitat analysis indicate Night Parrot roosting habitat is unlikely to occur within the Development Envelope, reducing uncertainties in previous assessments (Donato Environmental Services 2019). Therefore, additional acoustic surveys (or re-analysis of sound data collected by Donato Environmental Services (2019)) are unlikely to detect the presence of roosting Night Parrots within the Development Envelope. Acoustic surveys within potential foraging habitat are unlikely to detect Night Parrots, due to the small and fragemented extent of potentially suitable habitat available, and the relatively large distance Night Parrots would need to travel to access potential foraging habitat within the Development Envelope.

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1. Introduction

1.1. Project description

The West Musgrave Copper and Nickel Project (WMP) is located in the Musgrave Province of Western Australia and includes the Nebo-Babel nickel-copper and Succoth copper deposits. OZ Minerals is proposing to establish the WMP as a scaleable, low cost, long life, open pit mining operation.

In May 2021, OZ Minerals engaged Adaptive Natural Resource Management Pty Ltd (ANRM) to undertake a desktop analysis of potential Night Parrot habitat within the WMP Development Envelope (herein the Development Area) (Figure 1).

The aim of the desktop analysis was to determine if habitats suitable for the Night Parrot are extant within the Development Envelope. Three broad habitat types were assessed:

(1) Potential roosting habitat;
(2) Potential foraging habitat; and
(3) Potential flyway habitat.

Accordingly, the analysis will seek to establish whether potential Night Parrot habitat occurs within the Development Envelope, and whether further targeted surveys, including an acoustic survey within prospective habitat is warranted.

The analysis is based on the results of research from western Queensland and is supported by preliminary research from Western Australia.

1.2. Night Parrot habitat

1.2.1. Roost habitat

Night Parrots in western Queensland, central and northern Western Australia, establish long-term stable roost sites in long unburnt *Triodia* (Jackett *et al.* 2017; Murphy *et al.* 2017a; Murphy *et al.* 2017c), and may occupy these sites for extended periods of up to several years (S. Murphy, N. Leseberg unpubl. data). These roost sites are also critical for breeding. These

sites typically support a pair or small group of Night Parrots, with individual roosts spread across an area up to several hectares (S. Murphy, N. Leseberg, unpubl. data).

All areas where long-term stable roost sites have been detected in both Queensland and Western Australia have been in open landscapes (Jackett *et al.* 2017; Murphy *et al.* 2017a). While there may be some scattered shrubs or isolated trees, these sites are practically treeless. The Night Parrot may have lower visual acuity than most other parrot species, and therefore, as a compromise to its nocturnal habits, may select such areas to improve predator detection and reduce collision risk when flying (Iwaniuk *et al.* 2020).

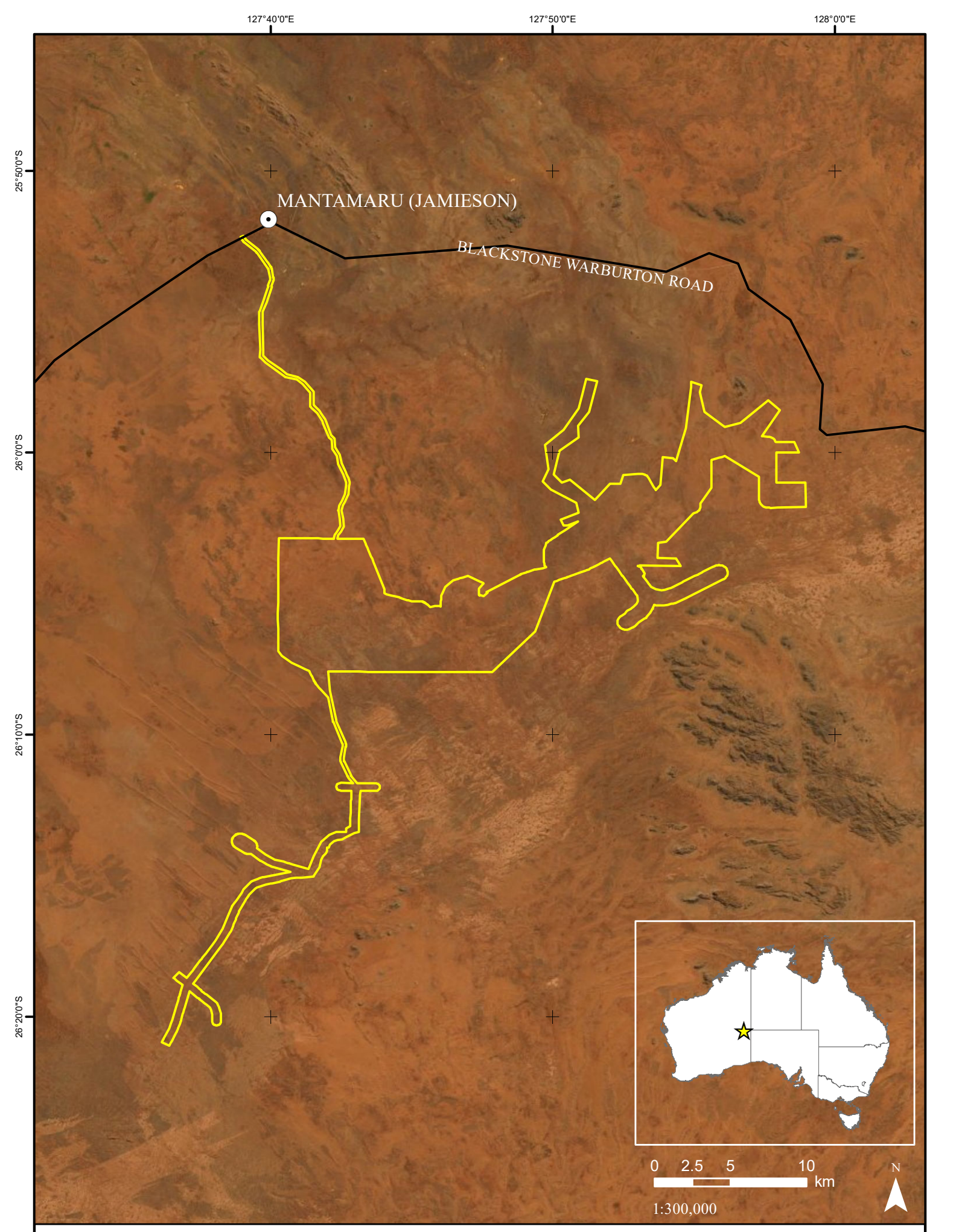
1.2.2. Foraging habitat

The nightly foraging activity of Night Parrots in western Queensland focuses on productive patches in an otherwise unproductive landscape (Murphy *et al.* 2017c), and preliminary research in Western Australia suggests similar behaviour (N. Jackett, N. Leseberg unpubl. data). These productive sites, characterised by their hydrology and the quick growth response of their vegetation after inundation, are detectable using a variety of methods, including remote-sensing techniques, hydrology data, vegetation mapping and aerial and satellite imagery. The proximity of such areas to suitable roosting habitat is likely to be an important factor determining the ability of a landscape to support Night Parrots.

1.2.3. Flyway habitat

Areas between roosting and foraging habitat that Night Parrots are likely to traverse are considered flyway habitat. In Western Australia, recent records indicative of flying Night Parrots have primarily occurred in drainage systems, and may indicate preferred flyway habitat when available (N. Jackett, N. Leseberg unpubl. data). In Queensland, two specimens collected as carcasses following probable collisions (and therefore potentially from flyway habitat) were found in areas of low mixed grassland, shrubs, herbs and chenopods with bare gibber (Boles *et al.* 1994; Cupitt and Cupitt 2008), with one of these observations occurring near a slight drainage depression (Cupitt and Cupitt 2008). Murphy *et al*. (2017c) demonstrated Night Parrots fly tens of kilometres when moving between distant resources (e.g. foraging areas, water sources), and are therefore likely to traverse a variety of habitat types in transit.

While there is no definitive evidence on flight heights for Night Parrots, observations suggest that birds do move at some height when travelling longer distances. A radio-tagged bird at Pullen Pullen was tracked flying over an observer at an estimated height of 40 m, and the same bird was known to fly over low range country and wooded areas, suggesting it probably flew at a height well above ground level (S. Murphy, pers. obs.). A bird has been observed in a thermal scope taking off from the ground and climbing to at least 30 m in height before it was lost from sight (N. Leseberg, pers. obs.).



Legend

WMP Development Envelope

Location of the Development Envelope

Figure 1.

Adaptive nrm

2. Methods

2.1. Project team

This assessment was conducted by a team who have authored all papers concerning the ecology, biology and detection of Night Parrots since 2013:

Nigel Jackett

Nigel is PhD candidate at the University of Queensland and has been involved in threatened species conservation projects since 2007. In 2017, Nigel was part of a team that provided the first evidence of an extant population of Night Parrots in Western Australia since the early 20th century and has subsequently published descriptions of nesting habitat and calls for this species. Nigel works an acoustic specialist for Night Parrot surveys, and assists Indigenous ranger groups surveying for Night Parrot populations in the southern Kimberley and Great Sandy Desert. Nigel is a member of DBCA's Night Parrot Technical Advisory Panel.

Nick Leseberg

Nick has been researching Night Parrots since 2016 and is nearing completion of his PhD at the University of Queensland. Nick's research has focused on using historical reports to establish the current status and distribution of the Night Parrot, and also how to detect the species using acoustic recorders. Nick has written several papers describing the ecology and calls of the Night Parrot, and has assisted with the discovery of Night Parrots at several locations in both Queensland and Western Australia. Nick is a member of the Night Parrot Recovery Team.

Dr Steve Murphy

Steve is a rangeland ecologist with several decades of experience. He was the first researcher to be involved in the Night Parrot project following their rediscovery in western Queensland in 2013. Steve conducted the initial fieldwork that established acoustics as the primary detection method, and also lead the effort to capture and radio tag two Night Parrots. The data from that research has informed our understanding of the Night Parrot's resource requirements and habitat preferences. Steve is a member of the Night Parrot Recovery Team.

2.2. Desktop habitat analysis

The habitat analysis consisted of four steps:

(1) identification of areas of open, long unburnt *Triodia* in the Development Envelope that could support long-term stable roost sites;

(2) identification of productive patches that could represent suitable foraging habitat within the Development Envelope;

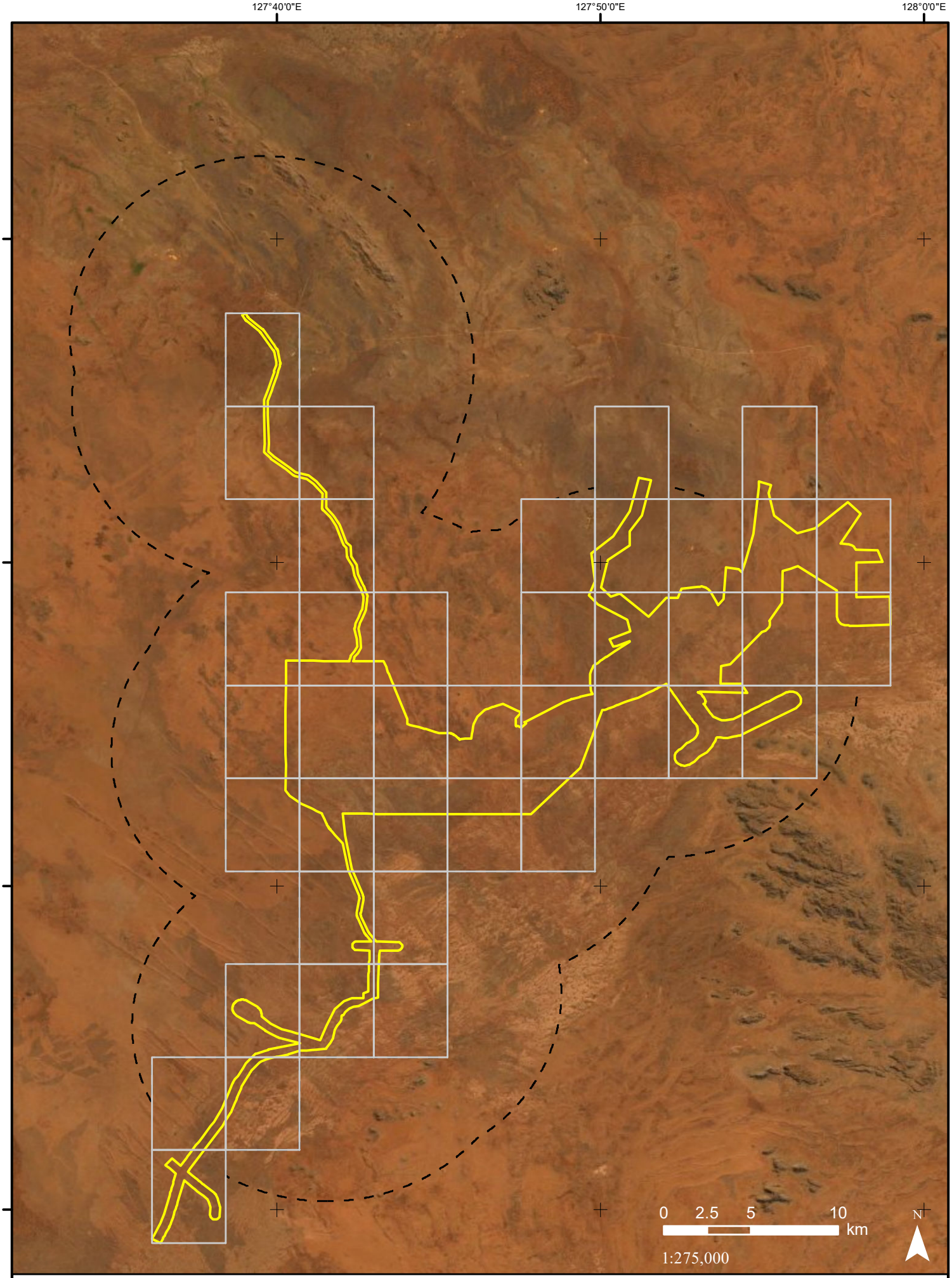
(3) identification of habitats or landforms located between potential roost and foraging that could represent potential flyway habitat within the Development Envelope; and,

(4) combining the results of steps (1), (2) and (3) to determine where within the Development Envelope Night Parrots are most likely to occur.

2.2.1. Potential roost habitat within the Development Envelope

All long-term stable roost sites detected in western Queensland and Western Australia have been found in relatively open areas of long unburnt *Triodia*. Although the total extent of *Triodia* at these sites does not appear critical, the size distribution of hummocks is important. The sites where Night Parrots occur all contain at least some patches of large, long unburnt *Triodia* hummocks, and are in open areas with few or no trees or shrubs. The tree and shrub density is typically fewer than 10–15 stems per hectare within roosting sites, and often lower than this (S. Murphy, N. Leseberg, unpubl. data).

We used available aerial and satellite imagery (ESRI World Imagery), in combination with previously mapped vegetation communities (Western Botanical 2019) to manually search the Development Envelope for potential roosting habitat using ArcGIS Desktop 10.7.1. (ESRI Inc., CA, USA). We applied a fishnet grid over the Development Envelope (Figure 2), to create 40 grid cells that were systematically searched for potential roosting habitat at a scale of 1:3000 m. Representative images of Night Parrot roost habitat as viewed with this scale are shown in Figure 3, and demonstrate the distinct structure of potential roost habitat is identifiable at such a scale.



Search areas for potential roost habitat within the Development Envelope

Figure 2.

Adaptive nrm

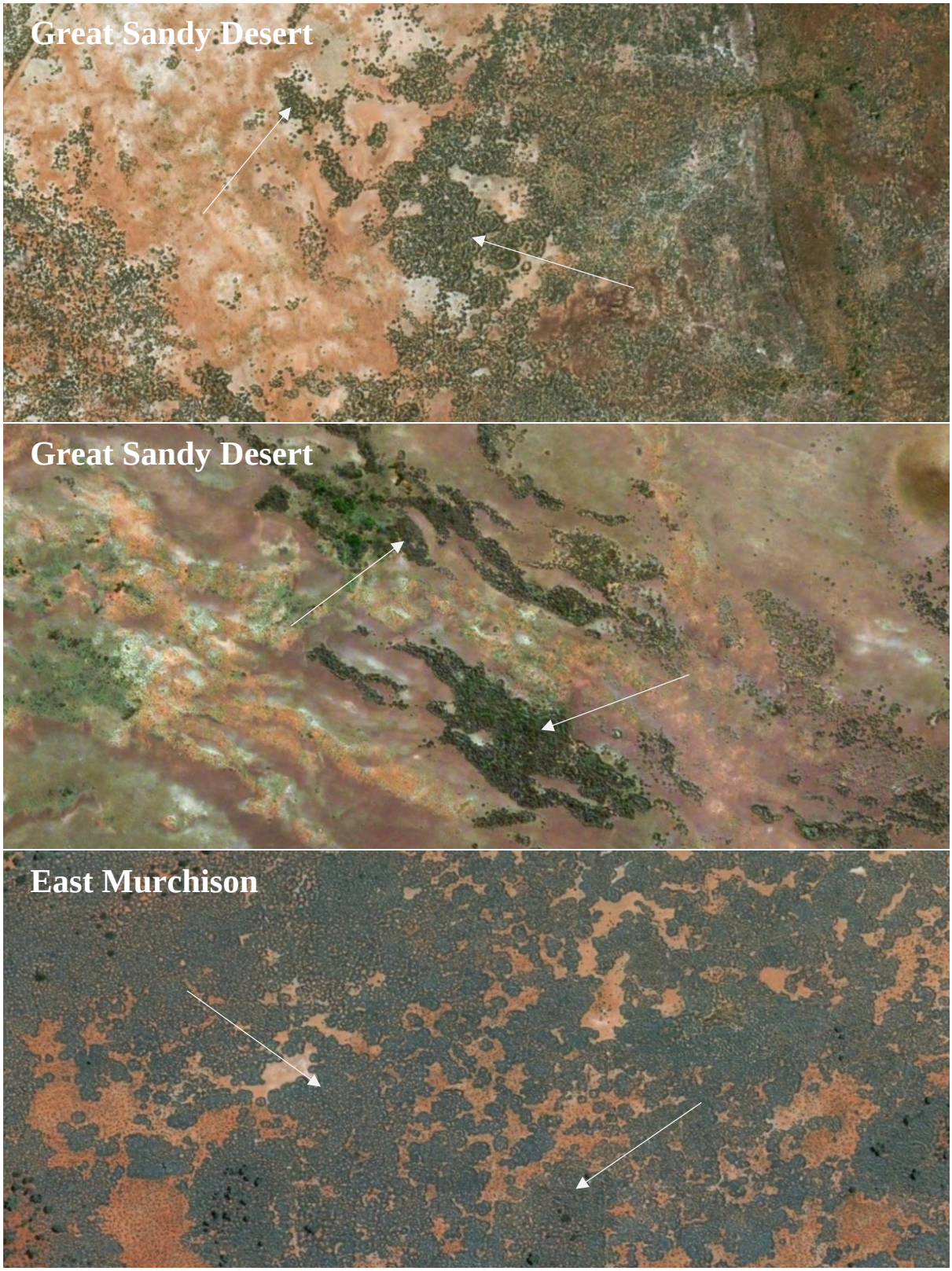


Figure 3. Examples of potential roost habitat at confirmed Night Parrot locations in Western Australia from satellite imagery at scale 1:3000. Note the complex *Triodia* formations (indicated by arrows), sparseness of trees, and surrounding bare ground.

2.2.2. Potential foraging habitat within the Development Envelope

Unpublished DNA analyses of faecal samples show that Night Parrots in western Queensland eat a relatively broad array of food plants including grasses (e.g. *Triodia longiceps*, *Uranthoecium truncatum*, *Brachyachne ciliaris*, *Astrebla lappacea*, *Dactyloctenium radulans*) and forbs (e.g. *Trianthema triquetra*) (S. Murphy, N. Leseberg, unpubl. data). Tracking studies show that Night Parrots visit floristically diverse run-on zones in the landscape, which can be large (e.g. floodplains) or small (e.g. gilgai formations) (Murphy *et al.* 2017c).

Available vegetation mapping (Western Botanical 2019) for the Development Envelope was examined to identify vegetation communities likely to comprise foraging habitat for the Night Parrot. Vegetation communities predominately containing an assemblage of grasses, forbs or chenopods, in relatively open landscapes, were selected from the dataset as potential foraging habitat. Identified foraging habitat was then overlayed on aerial or satellite imagery to obtain greater contextual information as to the likelihood of this habitat being available to Night Parrots.

2.2.3. Potential flyway habitat within the Development Envelope

Acoustic detections of Night Parrots in Western Australia indicate birds may prefer traveling along drainage lines when moving between resources. Hydrology and digital elevation model data layers for the WMP were analysed to determine potential flyway corridors within the Development Envelope.

2.2.4. Potential roost habitat within 10 km of potential foraging habitat

As Night Parrots are known to travel at least 9.4 km between roosting sites and foraging habitat (Murphy *et al.* 2017c), a 10 km buffer was created around all identified potential foraging habitat within the Development Envelope. The buffer area was searched using the same methods described above for identifying roost habitat within the Development Envelope.

3. Results

3.1. Potential roost habitat

A total of 20,851.9 ha was assessed for potential roost habitat. No habitat deemed suitable for roosting for Night Parrots was identified from the available aerial or satellite imagery.

Stands of *Triodia* were detected throughout much of the Development Envelope, but the complex structure associated with known Night Parrot roost habitat was not observed. The structure of these *Triodia* stands was typical of areas that are burnt relatively frequently, and therefore are relatively small in size and relatively open between hummocks. Additionally, the apparent (tree or shrub) stem density/ha in these *Triodia* stands was measured as being at least double of that observed at known Night Parrot roost locations (i.e. 10–15 stems/ha).

3.2. Potential foraging habitat

Four vegetation associations totalling 70.9 ha (0.3 % of Development Envelope) were determined to comprise potential foraging habitat for the Night Parrot (Table 1). Western Botanical (2019) provided the following descriptions of the four vegetation associations:

(1) AvS - *Maireana triptera* - *Atriplex vesicaria* Chenopod Shrubland: characterised by Low Shrubland of *Maireana triptera* 0.4m, PFC 10%, *Maireana* aff. *villosa* 0.4 m, PFC 10%, *Atriplex vesicaria* 0.5 m, PFC 5% and occasional *Eremophila clarkei* 1.2 m, PFC <1% with a grass component of occasional *Aristida contorta* 0.2 m, *Cenchrus ciliaris* (weed) 0.5m, PFC 1 to 2%. Landscape is level and has red silty sand forming a hard pan with a continuous lag gravel and stony mantle of ironstone (magnetite) to 5 cm diameter. A variable site with some bare areas with no vegetation, and other areas with occasional patches of Mulga in small groups which were not mapped separately. Associated species include *Enneapogon polyphyllus* 0.2 m, patches of *Neurachne munroi* 0.3 m, *Maireana integra* and as yet unverified species: *Maireana* aff. *villosa* (WB39955)

(2) COG - Calcrete Open Grassland: characterised by an open grass plain associated with shallow sands over a calcrete plain, the upper stratum that is restricted to the edges

of the association is dominated by *Acacia kempeana* 1-4 m, *Acacia tetragonophylla* 3 m and *Acacia victoriae* subsp. *victoriae* to 3 m, with a PFC of 1-2%. The ground stratum grassland is dominated by *Enneapogon polyphyllus* 0.15 m, *Aristida contorta* 0.15m, *Sclerolaena patenticuspis* 0.15 m *Sclerolaena cornishiana* 0.15 m *Eremophea spinosa* 0.15 m and *Boerhavia repleta* 0.2 m with a PFC of 50 -65%. Other associated species recorded within this vegetation association include *Panicum decompositum*, *Solanum lasiophyllum*, *Dysphania melanocarpa*, *Malvastrum americanum* (weed), *Brassica tournefortii* (weed), *Euphorbia australis*, *Salsola australis*, *Cenchrus ciliaris* (weed) *Sida* sp. *excedentifolia* (J.L. Egan 1925), *Solanum centrale*, *Ptilotus obovatus*, and *Tribulus terrestris* (weed).

(3) CPN-G Claypan Grassland: represents large, extensive low lying internally drained areas with medium to heavy heaving, cracking red sandy clay soil with numerous sink holes and would be subject to waterlogging and inundation following significant rainfall events. Vegetation is relatively uniform and consists of a perennial grassland of co-dominant Aristida latifolia 1.2 m tall, *Eragrostis xerophila* 0.3 m, *Eragrostis setifolia* 0.4 m, *Iseilema eremaea* 0.2 m with forbs dominated by *Rhynchosia minima* 0.4 m, PFC 50 - 65%, with occasional emergent *Eremophila longifolia* 2 m, *Acacia pteraneura* 2 - 4m, PFC < 1%. Occasional occurrences of *Cenchrus ciliaris* (weed) to 0.6 m were noted.

(4) CPP - Clay Pan Playa: found within the Hardpan Mulga Woodlands and represents the lowest part of that landscape. They are small, very open hardpan areas which may have a gravely lag gravel mantle. The vegetation within the Clay pan playa is dominated by annual grasses and herbs with very few to no perennial species present, due to being seasonally inundated for periods following rainfall. The fringing vegetation is characterised by a very scattered upper stratum of *Acacia tetragonophylla* 3 m, *Acacia pteraneura* 4 m, *Eremophila longifolia* 2 m and *Acacia victoriae* subsp. *victoriae* to 2.5 m, with a combined PFC 5 - 10% occurring in an annular ring on the margins of the clay pan. The central part of the claypans have a lower stratum characterised by a very open grassland dominated by *Eragrostis exigua* 0.4 m, *Diplachne fusca* subsp. *muelleri* 0.3 m, *Eragrostis pergracilis* 0.1 m, *Eragrostis dielsii* 0.05 m, *Trianthema triquetrum* 0.05 m and *Fimbristylis dichotoma* 0.15 m with a PFC 10- 15% (Plate 19, Plate 20).

Other associated species recorded within this vegetation association include *Tripogonella loliiformis*, *Dysphania melanocarpa*, *Salsola australis*, *Panicum decompositum*, *Atriplex elachophylla*, *Pluchea dentex*, *Aristida contorta*, *Dactyloctenium radulans*, *Enteropogon ramosus* and *Einadia nutans* subsp. *eremaea*. It is expected the species richness would be significantly higher in wetter seasons.

Table 1. Extent of potential foraging habitat within Development Envelope

Vegetation association	Extent within Development Envelope (ha)	Extent mapped by Western Botanical (2019) (ha)*	% of association within Development Envelope	% of Development Envelope
AvS	28.7	118.6	24.2	0.1
COG	11.4	699.2	3.6	0.1
CPN-G	5.8	143.9	4.0	0.0
CPP	11.4	23.5	48.6	0.1
Total	70.9	985.2	7.2	0.3

* Vegetation associations mapped by Western Botanical (2019) extended outside the current Development Envelope

3.3. Potential flyway habitat

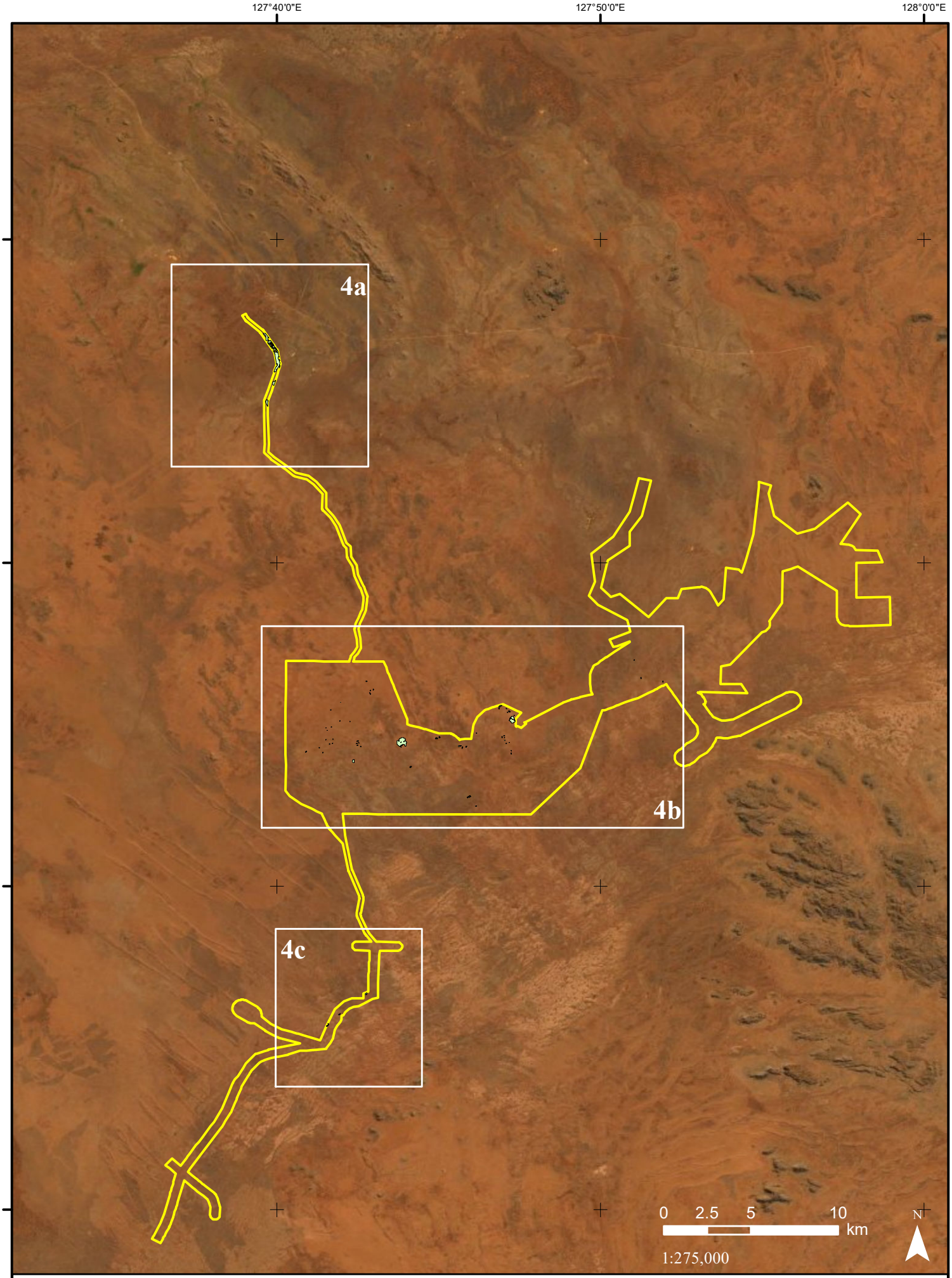
The analysis determined there was no habitat deemed suitable for Night Parrots to roost in within the Development Envelope. As such, there is difficulty in determining if potential flyway habitat is present. The Development Envelope does not comprise any distinct drainage lines that are potentially the preferred flyway habitat for Night Parrots. Additionally, the Development Envelope is not topographically complex, with a general gradual decrease in elevation from over 528m asl in the northern extreme, to 436 m asl in the southern extreme. Within the central part of the Development Envelope, changes in topography are minor, with small rises of 10–15 m being typical.

The largest, continuous area of potential foraging habitat is located along a proposed road alignment in the extreme north-west of the Development Envelope (Figure 4). As such, if these habitats are utilised by Night Parrots, it is likely they are traveling to this site from outside of the Development Envelope.

3.4. Potential roost habitat within 10 km of identified foraging habitat

A 10 km buffer was created around all identified potential foraging habitat within the Development Envelope (Figure 4). Available aerial and satellite imagery for the buffer area was manually searched for potential roost habitat. Overall, the landscapes adjacent to the Development Envelope were deemed similar to that within the Development Envelope. However, to the east and north of the Development Envelope, more topographically complex areas (e.g. rocky hills) were identified.

A total of 125,887.2 ha was assessed for potential roost habitat outside of the Development Envelope within the 10 km buffer. No potential roost habitat deemed suitable for Night Parrots was identified within the buffer area.



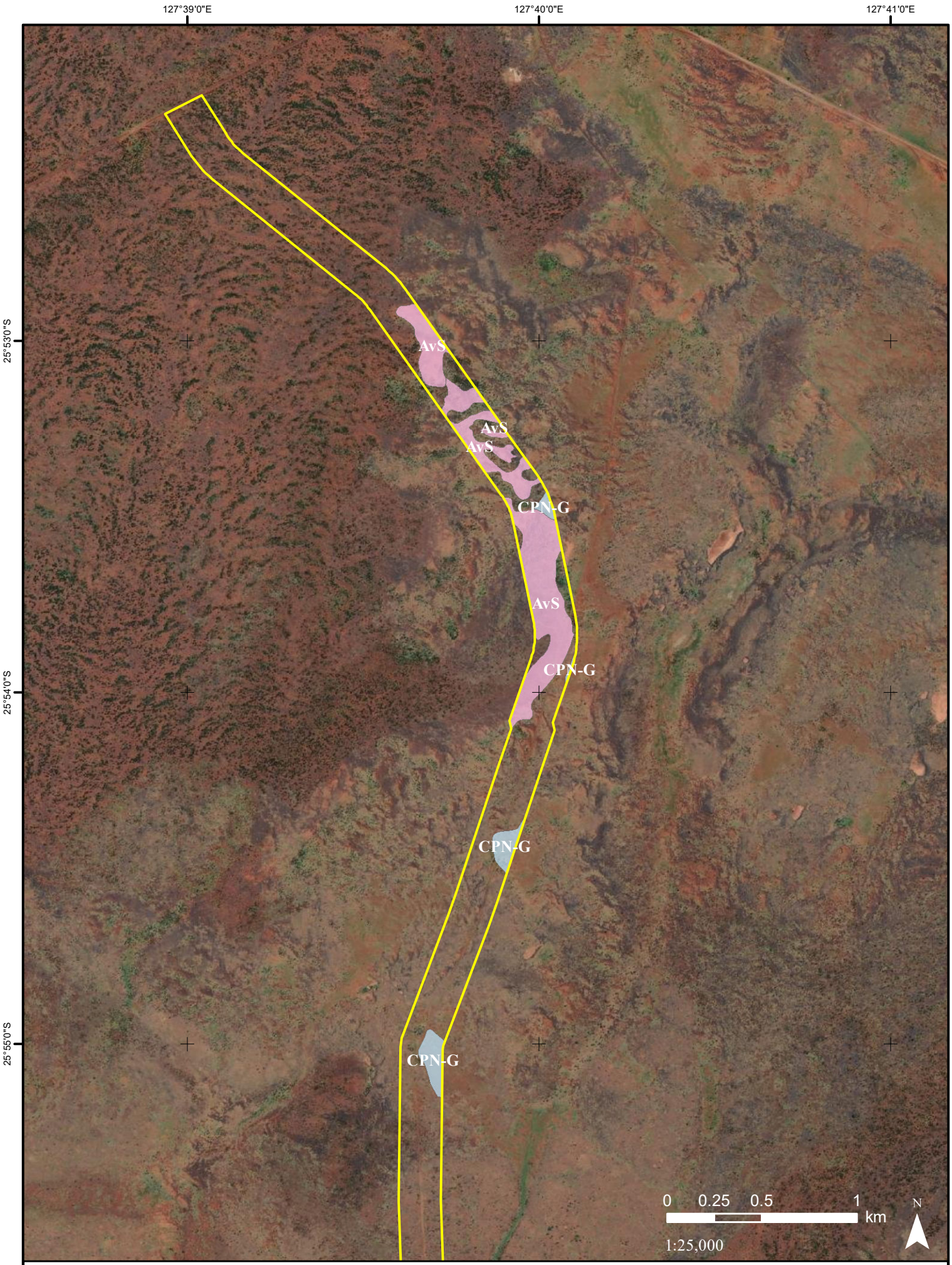
Legend

- Potential foraging habitat
- WMP Development Envelope

Distribution of potential foraging habitat - overview

Figure 4.

Adaptive nrm



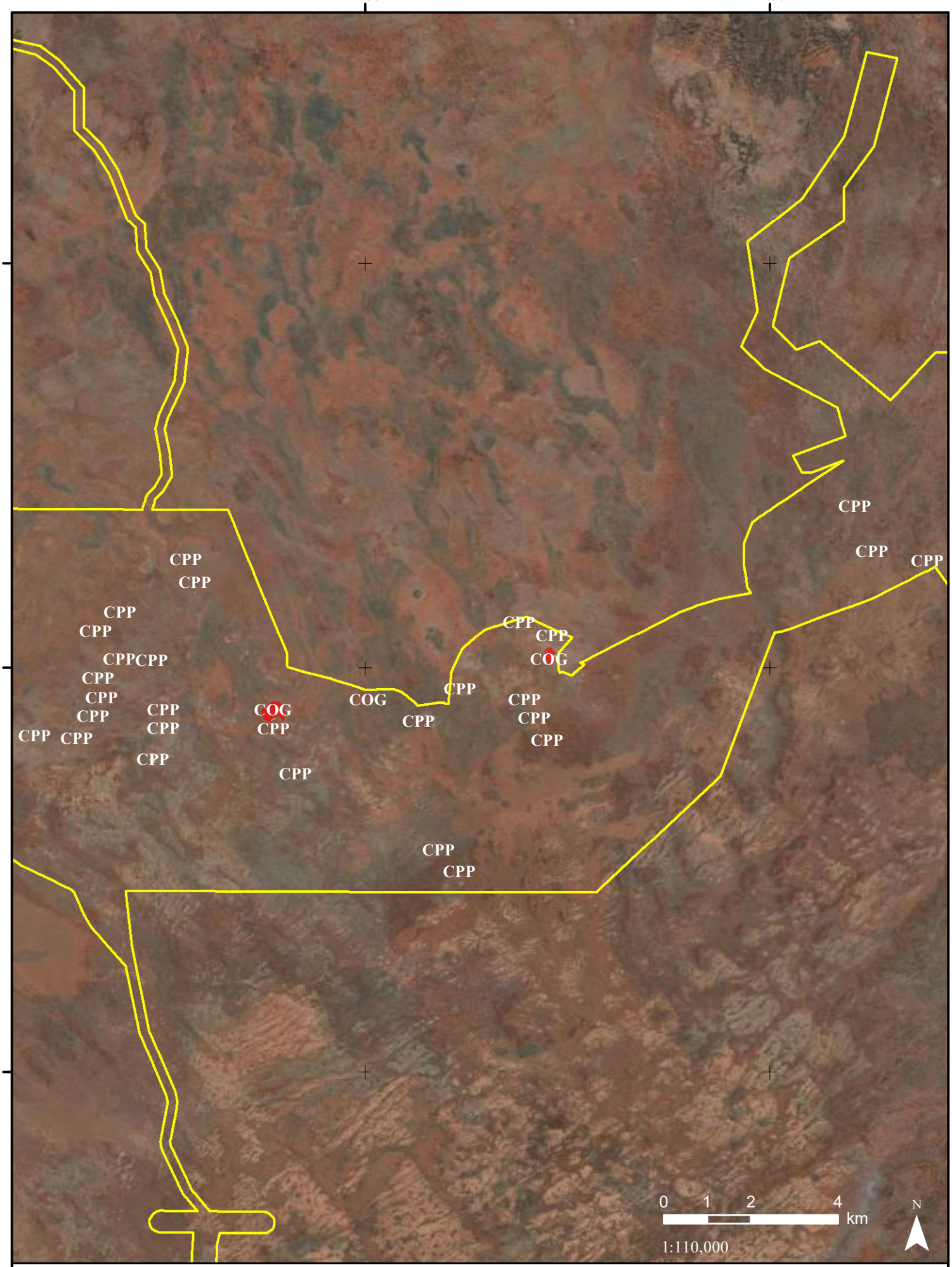
Vegetation association

- AvS
- CPN-G
- WMP Development Envelope

Distribution of potential foraging habitat - WMP north

Figure 4a.

Adaptive nrm



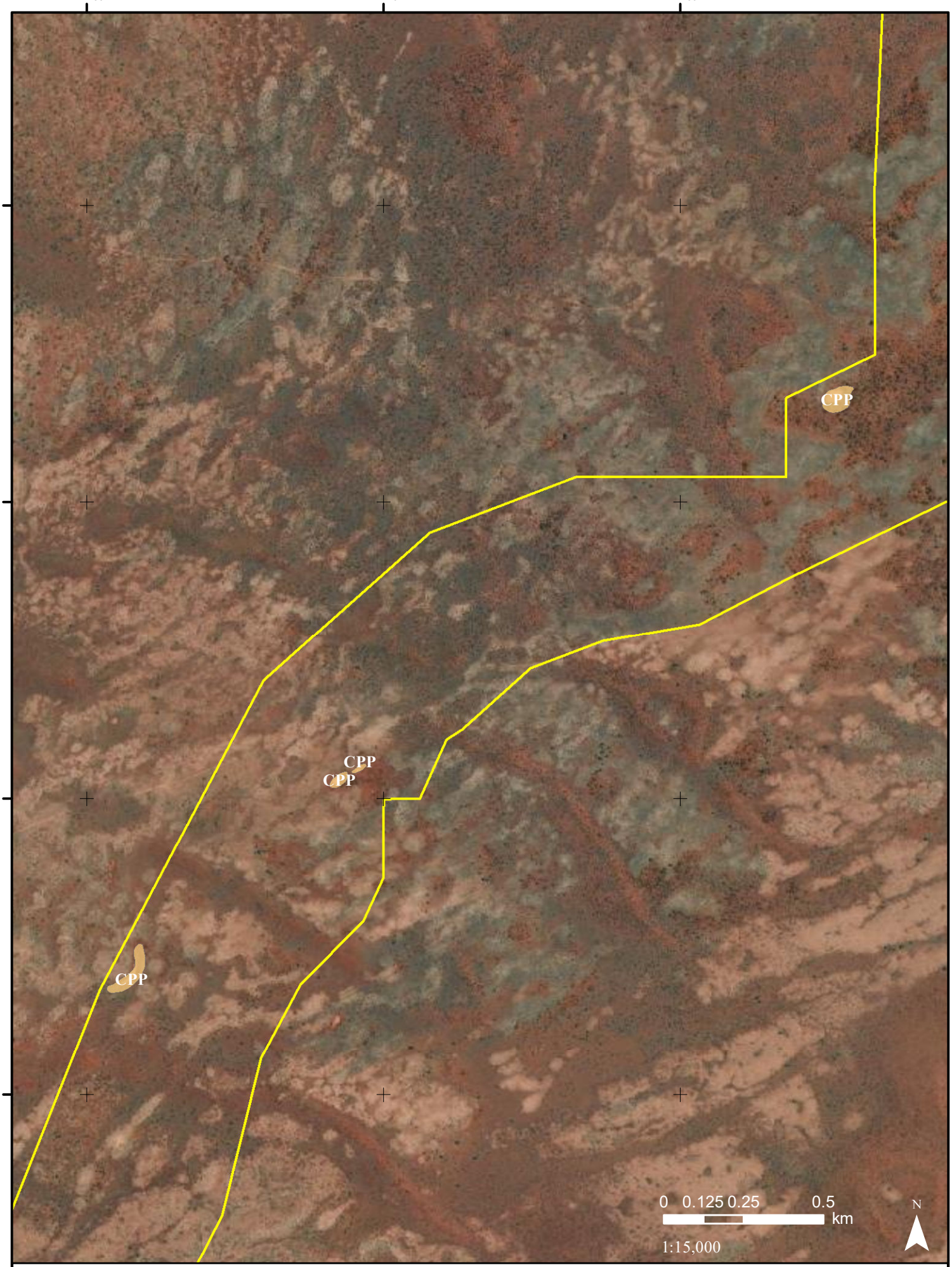
Vegetation association

- COG
- CPP
- WMP Development Envelope

Distribution of potential foraging habitat - WMP central

Figure 4b.

Adaptive nrm



Vegetation association

CPP

WMP Development Envelope

Distribution of potential foraging habitat - WMP south

Figure 4c.

Adaptive nrm

4. Discussion

4.1. Roost habitat

The results of the habitat analysis suggest it is unlikely that Night Parrots roost within the Development Envelope. Additionally, it was also determined that Night Parrots are unlikely to roost within 10 km of identified potential foraging habitat.

Known Night Parrot roost habitat is typically surrounded by breakaways or mesas, bare earth, stony plains, or salt tolerant vegetation (Jackett *et al.* 2017; Murphy *et al.* 2017b; Murphy *et al.* 2017c). These features are all typically devoid of fuel to permit extensive fire events. The limited topography within the Development Envelope, as well as a lack of significant palaeodrainage systems, likely prevents the formation of complex *Triodia* stands suitable for Night Parrots to roost within, due to the susceptibility of the landscape to wildfire.

4.2. Foraging habitat

Four vegetation associations described by Western Botanical (2019) were considered potentially suitable foraging habitat for Night Parrots within the Development Envelope. These associations were considered to share structural and vegetation assemblage similarities with areas known to be visited by Night Parrots in Western Australia and Queensland (Jackett *et al.* 2017; Murphy *et al.* 2017c). However, these associations were limited in spatial extent within the Development Envelope, totalling 70.9 ha (0.3 % of the Development Envelope).

Additionally, smaller areas of mapped potential foraging habitat were often enclosed by more densely wooded vegetation associations. Night Parrots are typically thought to forage in relatively open (treeless) landscapes, and therefore it is unknown whether they would access such enclosed habitat if they were present within the landscape.

4.3. Flyway habitat

There were no distinct features within the Development Envelope that were considered as flyway corridors for transiting Night Parrots. As no potential roost habitat was identified within 10 km of the identified potential foraging habitat, it is unlikely there are regularly used flyways intersecting the Development Envelope.

4.4. Likelihood of Night Parrot occurrence within the Development Envelope

Although potential foraging habitat was identified within the Development Envelope, it was determined that Night Parrots are unlikely to have suitable roosting opportunities within 10 km of these potential foraging sites. While it is likely Night Parrots can travel greater than 10 km to reach foraging resources, we believe 10 km to be an appropriate limit for assessing the likelihood of Night Parrots accessing the potential foraging habitats within the Development Envelope.

4.5. Justification for additional Night Parrot acoustic surveys

The results of the desktop habitat analysis indicate Night Parrot roosting habitat is unlikely to occur within the Development Envelope, reducing uncertainties in previous assessments (Donato Environmental Services 2019). Therefore, additional acoustic surveys (or re-analysis of sound data collected by Donato Environmental Services (2019)) are unlikely to detect the presence of roosting Night Parrots within the Development Envelope.

Potential foraging habitat for Night Parrots was determined to occur within the Development Envelope, albeit relatively limited in extent. The additional assessment of potential roost habitat outside of the Development Envelope also indicated Night Parrots are unlikely to roost within 10 km of the potential foraging habitat. Therefore, additional acoustic surveys within potential foraging habitat are unlikely to detect Night Parrots, due to the small and fragmented extent of potentially suitable habitat available, and the relatively large distance Night Parrots would need to travel to access potential foraging habitat within the Development Envelope.

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Appendix B. Short Range Endemic Habitat Connectivity Assessment

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MEMORANDUM

Attention:	Justin Rowntree	From:	Kristy Sell
Company:	OZ Minerals	Date:	31 May 2021
Subject:	Short Range Endemic (SRE) Habitat Assessment	Project:	West Musgrave Project

1. SRE HABITAT

Habitat mapping of the Study Area has been undertaken by Western Wildlife over a number of site visits between 2018 and 2020. The Study Area include the Development Envelope and adjacent areas and covered an area of 46,263 ha. This identified 11 different habitats based on observations made in the field, vegetation mapping and interpretation of aerial photography. Two of the eleven habitats are 'mosaics', where the Spinifex Sandplain or Mallee Sandplain occur in association with outcropping calcrete, at a scale too fine to be separately mapped. All habitats present in the fauna survey area are widely represented in the CR or GVD Bioregions (Western Wildlife, 2020).

Short Range Endemic (SRE) fauna surveys were conducted by Alacran (Alacran, 2020). This included targeted surveys consisting of three sampling events to identify SRE habitat, identify potential SRE species and determine if the fauna survey area supports SRE fauna. Survey effort for SREs at the WMP is shown in Figure 1. SRE sample sites corresponded with nine of the 11 fauna habitats identified and constitute the most likely of those habitats to support SREs within the fauna survey area. Of the nine habitats surveyed, eight yielded invertebrates belonging to SRE groups. Of those eight, Mulga Woodland supported the greatest species richness of taxa from SRE groups (28) and represented the largest habitat by area within the survey area (12,856 ha or 28% of the total survey area).

According to Alacran, only one location within the fauna survey area that supported SRE groups of invertebrates represented unique habitat; a small granite boulder outcrop. This outcrop falls within the Stony Hills and Plains habitat and is likely to represent an extension of the nearby granite hills approximately 0.5 km south west of this sampling location. The eastern and central parts of the fauna survey area and the south eastern section of the Southern Monitoring Bores area cross a large spinifex sandplain habitat. This was the only geographical feature that could potentially represent a barrier to dispersal for species not suited to this habitat.

2. SRE ASSEMBLAGE

SRE surveys yielded a total of 3,209 invertebrate specimens from SRE groups, with a total of six orders, 15 families and 55 different taxa (Alacran, 2020). The poor state of knowledge about invertebrate fauna in and around the fauna survey area resulted in the majority of species being interpreted as new species after comparisons with West Australian Museum (WAM) reference specimens and publicly available DNA sequences failed to find species matches. Identification of species and morphospecies involved the use of both morphological and DNA sequence data, Cytochrome C Oxidase subunit I (COI).

Of the 55 different taxa, 50 were identified as being potential SREs owing to data deficiency (DD) regarding their known distribution or taxa belonging to unresolved species complexes with the remaining five species being widespread. All of these species were recorded from habitat types that were also observed outside of, but in close proximity to the fauna survey area, suggesting they may not be restricted to the fauna survey area.

Development Envelope
SRE Sample Sites
Dry Pitfall Trap
Forage (litter sifting, burrow excavations)
Wet Pitfal Trap (Propylene Glycol)
Potential SRE Habitats
Calcrete/sandplain complex
Calcrete plains
Mallee sandplain
Mulga sandplain
Mulga woodland
Sand dunes
Spinifex sandplain
Stony hills and plains
Unsuitable habitat

CRS MGA94(52)
1:200000 @ A3

0 5 km

Figure 1: Short-Range Endemic Survey Effort per Habitat Type/Mosaic at the WMP

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3. IMPACT ASSESSMENT

The Project has potential to result in loss of SRE species and loss of SRE habitat.

The status of SRE invertebrate fauna recorded at the proposed project and surrounding area was based on categories developed by WAM in order to describe the status of taxa using current knowledge of distribution and biology of each species.

Of the 50 known potential SREs collected from the fauna survey area, 37 were recorded from both inside and outside of the Development Envelope and have thus not been considered further in this assessment. The impact assessment focuses on the remaining 13 potential SRE species.

Based on EPA Technical Guidance for Sampling of SREs (EPA, 2016), if vegetation units are restricted to the potential impact area, and are especially different from adjoining units, then there is potential for some SREs to be similarly confined (an example might be a granite outcrop in an otherwise sandy environment). In contrast, if similar vegetation units are contiguous and broadly distributed outside of the proposed impact area, then the likelihood of SREs being confined to the impact area is reduced.

Additionally, the EPA guidance states that a risk-based approach may be adopted for situations where surveys have been completed, but potential SREs are only recorded from within the Development Envelope. In this situation, a risk-based approach would be considered in cases where:

- A potential SRE taxon is represented by one or few specimens from only within proposed development areas
- Contextual data on the wider distribution and status of the taxon is unavailable from WAM or the Department of Biodiversity, Conservation and Attractions (DBCA).
- Additional targeted surveys appear unlikely to yield results in a reasonable timeframe.

For potentially restricted taxa that meet the above criteria, the use of habitat as a surrogate for inferring distributional boundaries can be considered. While there are limitations to the use of such surrogates, this provides the only practicable method of undertaking an informed assessment as to the likelihood of small-scale SRE distributional restrictions. Consideration can also be given to the known distribution patterns and ecology of other species belonging to the same genus, to inform assessment of potential restriction.

A vulnerability rating was undertaken and is provided in Table 1 for the remining 13 potential SRE species to inform the assessment of the likelihood of SRE species being lost as a result of clearing from the proposed project. This vulnerability rating is based on the number of locations where specimens were collected and the prevalence near to, but outside the Development Envelope of the habitat types at these locations. The following describes the three classes of vulnerability assignment:

- Low Vulnerability: species collected from within a common habitat type at either multiple locations or a potential species surrogate has been observed at the proposed project.
- Medium Vulnerability: species collected from either a common habitat type or multiple locations (but not both).
- High Vulnerability: species which were collected in only one location in a rare habitat type.

No potential SRE species recorded as part of the proposed project assessment are considered to have a high vulnerability rating, whilst three have a medium vulnerability rating and ten a low vulnerability rating (Table 1).

The prevalence of habitat types available to potential SREs is depicted in Figure 2.

Table 1: Relative Vulnerability of the Proposal on Potential SREs

Order	Family	Species	No. of Collection Locations	Habitat	Species Surrogate	Vulnerability Assessment
Araneae	Actinopodidae	*Missulena* 'WM1'	1	Mallee Sandplain		Medium
	Barychelidae	*Synothele* 'WM2'	1	Mulga Woodland	*Synothele* 'WM1'	Low
		Barychelidae 'WM1'	2	Calcrete/Spinifex Complex		Low
	Halonoproctidae	*Conothele* sp.	1	Mulga Woodland		Medium
	Nemesiidae	*Aname* 'WM4'	4	Mulga Woodland Calcrete Plains Mallee Sandplain	*Aname* 'MYG514' *Aname* 'WM1' *Aname* 'WM5' *Aname* 'WM7'	Low
		Aname 'WM6'	2	Calcrete Plains Mallee Sandplain		
		Kwonkan 'WM8'	1	Mallee Sandplain	*Kwonkan* 'WM3'	Low
		Kwonkan 'WM9'	1	Mallee Sandplain		
		Sundochernes 'WM1'	1	Mallee Sandplain		Medium
	Olpiidae	*Indolpium* 'WM1'	4	Calcrete/Spinifex Complex Mallee Sandplain	*Indolpium* 'WM2' *Indolpium* 'WM3'	Low
Scorpiones	Buthidae	*Lychas 'multipunctatus* mosaic'	5	Mallee Sandplain Calcrete/Spinifex Complex	*Lychas adonis'* *Lychas 'annulatuss* mosaic'	Low
	Urodacidae	*Urodacus* 'WM2'	1	Calcrete/Spinifex Complex	*Urodacus* 'WM1' *Urodacus* 'yaschenkoi' complex *Urodacus holplurus*	Low
	Armadillidae	*Acanthodillo* 'WM3'	1	Mulga Woodland	*Acanthodillo* 'WM1' *Acanthodillo* 'WM2'	Low

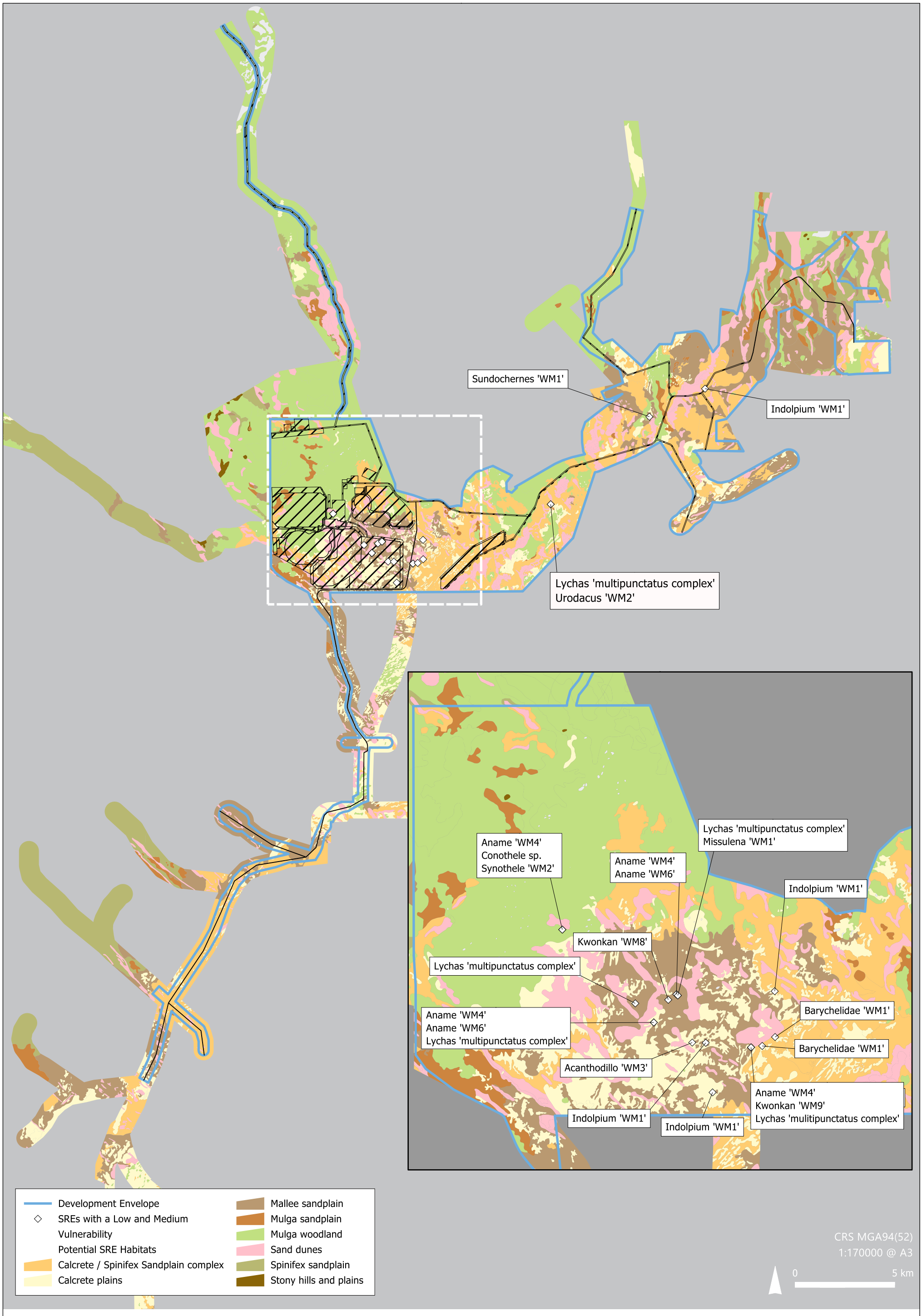

Figure 2: Indicative Site Layout Depicting Potential Short Range Endemics over Habitat Type Restricted to the Proposal Area

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Of the species which have a medium vulnerability rating:

- Two (*Missulena 'WM1'* and *Sundochernes 'WM1'*) occur within the Mallee Sandplain habitat. A single individual of each was found. *Missulena 'WM1'* was found in the Main Mining area. *Sundochernes 'WM1'* was found in the Northern Borefield area.
- One (*Conothele sp.*) occurs in the Mulga Woodland habitat within the Main Mining area. The *Conothele sp.* found was a juvenile species and therefore could not be compared with any species based on its morphology. Two attempts to amplify COI sequences from the specimen also failed. Due to it being the only representative of this genus and family from the fauna survey area, it was treated as an undiagnosable morphospecies rather than an ambiguous species by Alacran

Both of the habitats within which the three medium vulnerability rating potential SRE species were found are common within the Development Envelope, fauna survey area and the wider region. Project specific studies have mapped:

- 6,310.1 ha of the Mallee Sandplain fauna habitat in which *Missulena 'WM1'* and *Sundochernes 'WM1'* were found. Of this:
  - 3,445.7 ha (54.6%) is present within the Development Envelope.
  - 524.7 ha is expected to be impacted by the proposed project. This equates to 8.3% of the total mapped area.
- 12,856.1 ha of Mulga Woodland habitat in which *Conothele sp was found.* Of this:
  - 5,274.6 ha (41%) is present within the Development Envelope.
  - 1,264.8 ha is expected to be impacted by the proposed project. This equates to 9.8% of the total mapped area.

From Figure 2, it can be seen that Mallee Sandplain and Mulga Woodland habitats are extensive and well connected in the Main Mining Area and Northern Borefield area both within the Development Envelope and surrounds.

Based on only three species receiving a medium vulnerability rating, and each of these species occurring in habitats that are both common in the fauna survey area and region, and are continuous between the Development Envelope and beyond, these potential SREs are considered likely to be widely occurring, and as such unlikely to be materially impacted by the proposed project.

Yours sincerely
MBS Environmental

Kristy Sell
Managing Director

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Appendix C. Feral Animal Monitoring and Control Program

C1. PURPOSE

The Feral Fauna Species Monitoring and Control Program (the Program) seeks to ensure feral animals are managed effectively to prevent any negative environmental impact on the existing environment in the West Musgrave region and to ensure the EPA Objective for Terrestrial Fauna "*to protect terrestrial fauna so that biological diversity and ecological integrity are maintained*" is achieved.

This document provides the basis for the development of the Program.

C2. BASELINE ENVIRONMENT

During baseline ecology surveys, eight species of feral mammals were recorded (Table C1) with several groups of Camels (*Camelus dromedarius*) sighted and evidence, such as tracks, scats and trampling of vegetation, almost ubiquitous across the fauna survey area. The cat (*Felis catus*), fox (*Vulpes vulpes*) and wild dog (*Canis familiaris*) were also commonly recorded on camera traps.

Table C1: Feral Animals Observed in the Project Area

Species	Common Name
Mus musculus	house mouse
Oryctolagus cuniculus	rabbit
Canis familiaris	dog/dingo
Vulpes vulpes	fox
Felis catus	feral cat
Equus caballus	horse
Camelus dromedarius	camel
Bos taurus	cow

Camels (Camelus dromedarius) were very common, and cause environmental damage through their foraging behaviour and trampling of vegetation, competing with native species for food and shelter. Camels can range over extremely large areas of thousands to tens of thousands of square kilometres. Though they can live without free water for considerable periods of time, in hot dry summers they may encroach into communities searching for water and cause damage to wetland habitats. The Survey Area is within an area with some of the highest camel densities in Australia, estimated at between 0.5 and up to 1.0 camel per square kilometre in 2013, though this is down from 2008 estimates of up to 2.0 camels per square kilometre.

The Cat, Fox and Wild Dog are feral predators known to prey on native fauna species. 'Predation by Feral Cats' and 'Predation by the European Red Fox' are listed as a key threatening processes under the EPBC Act. Feral Cats and Foxes were commonly recorded on camera traps across the Survey Area. The overall status of Dogs in the Survey Area is difficult to determine, as some are Dingo-like in appearance and others are not.

Foxes prey on 'critical weight range' mammals (i.e. those between 35 g and 5.5 kg) and ground-nesting birds. Feral Cats have contributed to the extinction of many small to medium sized native mammals and ground-nesting birds in the arid zone. Though mammals tend to be the dominant prey, each Feral Cat in natural environments kills on average 225 reptiles per year, with cats in arid areas taking even more, equating to the predation of about 1.8 million reptiles per day. Though the overall impact on reptile populations remains undetermined, Cats are known to prey on the Great Desert Skink (*Liopholis kintorei*). Predation by Cats and/or Foxes is listed as a threat to many EPBC-listed species, including the Bilby (*Macrotis lagotis*) and the MacDonnell Ranges Black-footed Rock-Wallaby (*Petrogale lateralis*).

C3. THREATENING PROCESSES

There are a number of threatening processes associated with feral fauna species in relation to potential impacts to significant fauna. The conservation objective identified in the conservation advice for the species is to "increase the extent of suitable habitat for the species and retain its evolutionary potential across its range". This can be achieved through:

- Targeted feral predator control at key Great Desert Skink populations (both Cats and Foxes are known to prey on the Great Desert Skink)
- Prevention of habitat degradation from feral camels, cows and rabbits in Great Desert Skink habitat

The relationships between feral predators are complex, as they may compete for prey, prey on each other or kill to remove a competitor. The presence of one predator, such as a wild dog or dingo, may affect the behaviour or suppress the abundance of smaller species, such as Cats. Also, the presence of feral prey species such as Rabbits (*Oryctolagus cuniculus*) can support Fox populations. These complex interactions mean that control of these species is not straightforward, as reducing the population of one species may result in the increase in another.

C4. MANAGEMENT TARGETS

As part of the West Musgrave Project (WMP) Terrestrial Fauna Management Plan, OZ Minerals have committed to the development of the Program, with the following overarching management targets:

- Minimise feral fauna species access to attractants (e.g. water sources and uncovered waste)
- Minimise feral fauna species access to ponded water in constructed landforms, including borrow pits
- Reduced observations of feral fauna species in project attractant areas (landfill, WWTP, water storage ponds, accommodation village).

C5. ADAPTIVE MANAGEMENT

Arid landscapes such as the West Musgrave region are climatically dynamic; they tend to undergo 'boom-and-bust' cycles of plant recruitment and animal population fluctuations according to the amount of rainfall in a given season. It is therefore unrealistic to prescribe a single management approach that is inflexible to such change. Management actions undertaken in one year may be wholly ineffective in another year depending on ecological productivity.

Adaptive management in this document relates to the ongoing management of feral pests, with a particular focus on those threatening processes that may impact significant fauna. Adaptive management uses the Monitoring, Evaluation, Reporting, and Improvement cycle. Baseline feral animal presence has been established, and ongoing monitoring and, if necessary, management will establish whether management is effective or otherwise.

If necessary, management actions will be revised following monitoring to continually improve on-ground management and ecological outcomes. Regardless of these outcomes, the Feral Fauna Species Monitoring and Control Plan will be subject to a detailed review, in consultation with the Ngaanyatjarra People, the NGC and other stakeholders, three years from the commencement of Project activities. This review will seek to ensure that there has been no deterioration in the ecological values in the West Musgrave region as a result of pest fauna over the baseline, and ensure that the management approach is appropriate to achieve the desired outcomes.

C6. MITIGATION AND MANAGEMENT MEASURES

Committed management measures related to feral animal control are:

- Landfill would be fenced and putrescible wastes would be regularly covered
- Borrow pits would be designed and constructed to minimise surface water ponding after rehabilitation
- Tailings and other water bodies would minimise vegetative debris or other material that would provide roosts or feeding locations (e.g. facility would be made to be inhospitable for habituation of animals)
- Feral animal control would be undertaken as required, in co-operation with regional control programs and the Traditional Owners

Beyond these, other measures may include:

- Designing putrescible waste bins to be bird and animal proof
- Making sure waste is collected regularly
- Educating the workforce to not feed or otherwise interact with native and pest fauna

Feral animal control, if required, would be undertaken with consideration to the following.

C6.1. Fox Control

Eradication of Foxes is well beyond the capacity of available techniques and resources. Reducing the impact of the Fox is, however, feasible, provided that a combination of control techniques is used. The most common control techniques are ground or aerial baiting with 1080 poison and ground and/or aerial shooting, noting that these practices can be successful but generally only have a short-term effect on local fox populations. The use of alternative control measures, such as trapping, fencing and the use of guard animals, are not feasible given the large scale of the landscape within which the Project sits.

Broad scale baiting using the toxin 1080 is generally considered the most effective method of fox control currently available. Baiting with 1080 is accepted practice in many areas, however the effective use of 1080 baiting is limited by various factors and must be implemented in conjunction with regulatory authorities. The National Registration Authority (NRA) places restrictions on the use of 1080 poison to reduce reduce risks to people and non-target animals. For example, baits must not be laid where specified distance restrictions cannot be met. In these instances other methods of control should be sought.

Rainfall and ground water saturation results in the rapid breakdown of 1080 baits, rendering them ineffective as control agents. Periods of rainfall can preclude the use of 1080 as a control method, and in these circumstances other methods of control should be sought. Additionally, some foxes may

develop a condition known as 'bait shyness'. This condition may be a natural awareness in some individuals or arise from exposure to a sub-lethal dose of 1080 toxin. These individuals may refuse to take further baits and cannot therefore be targeted through a 1080 program.

Poisoned baits are distributed either on the ground by hand or from the air in a helicopter or fixed-wing aircraft. Ground baiting is more cost effective than aerial baiting. 1080 poison use is regulated by the *Poisons Act 1964* (WA) that defines the requirements for use.

A major caveat of poison baiting is that it may affect native carnivores and scavengers such as goannas and some scavenging birds, including Wedge-tailed Eagles.

Lethal shooting of Foxes with a rifle is one of the most humane methods of Fox control, provided it is carried out by a skilled shooter. Firing at close range ensures that the target can be correctly identified as a Fox and therefore reduces the risk of injury to non-target animals. Shooting is typically carried out at night (i.e. when Foxes are most active) from a vehicle with the aid of a spotlight. The use of whistles that resemble a Rabbit distress call can be used to lure the Fox into shooting range. Firing at close range is desirable as it ensures an accurate lethal shot to either the head (brain) or chest (heart-lung).

C6.2. Cat Control

Strategies for controlling Cats in Australia include shooting, trapping, poisoning and the introduction of feline panleucopaenia. Cat eradication has been successful using these control strategies, however this is generally only achieved on islands or within areas bounded by predator-proof fencing. Feral cats are known to prey on many small native animals. 1080 programs cannot be used to control feral cats, with trapping being the preferred method.

Management of Cat populations may also be achieved through reductions in the rabbit population, however this may also result in increased pressure on native animals, especially in the short term.

Management of trapped cats would be in accordance with relevant regulatory guidance.

C6.3. Wild Dog/Dingo Control

Wild dog management will be undertaken as required, triggered by an observed significant rise in wild dog numbers, typically after a boom in rabbit populations after rainfall. Should control be required, control programs such as aerial and ground baiting (spring and autumn), trapping and shooting may be implemented.

When 1080 poison baits routinely used for Fox control are eaten by Dingoes / Wild Dogs they are not likely to be lethal but the dose may make the animal ill and then averse to taking a bait in future. For this reason, baits for foxes will be of a strength suitable to provide a lethal dose to wild dogs.

C6.4. Rabbit Control

Rabbits are now widely established and abundant in Australia and eradication is not possible with current techniques. Effective Rabbit control requires integration of different methods. Any single technique used in isolation is less effective than two or more techniques carefully combined. When reliance is placed on only one technique and follow-up control is not implemented, initial gains are lost as Rabbits will readily recolonise in the absence of further control, especially after rainfall.

Rabbit control should be instigated immediately if Rabbits are detected to have increased in population around the Project area. This control may be via the following methods:

- Biological control: At present, control of Rabbits in Australia is heavily reliant on established biocontrols such as myxomatosis and Rabbit Haemorrhagic Disease (RHD). Myxomatosis has become less effective against Rabbits due to increased resistance and the percentage killed is generally too low to achieve significant reduction of their impacts. RHD has a high mortality rate resulting in the death of 70–90 per cent of susceptible Rabbits.
- Poison: Poisoning is most effective during the non-breeding season (when Rabbits are less territorial and less tied to warrens) and feed is scarce. The best time is usually during mid to late summer. The objective of poisoning is to remove 90% or more of Rabbits, which will prevent the population from quickly recovering, allowing time to implement follow up control. Carrots are the preferred feed material for Rabbits, but oats and pellets may be used also. Poisoning is most effective when combined with warren ripping as a follow-up control measure to further discourage Rabbits from taking up residence on site. However warren ripping may result in impacts to native vegetation and areas of cultural heritage, so may only be undertaken in consultation with relevant stakeholders.
- Shooting, trapping and fencing: These can be highly effective control measures for Rabbits over smaller areas, or when Rabbit numbers are already low. However, they should not be relied upon to control medium to high density Rabbit populations and should be implemented in concert with poisoning and/or biological control measures.

C6.5. Mice Control

Introduced mice and rats may be present within the Project area. Maintaining an environment free of food scraps and periodic waste collection will limit the numbers of introduced rodents. Where numbers dictate, controls may include trapping and poisoning. This would be done in consultation with an ecologist to minimise the risk to non-target species.

C6.6. Large Mammal Control

Due to Australia being the only country with a significant number of feral camels, there is relatively little research on controlling their numbers. In 2010, the Natural Resource Management Ministerial Council endorsed the National Feral Camel Action Plan. The main control methods nominated and used currently are culling, and exclusion fencing for commercially or ecologically significant sites. Camels are culled in remote areas by shooting from helicopters or from the ground. These culls aim to reduce the density of camels especially in areas of high conservation value.

The highest standards of animal welfare are followed during the culling process. Controlling camel numbers also results in fewer camels dying cruelly from starvation, dehydration and trampling, particularly during drought. Attempts to develop a feral camel live-export trade and a meat industry has not been commercially sustainable to date.

Similar controls may be implemented for feral horses where population numbers determine this is necessary.

C7. MONITORING METHODOLOGY

The control of feral animals (see previous section) would be triggered by a rise in the population of the feral species or observations of negative impacts as a result of feral species to significant fauna.

The proposed monitoring is detailed in Table C2.

Table C2: Location and Proposed Extent of Monitoring

Monitoring Description	Location	Frequency	Records
Feral animal presence / absence survey and, where present, relative feral animal density/population estimations.	• Water storages • Populated areas (offices, accommodation camp) • Great Desert Skink habitat • Landfill and Waste Transfer Facility	Quarterly	• Presence / absence of feral animal species • Evidence of feral animal presence / impacts
Infrastructure status	• Landfill exclusion fencing and waste cover • Water storage exclusion fencing • Water storage beach debris presence / absence	Monthly (and as soon as practicable after rainfall events)	• Record of completed inspections and/or the requirement for corrective actions

Monitoring Description	Location	Frequency	Records
	• Ponding water in rehabilitated areas presence / absence • Putrescible waste bin condition		
(If Required) Monitoring of pre-and post- animal control population densities	In areas where animal control has been applied	As required. Daily during animal control program implementation	• Records of observed feral animal mortalities • Post-control records of relative reductions in feral animal densities

C8. REPORTING

Reporting of the performance of feral animal monitoring and control will include:

- Internal incident reports and monitoring/inspection records
- Annual MRF reports
- Annual WMP Compliance Assessment Report
- Routine reporting to the Ngaanyatjarra People and the Ngaanyatjarra Council.