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Assessment of habitat availability for the Sandhill Dunnart *Sminthopsis psammophila* in Western Australia.

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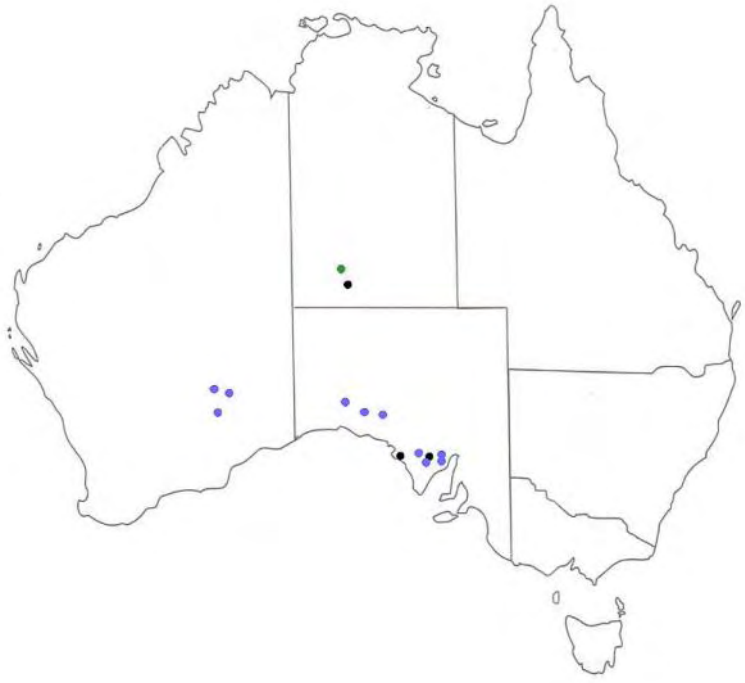
The Sandhill Dunnart has been captured at sites extending over a broad area of the southern Northern Territory, South Australia and Western Australia (Map 1).



Map 1. Distribution of Sandhill Dunnarts. Green indicates the type locality at Lake Amadeus in 1896, black dots represent sub-fossil records, blue indicates recent records (Pearson & Churchill 2008).

Sandhill Dunnart Habitat

The Sandhill Dunnart is known to occur on sandy substrates in arid and semi-arid regions. The most consistent features of the habitat are the presence of hummock grass (*Triodia* species) and sand dunes. The remainder of the vegetation varies but is most commonly mallee or Marble Gum (*Eucalyptus gongylocarpa*), often with *Callitris verrucosa* and an associated complex shrub understorey (Pearson and Robinson 1989).

Although no detailed habitat assessment has been made for the Sandhill Dunnart there appear to be large areas of potentially suitable habitat types throughout the southern Great Victoria Desert.

The presence of large hummocks of hummock grasses (*Triodia* spp.) appears to be a critical factor for this species on Eyre Peninsula, South Australia, where suitable hummocks occur in areas approximately 8 to 20 years post-fire (Churchill 2001b).

Methods

The vegetation associations from known Sandhill Dunnart capture sites in South and Western Australia were used to summarise Sandhill Dunnart habitat (Appendix 1). This was compared with vegetation surveys conducted within and adjacent to the Tropicana Operational Area (B6 *ecologia* Environment report) and the Infrastructure Corridor (C5 Mattiske Consulting report) to assess the availability of potentially suitable Sandhill Dunnart habitat within the Tropicana JV area. Further comparisons were made using broad scale habitat mapping (A1 GHD - Landscape Assessment Report) to assess the availability of suitable habitat within the rest of Western Australia.

The potential habitat of Sandhill Dunnarts can broadly be categorised as:

- 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. 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 my use (and occasionally be sampled) marginal habitat, but they will not often live in it. Marginal habitat is may be used for movement between patches of higher quality habitat, or for foraging if adjacent to appropriate cover/ breeding habitat.

1. Habitat Availability in the Tropicana Operational Area

Using the *ecologia* Environment 2009 report - TGP Operational Area Flora and Vegetation Assessment, there are several vegetation types potentially used by Sandhill Dunnarts in the Tropicana Operational Area. See Map 2. These areas are defined as:

Prime Habitat

$e_{19}L.t_2t_7H$ Marble gum open woodland over *T. desertorum* or *T. basedowii* open hummock grasses on swales and lower dune slopes.

including subtypes **e_{19}L.$d_3$$er_1$$St_2$$t_7$H** Marble gum open woodland over *Dodonaea viscoe/Eremophila platythamnos* open shrubland over *T. desertorum* or *T. basedowii* open hummock grasses.

and subtype **$e_{19}$$e_x$L.x$St_7$H** *Eucalyptus gongylocarpa/ E. youngiana/E. concinna* open woodland over mixed open shrubland over *T. desertorum* open hummock grassland.

xS.$t_2$$t_7$H Isolated trees of marble gum over mixed shrub and *T. desertorum* and/or *T. basedowii* sparse hummock grassland on longitudinal dunes

Marginal Habitat

e_xL.t_2H Mixed Eucalypt woodlands over open shrublands over *Triodia basedowii* hummock grasslands.

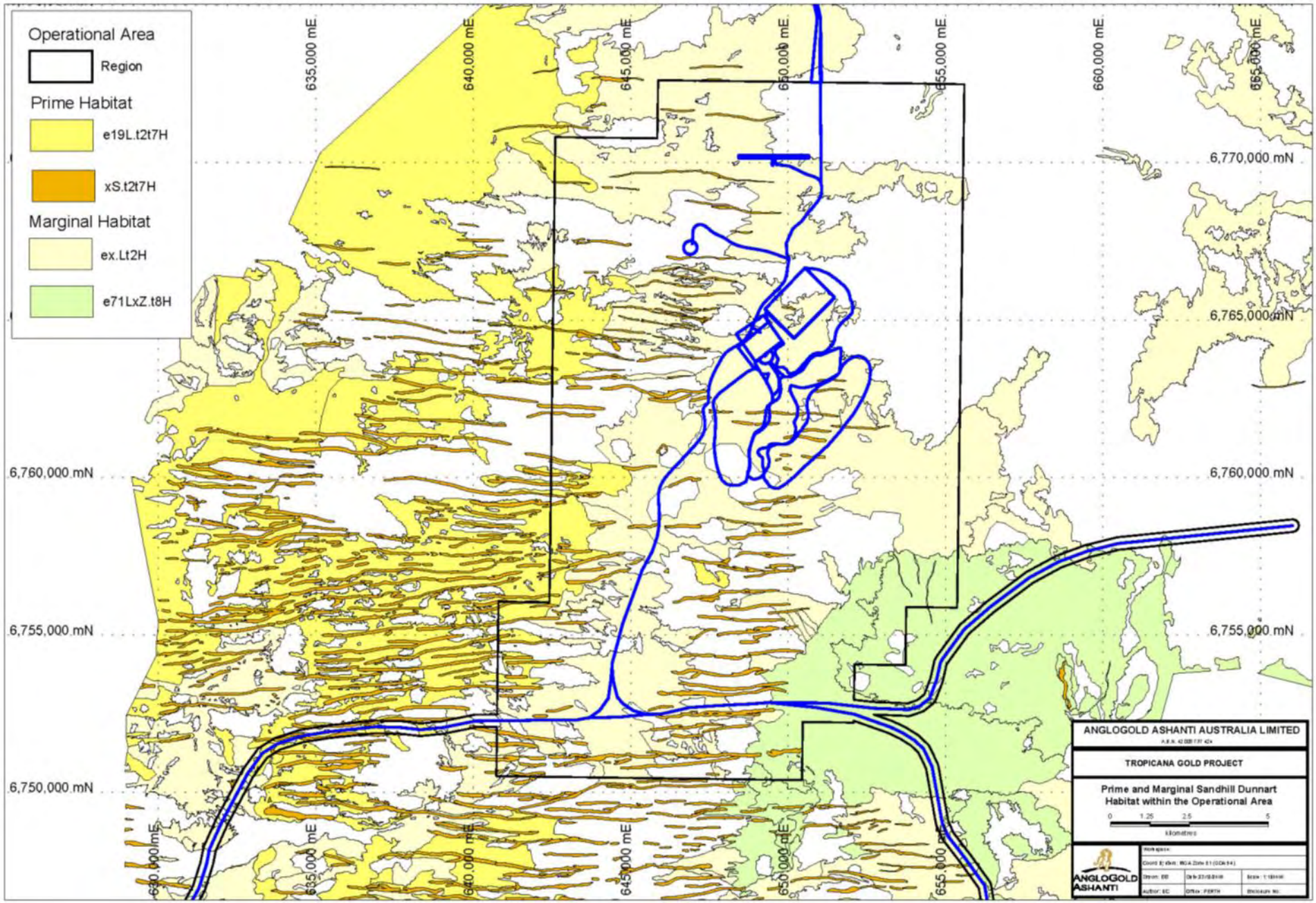
including subtypes **e_xL.a_{20}S.t_2H** *Eucalyptus youngiana*, *E. trivalva* or *E. leptopoda* open mallee woodland over *Acacia murrayana* tall open shrub stratum over *T. basedowii* hummock grassland.

and subtype **$e_{20}$$p_2$L.x$St_2$H** *Eucalyptus youngiana*, open woodland over *Callitris preissii* sparse tall open shrubland over mixed open shrubland over *T. basedowii* open to dense hummock grassland.

e_{71}L.xZt_8H *E. concinna* open mallee woodland over sparse to open low shrubs over *T. scariosa* open hummock grassland on undulating plains.

Conclusion

Although adjacent to large areas of Prime habitat, the majority of the proposed Operational footprint is situated in habitat considered Marginal for Sandhill Dunnarts.


Operational Area
Region
Prime Habitat
e19L.t2t7H
xS.t2t7H
Marginal Habitat
ex.Lt2H
e71LxZ.t8H
635,000 mE
640,000 mE
645,000 mE
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665,000 mE
6,770,000 mN
6,765,000 mN
6,760,000 mN
6,755,000 mN
6,750,000 mN
ANGLOGOLD ASHANTI AUSTRALIA LIMITED
TROPICANA GOLD PROJECT
Prime and Marginal Sandhill Dunnart Habitat within the Operational Area
0 1.25 2.5 5
Kilometres
ANGLOGOLD ASHANTI

2. Habitat Availability in the Infrastructure Corridor

Using the C5 Mattiske Consulting - Flora and Vegetation Assessment of Infrastructure Corridor report the Sandhill Dunnart habitat includes:

Prime habitat

E4: Low Woodland to Low Open Woodland of Marble gum with *Callitris preissii* and *Eucalyptus* spp. Over mixed shrubs over *Triodia* spp. This community occurs of orange, red-orange, yellow orange and yellow sandy loams on mixed topographies.

Likely habitat

E13: Open Shrub Mallee to Very Open Shrub Mallee of *E. leptophylla* with *E. trivalva, E. youngiana* and *Callitris preissii* over *Acacia helmsiana, Hakea francisiana* over *Triodia rigidissima.* This community occurs on orange-yellow sandy loams on flats and undulating plains.

E15: Very Open Shrub Mallee of *E. youngiana* and mixed *Eucalyptus* spp. Over *Acacia desertorum*, *Bertya dimerostigma, Westringia cephalantha, Cryptandra distigma* with mixed shrubs over *T. desertorum*. This community occurs on orange sandy loams on lower slopes.

Marginal habitat

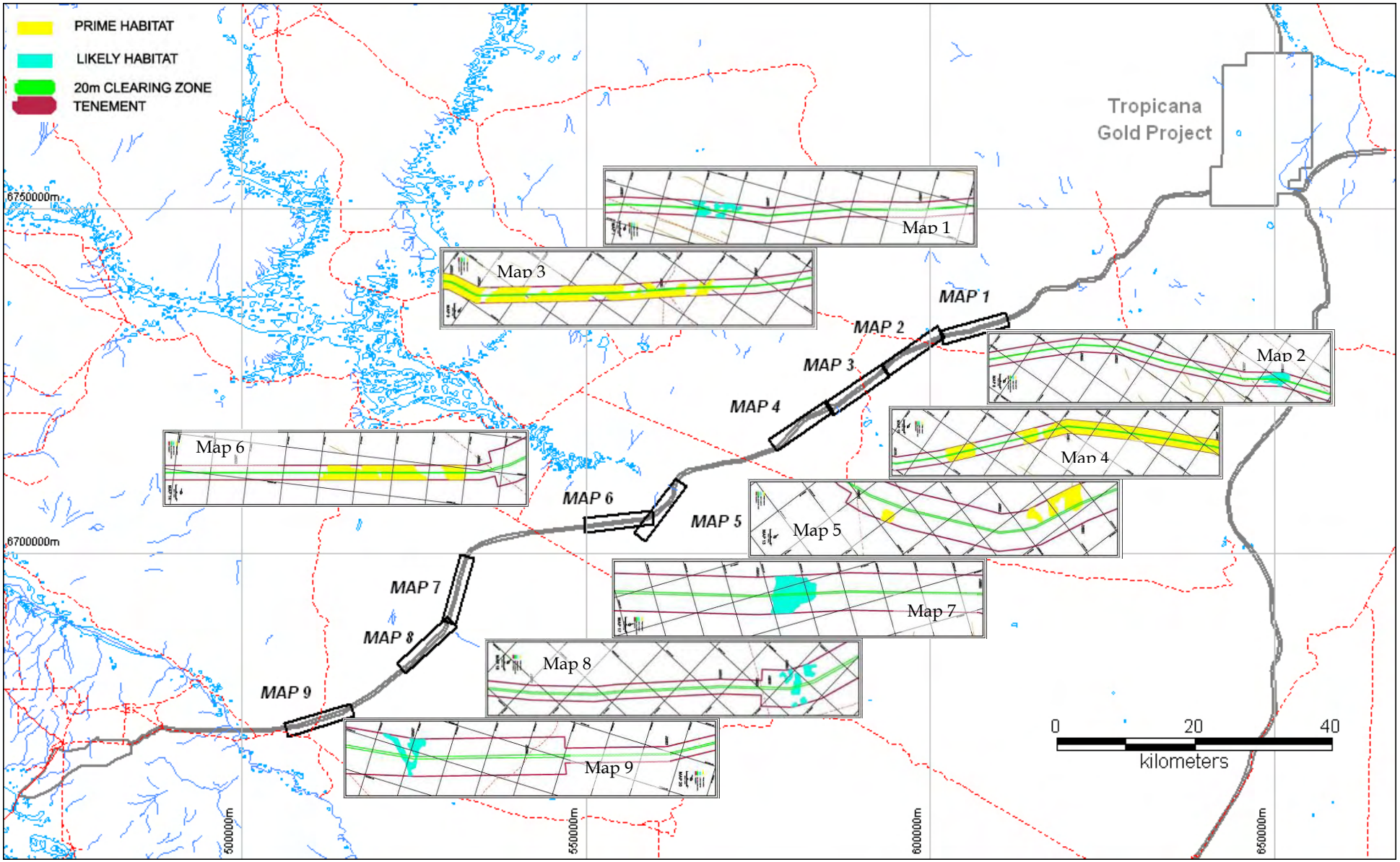
E12: Open Shrub Mallee to Very Open Shrub Mallee of *E. platycorys, E. oleosa, E. horistes* and other *Eucalyptus* spp. over *Westringia cephalantha, Acacia sibina, Acacia hemiteles* over *Triodia* spp.. This community occurs on orange sandy loams on flats.

E14: Very Open Shrub Mallee of *E. rosacea* with *Callitris preissii* over *Acacia sibina, Phebalium laevigatum* and low Myrtaceous shrubs over *Triodia* spp. This community occurs on orange sandy loams on flats.

The Mattiske Consulting 2009 report states (on p.25 Table 20) that within the survey area suitable Sandhill Dunnart habitat (E4 community) covers 1170.7ha of which 62.97ha (5.38%) is impacted by the corridor.

Conclusion

Although this report indicates that there are patches of vegetation that may be Prime or Likely Sandhill Dunnart habitat along the Infrastructure Corridor, most of these have been severely burned in the last few years making them unsuitable for at least the next decade.


PRIME HABITAT
LIKELY HABITAT
20m CLEARING ZONE
TENEMENT
Tropicana
Gold Project
6750000m
6700000m
Map 1
Map 2
Map 3
Map 4
Map 5
Map 6
Map 7
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MAP 1
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MAP 4
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20
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kilometers
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3. Regional Habitat Availability in the Great Victoria Desert

In the GHD 2008 - Landscape Assessment Report on p.16 Table 2 lists the vegetation associations (Beard 1974) in the Great Victoria Desert and their area. These are the vegetation associations that are potential Sandhill Dunnart habitat.

Veg Assoc	Description	Area of habitat (ha).
84	Marble gum, mallee, *Triodia basedowii* between dunes	1,781,533
85	Marble gum, mallee, *T. basedowii* on sandplain	63,151,694
109	*E. youngiana* mallee over shrubs & *T. basedowii*	374,114
110	*E. oleosa* mallee over shrubs & *Triodia scariosa*	319,137
239	Marble gum & *E. youngiana* mallee over *T. basedowii* between dunes	1,036,406
1239	Marble gum & *E. youngiana* mallee over *T. basedowii* on sandplain	2,233,681

These vegetation associations are shown in colour in Map 3 (see pg 8). It can be seen that there are very extensive areas of possible Sandhill Dunnart habitat throughout the West Australian portion of the Great Victoria Desert.

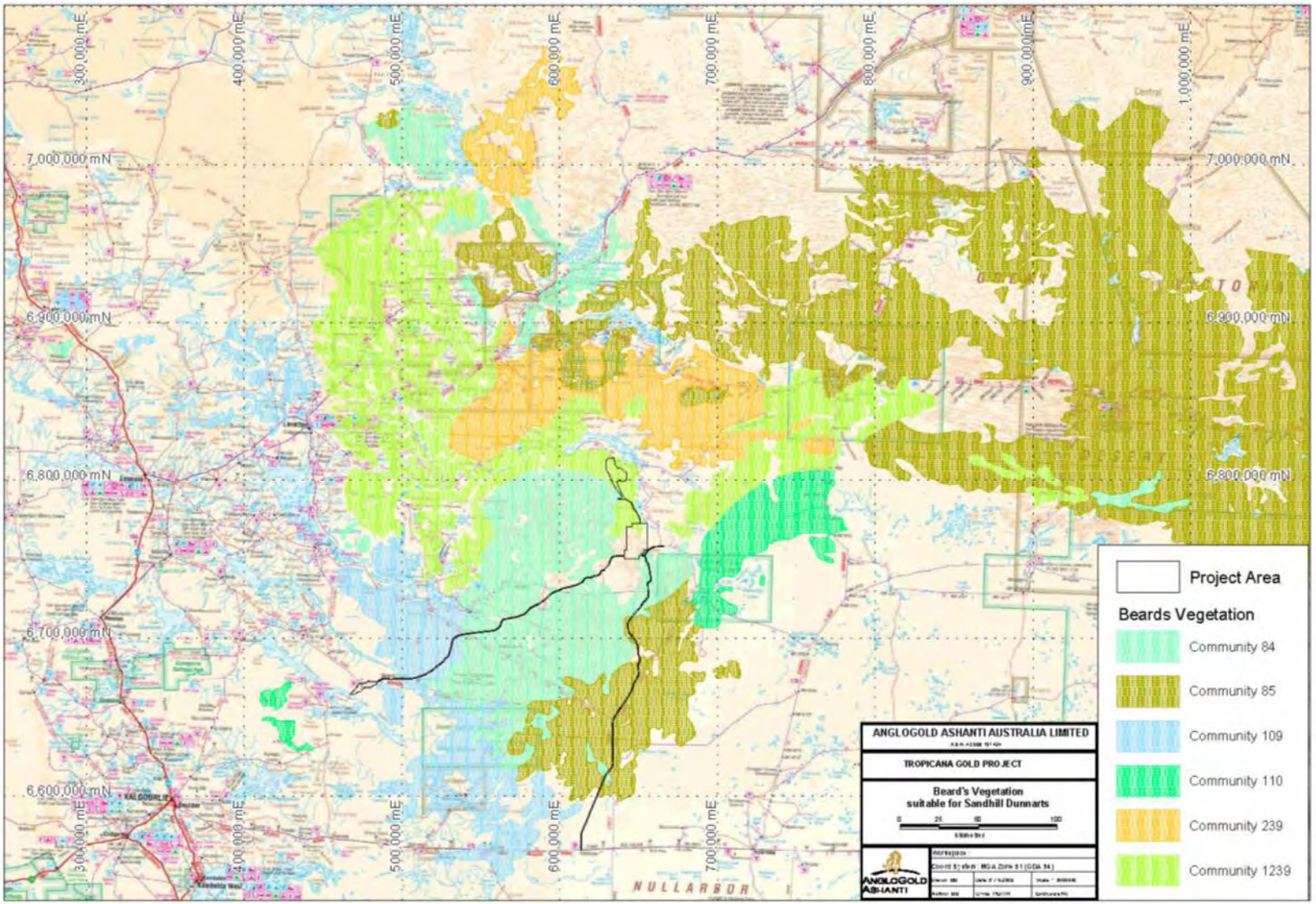
Most of the Tropicana Operational Area lies outside this and is considered not to be suitable Sandhill Dunnart Habitat. It is defined by Beard 1974 as Vegetation Association 19 comprising of 'low woodland with mulga between sand ridges" with an area of 2,866,289 ha.

4. Regional Habitat Assessment based on previous Sandhill Dunnart Surveys.

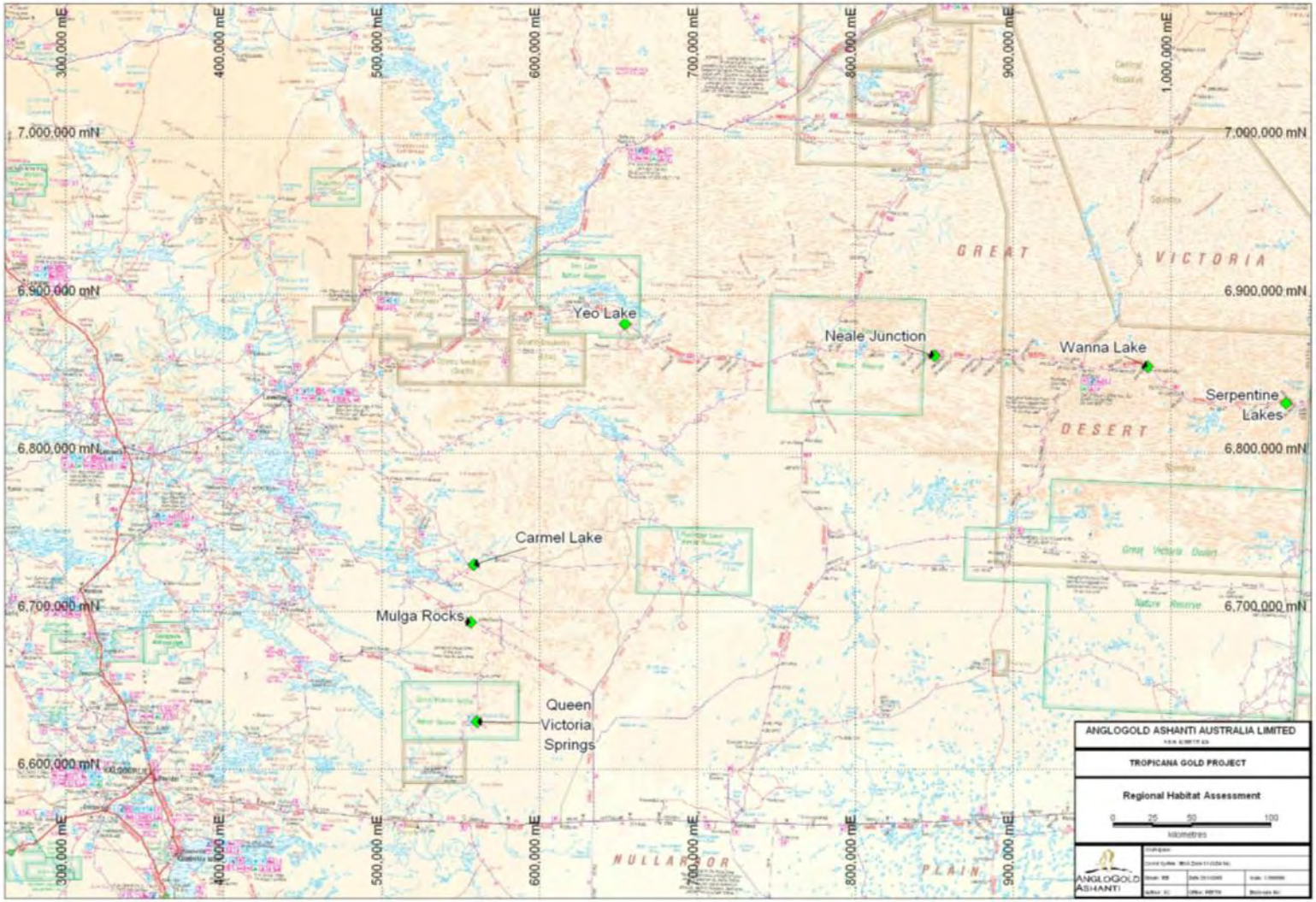
Between October – November 1999 an extensive Sandhill Dunnarts survey was undertaken over the Western Australian side of the Great Victoria Desert The survey extended from Kalgoorlie through to Mulga Rock and into the Queen Victoria Spring NR, then north past Lake Minigwal, to Yeo Lakes and east to Neal Junction and along the Anne Beadell Highway to Coober Pedy (Map 4 pg 9). In Western Australia five areas were surveyed using Pit and Elliott traps and a further two areas surveyed using only Elliott traps. The trapping was conducted over 15 nights with a total of 3950 trap nights, 3296 with Elliott traps and 654 with Pit traps. All these sites were either previous capture locations (Mulga Rock and Queen Victoria Springs NR) or were areas of apparently suitable habitat. No Sandhill Dunnarts were caught in this survey.

Latitude	**Long**	**Dates**	**Site name**	**Elliott nights**	**Pit nights**	**Total trap-nights**
30 27 37	123 37 39	25-26/10/99	Queen Victoria Spring	390	0	390
29 53.37	123 35.15	21-25/10/99	Mulga Rock	714	204	918
29 33.38	123 36.13	28/10-2/11/99	Carmel Lake	824	216	1040
28 10 46	124 36 13	2-3/11/99	Yeo Lake	438	24	462
28 19 17	126 34 07	4/11/99	Neale Junction	195	12	207
28 20 24	127 56 44	4-7/11/99	Wanna Lake	540	198	738
28 30 49	128 50 48	7/11/99	Serpentine lakes	195	0	195
Total				**3296**	**654**	**3950**

It is my opinion that despite these results the area of suitable Sandhill Dunnart habitat is very extensive. There is a continuum of habitat from the known capture sites in Western Australia to those in South Australia. DNA analysis (Gaikhorst *et al,* in prep.) indicates genetic mixing of the populations and it would be reasonable to expect to find them in the intervening area.



Map 3 Beards vegetation Communities potential suitable for Sandhill Dunnarts



Map 4 Regional Sandhill Dunnart Assessment sites

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Appendix 1. Summary of Habitat types at Sandhill Dunnart capture sites (from Churchill 2001a)

Northern Territory

The habitat at the type locality near Lake Amadeus is 30 m high parallel sand dunes covered with hummocks grasses (*Triodia* spp.). Between the dunes were small flats covered with stands of Desert Oaks (Spencer 1896a).

Great Victoria Desert, Western Australia.

At Mulga Rock, south-east of Lake Minigwal, in Western Australia, five specimens were caught in scattered locations in June/July 1985. The area is a mosaic of marble gum (*Eucalyptus gongylocarpa*) and mallee woodland, both over spinifex (*Triodia basedowii*) with some shrubs. Two animals were caught in a small area of broombush (*Melaleuca uncinata*) shrubland up to 2.5 m high with very little spinifex. The other three specimens were caught in areas of 20 to 30 percent cover of spinifex. The area consists of undulating sand plain with areas of well-defined parallel sand ridges up to 30 m high (Hart and Kitchener 1986).

(Photo. S. Churchill)

Figure 1. Typical Marble Gum (*E. gongylocarpa*) vegetation at the Mulga Rock site.

At Queen Victoria Spring (approximately 35 kms to the south of the Mulga Rock site) the vegetation is low open woodland of Marble gum (*E. gongylocarpa*) with occasional mallees and a diverse shrub layer. Beneath this shrub layer, spinifex (*Triodia basedowii*) provided 25% ground cover. The landform is an area of sand plain with low dunes present 1 km to the north and north-east (Pearson and Robinson 1989).

Great Victoria Desert, South Australia

Yarle Lakes site, South Australia, is within a corridor of parallel dunes that run north west from Ooldea and is part of the Ooldea Range. The vegetation is a low open woodland of mallee (*E. oleosa* and *E. socialis*), Bullock bush (*Alectryon*

oleifolium), Sandalwood (*Santalum acuminatum*), Mulga (*Acacia aneura*) and Black Oak or Belah (*Casuarina pauper*) with a diverse and very open shrub layer. Beneath this shrub layer spinifex (*Triodia scariosa*) provides 10 to 30% ground cover (Pearson and Robinson 1989).

The Ooldea site is within a large area of confused sand dunes, 10 to 15m high. The vegetation is low mallee woodland (*E. concinna, E. oleosa* and *E. socialis*) with False Sandalwood (*Myoporum platycarpum*) and denser clumps of Cypress (*Callitris verrucosa*). The shrub layer is diverse but very open with dense spinifex (*Triodia scariosa*) providing 30 to 70% of the ground cover (Pearson and Robinson 1989).

(Photo. S. Churchill)

Figure 2. Sand dune with spinifex and mallee at Ooldea.

The Mt Christie site is also in sand dunes. The vegetation is low open mallee (*E. striaticalyx, E. oleosa* and *E. socialis*) with False Sandalwood (*Myoporum platycarpum*)), Bullock bush (*Alectryon oleifolium*), Sandalwood (*Santalum acuminatum*), Mulga (*Acacia aneura*) and Black Oak or Belah (*Casuarina pauper*). The shrub layer is diverse and spinifex (*Triodia scariosa*) provides 10 to 30% of the ground cover (Pearson and Robinson 1989).

(Photo. S. Churchill)

Figure 3. Vegetation on sand dunes at Mt Christie site, South Australia.

Eyre Peninsula, South Australia

At Mamblin in the Eyre Peninsula the country consists of parallel sand dunes 10 to 15 m high separated by valleys 200 to 300 m wide. The original vegetation was a uniform covering of mallee with an understorey of broombush (*Melaleuca uncinata*) and other shrubs. Semi-open areas of spinifex (*Triodia lanata*) appeared intermittently on the dune slopes. In the 1950's and 1960's large areas of scrub were being cleared from the interdune valleys but the vegetation on the sand dunes has been left largely intact, or was allowed to regrow after the initial clearances (Aitken 1971). This area has since been cleared for agriculture.

At Boonerdo, the vegetation and topography is very similar to Mamblin. All four specimens were captured, during land clearing operations, from an area immediately adjacent to the Hambidge Conservation Park (Aitken 1971). Unfortunately the Hambidge Conservation Park was badly affected in a wildfire, in January 2000, which burnt approximately 80% of the vegetation.

At the Cowell site the dunnarts were captured on a series of white sand dunes 10 to 25 m high along a property boundary. The vegetation to the south has been cleared for agriculture. The vegetation on the dunes comprised of mallee (*E. gracilis, E. incrassata, E. oleosa* and *E. socialis*) with Cypress, (*Callitris verrucosa*) and *Hakea francisciana*. There is an understorey of mixed shrubs and 30 to 85% ground cover of spinifex (*Triodia irritans*). The area was extensively burnt in a wildfire on 8 November 1990.

(Photo. S. Churchill)

Figure 4. Dune vegetation at the Cowell site. This vegetation did not get burnt in the 1990 fire and supports a denser shrub layer and less spinifex than the burnt areas.

(Photo. S. Churchill)

Figure 5. Vegetation at the Middleback site. This is regrowth vegetation from the 1990 fire. Middleback Range is in the background.

The Middleback site is to the west of the Middleback Range and comprises parallel sand dunes 10 to 20 m high. The vegetation consists of mallee overstorey containing a mix of species including *Eucalyptus socialis*, *E. gracilis, E. incrassata, E. oleosa* and *E. brachycalyx.* The understorey contains a variety of shrubs such as *Alyxia buxifolia*, *Eremophila scoparia*, *Senna artemissioides*, *Hakea francisiana* and *Melaleuca lanceolata* and *Dodonaea viscosa*. *Triodia irritans* is the dominant ground cover and provides 10 to 90% cover.

Throughout its range the observed habitat of Sandhill Dunnarts consists of sandy areas usually in or near to sand dunes. The vegetation is mallee or open eucalypt woodland usually with a diverse shrub layer and a ground cover of spinifex hummocks (10 to 70% cover). This habitat type is widespread throughout the Great Victoria Desert and much of inland Australia.