TROPICANA GOLD PROJECT

Sandhill Dunnart Survey of the Proposed Operational Area and Infrastructure Corridors (Pinjin and Bypass)

September 2009

A Sandhill Dunnart (*Sminthopsis psammophila*) from the Great Victoria Desert, Western Australia

Gaikhorst and Lambert (2008)

Tropicana Joint Venture

ANGLOGOLD ASHANTI AUSTRALIA

INDEPENDENCE GROUP NL

TABLE OF CONTENTS

FIGURES

PLATES

TABLES

APPENDIX

1.0 EXECUTIVE SUMMARY

The Tropicana JV (TJV) is planning to establish the Tropicana Gold Project (TGP), which aims to mine the Tropicana and Havana gold deposits. The proposed TGP is located approximately 330 km east north-east of Kalgoorlie, and 15km west of the Plumridge Lakes Nature Reserve, on the western edge of the Great Victoria Desert (GVD) biogeographic region of Western Australia. The project is a joint venture between AngloGold Ashanti Australia Limited (70% and Manager) and the Independence Group NL.

The project will be comprised on an Operational Area, Water Supply Area and Pipeline and Infrastructure corridors. The infrastructure corridors will house an access road and / or fibre optical cable for the site communication. The TJV is currently evaluating two different routes: one via Pinjin Station and one via the existing Trans Australian Railway line access road (Figure 1).

Two experienced Zoologists, Glen Gaikhorst and Cathy Lambert, were commissioned by TJV to conduct a assessment for the presence of the Sandhill Dunnart *(Sminthopsis psammophila)* within potentially suitable habitat within the Operational Area, Pinjin Infrastructure corridor and a conceptual public bypass corridor. Gaikhorst and Lambert have extensive knowledge of the Sandhill Dunnart, having assisted in Sue Churchill's year long study of the Sandhill Dunnart, before embarking on their own field and captive studies. Sue Churchill's study was undertaken to accumulate knowledge of the species and to develop an approved survey methodology. Gaikhorst and Lambert have since spent 9 years studying the species and have completed 12 field trips to Western Australia's Great Victoria Desert, which have yielded information regarding the distribution, abundance and ecology of the Sandhill Dunnart, and conducted captive studies which have provided information regarding the Sandhill Dunnart's reproductive biology.

The survey methodology for this assessment was developed in consultation with Sue Churchill in 2000.

Potential habitat for the Sandhill Dunnart in the survey area was initially identified through a desktop assessment of aerial photography. Following identification of these areas, ground truthing of each site was undertaken and fauna surveys were then conducted in areas of interest.

Sandhill Dunnarts have specific habit requirements in Western Australia's Great Victoria Desert, these being:

- Deep yellow sands (occasionally orange) ranging from very gently undulating sandplains to well defined dunes up to 30 metres in height. The species can also be found in swale areas with association to dune areas.
- Preferred vegetation structure consists of tall mallee (10 - 30% cover), mixed shrubland (10 - 30% cover), and/or a combination of mallee, marble gum, Callitris and shrubland.
- Presence of dense, compact clumps of Spinifex (at least 10 – 30% cover) which have been unburnt for between approximately 10 and 30 years with Spinifex life stages of 2 to 3.5.
- Optimum Spinifex size at life stage 3 is 70 - 100 centimetres in diameter, and about 40 centimetres tall.

Two surveys were conducted, between March – May 2008 (a 10 day period from the 5th to the 14th March 2008, and an eight day period from the 21st to the 28th May 2008). Opportunistic sightings of other fauna were also recorded. Two trapping types were used, deep pitfall traps and Elliott traps.

No Sandhill Dunnarts were captured during the surveys. Most sites surveyed had been affect by fire relatively recently making the habitat unsuitable for them. As the vegetation at these sites ages, it may become more typical of their requirements and warrant further investigation at a later date.

Sites surveyed that had not been affected by fire were long unburnt and had poor Spinifex quality that provided little long term habitat for the species. Landforms of sites (sand type) was also not the desired type (red vs yellow or yellow/orange).
Sites 19A, 19B, 19C and 19D that were considered suitable was an isolated area with little connectivity to other suitable dune areas, the vegetative cover was also of a lower percentage to that of known capture sites.

In summary although trapping efforts were undertaken in potential sites in the Operational Area and Pinjin Infrastructure corridor no areas for filled all of the known requirements of Sandhill Dunnart habitat and no Sandhill Dunnarts were captured.

2.0 INTRODUCTION

2.1 PROJECT OVERVIEW

AngloGold commissioned two experienced zoologists to conduct a study to identify the presence of the Sandhill Dunnart in areas of potentially suitable habitat in the Tropicana project area, access road corridor and the public bypass road corridor.

The Tropicana project area is located approximately 330 kilometres east north-east of Kalgoorlie. The proposed access road extends approximately 220 kilometers in a northeasterly direction from Pinjin to the Tropicana project area and is on the western border of the Great Victorian Desert. The proposed public bypass road extends a further 25 kilometres to the northeast of the project area. Figure 1. Tropicana Gold Project Location.

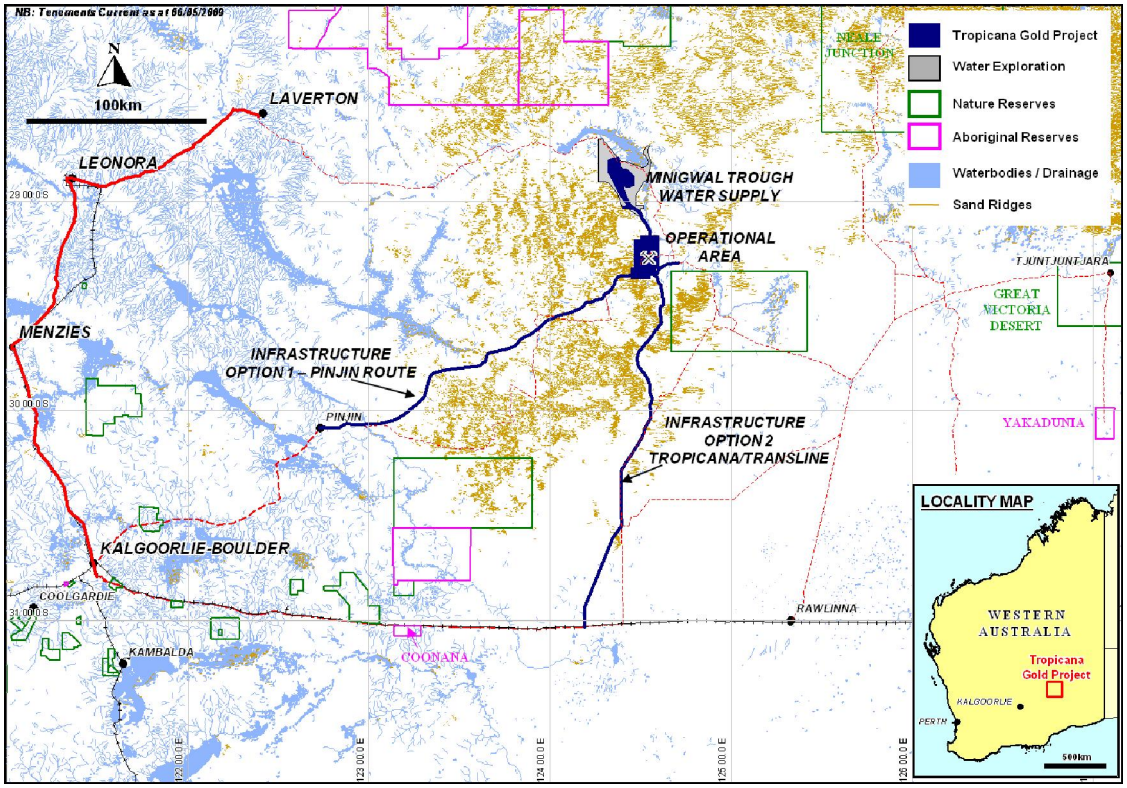


Figure 1 Tropicana Gold Project Location

2.2 SURVEY OBJECTIVES

The objectives of the Sandhill Dunnart survey were to:

- Identify potentially suitable Sandhill Dunnart habitat within a defined area.
- Conduct trapping sessions within identified potentially suitable Sandhill Dunnart habitat.
- Make recommendations regarding potential impacts of the proposed project on Sandhill Dunnarts.
- Identify any future survey work that may be required.

3.0 BACKGROUND INFORMATION

The endangered Sandhill Dunnart is a small, arid-dwelling, carnivorous marsupial known from under 100 specimens since being described in 1894. It has been recorded in the Northern Territory, South Australia and Western Australia, but it has not been observed in the Northern Territory since its initial discovery. The species was thought to be extinct until 1969, when five animals were discovered in South Australia (Van Dyck and Strahan, 2008). It was also discovered in Western Australia in 1985 when 10 animals were captured at two sites near Queen Victoria Springs (Hart and Kitchener, 1986). There have been few studies into their distribution, abundance, ecology and conservation biology.

The Sandhill Dunnart is one of the largest in the *Sminthopsis* genus, ranging from 30 to 55 grams (Churchill, 2001b). They are primarily insectivorous, and may be found in arid and semi-arid areas amongst sandy dunes with a healthy coverage of Spinifex hummocks (Churchill, 2001b). The Sandhill Dunnart was described in 1894 from a specimen found near Lake Amadeus in the Northern Territory (Aitken, 1983). However, the species is now known from only four locations including southern Northern Territory, South West Great Victoria Desert (Including Queen Victoria Springs Nature Reserve), Yellabinna sand dunes in Central South Australia and the Eyre Peninsula in South Australia (Menkhorst and Knight 2004) (see Figures 2, 3 and 4).

All sites where Sandhill Dunnarts have been found in Western Australia prior to 2001 (Hart and Kitchener; 1986; Pearson and Robinson; 1990) have been impacted by fire, fragmenting populations and making them harder to find. Similarly, the fact that only four of the 10 sites where Gaikhorst and Lambert have found Sandhill Dunnarts in Western Australia between 2001 and 2008 remain intact highlights the fragility of the desert landscape, where wildfires burn unchecked and alter vast stretches of habitat on a regular basis.

There is limited information available regarding the reproduction of Sandhill Dunnarts in the wild. Churchill (2001b) estimated the breeding season in the wild to be from September through to December / January, but captive studies at Perth Zoo by Gaikhorst and Lambert indicate that mating can occur from as early as July.

In 1999-2001, an extensive study and trapping programme (Churchill, 2001a) was conducted by South Australia's Department for Environment, Heritage and Aboriginal Affairs, resulting in the capture of 22 individual Sandhill Dunnarts from over 21,000 trap nights. This study resulted in the development of a Recovery Plan for the species (Churchill, 2001b). However, despite these and various other trapping efforts since, the species is still known from less than 100 individuals, with the recovery plan indicating that there is still much research to be done.

Sandhill Dunnarts in Western Australia have been captured in Queen Victoria Springs, (Pearson and Robinson, 1990) and near Mulga Rock in the Great Victoria Desert (Hart and Kitchener, 1986). The only Sandhill Dunnart captures known to have been recorded within the greater Tropicana area were made by Gaikhorst and Lambert between 2001 and 2008. Seventeen animals were captured during this period over seven sites. Most of these animals where located 90 km or further, south west from the main Operational Area of the TGP. One animal was captured closer, approximately 50km south west from the main Operational Area of the TGP on the Plumridge east/west Road.

Other trapping sessions to specifically target Sandhill Dunnarts within the region were conducted by *Ecologia* Environmental Consultants as part of the Cable Haul Road Infrastructure Corridor and TGP Operational Area fauna surveys (Ecologia 2007), following discussions and guidance from Gaikhorst and Lambert regarding appropriate habitat and trap type. No Sandhill Dunnarts were captured by *Ecologia*.

The following sub-sections provide a summary description of biophysical environment preferred by the Sandhill Dunnart based on all known capture sites within Western Australia. This information comes from records made by Hart and Kitchener (1986), Pearson and Robinson (1989), and Gaikhorst and Lambert between 2001 and 2008. Although there are 16 different sites described, the summary represents the most consistent description of Sandhill Dunnart habitat.

3.1 CLIMATE

The climate of the GVD is classified as hot, persistently dry desert, according to a modified Koëppen climate classification system (BoM 2008). Average annual rainfall within the GVD ranges from 150 mm to over 250 mm (Laut, 1977; Newby, 1984). Northern sectors are slightly more dominated by summer rainfall patterns (or tropical lows); however, rainfall across the region is still largely unpredictable and highly variable from year to year.

Mean maximum summer temperatures range from 32 – 35 ^{0}C (World Wildlife, 2008). Diurnal ranges are also considerable with winter temperatures commonly falling overnight to below 0 ^{o}C.

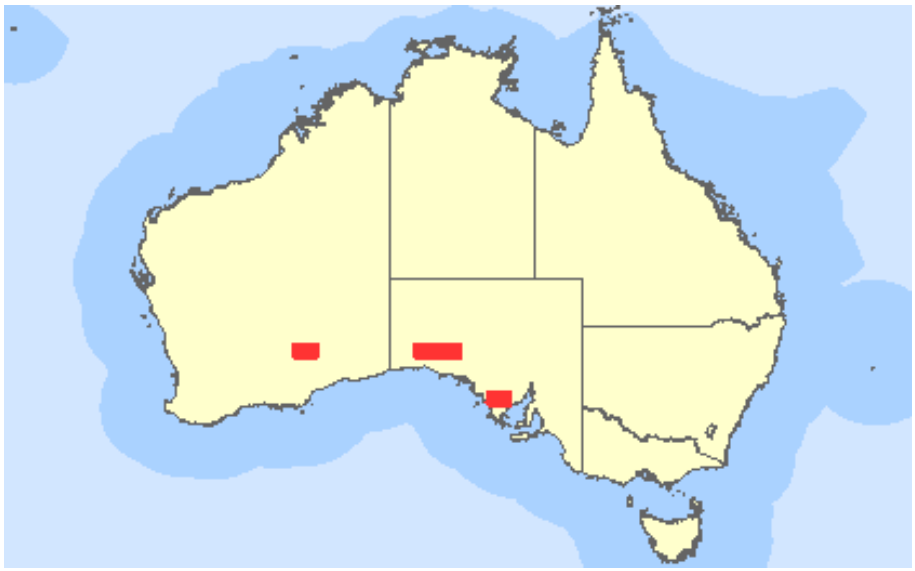
No specific climatic data are available for the TGP site; however, the operational area is situated roughly between two official Bureau of Meteorology weather recording stations located at Laverton (200 kms to the north west) and Rawlinna (200 kms to the south east). Laverton has records spanning from 1899 to 2008 and Rawlinna from 1915 to 2002.

Mean maximum temperatures recorded at Laverton range from 35.8 ^{o}C in January to 17.8 ^{o}C in July. Mean minimum temperatures range from 20.5 ^{o}C in January to 5.2 ^{o}C in July. Laverton's mean annual rainfall is 232.2 mm, with monthly averages ranging from 8.1 mm in September to 30.4 mm in March (BoM, 2008).

Mean maximum temperatures recorded at Rawlinna range from 32.9 ^{o}C in January to 18.0 ^{o}C in July. Mean minimum temperatures range from 15.6 ^{o}C in January to 4.6 ^{o}C in July. Rawlinna's mean annual rainfall is 198.6 mm, with monthly averages ranging from 12.8 mm in October to 21.0 mm in March (BoM, 2008).

3.2 DISTRIBUTION

The distribution of the Sandhill Dunnart is restricted to southern Australia Figure 2. In Western Australia the species in known to occur in Queen Victoria Springs Nature Reserve and areas to the north and north west in the vicinity of Mulga Rocks and close to PNC airstrip. Unpublished capture data from Gaikhorst and Lambert is also presented in Figure 5. In South Australia Sandhill Dunnarts are known to occur in the Ooldea and Yellabinna region and on the Eyre Peninsula as presented in Figure 6. Since being described the Sandhill Dunnart has not been recorded in the Northern Territory.



Source: Department of the Environment, Water, Heritage and the Arts (2008)'

Figure 2: Current Distribution of the Sandhill Dunnart

3.3 BIOGEOGRAPHY AND LANDFORMS

Sandhill Dunnarts have been found on sites with deep yellow sands (occasionally orange) ranging from very gently undulating sandplains to well defined dunes up to 30 metres in height. These have been formed by erosion of the underlying igneous and sedimentary bedrock. They are occasionally found on flat sandplains with an association to an undulating or dunal system. Plate 1 to Plate 6 show photographs of habitat at Sandhill Dunnart capture sites located prior to this survey.

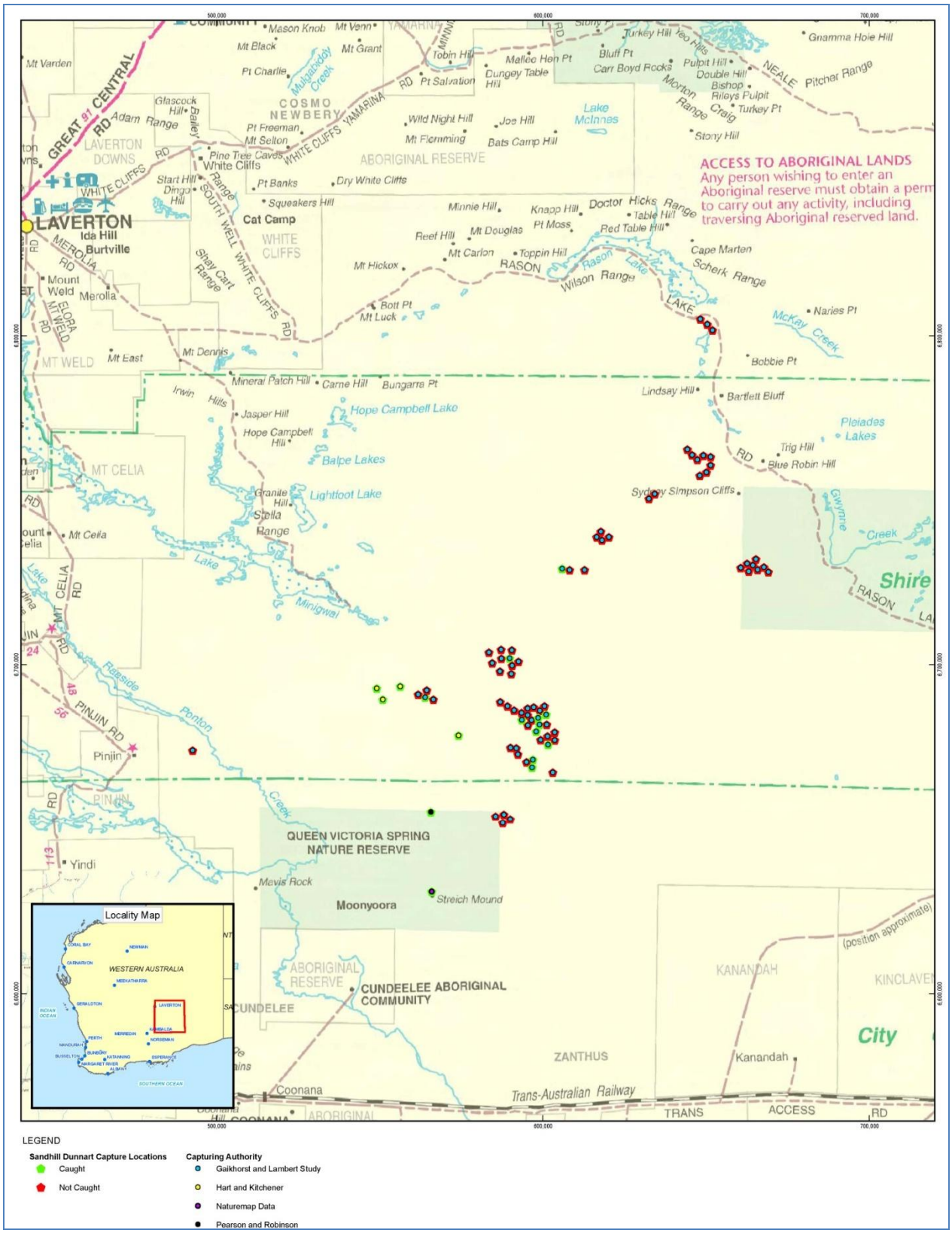


Figure 3: Distribution of Sandhill Dunnarts in Western Australia

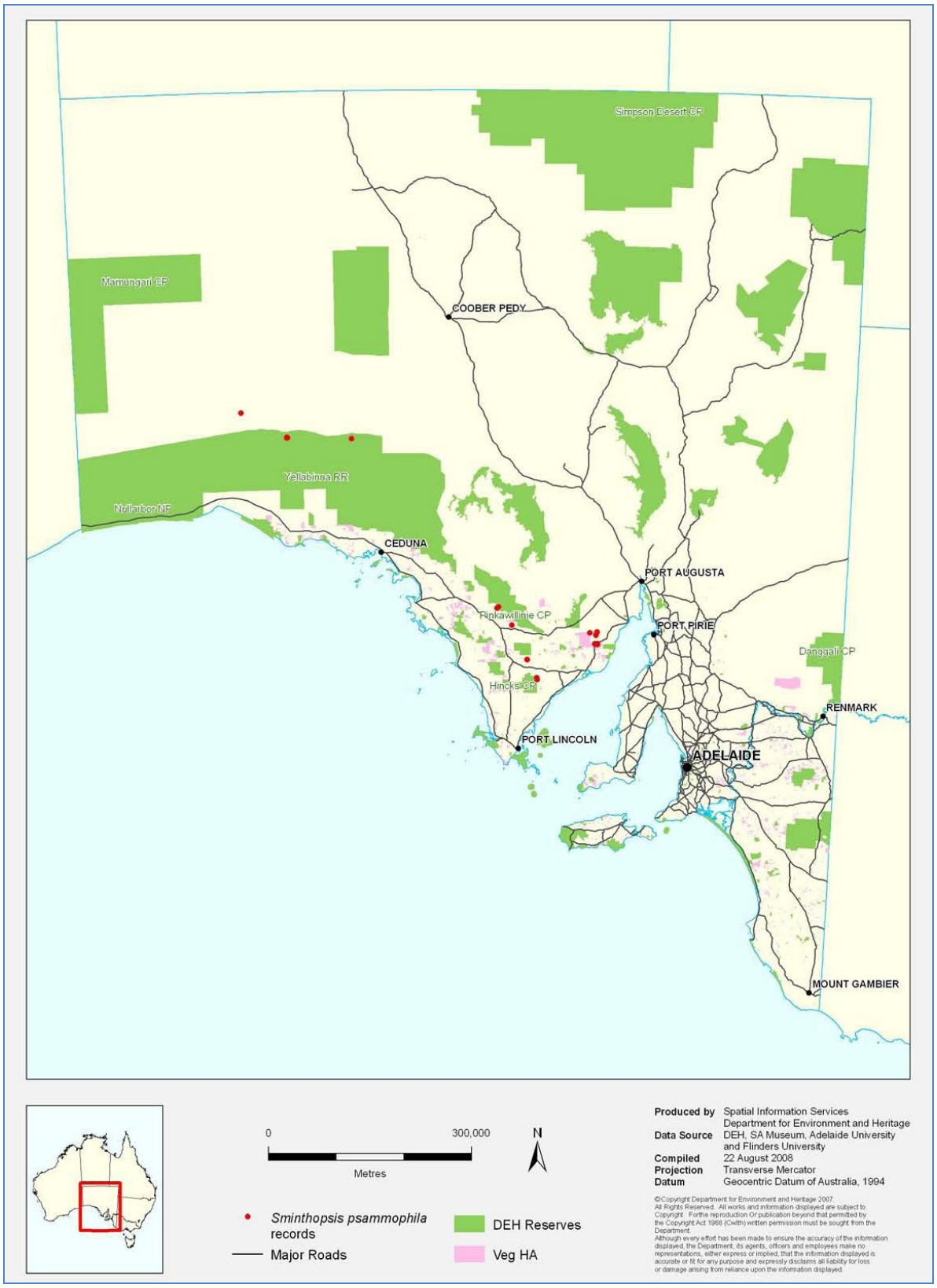


Figure 4 Distribution of Sandhill Dunnarts in South Australia (from Way, 2008)

Plate 1: Known Sandhill Dunnart habitat approximately 65km NE of Queen Victoria Springs. Yellow dune system with Spinifex cover of 10-30%, Mallee and Marble Gum (10-30%), mixed shrub layer with Spinifex life stages of 2, 3 and 4.

Plate 2: Known Sandhill Dunnart habitat approximately 65km NE of Queen Victoria Springs. Yellow dune system with Spinifex cover of 10-30%, Mallee and Marble Gum (10-30%), mixed shrub layer with Spinifex life stages of 2, 3 and 4.

Plate 3: Known Sandhill Dunnart habitat approximately 65km NE of Queen Victoria Springs. Swale area in association with yellow dune system which has Spinifex cover of 10-30%, Mallee and Marble Gum (10-30%), little mixed shrub layer with Spinifex life stages of 3 and 4 (but dominated by 3).

Plate 4: Known Sandhill Dunnart habitat approximately 65km NE of Queen Victoria Springs. Yellow dune system with Spinifex cover of 10-30%, Mallee and Marble Gum (10-30%), mixed shrub layer with Spinifex life stages of 2, 3 and 4.

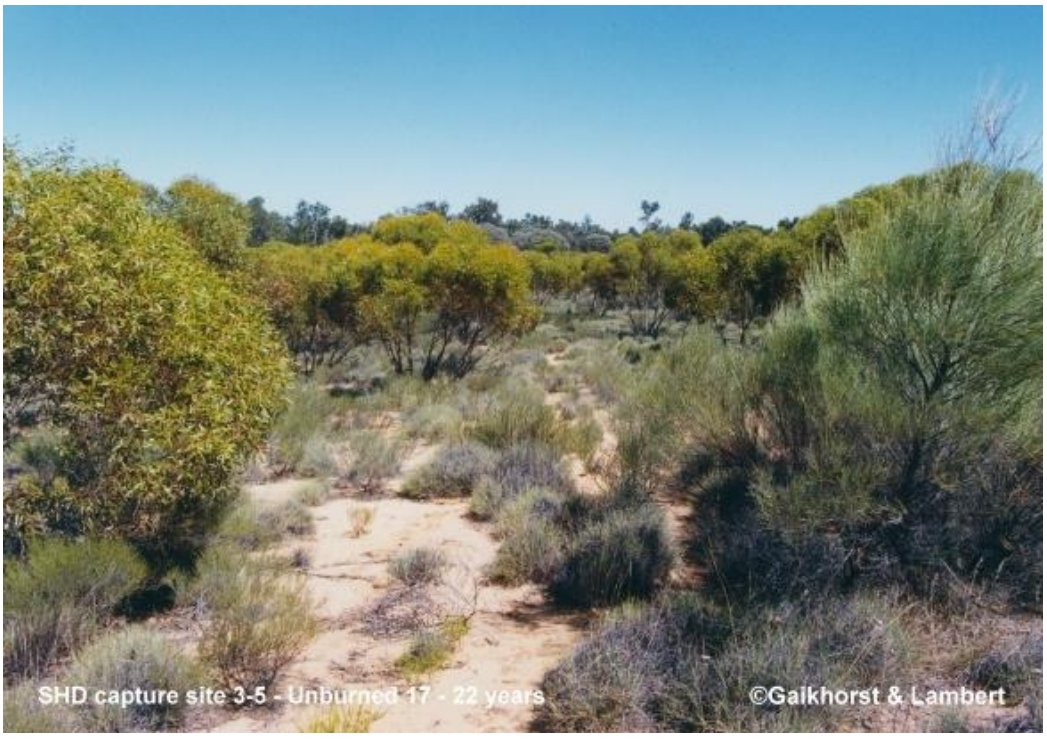


Plate 5: Known Sandhill Dunnart habitat approximately 90km NE of Queen Victoria Springs. Yellow dune system with Spinifex cover of 10-30%, Mallee (10-30%), mixed shrub layer with Spinifex life stages of 2, 3 and 4.

Plate 6: Known Sandhill Dunnart habitat approximately 110km NE of Queen Victoria Springs. Yellow dune system with Spinifex cover of 10-30%, Mallee, Marble Gum and Callitris (10-30%), mixed shrub layer with Spinifex life stages of 3 and 4.

3.4 FLORA AND VEGETATION

Sandhill Dunnarts have been captured in a range of flora and vegetation communities which commonly have Spinifex hummock grasses (*Triodia species*), Mallee (*Eucalyptus species*), Marble Gum (*Eucalyptus gongylocarpa*) and *Callitris verrucosa* (Churchill 2001b). This information is based on Sue Churchill's work and described South Australian vegetation types. Spinifex quality is described in greater detail in section 3.6.

In Western Australia Hart and Kitchener's (1986) sites included mosaic areas of Marble Gum (*Eucalyptus gongylocarpa*) and Mallee Woodlands over Spinifex (*Triodia basedowii*) with some shrubs including Broombush (*Malaleuca uncinata*) to 2.5m tall. Spinifex cover ranged from 1 -30%, with most animals caught in 20-30%.
In Queen Victoria Springs Nature Reserve Pearson and Robinson (1989) recorded specimens caught in low open Marble Gum (*Eucalyptus gongylocarpa*) woodlands with occasional Mallees with a diverse shrub layer. Spinifex (*Triodia basedowii*) under the shrub layer provided approximately 25% cover.

Sandhill Dunnarts have been captured in a range of flora and vegetation communities. Gaikhorst and Lambert (unpublished data) have found the preferred vegetation community to comprises of tall mallee (<10 - 30% cover), mixed shrubland (10 - 30% cover), or a combination of both mallee and mixed shrubland (<10 - 30% cover). Beneath this layer is a minimum of 10 - 30% cover of Spinifex (*Triodia sp*.). Occasionally Grevillea, Melaleuca or Casuarina may dominate a particular site, but more often the shrub layer will include a diverse array of species, which will commonly include *Acacia* spp., *Gravillea spp*. and *Callitris verrucosa*. Sandhill Dunnarts have also been captured in low, open (<10%) Marble Gum (*Eucalyptus gongylocarpa*) woodland, or mallee with emergent Marble Gums (10 - 30% cover). These sites also carry a diverse mix of shrubs (10 - 30% cover) and 10 - 30% cover of Spinifex.

There have been two sites somewhat different to the above description. One of the Gaikhorst and Lambert sites had more Spinifex cover (30 - 70%), which would probably simply provide better shelter and protection for the animals, and one of the Hart and Kitchener sites had red soil and about 1% cover of Spinifex. This is quite inconsistent with other known Sandhill Dunnart capture sites, including those from South Australia. Spinifex is considered to be a critical habitat requirement (Churchill, 2001b), and so it is possible that the animal was moving through this site in its search for more suitable habitat.

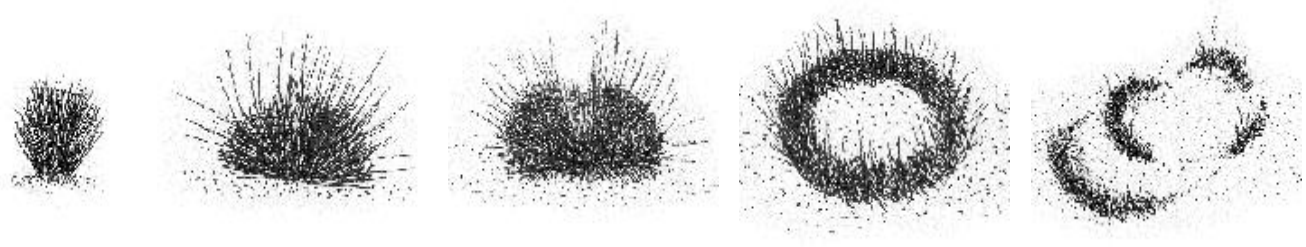
3.5 FIRE FREQUENCY

All Sandhill Dunnart capture sites in Western Australia are quite long unburned, ranging from an estimated eight years or more for the Hart and Kitchener sites and up to 28 to 38 years for the Pearson and Robinson sites (Hart and Kitchener, 1986, Pearson and Robinson, 1989).

3.6 SPINIFEX AS A CRITICAL HABITAT REQUIREMENT

Churchill (2001a) reports that on the Eyre Peninsula in South Australia, habitat unburnt for between eight and 20 years appears to provide the best vegetation structure for occupation by Sandhill Dunnarts. This particularly relates to the use of Spinifex hummocks for shelter, and the time it takes post-fire for the clumps to reach a size that will provide sufficient cover, perhaps from predators, and also protection from the extremes of temperature. After 20 years post-fire, the clumps begin to die from the middle outwards, leaving a very thin large ring of loose and sparse Spinifex, providing little shelter, and by 30 years post-burn, the Spinifex generally dies out altogether. Apart from making a nest in the centre of a Spinifex hummock, a Sandhill Dunnart may also dig a burrow into the sand beneath for extra protection, particularly as the hummock begins to die out and lose its structure (Churchill 2001a).

The Department for Environment and Heritage, South Australia has developed a key to describe the life stages of Spinifex and the relationship of these life stages to Sandhill Dunnart usage. It was found that Spinifex at life stage 3 was optimum for Sandhill Dunnart utilization, with the animals utilizing preferred clumps every 3-4 days (Churchill 2001a). The life stages are shown below.



Stages of Spinifex growth (taken from Department for Environment and Heritage)

The age that Spinifex is useful to Sandhill Dunnarts is likely to differ from area to area, and from species to species. Good rainfall may make young Spinifex useful at an earlier age, and very old Spinifex may remain useful for longer if there is not more suitably aged vegetation close by, forcing animals to remain in sub-optimal habitat. In Western Australia it is clear that Sandhill Dunnarts can be found in vegetation much older than the 20 years post-burn (Pearson and Robinson, 1989) that seems typical in South Australia. Although in Western Australia there have been no studies regarding the size of Spinifex clumps at Sandhill Dunnart capture sites, Churchill (2001a) suggests from studies based in South Australia that Spinifex hummocks 70 - 100 centimetres in diameter, and about 40 centimetres tall with a life stage of 3 make preferred nesting sites.

Gaikhorst and Lambert have found that in Western Australia, Sandhill Dunnarts can be found in areas with slightly smaller (Stage 2) or older Spinifex (Stage 4). Stage 4 however is degraded and already broken into a ring where an interval stage of 3.5 should be included which demonstrates a clump that still has shape with more of the sides dead but yet to cave in. Therefore Spinifex life stages of 2 to 3.5 have been observed to be used in Western Australia by Sandhill Dunnarts.

3.7 FIRE AS A LIMITING FACTOR

The rejuvenation of Spinifex by fire is a necessary requirement in order to provide the correct aged Spinifex for the Sandhill Dunnart's needs. However, the incidence of wildfire in the Great Victoria Desert area over the past years has devastated vast areas, leaving very little long unburnt vegetation suitable for Sandhill Dunnarts. Of the 16 sites where animals have been captured in Western Australia, only four have not been impacted by fire, with one of these being a small pocket of unburnt vegetation surrounded by a recent burn. Large unchecked fires make it very difficult for animals to recolonise habitat as it becomes suitable to occupy, as they must cover kilometres of open ground to get there, exposing them to predation. The protection of what remains of long unburned vegetation is therefore very important, as is the concept of smaller burns which create a mosaic of differently aged vegetation which may assist recolonisation following fire, and prevent the further fragmentation of the remaining populations.

4.0 RELEVANT LEGISLATION AND COMPLIANCE WITH RECOGNISED STANDARDS

4.1 COMMONWEALTH LEGISLATION

The *Environment Protection and Biodiversity Conservation Act 1999* (*EPBC Act*) is the Commonwealth Government's central piece of environmental legislation that protects matters of national environmental significance including nationally and internationally important flora, fauna, ecological communities and heritage places. It is administered by the Department of Environment, Water, Heritage and the Arts (DEWHA).

Species of conservation significance listed under the *EPBC Act* and are categorised as either:

- Extinct.
- Extinct in the wild.
- Critically endangered.
- Endangered.
- Vulnerable, or
- Conservation dependant.

The Sandhill Dunnart is listed as Endangered under the *EPBC Act*. A native species is eligible to be included in the Endangered category at a particular time if, at that time, it is not critically endangered and it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with prescribed criteria.

4.2 STATE LEGISLATION

The *Western Australian Wildlife Conservation Act 1950* (*WC Act*) is State legislation for fauna protection administered by the Department of Environment and Conservation (DEC). In 2008, the list of conservation significant species was reviewed and the Wildlife Conservation (Specially Protected Fauna) Notice 2008 (2) was published. The Schedules defined under this legislation comprise:

- Schedule 1, fauna that is rare or is likely to become extinct.
- Schedule 2, fauna presumed to be extinct.
- Schedule 3, birds protected under an international agreement such as the Japan-Australian Migratory Bird Agreement (JAMBA) or the China-Australia Migratory Bird Agreement (CAMBA).
- Schedule 4, other specially protected fauna.

The Sandhill Dunnart is listed in Schedule 1 as "Fauna that is rare or is likely to become extinct."

4.3 LICENCES AND ETHICS

People wishing to undertake research on threatened wildlife and other protected wildlife in WA require licences issued pursuant to the *WC Act*. Administration of these requirements is coordinated by the DEC's Species and Communities Branch.

Fieldwork was conducted under DEC Special Fauna licence SF006210, valid between 1 March 2008 and 28 February 2009.

5.0 METHODOLOGY

5.1 SURVEY TEAM

The survey team consisted of:

- Glen Gaikhorst: Masters, Captive Vertebrate Management — Senior Zoologist
- Cathy Lambert: BSc, Environmental Biology — Senior Zoologist
- Michael Cranley: — Technical Support Officer

In 2000 Gaikhorst and Lambert assisted Sue Churchill in her year long study of the Sandhill Dunnart, each spending three weeks in the Great Victoria Desert and Eyre Peninsula. This was done to accumulate knowledge of the species before embarking on their own field and captive studies. Between 2000 and 2009 Glen and Cathy completed 12 field trips (of two to three weeks) to Western Australia's Great Victoria Desert and captured 25 Sandhill Dunnarts - collecting information regarding the distribution, abundance and ecology of the Sandhill Dunnart - and have conducted captive studies which have answered questions regarding their reproductive biology.

The surveys for Sandhill Dunnarts in the defined Pinjin and Bypass infrastructure corridors and Operational Areas were undertaken in accordance with the Environmental Protection Authority (2004) Guidance Statement 56.

5.2 SITE SELECTION

Prior to undertaking a field survey, a desktop assessment of aerial photos was conducted looking at the following survey zones:

- The Tropicana Operational Area consisting of a 10 kilometre by 10 kilometre zone encompassing the existing camp, the proposed mining area and surrounding areas.
- The proposed Pinjin Infrastructure Corridor (maps 1 to 23) consisting of a 200 metre buffer either side of the central alignment with this buffer increasing in some areas to 500 metres either side of the alignment. The maps provided extended for two kilometres in width, although assessments were restricted to within or only just outside the buffer zone.
- The public bypass corridor consisting of a 100 metre wide corridor and the same map dimensions as the infrastructure corridor.

Assessment of aerial photographs focused on:

- Identification of dune systems and sand plain areas with dune systems nearby or connectivity to them;
- Well vegetated areas (except that of mulga thickets); and
- Areas where there had been no obvious, recent and extensive fires throughout which left no patches of remnant vegetation.

Examination of aerial photographs identified 21 areas of potentially suitable Sandhill Dunnart habitat. These consisted of eight sites in the Operational Area and 13 sites along the infrastructure corridors. Although imagery of the western extent of the public bypass appeared to show some possible habitat, ground truthing of the areas exposed the sites as unsuitable.

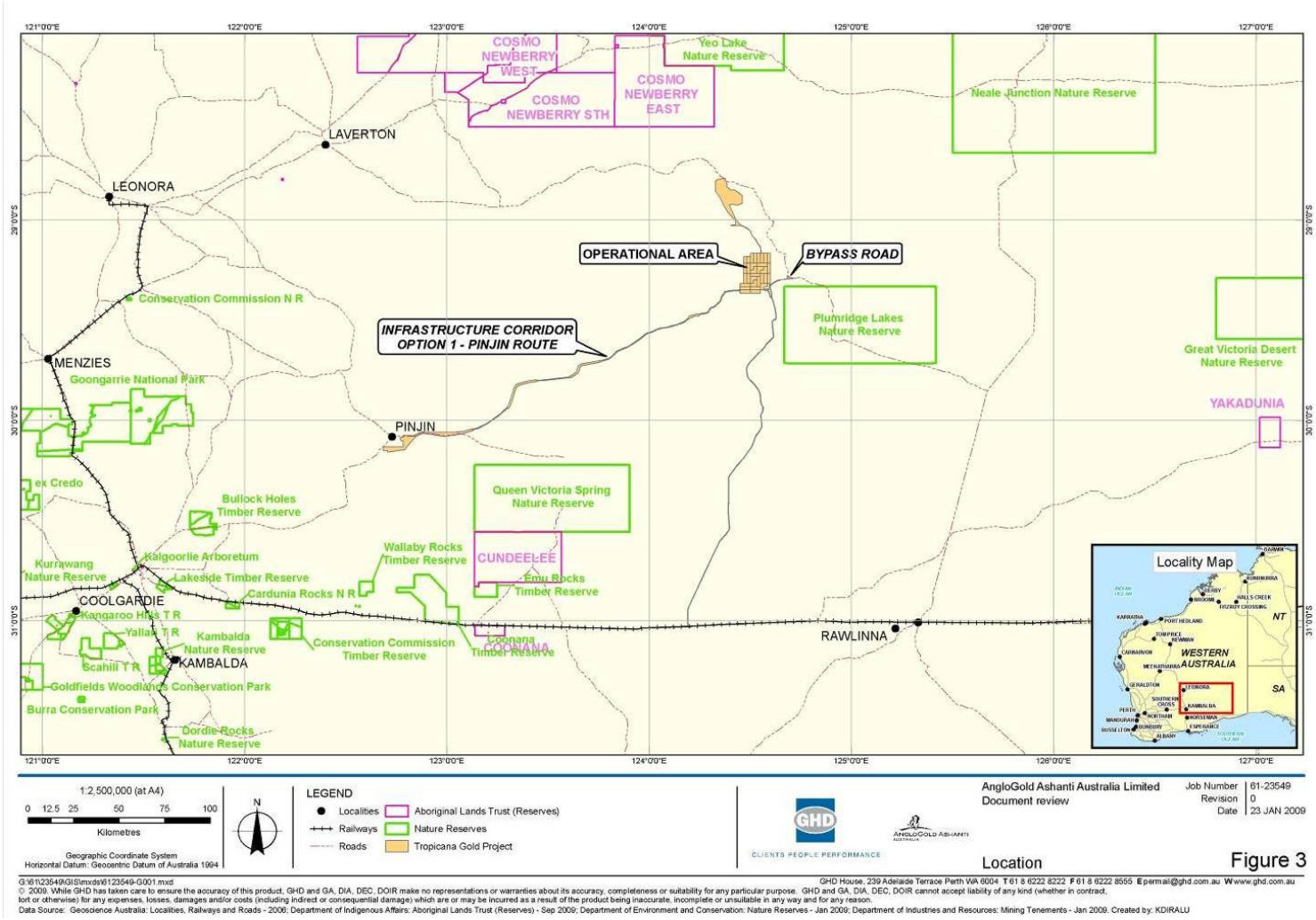


Figure 5: The Sandhill Dunnart Survey area – Operational Area, Pinjin Corridor and Public Bypass

5.3 GROUND ASSESSMENT

Two experienced zoologists and one technical assistance officer conducted the field components of the Sandhill Dunnart Survey over a 10 day period from the 5 to the 14 March, and an eight day period from the 21 to the 28 May 2008.

Areas identified from aerial photographs were visited and ground truthed, further assessed for suitability by identifying key habitat qualities as outlined in Section 3 of this report. Assessment of habitat was undertaken using techniques adopted by Churchill.

Habitat was assessed for:

- Deep yellow sands (occasionally orange) 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 10 – 30% cover) which have been unburnt for between approximately 10 and 30 years having at least 6% cover of Spinifex life stages of 2 to 3.5.

Sites were selected for trapping if the majority of the above assessment criteria were met. The presence or absence of small mammal tracks was also used as a tool in assessing the potential of an area. However, tracks could not be used as a definitive guide to the presence of Sandhill Dunnarts as *S. hirtipes* and *S. dolichura* have similar tracks.

5.4 TRAPPING

Elliott and pitfall traps were used in sites selected as having habitat potentially suitable for Sandhill Dunnarts. For animal welfare, pitfall traps were cleared twice each day – early morning for the nocturnal animals, and late in the day for diurnal reptiles. Elliott traps were similarly cleared in the early morning, but closed during the day to avoid the likelihood of animals entering the traps and over-heating. Elliott traps were re-opened late in the day.

In May 2000 a proposal of works and trapping methodology was discussed with, and endorsed by, Sue Churchill.

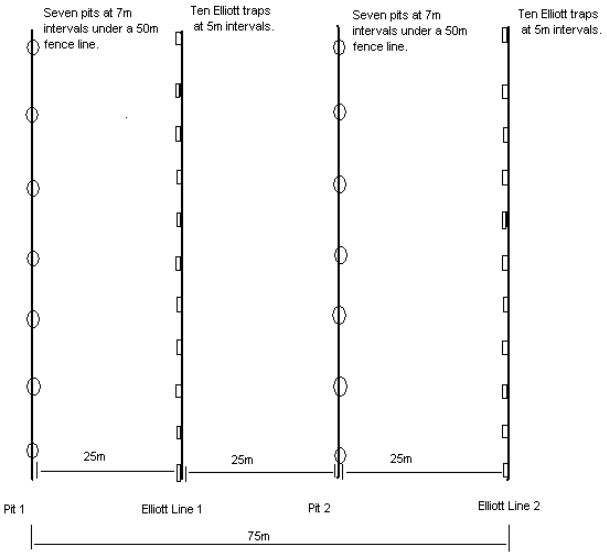
Sandhill Dunnarts are a large species that may have the potential to jump out of the pit-traps often used with standard survey methods. Based on recommendations by Churchill (pers. comm. 2000) and Churchill (2001a, 2001b) for the use of deep pitfall traps to capture this species, a design of 600 millimetre deep traps with a 250 millimetre diameter was adopted and is highly recommended as the critical factor when trapping for Sandhill Dunnarts (Churchill 2001b). Based on previous trapping efforts, Sandhill Dunnarts are more readily captured in deep pitfall traps than Elliott traps (Churchill 2001a). Elliott traps are used as a supplementary trap type in Sandhill Dunnart surveys. Gaikhorst and Lambert used 5m intervals between Elliot traps to concentrate trapping efforts within a defined quadrat size (see methods below), while other Sandhill Dunnart Elliott intervals have varied considerably between projects, 10m (Churchill 2001a), 10m (Way 2008), 10m (Hart and Kitchener, 1986) and 20+m (DEC comments 2009). Churchill (2001a) caught 9 out of 15 animals in deep pitfall traps and Gaikhorst and Lambert (unpublished data) caught 23 out of 25 animals in deep pitfall traps, reiterating the importance of deep pitfall traps over Elliott traps.

Comments were sought from Matthew Ward (Department for Environment and Heritage, South Australia) on the trapping method used by Gaikhorst and Lambert and he could see no problem with the trapping technique. This memo is provided at Appendix 1.

The following method was used to systematically sample selected sites:

- A 75 metre by 75 metre quadrat was delineated and fourteen pit-traps and 20 Elliott traps set up in the quadrat.
- Each quadrat had two lines of pitfall traps, alternating with two lines of Elliott traps (all 25 metres apart) and they were generally set up to straddle the crest of a dune.
- Each pit-trap line had seven pits (7 per line - 14 pits per quadrat), was 600 millimetres deep and spaced at seven metre intervals along a 50 metre fly-wire fence that ran across the centre of each pit. The fly-wire fence (approximately 300 millimetres high) was dug approximately 100 millimetres into the ground to prevent animals from digging or forcing their way under it.
- The Elliott trap lines (10 per line- 20 per quadrat) were placed at five metre intervals and were positioned under shrubs or around Spinifex clumps. The Elliott traps were baited every afternoon with a small ball of a mixture consisting of peanut butter, rolled oats and sardines.
- Each quadrat was trapped for a minimum of four days, and up to seven when time and weather permitted. This allowed a minimum of 56 pit nights and 80 Elliott trap nights per quadrat (a combined trap session of 136 trap nights). The maximum trap nights were 98 pit nights and 140 Elliott trap nights per quadrat (a combined trap session of 238 trap nights). Note: Because of the small areas suitable for trapping, quadrat were often placed close to each other, covering most of the available suitable habitat.
- Captured animals were placed in calico bags, processed on-site and then released at point of capture before moving on to the next quadrat. Details of the species, sex, age and reproductive condition were recorded.

  The diagram below shows trap design.



5.5 OPPORTUNISTIC DATA

Other animals observed during field trips, but not captured in traps, were recorded in the dataset. Malleefowl nests, and footprints and scats from introduced predators were also recorded.

6.0 RESULTS

6.1 SITE ASSESSMENT

The results of ground truthing sites chosen from the desktop assessment of aerial photos are provided in Table 1. This includes:

- Site location.
- Landform.
- Vegetation condition and Spinifex life stage assessment.
- Approximate years since fire.
- Assessment of suitability for Sandhill Dunnart habitat.
- Number of grids set up.

Trap sites established along the Pinjin access road and in the Operational Area are presented in Figure 6 and Figure 7 respectively. Photographs of each trap site are presented in Plates 7 to 20.

Table 1: Results of ground truthing potentially suitable sites

Map Reference	Centre Easting	Centre Northing	Landform	Vegetation condition/description	Approximate years since fire	Potentially suitable habitat (Y/N)	Number of trap grids set up	Comments
Project Area								
Site 1A	647873	6761994	• South facing slope of sand dune. • Reddish sand.	• Open Marble Gum / *Callitris* woodland (<10%) over open hummock grassland (10 - 30% cover) with sparse mixed open shrub layer dominated by *Leptospermum* sp (<10%). • Spinifex is a mix of small, well formed clumps plus some older ones dying from the middle outwards. • Spinifex life stages 2, 3 and 3.5.	20 - 30 years	Y	1 • 4 Trapping nights • 56 Pit-nights • 80 Elliott-nights	• The area to the east of Site 1 grids had too much mulga, and the remainder was too recently burned, particularly along the southern edge, to be considered typical of Sandhill Dunnart habitat. However, as the vegetation gets older, it may become more typical and warrant investigation at a later date.
Site 1B	649551	6762077	• North facing slope of sand dune. • Orange/red sand.	• Open Marble Gum woodland (<10%) over open hummock grassland (10 - 30% cover), with a sparse open shrub layer dominated by Acacia (10 - 30% cover). • Spinifex clumps reasonably sized but fairly poor quality. • Spinifex life stages 3 and 4.	15 - 20 years	Y	1 • 4 Trapping nights • 56 Pit-nights • 80 Elliott-nights	

Map Reference	Centre Easting	Centre Northing	Landform	Vegetation condition/description	Approximate years since fire	Potentially suitable habitat (Y/N)	Number of trap grids set up	Comments
Site 2A	650753	6761308	• North facing slope of sand dune. • Orange/red sand.	• Tall open mallee (<10%) with emergent Marble Gums over open hummock grassland (10 - 30% cover). Mixed low open shrub layer dominated by *Acacia* (<10%). • Spinifex still fairly small, but scattered throughout were some good sized clumps that were quite compact. • Spinifex life stages 2 and 3.	15 years	Y	1 • 4 Trapping nights • 56 Pit-nights • 80 Elliott-nights	• Most of the area surrounding the Site 2 grids had been too recently burned (5 – 10 years) to be considered typical of Sandhill Dunnart habitat. However, as the vegetation gets older, it may become more typical and warrant investigation at a later date.
Site 2B	650732	6762140	• North facing slope of sand dune. • Orange sand.	• Tall open mallee (<10%) over open hummock grassland (10 - 30% cover) with low open shrub layer dominated by *Acacia* and *Leptospermum* (10 - 30% cover). • Large compact Spinifex clumps. • Spinifex life stages 3 and 3.5.	At least 30 years	Y	1 • 4 Trapping nights • 56 Pit-nights • 80 Elliott-nights	• Site 2B was an isolated dune surrounded by mulga, but was considered possibly Sandhill Dunnart habitat due to the large dense Spinifex clumps with good over-storey.
Site 3	652500	6761500	• Sand ridge • Orange sand	• Spinifex in poor condition. • Spinifex life stages 4 and 5.	At least 30 years	N	0	• Vegetation too old to be considered typical of Sandhill Dunnart habitat

Map Reference	Centre Easting	Centre Northing	Landform	Vegetation condition/description	Approximate years since fire	Potentially suitable habitat (Y/N)	Number of trap grids set up	Comments
Site 4A –	649850	6758163	• South facing slope of sand dune. • Orange/red sand.	• Low open mixed shrubland (10 - 30% cover) dominated by *Acacia* with the occasional mallee and Marble Gum over very open hummock grassland (10 - 30% cover). • Reasonably sized Spinifex, but not very compact. • Spinifex life stages 3.5 and 4.	20 years	Y	1 • 4 Trapping nights • 56 Pit-nights • 80 Elliott-nights	• The area north of Site 4 had been too recently burned to be typical of Sandhill Dunnart habitat however, as the vegetation gets older, it may become more typical and warrant investigation at a later date.
Site 4B –	650261	6758532	• North facing slope of sand dune. • Orange/red sand.	• Tall open mallee (<10%) with emergent Marble Gums over open hummock grassland (10 - 30% cover) and a low open shrublayer (<10%). • Mixed sizes of Spinifex and quite compact clumps. • Spinifex life stages 2, 3 and 4.	10 years	Y	1 • 4 Trapping nights • 56 Pit-nights • 60 Elliott-nights	
Site 5A –	646844	6762594	• North facing slope of sand dune. • Red sand.	• Marble Gum / *Callitris* woodland (<10%) over open hummock grassland (<10%) with a low open shrublayer (<10%). • Spinifex in large open rings with odd scattered small compact clumps. • Spinifex life stages 2, 3, 4 and 5.	20 - 30 years	Y	1 • 4 Trapping nights • 56 Pit-nights • 60 Elliott-nights	• Most of the area surrounding the Site 5 grids had been burnt within the last 5 – 10 years, so was not considered typical of Sandhill Dunnart habitat. However, as the vegetation gets older, it may become more typical

Map Reference	Centre Easting	Centre Northing	Landform	Vegetation condition/description	Approximate years since fire	Potentially suitable habitat (Y/N)	Number of trap grids set up	Comments
Site 5B –	646894	6762662	• South facing slope of sand dune. • Red sand.	• Marble Gum woodland with tall open mallee (<10%) over open hummock grassland (10 - 30% cover) and a mixed open shrublayer (10 - 30% cover). • Spinifex quite small and not as compact as desirable. • Spinifex life stages 2 reaching 3.	10 years	Y	1 • 4 Trapping nights • 56 Pit-nights • 60 Elliott-nights	and warrant investigation at a later date. Neither of the trapping grids were particularly typical either, as the soil was very red, and Spinifex was poor.
Site 6 –	645000	6767000	• Dune complex. • Yellow/orange sand.	• Based on recent burn history, difficult to describe vegetation. • Spinifex life stages 1.	5 - 10 years	N*	0	• There were isolated patches of approximately 30 years unburnt habitat, but these were considered too old to support a Sandhill Dunnart population. • Although this site is not currently typical of Sandhill Dunnart habitat, as the vegetation gets older, it may warrant investigation at a later date.

Map Reference	Centre Easting	Centre Northing	Landform	Vegetation condition/description	Approximate years since fire	Potentially suitable habitat (Y/N)	Number of trap grids set up	Comments
Site 7 –	647000	6766500	• Dune complex. • Yellow/orange sand. • Stony ridge and small breakaway protruding into dune field.	• Based on recent burn history, difficult to describe vegetation. • Spinifex life stages 1.	5 - 10 years	N*	0	• Although this site is not currently typical of Sandhill Dunnart habitat, as the vegetation gets older, it may warrant investigation at a later date.
Site 8 –	644000	6762000	• Dune system. • Yellow sand.	• Based on recent burn history, difficult to describe vegetation. • Spinifex life stages 1.	5 – 10 years	N*	0	• Although this site is not currently typical of Sandhill Dunnart habitat, as the vegetation gets older, it may warrant investigation at a later date.
Pinjin Infrastructure Corridor								
Site 9 (Map 2)	646853	6758371	• Dune system. • Yellow/orange sand.	• Good vegetation layers. • Good Spinifex density. • Spinifex life stages 2 and 3.	At least 10 – 15 years	Y	0	• Although this area is typical of other Sandhill Dunnart capture sites, it was right on the edge of the 400m buffer zone, and if the road corridor stays within the 100m proposed zone, this area would not be disturbed.

Map Reference	Centre Easting	Centre Northing	Landform	Vegetation condition/description	Approximate years since fire	Potentially suitable habitat (Y/N)	Number of trap grids set up	Comments
Site 10 (Map 2)	645608	6757362	• Small sand ridge. • Yellow/orange sand.	• Based on recent burn history, difficult to describe vegetation. • Spinifex life stages 1.	5 – 10 years	N*	0	• Although this site is not currently typical of Sandhill Dunnart habitat, as the vegetation gets older, it may warrant investigation at a later date.
Site 11 (Map 2)	645368	6757096	• Dune system. • Yellow/orange sand.	• Based on recent burn history, difficult to describe vegetation. • Spinifex life stages 1.	5 – 10 years	N*	0	
Site 12 (Map 3)	642000	6752500	• Small sand dune. • Yellow sand.	• Based on recent burn history, difficult to describe vegetation. • Spinifex life stages 1.	5 – 10 years	N*	0	• Although this site is not currently typical of Sandhill Dunnart habitat, as the vegetation gets older, it may warrant investigation at a later date.
Site 13 (Map 3)	640090	6752272	• Small sand dune. • Yellow sand.	• Based on recent burn history, difficult to describe vegetation. • Spinifex life stages 1.	5 – 10 years	N*	0	• Although this site is not currently typical of Sandhill Dunnart habitat, as the vegetation gets older, it may warrant investigation at a later date.
Site 14 (Map 3)	638321	6751991	• Extensive dune. • Yellow sand.	• Based on recent burn history, difficult to describe vegetation, although in the long unburned areas, the Spinifex was of poor quality. • Spinifex life stages 1 with patches of 5.	5 – 10 years plus patches of long unburned	N*	0	• Although this site is not currently typical of Sandhill Dunnart habitat, as the vegetation gets older, it may warrant investigation at a later date.

Map Reference	Centre Easting	Centre Northing	Landform	Vegetation condition/description	Approximate years since fire	Potentially suitable habitat (Y/N)	Number of trap grids set up	Comments
Site 15 (Map 3)	636894	6752081	• Sand dune. • Yellow sand.	• Patches of good Spinifex, but too fragmented to warrant trapping. • Spinifex life stages 1,2,3,4 and 5. (But very patchy).	At least 30 years, with patches of more recently burned vegetation.	N*	0	• Although this area had patches of habitat similar to other Sandhill Dunnart capture sites, it was considered too fragmented to warrant trapping. It was also right on the edge of the 400m buffer zone, and if the road corridor stays within the 100m proposed zone, this area would not be disturbed. As the vegetation of the burnt areas gets older, it may warrant investigation at a later date.
Site 16 (Map 3)	635374	6751924	• Sand dune. • Yellow sand.	• Spinifex not compact enough to be typical. • Spinifex life stages 4 and 5.	At least 30 years	N	0	• This area had been too long unburned to be considered typical of Sandhill Dunnart habitat.

Map Reference	Centre Easting	Centre Northing	Landform	Vegetation condition/description	Approximate years since fire	Potentially suitable habitat (Y/N)	Number of trap grids set up	Comments
Site 17A (Map 3)	633985	6751806	• North facing sand dune. • Yellow/orange sand.	• Low open Marble Gum woodland (<10%), with some *Callitris* and mallee over open hummock grassland (10 - 30% cover), with a mixed open shrub layer (<10%) including *Grevillea*. • Mixed Spinifex, some quite dead in patches, many large broken rings with bare sand in the middle, although quite good big compact clumps. • Spinifex life stages 3, 4 and 5.	At least 30 years	Y	1 • 7 Trapping nights • 98 Pit-nights • 100 Elliot-nights	• The area of dune to the east of the Site 17 grids has been burned within 5 – 10 years, and although not currently typical of Sandhill Dunnart habitat, as the vegetation gets older, it may warrant investigation at a later date. • The area of dune to the west of the Site 17 grids, Although this area had patches of habitat similar to other Sandhill Dunnart capture sites, it was considered too fragmented to warrant trapping.
Site 17B (Map 3)	634294	6751894	• North facing sand dune. • Yellow/orange sand.	• Tall open mallee shrubland (<10%) over open hummock grassland (10 - 30% cover). Mixed shrublayer including Leptospermum, Acacia, *Grevillea* and the occasional *Callitris* tree (<10%). • Mixed Spinifex from large broken rings with bare sand in the middle to quite good big compact clumps. • Spinifex life stages 3, 4 and 5.	At least 30 years	Y	1 • 7 Trapping nights • 98 Pit-nights • 100 Elliot-nights	

Map Reference	Centre Easting	Centre Northing	Landform	Vegetation condition/description	Approximate years since fire	Potentially suitable habitat (Y/N)	Number of trap grids set up	Comments
Site 18 (Map 5 - 6)	619743 6738383 TO 617447 6738383		• Extensive dune system. • Yellow sand.	• Based on recent burn history, difficult to describe vegetation. • Spinifex life stage 1.	5 – 10 years plus patches a little older.	N*	0	• Although this site is not currently typical of Sandhill Dunnart habitat, as the vegetation gets older, it may warrant investigation at a later date.
Site 19A (Map 6)	618076	6738570	• South facing sand dune. • Yellow/orange sand.	• Low open Marble Gum Woodland (<10%), with some *Callitris* over open hummock grassland (10 - 30% cover), with a tall open shrub layer (<10%) dominated by Casuarina, with some *Acacia* and *Xanthorrhoea*. • Spinifex is dead in patches, with many large rings with bare sand in the middle, although plenty of quite good compact clumps as well. • Spinifex life stages 3, 4 and 5.	At least 30 years	Y	1 • 6 Trapping nights • 84 Pit-nights • 100 Elliot-nights	• The remainder of Site 19 surrounding the trapping grids was also quite typical of Sandhill Dunnart habitat, however we consider the area to have been sufficiently sampled.

Map Reference	Centre Easting	Centre Northing	Landform	Vegetation condition/description	Approximate years since fire	Potentially suitable habitat (Y/N)	Number of trap grids set up	Comments
Site 19B (Map 6)	618244	6738669	• South facing sand dune. • Yellow/orange sand.	• Tall open mallee / *Casuarina* shrubland (<10%) over open hummock grassland (10 - 30% cover), with a mid shrub layer dominated by *Leptospermum* (<10%). • Spinifex is quite dead in patches, with many large rings with bare sand in the middle, although plenty of quite good compact clumps as well. • Spinifex life stages 3, 4 and 5.	At least 30 years	Y	1 • 6 Trapping nights • 84 Pit-nights • 80 Elliot-nights	
Site 19C (Map 6)	618387	6738711	• South facing sand dune • Yellow/orange sand.	• Tall open mallee shrubland (<10%) over hummock grassland (10 - 30% cover), with a low shrub layer of mostly Grevillea and Acacia with some Xanthorrhoea (<10%). • Spinifex in some areas in good condition and size, and quite compact. • Spinifex life stages 3 and 3.5.	15 - 20 years	Y	1 • 6 Trapping nights • 65 Pit-nights • 80 Elliot-nights	

Map Reference	Centre Easting	Centre Northing	Landform	Vegetation condition/description	Approximate years since fire	Potentially suitable habitat (Y/N)	Number of trap grids set up	Comments
Site 19D (Map 6)	618563	6738730	• South facing sand dune. • Yellow/orange sand.	• Low open Marble Gum woodland (<10%) over open hummock grassland (10 - 30% cover), with some tall open mallee • Spinifex in good condition and size, and quite compact. • Spinifex life stages 3 and 3.5.	15 – 20 years	Y	1 • 5 Trapping nights • 70 Pit-nights • 80 Elliot-nights	
Site 20 (Map 12)	564000	6712000	• Isolated sand dune	• Based on recent burn history, difficult to describe vegetation. • Spinifex life stage 1.	0 – 5 years	N*	0	• Although this site is not currently typical of Sandhill Dunnart habitat, as the vegetation gets older, it may warrant investigation at a later date.
Site 21 (Map 16)	539000	6702000	• Isolated sand dune	• Based on recent burn history, it is difficult to describe vegetation. • Spinifex life stage 1.	0 – 5 years	N*	0	• Although this site is not currently typical of Sandhill Dunnart habitat, as the vegetation gets older, it may warrant investigation at a later date.

Note: Site coordinates represent a central point of the potential habitat.
* Represents sites that are too recently burned to currently be considered typical of Sandhill Dunnart habitat, but which may have potential in another 5 – 10 years.

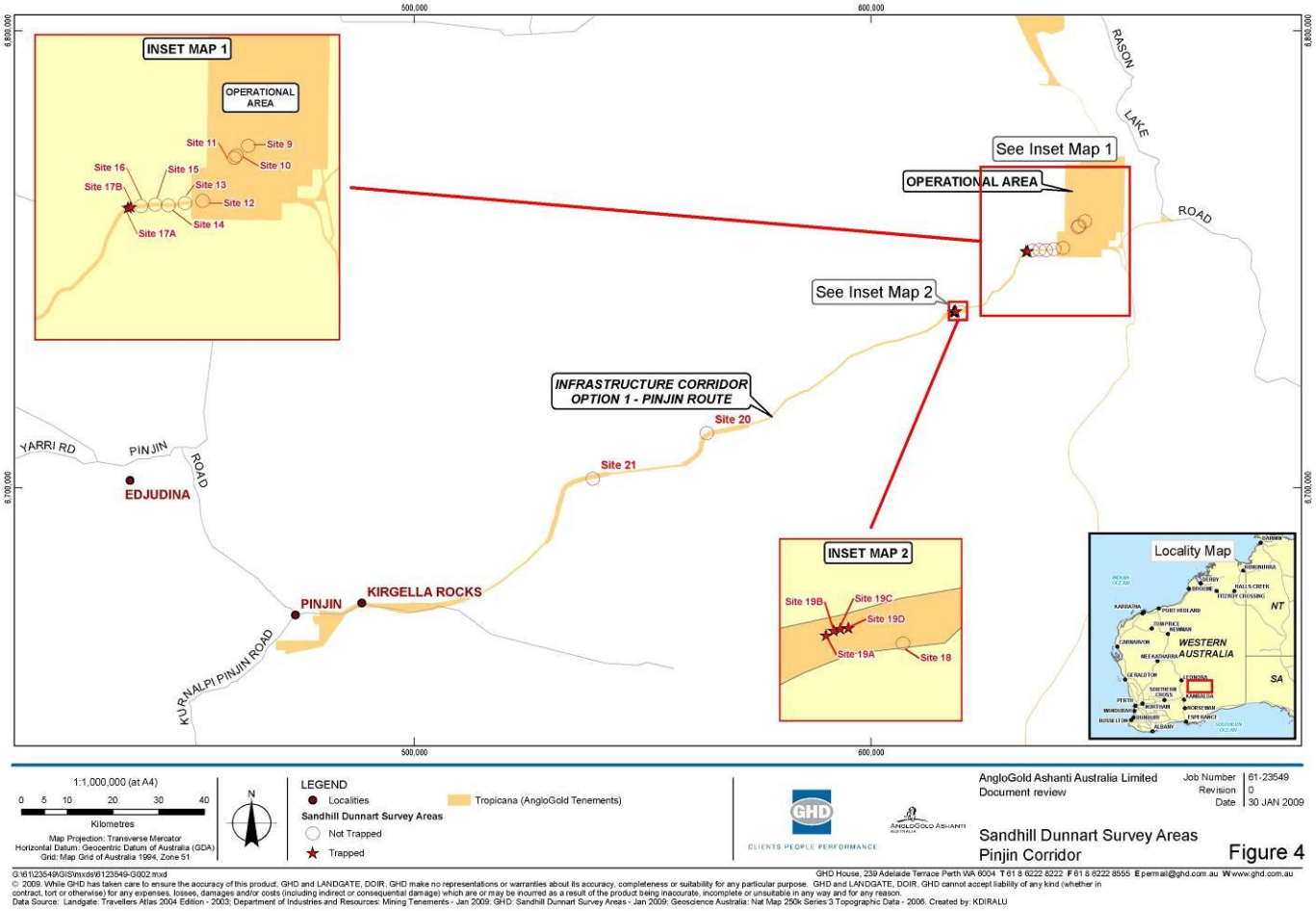


Figure 6: Sandhill Dunnart Survey Areas - Pinjin Corridor

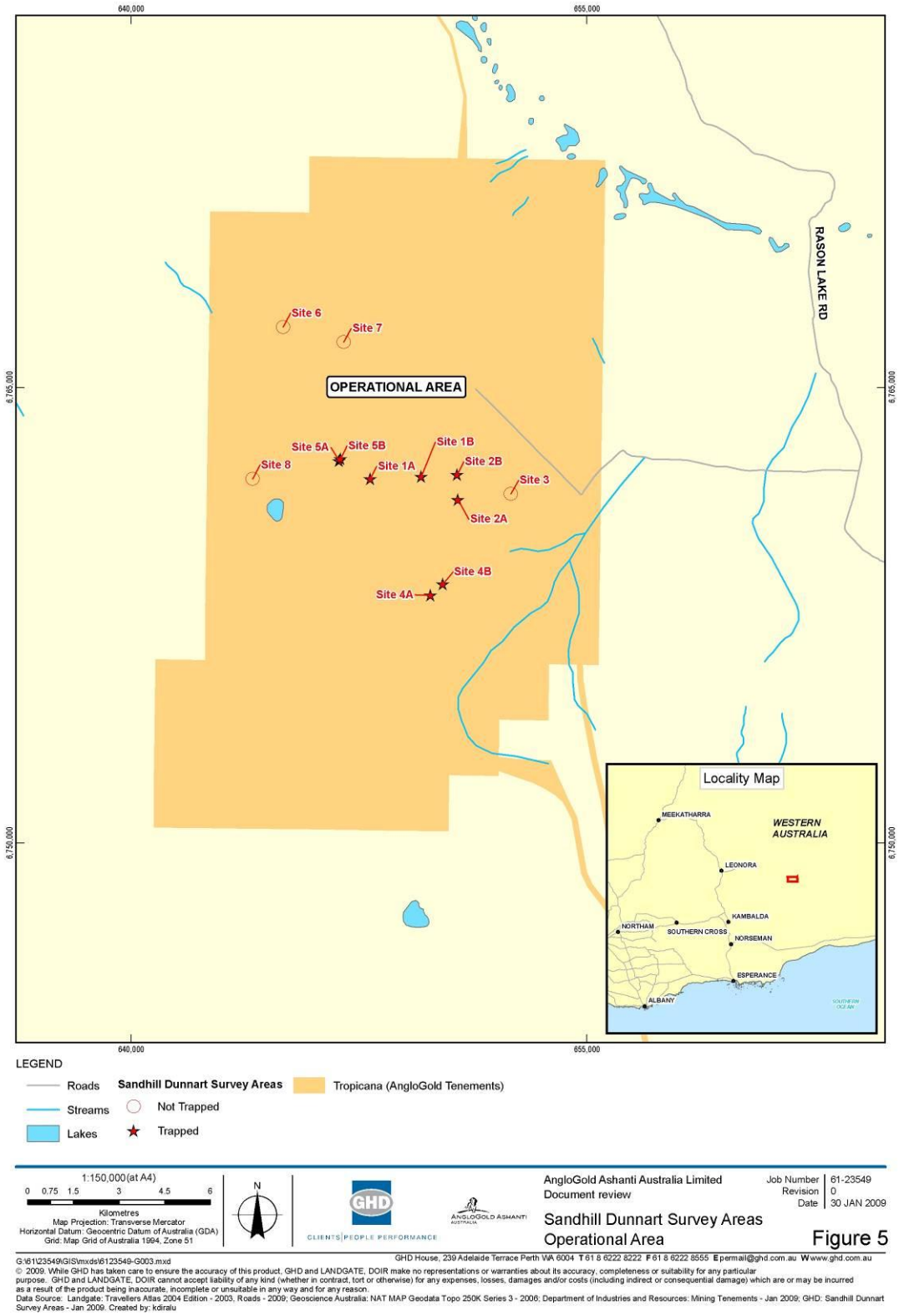


Figure 7 Sandhill Dunnart Survey Areas-Operational Area

Plate 7: Trapping Site 1A

Plate 8: Trapping Site 1B

Plate 9: Trapping Site 2A

Plate 10: Trapping Site 2B

Plate 11: Trapping Site 4A

Plate 12: Trapping Site 4B

Plate 13: Trapping Site 5A

Plate 14: Trapping Site 5B

Plate 15: **Trapping Site 17A**

Plate 16: Trapping Site 17B

Plate 17: Trapping Site 19A

Plate 18: Trapping Site 19B

Plate 19: Trapping Site 19C

Plate 20: Trapping Site 19D

6.2 OPERATIONAL AREA

No Sandhill Dunnarts were found in this area, and no sites currently match all the requirements for what is considered to be typical of Sandhill Dunnart habitat. In the operational area all sites had red soil not yellow or yellow/orange. Spinifex quality varied from life stage 2-4 which mostly was suitable but available habitat was very patchy between recently burnt areas and long unburnt areas.

Other mammals and reptiles that were captured are presented in Table 2 and Table 3 respectively with corresponding trap locations.

Table 2: Summary list of mammal captures during the survey

Species Name	Site 1A	Site 1B	Site 2A	Site 2B	Site 4A	Site 4B	Site 5A	Site 5B
Dasyuridae								
Ningaui sp. (ridei or yvonnae)	X	X	X	X	X	X	X	X
Sminthopsis hirtipes	X		X			X		X
Sminthopsis ooldea				X	X	X	X	
Muridae								
Notomys alexis							X	
Pseudomys desertor			X		X			
Pseudomys hermannsburgensis			X					

Table 3: Summary list of reptile captures during the survey

Species Name	Site 1A	Site 1B	Site 2A	Site 2B	Site 4A	Site 4B	Site 5A	Site 5B
Gekkonidae								
Lucasium damaeum				X	X	X		
Nephrurus laevissimus			X	X	X	X	X	X
Scincidae (Skinks)								
Ctenotus brooksi					X		X	
Ctenotus dux	X	X	X		X		X	X
Ctenotus helenae			X	X		X		X
Ctenotus quattuordecimilineatus	X	X	X	X	X	X	X	X
Ctenotus schomburgkii					X			
Eremiascincus fasciatus		X			X			
Lerista bipes	X	X	X	X	X	X	X	X
Lerista desertorum			X	X				
Lerista labialis							X	X
Lerista muelleri sp.		X						
Lerista taeniata	X					X		
Tiliqua occipitalis						X		
Agamidae (Dragons)								
Ctenophorus cristatus								X
Ctenophorus isolepis			X	X				

Species Name	Site 1A	Site 1B	Site 2A	Site 2B	Site 4A	Site 4B	Site 5A	Site 5B
Cyclodomorphus melanops elongatus	X							
Diporiphora reginae	X			X	X		X	X
Pogona minor		X		X				X
Pygopodidae (Legless lizards)								
Delma butleri	X					X		
Delma nasuta			X					
Delma petersoni		X						
Lialis burtonis		X						
Varanidae (Monitor lizards)								
Varanus eremius	X							
Varanus gouldii		X	X		X	X		X
Elapidae (Venomous snakes)								
Demansia psammophis psammophis					X			
Simoselaps bertholdi	X						X	X

6.3 PROPOSED PINJIN INFRASTRUCTURE CORRIDOR

No Sandhill Dunnarts were found in this area, despite most trap sites within Sites 17 and 19 fitting most criteria for what is considered to be typical of Sandhill Dunnart habitat.

Site 19 in particular was very typical. However, the habitat was isolated completely within a more recent burn, effectively cutting it off from connection to other typical habitat. The area was trapped heavily (4 quadrats), so it is possible that Sandhill Dunnarts may have been isolated away from this pocket.

Other mammals and reptiles that were captured are presented in Table 4 and Table 5 respectively.

Table 4: Summary list of mammal captures along proposed Pinjin/infrastructure corridor

Species Name	Site 17A	Site 17B	Site 19A	Site 19B	Site 19C	Site 19D
Dasyuridae						
Ningaui sp. (ridei or yvonnae)	X	X	X	X	X	X
Sminthopsis dolichura						X
Sminthopsis hirtipes	X				X	
Muridae						
Notomys alexis	X		X			
Pseudomys hermannsburgensis		X	X	X	X	

Table 5: Summary list of reptile captures along proposed Pinjin Infrastructure Corridor

Species name	Site 17A	Site 17B	Site 19A	Site 19B	Site 19C	Site 19D
Gekkonidae						
Lucasium damaeum	X			X		
Nephrurus laevissimus			X			
Scincidae (Skinks)						
Ctenotus dux	X	X	X	X		
Ctenotus quattuordecimilineatus	X	X		X	X	
Lerista bipes				X		
Proablepharus reginae		X		X		X
Agamidae (Dragons)						
Ctenophorus isolepis		X				X
Ctenophorus fordi	X	X			X	X
Diporiphora reginae		X				
Moloch horridus						X
Pogona minor		X				
Pygopodidae (Legless lizards)						
Delma australis		X				
Varanidae (Monitor lizards)						
Varanus eremius	X	X				X

6.4 PROPOSED PUBLIC BYPASS CORRIDOR

No sites typical enough of Sandhill Dunnart habitat to warrant any trapping effort were found in this area.

6.5 OPPORTUNISTIC DATA

A summary of the opportunistic evidence of fauna present is presented in Table 6. Opportunistic evidence showed the presence of both native and introduced species. Feral cats were identified at sites 5B, 17A, 17B and 19A through tracks. Dingo scats were found at sites 17 A and 19B, and tracks were seen at site 19B. Two old, disused Malleefowl mounds were recorded during the survey. The coordinates are given in Table 6.

Table 6: Opportunistic Data

Species Name	Site	Description
Felis catus (feral cat)	5B, 17A, 17B and 19A	Tracks
Canis lupus dingo (dingo)	19B	Tracks
Canis lupus dingo (dingo)	17A and 19B	Scats
Leipoa ocellata (Malleefowl)	E 0618323 N 6737197 E 0648369 N 6752718	Very old, disused mounds

7.0 DISCUSSION

Of the 29 sites deemed suitable habitat for Sandhill Dunnarts from aerial photographs, 14 were confirmed as suitable habitat through ground truthing and were trapped. Even though these sites fitted most criteria for suitable habitat, no Sandhill Dunnarts were trapped.

Ground truthing showed eleven of the 29 sites had been too recently burnt (0 - 15 years) to be considered typical of Sandhill Dunnart habitat. Recent fire activity in these areas within the periods described has not allowed Spinifex clumps to grow to the size and density known to be preferred by Sandhill Dunnarts. As the vegetation at these sites gets older, it may become more typical and warrant investigation at a later date.

Three of the 29 sites were too long unburnt (greater than 30 years) to be considered suitable habitat.

One site was suitable habitat but was found to be outside the study area and would not be impacted.

7.1 OPERATIONAL AREA

Of the sites trapped in the operational area, sites 1, 2, 4 and 5 fitted most criteria for suitable habitat for Sandhill Dunnarts, but no Sandhill Dunnarts were trapped in these areas.

Sites 6, 7 and 8 contained areas that may have future potential as Sandhill Dunnart habitat once the vegetation recovers from recent burns. Sites 6 and 7 are considered to have the best potential for habitat in the future, as they also have the same yellow/orange soil colour which is lacking in the other areas, and which is consistent with known Sandhill Dunnart capture sites. If no development occurs in these areas before the vegetation has grown back sufficiently to become typical habitat (5 – 10 years, depending on rainfall), then resurveying these areas is recommended. Trapping sites should also be looked at again at this time.

The vegetation of site 3 was too long unburnt to be considered suitable habitat.

7.2 PINJIN INFRASTRUCTURE CORRIDOR

Sites 17 and 19 fitted most criteria for habitat for Sandhill Dunnarts, and were trapped accordingly, but no Sandhill Dunnarts were trapped in these areas.

Site 9 contained an area quite typical of Sandhill Dunnart habitat, however it was right on the edge of the 400 metre buffer zone for the infrastructure corridor. Provided the corridor stays within the 100 metre proposed zone, this area will not be disturbed. If however, it cannot be left intact by aligning the corridor away from it, then it is recommended to conduct trapping surveys.

Sites 10, 11, 12, 13, 14, 15, 18, 20 and 21 contain vegetation that may have future potential as Sandhill Dunnart habitat once they recover from recent burns. If no development occurs in these areas before the vegetation has grown back sufficiently to become typical habitat (5 – 10 years depending on rainfall), and these areas cannot be left intact by aligning the road away from them, then resurveying these areas is recommended. Trapping sites should also be looked at again at this time.

Site 16 was too long unburnt to be considered suitable habitat.

7.3 CONCLUSIONS AND RECOMMENDATIONS

No Sandhill Dunnarts were trapped in this targeted survey.

As with most species, a single unproductive trapping session at a particular site cannot preclude the possibility that the target animal is present or close by. This is particularly the case for an animal such as the Sandhill Dunnart, which, when present, is found in very low numbers. This is demonstrated in the results of previous studies conducted by Gaikhorst and Lambert, where Sandhill Dunnarts were present at one site in only four of the seven separate survey periods, which were conducted over seven years.

However, based on the thoroughness of the trapping sessions and the fact that all suitable habitats on the lease were surveyed, it seems unlikely that Sandhill Dunnarts are present in the survey area at this time.

Although several areas of potentially suitable habitat were identified, no sites yielded indications of Sandhill Dunnart presence. This result is due to many factors. Primarily, although many of the sites where trapping was undertaken possessed habitat characteristics preferred by the Sandhill Dunnart, in most cases, not all features were present to make it ideal habitat.

Factors contributing to the sub-ideal habitats within the survey area were that many areas had been too recently burnt, or had remained unburnt for too long a period. As seen in this survey many potentially suitable habitats are now unsuitable due to recent fires. Altered fire regimes in the region have resulted in larger, more intense fires, which degrade Sandhill Dunnart habitat, fragment populations and increase their vulnerability to predators when moving between suitable areas. Other sites lacked appropriately sized Spinifex clumps or had the incorrect soil and vegetation known to be favoured by the Sandhill Dunnart. Areas that were suitable were often isolated, or had encountered fragmentation of appropriate habitat through wildfires.

Another factor contributing to the lack of Sandhill Dunnarts sampled is that less than 100 Sandhill Dunnarts have ever been sampled since their initial discovery. This would indicate total numbers of the species are low, a result of factors described previously including their specific habitat requirements and many threats.

Experts have identified the potential for several large areas of habitat to become suitable for the Sandhill Dunnart in 5 - 10 years. As Sandhill Dunnarts have been collected close to the surveyed areas it is possible that recolonisation of these habitats will occur in the future, as they age and become more suitable. As the Tropicana mine will still be operating in this timeframe it is recommended that some of the suitable habitats in the surveyed area be set aside for potential recolonisation by Sandhill Dunnarts in the future.

The survey confirms that the Operational Area, Pinjin Infrastructure Corridor and Bypass Corridor are unlikely, in their current states, to support Sandhill Dunnart populations, although Sandhill Dunnarts are found in very low densities, and may have escaped detection in these single session surveys. It appears unlikely that the Sandhill Dunnart will be impacted by the proposal at this stage.

8.0 ACKNOWLEDGEMENTS

We would like to thank the AngloGold Tropicana team for their on-ground assistance and support, particularly the field technicians for helping in setting up and removing quadrats, and navigating us around the exploration area and proposed road corridor. Their knowledge of the area was invaluable.

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Way 2008. Sandhill Dunnart (*Sminthopsis psammophila*) surveys on eastern Eyre Peninsula, SA. Department for Environment and Heritage, South Australia.

10.0 KEY RESOURCES

Department for Environment and Heritage, Sandhill Dunnart information sheet.
http://www.environment.sa.gov.au/biodiversity/threatened-species/sandhill.html

Parks and Wildlife Commission of Northern territory, threatened Species information Sheet.
http://www.nt.gov.au/nreta/wildlife/animals/threatened/pdf/mammals/sandhill_dunnart_dd.pdf

Department of the Environment, Water, Heritage and the Arts. Species profiles and threats database.
http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=291

Perth Zoo, Sandhill Dunnart information page.
http://www.perthzoo.wa.gov.au/Documents/PDF/Sandhill%20Dunnart%20Fact%20Sheet.pdf

Department for Environment and Heritage, 2007 Eyre Peninsular threatened fauna update.
http://www.environment.sa.gov.au/biodiversity/west_bcp/pdfs/tfauna_update_march2007.pdf

Department for Environment and Heritage, Threatened Fauna of Eyre Peninsular. Action Statement.
http://www.epnrm.sa.gov.au/Portals/3/Sandhill%20Dunnart%20Action%20Statement%202008.pdf

Department for Environment and Heritage, Online Sandhill Dunnart Recovery Plan.
http://www.environment.sa.gov.au/biodiversity/west_bcp/pdfs/sandhill_dunnart_recovery_plan.pdf

Bureau of Meteorology- Australia, Online Climate and weather data.
http://www.bom.gov.au/climate/data/weather-data.shtml

World Wildlife Fund (2008) *Terrestrial Ecoregions – Great Victoria Desert (AA1305)*
http://www.worldwildlife.org/wildworld/profiles/terrestrial/aa/aa1305_full.html

APPENDIX 1

Bastow, Belinda

Subject: FW: Sandhill Dunnart Survey

From: Ward, Matthew (DEH) [mailto:Ward.Matthew@saugov.sa.gov.au]
Sent: Friday, 3 July 2009 1:57 PM
To: Bastow, Belinda
Subject: RE: Sandhill Dunnart Survey

Hi Belinda

I have read the report - I see no problem with their monitoring techniques - they used large diameter and deep pitfall traps which is recommended for SHDs. It was an interesting report because the plates which demonstrated trapping areas looked like good SHD habitat - big spinifex! I think it is important that the report has indicated the great potential of the habitat and that whilst this survey has not trapped any SHDs, then great habitat suggests that they may still be present in low numbers, or if not now potentially in the future given suitable conditions. Given numerous fires in the region (from what I have been told?), it looks like much of this area is important long-unburnt habitat which should be protected as much as possible.

Matt

From: Bastow, Belinda
Sent: Monday, 18 May 2009 8:41 AM
To: Ward, Matthew (DEH)
Subject: Sandhill Dunnart Survey

Matt,

Further to our phone conversation please find attached the Sandhill Dunnart Report for the Assessment undertaken by Glen Gaikhorst and Cathy Lambert as part of the Tropicana Gold Project.

I am keen to get you comments on the work we have completed to date and your advice on how to proceed from hear.

I look forward to hearing from you on this matter.

By the way I think we meet in 2007 at the Malleefowl Workshop in Katanning.

Regards,

Belinda Bastow
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1