



Vimy Resources Limited

## Terrestrial Fauna Monitoring and Management Plan

*(Management-Based Condition Environmental Management Plan)*



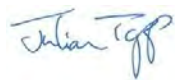

Mulga Rock Uranium Project

EMP-EHS-002

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## Summary

Title of proposal	Mulga Rock Uranium Project
Proponent name	Vimy Resources Limited
Ministerial Statement No.	1046
Purpose of the CEMP	The Terrestrial Fauna Monitoring and Management Plan is submitted to fulfill the requirements of Conditions 7 and 10 of the above Statement.
Key environmental factor	To maintain representation, diversity, viability and ecological function at the species, population and assemblage level.
Key environmental objectives	1) Minimise direct and indirect impacts as far as practicable on conservation significant fauna species; and 2) Monitor the presence of the Sandhill Dunnart using methodology established in the Camera Trapping Program.
Management target/s	<p><b>Management Target 1:</b> No unauthorised clearing or disturbance of flora and vegetation.</p> <p><b>Management Target 2:</b> Minimise impact to conservation significant fauna species from trenching activities.</p> <p><b>Management Target 3:</b> Minimise impact to conservation significant fauna species from open sources of water.</p> <p><b>Management Target 4:</b> Minimise vehicle strikes to conservation significant fauna species.</p> <p><b>Management Target 5:</b> No increase in feral animal numbers above baseline levels in the MRUP Development Envelope.</p>

## 1. Context, Scope and Rationale

### 1.1 Proposal

Vimy Resources Limited (Vimy) proposes to develop the Mulga Rock Uranium Project (MRUP or the Project) which lies approximately 240km east-northeast of Kalgoorlie-Boulder in the Shire of Menzies. The area is remote, located on the western flank of the Great Victoria Desert, comprising series of large, generally parallel sand dunes, with inter-dunal swales and broad flat plains.

The MRUP covers approximately 102,000 hectares on granted mining tenure, primarily M39/1104 and M39/1105 (formerly M39/1080 and M39/1081), within Unallocated Crown Land (UCL). It includes two distinct mining centres, Mulga Rock East (MRE) comprising the Princess and Ambassador resources and Mulga Rock West (MRW) comprising the Emperor and Shogun resources, which are approximately 20km apart. The deposits will be mined using large-scale open pits to produce an annualised peak capacity of 2,180 t/a (4.8 Mlbs)  $U_3O_8$ .

The anticipated Life-of-Mine (LOM) is up to 16 years, based on the currently identified resource.

This Condition Environment Management Plan (CEMP) has been written in accordance with the Instructions on how to prepare Environmental Protection Act 1986 Part IV Environmental Management Plans (EPA, 2016).

### 1.2 Key environmental factors

This CEMP specifically addresses the Terrestrial Fauna environmental factor, which is part of the overall Land theme.

Terrestrial Fauna is a key environmental factor for this proposal because surveys have identified the regional presence of at least eight species of native marsupial, 10 species of other native mammals (rodents, bats and dingoes), 38 species of native bird, 53 species of reptiles, one species of frog. Only six species of conservation significant fauna species have been positively identified within the MRUP, of which three are also Matters of National Environmental Significance (MNES).

Potential direct impacts to terrestrial fauna include:

- Clearing / ground disturbance – Clearing of native vegetation may result in the removal, degradation and / or loss or fragmentation of fauna habitat.
- Trenching activities – Trenching for pipelines and other infrastructure may result in impacts to fauna if they fall into the trench and / or they can't escape.
- Open sources of water – open sources of water (e.g. Turkey's Nest, ponds) may lead to the drowning of fauna species if they fall in.
- Vehicle strike.

Potential indirect impacts on fauna include:

- Altered fire regimes – altered fire regime may either have a direct impact on fauna species or an indirect impact by influencing or changing the distribution and composition of the vegetation.
- Feral fauna species – feral fauna species may either outcompete native fauna for resources or consume native species as a food source.

- Weeds – weeds may outcompete native flora species changing vegetation communities and impacting on fauna habitat.
- Dust – dust may influence flora and vegetation communities and in turn impact on fauna habitat.
- Saline water – saline water used during dust suppression activities or resulting from uncontrolled discharges may impact on flora and vegetation communities, and thus on fauna habitats.

### 1.3 Condition requirements

Condition	Section in CEMP
10-1 The proponent shall manage the implementation of the Proposal to meet the following environmental objectives: <ol style="list-style-type: none"> <li>1) Minimise direct and indirect impacts as far as practicable on conservation significant fauna species; and</li> <li>2) Monitor the presence of the Sandhill Dunnart using methodology established in the Camera Trapping Program.</li> </ol>	Whole document
10-2 The proponent shall consult with the Parks and Wildlife and prepare and submit a Terrestrial Fauna Monitoring and Management Plan (including a Camera Trapping Program) required by Condition 7-1 that satisfies the requirements of Condition 7-2, to meet the objective of Condition 10-1.	Section 4
10-3 The Terrestrial Fauna Monitoring and Management Plan required by Condition 7-1 shall include: <ol style="list-style-type: none"> <li>1) provisions required by Condition 7-2 to manage potential impacts of the proposal on conservation significant fauna including from, but not limited to degradation of habitat from weeds, loss of habitat, feral animals, changes to fire regime, trenching for pipelines, and risk of vehicle strikes;</li> <li>2) the methodology of recording impacts to conservation significant fauna; and</li> <li>3) the methodology of monitoring and registering the presence of the Sandhill Dunnart.</li> </ol>	Section 2, and Appendix A (Camera Trapping Protocol)
10-4 The proponent shall provide the results of the Sandhill Dunnart register and the record of impacts to conservation significant fauna annually to Parks and Wildlife.	Section 2.5
10-5 The proponent shall continue to implement the version of the Terrestrial Fauna Monitoring and Management Plan most recently approved by the CEO until the CEO has confirmed by notice in writing that the Terrestrial Fauna Monitoring and Management Plan required by Condition 7-1 satisfies the requirements of Condition 7-2 to meet the objectives required by Condition 10-1.	Whole document

In addition to the above Condition 10 requirements, direct and indirect impacts to flora and vegetation communities within the MRUP, including clearing / disturbance, weeds, fire, dust, and saline water, are further protected by Condition 9 and are managed by the Flora and Vegetation Monitoring and Management Plan developed in accordance with Condition 9-2 of Ministerial Statement 1046. This CEMP works together with the Terrestrial Fauna Monitoring and Management Plan to protect the flora and vegetation and subsequently fauna habitat within the MRUP.

## 1.4 Rationale and approach

### 1.4.1 Survey and study findings

A number of general and targeted terrestrial fauna surveys and related studies have been conducted across the MRUP Development Envelope, and over the wider area to establish regional context. Terrestrial fauna surveys undertaken within the MRUP since 1985 are summarised below.

Date	Survey	Author	Comment
June/July 1985	Mulga Rock: Flora, fauna and radioecology survey.	W.G. Martinick & Associates Pty Ltd (1986)	A Level 2 ecological survey of MRUP was completed for PNC Exploration. It included collection and preparation of animal and plants samples for radionuclide testing, though no reporting of such tests was sourced.
October 2009	A fauna survey of the proposed Mulga Rock Project area, Great Victoria Desert, Western Australia.	Ninox Wildlife Consulting (Ninox 2010)	A Level 2 survey completed for Energy and Minerals Australia Ltd. This survey focused upon the Mulga Rock East area but included a site in the Mulga Rock West area.
August-November 2014; ongoing	Camera Trapping Protocol – Sandhill Dunnart.	Vimy Resources (2015b)	A targeted survey for Sandhill Dunnart ( <i>Sminthopsis psammophila</i> ) utilising camera traps, with detailed discussion on camera trapping protocol.
January 2013 – March 2014	A report of the Southern Marsupial Mole, Mulga Rock Uranium Project, Great Victoria Desert, Western Australia.	Ninox Wildlife Consulting (Ninox 2015a)	A targeted survey for Southern Marsupial Mole ( <i>Notoryctes typhlops</i> ) involving trenches surveyed for mole holes.
2009-2014 (Helicopter 2009-2010)	Fauna assessment for the Malleefowl ( <i>Leipoa ocellata</i> ).	Vimy Resources (2015c)	Targeted surveys for Malleefowl ( <i>Leipoa ocellata</i> ) involving helicopter surveys and track surveys.
October 2014	An updated report on the herpetofauna of the proposed Mulga Rock Project Area, Great Victoria Desert, Western Australia.	Ninox Wildlife Consulting (Ninox 2015b)	A Level 1 Desktop Study to update and complement previous survey completed by Ninox (2010).
October 2014	Short-range endemic fauna at the Mulga Rock Uranium Project.	Bennelongia (2015)	A Level 1 desktop study and reconnaissance SRE survey.



The above fauna surveys have identified the regional presence of at least eight species of native marsupial, 10 species of other native mammals (rodents, bats and dingoes), 38 species of native bird, 53 species of reptiles, one species of frog and several feral animal species. These surveys have also positively identified six conservation significant fauna species, of which three are also MNES (in bold below), and include:

- **Southern Marsupial Mole** (*Notoryctes typhlops*)
- **Sandhill Dunnart** (SHD; *Sminthopsis psammophila*)
- Woma Python (*Aspidites ramsayi*)
- Brush-tailed Mulgara (*Dasycercus blythi*)
- **Rainbow Bee-eater** (*Merops ornatus*)
- Bustard (*Ardeotis australis*)

Of the three MNES listed species identified in the MRUP:

- Only one record of a Rainbow Bee-eater (*Merops ornatus*) occurred in 2009, with no other sightings since then. The habitat within the MRUP is generally unsuitable for the Rainbow Bee-eater and therefore it is not likely to occur in the MRUP and no direct or indirect impact on these birds is likely.
- No live specimens of *Notoryctes typhlops* (Southern Marsupial Mole) has been recorded within the MRUP, but evidence of mole holes have been observed in shallow trenching activities. Although the habitat of this species is poorly understood, its distribution in the arid sandy regions of Australia is thought to be widespread. The very low density of mole holes recorded, and the absence of any live sightings, indicates that this species is not prevalent within the MRUP and thus no significant impact on *Notoryctes typhlops* is likely to occur (Ninox, 2015a).
- *Sminthopsis psammophila* (Sandhill Dunnart; SHD) has been frequently observed within the Development Envelope of the MRUP, and widespread within the YSP (Vimy, 2015a). In November 2014, a large (80,000ha) bushfire occurred within the MRUP, severely degrading 74% of the vegetation within the Development Envelope, including large areas of preferred SHD habitat within the Project Area. As such, it is concluded that the MRUP will not have any significant impact on any current populations of *Sminthopsis psammophila*.

A large number of invertebrates were also identified over the course of a short-range endemic (SRE) survey (Bennelongia, 2015). Twelve of these species were regarded as having a moderate risk of being an SRE while three were identified to be potential SREs. It was determined that all of the SREs identified, including those only sampled within the proposed Disturbance Footprint, were likely to be more widespread than the vicinity of the Project due to the wider occurrence of the habitats in which they occurred, and are therefore unlikely to be threatened by the MRUP.

In order to more accurately survey for SHD's, a Camera Trapping Protocol (CTP) was developed by Vimy (Appendix A), in accordance with the Department of Environment and Conservation (DEC) (2011). *Standard Operating Procedure 5.2 – Remote Operation of Cameras*, Version 1.0. This CTP was peer reviewed by Department of Parks and Wildlife (DPaW; now the Department of Biodiversity, Conservation and Attractions – DBCA). This technique provides a non-invasive method to accurately identify SHD and is more cost and time effective than traditional fauna survey techniques, including pit fall and Elliot traps, with a greater efficiency.

#### 1.4.2 Key assumptions and uncertainties

It is assumed that the desktop investigations and field surveys undertaken for MRUP have sufficiently identified the species within and surrounding the Project area. However, given the transitory and

migratory nature of most fauna species, and the large spatial scales of the MRUP, it is possible that some species have not been recorded during the survey effort.

#### 1.4.3 Management approach

The management approach developed by Vimy to minimise direct and indirect impacts, as far as practicable, on conservation significant fauna, includes the use of a register to record all sightings and impacts on conservation significant fauna due to operational activities (e.g. vehicle strikes, trenching activities), continued fauna surveys using the Camera Trapping Protocol, and implementation of management strategies that minimise impacts to vegetation and subsequently conserve and protect fauna habitats.

In addition, the management approach will rely on:

- Environmental Inductions – to ensure that all new personnel entering the MRUP are aware of the environmental qualities within the MRUP and how their actions may impact on these qualities.
- Environmental Training – this will ensure that all personnel undertaking works that may have either a direct or indirect impact on conservation significant fauna species are properly trained, are competent to perform the task, and that fit-for-purpose equipment is used to minimise the environmental impacts.

If direct or indirect impacts are reported on conservation significant fauna species then investigations will be undertaken to determine the contributing factors and re-evaluate the appropriateness of existing management actions, establishing new management actions, if required, to achieve the management targets and overall environmental objectives.

Given the management approach to minimising indirect impacts to conservation significant fauna species relies heavily on protecting vegetation communities and thus habitat, this CEMP should be implemented in combination with the Flora and Vegetation Monitoring and Management Plan, as required by Condition 9-2 of Ministerial Statement 1046.

Further protection to the Sandhill Dunnart is also provided by Condition 2 of the EPBC Approval (2013/7083). This condition requires that a Sandhill Dunnart Conservation Plan be developed to establish the management targets and corresponding management actions to reduce the threat posed by feral animals within the MRUP.

#### 1.4.4 Rationale for choice of provisions

A management target has been established for each contributing factor listed in Section 1.2 that may cause either a direct or indirect impact on conservation significant fauna species as a result of the MRUP. It is expected that by implementing the identified management actions, then the management targets will be achieved which will ensure that the environmental objectives are met.

Further protection of conservation significant fauna species from indirect impacts on habitat are provided by the following Conditions and mitigating factors:

- Weeds – Condition 8-1 (3) requires the “eradication of all weeds introduced in the development envelope as a result of the implementation of the proposal”.
- Saline water – Condition 13-1 (1) requires the maintenance of “soil quality within background concentrations established during baseline studies 10 metres from areas where dewater has been used for dust suppression in Sandhill Dunnart Habitat (i.e. E3 and S6 vegetation communities).



- Feral animals – Condition 2 of EPBC Approval (2013/7083) requires the development and implementation of a Sandhill Dunnart Conservation Plan to reduce the threat to the Sandhill Dunnart posed by feral animals.
- Fire – 78% of the proposed Disturbance Footprint was burnt in the large November 2014 bushfire. Research has shown that it will take 15-20 years for the *Trioda sp.* to re-establish sufficiently interconnecting groundcover to 'carry' or 'support' a fire and therefore no fires are likely to occur within the MRUP for the next 15-20 years.

## 2. CEMP Provisions

This section of the CEMP identifies the legal provisions that Vimy proposes to implement to minimise direct and indirect impacts as far as practicable on conservation significant fauna species; and to continue monitoring the presence of the Sandhill Dunnart using the methodology established in the Camera Trapping Program. It identifies the management actions that Vimy will implement and how they will be monitored and reported, to achieve the management target, thereby ensuring that the environmental objectives of Condition 10-1 are met. Table 1 provides a detailed list of these provisions.

This section also identifies how Vimy will review and revise management actions if the management targets are exceeded.

### 2.1 Objective

As specified in Ministerial Statement No. 1046 the environmental objectives for Condition 10 are:

- Condition 10-1(1): Minimise direct and indirect impacts as far as practicable on conservation significant fauna species; and
- Condition 10-1(2): Monitor the presence of the Sandhill Dunnart using methodology established in the Camera Trapping Program.

### 2.2 Management targets

The following management targets have been identified to ensure that the above environmental objectives are met:

- **Management Target 1:** No unauthorised clearing or disturbance of flora and vegetation.
- **Management Target 2:** Minimise impact to conservation significant fauna species from trenching activities.
- **Management Target 3:** Minimise impact to conservation significant fauna species from open sources of water.
- **Management Target 4:** Minimise vehicle strikes to conservation significant fauna species.
- **Management Target 5:** No increase in feral animal numbers above baseline levels in the MRUP Development Envelope.
- **Management Target 6:** Further confirm the presence of the Sandhill Dunnart within the MRUP and within the broader regional environment of the YSP.

Specific management targets for protecting conservation significant fauna species, and their habitats, from contributing factors including dust, weeds, fire and saline water, are the same as specified in the Flora and Vegetation Monitoring and Management Plan and are thus not repeated in this Terrestrial Fauna Monitoring and Management Plan. Consequently, if the management targets specified in the

Flora and Vegetation Monitoring and Management Plan are achieved, then no impact to conservation significant fauna species, and their habitats, from these factors will likely occur.

## 2.3 Management actions

The following specific management actions will be implemented to achieve the above management targets. They are prioritised such that the greatest management effort will be placed on the Project activities that have the highest risk of causing environmental impact.

### 2.3.1 Direct Risks / Impacts

#### Clearing / Disturbance of Habitat

**Risk Rating:** High

**Corresponding Management Target:** 1. No unauthorised clearing or disturbance of flora and vegetation.

Management Actions to be implemented to achieve Management Target 1:

- **Management Action 1** (Development Envelope) – no clearing outside of the approved Development Envelope.
- **Management Action 2** (Disturbance Footprint) – no unauthorised clearing outside of the approved Disturbance Footprint.
- **Management Action 3** (Ground Disturbance) – Implement GDAP system to prevent unauthorised clearing.
- **Management Action 4** (Remnant Vegetation) – no unauthorised access to remnant (unburnt) vegetation areas.
- **Management Action 5** (Environmental Induction) – all new site personnel will undertake an environmental induction, emphasising importance of flora and vegetation in the MRUP. This will be supplemented by the inclusion of refreshers into regular tool-box meetings.
- **Management Action 6** (Environmental Training) – all personnel involved in clearing of vegetation will undertake training on GDAP process, which includes sign off by operators that they understand work involved. This will be supplemented by the inclusion of refreshers into regular tool-box meetings.

#### Trenching Activities

**Risk Rating:** Moderate

**Corresponding Management Target:** 2. Minimise impact to conservation significant fauna species from trenching activities.

Management Actions to be implemented to achieve Management Target 2:

- **Management Action 7** (Authorisation) – all trenching activities must be authorised and recorded in the GDAP system.
- **Management Action 8** (Egress) – all trenches or sumps > 1.2m depth, remaining open for ≥ 12 hours, must have accessible points of egress for fauna species.
- **Management Action 9** (Monitoring) – all trenches or sumps > 1.2m depth, remaining open for ≥ 24 hours, must be checked on a daily basis for egress and fauna by a suitably trained person.

- **Management Action 10** (Backfilling) – all trenches will be backfilled as soon as practicable after completion of work.
- **Management Action 11** (Reporting) – all impacts on conservation significant fauna species from trenching activities, including sumps, will be recorded in an on-site register.
- **Management Action 12** (Environmental Training) – all personnel involved in trenching activities will undertake training to help identify conservation significant fauna species and highlight how this activity could impact on fauna species and what should be done to minimise potential impacts. This will be supplemented by the inclusion of refreshers into regular tool-box meetings.

### **Open Sources of Water**

**Risk Rating:** Moderate

**Corresponding Management Target:** 3. Minimise impact to conservation significant fauna species from open sources of water.

Management Actions to be implemented to achieve Management Target 3:

- **Management Action 13** (Fencing) – all open sources of water that are accessible to terrestrial fauna must be fenced to withstand camels and other large herbivores.
- **Management Action 14** (Egress) – all open sources of water that are accessible to terrestrial fauna must have egress points suitable for small mammals and reptiles.
- **Management Action 15** (Monitoring) – all open sources of water that are accessible to terrestrial fauna must be regularly checked for fauna species.
- **Management Action 16** (Reporting) – all impacts on conservation significant fauna species from open sources of water will be recorded in an on-site register.

### **Vehicle Strikes**

**Risk Rating:** Moderate

**Corresponding Management Target:** 4. Minimise vehicle strikes to conservation significant fauna species.

Management Actions to be implemented to achieve Management Target 4:

- **Management Action 17** (Speed limits) – Speed limits will be set to as low as practicable consistent with minimising vehicle strikes. Speed limits will be initially set as follows:
  - Site Access Road – 80km/hr;
  - Plant, Village and Aerodrome Access Roads – 60km/hr; and
  - Haul Roads and Site Tracks – 40 km/r.
- **Management Action 18** (Restricted driving) – Limit driving and the number of vehicles on the roads at dawn and dusk, where practicable.
- **Management Action 19** (Reporting) – all vehicle strikes with conservation significant fauna species will be recorded in an on-site register.
- **Management Action 20** (Injured animals) – animals struck by vehicles will be removed from roads and treated accordingly, with the pouches of female marsupials checked for live young.

- **Management Action 21** (Environmental Induction) – all new site personnel will undertake an environmental induction to help identify conservation significant fauna species in the MRUP. This will be supplemented by the inclusion of refreshers into regular tool-box meetings.

### 2.3.2 Indirect Risks / Impacts

#### Feral Animals

**Risk Rating:** Moderate

**Corresponding Management Target:** 5. No increase in feral animal numbers above baseline levels in the MRUP Development Envelope.

Baseline levels (of feral animal numbers) will be determined by camera surveys undertaken 'within the Development Envelope' commencing prior to construction activity. In addition to the cameras deployed as part of the Sandhill Dunnart Conservation Management Plan, cameras will also be placed in locations adjacent to where facilities will be built to ensure that the area around where the facilities will be built are not substantially different in terms of feral animal numbers than the regional estimate that will be used to determine baseline levels for the MRUP Development Envelope area.

Once baseline levels have been determined from the regional deployment of cameras, and cameras deployed around facilities prior to construction have confirmed that feral animal densities are no different in the area where facilities were being constructed, the cameras deployed adjacent to where facilities were scheduled to be built will be redeployed into monitoring specific facilities (food and water sources) that have the potential to be attractors of feral animals. The regional deployment of the cameras monitoring feral animal numbers in the wider MRUP Development Envelope will continue to operate.

Every site that has the potential to attract feral animals and support an increase in their numbers will have one or more monitoring camera allocated to it, which will be set up in the best positions to capture images if such animals are present. The cameras will be set up as soon as the facility concerned is completed and will then operate continuously with data being downloaded on a quarterly basis. After two years of camera operations an assessment will be made for each site as to the frequency with which the site is visited by feral animals and the number of individuals involved (where identification of individuals by markings is possible). Thereafter the same monitoring will continue with a view to determining whether frequency of visits and/or the number of individuals concerned is increasing.

Management Actions to be implemented to achieve Management Target 5:

- **Management Action 22** (Food sources) – all food sources, including bins and landfill, will be appropriately contained and / or fenced to withstand camels and other large herbivores to prevent feral animals accessing and being attracted to them.
- **Management Action 23** (Water sources) – all open sources of water, that are accessible to terrestrial fauna, must be fenced to withstand camels and other large herbivores to prevent feral animals accessing and being attracted to them.
- **Management Action 24** (Reporting) – sightings of feral animals within the MRUP, excluding the transport route, will be recorded in an on-site register to help monitor their numbers.
- **Management Action 25** (Control) – if required, feral animal numbers will be controlled by DBCA approved baiting, trapping or muster techniques.
- **Management Action 26** (Environmental Induction) - new site personnel will undertake an environmental induction, illustrating the impact that feral animals may cause to conservation

significant fauna species and how they can help reduce the feral animal numbers within the MRUP. This will be supplemented by the inclusion of refreshers into regular tool-box meetings.

### 2.3.3 Sandhill Dunnart (SHD)

**Corresponding Management Target:** 6. Further confirm the presence of the Sandhill Dunnarts within the MRUP and within the broader regional environment of the YSP.

Management Actions to be implemented to achieve Management Target 6:

- **Management Action 27** (Implementation) – install camera traps, in accordance with the CTP, and the Sandhill Dunnart Conservation Plan, within the MRUP and regionally within the YSP.
- **Management Action 28** (Monitoring) – monitor the camera traps for at least 60 days to confirm the presence / absence of SHD.
- **Management Action 29** (Duration) – implement the CTP within the MRUP and regional environment for a period of at least 5 years from approval of this CEMP.
- **Management Action 30** (Reporting) – positive identifications of SHD will be reported in the Sandhill Dunnart Register.
- **Management Action 31** (Environmental Induction) - new site personnel will undertake an environmental induction, highlighting the sensitive nature of SHD and how their actions can impact on the presence of SHD in the MRUP. This will be supplemented by the inclusion of refreshers into regular tool-box meetings.

## 2.4 Monitoring

For each management action listed above, a specific monitoring program or task will be undertaken to ensure that the management action is implemented, and its requirements met. If monitoring identifies that the requirements of the management action has not been met, then there is a risk that the management target will not be achieved and that the environmental objectives are not attained.

The specific monitoring tasks to be undertaken for each management action is outlined below.

Management Action	Monitoring
<b><i>Clearing / Disturbance of Habitat (Management Target 1: No unauthorised clearing or disturbance of flora and vegetation).</i></b>	
1. No clearing outside of the approved Development Envelope.	<p>Monitoring of this will be a continuous process with a requirement, each time that any clearing is proposed, for a Ground Disturbance Activity Permit (GDAP) to be issued.</p> <p>Annual audit of cleared / disturbed areas recorded in the GDAP system against approved Development Envelope boundary.</p>
2. No unauthorised clearing outside of the approved Disturbance Footprint.	Monitoring of this will be a continuous process with each authorised clearing activity subject to a co-ordinate check after clearing has taken place to ensure that what was approved has been complied with.

Management Action	Monitoring
	Annual audit of cleared / disturbed areas in the GDAP system against approved Disturbance Footprint area.
3. Implement GDAP system to prevent unauthorised clearing.	<p>The GDAP system when implemented is a continuous process that is related to activities taking place – so rather than having a particular frequency or duration it happens each time activity is proposed and requires authorisation prior to the activity being allowed and follow up measures to ensure that what was approved is complied with including closure and rehabilitation obligations.</p> <p>Annual audit of authorised versus actual cleared areas and of the requirements of Condition 9-1 (1) &amp; (2).</p>
4. No unauthorised access to remnant (unburnt) vegetation areas.	<p>The monitoring is through the GDAP system and therefore is continuous and applies each time clearing activities are proposed.</p> <p>Annual assessment of aerial photography.</p>
5. All new site personnel will undertake an environmental induction, emphasising importance of flora and vegetation in the MRUP. This will be supplemented by the inclusion of refreshers into regular tool-box meetings.	<p>Monitoring of whether environmental inductions have taken place will be effected through induction records that will be created each time new personnel are inducted.</p> <p>Annual audit of induction records.</p>
6. All personnel involved in clearing of vegetation will undertake training on GDAP process, which includes sign off by operators that they understand work involved. This will be supplemented by the inclusion of refreshers into regular tool-box meetings.	<p>Monitoring of whether personnel involved in clearing vegetation have been trained on GDAP processes will be effected through the signing of training records testifying that the training has been completed and been understood.</p> <p>Annual audit of training records.</p>
<b><i>Trenching Activities (Management Target 2: Minimise impact to conservation significant fauna species from trenching activities).</i></b>	
7. All trenching activities must be authorised and recorded in the GDAP system.	<p>Monitoring of this will be a continuous process with a requirement, each time that any trenching activity is proposed, for a Ground Disturbance Activity Permit (GDAP) to be issued.</p> <p>Annual audit of authorised vs. actual trenching activities recorded in the GDAP system.</p>



Management Action	Monitoring
8. All trenches or sumps >1.2m depth, remaining open for ≥ 24 hours, must have accessible points of egress for fauna species.	<p>Monitoring of this will be a continuous process with every authorised trench or sump subject to a specification check after development to ensure that what was approved has been complied with.</p> <p>Annual audit of Compliance Records stored in the GDAP system.</p>
9. All trenches or sumps >1.2m depth, remaining open for ≥24 hours, must be checked on a daily basis for egress and fauna by a suitably trained person.	<p>Trenches or sumps that require checking will be monitored on a daily basis whilst the risk exposure exists. Daily inspections will happen first thing in the morning.</p> <p>Annual audit of Compliance Records stored in the GDAP system.</p>
10. All trenches will be backfilled as soon as practicable after completion of work.	<p>Monitoring of this will be through the GDAP system and therefore is a continuous process. The Permit application will specify the expected duration and hence the time until appropriate rehabilitation (i.e. backfilling) is required. If the work has not been completed in the time allocated – an extension will be required. If the work has been completed, then the system will require details and/or evidence on the rehabilitation undertaken.</p> <p>Annual audit of Compliance Records stored in the GDAP system.</p>
11. All impacts on conservation significant fauna species from trenching activities, including sumps, will be recorded in an on-site register.	<p>This requirement only materialises in the event of an impact upon conservation significant fauna.</p> <p>Any such impact would be notified to the registrar of the on-site register.</p> <p>Annual audit of Conservation Significant Fauna Impact Register.</p>
12. All personnel involved in trenching activities will undertake training to help identify conservation significant fauna species and highlight how this activity could impact on fauna species and what should be done to minimise potential impacts. This will be supplemented by the inclusion of refreshers into regular tool-box meetings.	<p>Monitoring of whether personnel involved in trenching activities have been trained in the identification of conservation significant fauna and in avoiding potential impacts, will be effected through the signing of training records testifying that the training has been completed and been understood.</p> <p>Annual audit of training records.</p>

Management Action	Monitoring
<b><i>Open Sources of Water (Management Target 3: Minimise impact to conservation significant fauna species from open sources of water).</i></b>	
13. All open sources of water, that are accessible to terrestrial fauna, must be fenced to withstand camels and other large herbivores.	<p>The creation of an open source of water will involve activities that require pre-authorisation through the GDAP system. The GDAP system will require that the authorisation required to create an open source of water includes suitable fencing to prevent fauna entry into the area. As such the monitoring is continuous and triggered prior to such activity.</p> <p>Annual audit of Compliance Records stored in the GDAP system.</p>
14. All open sources of water, that are accessible to terrestrial fauna, must have egress points suitable for small mammals and reptiles.	<p>The creation of an open source of water will involve activities that require pre-authorisation through the GDAP system. The GDAP system will require that the authorisation required to create an open source of water includes egress point(s) associated with the water located to enable fauna egress. As such the monitoring is continuous and triggered prior to such activity.</p> <p>Annual audit of Compliance Records stored in the GDAP system.</p>
15. All open sources of water, that are accessible to terrestrial fauna, must be regularly checked for fauna species.	<p>Monitoring of open sources of water (all of which will have been fenced) will be undertaken on a regular basis with the frequency determined by a balance between ease of inspection and risk to fauna.</p> <p>Most open sources of water (fenced) will be in close proximity to everyday work activities and will be subject to daily inspections despite the absence of risk.</p> <p>Where open water sources (fenced) are remote from daily activities, inspection frequency will be aligned with risk. Initial inspections will be weekly, and frequency will subsequently be increased or decreased depending on observations concerning the effectiveness and durability of the fencing.</p> <p>Annual audit of Compliance Records stored in the GDAP system.</p>

Management Action	Monitoring
16. All impacts on conservation significant fauna species from open sources of water will be recorded in an on-site register.	<p>This requirement only materialises in the event of an impact upon conservation significant fauna.</p> <p>Any such impact would be notified to the registrar of the on-site register.</p> <p>Annual audit of Conservation Significant Fauna Impact Register.</p>
<b><i>Vehicle Strikes (Management Target 4: Minimise vehicle strikes to conservation significant fauna species).</i></b>	
<p>17. Speed limits should be set to as low as practicably possible to minimise vehicle strikes.</p> <p>Speed limits will be initially set as follows:</p> <ul style="list-style-type: none"> <li>- Site Access Road – 80km/hr;</li> <li>- Plant, Village and Aerodrome Access Roads – 60km/hr; and</li> <li>- Haul Roads/Site Tracks – 40 km/hr.</li> </ul>	<p>All vehicle strikes will be recorded in an on-site register. This register will be monitored as vehicle strikes are recorded to determine whether the speed limits have been set at an appropriate level consistent with minimising vehicle strikes to the lowest extent practicable.</p> <p>Annual audit of Conservation Significant Fauna Impact Register.</p>
18. Limit driving and the number of vehicles on the roads at dawn and dusk, where practicable.	<p>All vehicle strikes will be recorded in an on-site register. This register will be monitored as vehicle strikes are recorded to determine whether driving is occurring during higher risk periods (dawn and dusk) and whether this is resulting in increased vehicle strikes that could be avoided by shifting the time periods when vehicle movements are scheduled.</p> <p>Annual audit of shift and transport rosters.</p>
19. All vehicle strikes with conservation significant fauna species will be recorded in an on-site register.	<p>All vehicle strikes will be recorded in an on-site register as soon as is practicable after the strikes have occurred. This is a continuous process that happens each time a strike occurs.</p> <p>Annual audit of Conservation Significant Fauna Impact Register.</p>
20. Animals struck by vehicles will be removed from roads and treated accordingly, with the pouches of female marsupials checked for live young.	<p>All vehicle strikes will be recorded in an on-site register. The information recorded will include details of actions taken. This is a continuous process that happens each time a strike occurs.</p> <p>Annual audit of Conservation Significant Fauna Impact Register.</p>

Management Action	Monitoring
21. All new site personnel will undertake an environmental induction to help identify conservation significant fauna species in the MRUP. This will be supplemented by the inclusion of refreshers into regular tool-box meetings.	<p>Monitoring of whether environmental inductions have taken place will be effected through induction records that will be created each time new personnel are inducted. That monitoring process will include inductees confirming that they have received relevant training in the identification of conservation significant fauna.</p> <p>Annual audit of induction records.</p>
<b><i>Feral Animals (Management Target 5: No increase in feral animal numbers above baseline levels in the MRUP Development Envelope).</i></b>	
22. All food sources, including bins and landfill, will be appropriately contained and / or fenced to withstand camels and other large herbivores to prevent feral animals accessing and being attracted to them.	<p>Containment of food sources will be regularly monitored and maintained to ensure they are fit-for-purpose and functioning appropriately.</p> <p>The frequency of monitoring will be determined by a balance between ease of inspection and risk to fauna.</p> <p>Most food sources (such as bins) will be in close proximity to everyday work activities and will be subject to daily inspections despite the absence of risk.</p> <p>Where potential food sources (fenced) are remote from daily activities (such as landfill), inspection frequency will be aligned with risk. Initial inspections will be weekly, and frequency will subsequently be increased or decreased depending on observations concerning the effectiveness and durability of the fencing.</p> <p>All potential food sources, in addition to being checked to ensure that protection measures to prevent access by feral animals are in place and effective, will also be monitored continuously by cameras with the captured images downloaded and analysed on a quarterly basis.</p>
23. All open sources of water, that are accessible to terrestrial fauna, must be fenced to withstand camels and other large herbivores to prevent feral animals accessing and being attracted to them.	<p>Fencing of open water sources, accessible to terrestrial fauna, will be regularly monitored and maintained to ensure they are fit-for-purpose and functioning appropriately.</p> <p>The frequency of monitoring will be determined by a balance between ease of inspection and risk to fauna.</p> <p>All potential water sources, in addition to being checked to ensure that protection measures to prevent access by feral animals are in place and effective, will also be monitored continuously by cameras with the captured images downloaded and analysed on a quarterly basis.</p>

Management Action	Monitoring
24. Sightings of feral animals within the MRUP, excluding the transport route, will be recorded in an on-site register to help monitor their numbers.	<p>The recording of any sighting of feral animals is a continuous process with site personnel required to report such sightings as soon as is reasonably practicable and expected to be on the same day as any sighting.</p> <p>Annual audit of on-site Feral Animal Register.</p>
25. If required, feral animal numbers will be controlled by DBCA approved baiting, trapping or muster techniques.	<p>Feral animal monitoring will take place via reported sightings, and regular monitoring (including camera monitoring) of sites expected to attract feral animals (such as food sources and water sources).</p> <p>Annual audit of on-site Feral Animal Register.</p>
26. New site personnel will undertake an environmental induction, illustrating the impact that feral animals may cause to conservation significant fauna species and how they can help reduce the feral animal numbers within the MRUP. This will be supplemented by the inclusion of refreshers into regular tool-box meetings.	<p>Monitoring of whether environmental inductions have taken place will be effected through induction records that will be created each time new personnel are inducted. That monitoring process will include inductees confirming that they have received relevant training in the impacts of feral animals upon conservation significant fauna.</p> <p>Annual audit of induction records.</p>
<b><i>Sandhill Dunnart (Management Target 6: Further confirm the presence of the Sandhill Dunnarts within the MRUP and within the broader regional environment of the YSP).</i></b>	
27. Install camera traps, in accordance with the CTP, and the Sandhill Dunnart Conservation Plan, within the MRUP and regionally within the YSP.	<p>Camera traps will be active continuously once installed and the information recorded will be downloaded with a frequency determined by storage capacity and battery life and likely to be at least every 3 months.</p> <p>Annual audit of camera trapping investigations and comparison with the approved CTP to establish compliance.</p>
28. Monitor the camera traps for at least 60 days to confirm the presence / absence of SHD.	<p>Camera traps will be active continuously once installed and the information recorded will be downloaded with a frequency determined by storage capacity and battery life and likely to be at least every 3 months.</p> <p>Quarterly review of camera trapping results to determine performance and identify if new locations should be established.</p>

Management Action	Monitoring
29. Implement the CTP within the MRUP and regional environment for a period of at least 5 years from approval of this CEMP.	<p>Camera traps will be active continuously once installed and the information recorded will be downloaded with a frequency determined by storage capacity and battery life and likely to be at least every 3 months.</p> <p>Annual review of the camera trapping results to determine performance and confirm that the management target and environmental objective is being met.</p>
30. Positive identifications of SHD will be reported in the Sandhill Dunnart Register.	<p>Each time information is downloaded from cameras (likely to be every 3 months or more frequently), it will be reviewed (as soon as practicable) to determine whether Sandhill Dunnarts were present.</p> <p>Annual audit of Sandhill Dunnart Register.</p>
31. New site personnel will undertake an environmental induction, highlighting the sensitive nature of SHD and how their actions can impact on the presence of SHD in the MRUP. This will be supplemented by the inclusion of refreshers into regular tool-box meetings.	<p>Monitoring of whether environmental inductions have taken place will be effected through induction records that will be created each time new personnel are inducted. That monitoring process will include inductees confirming that they have received relevant training on matter related to the SHD.</p> <p>Annual audit of induction records.</p>

As specified in Condition 7-5, if the above monitoring indicates that one or more management actions specified in this CEMP have not been implemented, then:

- (1) A report will be issued to the CEO of the DWER, in writing, within 7 days of identification of the failure to implement the management action/s;
- (2) An investigation will be undertaken to determine the cause of the management action/s not being implemented;
- (3) The potential environmental harm or alteration that may have occurred due to the failure to implement the management action/s will be determined;
- (4) A written report will be issued to the CEO of the DWER within 21 days of the reporting required by Condition 7-5(1), with the report containing:
  - (a) the cause for the failure to implement the management action/s;
  - (b) the findings of the investigation required by Conditions 7-5(2) and 7-5(3);
  - (c) the relevant changes to the implemented to the management actions; and
  - (d) the measures to be undertaken to prevent, control or abate the environmental harm which may have occurred.



As specified in Condition 7-4, if the above monitoring indicates that one or more management targets specified in this CEMP have not been met, then:

- (1) A report will be issued to the CEO of the DWER, in writing, within 21 days of identification of the management target/s not being met;
- (2) An investigation will be undertaken to determine the cause of the management target/s not being met;
- (3) A written report will be issued to the CEO of the DWER within 90 days of the reporting required by Condition 7-4(1), with the report containing:
  - (a) the cause of the management target/s not being met;
  - (b) the findings of the investigation required by Condition 7-4(2);
  - (c) details of the revised and / or additional management actions to be implemented to ensure that the management target/s are met; and
  - (d) relevant changes to the proposal activities.

## 2.5 Reporting

Reporting of the above monitoring results, and achievement of the management actions and management targets that satisfy the environmental objectives, will occur in the Compliance Assessment Report (CAR) to be submitted annually (in March; starting in 2018) to the CEO of the DWER.

In accordance with Condition 4-6, the CAR shall:

- (1) be endorsed by Vimy's CEO or other person delegated to sign on the CEO's behalf;
- (2) include a statement as to whether Vimy has complied with the conditions;
- (3) identify all potential non-compliances and describe corrective and preventative actions taken;
- (4) be made publicly available in accordance with the approved Compliance Assessment Plan (CAP); and
- (5) indicate any proposed changes to the CAP required by Condition 4-1.

The CAR will also include:

- Monitoring results and trends against management targets;
- Any exceedance of management targets; and
- A review of the management actions and their appropriateness in achieving the management targets and the overall environmental objectives.
- Proposed revision of the management actions, if required, to obtain formal approval from the Department of Water and Environmental Regulation to amend the CEMP.

In addition, in accordance with Condition 10-4, the results of the Sandhill Dunnart Register and the Conservation Significant Fauna Register will be submitted annually to Parks and Wildlife (now the Department of Biodiversity, Conservation and Attractions – DBCA). Condition 2 of EPBC Approval

(2013/7083) also requires that a report addressing compliance to the approved Sandhill Dunnart Conservation Plan be published on the Vimy website, and under section 458 of the EPBC Act all SHD activities, including implementation and compliance to the Sandhill Dunnart Conservation Plan may be audited by the Department of the Environment and Energy (DotEE) or by an appointed independent auditor.

Furthermore, all clearing and disturbance areas, including rehabilitated areas (or impacts to habitat), will be submitted in the annual Mine Rehabilitation Fund (MRF) reporting, and results from specific monitoring programs (e.g. dust monitoring, vegetation monitoring) and details of any environmental discharges (e.g. saline water spills) will be presented in the Annual Environmental Report (AER).

### **3. Adaptive Management and Review of the CEMP**

#### **3.1 Review and revision of management actions**

In the event that a management target is not met or is exceeded, Vimy will review and revise the risk assessment, review and revise management actions and identify additional management actions where necessary.

Risks and key impacts with associated management actions and priorities will be reviewed and revised and, if necessary, implement the following adaptive management procedure:

- Investigate the potential cause of failing to meet the management target and identify any impacts to conservation significant fauna resulting from this failing.
- If the causes of failing to meet the management target or any impacts identified are a result of the MRUP, the risk assessment will be reviewed and revised risk based management actions will be implemented, following formal approval from the DWER, so that the MRUP environmental objective is met.

In accordance with Conditions 7-2(5) and 7-6, the management actions will be reviewed annually (or as directed by the CEO) and revised so that the management targets, and the overall environmental objectives, are met.

Vimy will also implement adaptive management to learn from the implementation of mitigation measures, monitoring and evaluation against management target/s, to more effectively meet the environmental objectives. The following approach will be followed:

- Monitoring data will be systematically evaluated and compared to baseline and reference site data in a process of adaptive management to verify whether responses to the impact are the same or similar to predictions.
- Re-evaluate the risk assessment and revision of risk-based priorities on the basis of monitored information.
- Review management actions when existing actions are shown not to be as effective as predicted
- Update management actions when external changes during the life of the proposal occur (e.g. changes to the sensitivity of the key environmental factor, implementation of other activities in the area, etc.).
- Review of CEMP – changes to CEMP provisions required by a condition, timeframe, etc.

### 3.2 Corrective Actions

If the results of monitoring show that the management targets are not being met then the corrective actions outlined below will be implemented.

Performance Indicator	Corrective Action	Responsibility
Unauthorised clearing or disturbance of vegetation communities.	<ul style="list-style-type: none"> <li>• Immediately stop ground disturbance activity in the immediate vicinity.</li> <li>• Conduct investigation to determine specific cause of the over clearance.</li> <li>• Review GDAP process and develop additional management actions if required.</li> <li>• Implement appropriate control measures to reduce or rectify impact.</li> <li>• Rehabilitate as soon as practicable.</li> <li>• Review and revise management actions so that management targets and environmental objectives are met.</li> </ul>	Mine Manager and Environmental Manager
Evidence that trenching activities are having a direct impact on conservation significant fauna species.	<ul style="list-style-type: none"> <li>• Conduct investigation to determine the contributing factors for the observed direct impacts.</li> <li>• Quantify the direct impacts on conservation significant fauna species.</li> <li>• Implement appropriate control measures to reduce or rectify the impact.</li> <li>• Review and revise management actions so that management targets and environmental objectives are met.</li> </ul>	Mine Manager and Environmental Manager
Evidence that open sources of water are having a direct impact on conservation significant fauna species.	<ul style="list-style-type: none"> <li>• Conduct investigation to determine the contributing factors for the observed direct impacts.</li> <li>• Quantify the direct impacts on conservation significant fauna species.</li> <li>• Implement appropriate control measures to reduce or rectify the impact.</li> <li>• Review and revise management actions so that management targets and environmental objectives are met.</li> </ul>	Mine Manager and Environmental Manager

Performance Indicator	Corrective Action	Responsibility
Evidence that vehicle strikes are having a direct impact on conservation significant fauna species.	<ul style="list-style-type: none"> <li>Conduct investigation to determine the contributing factors for the observed direct impacts.</li> <li>Quantify the direct impacts on conservation significant fauna species.</li> <li>Implement appropriate control measures to reduce or rectify the impact.</li> <li>Review and revise management actions so that management targets and environmental objectives are met.</li> </ul>	Mine Manager and Environmental Manager
Increase in the number of feral animals above baseline levels.	<ul style="list-style-type: none"> <li>Conduct investigation to determine the contributing factors for the increase in feral animal numbers,</li> <li>Quantify impacts to conservation significant fauna species.</li> <li>Implement appropriate control measures to reduce or rectify impact.</li> <li>Review and revise management actions so that management targets and environmental objectives are met.</li> </ul>	Mine Manager and Environmental Manager

#### 4. Stakeholder consultation

Appropriate consultation regarding terrestrial and conservation significant fauna species within the MRUP, and potential impacts that may result from the operation, occurred during the Public Environmental Review (PER; Section 3). Specific consultation with regards to this CEMP with the Department of Biodiversity, Conservation and Attractions (DBCA; formerly the Department of Parks and Wildlife - DPAW) is outlined below.

Whilst a draft copy of this CEMP was provided to DBCA (on the 19 February 2017) for their input and feedback, an email response from DBCA on the 27 July 2017 (Appendix B), indicated that they are unable to review the CEMP due to competing priorities. DBCA recommended that the CEMP is first discussed with DWER (OEPA) rather than meeting with DBCA, and that DWER will engage DBCA directly if required.

Date	Decision Making Authority	Comment	Response
19.02.2016	DPaW	Discussed CEMP via phone with Murray Baker, advised Vimy to email draft CEMP's for review.	No response needed.
27.07.2017	DBCA	Email response from Murray Baker with expedited review comments reviewing the draft Terrestrial Fauna Monitoring and Management Plan.	Revise CEMP as per comments and send to DWER as per comments.

**Table 1: CEMP Provisions (management-based) table.**

Purpose of CEMP	To meet the legal requirements of Condition 10 of Ministerial Statement 1046.			
EPA Factor	Terrestrial Fauna			
EPA Objective	To maintain representation, diversity, viability and ecological function at the species, population and community level.			
MS 1046 Condition 10-1 Environmental Objectives:	(1) Minimise direct and indirect impacts as far as practicable on all conservation significant fauna species.			
	(2) Monitor the presence of the Sandhill Dunnart using methodology established in the Camera Trapping Program.			
Management-based provisions				
Risk / Impact (Risk Ranking)	Management Actions	Management Targets	Monitoring	Reporting
Direct Risks / Impacts				
Clearing / disturbance of habitat. (High)	Development Envelopment – no clearing outside of the approved 9,664ha Development Envelope.	No unauthorised clearing or disturbance of vegetation.	Monitoring of this will be a continuous process with a requirement, each time that any clearing is proposed, for a Ground Disturbance Activity Permit (GDAP) to be issued.  Annual audit of cleared / disturbed areas recorded in the GDAP system against approved Development Envelope boundary.	CAR MRF AER
	Disturbance Footprint – no unauthorised clearing outside of the approved 3,563ha Disturbance Footprint.		Monitoring of this will be a continuous process with each authorised clearing activity subject to a co-ordinate check after clearing has taken place to ensure that what was approved has been complied with.	CAR MRF AER

Risk / Impact (Risk Ranking)	Management Actions	Management Targets	Monitoring	Reporting
			Annual audit of cleared / disturbed areas in the GDAP system against approved Disturbance Footprint area (3,563ha).	
	Ground Disturbance – Implement GDAP system to prevent unauthorised clearing.		<p>The GDAP system when implemented is a continuous process that is related to activities taking place – so rather than having a particular frequency or duration it happens each time activity is proposed and requires authorisation prior to the activity being allowed and follow up measures to ensure that what was approved is complied with including closure and rehabilitation obligations.</p> <p>Annual audit of authorised vs. actual cleared areas and of the requirements of Condition 8-1 (1) &amp; (2).</p>	CAR MRF AER



Risk / Impact (Risk Ranking)	Management Actions	Management Targets	Monitoring	Reporting
	Remnant Vegetation – no unauthorised access to remnant (unburnt) vegetation areas outside of the Development Envelope.		<p>The monitoring is through the GDAP system and therefore is continuous and applies each time clearing activities are proposed.</p> <p>Annual assessment of aerial photography.</p>	CAR
	Environmental Induction – all new site personnel will undertake an environmental induction, emphasising the importance of flora and vegetation, and of conservation significant fauna species in the MRUP. This will be supplemented by the inclusion of refreshers into regular tool-box meetings.		<p>Monitoring of whether environmental inductions have taken place will be effected through induction records that will be created each time new personnel are inducted.</p> <p>Annual audit of induction records.</p>	CAR
	Environmental Training – all personnel involved in clearing of vegetation will undertake training on GDAP process, which includes sign off by operators that they understand work involved. This will be supplemented by the inclusion of refreshers into regular tool-box meetings.		<p>Monitoring of whether personnel involved in clearing vegetation have been trained on GDAP processes will be effected through the signing of training records testifying that the training has been completed and been understood.</p> <p>Annual audit of training records</p>	CAR

Risk / Impact (Risk Ranking)	Management Actions	Management Targets	Monitoring	Reporting
Trenching activities	Authorisation – all trenching activities must be authorised and recorded in the GDAP system.	Minimise impact to conservation significant fauna species from trenching activities.	Monitoring of this will be a continuous process with a requirement, each time that any trenching activity is proposed, for a Ground Disturbance Activity Permit (GDAP) to be issued.  Annual audit of authorised vs. actual trenching activities recorded in the GDAP system.	CAR
	Egress – all trenches or sumps >1.2m depth, remaining open for ≥24 hours, must have accessible points of egress for fauna species.		Monitoring of this will be a continuous process with every authorised trench or sump subject to a specification check after development to ensure that what was approved has been complied with. Annual audit of Compliance Records stored in the GDAP system.	CAR
	Monitoring – all trenches or sumps >1.2m depth, remaining open for ≥24 hours, must be checked on a daily basis for egress and fauna by a suitably trained person.		Trenches or sumps that require checking will be monitored on a daily basis whilst the risk exposure exists. Daily inspections will happen first thing in the morning.  Annual audit of Compliance Records stored in the GDAP system.	CAR

Risk / Impact (Risk Ranking)	Management Actions	Management Targets	Monitoring	Reporting
	Backfilling – all trenches will be backfilled as soon as practicable after completion of work.		Monitoring of this will be through the GDAP system and therefore is a continuous process. The Permit application will specify the expected duration and hence the time until appropriate rehabilitation (i.e. backfilling) is required. If the work has not been completed in the time allocated – an extension will be required. If the work has been completed, then the system will require details and/or evidence on the rehabilitation undertaken.  Annual audit of Compliance Records stored in the GDAP system.	CAR
	Reporting – all impacts on conservation significant fauna species from trenching activities, including sumps, will be recorded in an on-site register.		This requirement only materialises in the event of an impact upon conservation significant fauna.  Any such impact would be notified to the registrar of the on-site register.  Annual audit of Conservation Significant Fauna Impact Register.	CAR DBCA

Risk / Impact (Risk Ranking)	Management Actions	Management Targets	Monitoring	Reporting
	Environmental Training – all personnel involved in trenching activities will undertake training to help identify conservation significant fauna species and highlight how this activity could impact on fauna species and what should be done to minimise potential impacts. This will be supplemented by the inclusion of refreshers into regular tool-box meetings.		Monitoring of whether personnel involved in trenching activities have been trained in the identification of conservation significant fauna and in avoiding potential impacts, will be effected through the signing of training records testifying that the training has been completed and been understood.  Annual audit of training records.	CAR
Open sources of water	Fencing – all open sources of water, that are accessible to terrestrial fauna, must be fenced to withstand camels and other large herbivores.	Minimise impact to conservation significant fauna species from open sources of water.	The creation of an open source of water will involve activities that require pre-authorisation through the GDAP system. The GDAP system will require that the authorisation required to create an open source of water includes suitable fencing to prevent fauna entry into the area. As such the monitoring is continuous and triggered prior to such activity.  Annual audit of Compliance Records stored in the GDAP system.	CAR

Risk / Impact (Risk Ranking)	Management Actions	Management Targets	Monitoring	Reporting
	Egress – all open sources of water, that are accessible to terrestrial fauna, must have egress points suitable for small mammals and reptiles.		<p>The creation of an open source of water will involve activities that require pre-authorisation through the GDAP system. The GDAP system will require that the authorisation required to create an open source of water includes egress point(s) associated with the water located to enable fauna egress. As such the monitoring is continuous and triggered prior to such activity.</p> <p>Annual audit of Compliance Records stored in the GDAP system.</p>	CAR
	Monitoring – all open sources of water, that are accessible to terrestrial fauna, must be regularly checked for fauna species.		<p>Monitoring of open sources of water (all of which will have been fenced) will be undertaken on a regular basis with the frequency determined by a balance between ease of inspection and risk to fauna.</p> <p>Most open sources of water (fenced) will be in close proximity to everyday work activities and will be subject to daily inspections despite the absence of risk.</p> <p>Where open water sources (fenced) are remote from daily</p>	CAR

Risk / Impact (Risk Ranking)	Management Actions	Management Targets	Monitoring	Reporting
			<p>activities, inspection frequency will be aligned with risk. Initial inspections will be weekly, and frequency will subsequently be increased or decreased depending on observations concerning the effectiveness and durability of the fencing.</p> <p>Annual audit of Compliance Records stored in the GDAP system.</p>	
	Reporting – all impacts on conservation significant fauna species from open sources of water will be recorded in an on-site register.		<p>This requirement only materialises in the event of an impact upon conservation significant fauna.</p> <p>Any such impact would be notified to the registrar of the on-site register.</p> <p>Annual audit of Conservation Significant Fauna Impact Register.</p>	CAR DBCA



Risk / Impact (Risk Ranking)	Management Actions	Management Targets	Monitoring	Reporting
Vehicle strikes	<p>Speed limits – Speed limits will be set to as low as practicable consistent with minimising vehicle strikes.</p> <p>Speed limits will be initially set as follows:</p> <ul style="list-style-type: none"> <li>- Site Access Road – 80km/hr;</li> <li>- Plant, Village and Aerodrome Access Roads – 60km/hr; and</li> <li>- Haul Roads/Site Tracks – 40 km/hr.</li> </ul>	Minimise vehicle strikes to conservation significant fauna species.	<p>All vehicle strikes will be recorded in an on-site register. This register will be monitored as vehicle strikes are recorded to determine whether the speed limits have been set at an appropriate level consistent with minimising vehicle strikes to the lowest extent practicable.</p> <p>Annual audit of Conservation Significant Fauna Impact Register.</p>	CAR DBCA
	<p>Restricted driving – Limit driving and the number of vehicles on the roads at dawn and dusk, where practicable.</p>		<p>All vehicle strikes will be recorded in an on-site register. This register will be monitored as vehicle strikes are recorded to determine whether driving is occurring during higher risk periods (dawn and dusk) and whether this is resulting in increased vehicle strikes that could be avoided by shifting the time periods when vehicle movements are scheduled.</p> <p>Annual audit of shift and transport rosters.</p>	CAR

Risk / Impact (Risk Ranking)	Management Actions	Management Targets	Monitoring	Reporting
	Reporting – all vehicle strikes with conservation significant fauna species will be recorded in an on-site register.		<p>All vehicle strikes will be recorded in an on-site register as soon as is practicable after the strikes have occurred. This is a continuous process that happens each time a strike occurs.</p> <p>Annual audit of Conservation Significant Fauna Impact Register.</p>	CAR DBCA
	Injured animals – animals struck by vehicles will be removed from roads and treated accordingly, with the pouches of female marsupials checked for live young.		<p>All vehicle strikes will be recorded in an on-site register. The information recorded will include details of actions taken. This is a continuous process that happens each time a strike occurs.</p> <p>Annual audit of Conservation Significant Fauna Impact Register.</p>	CAR DBCA

Risk / Impact (Risk Ranking)	Management Actions	Management Targets	Monitoring	Reporting
	Environmental Induction – all new site personnel will undertake an environmental induction to help identify conservation significant fauna species in the MRUP. This will be supplemented by the inclusion of refreshers into regular tool-box meetings		Monitoring of whether environmental inductions have taken place will be effected through induction records that will be created each time new personnel are inducted. That monitoring process will include inductees confirming that they have received relevant training in the identification of conservation significant fauna.  Annual audit of induction records.	CAR
<i>Indirect Risks / Impacts</i>				
Feral animals	Food sources – all food sources, including bins and landfill, will be appropriately contained and / or fenced to withstand camels and other large herbivores to prevent feral animals accessing and being attracted to them.	No increase in feral animal numbers above baseline levels in the MRUP Development Envelope.	Containment of food sources will be regularly monitored and maintained to ensure they are fit-for-purpose and functioning appropriately.  The frequency of monitoring will be determined by a balance between ease of inspection and risk to fauna.  Most food sources (such as bins) will be in close proximity to everyday work activities and will be subject to daily inspections despite the absence of risk.	CAR

Risk / Impact (Risk Ranking)	Management Actions	Management Targets	Monitoring	Reporting
			<p>Where potential food sources (fenced) are remote from daily activities (such as landfill), inspection frequency will be aligned with risk. Initial inspections will be weekly, and frequency will subsequently be increased or decreased depending on observations concerning the effectiveness and durability of the fencing.</p> <p>All potential food sources, in addition to being checked to ensure that protection measures to prevent access by feral animals are in place and effective, will also be monitored continuously by cameras with the captured images downloaded and analysed on a quarterly basis.</p>	
	Water sources – all open sources of water, that are accessible to terrestrial fauna, must be fenced to withstand camels and other large herbivores to prevent feral animals accessing and being attracted to them.		<p>Fencing of open water sources, accessible to terrestrial fauna, will be regularly monitored and maintained to ensure they are fit-for-purpose and functioning appropriately.</p> <p>The frequency of monitoring will be determined by a balance between ease of inspection and risk to fauna.</p>	CAR

Risk / Impact (Risk Ranking)	Management Actions	Management Targets	Monitoring	Reporting
			All potential water sources, in addition to being checked to ensure that protection measures to prevent access by feral animals are in place and effective, will also be monitored continuously by cameras with the captured images downloaded and analysed on a quarterly basis.	
	Reporting – sightings of feral animals within the MRUP, excluding the transport route, will be recorded in an on-site register to help monitor their numbers.		The recording of any sighting of feral animals is a continuous process with site personnel required to report such sightings as soon as is reasonably practicable and expected to be on the same day as any sighting.  Annual audit of on-site Feral Animal Register.	CAR
	Control – if required, feral animal numbers will be controlled by DBCA approved baiting, trapping or muster techniques.		Feral animal monitoring will take place via reported sightings, and regular monitoring (including camera monitoring) of sites expected to attract feral animals (such as food sources and water sources).  Annual audit of on-site Feral Animal Register.	CAR

Risk / Impact (Risk Ranking)	Management Actions	Management Targets	Monitoring	Reporting
	Environmental Induction - new site personnel will undertake an environmental induction, illustrating the impact that feral animals may cause to conservation significant fauna species and how they can help reduce the feral animal numbers within the MRUP. This will be supplemented by the inclusion of refreshers into regular tool-box meetings.		Monitoring of whether environmental inductions have taken place will be effected through induction records that will be created each time new personnel are inducted. That monitoring process will include inductees confirming that they have received relevant training in the impacts of feral animals upon conservation significant fauna.  Annual audit of induction records.	CAR
Sandhill Dunnart	Implementation – install camera traps, in accordance with the CTP, and the Sandhill Dunnart Conservation Plan, within the MRUP and regionally within the YSP.	Further confirm the presence of the Sandhill Dunnarts within the MRUP and within the broader regional environment of the YSP.	Camera traps will be active continuously once installed and the information recorded will be downloaded with a frequency determined by storage capacity and battery life and likely to be at least every 3 months.  Annual audit of camera trapping investigations and comparison with the approved CTP to establish compliance.	CAR

Risk / Impact (Risk Ranking)	Management Actions	Management Targets	Monitoring	Reporting
	Monitoring – monitor the camera traps for at least 60 days to confirm the presence / absence of SHD Duration – implement the CTP within the MRUP and regional environment for a period of at least 5 years from approval of this CEMP.		<p>Camera traps will be active continuously once installed and the information recorded will be downloaded with a frequency determined by storage capacity and battery life and likely to be at least every 3 months.</p> <p>Quarterly review of camera trapping results to determine performance and identify if new locations should be established.</p>	CAR
	Duration – implement the CTP within the MRUP and regional environment for a period of at least 5 years from approval of this CEMP.		<p>Camera traps will be active continuously once installed and the information recorded will be downloaded with a frequency determined by storage capacity and battery life and likely to be at least every 3 months.</p> <p>Annual review of the camera trapping results to determine performance and confirm that the management target and environmental objective is being met.</p>	CAR DBCA



Risk / Impact (Risk Ranking)	Management Actions	Management Targets	Monitoring	Reporting
	Reporting – positive identifications of SHD will be reported in the Sandhill Dunnart Register.		Each time information is downloaded from cameras (likely to be every 3 months or more frequently), it will be reviewed (as soon as practicable) to determine whether Sandhill Dunnarts were present.  Annual audit of Sandhill Dunnart Register.	CAR
	Environmental Induction – new site personnel will undertake an environmental induction, highlighting the sensitive nature of SHD and how their actions can impact on the presence of SHD in the MRUP. This will be supplemented by the inclusion of refreshers into regular tool-box meetings.		Monitoring of whether environmental inductions have taken place will be effected through induction records that will be created each time new personnel are inducted. That monitoring process will include inductees confirming that they have received relevant training on matter related to the SHD.  Annual audit of induction records.	CAR

NOTE: The management-based provisions for the indirect risks / impacts, dust, weeds, fire and saline water, are covered in the Flora and Vegetation Monitoring and Management Plan, as required by Condition 9-2. The management-based provisions specified in both CEMPs will therefore be implemented together to achieve the environmental objectives of Condition 10-1.

## 5. References

The following references were used in developing this CEMP.

Bennelongia (2015). *Short-range Endemic Fauna at the Mulga Rock Uranium Project*, unpublished report by Bennelongia Pty Ltd for Vimy Resources, February 2015.

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Vimy (2015a). *Camera Trapping Protocol - Sandhill Dunnart (Sminthopsis psammophila) - Mulga Rock Project Area*, unpublished report prepared by Jan Henry, Xavier Moreau and Morris Wu for Vimy Resources, June 2015.

Vimy (2015b). A targeted survey for Sandhill Dunnart (*Sminthopsis psammophila*) utilising camera traps, with detailed discussion on camera trapping protocol. Vimy Resources Limited.

Vimy (2015c). *Fauna Assessment for the Malleefowl (Leipoa ocellata) – Mulga Rock Project Area*, unpublished report prepared by Woolard Consulting Pty Ltd for Vimy Resources, May 2015.



## **6. Appendices**

### **Appendix A: Camera Trapping Protocol**



# Camera Trapping Protocol

Sandhill Dunnart  
(*Sminthopsis psammophila*)

**Mulga Rock Uranium Project Area**

October 2015

## Authorship and Review

Name	Role	Version	Date
Colin Woolard	Lead Author	1.3	9/02/2015
Xavier Moreau	Project Manager/Reviewer	1.3	10/02/15
Jan Henry	Fauna Technical Advisor	1.3	11/02/2015
Morris Wu	Author / Scientific Officer	1.3	13/02/2015
Gerry Bradley	Reviewer – Protocol	1.3	13/02/2015
Paul Meek	Peer Reviewer – Protocol	1.3	17/02/2015
Sue Churchill	Peer Reviewer – Protocol	1.3	17/02/2015
Xavier Moreau	Authorised for distribution	1.4	09/06/2015
Gay Bradley	Update with new mining parameters and survey results	2.1	08/10/2015

## Notes and Acknowledgements

This Camera Trapping Protocol has been prepared using information provided from a range of published sources, in some cases unpublished research results and material from documents submitted for EIA-assessed projects in the Great Victoria Desert in both Western Australia and South Australia. These are acknowledged in the text and referenced in Section 6.0.

## Suggested Document Citation

Vimy Resources Limited (2015), Camera Trapping Protocol - Sandhill Dunnart (*Sminthopsis psammophila*) – Mulga Rock Uranium Project (2015)

Cover photo: Sandhill Dunnart (*Sminthopsis psammophila*). - Photo Credit Amanda McLean

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## 1.0 Introduction

### 1.1 Context and Background to the Project

Vimy Resources Limited (Vimy), formerly known as Energy and Minerals Australia Limited (EMA or EAMA), is proposing to develop the remote Mulga Rock Uranium Project (MRUP) which is located 240km east-northeast of Kalgoorlie in dune fields on the western flank of the Great Victoria Desert (GVD).

Planned development will involve the shallow open pit mining of four polymetallic deposits with commercial grades of uranium hosted in carbonaceous material. Proposed disturbance of vegetated dune field and sand sheet for Project development is estimated at 3787ha for the Life of Mine (LOM) within a Development Envelope of under 10,000ha which will include habitats in which the Sandhill Dunnart (*Sminthopsis psammophila*) (SHD), a State and Federally recognised conservation significant species, has previously been recorded. The location of the Project, regional infrastructure and the proposed Development Envelope is shown on Figure 1.

The Project is a “controlled action” for the purpose of the *EPBC Act 1999*, and the potential impact to threatened species such as the Sandhill Dunnart (*Sminthopsis psammophila*) is one of the controlling provisions. The Project will be assessed by the Western Australian Environmental Protection Authority (EPA) and, in accordance with a new bilateral agreement, by the Federal Minister for the Environment under the *Environmental Protection and Biodiversity Conservation Act 1999*.

Following several conventional onsite surveys for the Sandhill Dunnart at Mulga Rock spanning 30 years, and 12 months trialling of camera trapping techniques, Vimy has commenced a ten month continuous presence/absence inventory for SHDs across a range of modified habitats using eight Bushnell Trophy Cam High Definition (HD) and thirty Reconyx 550 Hyperfire cameras. The programme will be conducted in a range of habitats considered suboptimal for Sandhill Dunnarts following the substantial wildfire which burnt through the Project area in November 2014, potentially removing suitable Sandhill Dunnart habitat for at least 10 to 15 years.

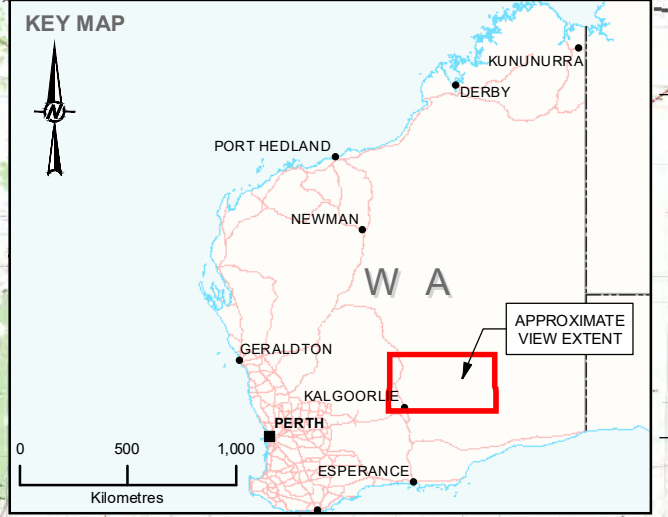
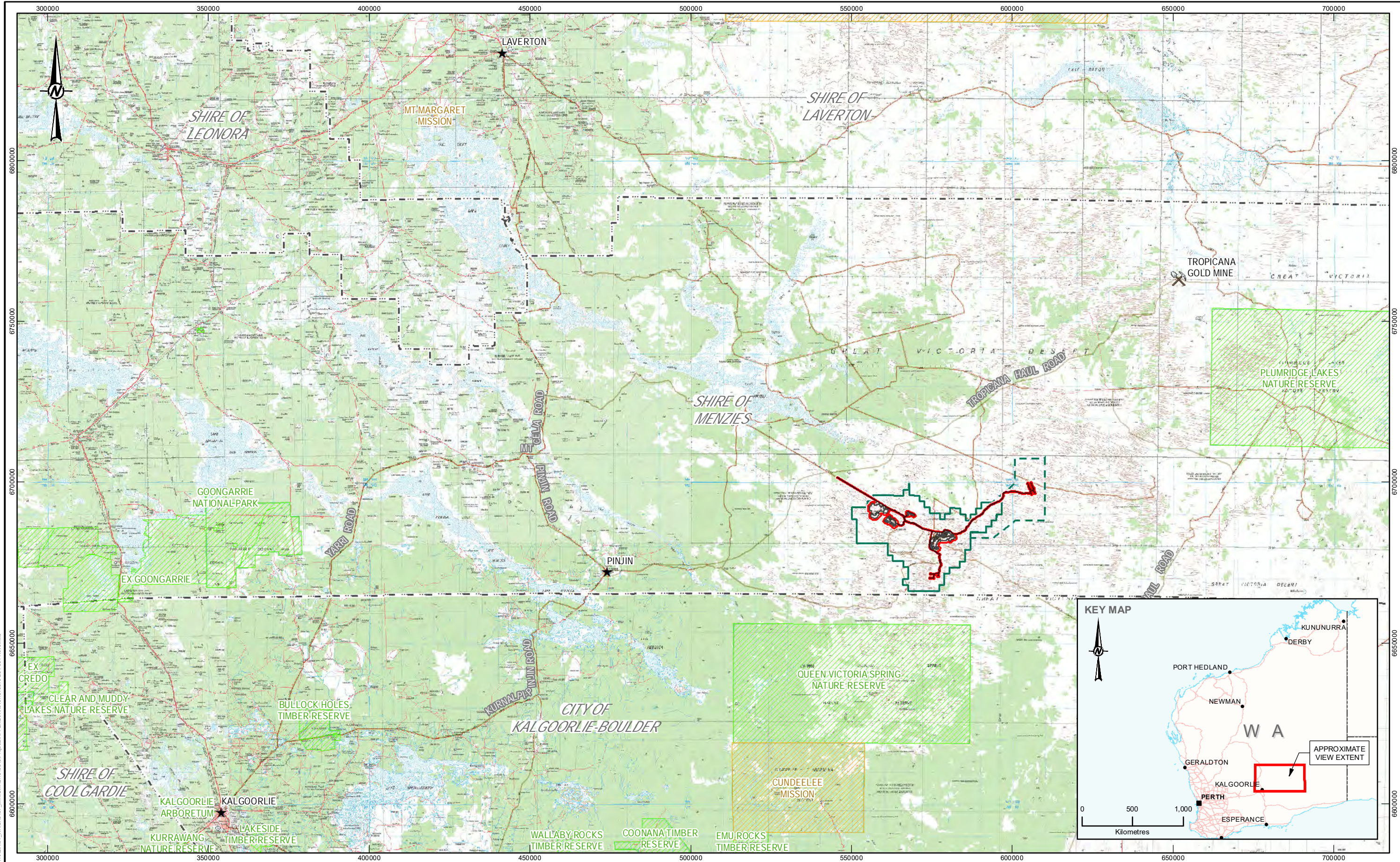
#### 1.1.1 Previous Work in the Great Victoria Desert

The Sandhill Dunnart, a small nocturnal insectivorous marsupial, was first discovered in Western Australia at the Mulga Rock site in 1985 during EIS Baseline Studies for the Pacific Nuclear Corporation (PNC) of Japan (Martinick 1986 and Hart and Kitchener 1986).

Prior to its West Australian discovery, it was recorded in the mid-1960s from sites on the Eyre Peninsula in South Australia, and from a historic 1894 record from the Lake Amadeus region in the Northern Territory. It has since been recorded in several conservation reserves in South Australia in the upper Eyre Peninsula and in the Yellabinnia Ooldea region of the southern Great Victoria Desert (Woinarski *et al.* 2014).

Since the initial PNC discovery at Mulga Rock, several ecologists have undertaken studies on the Western Australian populations of SHD including Pearson and Robinson (1990), Churchill (2001a, 2001b and 2009), Gaikhorst and Lambert (2008 and 2010), Gaikhorst and Churchill (2009), Ninnox (2010) and Turpin (2014). A significant factor guiding research for the conservation of the SHD, and reported from both Western and South Australia, is that long term occupancy is not assured at sites where animals have been previously detected (Woinarski *et al.* 2014), and that the exact distribution and abundance of the taxa is uncertain, although extensive areas of potentially suitable hummock grasslands on sand terrain habitats occur in the southern GVD (Churchill 2009). Previous survey and capture locations in Western Australia are shown on Figure 2 (Gaikhorst and Lambert 2014).





**LEGEND**

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

**NOTES**

1. COORDINATE SYSTEM: GDA 1994 MGA ZONE 51

**REFERENCE**

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

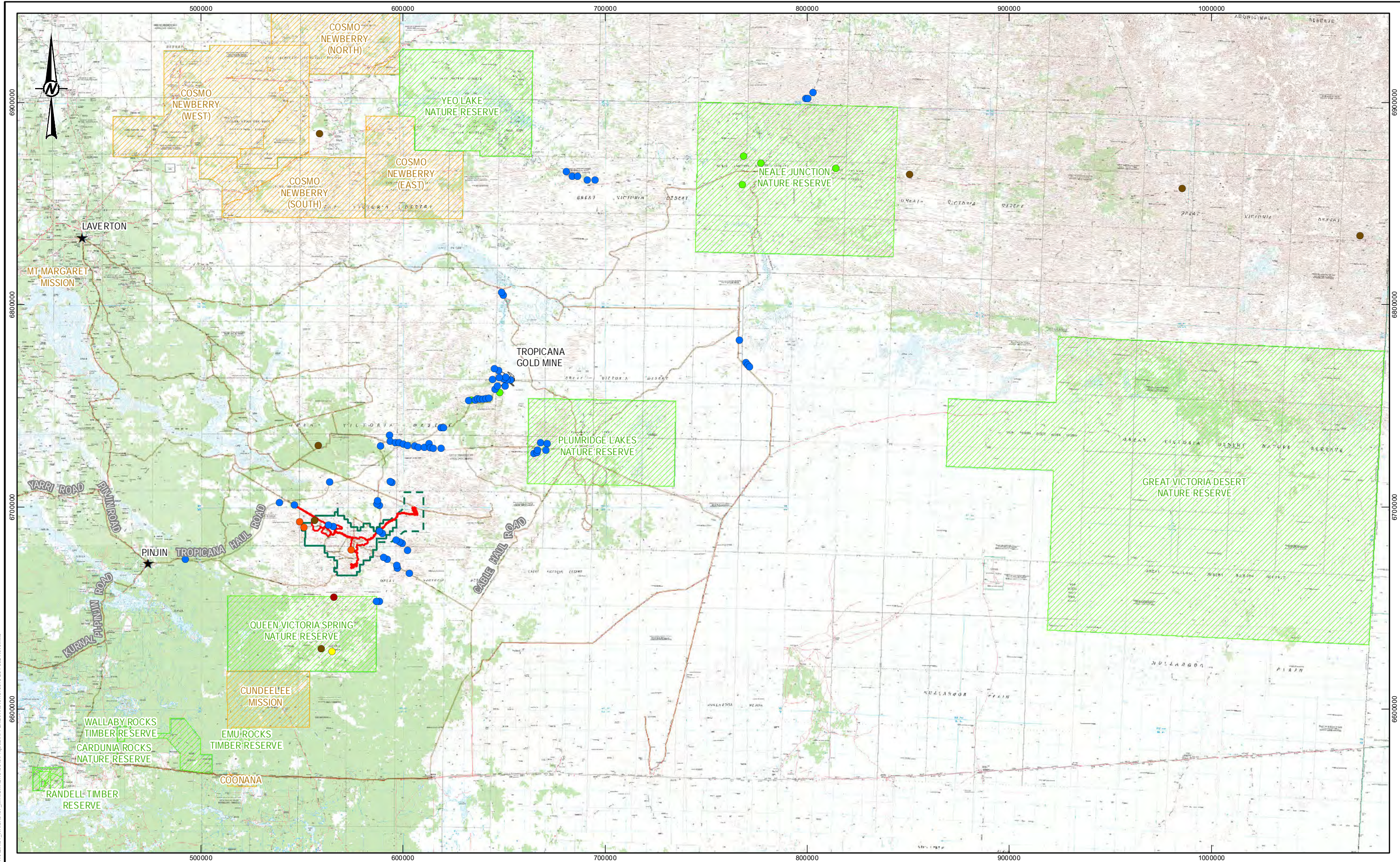
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1:1,100,000 KILOMETRES

CLIENT	VIMY RESOURCES LIMITED		
CONSULTANT			
YYYY-MM-DD	2015-10-27		
DESIGNED	MS		
PREPARED	MS		
REVIEWED	GB		
APPROVED	GB		
PROJECT MULGA ROCK URANIUM PROJECT			
TITLE REGIONAL LOCATION			
PROJECT NO. 1540340	CONTROL B3	REV. 0	FIGURE 1

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TROPICANA GOLD MINE

TOWN

ROAD

SAND HILL DUNNART TRAP SITES

BUTLER

CHURCHILL

ECOLOGIA

GAIKHORST & LAMBERT

MARTINICK & HART & KITCHENER

PEARSON & ROBINSON

MRUP DEVELOPMENT ENVELOPE

PROJECT BOUNDARY (MINING TENURE)

PROJECT BOUNDARY (MISCELLANEOUS TENURE)

CONSERVATION RESERVE

ABORIGINAL LAND TRUST ESTATE

NOTES

1. COORDINATE SYSTEM: GDA 1994 MGA ZONE 51

REFERENCE

INFRASTRUCTURE DATA PROVIDED BY CLIENT  
BASE DATA © WESTERN AUSTRALIAN LAND INFORMATION  
AUTHORITY TRADING AS LANDGATE (2015)  
IMAGE SOURCED FROM GEOSCIENCE AUSTRALIA 250K TOPO  
SHD TRAP SITES DIGITISED FROM FIGURE 1, GHD, 06 APR 2014

0

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KILOMETRES

CLIENT

VIMY RESOURCES LIMITED

CONSULTANT

YYYY-MM-DD

2015-10-27

DESIGNED

MS

PREPARED

MS

REVIEWED

GB

APPROVED

GB

PROJECT

MULGA ROCK URANIUM PROJECT

TITLE

LOCATION OF PREVIOUS SANDHILL DUNNART TRAP AND CAPTURE SITES IN THE GREAT VICTORIA DESERT (SOURCE: GAIKHORST AND LAMBERT 2014)

PROJECT NO.

1540340

CONTROL

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FIGURE

2

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Primary threats to the Sandhill Dunnart in WA are listed as loss of spinifex habitat through clearing, extensive and frequent wildfires and predation from introduced predators such as feral cats. Both of the latter threats are currently realised in the Great Victoria Desert, although no published data on predation is available.

A Recovery Plan for the Sandhill Dunnart was published in 2001 (Churchill 2001a) and revised in 2011 (van Weenen *et al.* 2011). Gaikhorst and Lambert (2008) reported on several survey trips within 100km of the MRUP area undertaken over the period from 2000 to 2008 which returned very low numbers of specimens for the survey effort. An estimate (some capture data has not been published) of the total survey effort in the GVD 1 Shield subregion is in excess of 48,000 trap nights for 44 captures, including 14,964 trap nights for seven captures in the MRUP area. Trapping has been largely by Elliott and deep pitfall traps with the pitfall vs Elliott capture rate success ratio as approximately 3 to 1. Trapping details are summarised in Table 1.

## 1.2 Rationale for Use of Camera Traps

Camera trapping is becoming a more common and accepted method of fauna surveying (DSEWPaC 2011), particularly as cameras allow for the detection of species that are difficult to study due to their elusive and commonly nocturnal habits, or low density in the landscape (Meek 2012). This type of surveying is considered less costly and less invasive than long term capture and release of target species and has the advantage of being able to be utilised for longer continuous periods in remote or difficult to reach locations such as the Great Victoria Desert. Survey inventory time is an important constraint and Cowan and How (2004) conclude that conventional short-term studies infrequently encounter threatened and/or rare ground-dwelling vertebrate fauna species and therefore do not always provide adequate information to assist land managers. By comparison Mulga Rock has been surveyed by several highly experienced ecologists in five programmes over thirty years with consistently low detection rates approaching 0.05 captures per 1,000 trap nights.

Camera trapping over long time spans can potentially address this issue and allow for the collection of data on co-existing and feral species within the target community over a longer time frame and potentially identify 'hot spots' for further conventional trapping programmes. Under some circumstances, camera trapping methods can provide data that is more permanent and less disputable than data gathered by direct observation and less invasive than physical capture (DSEWPaC 2011).

However there is some debate in the scientific community that camera trapping, if not used in accordance with tested protocols, can affect animal behaviour, and that photo-capturing of target animals can be biased by the use of lures or attractants, although these techniques are also commonly used in conventional trapping programmes. Camera use for the monitoring of large animals is well established, however the difficulties of capturing images of sufficient quality that allow for positive identification of the small mouse-sized target species, when sympatric species are present (DSEWPaC 2011; Meek *et al.* 2013) is a matter that has been addressed in this Protocol through the utilisation of 'fit for purpose' cameras, robust data collection processes and the establishment of a peer review group of ecologists, experienced with *Sminthopsis* in the region, who will confirm SHD presence on images for reporting.

These issues have also been addressed in several recent studies. DSEWPaC (2011), Meek (2010) and Meek *et al.* (2014) have released guidelines on ways of increasing the success rate of detection with cameras and many of these have been adopted in this Protocol.

Following the application of conventional trapping techniques by researchers on four separate occasions (1985, 1999, 2008 and 2009) in the MRUP area, with very limited trap success for the effort expended, Vimy proposed to trial targeted camera trapping methods to attempt to confirm the presence or absence of the Sandhill Dunnart for impact assessment purposes. The success of this technique has recently been demonstrated in 2014 for a gas pipeline corridor survey to the north of Mulga Rock, where two of the four Sandhill Dunnart 'captures' were as a result of camera trapping (Turpin 2014).

**Table 1 Summary of survey work in Sandhill Dunnart habitats in GVD 1 Shield subregion in WA**

Year	Location	Trap Efficiency			Reference
		Elliott	Pitfall	SHD	
1975	Queen Victoria Spring Nature Reserve	No Record	No Record	0	Burbidge, McKenzie, Chapman and Lambert (1976)
1985	Mulga Rock – Shogun, Emperor and Ambassador	1,520	1520 (Est)	5	W.G. Martinick & Assoc. Pty Ltd (1986) Hart and Kitchener (1986)
1987-1989	Northern boundary of Queen Victoria Spring Nature Reserve	2,700	7,400	6	Pearson & Robinson (1990)
1990-1998	North of Queen Victoria Spring Nature Reserve	No Record	No Record	12	D. Pearson pers. comm. in Churchill (2001b) and van Weenen, Ward & Churchill (2011)
1999	Queen Victoria Spring Nature Reserve	390	0	0	Churchill (2009)
1999	Mulga Rock - Shogun - Emperor	714	204	0	Churchill (2009)
2000	25km NNE of Queen Victoria Spring	No Record	No Record	1	D. Pearson pers. comm. in Churchill (2001b) and van Weenen, Ward & Churchill (2011)
2000-2008	Pinjin, West MR, East MR - Rason Rd, Plumridge Nature Reserve	9957 (MR 480)	5427 (MR 680)	17 (MR 2)	Gaikhurst & Lambert (2000 to 2008)
2007	Tropicana Gold Mine Operations Area – Pinjin Infrastructure Targetted Survey #2	640	320	0	<i>ecologia</i> (2009)
2008	Tropicana Gold Mine Operations Area – Pinjin Infrastructure Targetted Survey #1	560 540	440 499	0	Gaikhurst & Lambert (2008)
2009	Tropicana Gold Mine Operations Area - Pinjin Infrastructure Targetted Survey #2	2,600	910	0	GHD (2010a)
2009	Mulga Rock Project Area Targetted Survey #1	1,336	710	0	Ninox Wildlife Consulting (2010)
2010	Tropicana Group 2/3 Exploration Area – East of Mulga Rock SHD Habitat Assessment	Field Survey	Field Survey	-	GHD (2010b)
2014	Sunrise Dam -Tropicana Gas Pipeline Corridor	1,680	693	4	Turpin (2014) and Kingfisher Environmental Consulting (2014)
2012-2014	Mulga Rock - Pilot Camera Trapping (CT)	> 4,300 (9 cameras)		0	Vimy Resources Limited Unpublished Data
2014-2015	Mulga Rock - Targetted Camera Trapping (CT)	> 2,500 (30 cameras)		0	Vimy Resources Limited Unpublished Data

### 1.3 Work Programmes Completed at Mulga Rock

Following consultation with Department of Environment and Conservation ecologists, Ninox Wildlife Consulting (Ninox) undertook a Level 2 targeted survey for SHDs in 2009 in the MRUP area as part of baseline studies for impact assessment. This programme included modifications to trap methodology and layout and increased deployment of Elliott traps and deep pitfalls to compensate for the reported athletic attributes of SHD's.

In addition, trapping grids were increased to ten sites over 15km and the range of habitats, based on substrate, spinifex cover and burn history, was increased to nine communities of which four were Prime Habitats using the regional vegetation criteria comparison developed by Mattiske (Table A-1 in Appendix A) as defined by Churchill (2009) and discussed in Gaikhorst (2009a). Camera traps were utilised for the first time in the Ninox survey (Ninox 2010), although no SHDs were detected.


Habitat assessments included focused field and dunal (sand pad) inspection, in conjunction with recently completed detailed vegetation mapping (Mattiske 2009), a review of regional fire data (Mattiske 2009) and a preliminary comparison of the structure of vegetation communities described by Churchill (2009) as prime habitat types in Western Australia.

In addition, part of the Ninox programme included re-trapping three old sites where habitat conditions were met, and where Sandhill Dunnarts were captured in 1985 and surveyed for without success in 1999. Two specimens were captured in the same area (Shogun and Emperor) in 2008 (Gaikhorst and Lambert 2008). No Sandhill Dunnarts were captured during the October 2009 targeted survey although reasonable trapping success was obtained with a range of small marsupials, including three other *Sminthopsis* species, recorded.

Following discussions with a Ninox, a GVD-based sand mining company and university researchers in South Australia in 2011/12, Vimy initiated a Pilot Camera Trapping Programme in 2013 to determine if passive infrared cameras, set up in selected former 1985, 2009 and new "wild card" survey site environments could provide the necessary detail on presence or absence of small marsupials. The results were encouraging; showing that with the appropriate habitat assessment and correct camera layout, small marsupials (and a host of other mammals, feral predators, birds and reptiles) could be camera trapped. However, species identification for some taxa to a standard required for impact assessment was lacking in the original methodology.







Advice was sought from the Department of Parks and Wildlife (DPaW) and Paul Meek (NSW DPI), and the programme was modified and expanded to a targeted survey commenced in late 2014. This programme was halted in mid-November 2014 when a wildfire burnt out over 85% of the Project Development Envelope and much of the surrounding area, including all the previous camera trap sites (see Plate 2). Camera trapping has recommenced in some of the burnt areas and small mammals have been recorded. The pre- and post-fire results have demonstrated (see Table 2 and Table 3) that, with the application of appropriate trap setup methodology, small mammals could be camera trapped and identified with the required level of certainty.

**Table 2** Examples of small mammal images camera trapped in the 2014 MRUP trapping programme

	
<p><b>2(a): Station M5 - Pre-burn Mulgara (<i>Dasycercus</i> sp.)</b></p>	<p><b>2(b): Station M2/3 - Pre-burn Dunnart (<i>Sminthopsis</i> sp.)</b></p>
	
<p><b>2(c): Station MR-9 - Pre-burn Dunnart (<i>Sminthopsis</i> sp.)</b></p>	<p><b>2(d): Station MR-1 - Post-burn Mulgara (<i>Dasycercus</i> sp.)</b></p>
	
<p><b>2(e): Station MR-2 - Post-burn Hopping Mouse (<i>Notomys</i> sp.)</b></p>	<p><b>2(f): Station MR15 - Post-burn Dunnart (<i>Sminthopsis</i> sp.)</b></p>



**Table 3** Natural and introduced predators and competitors

 <p>2014-12-11 2:46:49 PM M 1/5 37°C MR6</p>	 <p>2014-12-28 10:55:22 AM M 2/5 46°C MR6</p>
<p><b>3(a): Station MR-6 - <i>Varanus gouldii</i> (Gould's Monitor)</b></p>	<p><b>3(b): Station MR-6 - <i>Varanus tristis tristis</i> (Black Headed Monitor)</b></p>
 <p>2015-01-27 8:32:29 PM M 4/5 28°C MR14</p>	 <p>2015-01-27 8:34:00 PM M 2/5 26°C MR14</p>
<p><b>3(c): Station MR-14 - <i>Felis catus</i> (Feral Cat)</b></p>	<p><b>3(d): Station MR-6 – <i>Felis Catus</i> (Feral Cat)</b></p>
 <p>2015-01-13 4:01:08 AM M 2/3 23°C MR11</p>	 <p>2015-01-17 5:01:52 AM M 3/5 17°C MR14</p>
<p><b>3(e): Station MR-11 – <i>Canus lupis dingo</i> (Dingo)</b></p>	<p><b>3(f): Station MR-6 – <i>Oryctolagus cuniculus</i> (Rabbit)</b></p>

## 1.4 Purpose of Protocol and Scope of Works

Sandhill Dunnarts were captured at four locations within the MRUP Project area in 1985 when the Project was being explored by the Pacific Nuclear Corporation (Hart and Kitchener 1986). In spite of subsequent surveys in 1991 when no specimens were captured (Churchill 2009), two specimens were captured in 2008 near previous capture sites (Gaikhorst and Lambert 2008). No SHD were captured in the Ninox Level 2 Survey (Ninox 2010), although a range of other small marsupials were recorded. This Ninox survey trapped in a range of habitats, including sites where SHDs had been previously recorded (Ninox 2010).

Regional surveys, undertaken in different seasons in dunefields surrounding the MRUP area, concentrating in long unburnt areas and conservation reserves where optimal habitat was available (Pearson and Robinson 1990, Churchill 2009, Gaikhorst and Lambert 2000-2008 and ecologia 2008), resulted in the capture of 40 individual SHDs in 48,560 trap nights spread over nine years. A further 7,800 camera trap nights have been recorded during the MRUP pilot and targeted surveys in 2013/14 (Vimy 2014). The overall survey effort in Western Australia of one capture per 1,103 trap nights suggests the target species are difficult to trap, are low in abundance and exhibit patchy distribution or seasonal fluctuations in response to wildfires or other influences. Camera trapping was seen as another monitoring tool that would complement previously implemented conventional trap methodology and was not intended to replace these techniques but is being proposed to initially provide presence/absence information in the broader dune field remnant patches for impact assessment within the Project Development Envelope, and following the November 2014 wildfire which appears to have removed suitable SHD habitat for at least 10 to 15 years.

Due to the extent of the area, the range of potential habitats and the documented difficulties in capturing these very small marsupials with conventional trapping techniques, Vimy sought to pilot the use of camera trapping methods to identify if SHDs were still present within the Project Development Area and potentially in adjacent areas, where fire histories are known and some suitable habitat was preserved. This Protocol outlines the past trapping history for SHD's and outlines the current standard to be adopted for camera trapping, recording of information, species verification and reporting of results. It incorporates adaptive management principles and procedures to manage identified limitations, and will be updated as new data on the camera trapping process is identified. In the event that SHD are identified, Vimy will advise DPaW and discuss what further action is required. This may take the form of further intensive camera trap monitoring of the site, no action or follow-up targeted surveys using conventional survey techniques, or a combination of both.

### Compliance with Work Requirement of Environmental Scoping Document

This Protocol is designed to satisfy the EPA objective referenced in the Mulga Rock Uranium Project Environmental Scoping Document (2014) to maintain representation, diversity, viability and ecological function at the species, population and assemblage level. The work required was to consist of further surveys for *Sminthopsis psammophila* (Sandhill Dunnart) in the form of a targeted survey utilising specialised wildlife cameras to identify the existence or otherwise of specimens within and surrounding the proposed areas of disturbance in accordance with a Department of Parks and Wildlife approved monitoring programme.

### Scope of Works

To assist in obtaining further data on the presence or absence of the Sandhill Dunnart in the Project Development Area, Vimy purchased two different camera types to trial on a continuous basis for twelve months at a range of former trap sites and new locations within the Project area, where habitat conditions were considered optimal. Individual trap stations will utilise a combination of lured and non-lured sampling for up to 60 days per site to maximise detection, with trap layouts to traverse unburnt refugia and recently burnt zones. Trap designs will cover a range of camera placements up to a maximum of four cameras per site. Site selection is based on (a) habitat information described in Churchill (2009) and in the most recent Recovery Plan (van Weenen *et al.* 2011), (b) where Sandhill Dunnarts have been captured previously (Gaikhorst and Lambert 2009) and refugia sites following the recent fires.

The aims of the Camera Trapping Programme (CTP) are to:

- confirm the presence/absence of Sandhill Dunnarts within the MRUP Development Area so as to meet the requirements of Federal and State assessment agencies in respect to minimising impacts on matters of national environmental significance and threatened fauna.

This information would assist in defining actual and potential impacts of the proposed MRUP development on the Sandhill Dunnart populations and habitat and identifying ways to mitigate any impacts.

### Definition of Terms

Throughout this document three terms are used to spatially describe the Project. The '*Project area*' describes the boomerang-shaped area contained within Vimy mining tenure and covers an area of 101,804ha (See Figure 1). For assessment purposes, a second smaller area is identified as the '*Development Envelope*' in referral documentation (Figure 3). This zone covers approximately 10,000ha and envelopes the *Disturbance Footprint* which covers the proposed LOM disturbance of 3,787ha. As described in subsequent sections, prior to the November 2014 wildfire which burnt most parts of the Project area, all the recent trapping effort at MRUP was contained within the Development Envelope supported by a substantial trapping effort undertaken by others within 100km of the Project in similar habitat. After the 2014 fire, the targeted Camera Trapping Programme will be extended outside the Development Envelope to test remnant unburnt or refuge habitats and corridors. These locations are shown in Figure 8.

### 1.5 Conservation Status of Sandhill Dunnart

The Sandhill Dunnart is listed nationally as "Endangered" under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). This classification is consistent with International Union for Conservation of Nature (IUCN) criteria of Endangered B2ab (ii, iii, iv, v) and C1 (Barton & Cowan 2001). In Western Australia, the species is listed as "Threatened" under the *Wildlife Conservation Act 1950* (WC Act).

MRUP sits approximately midway between two nature reserves – Queen Victoria Springs, 35km to the south, and Plumridge Lakes 105km to the northeast. Sandhill Dunnarts have been recorded in the Queen Victoria Springs Nature Reserve (Pearson and Robinson 1989), but none have been recorded to date within the Plumridge Lake Nature Reserve, despite suitable habitat being present. The location of SHD capture sites and areas surveyed in Western Australia is shown on Figure 2 (Gaikhorst and Lambert 2014).

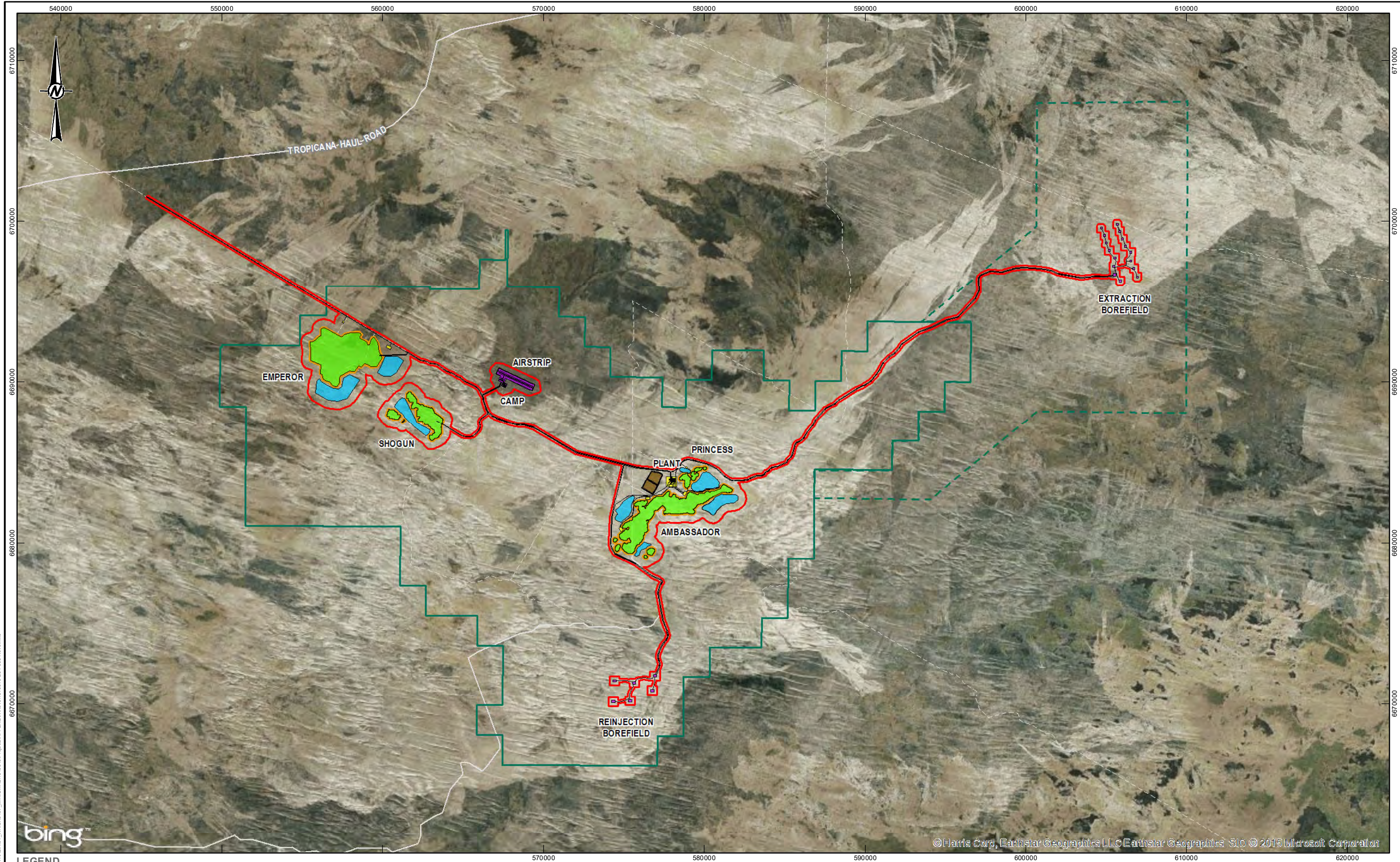
### 1.6 Permitting

Camera monitoring involves the use of remotely triggered cameras, activated when an animal passes through a motion or infrared sensor and triggers an image capture. The process is currently called camera trapping. In Western Australia, DPaW has developed a Standard Operating Procedure No. 5.2 (DPaW 2011) covering specific instructions on the use of remote cameras for monitoring of fauna.

The taking of fauna in Western Australia for scientific purposes requires a licence under *Regulation 17 of the Wildlife Conservation Act (1950)*. Although Camera Trapping does not result in physical contact with the target species, advice received from the Department confirmed that no licence was required for programmes where lures (attractants) were not used.

As part of the implementation of the post-fire refuge programme, it is proposed that lures will be used as attractants at some sites and an application for a Regulation 17 licence under the *Wildlife Conservation Act (1950)* "to take" fauna for scientific purposes, was lodged with DPaW in 2015 (Appendix C). Inherent in this process is compliance, where appropriate, with obligations under the Australian Code for the care and use of animals for scientific purposes (NHMRC 2013).





**LEGEND**

--- MINOR ROAD/TRACK

— ROAD

MRUP DEVELOPMENT ENVELOPE

PROJECT BOUNDARY (MINING TENURE)

PROJECT BOUNDARY (MISCELLANEOUS TENURE)

PIT

OVERBURDEN LANDFORM

PROCESSING INFRASTRUCTURE

ABOVE GROUND TSF

SUPPORTING INFRASTRUCTURE

PIT CLEARING (50 m BUFFER)

**NOTES**

1. COORDINATE SYSTEM: GDA 1994 MGA ZONE 51

**REFERENCE**

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

0 5 10  
1:220,000 KILOMETRES

CLIENT  
VIMY RESOURCES LIMITED

CONSULTANT

YYYY-MM-DD	2015-10-27
DESIGNED	MS
PREPARED	MS
REVIEWED	GB
APPROVED	GB

PROJECT  
MULGA ROCK URANIUM PROJECT

TITLE  
**PROJECT TENURE, PROPOSED DEVELOPMENT ENVELOPE  
AND DISTURBANCE FOOTPRINT**

PROJECT NO. 1540340	CONTROL B3	REV. 0	FIGURE <b>3</b>
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Path: G:\Spatial\_Information\_Group\GIS\_WORKSPACE\_AUSTRALIA\01\_MUNICIPALITY\1540340\Project\Appendix\Rev01\1540340-01-01-F003-Rev0.mxd

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN THE SHEET SIZE HAS BEEN INCORRECTLY PRINTED FROM ISO A3 25mm



## 1.7 Guidance Documents and Advice

Guidance statements are released by the West Australian Environmental Protection Agency for the use of Project Developers and describe the EPA's position in relation to the use of best practice to protect the environment. Similar documents are provided by other State and the Federal Government departments in the form of Recovery Plans and Sampling Protocols that set out the actions necessary to stop the decline of and support the recovery of listed threatened species and to inventory such target species.

The approach adopted in this programme is generally consistent with:

- Environmental Protection Authority (EPA) Position Statement No. 3: *Terrestrial Biological Surveys as an Element of Biodiversity Protection* (EPA 2002);
- EPA Guidance Statement No. 56: *Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia* (EPA 2004);
- EPA & Department of Environment and Conservation *Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* (EPA & DEC 2010);
- Department of Environment and Conservation: Standard Operating Procedure – *Remote Operation of Cameras SOP No. 5.2* (DEC 2011);
- Department of Sustainability, Environment, Water, Population and Communities – *Survey Guidelines for Australia's Threatened Mammals* (2011);
- Department of Environment and Natural Resources, South Australia – *National Recovery Plan for the Sandhill Dunnart (Sminthopsis psammophila)* (2011); and
- National Health and Medical Research Council, (2014). A Guide to the Care and use of Australian Native Mammals in Research and Teaching. EA29. Canberra.

Valuable operational advice was received from regional science staff at DPaW during the preparation of the Pilot Study for the MRUP, and from the findings from several targeted conventional SHD surveys for the Tropicana Gold Project which have been undertaken for infrastructure planning in tenure to the north, east and west of the MRUP.

Detailed guidance was also obtained from Ms Amanda McLean of the University of Adelaide on dunnart behaviour and from *An Introduction to Camera Trapping for Wildlife Surveys in Australia* (Meek *et al.* 2012). Valuable discussions have been held with Ninox Consulting Principal Ms Jan Henry on small mammal image identification, and with ecologists attending the GVD Biodiversity Workshop on Sandhill Dunnarts (DPaW 2014). The protocol was peer reviewed by Sue Churchill (Wildlife Ecologist) and Paul Meek (NSW DPI). A consultation matrix is shown in Table 4.

**Table 4 Consultation matrix associated with the Mulga Rock Camera Trapping Programme**

Who	Organisation	When	Matters raised
J. Henry	Ninox Wildlife Consulting	2009-2015	Habitat, methodology and identification and managed 2009 MRUP Targeted Fauna Survey (Ninox 2010)
M. Cowan	WA DPaW	May 2014	Camera specifications, trapping methodology for small mammals, surveys in arid environments
P. Meek	NSW DPI (Biosecurity NSW)	May 2014 March 2015	Camera recommendations, trapping methodology for small mammals, detectability of small mammals, peer review of protocol
D. Pearson	WA DPaW	2013-2014	Advice on SHD and fire regimes in GVD
I. Kealley, J. Futter	WA DPaW	2007, 2013- 2014	Advice on fire regimes in GVD

Who	Organisation	When	Matters raised
G. Gaikhorst	GHD	2014	Discussion on habitat and methodology
A. McLean	University of Adelaide, PhD candidate	2013-2014	Research findings on SHD's in SA, hands-on advice on habitat and capture efficiency, and identification
SHD workshop	GVD Biodiversity Trust	2014	Latest research and findings presented at workshop
S. Churchill	SHD Fauna Specialist	March 2015	Peer reviewed Protocol and provided advice on identification

### 1.8 Fauna Identification, Nomenclature and Peer Review

The following literature sources have been used to outline nomenclature, ecology, habitat assessment fauna distribution patterns and faunal characteristics in this report:

- Hart, R.P. and Kitchener, D.J. (1986) First record of *Sminthopsis psammophila* (Marsupialia: Dasyuridae) from Western Australia. Rec West. Aust. Mus. 13 Part 1 pp 139-144;
- Churchill, S. (2009). Assessment of habitat availability for the Sandhill Dunnart *Sminthopsis psammophila* in Western Australia;
- Field Companion to the Mammals of Australia (2013). Eds S. Van Dyck, I. Gynther and A. Baker; New Holland Publishers;
- Van Dyck and Strahan (2008). Mammals of Australia 3<sup>rd</sup> Edition;
- van Weenen, J., Ward, M.J. and Churchill, S. (2011). National Recovery Plan for the Sandhill Dunnart (*Sminthopsis psammophila*). Department of Environment and Natural Resources, South Australia;
- Western Australian Museum Checklist of the Vertebrates of Western Australia. Located on the Museum website at: [www.museum.wa.gov.au/research/departments.terrestrial-zoology/checklist-terrestrial-vertebrate-fauna-western-australia](http://www.museum.wa.gov.au/research/departments.terrestrial-zoology/checklist-terrestrial-vertebrate-fauna-western-australia); and
- Woinarski, J.C., Burbridge, A.A., and Harrison, P.L. (2014). The Action Plan for Australian Mammals 2012-2014. CSIRO Publishing.

The most recent taxonomic revisions have been used within the text of this report. Identification procedures for camera images and reporting standards are discussed in Section 5.0.

#### Peer Review

Consistent with the protocol of continuous environmental improvement and adaptive environmental management, Vimy implemented a peer review process to ensure all the risk issues were identified at the commencement of the Camera Trapping Programme and that these were addressed to ensure an appropriate level of survey for potential impact assessment.

Review comments received during the regulatory assessment of the draft Protocol (Baker 2015) and during peer review by Sue Churchill (Wildlife Ecologist) and Paul Meek (NSW DPI) have been included in Appendices C and D. These related to identifying key characteristics of SHDs in images from other *Sminthopsis* species present in the area, along with technical aspects of the camera layout. Vimy has developed a key characteristics table (Table B-5 in Appendix B) which identifies five characteristics that should support positive identification in captured images.

In addition to promoting maximum resolution in images, modifications to camera layout will be trialled with the use of an overhead camera for sites where lures are utilised. Camera setup will include multiple image capture for each trigger and this will increase potential for identifying these key characteristics. In the event of uncertainty, the Vimy Protocol endorses consulting expertise from fauna experts for advice in respect to species identification and confirmation.

## **2.0 Existing Environment**

### **2.1 Study Area**

The Mulga Rock Uranium Project (MRUP) is located on unallocated Crown Land approximately 770km east-northeast of Perth in Western Australia and 240km northeast of the regional city of Kalgoorlie-Boulder. The Project area is located between the Queen Victoria Springs and Plumridge Lake Nature Reserves (Figure 1), however project activities are at some distance from the Reserves and no direct or indirect impacts are anticipated.

The Project consists of three subsurface uranium bearing carbonaceous deposits that formed in Pleistocene times and together they comprise the Mulga Rock Deposits. The Project area is located on the western margin of the Great Victorian Desert 1 (GVD1) Shield subregion, as defined in the Interim Biogeographic Regionalization of Australia (IBRA) Version 7.0 (DoTE 2014). The Project area is at an elevation of 350-400m (AHD) and is crossed by vegetated east-southeast trending, 8m to 12m high yellow, orange and red sand dunes and sand sheets. Project tenure, proposed development locations and buffers are shown in Figure 3.

As a consequence of the climate and the geographical isolation of the region, pastoralism and agriculture are not considered viable within the sandplain terrains. Consequently, there has been little land clearance or grazing by domestic stock although feral camels are present. The region is considered relatively undisturbed, with some elements of the yellow sandplains exhibiting high ecological values (Barton and Cowan 2001).

The hummock grasslands are prone to frequent, widespread and commonly hot wildfires, which have a devastating impact on the quality of Sandhill Dunnart habitat by reducing the structure and density of spinifex and ground cover. Survival of Sandhill Dunnart populations after wildfires is not documented, but information from other small mammal species suggests it can depend on aspects such as the availability and connectivity between the small unburnt vegetation patches that exist following a fire in hummock grassland environments.

### **2.2 Biophysical Elements**

#### **2.2.1 Climate**

The Project area is located on the western edge of the Great Victoria Desert. Long term regional weather data is available from Bureau of Meteorology BOM stations at Laverton, 182km northwest of the Project area, Kalgoorlie 260km southwest and Balgair 204km to the southeast. In addition three automatic weather stations providing a range of climatic data were established on the Mulga Rock site in 2009.

The climate is arid, with mean annual rainfall ranging from below 150mm to over 250mm. Rainfall is aseasonal, but shows great variability between years with above average rainfall experienced at site in 2011 (584mm) and below average (<220mm) in 2012 to 2014. Summers are very hot, with mean maxima during summer between 32°C and 35°C. Diurnal ranges are also large, and overnight temperature minima commonly fall below 0°C during winter.

Studies by McLean (pers. comm. 2014) suggest that increased SHD activity is observed following phases of the moon and rain events. This data will be collected monthly for the monitoring project from the cameras and site weather stations and is included on the Data Recording sheet.

#### **2.2.2 Terrain**

The Project area lies wholly within the Shield Subregion of the GVD Interim Biogeographic Regionalisation of Australia (DoTE 2014).

The western part of GVD 1 is underlain by the Yilgarn Craton and a higher proportion of sandplains are present in comparison to the rest of the bioregion. To the east is an arid active sand-ridge desert of deep Quaternary Aeolian

sands overlying Permian and Mesozoic strata of the Officer Basin. Regional landforms consist of isolated salt lakes and major wide valley floors with lake derived (local) dunes and sandplains with patches of longitudinal dunes running approximately east west. The subregion contains the major Ponton Creek channel.

The MRUP area consists essentially of yellow and orange sandplain communities with a diverse mammalian and reptile fauna and distinctive hummock grasslands (Barton and Cowan 2001).

The major lithostratigraphic dune forming units for the GVD appear to have been stable for a long time (Sheard *et al.* 2006) and several researchers (Hesse, P.P. *et al.* 2004) have suggested some dune ages greater than 125,000 years. Swale areas between the dunes are characterised by shallow red, earthy soils and sand from the dunes.

### 2.2.3 Vegetation

The MRUP area is entirely located in the Helms Botanical District. Matiske (2014) has completed detailed mapping and identified 22 vegetation communities which Beard (1974) broadly mapped as being characterised by tree steppe of *Eucalyptus gonglocarpa* over *Eucalyptus youngiana* mallee and *Triodia basedowii*. Twelve of these communities are eucalypt woodlands over hummock grasses, eight consist of mixed shrublands with occasional emergent eucalyptus species over *Triodia*, and the final two communities are pockets of *Acacia* woodland and chenopod shrublands. Eight of these habitats were selected as core sites for the Ninox (2009) survey and two coincided with sites where Sandhill Dunnarts were captured in the 1985 Survey (Hart and Kitchener 1986) and in 2009 (Gaikhorst and Lambert 2009).

A vegetation – habitat – terrain description of each of the sites chosen for sampling during the (Ninox 2009) survey was provided by Matiske Consulting Pty Ltd and is referenced in Appendix A –Table A-3. Habitat descriptions for refugia sites within the Development Envelope will be undertaken in 2015 when access to these sites is established.



### 3.0 Species Profile

#### 3.1 Source of Information

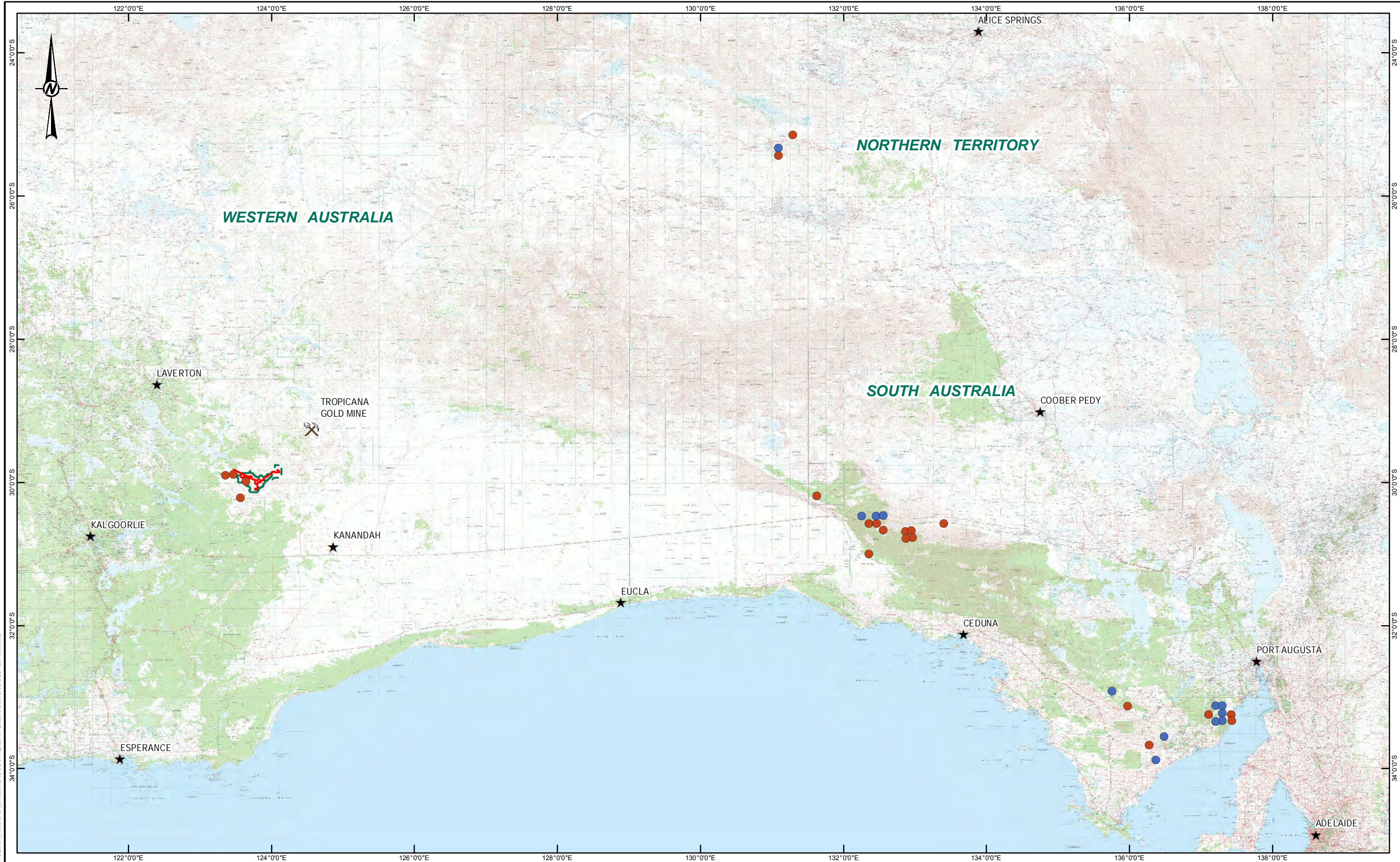
The following detail on the Sandhill Dunnart (*Sminthopsis psammophila*) has been substantially obtained from *Assessment of habitat availability for the Sandhill Dunnart in Western Australia* (Churchill 2009), the *National Recovery Plan for the Sandhill Dunnart* (van Weenen *et al.* 2011) and *The Action Plan for Australian Mammals - 2012* (Woinarski *et al.* 2014).

#### 3.2 Distribution








Sandhill Dunnarts are currently known to occur from four major populations in South Australia and one in Western Australia. No recent survey information is published for the historic Lake Amadeus location in the Northern Territory.

The South Australian populations occur on the Eyre Peninsula; near Whyalla, Hincks Conservation Park and Pinkawillnie Conservation Park. Two populations occur in the Great Victoria Desert – one near Ooldea in the Yellabinna Regional Reserve in South Australia and the remaining occurrences are in Western Australia, north of the Queen Victoria Springs Nature Reserve (van Weenen *et al.* 2011). They may still exist in the south central ranges of the Northern Territory although there have been no live specimens collected since 1894. Current populations are shown on Figure 4.





LEGEND

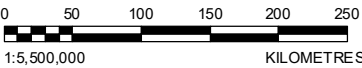
-  TROPICANA GOLD MINE
-  TOWN
-  HUMAN OBSERVATION
-  PRESERVED SPECIMEN
-  MRUP DEVELOPMENT ENVELOPE
-  PROJECT BOUNDARY (MINING TENURE)
-  PROJECT BOUNDARY (MISCELLANEOUS TENURE)

NOTES

1. COORDINATE SYSTEM: GCS GDA 1994

REFERENCE

INFRASTRUCTURE DATA PROVIDED BY CLIENT  
BASE DATA © WESTERN AUSTRALIAN LAND INFORMATION  
AUTHORITY TRADING AS LANDGATE (2015)  
IMAGE SOURCED FROM GEOSCIENCE AUSTRALIA 250K TOPO  
SANDHILL DUNNARTS DIGITISED FROM ATLAS OF LIVING AUSTRALIA



CLIENT  
VIMY RESOURCES LIMITED

CONSULTANT



YYYY-MM-DD	2015-10-27
DESIGNED	MS
PREPARED	MS
REVIEWED	GB
APPROVED	GB



PROJECT  
MULGA ROCK URANIUM PROJECT

TITLE  
**DISTRIBUTION OF SANDHILL DUNNARTS BASED ON  
CAPTURES 1895-2012 (SOURCE: ATLAS OF LIVING  
AUSTRALIA)**

PROJECT NO. 1540340	CONTROL B3	REV. 0	FIGURE <b>4</b>
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### 3.3 Appearance

The Sandhill Dunnart (SHD) is one of nineteen species of the carnivorous marsupial genus *Sminthopsis* (Dasyuridae) that occur predominantly throughout the arid and semi-arid regions of Australia and one of five dunnart species recorded at Mulga Rock. The other four species include *Sminthopsis crassicaudata*, *S. dolichura*, *S. hirtipes* and *S. ooldea*. All species are nocturnal and insectivorous and are generally similar in appearance, characterised by their long pointed snouts, large eyes and ears and relatively long slender hind feet. The SHD differs from other members of its genus by several features, most noticeably by its larger size (30 to 55 grams) with males weighing 26-55g (mean 36g) and females 25-42g (mean 33g) and a distinctive tail that can be bicolour and has a crest of stiff black hairs along the ventral surface of the distal portion (Hart and Kitchener 1986). They lie within the 'critical weight range' (Burbidge and McKenzie 1989); for terrestrial mammals that have an elevated likelihood of extinction or significant decline, especially in arid areas.

The fur colour is generally drab grey with buff fur above and white fur on the underside of feet, a pale grey head and a black pencilling extending from the shoulders to the wedge between the eyes, large dark eyes and a black eye-ring. The ears are large and the tail is pale above and dark grey below tapering towards the crested tip. The head to body length ranges from 85-114mm long and the tail length is 107-128mm long (Pearson 1995). Tracks are quadruped with a gait of 6-8cm (Plate 1) and a foot length of approximately 22 to 26mm (Way 2008). The identification of SHD tracks from those of other *Sminthopsis* in the region is only possible after rain when moist sand may retain footpad features as described by (Gomez *et al.* 2013).



**Plate 1** Sandhill Dunnart tracks at Shirrocoe sandplot site SHD\_069, Eyre Peninsula, South Australia (from Way 2008)

### 3.4 Habitat Use

Studies of the Sandhill Dunnart (Churchill 2001b, Churchill 2009) have shown that large spinifex (*Triodia* species) hummocks are favoured for nest sites.

On Eyre Peninsula, Churchill (2001b) recorded Sandhill Dunnarts nesting in large spinifex hummocks that had started to die off in the centre. They have been observed to enter these spinifex hummocks by leaping up onto the hummock and climbing over the needles to the centre before scrambling down through the central portion of dead leaves. In the centre of the hummock, they build a circular depression or space within the dead spinifex needles usually 10 to 15cm in diameter. Adult female Sandhill Dunnarts occasionally dug burrows; starting from the inside of the spinifex with the burrows spiralling down under the plant. These burrows are up to 90cm long and had a small terminal chamber that contained nesting material of leaves and shredded bark. Male Sandhill Dunnarts were found to use a greater variety of nest sites than females, including small burrows between spinifex clumps, hollow logs and Mitchell's Hopping-mouse (*Notomys mitchelli*) burrows.

Both the West Australian and South Australian populations are known to occur on sandy substrates in arid and semi-arid regions. The most consistent features of the habitat is the presence of spinifex (*Triodia* species)

hummocks associated with parallel sand dunes and sheets. The associated vegetation in the southern GVD varies but is most commonly mallee species or Marble Gum (*Eucalyptus gongylocarpa*), often with Southern Cypress Pine (*Callitris verrucosa*) over a complex shrub understorey (Hart and Kitchener 1986, Pearson and Robinson 1989) including *Acacia* sp.

Although reconnaissance surveys have been undertaken, no detailed regional habitat assessment has been made for the Sandhill Dunnart across the full expanse of the Great Victoria Desert (Churchill 2009), and there does appear to be large areas of potentially suitable habitat types throughout the southern GVD. The locations of recorded SHD trap and capture sites in the GVD in Western Australia are shown in Figure 2.

### Spinifex Habitat Stages

Potential suitable habitat is recorded as consisting of areas of large spinifex hummocks. Typically, there are mixed sizes of spinifex plants but the presence of plentiful large hummocks of approximately 40 cm high and 70 to 100 cm diameter reportedly make ideal nest sites. Sandhill Dunnarts show a preference for large hummocks that form an intact mound or have just started to die off in the centre (See Table B-2 Data Recording Sheet Appendix B). Sandhill Dunnart trapping has been most successful on or adjacent to sand dunes or sheets.

The presence of large spinifex hummocks appears to be a critical factor for this species on the Eyre Peninsula where suitable spinifex occurs in areas approximately >20 years post-fire and these sites are usually associated with mallee communities. Early regrowth of mallee (less than 10 years old) appears to favour spinifex growth, but after 20-year regrowth, the spinifex have become sparse, dissected and are shaded by mallee and shrub regrowth. This is not observed to the same extent at Mulga Rock where mallee development is controlled by wildfire.

At Ooldea, in the South Australian part of the Great Victoria Desert, Churchill (2009) reported that the age of the spinifex is much older and not as suitable for nest sites, but the Dunnarts at this site reside in burrows they have dug under the spinifex. The reason for the different nesting behaviour at the two sites is unclear.

Recent variations in capture rates near Immarna in northwest Yellabinna (SA) have indicated that greater spinifex cover was correlated with greater Sandhill Dunnart densities and hence capture rates (Ward *et al.* 2008). However, additional trapping has demonstrated that spinifex cover, structure and separation are not, in isolation, reliable predictors of Sandhill Dunnart occupancy and density within their known range. Sites near Oak Valley in the Maralinga Tjarutja Lands contained equivalent spinifex cover and size to the occupied Yellabinna sites; however no Sandhill Dunnarts have been captured in the area. The lack of sand dunes or suitable sand for burrowing or differences in spinifex phenology may explain the lack of captures at the Oak Valley sites sampled (Ward *et al.* 2008).

On Eyre Peninsula, Sandhill Dunnarts were trapped and radio-tracked only in areas that had been burnt ten years earlier (Churchill 2001b). They did not use an adjacent area of habitat that had remained unburnt for approximately 30 years. This unburnt area retained vestiges of spinifex but most of the spinifex was old and its structure had broken down into large broken rings that provided little cover for Sandhill Dunnarts.

### 3.5 Reproduction

Recent information regarding the reproductive biology of Sandhill Dunnarts has been reported from laboratory studies conducted at the Perth Zoo (Lambert *et al.* 2011) and field observations, from the literature and examination of museum material (Hart and Kitchener 1986, Pearson and Robinson 1989, Pearson 1995). Female Sandhill Dunnarts possess eight teats and have been recorded with up to eight young. Both males and females reach sexual maturity in their first year. Studies by Lambert *et al.* (2011) show they are seasonal breeders with an average interval from mating to birth of 18 days. The pattern of reproduction appears to be mating in September; with young being born in September/October; and pouch young weaned in December/January (van Weenen, Ward and Churchill 2011).

However, young have also been captured in October and April showing that the species has a broader period of reproduction. It is likely that Sandhill Dunnarts usually produce only a single litter each year. However during a period of good seasons, they may be able to vary or extend the timing of reproduction or perhaps produce a second litter (Churchill 2001b).

### 3.6 Home Range Requirements

A radio-tracking study in South Australia (Churchill 2001b) of fifteen individuals found them to have an average home range size of 7.8 ha (range 1.8 ha to 19.0 ha). The males' home ranges overlap those of other males and females. The females may have exclusive home ranges. In general, tracking showed they move 200 to 300 m per foraging period but they have the ability to traverse long distances in short periods of time with one movement of 1,940 m recorded in two hours (Churchill 2001b). Limited data indicates that they remain within an area for at least eight months, but the boundaries of the home range may drift over time.

At one site in South Australia, five adult Sandhill Dunnarts occupied an area of 20ha indicating a potential density, in suitable habitat, of up to 25 Sandhill Dunnarts per square km. During trapping at Ooldea in 2008, between two and six individual Sandhill Dunnarts were caught in individual Elliott trapping grids across four sites (6.7ha each), indicating potential densities of 30 to 90 animals per square km (Ward *et al.* 2008). Trapping data for Western Australian populations suggest substantially lower densities per square km.

### 3.7 Threatening Processes

Barton and Cowan (2001) list cats and foxes as specific species threats and potential threats as clearing associated with mining, introduced herbivores such as rabbits and camels and impacts from frequent wildfires. Churchill (2001a) and van Weenen *et al.* (2011) discuss potential threats in the context of unexplained losses of small mammals in critical weight ranges, impacts from introduced species (dingo, foxes and cats) including buffel grass (*Cenchrus ciliaris*) in South Australia, changes in fire patterns and frequency and the fire age of spinifex. Indirect impacts identified included loss of specialised habitat, land clearance and inadequate survey.

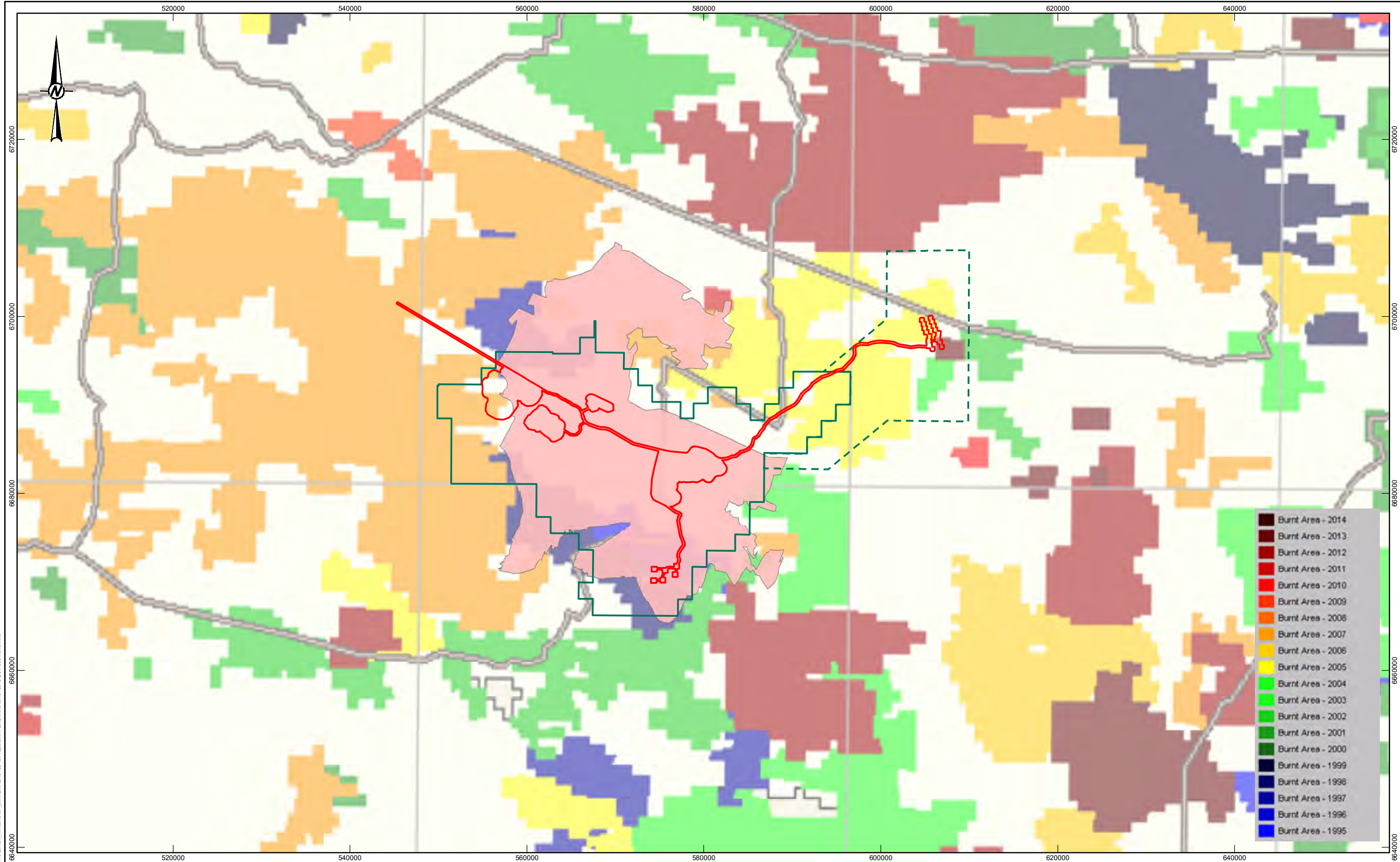
Although their decline has not been substantiated, SHDs lie within the 'critical weight range' (Burbidge and McKenzie 1989), for terrestrial mammals that have an elevated likelihood of extinction or significant decline, especially in arid areas. The species' shelter behaviour inside spinifex hummocks or in burrows, would assist in limiting predation by feral cats; however, they would still be prone to predation while foraging. Extensive, hot, summer fires, which are now common in the central and western spinifex deserts, are a significant threat, as they destroy habitat over very large areas, isolating vegetation remnants, and often limiting connectivity and reoccupation as the vegetation recovers (Woinarski *et al.* 2014). Studies on the fire prone and fire adapted landscapes of the GVD and their effects on biota are limited. Hayden *et al.* (2000) suggested the average fire return interval is at least 20 years however recent records for the broader Mulga Rock area, where fires were recorded in 1999, 2005, 2007 and 2014, suggest a shorter timeframe, possibly in response to increased annual rainfall (see Figure 5, Figure 6 and Figure 7).

Fire regimes describe when and how often an area is burned as well as the intensity, size, patchiness and impact on biodiversity. In describing fires in the GVD, the layman's terms 'cool' or 'hot' fire have been used in this document based on the observed impact to vegetation and not on the typical Fireline Intensity (Bushfire Front website - 2014 <http://bushfirefront.com.au>) energy descriptors.

Observations following the November 2014 fire at the MRUP area, suggest that in cool fires, isolated shrub thickets, gridline/road verge vegetation and, depending on wind direction, dunal vegetation can be preserved and form connecting corridors between vegetation patches of varying sizes.

Fire history mapping has been undertaken as a targeting tool for SHD camera trapping site identification. Fire histories from Landgate for the broader region are shown in Figure 5. They show that the Project area has not received a major fire since 1999 although isolated patches have burnt. The extent of the fires in 1999 is shown in Figure 6 and those in 2005 and 2007 in Figure 7. This situation changed in November 2014 when a "cool" fire (as described in Bushfire Front 2014) burnt through the Project Development Envelope and surrounds, potentially making most of this area unsuitable for SHD habitat for the next ten years. The spatial extent of this burn is shown on Figure 7.





- LEGEND**
- MRUP DEVELOPMENT ENVELOPE
  - PROJECT BOUNDARY (MINING TENURE)
  - PROJECT BOUNDARY (MISCELLANEOUS TENURE)
  - NOVEMBER 2014 FIRE SCAR

**NOTES**

1. COORDINATE SYSTEM: GDA 1994 MGA ZONE 51

**REFERENCE**

INFRASTRUCTURE DATA PROVIDED BY CLIENT  
BASE DATA © WESTERN AUSTRALIAN LAND INFORMATION  
AUTHORITY TRADING AS LANDGATE (2015)



CLIENT  
VIMY RESOURCES LIMITED

CONSULTANT



YYYY-MM-DD	2015-10-27
DESIGNED	MS
PREPARED	MS
REVIEWED	GB
APPROVED	GB

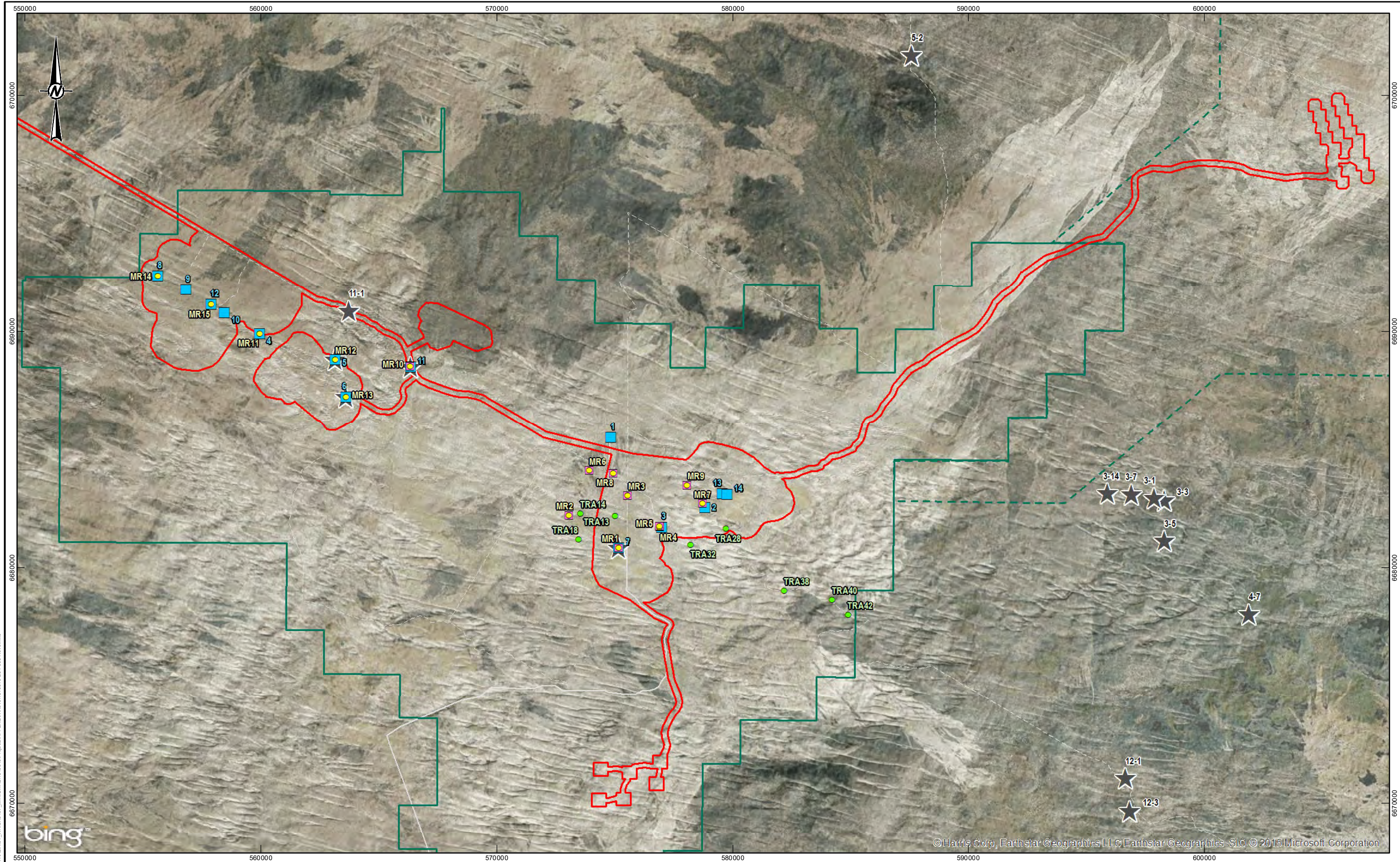


PROJECT  
MULGA ROCK URANIUM PROJECT

TITLE  
**FIRE MAPPING SHOWING BURN HISTORY OF THE WESTERN  
SHIELD REGION OF THE GREAT VICTORIAN DESERT 1995-  
2014 (DATA FROM LANDGATE 2015)**

PROJECT NO. 1540340 CONTROL B3 REV. 0 FIGURE 5





**LEGEND**

- TARGETED SURVEY SITE
- PILOT SURVEY SITE
- NINOX (2009) TRAP SITE
- MARTINICK & HART (1985) TRAP SITE
- ★ GAIKHORST & LAMBERT (2000-2008) SHD CAPTURE SITE
- MINOR ROAD/TRACK
- ROAD
- ▭ MRUP DEVELOPMENT ENVELOPE
- ▭ PROJECT BOUNDARY (MINING TENURE)
- ▭ PROJECT BOUNDARY (MISCELLANEOUS TENURE)

**NOTES**

1. COORDINATE SYSTEM: GDA 1994 MGA ZONE 51

**REFERENCE**

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

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CLIENT  
VIMY RESOURCES LIMITED

CONSULTANT

YYYY-MM-DD	2015-10-27
DESIGNED	MS
PREPARED	MS
REVIEWED	GB
APPROVED	GB

PROJECT  
MULGA ROCK URANIUM PROJECT

TITLE  
**DISTRIBUTION OF CONVENTIONAL, PILOT AND TARGETTED TRAP SITES OVERLAYED ON 1999 BURN AREA IMAGE**

PROJECT NO. 1540340	CONTROL B3	REV. 0	FIGURE <b>6</b>
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### **3.8 Conservation Objectives and Management**

Sandhill Dunnarts are represented in conservation reserves in South Australia and Western Australia although prime habitat in both areas is prone to regular wildfires and other threatening processes. With mining development occurring in the region, the opportunity exists in Western Australia for the partnership development of a regional management plan through an organisation such as the GVD Biodiversity Trust that can promote biodiversity research on threatened species, knowledge transfer and support aspects such as long term monitoring and sound fire management.

Woinarski *et al.* (2014) describe conservation objectives for the species as:

- Conduct additional research to aid the development of management prescriptions and establish monitoring sites in Western Australia;
- Locate subpopulations and implement adaptive management strategies to promote conservation of the species,
- Assessment of relative impacts of the threats on the SHD and work with communities and mining companies to manage SHD populations.

The proposed MRUP Camera Trapping Programme will provide further inventory information on this species that will assist in better defining conservation and management requirements.

## 4.0 Methodology

A review on published literature and discussions with regulatory agency personnel and experienced fauna consultants and researchers who have worked in the Great Victoria Desert Bioregion for several years have highlighted that the Sandhill Dunnart is difficult to trap, and probably occurs at low densities, although potential prime habitat is considered extensive (Churchill 2009). Recovery Plans (Churchill 2001 and van Weenen *et al* 2011) have been developed citing detailed habitat requirements and conventional trap and monitoring approaches. New trapping approaches for cryptic species, using remote cameras for management and presence inventory, have been released by DSEWPaC (2011). Monitoring and evaluation for environmental management effectiveness at Mulga Rock use the principles of active adaptive management which results in continuous adjustment to camera trap programmes on the basis of new data acquisition. These aspects are managed through internal quarterly reviews, attendance of species targeted workshops and discussions with regulatory and other researchers.

Following a survey in 2009 which included a targeted survey for Sandhill Dunnarts, Ninox (2010) utilised, in addition to conventional trapping methods, camera traps in different habitats to increase trap effort. Realising the value of camera trapping in desert environments, Vimy opted to trial cameras to determine if they would be suitable for longer term monitoring.

A Pilot Programme using a modified trap layout over two 0.1ha grid areas in swale and dune environments (see Plate 3 and Plate 4), utilising Bushnell Trophy Cam HD IR cameras, was conducted in 2012. No SHDs were observed and although other small marsupials were detected, it was realised that faster trigger times and white flash were required to provide clarity of image. Camera type and techniques were modified and a new camera progressive deployment using 30 Reconyx 550 Hyperfire Led white flash was established in 2013/14.

### 4.1 Survey Area

The original targeted programme was established in monitoring sites set up by Ninox in 2009 which include sites from the Martinick (1985) survey where SHDs were first recorded in Western Australia. The trap site locations from the 1985 and 2009 surveys are shown in relation to the proposed Development Envelope on Figure 6 and Figure 7 and which also shows the extent of wildfires in 1999, 2005 and 2007. Understanding site burn history has been an important part of the site targeting exercise.

Following habitat assessment in 2014, some of the 1985 and 2009 monitoring sites were utilised for the camera inventory which was operational for 60 days before the study sites were burnt by a cool fire in November 2014 resulting in a review of the camera trapping programme. The extent of the impact of the November 2014 fire on monitoring sites is shown in Figure 8.

Since the fire, identification of remnant vegetation stands is in progress and the revised programme will target (a) remnant vegetation patches greater than 5ha in size, (b) road verge vegetation corridors connecting vegetation patches in the development area, and (c) unburnt optimal habitat outside Vimy's tenure. The location of the proposed sites is shown on Figure 8.

### 4.2 Survey Timing

The targeted camera trapping programme at former Martinick and Ninox sites commenced in August 2014 and ran continuously until the Project area was burnt out in mid-November 2014 when the programme was discontinued. A revised post-fire programme commenced in January 2015 and will run continuously until 30 October 2015 when the programme will be reviewed.

### 4.3 Habitat Assessment

Habitat assessment was based on recommended survey techniques outlined in Survey Guidelines for Australia's Threatened Mammals – Sections 3.1 and 5.0 (DSEWPaC 2011), on habitat information contained in previous survey

reports for the region, where SHDs were captured; Hart and Kitchener (1986), Pearson and Robinson (1989), Gaikhorst and Lambert (2009, 2010 and 2014), from National Recovery Plans (Churchill 2001, and van Weenen *et al.* 2011) and recent habitat assessments of potentially available sites in Western Australia (Churchill 2009, GHD 2010 and Turpin 2014).

Fine scale vegetation mapping of the MRUP Area (Mattiske 2009) was used by Ninox (2009) to define an additional range of habitats located across the Project area and these sites were trap tested by conventional trapping methods in 2009. Descriptions of these sites are listed in Table A-3 in Appendix A. These sites were used as the initial locations for the targeted presence/absence survey using the camera trapping protocol up to November 2014 when all camera trap sites were burned. The initial fifteen sites included three trap locations where dunnarts were captured in 1985 and two sites in 2008 (Gaikhorst and Lambert 2009).

Churchill (2009), using vegetation associations from known Western Australian SHD capture sites, identified potential habitat types for the Tropicana Gold Project area and the associated infrastructure corridors and extended this comparison to cover the broader GVD region. Due to the different vegetation survey codes used in public domain reports on likely SHD habitats in the region, and to ensure any prime habitat in the potential development areas at Mulga Rock were identified, a preliminary comparison of Churchill's vegetation communities with Mulga Rock vegetation mapping was undertaken by Mattiske (2015).

Churchill (2009) has broadly described the potential habitats of Sandhill Dunnarts into three categories:

- **Prime:** Core habitat that is functional and able to meet all the needs of a breeding population. Prime habitat has the highest likelihood of supporting a current population and therefore the highest likelihood of sampling success. Note that actual sampling events are rare (high trap effort is usually required), even in the presumed best areas of habitat in the GVD.
- **Likely:** Meets the majority of the needs of a breeding population. May contain small, disjunct areas of Prime habitat within a matrix of lower quality habitat. Medium likelihood of successful sampling.
- **Marginal:** Sandhill Dunnarts may use (and have occasionally been sampled in) marginal habitat, but they will not often live in it. Marginal habitat may be used for movement between patches of higher quality habitat, or for foraging if adjacent to appropriate cover/breeding habitat.
- **Potential:** These habitats possess several of the attributes of likely habitats but may have different burn histories, or are located as isolated communities, or exhibit different terrain features. They are worthy of trapping.

The comparison results are listed in Appendix A –Table A -1 and these will be used to cross check and code sites selected for the Refuge Programme.

#### **4.4 Prime Habitat Criteria**

Prime SHD habitat in the western GVD is defined as:

- Yellow (occasionally orange) sands ranging from very gently undulating sandplains to well defined dunes up to 30 metres in height;
- Preferred flora and vegetation structure consisting of tall mallee (10-30% cover), mixed shrubland (10-30% cover), and/or a combination of mallee, marble gum, *Callitris* and mixed shrubland (10-30% cover);
- Presence of dense, compact clumps of spinifex (at least 6-30% cover);
- Spinifex life stages of 2 to 3.5 or unburnt for eight to ten years, and
- Areas where SHDs have been trapped previously.

The presence or absence of small mammal tracks has also been used as a tool in assessing the potential of an area. However current knowledge suggests that tracks could not be used as a definitive guide to the presence of Sandhill Dunnarts as *S. hirtipes* and *S. dolichura* display similar traits.

#### 4.5 Impact of Local Wildfires

Wildfires are dramatic natural episodic events that characterise the environment of the Great Victoria Desert. Fire events with short recurrence times can directly impact on Sandhill Dunnarts through species destruction and indirectly from loss of habitat, removal of safe movement corridors and food sources. Post-fire impacts can be equally devastating resulting in increased predation and, depending on climatic conditions, long term decline in spinifex structure and density (DENR 2013).

Patches of habitat have been preserved in recent (post-2000) site fires (Figure 8). These have identified by age from landsat imagery and it is proposed to assess their status against habitat criteria and target suitable habitat in the proposed 2015 Camera Trapping (CT) Refuge Programme as a substitute for the planned systematic 2014 Pre-fire Trapping Programme that ceased when all camera trap sites (Plate 2) were burnt. Marginal habitats and sites burnt in 1995 and 2005 will be included in the mix.



**Plate 2** Post-fire image of a Ninox camera trap site

#### 4.6 Camera Trap Methodology

##### 4.6.1 Survey Design

The primary objective of this Camera Trapping Protocol is to provide details on the presence or absence of Sandhill Dunnarts within the MRUP proposed Development Envelope. Information on the habitat preferences of this small dasyurid have been established (Churchill 2009, van Weenen *et al.* 2011) and several surveys have captured very low numbers in a range of these habitats over the past 30 years. Recent fires have destroyed most of the “prime” habitat and the programme has refocused as (a) a stratified sampling test of unburnt or partially burnt refugia of different habitat type with replicated sampling effort in areas in proximity to previous capture sites, (b) some additional trapping around infrastructure - primary borefield and reinjection borefield areas that were not extensively burnt and have not been exhaustively tested, and (c) areas outside the Project tenure where previous SHD captures have been recorded. Some of the post-fire sites selected are in edge effects areas and have received comment from reviewers. Edge effect impacts on small mammals in most habitats in Australia are poorly understood and very limited work has been done in the arid lands. However, some trapping success has been reported for SHDs in edge environments in the GVD and for this reason this category has been included in the programme. Churchill (2001) reports that

Dave Pearson captured an adult male in a burnt area adjacent to an unburnt area in the Queen Victoria Spring Nature Reserve in September 1991 and Gaikhorst and Lambert report the capture of a juvenile male on the edge of a small unburnt remnant in 2007 (Gaikhorst & Lambert 2009a).

The strategy for trapping at the nominated sites is outlined below and is shown on Figure 8.

This new strategy for the Camera Trapping at MRUP will implemented by:

- Continue to CT existing sites where SHDs have been captured in the past if the habitat is still suitable. The November 2014 fire, although widespread in the Project area, was a cool fire and sufficient cover for small mammals may be present in some locations. Sites MR5/6 and 10/11 are the most prospective if habitat is available. Locations are shown on Figure 8;
- CT refugia areas >3ha close to sites where SHD's have been captured in past where habitat is suitable. (Sites E1, E2, E3, E4 – S7, S8, A18);
- CT refugia, or partially burnt areas, close to non-spinifex (*Melaleuca*, Mulga) bearing depressions, with the exclusion of large kopi depressions (Sites E6, E10);
- CT suitably sized (>3ha) isolated refugia that is connected by unburnt corridors (including road) and inside tenure but outside development areas (Sites E6, E9, E10, E11, E12, E13, E14, E16, E17);
- CT in infrastructure areas not previously tested such as sections of the borefield and reinjection areas (search is not restricted to SHD in these areas) but to cover gaps (Sites E15, A18, A19, A20, A21);
- CT wildcard areas (designated 'X') such as unburnt site previously identified by Gaikhorst and Lambert (2008) on the PNC baseline east of Ambassador (Sites X22), Malcolm Soak - X23 and, if details are available, any of the previously trapped area by Pearson (1987) north of Queen Victoria Spring Nature Reserve (Sites X23 or X24), and
- Minesite rehabilitation area at Shogun (Site X27).

General guidelines that can increase the success of CT programmes include:

- Cameras should be set up in a location that is flat or gently sloping with limited vegetation in the field of view to reduce false triggers. However, the location chosen for placement of cameras has to be a balance between being able to capture images unimpeded and the habitat preference of the species.
- Lure stations will be located approximately 1.5–2.0m from the horizontal camera. Any vegetation between the camera and the lure, and either side of the lure should be cleared or trimmed. Where possible, any objects that may obstruct the camera's field of view will be removed.
- Station markers or identifiable features (i.e. reference scale) should be included within the camera view, to allow animal size comparisons and to ensure that any pictures can be easily verified to a specific site, if required.
- Where possible, the background (area behind the lure) should be uniform to help reduce temperature differentials between objects i.e. where possible create the optimal homogenous background temperature.
- Selected camera trap sites will have an iButton sensor located with the lure to evaluate temperature dead zones, as this will identify when Passive Infrared (PIR) sensors will not work due to temperature differentials between background and target species body temperature.
- Where camera traps are oriented in a vertical position (facing downwards), cork tile(s) will be placed centrally under the bait device to support low reflectivity from sand grains which will assist in maintaining a constant temperature surface to maximise detection of target species.
- Cameras must be fixed to a stake that will not move in the wind, and the unit should face south to avoid direct sunlight on the lens.
- Where more than two camera setups (same model) are being used, cameras should be set at least 50-75m apart from each other to ensure a reasonable area is surveyed and to maintain conformity with quadrat areas



utilised in previous successful surveys. However, the minimum distance between cameras will depend on the species known mobility and home range size. Different fence lengths will be trialled ranging from 10m to 20m.

- The height of the camera should be set at a height that is specific to the target species of the survey and for SHDs horizontal cameras are located 20cm above the ground and vertical cameras 1.0m above the lure.
- Completion of the site information on the Data Sheet should be done in the field on the setup day (example in Appendix B). The camera's exact location should be recorded as a GPS coordinate on the data record sheet and will conform to the reporting guidelines specified in Meek *et al.* (2014).

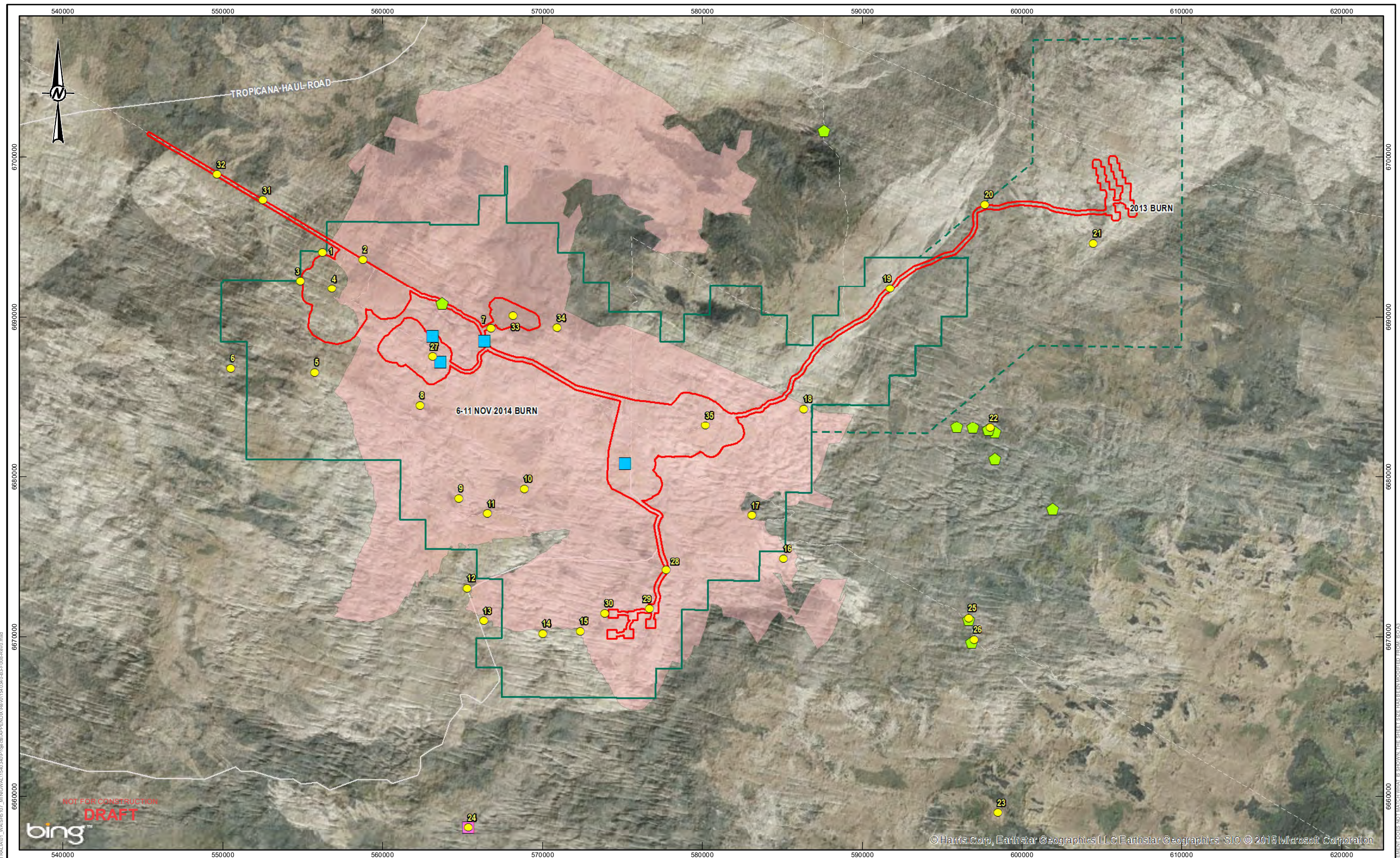
#### 4.6.2 Use of Attractants

Lures or attractants are placed to encourage animals into the detection zone of the camera (Davis 2011) and increase detection probability. To date, lures have not been used in the Pilot or Targetted Camera surveys at Mulga Rock as a review of the early pilot study images identified a robust *Varanus gouldii* and *V. tristis* population that were thought may increase predation on small mammals (see Table 2 c and d). Following the wildfire that has removed most of the ground cover and protective litter, Varanid numbers appear to have decreased.









Because the camera trapping programme has been revised to cover marginal and remnant habitats and corridors, attractants will be utilised for short periods (4-7 days) in some circumstances. The attractant to be used will be the Universal Lure (DEC 2011) (or a variation thereof) dispensed in an appropriate container to minimise ant attack. The use of the Universal Mix lure was selected due to its successful use during the Gaikhorst and Lambert and Ninox surveys in the region.

Several other attractant management methods are outlined in Meek *et al.* (2012) and these will be trialled to determine the most appropriate technique.





## LEGEND

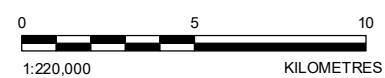
- |   |  |   |   |
|---|--|---|---|
|  | PROPOSED 2015/2016 TRAPPING SITE         |  | ROAD                                    |
|  | PEARSON (CALM) SHD CAPTURE SITE          |  | MRUP DEVELOPMENT ENVELOPE               |
|  | MARTINICK & HART (1985) SHD CAPTURE SITE |  | PROJECT BOUNDARY (MINING TENURE)        |
|  | GAIKHORST & LAMBERT SHD CAPTURE SITE     |  | PROJECT BOUNDARY (MISCELLANEOUS TENURE) |
|  | MINOR ROAD/TRACK                         |  | NOVEMBER 2014 FIRE SCAR                 |

## NOTES

1. COORDINATE SYSTEM: GDA 1994 MGA ZONE 51

## REFERENCE

INFRASTRUCTURE DATA PROVIDED BY CLIENT  
AERIAL IMAGERY SOURCED FROM ESRI ONLINE  
TOPOGRAPHY BASED ON NATIONAL DEM 1 S SOURCED  
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MULGA ROCK URANIUM PROJECT

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## PROPOSED POST-2014 BURN TRAP SITES

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FIGURE 8



**Table 5 Proposed post-fire deployment plan in 2015**

Camera Setup	Existing Trap Sites where Suitable Habitat Remains	Refuge Sites >3ha in Vicinity where SHD's Previously Captured	Refuge Sites >3ha outside of Buffer Zone in Project area	New Sites in Infrastructure Areas not Previously Surveyed	Wild Card Unburnt Sites outside Mulga Rock Tenure	Minesite Rehabilitation Areas
Horizontal & Vertical Camera with Drift Fence – No Lures	Sites MR5,6 and 10/11	Sites E1, E2, E3, E4 – S7, S8, A18	Sites E6, E9, E10, E11, E12, E13, E14, E15	Sites E15, A18, A19, A20, A21	Sites X26, X27	-
Horizontal & Vertical Cameras with Drift Fence – with Lures	Sites MR5,6 and 10/11	Sites E1, E2, E3, E4 – S7, S8, A18		Sites E15, A18, A19, A20, A21	Sites X22, X23, X24	Shogun Slot Rehabilitation Area – Site X27
Horizontal Camera No Drift Fences, +/- Lures	Sites MR5, 6 and 10/11	-	Sites E6, E9, E10, E11, E12, E13, E14, E15	-	Sites X22, X23, X24	-
Vertical Camera No Drift Fences, +/- Lures	Sites MR5, 6 and 10/11	-		-	Sites X22, X23, X24, X25, X26	-

#### 4.6.3 Camera Type

Two camera types are currently used as part of the MRUP Targeted Camera Trapping Programme. These include the Bushnell Trophy Cam HD MAX with passive infra-red flash and the Reconyx Hyperfire 550 with white LED flash for colour day/night photo capture at close range. Reporting based on differences in camera models will ensure that any variance in detection probability between camera types is clearly identified. Layout design will utilise like model cameras to ensure data results can be compared. Selected settings details are outlined in Table 6.

**Table 6 Detection parameters for site cameras**

Parameter	Bushnell Trophy Cam	Reconyx 550 Hyperfire
Image Type	D: Color; N : Grey scale	D & N: HD Color
Pixel Resolution	5M pixel	1080p/3.1M pixel
Frames per Second	1	2
Trigger Speed (Aver. time)	1.34 Seconds	0.2 seconds
Recovery Time	N/A	N/A
Sensor	Passive infrared Motion	Passive infrared Motion
Flash Source and Range	Infrared; 15m	White Flash (LED); 10m
SDHC Card Class 2	4GB - fast write	16GB - fast write
Field of View - Width/Angle	7.0m/50°	6.7m/40°
Image Data	Station, Time/Date, T°C	Station, Time/Date, T°C



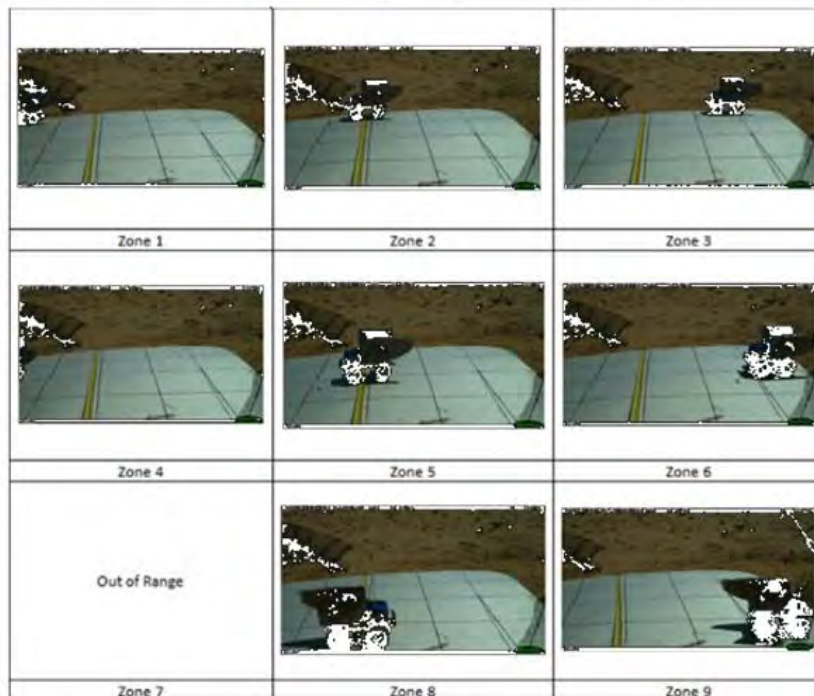
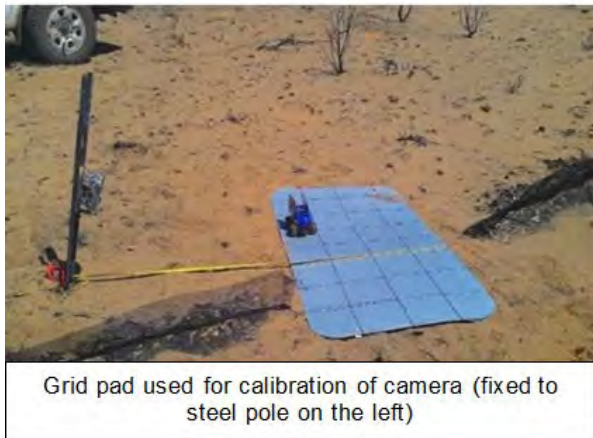
#### **4.6.4 Camera Setup and Calibration**

The precise layout and placement of cameras setup will involve several options depending upon accessibility of the site,, terrain characteristics and camera availability.

Paired cameras (same model) will be set up in stable horizontal and or vertical orientations at selected trap grid sites depending on the site slope and aspect. Single camera setup is currently the standard set up at MRUP and will continue to be used in most situations as it allows a larger number of sites to be tested. This approach is an acceptable strategy during presence /absence surveying.

In all situations, details will be entered onto the data sheet for each camera. Target species will be passively focused to travel past gaps in 10 to 20m long drift net fences (or natural constructions) where detection zones, which may include bait stations, are established. In most cases, cameras will be sited to avoid removal of vegetation. Standardisation of camera set-up is necessary to enable consistent and effective image and future programme comparisons. Cameras are set up (a) to produce five images per trigger, (b) rapid fire and (c) high sensitivity..

Heat and movement detection zones are calibrated using a combination of remote controlled car with a heat source and walk tests. Details of the calibration process for horizontal cameras are shown in Figure 9.



**Figure 9 Calibration of camera for horizontal image capture**

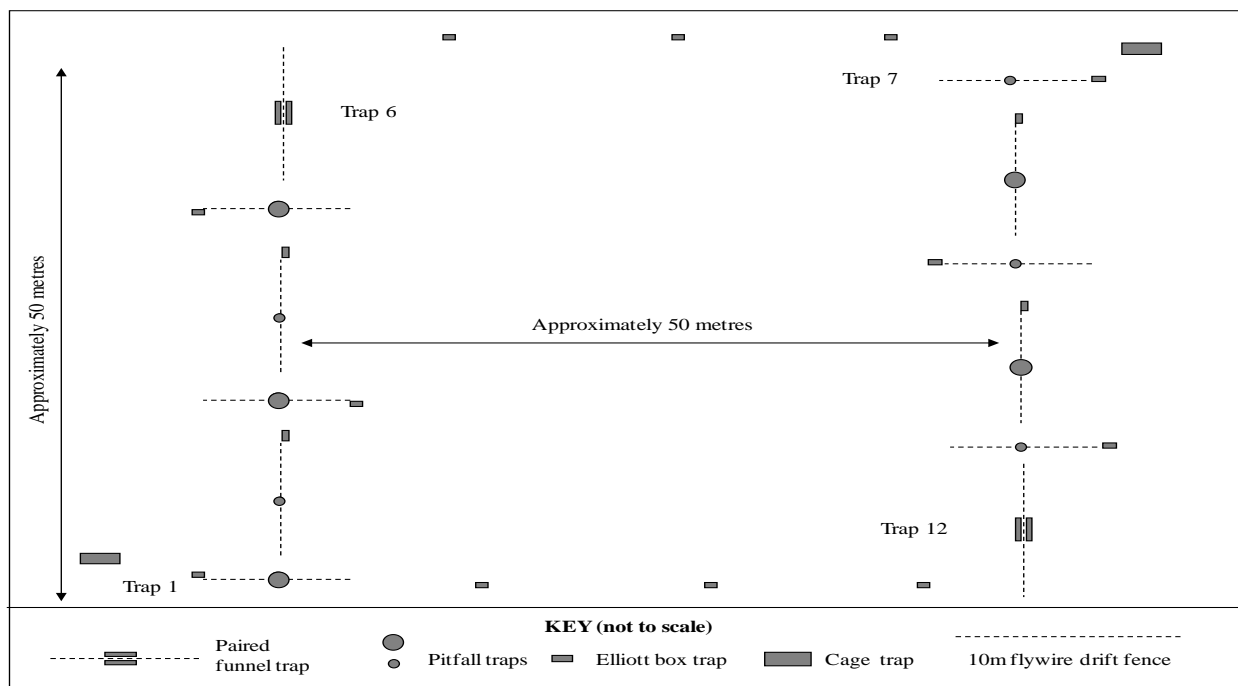
#### Vertical Placement Setup

Diagnostic identification features of the Sandhill Dunnart are the distinctive crest on the last quarter of the tail, large ears, distinctive tail body length and the black anterior colouration on the ears (see Identification Matrix - Table B-5 in Appendix B). To assist in the identification of features, it is proposed to trial, in conjunction with a horizontal camera, a vertically oriented downward directed camera targeting the lure zone. Special attention will be applied during vertical camera set-up to ensure the PIR bands cover the focal zone to ensure small mammals are detected. An example is shown in Figure 11.

#### 4.7 Trap Layout

Four trap layout designs have been trialled to date for the CT Programme, based on the terrain evidence of small mammal activity and vegetation criteria. Fence lengths will vary depending on terrain. Trap layouts include:

- Variations on the Ninox trap quadrat layout (Figure 10) where two sides of the quadrat were fenced with aluminium fly wire approximately 30cm high and buried to a depth of 100mm. Cameras were established to target 1m windrows in the fence line at nominated distances ranging from 10-20m.
- The “X” trap layout (Plate 3) is similar in establishment to the Ninox setup, but had the camera/s located at the intersection point of the fence lines.
- The Dune Trap (Plate 4) was established on small mammal travel ways identified on dune crests. Netting fences were generally not required although placement of branches were used to direct the animal into the camera target zone.



**Figure 10 Diagrammatic Layout of Existing Fauna Trapline Grid**

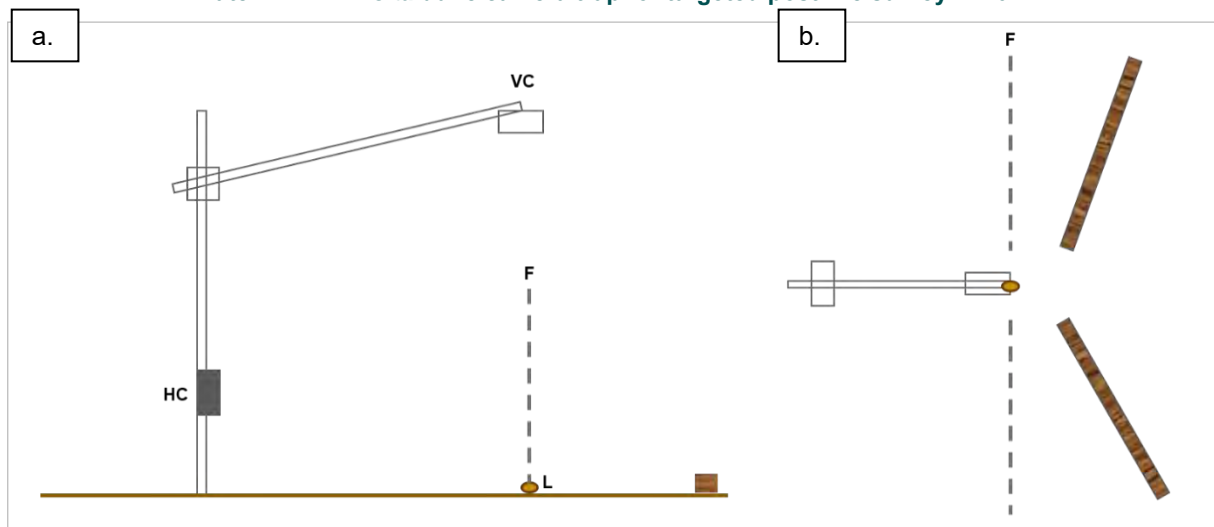
Trap layouts with vertical and horizontal cameras will be deployed in lured and non-lured configurations. The primary aim is to focus the animal's travel to within the vertical camera's field of view and relocatable barriers (i.e. timber branches), shown as brown bars in Figure 11, will be trialled.



**Plate 3** *In situ* camera trap layout for pilot survey in 2013



**Plate 4** *In situ* dune camera trap for targeted post-fire survey in 2014



**Figure 11** Schematic of vertical (VC) and horizontal (HC) camera setup (side and vertical views) with fence (F) and lure (NTS) (a. side view; b. plan view)

#### 4.8 Survey Period and Camera Schedule

The post-fire review has identified 27 potential camera trapping sites to be covered by 35 cameras. Three cameras will be retained as maintenance spares. The post-fire Programme is scheduled to run for approximately nine months or until October 2015 to avoid the risk of camera loss in lightning generated fires. Provisional details are outlined in Table 7 and final deployment matrices will be finalised once habitat inspections are completed. Camera traps may be deployed for up to 60 days at each grid location.

**Table 7 Deployment schedule - Camera Trapping Programme**

	2012				2013				2014				2015			
Mulga Rock Ninox Level 2 Survey 2009																
Mulga Rock Pilot Camera Trap – Swale Sites																
Mulga Rock - Pilot Camera Trap – Dune Sites																
Mulga Rock - Targetted Camera Ninox/Hart Sites Pre-fire - (non lured)																
Mulga Rock - Development Buffer Area Targetted Camera Post-fire Refuge Programme >5ha																
Mulga Rock - External to Development Buffer Area Targetted Fire Boundaries , Refuges and Corridors >5ha																
External Sites to Project – Targetted Camera Unburnt																
Review of Programme																

## 5.0 Data Collection and Reporting

### 5.1 Requirements to Demonstrate Presence of Sandhill Dunnarts

Sandhill Dunnarts have now been detected in the Western Australian GVD over a 30 year period by a range of mammal survey techniques. The most successful reported techniques (although detection rates are extremely low for SHDs by Australian mammal trapping standards), have been live capture in deep pitfall and Elliott traps, camera trapping and scat searches in specialised spinifex habitats on sandy terrains. Although a relatively new process, camera trapping is proposed as the most appropriate of the secondary detection methods and is potentially the most ethical (animals are not physically captured), efficient and cost-effective technique for detecting the presence of Sandhill Dunnarts at the MRUP site when appropriate habitat is present.

The process, described in previous sections, has outlined habitat assessments in accordance with the national Recovery Plan and local surveys, application of camera techniques using best available technology and survey effort, that when implemented, would have provided a reasonable opportunity of detecting SHDs if they are present. The final step in this process is to define what are reasonable records to demonstrate presence/absence and what validation mechanism is proposed. The approach adopted is similar to methodology adopted for *Dasyurus maculatus* (Spotted Quoll) presence in Victorian surveys (DSEWPaC 2011).

### 5.2 Acceptable Records

The absence of a physical specimen requires that a transparent protocol is established to demonstrate that the image contains the animal under review. Acceptable records in respect to camera trapping are considered to be:

- Digital images of Sandhill Dunnarts obtained from remote cameras deployed at identifiable survey sites with selected site data imprinted (including date stamping) on the frame, and
- Digital images to be retained to allow independent confirmation by experienced fauna specialist(s) that the target species is present.

Vimy have identified two specialist fauna groups who have had wide experience with small mammal dasyurids in the arid environments who will provide species verification services from camera images.

They are:

- Ninox Wildlife Consulting: Jan Henry – Principal  
Subconsultants: Andrew Chapman and Peter Orell, and
- GHD: Glen Gaikhorst - Senior Zoologist.

### 5.3 Reporting Standards to Confirm Presence/Absence

The data required for the presence-only reporting also needs to be provided for the presence/absence surveys. A standard reporting data sheet has been developed for the project based on the current version in the Invasive Animals CRC Camera Trapping Manual (Meek *et al.* 2012), and is referenced in Appendix B.

This information will be provided for all surveys, including those that did not detect the target species. The following data is included in the Data Record Sheet (Appendix B) and is considered necessary to support a 'presence' or 'absence' record:

- Start and end date for the survey;
- Name and contact details of the site environmental observer;



- Research permit details where required (i.e. if use of attractants are used), under the *Wildlife Conservation Act 1950*.
- Details of the target species present, number of individuals detected or number of observations;
- Date and time of record on image;
- Description of geographic location, grid size, habitat stage, burn history and cover percentage of the camera site (including GPS coordinates);
- Documentation of the size of the survey area, the number of sites surveyed, the number of camera traps deployed at each site and distance between them;
- The type of camera used and the camera settings;
- GPS co-ordinates of each camera location;
- Photographic evidence of the trap location with a fixed re-locatable feature in the frame;
- Method of observation, including the sampling effort (e.g. number of camera trap nights);
- The name and expertise of the person identifying the image is required.

#### 5.4 Requirement to Demonstrate Absence

While it is relatively straightforward to document if the target species is present, it is generally impossible to determine if a species is truly absent if it was just not recorded during a particular survey, or if the survey was not adequate to reliably record the species or biophysical conditions precluded the likelihood of the species being present.

While there can never be complete certainty that a species is absent, for planning purposes, a species is effectively absent if it is not recorded in a nominated test area in given time frame and surveys are undertaken in accordance with approved sampling guidance documents and recovery plans.

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## 7.0 Glossary of Terms

<b>Camera Trap:</b>	A camera installed in the field to automatically take photographs of animals passing in front of it. The camera trap consists of the camera, a control unit, a sensor and a memory card.
<b>Camera Trap Array:</b>	A set of camera trap points (usually 20-30) distributed at a density according to the home range of the target species. All camera traps in the array sampled during the same 30 day period.
<b>Trap Excel Template:</b>	A blank Excel file with predetermined worksheets and columns used to create camera trap excel files.
<b>Camera Trap Setup:</b>	A form used in the field to record camera trap data such as date and time the camera is set, camera trap number, name of person setting up the camera trap. See Data Recording Sheet – Appendix A.
<b>Camera Trap Point ID:</b>	A unique code, assigned on the basis of a standard convention to a particular <b>camera trap point</b> (i.e., the location, <b>not</b> the camera trap itself). See Data Recording Sheet – Appendix A.
<b>Control Unit:</b>	An electronic camera board with a small central processor unit that turns the camera on and off in response to a signal provided by the sensor. The control unit can be programmed by a user to specify the level of sensitivity to movement, the number of photographs the camera takes when it is activated etc.
<b>Data Recording Sheet:</b>	A paper form to check the status and maintenance, camera trap point data, camera trap metadata records of camera traps before they are deployed in the field. A blank camera trap Data Sheet appears in Appendix A.
<b>Deployment Plan:</b>	A plan describing when, where, and how the protocol will be implemented at a specific site. The plan must contain the proposed sampling design, including the proposed geo-spatial location of each camera trap array, relevant geographic information system ( <b>GIS</b> ) layers (shape files) for each array (e.g. topography, access, water drainages), and a detailed chronogram of activities.
<b>Detection Zone:</b>	The zone within which movement triggers the remote camera to take a photograph. This zone is often cone shaped and may be between 3-10m long and 15° to 72° degrees wide.
<b>Event:</b>	The period of time between independent triggers of distinct individuals regardless of the number of images.
<b>False Negative:</b>	Failure to detect an animal when it is in fact present.
<b>False Positive:</b>	Incorrectly detecting an animal when none are present.
<b>Field of View:</b>	The area captured in an image usually between 35-45°.
<b>Focal Point:</b>	The centre of the image – the subject of interest.
<b>Lure:</b>	A generic term referring to an attractant to encourage animals to investigate a point within the detection zones. Lures may be auditory, olfactory, visual or some combination of these in nature.

<b>Motion Sensor:</b>	A small device mounted in front of and on the outside of the camera trap that detects movement within the area in front of the camera. Signals from the motion sensor travel to the control unit, which in turn, controls the camera.
<b>Night Mode:</b>	This setting allows the device to be set to maximize clarity at night by reducing the illumination power and increasing the speed of the shutter, thus reducing blur.
<b>PIR Sensor:</b>	Passive detectors of infrared light.
<b>Pilot Study:</b>	Replication of an activity on a small scale to check design of an experiment, prior to commencing it on a larger scale
<b>Processed Image:</b>	A photograph that has been annotated using the camera software available and recorded to the Data Recording Sheet and Database.
<b>Rapidfire:</b>	A camera trap setting that allows images to be taken continuously following a trigger event.
<b>Recovery Time:</b>	The time it takes for a remote camera to return to a state where it can take another image. This can vary between 0.1 to 4 seconds depending on the model.
<b>Refugia (Refuge):</b>	An area where conditions have enabled a species or a community of species to survive after extinction in a surrounding area from an agent such as wildfire
<b>Sampling Cycle:</b>	A period of 15 to 30 days during which a set of camera traps is active (sampling) in a given area.
<b>Sampling Design:</b>	Refers to the number of camera traps (sample size), their locations (spatial distribution), the time of year and frequency of successive sampling periods (temporal distribution), and the length of time the cameras are deployed in the field during each sampling period (effort).
<b>Sampling Period:</b>	A specified period of time (e.g. week, month, climatic season) during which all camera trap points are sampled.
<b>SD Card:</b>	The acronym for Secure Digital cards. A removable digital storage medium that is currently the standard in camera traps.
<b>Sensitivity:</b>	A setting, often adjustable, that reflects the camera's response to heat in motion for PIR sensors. Higher sensitivity is associated with more images, and lower sensitivity with fewer images. Increased sensitivity, however, does not guarantee detection of a target.
<b>Sequence:</b>	A series of still images or video taken in rapid succession but separated by a time interval less than the set independence interval and forming an animated record of a triggering event.
<b>Targetted Survey</b>	The aim of a targeted survey is to detect the presence of a significant species.
<b>Time Lapse:</b>	A program function available on some camera traps. The time-lapse function typically allows a user to prescribe times of day/night when the camera is inactive, regardless of activity within the detection zone. Some time-lapse cameras do not have a PIR and, instead, capture images at prescribed times or intervals.



<b>Time to First Trigger:</b>	The speed of the camera from detection by the PIR sensor to the first image captured.
<b>Trigger time</b>	The time it takes for a remote camera to take a photo after an animal has moved into the detection zone.
<b>Trigger or Capture Speed:</b>	The time difference between detecting heat in motion and capturing an image. Also known as response time. Slower trigger speed (i.e. more time elapsing between trigger and image capture) may decrease the likelihood of capturing a target.
<b>Walk Test:</b>	A program function available on some camera traps. Walk test, or similar, can be used to identify where a camera will respond to heat in motion. Consequently, it can be used to 'focus' the camera's detection zone, as desired.
<b>White LED:</b>	A white flash consisting of white LED's in an array similar to an infra-red array that illuminates the subject at night in full colour and is faster than xenon flash technology.

## 8.0 List of Abbreviations

<b>Abbreviation</b>	<b>Description</b>
BOM	Bureau of Meteorology
DPaW	Department of Parks and Wildlife (formerly Department of Environment and Conservation – DEC, formerly Department of Conservation and Land Management – CALM)
DPI	Department of Primary Industries
DSEWPoC	Department of Sustainability, Environment, Water, Population and Communities
EAMA or EMA	Energy and Minerals Australia Limited
Ecologia	Ecologia Environmental Pty Ltd
EPA	Environmental Protection Authority
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i> (Cth)
GHD	GHD
GVD	Great Victoria Desert
HD	High Definition
IBRA	Interim Biogeographic Regionalisation of Australia
IUCN	International Union for Conservation of Nature
Mattiske or MCPL	Mattiske Consulting Pty Ltd
MRUP	Mulga Rock Uranium Project
Ninox	Ninox Wildlife Consulting
NSW	New South Wales
PIR	PIR Sensor: passive detectors of infrared light
PNC	Pacific Nuclear Corporation of Japan
QVS NR	Queen Victoria Springs Nature Reserve
SHD	<i>Sminthopsis psammophila</i> (Sandhill Dunnart)
SPRAT	Species Profile and Threats Database
Vimy	Vimy Resources Limited
WC Act	The <i>Wildlife Conservation Act 1950</i> (WA) (WC Act)



## Appendix A

Habitat Review of Sampling Sites and Assessment  
of what constitutes a preferred Sandhill Dunnart Habitat

## Appendix A1

### Comparison of GVD habitat descriptions with Mattiske MRUP vegetation types



**TABLE A-1: SANDHILL DUNNART HABITAT PREFERENCES: PRELIMINARY COMPARISON BETWEEN VEGETATION COMMUNITIES DEFINED IN THE SOUTH WEST OF THE GREAT VICTORIA DESERT**

**Note:** Text in Orange is the overlap points.

Sandhill Dunnart Habitat Likelihood	Other Code	Other Vegetation Description	Most Similar: MRUP Code	Most Similar VRL: MRUP Vegetation Description	MCPL Confidence On Similarity
Prime	E04 (AGA0902)	Low Woodland to Low Open Woodland of <i>Eucalyptus gongylocarpa</i> with <i>Callitris preissii</i> and <i>Eucalyptus</i> spp. over mixed shrubs over <i>Triodia</i> spp. This community occurs on orange, red-orange, yellow-orange and yellow sandy loams on mixed topographies	E3	Low open woodland of <i>Eucalyptus gongylocarpa</i> over <i>Eucalyptus youngiana</i> , <i>Eucalyptus ceratocorys</i> , <i>Grevillea juncifolia</i> , <i>Hakea francisiana</i> and <i>Callitris preissii</i> over <i>Acacia helmsiana</i> , <i>Cryptandra distigma</i> and mixed low shrubs over <i>Triodia desertorum</i> , <i>Chrysitrix distigmata</i> and <i>Lepidobolus deserti</i> . This community occurs on yellow and yellow-orange sands on flats, slopes and between dunes.	<b>MEDIUM</b> The more common <i>Eucalyptus</i> community with mixed <i>Eucalyptus</i> spp. and common shrub spp. occurring on most sand types.
Prime	e19L.t2t7H including subtype e19L.d3er1St2t7 H and e19exL.xSt7H (ecologia)	<i>Eucalyptus gongylocarpa</i> over <i>Triodia desertorum</i> or <i>Triodia basedowii</i> open hummock grasses on swales and lower dune slopes or over <i>Dodonaea viscosa</i> , <i>Eremophila platythamnus</i> open shrubland over <i>Triodia</i> or with <i>Eucalyptus youngiana</i> or <i>Eucalyptus concinna</i> over mixed open shrubland	E3	Low open woodland of <i>Eucalyptus gongylocarpa</i> over <i>Eucalyptus youngiana</i> , <i>Eucalyptus ceratocorys</i> , <i>Grevillea juncifolia</i> , <i>Hakea francisiana</i> and <i>Callitris preissii</i> over <i>Acacia helmsiana</i> , <i>Cryptandra distigma</i> and mixed low shrubs over <i>Triodia desertorum</i> , <i>Chrysitrix distigmata</i> and <i>Lepidobolus deserti</i> . This community occurs on yellow and yellow-orange sands on flats, slopes and between dunes.	<b>MEDIUM</b> Could be the common (E3) <i>Eucalyptus gongylocarpa</i> community that occurs in the MRUP area.
Prime	xS.t2t7H (ecologia)	Isolated trees of <i>Eucalyptus gongylocarpa</i> over mixed shrub and <i>Triodia desertorum</i> and or <i>Triodia basedowii</i> sparse hummock grasses on longitudinal dunes	S6	Low shrubland of <i>Thryptomene biseriata</i> , <i>Allocasuarina spinosissima</i> , <i>Allocasuarina acutivalvis</i> subsp. <i>acutivalvis</i> , <i>Jacksonia arida</i> , <i>Calothamnus gilesii</i> , <i>Acacia fragilis</i> , <i>Conospermum toddii</i> (P4), <i>Pityrodia lepidota</i> , <i>Lomandra leucocephala</i> , <i>Anthotroche pannosa</i> and mixed low shrubs over <i>Triodia desertorum</i> with <i>Lepidobolus deserti</i> with emergent <i>Eucalyptus gongylocarpa</i> , <i>Eucalyptus youngiana</i> , <i>Eucalyptus ceratocorys</i> and <i>Eucalyptus mannensis</i> subsp. <i>mannensis</i> . This community occurs on yellow sand dunes.	<b>HIGH</b> Longitudinal dune presence determines vegetation community. This community might also match E11 from AGA0902 which didn't mention <i>Triodia</i> presence.
Likely	E13 (AGA0902)	Open Shrub Mallee to Very Open Shrub Mallee of <i>Eucalyptus leptophylla</i> with <i>Eucalyptus trivalva</i> , <i>Eucalyptus youngiana</i> and <i>Callitris preissii</i> over <i>Acacia helmsiana</i> , <i>Hakea francisiana</i> over <i>Triodia rigidissima</i> . This community occurs on orange-yellow sandy loam on flats and undulating plains	E8	Open scrub mallee to very open scrub mallee of <i>Eucalyptus ceratocorys</i> and <i>Eucalyptus mannensis</i> subsp. <i>mannensis</i> with <i>Eucalyptus youngiana</i> , <i>Hakea francisiana</i> and <i>Grevillea juncifolia</i> over <i>Acacia fragilis</i> , <i>Acacia helmsiana</i> and mixed low shrubs over <i>Triodia desertorum</i> , <i>Chrysitrix distigmata</i> and <i>Lepidobolus deserti</i> with emergent <i>Eucalyptus gongylocarpa</i> . This community occurs on yellow sands on flats and slopes.	<b>HIGH</b> Mixed <i>Eucalyptus</i> woodlands with mixed shrubs which were not myrtaceous on yellow sand flats.

Sandhill Dunnart Habitat Likelihood	Other Code	Other Vegetation Description	Most Similar: MRUP Code	Most Similar VRL: MRUP Vegetation Description	MCPL Confidence On Similarity
Likely	E15 (AGA0902)	Very Open Shrub Mallee of <i>Eucalyptus youngiana</i> and mixed <i>Eucalyptus</i> spp. over <i>Acacia desertorum</i> var. <i>desertorum</i> , <i>Bertya dimerostigma</i> , <i>Westringia cephalantha</i> , <i>Cryptandra distigma</i> with mixed shrubs over <i>Triodia desertorum</i> . This community occurs on orange sandy loams on lower slopes	E13	Low open mallee woodland of <i>Eucalyptus youngiana</i> over low shrubland of <i>Grevillea didymobotrya</i> subsp. <i>didymobotrya</i> , <i>Cryptandra distigma</i> , <i>Banksia elderiana</i> , <i>Calothamnus gilesii</i> , <i>Acacia desertorum</i> var. <i>desertorum</i> and other <i>Acacia</i> spp. over open <i>Triodia</i> spp. hummock grassland with <i>Chrysitrix distigmata</i> and some low myrtaceous shrubs (and occasional emergent <i>Eucalyptus gongylocarpa</i> ). This community occurs on orange-yellow sandy loams on lower slopes and flats	MEDIUM <i>Eucalyptus youngiana</i> woodland with mixed shrubs on orange sandy loams on lower slopes.
Marginal	E14 (AGA0902)	Very Open Shrub Mallee of <i>Eucalyptus rosacea</i> with <i>Callitris preissii</i> over <i>Acacia sibina</i> , <i>Phebalium laevigatum</i> and low <i>Myrtaceous</i> shrubs over <i>Triodia</i> spp. This community occurs on orange sandy loams on flats	S5	Shrubland to open shrubland of <i>Acacia sibina</i> with <i>Phebalium tuberosum</i> over <i>Enekbatus eremaeus</i> , <i>Bertya dimerostigma</i> , <i>Homalocalyx thryptomenoides</i> , <i>Baeckea</i> sp. Great Victoria Desert (A.S. Weston 14813), <i>Melaleuca hamata</i> and mixed low shrubs over <i>Triodia desertorum</i> and <i>Chrysitrix distigmata</i> with occasional emergent <i>Eucalyptus gongylocarpa</i> and <i>Eucalyptus youngiana</i> . This community occurs on yellow-orange sands on flats and lower slopes.	HIGH Myrtaceous heath on orange flats with emergent <i>Eucalyptus</i> spp.
Marginal	E12 (AGA0902)	Open Shrub Mallee to Very Open Shrub Mallee of <i>Eucalyptus platycorys</i> , <i>Eucalyptus oleosa</i> , <i>Eucalyptus horistes</i> and other <i>Eucalyptus</i> spp. over <i>Westringia cephalantha</i> , <i>Acacia sibina</i> , <i>Acacia hemiteles</i> over <i>Triodia</i> spp. This community occurs on orange sandy loam on flats.	E2	Low woodland to open scrub mallee of <i>Eucalyptus trivalva</i> and <i>Eucalyptus platycorys</i> with <i>Callitris preissii</i> and <i>Hakea francisiana</i> over <i>Acacia colletioides</i> , <i>Acacia hemiteles</i> , <i>Melaleuca hamata</i> , <i>Westringia cephalantha</i> , <i>Bertya dimerostigma</i> and mixed shrubs over <i>Triodia desertorum</i> with occasional emergent <i>Eucalyptus gongylocarpa</i> . This community occurs on red-orange sandy loams on flats.	LOW Mixed woodlands over mixed <i>Acacia</i> on orange sand flats
Marginal	exL.t2H including subtypes exL.a20S.t2H and e20p2L.xSt2H (ecologia)	<i>Eucalyptus</i> spp, woodlands over open shrublands over <i>Triodia basedowii</i> , or with <i>Eucalyptus youngiana</i> , <i>Eucalyptus trivalva</i> or <i>Eucalyptus leptopoda</i> open mallee woodland over <i>Acacia murrayana</i> over <i>Triodia</i> , or with <i>Callitris preissii</i>	E2	Low woodland to open scrub mallee of <i>Eucalyptus trivalva</i> and <i>Eucalyptus platycorys</i> with <i>Callitris preissii</i> and <i>Hakea francisiana</i> over <i>Acacia colletioides</i> , <i>Acacia hemiteles</i> , <i>Melaleuca hamata</i> , <i>Westringia cephalantha</i> , <i>Bertya dimerostigma</i> and mixed shrubs over <i>Triodia desertorum</i> with occasional emergent <i>Eucalyptus gongylocarpa</i> . This community occurs on red-orange sandy loams on flats.	LOW This community has multiple <i>Eucalyptus</i> spp. over <i>Acacia</i> shrublands with <i>Callitris preissii</i> and <i>Triodia</i> grasslands.
Marginal	e71L.xZt8H (ecologia)	<i>Eucalyptus concinna</i> open mallee woodland over sparse to open low shrubs over <i>Triodia scariosa</i> open hummock grassland on undulating plains.	E1, E2, E4, E10, E11	Too vague	UNSURE Maybe E10 or E11 which are <i>Eucalyptus concinna</i> over shrublands and <i>Triodia</i> ( <i>T. desertorum</i> and <i>T. rigidissima</i> ).

Sandhill Dunnart Habitat Likelihood	Other Code	Other Vegetation Description	Most Similar: MRUP Code	Most Similar VRL: MRUP Vegetation Description	MCPL Confidence On Similarity
Potential	Veg Assoc 84 (Beard 1974)	<i>Eucalyptus gongylocarpa</i> , Mallee, <i>Triodia basedowii</i> between dunes	E5	Low open woodland of <i>Eucalyptus gongylocarpa</i> over <i>Eucalyptus rigidula</i> and <i>Eucalyptus</i> sp. Mulga Rock (K.D. Hill & L.A.S. Johnson KH 2668) with <i>Hakea francisiana</i> and <i>Grevillea juncifolia</i> over <i>Westringia cephalantha</i> , <i>Acacia helmsiana</i> , <i>Acacia rigens</i> , <i>Eremophila platythamnus</i> subsp. <i>platythamnus</i> , <i>Cryptandra distigma</i> and mixed low shrubs over <i>Triodia desertorum</i> , <i>Triodia rigidissima</i> and <i>Chrysitrix distigmata</i> . This community occurs on yellow and orange sands on flats and slopes.	<b>MEDIUM</b> Dominated by <i>Eucalyptus gongylocarpa</i> , without <i>Eucalyptus youngiana</i> , with other <i>Eucalyptus</i> spp. mallees and <i>Triodia</i> spp. between dunes.
Potential	Veg Assoc 85 (Beard 1974)	<i>Eucalyptus gongylocarpa</i> , Mallee, <i>Triodia basedowii</i> on sandplain	E5	Low open woodland of <i>Eucalyptus gongylocarpa</i> over <i>Eucalyptus rigidula</i> and <i>Eucalyptus</i> sp. Mulga Rock (K.D. Hill & L.A.S. Johnson KH 2668) with <i>Hakea francisiana</i> and <i>Grevillea juncifolia</i> over <i>Westringia cephalantha</i> , <i>Acacia helmsiana</i> , <i>Acacia rigens</i> , <i>Eremophila platythamnus</i> subsp. <i>platythamnus</i> , <i>Cryptandra distigma</i> and mixed low shrubs over <i>Triodia desertorum</i> , <i>Triodia rigidissima</i> and <i>Chrysitrix distigmata</i> . This community occurs on yellow and orange sands on flats and slopes.	<b>MEDIUM</b> Dominated by <i>Eucalyptus gongylocarpa</i> without <i>Eucalyptus youngiana</i> with other mallees and <i>Triodia</i> on flat sand.
Potential	Veg Assoc 109 (Beard 1974)	<i>Eucalyptus youngiana</i> mallee over shrubs and <i>Triodia basedowii</i>	E13	Low open mallee woodland of <i>Eucalyptus youngiana</i> over low shrubland of <i>Grevillea didymobotrya</i> subsp. <i>didymobotrya</i> , <i>Cryptandra distigma</i> , <i>Banksia elderiana</i> , <i>Calothamnus gilesii</i> , <i>Acacia desertorum</i> var. <i>desertorum</i> and other <i>Acacia</i> spp. over open <i>Triodia</i> spp. hummock grassland with <i>Chrysitrix distigmata</i> and some low myrtaceous shrubs (and occasional emergent <i>Eucalyptus gongylocarpa</i> ). This community occurs on orange-yellow sandy loams on lower slopes and flats	<b>LOW</b> <i>Eucalyptus youngiana</i> dominated community, however this species is common with or without other mallees. The shrubland in this community is also common but hard to compare with the veg. association 'shrubs', and has y spp.
Potential	Veg Assoc 110 (Beard 1974)	<i>Eucalyptus oleosa</i> mallee over shrubs and <i>Triodia scariosa</i>	-		<b>N/A</b> Occurs further east of the MRUP area, MCPL has not defined a <i>Eucalyptus oleosa</i> community for MRUP.
Potential	Veg Assoc 239 (Beard 1974)	<i>Eucalyptus gongylocarpa</i> and <i>Eucalyptus youngiana</i> mallee over <i>Triodia basedowii</i> between dunes	E3	Low open woodland of <i>Eucalyptus gongylocarpa</i> over <i>Eucalyptus youngiana</i> , <i>Eucalyptus ceratocorys</i> , <i>Grevillea juncifolia</i> , <i>Hakea francisiana</i> and <i>Callitris preissii</i> over <i>Acacia helmsiana</i> , <i>Cryptandra distigma</i> and mixed low shrubs over <i>Triodia desertorum</i> , <i>Chrysitrix distigmata</i> and <i>Lepidobolus deserti</i> . This community occurs on yellow and yellow-orange sands on flats, slopes and between dunes.	<b>MEDIUM</b> This community has both <i>Eucalyptus gongylocarpa</i> and <i>Eucalyptus youngiana</i> over <i>Triodia</i> between dunes.

## Appendix A2

### **Mulga Rock – 1985 Survey (Martnick 1986)**



**Table A-2: Mulga Rock Uranium Project – Sandhill Dunnart Capture Sites (Martinick 1986)<sup>1</sup>**

Fauna Site Code	Mattiske Plant Community Code	Description	Easting Northing
M-05	E7	Marble Gum ( <i>E. gonylocarpa</i> ) Tree Steppe – <i>Callitris collumellaris</i> , <i>E. incrassata</i> , <i>E. leptophylla</i> – 3-6m, 30% <i>Acacia justonii</i> , <i>Bertya dimerostigma</i> , <i>Santalum acuminatum</i> , <i>Eremophila platythamnus</i> . 0.5-1.5m, <30%, <i>Triodia basedowii</i> <30%. Bare ground >50%. Deep yellow sand.	563,110 mE 6,688,790 mN
M-06	E5	Mallee ( <i>E. leptophylla</i> var. <i>floribunda</i> – shrubland, <i>E. concinna</i> – 2-4m, 1-10%; <i>Melaleuca uncinata</i> , <i>Grevillea</i> sp. <i>Bertya dimerostigma</i> 0.8-1.5m, 10%. <i>Triodia basedowii</i> , <i>Chrysitrix distigmatica</i> 20%. Bare ground >50%.	563,520 mE 6,687,290 mN
M-07	E5	Narrow leafed Mallee ( <i>E. leptophylla</i> ), shrubland – open 2.5-3.0m, 1% <i>Acacia jutsonii</i> shrub, <i>Leptospermum fastigiatum</i> 0.8-1m, 10-30%, <i>Grevillea</i> sp. <i>affhakeoides</i> , <i>Allocasuarina corniculata</i> , <i>Cryptandra</i> sp., <i>Bertya dimerostigma</i> , <i>Triodia basedowii</i> - 30% Bare ground - 50%.	575,160 mE 6,682,830 mN
M-11	S1	Broombush ( <i>Melaleuca uncinata</i> ) Thicket adjacent to <i>Eucalyptus Euc-concinna</i> <1%, <i>Acacia colletioides</i> , <i>Olearia</i> sp. 1-2m >30%. <i>Triodia basedowii</i> – 1%. Bare ground 50%.	566,340 mE 6,688,500 mN

<sup>1</sup> The one male Sandhill Dunnart reported in Gaikhorst and Lambert (2008) for site 11-1 (563,860 mE/ 6,691,015 mN) was captured on Mattiske Plant Community Code S8 characterised by Low Open Shrubland of *Calothamnus gilesii*, *Persoonia pertinax*, *Thryptomene biseriata*, and *Leptospermum fastigiatum* with *Anthroche pannosa*, *Acacia helmsiana*, *Microcorys macredieana*, *Micromyrtus stenocalyx*, and mixed low shrubs over *Triodia desertorum* with *Lepidobolus deserti*, *Chrysitrix distigmatica* and *Caustis dioica* with emergent *Eucalyptus youngiana* and *Eucalyptus gonylocarpa*. This community occurs on yellow sands flats adjacent to yellow sands dunes and undulating plains.

**Trap Site Locations (Martinick 1986)**



**Trap Site M-01**



**Trap Site M-02**



**Trap Site M-03**



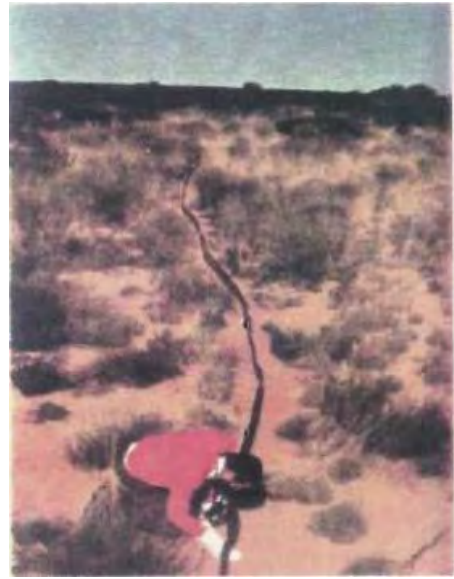
**Trap Site M-04**



**Trap Site M-05**



**Trap Site M-06**



**Trap Site M-07**



**Trap Site M-08**



**Trap Site M-09**



**Trap Site M-10a**



**Trap Site M-10b**





**Trap Site M-11**



**Trap Site M-12a**



**Trap Site M-12b**



**Trap Site M-13**



**Trap Site M-14**



## Appendix A3

### **Mulga Rock – 2009 Survey (Ninox 2010)**

**Table A-3: List of Sampling Sites within the Mulga Rock Project Area (Ninox 2009)**

Fauna Site Code	PNC Site Code	Mattiske Plant Community Code	Description	Easting Northing
MR01	M-07	E6 with influence E5 species	<p>E6 Open Scrub Mallee to Very Open Scrub Mallee of <i>Eucalyptus rigidula</i> over <i>Westringia rigida</i>, <i>Grevillea acuaria</i> and mixed low shrubs over <i>Triodia desertorum</i> with <i>Halgania cyanea</i>.</p> <p>E5 Low Open Woodland of <i>Eucalyptus gongylocarpa</i> over <i>Eucalyptus rigidula</i> with <i>Hakea francisiana</i> and <i>Grevillea juncifolia</i> over <i>Westringia cephalantha</i>, <i>Eremophila platythamnus</i> subsp. <i>platythamnus</i> and mixed low shrubs over <i>Triodia desertorum</i>.</p>	575 160 6 680 830
MR02		E8	E8 Open Scrub Mallee to Very Open Scrub Mallee of varying <i>Eucalyptus</i> spp. with <i>Hakea francisiana</i> and <i>Grevillea juncifolia</i> over <i>Westringia cephalantha</i> , <i>Acacia hemiteles</i> , <i>Acacia fragilis</i> , <i>Acacia helmsiana</i> and mixed low shrubs over <i>Triodia desertorum</i> with emergent <i>Eucalyptus gongylocarpa</i> .	573 052 6 682 213
MR03		E3	E3 Low Open Woodland of <i>Eucalyptus gongylocarpa</i> over <i>Eucalyptus youngiana</i> , <i>Grevillea juncifolia</i> , <i>Callitris preissii</i> and <i>Hakea francisiana</i> over mixed low shrubs over <i>Triodia desertorum</i> with <i>Chrysitrix distigmata</i> and <i>Lepidobolus deserti</i> (P4).	575 537 6 683 050
MR04	M-03	E6	E6 Open Scrub Mallee to Very Open Scrub Mallee of <i>Eucalyptus rigidula</i> over <i>Westringia rigida</i> , <i>Grevillea acuaria</i> and mixed low shrubs over <i>Triodia desertorum</i> with <i>Halgania cyanea</i> .	576 919 6 681 716
MR05		S6	S6 Low Shrubland of <i>Thryptomene biseriata</i> , <i>Allocasuarina spinosissima</i> , <i>Jacksonia arida</i> (ms), <i>Calothamnus gilesii</i> , <i>Acacia fragilis</i> , <i>Conospermum toddii</i> (R), <i>Pityrodia lepidota</i> , <i>Lomandra leucocephala</i> , <i>Anthotroche pannosa</i> and mixed low shrubs over <i>Triodia desertorum</i> with <i>Lepidobolus deserti</i> (P4) and occasional emergent <i>Eucalyptus</i> spp. This community occurs on yellow sand dunes.	576 869 6 681 745
MR06		Near ecotone of E5 and E3	<p>E3 Low Open Woodland of <i>Eucalyptus gongylocarpa</i> over <i>Eucalyptus youngiana</i>, <i>Grevillea juncifolia</i>, <i>Callitris preissii</i> and <i>Hakea francisiana</i> over mixed low shrubs over <i>Triodia desertorum</i> with <i>Chrysitrix distigmata</i> and <i>Lepidobolus deserti</i> (P4).</p> <p>E5 Low Open Woodland of <i>Eucalyptus gongylocarpa</i> over <i>Eucalyptus rigidula</i> with <i>Hakea francisiana</i> and <i>Grevillea juncifolia</i> over <i>Westringia cephalantha</i>, <i>Eremophila platythamnus</i> subsp. <i>platythamnus</i> and mixed low shrubs over <i>Triodia desertorum</i>.</p>	573 908 6 684 097
MR07		E5	E5 Low Open Woodland of <i>Eucalyptus gongylocarpa</i> over <i>Eucalyptus rigidula</i> with <i>Hakea francisiana</i> and <i>Grevillea juncifolia</i> over <i>Westringia cephalantha</i> , <i>Eremophila platythamnus</i> subsp. <i>platythamnus</i> and mixed low shrubs over <i>Triodia desertorum</i> .	578 700 6 682 698
MR08		S7 next to track, then moves into E3	<p>S7 Low Shrubland to Low Open Shrubland of <i>Enekbatus eremaeus</i>, <i>Acacia desertorum</i> var. <i>desertorum</i>, <i>Verticordia helmsii</i>, <i>Homalocalyx thryptomenoides</i>, <i>Leptospermum fastigiatum</i>, <i>Baeckea</i> sp. Great Victoria Desert (A.S. Weston 14813) (P2), <i>Leptosema chambersii</i> and mixed low shrubs over <i>Triodia desertorum</i> and <i>Chrysitrix distigmata</i> with occasional emergent mallee <i>Eucalyptus</i> species, <i>Grevillea juncifolia</i> and <i>Hakea francisiana</i>.</p> <p>E3 Low Open Woodland of <i>Eucalyptus gongylocarpa</i> over <i>Eucalyptus youngiana</i>, <i>Grevillea juncifolia</i>, <i>Callitris preissii</i> and <i>Hakea francisiana</i> over mixed low shrubs over <i>Triodia desertorum</i> with <i>Chrysitrix distigmata</i> and <i>Lepidobolus deserti</i> (P4).</p>	574 930 6 683 986
MR09		S8 at top of slope, E3 at bottom	<p>S8 Low Open Shrubland of <i>Calothamnus gilesii</i>, <i>Persoonia pertinax</i> and mixed low shrubs with occasional emergent <i>Eucalyptus youngiana</i> and <i>Eucalyptus gongylocarpa</i>.</p> <p>E3 Low Open Woodland of <i>Eucalyptus gongylocarpa</i> over <i>Eucalyptus youngiana</i>, <i>Grevillea juncifolia</i>, <i>Callitris preissii</i> and <i>Hakea francisiana</i> over mixed low shrubs over <i>Triodia desertorum</i> with <i>Chrysitrix distigmata</i> and <i>Lepidobolus deserti</i> (P4).</p>	578 057 6 683 470
MR10	M-11	S1	S1 Shrubland of <i>Melaleuca hamata</i> with <i>Hakea francisiana</i> and mixed shrubs over <i>Triodia desertorum</i> with emergent <i>Eucalyptus</i> spp.	566 315 6 688 517

**Trap Site Photographs (Ninox 2010)**



**Trap Site N-01**



**Trap Site N-02**



**Trap Site N-03**



**Trap Site N-04**



**Trap Site N-05**



**Trap Site N-06**





**Trap Site N-07**



**Trap Site N-08**



**Trap Site N-09**



**Trap Site N-10**





## Appendix B

### Data Recording Sheets

## CAMERA MONITORING DATA SHEET

*Fill out a data sheet for each station and record data by circling relevant information*
















Location and Site Code:		Date Set:	Date Retrieved:		
			No of Observation Days:		
OBSERVER/S			Insert Site Photo Here		
LOCATION DESCRIPTION:					
Landscape Photopoint:      Orientation:		Photo File No:			
MGA COORD (GDA 94 - Zone 51)	Easting:				
	Northing:				
	RL:				
	Accuracy:				
Landform Type	Soils	Drainage	Vegetation Community	Fire History	Spinifex Stage and % Cover
<input type="checkbox"/> Longitudinal Dune <input type="checkbox"/> Complex (Tuning Fork) <input type="checkbox"/> Network Dune <input type="checkbox"/> Sandsheet <input type="checkbox"/> Crest <input type="checkbox"/> Flank <input type="checkbox"/> Swale Dune Height:            m Dune Separation:       m	<input type="checkbox"/> Red Sands <input type="checkbox"/> Orange Sands <input type="checkbox"/> Yellow Sands <input type="checkbox"/> Kopi <input type="checkbox"/> Red Earth <input type="checkbox"/> Other	<input type="checkbox"/> Claypan <input type="checkbox"/> Lunette <input type="checkbox"/> Kopi <input type="checkbox"/> Mounds <input type="checkbox"/> Swale <input type="checkbox"/> Other	<input type="checkbox"/> Open Woodland <input type="checkbox"/> Woodland <input type="checkbox"/> Low Woodland <input type="checkbox"/> Thicket <input type="checkbox"/> Shrubland <input type="checkbox"/> Hummock Grasslands <input type="checkbox"/> Mechanically Disturbed	<input type="checkbox"/> > 30 years unburnt <input type="checkbox"/> Burnt in last 20 to 30 years <input type="checkbox"/> Burnt in last 10 to 20 years <input type="checkbox"/> Burnt in last 1-10 years <input type="checkbox"/> Burnt in last year  Distance to nearest burn area Reference:	
HABITAT DESCRIPTION					
VEGETATION TYPE from attached legend					
Camera Type:		Camera Code:		Lock Key: #	
ASPECT TO TARGET ZONE		CAMERA HEIGHT:                      cm		DISTANCE TO TARGET ZONE:                      m	
FACING DOWN: <input type="checkbox"/> Yes <input type="checkbox"/> No		CAMERA ORIENTATION:		LURE RECIPE:	
LANDSCAPE: <input type="checkbox"/> Yes <input type="checkbox"/> No		ANGLE TO GROUND:		LURE TYPE/PLACEMENT :	
CAMERA SETTINGS: <input type="checkbox"/> Animal Trail <input type="checkbox"/> Fence Gap <input type="checkbox"/> Other                      Lens Cleaned: <input type="checkbox"/> Yes <input type="checkbox"/> No					
BATTERY TYPE:                      NO:		BATTERY REPLACEMENT DATE:			
CARD TYPE:                      CAPACITY:		REPLACEMENT DATE:		No. of IMAGES:	
Camera Type :		Camera Code:		Lock Key: #	
ASPECT TO TARGET ZONE		CAMERA HEIGHT:                      cm		DISTANCE TO TARGET ZONE:                      m	
FACING DOWN: <input type="checkbox"/> Yes <input type="checkbox"/> No		CAMERA DIRECTION:		LURE RECIPE:	
LANDSCAPE: <input type="checkbox"/> Yes <input type="checkbox"/> No		ANGLE TO GROUND:		LURE TYPE/PLACEMENT :	
CAMERA SETTINGS: <input type="checkbox"/> Animal Trail <input type="checkbox"/> Fence Gap <input type="checkbox"/> Other                      Lens Cleaned: <input type="checkbox"/> Yes <input type="checkbox"/> No					
BATTERY TYPE:                      NO:		BATTERY REPLACEMENT DATE:			
CARD TYPE:                      CAPACITY:		REPLACEMENT DATE:		No of IMAGES:	
Weather Station # 1, 2, 3		Data File:		Synopsis during Monitoring Period:	
GENERAL COMMENTS: Presence of tracks, scats, significant sand disturbance and positioning of trap in respect to animal passage.					

Data sheet modified after Meek P.D., Ballard G., Fleming P. (2012), Pestsmart Toolkit

**TABLE B-1: MULGA ROCK PROJECT AREA - MATTISKE VEGETATION CODES**

Fauna Site	Site Description	Mattiske Vegetation Community Code	Vegetation Description described by Mattiske (2008)
MR01	Open Scrub Mallee of <i>Eucalyptus rigidula</i> over low shrubs and <i>Triodia</i> .	E6 with influence E5 species	<p>E6 Open Scrub Mallee to Very Open Scrub Mallee of <i>Eucalyptus rigidula</i> over <i>Westringia rigida</i>, <i>Grevillea acuarina</i> and mixed low shrubs over <i>Triodia desertorum</i> with <i>Halgania cyanea</i>.</p> <p>E5 Low Open Woodland of <i>Eucalyptus gongylocarpa</i> over <i>Eucalyptus rigidula</i> with <i>Hakea francisiana</i> and <i>Grevillea juncifolia</i> over <i>Westringia cephalantha</i>, <i>Eremophila platythamnus</i> subsp. <i>platythamnus</i> and mixed low shrubs over <i>Triodia desertorum</i>.</p>
MR02	Open Scrub Mallee of <i>Eucalyptus ceratocorys</i> over <i>Grevillea juncifolia</i> , <i>Acacia</i> spp., and mixed shrubs over <i>Triodia desertorum</i> with occasional emergent <i>Eucalyptus gongylocarpa</i>	E8	E8 Open Scrub Mallee to Very Open Scrub Mallee of varying <i>Eucalyptus</i> spp. with <i>Hakea francisiana</i> and <i>Grevillea juncifolia</i> over <i>Westringia cephalantha</i> , <i>Acacia hemiteles</i> , <i>Acacia fragilis</i> , <i>Acacia helmsiana</i> and mixed low shrubs over <i>Triodia desertorum</i> with emergent <i>Eucalyptus gongylocarpa</i> .
MR03	Low Open Woodland of <i>Eucalyptus gongylocarpa</i> over <i>Eucalyptus youngiana</i> , <i>Eucalyptus ceratocorys</i> , <i>Eucalyptus mannensis</i> , <i>Callitris preissii</i> and <i>Hakea francisiana</i> over <i>Acacia helmsiana</i> and mixed shrubs over <i>Triodia</i> .	E3	E3 Low Open Woodland of <i>Eucalyptus gongylocarpa</i> over <i>Eucalyptus youngiana</i> , <i>Grevillea juncifolia</i> , <i>Callitris preissii</i> and <i>Hakea francisiana</i> over mixed low shrubs over <i>Triodia desertorum</i> with <i>Chrysitrix distigmata</i> and <i>Lepidobolus deserti</i> (P4).
MR04	Open Scrub Mallee of <i>Eucalyptus rigidula</i> over low shrubs and <i>Triodia</i>	E6	E6 Open Scrub Mallee to Very Open Scrub Mallee of <i>Eucalyptus rigidula</i> over <i>Westringia rigida</i> , <i>Grevillea acuarina</i> and mixed low shrubs over <i>Triodia desertorum</i> with <i>Halgania cyanea</i> .
MR05	Low Mixed Shrubland over <i>Triodia</i> with emergent <i>Eucalyptus</i> spp. on dune.	S6	S6 Low Shrubland of <i>Thryptomene biseriata</i> , <i>Allocasuarina spinosissima</i> , <i>Jacksonia arida</i> (ms), <i>Calothamnus gilesii</i> , <i>Acacia fragilis</i> , <i>Conospermum toddii</i> (R), <i>Pityrodia lepidota</i> , <i>Lomandra leucocephala</i> , <i>Anthotroche pannosa</i> and mixed low shrubs over <i>Triodia desertorum</i> with <i>Lepidobolus deserti</i> (P4) and occasional emergent <i>Eucalyptus</i> spp. This community occurs on yellow sand dunes.
MR06	Low Open Woodland of <i>Eucalyptus gongylocarpa</i> over <i>Callitris preissii</i> and mixed <i>Eucalyptus</i> species over <i>Bertya dimerostigma</i> , <i>Acacia elmsiana</i> and mixed shrubs over <i>Triodia</i> .	Near ecotone of E5 and E3	<p>E3 Low Open Woodland of <i>Eucalyptus gongylocarpa</i> over <i>Eucalyptus youngiana</i>, <i>Grevillea juncifolia</i>, <i>Callitris preissii</i> and <i>Hakea francisiana</i> over mixed low shrubs over <i>Triodia desertorum</i> with <i>Chrysitrix distigmata</i> and <i>Lepidobolus deserti</i> (P4).</p> <p>E5 Low Open Woodland of <i>Eucalyptus gongylocarpa</i> over <i>Eucalyptus rigidula</i> with <i>Hakea francisiana</i> and <i>Grevillea juncifolia</i> over <i>Westringia cephalantha</i>, <i>Eremophila platythamnus</i> subsp. <i>platythamnus</i> and mixed low shrubs over <i>Triodia desertorum</i>.</p>
MR07	Low Open Woodland of <i>Eucalyptus gongylocarpa</i> over <i>Eucalyptus rigidula</i> over <i>Westringia cephalantha</i> , <i>Hakea francisiana</i> , <i>Acacia</i> spp. over <i>Triodia</i> .	E5	E5 Low Open Woodland of <i>Eucalyptus gongylocarpa</i> over <i>Eucalyptus rigidula</i> with <i>Hakea francisiana</i> and <i>Grevillea juncifolia</i> over <i>Westringia cephalantha</i> , <i>Eremophila platythamnus</i> subsp. <i>platythamnus</i> and mixed low shrubs over <i>Triodia desertorum</i> .
MR08	Next to track is patch of Myrtaceous Shrubland then moves into unburnt Low Open Woodland of <i>Eucalyptus gongylocarpa</i> over <i>Eucalyptus mallees</i> over shrubs over <i>Triodia</i> .	S7 next to track, then moves into E3	<p>S7 Low Shrubland to Low Open Shrubland of <i>Enekbatus eremaeus</i>, <i>Acacia desertorum</i> var. <i>desertorum</i>, <i>Verticordia helmsii</i>, <i>Homalocalyx thryptomenoides</i>, <i>Leptospermum fastigiatum</i>, <i>Baeckea</i> sp. Great Victoria Desert (A.S. Weston 14813) (P2), <i>Leptosema chambersii</i> and mixed low shrubs over <i>Triodia desertorum</i> and <i>Chrysitrix distigmata</i> with occasional emergent mallee <i>Eucalyptus</i> species, <i>Grevillea juncifolia</i> and <i>Hakea francisiana</i>.</p> <p>E3 Low Open Woodland of <i>Eucalyptus gongylocarpa</i> over <i>Eucalyptus youngiana</i>, <i>Grevillea juncifolia</i>, <i>Callitris preissii</i> and <i>Hakea francisiana</i> over mixed low shrubs over <i>Triodia desertorum</i> with <i>Chrysitrix distigmata</i> and <i>Lepidobolus deserti</i> (P4).</p>
MR09	At top of slope vegetation is Low Open Shrubland of <i>Calothamnus gilesii</i> with mixed shrubs over <i>Triodia</i> and <i>Lepidobolus</i> . At bottom of slope vegetation is Low Open Woodland of <i>Eucalyptus gongylocarpa</i> over shrubs over <i>Triodia</i> .	S8 at top of slope, E3 at bottom	<p>S8 Low Open Shrubland of <i>Calothamnus gilesii</i>, <i>Persoonia pertinax</i> and mixed low shrubs with occasional emergent <i>Eucalyptus youngiana</i> and <i>Eucalyptus gongylocarpa</i>.</p> <p>E3 Low Open Woodland of <i>Eucalyptus gongylocarpa</i> over <i>Eucalyptus youngiana</i>, <i>Grevillea juncifolia</i>, <i>Callitris preissii</i> and <i>Hakea francisiana</i> over mixed low shrubs over <i>Triodia desertorum</i> with <i>Chrysitrix distigmata</i> and <i>Lepidobolus deserti</i> (P4).</p>
MR10	Shrubland of <i>Melaleuca hamata</i> over <i>Triodia</i> with occasional emergent <i>Eucalyptus</i> Mallees	S1	S1 Shrubland of <i>Melaleuca hamata</i> with <i>Hakea francisiana</i> and mixed shrubs over <i>Triodia desertorum</i> with emergent <i>Eucalyptus</i> spp.

**TABLE B-2: SPINIFEX LIFE STAGE**

Triodia life stage (Sketches by V Reynolds from Churchill 2001)					
	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
Triodia life stages in life					
On a landscape scale					

from Gaikhorst and Lambert (2014)



**TABLE B-3: COMMENTS AND ADDITIONAL INFORMATION CAMERA PERFORMANCE**

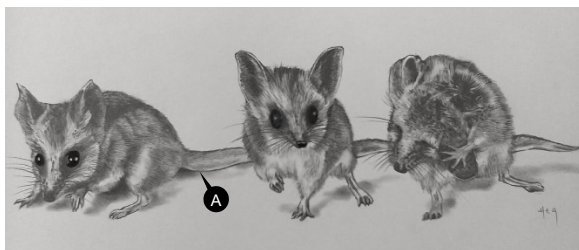

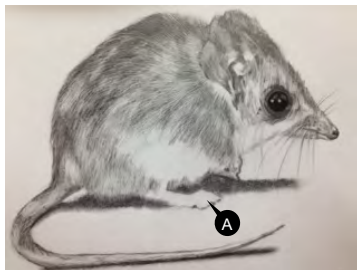
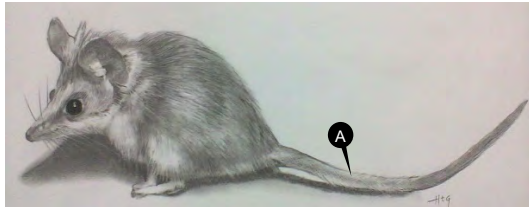
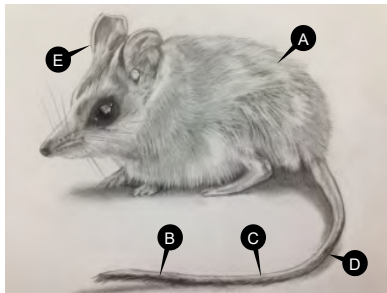
Poor camera battery performance	<input type="checkbox"/> Yes	<input type="checkbox"/> No	.....
None or few images	<input type="checkbox"/> Yes	<input type="checkbox"/> No	.....
Camera programming faults	<input type="checkbox"/> Yes	<input type="checkbox"/> No	.....
Numerous false triggers	<input type="checkbox"/> Yes	<input type="checkbox"/> No	.....
Camera interference	<input type="checkbox"/> Yes	<input type="checkbox"/> No	.....
Vandalism/Animal Damage	<input type="checkbox"/> Yes	<input type="checkbox"/> No	.....
Other Comments:			

**TABLE B-4: IDENTIFICATION**

Photo ID	Species ID and Numbers	Identified by	Date / Time	Event

**SKETCH MAP OF CAMERA LOCATION**

**TABLE B-5: *SMINTHOPSIS* SPECIES FOUND IN MULGA ROCK URANIUM PROJECT AREA  
WITH DISTINGUISHING FEATURES HIGHLIGHTED**

Species	Physical Characteristics and Identifying Features										
	Head / ears / feet	Tail	General body								
<b><i>S. crassicaudata</i></b> 	Large eyes, blaze patch but in WA generally no pronounced head stripe, prominent ears extended and large (15mm)	<b>A</b> Tail fat, carrot-shaped and less than H/B length (mean 55mm)	<table><tr><td><b>Weight:</b></td><td>15gm</td></tr><tr><td><b>Head/Body (H/B) length:</b></td><td>75mm</td></tr><tr><td><b>Body size:</b></td><td>Very small</td></tr><tr><td><b>Colour:</b></td><td>Dorsal surface sandy pale brown to grey, ventral fur white</td></tr></table>	<b>Weight:</b>	15gm	<b>Head/Body (H/B) length:</b>	75mm	<b>Body size:</b>	Very small	<b>Colour:</b>	Dorsal surface sandy pale brown to grey, ventral fur white
<b>Weight:</b>	15gm										
<b>Head/Body (H/B) length:</b>	75mm										
<b>Body size:</b>	Very small										
<b>Colour:</b>	Dorsal surface sandy pale brown to grey, ventral fur white										
<b><i>S. dolichura</i></b> 	Large eyes with thin black eye-ring. Ears large, mean length 18mm	<b>B</b> Tail thin, 20% longer than head/body length (mean 90mm). Dorsal surface grey with white base	<table><tr><td><b>Weight:</b></td><td>13gm</td></tr><tr><td><b>H/B length:</b></td><td>74mm</td></tr><tr><td><b>Body size:</b></td><td>Very small</td></tr><tr><td><b>Colour:</b></td><td><b>A</b> Dorsal fur pale to dark grey. Cheeks brownish. Ventral fur – white</td></tr></table>	<b>Weight:</b>	13gm	<b>H/B length:</b>	74mm	<b>Body size:</b>	Very small	<b>Colour:</b>	<b>A</b> Dorsal fur pale to dark grey. Cheeks brownish. Ventral fur – white
<b>Weight:</b>	13gm										
<b>H/B length:</b>	74mm										
<b>Body size:</b>	Very small										
<b>Colour:</b>	<b>A</b> Dorsal fur pale to dark grey. Cheeks brownish. Ventral fur – white										
<b><i>S. hirtipes</i></b> 	Large eyes. <b>A</b> Long broad hind feet (16-19mm) covered with silvery hairs. Ears 15mm	Base of tail thickened. Tail length - mean 85mm. Tail colour pinkish white	<table><tr><td><b>Weight:</b></td><td>15gm</td></tr><tr><td><b>H/B length:</b></td><td>77mm</td></tr><tr><td><b>Body size:</b></td><td>Very small</td></tr><tr><td><b>Colour:</b></td><td>Brown to yellow brown above white fur below</td></tr></table>	<b>Weight:</b>	15gm	<b>H/B length:</b>	77mm	<b>Body size:</b>	Very small	<b>Colour:</b>	Brown to yellow brown above white fur below
<b>Weight:</b>	15gm										
<b>H/B length:</b>	77mm										
<b>Body size:</b>	Very small										
<b>Colour:</b>	Brown to yellow brown above white fur below										
<b><i>S. ooldea</i></b> 	Large eyes and ears, triangular dark patch on crown and forehead in front of eyes	<b>A</b> Tail thickened, slightly longer than body (mean 78mm)	<table><tr><td><b>Weight:</b></td><td>11gm</td></tr><tr><td><b>H/B length:</b></td><td>72mm</td></tr><tr><td><b>Body size:</b></td><td>Very small</td></tr><tr><td><b>Colour:</b></td><td>Greyish/brown yellow above, white below</td></tr></table>	<b>Weight:</b>	11gm	<b>H/B length:</b>	72mm	<b>Body size:</b>	Very small	<b>Colour:</b>	Greyish/brown yellow above, white below
<b>Weight:</b>	11gm										
<b>H/B length:</b>	72mm										
<b>Body size:</b>	Very small										
<b>Colour:</b>	Greyish/brown yellow above, white below										
<b><i>S. psammophila</i></b> 	Large eyes, black eye rings <b>E</b> Large ears with black anterior bristles. Dark patch on forehead. Long rear legs. All legs and underbelly white fur.	<b>C</b> Tail thin and tapered, longer than H/B length (mean 118mm). <b>B</b> Black grey ventral hair fin in final quarter. <b>D</b> Tail bi-colour – dorsal light grey/buff, with darker grey base	<table><tr><td><b>Weight:</b></td><td>36gm</td></tr><tr><td><b>H/B length:</b></td><td>97mm</td></tr><tr><td><b>Body size:</b></td><td><b>A</b> Larger body than any other Dunnart recorded in the region</td></tr><tr><td><b>Colour:</b></td><td>Dorsal fur grey to brindle, underside white</td></tr></table>	<b>Weight:</b>	36gm	<b>H/B length:</b>	97mm	<b>Body size:</b>	<b>A</b> Larger body than any other Dunnart recorded in the region	<b>Colour:</b>	Dorsal fur grey to brindle, underside white
<b>Weight:</b>	36gm										
<b>H/B length:</b>	97mm										
<b>Body size:</b>	<b>A</b> Larger body than any other Dunnart recorded in the region										
<b>Colour:</b>	Dorsal fur grey to brindle, underside white										

**TABLE B-6: VOUCHER IMAGES SHOWING SANDHILL DUNNART**  
**(*Sminthopsis psammophila*) Identifying Features**



Photos by Amanda McLean (2014)

**TABLE B-6: IMAGE IDENTIFIER UNCERTAINTY MATRIX**  
**(FIELD COMPANION TO MAMMALS OF AUSTRALIA 2013)**

Feature	Present	Absent	Not Determined	Comment
Large eyes and dark eye rings				
Anterior half of external ear black				
Dark head patch to centre of eyes				
Dorsal fur - brindle colour				
Buff cheeks and flanks				
White underside				
White feet				
Rear legs - long and slender				
Pointed Snout and large ears				
Tail - dorsal pale grey				
Tail - ventral dark grey				
Tail tapering to crested tip				
Tail – ventral fin of grey hair final quarter				Diagnostic feature
Head to body length (Mean 97mm)				
Tail Length (Mean 118mm)				
Body Size				



**TABLE B-7: CAMERA TRAP IMAGES**

<div>Insert Image</div>	<div>Insert Image</div>
<div>Insert Image</div>	<div>Insert Image</div>

## Attachment A

### **Churchill review of Draft Camera Trapping Protocol**

Sue Churchill  
Wildlife Ecologist  
ABN 67 730 373 945  
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PO Box 1170  
Port Douglas,  
QLD 4877  
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**Review of Vimy Resources Limited, Draft Camera Trapping Protocol, Sandhill Dunnart, *Sminthopsis psammophila*, Mulga Rock Uranium.**

Sue Churchill

7 April 2015

The accepted technique for capturing and identifying Sandhill Dunnarts is live capture in pitfall and Elliott traps. To be effective pitfall traps need to be deeper than those used for comparable small mammals. Elliott traps are less useful but are effective in areas where there is a reasonably high density of these animals.

Sandhill Dunnarts are patchily distributed over a wide area. They also appear to move around and may be absent from an area where they were previously captured. They are a difficult species to capture, typically being captured at a rate of less than one Sandhill Dunnart per 1,000 trap nights. This requires immense resources for very limited results and can have a deleterious impact on the other fauna in the area if conducted long term. Another consideration is that live trapping techniques will be less effective following the widespread fire that went through the study area in November 2014.



The proposed study involves the use of camera trapping which, although a relatively new method, could prove to be efficient and cost effective.

It also has an ethical advantage in that the animals are not so disturbed.

Being a relatively new technique it is not certain how reliable the results may be but given these advantages it is certainly worth undertaking this project. Camera trapping may highlight the effect of local rainfall or moon phase on dunnart activity patterns and perhaps discover hot spots for further live trapping surveys.

I have no experience in Camera Trapping technique but the authors of this protocol have clearly taken the best advice and set up a well considered survey.

The Data Recording Sheets are good. There are no problems with the Matiske Vegetation Codes or the Spinifex Life Stage Categories. I do see a problem with respect to Table B-5 and B-6 the Image Identifier Uncertainty Matrix. I think that it may prove very difficult to identify dunnarts to the species level from photographs. The technique would work very well if the target animal were as distinctive as the *Mulgara*. It is relatively easy to identify a dunnart from other small mammals but there is a greater problem in identifying it as a Sandhill Dunnart rather than one of the other dunnarts potentially present. I feel that the image identifier needs to list the features of all 7 dunnart species that may occur at Mulga Rock. If you only list the identifying features for one species it is too easy to convince yourself that this is what you are looking at.

Photographs of all dunnart species are needed in addition to those of the Sandhill Dunnart. Perhaps it would be possible to develop a key based on external characteristics that can be seen on a photograph.

Potentially there are 7 species of dunnarts that could occur in the area.

*S crassicaudata*, Fat-tailed Dunnart

*S macroura*, Stripe-Faced Dunnart

*S dolichura*, Little Long-tailed Dunnart

*S hirtipes*, Hairy-footed Dunnart

*S ooldea*, Ooldea Dunnart

*S longicaudata*, Long-tailed Dunnart

*S psammophila*, Sandhill Dunnart

I think that the protocol is well conceived and worth carrying out. The project has the potential to highlight areas where dunnarts of any species are present, absent, common or uncommon.

## Attachment B

**Email of Vimy Resources response to DPaW queries (June 2015)**





Mr Murray Baker  
Department of Parks and Wildlife  
Environmental Management Branch  
Locked Bag 104  
Bentley Delivery Centre WA 6983

12<sup>th</sup> June 2015

Dear Murray

**RE: SANDHILL DUNNART- CAMERA TRAPPING PROTOCOL**

Thank you for your review comments of the 26<sup>th</sup> May 2015 in respect to aspects and procedures proposed by Vimy Resources (Vimy) regarding their ongoing Camera Trapping (CT) Programme for the Sandhill Dunnart (*Sminthopsis psammophila*) which has been trialled at the Mulga Rock Uranium Project (the Project) since 2013. Responses to your queries regarding Protocol Procedures are provided in bold italics.

The presentation provided to DPAW on the 15<sup>th</sup> January 2015 and during the site visit in March 2015 stressed that, in view of the four previous conventional targeted surveys undertaken at Mulga Rock with limited capture success and the November 2014 fire that burnt through the Project area removing suitable Sandhill Dunnart (SHD) habitat for at least 10 to 15 years, the primary CT focus and methodology could only be directed towards demonstrating presence/absence to a level to satisfy impact assessment requirements. The CT methodology is considered as another fauna survey tool and was not intended to replace conventional trapping techniques. It remains experimental and subject to adaptive management processes as available Western Australian regulatory technical guidelines provide limited advice in this area. Vimy have consulted with researchers in South Australia and Western Australia with experience in dunnarts and have initiated an external image review process and a programme peer review process for both Sandhill Dunnarts and camera trapping in the Project Development Envelope to a level necessary to satisfy impact assessment requirements.

Fauna surveying has traditionally required multiple assessment techniques and Vimy considers that CT methodology, while it currently does have some reported limitations, is another fauna survey tool, albeit with some distinct advantages in respect to fauna welfare, coverage and cost. It was not intended to replace, but rather to augment, conventional trapping techniques. Some aspects are experimental for small mammals and current trials need to remain flexible and subject to adaptive management processes as available Western Australian regulatory technical guidelines have limited advice in this area. Vimy, in addition to conducting their own trials since 2013, have consulted with researchers and consultants in South Australia and Western Australia with experience in dunnart capture and research. They have initiated an external identification review of images for SHDs and a peer review process covering camera trapping procedures. The current baseline camera trapping programme for environmental impact assessment purposes will run continuously until the start of the next fire season in November 2015 when the cameras will be recovered.

- 1. Based on the limited amount of testing in environments where there are confirmed populations of Sandhill dunnarts, the Department considers the use of camera trapping as a primary detection / survey tool for this species as experimental for this purpose at this time (i.e. unproven).

**Response:** *The records show that there has been extensive targeted surveying for SHDs in and around the Project area since five animals were discovered there in 1985. Table 1 of the Protocol shows that five conventional surveys, one conducted over an extended period of 8 years (Gaikhorst and Lambert 2001-2008), have been undertaken within 30km of the original capture sites up to 2014, resulting in the capture of 18 adult Sandhill Dunnarts (22 animals). Additional animals have been captured in the surrounding regional dune fields and conservation reserves. Trapping has been largely by Elliot Traps (15,178 trap nights) and deep pitfalls (11,821 trap nights). Vimy's camera trapping effort for the period 2012-2015 is 6,880 trap nights with no SHDs identified. Reported data suggests the capture rate - Pitfall vs Elliot is-approximately 3 to 1.*

- 2. The proposed survey work, if well designed and documented, is likely to assist in the determination of an appropriate survey methodology to apply to this species rather than providing for definitive conclusions about the presence / absence or suitability of the project area as habitat for Sandhill Dunnart.

**Response:** *There is a growing body of evidence that suggests that remote cameras are a cost effective, fauna friendly and efficient means of collecting presence/absence data over an extended timeframe (see Meek and Ballard 2014 - Camera Trapping – Wildlife Management and Research). Camera trapping undertaken at the Project is not intended to replace other conventional trapping techniques but is being used as another tool to initially provide presence/absence information for impact assessment in the Project Development Envelope, and following the November 2014 wildfire, in the broader dune field remnant patches.*

- 3. It is currently unclear from the document, if a specimen not definitively identified but believed to be Sandhill Dunnart identified via camera traps, would trigger a conventional survey response.

**Response:** *During the current baseline programme, field camera data recovery is undertaken after approximately 30 days, the images are checked for small mammals, entered into the database and those image sequences with small mammals forwarded to the fauna specialist for identification. Following advice from the consultant fauna specialist that an image containing a SHD has been identified, Vimy will advise the Department of Parks and Wildlife and discuss what further action is required. This may take the form of further intensive camera trap monitoring of the site, no action or follow-up targeted surveys using conventional survey techniques, or a combination of both. This advice is included in Section 5.5 of the Protocol.*

- 4. It appears that some key characteristics to discriminate a specimen of *Sminthopsis psammophila* from other *Sminthopsis* species, (e.g. the crested hairs on the ventral surface of distal quarter of the tail) may not be able to be distinguished or may only occasionally be visible in photographs.

**Response:** *Following discussions with Sue Churchill, and other fauna specialists who have had extensive experience with Dasyurid species found coexisting with the Sandhill Dunnart, Vimy have developed a key characteristics table (See Table B-5) which identifies five characteristics that should support positive identification. Modifications to camera layout with the addition of an overhead camera for sites where lures are utilised, and multiple image capture for each trigger will increase potential for identifying these key characteristics. In addition, it is proposed that camera placement would be for an extended period up to 30 days and, due to the mobility of SHDs and the limited size of the SHD's home range, further image capture would likely occur in this time. As outlined in Section 5, in the event of uncertainty, Vimy have included in the Protocol, access to consultants whose advice would be sought in respect to species identification and confirmation.*

- 5. The document indicates that two different models of camera will be used as a part of the methods. The use of two different models of camera has the potential to diffuse the power of the experimental design as the results gathered using the different models may not be directly comparable.

**Response:** *The use of 2 different cameras types at the same trap site was not intended (See Section 4.6.3) and the text has been revised to counter this perception.*

- 6. The document also does not appear to compare the different methods of trapping in relation to effectiveness and efficiency. It is currently difficult to determine the level of effort being applied to the different trapping methods (e.g. camera traps versus Elliot/pitfall traps) and trapping parameters being tested (e.g. configuration of site layouts, use of horizontal versus vertical camera settings, use of lures, habitat type, time since last fire, etc.). It is, therefore, recommended that Vimy develops a simplified summary of the methodology including effort required, for example the table below.

**Response:** *Vimy does not believe there is a need to compare the efficiency of cameras with other trapping methods in the Protocol, as again it is a tool for detecting the presence or absence of a particular taxa. The Data Recording Form in Appendix B includes all of the nominated aspects outlined above and this form is completed for each trap location/deployment.*

- 7. In general, there should be caution in targeting preferred habitat as low detections of species can occur due to unknown habitat preferences even after extensive sampling.



**Response:** Mark Cowan has previously made this point during consultation in 2014. CT site selection prior to the extensive fire in November 2014 was centred on:

- (a) re-trapping previous sites where SHDs had been captured in 1985,
- (b) a range of sites selected by Ninox following their review of habitat mapping by Mattiske (2009) that recorded burn history and
- (c) “X” sites within the dune field that were based on the presence of small mammal track densities on sand dunes.

The post November burn landscape within the Project Development Envelopment is very different and trap site selection as part of the current Refugia Programme has included testing of a restricted range of habitats associated with small remnant vegetation stands that are not considered quality SHD habitats and would not have previously been considered.

- 8. Table 1, p. 10 should indicate which method and amount of effort (Elliot or pit traps) was responsible for past captures.

**Response:** Trap effort data for Pitfall and Elliot traps is shown in Table 1 where available. This data was obtained from Hart and Kitchener (1986), Pearson and Robinson (1990), Churchill (2001, 2009), Gaikhorst and Lambert (2000 to 2008, 2014) Ninox (2010), ecologia (2009) and GHD (2010a, 2010b). All references covering survey data for Queen Victoria Spring Nature Reserve has not been located although Gaikhorst and Lambert (2014) list a total of 40 adult animals captured for the Western Australian portion of the GVD. Published SHD capture data for the GVD suggests 7 Elliot Trap captures for 23,939 trap nights and 21 by Pitfall for 18,123 trap nights. The Table has been updated to include capture details for the 2 methods.

- 9. Section 3.3, p. 22 indicates that *Sminthopsis psammophila* has a “...foot length of approximately 10mm”, this is unlikely. The smallest of the species in that area, *Sminthopsis ooldea*, has an average pes length of around 13.4mm and slightly larger species, *Sminthopsis macroura* and *Sminthopsis crassicaudata* are around 15.3mm. These are all much smaller species than *Sminthopsis psammophila*;

**Response:** Correct, the typo error has been corrected to 22mm to 26mm.

- 10. Section 4.6.1 p. 33 states that “The strategy is to increase the sampling effort (number of sites multiplied by the number of survey days) and reduce the error associated with occupancy estimation (Shannon et.al 2014).” It is unclear what error the document is referring to and how the error will be ameliorated given the information provided in the document, particularly if there are no detections/captures. This should be further explained in the document.

**Response:** Trap effort data for Pitfall and Elliot traps is shown in Table 1 when available. This data was obtained from Hart and Kitchener (1986), Pearson and Robinson (1990), Churchill (2009), Gaikhorst and Lambert (2000 to 2008) Ninox (2010), ecologia (2009) and GHD (2010a, 2010b). References covering survey data for Queen

**Victoria Spring Nature Reserve has not been located, with only one reference to that site documented on p. 3 of Gaikhorst and Lambert's June 2001 report to CALM, showing a location just north of the Queen Victoria Spring Nature Reserve. Capture data for the GVD has identified 7 Elliot Trap captures and 21 by pitfall.**

- 11. Section 4.6.1 p. 34 states that "Lure stations should be located approximately 1.5–2.0m from the horizontal camera". The document should indicate that in some circumstances lures may increase the detection of some species at the expense of other species. How this is determined should be explained in the document.

**Response: As noted by various specialists in the field and consistent with DPaW's guidelines on the matter, lures have the potential to affect behavioural patterns of vertebrate fauna and the same would be expected from the small mammals present in the southwest GVD. However, this is not relevant to the scope of the CT trapping protocol, which primary aim to confirm presence or absence of the Sandhill Dunnart on the project.**

**Camera trapping activities to date have been undertaken at the Project since 2013 without the use of lures. It has been proposed that lures (Universal Mix) would be trialled under some circumstances in the Refugia Habitat Programme. Long deployment of lures is labour intensive and is not proposed due to management considerations and the vibrant ant population. The use of the Universal Mix lure was selected due to its successful use during the Gaikhorst and Lambert and Ninnox surveys in the region.**

- 12. Section 4.6.1 p. 34 states that "Where camera traps are oriented in a vertical position (facing downwards), cork tiles will be placed centrally under the bait device to maximise detection of target species." It is unclear how large the tile will need to be to ensure the passive detectors of infrared light covers the actual bait for a camera at a height of 1.5m. It is also unclear if this method has been tested to determine its effectiveness in detection.

**Response: The purpose of the ~45cmx30cm cork tile is to provide a low reflectivity, constant temperature surface for image collection within the detection zone and allow the inclusion of a reference scale in the photo frame to aid identification. The process has been described by Meek et al. (2012) and Welbourne (2013), however, it requires calibration to identify the optimal detection zone for the layout selected. Comment on this aspect was provided by Paul Meek following his peer review of the Protocol.**

- 13. Section 4.6.1 p. 34 indicates that "Where more than two camera setups are being used, cameras should be set at least 50-75m apart from each other to ensure a reasonable area is surveyed...". It appears from the document that placing the cameras 50 to 75m apart is an arbitrary value. The document should clearly indicate the reasoning for this spacing.

**Response: The distances between cameras in the same quadrat were not arbitrary. Previous conventional trapping programmes at Mulga Rock (Marti nick 1985 and Ninnox**

2009) had used quadrat sizes of approximately 50mx70m. The original camera trapping strategy (prior to the November 2014 Project area wildfire) was to incorporate the Ninox (and Martinick) trap sites and drift fence layout into the CT programme because they represented what was considered to be optimal SHD habitat (Martinick 1986, Churchill 2009, and Gaikhorst and Lambert 2001-2008, Ninox 2009). Furthermore, animal inventories for these sites were known from the previous classic trapping programmes and this information would assist in species identification. Separate trials of drift fence layout and camera placement were undertaken in 2013, depending on terrain layout and these are shown in Figures 11 to 13 of the Protocol. Trap layout in the post November 2014 fire remnants will continue to be modified to fit the habitat and circumstances in this regard, they are considered experimental, although standardised quadrat size and camera placement is not considered necessary for presence / absence survey, all site the data will be collected on the Data Recording Sheet and validated in Vimy's environmental database for future analysis.

Vimy also drew on some advice provided by DEC with regards to Sandhill Dunnart trapping the Tropicana Joint Venture and documented on p.26 of GHD's 2010 SHD survey report, published as a supplementary study to the Tropicana PER: "Trapping for Sandhill Dunnarts usually position Elliott traps in excess of 20m intervals".

- 14. Figure 10, p. 36 indicates that several of the proposed trapping sites are to be located on the edge of remnant (i.e. unburnt vegetation). The location of these sites should be further clarified in relation to potential edge effects.

**Response:** Figure 10 shows there are only 5 small (<3ha) patches (Sites 2, 3, 4, 7 and 19) of recently unburnt habitat in the Project Development Envelope (PDE) and following field inspection, none are considered suitable habitat for SHD's using the Churchill and Gaikhorst criteria, however for impact assessment purposes these remain the primary focus and will be tested in accordance with this protocol. Based on the evidence that SHD distribution and survival is governed by the presence of spinifex hummocks of specific maturity and structure, the remainder of the Project Development Envelope is unlikely to provide suitable post burn habitat for 10 to 15 years. External to the PDE, within the Vim's Project Area are a similar number of patches of remnant vegetation, some of larger area where CT monitoring is proposed.

Edge effect impacts on small mammals in most habitats in Australia is poorly understood and very limited work has been done in the arid lands, however some trapping success has been reported for SHDs in edge environments in the GVD and for this reason it has been included in the programme. Churchill (2001) reports that Dave Pearson captured an adult male in a burnt area adjacent to an unburnt area in the Queen Victoria Spring Nature Reserve in September 1991 and Gaikhorst and Lambert report the capture of a juvenile male on the edge of a small unburnt remnant at Station 3 in 2007 (Station 25 on Figure 10). Post-fire CT monitoring in 2015 at several former Ninox and Martinick sites have continued to record a range of small mammals that clearly survived the fire. Vimy believes that unburnt edge monitoring fits the Programme's objective of monitoring all available habitats.



- 15. Section 4.6.4 p. 38 indicates that “There may be situations where only one camera will be established.” It is unclear, why only one camera would be used at some sites and two at others. As mentioned above (use of two different models of camera), the use of two different methods has the potential to diffuse the power of the experimental design.

***Response: Based on the review of the camera image data collected over the past 2 years, Vimy believe that identification of SHDs by species knowledgeable fauna specialists using the key criteria outlined in Table B5B-5 of the Protocol is sufficiently robust using one horizontal camera and is adequate for the intended presence - absence objective. The use of the vertical camera at some sites is considered experimental and believed to be only of value when in ground lures are used (potentially allowing a dorsal view of ear colouration and size comparison against a fixed scale) or as insurance against single camera failure. The one camera approach provides for a greater number of sites to be tested – an advantage in presence-absence surveying.***

Please do not hesitate to contact the undersigned or Vimy's Environmental Advisor - Colin Woolard (08 9368 5019) if further information is required.

Yours sincerely  
**Vimy Resources Limited**

Xavier Moreau  
**General Manager – Geology and Exploration**

Attachment A – Camera Trapping Protocol Rev1.4



## Appendix C

Wildlife Conservation Act 1950, Section 17 Fauna licence to take fauna for scientific purposes (for use of attractants)



# DEPARTMENT OF PARKS AND WILDLIFE



Department of  
Parks and Wildlife



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PAGE NO. 1  
PERSON NO. SF010472  
52425

RECEIPT NO. AMOUNT  
\$0.00

## WILDLIFE CONSERVATION ACT 1950 REGULATION 17

### LICENCE TO TAKE FAUNA FOR SCIENTIFIC PURPOSES

THE UNDERMENTIONED PERSON MAY TAKE FAUNA FOR RESEARCH OR OTHER SCIENTIFIC PURPOSES AND WHERE AUTHORISED, KEEP IT IN CAPTIVITY, SUBJECT TO THE FOLLOWING AND ATTACHED CONDITIONS, WHICH MAY BE ADDED TO, SUSPENDED OR OTHERWISE VARIED AS CONSIDERED FIT.

DIRECTOR GENERAL

#### CONDITIONS

- 1 The licensee shall comply with the provisions of the Wildlife Conservation Act 1950, Wildlife Conservation Regulations 1970 and any notices in force under this legislation.
- 2 Unless specifically authorised in the Conditions of this Licence or otherwise in writing by the Director General, species of fauna declared as likely to become extinct, rare or otherwise in need of special protection shall not be captured or otherwise taken.
- 3 No fauna shall be taken from any Nature Reserve, National Park, Marine Park, Marine Nature Reserve, Timber Reserve or State Forest without prior written approval of the Director General. No fauna shall be taken from any other public land without the written approval of the Government Authority managing that land.
- 4 No entry or collection of fauna to be undertaken on any private property or pastoral lease without the consent in writing of the owner or occupier, or from any Aboriginal lands without the written approval of the Department of Aboriginal Affairs.
- 5 No fauna or their progeny shall be released in any area where it does not naturally occur, nor be handed over to any other person or authority unless approved by the Director General, nor shall the remains of such fauna be disposed of in such manner as to confuse the natural or present day distribution of the species.
- 6 This licence and the written permission referred to at conditions 3 & 4 must be carried by the licensee or authorised agent at all times for the purpose of proving their authority to take fauna when questioned as to their right to do so by a Wildlife Officer, any other State or Local Government employee or any member of the public.
- 7 Any interaction involving Gazetted Threatened Fauna that may be harmful and/or invasive may require approval from the Department of the Environment ph 02 6274 1111. Interaction with such species is controlled by the Commonwealth Government's "Environment Protection and Biodiversity Conservation Act 1999" and "Environment Protection and Biodiversity Conservation Regulations 2000" as well as this Department's Wildlife Conservation Act 1950 and Wildlife Conservation Regulations 1970.
- 8 No bioprospecting involving the removal of sample aquatic and terrestrial organisms (both flora and fauna) for chemical extraction and bioactivity screening is permitted to be conducted without specific written approval by the Director General.
- 9 Further conditions (numbered 1 to 9) are attached.

#### PURPOSE

FAUNA SURVEY TARGETING THE SANDHILL DUNNART (SMINTHOPSIS PSAMMOPHILA) VIA CAMERA TRAPPING USING LURES AND REMOTE ACTIVATED CAMERAS AT SELECTED SITES AT THE MULGA ROCK PROJECT AREA, 240KM NORTHEAST OF KALGOORLIE IN THE GREAT VICTORIA DESERT, IN ACCORDANCE WITH THE VIMY RESOURCES LTD CAMERA TRAPPING PROTOCOL.

#### AUTHORISED PERSONS

XAVIER MOREAU  
MORRIS WU



# WILDLIFE CONSERVATION REGULATIONS 1970

## Regulation 17:- Licence to Take Fauna for Scientific Purposes

FURTHER CONDITIONS (OF LICENCE NUMBER SF010472)

1. The licensee shall take fauna only in the manner stated on the endorsed Regulation 17 licence application form and endorsed related correspondence.
2. Except in the case of approved lethal traps, the licensee shall ensure that measures are taken in the capture and handling of fauna to prevent injury or mortality resulting from that capture or handling. Where traps or other mechanical means or devices are used to capture fauna these shall be deployed so as to prevent exposure of trapped animals to ants and debilitating weather conditions and inspected at regular intervals throughout each day of their use. At the conclusion of research all markers etc and signs erected by the licensee and all traps shall be removed, all pitfalls shall be refilled or capped and the study area returned to the condition it was in prior to the research/capture program. During any break in research, cage traps should be removed and pitfalls either removed, capped or filled with sand.
3. No collecting is to be undertaken in areas where it would impinge on pre-existing scientific research programs.
4. Any form of colour marking of birds or bats shall only be undertaken in accordance with the requirements of the Australian Bird and Bat Banding Scheme.
5. Any inadvertently captured specimen of fauna which is declared as likely to become extinct, rare or otherwise in need of special protection is to be released immediately at the point of capture. Where such a specimen is injured or deceased, the licensee shall contact Department of Parks and Wildlife licensing staff at Kensington (08 9219 9831) for advice on disposal. Records are to be kept of any fauna so captured and details included in the report required under further condition 6 below.
6. Within one month of the expiration of this licence, the holder shall submit an electronic return detailing the locality, site, geocode, date and number of each species captured, sighted or vouchered during the currency of the licence, into the Department of Parks and Wildlife Fauna Survey Database (FSD). A copy of any paper, report or thesis resulting from the research shall on completion be lodged with the Director General. If a renewal of this licence is required, the licensee shall submit a written progress report for activities undertaken during this licence period prior to the expiry of this licence.
7. Not more than ten specimens of any one protected species shall be taken and removed from any location less than 20km apart. Where exceptional circumstances make it necessary to take large series in order to obtain adequate statistical data the collector will proceed with circumspection and justify their actions to the Director General in advance.
8. All holotypes and syntypes and a half share of paratypes of species or subspecies permitted to be permanently taken under this licence shall be donated to the Western Australian Museum. Duplicates (one pair in each case) of any species collected which represents a significant extension of geographic range shall be donated on request to the Western Australian Museum.
9. To prevent any unnecessary collecting in this State, all specimens and material collected under the authority of this license shall, on request, be loaned to the Western Australian Museum. Also, the unused portion or portions of any specimen collected under the authority of this license shall be offered for donation to the Western Australian Museum or made available to other scientific workers if so required.



## **Appendix B: DBCA Email Correspondence**

**From:** Murray Baker  
**To:** [Adam Pratt](#)  
**Cc:** [Paula Arthur](#); [Sandra Thomas](#); [Michelle Corbellini](#)  
**Subject:** FW: Environmental Management Plans  
**Date:** Thursday, 27 July 2017 11:31:38 AM

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Hi Adam

Thanks for your email and apologies for the delay in providing comment on the Environmental Management Plans. The Department of Biodiversity, Conservation and Attractions (DBCA), formerly Parks and Wildlife, has been unable to extensively review the plans given competing priorities.

Based on an expedited review the following comments are provided in relation to the Flora and Vegetation Monitoring and Management Plan and the Terrestrial Fauna Monitoring and Management Plan:

- That consistency with the *EPA's Instructions on how to prepare Environmental Management Plans* (April, 2017) should be ensured, or discussed with the Department of Water and Environmental Regulation (DWER) where the proposed plan does not align with these instructions;
- That the purpose of the Flora and Vegetation Monitoring and Management Plan is amended to meet the requirements of the conditions;
- That the trigger and threshold criteria / management targets are reviewed and modified based on clearly defined SMART (specific, measurable, attainable, relevant, time-bound) objectives and outcomes and BACI (before, after, control, impact) design principles;
- That the trigger and threshold criteria or management targets should clearly align with the environmental outcomes (condition 8) and the environmental objectives (condition 9 and 10); and
- That monitoring provides a focus on ensuring that compliance with conditions can be assessed. DBCA notes that the plans currently contain limited information on monitoring methodologies and baseline state.

DWER is the decision making authority for Ministerial Statement 1046, and should be able to provide advice on whether the Flora and Vegetation Monitoring and Management Plan and the Terrestrial Fauna Monitoring and Management Plan meet the requirements of the conditions. DBCA recommends discussing the plans with DWER initially rather than meeting with DBCA, at this stage. It is also recommended that the next versions of the plans are submitted to DWER who can involve DBCA in the process as necessary.

Kind regards

**Murray Baker**  
Acting Area Manager South

**Environmental Management Branch**  
**Department of Biodiversity, Conservation and Attractions**

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Ph: (08) 9219 9504

Fax: (08) 9334 0140

E-mail: [murray.baker@dpaw.wa.gov.au](mailto:murray.baker@dpaw.wa.gov.au)



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**From:** Adam Pratt [<mailto:apratt@vimyresources.com.au>]  
**Sent:** Wednesday, 26 July 2017 12:30 PM  
**To:** Murray Baker  
**Cc:** Paula Arthur  
**Subject:** Environmental Management Plans

Hi Murray,

Is there a time in the next week or two where we can catch up to discuss the Condition Environmental Management



Plans (CEMPs) for Flora and Vegetation and Fauna, that we submitted to DPaW in February 2017. We really need to finalise these documents and get a written (1 page statement) from DPaW confirming that the CEMPs meet the requirements of the Ministerial Statement 1046.

Let me know when you're free to catch up.

Cheers,  
Adam

  
**Adam Pratt**  
Environment, Health and Safety Manager  
[apratt@vimyresources.com.au](mailto:apratt@vimyresources.com.au)

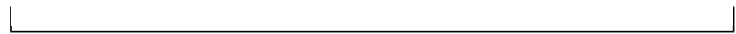
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**From:** Paula Arthur  
**Sent:** Wednesday, 15 March 2017 10:59 AM  
**To:** [Murray.Baker@DPaW.wa.gov.au](mailto:Murray.Baker@DPaW.wa.gov.au)  
**Subject:** Environmental Management Plans

Hi Murray

I am just touching base to see if you have any comments on the EMP's I emailed through to you in February.

As part of our Ministerial Statement No. 1046, conditions 9-2 and 10-2 we are required to consult with DPaW in regards to our Flora and Vegetation monitoring and Management Plan and Terrestrial Fauna Monitoring and Management Plan.

Any feedback you have on these would be great.

Thanks

Paula

**Paula Arthur**

Senior Operations Assistant / Senior Environmental Officer

[parthur@vimyresources.com.au](mailto:parthur@vimyresources.com.au)

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