




Greening Australia

Great Victoria Desert Targeted Sandhill Dunnart and Malleefowl Survey 2018

*January 2019
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Executive Summary

The Great Victoria Desert Biodiversity Trust (GVDBT) is seeking to better understand the ecology of the Sandhill Dunnart (*Sminthopsis psammophila*) and Malleefowl (*Leipoa ocellata*) within the Great Victoria Desert in Western Australia. The GVDBT commissioned Greening Australia (GA) to conduct a survey for the Sandhill Dunnart (the Survey) to verify its presence (ie. from previous motion camera records) and to gather further information on the species' habitat and range. The Survey also investigated the distribution and habitat preferences of Malleefowl within proximity of these locations.

The Survey, which centred on two locations of likely occurrence (approx. 130 km apart) in the south-western Great Victoria Desert, comprised pitfall trapping (October 2018) supplemented with the use of motion sensor cameras (August – October 2018). Sixteen survey sites were established across the two survey regions, with pitfall trapping conducted over seven consecutive nights (a total of 1,305 trap nights) and 64 cameras deployed for a minimum of 30 days (2,526 camera nights). Targeted searches for Malleefowl (long walks) were conducted across 62 km (i.e. 16 long walks) between Eastern and Western sites (in proximity to Sandhill Dunnart pitfall locations) across a range of habitats following GVDBT guidance (ie. to include Mulga habitat and recently burnt swathes).

A total of 172 fauna species were recorded during the survey via pitfall trapping, opportunistic observations and motion sensor cameras, comprising 63 reptile, 69 bird, 27 native mammal and 13 introduced. The assemblage recorded included several species rarely encountered in the Great Victoria Desert or recorded in the region near the extreme edge of their range, including:

- Sandhill Dunnart (*Sminthopsis psammophila*): trapped at two sites and on camera at four sites;
- Malleefowl (*Leipoa ocellata*): EPBC Vulnerable, four observed and several mounds recorded;
- Striated Grasswren (*Amytornis striatus*): DBCA Priority 4, several groups observed;
- Brush-tailed Mulgara (*Dasycercus blythi*): DBCA Priority 4, trapped at one site and recorded on camera at four sites;
- Scarlet-chested Parrot (*Neophema splendida*): uncommon in the GVD, two groups observed;
- Several temperate-adapted species occurring in the region at the arid extreme of their range (Regent Parrot *Polytelis anthopeplus*, Australian Raven *Corvus coronoides*, White-eared Honeyeater *Lichenostomus leucotis* and Bobtail *Tiliqua rugosa*); and
- Two DBCA Priority flora species (*Conospermum toddii*, *Eucalyptus pimpiniana*).

The Sandhill Dunnart was detected at four locations, extending occupied SHD habitat south of its known Eastern occupancy (approximately 70 kilometres) and confirming baseline motion sensor captures. The species was recorded from long unburnt vegetation and in habitat closely resembling that occupied elsewhere in the GVD. The species was associated sand dunes supporting long unburnt vegetation including; Marble Gum (*Eucalyptus gongylocarpa*), *Callitris preissii*, a mature shrub layer (including *Allocasuarina spinosissima*, *Persoonia coriacea*, *Acacia helmsiana*, *Grevillea didymobotrya* and *Banksia elderiana*) over a mature hummock grassland (*Triodia desertorum* with *Lepidobolus deserti*). While much of the surrounding landscape had been burnt at least twice within the last 20 years (US Geological Survey 2018), the Sandhill Dunnart was recorded from the relatively small remaining areas of long unburnt vegetation.

The Malleefowl was recorded widely across the area surveyed (via direct observation, sightings of tracks and mounds). Evidence of previous breeding was noted – five mounds were recorded, typically associated with dense Acacia shrublands.

The Sandhill Dunnart survey increased the species known distribution and reinforced habitat preferences observed elsewhere in the GVD. The survey results reveal that significant and targeted effort is required to detect new populations of the Sandhill Dunnart as the species appears to have a highly restricted regional distribution.

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TABLE OF CONTENTS

Executive Summary.....	1
Table Of Contents.....	4
List of Tables	6
List of Figures	6
List of Plates	6
1 Introduction.....	7
1.1 Background.....	7
1.2 Survey Scope and Objectives.....	9
2 Methods.....	11
2.1 Survey Team and Licensing	11
2.2 Survey Timing	11
2.3 Survey Site selection and Survey effort.....	11
2.4 Climate and Weather	15
2.5 Methods	17
2.5.1 <i>Habitat Assessment</i>	17
2.5.2 <i>Motion Sensor Cameras</i>	17
2.5.3 <i>Pit Trapping</i>	18
2.5.4 <i>Processing, Marking and Measurements</i>	19
2.5.5 <i>Targeted searching</i>	20
2.5.6 <i>Opportunistic Sampling</i>	20
2.5.7 <i>Survey limitations</i>	21
2.6 Data Management and analysis.....	21
2.6.1 <i>Image management and recording</i>	21
3 Results and Discussion	22
3.1 Fauna Habitats and Field Observations	22
3.2 Fauna Observations	24
3.3 Trapping Results	25
3.4 Camera Results.....	26
3.5 Sandhill Dunnart.....	29
3.6 Other Species Of Significance	35
3.6.1 <i>Malleefowl</i>	35
3.6.2 <i>Brush-tailed Mulgara</i>	37
3.6.3 <i>Striated Grasswren</i>	37
3.6.4 <i>Other Species</i>	38
4 Conclusion	40
5 Acknowledgements	41
6 References	42

7 Appendices	44
Appendix 1: Detailed Malleefowl long walk maps across eastern and western locations	45
Appendix 2: GVD MAlleefowl modelling site selection mapbook and suitability map(GVDBT)	51
Appendix 3: Pitfall and camera locations between phases 1, 2 & final.....	53
Appendix 4: Broad vegetation survey parameters (DPaW, 2016).....	62
Appendix 5: Habitat assessments for survey SITES and locations.....	63
Appendix 6: Habitat photos for eastern sites with SHD presence: A (top collection) and F (BOTTOM collection)	68
Appendix 7: Total fauna assemblage trapped during the survey	70
Appendix 8: Other conservation significant taxa recorded during the survey	71
Appendix 9: Tissue samples forwarded to the Western Australian Museum.....	72
Appendix 10: Species Detected on Motion camera during the survey	73
Appendix 11: Written habitat descriptors taken during malleefowl walks	74

LIST OF TABLES

Table 1: Survey team for the Sandhill Dunnart targeted Survey 2018.....	11
Table 2 Summary of sampling methods and effort for GVD fauna survey 2018 (27/08/18-17/10/18) 14	
Table 3: Long walks undertaken during the 2018 survey	20
Table 4: Potential limitations and extent for the Survey undertaken	21
Table 5: Habitat characteristics at sites of known SHD occurrence	24
Table 6: The fauna assemblage recorded during the survey	24
Table 7: Sandhill dunnarts recorded during the survey	29
Table 8: Malleefowl mounds recorded during the survey	36
Table 9: Malleefowl recorded during the survey	36
Table 10: Records of the Striated Grasswren during the survey period	38

LIST OF FIGURES

Figure 1: Targeted Sandhill Dunnart survey 2018 relating to baseline literature and GA survey 2017.	10
Figure 2: All sixteen survey locations across Eastern and Western Sites.....	12
Figure 3: Malleefowl site visitations relating to Habitat suitability and likelihood modeling.	13
Figure 4: Mean monthly rainfall and temperature for Kalgoorlie & Laverton weather stations.....	15
Figure 5: Maximum and Minimum daily temperatures and rainfall during the Survey	16
Figure 6: Pitfall trapping layout regime across Western and Eastern sites, locations A-H.....	19
Figure 7: The detection of fauna across all survey Locations.....	28
Figure 8: Locations of Sandhill Dunnart records (2018) comparing Western and Eastern sites	31
Figure 9: Locations of Sandhill Dunnart at Eastern site location A-H during the 2018 survey	32
Figure 10: A Sandhill Dunnart recorded along a fence line (Site A) where the species was trapped on three occasions	34

LIST OF PLATES

Plate 1: Confirmed Sandhill Dunnart image recorded during the 2017 survey.....	8
Plate 2: Likely Sandhill Dunnart recorded from the south western GVD during the 2017 survey	8
Plate 3: Camera deployment during Phase 1 (left, with bait lure) and Phase 2 (right, without bait lure and along trapping fence line).....	18
Plate 4: Typical sandplain and dune landscapes sampled at Eastern Site locations	23
Plate 5: <i>Sminthopsis hirtipes</i> and <i>Sminthopsis dolichura</i> recorded during the survey.....	25
Plate 6: Sandhill Dunnart, identifiable by a combination of size and tail crest (left).....	26
Plate 7: Mulgara, identifiable by a combination of size and tail crest.....	26
Plate 8: Hopping mouse individuals captured with motion imagery	27
Plate 9: Western Pygmy Possum (<i>Cercartetus concinnus</i>) observed during pitfall trapping efforts...27	
Plate 10: Sandhill Dunnarts captured during the 2018 survey (left to right: Female 1, Male 1, Female 2)	33
Plate 11: Malleefowl observed North of Mulga Rockhole	35
Plate 12: Brush-tailed Mulgara recorded during the survey	37
Plate 13 Bobtail (<i>Tiliqua rugosa</i>) variant observed at Western site	38
Plate 14: Smokebush (<i>Conospermum toddii</i>) observed at Eastern site, location A during Survey	39

1 Introduction

1.1 BACKGROUND

The Great Victoria Desert (GVD) bioregion (approx. 418,750 km²) spans the southern rangelands of Western Australia (WA; 52% of bioregion area) and stretches into the western half of South Australia (SA). Several species of conservation significance are present throughout the bioregion, including the nationally threatened Sandhill Dunnart (*Sminthopsis psammophila*) (SHD).

Listed as Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the *Biodiversity Conservation Act 2016* (Western Australia), SHD ecology, habitat requirements and key threats are poorly known, especially within WA. Previous surveys targeting the SHD within the WA portion of the GVD have been highly localised and typically associated with mining development. To build on the limited knowledge base, the GVDBT commissioned the WA Department of Parks and Wildlife (DPaW, now the Department of Biodiversity, Parks and Attractions (DBCA)) in 2015/16 to produce survey and monitoring guidelines (DPaW 2016a) and a baseline survey design (DPaW 2016b) to guide future survey effort for Sandhill Dunnart in the Great Victoria Desert (GVD).

Subsequent to their completion, GVDBT commissioned Greening Australia (GA) to lead a regional baseline survey for the species, in accordance with the guidelines and survey design. The survey focused on the deployment of camera arrays at 20 sites across the GVD to:

- establish a baseline dataset of SHD occurrence to guide future analysis, survey and monitoring;
- collect environmental data to investigate the relationship between SHD and relevant environmental variables;
- collect opportunistic data for other fauna species (including conservation significant fauna) whilst undertaking SHD surveys; and
- transfer knowledge (ie. contribute to other research, broader programmes and datasets).

This initial field survey was conducted between September and December 2017. Sandhill Dunnart were confirmed from one new area (Plate 1) (extending the known range approximately 100 km to the east) (within a sand dune ridge (a typical habitat preference of the species (Turpin et al. 2017)) and a second location considered likely to support the species, though due to size and clarity of images identification was uncertain (Plate 2).

Additionally, a range of conservation significant species were detected in the baseline survey, and environmental data highlighted the major threats to the Sandhill Dunnart; namely fire and introduced mammals.



Plate 1: Confirmed Sandhill Dunnart image recorded during the 2017 survey



Plate 2: Likely Sandhill Dunnart recorded from the south western GVD during the 2017 survey

1.2 SURVEY SCOPE AND OBJECTIVES

The GVDBT commissioned Greening Australia (GA) to build on the work conducted during the initial baseline survey and undertake a targeted SHD trapping survey at these sites (Figure 1) to verify the presence of SHD at the two locations of known/likely occurrence while also surveying for the presence of Malleefowl (*Lepioa ocellata*) within the vicinity of these locations. Specific objectives were to:

- deploy motion sensor cameras at the two locations of known/likely occurrence of SHD (in accordance with DPaW methodology (2016a));
- conduct pit trapping at the two locations of known/likely occurrence of SHD (in accordance with DPaW methodology (2016a));
- conduct habitat assessments at all survey locations using DPaW methodology (2016a);
- undertake surveys for the presence of the Malleefowl (termed “long walks”) within the vicinity of the two locations of known/likely occurrence of SHD, as per Benshemesh (2016);
- work collaboratively with the GVDBT and foster inter-organisation knowledge transfer (ie. contribute to broader programmes or datasets, wherever possible); and
- provide a comprehensive analysis and written report on the above.

The scope and objectives adopted for this survey were aligned with the following guidelines and documents, where relevant:

- DPaW (2016a). Survey and Monitoring Guidelines for the Sandhill Dunnart (*Sminthopsis psammophila*) in Western Australia;
- DPaW (2016b). Defining a Baseline Survey Design for the Sandhill Dunnart (*Sminthopsis psammophila*) in the Great Victoria Desert of Western Australia;
- EPA and DPaW Technical Guide (2010). *Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment*;
- The Department of Primary Industries and Regional Development (DPIRD). *Licence to use animals for scientific purposes*;
- Western Australian Museum (2015). Preservation and Lodgement of Specimens (Reptiles, Frogs, Mammals and Birds);
- Benshemesh (2016). Malleefowl Monitoring Protocols for Use in the Great Victoria Desert;
- Greening Australia Workplace Health and Safety Management System; and
- Department of Biodiversity, Conservation and Attractions (DBCA) Standard Operating Procedures to conduct fauna work under a DBCA Regulation 17 (Licence to take Fauna for Scientific Purposes) (DBCA 2019).

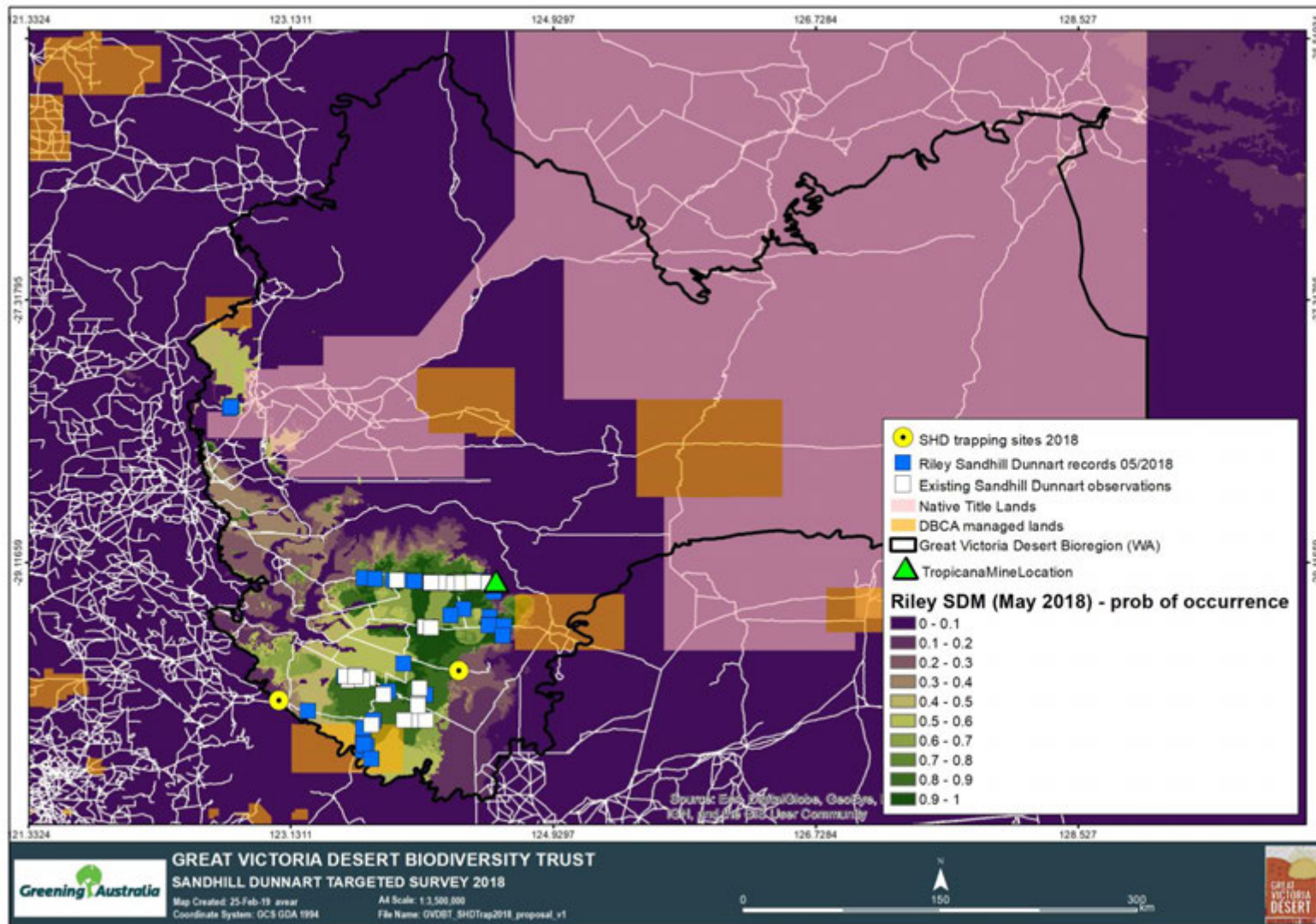


Figure 1: Locations of Sandhill Dunnart survey 2018 effort relative SHD occupancy literature

2 Methods

2.1 SURVEY TEAM AND LICENSING

The field component of this survey was led by Greening Australia in partnership with Kingfisher Environmental, with significant contributions made by dedicated volunteers (Table 1). The survey was conducted under both DBCA Regulation 17 Licence 080026971 and DPIRD Licence to use animals for scientific purposes Licence U12/2018-2020.

Table 1: Survey team for the Sandhill Dunnart targeted Survey 2018

Person	Qualification	Position
Liam Mulcahy	BSc. (Botany/Geography)	Project Manager
Jeff Turpin	BSc. (Zoology)	Zoologist/Technical Lead
Joe Meadham	BSc. Hons. (Zoology / Cons. Biol.)	Zoologist
Jo Riley	BSc. Hons (Zoology / Biochemistry)	Zoologist
Arielle Fontaine	BSc. Hons. (Env. Sci.)	Field Technician
Annelise Bone	BSc. Hons. (Env. Sci.)	Field Technician (volunteer)

2.2 SURVEY TIMING

The field survey comprised two on-ground phases (Phase 1: pit trap and camera establishment – eight days, 27 Aug – 3 Sept) Phase 2: pit trapping and camera redeployment/collection – 17 days, (01 – 17 Oct). This timing corresponds with mild temperatures suitable for trapping animals and aligns with the appropriate time of year for surveying Sandhill Dunnarts (DPaW 2016a; 2016b).

2.3 SURVEY SITE SELECTION AND SURVEY EFFORT

The survey was centred on two locations deemed likely to support the Sandhill Dunnart (Greening Australia 2018), spaced approximately 130 km apart in the south-western GVD (Figure 1). To verify the species presence, 16 sampling locations were established (termed “east” or “west”) (Figure 2) and consisted of a combination of pitfall traps (12 per site according to DPaW, 2016a, Table 2) and motion sensor cameras (four per site, Table 2). Sites were situated within areas of suitable habitat and located proximal to the 2017 camera records (Figure 1).

One survey site was established at each of the 2017 camera records (east and west), and the additional seven survey sites were situated within areas of suitable habitat nearby. Sites were spaced to ensure spatial independence (at least 2 km apart) with some sites spaced significantly further to avoid recently burnt habitat, which was widespread within the Study Area.

Targeted searches for the Malleefowl (long walks) were undertaken over a total of 62 km across six locations (See Appendix 1) within and/or proximal to areas of Malleefowl Likelihood (Figure 3) (See Appendix 2) and additional areas near Mulga Rockhole.

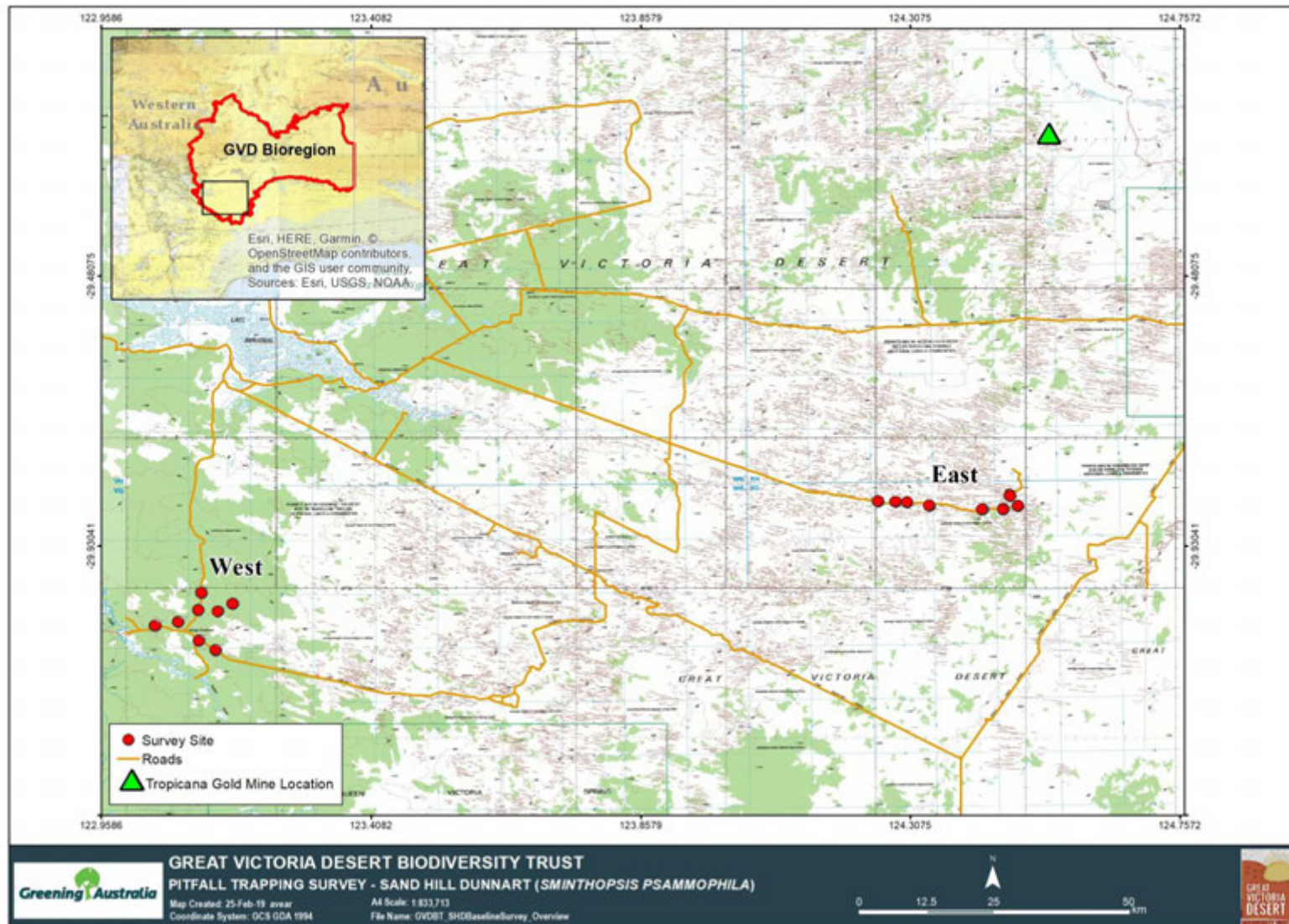


Figure 2: Survey locations across Eastern and Western sites

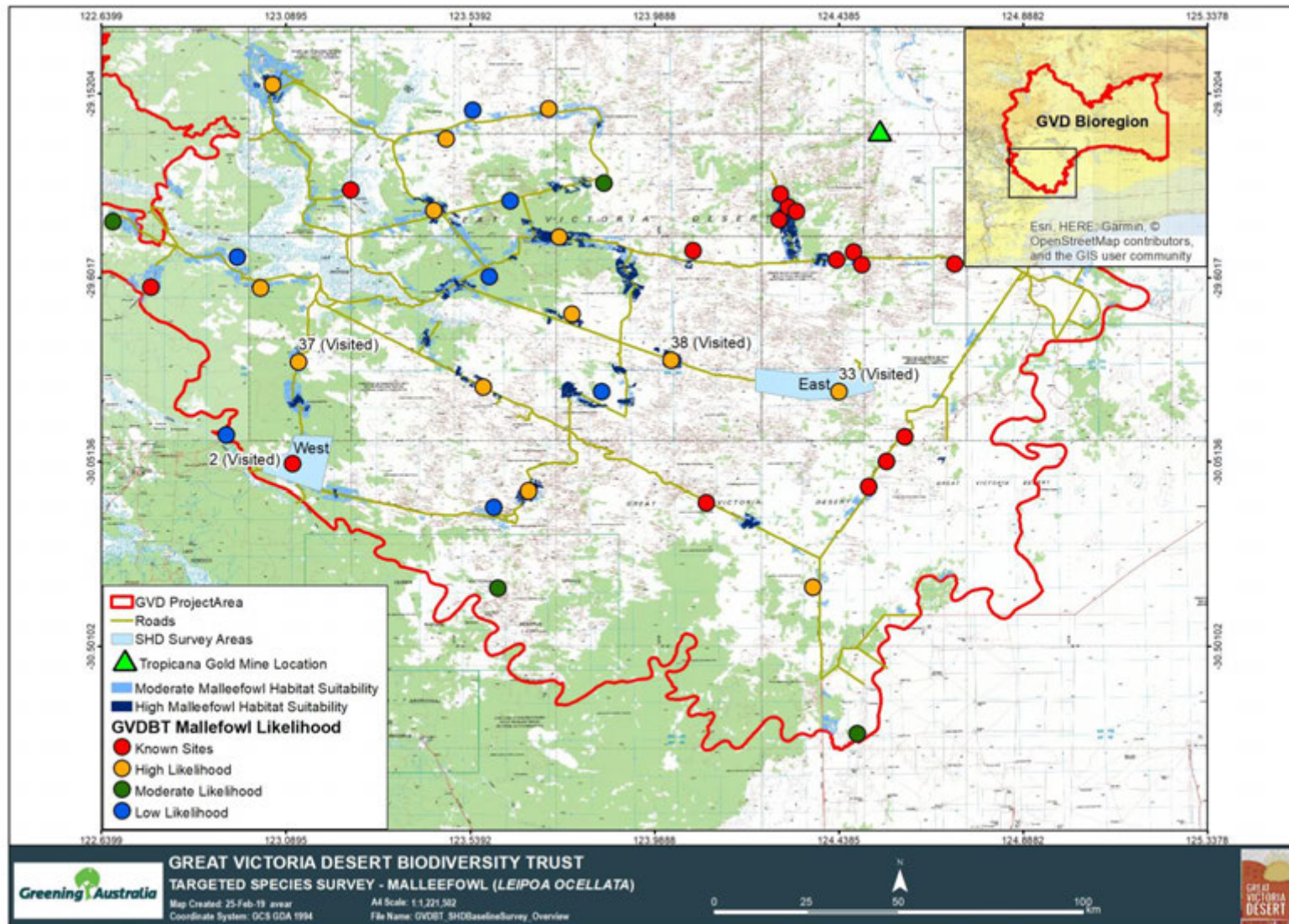


Figure 3: Malleefowl survey locations relative to habitat suitability and likelihood modeling

Table 2 Summary of sampling methods and effort for GVD fauna survey 2018 (27/08/18-17/10/18)

Sampling technique		Sites	Survey locations	Sampling effort per site	Effort	Total Effort
Systematic sampling (SHD)	Camera trapping (Phase 1)	East	8 Sites (A-H)	4 per site <i>(three cameras for sites D, E, F)</i>	30-31 nights	882 nights
		West	8 Sites (A-H)	4 per site	40-43 nights	1,196 nights
	Camera trapping (Phase 2)	East	8 Sites (A-H)	4 per site	7 nights	224 nights
		West	8 Sites (A-H)	4 per site	7 nights	224 nights
	Dry pitfall trapping (Phase 2)	East	8 Sites (A-H)	12 per site	4-7 nights <i>(Site A closed early)</i>	633 nights
		West	8 Sites (A-H)	12 per site	7 nights	672 nights
Targeted sampling (Malleefowl)	Long walks	East	Polygon 33	9 walks	20.2 km	28.8 km
			Polygon 38	3 walks	8.6 km	
		West	Polygon 2	2 walks	8.2 km	33.2 km
			Polygon 37	2 walks	8.0 km	
			S of polygon 37	1 walk	8.0 km	
			Nippon Highway	2 walks	8.8 km	

2.4 CLIMATE AND WEATHER

The survey was conducted at an appropriate time and season considering:

- SHD survey and monitoring guidelines (DPaW, 2016a);
- SHD species breeding and movements (DPaW, 2016a);
- daily temperatures (influencing both capture rates and animal condition);
- non-target species of interest (such as the Malleefowl); and
- the ability to maximise survey effort given the region's temperature extremes.

The Great Victoria Desert is characterised by both low and variable rainfall and temperature extremes (**Figure 4**) (Australian Natural Resources Atlas 2002; Bastin 2008). Rainfall is highly unpredictable and often very localised (influenced by temperate weather systems in the south and tropical systems from the north, Bureau of Meteorology 2018).

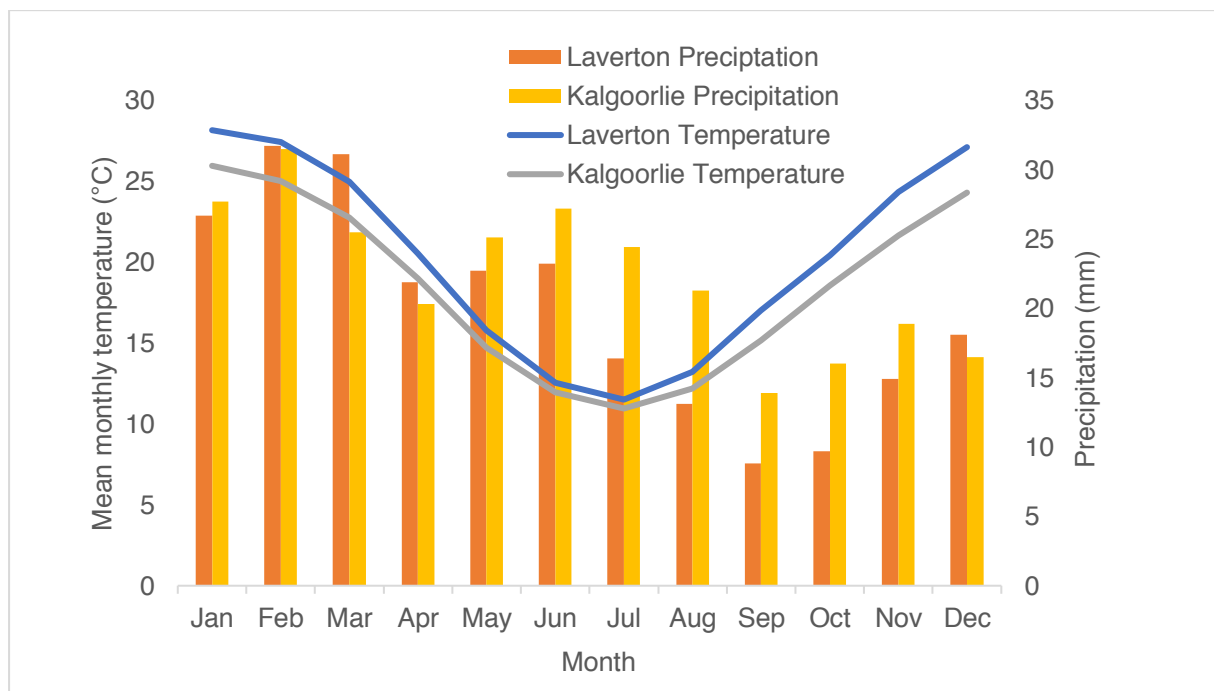


Figure 4: Mean monthly rainfall and temperature for Kalgoorlie & Laverton weather stations

Source: BOM (2018). Rainfall and temperature data from station 012038 (all years), 012240 (all years)

The nearest weather station at Tropicana recorded a temperature range of 10 – 26 °C, with rainfall recorded on six days (Figure 5). These mild conditions influenced capture rates (high for mammals and low - moderate for reptiles) and were considered adequate to survey for the SHD.



Figure 5: Maximum and minimum daily temperatures and rainfall during the Survey

Source: TGM Aerodrome Weather Station (AWOS) (2018)

2.5 METHODS

2.5.1 Habitat Assessment

Standardised habitat assessments were conducted at each survey location (*A-H*). Four habitat photos were taken at each of the camera locations and the following parameters documented (as per DPaW 2016a) guidelines:

- fire history (estimated time since last burn, percentage burnt, scorch height and fire intensity);
- landform and soil features (surface and colour);
- vegetation structure (Muir 1977), cover, condition and broad species composition;
- spinifex stage;
- estimate of leaf litter cover percentage and type; and
- the presence or absence of logs, rocks, woody debris or other habitat features (e.g. water, disturbances).

2.5.2 Motion Sensor Cameras

Four motion sensor cameras were installed at each survey location (16 locations overall: *A-H* at both East and West sites), resulting in a total of 64 motion cameras (Reconyx Hyperfire HC900) deployed throughout the survey period (August – October 2018) (Table 2). While four cameras were installed at each location (Survey Phase 1) (See Appendix 3), cameras were subsequently re-positioned during pitfall trapping (Survey Phase 2) (See Appendix 3) after a minimum deployment of 30 nights to assess the movement of fauna at established trap sites.

Camera installation was identical across all sites; however, the use of an attractant varied because of animal welfare considerations (ie. cameras were baited only during the initial survey phase). During Phase 1, bait lures (baited with universal bait, a mixture of peanut butter, rolled oats and sardines in oil) were installed at each camera site. Bait lures were subsequently removed (during Survey Phase 2, after a minimum deployment of 30 camera nights), as cameras were re-positioned proximally to pitfall traps, and under animal ethic guidance (DPIRD) bait lures were not installed. In all instances, cameras were installed according to DPaW guidelines (DPaW 2016b) (Plate 3):

- placement of cameras on flat or gently sloping ground with a limited amount of vegetation in the field of view;
- cameras set approximately 30 cm above ground at an angle of 10 degrees, 1 m from the target area;
- capture set to three pictures per trigger with a one second delay;
- cameras baited with an attractant comprising universal bait and foam soaked in fish oil packed inside a small PVC pipe receptacle (12 cm long, 25 mm in diameter). Receptacles were secured into the ground using a 20mm tent peg.
- all cameras deployed for a period of no less than 28 days.



Plate 3: Camera deployment during Phase 1 (left, with bait lure) and Phase 2 (right, without bait lure and along trapping fence line)

At each camera deployment, the following information was recorded:

- Site location (including GPS coordinates);
- Camera identification number;
- Card identification number;
- Date of deployment and collection;
- Bearing/direction of deployment;
- Height of deployment;
- Angle to target (inclination);
- Distance to target (m); and
- Bait/lure used for Phase 1 only (Phase 2 cameras were in proximity to pitfall traps, so were not used under animal ethic guidance (DPIRD)).

Following deployment and capture period, species recorded via motion sensor cameras were processed through a tiered review system, ahead of final identification.

2.5.3 Pit Trapping

Twelve pitfall traps were established at each survey location (See Appendix 3), resulting in a total of 192 pitfall traps installed across 16 trapping locations (locations A-H for both the two East and West sites) (Table 2) At each survey location (A-H), two lines of six pits (PVC pipes of 225 mm diameter, 600-700 mm deep) were set into the ground and spaced 100 m apart (Figure 6 DPaW 2016a).

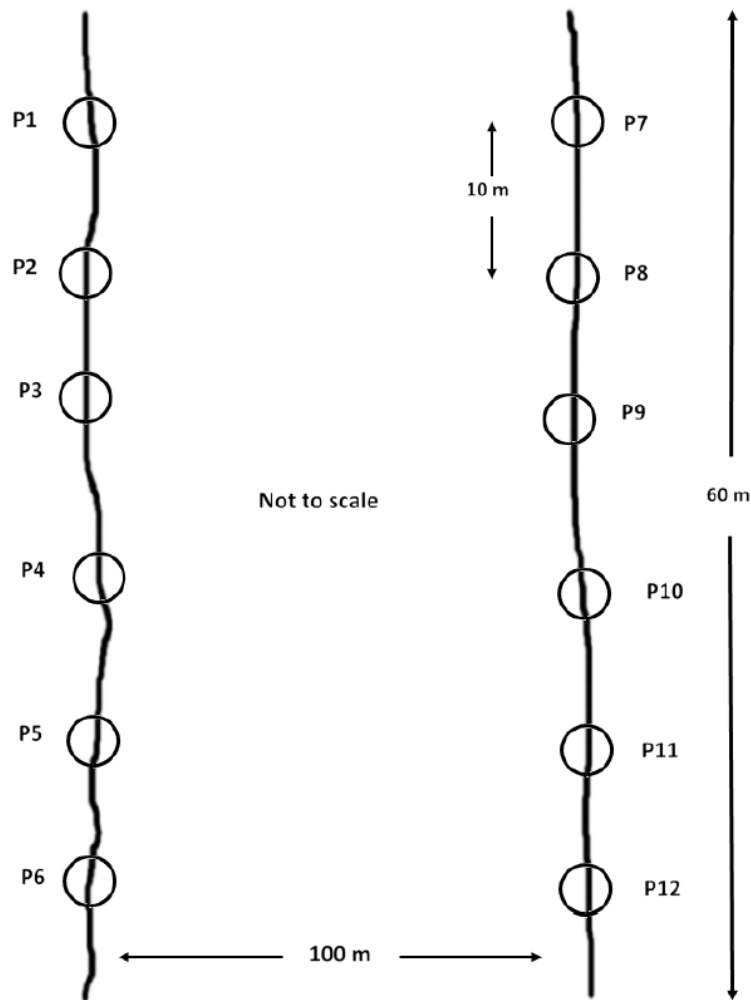


Figure 6: Pitfall trapping layout regime across Western and Eastern sites, locations A-H

For each line, each pit was crossed by a drift fence (~40 cm high and 50 m in length) and set into substrate with pins fixed either side of each pit.

As per DBCA guidelines (DPaW 2016a), trapping was conducted over seven consecutive nights. Total trapping effort comprised 1,305 trap nights; note due to ethical considerations Eastern Site, Location A sampled four consecutive nights) (Table 2)

2.5.4 Processing, Marking and Measurements

As per DBCA and WA Museum guidelines and licence conditions, the following parameters were recorded for each animal capture (including both target and non-target species):

- taxon identification;
- sex – male or female (if possible);
- age – juvenile, sub-adult or adult (if possible);
- general condition – markings, fur condition, damage, health and behaviour;

In addition, the following parameters were recorded for target species (SHD):

- reproductive condition;
- weight (g);

- hindfoot length (PES length) (mm);
- tail length (mm);
- tissue sample (small ear notch stored in 100 % ethanol).

To identify re-captured mammals (both target and non-target), all new individuals were marked by clipping fur above the base of the tail. A tissue sample was collected from species of conservation significance (a small ear notch taken). Tissue samples were preserved in 100% ethanol and submitted to the Western Australian Museum, for use in ongoing research.

2.5.5 Targeted searching

Concurrent to the pitfall trapping program, targeted searches for Malleefowl were conducted (Table 3). In acknowledgement of the sparse distribution of Malleefowl in the GVD and paucity of records of occurrence (Benshemesh, 2016), long walks were undertaken across a range of habitats and in accordance with survey guidelines (Benshemesh, 2016). As the Malleefowl constructs readily identifiable, large mounds and has distinctive tracks, scats and feathers, searches were undertaken on foot, aiming to locate evidence of the species presence. Long walks were conducted in six broad areas (Table 3).

Table 3: Long walks undertaken during the 2018 survey

Survey Site	Location	Habitats traversed	Distance walked (km)
33	30 km south-west of Plumridge Lakes NR	Mulga, spinifex sandplain, sand dunes	20.2
38	60 km west of Plumridge Lakes NR	Sandplain, Eucalypt Woodland, Mallee	8.6
2	Mulga Rockhole	Mulga, dense Acacia shrublands, Mallee	8.2
37	30 km north of Mulga Rockhole	Mallee, Sheoak and Eucalypt Woodland	8.0
37 South	16 km north of Mulga Rockhole	Mallee, Sheoak and Eucalypt Woodland	8.0
Nippon Hwy	10 km east of Mulga Rockhole	Mulga, spinifex sandplain	8.8

2.5.6 Opportunistic Sampling

Sightings and/or evidence of fauna were documented throughout the survey period. These records included direct visual and/or aural observation, or indirect signs such as tracks, scats or burrows. These opportunistic records supplement those obtained during the systematic sampling, and were generated because of observations made:

- during camera deployment and/or collection;
- while travelling between survey sites; and
- at any other time whilst working in or travelling within the Survey Area.

2.5.7 Survey limitations

Table 4: Potential limitations for the Survey

Potential Limitation	Extent of limitation for the fauna survey	
Experience of fauna personnel	Not limiting	The supervising zoologist has over 20 years' experience in fauna surveys, and team members have 1 to 20 years' experience.
Types of traps or other survey methods used	Not limiting	Trap types used in the Survey (pitfalls and motion sensor camera traps) were as per DBCA guidelines for the Sandhill Dunnart. Targeted survey method used for the Malleefowl (long walks) were as per guidelines produced by Benshemesh (2018).
Number of trapping sites	Not limiting	Sixteen trapping sites were established, in the second phase of the Survey. Trap effort was appropriate to achieve the stated objectives.
Ability to survey all habitats present	Not limiting	All habitats present at both Eastern and Western locations were surveyed during the fauna survey.
Effects of weather during the survey	Minor limitation	Rainy weather was experienced throughout all phases of the trip. Heavy rain on several occasions throughout Eastern and Western surveys may have impacted captures, but good capture rates were experienced on subsequent nights. Despite being the recommended season, cooler temperatures during surveys at the Eastern Site may have reduced the number of reptiles but had no impact on mammals. An increase in reptile captures was seen when moving to Western sites, associated with an increase in temperatures.
Seasonal effects	Not limiting	Surveys were undertaken in Spring when faunal activity is high.
Disturbance to site such as recent fires	Minor limitation in some areas	Portions of the Survey Area are recovering after extensive fire. SHD survey areas were left unaffected, whereas some sites where targeted surveys were conducted (for Malleefowl) had experienced recent fires. With some areas burnt where Malleefowl presence had been modelled facilitated on-ground truthing and in some instances made traversing habitat easier and locating Malleefowl mounds, but reduced the number of other fauna observations and is likely to have impacted the distribution of some species such as SHD. Similar unburnt habitats were available nearby to survey.
Ease of access to site	Not limiting	All sites at both Eastern and Western locations were accessible using Tropicana site access roads and connecting tracks.

2.6 DATA MANAGEMENT AND ANALYSIS

2.6.1 Image management and recording

All images retrieved from motion sensor cameras were processed manually according to the following procedure:

- all images were copied from SD cards to a folder structure relating each set of photos to an individual camera (ie. four per trapping location), and an individual site (ie. a total of 64 for the survey), allowing for comparison with environmental variables and further analysis, where warranted.
- images were sorted and processed manually with the total number of active and blank images recorded per camera (ie. images with both animals present and absent recorded);
- species identification: species presence was recorded for each motion sensor camera deployed for both position 1 and 2. Here a staggered approach was taken with a first pass review (marking those images where ID was uncertain) followed by a final assessment and identification by Jeff Turpin.

3 Results and Discussion

3.1 FAUNA HABITATS AND FIELD OBSERVATIONS

In alignment with the Sandhill Dunnart Baseline Survey (Greening Australia 2018), habitats assessed throughout this Survey were also based on broad vegetation units (See Appendix 4).

Sites surveyed largely comprised sandplain and dune habitats, supporting species such as *Eucalyptus youngiana*, *Triodia desertorum* and a complex and variable shrub layer including species such as *Grevillea juncifolia* and *Acacia ligulata* (Plate 4). It should be noted that limitations and external factors were experienced throughout this project.



Plate 4: Typical sandplain and dune landscapes sampled at Eastern Site locations

In addition to dominant landform habitats, sand crests, slopes and swales were also sampled. These habitats also supported a mosaic of vegetation fire stages. Long unburnt areas (20+ years) were usually associated with surrounding tall sand dunes and/or patches of adjacent Mulga whereas more recently burnt sites areas were associated with unprotected and more frequently burnt sandplain habitat (See Appendix 5).

Consistent with the previous baseline survey and other SHD monitoring efforts in the GVD (J. Riley and J. Turpin unpublished data), the Survey showed long unburnt habitats recorded SHD individuals as well as associated flora of SHD occupancy (Table 5, see Appendix 6).

Table 5: Habitat characteristics at sites of known SHD occurrence

Site No.	East, A	East, F
No. of SHD captured	Two (♂/♀)	One (♀)
Last burnt	20+ years	20+ years
Landform	Dune foot slope	Dune crest
Upper stratum dominants	<i>Eucalyptus gongylocarpa</i> <i>Callitris preissii</i>	<i>Eucalyptus gongylocarpa</i> <i>Callitris</i> sp. <i>Acacia</i> sp. (Mulga) <i>Eucalyptus youngiana</i>
Middle stratum dominants	<i>Acacia</i> spp. inc <i>helmsiana</i> <i>Allocasuarina spinosissima</i> <i>Callitris preissii</i> <i>Hakea</i> spp. <i>Persoonia</i> spp. <i>Grevillea</i> spp. inc <i>juncifolia</i>	<i>Acacia</i> spp. inc <i>colletoide</i> <i>Eremophila</i> spp. <i>Grevillia juncifolia</i> <i>Thryptomene</i> spp.
Lower stratum dominants	<i>Triodia desertorum</i>	<i>Triodia desertorum</i>

3.2 FAUNA OBSERVATIONS

A total of 172 fauna species were recorded during the survey (63 reptile, 69 bird, 27 native mammal and 13 introduced mammal species) (Table 6) (See Appendix 7).

Table 6: The fauna assemblage recorded during the survey

Species Recorded	Observations	Pit Trapping	MS Camera records	Secondary evidence	Total
Reptiles	20	35	8	-	63
Birds	61	0	6	2	69
Native Mammals	2	11	9	5	27
Introduced Mammals	3	0	5	5	13
Total	86	46	28	12	172

The assemblage recorded included several species rarely encountered in the Great Victoria Desert or recorded in the region near the extreme edge of their range (See Appendix 8). Species of note included:

- Sandhill Dunnart (*Sminthopsis psammophila*): trapped at two sites and on camera at four sites;
- Malleefowl (*Leipoa ocellata*): four observed and several mounds recorded;
- Striated Grasswren (*Amytornis striatus*): DBCA Priority 4, several groups observed;
- Brush-tailed Mulgara (*Dasycercus blythi*): DBCA Priority 4, trapped and recorded on camera;
- Scarlet-chested Parrot (*Neophema splendida*): uncommon in the GVD, two groups observed.

The southern Great Victoria Desert is a biogeographic interzone, containing elements of both the temperate south-west and arid interior. Several temperate-adapted species occur in the region in small populations at the arid extreme of their range (Turpin and Johnstone, 2017). A number were recorded during the survey, including the Bobtail, Regent Parrot, Australian Raven and White-eared Honeyeater.

3.3 TRAPPING RESULTS

The assemblage trapped included a range of terrestrial vertebrates, with an almost equivalent number of reptiles and mammals recorded (284 mammals and 281 reptiles).

A total of 565 captures were recorded across all survey sites. In total 46 species were trapped, comprising 11 native mammal and 35 reptile species.

More reptiles were trapped during the second survey phase (212 captures from the western sites compared to 70 captures from eastern sites) reflecting the warmer conditions experienced (Figure 5). Mammal captures were consistent throughout the survey period (139 captures from eastern sites compared to 144 captures from western sites). The majority of native mammals trapped comprised rodents (*Notomys alexis*, *Pseudomys desertor*, *Pseudomys hermannsburgensis*), Ningauis (both *N. yvonnae* and *N. ridei* trapped) and Western Pygmy Possum (*Cercartetus concinnus*).

Four dunnart species (*Sminthopsis* sp., 23 captures) were recorded, readily distinguishable by a combination of size, feet and tail characteristics. *Sminthopsis dolichura* and *Sminthopsis hirtipes* (Plate 5) were trapped in the highest abundance and recorded from a number of sites. Both *Sminthopsis psammophila* *Sminthopsis ooldea* were trapped in reduced numbers and recorded from fewer survey sites.



Plate 5: *Sminthopsis hirtipes* and *Sminthopsis dolichura* recorded during the survey

Tissue samples were collected from 65 animals (43 mammals and 22 reptiles) (See Appendix 9). Ear notch samples were collected from mammals, while reptile samples included dropped tails, tail tips,

shed skin or scales. All samples were stored in 100% ethanol and forwarded to the Western Australian Museum.

3.4 CAMERA RESULTS

All motion sensor cameras operated over a minimum of 30 consecutive nights (ranged from 30 – 43), resulting in a total of 2,526 camera survey nights from the 64 cameras installed (Table 2). Motion sensor cameras detected a varied assemblage (28 species in total; 22 from the west sites and 14 from the east sites, See Appendix 10) including rare /cryptic taxa such as the Sandhill Dunnart and Brush-tailed Mulgara (Plate 6 and Plate 7).



Plate 6: Sandhill Dunnart, identifiable by a combination of size and tail crest (left).



Plate 7: Mulgara, identifiable by a combination of size and tail crest.

Most camera detections were triggered by small mammals, attributable to the type of attractants used, the method of installation and the physiology of target fauna (ie. providing the temperature contrast

suitable for detection). Camera detections reflected the density and abundance of fauna, with common and widespread species comprising the bulk of the fauna recorded.

Native rodents, such as the Spinifex Hopping Mouse (*Notomys alexis*) and Sandy Inland Mouse (*Pseudomys hermannsburgensis*), were widely recorded (Plate 8, Figure 7). Conversely, the Desert Mouse (*Pseudomys desertor*) and some dasyurids (such as *D. blythi*, *S. psammophila*) were recorded from few locations.



Plate 8: Hopping mouse individuals captured with motion imagery

The fauna assemblage detected via motion sensor cameras was broadly consistent with that recorded from pit trapping, with most mammal species trapped via pitfalls also recorded on camera. One exception was the Western Pygmy Possum (*Cercartetus concinnus*) (Plate 9), which although commonly trapped (11 from 16 sites), was not detected by the cameras. This is likely to be attributable to the camera attractants used and the species arboreal habits.



Plate 9: Western Pygmy Possum (*Cercartetus concinnus*) observed during pitfall trapping efforts

The motion sensor cameras detected several species that were not trapped during the survey (ie. larger mammals such as Echinda *Tachyglossus aculeatus*, Feral Cat *Felis catus*, Western Grey Kangaroo *Macropus fuliginosus*, Dingo *Canis lupus*, Rabbit *Oryctolagus cuniculus*, Red Fox *Vulpes vulpes*) and

also detected some rare species at a higher rate than the trapping regime (such as *D. blythi*, *S. psammophila*). Several species of note were recorded via motion sensor cameras:

1. Sandhill Dunnart: recorded from 10 cameras installed at four of the eastern sites (A, E, F, H);
2. Brush-tailed Mulgara: DBCA Priority 4, few records for the GVD, detected from seven cameras at five sites during the survey (four sites from the western group: B, C, G, H and eastern site E);
3. Bobtail: temperate adapted species recorded in the southern GVD at its arid extreme, recorded from seven cameras installed at four sites (West Sites A, B, E, F);
4. Feral Cat: widely recorded from 11 of the 16 survey sites, including three of the sites supporting the Sandhill Dunnart (A, E, F).
5. Red Fox (*Vulpes vulpes*): recorded from eastern Site H, where the Sandhill Dunnart was also recorded.

Two species, *Notomys alexis* and *Pseudomys hermannsburgensis* accounted for the majority of camera detections (recorded at all sites, Figure 7). Feral Cat and Western Grey Kangaroo were widely detected, recorded from several sites (11 and 14 sites respectively). The Sandhill Dunnart was recorded from four sites (Figure 7) and the Brush-tailed Mulgara from five sites. A high number of detections at three survey sites elevated the overall detection rate of the Sandhill Dunnart and suggested cameras were placed proximal to shelter sites. Both the European Red Fox (*Vulpes vulpes*) and the Feral Cat (*Felis catus*) were recorded at sites occupied by the Sandhill Dunnart (Figure 7). Several species were only detected from one location, including the Echidna, Desert Mouse, Rabbit and a number of birds and reptiles.

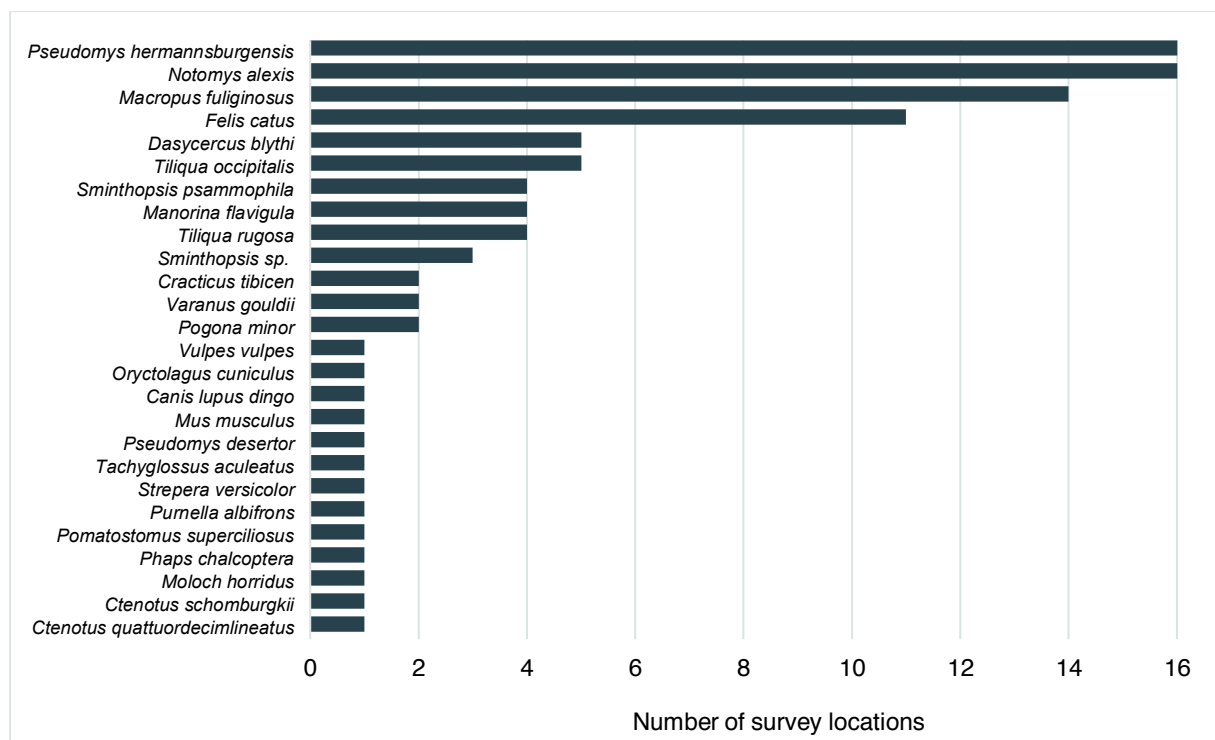


Figure 7: The detection of fauna across all survey locations

3.5 SANDHILL DUNNART

The Sandhill Dunnart was confirmed from the East site (Figure 8) locations A, E, F and H (Figure 9) (approximately 23 – 40 km south-west of Plumridge Lakes Nature Reserve).

The species was trapped at two sites (eastern sites A and F) and was captured on ten motion sensor cameras across sites (recorded on camera at sites A, E, F and H) (Table 7).

Records of SHD from this survey confirm the presence of the species from a previously un-surveyed area and are situated on the eastern fringe of a broad area of undulating yellow sandplains, see Table 4.

Three individuals were trapped during the survey, including two breeding females (pouch young present) and an adult male (Table 7, Plate 10). One female was re-trapped on a further two occasions, suggesting the close proximity of shelter sites. SHD were also recorded from 10 cameras installed at four survey locations (Table 7) between 27/08/18 - 16/10/18. Due to proximity of cameras to pitfall traps it may be suggested that individuals caught on camera throughout this period may have subsequently been caught in pitfall traps.

Table 7: Sandhill dunnarts recorded during the survey

Site	Method	Latitude	Longitude	Gender	Weight (g)	Reprod. condition
E,A	Trapped	-29.862208°	124.487150°	Female	23	Pouch young
E,A	Trapped	-29.862111°	124.487189°	Male	48	Large testes
E,F	Trapped	-29.868550°	124.427528°	Female	31	Pouch young
E,A	Camera 2	-29.862253°	124.487375°	-	-	-
E,A	Camera 20	-29.862636°	124.486525°	-	-	-
E,E	Camera 33	-29.861467°	124.338503°	-	-	-
E,E	Camera 44	-29.862372°	124.339025°	-	-	-
E,E	Camera 55	-29.862128°	124.340317°	-	-	-
E,F	Camera 14	-29.868794°	124.427125°	-	-	-
E,H	Camera 21	-29.846364°	124.473733°	-	-	-
E,H	Camera 45	-29.845553°	124.472778°	-	-	-
E,H	Camera 51	-29.844878°	124.473100°	-	-	-
E,H	Camera 58	-29.845167°	124.474269°	-	-	-

The Sandhill Dunnart was recorded within patches of long unburnt vegetation situated within landscapes affected by widespread recent fire (several high intensities burns from 2000 - 2017, US Geological Survey 2018). Sandhill Dunnarts were recorded in areas where the local topography provided some protection from fire (occurring between tall sand dunes or adjacent to mulga shrublands).

Vegetation comprised Marble Gum (*Eucalyptus gongylocarpa*) and *Callitris preissii* with a mature shrub layer (including *Allocasuarina spinosissima*, *Persoonia coriacea*, *Acacia helmsiana*, *Grevillea didymobotrya* and *Banksia elderiana*) over a mature hummock grassland (*Triodia desertorum* with *Lepidobolus deserti*) (See Appendix 5).

The Sandhill Dunnart was not recorded from the western group of sites near Mulga Rockhole (Figure 8). The area was sampled due to the apparent suitability of vegetation (reflecting that present at other

nearby records), the proximity of previous records and the recording of a small dunnart with a head-stripe during the 2017 survey.

While the target species was not recorded, the Hairy-footed Dunnart (*Sminthopsis hirtipes*) (Plate 5) was commonly recorded, including from the 2017 survey location. Mulga Rockhole is likely to lie near the western fringe of the species' range, and if present, the Sandhill Dunnart may occur in the area in low densities.

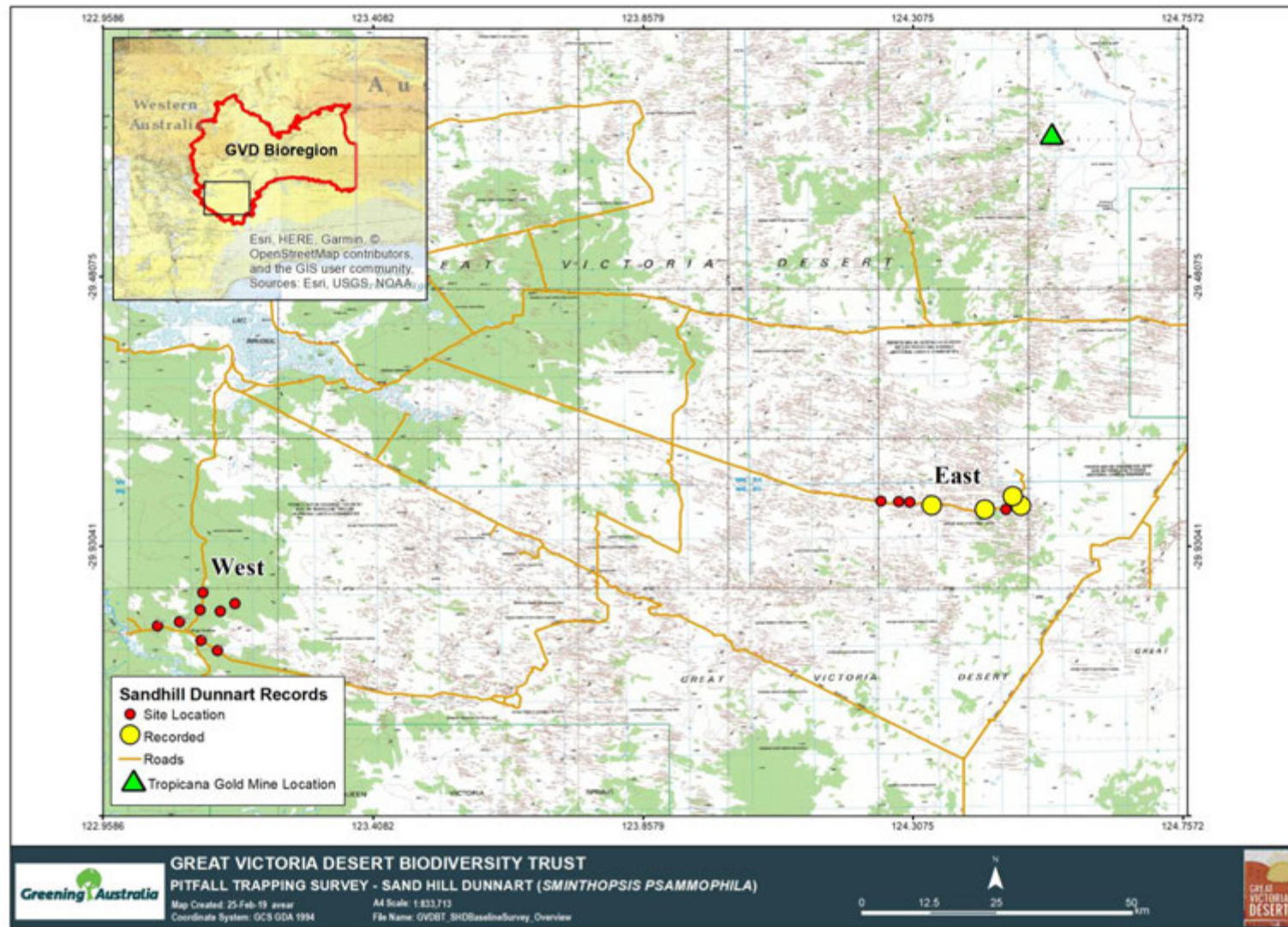


Figure 8: Locations of Sandhill Dunnart records (2018) across Western and Eastern sites

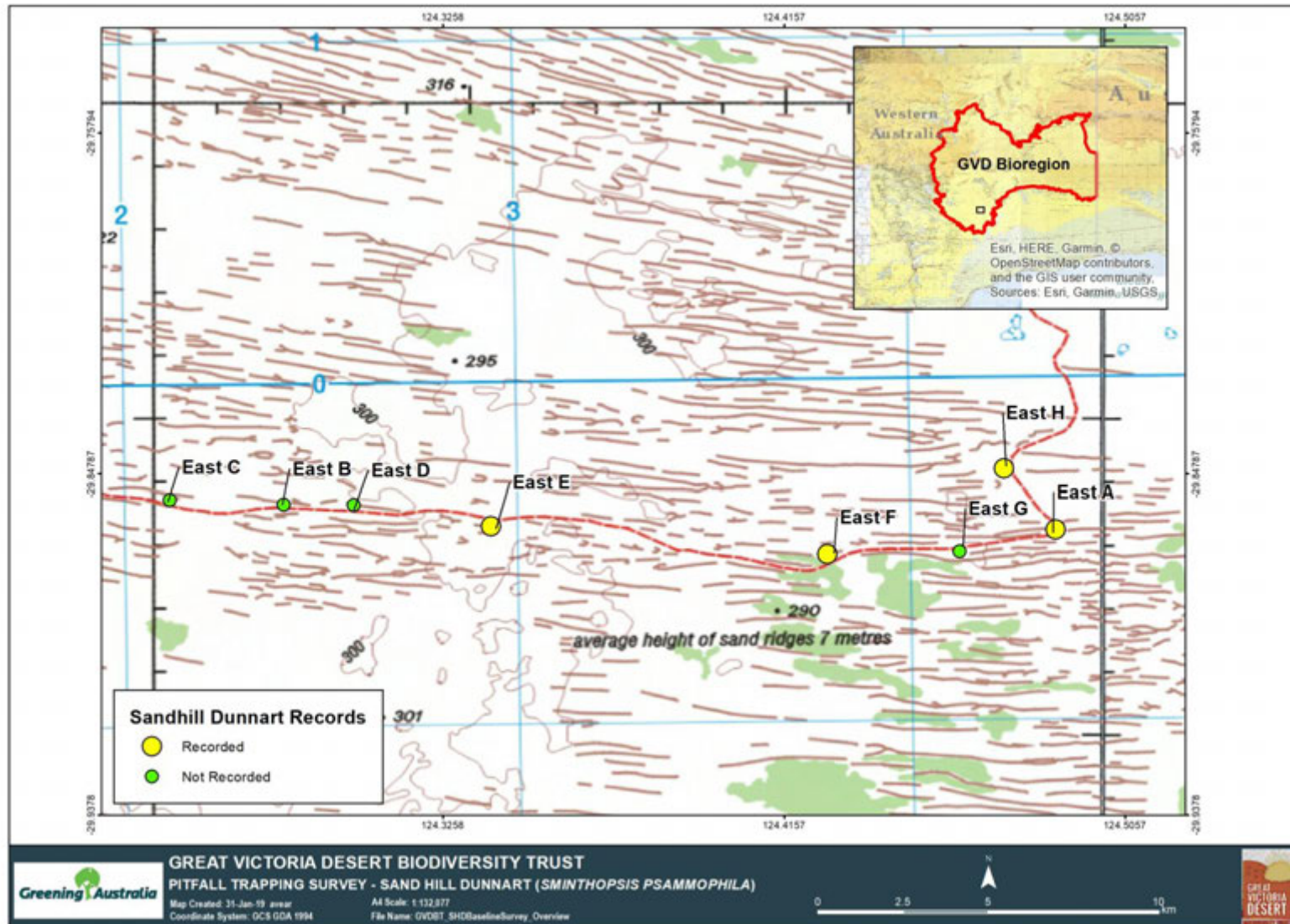


Figure 9: Locations of Sandhill Dunnart at Eastern site location A-H during the 2018 survey



Plate 10: Sandhill Dunnarts captured during the 2018 survey (left to right: Female 1, Male 1, Female 2)

*The Sandhill Dunnart is identified by its large size and bicoloured tail with a terminal crest

Trap success for the SHD was low, accounting for 0.5 % of all captures (3 out of 565 individuals). While the species was trapped at two survey sites, it's presence was detected by camera at four sites (10/64 cameras), revealing the relative effectiveness of the survey techniques employed.

One camera (Camera 2) installed at Eastern pitfall trap Location A detected individual(s) moving along pitfall fencelines (Figure 10), indicating that the fenceline height (30cm) was adequate to influence the species movements. It could also be suggested that this was the Male and or Female captured along this line, as the proximity of Camera 2 to the point of capture is reasonable.

However, few cameras overall recorded the species at pitfall lines, and the species was only recorded by cameras along those lines where it was also successfully captured in a pitfall trap (e.g. Site A, trapped 3 times).



Figure 10: A Sandhill Dunnart recorded along a fence line (Site A) where the species was trapped on three occasions

The low detection rate of the Sandhill Dunnart is not unexpected and is consistent with that observed elsewhere in the GVD and in South Australia (McLean 2015). While known populations can be readily detected by motion cameras, the Sandhill Dunnart has a very patchy distribution and occurs at low densities, so new populations can be difficult to detect (often requiring repeated survey visits). Due to its sparse occurrence combined with the large home ranges and movements during the breeding season, the Sandhill Dunnart's detectability can vary.

At occupied sites near Tropicana Gold Mine (~70km), variations in detectability mean the species is not always confirmed from known sites (detectability varying from 22 – 100%) and significant effort is required to detect populations in new areas. While some of the sites surveyed are unlikely to support the species, a lack of camera images does not necessarily equate to the species absence, particularly

within habitats supporting seemingly suitable vegetation. Therefore, while no further observations were made, the potential exists for the species to occur across a wider area of the GVD and at some of the survey sites sampled. As such, further survey effort is considered likely to detect the species across a wider area.

The survey results reveal that significant and targeted effort is required to detect new populations of the Sandhill Dunnart. In addition to detecting a new population, the survey has recorded an extension to the known range of this cryptic, endangered and poorly known species.

3.6 OTHER SPECIES OF SIGNIFICANCE

While the survey focused on the Sandhill Dunnart, additional species of conservation significance were recorded during target searches, opportunistically, or on the motion cameras installed (Table 8 & Table 9). Significant fauna included species listed under state or national legislation (e.g. Malleefowl), priority fauna listed by DBCA (Brush-tailed Mulgara, Striated Grasswren), and regionally significant fauna (with few regional records or recorded at the extreme of their known range).

3.6.1 Malleefowl

The Malleefowl (*Leipoa ocellata*, listed as Vulnerable under the EPBC and Wildlife Conservation Acts) has a patchy range within the Great Victoria Desert where it is restricted to areas of dense vegetation, typically dense thickets of long unburnt Mulga shrubland. The species was recorded during the 2018 survey via target searches (long walks) (Figure 3). Overall, four birds were observed (Plate 11), five inactive mounds recorded (Table 8) and the species distinctive tracks sighted in several locations (Table 8 and Table 9) (See Appendix 1).



Plate 11: Malleefowl observed North of Mulga Rockhole

Malleefowl mounds were recorded from areas of dense vegetation (See Appendix 1), typically dense Mulga thickets (*Acacia caesaneura*, *Acacia incurvaneura*) with an understorey of dense *Aluta maisonneuvei* and *Eremophila* shrubs (*Eremophila latrobei*, *Eremophila forrestii*, *Eremophila clarkei*). The five mounds recorded were all inactive and varied in age, profile and depth (Table 8). Four mounds were located within areas of dense Mulga at Malleefowl Survey Site 33, which was considered likely to support the species. The fifth mound, located along the Nippon Highway east of Mulga Rockhole, was more recently used (loose soil and mound depth indicating a more recent excavation). Evidence of extant populations (such as sightings, tracks or recent breeding activity) are uncommon and provide important insights into the species current regional range.

Malleefowl were observed on three occasions in the vicinity of Mulga Rockhole, spaced over approximately 1 km. A pair was observed foraging together and single birds were observed on two occasions. Due to the regular presence of birds at Mulga Rockhole, several mounds are likely to occur in the local area. Malleefowl tracks were observed from the vicinity of Mulga Rockhole and also along the Nippon Highway and at Survey Site 37 (Table 9).

Table 8: Malleefowl mounds recorded during the survey

Mound	Latitude	Longitude	Profile	Width (m)	Height (cm)	Depth (cm)	Comments
1	-29.878145°	124.428689°	6	5	15	2	Inactive, approx. 100+ years
2	-29.877986°	124.446578°	6	6	15	None	Inactive, approx. 50+ years
3	-29.892288°	124.429222°	1	7	15	10	Inactive, approx. 20+ years
4	-29.892942°	124.432980°	1	7	30	15	Inactive, approx. 20+ years
5	-30.120597°	123.184603°	1	7	10	40	Inactive, approx. 20+ years

Table 9: Malleefowl recorded during the survey

Observation	Latitude	Longitude	Comments
Sighting	-30.047054°	123.115558°	Two birds observed foraging, two adults
Sighting	-30.052606°	123.113334°	One bird observed, one adult
Sighting	-30.056012°	123.108929°	One bird flushed from dense Acacia shrubland, one adult
Tracks	-30.038524°	123.152898°	Fresh tracks observed
Tracks	-30.121066°	123.178386°	Fresh tracks observed
Tracks	-29.798650°	123.114402°	Fresh tracks observed
Tracks	-29.798434°	123.114391°	Fresh tracks observed
Tracks	-29.799641°	123.117259°	Fresh tracks observed
Tracks	-29.799119°	123.114827°	Fresh tracks observed

3.6.2 Brush-tailed Mulgara

The Brush-tailed Mulgara (*Dasycercus blythi*, listed as Priority 4 by DBCA) has a widespread distribution across arid Australia however there are few regional records from the GVD (ALA, 2018). The species was trapped near Mulga Rockhole (Survey Site B, Plate 12) and was also recorded from seven cameras installed at five survey sites. The species was recorded from undulating sand plains supporting spinifex hummock grasslands with Mallee (*Eucalyptus* spp.), *Callitris preissii*, and scattered shrubs including *Hakea francisiana*, *Grevillea juncifolia* and *Bertya dimerostigma*.



Plate 12: Brush-tailed Mulgara recorded during the survey

3.6.3 Striated Grasswren

The Striated Grasswren (*Amytornis striatus striatus*) is listed as Priority 4 by DBCA. It has a scattered occurrence across central Australia where it favours long-unburnt spinifex grasslands with an over-storey of Mallee or shrubs.

The Striated Grasswren was recorded from three survey sites and opportunistically elsewhere during the survey period (Table 10). All records were from areas of sandplain supporting mature *Triodia* (*T. basedowii* or *T. desertorum*) with mallee (typically *Eucalyptus youngiana* with *E. gongylocarpa*) with areas of dense shrubs including *Hakea francisiana*, *Grevillea juncifolia* and mixed *Acacia* species. The regions few records are concentrated along major access roads and so these records add to the occurrence of the Striated Grasswren throughout the GVD.

Table 10: Records of the Striated Grasswren during the survey period

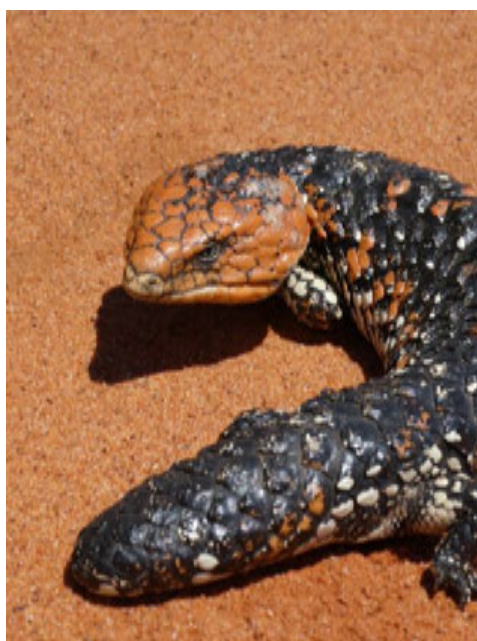
Site	Easting	Northing	Habitat
Opportunistic	-29.857339	124.294685	Spinifex dominated sandplain, shrubby overstorey
Opportunistic	-29.7992631	124.02408	Shrubland / Spinifex sandplain
Opportunistic	-29.7993561	124.021391	Shrubland / Spinifex sandplain
East Site D	-29.8565367	124.303774	Spinifex dominated sandplain, shrubby overstorey
East Site E	-29.8599026	124.339813	Spinifex dominated sandplain, shrubby overstorey
East Site E	-29.8616551	124.338729	Mallee and spinifex on lower dune slope
Opportunistic	-29.8578118	124.262641	Shrubland on sandplain
West Site G	-30.0387238	123.151955	Acacia / Hakea thicket on Mallee / spinifex sandplain

3.6.4 Other Species

As the GVD is remote and poorly surveyed, many fauna species are known from few locations. Several additional species of significance were recorded during the survey and area documented below. These include species considered uncommon in the region and temperate-adapted species occurring at the arid extreme of their range (Turpin and Johnstone, 2017). Additionally, two DBCA Priority Flora species were recorded at the Sandhill Dunnart sampling sites (See Appendix 8).

The Scarlet-chested Parrot (*Neophema splendida*) has declined due to extensive habitat clearance and degradation in the extremes of its range and has thought to have declined in the Goldfields and Murchison regions (Garnett and Crowley 2000). It is sparsely distributed throughout the Great Victoria Desert and was observed in two locations (Table 10).

Several temperate-adapted species occur in the GVD in small populations at the arid extreme of their range (Turpin and Johnstone, 2017). A number were recorded during the survey, including the Regent Parrot, Australian Raven, White-eared Honeyeater and Bobtail (Plate 13) (See Appendix 8).

**Plate 13 Bobtail (*Tiliqua rugosa*) variant observed at Western site**

Additionally, two DBCA Priority flora were recorded during the survey (See Appendix 8). The Victoria Desert Smokebush (*Conospermum toddii*) is listed by the DBCA as Priority 4 (Plate 14). The species has a restricted distribution to the south-western parts of the GVD. Several plants were recorded from the slopes of a yellow sand dune at Sandhill Dunnart site East location A.

Eucalyptus pimpiniana (DBCA Priority 3) is known from a few widely scattered localities in the southern GVD. Several plants were recorded from an orange sandplain north of Mulga Rockhole at Sandhill Dunnart survey site West H.



Plate 14: Smokebush (*Conospermum toddii*) observed at Eastern site, location A during Survey

4 Conclusion

A total of 172 species (comprising; 63 reptile, 69 bird, 27 native mammal and 13 introduced mammal species) were detected via pitfall trapping, opportunistic observations and motion sensor camera efforts throughout this survey. Targeted efforts identified four locations of Sandhill Dunnart occurrence, extending the species known Eastern range approximately 70 km south and confirmed previous baseline study findings (Greening Australia 2018). A total of three individuals, two females and one male were captured via pitfall trapping efforts, and 10 out of 64 cameras deployed caught footage of Sandhill Dunnarts in proximity to these pitfall trap sites.

The species was recorded from long unburnt vegetation, from within habitat closely resembling occupied sites elsewhere in the GVD. The species was associated sand dunes supporting long unburnt vegetation including Marble Gum (*Eucalyptus gongylocarpa*), *Callitris preissii*, a mature shrub layer (including *Allocasuarina spinosissima*, *Persoonia coriacea*, *Acacia helmsiana*, *Grevillea didymobotrya* and *Banksia elderiana*) over a mature hummock grassland (*Triodia desertorum* with *Lepidobolus deserti*). While much of the surrounding landscape had been burnt at least twice within the last 20 years (U.S. Geological Survey 2018), the Sandhill Dunnart was recorded from the relatively small areas escaping the effects of wildfire during that time.

Additional targeted efforts focusing on Malleefowl, traversed 62 km (i.e. 16 walks) of identified Malleefowl habitat suitability. Walks encompassed typical Mulga habitat and recently burnt swathes. Five inactive mounds (which varied in age, profile and depth), three sightings and six track records were all observed throughout the survey. Evidence of activity was recorded in locations associated with dense Acacia shrublands.

Other species of significance included priority species, those rarely encountered in the Great Victoria Desert or those considered near the edge of their range, including:

- Striated Grasswren (*Amytornis striatus*): DBCA Priority 4, several groups observed;
- Brush-tailed Mulgara (*Dasymercus blythi*): DBCA Priority 4, trapped at one site and recorded on camera at four sites;
- Scarlet-chested Parrot (*Neophema splendida*): uncommon in the GVD, two groups observed;
- Several temperate-adapted species occurring in the region at the arid extreme of their range (Regent Parrot *Polytelis anthopeplus*, Australian Raven *Corvus coronoides*, White-eared Honeyeater *Lichenostomus leucotis* and Bobtail *Tiliqua rugosa*); and
- Two DBCA Priority flora species (*Conospermum toddii*, *Eucalyptus pimpiniana*).

This targeted Sandhill Dunnart and Malleefowl survey has increased and confirmed the known distribution of Sandhill Dunnart populations in the GVD whilst reinforcing habitat preferences from the existing literature. For Malleefowl, survey findings were broadly consistent with existing literature on habitat preference and occurrence; however, on-ground reconnaissance has challenged the accuracy of remotely sensed data, particularly with respect to fire history.

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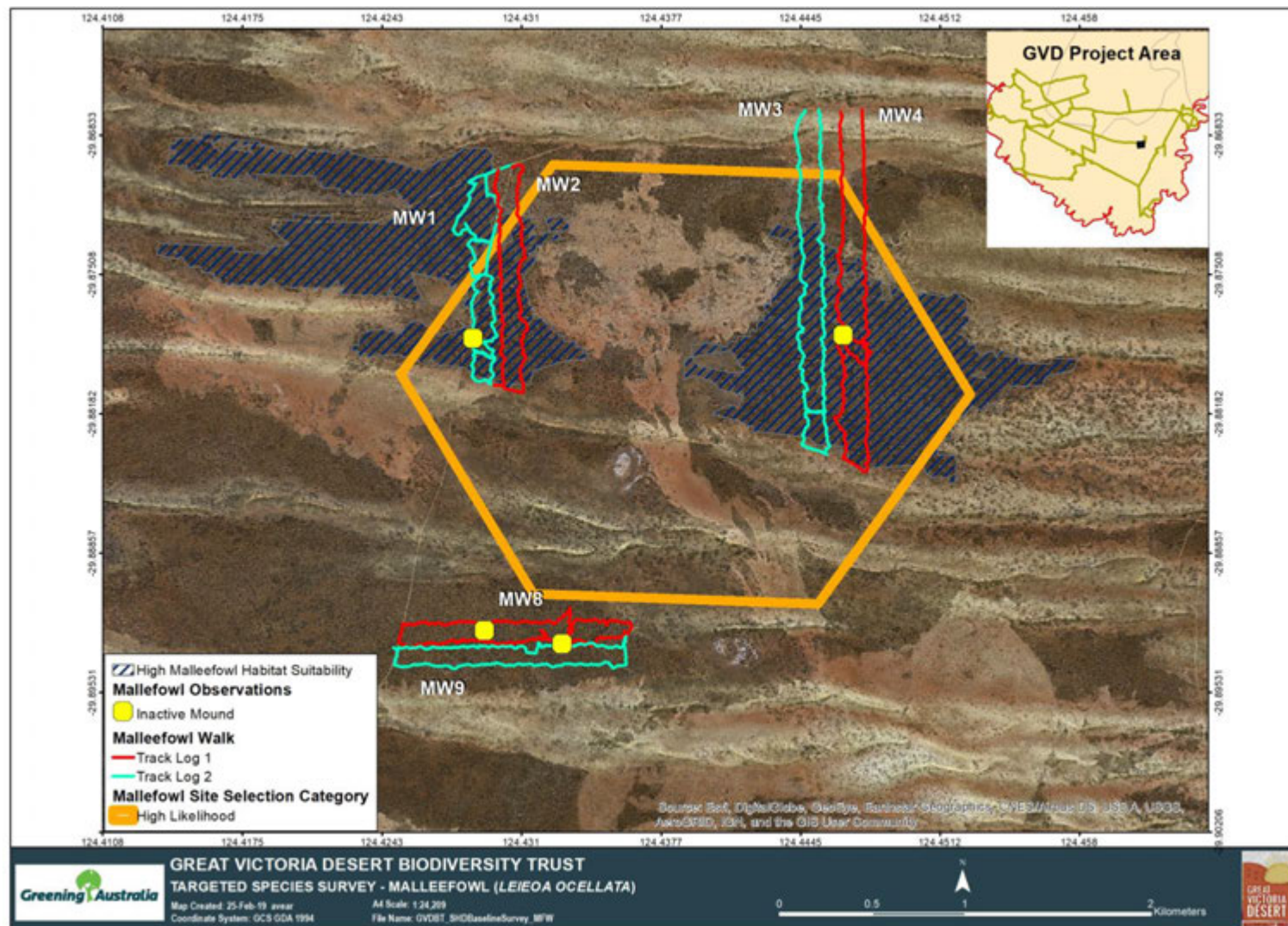
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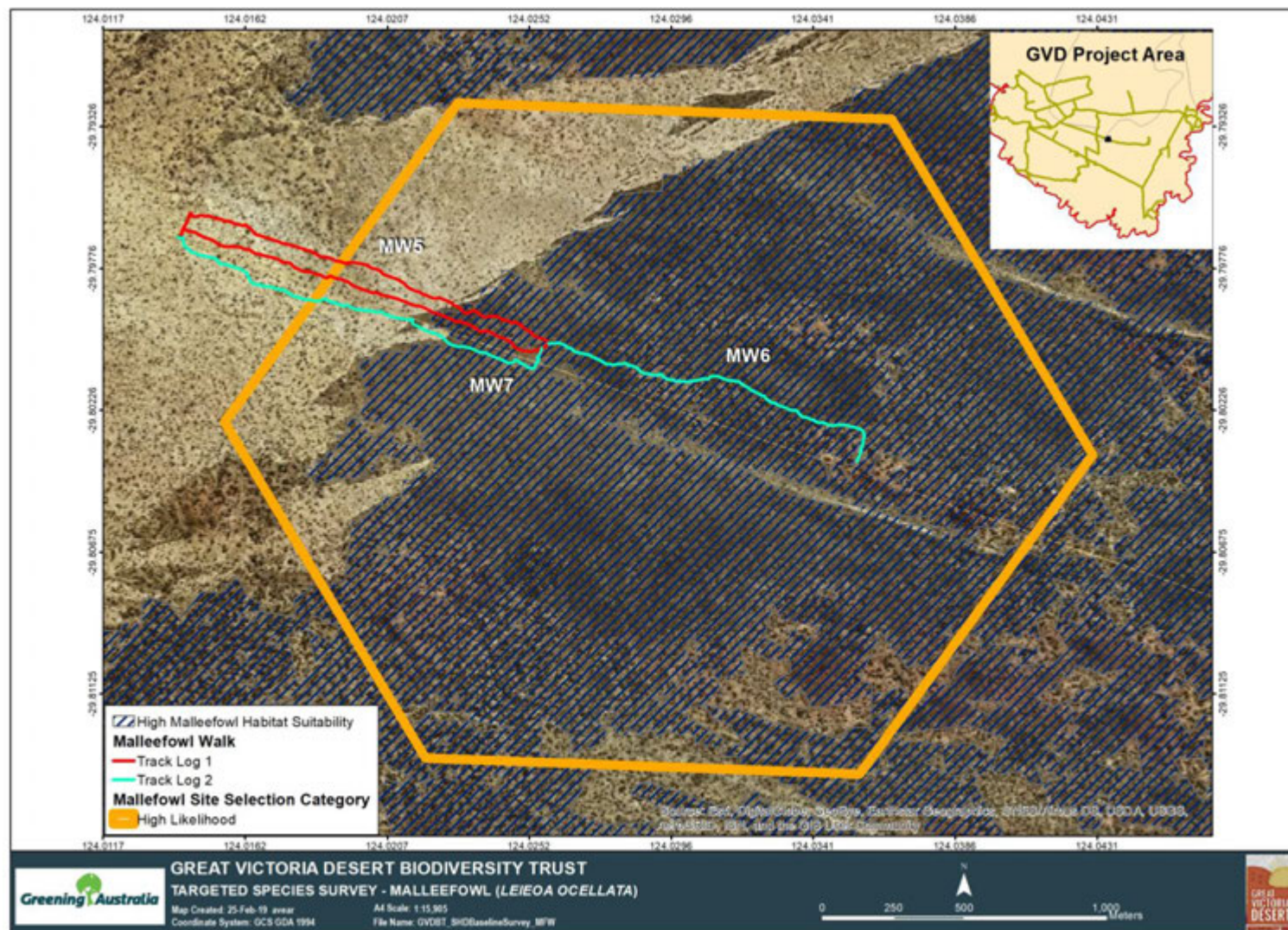
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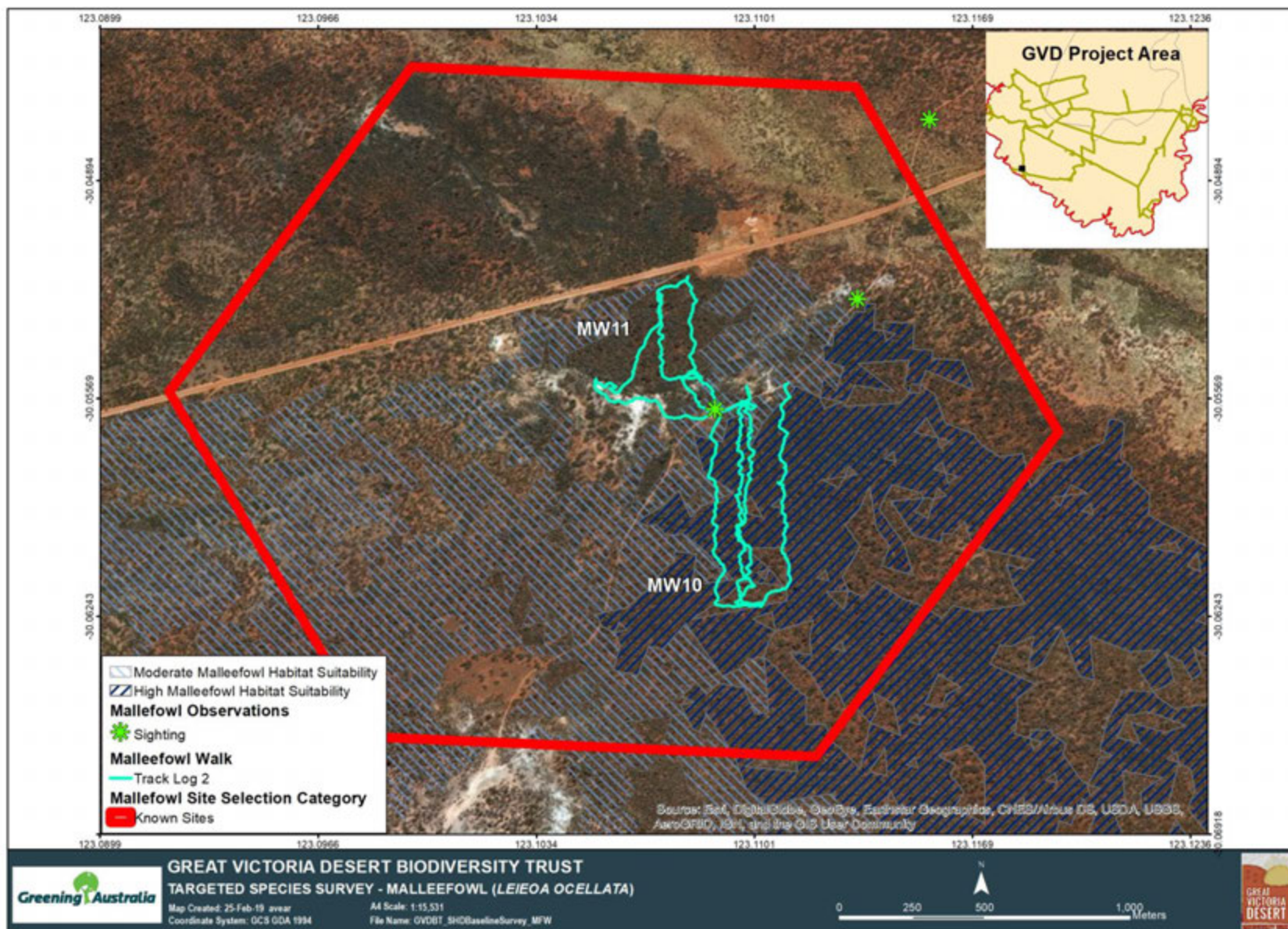
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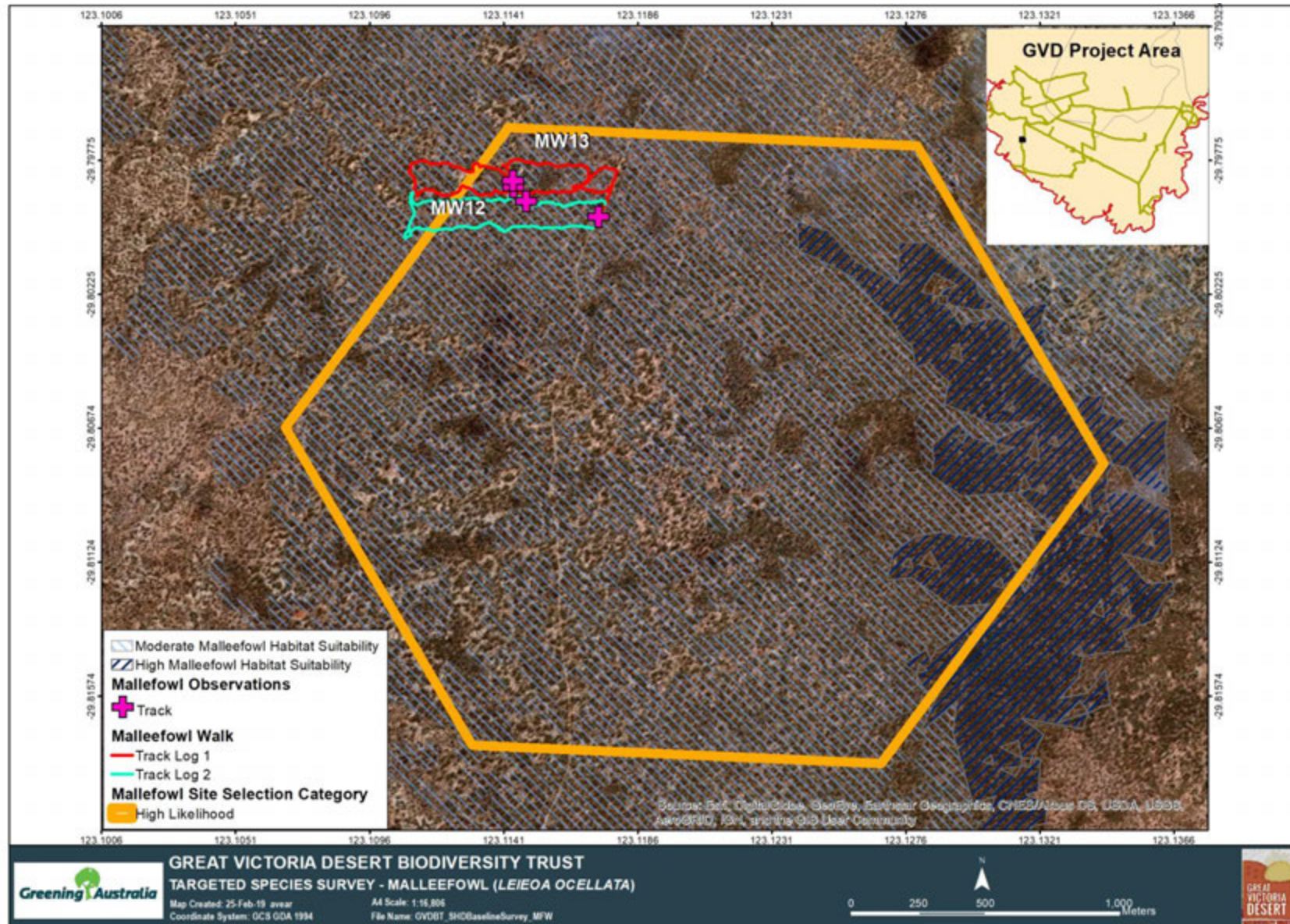
7 Appendices

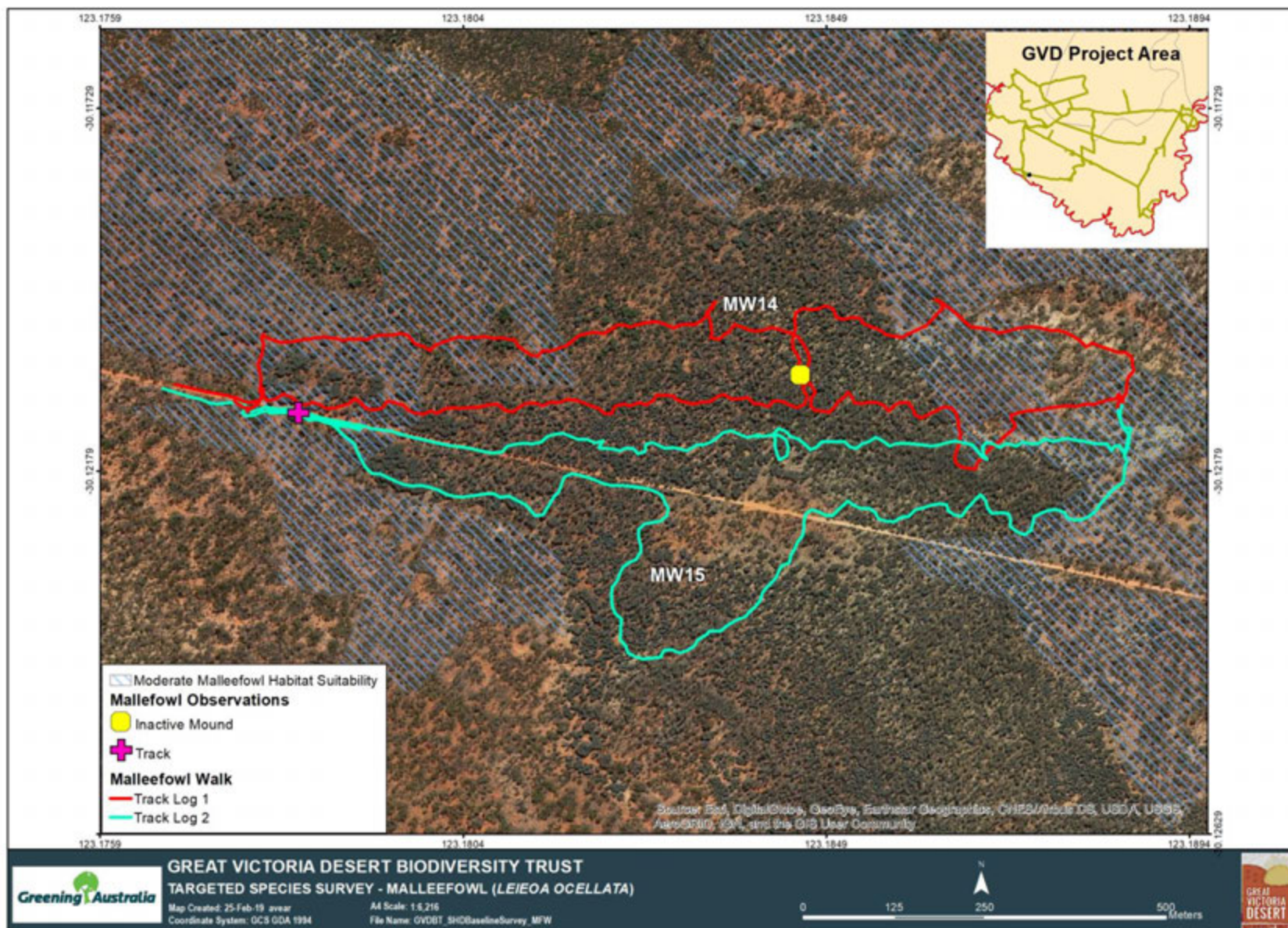
APPENDIX 1: DETAILED MALLEEFOWL LONG WALK MAPS ACROSS EASTERN AND WESTERN LOCATIONS

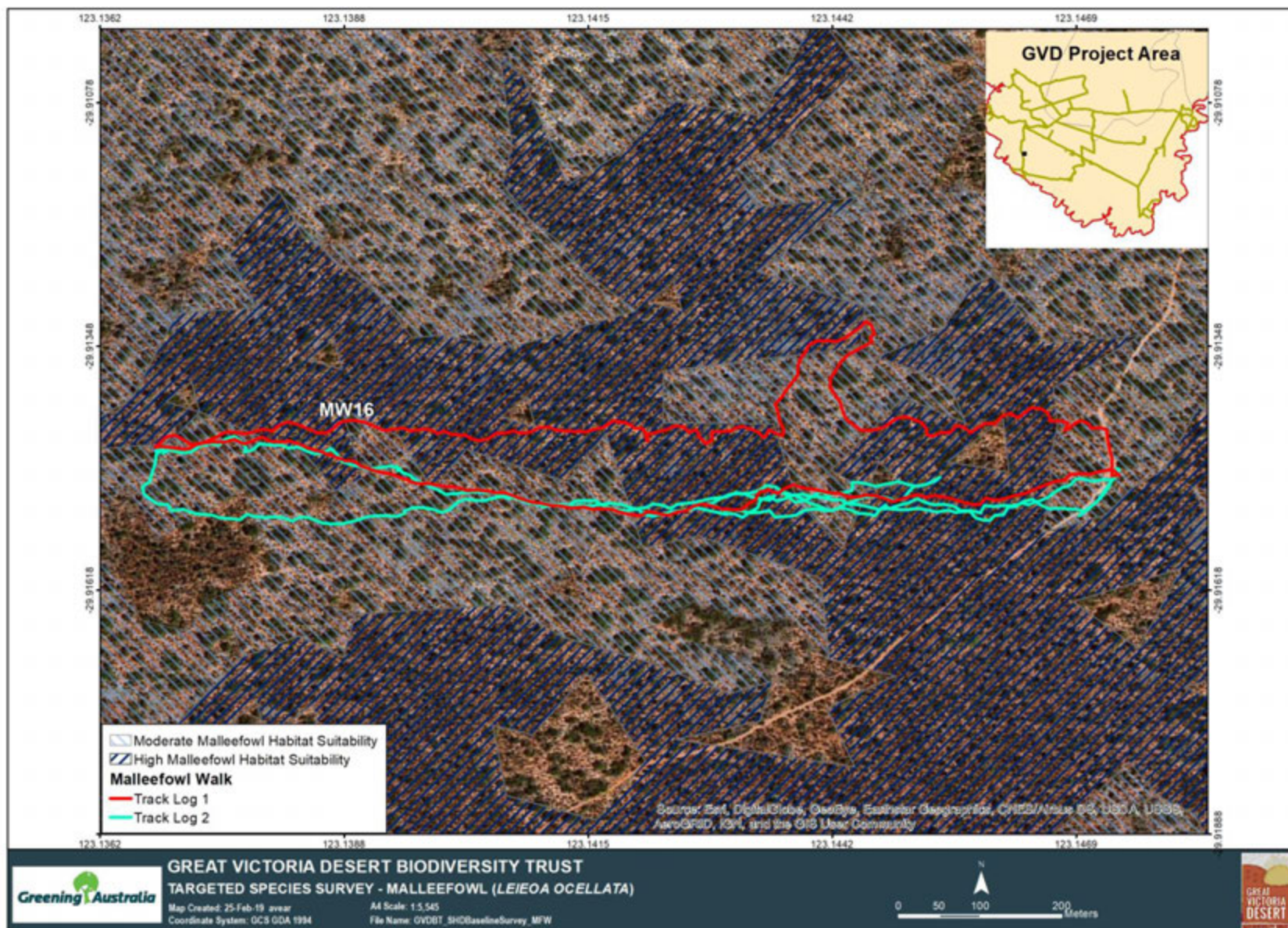




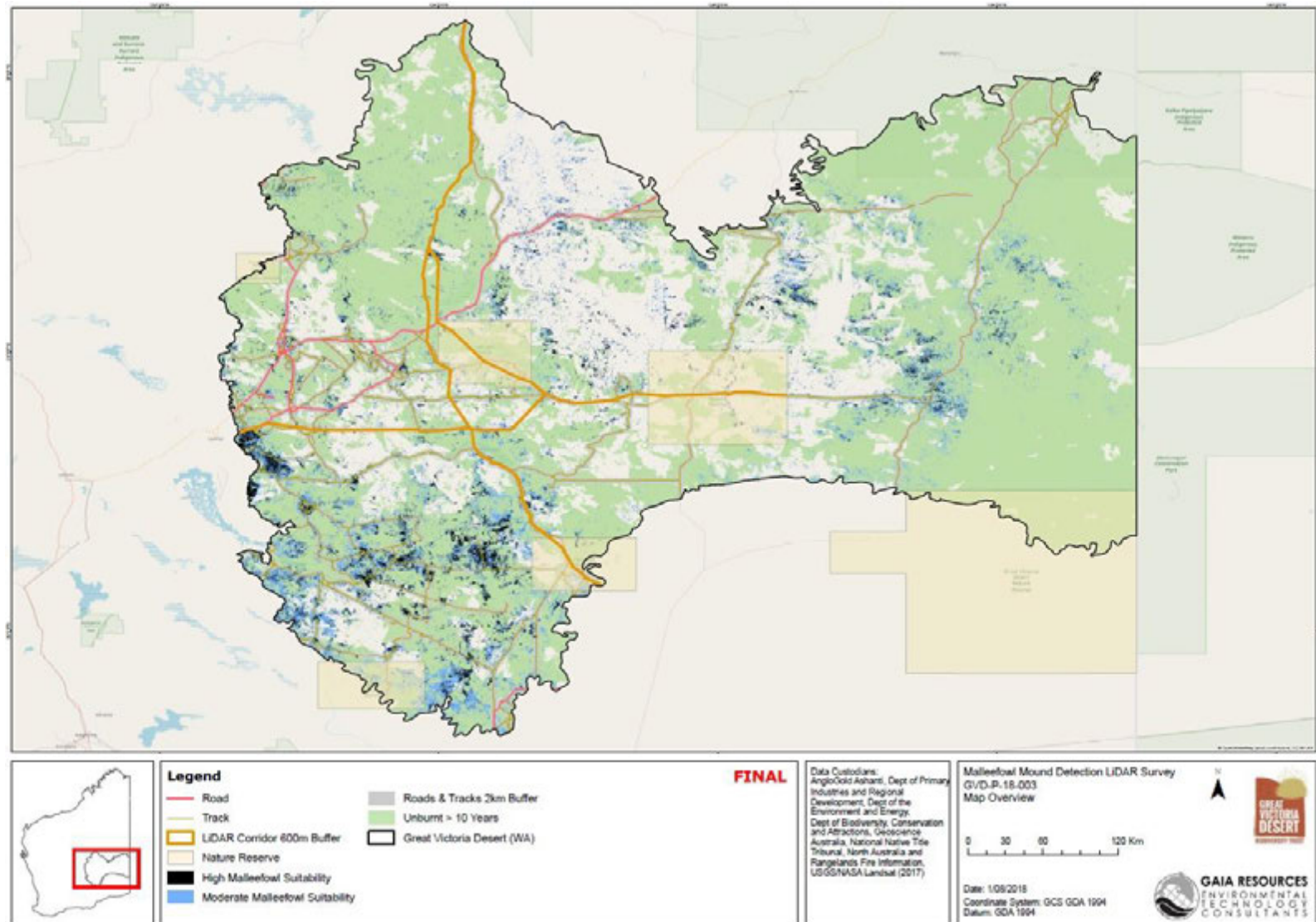


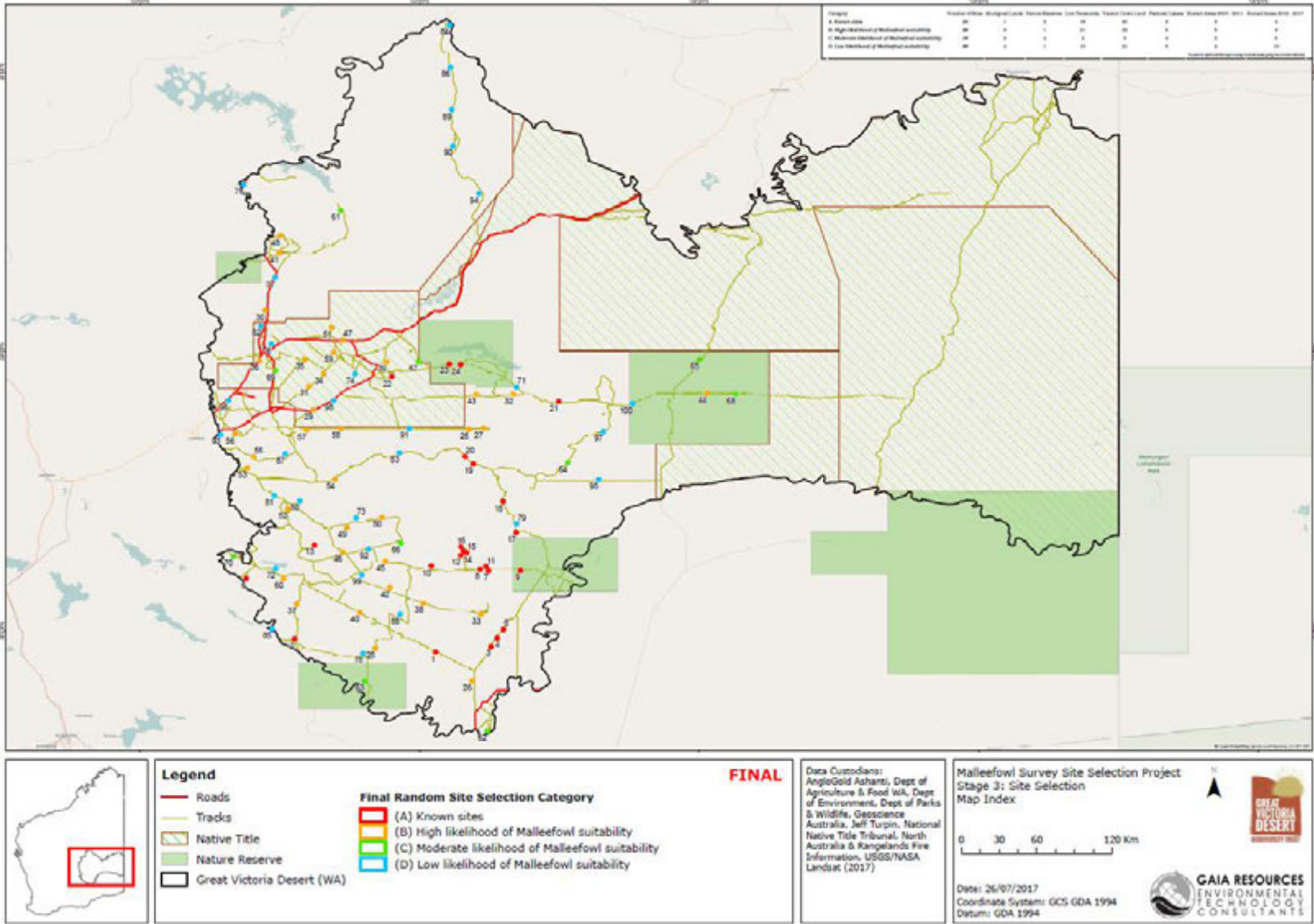






APPENDIX 2: GVD MALLEEFOWL MODELLING SITE SELECTION MAPBOOK AND SUITABILITY MAP(GVDBT)





APPENDIX 3: PITFALL AND CAMERA LOCATIONS BETWEEN PHASES 1, 2 & FINAL

Western and Eastern cameras, locations A-H, Phase 1					
Known location Site reference	Site ID	Camera ID	Sim card ID	Lat.	Long.
West	A	3	3A	-30.06265556	123.0491333
West	A	4	4A	-30.06304722	123.0485667
West	A	19	19A	-30.06264722	123.0482861
West	A	48	48A	-30.06271389	123.0472417
West	B	8	8A	-30.05680278	123.0856778
West	B	17	17A	-30.05612778	123.0861167
West	B	65	65A	-30.05628611	123.0862833
West	B	66	66A	-30.05590278	123.0863056
West	C	24	24A	-30.00685833	123.1249806
West	C	27	27A	-30.00731944	123.1254333
West	C	59	59A	-30.007475	123.1248694
West	C	67	67A	-30.00849444	123.1252222
West	D	30	30A	-30.0359	123.1201972
West	D	35	35A	-30.03665833	123.1200472
West	D	49	49A	-30.03624444	123.1204333
West	D	74	74A	-30.03637222	123.1198222
West	E	6	6A	-30.104375	123.1495917
West	E	40	40A	-30.10373889	123.1491833
West	E	41	41A	-30.10411111	123.1490528
West	E	50	50A	-30.10349444	123.1487528
West	F	16	16A	-30.08740278	123.121575
West	F	18	18A	-30.08823056	123.1218694
West	F	22	22A	-30.08755	123.1209167
West	F	36	36A	-30.08801111	123.1204972
West	G	43	43A	-30.03847778	123.1534861
West	G	47	47A	-30.03943889	123.1534278
West	G	53	53A	-30.03862222	123.1523528
West	G	56	56A	-30.03835833	123.1529278
West	H	38	38A	-30.02566389	123.1781528
West	H	62	62A	-30.0264	123.1776083
West	H	63	63A	-30.02582778	123.1775139
West	H	64	64A	-30.02658889	123.1766500
East	A	2	2A	-29.86225278	124.487375
East	A	10	10A	-29.86196111	124.4869389
East	A	20	20A	-29.86263611	124.486525
East	A	75	75A	-29.86286111	124.4875778
East	B	39	39A	-29.855825	124.2838972
East	B	42	42A	-29.8556	124.2831333
East	B	46	46A	-29.85592778	124.2830583
East	B	73	73A	-29.855625	124.2824972
East	C	15	15A	-29.85510833	124.2531361

East	C	37	37A	-29.85463056	124.2538639
East	C	52	52A	-29.85550833	124.254
East	C	72	72A	-29.85515278	124.2547861
East	D	9	9A	-29.856825	124.3020556
East	D	11	11A	-29.85723889	124.3026972
East	D	71	71A	-29.85594722	124.3023611
East	D				
East	E	33	33A	-29.86146667	124.3385028
East	E	44	44A	-29.86237222	124.339025
East	E	55	55A	-29.86212778	124.3403167
East	E				
East	F	12	12A	-29.86841389	124.429425
East	F	14	14A	-29.86879444	124.427125
East	F	60	60A	-29.86787778	124.4282278
East	F				
East	G	7	7A	-29.8673	124.4639944
East	G	13	13A	-29.86707778	124.4621472
East	G	25	25A	-29.86809722	124.4619528
East	G	54	54A	-29.868025	124.4633333
East	H	21	21A	-29.84636389	124.4737333
East	H	45	45A	-29.84555278	124.4727778
East	H	51	51A	-29.84487778	124.4731
East	H	58	58A	-29.84516667	124.4742694
Western and Eastern cameras, locations A-H, Phase 2					
West	A	3	3A	-30.062675	123.0488889
West	A	4	4A	-30.0629	123.0489528
West	A	19	19A	-30.06275833	123.0475167
West	A	48	48A	-30.06250278	123.047325
West	B	8	8A	-30.05683889	123.0858333
West	B	17	17A	-30.05644444	123.0864472
West	B	65	65A	-30.05632222	123.08645
West	B	66	66A	-30.05655833	123.0858389
West	C	24	24A	-30.00703056	123.1247083
West	C	27	27A	-30.00810278	123.1252417
West	C	59	59A	-30.00711944	123.1248972
West	C	67	67A	-30.00808889	123.1249306
West	D	30	30A	-30.03605	123.1201917
West	D	35	35A	-30.03691389	123.1198639
West	D	49	49A	-30.03681944	123.1199194
West	D	74	74A	-30.03612778	123.1198306
West	E	6	6A	-30.10436389	123.1494222
West	E	40	40A	-30.10373056	123.1487556
West	E	41	41A	-30.10431944	123.1494889
West	E	50	50A	-30.10356389	123.1489472
West	F	16	16A	-30.087325	123.1214972
West	F	18	18A	-30.08745833	123.1213611

West	F	22	22A	-30.08786111	123.1210278
West	F	36	36A	-30.08795556	123.1211333
West	G	43	43A	-30.038625	123.1533389
West	G	47	47A	-30.03888611	123.1521
West	G	53	53A	-30.03878889	123.1521833
West	G	56	56A	-30.03868333	123.1533833
West	H	38	38A	-30.02593889	123.1778528
West	H	62	62A	-30.02573611	123.177825
West	H	63	63A	-30.02656389	123.1770056
West	H	64	64A	-30.02651667	123.1768778
East	A	2	2A	-29.86231667	124.4871528
East	A	10	10A	-29.86220833	124.4871583
East	A	20	20A	-29.86300278	124.4867639
East	A	75	75A	-29.86306111	124.4867222
East	B	39	39A	-29.85590278	124.2835278
East	B	42	42A	-29.85596389	124.2835306
East	B	46	46A	-29.85566111	124.2826694
East	B	73	73A	-29.85557778	124.2827528
East	C	15	15A	-29.85516111	124.2533778
East	C	37	37A	-29.85505	124.2534111
East	C	52	52A	-29.85498056	124.2543444
East	C	72	72A	-29.85515278	124.254375
East	D	9	9A	-29.85648889	124.3023583
East	D	11	11A	-29.857275	124.3024
East	D	71	71A	-29.85635833	124.3023222
East	D	5	5A	-29.85711389	124.3023722
East	E	33	33A	-29.86170556	124.3386361
East	E	44	44A	-29.86227222	124.3400111
East	E	55	55A	-29.86216667	124.3398972
East	E	26	26A	-29.86180278	124.3385778
East	F	12	12A	-29.86839167	124.4288111
East	F	14	14A	-29.86867222	124.4275972
East	F	60	60A	-29.86849444	124.4288667
East	F	69	69B	-29.86875	124.4276611
East	G	7	7A	-29.86706111	124.4630833
East	G	13	13A	-29.86792778	124.4622806
East	G	25	25A	-29.86804444	124.4624028
East	G	54	54A	-29.86692778	124.4630167
East	H	21	21A	-29.84591667	124.4743
East	H	45	45A	-29.84621111	124.4741306
East	H	51	51A	-29.84638333	124.4742472
East	H	58	58A	-29.84593611	124.4740722

Western and Eastern cameras, locations A-H, Final locations								
Known location Site reference	Site ID	Line ID	Camera ID	Sim card ID	Lat.	Long.	Date of final set-up	Battery (%)
West	A	1	3	3B	-30.062675	123.0488889	17-10-18	98
West	A	1	19	19B	-30.06275833	123.0475167	17-10-18	70
West	B	1	8	8B	-30.05683889	123.0858333	17-10-18	90
West	B	1	65	65B	-30.05632222	123.08645	17-10-18	92
West	C	1	59	59B	-30.00711944	123.1248972	17-10-18	86
West	C	2	67	67B	-30.00808889	123.1249306	17-10-18	94
West	D	1	30	30B	-30.03605	123.1201917	17-10-18	84
West	D	2	35	35B	-30.03691389	123.1198639	17-10-18	84
West	E	2	40	40B	-30.10373056	123.1487556	17-10-18	86
West	E	1	41	41B	-30.10431944	123.1494889	17-10-18	86
West	F	2	18	18B	-30.08745833	123.1213611	17-10-18	96
West	F	2	36	36B	-30.08795556	123.1211333	17-10-18	96
West	G	1	43	43B	-30.038625	123.1533389	17-10-18	90
West	G	2	47	47B	-30.03888611	123.1521	17-10-18	98
West	H	1	38	38B	-30.02593889	123.1778528	17-10-18	99
West	H	12	63	63B	-30.02656389	123.1770056	17-10-18	92
East	A	1	2	2B	-29.86231667	124.4871528	06-10-18	90
East	A	2	20	20B	-29.86300278	124.4867639	06-10-18	86
East	B	1	39	39B	-29.85590278	124.2835278	09-10-18	86
East	B	2	46	46B	-29.85566111	124.2826694	09-10-18	94
East	C	1	15	15B	-29.85516111	124.2533778	09-10-18	88
East	C	2	52	52B	-29.85498056	124.2543444	09-10-18	92
East	D	1	11	11B	-29.857275	124.3024	09-10-18	86
East	D	2	71	71B	-29.85635833	124.3023222	09-10-18	94
East	E	1	33	33B	-29.86170556	124.3386361	09-10-18	92
East	E	1	55	55B	-29.86216667	124.3398972	09-10-18	90
East	F	2	14	14B	-29.86867222	124.4275972	08-10-18	96
East	F	1	60	60B	-29.86849444	124.4288667	08-10-18	99
East	G	1	25	25B	-29.86804444	124.4624028	08-10-18	96
East	G	2	54	54B	-29.86692778	124.4630167	08-10-18	94
East	H	1	21	21B	-29.84591667	124.4743	09-10-18	94
East	H	2	45	45B	-29.84621111	124.4741306	09-10-18	96

Western and Eastern pitfall locations A-H, Final locations					
Known location Site reference	Site ID	Line Reference	Pit Trap number	Latitude	Longitude
West	A	1	1	-30.06276667	123.0475111
West	A	1	2	-30.06270833	123.0474917
West	A	1	3	-30.06266111	123.0474333
West	A	1	4	-30.06261667	123.0473833
West	A	1	5	-30.06255833	123.0473472
West	A	1	6	-30.06249167	123.0473139
West	A	2	1	-30.06298611	123.0489889
West	A	2	2	-30.062925	123.0489472
West	A	2	3	-30.06284167	123.0489083
West	A	2	4	-30.0628	123.048925
West	A	2	5	-30.06273333	123.0489194
West	A	2	6	-30.06266667	123.0489056
West	B	1	1	-30.056875	123.0858361
West	B	1	2	-30.0568	123.0858528
West	B	1	3	-30.05673889	123.08585
West	B	1	4	-30.056675	123.0858528
West	B	1	5	-30.05660278	123.0858417
West	B	1	6	-30.05654167	123.0858306
West	B	2	1	-30.05626389	123.0864972
West	B	2	2	-30.05632222	123.0864556
West	B	2	3	-30.05638611	123.0864306
West	B	2	4	-30.05643333	123.0864389
West	B	2	5	-30.05648611	123.0864694
West	B	2	6	-30.05653333	123.0865111
West	C	1	1	-30.00696667	123.1247472
West	C	1	2	-30.00703889	123.1247889
West	C	1	3	-30.00706944	123.1248694
West	C	1	4	-30.00712778	123.1249111
West	C	1	5	-30.00714444	123.1249806
West	C	1	6	-30.00718611	123.1250278
West	C	2	1	-30.00808056	123.1248917
West	C	2	2	-30.00808889	123.1249389
West	C	2	3	-30.00808889	123.1250056
West	C	2	4	-30.00808611	123.125075
West	C	2	5	-30.00810556	123.12515
West	C	2	6	-30.00810278	123.1252167
West	D	1	1	-30.03612222	123.1198528
West	D	1	2	-30.03608889	123.1199167
West	D	1	3	-30.03608333	123.1199972
West	D	1	4	-30.03607778	123.1200583
West	D	1	5	-30.03608611	123.1201194

West	D	1	6	-30.03607778	123.1202139
West	D	2	1	-30.03691944	123.1198056
West	D	2	2	-30.03690556	123.1198639
West	D	2	3	-30.03685278	123.1199
West	D	2	4	-30.03680556	123.1199139
West	D	2	5	-30.03677222	123.1199611
West	D	2	6	-30.03674167	123.1200278
West	E	1	1	-30.10454167	123.1494083
West	E	1	2	-30.104475	123.1494111
West	E	1	3	-30.10442778	123.1494361
West	E	1	4	-30.10436667	123.1494583
West	E	1	5	-30.10429167	123.14945
West	E	1	6	-30.10425833	123.1494861
West	E	2	1	-30.10375833	123.1486944
West	E	2	2	-30.10373611	123.1487694
West	E	2	3	-30.10371389	123.1488639
West	E	2	4	-30.10365556	123.1489056
West	E	2	5	-30.10359722	123.1489222
West	E	2	6	-30.10357222	123.148975
West	F	1	1	-30.087225	123.1216083
West	F	1	2	-30.08728056	123.1215528
West	F	1	3	-30.08733889	123.1214972
West	F	1	4	-30.0874	123.1214611
West	F	1	5	-30.08741667	123.1214167
West	F	1	6	-30.08743889	123.1213583
West	F	2	1	-30.08781667	123.1209417
West	F	2	2	-30.08783611	123.1210028
West	F	2	3	-30.08787778	123.1210361
West	F	2	4	-30.0879	123.1210972
West	F	2	5	-30.08797778	123.1211722
West	F	2	6	-30.088	123.1212
West	G	1	1	-30.03855278	123.1532833
West	G	1	2	-30.03861111	123.1533333
West	G	1	3	-30.03863333	123.1533167
West	G	1	4	-30.03870556	123.1533944
West	G	1	5	-30.038775	123.1534167
West	G	1	6	-30.0388	123.1534556
West	G	2	1	-30.03870556	123.1521194
West	G	2	2	-30.038775	123.1521778
West	G	2	3	-30.03881944	123.1521417
West	G	2	4	-30.03888611	123.1521194
West	G	2	5	-30.038925	123.1520333
West	G	2	6	-30.03893056	123.1519611
West	H	1	1	-30.025625	123.177775

West	H	1	2	-30.02569722	123.1778083
West	H	1	3	-30.02573889	123.1778583
West	H	1	4	-30.02579722	123.1778139
West	H	1	5	-30.02589167	123.1778389
West	H	1	6	-30.02593889	123.1778222
West	H	2	1	-30.02643333	123.1767139
West	H	2	2	-30.02648333	123.1767889
West	H	2	3	-30.02650833	123.1768833
West	H	2	4	-30.02651944	123.1769556
West	H	2	5	-30.02654444	123.1770083
West	H	2	6	-30.02658889	123.1770722
East	A	1	1	-29.86322778	124.486725
East	A	1	2	-29.86316667	124.4867389
East	A	1	3	-29.86311389	124.4867389
East	A	1	4	-29.86306389	124.4867222
East	A	1	5	-29.86298611	124.4867222
East	A	1	6	-29.86294167	124.4867389
East	A	2	1	-29.86236389	124.487175
East	A	2	2	-29.86229722	124.4871389
East	A	2	3	-29.86224722	124.4871417
East	A	2	4	-29.86220833	124.48715
East	A	2	5	-29.86215833	124.4871667
East	A	2	6	-29.86211111	124.4871889
East	B	1	1	-29.85605833	124.283525
East	B	1	2	-29.856	124.2835361
East	B	1	3	-29.855975	124.2835528
East	B	1	4	-29.85592778	124.2835417
East	B	1	5	-29.85586667	124.2835222
East	B	1	6	-29.85583889	124.2835333
East	B	2	1	-29.85572222	124.2826611
East	B	2	2	-29.85567778	124.2826861
East	B	2	3	-29.85562778	124.2827111
East	B	2	4	-29.855575	124.2827528
East	B	2	5	-29.85551667	124.2827667
East	B	2	6	-29.85545278	124.2827861
East	C	1	1	-29.855175	124.2533556
East	C	1	2	-29.855125	124.2533917
East	C	1	3	-29.85506389	124.2533944
East	C	1	4	-29.85496389	124.25335
East	C	1	5	-29.85487778	124.2533222
East	C	1	6	-29.85481944	124.2533333
East	C	2	1	-29.85516667	124.2543611
East	C	2	2	-29.85512222	124.2543472
East	C	2	3	-29.85505556	124.2543528

East	C	2	4	-29.85499444	124.2543361
East	C	2	5	-29.85493056	124.2543389
East	C	2	6	-29.85486111	124.2543306
East	D	1	1	-29.85730556	124.3024111
East	D	1	2	-29.85726389	124.30235
East	D	1	3	-29.85716111	124.3023778
East	D	1	4	-29.85713056	124.3023556
East	D	1	5	-29.85708611	124.30235
East	D	1	6	-29.85704167	124.3023528
East	D	2	1	-29.85649722	124.3023389
East	D	2	2	-29.85645278	124.3023444
East	D	2	3	-29.85638333	124.3023361
East	D	2	4	-29.85631389	124.3023333
East	D	2	5	-29.85624722	124.3023194
East	D	2	6	-29.8562	124.3023222
East	E	1	1	-29.86215556	124.3399028
East	E	1	2	-29.86218056	124.33995
East	E	1	3	-29.86221389	124.3400028
East	E	1	4	-29.86227778	124.3400361
East	E	1	5	-29.86232778	124.3400972
East	E	1	6	-29.86237222	124.3401111
East	E	2	1	-29.86153889	124.3387056
East	E	2	2	-29.86160833	124.3386917
East	E	2	3	-29.86162222	124.3386361
East	E	2	4	-29.86168889	124.3386306
East	E	2	5	-29.86173611	124.3386306
East	E	2	6	-29.8618	124.3385889
East	F	1	1	-29.86864444	124.4289389
East	F	1	2	-29.86858611	124.4289278
East	F	1	3	-29.86851389	124.4288944
East	F	1	4	-29.86846111	124.4288444
East	F	1	5	-29.86843333	124.428825
East	F	1	6	-29.868325	124.4287917
East	F	2	1	-29.86876944	124.4276889
East	F	2	2	-29.86869722	124.4276778
East	F	2	3	-29.86866944	124.4276139
East	F	2	4	-29.86864167	124.4276
East	F	2	5	-29.86856944	124.4275639
East	F	2	6	-29.86855	124.4275278
East	G	1	1	-29.86676667	124.4629667
East	G	1	2	-29.86685	124.4629944
East	G	1	3	-29.86690833	124.4630083
East	G	1	4	-29.86696667	124.4630306
East	G	1	5	-29.86698889	124.4630444

East	G	1	6	-29.86703333	124.46305
East	G	2	1	-29.86783333	124.4622194
East	G	2	2	-29.86787778	124.4622583
East	G	2	3	-29.86792222	124.4623083
East	G	2	4	-29.86797222	124.4623278
East	G	2	5	-29.86803333	124.4623694
East	G	2	6	-29.86807778	124.4624028
East	H	1	1	-29.84590556	124.4742889
East	H	1	2	-29.84590556	124.4742083
East	H	1	3	-29.84593333	124.474175
East	H	1	4	-29.84595556	124.4741167
East	H	1	5	-29.84595	124.4740333
East	H	1	6	-29.84595833	124.4739778
East	H	2	1	-29.84640833	124.4742861
East	H	2	2	-29.84637778	124.4742167
East	H	2	3	-29.84633333	124.4742111
East	H	2	4	-29.84629444	124.4741778
East	H	2	5	-29.84624167	124.4741278
East	H	2	6	-29.84618333	124.4741222

APPENDIX 4: BROAD VEGETATION SURVEY PARAMETERS (DPAW, 2016)

Vegetation form	Structural description	Floristic description
Bare areas	Salt lake, lagoon, claypan, rock	-
Halophyll and sarcophyll communities	Saltbush and bluebush	<i>Atriplex</i> sp., <i>Maireana</i> sp. communities on alkaline soils
	Saltbush and bluebush with scrub or open scrub	<i>Atriplex</i> sp., <i>Maireana</i> sp. with mulga (<i>Acacia aneura</i>), other wattle (<i>Acacia</i> sp.)
	Saltbush and/or bluebush with scattered low trees	<i>Atriplex</i> sp., <i>Maireana</i> sp. with mulga (<i>Acacia aneura</i>), other wattle (<i>A. papyrocarpa</i>), casuarina (<i>Allocasuarina pauper</i>)
	Samphire	<i>Tecticornia</i> sp. communities in saline areas
Low woodland (< 10m tall)	Low woodland or open low woodland	Other wattle (<i>Acacia</i> sp.), cypress pine (<i>Callitris</i> sp.), casuarina (<i>Allocasuarina</i> sp.), Eucalypt species (<i>Eucalyptus</i> spp.)
	Low woodland, open low woodland or sparse woodland	Mulga (<i>Acacia aneura</i> complex) and associated species
Medium woodland (10-30m tall)	Woodland	Goldfields associated Eucalypt species (e.g. gimlet, <i>E. salubris</i> ; redwood, <i>E. transcontinentalis</i> , salmon gum, <i>E. salmonophloia</i>)
Spinifex grassland	Low tree-steppe	Hummock grassland (<i>Triodia</i> sp.) with scattered Eucalypts (<i>Eucalyptus</i> spp.)
	Shrub-steppe	Hummock grassland (<i>Triodia</i> sp.) with scattered shrubs (<i>Acacia</i> sp., <i>Grevillea</i> sp.) or mallee (<i>Eucalyptus</i> sp.)
	Sparse low tree-steppe	Hummock grassland (<i>Triodia</i> sp.) with sparse eucalypts (<i>Eucalyptus</i> spp.)
	Sparse shrub-steppe	Hummock grassland (<i>Triodia</i> sp.) with sparse shrubs (<i>Acacia</i> sp.)
	Tree- and shrub-steppe	Hummock grassland (<i>Triodia</i> sp.) with scattered eucalypts (<i>Eucalyptus gongylocarpa</i>) over wattle scrub (<i>Acacia</i> sp.) or mallee (<i>E. youngiana</i>)
Tall (sclerophyll) shrubland (> 1m tall)	Mallee	Eucalypt shrubland (<i>Eucalyptus</i> spp.)
	Scrub, open scrub or sparse scrub	Wattle (<i>Acacia</i> sp.), tea tree (<i>Melaleuca</i> sp.) and other species

APPENDIX 5: HABITAT ASSESSMENTS FOR SURVEY SITES AND LOCATIONS

	Site reference	West A	West B	West C	West D	West E	West F	West G	West H
Site details	Latitude	-30.061993	-30.056841	-30.008092	-30.036905	-30.104276	-30.086879	-30.038316	-30.026664
	Longitude	123.047505	123.087186	123.125237	123.119914	123.148224	123.121986	123.152107	123.176863
	Last burnt	10-20 years	20+ years	10-20 years	20+ years	20+ years	20+ years	10-20 years	20+ years
Fire history	Percentage burnt	0	0	0	0	0	0	80	0
	Scorch height	0	0	0	0	0	0	5	0
	Fire Intensity	None	None	None	None	None	None	Patchy	None
	Landform	Sandy plain	Sandy plain	Sandy plain	Sandy plain	Sandy rise	sandy flat	Sandy rise	sand plain
Landform and soils	Dry soil surface	Firm	Loose	Soft	Soft	Soft	Loose	Loose	Loose
	Soil colour	Orange	Yellow	Yellow	Yellow	Yellow	Orange	Orange	Red
	Soil shade	Pale	Pale	Pale	Pale	Pale	Pale	Pale	Pale
	Bare ground	15	20	20	10	20	20	20	15
Ground cover	Crust	0	0	0	0	0	0	0	0
	Stones	1	0	0	0	0	0	0	0
	Rocks	0	0	0	0	0	0	0	0
	Litter	2	5	5	10	10	10	5	15
	Coarse WD	1	10	5	5	2	3	3	2
	Logs < 50mm	1	2	2	1	1	2	2	1
	Logs > 50mm	1	2	1	1	1	1	1	1
	Spinifex stage	Stage 3	Stage 5	Stage 3	Stage 5	Stage 5	Stage 5	Stage 3	Stage 5
Vegetation details	Muir classification	Hummock grasses ▶ Very open hummock grassland	Hummock grasses ▶ open hummock grassland	Hummock grasses ▶ open hummock grassland	Hummock grasses ▶ Open hummock grassland	Hummock grasses ▶ Open hummock grassland	Hummock grasses ▶ Open hummock grassland	Hummock grasses ▶ Open hummock grassland	Mallee >3m ▶ Open Mallee
	Vegetation notes	Locations approx 50 metres in from	Locations approx 50 metres in from						

		Tropicana Site Access Road	Tropicana Site Access Road						
Upper stratum	Growth form	Trees	Tree mallee	Tree mallee	Tree mallee	Tree mallee	Tree	Shrub mallee	Shrub mallee
	Height	6	6	6	6	7	10	5	5
	Cover	1	10	10	1	20	25	25	40
	Dominants	Marble gum, Acacia (mulga)	Mallee sp. oleosa	Eucalyptus sp.	Mallee	Eucalyptus sp.	Eucalyptus sp.	Eucalyptus sp.	Eucalyptus sp.
	Emergents	Marble gum	Mallee, Euc. Youngiana	Marble gum	Marble gum	Marble gum	Marble gum	Callitris sp, Marble Gum	Marble gum
Middle stratum	Growth Form	Woody shrub	Woody shrub	Woody shrub	Woody shrub	Woody shrub	Woody shrub	Woody shrub	Woody shrub
	Height	5	3	3	3	2	2	5	1.5
	Cover	10	10	20	10	35	35	25	30
	Dominants	Grevillea juncifolia, Callitris preissii, Eucalyptus leptopoda, Acacia desertorum	Callitris preissii, Melaleuca sp. Acacia sp.	Acacia desertorum, Grevillea juncifolia	Eucalyptus youngiana, Eucalyptus concinna	Eucalyptus youngiana, Eucalyptus concinna	Callitris sp., Acacia burkittii, Acacia hemiteles	Eucalyptus youngiana, Eucalyptus concinna	Melaleuca sp., Acacia colletoides, Acacia hemiteles
	Emergents	Callitris sp., Malle sp.	Hakea francisiana, Allocasuarine sp.,	Marble gum	Acacia desertorum, Callitris sp., Hakea francisiana	Callitris sp. Allocasuarina acutivalvis, Acacia sp., Leptospermum fastigiatum, Bertya dimerostigma	Santalum acuminatum, Melaleuca sp.	Callitris sp., Marble Gum	Santalum acuminatum
	Growth Form	Hummock	Hummock	Hummock	Hummock	Hummock	Hummock	Hummock	Hummock

Lower stratum	Height	0.6	0.5	3	0.3	0.3	0.3	0.3	0.3
	Cover	30	15	20	25	60	45	40	50
	Dominants	Triodea desertorum	Triodea desertorum	Triodea desertorum	Triodea desertorum	Triodea desertorum	Triodea desertorum	Triodia desertorum	Triodia scariosa
	Emergents	Swainsona formosa	Leptosema chambersii	Sedge sp., Eremophila sp., Lambertia sp.	Calothamnus sp. (seedlings),	Dianella revoluta	Calothamnus sp. (seedlings),	Cryptandra sp.	Sedge sp.

	Site reference	East A	East B	East C	East D	East E	East F	East G	East H
Site details	Latitude	-29.863072	-29.856015	-29.855106	-29.857297	-29.861485	-29.868792	-29.866763	-29.846342
	Longitude	124.48678	124.283523	124.254331	124.3024	124.33875	124.427702	124.462972	124.474301
	Last burnt	20+ years	20+ years	20+ years	10-20 years	10-20 years	20+ years	20+ years	20+ years
Fire history	Percentage burnt	0	0	0	0	80	0	0	0
	Scorch height	0	0	0	0	2	0	0	0
	Fire Intensity	None	None	None	None	Patchy	None	None	None
	Landform	Dune footslope	Swale	Dune slope	Dune slope	Dune footslope	Dune crest	Sandy plain	Dune crest
Landform and soils	Dry soil surface	Soft	Soft	Soft	Soft	Soft	Soft	Soft	Soft
	Soil colour	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow
	Soil shade	Pale	Pale	Pale	Pale	Pale	Pale	Pale	Pale
	Bare ground	30	20	10	30	30	30	20	30
Ground cover	Crust	0	0	0	0	0	0	0	0
	Stones	0	0	0	0	0	0	0	0
	Rocks	0	0	0	0	0	0	0	0
	Litter	5	10	10	10	0	5	5	5
	Coarse WD	5	5	1	5	1	2	5	5
	Logs < 50mm	1	1	1	1	1	1	1	1
	Logs > 50mm	1	1	1	2	0	1	1	1

	Spinifex stage	Stage 5	Stage 5	Stage 5	Stage 4	Stage 3	Stage 5	Stage 5	Stage 5
Vegetation details	Muir classification	Hummock grasses ▶ Hummock grassland	Tree mallee	Hummock grasses ▶ Hummock grassland	Hummock grasses ▶ Open hummock grassland	Hummock grasses ▶ Open hummock grassland	Hummock grasses ▶ Hummock grassland	Hummock grasses ▶ Open hummock grassland	Hummock grasses ▶ Open hummock grassland
	Vegetation notes	Spinifex seeding, Grevillea sp. Flowering.	Seeding spinifex, Pityrodia loricata flowering	Mallee sp., Acacia sp., Calothamnus sp., Euc, Triodea flowering	Spinifex seeding	Seeding spinifex	Acacia sp., Grevillea sp, & Callitris sp.flowering	Aluta sp. & Grevillea sp. flowering	Acacia sp. flowering
Upper stratum	Growth form	Tree	Tree	Shrub mallee	Shrub mallee	Shrub mallee	Tree mallee	Tree	Tree
	Height	6	6	5	3	2	6	6	6
	Cover	15	5	5	15	10	5	10	5
	Dominants	Eucalyptus concinna	Mallee, Euc. youngiana	Mallee, Euc. youngiana	Mallee, Euc. youngiana & concinna	Mallee, Euc. youngiana & leptopoda	Eucalyptus youngiana	Callitris preissii, Acacia aneura, Euc. youngiana	Marble gum
	Emergents	Marble gum	Eucalyptus ceratocorys	Marble gum	Marble gum	Marble gum	Marble gum	Marble gum	Eucalyptus concinna
Middle stratum	Growth Form	Woody shrub	Woody shrub	Woody shrub	Woody shrub	Woody shrub	Woody shrub	Woody shrub	Woody shrub
	Height	2	2	2	2	1.5	3	2	3
	Cover	20	15	20	15	30	15	35	20
	Dominants	Grevillea juncifolia, Hakea francisiana, Grevillea didymobotrya, Callitris preissii, Lambertia sp., Acacia helmsiana, Acacia prainii	Allocasuarina spinosum, Callitris preissii Banksia sp., Grevillea didymobotrya, Hakea francisiana,	Callitris preissii, Hakea francisiana, Acacia helmsiana, Calothamnus gilesii, Acacia ligulata, Grevillea juncifolia	Hakea francisiana, Persoonia, Acacia sieberiana, Acacia desertorum, Grevillea juncifolia, Acacia helmsiana, Acacia ligulata	Hakea francisiana, Acacia sieberiana, Callitris preissii	Callitris preissii, Grevillea juncifolia, Acacia ligulata	Aluta sp., Grevillea juncifolia, Acacia ridgens, Lambertia sp.	Callitris preissii, Acacia ligulata, Leptospermum sp., Acacia stenoptera, Acacia helmsiana

	Emergents	Marble gum	Grevillea juncifolia	Micromertus stenocalics	Banksia sp.	Callitris preissii	Acacia ligulate & Acacia helmsiana	Eucalyptus leptopoda	Callitris preissii
Lower stratum	Growth Form	Woody shrub	Hummock	Hummock	Hummock grasses	Hummock grasses	Hummock	Hummock	Hummock
	Height	2	0.35	0.3	0.4	0.3	0.3	0.3	0.3
	Cover	20	55	40	40	25	35	35	29
	Dominants	Triodea desertorum Lomandra leucocephala	Triodea desertorum	Triodea desertorum	Triodea desertorum	Triodea desertorum	Triodea desertorum	Triodea desertorum	Triodea desertorum
	Emergents	Pityrodia sp., Persoonia sp., Lepidibolus sp	Pityrodia sp., Anthrotroche pannosa, Grevillea secunda	Cryptandra sp.	Acacia acanthoclada, Cryptandra distigma	Thryptomene sp.	Lomandra leucocephala, Anthrotroche pannosa, Chrysocephalum sp.	Keradrenia sp.	Anthrotroche pannosa, Pityrodia sp.

**APPENDIX 6: HABITAT PHOTOS FOR EASTERN SITES WITH SHD
PRESENCE: A (TOP COLLECTION) AND F (BOTTOM COLLECTION)**





APPENDIX 7: TOTAL FAUNA ASSEMBLAGE TRAPPED DURING THE SURVEY

Species Trapped	Sites: East captures								Sites: West captures								Total
	A	B	C	D	E	F	G	H	A	B	C	D	E	F	G	H	
<i>Anilius bicolor</i>						1											1
<i>Brachyurophis fasciolatus</i>										1							1
<i>Ctenophorus cristatus</i>									1				1				2
<i>Ctenophorus fordi</i>	1			1		1		1									4
<i>Ctenophorus isolepis</i>									10		7	3			11		31
<i>Ctenotus atlas</i>	1		1		1			4	1	3				2		2	15
<i>Ctenotus brooksi</i>	1					2		1									4
<i>Ctenotus leae</i>									1								1
<i>Ctenotus pantherinus</i>					1												1
<i>Ctenotus</i>									2					1			3
<i>Ctenotus schomburgkii</i>			1				5		35	16	6	8	1	11	2	7	92
<i>Cyclodomorphus melanops</i>											1						1
<i>Delma australis</i>		1															1
<i>Delma butleri</i>						1				1				1			3
<i>Demansia psammophis</i>									1						1	1	3
<i>Diplodactylus wiru</i>			1	1			1		2	1	1	1			1	4	13
<i>Diporiphora reginae</i>	2					1		4									7
<i>Gehyra variegata</i>									2								2
<i>Lerista bipes</i>											1						1
<i>Lialis burtonis</i>					1		1					1					3
<i>Liopholis inornata</i>		1	1		1				5		4	6					18
<i>Lucasium damaeum</i>									1							1	2
<i>Menetia greyii</i>			1													1	2
<i>Moloch horridus</i>	1			1	1	1	1				2	1		1			9
<i>Morethia butleri</i>			1								1						2
<i>Nephrurus laevisissimus</i>		3	1	2	2	7	2	2		1	8	7	6				41
<i>Pogona minor</i>		1								1			1		1		4
<i>Proablepharus reginae</i>													1		2		3
<i>Rhynchoedura ornata</i>									1								1
<i>Simoselaps bertholdi</i>																1	1
<i>Strophurus assimilis</i>					1					2	1						4
<i>Strophurus elderi</i>									1								1
<i>Tiliqua rugosa</i>									1								1
<i>Varanus eremius</i>				1	1												2
<i>Varanus gouldii</i>												1					1
Native Mammals																	
<i>Cercartetus concinnus</i>	1	1	7			3			2	8	8	4		9	8	1	52
<i>Dasycercus blythi</i>										1							1
<i>Ningau sp. (ridei or</i>	4	9	5	6	17	15	11	8	2	8	6	8	16	5	4	4	128
<i>Notomys alexis</i>	2	2		2		2	3	2	3	2	2				2	1	23
<i>Pseudomys desertor</i>						1			2	1	3						7
<i>Pseudomys</i>	2	5	6	3	2	6	3	1	2	5	4	7	3			1	50
<i>Sminthopsis dolichura</i>					1			2	3				3			1	10
<i>Sminthopsis hirtipes</i>									1			1	2	1	1		6
<i>Sminthopsis ooldea</i>			1					1									2
<i>Sminthopsis psammophila</i>	4					1											5
Total	19	24	26	17	29	42	27	26	79	51	55	48	34	31	33	25	565

APPENDIX 8: OTHER CONSERVATION SIGNIFICANT TAXA RECORDED DURING THE SURVEY

Species	Latitude	Longitude	Comments
Scarlet-chested Parrot	124.4183563	-29.87236444	Uncommon in GVD, two birds observed
Scarlet-chested Parrot	124.4144686	-29.87200011	Uncommon in GVD, two birds observed
Regent Parrot	123.1013516	-30.07271376	Four birds observed, occurs at arid extreme
Regent Parrot	124.4875101	-29.86352725	Six birds observed, occurs at arid extreme
White-eared Honeyeater	123.0858263	-30.05715752	One bird observed, occurs at arid extreme
White-eared Honeyeater	123.1775403	-30.02540762	One bird observed, occurs at arid extreme
Australian Raven	123.1012893	-30.07260551	One bird observed, occurs at arid extreme
Australian Raven	124.3025264	-29.85770405	Two birds observed, occurs at arid extreme
Australian Bustard	124.3780779	-29.86309098	Two birds observed, culturally significant
Australian Bustard	124.3755133	-29.86179128	Two birds observed, culturally significant
Bobtail (<i>Tiliqua rugosa</i>)	123.1013412	-30.07262352	One individual observed, occurs at arid extreme
Bobtail (<i>Tiliqua rugosa</i>)	123.1116216	-30.07999723	One individual observed, occurs at arid extreme
Priority and Rare Flora			
<i>Conospermum toddii</i>	124.4867306	-29.86331947	DBCA Priority 4, several plants recorded
<i>Eucalyptus pimpiniana</i>	123.1746551	-30.02421122	DBCA Priority 3, several plants recorded
<i>Eucalyptus pimpiniana</i>	123.1742314	-30.02508716	DBCA Priority 3, several plants recorded
<i>Eucalyptus pimpiniana</i>	123.1739315	-30.02560196	DBCA Priority 3 several plants recorded
<i>Lechenaultia brevifolia</i>	124.2834907	-29.8562482	Uncommon in GVD, several plants recorded

APPENDIX 9: TISSUE SAMPLES FORWARDED TO THE WESTERN AUSTRALIAN MUSEUM

Species	Samples	East	West
Mammals			
<i>Cercartetus concinnus</i> - Western Pygmy-possum	5	3	2
<i>Dasyercus blythi</i> – Brush-tailed Mulgara	1	0	1
<i>Ningauai yvonneae</i> - Southern Ningauai	5	0	5
<i>Ningauai ridei</i> - Wongai Ningauai	8	5	3
<i>Notomys alexis</i> - Spinifex Hopping-mouse	3	2	1
<i>Pseudomys desertor</i> - Desert Mouse	2	0	2
<i>Pseudomys hermannsburgensis</i> - Sandy Inland Mouse	3	2	1
<i>Sminthopsis dolichura</i> - Little long-tailed Dunnart	8	3	5
<i>Sminthopsis hirtipes</i> - Hairy-footed Dunnart	3	0	3
<i>Sminthopsis ooldea</i> - Ooldea Dunnart	2	2	0
<i>Sminthopsis psammophila</i> - Sandhill Dunnart	3	3	0
Reptiles			
<i>Ctenophorus fordi</i> - Mallee Sand Dragon	2	2	0
<i>Ctenophorus isolepis</i> – Military Dragon	1	1	0
<i>Ctenophorus salinarum</i> – Salt lake Dragon	1	0	1
<i>Ctenotus atlas</i> - Southern Mallee Ctenotus	3	2	1
<i>Ctenotus brooksi</i> - Brooks' Ctenotus	1	0	1
<i>Ctenotus schomburgkii</i> - Barred Wedge-snout Ctenotus	2	1	1
<i>Delma butleri</i> - Unbanded Delma	2	2	0
<i>Diplodactylus wiru</i> - Desert Wood Gecko	1	0	1
<i>Lialis burtonis</i> - Burton's Legless Lizard	2	1	1
<i>Liopholis inornata</i> - Desert Skink	2	2	0
<i>Lucasium damaeum</i> - Beaded Gecko	1	0	1
<i>Menetia greyii</i> - Dwarf Skink	1	1	0
<i>Pogona minor</i> - Bearded Dragon	1	1	0
<i>Proablepharus reginae</i> - Spinifex Snake-eyed Snake	1	0	1
<i>Varanus eremius</i> - Pygmy Desert Monitor	1	0	1

APPENDIX 10: SPECIES DETECTED ON MOTION CAMERA DURING THE SURVEY

Species	West Sites								East Sites								Total
	A	B	C	D	E	F	G	H	A	B	C	D	E	F	G	H	
Reptiles																	
<i>Ctenotus quattuordecimlineatus</i>			X														1
<i>Ctenotus schomburgkii</i>			X														1
<i>Moloch horridus</i>						X											1
<i>Pogona minor</i>										X					X		2
<i>Tiliqua occipitalis</i>			X				X	X						X		X	5
<i>Tiliqua rugosa</i>	X	X			X	X											4
<i>Varanus gouldii</i>			X					X									2
Birds																	
<i>Cracticus tibicen</i>					X				X								2
<i>Manorina flavigula</i>						X		X	X	X							4
<i>Phaps chalcoptera</i>		X															1
<i>Pomatostomus superciliosus</i>														X			1
<i>Purnella albifrons</i>			X														1
<i>Strepera versicolor</i>						X											1
Mammals																	
<i>Tachyglossus aculeatus</i>									X								1
<i>Dasycercus blythi</i>		X	X				X	X					X				5
<i>Sminthopsis psammophila</i>									X				X	X		X	4
<i>Sminthopsis sp.</i>				X	X	X											3
<i>Macropus fuliginosus</i>	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	14
<i>Notomys alexis</i>	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	16
<i>Pseudomys desertor</i>							X										1
<i>Pseudomys hermannsburgensis</i>	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	16
<i>Mus musculus</i>				X													1
<i>Canis lupus dingo</i>								X									1
<i>Felis catus</i>		X		X	X		X	X	X	X	X		X	X	X		11
<i>Oryctolagus cuniculus</i>	X																1
<i>Vulpes vulpes</i>																X	1
Total	5	7	9	6	7	8	6	9	8	6	4	3	5	7	5	6	26

Note: *Sminthopsis hirtipes*, *Sminthopsis dolichura* and *Sminthopsis ooldea* are all grouped together under *Sminthopsis sp.*

APPENDIX 11: WRITTEN HABITAT DESCRIPTORS TAKEN DURING MALLEEFOWL WALKS

<u>MW1</u>
Transiting landscape through dense Mulga patch. 637969 6693860 GPS location of extinct Malleefowl mound (100 years+), 5m circ. Flat profile (6). Slight central depression (2cm). Mound covered in crust and colonised by shrubs. MF sighting.
<u>MW2</u>
Nothing of noted significance. Transitioning once again between Mulga and open Mulga.
<u>MW3</u>
Transitional landscape. Starting walk prior to sand dune area. Moving into Mulga patch. Back into spinifex area, then back into Mulga. On walk, mound spotted in dense mulga Aluta thicket (extinct mound 50+ years), GPS co-ordinates: 639700 6693849. 6m diameter, height approx 15cm, profile 6 no obvious signs of depression, covered in lichen and crust. Composed of sand and gravel. Clear evidence of disturbance from rabbits and kangaroo. Species sightings, brown falcon. Grey butcher bird, inland thornbill, red throat, chestnut quail thrush, white fronted honey eater.
<u>MW4</u>
Starting in open mulga area. Transitioning into Aluta dominated areas with high overstory. Transitioned to mulga over spinifex. Final section spinifex (<i>Triodea basedowii</i> dominated). Hummock grassland apparent at the end (Fire burn age close to track 3 years) elsewhere older. Fauna sightings: Crested bellbird nest noted, GPS 639561 6693442. Tawny frogmouth sighting, GPS 639591 6694356. Spiny cheek honeyeaters heard and seen. Maskedwood swallow.
<u>MW5</u>
Location related to polygon 37. Walk starts on Mallee, sandplain, with spinifex. 500m walking, spinifex mallee mix still present. Bare ground relatively high, with juvenile upper story and lower story species dominant. Allocasuarina shrubland on yellow sand. Moves from Sheoak, <i>Anthrotrachne pernosa</i> , <i>Thryptomene bisariata</i> plain to Acacia dominant with increased spinifex dominance (signs of <i>Gastrolobium</i> , <i>Banksia lepidopolis</i>), stage 3. Takeaway note, good SHD country, appears to be very open for Malleefowl and low likelihood (5 years + since last burn). Fauna sightings: Grass wren X4 (GPS 598948 6702966) Emu tracks. Patchy fireage between three and ten years, skeleton of Hakeas present.
<u>MW6</u>
Continuing from the end of MW5. Open grass Spinifex hummocks with; Allo, Acacia, tussock grasses, Euc, Banksia and call to start. 250m, composition similar, with older aged calitris present. Good SHD country. Develops into woodland community. Picture 2. Two potential disused SHD burrow, GPS: 599429 6702754, picture 3 of habitat, JM personal camera photo and phone for more details.
<u>MW7</u>
Spinifex hummocks continue to dominate, last burn age 5+ years.
<u>MW8</u>
Starting off with thick Mallee woodland, Aluta thicket, juvenile mallee. Malleefowl mound located, picture 3. 20 years+, GPS 638001 6692292. Profile 1, 7 metres wide. Height 15cm, depression 10cm. Interior width 2 metres. Composed of laterite gravel. Light fragments of lichen and crusting. Found in Aluta <i>Eremophola</i> thicket area. Evidence of disturbance from kangaroos. Secondary mound located at GPS location 638363 6692215, 7 metres wide, 30 cm high, 15cm deep, again Aluta thicket, minimal lichen and crust, composed of gravel and stones pale orange sand. Age 20+ , profile 1, currently inactive, previously used then dug out once again. At 1km (picture 4), Aluta thicket still dominant, with occasional spinifex clusters present. Dune located to West.
<u>MW9</u>
Starting in Aluta thicket area with mulga individuals dispersed. Patches of stage 5 spinifex also present. Crust and lichen quite high at this end. <i>Eremophola</i> fields interspersed with Mulga individuals (3metres) and Aluta thicket continues. Boodie mounds present throughout, one extinct burrow GPS: 637971 6692201. Reticulated dragon opp sighting. Sand goanna opp sighting.
<u>MW10</u>

Picture 1, shows starting location. First station, high quartz bed with broken rocks, ranging from 1mm to 100mm. Mallee present, with woody mid-stratum. High crust levels. Soil pale orange. Thickets of present throughout with breaks of rocky ground with intermittent areas of grassy tussock. Termite mounds throughout. No stark changes in environment, consistently rocky plain with Mallee.

MW11

Starting location on high altitude, rocky outcrop. Picture 1. High bare ground cover with woody debris and stones, ranging from 1 -100mm. Woody Mulga thicket starts to dominate ten metres into walk. Walking through downward slope, rock cover increases, with crusting increasing. Soil softening on declining mound. Mallee coverage also decreases leaving open bare ground. Upper story Mulga 6metres in height. Termite mounds present throughout (0.5m max).

MW12

Polygon 37. Initial track beginning with open hummock grassland. Interspersed with *Tryodea scariosa*, Mallee, Acacia. Photo 1. Transitioning across the walk was minimal, with Euc. mallee dominating with a woody shrub understory dominated by Acacias and *Eremophola*, and a lower story dominated with *Tryodea scariosa*. Malleefowl tracks identified, pictures 5 - 8 GPS location 511093 6703474.

MW13

Starting track coverage of *Tryodea* stage 5 patchy, with Euc mallee present. Transitioning between MW12 and 13 habitat has little difference. 200m walking, track opens up to open sandy area with small gypsum rock flecks. Bare ground dominates for 10m+ (photos 4 & 5). Approx. 750m into walk, vegetation coverage increases with a decrease in bare ground cover. Malleefowl tracks located at GPS 511060 6703522 (photos 7&8). Malleefowl track 511336 6703407 (photos 12).

MW14

Start of walk, high leaf litter content and woody shrub overstory (Mulga thicket). Bare ground at a relatively high percentage. Picture 1. Twenty metres in, *Spinifex* *Tryodea* patches occur. Transitioning from bare ground and *spinifex* patches, a thicken understory carpet occurs with dominance from *Aluta* species. Moving East, understory transitioning to *Spinifex* species (stage 5) with an increased overstory of *Callitris* (5 meters). Bare ground increases and mid story develops with a mixing of *Melaleuca* sp. *Acacia* sp. *Eremophola* sp. and *Allocasuarina*. *Spinifex* continued, with overstory developing to Woody shrub overstory (mulga) 6 metres, midstory still dominated with *Acacia*, *Eremophola* and *Melaleuca* species. Understory also contains *Aluta* and *Prostranthera*. This dominance continues throughout the Kilometre walk. Termite mounds also present, at low numbers. At approx 800m, habitat overstory reduces opening to open hummock area, dominated by Stage 5 *Tryodea* species and Mallee. Final 50 metres, very open hummock grassland, picture 12. Malleefowl mound located: GPS 517783 6667837. 7metres across, 10cm high, depression 40 cm (excavated but not used), crust level low. Profile 1, aged approx 20+ years. Composed of sand and gravel. In between *Acacia* and *Eremophola* thicket. Picture 9. 600metres into walk.

MW15

Walk starts within open *Spinifex* area (stage 5), with Mulga overstory. *Acacia* sp. also present with *prethothera* and *Melaleuca* sp. Ten metres into walk, overstory thickens. Picture 2, no stark changes to understory species. Woody debris increased, bare ground also with limited understory species. *Eremophola letrobiei* dominates understory complimenting Mulga overstory. Pictures 2/3. Termite presence also apparent. Mulga continues to dominate, with *Allocas.* apparent in patches. Little habitat transition. *Petrophora* understory begins to increase, again Mulga overstory. Picture 4. Picture 5. Moving South, habitat transition greater (mulga to *Spinifex*). Picture 6. Rock levels increase, from 0, to 10%. Transitioning to open understory and Mulga. Picture 8. Final kilometre stretch open Hummock country with Euc mallee overstory.

MW16

Walk starts in high overstory Euc mallee. With a woody assortment of *Acacia*, *Eremophola*, *Dodenea* as midstory and limited lowerstory species cover. *Tryodea scariosa* and tussock grasses dominate. Picture 1. Transition limited, with 50metres in, Sheoak (mulga) beginning to appear. *Spinifex* (stage 5) in patchy array throughout the walk. (Picture 3). Patchy sandlewood species. Leaf litter sporadic with increased cover apparent near Euc mallee. Picture 4. Increasing coverage of *Spinifex* cover supported by Euc mallee. Overstory begins to become patchy 600m into walk, with mid story and its

emergents beginning to dominate, transition of species types limited. 700m woody shrub midstory increases, transition with species diversity, minimal. Final 100m of 1km walk, area opens out again, with an increase in understory and an increase in bare ground. Pic 7.