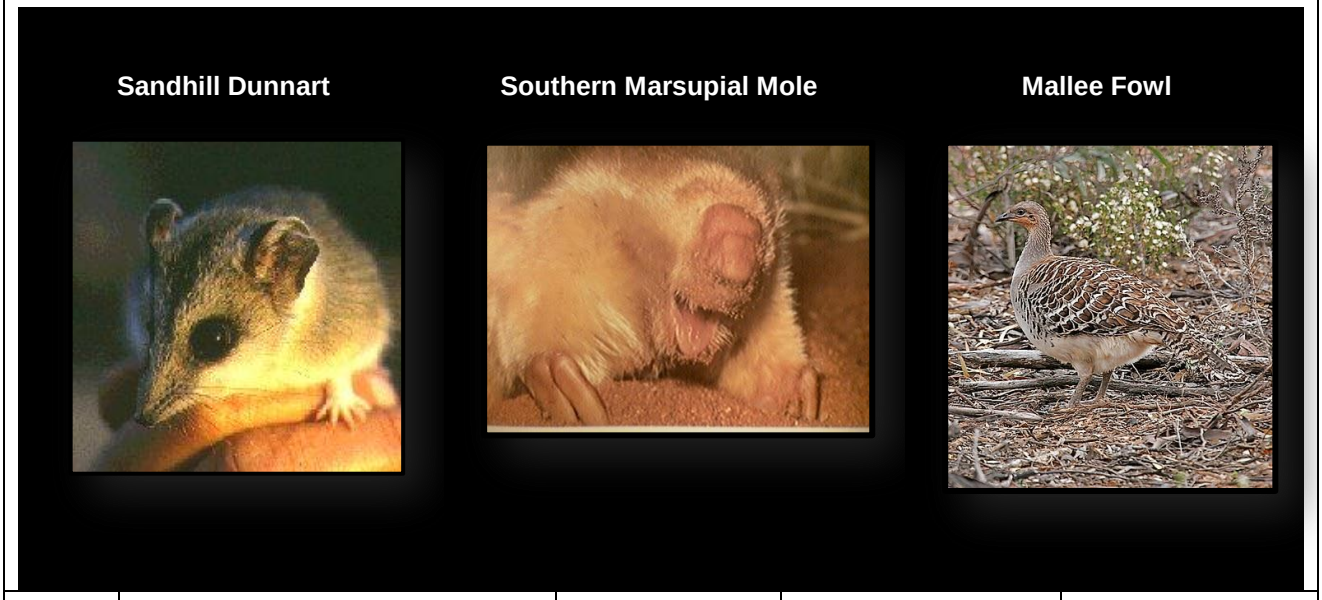
Tropicana Joint Venture

AUSTRALIA EXPLORATION GROUPS 2 AND 3 EPBC COMPLIANCE REPORT 2014

DOCUMENT NUMBER: ENV-8.1-REP-GFXA-Groups 2 and 3 EPBC Compliance 2014



Rev	Status Description	Date	Prepared by	Approved by
1	Internal – Issued for Comment	01-04-2015	TVanderStap	AKneeshaw
1	External – Approved for Publication	01-05-2015	TVanderStap	AKneeshaw

AngloGold Ashanti Australia Ltd is the Manager of the Tropicana Joint Venture and is acting as agent severally for each of the Joint Venturers in their respective percentage interests in the Joint Venture from time to time, with such interests currently being AngloGold Ashanti Australia Limited 70% and Independence Group NL 30%. The obligations and liabilities of the Joint Venturers are several only, in accordance with their respective percentage interests.

Table of Contents

List of Figures

List of Tables

1 Background

Project Name:	Tropicana Joint Venture
Exploration Tenements:	Primarily Groups 2 and 3 Exploration Area
POW Numbers:	REG ID 45440 (POW_140201) Tropicana Group 2 REG ID 45520 (POW_143001) Tropicana Group 3 REG ID 47917 (POW_140103) Tropicana West REG ID 47349 (POW_142502) Tropicana Group 1
Tenement Holder:	AngloGold Ashanti Australia Ltd/Independence Group NL
Report Period:	1st January 2014 to 31st December 2014

1.1 EPBC Referral No: 2008/4463 and Approval

Exploration activities predominantly within the Groups 2 and 3 area were referred to the Federal Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC now Department of Environment DoE) in September 2008 as it was identified that the activities may significantly impact two matters of national environmental significance as listed in the Federal Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act), these being; Listed Threatened Species and Ecological Communities and Listed Migratory Species. DoE determined the proposed activities to be a “Controlled Action” requiring Federal assessment via an instrument to be determined at a later date and depending on the status of the proposed activities under State Legislation.

In February 2010 the proposed activities were referred to the State Environmental Protection Authority (EPA) under Section 38 of the Environmental Protection Act 1986 to enable a level of assessment to be determined. The EPA set a level of assessment of “Not Assessed – Public Advice Given” with the recommendation that a Conservation and Environmental Management Plan (CEMP) be developed in consultation with then Western Australian Department of Environment and Conservation (DEC now Department of Environmental Regulation DER).

A CEMP was prepared for the proposed exploration activities in consultation with the DEC Environmental Management Branch. The plan identified the existing environmental values, potential impacts from the proposed exploration activities and the management and mitigation of those potential impacts. The CEMP, dated 17 December 2010, was approved by the WA Department of Environment and Conservation (DEC) and DSEWPaC in January 2011. On the 27th of October 2011 approval was granted to AngloGold Ashanti Australia (AGAA) to begin exploration activities within the EPBC referral area subject to a number of conditions.

AGAA formally communicated the start of works in the area on the 10th of April 2012, however DSEWPaC informed the company of its requirements to have in place an approved Southern Marsupial Mole Monitoring Program. This led to a request for variations of the EPBC conditions, which were approved, together with the Monitoring Program, on 19 February 2013.

The planning of the drilling programs for the EPBC Referral area commenced thereafter, making 19 February 2013 the 'commencement of the action' under the EPBC conditions. After this date, works were conducted under consolidated Programmes of Work (POW's) which are approved by the Environmental Division of the Western Australia Department of Mines and Petroleum (DMP).

AGAA is committed to all conditions outlined and will continue to work with the DoE, DER and DMP. This report is made available to the public as part of AGAA's environmental values and in accordance with Condition 7 of the approved Variation to Conditions, which states:

"Within three months of every 12 months anniversary of the commencement of the action, the person taking the action must make public a report on their website addressing compliance with the conditions of this approval over the previous 12 months. Including implementation of any management plans specified in the conditions."

1.2 Location, Climate and Landscape

The EPBC Referral area lies approximately 220 km southeast of Laverton and 330 km northeast of Kalgoorlie on the western edge of the Great Victoria Desert as shown in Figure 1. The Plumridge Lakes Nature Reserve lies immediately to the northeast of the exploration area and the Queen Victoria Springs Nature Reserves lies to the southwest.

The EPBC Referral area is primarily situated within the Great Victoria Desert bioregion (GVD1) with the northern section entering the Central Subregion (GVD2) and the southern tip within the Coolgardie Eastern Goldfields bioregion. As such its climate can be described as arid, with hot summers and cool winters and an average rainfall of 200-300 mm annually. The area's landforms consist of salt lakes, lake derived dunes, Aeolian sand dunes and sand plains, and redder soils occasionally with out-cropping rocks.

Spinifex (*Triodia spp*) and mallee (*Eucalyptus kingsmilli, E. youngiana*) with scattered marble gum (*E.gongylocarpa*) and native desert pines (*Callitris spp*) cover the sandy areas, while Mulga and Acacia woodlands occur through the red soils and outcrop areas. The salt lakes are dominated with salt bush *(Atriplex spp*), bluebush (*Kochia spp.*) and pearl bush (*Maireaina spp*.). The Priority Ecological Community (PEC) known as the *"Yellow Sandplain Communities of the Great Victoria Desert"* can also be found along the western edges of the EPBC Referral Area.

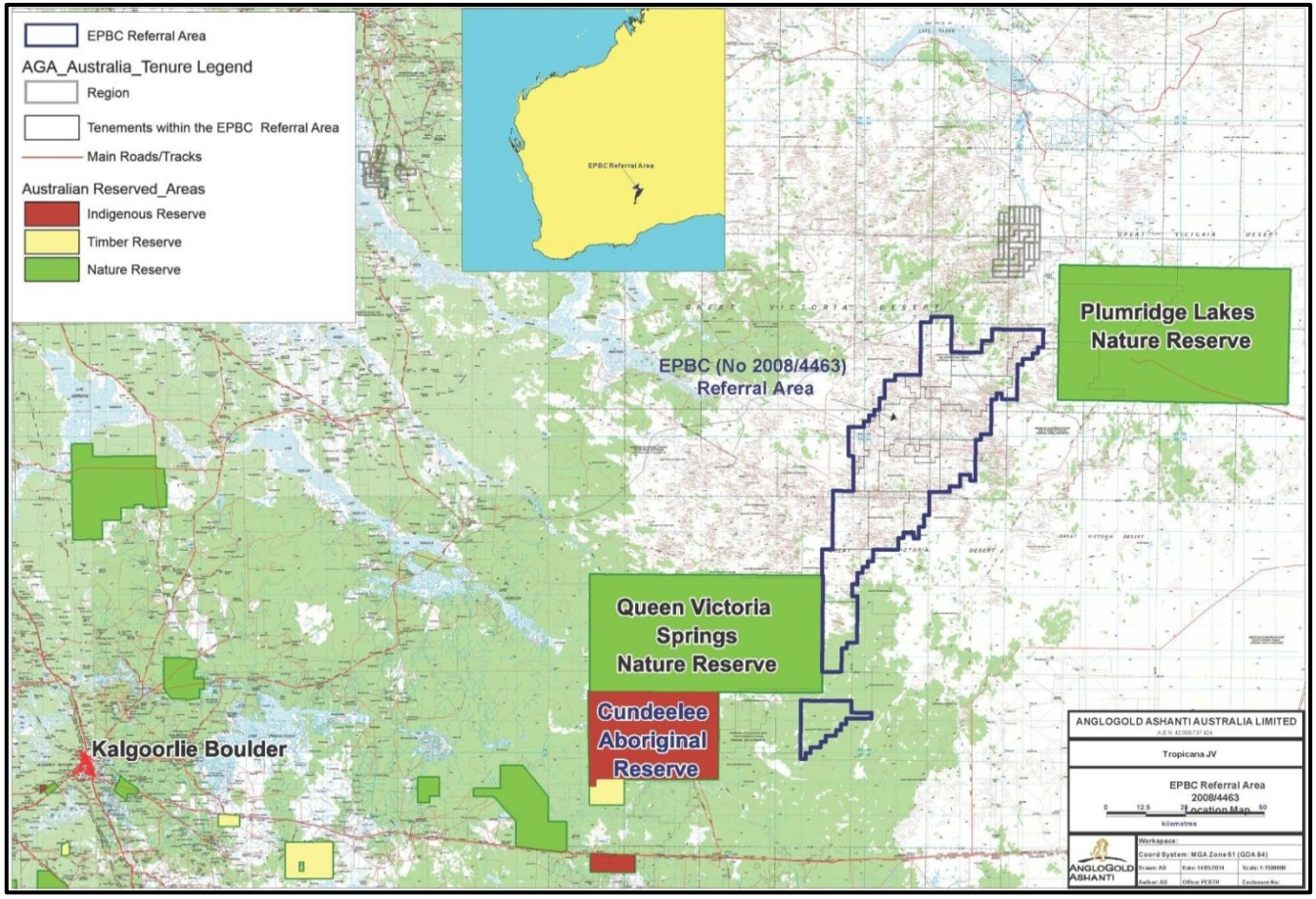


Figure 1 EPBC Referral Area

1.3 Tenement and POW Details

At the time of approval of EPBC Referral No: 2008/4463, all tenements within the EPBC referral area were held with AngloGold Ashanti Australia Ltd (AGAA) as the Manager of the Tropicana Joint Venture. AGAA was acting as agent severally for each of the Joint Venturers in their respective percentage interests of AGAA 70% and Independence Group NL (IGO) 30%. Accordingly the subsequent Variation to EPBC Referral No: 2008/4463 also identified both AGAA and IGO as 'Person to whom the approval is granted'.

On 30 October 2014, some tenements within the Referral Area became under the management of IGO.

IGO were advised that an EPBC Annual Compliance Report is required to be published publically by 19 May 2015. It was agreed that for the 2014 period, AGAA would assume responsibility for reporting on IGO's behalf for the period 30 October 2014 to 31 December 2014 for those tenements held by them within the referral area (the report herein), and confirm IGO's advice that no works of a ground disturbing nature have been undertaken by IGO within those tenements under their management and within the EPBC Referral Area during this period.

It was also agreed that for 2015 and subsequent years, IGO would comply with Condition 7 of the EPBC Referral No: 2008/4463 by submitting an EPBC Compliance Report via their website for those tenements held by them within the referral area. Concurrently, AGAA remain committed to continued compliance to the EPBC Referral conditions.

Tenements held by AGAA at 31 December 2014 within the EPBC Referral Area are provided below.

The tenements included in the Group 2 Consolidated Programme of Work (POW) are listed in Table 1 below.

Table 1 - Tropicana Group 2 Tenements

Tenements		
E 39/1012	E 39/1013	E 39/1037
E 39/1038	E 39/1040	E 39/1043
E 39/1042	E 39/1041	E 39/1044
E39/1763	E 39/1214	

The tenements included in the Group 3 Consolidated POW are listed in Table 2.

Table 2- Tropicana Group 3 Tenements

Tenements		
E 39/1028	E 39/1029	

The tenements included in Tropicana West Consolidated POW's within the EPBC Referral area are listed in Table 3.

Table 3 - Tropicana West Tenements

Tenements
E39/948 (Tropicana West)

Tenements held by the Salt Creek Joint Venture within the EPBC Referral Area are as follows:

Table 4 – Salt Creek Joint Venture Tenements

Tenements		
E28/1364	E28/2288	E39/1227
E28/1366	E39/1090	E39/1238
E28/1367	E39/1212	E39/1454
E28/1616	E39/1224	E39/1759
	E39/1848	E39/1090

Contact details for IGO are as follows:

Tim Kennedy
Exploration Manager
Suite 4, Level 5, South Shore Centre,
85 South Perth, Esplanade

Tim.Kennedy@igo.com.au
Direct Tel: +61 8 9238 8340
Main Tel: +61 8 9238 8300

1.4 Environmental Management Systems

AngloGold Ashanti Australia Greenfields Exploration (GFXA) business unit was awarded ISO 14001 accreditation for its environment management system on 12 November 2007 by Lloyds Register Quality Assurance Limited. Reaccreditation has been maintained since and awarded again on 21 November 2013. Works in EPBC Referral Area are undertaken through the implementation of the ISO 14001 accredited environmental management system.

1.5 Definitions

In reading this report, reference should be made to the following definitions contained within the EPBC Referral Approval and Variation to Conditions Attached to Approval enacted by DoE in relation to EPBC 2008/4463.

The EPBC Act is the Environment Protection and Biodiversity Conservation Act 1999.

The Minister means the minister administering the Environment Protection and Biodiversity Conservation Act 1999 and includes a delegate of the minister.

The Department means the Australian Government Department administering the Environment Protection and Biodiversity Conservation Act 1999.

To commence the action means any preparatory worked required to be undertaken including clearing vegetation, the erection of any onsite temporary structures and the use of heavy duty equipment for the purpose of breaking the ground for mining, buildings or infrastructure.

Disturbance includes the clearance of native vegetation, construction of access tracks, establishment of drillpads and sumps or any other supporting infrastructure for exploration activities.

Clearance of native vegetation includes the cutting down, felling, thinning, logging, removing, killing, destroying, poisoning, ringbarking, uprooting or burning of native vegetation.

Exploration drilling includes activities that require the clearing of vegetation to facilitate access prior to undertaking any work, such as Aircore Drilling, RC Drilling and Diamond drilling.

National Malleefowl Monitoring Database means that national database for the monitoring of Malleefowl available on the internet at http://database.malleefowlvictoria.org.au/Start.aspx

Adjacent: means any Malleefowl mounds immediately outside the 100 metre buffer area as identified in approval condition 2 (d) and Sandhill Dunnart habitat immediately outside the 50 metre buffer area as detailed in approval condition 4 (b) and located within Group 2 and Group 3 tenement areas as shown in figures at Attachments A and B.

Targeted exploration program: An area which, having been geologically assessed for prospectivity, warrants on ground exploration. Typical activities potentially include ground disturbing work such as drilling programs, and /or less invasive activities such as surface geochemical sampling and ground based geophysical surveys. Such programs will represent the location of any ground disturbance, such as drill lines, drill hole locations and associated works, and any required access/egress tracks.

2 EPBC Act Compliance

This report presents the EPBC Act conditions, under which GFXA are permitted to conduct exploration activities on existing exploration tenements in the Great Victorian Desert bioregion, collectively known as the EPBC Referral Area, primarily comprising Group 2 and 3 tenements.

The wording of the EPBC Act Conditions is provided below in italicized text. Against each condition, GFXA has provided an explanation regarding how this condition has been met. The explanation is provided in standard text.

2.1 Condition 1

Condition 1 reads:

Within 14 Days after the commencement of the action, the person taking the action must advise the Department in writing of the actual date of commencement.

Reference should be made to the EPBC Compliance Report 2013 available at:
http://www.tropicanajv.com.au/irm/content/document-library1.aspx?RID=406

2.2 Condition 2

Condition 2 reads:

In order to protect the Malleefowl (Leipoa ocellata), the person undertaking the action must implement the following mitigation measures;

a. *Undertake a monitoring program of Malleefowl mounds identified within the Malleefowl Preservation Group report dated November 2009, on an annual basis during the Malleefowl breeding season (September through to March), starting within the year exploration drilling commences. The monitoring program must be undertaken in accordance with the National Manual for the Malleefowl Monitoring System (2007)*

In November 2014 a targeted survey was conducted by GFXA Environmental Officers with data collected in accordance with the National Manual for the Malleefowl Monitoring System. The data has being collated and was submitted prior to 31 December 2014 for entry into the National Monitoring System Database.

In addition, all employees and contractors working within Groups 2 and 3 have been provided with instruction using the Environmental Group 2 and 3 EPBC Induction to identify and report sightings of Malleefowl and mounds. Such reports are included in the AGAA environmental database and also submitted to the National Malleefowl Monitoring System. GFXA will commence the next monitoring program by 31 November, 2015.

b. *Prior to the commencement of each targeted exploration program, undertake inspection for evidence of Malleefowl mounds. Where evidence is observed, undertake a further targeted survey for Malleefowl's and mounds within the area of observations and surrounding suitable habitat within one month of the initial inspection, in accordance with the Department's Survey Guidelines for Australia's Threatened Birds (DEWGA 2010).*

GFXA's standard practice as documented in the Environmental and Heritage Notification Procedure is to conduct an Environmental Inspection of the proposed drilling and associated activities area, for the presence of flora and fauna of environmental value, including Malleefowl. The inspection is undertaken prior to any works taking place on the ground. An Environmental Inspection Notification (EIN) Report is prepared for each proposed drilling program. The drill program is modified to minimise environmental impact and to ensure the required buffers are implemented.

GFXA has a multi-level reporting system which is part of the ISO 14001 accredited environmental management system. The system includes incident reporting and environmental observation reporting. All GFXA employees and contractors are trained to report sightings of Malleefowl and Malleefowl mounds. Reporting is mandated and therefore monitoring is continuous for the duration of each drilling program that is undertaken in the EPBC Referral Area.

c. *Submit the results of the inspection, monitoring program and targeted surveys to the National Malleefowl Monitoring Database within two months of completion of each activity.*

In determining the timing of the submission of survey results to the National Malleefowl Monitoring Database, due consideration was given to the completion of the drilling program for Groups 2 and 3, which is undertaken by calendar year. Consideration was also given to the duration of the breeding season which runs approximately from October to January.

Accordingly, the survey results were submitted by 31 December 2014 for entry into the database ie in accordance with the required timeframe for completion.

d. *Prior to the commencement of any targeted exploration activities, establish a buffer zone of a minimum of 100 metres around any identified mounds, including those identified in the targeted survey in condition 2(b) that occur adjacent to each targeted exploration area, as identified in Attachment A. No disturbance must occur within the buffer zone.*

GFXA records all threatened fauna sightings and the locations of both active and inactive Malleefowl mounds, using positional data, and records this in the Geographic Information System (GIS). This system allows a 100 metre buffer to be automatically added around any malleefowl mound identified within the Group 2 and 3 areas and prevents any works being planned or undertaken within the buffered area.

The field crew who carry out clearing works to prepare for the drill program and associated activities are provided with the positional data and maps with required buffers delineated. Digital positioning data is also collected by the field crew during clearing activities which allows GFXA to verify compliance to buffer zone requirements.

A copy of Attachment A is provided in Appendix A. This identifies those malleefowl mounds documented in the Malleefowl Preservation Group's Report dated November 2009.

2.3 Condition 3

Condition 3 reads:

> *In order to protect the Southern Marsupial Mole (SMM), the person undertaking the action must implement the following mitigation measures:*

a. installation of access tracks along sand dunes must be avoided;

GFXA used aerial photography to identify sand dunes within the Fraser Region and purchased GIS data of their locations. This information is projected into the GFXA GIS system and all tracks are planned to avoid these areas.

The Environmental Inspection Notification process described in 2.2b is also used to identify sand dunes within the proposed drilling program area. An Environmental Officer undertakes an on ground inspection of the proposed area by light vehicle or all terrain vehicle. Dune positional data is mapped and the required buffer zone/s established digitally.

GFXA avoids the installation of any tracks upon sand dunes due to their environmental significance and also the impracticality for traversing exploration equipment because of the safety risk of vehicle and rig rollover.

b. Access tracks must be designed and installed to minimise impacts on SMM habitat including minimising the use of soft-sandy uplands, and position tracks in areas between dunes;

GFXA engaged the services of Dr Joe Benshemesh to provide environmental expertise in relation to the habitat and behaviours of the Southern Marsupial Mole. The advice given as documented in the Southern Marsupial Mole Program approved by DoE is that prime habitat is located in the upper crest of the sand dunes. Specifically, section 4.4 of the Program reads:

> *"Defining prime habitat for marsupial moles*
> *As indicated above, every survey undertaken in every region of central Australia has shown that marsupial mole underground signs are substantially higher on the main body of the dune (i.e. crests and slopes) than at the base of dunes or in interdune swales. This relationship has been highly significant in each of these surveys (Benshemesh 1998, 1999, 2001; Benshemesh 2005b, c, d, e, 2006; Benshemesh and Mann 2009; Benshemesh and Schulz 2008, 2009, 2010a, b) attesting to the generality of the finding. This knowledge is not new: Aboriginal people primarily associate marsupial moles with dunefields (Ginger Wikilyiri pers. comm.; Robin Kankanpakantja pers. comm.), and in some areas of the central deserts (e.g. Kiwikurra) marsupial moles are sometimes called 'tali-tali', which literally means 'dune-dune'. Likewise, the importance of dunefields as habitat for marsupial mole has been stated by some of the earliest commentators (Marlow 1962; Parker 1973; Ride 1970; Spencer 1896; Stirling 1888, 1891; Wood Jones 1923), as well as recent scientific authors apart from myself (Pearson and Turner 2000).*
>
> *While some of these authors have suggested that sand flats may also be suitable habitat for marsupial moles, the importance of dune habitat is incontestable. On the other hand, the finding that distribution of marsupial moles depends on the connectivity of dunes (Benshemesh and Schulz 2008, 2010b), suggests that the sandplains and sandflats between dunes may be regarded as barriers rather than prime habitat, and that marsupial moles may only occur in off-dune habitats if there are dunes and dunefields nearby.*

There are a number of reasons why the main body of dunes provide sand habitat that is likely to be ideal for marsupial moles. The dunes that comprise the dunefields of the central Australian deserts are aeolian in origin (Bowler 1976), deposited grain by grain by the action of wind. As a result of the physical sorting provided by the wind (Pye and Tsoar 2009), grain size is relatively uniform on Australian dunes (Buckley 1989; Buckley 1982), providing void spaces that are filled with air. These void spaces are important for extreme fossorial animals such as marsupial moles by providing a relatively high aeration and gas flow underground (Seymour and Seely 1996). The void spaces also provide excellent drainage, so that water that fills the void spaces and replaces air does so for only a relatively short period of time. Aboriginal people often state that marsupial moles come to the surface more commonly following rain (e.g.Bolam 1927; Johnson 1995; Pearson and Turner 2000), and this may well be a response of the animals essentially suffocating due to water replacing air in the void spaces. Waterlogged soils are more likely to occur in poorly sorted soils in sandplains than on dunes (Tsoar 2005) where drainage is enhanced by both the relatively even grain size (increased void spaces) and by elevation. Finally, the relatively even grain size of sand on dunes results in fewer contacts between grains than occurs between poorly sorted substrates. Fine clay particles are sucked into these contacts during wet/dry cycles, resulting in bonding between grains and providing the light cementation that is characteristic of the Australian dunefields (Hesse 2011; Hesse 2010). An important consequence of the fewer bonds in well-sorted sands is that the soil is less hard than in poorly sorted sand, making tunnelling easier for subterranean animals (Jackson et al. 2008). There is, in fact, a very strong and highly significant relationship between the abundance of marsupial mole signs underground and soil hardness, and this has been reported in each of the survey reports referred to above.

In summary, dune environments have been shown to represent prime habitat for marsupial mole in terms of the species' abundance, and this is understandable in terms of improved aeration, drainage and ease of tunnelling. Off the main body of the dune, including the base of the dune, the physical environment is generally less suitable for marsupial moles and underground signs are less common. Off dune areas may thus be regarded as sub-prime: marsupial moles may still occur in such areas, albeit at lower densities than on dunes, and the physical environment is less than ideal. Moreover, it has yet to be established whether marsupial mole populations can maintain themselves in areas where dunes are not close by."

Accordingly, GFXA has determined prime SMM habitat to be within 40 m of the crest of sand dunes. Using GFXA's internal GIS system a 40 m buffer has been placed around all sand dunes ensuring no work is planned or conducted within this area. The process is managed in accordance with the Environmental Inspection Notification Procedure described in 2b.

c. *By the end of October 2012, submit a SMM monitoring program to the Minister for approval. The program must include details of a progressive monitoring strategy to monitor the potential impacts from exploration drilling on prime SMM habitat and evidence of the SMM population, and details of targeted surveys within suitable SMM habitat areas adjacent to the proposed exploration program;*

The Southern Marsupial Mole Monitoring Program was developed in liaison with Dr Joe Benshemesh and submitted to DoE for approval on 14 December 2012. The program was approved by DoE on 19 February 2013.

Details of early SMM survey works are provided in EPBC Compliance Report 2013 available at: http://www.tropicanajv.com.au/irm/content/document-library1.aspx?RID=406

In June 2014, GFXA undertook the second phase of the SMM monitoring program, completing the estimated 200 trenches and associated mole hole readings. The first half of the program was completed in 2013 by GFXA environmental team members, after being deemed competent by Dr. Joe Benshemesh.

In 2014, GFXA were privileged to enlist the involvement of members of the Spinifex Land Management Pila Nguru Aboriginal Corporation. The story published in AGAA's internal newsletter is provided for public interest in Appendix C.

d. The approved SMM Monitoring Program must be implemented,

The SMM Monitoring Program was implemented in 2013, as described in 3c. The Program stipulates that a baseline survey of 200 monitoring trenches must be completed within 2 years. The first stage of the monitoring program was undertaken in November 2013 with 100 trenches completed. The second stage was completed in June 2014.

Data from the two staged SMM survey was collated in December 2014 and provided to Dr Joe Benshemesh for analysis and the preparation of a report. Upon completion the report will be submitted to DoE and DER.

e. Areas identified as prime Southern Marsupial Mole (SMM) habitat, including those identified through the targeted surveys and monitoring programs required under condition 3 (c), must be avoided, including through establishment of a buffer zone of a minimum of 40 metres around any SMM habitat. The buffer zones must be established and managed in accordance with the approved SMM monitoring program.

The Environmental Inspection Notification process described in 2.2b is used to identify sand dunes within the proposed drilling program area. Positional data is gathered and entered into the GFXA internal GIS system. A 40m buffer is added. As described in 2.2d, the field crew utilise the positional data to ensure that tracks or other areas are not cleared within the buffer area. Accordingly, prime SMM habitat remains undisturbed.

2.4 Condition 4

Condition 4 reads:

In order to protect the Sandhill Dunnart, the person undertaking the action must implement the following mitigation measures;

a. *Implement the avoidance measures detailed in Section 6 of the Tropicana Joint Venture Group 2 and Group 3 Exploration Areas Conservation and Environmental Management Plan (CEMP) dated 14 December 2010, as relevant to the Sandhill Dunnart. Where these measures cannot be implemented, the person undertaking the action must undertake a detailed monitoring program and follow up monitoring for the duration of the exploration activities. The monitoring program must target those Sandhill Dunnart habitats identified in the Sandhill Dunnart assessment undertaken by GHD in 2009 (reported in GHD report, Sandhill Dunnart habitat assessment, Group 2 & 3 tenements, dated July 2010) and are located adjacent to areas of exploration activities within Group 2 and Group 3 tenements as identified at Attachment B.*

Reference should be made to EPBC Compliance Report 2013 available at:
http://www.tropicanajv.com.au/irm/content/document-library1.aspx?RID=406

During 2014, those practices identified in the 2013 Compliance Report were continued to be followed. Identified and potential habitats were avoided and therefore a 'detailed monitoring program' was not required.

Locations of those habitats identified by GHD consultants and documented in their 2009 report are provided in Attachment B (Appendix B).

b. *Prior to the commencement of any targeted exploration activities, establish a buffer zone of a minimum of 50 metres around any identified Sandhill Dunnart habitat and 100 metres around all confirmed habitat based on the results of the monitoring program in condition 4(a). No disturbance must occur within the buffer zones.*

GFXA has implemented the required 100 metre buffers around those Sandhill Dunnart habitats identified by GHD that are within the EPBC Referral Area using the internal GIS system.

2.5 Condition 5

Condition 5 reads:

The results of the inspections, targeted surveys and monitoring programs in conditions 2, 3 and 4 must be made available publically on the Tropicana JV website in accordance with condition 7.

Malleefowl Monitoring
Results of the inspection, monitoring program and targeted surveys for Malleefowl were submitted to the National Malleefowl Monitoring Database by 31 December 2014. The data will be loaded to: http://database.malleefowlvictoria.org.au/Start.aspx

Southern Marsupial Mole Monitoring
The results of the Southern Marsupial Mole survey have been analysed by Dr Joe Benshemesh and a report prepared. The key findings have been provided in Appendix D of this document for public benefit. Locational data of the survey sites has been excluded for confidentiality reasons.

Sandhill Dunnart Monitoring
Prior to undertaking any ground disturbing works, GFXA undertake an on-ground assessment for environmental values. The risk review is captured in an Environmental Inspection Notification (EIN). Since the 'commencement of the action' (19 February 2013), 24 EIN's have been undertaken within the EPBC Referral Area ahead of planned drilling programs.

During such EIN's, GFXA identified a total of 24 Sandhill Dunnart Habitats as 'Prime Habitat'. Accordingly, these were recorded in the Threatened Fauna GIS layers and effectively prevented work from occurring within these areas together with the required buffer. The current coverage of such 'exclusion zones' is approximately 379 hectares.

In addition to exclusion due to prime habitat, 21 of the EIN's undertaken resulted in the drilling program being adjusted to avoid 'potential habitat'. Such areas are notable through the iterative changes made to the relevant drilling programs.

Should in future, significant changes occur to prime habitats identified by AGAA, for instance due to fire causing such areas to no longer be 'prime habitat', works in excluded area may be considered subject to further on-ground inspection and verification of the change in habitat status.

Statutory Reporting
As per the CEMP and POW conditions, an Environmental Progress Report for the Groups 2 and 3 areas has been supplied to the Department of Mines and Petroleum, The Department of Environmental Regulation and the Commonwealth Department of the Environment.

2.6 Condition 6

Condition 6 reads:

The person taking action must, within 12 months of the commencement of the action, complete and submit to the Minister for approval a detailed Rehabilitation Plan for the progressive rehabilitation and revegetation of the project area.

This Rehabilitation Plan must include, at a minimum, the following information:

a. *the desired outcomes/objectives of implementing the plan;*
b. *details of the vegetation communities to be re-established and the timing of progressive rehabilitation;*
c. *criteria to determine success of re-establishment of vegetation communities;*
d. *a process to progressively report to the Department the rehabilitation management actions undertaken and the outcomes of those actions, and the mechanisms to be used to identify the need for improved management;*
e. *a description of the potential risks to successful management and rehabilitation on the project site, and a description of the contingency measures that would be implemented to mitigate these risks; and*
f. *details of parties responsible for reviewing and implementing the Plan.*

The approved Rehabilitation Plan must be implemented.

On 5 December 2014, GFXA received approval of the Rehabilitation Plan, from the Department of the Environment, in accordance with Condition 6. Rehabilitation will be undertaken using approved practices.

2.7 Condition 7

Condition 7 reads:

Within three months of every 12 months anniversary of the commencement of the action, the person taking the action must publish a report on their website addressing compliance with the conditions of this approval over the previous 12 months, including implementation of any management and monitoring programs as specified in the conditions. Non-compliance with any of the conditions of this approval must be reported to the Department at the same time as the compliance report is published.

This report serves to fulfil this condition.

Reference may be made to the EPBC Compliance Report 2013 available at:
http://www.tropicanajv.com.au/irm/content/document-library1.aspx?RID=406

Should further information be required please contact the GFXA's Environmental Management Team directly through explorationapprovals@anglogoldashanti.com.au

2.8 Condition 8

Condition 8 reads:

Upon the direction of the Minister, the person taking the action must ensure that an independent audit of compliance with the conditions of approval is conducted and a report submitted to the Minister. The independent auditor must be approved by the Minister prior to the commencement of the audit. Audit criteria must be agree to by the minister and the audit report must address the criteria to the satisfaction of the Minister.

Should such direction be issued by the Minister, GFXA will arrange an independent audit.

2.9 Condition 9

Condition 9 reads:

If the person talking the action wishes to carry out any activity otherwise than in accordance with the condition 7, the person taking the action must submit for the Minister's written approval a revised version of any such plan. The varied activity shall not commence until the Minister has approved the varied plan in writing. If the Minister approves such a revised plan, that plan must be implemented in place of the plan originally approved. Unless the Minister has approved the revised plan, then the person taking the action must continue to implement the plan originally approved.

Condition 9 is subject to condition 8 being undertaken by the Minister.

2.10 Condition 10

Condition 10 reads:

If the Minister believes that is necessary or convenient for the better protection of the listed threatened species and communities to do so, the Minister may request the person taking the action make specified revisions to the plans approved pursuant to these conditions and submit the revised plan for the Minister's written approval. The person taking the action must comply with any such request. The revised approved plan must be implemented. Unless the Minister has approved the revised plan then the person taking the action must continue to implement the plan originally approved.

Condition 10 is subject to condition 8 being undertaken by the Minister.

2.11 Condition 11

Condition 11 reads:

If, at any time after 5 years from the date of this approval, the person taking the action has not commenced the action, then the person taking the action must not substantially commence the action without the written agreement of the Minister.

Work formally commenced after approval was granted to the EPBC Condition Variation in February 2013, however should GFXA stop works within the area for 5 years, the Minister shall be informed before work re-commences.

2.12 Condition 12

Condition 12 reads:

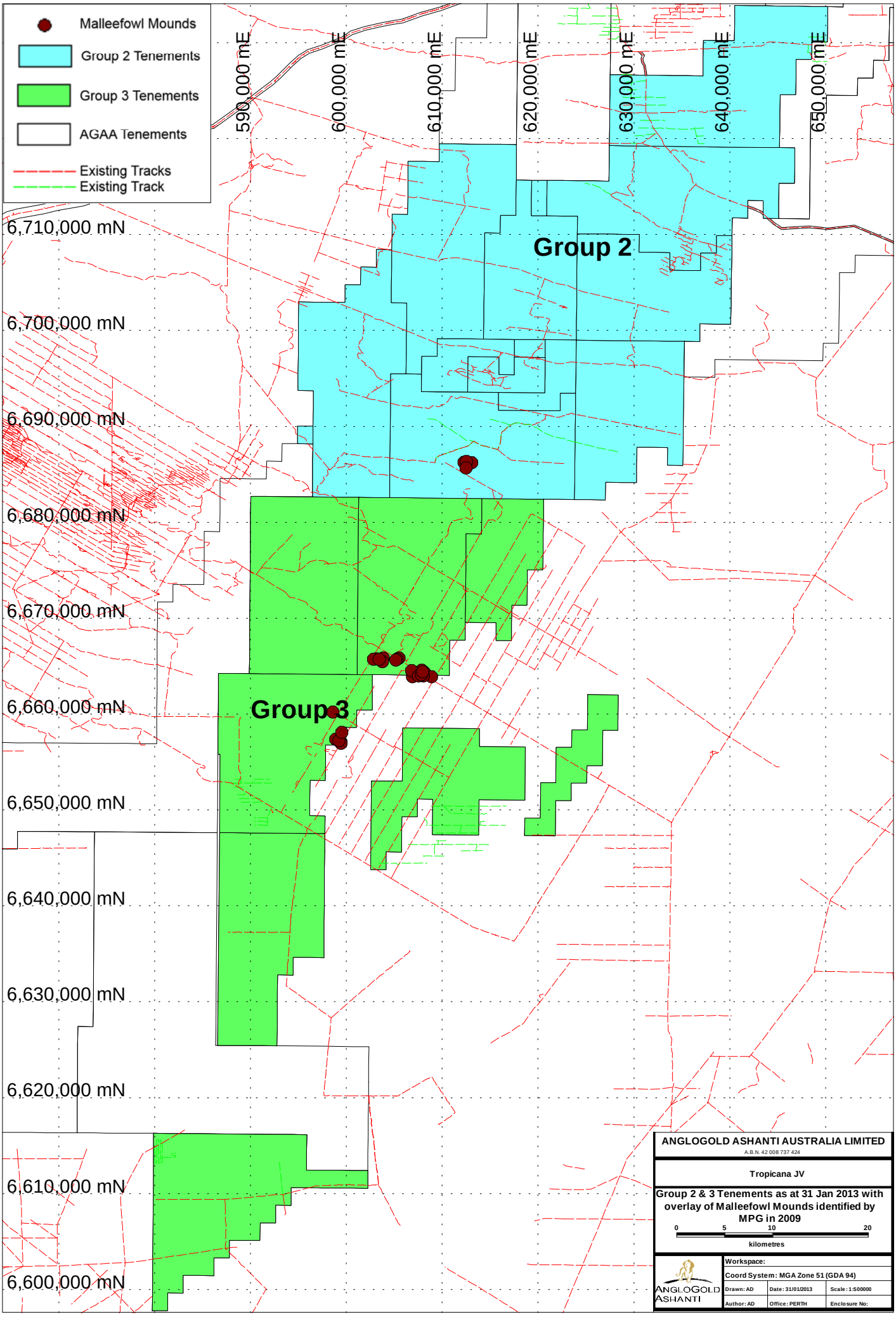
The person taking the action must maintain accurate records substantiating all activities associated with or relevant to the conditions of approval, including measures taken to implement the management plans required by this approval, and make them available upon request to the Department. Such records may be subject to audit by the Department or an independent auditor in accordance with section 458 of the EPBC Act, or used to verify compliance with the conditions of approval. Summaries of audits will be posted on the Department's website. The results of audits may also be publicised through the general media.

AGAA's internal GIS system and record keeping system was successfully audited in 2013 to maintain the companies ISO14001 standard. Should any records be required by the Department of the Environment, GFXA is able to provide them.

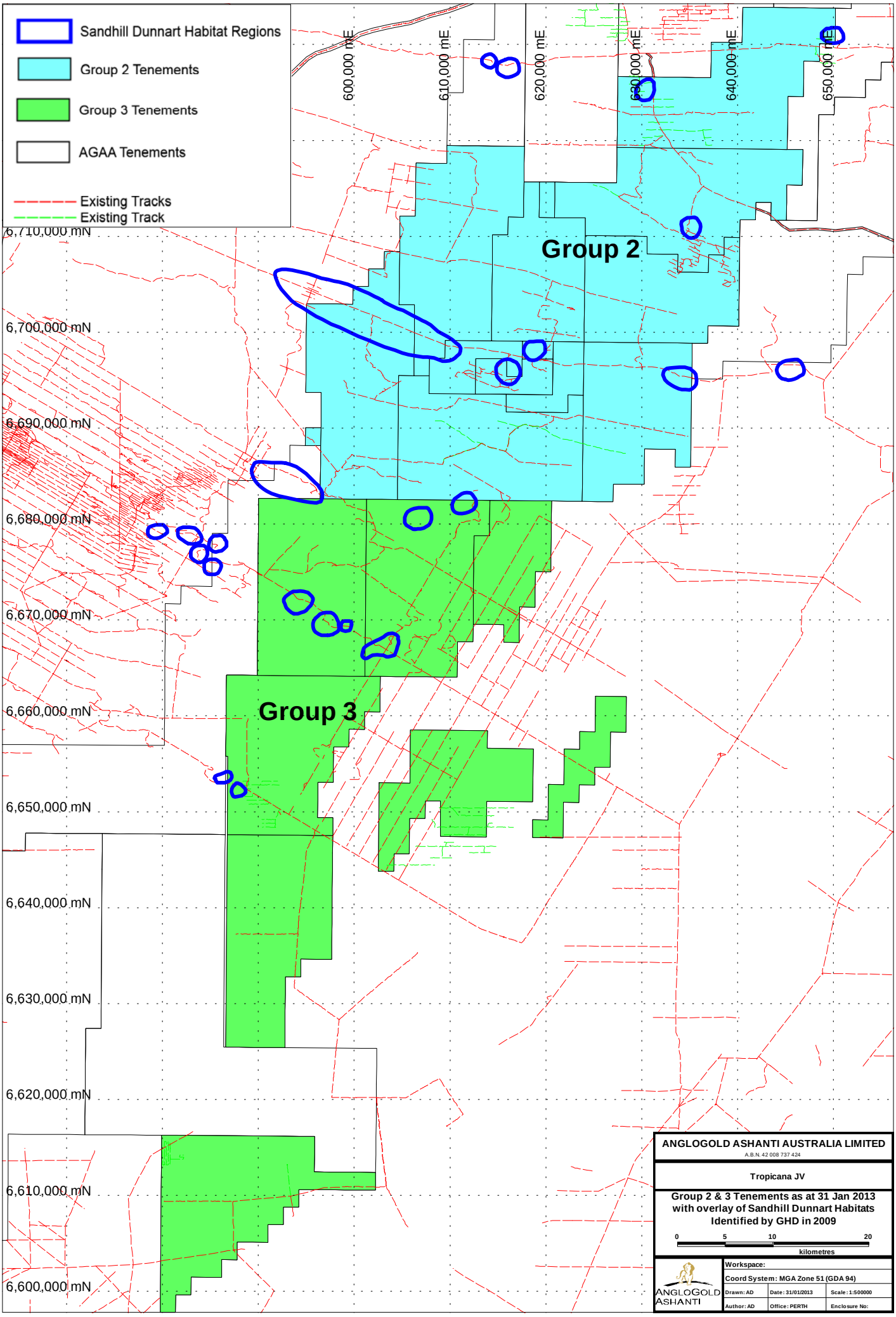
3 Conclusion

This report serves to provide an update on AGA GFXA's commitment to meeting the conditions outlined EPBC 2008/4463. As mentioned above environmental progress reports (EPR's) are supplied to the WA Department of Mines and Petroleum (DMP), the WA Department of Environmental Regulation (DER) and the DOE as per a condition of AngloGold Ashanti Australia's consolidated POW's and the Conservation and Environmental Management Plan for the EPBC Referral Area.

Appendix A - Attachment A.



Appendix B - Attachment B



Appendix C. Southern Marsupial Mole Monitoring Survey Internal Newsletter Article October 2014

ANGLOGOLDASHANTI AUSTRALIA

ANGLOGOLD ASHANTI AUSTRALIA

ONE to ONE

/ISSUE 09

/ OCTOBER 2014

In this edition

Rangers make it a survey first

A survey for the elusive Southern Marsupial Mole was undertaken at Tropicana in June. For the full coverage turn to page 4. Pictured above is AGAA Exploration Geologist Brendon Hardwick (left back), Indiigenous rangers Jarret Franks and Troy Hansen and Justin Graham, AusEx Environmental & Heritage Officer Alex Dent, Land Management Coordinator Liam Mulcahy, Great Victoria Desert Biodiversity Trust Coordinator Kathryn Sinclair, AGAA geological field technician Duncan Wells (front row left) and AGAA geotechnician Dylan Tucker.

Rangers make it a survey

In another first for AngloGold Ashanti Australia (AGAA), indigenous rangers have assisted in a baseline survey in the Great Victoria Desert (GVD) of Western Australia as part of a Southern Marsupial Mole Monitoring (SMM) Programme.

The programme was undertaken within Tropicana Joint Venture (TJV) exploration tenements located in the southwest corner of the GVD, 250 kilometres northeast of Kalgoorlie-Boulder.

The survey was conducted by the AGA Australia Exploration (AusEx) team to fulfil environmental commitments made for TJV exploration tenements (primarily Groups 2 and 3) under the Environmental Protection and Biodiversity Act 1999 (EPBC).

In September 2008, the area was referred to the Commonwealth Department of Environment (then DSEWPaC) on the basis of Listed Threatened Species, Ecological Communities and Listed Migratory Species. The commitments include specific requirements for the protection of Sandhill Dunnart, Mallee Fowl, Southern Marsupial Mole and their associated habitats.

The latest phase 2 programme, undertaken in June 2014, was successfully completed with the participation of three Spinifex Land Management Pila Nguru Aboriginal Corporation rangers with support from Coordinator Liam Mulcahy.

Alex Dent, AusEx Environment and Heritage Officer, organised and led the week-long event based out of a remote exploration camp.

The involvement of the indigenous rangers demonstrates AGAA's visible commitment to both its environmental and community values and in particular to the value: "The communities and societies in which we operate will be better off for AGA having been there and we respect the environment", Alex said.

"The Spinifex Native Title Determination is a very remote part of Australia and it is vital for the sustainability of our project that we develop opportunities and work with other stakeholders of the GVD," Mulcahy said.

"Spinifex Land Management is grateful for AngloGold Ashanti's invitation and their Australian Exploration team were a pleasure to work with."

In May 2012 Pila Nguru Corporation secured government funding, marking a significant step on the path to realising the Spinifex People's long-held aspiration to maintain traditional and customary management regimes over Spinifex Country – a 5.5 million hectare area of sand hills and sand plains, salt lakes and breakaways in the GVD.

The core aim of the Corporation's mission is to facilitate inter-generational transfer of cultural knowledge from older to younger generations, and to integrate that knowledge with western science and management techniques where appropriate.

By assisting the AGA team, the Ranger Team will gain the appropriate knowledge to conduct a Marsupial Mole Monitoring Programme within Spinifex Country. Limited data exists for this species within the region and Spinifex Land Management can now contribute to the data base.

The indigenous rangers will also gain knowledge of modern environmental management practices enhancing the opportunity for their employment in other industry programmes beyond AGAA.

The specific requirements associated with the EPBC conditions are unique and interesting. For instance, any exploration drilling in the EPBC referral area is required to be outside a 40m exclusion zone on sand dunes which may be SMM habitat.

Monitoring on the tenements, in conjunction with exploration activities, is designed to determine whether there are adverse effects on SMM populations, particularly from noise or vibration.

Marsupial moles are extremely enigmatic native mammals that inhabit the sandy deserts of central Australia and rarely venture to the surface. Occurring in remote areas,

first in search for elusive mole

Digging trenches was all in a day's work during the survey for Liam Mulcahy, Jarret Franks and Troy Hansen.

and with an elusive nature and extraordinary habits, SMM are one of the nation's most poorly known and intriguing animals. They are a mere 140 millimetres in length and weigh anywhere between 30 and 60 grams. There are two types of species that occur in the GVD – the Northern Marsupial Mole and the slightly larger Southern Marsupial Mole.

Environmental consultant Dr Joe Benshemesh, a world expert on the marsupial moles, was engaged by AGAA to provide advice on the number and location of the survey sites within the referral area and will also analyse the survey data before releasing the findings in a report to government.

The monitoring programme itself involved the digging and 'reading' of 200 trenches. A number of mole holes were detected and the data recorded such as the age, size and direction of the mole holes. According to Alex, ascertaining the age of the tunnels can be quite challenging due to the elusive nature of the creatures. While the species have been known to Aboriginal people for many thousands of years, and to scientists for over a century, there are no known techniques for capturing the individuals at will, apart from picking them up when they are encountered on the surface, an extremely rare and unpredictable event. Accordingly, survey and monitoring must rely on indirect observation of the animals' signs rather than direct capture or sightings.

Marsupial mole fragments in predator scats (fox, cat and dingo) have been used historically to confirm the presence of moles in some areas but because predators can travel many kilometres between ingesting and depositing mole remains in faeces, the technique has been found to have no application in monitoring mole abundance at specific locations. The most efficient means of surveying and monitoring is to count their underground signs (mole holes).

Marsupial moles use an unusual and sophisticated means of locomotion underground. Rather than hollow out tunnels as do virtually all other subterranean mammals or 'sand-swimming' through loose sand, SMM tunnel and backfill as they go, moving slowly but freely through the lightly bonded sand of the desert dunes. Studies into the degradation of mole holes have shown that about 50% disappear over a four to six year period. Visual estimates of their age and relative hardness are made using a penetrometer.

Continued on next page

...Rangers make it a survey first in search for elusive mole

Top: Time for a tea break. Liam Mulcahy (left), Duncan Wells, Jarret Franks, Troy Hansen, Justin Graham and Alex Dent
Middle: Duncan Wells and Dylan Tucker take five.
Bottom: Justin Graham and Duncan Wells.

From previous page

Mole holes that are filled with loose, flowing sand (fresh) have been created since the last soaking rain and provide a measure of recent activity. Once wetted, the loose sand becomes lightly cemented and mole holes that were previously categorised as 'fresh' would most likely be considered 'recent'. Fresh holes therefore become rarer after rains and are most common following dry conditions.

This technique has been applied beyond AGAA tenements in local and large scale surveys examining the distribution and abundance of marsupial moles across the continent, including the Great Victoria, Great Sandy, Little Sandy, Gibson, Pedirka, Simpson, Strzelecki and Tanami Deserts.

Data from previous trench surveys within the AGAA referral area, suggest there is about an 80% chance of detecting mole holes in a single trench. One trench may take 20 minutes to excavate and a similar time to read, equating to the creation of about one mole hole per five trenches each year or 15km of mole tunnel per hectare of dune crest/slope.

Trenches are excavated with their longest side facing north in order to maximise sunlight on their most southern side. The standard trench size reaches a length of 120cm, a width of 40cm and a depth of 80cm.

The objective is to expose a vertical north facing wall of about 100cm in length (top to bottom) to a depth of 70cm. Only the north facing wall is inspected for mole holes as this side is protected from shovel marks and other disturbance.

Previous research has already determined that underground signs are substantially higher on the main body of the dune (i.e. crests and slopes) than at the base of dunes or in inter-dune swales.

AGAA, in consultation with Dr Benshemesh, has conducted a number of SMM Surveys over the last few years, in areas where high, medium and low intensity exploration drilling has occurred. Analysis of this data to date shows little evidence of a deleterious effect on SMM populations as a result of drilling.

AGAA has proudly contributed substantially to the knowledge base of the SMM, which can be utilised for long-term evaluation of their population nationally.

This year it was a pleasure to include the Pila Nguru Aboriginal Corporation Rangers who are now equipped to undertake further survey work where opportunities arise to assess the habitat of these unique creatures.

Tropicana Joint Venture

AUSTRALIA GREENFIELDS EXPLORATION EPBC REFERRAL AREA
SOUTHERN MARSUPIAL MOLE BENCHMARK SURVEY REPORTS 2015

DOCUMENT NUMBER: ENV-8.1-REP-GFXA-Groups 2 and 3 SMM Benchmark Survey Reports 2015

Rev	Status Description	Date	Prepared by	Approved by
1	SMM Benchmark Survey Reports	30th January 2015	Alexandra Dent	TVanderStap

Introduction

Project Name: Tropicana Joint Venture

Exploration Tenements: EPBC Referral Area
(Primarily Groups 2&3 Exploration tenements)

Tenement Holder: AngloGold Ashanti Australia Ltd/Independence Group NL

EPBC Referral No: 2008/4463 and Approval
Exploration activities predominantly within the Groups 2 and 3 area were referred to the Federal Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC now Department of the Environment DoE) in September 2008 as it was identified that the activities may significantly impact two matters of national environmental significance as listed in the Federal *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), these being; Listed Threatened Species and Ecological Communities and Listed Migratory Species. DSEWPaC determined the proposed activities to be a "Controlled Action" requiring Federal assessment via an instrument to be determined at a later date and depending on the status of the proposed activities under State Legislation.

In February 2010 the proposed activities were referred to the State Environmental Protection Authority (EPA) under Section 38 of the *Environmental Protection Act 1986* to enable a level of assessment to be determined. The EPA set a level of assessment of "Not Assessed – Public Advice Given" with the recommendation that a Conservation and Environmental Management Plan (CEMP) be developed in consultation with then Western Australian Department of Environment and Conservation (DEC now split into Department of Environmental Regulation DER and Department of Parks and Wildlife (DPaW).

A CEMP was prepared for the proposed exploration activities in consultation with the DEC Environmental Management Branch. The plan identified the existing environmental values, potential impacts from the proposed exploration activities and the management and mitigation of those potential impacts. The CEMP, dated 17 December 2010, was approved by the WA Department of Environment and Conservation (DEC) and DSEWPaC in January 2011. On the 27th of October 2011 approval was granted to AngloGold Ashanti Australia (AGAA) to begin exploration activities within the EPBC referral area subject to a number of conditions.

AGAA formally communicated the start of works in the area on the 10th of April 2012, however DSEWPaC informed the company of its requirements to have in place an approved Southern Marsupial Mole Monitoring Program. This led to a request for variations of the EPBC conditions, which were approved, together with the Monitoring Program, on 19 February 2013.

The planning of the drilling programs for the EPBC Referral area commenced thereafter, making 19 February 2013 the 'commencement of the action' under the EPBC conditions.

EPBC Act Compliance Condition 3

This report refers to the implementation and completion of a Southern Marsupial Mole (SMM) Benchmark Survey in Tropicana Group 2/3 as described in the approved SMM monitoring program (section 5.3). The submission and implementation of the approved SMM monitoring program is stated in EPBC Condition 3 and reads:

a. *By the end of October 2012, submit a SMM monitoring program to the Minister for approval. The program must include details of a progressive monitoring strategy to monitor the potential impacts from exploration drilling on prime SMM habitat and evidence of the SMM population, and details of targeted surveys within suitable SMM habitat areas adjacent to the proposed exploration program;*

The Southern Marsupial Mole Monitoring Program was developed in liaison with Dr Joe Benshemesh and submitted to DoE for approval on 14 December 2012. The program was approved by DoE on 19 February 2013.

In the interim, as a result of discussions with DoE, AGAA Greenfields Exploration (GFXA), in liaison with Tropicana Gold Mine (TGM) Sustainability, undertook a survey for SMM in the TGM area which is bounded by the mining lease. The survey was undertaken under the guidance, training and instruction of Dr Joe Benshmesh. The analysis and findings provided background information for the SMM monitoring program developed by GFXA for the EPBC Referral Area (primarily Groups 2 and 3 tenements). The report on the survey completed at TGM was written by Dr Benshemesh on behalf of GFXA, and submitted to DoE in June 2013.

In May 2013, GFXA completed the Southern Marsupial Mole (Notoryctes Typhlops) Benchmark Survey Plan for Tropicana Groups 2 and 3. The plan was developed in liaison between the GFXA Environmental Management Team and Dr Joe Benshemesh.

The proposed scope was for:

- The surveying of 200 trenches within two years of the approval of the SMM Monitoring Program ie by February 2015.
- Surveying in two phases split over 2013 and 2014 with equivalent number of trenches, subject to suitable weather conditions, logistics and personnel availability.

b. *The approved SMM Monitoring Program must be implemented,*

The Southern Marsupial Mole Monitoring Program was implemented in 2013 and 2014, as described in 3c. The Program stipulates that a baseline survey of 200 monitoring trenches must be completed within 2 years.

.

Summary

AGAA's Greenfields Exploration environmental team completed the fieldwork and collected data for the benchmark Survey over two years. The first stage of the survey was undertaken in November 2013 and the second stage in June 2014 in consultation with Dr Joe Benshemesh who was commissioned to collate and analyse the data.

In conclusion, the survey was undertaken in accordance with the EPBC referral commitments, completed to a high standard and will provide an invaluable reference for determining trends in marsupial mole populations in the future.

Attached are the two reports that provide the background information, participants, methodology, maps, data, results and analysis of the two year benchmark survey.

Attachment I
Southern Marsupial Mole Benchmark Survey 2013 and 2014. Compiled Field Work and Data.
Anglogold Ashanti Australia October 2014

Attachment II
Establishment of monitoring benchmark for Southern Marsupial Moles
Dr Joe Benshemesh, January 2015.

Southern Marsupial Mole Benchmark Survey 2013 and 2014 Compiled Field Work and Data

October 2014

Background Information

This study is in compliance with the approved Southern Marsupial Mole (SMM) Monitoring Program January 2013 (SMMMP). Condition 3(d) in the 'Variation to Conditions' for approval under the *Environmental Protection and Biodiversity Conservation ACT 1999* (EPBC Act) to undertake exploration activities mainly within AGAA's Tropicana Joint Venture (TJV) Group 2 and 3 Tenements (EPBC No2008/4463) states that the SMMMP must be implemented. Section 5.3 of the SMMMP outlines the commitment to undertake a Benchmark Survey at Tropicana Group 2/3 for the benefit of marsupial mole conservation.

This monitoring program will provide benchmark data on the abundance of SMM within the TJV Group 2 & 3 tenements selected sites. It also provides a rare opportunity to test effects of exploration drilling on the marsupial mole behaviours through before and after AGAA exploration activities statistical data comparisons.

The Southern Marsupial Mole (*Notoryctes typhlops*) is listed as endangered under the Australian Government's *EPBC Act 1999*. However due to its cryptic nature and overall lack in data for the distribution, abundance, and ecological habits, an accurate conservation status has been virtually impossible (Maxwell et al. 1996). The collection of benchmark data is important in the monitoring of the species and may eventually lead to a more accurate classification of the species conservation status (Wayne *et al.* 2013).

Tropicana Group 2 stretches 30-90km, and Tropicana Group 3 continues 90-180km, SSW of the Tropicana Gold Mine in the Great Victorian Desert, GVD1 Bioregion (Figure 1). Six areas were sampled within Group 2 and 3 exploration tenements (Figure 2). Areas 1 to 3 were sampled in 2013 (Total of 97 trenches) and areas 4 to 6 were sampled in 2014 (Total of 100 trenches). All are considered prime SMM habitat (the dune slopes) but vary in dune height length and interconnectivity. Trench sites were selected randomly along the slopes of dunes. The dunes themselves were selected to be within proximity to pre-existing tracks so to minimize environmental damage during the survey and in areas where exploration is likely to occur.

Location, Climate and Landscape

The EPBC Referral area lies approximately 220 km southeast of Laverton and 330 km northeast of Kalgoorlie on the western edge of the Great Victoria Desert as shown in Figure 1. The Plumridge Lakes Nature Reserve lies immediately to the northeast of the exploration area and the Queen Victoria Springs Nature Reserves lies to the southwest.

The EPBC Referral area is primarily situated within the Great Victoria Desert bioregion (GVD1) with the northern section entering the Central Subregion (GVD2) and the southern tip within the Coolgardie Eastern Goldfields bioregion. As such its climate can be described as arid, with hot summers and cool winters and an average rainfall of 200-300 mm annually. The area's landforms consist of salt lakes, lake derived dunes, Aeolian sand dunes and sand plains, and redder soils occasionally with out-cropping rocks.

The Priority Ecological Community (PEC) known as the *"Yellow Sandplain Communities of the Great Victoria Desert"* can also be found along the western edges of the Group 2 and 3 area. This PEC is described as;
Spinifex (Triodia spp) and mallee (Eucalyptus kingsmilli, E. youngiana) with scattered marble gum (E.gongylocarpa) and native desert pines (Callitris spp) cover the sandy areas, while Mulga and Acacia woodlands occur through the red soils and outcrop areas. The salt lakes are dominated with salt bush (Atriplex spp), bluebush (Kochia spp.) and pearl bush (Maireaina spp.).

Tjuntjuntjara participation
Three Spinifex Land Management Pila Nguru Aboriginal Corporation rangers from the Tjuntjuntjara community assisted in the SMM benchmark survey in 2014, with support from the Land Management Corporate Coordinator.

The involvement of the indigenous rangers contributed to their knowledge of modern environmental management practices and provided opportunities for their employment in other industry programmes beyond AGAA. The rangers helped the exploration team to dig the trenches, survey the trenches for evidence of mole holes, collect data and remediate the trenches.

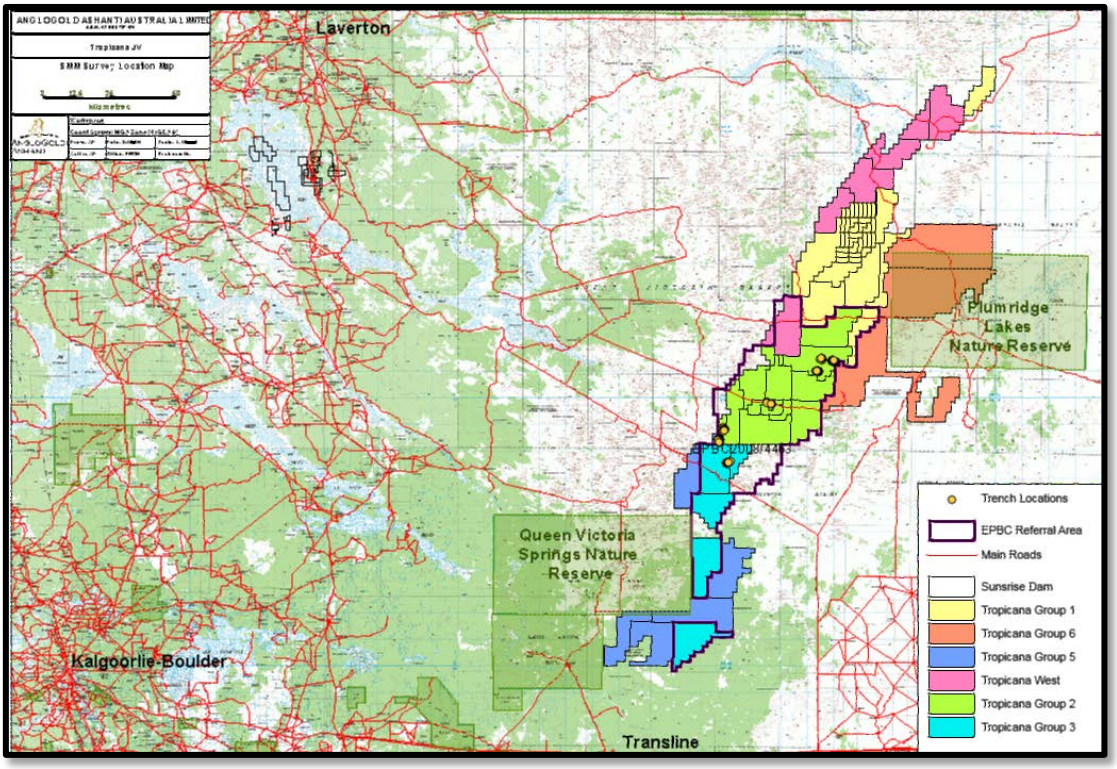


Figure 1 AGAA Tenements Location Map

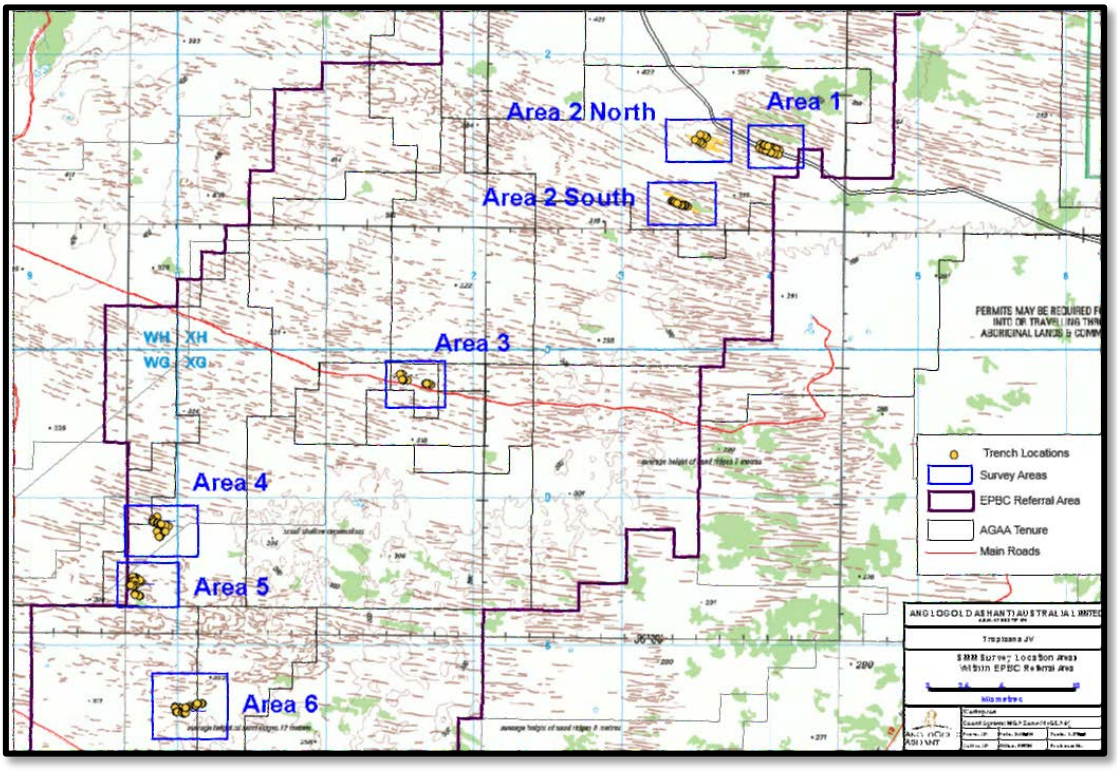


Figure 2 SMM Sample Areas Map

Method

Trenches are dug into the northern side of sand dunes (to maximise drying by sunlight), approximately mid slope, within 20 m of the dune crest and at least three metres from trunks of shrubs and trees to minimise environmental damage and the presence of large roots within the trenches (Figure 3).

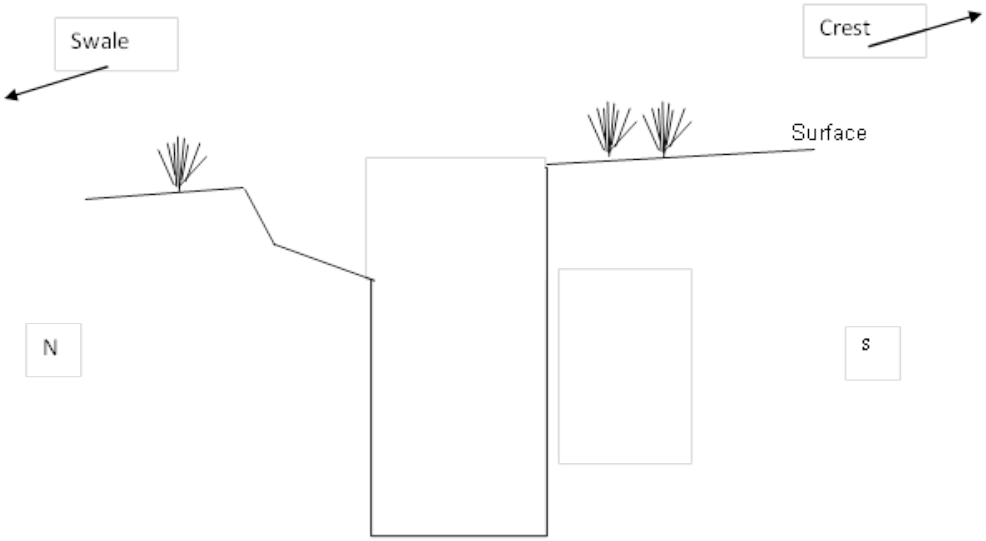


Figure 3: Cross-section of trench structure. The step in the northern wall increases sunlight onto the north-facing, southern wall of the trench which is the only wall inspected for moleholes.

Trench excavation and preparation

Each area had between 7 to 14 sites and at each site Three trenches were dug approximately 20m apart. Trench sizes ranged between 1.2m and 1.4m in length and between 0.6 - 0.8m deep. Branches were placed in each trench and arranged as an escape route for any animals that fall into the trench (eg. native mice, lizards). The trenches were backfilled immediately after the data was collected.

Trench orientation was east/west so the "reading" wall was facing north. Trenches remained open for 3 days to ensure the "reading" wall was completely dry before being inspected. In preparation, the north facing wall was made flat and smooth and as vertical as possible. Loose, dry sand was thrown onto the wall to reveal any signs of moleholes.

Trench inspection.

Trench inspections occurred approximately 3 days after the trenches were dug, to give the reading face time to dry. Each trench was inspected for between 15 to 20 minutes to ensure all moleholes were detected. Data was collected on a record sheet and included:

- Trench length and width
- Penetrometer readings were recorded at 10cm /20cm/50cm, three readings per depth. (Kr/sq cm)
- For each Molehole:
    - Depth and distance from left side of trench
    - Penetrometer in / Penetrometer out
    - Clarity (0-3) and Confidence (0-3)
    - Age (Fresh/recent/oldish/old/very old)
    - Diameter of hole
    - Angle of the hole

Table 1 shows the dates the trench sites were surveyed as well as the number of Trenches in each Area.

Site	Survey Dates	Site No.	Total No. of Trenches per Area
Area 1	15/11/2013	Site 1 - 12	36
Area 2	16/11/2013	Site 1 -14	42
Area3	5/12/2013	Site 1 - 5	13
	4/12/2013	Site 6 -7	6
Area 4	27/06/2014	Site 1 - 6	18
	26/06/2014	Site 7 - 11	15
Area 5	27/06/2014	Site 1 -4	12
	28/06/2014	Site 5 - 12	24
Area 6	26/06/2014	Site 1	1
	28/06/2014	Site 5 - 7	9
	29/06/2014	Site 1 - 4 & 8 - 10	21
		Total No. of Trenches	**197**

Area 1-6 Maps, Figures 4 to 10

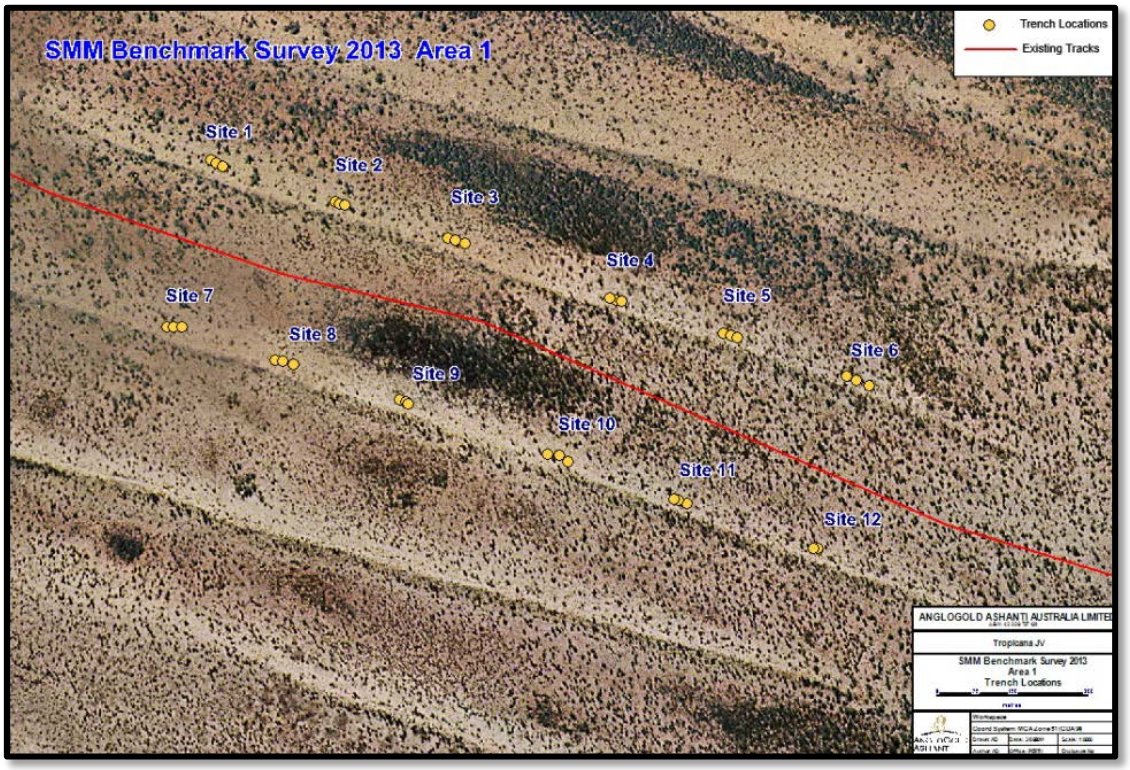


Figure 4 Survey Area 1 2013 with Aerial Photo

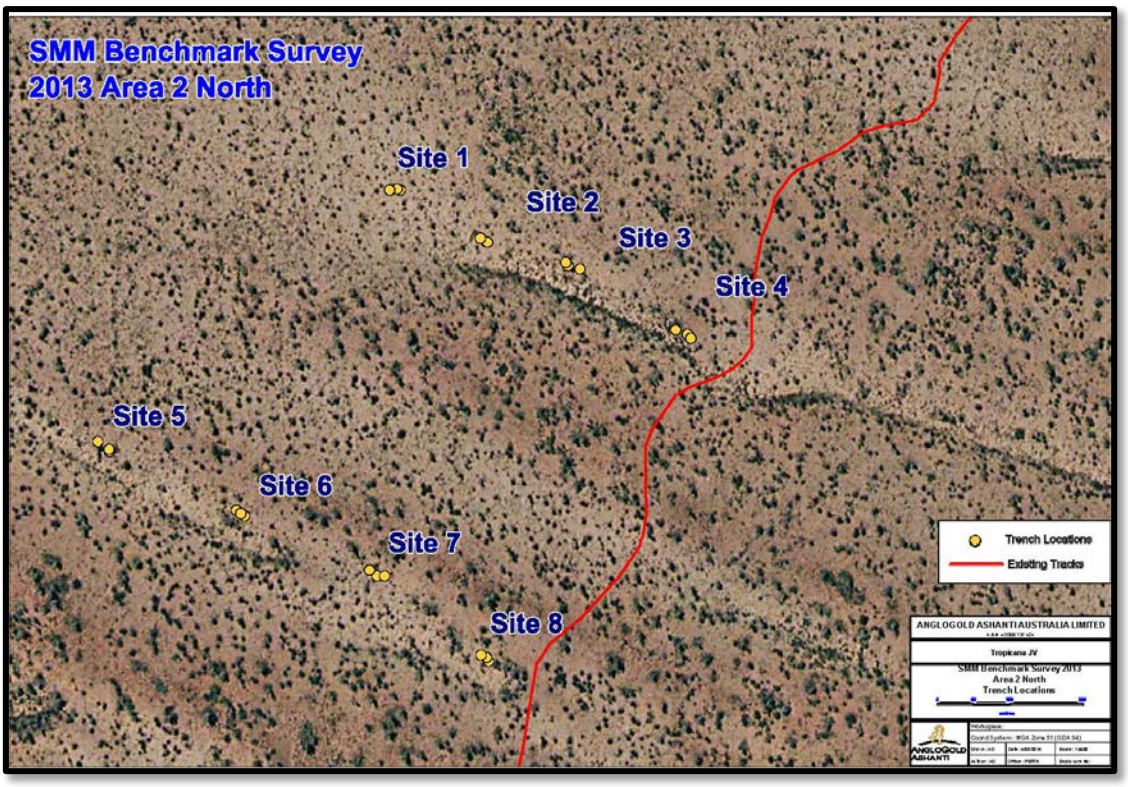


Figure 5 Survey Area 2 North 2013 with Aerial Photo

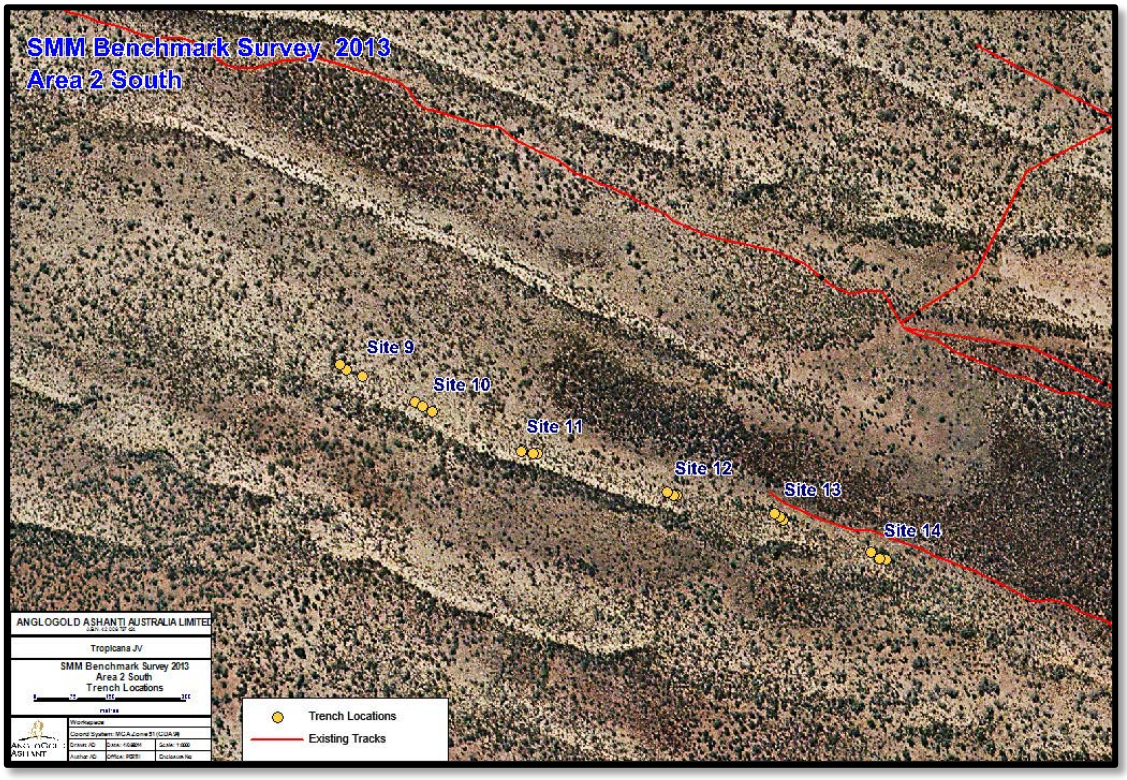


Figure 6 Survey Area 2 South 2013 with Aerial Photo

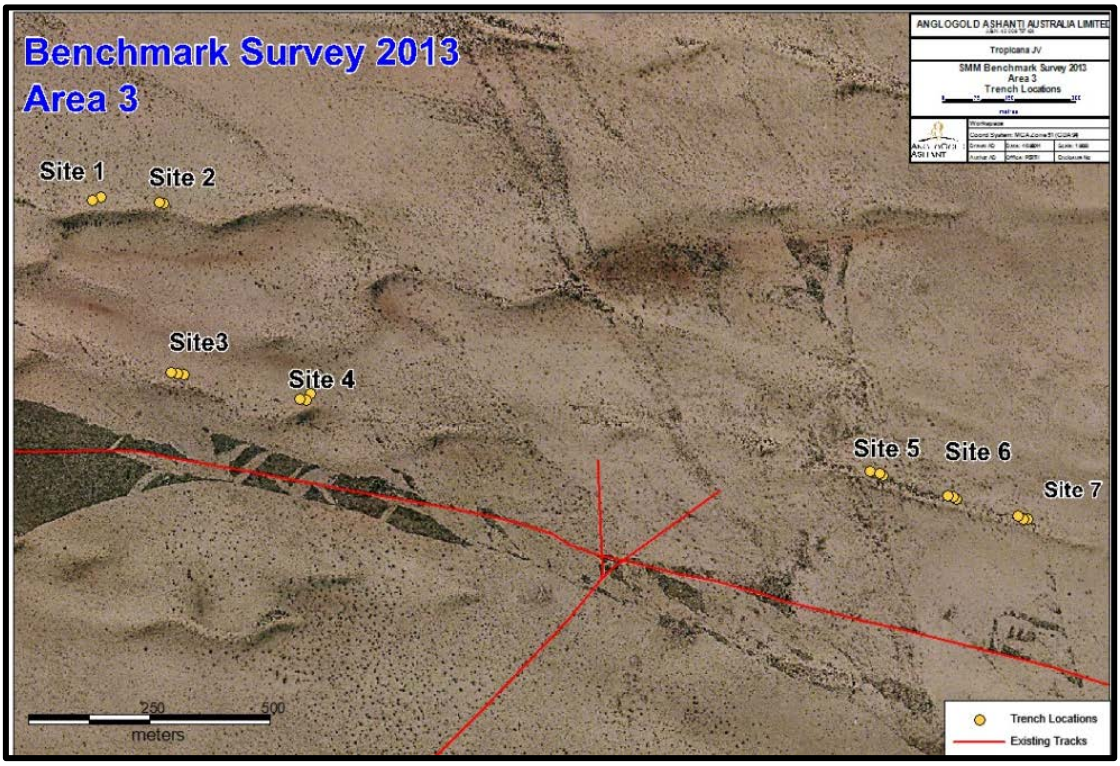


Figure 7 Survey Area 3 2013

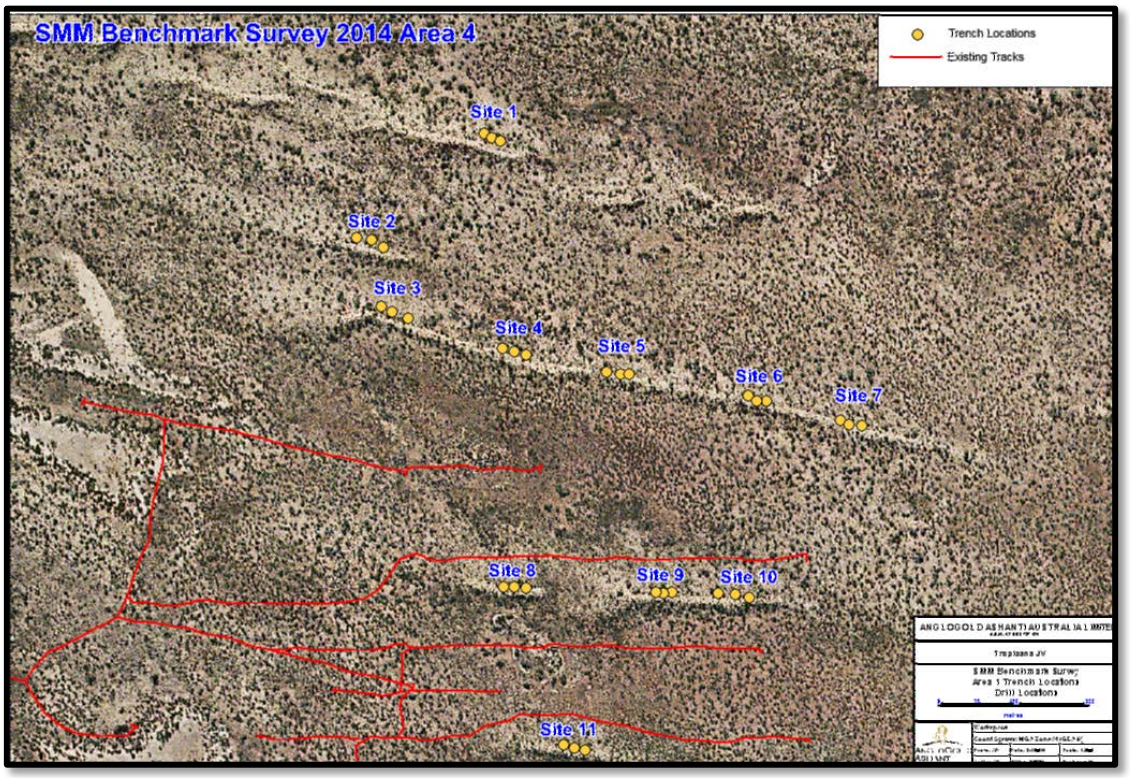


Figure 8 Survey Area 4 2014

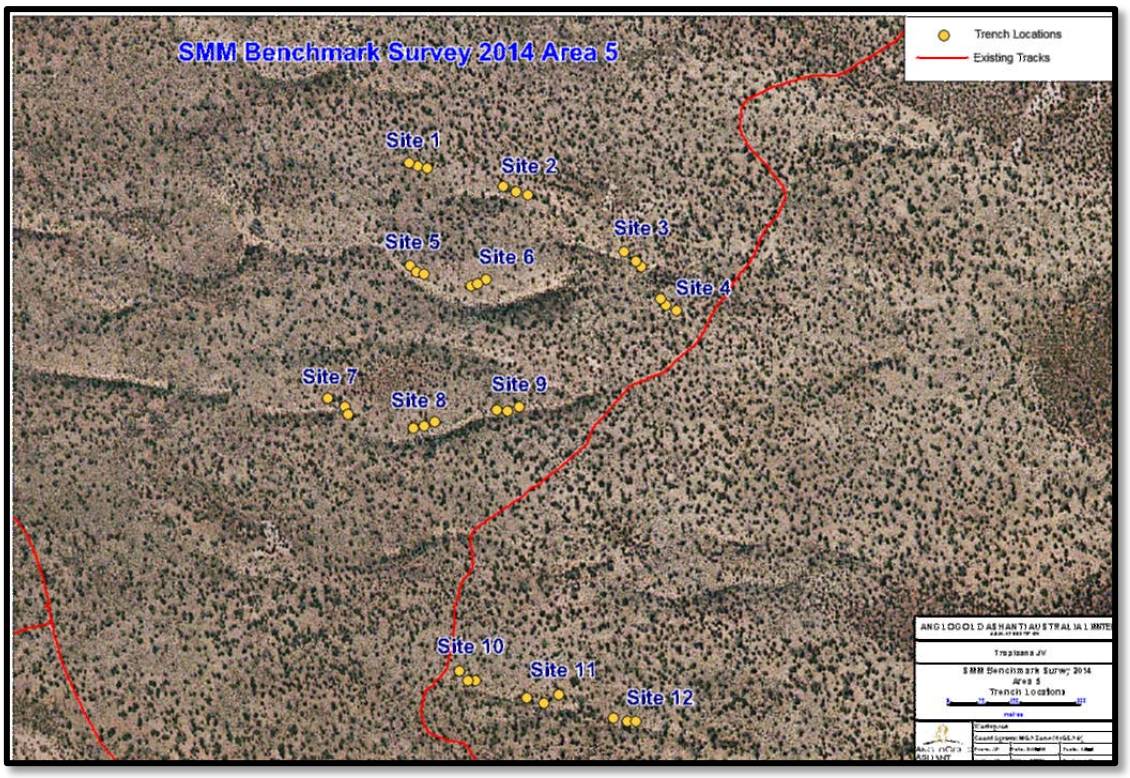


Figure 9 Survey Area 5 2014

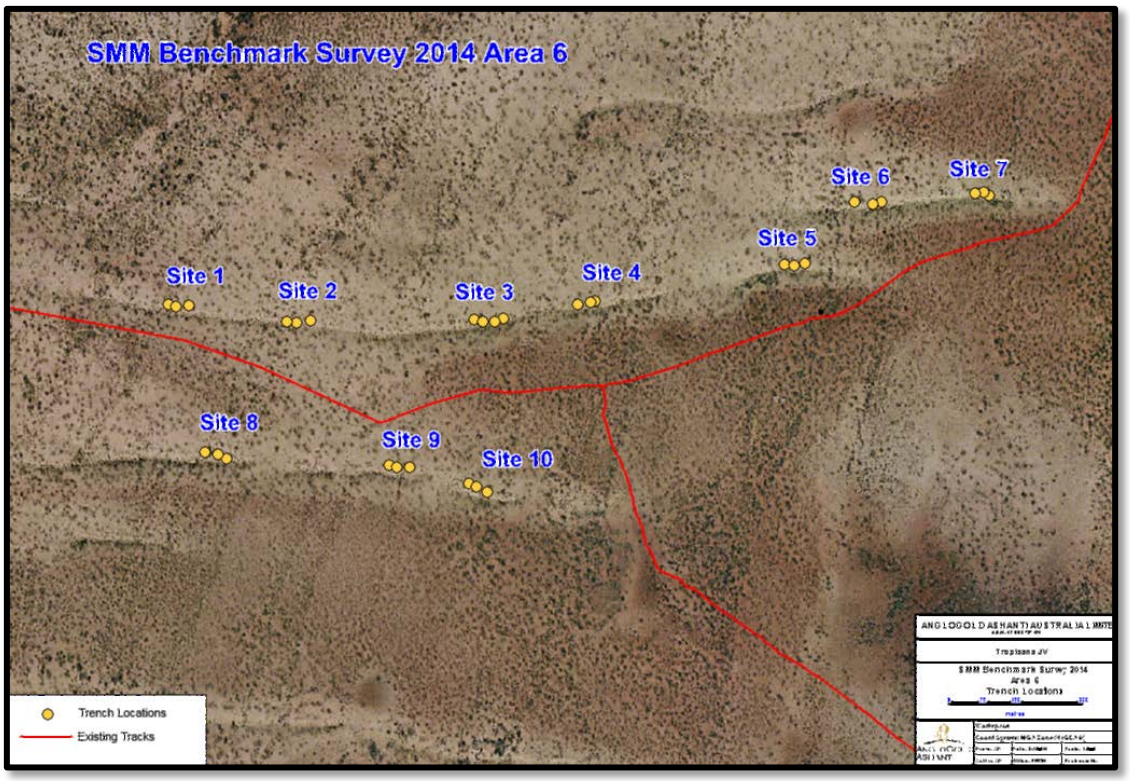


Figure 10 Survey Area 6 2014

Sand Dune Description
All the sites in this benchmark survey for MMS 2013-2014 were conducted on undulating yellow sand dunes typical to the AGAA group 2/3 tenement area. The vegetation consisted of *Callitris sp*, and mixed shrubland with an understorey of *Trioda sp.*, acacia shrubs, and the open woodland of *Eucalyptus gongylocarpa*).

Results_DATA
All Complete data sheets have been combined into 1 excel folder:

- Benchmark Survey 2013 Combined Data
- Benchmark Survey 2014 Combined Data

Weather Data
Below is the Tropicana rainfall data for the months before and during the surveys and for the last 3 years prior to the survey.

Daily temperatures were between 15 and 25C^{o}.

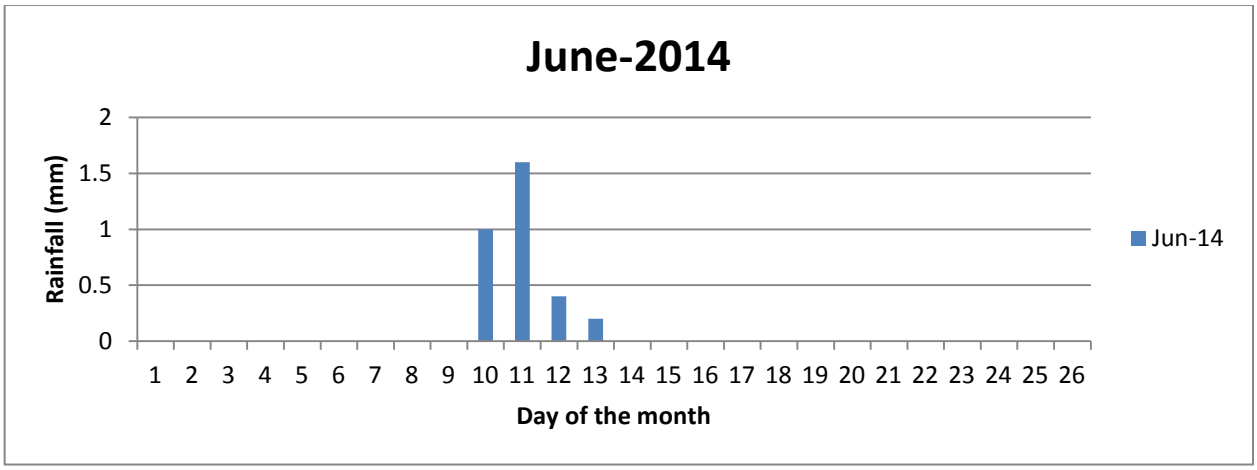


Figure 11 Rainfall Data June 2014

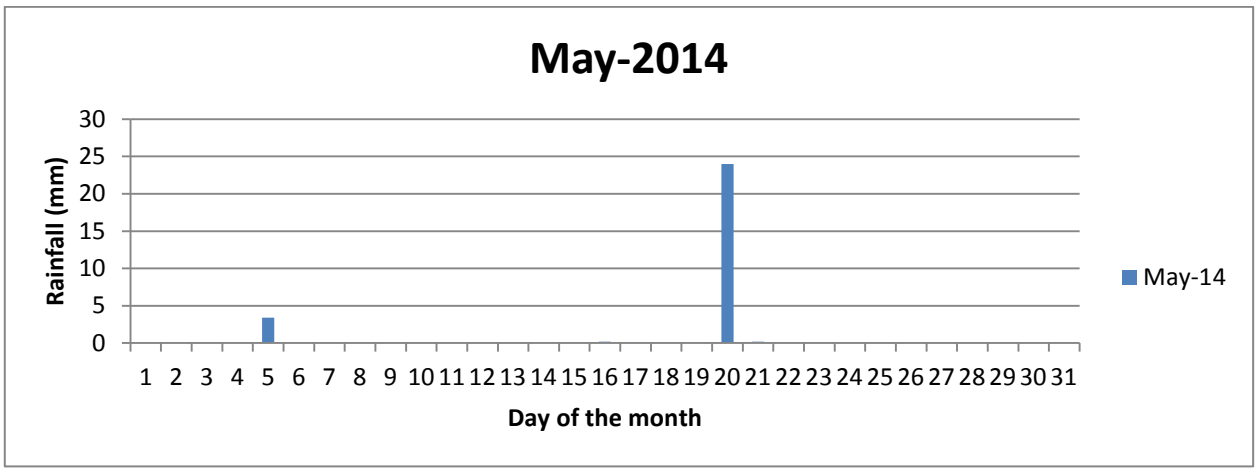


Figure 12 Rainfall Data May 2014

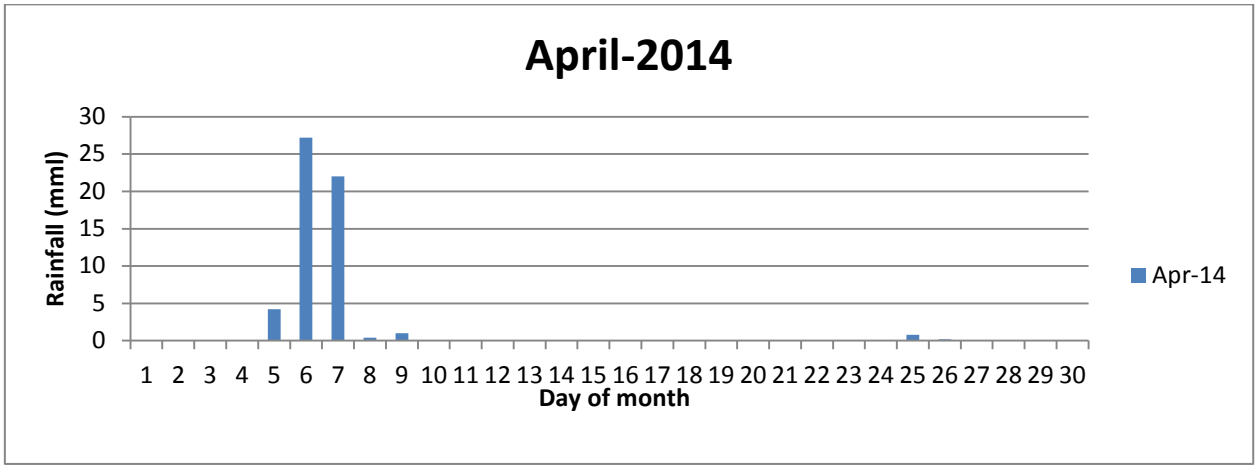


Figure 13 Rainfall Data April 2014

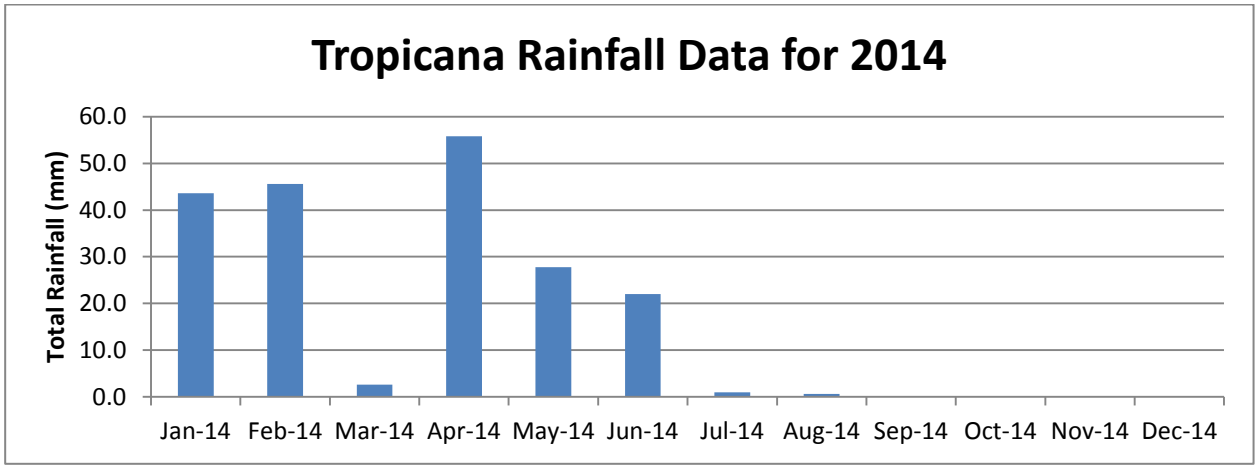


Figure 14 Rainfall Data for 2014

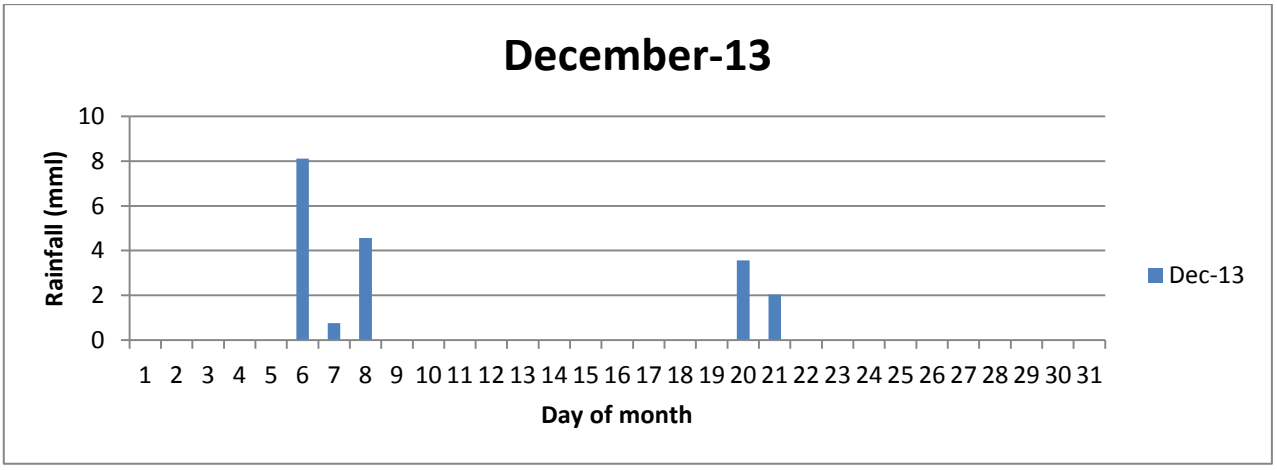


Figure 15 Rainfall Data December 2013

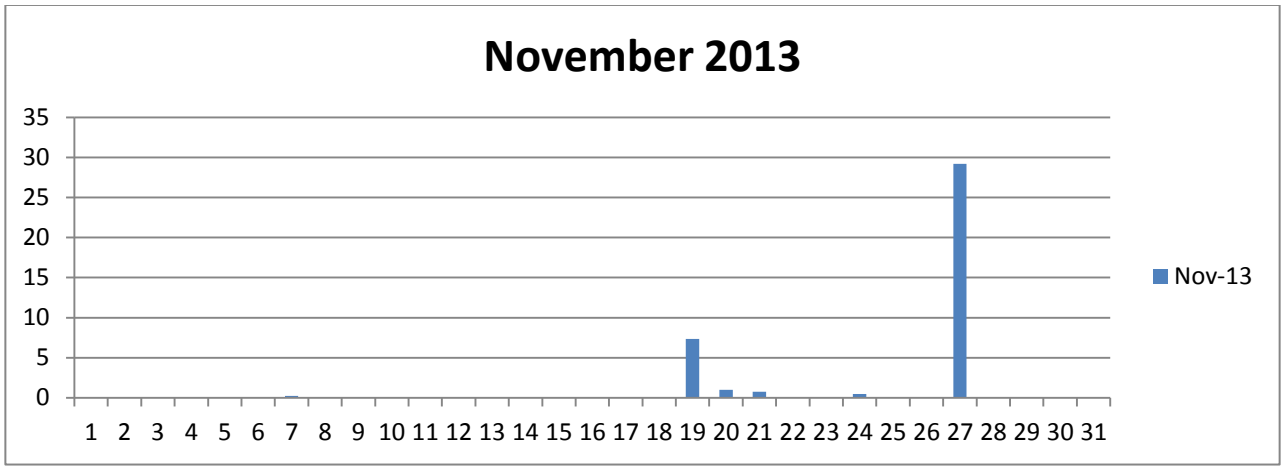


Figure 16 Rainfall Data November 2013

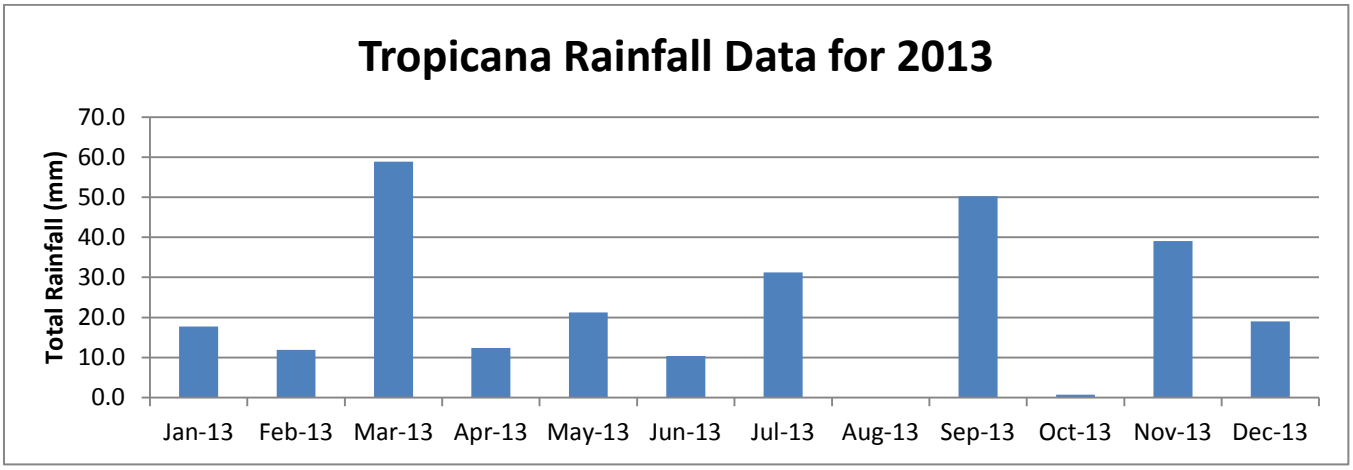


Figure 17 Rainfall Data for 2013

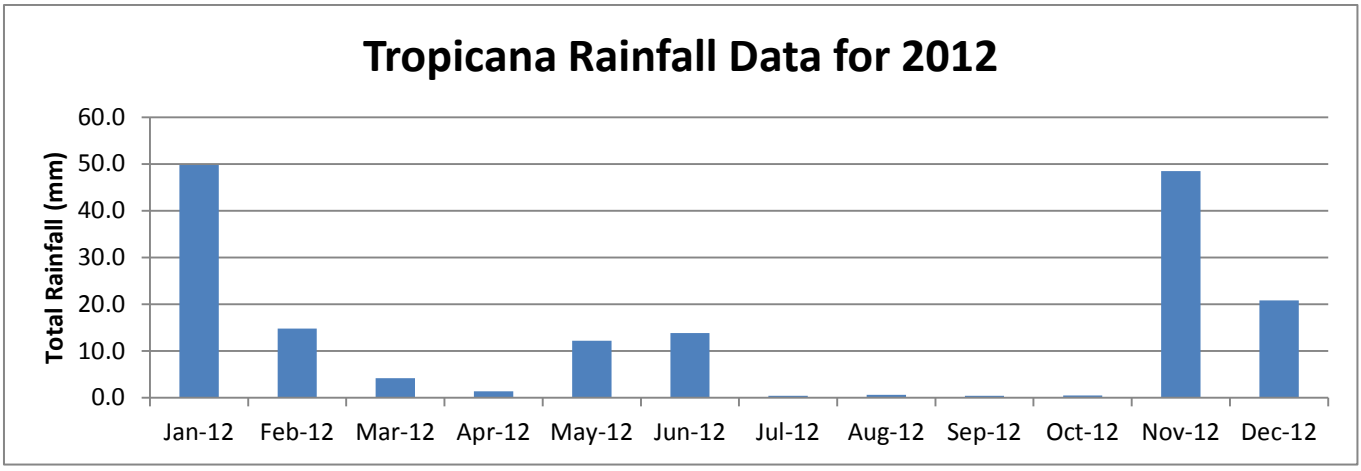


Figure 18 Rainfall Data for 2012

Table 2 Total Rainfall 2014 so far.

	Jan-12	Feb-12	Mar-12	Apr-12	May-12	Jun-12	Jul-12	Aug-12	total
Total Rain	40973.8	40996.2	41018.0	41005.0	41032.2	41061.0	41091.0	41122.0	199.03
Total Rain	6	6	8	6	4	3	3	3	33

Table 3 Total Rainfall 2013

	Jan-12	Feb-12	Mar-12	Apr-12	May-12	Jun-12	Jul-12	Aug-12	Sep-12	Oct-12	Nov-12	Dec-12	Total
Total Rai	17.76	11.9	58.89	12.4	21.28	10.35	31.24	0	50.22	0.75	39.06	19.02	272.87
Total Rai	4	4	6	3	5	7	5	0	10	2	6	5	57

Table 4 Total Rainfall 2012

	Jan-12	Feb-12	Mar-12	Apr-12	May-12	Jun-12	Jul-12	Aug-12	Sep-12	Oct-12	Nov-12	Dec-12	Total
Total Rainfall	49.8	14.8	4.2	1.4	12.2	13.8	0.4	0.6	0.4	0.5	48.5	20.8	167.42
Total Raindays	11	6	4	1	5	9	2	2	2	1	7	5	55

Molehole Density

The average size and molehole density at the three survey sites are shown in Table 1. Across all six areas, the average molehole density was 1.3 moleholes per vertical meter square (n=119 se=0.16).

Table 5 Trench area Moleholes, and the density of moleholes (mh/m^2)

Area_ dune	Trenches	Trench Length (mm)	Trench depth (mm)	Trench Area (m^2)	Mole-holes	MHD (mh/m^2)
Area 1	36	1332	796	38.2	62	1.6
Area 2	42	1284	808	43.5	57	1.3
Area 3	19	945	668	12.0	20	1.6
Area 4	33	1250	779	32.1	22	0.7
Area 5	36	1274	814	37.4	50	1.3
Area 6	31	1257	772	30.1	47	1.6
Total	197			193.3	258	1.3

List of references

Wayne A. F., Maxwell M. A. Ward C.G., Vellios C. V., Ward B.G., Liddelow G. L., Wilson I., Wayne J. C. & Williams M. R. (2013) Importance of getting the numbers right: quantifying the rapid and substantial decline of an abundant marsupial, Bettongia penicillata. Wildlife Research 40, 169–183

Maxwell, S, Burbidge A. A, and K. D. Morris. (1996). The 1996 action plan for Australian marsupials and monotremes. IUCN/SSC Australasian Marsupial and Monotreme Specialist Group, Wildlife Australia Endangered Species Program

Establishment of monitoring benchmark for Southern Marsupial Moles

Report to AngloGold Ashanti Australia

Joe Benshemesh

January 2015

Introduction

Marsupial moles are amongst the most enigmatic and elusive animals in the world. They have no eyes, spade-like forelimbs, a silky pale fur and live underground in the dunefields of central Australia (Benshemesh & Johnson 2003, Johnson & Walton 1989). There are two recognised species, the Kakarratul or Northern Marsupial Mole (*Notoryctes caurinus*) which occurs in the north-west of Western Australia through the Great Sandy and Little Sandy Deserts (GSD and LSD), and Itjaritjari or the Southern Marsupial Mole (*N. typhlops*) which occurs in the southern dunefields of WA primarily in the Great Victoria Desert (Benshemesh 2004). Itjaritjari also occurs in the dunefields of the South Australia and the Northern Territory, and the two species are likely to be in contact in the central GSD although precisely where is not known. Both species are very similar in appearance, and both are listed as Endangered under the Australian Government's Environment Protection and Biodiversity Conservation Act 1999, and in WA as 'Fauna that is rare or is likely to become extinct' under Schedule 1 of the Wildlife Conservation (Specially Protected Fauna Notice 2012). However, the actual conservation status of the two species is unclear and they may be more secure than previously supposed (Benshemesh 2004, Benshemesh 2008, Benshemesh & Aplin 2008, WoinarskiBurbidge & Harrison 2014).

Given the uncertain conservation status of marsupial moles, establishing a means of monitoring the species is essential. Techniques for monitoring have been developed that rely on the traces left behind by marsupial moles when they tunnel (Benshemesh 2014, Benshemesh 2005), and these methods have been taught to AGAA (AngloGold Ashanti Australia) personnel (Benshemesh 2012b). AGAA have subsequently employed these techniques to examine the effects of intense drilling on Itjaritjari (Benshemesh 2013) in an area known as Group 1 that contains the Tropicana minesite.

This study was undertaken in accordance with commitments made by AGAA regarding monitoring the effects of exploration activities on marsupial moles (Benshemesh 2012a) and discussions held in August 2012 between AGAA, DSEWPaC, and myself in regard to optimising the monitoring program of marsupial moles in exploration tenements. Part of these commitments involved the establishment of benchmark monitoring sites in Group 2/3 sites in which exploration was taking place.

The purpose of the current report is to provide an overview and assessment of the benchmarks established by AGAA. The aim of these was to provide a reliable snapshot of the current population condition as a reference for future studies and monitoring programs. As there are no immediate plans to undertake ongoing monitoring, in this report I focus on a description of key variables that may be important for monitoring should it be implemented in the future.

Methods

Appendix I provides details of the study site, locations and data collected. The Group 2/3 tenements are located about 350 kilometres north-east of Kalgoorlie in the Great Victoria Desert (GVD; Figure 1). The region is characterised by sand-ridge desert with extensive dune fields of deep Quaternary aeolian sands and sandplains of sandy to loamy earths overlying Permian strata of the Gunbarrel Basin.

Benchmark monitoring sites were selected to sample molehole abundance and attributes in areas at widely locations with vehicle access in the Group2/3 dunefields.

Trenches

All sites were located on dunes. At each site, three trenches were excavated on the mid slope on the north side of the dune to maximise exposure to the sun. The precise location of each trench was influenced by existing vegetation and trenches were placed away from trees and large shrubs so that few large roots needed to be severed. Avoiding large roots made working in the trenches easier and minimised damage to surrounding vegetation.

Trenches were excavated to be at least 100cm long by 60cm deep and 30-40cm wide by AGAA staff following standard procedures (Benshemesh 2005). The long axis of each trench was aligned east-west to maximise sunshine on the north face of the trench wall. This was the only trench face that was inspected for marsupial mole signs and was carefully rubbed to present a flat and smooth surface. The top of the opposite wall was also dug out to maximise sunshine on the north face. Branches were placed in each trench and arranged as an escape route for any animals that accidentally fell into the trench.

Moleholes

Each site was visited twice, first to excavate the trenches and once again several days later to obtain a final reading of the number of moleholes. To detect moleholes during the final readings, standard procedures were followed (Benshemesh 2005), AGAA staff having previously been trained to recognise and record moleholes (Benshemesh 2012b). The surface of the north facing trench wall was once again gently rubbed until it was smooth and flat and then handfuls of dry sand were lightly thrown onto the wall (Benshemesh 2005). This process gently erodes the surface and tends to make the edges of moleholes more apparent as the backfilled passage erodes more than the surrounding sand. All oval and symmetrical sand filled structures with a minimum dimension greater than 20 mm were measured in regard to their depth, minimum and maximum dimensions, and the angle of their long axis from vertical (measured with a plumb). Moleholes were also rated for how fresh they appeared with scores ranging from 1 (Very Old) to 5 (Fresh and with free flowing sand in the tunnel). In addition, each molehole was scored from 1 (low) to 3 (high) in regard to its clarity, and how confident the observer was that the structure was from a marsupial mole.

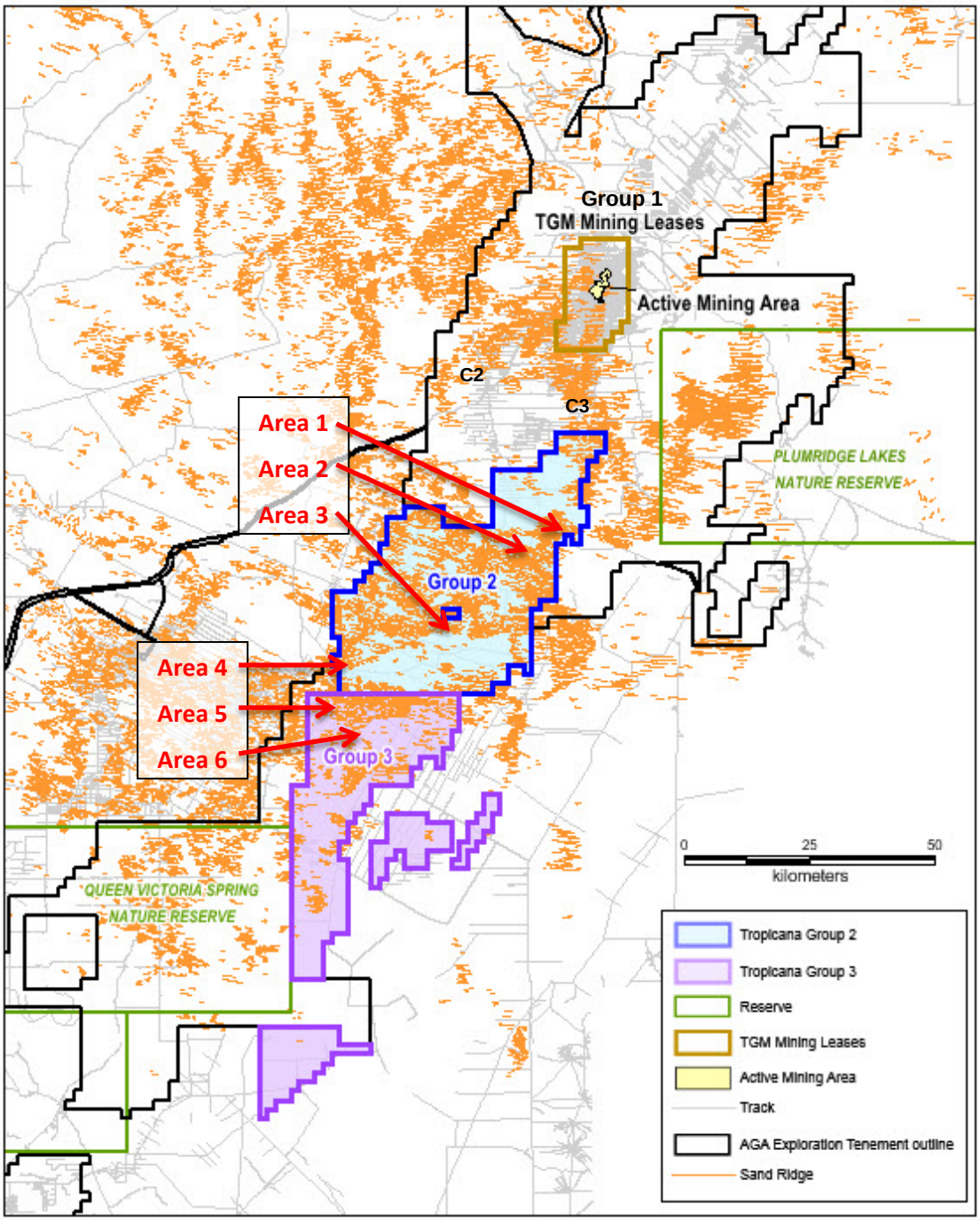


Figure 1. Location map showing the tenements, mine area, and study sites (Areas 1-6).

An objective measure of the likely age of moleholes was also obtained by using a pocket penetrometer ("Geotester", Facchini, Italy, with 1 cm shoe) which was applied to the centre of each molehole, and 5cm to the side; the ratio of the outside to inside readings (Pratio) provided a measure of the relative hardness of each molehole. Soil hardness within each trench was also measured with a penetrometer: in each trench three penetrometer readings were obtained for three depths (10cm, 25cm and 50cm) from undisturbed sand that had dried in the sun for several days. Used in this way, the penetrometer measured the force required to fracture rather than to compress the sand.

Data and Analysis

Descriptive analysis focussed on 3 variables that will be most useful in future efforts to gauge the conservation status of Itjaritjari: molehole abundance and two variables reflecting the age of moleholes (EstAge and Pratio) (Table 2). The dataset collected by AGAA also includes detailed information on the attributes of both trenches (size, soil hardness) and moleholes (tunnel dimensions, tilt, depth, hardness and appearance). However, molehole abundance and age are the most pertinent to assessing population trends for conservation. Data from a previous study (Benshemesh 2013) describing moleholes at Group1 sites is included in order to provide context and comparison to the benchmark data. While some other consultants have undertaken molehole trench surveys in the Group1 area, the surveys completed by AGAA staff are considered most reliable as they were associated with training and verification.

Table 1. Molehole variables at benchmark sites of particular relevance to monitoring trends in abundance.

Variable	*Description*	*Inference*
MH density	Density of all moleholes within each trench	Abundance
EstAge	1 (Very Old) to 5 (Fresh with free flowing sand in the tunnel)	Age of tunnels (subjective scored)
Pratio	Ratio of penetrometer readings in centre of object and 5cm to side (kg/cm_2)	Age of tunnels (objectively measured)

Results

AGAA excavated a total of 197 trenches for detecting moleholes at six areas (Figure 1), exposing a total of 193 m^2 of vertical trench face to an average depth of 0.78 m (Table 2). Moleholes were detected in 74% of trenches and at all of the six sites with an overall density of 1.40 (SE= 0.11) moleholes per vertical m^2.

Table 2. Number and size of trenches and number and density of moleholes in trenches at the 6 benchmark sites.

Area_dune	Trenches	Trench length (mm)	Trench Depth (mm)	Trench Area (m^2)	Moleholes (n)	MHd (mh/m^2)
Area 1	36	1332	797	38.2	61	1.63
Area 2	42	1298	794	43.3	57	1.34
Area 3	19	945	668	12.0	20	1.54
Area 4	33	1250	779	32.2	22	0.86
Area 5	36	1274	814	37.5	50	1.39
Area 6	31	1257	772	30.3	49	1.73
Total	**197**			**193.5**	**259**	**1.40**

Molehole density

Molehole density varied across sites (Figure2), but not greatly and differences between sites were not significant (ANOVA on ln transformed data: $F_{5,191}$= 1.99, P=.083). In comparison with molehole densities recorded at sites to the north in Tropicana Group 1 (Benshemesh 2013), molehole densities in Areas 1-6 were similar to those recorded at sites south of the Tropicana Minesite area (sites C2 and C3 in Benshemesh 2013; Figure 1), but lower than molehole densities recorded within 5 km of the Tropicana Minesite area (Figure2, Figure3) (see Benshemesh 2013 for further information on molehole densities in Group 1 sites). Significant differences existed among the 6 benchmark sites and the 5 sites in Group 1 (ANOVA on ln-transformed data; : $F_{10,369}$= 13.2, P<.001), and Tukey multiple comparisons suggested these differences were due to sites A2 and C1 close to the minesite (Figure 4). There were no significant differences among the 8 sites (6 benchmark sites plus 2 Group 1 sites) that were more than 5 km of the Tropicana Minesite area (ANOVA on ln transformed data: $F_{7,249}$= 1.57, P=.145).

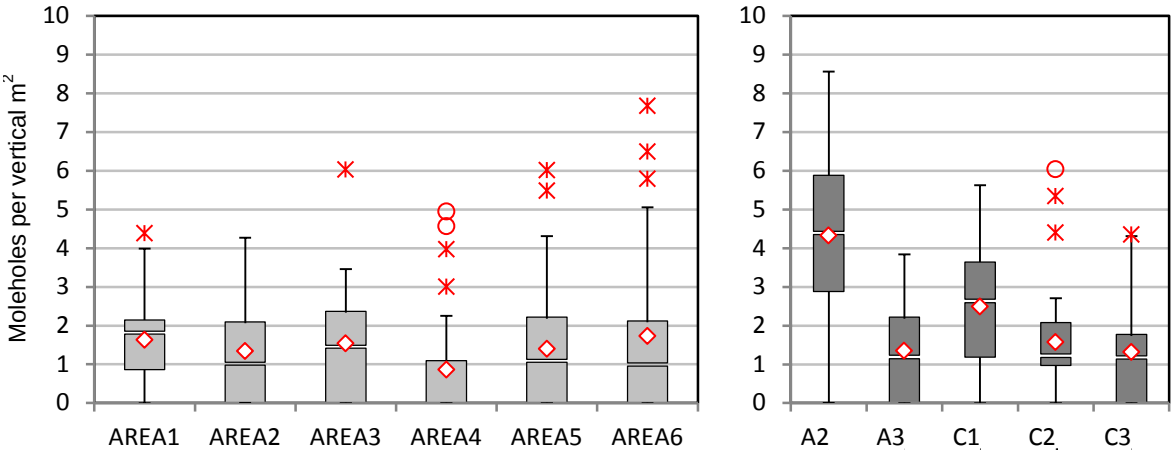


Figure 2. Boxplots showing molehole densities at benchmark sites in Group 2/3 (left) and at Group 1 areas (right) from previous studies. The boxplots show the central 50% of observations in each data set as boxes divided in two by the median and bounded below by the lower (first) quartile and above by the upper (third) quartile. The whiskers (error bars) extend to 1.5 times the box height (interquartile range, IQR. Values outside the whiskers are considered to be outliers: 'mild' outliers (cross) are between 1.5 to 3 times the IQR from the top or bottom of the grey box; and 'extreme' outliers (circles) are more than 3 times the IQR from the top or bottom of the grey box. Means are indicated by the diamonds.

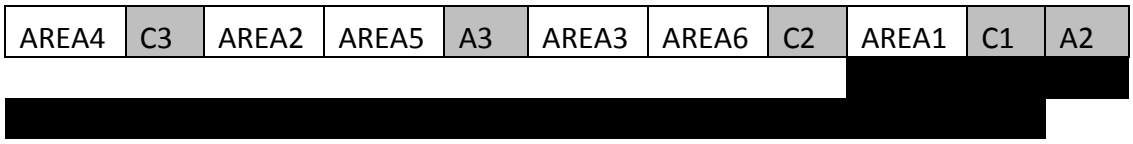


Figure 4. Tukey multiple comparison result showing two overlapping groups. Within each line sites appear to have similar means, but there are significant differences between sites occur on different lines. Sites in Group 1 are shaded grey.

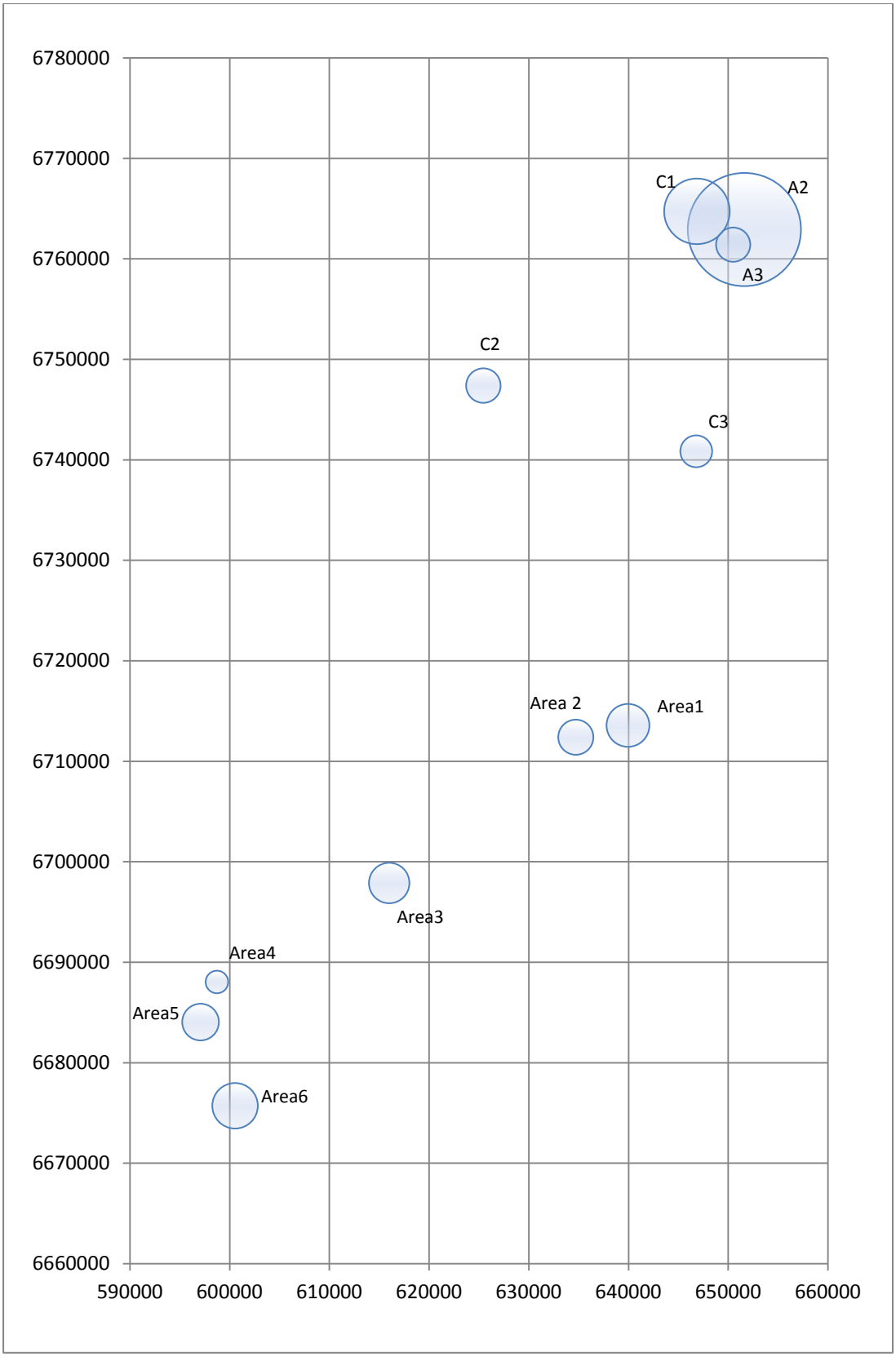


Figure 3. Bubble plot showing molehole densities at Group 1 and Group 2/3 sites. With width of each circle represents the density of moleholes at that site.

EstAge and Pratio

Moleholes at benchmark sites were characterised as mostly of medium age, with fewer numbers of Fresh and Very old moleholes, and this pattern was similar to that recorded in Group 1 (Benshemesh 2013) (Figure5).

The proportion of moleholes regarded as Fresh varied from 0 to 21% at the six sites, and no Fresh moleholes were detected at two sites (Area3 and Area5). However, the proportion of Recent moleholes was consistent across the six sites, varying from 31% (Area 6) to 40% (Area 5) (Figure 6). Together, Fresh and Recent moleholes accounted for between 33-56% (43% over-all) of moleholes detected at each of the six benchmark sites. These results were similar to those previously recorded in Group 1.

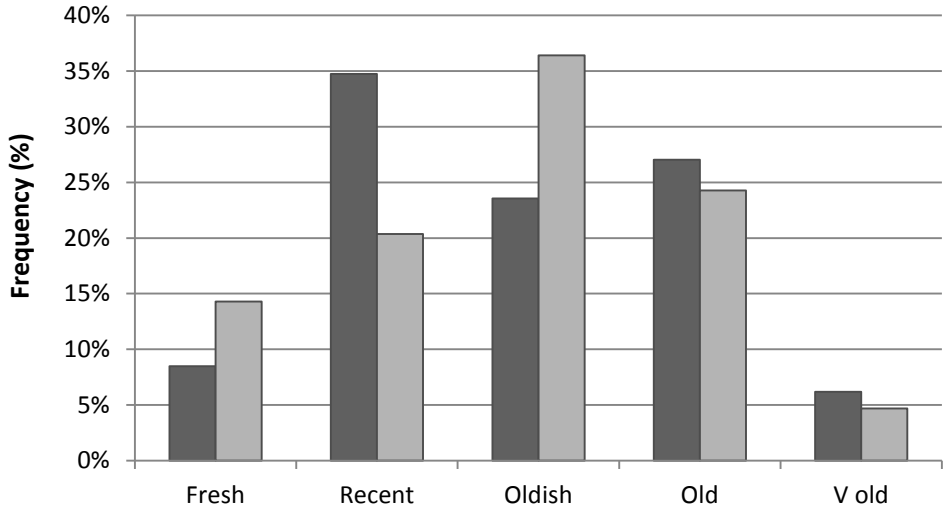


Figure 5. Frequency distribution of EstAge categories at Group 2/3 benchmark sites (black) and Group 1 sites (grey).

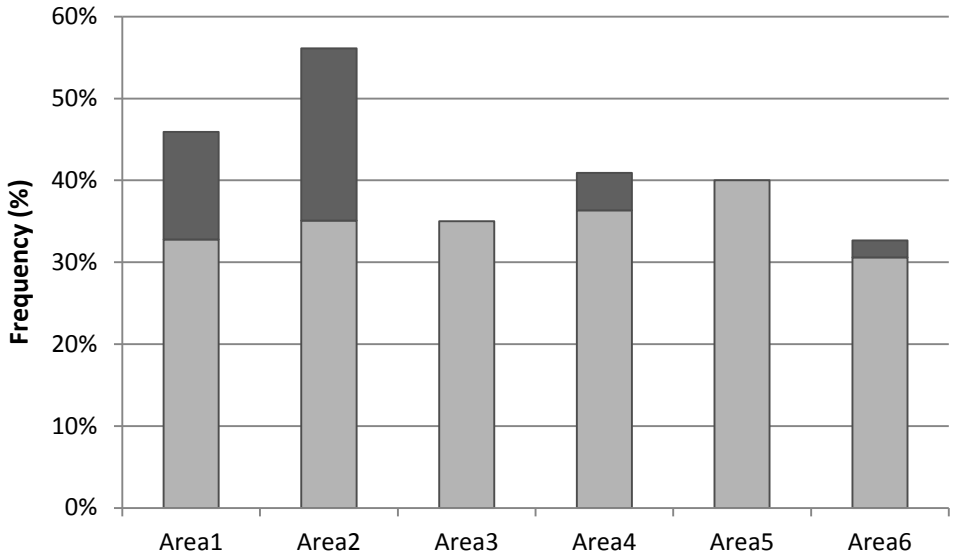


Figure 6. Frequency of Fresh (black) and Recent (grey) EstAge categories at each of the 6 benchmark sites in Group 2/3.

The frequency distribution of Pratio scores for the six benchmark sites shows that that the distribution is broadly similar to that described for Group 1 sites (Figure 7) with the sand in most moleholes considerably softer than the surrounding matrix.

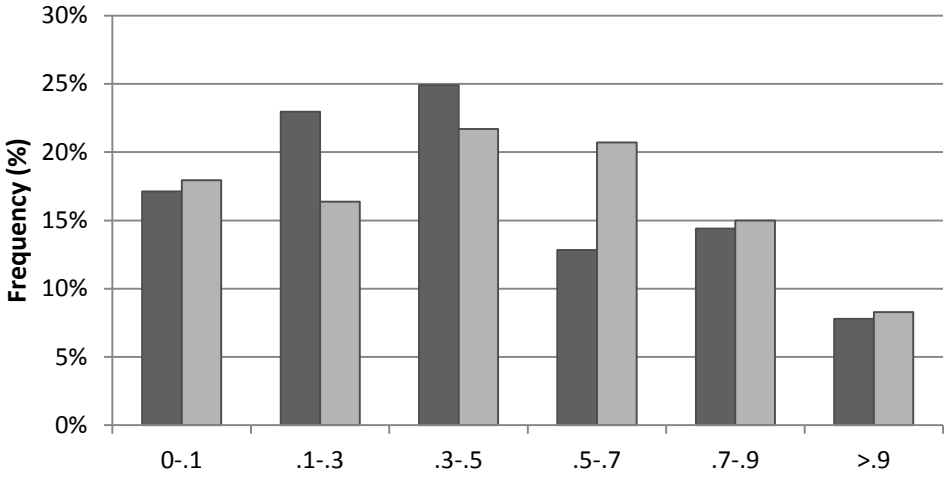


Figure 7. Frequency of Pratio values at Group 2/3 benchmark sites (black) and Group 1 sites (grey).

There was also a strong correlation between the subjective EstAge scores and Pratio measures (r^2=0.33, n= 257, p<.001) which was expected as both indices are thought to reflect the age of moleholes. A boxplot of Pratio values in relation to EstAge categories is shown in Figure 8.

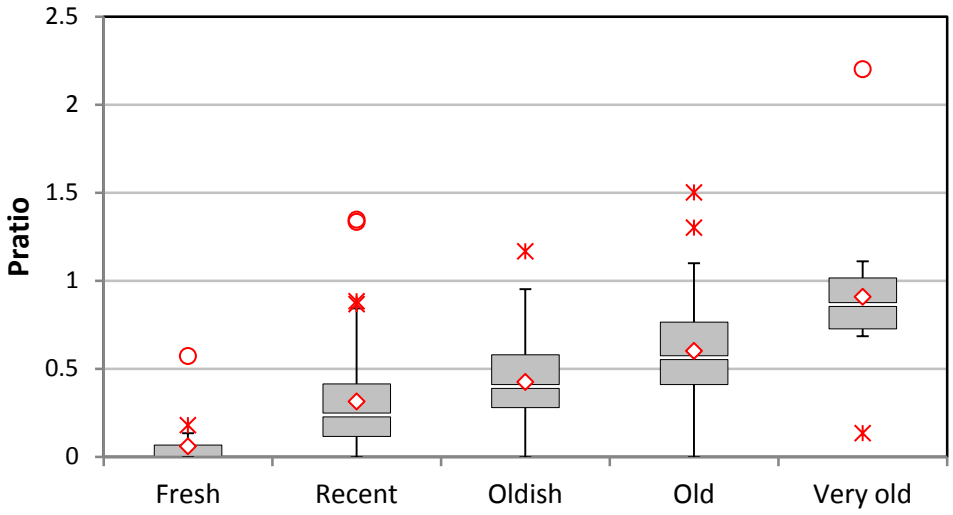


Figure 8. Boxplot of Pratio values at Group 2/3 benchmark sites in relation to EstAge categories (see Figure 2 caption for explanation and key).

Discussion

The data collected by AGAA provides a satisfactory benchmark for monitoring the abundance of the species in the future. The establishment of such benchmark sites is of great importance for the conservation of the species as it will enable future studies to measure trends in the abundance of marsupial moles that may indicate changes in the viability of existing populations.

Molehole abundance

The three variables described herein provide different information that may reveal trends in populations of concern to conservation. Molehole density is the most basic of these variables describing the absolute abundance of moleholes of all ages. As moleholes are likely to persist for 10-20 years (Benshemesh 2010), this variable is likely to be slow to change and this may be a disadvantage to monitoring where short term change is of interest. On the other hand, that molehole abundance reflects the abundance of marsupial moles over a period of a decade or more is an advantage for longer term monitoring programs because the frequency (or intensity) of monitoring may be reduced without a concomitant loss of information. For instance, annual monitoring of molehole density at the same site is likely to result in highly redundant data and provide little analytical benefit over monitoring every three or even five years. Moreover, as molehole density integrates the occurrence of tunnels over many years, the measure is unlikely to be sensitive to short term environmental conditions or population fluctuations.

There are no previous estimates of molehole densities in the Group 2/3 areas in which AGAA established benchmark sites in this study. However, molehole densities were similar to those recorded in Group 1 areas in 2012 south of the Tropicana mine and north of Group 2/3 (see Results), but were lower than densities recorded in the vicinity of the minesite. Benshemesh and Schulz (2008) also passed through the general area in 2008 during a large scale survey of the occurrence of marsupial moles in the WA Great Victoria Desert. They examined 14 trenches on the crests and midslopes of dunes within 60km of the benchmark sites in Group 2/3, and their results were comparable but marginally lower (averaged 1.0 moleholes per m^2, SE= 0.21) than those reported at the benchmarks.

Molehole age

The two indices of molehole age considered here reflect aspects of the degradation of sand filled tunnels with time and repeated wetting and drying. EstAge was a subjective evaluation of the distinctiveness of each molehole, whereas Pratio was derived from objectively from measures of the soil hardness inside and outside each molehole. As the subjective score was always obtained first, these two indices may be regarded as having been obtained independently for each molehole. Nonetheless, the two were highly correlated at the benchmark sites and this was expected as they both reflect degradation.

In contrast to molehole density, EstAge and Pratio provide information on molehole ages. Both of these variables have been shown to be highly correlated with the actual age of moleholes (Benshemesh 2010) and their frequency distributions provide an insight into how recently marsupial moles have tunnelled through the substrate. In this regard, the benchmark sites show considerable activity in recent times: Fresh moleholes comprised 8% or records, and Fresh + Recent combined comprised 43% of all moleholes recorded in the benchmark sites. Compared to surveys in Group 1

(Benshemesh 2013), the benchmark sites showed fewer Fresh moleholes than the previous surveys but more Fresh + Recent moleholes (14% and 35% respectively in Group 1). The difference in the proportion of Fresh moleholes probably reflects the incidence of soaking rains: the proportion of Fresh moleholes in a sample is very sensitive to rain as Fresh moleholes require a dry substrate for formation and preservation. Although some information exists for rainfall at Tropicana for the study period (Appendix 1xx), this may not accurately reflect rainfall at the benchmark sites as they were 50-100km south of Tropicana. In any case, Pratio values for moleholes at Group 2/3 benchmark sites, and those obtained previously from Group 1 sites, were very similar and suggested that soft (and thus recently created) moleholes occurred at similar frequencies.

The frequency distributions of EstAge and Pratio provide an alternative means of assessing population trends to molehole density, and the data obtained from the current surveys in the benchmark sites, and those previously obtained for Group 1 sites, provide a standard to which future surveys may be compared.

Conclusion

AGAA have established six sites in the Group 2/3 area comprising 197 trenches in accordance with commitments made by the company regarding monitoring the effects of exploration activities on marsupial moles (Benshemesh 2012a). These sites were intended to serve as benchmarks for future reference, and signs of marsupial moles have been measured and recorded following established methods. The resulting data appears to be of high standard and will provide an invaluable reference for determining trends in marsupial moles populations in the future.

References

Benshemesh, J., (2004) Recovery Plan for Marsupial Moles *Notoryctes typhlops* and *N. caurinus*. 2005-2010. Northern Territory Department of Infrastructure, Planning and Environment, Alice Springs, NT.

Benshemesh, J., (2005) Manual for Marsupial Mole survey and monitoring by trenches, Version 1.0. Anangu-Pitjantjatjara Land Management and the Department of Environment and Heritage SA.

Benshemesh, J., (2008) Itjaritjari *Notoryctes typhlops*. In: *The mammals of Australia. Third edition*: 412. S. Van Dyck & R. Strahan (Eds.). Reed New Holland, Sydney.

Benshemesh, J., (2010) Degradation of simulated moleholes and the implications for survey and monitoring. 1. Report to Department of Natural Resources, Environment and the Arts, Northern Territory Government, Alice Springs.

Benshemesh, J., (2012a) Southern Marsupial Mole (*Notoryctes typhlops*) Monitoring Program for Tropicana Group 2/3 Exploration Tenements. AngloGold Ashanti Australia, Perth.

Benshemesh, J., (2012b) Training AGAA staff and contractors to undertake monitoring of Itjaritjari. Report to AngloGold Ashanti Australia, Perth.

Benshemesh, J., (2013) Effects of Intense Drilling on Southern Marsupial Moles. Report to AngloGold Ashanti Australia, Perth.

Benshemesh, J. (2014) Backfilled tunnels provide a novel and efficient method of revealing an elusive Australian burrowing mammal. *Journal of Mammalogy,* **95,** 1054.

Benshemesh, J. & K. Aplin, (2008) Kakarratul *Notoryctes caurinus*. In: *The mammals of Australia. Third edition*: 410. S. Van Dyck & R. Strahan (Eds.). Reed New Holland, Sydney.

Benshemesh, J. & K. Johnson, (2003) Biology and conservation of marsupial moles (Notoryctes). In: *Predators with Pouches: the biology of carnivorous marsupials*: 464. M. Jones, C. R. Dickman & M. Archer (Eds.). CSIRO Publishing, Melbourne.

Benshemesh, J. & M. Schulz, (2008) Survey of the underground signs of marsupial moles in the WA Great Victoria Desert. Report to AngloGold Ashanti Australia (Perth) and the Department of Natural Resources, Environment and the Arts, Northern Territory Government (Alice Springs).

Johnson, K. A. & D. W. Walton, (1989) Notoryctidae. In: *Fauna of Australia: Volume 1B Mammalia*: 591. D. W. Walton & B. J. Richardson (Eds.). Australian Government Printing Service, Canberra.

Woinarski, J., A. Burbidge & P. Harrison (2014) *Action Plan for Australian Mammals 2012*. Australia: CSIRO Publishing.