Metals X Ltd

Wingellina Nickel Project

Level 1 Flora and Vegetation

Assessment of the Wingellina Borefield

July 2011

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Executive Summary

Miscellaneous License L69/12 in Western Australia is being proposed as the site of a borefield to provide water to for the Wingellina Nickel Project. This license area lies 90 kilometres southwest of the Surveyor Generals' Corner, the junction between WA, the Northern Territory (NT) and South Australia (SA). It is also located 80 km south of the Tomkinson Ranges, which are part of the Central Ranges to the east of Warburton.

Outback Ecology was commissioned by Metals X Limited to conduct a Level 1 Flora and Vegetation Assessment on both sides of the 28.5 km long section of Tjuntjuntjarra Road through Miscellaneous License L69/12 in the Great Victoria Desert Biogeographical Region of Western Australia. The project brief stipulated that the study be confined to the vegetation up to 30 metres from the roadside (the Study Area), with the exception of designated Heritage Areas which were out-of-bounds for cultural regions. This field survey was undertaken by two Outback Ecology botanists from 4th to 9th May 2011, inclusive.

Outback Ecology was previously commissioned to undertake a Flora and Vegetation Assessment of the proposed mine site during April 2008 and in October 2010. Halpern Glick Maunsell (2002) also undertook a survey of the Project site. The results of both these assessments have been reviewed in the present report.

The key objectives of this current flora and vegetation assessment were to:

- Revise database searches and review all previous vegetation studies in the Wingellina region;
- Undertake a field survey of the Study Area to:
    - Develop an inventory of the terrestrial vascular flora occurring within the Study Area;
    - Determine (and notify Metals X Ltd of) the presence of any flora of conservation significance or flora of potential conservation significance, including any International Union for Conservation of Nature (IUCN) Red Listed Species;
    - Delineate and characterise vegetation associations across the Study Area;
    - Undertake broad-scale vegetation mapping and assessments of vegetation condition and potential conservation significance by relevé assessment across the Study Area;
    - Identify and specify locations of any introduced species including any declared weeds;
    - Identify potential impacts of the proposed clearing program.

The objectives and methods adopted for this survey and assessment were aligned with:

- EPA Position Statement No. 3, Terrestrial Biological Surveys as an Element of Biodiversity Protection (EPA 2002);
- EPA Guidance Statement No. 51 Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia (EPA 2004).

The May 2011 flora and vegetation survey gathered flora data from twelve quadrats sampling six vegetation communities. This was done in a manner sensitive to the traditional owners. Areas identified as being out-of-bounds for the survey for cultural reasons were carefully avoided. Approximately half of the roadside vegetation was only able to be observed from the roadside due to access being prohibited in culturally sensitive Heritage Area. Vegetation mapping of these areas was undertaken by extrapolation using remote sensing imagery. Targeted searches for DRF and Priority Flora species were also undertaken on both sides of the Tjuntjuntjarra Road, up to 30 metres from the roadside with the exception of in Heritage Areas. While undertaking this search any species not previously found in quadrats were also documented and collected.

A total of 163 taxa were recorded representing 32 families and 87 genera. Dominant families include Poaceae (27 taxa), Fabaceae (22 taxa) Chenopodiaceae (15 taxa), Malvaceae (13 taxa) and Myrtaceae (11 taxa). Dominant genera were *Acacia* (13 taxa), *Eremophila* (8 taxa), *Ptilotus* (8 taxa), *Eucalyptus* (7 taxa), *Sclerolaena* (5 taxa), *Senna* (5 taxa), and *Sida* (5 taxa).

Remote sensing imagery, ground truthing and cluster analysis of quadrat data were used to identify and describe all plant communities in the Study Area. A total of six vegetation communities were described and mapped. None of these vegetation communities are listed as Threatened Ecological Communities (TECs) or Priority Ecological Communities (PECs) in Western Australia. Vegetation condition across the majority of the Study Area was rated as being generally in Excellent to Pristine condition. The relatively unmodified nature of the vegetation is indicated by the high indigenous species richness at a number of sites (up to 45 species in 50m x 50 m quadrat).

No Threatened Flora (TF) (also called Declared Rare Flora) listed under the WA *Wildlife Conservation Act (1950)*, or threatened flora species listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999*, the South Australian *National Parks and Wildlife Act 1972* or the Northern Territories *Territory Parks and Wildlife Conservation Act* 2000 were recorded within the Study Area. Based upon the field survey undertaken, together with a habitat assessment of the likely occurrence of these species, none are expected to occur.

One Western Australian Priority Flora species was recorded within the Study Area during the May 2010 survey: Woolly Mulga-grass (*Neurachne lanigera*) (Priority 1 (WA); Rare (SA)). This was found within three quadrats (QWB01, QWB03 and QWB012). A number of plants were found in quadrat QWB012 in Mulga (*Acacia aneura*) Tall Open Shrubland over *Triodia basedowii* (Vegetation Community 4a). Solitary plants were also found in the other two quadrats in Marble gum (*Eucalyptus gongylocarpa*) Low Open Woodland (Vegetation Community 1) and in Mulga (*Acacia aneura*) Tall Open Shrubland over *Eragrostis eriopoda*, *Aristida holothera* & *Eriachne mucronata* (Vegetation Community 4b). This species appears to occur only as highly localised populations in the Study Area. The populations may be deleteriously affected by vegetation clearance (for roads and drill pads) and potential associated introduction of Buffel Grass (through the transport of weed seeds on earthmoving equipment) if not managed approprately.

Of significance was the location of a new undescribed species of *Goodenia* in the two quadrats sampling Red Mallee (*Eucalyptus socialis* subsp. *eucentrica*) Very Open Shrub Mallee (Vegetation Community 5). Several plants of this species, *Goodenia* sp. affin. *quasilibera* (L. Ransom 868), were found and it appears that this species is confined to calcrete area in the Study Area. Without further surveys it is difficult to ascertain how widespread this species is in the local region since these calcrete areas are moderately common in the local area and extend into the the Anangu Pitjantjatjara Lands of adjacent South Australia. If this species is highly localised, vegetation clearance and any associated invasion by Buffel Grass may present a significant threat unless managed appropriately.

Two other species recorded in the Survey Area represent disjunct populations well outside their main known distributions. Fifty plants of Harrow Wattle (*Acacia acanthoclada*) were found in flat sandy plain mallee (Vegetation Community 3) adjacent to the base of a dune, while *Thryptomene* (*Thryptomene longifolia*) was found to be dominant on the crest of high dunes in Vegetation Community 2. *Acacia acanthoclada* in the Study Area occurs as a disjunct population 500 km from the main distribution of the species in Western Australia and South Australia. The survey indicates that the species is highly localised in the Study Area and thus local populations could potentially be threated by vegetation clearance and Buffel Grass weed invasion.

Thryptomene longifolia is previously unknown from Western Australia. This population in the Study Area appears to be a relic disjunct outlier, the nearest known occurrence being 400 km to the southeast in South Australia. It is anticipated that drilling is unlikely to affect areas where *Thryptomene longifolia* occurs since high dune crests are unlikely to be targeted for drilling due to logistic reasons.

Two exotic species, Buffel Grass (**Cenchus ciliaris*) and Caltrop (**Tribulus terrestris*), were recorded in the Study Area. Another species, **Portulaca oleracea* (Common Purslane), which is considered to have indigenous and introduced forms in Western Australia (DEC 2011) but totally indigenous in South Australia (Barker et al. 2005), was also recorded. None of these species are Declared Plants under the *Agriculture and Related Resources Protection Act, 1976.* However, **Cenchus ciliaris* (Buffel Grass), is classified as a significant 'Environmental Weeds' by the *Environmental Weed Strategy for Western Australia* (WA Department of Environment and Conservation [DEC] 1999) due to its ability to invade and outcompete native species and its high flammability resulting in increased fire frequency and intensity (Robertson 2008). Only one individual of Buffel Grass was located in the Study Area near to an existing drill hole. This species is widespread around the Wingellina Community and its potential spread on earth moving equipment is a significant threat to the vegetation in the Study Area.

Managed appropriately, the proposed development will have only a local direct impact on the flora and vegetation of the Study Area or region. It is important that this management addresses:

1) the potential impact on significant flora;
2) the potential spread of Buffel Grass during road construction, maintenance and other earth works, and the associated potentially increased fire frequencies; and
3) the potential increased visitation by mine workers

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1. INTRODUCTION

1.1 Project Background and Location

Metals X Pty Ltd is developing the Wingellina Nickel Project (the Project) which is located in the vicinity of the Wingellina Hills in the Central Ranges near the Wingellina Community. The Project is situated on Aboriginal Reserve A17614 in Western Australia which abuts both the South Australian and Western Australian borders (**Figure 1**). The Project involves mining and mineral processing activities aimed primarily at the recovery of nickel and cobalt from large nickeliferous limonite deposits. Conventional open pit drilling, blast, load and haul methods will be utilised. Waste from subsequent pits may be backfilled into voids created by earlier stages of mining to the extent that it is compatible with safe and efficient mining operations. Ore will be loaded into haul trucks for delivery to the Ore ROM Pad where it will be stockpiled.

The processing plant is planned to be located some 500 m east of and central to the overall strike of the ore body. A dry crushing and screening plant will be established adjacent to the ROM Pad and ore will be fed by a front-end loader into a feed hopper. The ore from the mine will initially be crushed through a primary crusher (ore sizer), before processing via High Pressure Acid Leaching. The proposed central thickened discharge (CTD) tailing storage facility (TSF) and water storage facility (WSF) location is approximately 500 m to the north-east of the processing plant

Water supply is a critical component of the Project. Approximately 12 GL/yr of water are required for construction and operations. The raw water requirement for the processing plant is approximately 1,200 m^3/hour. This necessitates the development of a water supply borefield for the Project. The water will be sourced as bore water from groundwater reserves in the surrounding sedimentary basins. Two sources are being investigated:

- The Northern Borefield, which is a source in the Cobb Depression located approximately 100 km to the north of the processing plant, is a sedimentary sub-basin, marginal to the very large Canning Basin; and
- The Southern Borefield, a source in the extensive Officer Basin located approximately 100 km south-west of the Project, is within the Langkarta Sandstone. (**Figure 2**)

Previous drilling in both areas shows intersection of large quantities of water, and that the indicated quality of the water is suitable for the Project requirement. Current hydrogeological testing of the borefields indicates that the Southern borefield is likely to be chosen as the Project's groundwater source. Consequently, Miscellaneous License L69/12 in the Officer Basin is the main focus of ongoing groundwater investigations which will be finalised in 2011 prior to finalisation of the Public Environmental Review.

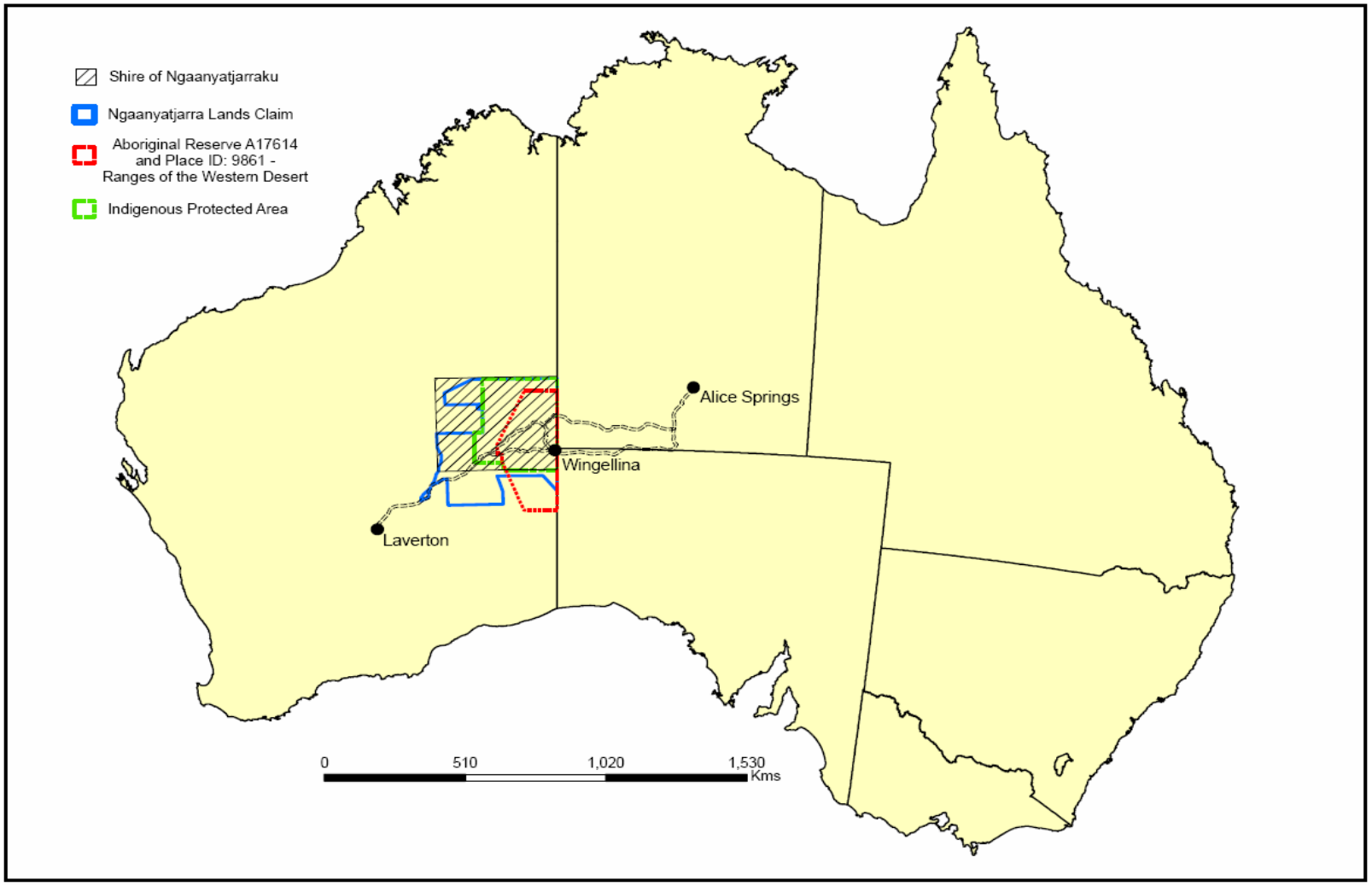

Figure 1: Regional location of the Wingellina Project

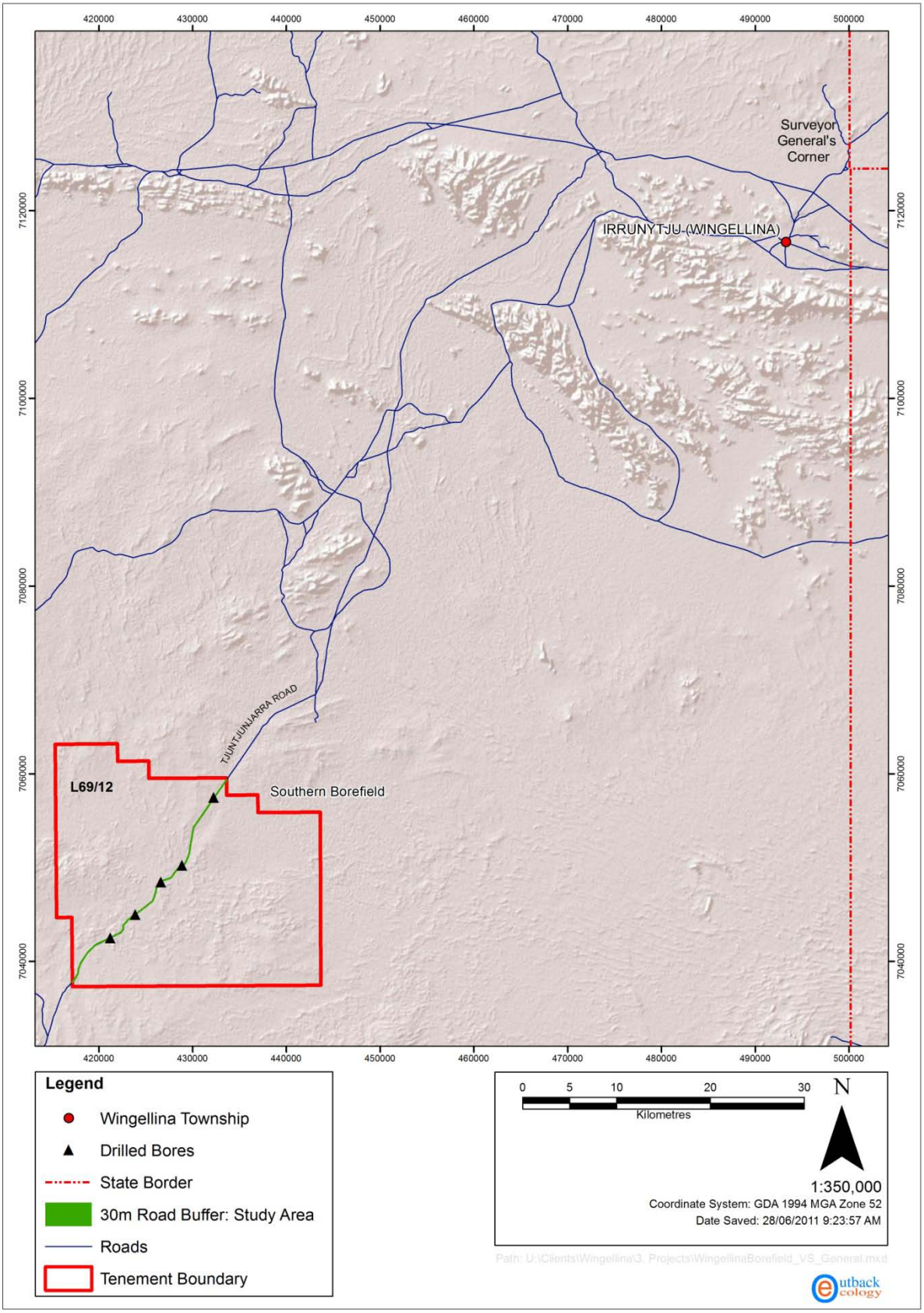

Figure 2: Map showing the regional location of the Study Area and Miscellaneous Licenses L69/12.

An initial clearing permit application has been approved for the area of proposed disturbance within Miscellaneous License L69/12. This allows the clearance of up to five hectares of native vegetation for the purpose of drilling water exploration drill holes.

Pipelines and an access track will be constructed to transport the water the 100km from the borefield to the treatment plant. The borefield design is conceptual, with further drilling required to confirm the source and production capacity. The conceptual borefield design consists of approximately 30 production bores spaced on a 3 km by 4.5 km grid, producing 20L/sec per bore to give a maximum capacity of 12.5 GL/a (34,000 m3/d). The raw water will discharge into a raw water surge tank, which then will overflow into two HDPE lined raw water ponds, providing 2 days of storage. Raw water for the water treatment plant will be drawn directly from the raw water tank and pumped to the RO plant.

The borefield disturbance footprint will not be finalised until the exploration drilling programme is completed. Preliminary drilling will involve no further clearance of native vegetation as it will occur on an existing drill pad. If this drilling establishes that there is a viable aquifer, it is likely that approximately 30 new drill pads and associated access roads will need to be established, although exact details are still to be finalised. The potential impacts and final footprints for the water supply borefield will be included in the final Public Environmental Review.

Outback Ecology was commissioned by Metals X Limited to conduct a Level 1 Flora and Vegetation Assessment on both sides of the 28.5 km long section of Tjuntjuntjarra Road through Miscellaneous License L69/12 (Figure 2). The project brief stipulated that the study be confined to the vegetation up to 30 metres from the roadside (the Study Area), with the exception of designated Heritage Areas which were out-of-bounds for aboriginal cultural regions. In total the Study Area covers an area of 171 ha. It was not possible to sample quadrats and undertake targeted species searches in these Heritage Areas. However, vegetation was mapped for the whole Study Area by extrapolation using remote sensing imagery.

1.2 Report Scope and Objectives

This report documents the results of a desktop survey, a field assessment and a targeted conservation significant flora search conducted between 4th and 10th May 2011, inclusive. The survey was designed and conducted as far as practicable in accordance with the WA Environmental Protection Authority's (EPA's) Position Statement No. 3 Terrestrial Biological Surveys as an Element of Biodiversity Protection (EPA 2002), and Guidance Statement No. 51 Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia (EPA 2004). According to Guidance Statement 51, the methodology used qualifies as a Level 1 flora and vegetation survey.

The overall objectives of the flora and vegetation survey were to:

- Produce a comprehensive species list for the Study Area;
- Search for conservation significant flora (including Threatened Flora listed under Commonwealth, Western Australian, Northern Territory and South Australian legislation, WA Priority Flora, and other conservation significant flora);
- Search for conservation significant ecological communities (WA Threatened Ecological Communities (TECs) and Priority Ecological Communities (PECs); plant communities considered significant in SA & NT)
- Describe and map vegetation associations over the Study Area; and
- Discuss the potential impacts of the proposed development on the flora and vegetation within the Study Area.

Both a desktop study and field based survey were undertaken to identify significant species and vegetation communities occurring, or likely to occur, in the Study Area.

2. BACKGROUND INFORMATION

2.1 Biogeographic Region

Thackway and Cresswell (1995) described a system of 85 biogeographical regions (bioregions) covering the whole of Australia; the result of collaboration between all state conservation agencies and the Australian Government Department of Environment and Heritage (now the Department of Environment and Water Resources). Bioregions are defined on the basis of climate, geology, landforms, vegetation and fauna.

The Study Area is located within the Great Victoria Desert Bioregion of the Interim Biogeographic Regionalisation for Australia (or IBRA) (Thackway and Cresswell 1995). The Great Victoria Desert includes six major components, or sub-regions; Shield (GVD1), Central (GVD2), Eastern/Maralinga (GVD3), Kintore (GVD4), Tallaringa (GVD5) and Yellabinna GVD6. The Study Area is located in GVD3 which is referred to as the Eastern Subregion in Western Australia and the Maralinga Subregion in South Australia. In South Australia the subregion extends east to near Maralinga while in Western Australia it extends west of the border by approximately 200 km (**Figure 3**).

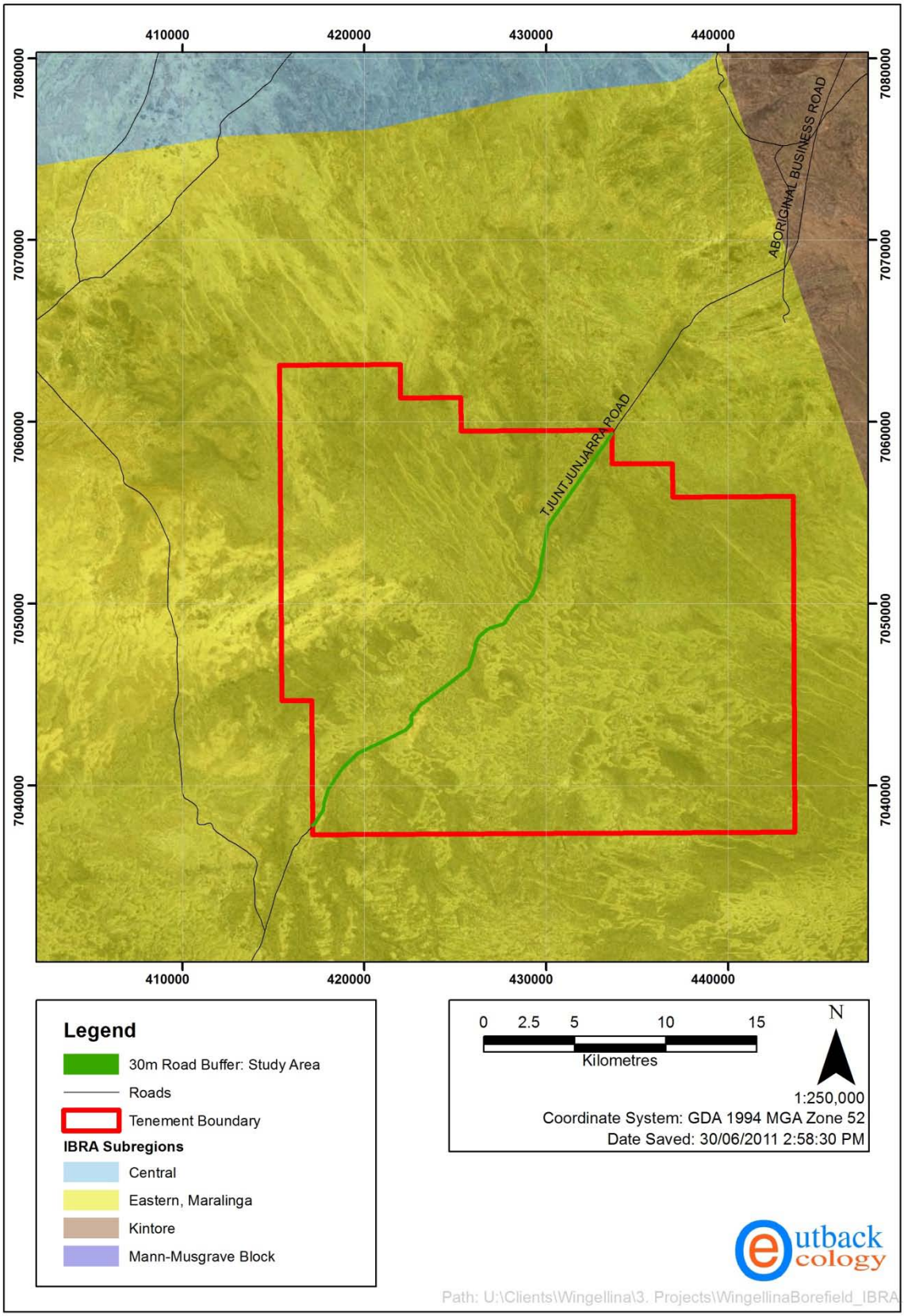

Figure 3: Location of the Study Area in Relation to the IBRA Sub-regions of the Great Victoria Desert Bioregion of Western Australia

The Eastern Subregion of the Great Victoria Desert Bioregion is underlain by Devonian sediments of the Gunbarrel Basin, with extensive sandplains of deep Quaternary aeolian sands (Barton and Cowan 2001). Landforms consist of salt lakes and major valley floors with lake derived dunes. Sandplains with extensive seif dunes running east west, occasional outcropping (breakaways) and quartzite hills provide minor relief.

Thackway and Cresswell (1995) describe the vegetation as primarily a Tree steppe of *Eucalyptus gongylocarpa*, Mulga and *E. youngiana* over hummock grassland dominated by *Triodia basedowii* on aeolian sands. *Acacia* dominates the colluvial soils with *Eremophila* and *Santalum* spp., while halophytes occur on the edges of salt lakes and saline drainage systems. The climate is arid, with summer and winter rain averaging 150 to 180 mm. This subregion covers an area of 5,051,155 ha in Western Australia. (Graham and Cowan 2001).

2.2 Climate

The climate of the Great Victoria Desert is characterised by hot summers and winters with mild days but cold nights. The region is influenced by a northern tropical/summer climatic pattern with easterly or south easterly prevailing winds. Rainfall is highly variable, however the majority is received during summer, largely due to the movement of low pressure troughs and tropical lows associated with monsoon troughs moving south in the region. In winter days are mild and nights cold under the influence of predominant high pressure subtropical ridges (BOM 2011).

The closest meteorological station to the Study Area is the Giles station which lies approximately 170 km to the north of the Borefield. Mean annual rainfall recorded at Giles is 282 millimetres (mm), with the majority received between November and March (**Figure 4**). On average, the highest mean monthly maximum temperature (37.3°C) is recorded during January, and the lowest minimum mean temperature (6.9 °C) is recorded during July (BOM 2011).

2.3 Landscape Zones

Tille (2006) provides descriptions of all the Soil-Landscape zones of the rangelands and interior of Western Australia. The Study Area falls within Zone 124: the Southern Great Victoria Desert Zone. This zone covers an area of 87,550 km^2 and is located in the southern arid interior between Lake Minigwal and the South Australian border. Tille (2006) describes this zone as consisting of sandplains and dunes (with some gravelly plains and calcrete plains) on sedimentary rocks of the Gunbarrel (and Officer) Basin. Associated soils are red deep sands and red sandy earths with some red loamy earths. Vegetation is described as being typically spinifex grasslands with mallee scrub and some mulga and eucalypt woodlands.

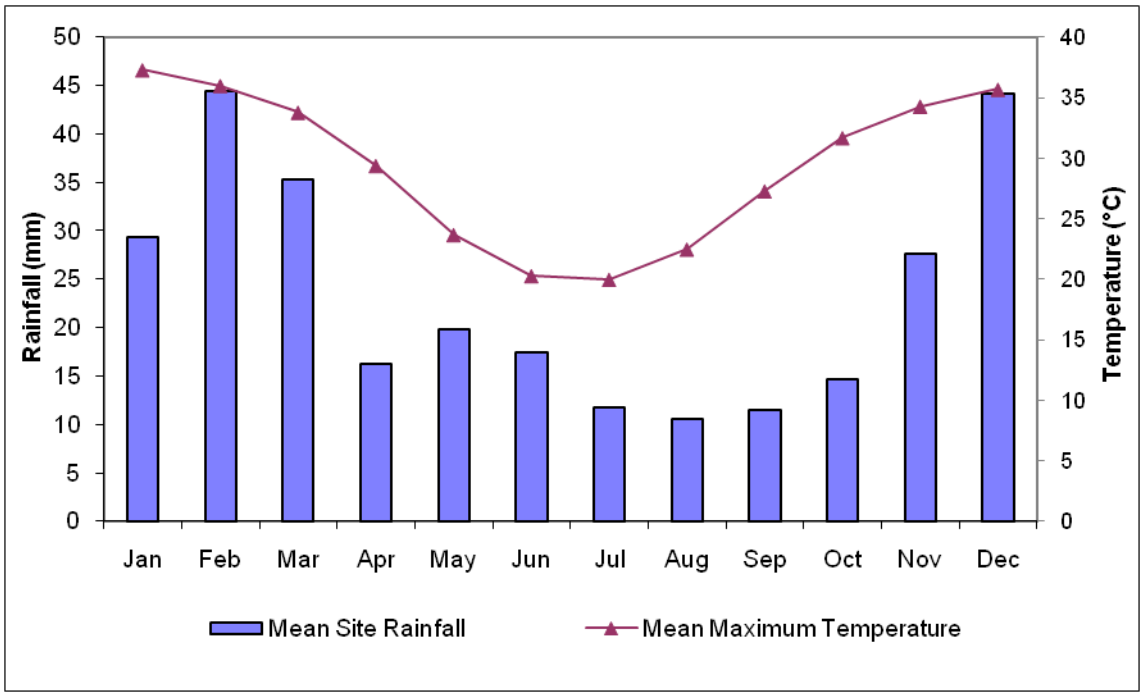

Figure 4: Climate Data for the Giles (013017) Weather Station (BOM 2010)

2.4 Beard Vegetation Mapping within the Study Area

Beard (1974) undertook broad-scale vegetation mapping in the region, based on interpretation of aerial photographs and ground-truthing. The Study Area is located in the Giles Botanical District as defined by Beard (1974) (**Figure 5**). The Giles Botanical District is approximately equivalent to the Central Ranges 1 (Mann-Musgrave Block Subregion) IBRA region. Beard (1974) broadly describes the vegetation of this region in relation to the underlying topography as being very varied, from low rounded quartzite ranges, sandy plains, confused dune systems, to salt lakes and kopi dunes.

Beard (1974) describes the plains in the Giles Botanical District as having both "loam flats with tall mulga" as well as very sandy plains with dunes of confused direction. He describes the sandhills as vegetated by desert bloodwoods *Grevillea stenobotrya, Acacia* sp., *Gyrostemon ramulosus, Crotalaria cunninghamii* and *Triodia melvillei.* Interdunal vegetation were described as typically a shrub steppe featuring *Hakea lorea* subsp. *suberea* (syn. *Hakea lorea* subsp. *lorea*), *Acacia pruinocarpa, A. aneura, A. cuthbertsonii, A. coriacea, Eucalyptus gamophylla, E. oxymitra, Eremophila forrestii* and *Triodia basedowii.* Beard (1974) also observed groves of *Allocasuarina decaisneana* throughout the region with no apparent pattern in their distribution or density.

Four Vegetation Associations occur in the vicinity of the Study Area as mapped by Beard (1974) (**Figure 5.**):

- Hummock grasslands, shrub steppe; mulga and mallee (marble gum) over hard spinifex - Beard Vegetation Association 236 (a1eSi t2Hi; 100% of Study Area); and

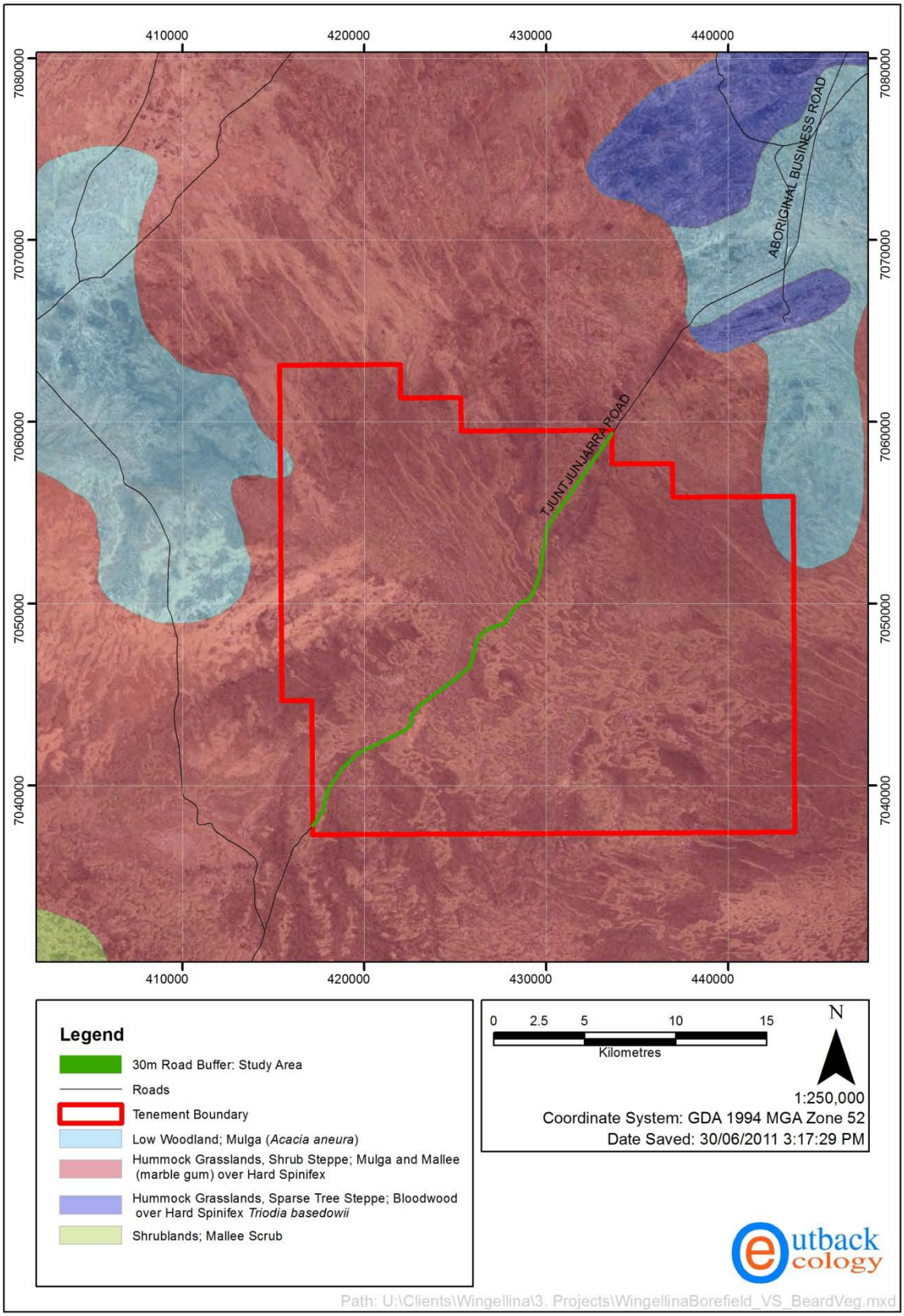

Figure 5: Beard Vegetation Units within and adjacent to the Study Area

- Hummock grasslands, sparse tree steppe; bloodwood over hard spinifex *Triodia basedowii* – Beard Vegetation Association 92 (e24Lb t2Hi; 0% of Study Area).
- Low woodland; mulga (*Acacia aneura*) - Beard Vegetation Association 18 (a1Li; 0% of Study Area).
- Shrubland; mallee scrub - Beard Vegetation Association 46 (eSi; 0% of Study Area).

Beard (1994) mapped the majority of the extant 1,624,226 ha within the Great Victoria Desert phytogeographic/IBRA bioregion (Government of Western Australia, 2011) and less than 2 % within the Central Ranges and Gibson Desert bioregions.

2.5 Land Use

2.5.1 Study Area

The Study Area is entirely within Aboriginal Reserve A17614, leased for 99 years to the Ngaanyatjarra Land Council (NLC), and on granted Native Title Land which is managed for and on behalf of the Traditional Owners by the Ngaanyatjarra Council. Metals X has signed a landmark mining agreement with the Traditional Owners and the granted Native Title holders of the Project providing consent for the grant of a Mining Lease and subsequent development of mining operations, subject to State regulatory approvals.

2.5.2 Study Area Surrounds

The Study Area lies within the Great Victoria Desert Eastern sub-bioregion. The dominant land use for this subregion is Aboriginal Reserve (57.37%). The remaining area is Unallocated Crown Land and Crown Reserves (32.87%) and Conservation Reserve (9.76%) (Graham and Cowan 2001).

3. METHODS

3.1 Regulatory Requirements

A Level 1 survey was undertaken within the Study Area in accordance with the EPA Guidance Statement No 51 (EPA 2004). This Guidance Statement stipulates that this level of survey requires a background study (desktop review), incorporating a literature review, database searches and reviews of maps of proposed area of disturbance. It also requires a reconnaissance survey; i) to verify the accuracy of the background study; ii) to further delineate and characterise the flora and range of vegetation units (vegetation communities) present in the target area; and iii) to identify potential impacts. A Level 1 survey requires a target area visit by a qualified botanist to undertake selective, low intensity sampling of the flora and vegetation, and to map vegetation and vegetation condition at “an appropriate scale”.

3.2 Desktop Review

A review of databases and publicly available information was conducted prior to the field survey to determine flora species and vegetation types of conservation significance known or likely, to occur within the Study Area and surrounds. Databases searched included the:

- DEC Threatened Ecological Communities (TEC) and Priority Ecological Communities (PEC) database (DEC 2011a);
- Department of Environment and Conservation (DEC) Threatened Flora database (DEC 2011b);
- Declared Rare and Priority Flora List (DEC 2011c);
- Western Australian Herbarium (WAH) Specimen database for Threatened and Priority species (WAH 2011);
- NatureMap database for all flora species records occurring within the Study Area (DEC 2011d); and
- Protected Matters Database Search Tool for Threatened Species and Threatened Ecological Communities (TEC) listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* (DSEWPC 2011)

Searches of the databases were undertaken for a 100 km radius surrounding the co-ordinate 26°41'12''S, 128°17'35''E (GDA94). The only exception was for the Naturemap database which only allows a search for a distance of 40 km surrounding a point.

Also consulted were the following sources:

- Declared weeds listed under the *Agriculture and Related Resources Protection Act, 1976*;
- International Union for Conservation of Nature (IUCN) Red Listed Species;
- Environment Reporting Tool of the Australian Government Department of Environment, Water, Heritage and Arts (DEWHA); and
- Australian Natural Resources Atlas of the National Land and Water Resources Audit (NLWRA).

A review was also made of previous flora surveys completed in the broader Wingellina Study Area in particular:

- Halpern Glick Maunsell. (2002) Acclaim Exploration NL Wingellina Baseline Biological Survey;
- Robinson, A.C., Copley, P.B., Canty, P.D., Baker, L.M., and Nesbitt, B.J. (2003) A Biological survey of the Anangu Pitjantjatjara Lands, South Australia 1991-2001. DEH, SA; and
- Outback Ecology (2011) Level 2 Flora and Vegetation Survey Wingellina Mine Site.

A previous general study which has been conducted around the Study Area was also reviewed as a component of this assessment. This study was:

- Graham, D. and Cowan, M. (2001). A Biodiversity Audit of Western Australia's 53 Biogeographic Subregions. Great Victoria Desert 3 (*GVD3 – Great Victoria Desert Eastern subregion*). Department of Environment and Conservation, Western Australia.

3.3 Field Based Study

The field based survey consisted of two components, 1) vegetation descriptions and mapping, and 2) significant flora searches:

3.3.1 Vegetation Descriptions and Mapping

Prior to the field surveys, a review of relevant supporting information was untaken. This included information from database searches and previous vegetation surveys/mapping in the general area (**Section 3.2**); and, topography, and soil landscape mapping (Tille 2006). Using this information and remote sensing imagery, preliminary mapping of vegetation communities was undertaken to determine where quadrats should be located to adequately sample all communities. This was fine-tuned during a preliminary reconnaissance of the Study Area.

This Study Area consisted of a 30 m wide belt transect along both sides of the 12 km long existing road through theStudy Area. Twelve quadrats were sampled between 4th and 7th May 2011(**Figure 7**). Two quadrats were established within each vegetation community identified. Each quadrat was orientated in a north-south east-west direction with a GPS reading taken at each corner. All quadrats were 50m x 50m and were measured out using tape measures prior to sampling. All four corners were marked out with aluminium stakes.

At least one labelled and uniquely numbered voucher was collected for each species and where identification was difficult multiple collections were made. A photopoint photograph of the vegetation was taken from the NW corner for each quadrat, and of the typical vegetation at each relevé site. The following information was recorded for both quadrat and relevé sites:

- Percentage cover and height for each recorded species
- GPS location (recorded in GDA94 UTM 50K);
- Vegetation condition, based on the Keighery scale (Keighery 1994) (**Appendix C**);
- Overall percentage weed cover and individual cover of perennial weeds;
- Vegetation description, based on the vegetation structural classification by Keighery (1994) (**Appendix D**);
- Descriptions of factors causing vegetation degradation and the relative importance of these factors;
- Habitat data including landform type; topography and aspect; soil texture and colour;
- Average size and rock-type of outcropping or exposed rock; and
- Estimated time since fire.

Remote sensing imagery, ground truthing and cluster analysis of quadrat data were used to identify, describe and map all plant communities in the Study Area. Extrapolation using remote sensing imagery was used to extend mapping into Heritage Areas where access was not permitted and for 100 metres out from the roadside.

Particular care was taken to document any vegetation communities listed as Threatened or Priority Ecological Communities on the DEC Threatened Ecological Communities and Priority Ecological Community database (DEC 2011a). In Western Australia, the DEC recognizes four categories of Threatened Ecological Communities (TECs), as developed by English and Blyth (1997). These include – 'Presumed Totally Destroyed', 'Critically Endangered', 'Endangered' and 'Vulnerable' (**Appendix A**). Other ecological communities that are possibly under threat but do not meet the survey criteria associated with TECs, are listed under the Department's Priority Ecological Community (PEC). These are categorised as Priority 1, Priority 2 or Priority 3 according to criteria listed in **Appendix A**. PECs that are considered to be adequately known, and are rare but not threatened, or which have been recently removed from the threatened list, are classified as Priority 4 and require regular monitoring. Conservation-dependent ecological communities are placed in Priority 5 (**Appendix A**).

In addition to TECs and PECs, ecosystems may also be described as being 'at risk'. The status of 'at risk' is recognised by the DEC and the Commonwealth Department of Sustainability, Environment, Water, Population and Communities (DSEWPC). While not conferring any form of legislative protection, the application of the 'at risk' status is a useful tool that highlights ecosystems that may be subject to threatening processes and as such, could potentially become a TEC or PEC in the future.

3.3.2 Significant Flora Searches

Targeted searches forThreatened Flora (TF) and Priority Flora (PF) as defined in **Appendix A** and as listed in Flora Base (DEC 2011e). While undertaking this search any species not previously found in quadrats were also documented and collected. These records were entered into Outback Ecology's Site Species Database as opportunistic records. Searches were confined to 30m belt transects along both side of the existing road through the Study Area, with the exception of areas where access was prohibited for aboriginal cultural reasons. In particular, targeted searches were conducted for TF and PF species identified as potentially occurring in the Study Area (**Section 4.1.3**). To facilitate this, known populations identified in the database searches as occurring in the vicinity of the Study Area were plotted on Landsat imagery. Based on previous records and collections, habitats in which these species occur in the vicinity of the study area were determined and particularly targeted during searches.

Where populations of TF and PF were located, these were photographed and described. This included the recording of exact coordinates using a GPS, counts of population size and description of

potential direct and indirect threats from the project and other factors. Rare flora report forms were completed where applicable.

Guideline 51 (EPA 2004) stipulates that surveys should be conducted following the season which contributes the most rainfall in the bioregion, and for this reason this survey was initially planned for March 2011. Long-term average monthly rainfall data (Giles Weather Station) show that a large proportion (64%) of rainfall falls between the months of November and March, with an average of 283 mm of rainfall per year (Figure 6: November 2009 to April 2011 Monthly Rainfall, and Mean Long-term Monthly Averages, for Giles Weather Station (BOM 2011). Red Line Indicates May 2011 Survey Time.

6). Leading up to the survey, well above average rainfall in February and March 2011 (**Figure 6)** resulted in access tracks to the site becoming undrivable. For this reason, the survey was undertaken in early May 2011 instead of March as initially planned. Rainfall for the twelve months leading up to the survey (482mm) was also well above average (282mm) (**Figure 6**). This included above average rainfall in summer, resulting in the flowering of a diverse range of grasses and other summer growing species.

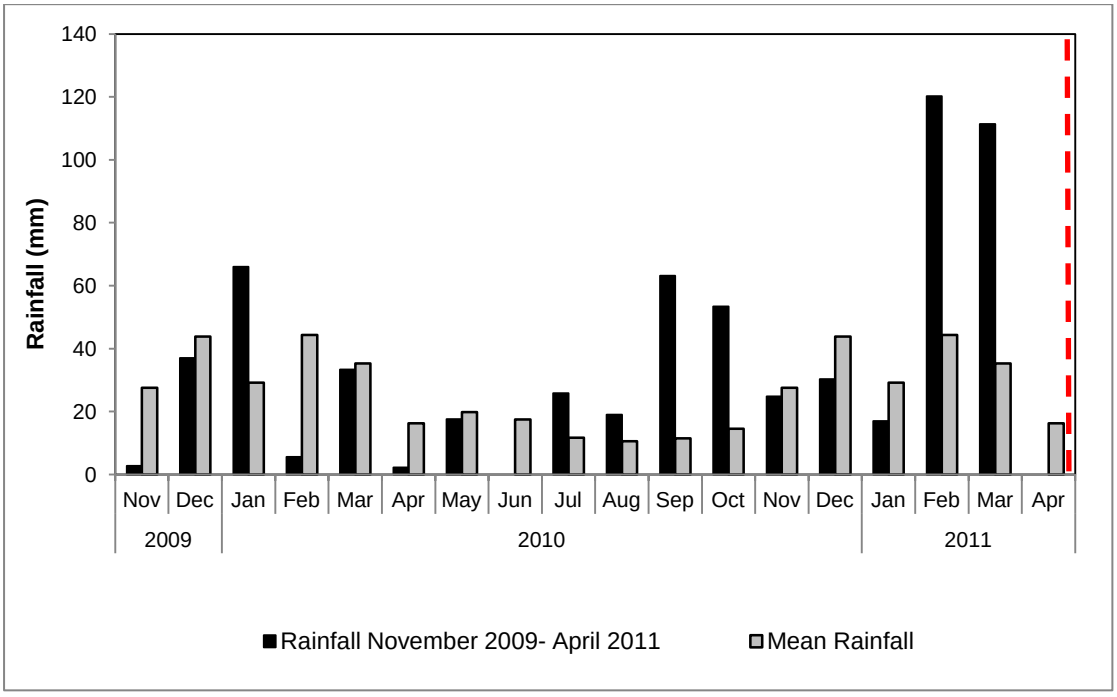

Figure 6: November 2009 to April 2011 Monthly Rainfall, and Mean Long-term Monthly Averages, for Giles Weather Station (BOM 2011). Red Line Indicates May 2011 Survey Time.

3.3.3 Identification of Flora Specimens

Plants were collected and pressed for verification and identification. Specimens were identified/verified with reference to taxonomic guides and WA Herbarium. A species list (**Appendix F**) was compiled using nomenclature from Paczkowska and Chapman (2000) and FloraBase (DEC 2011e).

3.3.4 Statistical Analysis

Cluster analysis of quadrat data was undertaken using the statistical package PRIMER 6 to define floristic communities. Analysis was carried out on presence/absence data using the Bray Curtis statistic to produce a dendrogram showing levels of similarity between quadrats.

3.3.5 Survey Personnel

The vegetation and flora field survey and reporting were undertaken by Dr Rick Davies and Lucinda Ransom (Outback Ecology).

Specimen identifications were undertaken by Dr Rick Davies (Outback Ecology) and Dr David Symon (Adelaide Herbarium) with assistance from Helen Vonow, Martin Oleary, Robyn Barker and Dr Peter Lang (Adelaide Herbarium) and Michael Hislop (WA Herbarium) for more difficult specimens.

3.3.6 Constraints and Limitations

The EPA (2004) lists a number of possible limitations and constraints that can impinge on the adequacy of flora surveys. These are listed in **Table 1** with an assessment relating to the May 2011 survey. All factors identified by the EPA (2004) were considered in the design of this survey, and only two possible limitations were identified:

- No survey after winter rains has been undertaken which may account for the paucity of winter germinating ephemeral species such as daisies.
- Part of the Study Area was not able to be accessed on foot due to aboriginal cultural requirements. However, observation from the road verge and the use of remote sensing imagery enabled all the Study Area vegetation to be accurately mapped. Examples of all landforms and vegetation communities occurred outside the prohibited area and were able to be sampled using quadrats.

Table 1: Summary of Potential Flora Survey Constraints

Aspect	Constraint	Comment regarding the flora and vegetation survey
Competency/experience of consultants	No	Members of the survey team were flora specialists employed by Outback Ecology, and who together had 30 years experience undertaking flora surveys of this kind within central Australia.
Scope	No	The scope was clearly defined and realistically achievable within the designated timeframe.

Aspect	Constraint	Comment regarding the flora and vegetation survey
Proportion of flora identified	No	Of the 163 taxa collected only five taxa could not be positively identified to species level. Unidentifiable taxa were compared to conservation significant species in order to remove the possibility of missing a significant species.
Information sources (e.g. historic or recent)	No	A number of local and regional studies have been carried out. Available data was reviewed within a few months prior to commencement of the survey.
Proportion of task achieved, and further work which might be needed	Yes	All vegetation communities occurring long Tjuntjuntjarra Road were sampled and searches made for potentially occurring DRF and PF species. All other plant species not found in quadrats were also recorded and vouchered.
Timing / weather / season / cycle	Yes	While the survey was preceeded by above average summer rain, no survey has been undertaken after winter rainfall. This possibly accounts for the paucity of winter germinating ephemerals such as daisies.
Disturbances	No	The whole Study Area has been little disturbed and is rated as being in 'Excellent' to "Pristine" condition.
Intensity	No	Survey intensity was in accordance with Guidance Statement 51.
Completeness	No	The majority of the Study was traversed on foot with at least two quadrats placed within each vegetation community. Surveys were undertaken in a peak flowering period after summer rain (May 2011). The survey is considered complete for a post-summer survey.
Resources	No	WAH specimens; taxonomic guides; DEC database searches and the FloraBase database were all used to prepare for the field surveys and used for the identification of unknown species and the confirmation of known species. Resources were adequate to carry out the survey.
Remoteness / access problems	Possible	All survey quadrats were accessible by 4WD vehicle and/or on foot. While part of the Study Area was not able to be accessed on foot due to aboriginal cultural reasons, observation from the road verge and the use of remote sensing imagery enabled all the Study Area vegetation to be accurately mapped. Examples of all landforms and vegetation communities occurred outside the prohibited area and were able to be sampled using quadrats.
Availability of contextual information	No	Information was available from the Interim Biogeographic Regionalisation for Australia (IBRA) Eastern Great Victoria Desert subregion, FloraBase, DEC lists and the Bureau of Meteorology.

4. RESULTS AND DISCUSSION

4.1 Desktop Review

4.1.1 EPBC Protected Matters Database Search

No threatened plant species or Threatened Ecological Communities (TECs) as defined under the *EPBC Act 1999* (DSEWPC 1999) were identified as occurring within the Study Area (DSEWPC 2011).

4.1.2 DEC Database Search – Threatened and Priority Ecological Communities

A search of the DEC TEC-PEC database for an area bound by a radius of 100 km from the co-ordinates 26°41'12''S, 128°17'35''E (GDA94) was undertaken (DEC 2011a). This search identified no Threatened or Priority Ecological Communities. However, the IBRA Eastern Great Victoria Desert Subregion contains the Mirramiratjarra Dunefield which is listed by Graham and Cowan (2001) to be an "Ecosystem at Risk". Graham and Cowan (2001) and CALM (2003) describes this dune field as a unique dune formation with a vegetation and drainage system threatened by grazing pressures and feral animals, in particular camels and rabbits. However, the specific location of these dune fields is poorly defined in these documents.

4.1.3 Database and Literature Searches – Threatened and Priority Flora

A total of ten taxa currently ascribed a conservation code in Western Australia have been recorded or collected from an area 100 km radius of the centre of the Study Area (26°41'12''S, 128°17'35''E (GDA94) according to databases and literature searched. Details of these records are given in **Table 2**. None of these taxa are considered Threatened Flora, as defined under the Western Australian *Wildlife Conservation Act 1950*. Based upon the habitat preferences of these species as described on herbarium records (WAH 2011; DEC2011e), it is likely that suitable habitat for two of these species, *Vittadinia pustulata* and *Eucalyptus sparsa*, occurs in the Study Area. It is possible that suitable habitat occurs for a further two species: *Stackhousia clementii* and *Acacia calcicola* (**Table 2)**. Herbarium records and information from other surveys suggest that the remaining seven species are confined to heavy soil, rocky hills and drainage lines, habitats that are absent from the Study Area (**Table 2)**. The whole of the study area consist of dunes and plains of sand and sandy loams with localised area of calcrete

Table 2: Results of Database and Literature Searches: Flora of Conservation Significance Collected or Recorded within the 100 km Radius of theStudy Area.

The table summarises the results of DEC database searches of an area of 100 km radius centred on 26°41'12''S, 128°17'35''E (GDA94).

Definitions of conservation codes (CC) are given in **Appendix A**; TF=Threatened Flora; PF=Priority Flora

Information sources: D=DEC (2011b); O11=OES (2011); W11=WAH (2011); W&S92=Whibley and Symon (1992)

Family	Taxa	CC	Nearest record	Info source	Habitat	Habitat in Study Area?
ASTERACEAE	*Calotis latiuscula*	P3	58km N	W11, D11	Low rocky hills of large of large granite boulders (W11); near creek bed on rocky hillside (W11); clay plain with calcrete floaters (W11); hardpan plain (W11); stony ridge (W11); Mitchell Grass plain (O11)	No
ASTERACEAE	*Vittadinia pustulata*	P2	74km N	W11	Sand flat adjacent to sand dune on one side (W11)	Yes
BRASSICACEAE	*Menkea lutea*	P1	69km NNW	W11,O11	Red loam (W11); Mitchell grass plain (O11)	No
CELASTRACEAE	*Stackhousia clementii*	P1	84km NW	W11	Shallow skeletal sand on calcrete platform (W11); soft, silty saline soil over limestone (W11); drainage tract woodland (W11); Saline playa in red-brown soil with gypsum (W11); Kopi dune (W11); watercourse (W11).	Yes?
EUPHORBIACEAE	*Euphorbia parvicaruncula*	P1	65km NNW	W11	On rocks (W11); in or near range (W11)	No
EUPHORBIACEAE	*Euphorbia inappendiculata*	P3	100km NNE	O11	Red loam depressions interspersed with quartzite in a plain (W11); clay soil in broken rocky scree (W11); syone red cracking clay (W11); open plain in heavy soil (W11); Mitchell grass plain (O11)	No
FABACEAE	*Acacia calcicola*	P4	100km NNE	W11	On plains (W11); calcareous soils, mainly crusty alkaline and neutral red duplex, brown calcareous or neural red earths (W&S92)	Yes?
GOODENIACEAE	*Goodenia lunata*	P1	82km NE	O11	Salt lake margin (W11); Mitchell grass plain (O11)	No
LAMIACEAE	*Teucrium grandiusculum* subsp. *grandiusculum*	P2	56km NE	W11	Rocky slope in red sand	No
MYRTACEAE	*Eucalyptus sparsa*	P3	54km N	W11	Flat plain with deep red sandy earth (W11); Near base of red sand-dune (W11)	Yes

4.1.4 Review of Existing Reports

HGM Maunsell 2002; Wingellina Baseline Biological Survey.

This report included an inventory of all the flora and fauna recorded during a Level 1 survey of the surrounds of the Wingellina community in April 2002 (an area of approx. 100km^2). This survey was undertaken in the Central Ranges (CR1 – Mann-Musgrave Block IBRA subregion) Central Ranges Bioregion (Graham and Cowan 2001) 100km to the north of the Study Area. This study consisted predominantly of desk-top assessment with limited ground truthing of the remotely captured data

A total of 188 plants were recorded during this survey, 75 of which had not been previously recorded for the area. No Threatened Flora or Priority Flora were identified from this survey. Six introduced taxa were recorded, five of which were new records for the Central Ranges bioregion. HGM Maunsell concluded that a high level of human activity in the vicinity of the Wingellina community had exacerbated the spread of weed species.

Seven vegetation communities were identified during the survey, none of which were restricted to the survey area. None of the plant communities recorded in the survey were nationally listed as Threatened Ecological Communities under the *EPBC Act* or Threatened Ecological Communities (TECs) or Priority Ecological Communities (PECs) as listed by DEC (2011a).

Three communities were considered to be regionally significant consisting of:

- Grassland of *Poaceae* spp. with occasional *Senna glutinosa* subsp. *glutinosa* and *Sida fibulifera* in patches of cracking clay;
- Low Scrub over *Triodia* spp. in sand over sand dunes; and
- Low Open Woodland of *Eucalyptus gamophylla* and *Eucalyptus socialis* subsp. *eucentrica* over *Acacia validinervia* over mixed shrubs over *Triodia scariosa* in clay loam on upper slopes of mafic ridges.

These vegetation communities were considered to be regionally significant due to their apparent isolation and underlying geomorphology.

A. C. Robinson, P. B. Copley, P. D. Canty, L. M. Baker and B. J. Nesbitt (Eds) (2003). A Biological Survey of the Anangu Pitjantjatjara Lands, South Australia. Department for Environment and Heritage, South Australia.

This report includes an inventory of all the flora and fauna recorded during a survey of the Anangu-Pitjantjatjara (AP) lands of South Australia. It forms part of a comprehensive biological survey of South Australia spanning 10 years. A total of 719 plant species were recorded in the Anangu-Pitjantjatjara lands with 18% recorded only once and 16 taxa discovered for the first time in South Australia indicating the general paucity of knowledge of the regions flora. Forty-four species had not been previously recorded from the North-western Herbarium Region of South Australia including a new undescribed species of *Calostemma*.

Species data was collected from 253 quadrats. This data was subject to a Cluster Analysis using the program PATN, resulting in the grouping of 30 qualitatively defined plant communities into eleven Floristic Groups or "Clusters". The report describes each of the plant communities in terms of species composition, structure, distribution and habitat. Quantitative data is provided for each of the dominant species indicating their importance value as indicator species for the communities in which they occur.

Graham, D. and Cowan, M. (2001). A Biodiversity Audit of Western Australia's 53 Biogeographic Subregions in 2002. Great Victoria Desert 3 (GVD3 – Great Victoria Desert Eastern subregion). Department of Environment and Conservation, Western Australia.

Graham and Cowan (2001) did not identify any Threatened Ecological Communities (TECs) or any Wetlands of National or subregional significance in the GVD3 bioregion. However, the Mirramiratjarra dune field is described as an "at risk" ecosystem in this bioregion due to its "unique dune formation, vegetation and drainage systems". Threats to this ecosystem were described as grazing and feral animals (camels and rabbits). No TF or PF were identified as occurring in the GVD3 bioregion in this report.

Over the bioregion as a whole, the authors identified changed fire regimes, feral herbivores, mining interests and inadequate knowledge as the main threatening processes. They describe 8.4% of the GVD3 bioregion as being reserved within IUCN I-IV reservations.

Outback Ecology 2010

Outback Ecology was commissioned by Metals X Limited to conduct a Level 2 Flora and Vegetation Assessment of the Wingellina mine site. This report documented the results of the flora and vegetation survey conducted across the Study Area in April 2008 and in October 2010. The survey gathered flora data from 33 quadrats and 44 relevé points. The initial survey identified a total of 154 taxa. The latest survey identified a total of 358 taxa, recorded from 46 families and 131 genera.

No Threatened Flora (TF) listed under the WA *Wildlife Conservation Act (1950)*, or threatened flora species listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999*, the South Australian *National Parks and Wildlife Act 1972* or the Northern Territories *Territory Parks and Wildlife Conservation Act* 2000 were recorded within the Study Area. Based upon the field survey undertaken, together with a habitat assessment of the likely occurrence of these species, it was predicted that none were expected to occur.

Four Priority taxa were recorded within the Study Area during the October 2010 survey: *Menkea lutea* (Priority 1), *Goodenia lunata* (Priority 1), *Euphorbia inappendiculata* (Priority 3) and *Calotis latiuscula* (Priority 3). Large numbers of *Menkea lutea* were recorded in the Mitchell Grass dominated southern sections of the Study Area. It was predicted that there was limited likelihood that this species may be impacted by the construction of the proposed accommodation camp. Since this species was found

extensively throughout the southern sections of the Study Area, it was argued that the proposed development would be likely to impact only a small percentage of the whole local population.

One individual *Euphorbia inappendiculata* was recorded adjacent to the western boundary of the Study Area while one individual of *Goodenia lunata* and *Calotis latiuscula* were recorded during the survey in the southern sections of the Study Area. The report stated that it was unlikely that any of these priority species will be impacted by the proposed mining activities, as they were not found within or adjacent to the proposed disturbance footprint.

Fourteen vegetation communities from 11 broad floristic formations were mapped and described within the Study Area. None of the vegetation communities mapped and described were listed as Threatened Ecological Communities (TECs) or Priority Ecological Communities (PECs) in Western Australia. Vegetation condition across the majority of the Study Area was rated as being generally in excellent condition.

Eight introduced species, **Cenchrus ciliaris* (Buffel Grass), **Cenchrus pennisetiformis* (Cloncurry Buffel Grass), **Acetosa vesicaria* (Ruby Dock), **Capsella bursa-pastoris* (Shepherd's Purse), **Malvastrum americanum* (Spiked Malvastrum), **Tribulus terrestris* (Caltrop), **Citrullus colocynthis* (Camel Melon) and **Citrullus lanatus* (Pie Melon) were listed as occurring within the Study Area. None of these nine species were Declared Plants under the *Agriculture and Related Resources Protection Act, 1976.* Eight were however, classified as 'Environmental Weeds' by the *Environmental Weed Strategy for Western Australia* (WA Department of Environment and Conservation [DEC] 1999). **Cenchus ciliaris* (Buffel Grass) was described as being located throughout the north-eastern sections of the Study Area, recorded in 15 quadrats and 12 relevé sites in this area. Low density, scattered occurrences of the remaining weed species were detected in the Study Area. *Cenchrus pennisetiformis* (Cloncurry Buffel Grass) was described as being not previously been recorded from Western Australia.

The report describes the Project as resulting in the removal of approximately 2,543 hectares of vegetation. It was calculated that the majority of the clearance would be of Sparse Tall Shrubland of *Acacia aneura*.

The report listed potential impacts from current and future disturbance as:

- damage to vegetation from clearing and dust,
- introduction and spread of weed species,
- alterations to site hydrology, and
- alterations to natural fire regimes.

The report concluded the proposed mine will have only a localised direct impact on the flora and vegetation of the Study Area or region as long as threats were appropriately managed. Potential

indirect impacts of the development of the mine were described as the spread of Buffel Grass during road construction and other earth works, associated increased fire frequencies, the spread of new species of weeds from gardens established at the site, increased rabbit and camel numbers due to increased availability of water and feed (e.g., lawns), and damage to native vegetation by recreational offroad vehicles (driven by mine staff and contractors)

4.2 Field Survey Results

4.2.1 Flora Composition

A total of 163 taxa were recorded representing 32 families and 87 genera. Dominant families include Poaceae (27 taxa), Fabaceae (22 taxa) Chenopodiaceae (15 taxa), Malvaceae (13 taxa) and Myrtaceae (11 taxa; **Table 4**). Dominant genera were *Acacia* (13 taxa), *Eremophila* (8 taxa), *Ptilotus* (8 taxa), *Eucalyptus* (7 taxa), *Sclerolaena* (5 taxa), *Senna* (5 taxa), and *Sida* (5 taxa; **Table 4**). The high diversity of identifiable grasses is indicative of the above average summer rainfall preceding the survey. The relatively unmodified nature of the vegetation is indicated by the high indigenous species richness at a number of sites (up to 45 species in 50m x 50 m quadrat)

The full species list can be found in **Appendix F.**

4.2.2 Introduced Species

Two exotic species, Buffel Grass (**Cenchus ciliaris*) and Caltrop (**Tribulus terrestris*), were recorded in the Study Area. Another species, **Portulaca oleracea* (Common Purslane), which is considered to have indigenous and introduced forms in Western Australia (DEC 2011), was also recorded. However, this species is considered to be totally indigenous in South Australia (Barker et al. 2005). None of these species are Declared Plants under the *Agriculture and Related Resources Protection Act, 1976.* However, **Cenchus ciliaris* (Buffel Grass), is classified as a significant 'Environmental Weed' by the *Environmental Weed Strategy for Western Australia* (WA Department of Environment and Conservation [DEC] 1999) due to its ability to invade and outcompete native species and its high flammability resulting in increased fire frequency and intensity (Robertson 2008). Only one individual of Buffel Grass was located in the Study Area (at AMG 52J 425676 7046405) near to an existing drill hole. This species is widespread around the Wingellina Community and its potential spread on earth moving equipment is a significant threat to the vegetation in the Study Area, especially where earth moving equipment has been previously operating in Buffel Grass infested areas. This perennial grass species quickly produces a large viable soil seedbank so its removal after it has become well established in a new location is difficult. However, early detection and removal has much greater chance of success.

Table 3: Numbers of Taxa from each Family Recorded within the Study Area.

Family	No. taxa	Family	No. taxa
Poaceae	26	Convolvulaceae	2
Fabaceae	22	Haloragaceae	2
Chenopodiaceae	15	Portulacaceae	2
Malvaceae	13	Rubiaceae	2
Myrtaceae	11	Santalaceae	2
Amaranthaceae	8	Acanthaceae	1
Goodeniaceae	8	Adiantaceae	1
Scrophulariaceae	8	Araliaceae	1
Asteraceae	6	Campanulaceae	1
Solanaceae	5	Capparaceae	1
Lamiaceae	4	Cyperaceae	1
Zygophyllaceae	4	Geraniaceae	1
Euphorbiaceae	3	Nyctaginaceae	1
Proteaceae	3	Pittosporaceae	1
Boraginaceae	2	Sapindaceae	1
Brassicaceae	2	Total # Species	162
Chloanthaceae	2	Total # Families	32

Table 4: Number of Taxa from each Genus Recorded within the Study Area .

Genera	# Taxa	Genera	# Taxa
Acacia	13	*Cymbopogon*	1
Eremophila	8	*Digitaria*	1
Ptilotus	8	*Dodonaea*	1
Eucalyptus	7	*Einadia*	1
Sclerolaena	5	*Enchylaena*	1
Senna	5	*Eragrostis*	1
Sida	5	*Eremophea*	1
Enneapogon	4	*Erodium*	1
Triodia	4	*Exocarpos*	1
Abutilon	3	*Hakea*	1
Aristida	3	*Hannafordia*	1
Dysphania	3	*Keraudrenia*	1
Euphorbia	3	*Lawrencella*	1
Goodenia	3	*Lepidium*	1
Scaevola	3	*Leptosema*	1
Solanum	3	*Malvaceae*	1
Dicrastylis	2	*Melaleuca*	1
Eriachne	2	*Menkea*	1
Grevillea	2	*Microcorys*	1
Halgania	2	*Micromyrtus*	1
Haloragis	2	*Minuria*	1

Table 4 (cont.): Number of Taxa from each Genus recorded within the Study Area.

Genera	# Taxa	Genera	# Taxa
Maireana	2	*Monachather*	1
Nicotiana	2	*Muelleranthus*	1
Prostanthera	2	*Neurachne*	1
Psydrax	2	*Paractaenum*	1
Tribulus	2	*Paraneurachne*	1
Zygophyllum	2	*Paspalidium*	1
Aluta	1	*Petalostylis*	1
Alyogyne	1	*Pittosporum*	1
Amphipogon	1	*Portulaca*	1
Asteraceae	1	*Rhagodia*	1
Boerhavia	1	*Rulingia*	1
Bonamia	1	*Rutidosis*	1
Brachychiton	1	*Salsola*	1
Brunonia	1	*Santalum*	1
Bulbostylis	1	*Schoenia*	1
Calandrinia	1	*Spartothamnella*	1
Cheilanthes	1	*Swainsona*	1
Cleome	1	*Themeda*	1
Convolvulus	1	*Thryptomene*	1
Thyridolepis	1	*Vittadinia*	1
Trachymene	1	*Wahlenbergia*	1
Tragus	1	Total # Species	162
Triraphis	1	Total # Genera	87
Velleia	1	Total # Families	32

4.2.3 Significant Flora

No Threatened Flora (TF) (also called Declared Rare Flora) listed under the WA *Wildlife Conservation Act (1950)*, or threatened flora species listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999*, the South Australian *National Parks and Wildlife Act 1972* or the Northern Territories *Territory Parks and Wildlife Conservation Act* 2000 were recorded within the Study Area. Based upon the field survey undertaken, together with a habitat assessment of the likely occurrence of these species, none are expected to occur.

One Western Australian Priority Flora species was recorded within the Study Area during the May 2010 survey: Woolly Mulga-grass (*Neurachne lanigera*) (Priority 1 in WA). This was found within three quadrats (QWB01, QWB03 and QWB012). This species also occurs in South Australia where it is listed as Rare (Barker et al. 2005; **Figure 7**). A number of plants were found in quadrat QWB012 in Mulga (*Acacia aneura*) Tall Open Shrubland over *Triodia basedowii* (Vegetation Community 4a). Solitary plants were also found in the other two quadrats in Marble gum (*Eucalyptus gongylocarpa*) Low Open Woodland (Vegetation Community 1) and in Mulga (*Acacia aneura*) Tall Open Shrubland

over *Eragrostis eriopoda*, *Aristida holothera* & *Eriachne mucronata* (Vegetation Community 4b). Locations where this species was observed in the Study Area are given in **Figure 8 and Appendix G**. This species appears to occur only as highly localised populations in the Study Area. The populations may be deleteriously affected by vegetation clearance (for roads and drill pads) and potential associated introduction of Buffel Grass (through the transport of weed seeds on earthmoving equipment) if not managed approprately.

Of significance was the location of a probable new undescribed species of *Goodenia* in the two quadrats sampling Red Mallee (*Eucalyptus socialis* subsp. *eucentrica*) Very Open Shrub Mallee (Vegetation Community 5). This species has a similar shaped indusium to *Goodenia heteromera* but lacks stolons and has significantly larger seeds with wider wings than the size range given for that species in the Flora of Australian Volume 35. It also has similarities with *G. concinna* and *G. quasilibera* but still differs from both in several respects. Due to its similarity with the latter species it is referred to below as *Goodenia* sp. affin. *quasilibera* (L. Ransom 868) as recommended by Michael Hislop at the Western Australian Herbarium. Several plants of this species were found and it appears that this species is confined to calcrete in the Study Area. Locations where this species was observed in the Study Area are given in **Figure 8** and **Appendix G**. Without further surveys it is difficult to ascertain how widespread this species in the local region since these calcrete areas are moderately common in the local area and extend into the the Anangu Pitjantjatjara Lands of adjacent South Australia. If highly localised, vegetation clearance and any associated Buffel Grass weed invasion may present a significant threat to the species unless managed appropriately.

Two other species recorded in the Survey Area appear to represent disjunct populations well outside their main normal distributions. Fifty plants of Harrow Wattle (*Acacia acanthoclada*) were found in flat sandy plain mallee (Vegetation Community 3) adjacent to the base of a dune, while Thryptomene (*Thryptomene longifolia*) was found to be dominant on the crest of high dunes in Vegetation Community 2 (**Figure 8** and **Appendix G)**. *Acacia acanthoclada* occurs in the region as a disjunct population 500 km from the main distribution of the species in Western Australia and South Australia (Maslin 2001; Robinson et al. 2003; **Figure 7**). The survey indicates that the species is highly localised in the Study Area and thus local populations could potentially be threated by vegetation clearance and Buffel Grass weed invasion. *Thryptomene longifolia* is previously unknown from Western Australia. This population in the Study Area appears to be a relic disjunct outlier, the nearest known occurrence being 400 km to the southeast in South Australia (**Figure 7**). It is anticipated that drilling is unlikely to affect areas where *Thryptomene longifolia* occurs since high dune crests are unlikely to be targeted for drilling due to logistic reasons.

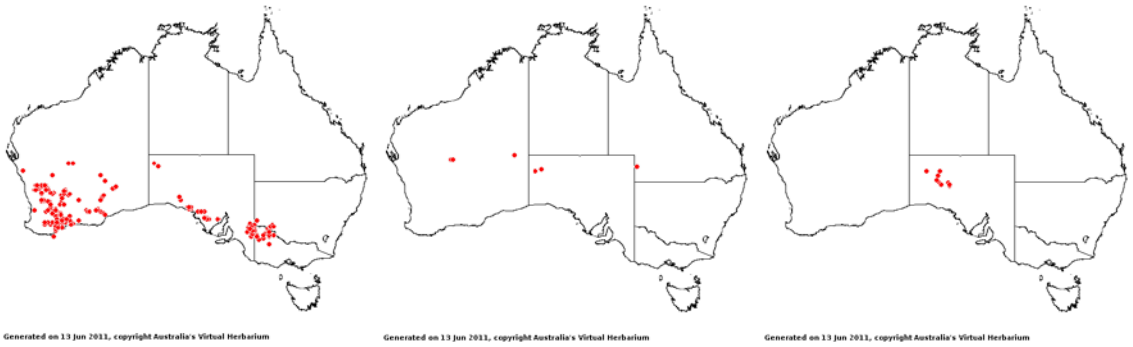

Figure 7: Australia-wide Distribution of Significant Species recorded within the Study Area.

From left: *Acacia acanthoclada*, *Neurachne lanigera, Thryptomene longifolia*

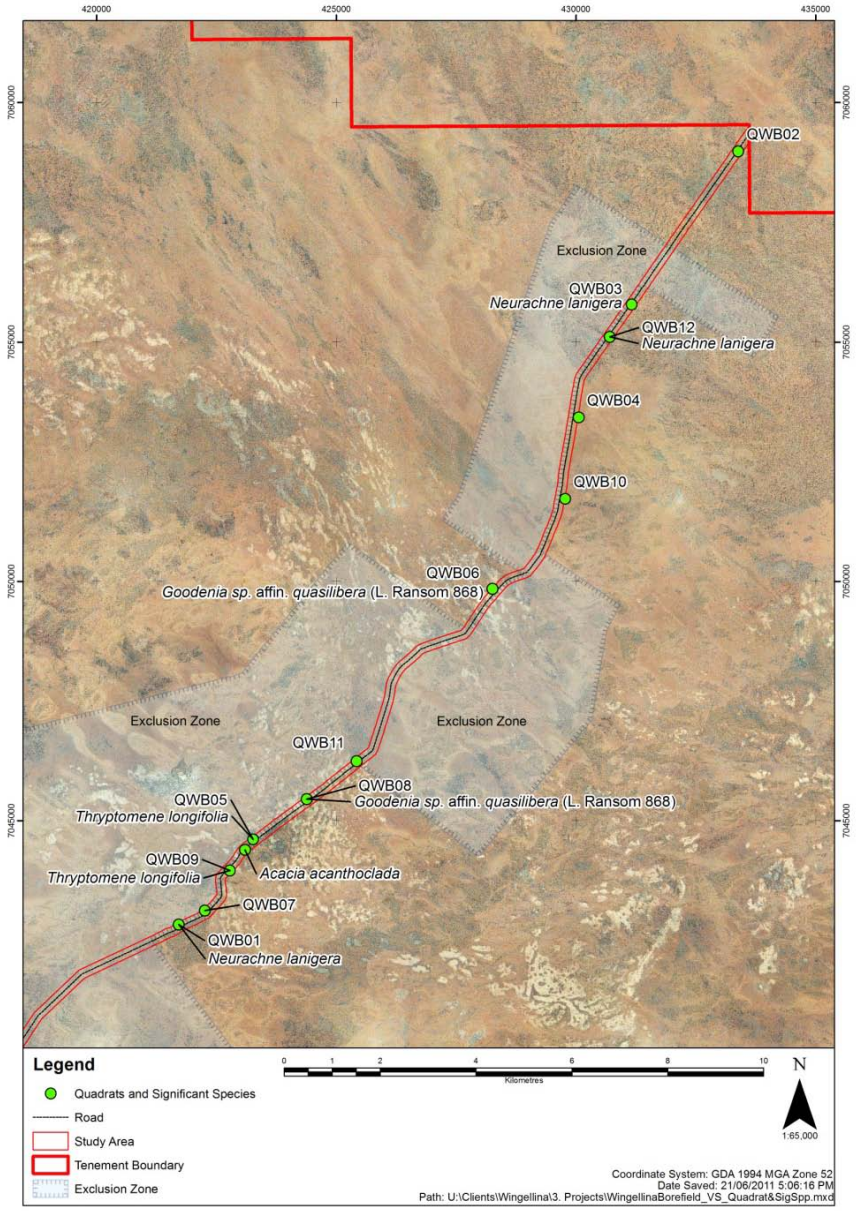

Figure 8: Location of Quadrats & Significant Species in the Study Area.

4.2.4 Vegetation Communities

Remote sensing imagery and ground truthing were used to identify all vegetation communities in the Study Area. These were differentiated and described qualitatively on the basis of 1) overstorey and understorey dominant species, 2) vegetation structure, and 3) the landforms and soils types on which they occur. Two quadrats were sampled in each of these communities and the following data collected for each: 1) quadrat location and coordinates, 2) soil and landform information, 3) dominant plant species and structure for each stratum, 4) vegetation condition and evident impacts, 5) a complete plant species list, and 6) height and cover for all species present **(Appendix E)**. The location of each quadrat is shown on **Figure 8**.

A total of six vegetation communities were described and mapped, viz. Vegetation Communities 1, 2, 3, 4a, 4b, and 5. Detailed descriptions of these communities are provided in the following text along with habitat information and details on the condition, conservation status and significance of each. The distribution of each vegetation communities in the Study Area is shown in **Figures 9,10,11,12**. Areas covered by each vegetation community are quantified in **Table 5**.

Absence and presence data from all quadrats was analysed using Cluster Analysis to determine quantitatively the degree of similarity between the six qualitatively determined vegetation communities. This analysis showed Communities 1, 2, 3, and 5 to be floristically highly dissimilar from one another and therefore distinct floristic communities (**Appendix H**). However, quadrats sampled in vegetation classified as Communities 4a and 4b (quadrat QWB02, QWB03, QWB11, QWB12) were found to be floristically highly dissimilar (**Appendix H**) despite having similar dominant species in their overstoreys and understoreys. This indicates that Mulga communities in the Study Area are floristically diverse, species composition varying significantly over distance in response to subtle changes in soil texture. To define these Mulga communities would require a much greater sampling effect, well beyond the resources and requirements of this study.

4.2.5 Threatened and Priority Ecological Communities

None of the vegetation communities recorded in the Study Area are listed as Threatened Ecological Communities (TECs) or Priority Ecological Communities (PECs) in Western Australia.

4.2.6 Vegetation Condition

Vegetation condition across the majority of the Study Area was rated as being generally in Excellent to Pristine condition (**Table 5; Appendix C)**. Vegetation Communities 1, 2, 3 and 5 were all in Pristine condition. Vegetation Communities 4a and 4b were considered to be in Excellent condition due to localised browsing of occasional individuals of a few species by camels. Despite large herds of up to 50 camels observed in the Study Area, these appeared to be having minimal observable impact on perennials species at the time of the survey. This was probably due to the well above-average rainfall in the year leading up to the survey resulting in abundant ephemeral herbage and thus ample feed.

Table 5: Summary of Vegetation Communities (VCs) within the Wingellina Borefield Study Area.

VC #	Vegetation Community Description	Landform	Area (ha) (%) of Study Area	Condition	Quadrat Number
VC1	Marblegum (*Eucalyptus gongylocarpa*) Low Open Woodland on Broad Sandy Ridges	Broad sandy ridges and swales towards the south-western corner of Study Area	25.0 ha (5%)	Pristine	QWB01; QWB07
VC2	Sharp-capped Mallee (*Eucalyptus oxymitra*) ± Ooldea Mallee (*E. youngiana*) Very Open Shrub Mallee on High Dunes	Crest and slopes of high dunes near the centre of the Study Area	30.2 ha (6%)	Pristine	QWB05, QWB09
VC3	Jingulu *(Eucalyptus glomerosa)* and/or Blue Mallee (*Eucalyptus gamophylla*) ± Ooldea Mallee (*E. youngiana*) Very Open Shrub Mallee grading into *Triodia basedowii* Grassland on Flat Sandy Plains	Flat sand plains near centre of the Study Area	172.2 ha (34%)	Pristine	QWB04, QWB10
VC4a	Mulga (*Acacia aneura*) Tall (Open) Shrubland with a Tussock Grass Understorey of *Triodia basedowii* on Undulating Sandy Loam Plains	Undulating sandy loam plains towards the north-eastern and south-western corners of the Study Area.	243.7 ha (48%)	Excellent; localised browsing by camels of *Psydrax suaveolens & Eremophila* spp.	QWB02, QWB12
VC4b	Mulga (*Acacia aneura*) Tall Shrubland with Hummock Grass Understorey of *Eragrostis eriopoda* and *Aristida holothera* on Loam Plains	Undulating sandy loam plains towards the north-eastern and south-western corners of the Study Area.			QWB03, QWB11
VC5	Inland Red Mallee (*Eucalyptis socialis* subsp. *eucentrica*) Very Open Shrub Mallee with Tussock Grass Understorey of *Triodia scariosa* on Undulating Calcrete Plains	Undulating calcete plains near the the centre of the Study Area.	41.6 ha (8%)	Pristine	QWB06, QWB08

Evidence of fire in the previous 5 to 10 years was observed in localised areas of Vegetation Communities 2, 3, 4a, 4b and 5. However, extensive healthy regeneration of all species indicated increased frequent fire was not an issue affecting long-term vegetation condition at the time of the survey. *Triodia* dominated communities are adapted to regenerate following fire and long-term declines in species diversity due to excessive fire generally only occurs when the length of time between fires is too short to allow adequate regeneration and seed production in fire susceptible species. Typically, species that are most susceptible to frequent fire are those where the adults are killed by fire, regenerate solely from seed in a single germination pulse, have a long juvenile period without seed available, and have limited seed dispersal. Particularly susceptible are species in the *Hakea* and *Grevillea* genera. The presence of healthy Hakeas and Grevilleas at a number of sites indicates fire is presently not a threat to the Study Area.

The majority of the vegetation across the Study Area was weed free. The only exotic species observed at any sample sites was Caltrop (**Tribulus terrestris*) which occurred at a low frequency and at only two of the twelve quadrat sites. This species is not highly invasive and does not out-compete indigenous species. The only other exotic species observed was one plant of Buffel Grass on the roadside near a drilling test site as previously mentioned. This species is of great concern since it is highly invasive and does out-compete indigenous species.

4.2.7 Detailed Descriptions of Vegetation Communities

Vegetation Community 1: Marblegum (*Eucalyptus gongylocarpa*) Low Open Woodland on Broad Sandy Ridges

Location and landform: Broad sandy ridges and swales towards south-western corner of Study Area.

Quadrats Sampled: QWB01, QWB07 **Area Mapped:** 25.0 hectares

Soil: Orange sandy loams and sands; **Rock Type:** Nil

Vegetation Structure and Dominant Species in each Stratum: *Eucalyptus gongylocarpa* Low Open Woodland over *Acacia prainii* ± *Dodonaea viscosa* subsp. *angustissima* Tall (Open) Shrubland over *Aluta maisonneuvei* Open Shrubland over *Triodia basedowii* Open Grassland

Vegetation Condition: Pristine

Conservation status: This community is conserved in the Unnamed Conservation Park in South Australia (Davies 1982; Davies et al. 1986; Neagle 1995). Beard (1974) indicates that this community is widespread in the Great Victoria Desert in Western Australia

Significance: One plant of the Priority 1 Flora species, *Neurachne lanigera*, was found in this community (Quadrat QWB01; Appendix G).

Plate 1: Marblegum (Eucalyptus gongylocarpa) Low Open Woodland on Broad Sandy Ridge

Vegetation Community 2: Sharp-capped Mallee (*Eucalyptus oxymitra*) ± Ooldea Mallee (*E. youngiana*) Very Open Shrub Mallee on High Dunes

Location and landform: Crest and slopes of high dunes in the centre of the Study Area.

Quadrats Sampled: QWB05, QWB09 **Area Mapped:** 30.2 hectares

Soil: Orange sands **Rock Type:** Nil

Vegetation Structure and Dominant Species in each Stratum: *Eucalyptus oxymitra* ± Ooldea Mallee *(E. youngiana)* Very Open Shrub Mallee over *Aluta maisonneuvei* and *Thryptomene longifolia* Open Shrubland over *Triodia basedowii* (Very) Open Grassland

Vegetation Condition: Pristine. Areas burnt 5-10 years previous to survey but no evidence of repeated high frequency burning.

Conservation status: Robinson *et al.* (2003) indicate that a closely related vegetation community (Group 26; Umbrella Bush Dune Shrubland) is widespread in the Anangu Pitjantjatjara Lands of North Western South Australia.

Significance: *Thryptomene longifolia* is a dominant species in this community (Quadrats QWB05 & QWB07; Appendix G). This is the first record of this species for Western Australia. This population

appears to be a relic outlier, the nearest known occurrence being 400 km to the southeast in South Australia.

Plate 2: Sharp-capped Mallee (*Eucalyptus oxymitra*) ± Ooldea Mallee (*E. youngiana*) Very Open Shrub Mallee on High Dunes

Vegetation Community 3: Jingulu (*Eucalyptus glomerosa*) and/or Blue Mallee (*Eucalyptus gamophylla*) ± Ooldea Mallee (*E. youngiana*) Very Open Shrub Mallee / *Triodia basedowii* Grassland on Flat Sandy Plains

Location and landform: Flat sand plains near centre of the Study Area.

Quadrats Sampled: QWB04, QWB10 **Area Mapped:** 172.2 hectares

Soil: Orange sands **Rock Type:** Nil

Vegetation Structure and Dominant Species in each Stratum: *Eucalyptus glomerosa* and/or *E. gamophylla* ± *E. youngiana* (Very) Open Shrub Mallee over *Acacia ligulata* & *Acacia melleodora* or *Eremophila forrestii* (Low) Open Shrubland over *Triodia basedowii* Grassland. This community grades into *Triodia basedowii* Grassland with emergent mallee and mulga.

Vegetation Condition: Pristine. Areas burnt 5 to 10 years previous to survey but no evidence of repeated high frequency burning.

Conservation status: Robinson *et al.* (2003) indicate that a closely related vegetation community (Group 27; Hard Spinifex Communities on Sand Plains and Dunes) is widespread in the Anangu Pitjantjatjara Lands of North Western South Australia.

Significance: Fifty plants of *Acacia acanthoclada* found in this community adjacent to the base of a dune (Appendix G). Populations in the vicinity of the Central Ranges are relic outliers of, and 500 km from, the main distribution of the species in Western Australia and South Australia (Figure 6).

Plate 3: Jingulu (*Eucalyptus glomerosa*) Very Open Shrub Mallee on Flat Sandy Plains

Vegetation Community 4a: Mulga (*Acacia aneura*) Tall (Open) Shrubland with a Tussock Grass Understorey of *Triodia basedowii* on Undulating Sandy Loam Plains

Location and landform: Undulating sandy loam plains towards the north-eastern and south-western corners of the Study Area.

Quadrats Sampled: QWB02, QWB12 **Area Mapped:** 243.7 hectares (with VC4b)

Soil: Orange brown sandy loam **Rock Type:** Laterite 1-10 mm in diameter

Vegetation Structure and Dominant Species in each Stratum: *Acacia aneura* Tall (Open) Shrubland over ± *Eremophila latrobei* over *Triodia basedowii* Grassland

Vegetation Condition: Excellent; evidence of localised disturbance by camels including localised heavy browsing by camels of *Psydrax suaveolens.*

Conservation status: Beard (1974) indicates that this community is widespread in the Great Victoria Desert in Western Australia..

Significance: Numerous plants of the Priority 1 Flora species, *Neurachne lanigera*, found in this community (Quadrat QWB12; Appendix G).

Plate 4: Mulga (*Acacia aneura*) Tall Shrubland with a Tussock Grass Understorey of *Triodia basedowii* on Undulating Sandy Loam Plains

Vegetation Community 4b: Mulga (*Acacia aneura*) Tall Shrubland with Hummock Grass Understorey of *Eragrostis eriopoda* & *Aristida holothera* on Loam Plains

Location and landform: Undulating sandy loam plains towards the north-eastern and south-western corners of the Study Area.

Quadrats Sampled: QWB03, QWB11 **Area Mapped:** 243.7 hectares (with VC4a)

Soil: Orange (sandy) loam **Rock Type:** Laterite 1 - 3 mm (- 30 mm) in diameter

Vegetation Structure and Dominant Species in each Stratum: *Acacia aneura* Tall Shrubland over *Eremophila latrobei* Low Open Shrubland over *Eragrostis eriopoda*, *Aristida holothera,* ± *Eriachne mucronata* (Very Open) Grassland

Vegetation Condition: Excellent; evidence of camels including scats and localised browsing of *Eremophila* spp. Areas burnt 5-10 years previous to survey but no evidence of repeated high frequency burning. High species diversity at one site (47 species/50 x 50m quadrats; QWB11).

Conservation status: This community is conserved in the Unnamed Conservation Park in South Australia (Davies 1982; Davies et al. 1986; Neagle 1995). Robinson *et al.* (2003) indicate that a closely related vegetation community (Group 29; Mulga Woodland) is widespread in the Anangu Pitjantjatjara Lands of North Western South Australia.

Significance: One plant of the Priority 1 Flora species, *Neurachne lanigera*, found in this community (Quadrat QWB03; Appendix G).

Plate 5: Mulga (*Acacia aneura*) Tall Shrubland with a Hummock Grass Understorey of *Eragrostis eriopoda* and *Aristida holothera* on Loam Plains

Vegetation Community 5: Inland Red Mallee (*Eucalyptus socialis* subsp. *eucentrica*) Very Open Shrub Mallee with Tussock Grass Understorey of *Triodia scariosa* on Undulating Calcrete Plains

Location and landform: Undulating calcrete plains near the centre of the Study Area.

Quadrats Sampled: QWB06, QWB08 **Area Mapped:** 41.6 hectares

Soil: Orange sandy loam **Rock Type:** Calcrete 1-20cm in diameter

Vegetation Structure and Dominant Species in each Stratum: *Eucalyptus socialis* subsp. *eucentrica* Very Open Shrub Mallee over *Triodia scariosa* Grassland

Vegetation Condition: Pristine. Areas burnt 5 years previous to survey but no evidence of repeated high frequency burning.

Conservation status: Robinson *et al.* (2003) indicate that a closely related vegetation community (Group 22: Spinifex Hummock Grassland on Limestone Plains) is moderately widespread in the Anangu Pitjantjatjara Lands of North Western South Australia.

Significance: Several plants of a new undescribed species, *Goodenia* sp. affin. *quasilibera* (L. Ransom 868), found in this community (Quadrats QWB06 & QWB08; Appendix G).

Plate 6: Inland Red Mallee (*Eucalyptus socialis* subsp. *eucentrica*) Very Open Shrub Mallee with Tussock Grass Understorey of *Triodia scariosa* on Undulating Calcrete Plains

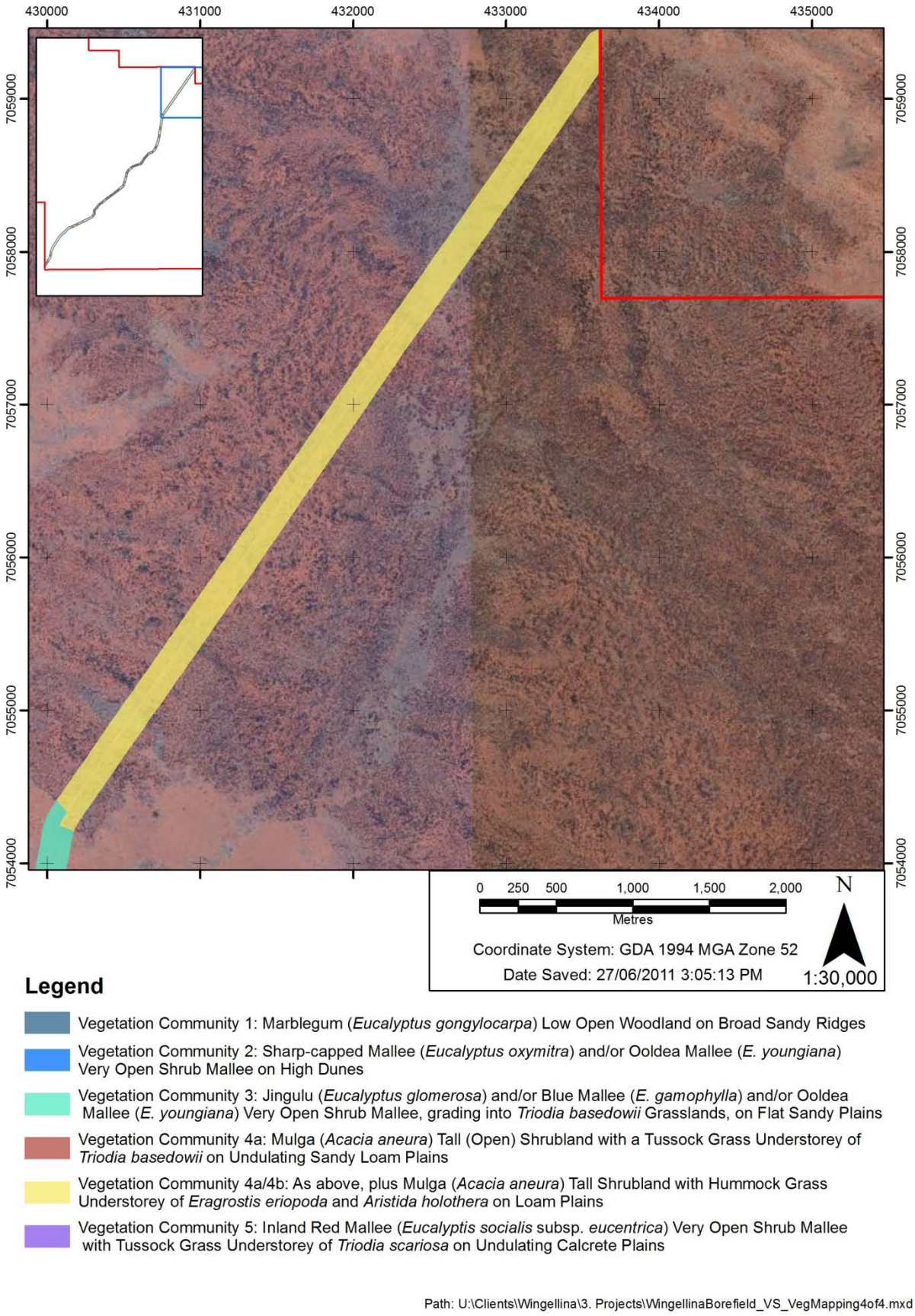

Figure 9: Vegetation Communities in the Study Area (Map 1 of 4)

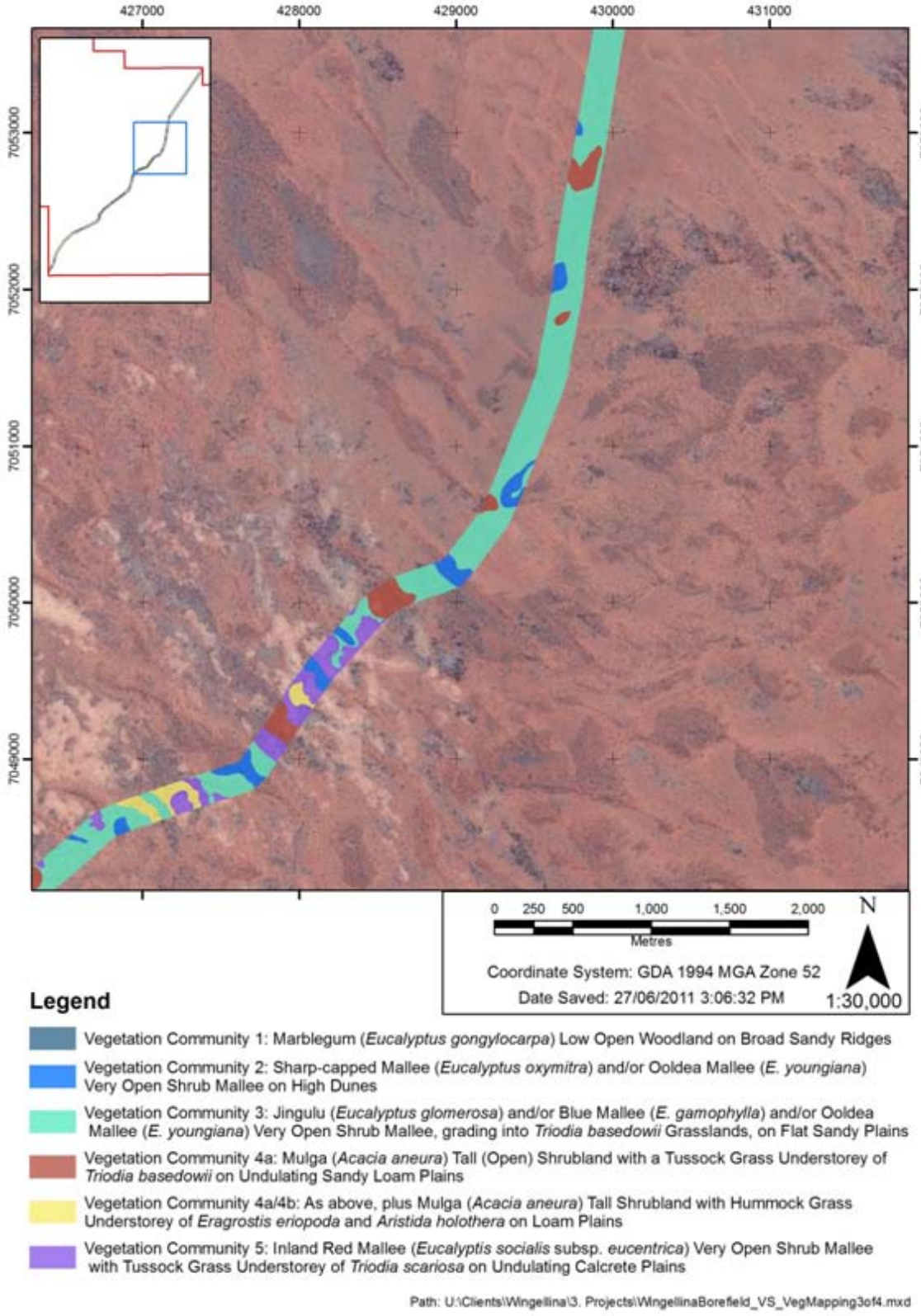

Figure 10: Vegetation Communities in the Study Area (Map 2 of 4)

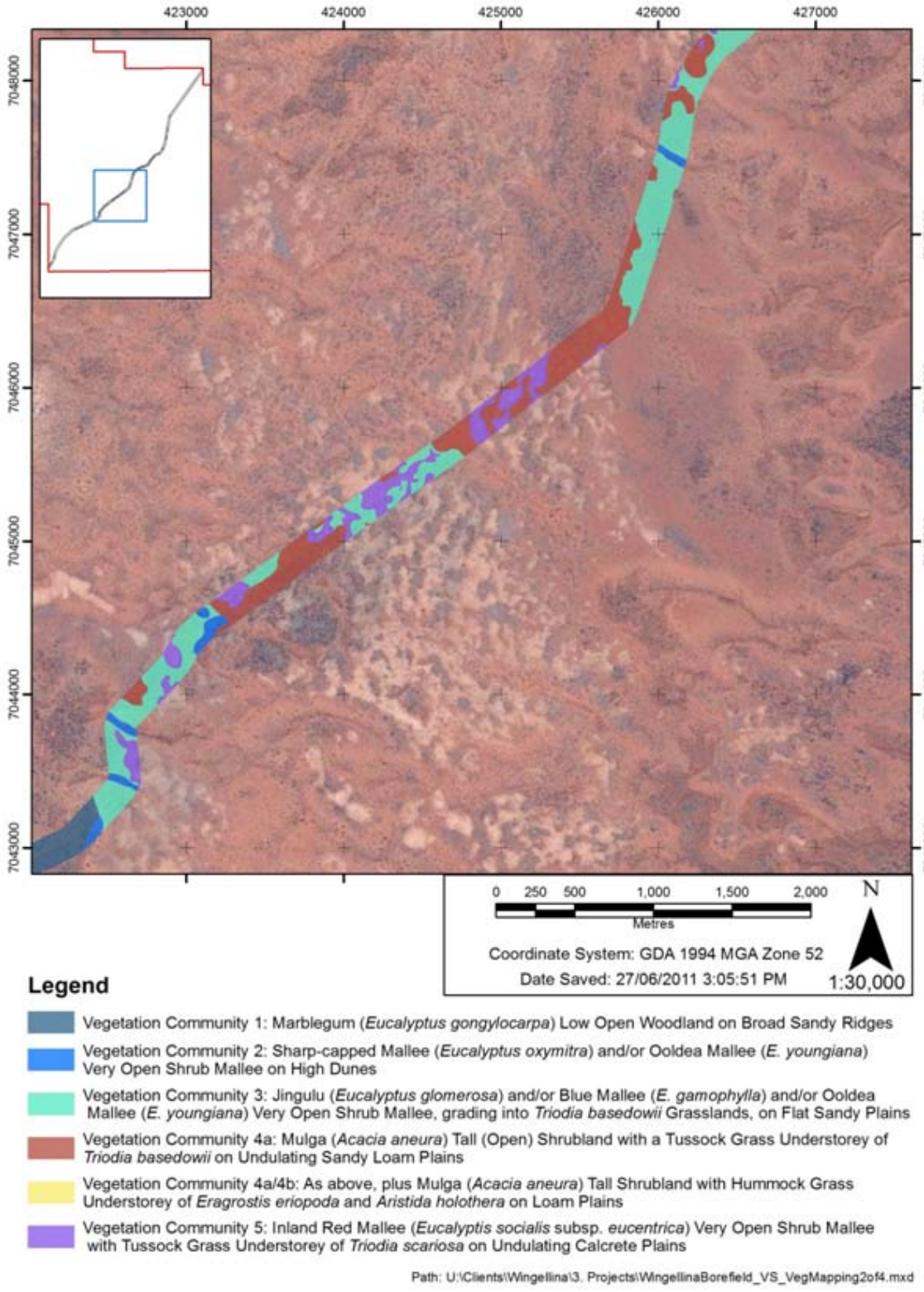

Figure 11: Vegetation Communities in the Study Area (Map 3 of 4)

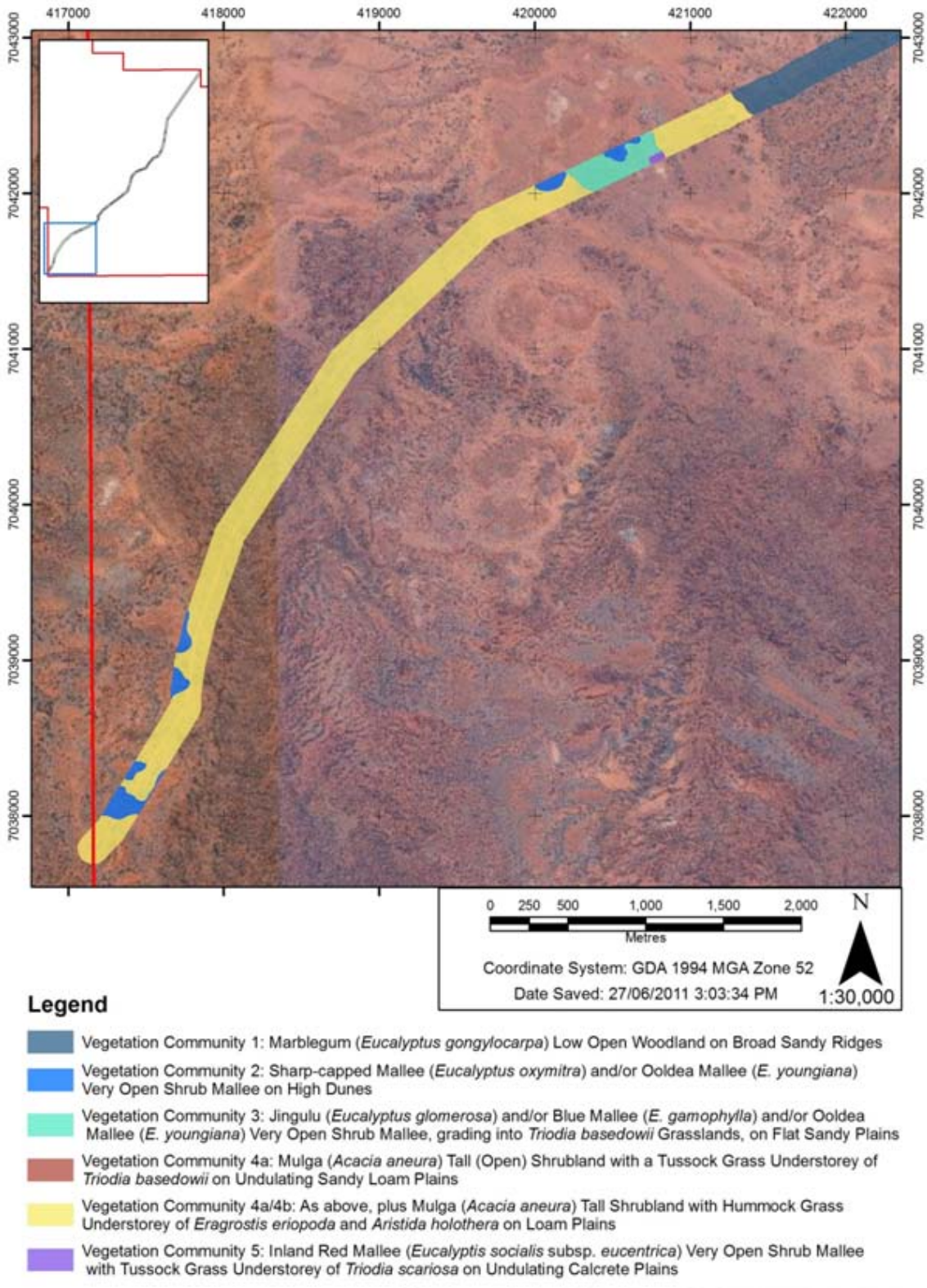

Figure 12: Vegetation Communities in the Study Area (Map 4 of 4)

5. CONCLUSIONS

While the location of proposed bores in Miscellaneous License L69/12 is still to be finalised, it is likely that 30 drill pads and associated access roads will need to be constructed if the project proceeds. For this reason, one of the main impacts of the developments will be vegetation clearance. A potential secondary impact is that of the introduction of Buffel grass and other weeds via earth moving equipment and the associated increased in fire frequency and intensity.

Of particular importance is the avoidance and protection of populations of the four significant species found in the Study Area:

- Woolly Mulga-grass (*Neurachne lanigera)*- Listed as Priority 1 in WA and Rare in SA
- *Goodenia* sp. affin. *quasilibera* (L. Ransom 868) – A probable new undescribed species
- Harrow Wattle (*Acacia acanthoclada*) – a disjunct population 500 km from the main distribution of the species in Western Australia and South Australia
- Thryptomene (*Thryptomene longifolia*) - relic disjunct population 400 km from the main distribution of the species in South Australia

While the present survey was confined to the area 30 metres each side of Tjuntjuntjarra Road through Miscellaneous License L69/12, it is likely these species also occur elsewhere in Miscellaneous License L69/12, since the vegetation communities in which they occur are widespread within the area.

Thryptomene longifolia is unlikely to be affected by clearance due to its occurrence as a dominant on the crest of high dunes where drilling is likely to be impractical. In comparison, populations of the other three species occur on flatter areas more suitable for drill pad and road construction. However, with careful management and planning it may be possible to avoid these species since they appear to occur as small localised populations. Of particular importance are areas of calcrete (Vegetation Community 5) where *Goodenia* sp. affin. *quasilibera* (L. Ransom 868) occurs since it is not known how widespread this probable new species is outside the study area and in the region generally.

While the Study Area is presently largely weed free, the introduction of weeds from areas surrounding Wingellina Community is a significant threat. Of particular concern is the potential introduction of Buffel Grass (**Cenchus ciliaris*) only one plant of which was found in the Study Area. This plant (now removed) was on the roadside near a test drill site suggesting that it may have been brought in on earth moving equipment. This species is classified as a significant 'Environmental Weeds' by the *Environmental Weed Strategy for Western Australia* (WA Department of Environment and Conservation [DEC] 1999). Buffel Grass readily invades intact native vegetation and out-competes native species (Robertson 2008). While native grass understoreys once burnt are unlikely to burn again for several years due significant decreases in biomass, Buffel Grass infested understoreys are able to burn at a much higher frequency and intensity due to the high regenerative ability of the species following fire (Robertson 2008). This species is widespread around the Wingellina Community and its potential spread as seed in soil on earth moving equipment is a significant threat to the vegetation in the Study Area. Weeds could also be potentially spread by off road vehicles.

With the large numbers of workers proposed for the Wingellina Mine Site (initially 1500 and later 500) increased visitation to the Study Site is possible unless carefully managed.

Increased fire frequency is also possible with significantly increased human visitation and potentially increased fuel loads resulting from introduced Buffel Grass. This has the potential to detrimentally impact native vegetation within the Study Area. While mallee communities (and to lesser extent Mulga communities) are adapted to regenerate from fire, of concern is the potential for increased fire frequency and intensity. Particularly vulnerable to increased fire frequency and intensity are fire sensitive perennial species (e.g. Hakeas) which rely on seedling regeneration after fire ("Obligate Seed Regenerators"). Loss of Obligate Seed Regenerators can occur if fire frequency increases to the extent that seedlings of such species are unable to reach maturity and set seed.

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Appendix A

Definitions: Threatened and Priority Flora and Ecological Communities

Definitions for Threatened Flora (TF) and Priority Flora (PF) (DEC 2011)

Under the Wildlife Conservation Act, the Minister for the Environment may declare species of flora to be protected if they are considered to be in danger of extinction, rare or otherwise in need of special protection.

T: Threatened Flora (Declared Rare Flora — Extant)

Taxa[1] which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such (Schedule 1 under the Wildlife Conservation Act 1950).

Threatened Flora (Schedule 1) are further ranked by the Department according to their level of threat using IUCN Red List criteria:

- CR: Critically Endangered – considered to be facing an extremely high risk of extinction in the wild
- EN: Endangered – considered to be facing a very high risk of extinction in the wild
- VU: Vulnerable – considered to be facing a high risk of extinction in the wild.
-

1: Priority One: Poorly-known taxa

Taxa that are known from one or a few collections or sight records (generally less than five), all on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, Shire, Westrail and Main Roads WA road, gravel and soil reserves, and active mineral leases and under threat of habitat destruction or degradation. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes.

2: Priority Two: Poorly-known taxa

Taxa that are known from one or a few collections or sight records, some of which are on lands not under imminent threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown land, water reserves, etc. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes.

3: Priority Three: Poorly-known taxa

Taxa that are known from collections or sight records from several localities not under imminent threat, or from few but widespread localities with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Taxa may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and known threatening processes exist that could affect them.

4: Priority Four: Rare, Near Threatened and other taxa in need of monitoring

1. Rare. Taxa that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special

2. protection, but could be if present circumstances change. These taxa are usually represented on conservation lands.
3. Near Threatened. Taxa that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.
4. Taxa that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

5: Priority Five: Conservation Dependent taxa

Taxa that are not threatened but are subject to a specific conservation program, the cessation of which would result in the taxon becoming threatened within five years.

Definitions for Threatened Ecological Communities (TEC) (DEC 2010)

Presumed Totally Destroyed (PD)

An ecological community that has been adequately searched for but for which no representative occurrences have been located. The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future. An ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant and either of the following applies (A or B):

A) Records within the last 50 years have not been confirmed despite thorough searches of known or likely habitats or

B) All occurrences recorded within the last 50 years have since been destroyed

Critically Endangered (CR)

An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated. An ecological community will be listed as Critically Endangered when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (A, B or C):

A) The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% and either or both of the following apply (i or ii):

   i) geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately

years);

ii) modification throughout its range is continuing such that in the immediate future (within approximately 10 years) the community is unlikely to be capable of being substantially rehabilitated.

B) Current distribution is limited, and one or more of the following apply (i, ii or iii):

i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 10 years);

ii) 0there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes;

iii) there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes.

C) The ecological community exists only as highly modified occurrences that may be capable of being rehabilitated if such work begins in the immediate future (within approximately 10 years).

Endangered (EN)

An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future. An ecological community will be listed as Endangered when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria (A, B, or C):

A) The geographic range, and/or total area occupied, and/or number of discrete occurrences have been reduced by at least 70% since European settlement and either or both of the following apply (i or ii):

i) the estimated geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term future (within approximately 20 years);

ii) modification throughout its range is continuing such that in the short term future (within approximately 20 years) the community is unlikely to be capable of being substantially restored or rehabilitated.

B) Current distribution is limited, and one or more of the following apply (i, ii or iii):

i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 20 years);

ii) there are few occurrences, each of which is small and/or isolated and all or most occurrences are very vulnerable to known threatening processes;

iii) there may be many occurrences but total area is small and all or most occurrences are small and/or isolated and very vulnerable to known threatening processes.

C) The ecological community exists only as very modified occurrences that may be capable of being substantially restored or rehabilitated if such work begins in the short-term future (within approximately 20 years).

Vulnerable (VU)

An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range. An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction or significant modification in the medium to long-term future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria (A, B or C):

A) The ecological community exists largely as modified occurrences that are likely to be capable of being substantially restored or rehabilitated.

B) The ecological community may already be modified and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations.

C) The ecological community may be still widespread but is believed likely to move into a category of higher threat in the medium to long term future because of existing or impending threatening processes.

Definitions for Priority Ecological Communities (PEC) (DEC 2010)

Possible threatened ecological communities that do not meet survey criteria or that are not adequately defined are added to the Priority Ecological Community List under priorities 1, 2 and 3. These three categories are ranked in order of priority for survey and/or definition of the community, and evaluation of conservation status, so that consideration can be given to their declaration as threatened ecological communities. Ecological communities that are adequately known, and are rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list, are placed in Priority 4. These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5.

Priority One: Poorly-known ecological communities

Ecological communities that are known from very few occurrences with a very restricted distribution (generally =5 occurrences or a total area of = 100ha). Occurrences are believed to be under threat either due to limited extent, or being on lands under immediate threat (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) or for which current threats exist. May include communities with occurrences on protected lands. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey

requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.

Priority Two: Poorly-known ecological communities

Communities that are known from few occurrences with a restricted distribution (generally =10 occurrences or a total area of =200ha). At least some occurrences are not believed to be under immediate threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.

Priority Three: Poorly known ecological communities

(i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or: (ii) communities known from a few widespread occurrences, which are either large or with significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or; (iii) communities made up of large, and/or widespread occurrences, that may or may not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes. Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.

Priority Four:

i) ***Rare*****.** Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands.

(ii) ***Near Threatened****.* Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.

(iii) ***Ecological communities that have been removed from the list of threatened communities during the past five years***.

These communities require regular monitoring.

Priority Five: Conservation Dependent ecological communities

Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

Appendix B

GPS locations & details of quadrats surveyed across the Study Area.

All sites are in located in Zone 52J and are recorded in MGA

Quadrat	Easting[1]	Northing[1]	Date surveyed	Vegetation community
QWB01	421579	7042666	4/05/2011	Vegetation Community 1
QWB02	433256	7058820	7/05/2011	Vegetation Community 4a
QWB03	431031	7055618	7/05/2011	Vegetation Community 4b
QWB04	429923	7053260	7/05/2011	Vegetation Community 3
QWB05	423132	7044445	7/05/2011	Vegetation Community 2
QWB06	428122	7049678	6/05/2011	Vegetation Community 5
QWB07	422122	7042959S	5/05/2011	Vegetation Community 1
QWB08	424248	7045288	6/05/2011	Vegetation Community 5
QWB09	422647	7043794	5/05/2011	Vegetation Community 2
QWB10	429643	7051559	6/05/2011	Vegetation Community 3
QWB11	425288	7046082	6/05/2011	Vegetation Community 4b
QWB12	430574	7054946	7/05/2011	Vegetation Community 4a

[1] **SW corner of quadrat**

Appendix C
Vegetation Condition Scale

Vegetation Condition Scale (Keighery 1994)

Code	Description
Pristine	Pristine or nearly so. No obvious signs of disturbance.
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
Very Good	Vegetation structure altered obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as ‘parkland cleared’ with the flora comprising weed or crop species with isolated native trees or shrubs.

Appendix D
Classification of Vegetation Structural Formation & Height Classes

Vegetation Structure Classification (Keighery 1994)

Lifeform / Height Class	**Canopy Cover**			
	100% - 70%	**70% - 30%**	**30% - 10%**	**10% - 2%**
Trees > 30m Trees 10-30m Trees < 10m	Tall Closed Forest Closed Forest Low Closed Forest	Tall Open Forest Open Forest Low Open Forest	Tall Woodland Woodland Low Woodland	Tall Open Woodland Open Woodland Low Open Woodland
Tree Mallee	Closed Tree Mallee	Tree Mallee	Open Tree Mallee	Very Open Tree Mallee
Shrub Mallee	Closed Shrub Mallee	Shrub Mallee	Open Shrub Mallee	Very Open Shrub Mallee
Shrubs > 2m Shrubs 1-2m Shrubs <1m	Closed Tall Scrub Closed Heath Closed Low Heath	Tall Open Scrub Open Heath Open Low Heath	Tall Shrubland Shrubland Low Shrubland	Tall Open Shrubland Open Shrubland Low Open Shrubland
Grasses	Closed Grassland	Grassland	Open Grassland	Very Open Grassland
Herbs	Closed Herbland	Herbland	Open Herbland	Very Open Herbland
Sedges	Closed Sedgeland	Sedgeland	Open Sedgeland	Very Open Sedgeland

Appendix E
Flora Quadrat Site Information and Photopoint Photos

MWNVS0211 Site: QWB01

Described by: Rick Davies **Date:** 4/05/2011 **Type:** Quadrat **Season:** Excellent

Location: Southern end of borefields

MGA Zone: 52J 421579 E; 7042666 S

Habitat: Sandy swale **Soil:** Orange sand **Rock Type:** Nil

Vegetation: *Eucalyptus gongylocarpa* Low Open Woodland over *Acacia prainii* Tall Open Shrubland over *Aluta maisonneuvei* Open Shrubland over *Triodia basedowii* Open Grassland

Vegetation Condition: Pristine **Fire Age:** Last burnt 10+ years ago

Notes: No sign of any other disturbance

Species List

Name	**Cover**	**Height**	**Collection No.**
Abutilon otocarpum	1	0.3	LR813
Acacia aneura var. *aneura*	+	6	LR817
Acacia ligulata	1	1.5	LR807
Acacia prainii	8	5	LR819
Aluta maisonneuvei	5	1.2	LR801
Aristida holathera	1	0.2	LR809
Bonamia rosea	1	0.2	LR811
Digitaria brownii	1	0.15	LR823
Dodonaea viscosa subsp. *angustissima*	1	1	LR818
Eragrostis eriopoda	1	0.4	LR821
Eremophila latrobei subsp. *glabra*	+	0.7	LR814
Eremophila platythamnos subsp. *exotrachys*	+	0.7	LR806
Eucalyptus glomerosa	1	7	LR825
Eucalyptus gongylocarpa	5	10	LR800
Grevillea juncifolia	1	3.5	LR820
Maireana planifolia	+	0.2	LR808
Monachather paradoxus	+	0.3	LR826
Neurachne lanigera	+	0.3	LR822
Paractaenum refractum	1	0.2	LR816
Ptilotus polystachyus	1	0.2	LR804
Senna artemisioides subsp. *filifolia*	+	1	LR815
Senna artemisioides subsp. *petiolaris*	1	1.5	LR805
Sida sp. Golden calyces (G.J. Leach 1966)	1	0.1	LR810
Solanum centrale	+	0.3	LR812
Triodia basedowii	10	0.5	LR802
Triodia schinzii	1	0.6	LR803

Photopoint photo for quadrat QWB01, 4/05/2011

MWNVS0211 Site: QWB02

Described by: Rick Davies **Date:** 7/05/2011 **Type:** Quadrat **Season:** Excellent

Location: Northern end of borefield area

MGA Zone: 52J 433256 E; 7058820 S

Habitat: Undulating plain **Soil:** Orange brown sandy loam

Rock Type and Size: Laterite 1-10 mm in diameter

Vegetation: *Acacia aneura* Tall Shrubland over *Triodia basedowii* Grassland

Vegetation Condition: Excellent

Fire Age: Last burnt 10+ years previous to survey

Notes: Evidence of disturbance by camels

Species List

Name	Cover	Height	Collection No.
Acacia aneura var. *major*	15	1.5	LR971
Acacia minyura	10	5	LR978
Acacia pachyacra	+	2	LR955
Brunonia australis	+	0.3	LR964
Eragrostis eriopoda	+	0.3	LR954
Eremophila clarkei	+	1	LR977
Eremophila latrobei subsp. *glabra*	1	1.5	LR814
Eriachne mucronata	+	0.2	LR956
Haloragis odontocarpa forma *rugosa*	+	0.2	LR951
Maireana planifolia	+	0.15	LR808
Monachather paradoxus	1	0.6	LR967
Muelleranthus stipularis	+	0.1	LR976
Nicotiana rosulata	+	0.3	LR973
Prostanthera sericea	+	1.5	LR979
Spartothamnella teucriiflora	+	0.5	LR970
Triodia basedowii	40	1.0	LR802
Velleia glabrata	+	0.15	LR974

Photopoint photo for quadrat QWB02, 7/05/2011

MWNVS0211 Site: QWB03

Described by: Rick Davies **Date:** 7/05/2011 **Type:** Quadrat **Season:** Excellent

Location: Towards northern end of borefields on east side of road

MGA Zone: 52J 431031 E; 7055618 S

Habitat: Flat plain **Soil:** Orange loam

Rock Type & Size: Laterite mostly 1-3mm in diameter (occasionally up to 30 mm)

Vegetation: *Acacia aneura* Tall Shrubland over *Eremophila latrobei* Low Open Shrubland over *Eragrostis eriopoda*, *Aristida holothera* & *Eriachne mucronata* Very Open Grassland

Vegetation Condition: Excellent **Fire Age:** Not burnt for 10+ years previous to the survey

Notes: Camel scat and browsing of *Eremophilas* by camels evident

Species List

Name	**Cover**	**Height**	**Collection No.**
Acacia aneura var. *aneura*	15	6	LR971
Acacia aneura var. *major*	+	0.3	LR830
Aristida contorta	1	0.2	LR895
Brunonia australis	+	0.3	LR964
Cheilanthes sieberi	+	0.2	LR962
Dodonaea viscosa subsp. *angustissima*	+	0.1	LR968
Eragrostis eriopoda	1	0.2	LR954, 965, 966
Eremophila gilesii	1	0.6	LR963
Eremophila latrobei subsp. *glabra*	1	0.6	LR814
Eriachne mucronata	1	0.3	LR956
Erodium sp.	+	0.1	LR1032
Haloragis odontocarpa forma *rugosa*	1	0.3	LR951
Maireana planifolia	1	0.3	LR808
Neurachne lanigera	+	0.3	LR953
Sida sp. Golden calyces glabrous (H.N. Foote 32)	+	0.2	LR838
Sida sp. Golden calyces/sp. Pindan	1	0.1	LR969
Spartothamnella teucriiflora	+	0.6	LR970
Thyridolepis multiculmis	1	0.3	LR952

Photopoint photo for quadrat QWB03, 7/05/2011

MWNVS0211 Site: QWB04

Described by: Rick Davies **Date**: 7/05/2011 **Type:** Quadrat **Season:** Excellent

Location: East side of road towards nothern end of borefields

MGA Zone: 52J 429923 E; 7053260 S

Habitat: Flat sand plain **Soil:** Orange sand **Rock Type:** Nil

Vegetation: *Eucalyptus glomerosa* Very Open Shrub Mallee over *Acacia ligulata* & *Acacia melleodora* Open Shrubland over *Triodia basedowii* Grassland

Vegetation Condition: Pristine **Fire Age:** Burnt 5-10 years previous to survey

Notes: No evidence of repeated high frequency burns

Species List

Name	Cover	Height	Collection No.
Abutilon otocarpum	+	0.1	LR813
Acacia ligulata	1	1.2	LR946
Acacia melleodora	1	1.5	LR843
Acacia pruinocarpa	+	0.3	LR943
Acacia tetragonophylla	+	0.6	LR842
Aristida holathera	1	0.2	LR809
Bonamia rosea	1	0.2	LR811
Brachychiton gregorii	1	2.5	LR1031
Dicrastylis exsuccosa	+	0.7	LR944
Eucalyptus glomerosa	4	4	LR825
Euphorbia drummondii	1	0.1	LR929
Exocarpos sparteus	+	1.5	LR945
Goodenia triodiophila	1	0.3	LR948
Grevillea juncifolia	+	0.5	LR820
Leptosema chambersii	1	0.4	LR941
Malvaceae sp.	1	0.1	LR949
Muelleranthus stipularis	+	0.1	LR947
Paspalidium clementii	1	0.2	LR905
Prostanthera wilkieana	+	0.4	LR942
Rulingia loxophleba	1	0.4	LR1007
Senna pleurocarpa	+	0.4	LR913
Sida sp. Golden calyces glabrous (H.N. Foote 32)	1	0.5	LR810
Triodia basedowii	40	0.5	LR802

Photopoint photo for quadrat QWB04, 7/05/2011

MWNVS0211 Site: QWB05

Described by: Rick Davies **Date:** 7/05/2011 **Type:** Quadrat **Season:** Excellent

Location: East side of road towards centre of borefields

MGA Zone: 52J 423132 E; 7044445 S

Habitat: Dune crest and slope **Soil:** Orange sand **Rock Type:** Nil

Vegetation: *Eucalyptus oxymitra* Very Open Shrub Mallee over *Aluta maisonneuvei* & *Thryptomene longifolia* Open Shrubland over *Triodia basedowii* Open Grassland

Vegetation Condition: Pristine **Fire Age:** Burnt 5-10 years previous to survey

Notes: No evidence of repeated high frequency burns

Species List

Name	**Cover**	**Height**	**Collection No.**
Acacia ligulata	1	0.7	LR935
Acacia melleodora	+	1.5	LR843
Aluta maisonneuvei	3	1.3	LR801
Alyogyne pinoniana	+	0.2	LR865
Aristida holathera	1	0.3	LR934
Bonamia rosea	1	0.3	LR811, 836
Brachychiton gregorii	+	8	LR1031
Digitaria brownii	+	0.4	LR900
Dodonaea viscosa subsp. *angustissima*	1	2	LR818
Einadia nutans	+	0.5	LR932
Enchylaena tomentose	+	0.3	LR937
Eragrostis eriopoda	1	0.3	LR821
Eremophila longifolia	+	1.5	LR939
Eremophila platythamnos subsp. *exotrachys*	+	0.4	LR915
Eucalyptus oxymitra	5	4	LR931
Euphorbia drummondii	+	0.1	LR929
Grevillea stenobotrya	1	0.4	LR850
Halgania erecta	1	0.2	LR829
Hannafordia bissillii	1	0.5	LR940
Microcorys macrediana	+	1.3	LR933
Micromyrtus flaviflora	+	0.3	LR936
Paractaenum refractum	1	0.3	LR816
Paspalidium clementii	+	0.2	LR905
Ptilotus polystachyus	1	0.3	LR804
Sida sp. Golden calyces (G.J. Leach 1966)	1	0.3	LR810
Thryptomene longifolia	3	2.2	LR938
Triodia basedowii	20	0.6	LR802
Triodia schinzii	1	0.6	LR803

Photopoint photo for quadrat QWB05, 7/05/2011

MWNVS0211 Site: QWB06

Described by: Rick Davies **Date:** 6/05/2011 **Type:** Quadrat **Season:** Excellent

Location: Near cebtre of borefields

MGA Zone: 52J 428122 E; 7049678 S

Habitat: Undulating calcrete plain **Soil:** Orange sandy loam

Rock Type: Calcrete 1-20cm in diameter

Vegetation: *Eucalyptis socialis subsp. eucentrica* Very Open Shrub Mallee over *Triodia scariosa* Grassland

Vegetation Condition: Pristine **Fire Age:** Burnt in last 5-10 years

Notes: No evidence of repeated high frequency burns

Species List

Name	Cover	Height	Collection No.
Acacia kempeana	1	0.5	LR871
Acacia ligulata	+	0.8	LR918
Acacia tetragonophylla	+	0.8	LR842
Alyogyne pinoniana	1	0.4	LR865
Bonamia rosea	1	0.1	LR836
Eremophila glabra subsp. *glabra*	1	0.7	LR906
Eucalyptus socialis subsp. *eucentrica*	3	4	LR863
Goodenia sp. affin. quasilibera (L. Ransom 868)	1	0.1	LR868
Halgania cyanea	1	0.3	LR916
Petalostylis cassioides	1	0.1	LR917
Ptilotus obovatus	1	0.4	LR861
Ptilotus sessilifolius	1	0.3	LR921
Sclerolaena parviflora	1	0.2	LR856
Senna artemisioides subsp. *filifolia*	1	0.7	LR920
Senna artemisioides subsp. x *artemisioides*	1	0.7	LR919
Senna pleurocarpa	+	0.3	LR913
Triodia scariosa	30	0.3	LR860
Zygophyllum tesquorum	1	0.1	LR858

Photopoint photo for quadrat QWB06, 6/05/2011

MWNVS0211 Site: QWB07

Described by: Rick Davies **Date:** 5/05/2011 **Type:** Quadrat **Season:** Excellent

Location: Towards southern end of borefields

MGA Zone: 52J 422122E; 7042959S

Habitat: Dune swale **Soil:** Orange sandy loam **Rock Type:** Nil

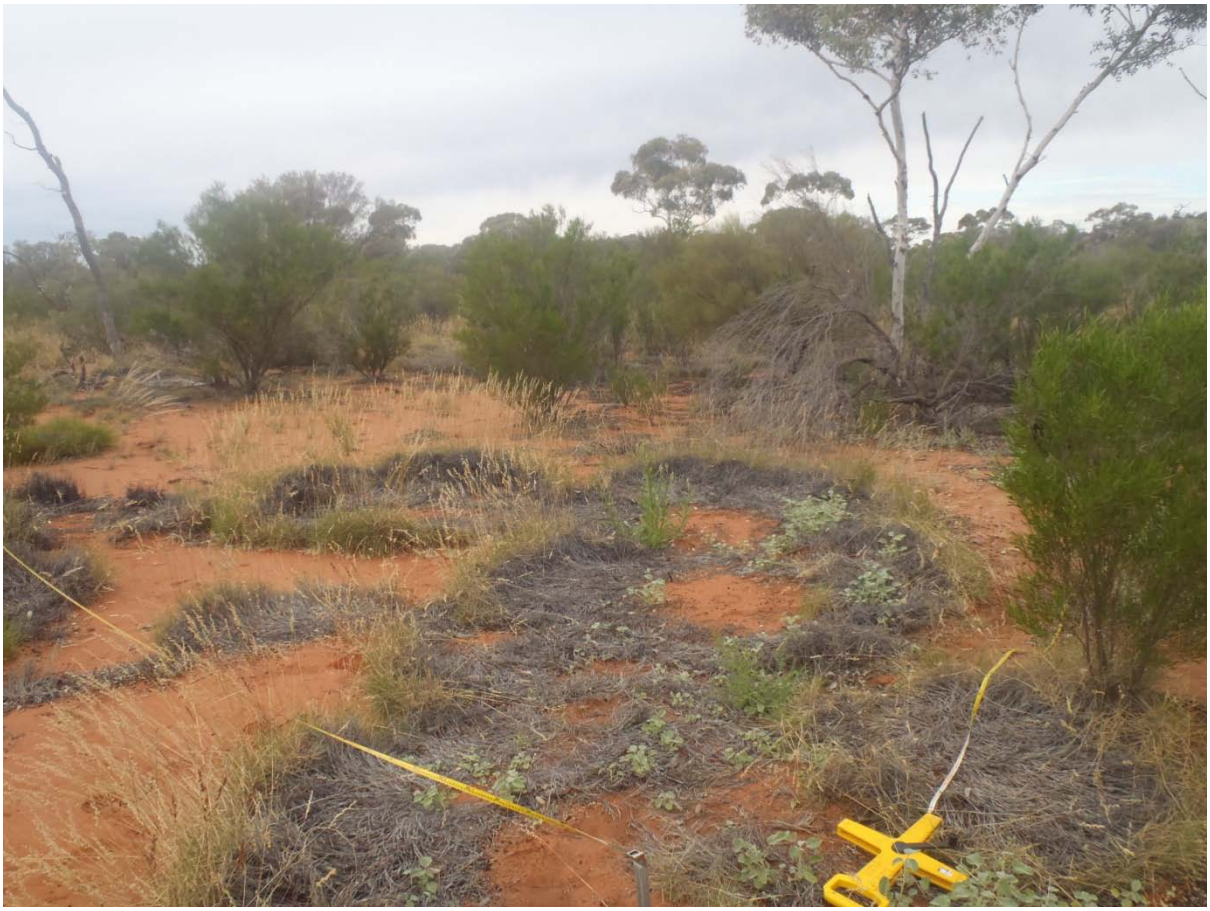
Vegetation: *Eucalyptus gongylocarpa* Low Open Woodland over *Acacia prainii* and *Dodonaea viscosa* Tall Shrubland over *Triodia basedowii* Open Grassland

Vegetation Condition: Pristine **Fire Age:** Last burnt 10+ years ago

Notes: No evidence of repeated high frequency burns

Species List

Name	Cover	Height	Collection No.
Abutilon otocarpum	1	0.15	LR827
Acacia aneura var. *major*	1	8	LR830
Acacia prainii	10	2	LR819
Aluta maisonneuvei	1	1	LR801
Aristida holathera	1	0.3	LR824
Bonamia rosea	1	0.25	LR811, 836
Dodonaea viscosa subsp. *angustissima*	15	3	LR818
Eragrostis eriopoda	1	0.2	LR821
Eucalyptus gongylocarpa	2	10	LR800
Grevillea juncifolia	1	4	LR820
Halgania erecta	1	0.2	LR829
Maireana villosa	1	0.2	LR832
Micromyrtus flaviflora	1	1.5	LR835
Monachather paradoxus	1	0.3	LR831
Paractaenum refractum	+	0.2	LR816
Paraneurachne muelleri	1	0.3	LR833
Ptilotus polystachyus	1	0.5	LR804
Salsola sp.	1	0.3	LR837
Scaevola basedowii	1	0.2	LR834
Sclerolaena clelandii	1	0.2	LR828
Senna artemisioides subsp. *filifolia*	+	1.2	LR815
Sida sp. Golden calyces (G.J. Leach 1966)	1	0.2	LR810
Solanum centrale	1	0.3	LR812
Triodia basedowii	20	0.8	LR802
Triodia schinzii	1	1.2	LR803



Photopoint photo for quadrat QWB07, 5/05/2011

MWNVS0211 Site: QWB08

Described by: Rick Davies **Date:** 6/05/2011 **Type:** Quadrat **Season:** Excellent

Location: At centre of borefields

MGA Zone: 52J 424248 E; 7045288 S

Habitat: Undulating calcrete plain **Soil:** Orange sandy loam

Rock Type: Calcrete 1-10cm in size

Vegetation: *Eucalyptis socialis subsp. eucentrica* Very Open Shrub Mallee over *Triodia scariosa* Open Grassland

Vegetation Condition: Pristine **Fire Age:** Last burnt approximately 5 years ago

Notes: No evidence of repeated high frequency burns

Species List

Name	Cover	Height	Collection No.
Acacia kempeana	+	0.3	LR871
Acacia tetragonophylla	1	0.5	LR842
Alyogyne pinoniana	1	0.4	LR865
Bonamia rosea	1	0.3	LR836
Dodonaea viscosa subsp. *angustissima*	+	0.4	LR818
Enneapogon avenaceus	1	0.2	LR854
Enneapogon cylindricus	1	0.3	LR855
Eremophila glabra subsp. *glabra*	1	0.9	LR862
Eremophila longifolia	1	0.4	LR867
Eucalyptus socialis subsp. *eucentrica*	2	6	LR863
Euphorbia australis	+	0.1	LR869
Goodenia sp. affin. quasilibera (L. Ransom 868)	1	0.1	LR868
Haloragis gossei	1	0.15	LR859
Paraneurachne muelleri	+	0.25	LR873
Ptilotus chippendalei	+	0.1	LR876
Ptilotus helipteroides	+	0.1	LR874
Ptilotus obovatus	1	0.3	LR861
Ptilotus sessilifolius	1	0.25	LR853
Scaevola amblyanthera var. *centralis*	+	0.2	LR866, 877
Scaevola spinescens	+	0.7	LR875
Sclerolaena parviflora	1	0.25	LR856
Senna artemisioides subsp. *filifolia*	1	1.2	LR872
Sida fibulifera	1	0.2	LR857
Solanum centrale	1	0.2	LR812
**Tribulus terrestris*	+	0.1	LR870
Triodia scariosa	20	0.4	LR860
Zygophyllum simile	1	0.1	LR864
Zygophyllum tesquorum	1	0.1	LR858

Photopoint photo for quadrat QWB08, 6/05/2011

MWNVS0211 Site: QWB09

Described by: Rick Davies **Date:** 5/05/2011 **Type:** Quadrat **Season:** Excellent

Location: Towards southern end of borefields

MGA Zone: 52J 422647 E; 7043794 S

Habitat: Dune crest **Soil:** Orange sand **Rock Type:** Nil

Vegetation: *Eucalyptus oxymitra* Very Open Shrub Mallee over *Thryptomene longifolia* & *Aluta maisonneuvei* Open Shrubland over *Triodia basedowii* Very Open Grassland

Vegetation Condition: Pristine **Fire Age:** Last burnt 10+ years ago

Notes: No signs of repeated high frequency burns

Species List

Name	Cover	Height	Collection No.
Abutilon otocarpum	+	0.3	LR813
Acacia ligulata	+	1.6	LR851
Acacia maitlandii	1	0.8	LR848
Acacia melleodora	1	1	LR843
Acacia tetragonophylla	+	1	LR842
Aluta maisonneuvei	5	0.8	LR801
Aristida holathera	1	0.3	LR846
Brunonia australis	1	0.15	LR845
Dicrastylis gilesii	+	0.3	LR849
Eragrostis eriopoda	1	0.2	LR821
Eremophila glabra subsp. *glabra*	1	0.8	LR841
Eremophila latrobei subsp. *glabra*	+	1.8	LR852
Eucalyptus oxymitra	2	4	LR840
Euphorbia drummondii	+	0.1	LR844
Grevillea stenobotrya	+	0.4	LR850
Paractaenum refractum	+	0.2	LR816
Ptilotus polystachyus	+	0.3	LR804
Scaevola basedowii	+	0.2	LR839
Senna artemisioides subsp. *petiolaris*	+	1.2	LR805
Sida sp. Golden calyces (G.J. Leach 1966)	1	0.2	LR810
Thryptomene longifolia	5	1.8	LR847
Triodia basedowii	5	0.5	LR802
Triodia schinzii	1	0.2	LR803

Photopoint photo for quadrat QWB09, 5/05/2011

MWNVS0211 Site: QWB10

Described by: Rick Davies **Date:** 6/05/2011 **Type:** Quadrat **Season:** Excellent

Location: Towards centre of borefields

MGA Zone: 52J 429643 E; 7051559 S

Habitat: Flat sandy plain **Soil:** Orange sand **Rock Type:** Nil

Vegetation: *Eucalyptus gamophylla* Open Shrub Mallee over *Eremophila forrestii* Low Open Shrubland over *Triodia basedowii* Grassland

Vegetation Condition: Pristine **Fire Age:** Last burnt 5-10 years previous to survey

Notes: No evidence of repeated high frequency burns

Species List

Name	Cover	Height	Collection No.
Acacia ayersiana	1	6	LR928
Acacia ligulata	+	0.7	LR807
Acacia prainii	+	0.6	LR924
Aluta maisonneuvei	+	0.1	LR925
Bonamia rosea	1	0.2	LR811
Eremophila forrestii subsp. *forrestii*	2	0.8	LR923
Eremophila glabra subsp. *glabra*	+	0.7	LR930
Eremophila platythamnos subsp. *exotrachys*	1	0.4	LR806
Eucalyptus gamophylla	10	5	LR922
Eucalyptus oxymitra	+	4	LR840
Eucalyptus youngiana	2	4	LR926
Euphorbia drummondii	+	0.1	LR929
Grevillea stenobotrya	+	2.5	LR820
Paractaenum refractum	1	0.2	LR816
Senna artemisioides subsp. *petiolaris*	+	0.5	LR805
Senna pleurocarpa	+	0.4	LR913
Sida sp. Golden calyces (G.J. Leach 1966)	1	0.3	LR810
Triodia basedowii	40	0.6	LR927

Photopoint photo for quadrat QWB10, 6/05/2011

MWNVS0211 Site: QWB11

Described by: Rick Davies **Date:** 6/05/2011 **Type:** Quadrat **Season:** Excellent

Location: Centre of borefields

MGA Zone: 52J 425288 E; 7046082 S

Habitat: Slight depression in plain **Soil:** Orange sand **Rock Type:** Nil

Vegetation: *Acacia aneura* Tall Open Shrubland over *Eremophila latrobei* Low Open Shrubland over *Eragrostis eriopoda* & *Aristida contorta* Grassland

Vegetation Condition: Excellent

Fire Age: Burnt approximately 5 years previous to survey

Notes: Light camel browsing of *Eremophila spp*. No evidence of repeated high frequency burns scattered plants of the exotic species **Tribulus terrestris*

Species List

Name	Cover	Height	Collection No.
Abutilon fraseri	1	0.2	LR896
Acacia aneura var. *aneura*	1	7	LR817
Acacia tetragonophylla	1	0.7	LR842
Aristida holathera	15	0.3	LR895
Asteraceae sp.	+	0.2	LR886
Boerhavia repleta	1	0.1	LR892
Bonamia rosea	1	0.3	LR836
Convolvulus clementii	1	0.1	LR902
Cymbopogon obtectus	1	0.5	LR910
Digitaria brownii	1	0.6	LR900
Dysphania melanocarpa	1	0.2	LR884
Enneapogon avenaceus	1	0.2	LR854
Enneapogon polyphyllus	1	0.3	LR908
Eragrostis eriopoda	25	0.4	LR821
Eremophea spinosa	1	0.2	LR887
Eremophila glabra subsp. *glabra*	1	1.7	LR906
Eremophila latrobei subsp. *glabra*	2	0.7	LR904
Eremophila longifolia	1	1.5	LR894
Euphorbia australis	1	0.1	LR869
Euphorbia drummondii	1	0.1	LR844
Hakea divaricata	1	5	LR909
Haloragis gossei	1	0.2	LR899
Lepidium phlebopetalum	+	0.15	LR907
Monachather paradoxus	1	0.4	LR903
Nicotiana occidentalis	+	0.4	LR911
Paractaenum refractum	+	0.2	LR816
Paspalidium clementii	1	0.2	LR905
Portulaca oleracea	1	0.2	LR882
Ptilotus chippendalei	1	0.1	LR876
Ptilotus helipteroides	1	0.2	LR874
Ptilotus macrocephalus	+	0.4	LR889
Ptilotus obovatus	1	0.3	LR861

Sclerolaena deserticola	1	0.2	LR890
Sclerolaena parviflora	1	0.1	LR856
Senna artemisioides subsp. *filifolia*	1	1.3	LR891
Senna artemisioides subsp. x *artemisioides*	1	0.7	LR897
Sida fibulifera	1	0.3	LR888
Solanum lasiophyllum	+	0.3	LR912
Spartothamnella teucriiflora	1	0.5	LR893
Tragus australianus	+	0.25	LR883
Tribulus astrocarpus	1	0.1	LR901
**Tribulus terrestris*	1	0.1	LR870
Triodia basedowii	1	0.5	LR802
Triraphis mollis	1	0.25	LR881
Vittadinia eremaea	1	0.2	LR898

Photopoint photo for quadrat QWB11, 6/05/2011

MWNVS0211 Site: QWB12

Described by: Rick Davies **Date:** 7/05/2011 **Type:** Quadrat **Season:** Excellent

Location: Towards northern end of borefields on east side of road

MGA Zone: 52J 430574 E; 7054946 S

Habitat: Undulating plain **Soil:** Orange sandy loam

Rock Type: Laterite 2-10mm in diameter

Vegetation: *Acacia aneura* Tall Open Shrubland over *Eremophila latrobei* Open Shrubland over *Triodia basedowii* Grassland

Vegetation Condition: Excellent **Fire Age:** Not burn for at least 10 years previous to survey

Notes: Heavy browsing by camels of *Psydrax suaveolens* but no other species

Species List

Name	Cover	Height	Collection No.
Acacia aneura var. *aneura*	3	4	LR817
Acacia pachyacra	1	2	LR955
Cheilanthes sieberi	+	0.1	LR962
Eragrostis eriopoda	1	0.3	LR954
Eremophila latrobei subsp. *glabra*	1	1.5	LR814
Eriachne mucronata	1	0.3	LR956
Haloragis odontocarpa forma *rugosa*	1	0.3	LR951
Maireana planifolia	1	0.3	LR808
Malvaceae sp.	+	0.1	LR949
Neurachne lanigera	2	0.3	LR953
Psydrax suaveolens	1	0.4	LR959
Ptilotus polystachyus	+	0.2	LR961
Sida sp. Golden calyces (G.J. Leach 1966)	1	0.2	LR950
Sida sp. Golden calyces/sp. Pindan	1	0.15	LR960
Solanum centrale	+	0.3	LR958
Thyridolepis multiculmis	1	0.2	LR952
Triodia basedowii	50	0.5	LR802

Photopoint photo for quadrat QWB12, 7/05/2011

MWNVS0211 Opportunistic Collections (taxa not found in quadrats)

Described by: Rick Davies **Date:** 5-9/05/2011 **Season:** Excellent

Species List

Taxa	Collection No.	No plants/condition	Coordinates
Abutilon cryptopetalum	LR1004		52 J 427806 7049116
Acacia acanthoclada	LR993	50+ plants in broader area; Waypoint 40	52 J 422957 7044223
Acacia pruinocarpa	LR943		52 J 429921 7053267
Amphipogon caricinus	LR1023	10+ healthy plants	52 J 433067 7058595
Aristida obscura	LR1018	100+ plants	52 J 430906 7055439
Bulbostylis barbata	LR1014	6 healthy plants	52 J 430610 7054998
Calandrinia remota	LR1026	2 healthy plants	52 J 432277 7057471
Cleome viscosa	LR995		52 J 422591 7043661
Dysphania glomulifera	LR1017	2 healthy plants	52 J 430906 7055439
Dysphania kalpari	LR972		52 J 433253 7058822
Enneapogon caerulescens	LR997	50+ plants in area	52 J 423599 7044793
Eremophila willsii	LR981	3 plants	52 J 421386 7042564
Eriachne pulchella	LR1016	100+ plants	52 J 430732 7055185
Eucalyptus intertexta	LR1022	1 plant	52 J 433500 7059219
Euphorbia tannensis	LR985	18 plants	52 J 422425 7043192
Goodenia centralis	LR1013		52 J 430005 7053688
Keraudrenia nephrosperma	LR1024	19 healthy plants	52 J 432870 7058326
Lawrencella davenportii	LR1028	1 healthy plant	52 J 432265 7057435
Melaleuca ?uncinata	LR992	6 healthy plants	52 J 422920 7044173
Menkea sphaerocarpa	LR996	1 plant centre of road	52 J 422462 7043250
Minuria leptophylla	LR878		52 J 424221 7045274
Nicotiana rosulata	LR1020		52 J 431304 7055991
Paspalidium clementii	LR983	1 big clump	52 J 421773 7042760
Pittosporum angustifolium	LR1009	1 healthy plant	52 J 429687 7051715
Psydrax latifolia	LR1008	2 plants, browsed by camels	52 J 429687 7051715
Ptilotus exaltatus	LR1003		52 J 427806 7049116
Ptilotus schwartzii	LR1011	1 healthy plant	52 J 429953 7053366
Rhagodia eremaea	LR1021		52 J 431414 7056163
Rhagodia eremaea	LR982	2 healthy large plants	52 J 421720 7042753
Rulingia loxophleba	LR1007		52 J 428724 7050096
Rutidosis helichrysoides	LR991	1 healthy plant	52 J 422551 7043326
Santalum acuminatum	LR987	1 plant	52 J 422436 7043188
Schoenia cassiniana	LR1025	100+ plants	52 J 432293 7057501
Sclerolaena diacantha	LR1000		52 J 424126 7045193
Sclerolaena patenticuspis	LR1002		52 J 424903 7045773
Senna artemisioides subsp. x *coriacea*	LR1015	2 healthy plants	52 J 430717 7055166
Senna pleurocarpa	LR913		52 J 425291 7046094
Sida sp. Tiny glabrous fruit (A.A. Mitchell PRP 1152)	LR980		52 J 421204 7042491
Solanum ellipticum	LR988	1 plant roadside	52 J 422460 7043240
Solanum lasiophyllum	LR914		52 J 428326 7049790
Swainsona acuticarinata	LR994	1 plant on road	52 J 422963 7044272

Themeda triandra	LR990		52 J 422544 7043325
Trachymene glaucifolia	LR1010	1 plant	52 J 429855 7052731
Triodia melvillei	LR1033	Southern end borefield area	
Wahlenbergia tumidifructa	LR1029		52 J 432235 7057397

Appendix F

Flora Species Recorded at Wingellina Borefields during 2011 Flora and Vegetation Surveys and their Conservation Status[1]

[1]DEC (2011d); Barker et al. (2005)

Family	Species	Conservation significance[1]
Adiantaceae		
	Cheilanthes sieberi	Not threatened (WA)
Amaranthaceae		
	Ptilotus chippendalei	Not threatened (WA)
	Ptilotus exaltatus	Not threatened (WA)
	Ptilotus helipteroides	Not threatened (WA)
	Ptilotus macrocephalus	Not threatened (WA)
	Ptilotus obovatus	Not threatened (WA)
	Ptilotus polystachyus	Not threatened (WA)
	Ptilotus schwartzii	Not threatened (WA)
	Ptilotus sessilifolius	Not threatened (WA)
Araliaceae		
	Trachymene glaucifolia	Not threatened (WA)
Asteraceae		
	Lawrencella davenportii	Not threatened (WA)
	Minuria leptophylla	Not threatened (WA)
	Rutidosis helichrysoides	Not threatened (WA)
	Schoenia cassiniana	Not threatened (WA)
	Vittadinia eremaea	Not threatened (WA)
Boraginaceae		
	Halgania cyanea	Not threatened (WA)
	Halgania erecta	Not threatened (WA)
Brassicaceae		
	Lepidium phlebopetalum	Not threatened (WA)
	Menkea sphaerocarpa	Not threatened (WA)
Campanulaceae		
	Wahlenbergia tumidifructa	Not threatened (WA)
Capparaceae		
	Cleome viscosa	Not threatened (WA)

Family	Species	Conservation significance
Chenopodiaceae		
	Dysphania glomulifera	Not threatened (WA)
	Dysphania kalpari	Not threatened (WA)
	Dysphania melanocarpa	Not threatened (WA)
	Einadia nutans	Not threatened (WA)
	Enchylaena tomentosa	Not threatened (WA)
	Eremophea spinosa	Not threatened (WA)
	Maireana planifolia	Not threatened (WA)
	Maireana villosa	Not threatened (WA)
	Rhagodia eremaea	Not threatened (WA)
	Salsola sp.	Not threatened (WA)
	Sclerolaena clelandii	Not threatened (WA)
	Sclerolaena deserticola	Not threatened (WA)
	Sclerolaena diacantha	Not threatened (WA)
	Sclerolaena parviflora	Not threatened (WA)
	Sclerolaena patenticuspis	Not threatened (WA)
Chloanthaceae		
	Dicrastylis exsuccosa	Not threatened (WA)
	Dicrastylis gilesii	Not threatened (WA)
Convolvulaceae		
	Bonamia rosea	Not threatened (WA)
	Convolvulus clementii	Not threatened (WA)
Cyperaceae		
	Bulbostylis barbata	Not threatened (WA)
Euphorbiaceae		
	Euphorbia australis	Not threatened (WA)
	Euphorbia drummondii	Not threatened (WA)
	Euphorbia tannensis	Not threatened (WA)
Fabaceae		
	Acacia acanthoclada	**Not threatened (WA); disjunct outlying population**
	Acacia aneura var. *aneura*	Not threatened (WA)
	Acacia aneura var. *major*	Not threatened (WA)
	Acacia ayersiana	Not threatened (WA)
	Acacia kempeana	Not threatened (WA)
	Acacia ligulata	Not threatened (WA)
	Acacia maitlandii	Not threatened (WA)
	Acacia melleodora	Not threatened (WA)
	Acacia minyura	Not threatened (WA)

Family	Species	Conservation significance
Fabaceae		
	Acacia pachyacra	Not threatened (WA)
	Acacia prainii	Not threatened (WA)
	Acacia pruinocarpa	Not threatened (WA)
	Acacia tetragonophylla	Not threatened (WA)
	Leptosema chambersii	Not threatened (WA)
	Muelleranthus stipularis	Not threatened (WA)
	Petalostylis cassioides	Not threatened (WA)
	Senna artemisioides subsp. *filifolia*	Not threatened (WA)
	Senna artemisioides subsp. *petiolaris*	Not threatened (WA)
	Senna artemisioides subsp. x *artemisioides*	Not threatened (WA)
	Senna artemisioides subsp. x *coriacea*	Not threatened (WA)
	Senna pleurocarpa	Not threatened (WA)
	Swainsona acuticarinata	Not threatened (WA)
Geraniaceae		
	Erodium sp.	Not threatened (WA)
Goodeniaceae		
	Brunonia australis	Not threatened (WA)
	Goodenia centralis	Not threatened (WA)
	Goodenia sp. affin. *quasilibera* (L. Ransom 868)	**New undescribed species**
	Goodenia triodiophila	Not threatened (WA)
	Scaevola amblyanthera var. *centralis*	Not threatened (WA)
	Scaevola basedowii	Not threatened (WA)
	Scaevola spinescens	Not threatened (WA)
	Velleia glabrata	Not threatened (WA)
Haloragaceae		
	Haloragis gossei	Not threatened (WA)
	Haloragis odontocarpa forma *rugosa*	Not threatened (WA)
Lamiaceae		
	Microcorys macrediana	Not threatened (WA)
	Prostanthera sericea	Not threatened (WA)
	Prostanthera wilkieana	Not threatened (WA)
	Spartothamnella teucriiflora	Not threatened (WA)
Malvaceae		
	Abutilon cryptopetalum	Not threatened (WA)
	Abutilon fraseri	Not threatened (WA)
	Abutilon otocarpum	Not threatened (WA)
	Alyogyne pinoniana	Not threatened (WA)
	Brachychiton gregorii	Not threatened (WA)

Family	Species	Conservation significance
Malvaceae		
	Hannafordia bissillii	Not threatened (WA)
	Keraudrenia nephrosperma	Not threatened (WA)
	Rulingia loxophleba	Not threatened (WA)
	Sida fibulifera	Not threatened (WA)
	Sida sp. Golden calyces (G.J. Leach 966)	Not threatened (WA)
	Sida sp. Golden calyces glabrous (H.N. Foote 32)	Not threatened (WA)
	Sida sp. Golden calyces/sp. Pindan	Not threatened (WA)
	Sida sp. Tiny glabrous fruit (A.A. Mitchell PRP 52)	Not threatened (WA)
Myrtaceae		
	Aluta maisonneuvei	Not threatened (WA)
	Eucalyptus gamophylla	Not threatened (WA)
	Eucalyptus glomerosa	Not threatened (WA)
	Eucalyptus gongylocarpa	Not threatened (WA)
	Eucalyptus intertexta	Not threatened (WA)
	Eucalyptus oxymitra	Not threatened (WA)
	Eucalyptus socialis subsp. *eucentrica*	Not threatened (WA)
	Eucalyptus youngiana	Not threatened (WA)
	Melaleuca ?uncinata	Not threatened (WA)
	Micromyrtus flaviflora	Not threatened (WA)
	Thryptomene longifolia	**New record for WA**
Nyctaginaceae		
	Boerhavia repleta	Not threatened (WA)
Pittosporaceae		
	Pittosporum angustifolium	Not threatened (WA)
Poaceae		
	Amphipogon caricinus	Not threatened (WA)
	Aristida contorta	Not threatened (WA)
	Aristida holathera	Not threatened (WA)
	Aristida obscura	Not threatened (WA)
	**Cenchrus ciliaris*	Serious environmental weed
	Cymbopogon obtectus	Not threatened (WA)
	Digitaria brownii	Not threatened (WA)
	Enneapogon avenaceus	Not threatened (WA)
	Enneapogon caerulescens	Not threatened (WA)
	Enneapogon cylindricus	Not threatened (WA)
	Enneapogon polyphyllus	Not threatened (WA)
	Eragrostis eriopoda	Not threatened (WA)

Family	Species	Conservation significance
Poaceae		
	Eriachne mucronata	Not threatened (WA)
	Eriachne pulchella	Not threatened (WA)
	Monachather paradoxus	Not threatened (WA)
	Neurachne lanigera	**Priority 1 Flora (WA); Rare (SA)**
	Paractaenum refractum	Not threatened (WA)
	Paraneurachne muelleri	Not threatened (WA)
	Paspalidium clementii	Not threatened (WA)
	Themeda triandra	Not threatened (WA)
	Thyridolepis multiculmis	Not threatened (WA)
	Tragus australianus	Not threatened (WA)
	Triodia basedowii	Not threatened (WA)
	Triodia melvillei	Not threatened (WA)
	Triodia scariosa	Not threatened (WA)
	Triodia schinzii	Not threatened (WA)
	Triraphis mollis	Not threatened (WA)
Portulacaceae		
	**Portulaca oleracea*	Not threatened (WA); native and exotic forms in WA (DEC 2011)
	Calandrinia remota	Not threatened (WA)
Proteaceae		
	Grevillea juncifolia	Not threatened (WA)
	Grevillea stenobotrya	Not threatened (WA)
	Hakea divaricata	Not threatened (WA)
Rubiaceae		
	Psydrax latifolia	Not threatened (WA)
	Psydrax suaveolens	Not threatened (WA)
Santalaceae		
	Exocarpos sparteus	Not threatened (WA)
	Santalum acuminatum	Not threatened (WA)
Sapindaceae		
	Dodonaea viscosa subsp. *angustissima*	Not threatened (WA)
Scrophulariaceae		
	Eremophila clarkei	Not threatened (WA)
	Eremophila forrestii subsp. *forrestii*	Not threatened (WA)
	Eremophila gilesii	Not threatened (WA)
	Eremophila glabra subsp. *glabra*	Not threatened (WA)
	Eremophila latrobei subsp. *glabra*	Not threatened (WA)
	Eremophila longifolia	Not threatened (WA)
	Eremophila platythamnos subsp. *exotrachys*	Not threatened (WA)
	Eremophila willsii	Not threatened (WA)

Family	Species	Conservation significance
Solanaceae		
	Nicotiana occidentalis	Not threatened (WA)
	Nicotiana rosulata	Not threatened (WA)
	Solanum centrale	Not threatened (WA)
	Solanum ellipticum	Not threatened (WA)
	Solanum lasiophyllum	Not threatened (WA)
Zygophyllaceae		
	**Tribulus terrestris*	Exotic species
	Tribulus astrocarpus	Not threatened (WA)
	Zygophyllum simile	Not threatened (WA)
	Zygophyllum tesquorum	Not threatened (WA)

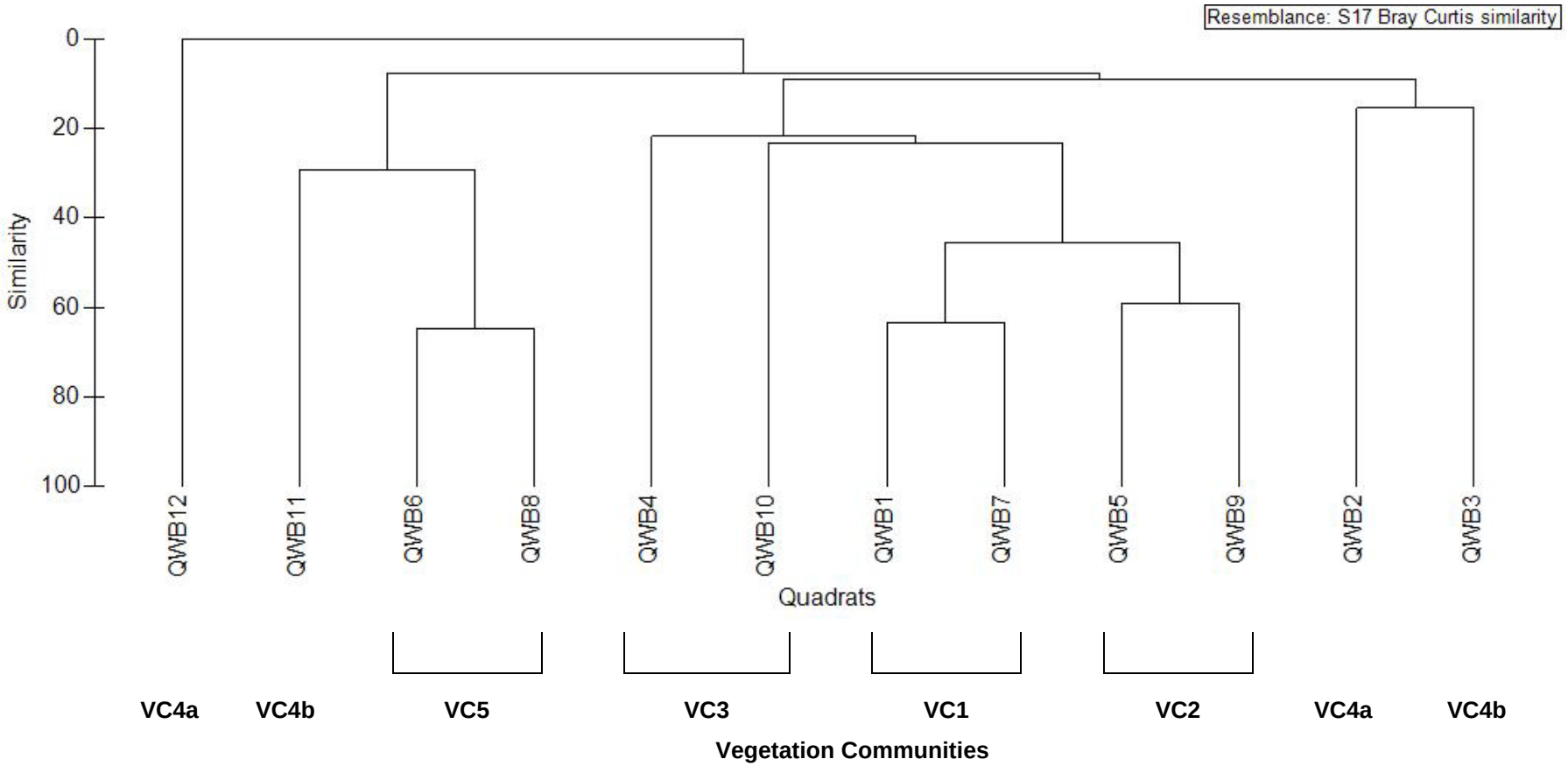
Appendix G
Numbers and Locations of
Observed Priority Flora and Other Significant Species

Species	Conservation significance	Quadrat	Easting & Northing[1]	# plants	% cover
Acacia acanthoclada	Disjunct outlying population	-	422957 7044223	50+ plants	-
Goodenia sp. affin. *quasilibera* (L. Ransom 868)	New undescribed species	QWB06	428122 7049678	Several	1
Goodenia sp. affin. *quasilibera* (L. Ransom 868)	New undescribed species	QWB08	424248 7045288	Several	1
Neurachne lanigera	Priority 1 Flora (WA); Rare (SA)	QWB01	421579 7042666	1	<1
Neurachne lanigera	Priority 1 Flora (WA); Rare (SA)	QWB03	431031 7055618	1	<1
Neurachne lanigera	Priority 1 Flora (WA); Rare (SA)	QWB12	430574 7054946	Numerous	2
Thryptomene longifolia	New record for WA; Disjunct outlying population	QWB05	423132 7044445	Numerous	3
Thryptomene longifolia	New record for WA; Disjunct outlying population	QWB09	422647 7043794	Numerous	5

[1] Zone 52J AMG

Appendix H

Results of the Vegetation Statistical Analysis


Resemblance: S17 Bray Curtis similarity
Similarity
0
20
40
60
80
100
QWB12
QWB11
QWB6
QWB8
QWB4
QWB10
QWB1
QWB7
QWB5
QWB9
QWB2
QWB3
Quadrats
VC4a
VC4b
VC5
VC3
VC1
VC2
VC4a
VC4b
Vegetation Communities