Native Vegetation Clearing Permit Application - Mount Mason DSO Hematite Project

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EXECUTIVE SUMMARY

Juno Minerals Limited's (Juno) Central Yilgarn Iron Ore Project (CYIP) is located approximately 110km northwest of Menzies and consists of two distinct project areas, Mount Ida and Mount Mason. The Project is 100% owned and managed by Juno Minerals Limited (Juno).

The Mount Mason Project (the Project) will involve mining of high-grade hematite ore over an initial period of approximately 5 years. Ore will be crushed/screened at the plant on site to produce a fines-only iron ore product with a particle size of 6.3mm. The product will be hauled by road trains from Mount Mason to the Yunndaga railway siding near Menzies. Product will then be loaded onto trains for rail to a Port facility and then export via shipping.

This Native Vegetation Clearing Permit (NVCP) – Purpose Permit relates to the Mount Mason Direct Shipping Ore (DSO) Hematite Project.

Total area of land proposed to be cleared is approximately 141 ha.

Project Footprint

Tenement Number	Activity	Disturbance (ha)
M29/408-I	Main pit - (includes 10m buffer)	20.09
M29/408-I	Secondary pit - southern pod (includes 10m buffer)	1.02
M29/408-I	Waste rock landform	18.27
G29/23	ROM pad	10.81
G29/23	Mining Operations Centre (MOC) compound	6.95
L29/79, L29/121 and G29/23	Road corridor	63.01
G29/23	Pipeline corridor	0.52
G29/23	Dust suppression Turkey's nest	0.04
G29/23	Explosives magazine	0.04
L29/100	Camp expansion - accommodation	2.75
L29/100	Surface water management - ponds & bunds	3.45
L29/100	Abandonment bund	1.16
G29/23, L29/100, G29/22, M29/414, L29/79^	Topsoil stockpiles	12.00
	TOTAL	**140.11**

* Note: No clearing is required for camp sewage effluent sprayfield (0.45ha).
^ Locations of topsoil stockpiles will be selected based on maintaining haul road safety and away from potential impacts to topsoil quality (e.g. flood and drainage areas).

An assessment of the Project against the Clearing Principles for native vegetation under Schedule 5 of the *Environmental Protection Act 1986* suggests the Project is unlikely to be at variance with any of the ten Clearing Principles.

An evaluation of the Project against the Offset Guidelines suggests the Project has "Residual impacts that are not significant" and no offsets are required.

All studies and surveys in support of this NVCP application have been carried out by suitably qualified persons using methodologies consistent with the EPA's standards, policies and guidance.

1 INTRODUCTION

Juno Minerals Limited's (Juno) Central Yilgarn Iron Ore Project (CYIP) is located approximately 110km northwest of Menzies and its tenements cover approximately 15,753ha. The CYIP consists of two distinct project areas, Mount Ida and Mount Mason. The Project is 100% owned and managed by Juno Minerals Limited (Juno).

Jupiter Mines Limited announced the demerger of its iron ore assets to Juno Minerals Limited via an in-specie distribution of Juno shares to Jupiter shareholders, and Juno was subsequently listed on the Australian Stock Exchange on 21 May 2021.

This Native Vegetation Clearing Permit (NVCP) relates to the Mt Mason Direct Shipping Ore (DSO) Hematite Project (the Project) (Figure 1).

The Project is currently approved for development through the Mount Mason and Yunndaga Mining Proposals (Registration ID 45133 and 46035) received on 31 July 2014. A Permit to Clear Native Vegetation under the Environmental Protection Act 1986 was issued on 17 October 2013 to Jupiter Mines Limited (CPS5764/2). The Permit has now lapsed, resulting in the requirement to submit this new application.

The Project will involve mining of high-grade hematite ore over a period of 5 years, within a clearing footprint of approximately 141ha. Ore will be crushed/screened at the plant on site to produce a fines-only iron ore product with a particle size of 6.3mm. The product will initially be hauled by road trains from the site to the Hampton Siding in Kalgoorlie until the completion of development on the proposed Yunndaga railway siding. Product will then be loaded onto rail wagons for transportation by train to a Port facility.

The Project is estimated to produce up to 10 million tonnes of hematite over the life of the mine, using open cut mining at two pits. The mining method used will be conventional drill, blast, load and haul with processing being limited to crushing and size separation only. Dewatering is expected to occur in the latter half of year two of operations, when groundwater is predicted to intersect the pit. Dewatering material will be used for dust suppression on roads around the mine, where salinity levels fall within guidelines.

Infrastructure requirements will include:

- Run of Mine (ROM) pad;
- Workshop and hardstand areas;
- Roads, fuel storage, explosives magazine;
- Administrative building;
- Wastewater treatment facility;
- Reverse osmosis plant; and
- Camp expansion.

1.1 Purpose of this Report

This report has been prepared in support of the following application for the development of the Project and associated infrastructure, to the Department of Mines, Industry Regulation and Safety (DMIRS):

- NVCP- Purpose Permit application in accordance with Section 51E of the *Environmental Protection Act 1986* (EP Act).

This report includes details of the Project associated with the clearing of native vegetation.

The scope of this NVCP application covers proposed mining related activities and transport up to the Menzies-Sandstone Road intersection.

To allow pre-stripping of mine site and infrastructure locations to commence as soon as possible, Juno is seeking approval to clear native vegetation in areas of the Project where *Drosera eremaea* (P1) or *Drosera* aff. *eremaea* has not been recorded and identified (pending the results of a further targeted spring survey in 2021 which may provide additional information on the local and regional distribution and prevalence of *Drosera eremaea* species to enable an appropriate management strategy to be implemented if required.

Additional approvals, including a separate NVCP application for the proposed Yunndaga rail siding and selected export option, will be sought separately from the relevant authorities.

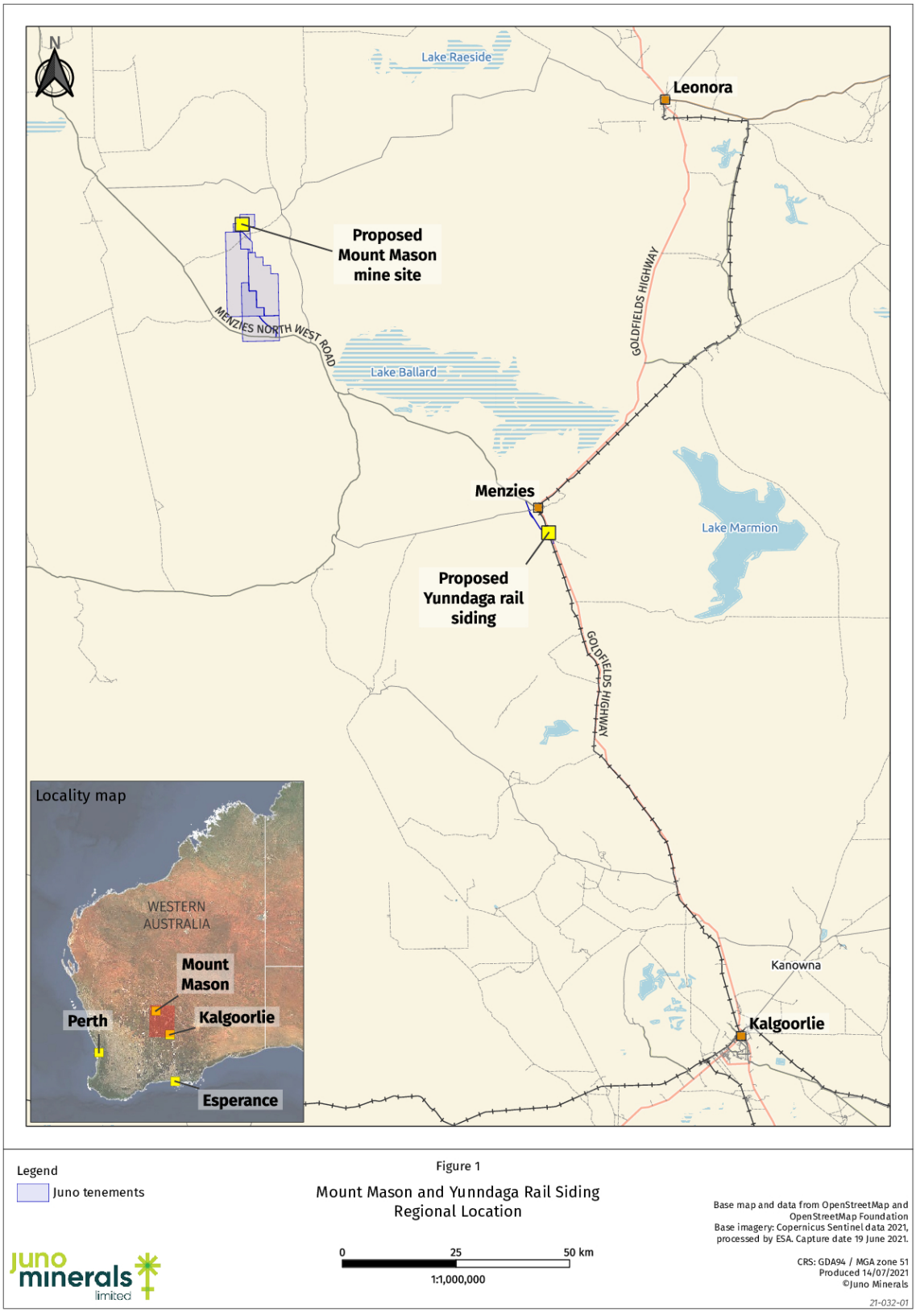


Figure 1: Mount Mason and Yunndaga Rail Siding Regional Location

1.2 Contact Details

Name:	Juno Minerals Limited
Contact Person:	Greg Durack (Managing Director and CEO)
Address:	Level 10, 16 St Georges Terrace, Perth WA 6000
Telephone:	08 9346 5599
Email:	greg.durack@junominerals.com.au
ABN:	94 645 778 892

1.3 Land Tenure

The mining tenements relevant to the Mt Mason DSO Hematite Project held by Juno include:

- Mining Lease M29/408 and M29/414;
- General Purpose Lease G29/22 and G29/23; and
- Miscellaneous Licence L29/79, L29/100 and L29/121.

The tenement details relevant to the proposed Project at Mt Mason as held by Juno are summarised in Table 1.

Table 1: List of Tenements for the Project

Tenement	Area (ha)	Status	Date of Grant	Date of Expiry
M29/408	300	Granted	28/11/2007	27/11/2028
M29/414	6,461	Granted	25/11/2011	24/11/2032
G29/22	9,634	Granted	06/09/2012	05/09/2033
G29/23	1,256.7	Granted	07/02/2013	06/02/2034
L29/79	6,886	Granted	24/08/2010	23/08/2031
L29/100	775	Granted	11/11/2011	10/11/2032
L29/121	64.3	Granted	30/07/2013	29/07/2034
Total Area	**25,377**			

1.4 Existing Facilities

Work previously conducted at the Project included exploration drilling for resource definition as well as hydrological and environmental investigations. To support these and current activities, Juno has the following established infrastructure:

- A 40-person camp which includes administration and management offices, mess, cold storage rooms, laundry facilities, store rooms, fully equipped single-quarter modular accommodation units, recreational rooms, outside recreational areas, parking and light vehicle refuelling areas;
- Seven water exploration boreholes, which were drilled between September 2011 and October 2011; and
- Four monitoring bores which were constructed in February and March 2012 to be used for long-term monitoring of groundwater levels and quality.

2 PROJECT DESCRIPTION

2.1 Location

The Project is situated in the Shire of Menzies, in the Goldfields district approximately 100km northwest of Menzies in Western Australia (Figure 1).

The Project is located within the northern portion of the Mount Ida Greenstone Belt. Land use in the area is predominantly pastoral, although exploration and mining activities occur in the vicinity of the Project area.

2.2 Project Characteristics

The Project will initially involve mining 1MT per annum of high-grade hematite ore over a period of 5 years (at a nominal mining rate of 1Mtpa with occasional maximum mining rate of up to 2Mtpa). There is also potential for the mine life to be extended beyond 5 years.

Juno intends to transport iron ore along the Menzies-Sandstone Road to Yunndaga Rail Siding south of the town of Menzies, from where it will be taken by rail to a port facility for export via shipping.

Key Project components include:

- Two small open pits and one associated waste rock dump;
- A Run of Mine (ROM) pad and product stockpiles;
- Mobile crushing and screening facilities;
- Ancillary infrastructure including but not limited to:
    - Mine operation centre (MOC);
    - Explosives magazine;
    - Power generation and distribution;
    - Workshops and warehouse;
    - Water pipeline from borefield;
    - Water treatment plant;
    - Reverse osmosis plant,
    - Stockpiles;
    - Haul road and access roads;
    - Fuel storage and loadout;
    - Administration office;
    - Washdown bay;
    - Water storage and distribution;
    - Sewage treatment plant; and
    - Septic system at the MOC.

Juno proposes to extend the existing 40-person camp to accommodate 100 personnel. The expansion will require modifications to, or establishment of, additional potable water supply treatment and infrastructure and sewage treatment facilities.

The proposed Project clearing footprint will be approximately 141ha) as shown in Table 2, Figure 2 and Figure 3.

A portion of the Project area (3.68ha) has been previously disturbed for exploration purposes (Figure 4).

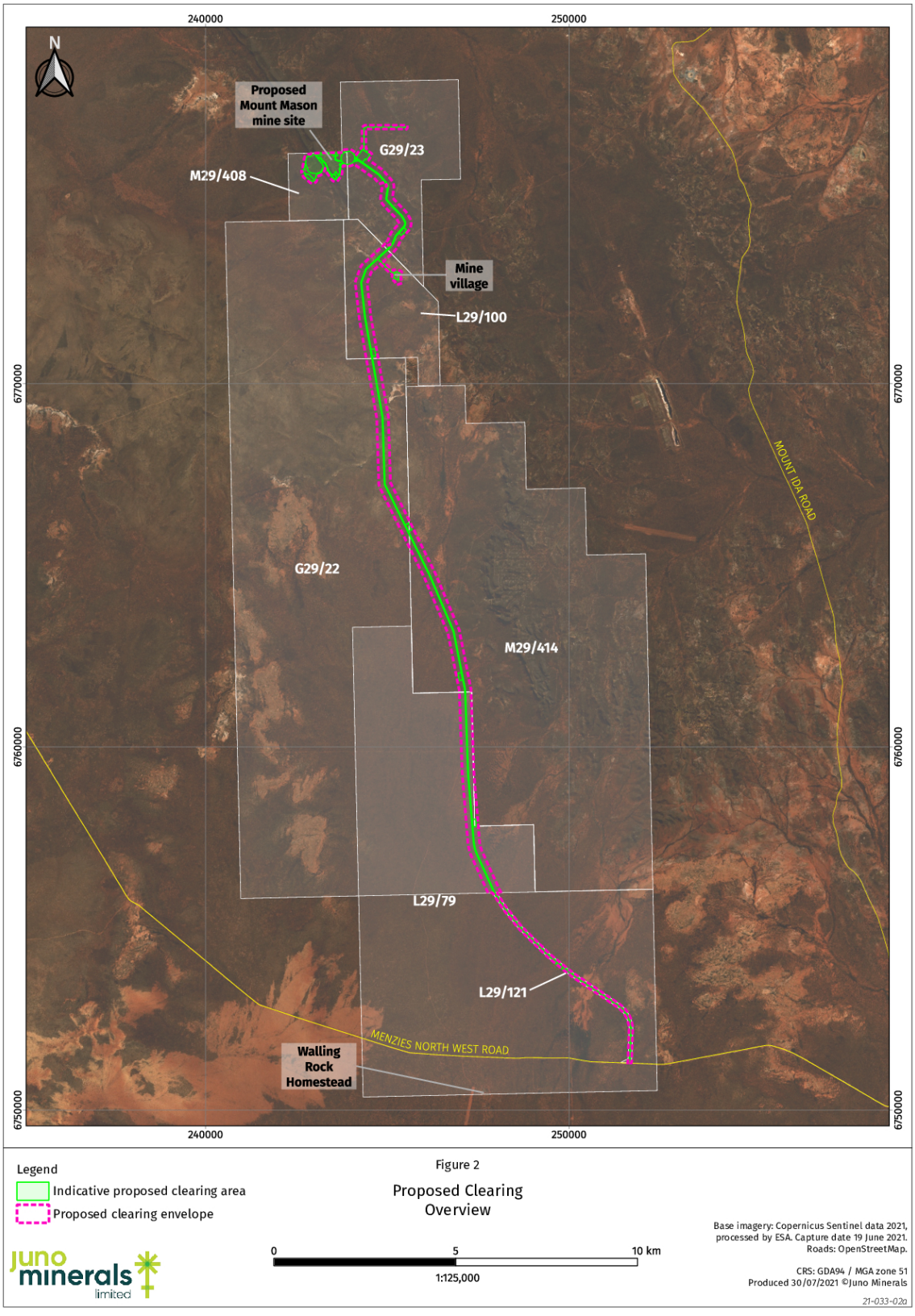


Figure 2: Proposed Clearing – Overview

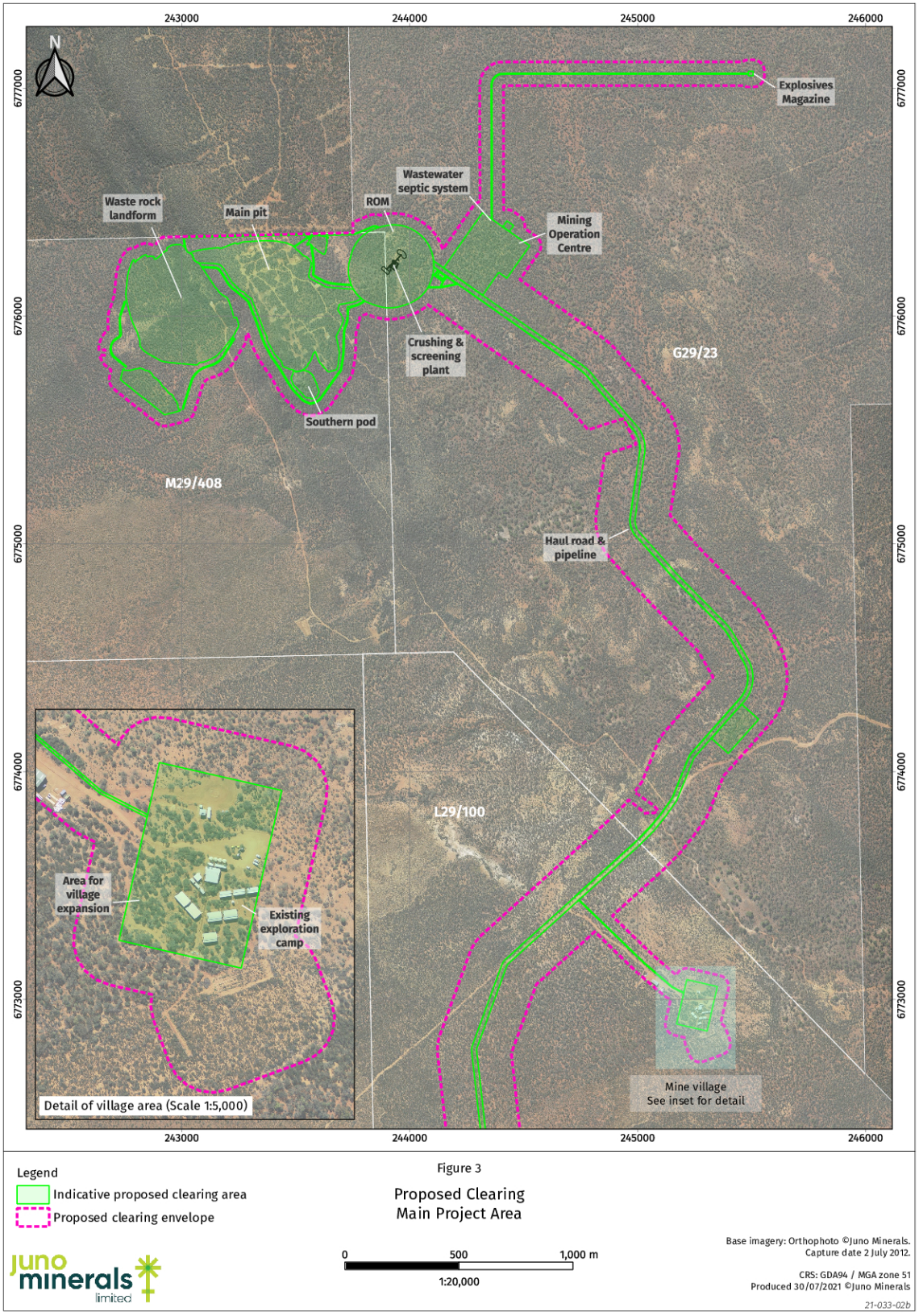


Figure 3: Proposed Clearing - Main Project Area

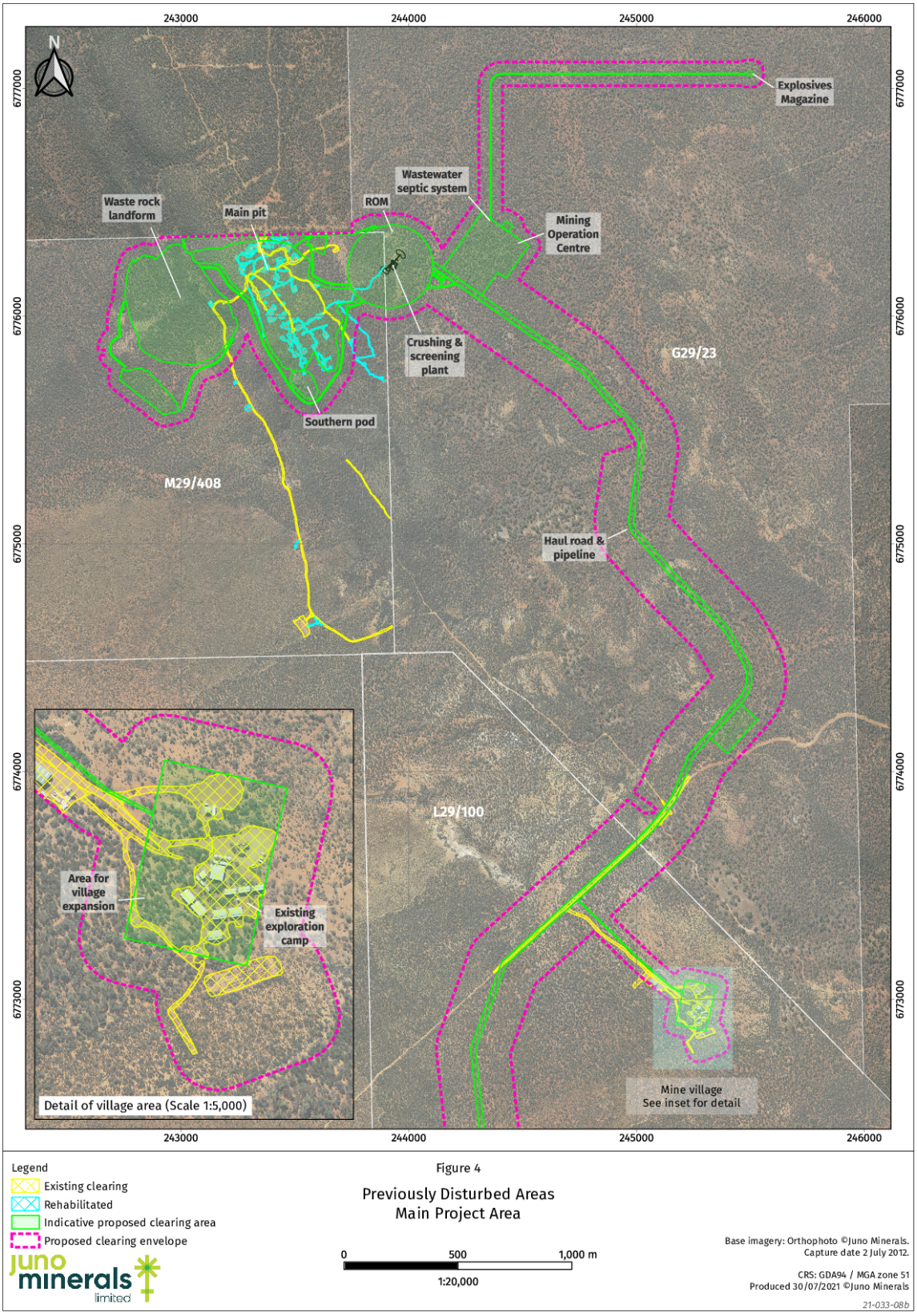


Figure 4: Previously Disturbed Areas – Main Project Area

Table 2: Project Footprint Including Areas Already Disturbed

Tenement Number	Activity	Disturbance (ha)	Area Already Disturbed (ha)
M29/408-I	Main pit - (includes 10m buffer)	20.09	0.99
M29/408-I	Secondary pit - southern pod (includes 10m buffer)	1.02	
M29/408-I	Waste rock landform	18.27	0.18
G29/23	ROM pad	10.81	
G29/23	Mining Operations Centre (MOC) compound	6.95	
L29/79, L29/121 and G29/23	Road corridor	63.01	1.27
G29/23	Pipeline corridor	0.52	0.01
G29/23	Dust suppression Turkey's nest	0.04	
G29/23	Explosives magazine	0.04	
L29/100	Camp expansion - accommodation	2.75	1.18
L29/100	Surface water management - ponds & bunds	3.45	0.03
L29/100	Abandonment bund	1.16	0.02
G29/23, L29/100, G29/22, M29/414, L29/79^	Topsoil stockpiles	12.00	
	TOTAL	**140.11**	**3.68**

* Note: No clearing is required for camp sewage effluent sprayfield (0.45ha).
^ Locations of topsoil stockpiles will be selected based on maintaining haul road safety and away from potential impacts to topsoil quality (e.g. flood and drainage areas).

2.3 Clearing Methods

Vegetation clearing will be undertaken in accordance with the Land Disturbance and Clearing Procedure (Appendix A) and the Jupiter Malleefowl Management Plan (Appendix B) using conventional earth moving equipment typical of civil works and mining programs.

Vegetation is dominated by Mulga communities and would be most effectively removed using bulldozers. The following clearing methodology will apply:

- Significant vegetation (e.g. large trees) shall be avoided and natural clearings will be favoured wherever possible to minimise damage to vegetation;
- Machinery blades shall be set above ground level to minimise disturbance to topsoil and rootstock and to reduce erosion when clearing;
- Vegetation and topsoil stockpiles will be located away from drainage lines and access tracks; and
- Topsoil (top 50mm) shall be stripped and stockpiled separately for use in rehabilitation.

3 SITE OVERVIEW

3.1 Regional Setting

3.1.1 Biogeography

The Project lies within the East Murchison (MUR1) Interim Biogeographic Regionalisation for Australia (IBRA) subregion of the Murchison Biogeographic Region, which encompasses the northern parts of the Yilgarn Craton (McKenzie, May, & McKenna, 2003). The Murchison is an important region for flora conservation, with over 800 indigenous species occurring in the region (Curry, Payne, Leighton, Hennig, & Blood, 1994) of which 142 are Priority Flora (Department of Environment and Conservation, 2011).

The East Murchison subregion comprises the northern parts of the Craton's 'Southern Cross' and 'Eastern Goldfields' Terrains and is characterised by internal drainage and extensive areas of elevated red desert sandplains with minimal dune development. Salt-lake systems are associated with the occluded palaeodrainage system. Broad plains of red-brown soils and breakaway complexes as well as red sandplains are widespread.

3.1.2 Land Systems & Landforms

The Western Australian Department of Agriculture completed a regional survey of land systems occurring within the Murchison to develop a comprehensive description of biophysical resources and to provide an assessment of the condition of the soils and the vegetation of the north-eastern Goldfields (Pringle et al, 1994). A component of the survey was the mapping of land types, land units and land systems of the Murchison including the Project area.

The Project lies within the Brooking Land System (Pringle et al, 1994) which is characterised by prominent ridges of banded iron formation, supporting mulga shrublands and occasional minor halophytic communities in the southeast.

The geomorphology is described by Pringle et al. (1994) as linear ridges up to 8km long and occasionally greater than 60m relief, generally much lower; gently inclined slopes with colluviums and sparse, often incised, narrow drainage tracts. Stone mantles provide effective protection against soil erosion.

Western Botanical (2021) identified the following landforms.

- Low banded ironstone formation (haematite) hills (two to three parallel series) of moderate relief, estimated at 20 to 75m above the surrounding plains, with moderate outcrop and small areas of tallus slopes;
- Colluvial slopes with laterite gravel, angular BIF colluvium and minor outcrop;
- Lower slopes with lateritic gravely and sandy lateritic gravely textures, colluvium and alluvium;
- Small, disjunct low rises of weathered ferruginous duricrust;
- Subcropping weathered, fractured basalt and gabbro with associated calcrete concretion;
- Aeolian yellow sandplain west of the orebody area;
- Aeolian orange sandplain on top of weathered Archaean granite plateaux;
- Weathered Archaean granite plateaux, low breakaway cliffs of 2-5m relief, kaolinitic footslopes and associated saline plains with coarse silty sand soils; and

- Narrow to broad drainage lines, extensive alluvial floodplains and areas subject to sheet flow, often with a mantle of shallow red silty sand.

Land Systems within the Project area as identified by Western Botanical (2021) are provided in Table 3.

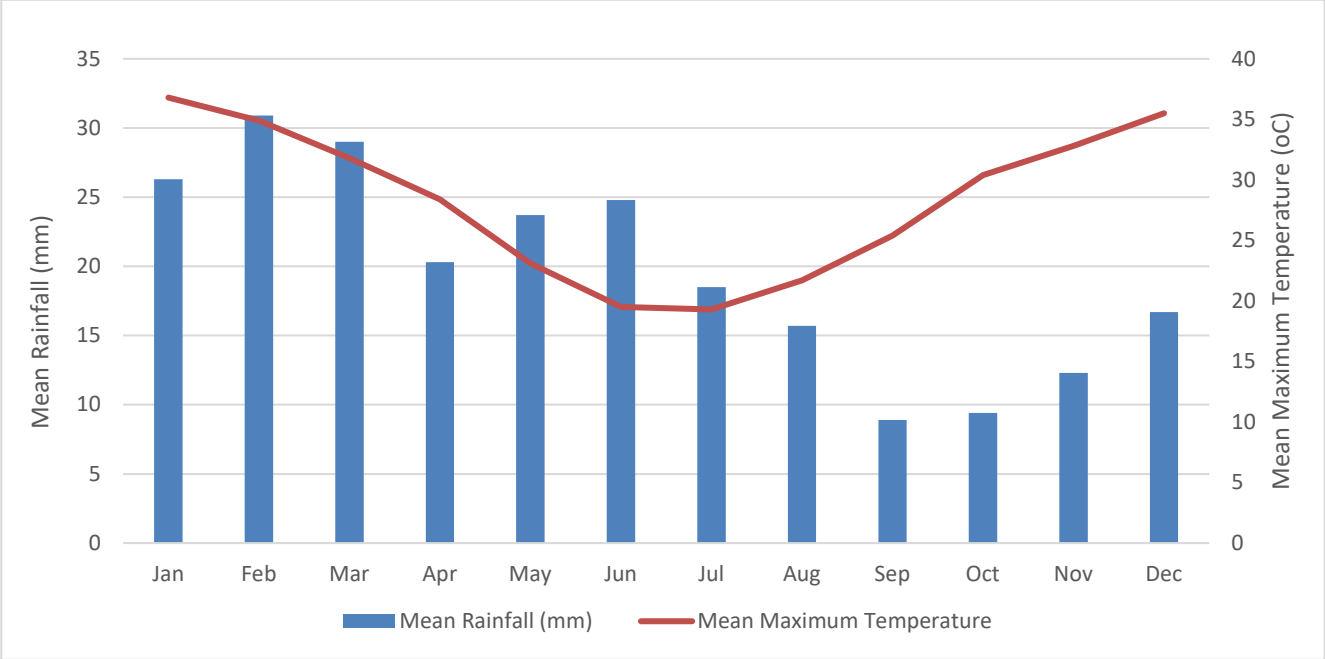
Table 3: Land Systems within the Project Area

Land System	Description
Rainbow	Hardpan plains supporting Mulga on alluvial plains subject to sheet flow; frequently with fine ironstone gravel mantles, and sparse, generally narrow and unincised concentrated drainage tracts.
Bevon	Irregular low hills supporting Mulga and Low shrubs on ?Tertiary limonite, minor Archaean greenstone and banded iron formation, extensive Quaternary colluvium and restricted areas of Quaternary alluvium and eluvium.
Brooking	Mulga shrublands, occasional minor halophytic shrublands on Archaean banded iron formation, locally quartzite, slate, shale and greywacke, with Quaternary colluvium and minor alluvium.
Waguin	*Acacia* shrublands and minor halophytic shrublands on very low breakaways (relief usually less than 4 m) with short footslopes above erosional plains and minor alluvial plains. This system usually occurs within large areas of sandplain, often occurring in parallel series.
Marmion	Gently undulating sandplains with mixed shrublands and hummock grasslands on Gently undulating sandplains with surface drainage features confined to areas fringing occasional exposures of granite.
Sherwood	Mulga shrublands, occasional minor halophytic shrublands on low breakaways (5 to 20 m relief), with pallid zone upper footslopes, depositional lower footslopes; extensive, level to gently undulating plains with pebble mantles; and lower alluvial plains and drainage floors receiving concentrated £low. Occasional low hills and tors.
Yowie	Mulga and Bowgada shrublands and patchy wanderrie grasslands on Quaternary sand and minor cemented alluvium.

3.2 Climate

The Project is located within the Goldfields-Esperance region of WA which is characterised by a semi-arid environment. The nearest meteorological station is Leonora, approximately 100km northeast of the Project. Leonora station has records from 1898 to 2020 for rainfall. Temperature records were from Leonora Aero station from 2007 to 2020, as temperature has not been recorded at the Leonora station since 2014 (Bureau of Meteorology, 2020).

The annual average rainfall between 1898 and 2020 was 236.5mm with the wettest period between January and June. Historic temperatures (1957-2020) vary from a winter minimum of 5.9ºC (mean minimum) to a summer maximum of 37ºC (mean maximum) (Bureau of Meteorology, 2020). Mean monthly rainfall and mean maximum temperatures are shown on 5.



Source: Bureau of Meteorology (2020).
*Note: temperature data was from Leonora Aero station is 2007-2020 as temperature has not been recorded at Leonora station since 2014.

Figure 5: Climate Statistics (1898-2020)*

During summer, winds are generally mild and hot, predominantly easterly in the morning, shifting south-easterly in the afternoon. During winter, winds are more variable in the morning, shifting to westerly in the afternoon.

Evaporation values for the Leonora station are shown in Table 4. Records show that the annual average evaporation is well in excess of the annual average rainfall, by more than an order of magnitude (SRK, 2012a).

Table 4: Monthly Average Precipitation and Evaporation Rates

Month	Precipitation (mm)	Evaporation (mm)
January	26	523
February	31	406
March	29	329
April	20	244
May	24	163
June	25	108
July	18	116
August	16	157
September	9	221
October	9	234

Month	Precipitation (mm)	Evaporation (mm)
November	12	378
December	17	464
Total	**236**	**3433**

3.3 Geology and Soils

3.3.1 Regional Geology

The Mt Mason iron ore deposit occurs within the Mt Ida Greenstone Belt. The most extensive area of greenstones of the Southern Cross Granite-Greenstone Terrane in the Mount Ida Greenstone Belt is in the north, in the poorly exposed area around Mt Mason. Here, shallow to steep, east-dipping units of banded iron formation (BIF), with intercalated mafic rocks, are structurally overlain by a very poorly exposed succession that appears to be dominated by metamorphosed mafic volcanic rocks, but includes gabbroic and ultramafic rocks (SRK, 2012a).

3.3.2 Project Geology

The main geological units outcropping in the area are BIF with minor associated shales and rare chert bands. Basalts and dolerites outcrop along the central area of the lease on the western side of the main scarp; granites in the southwest corner of the lease are typically overlain by a sand plain. Geological mapping is provided by Western Botanical (2021) in Appendix C.

The main geological features of the tenement described by Walsh (2005) are summarised as:

- BIF units at Mt Mason are cut by a WNW-striking fault dipping at 80° towards the north. A distinct zone of brecciation and quartz veining, associated with this fault, cross-cuts the BIF units. Weathering associated with this fault resulted in a substantial body of massive to bedded hematite. The hematite body outcrops over an approximate strike length of 600 m and width of 150 m. At the south end of the hematite body, another NNW-strike fault may cut the BIF, although field evidence is not strong. This was interpreted as an alteration boundary with minor displacement.
- Hematite mineralisation is believed to have formed by enrichment of the iron content of BIF and alteration of magnetite to hematite by the passage of iron-rich water through the system. Enrichment is localised and little is known about its controls. Hematisation generally appears to be bounded by shale units which themselves in some cases are partially mineralised. Faults and folding have been identified as possible important controls in fluid flow. The boundary between “hematised” and BIF units can be sharp (over a metre) or gradational (several metres).

3.3.3 Soils

The Project is located in the Salinaland Plains Zone of the Murchison Province soil landscape zone. It correlates with the bulk of the Wiluna, Laverton and Barlee vegetation systems of Beard (1976) and has a preponderance of the sandplains and occasional dunes with spinifex grasslands rangeland land type (Pringle et al, 1994).

Tille (2006) describes this zone as 'Sandplains (with hardpan wash plains and some mesas, stony plains and salt lakes) on granitic rocks (and some greenstone) of the Yilgarn Craton. Red loamy earths, red sandy earths, red shallow loams, red deep sands and red-brown hardpan shallow loams (with some red shallow sands and red shallow sandy duplexes) are present (KLA, 2012c).

Soils in the surveyed area are relatively uniform with little change throughout the landscape. Recurring soil profiles were observed with only 4 different soil profiles being identified from 23 excavated sites. Fine sandy loams leading into light sandy clay loams are found throughout the area. Shallow topsoils are common throughout the area and are the result of wind and water erosion (KLA, 2012c).

According to KLA (2012c) all sites have acidic horizons down the profile with pH values below 7 and are low in:

- Nitrogen;
- Phosphorus;
- Calcium;
- Magnesium;
- Sulphur;
- Potassium;
- Manganese; and
- Sodium.

The Project area is not within a known acid sulfate soil risk area.

3.4 Hydrology and Hydrogeology

3.4.1 Hydrology

Observations from surveys in the region indicate that significant creek systems drain from topographical highlands (greenstone belts) to areas of topographical low relief (sandplains and playa lakes). All major creeks are ephemeral in nature and experience a degree of flow as a response to major rainfall events. Less defined drainage lines are typified within sandplain areas. Sheet flow is likely to occur under major rainfall events given poor creek definition, and the relatively uniform gradient that exists. Runoff from outcrops of bedrock may also collect in gnamma holes or rockholes and soaks with water holes often occur next to rock outcrops, forming significant mechanisms of groundwater recharge in the region (Coffey, 2010).

The Project is located approximately 35km northwest of Lake Ballard which is listed on the Directory of Important Wetlands in Australia. There are no lakes, rivers or other significant water bodies within the Project Area.

The drainage of the Project Area is characterised by:

- Non-incised, broad, ephemeral drainage lines which drain the plains to the west of the Project; and
- Slightly incised ephemeral watercourses scattered throughout the Project Area on the sideslopes and flats associated with and to the east and west of the BIF ridge.

3.4.2 Hydrogeology

A general assessment of the regional distribution of playa lakes from the hydrogeological map of WA suggests that the drainage systems of the region comprise broad, structurally confined, sub parallel features with a suggested drainage direction in a south-easterly direction for systems north of the township of Kalgoorlie and an easterly direction for systems south of Kalgoorlie. The Playa lake systems mark the courses of palaeorivers that ceased to flow when the climate became arid during the Tertiary period. These palaeorivers are regionally referred to as palaeodrainages and tend to discharge into the large playa lakes that exist throughout the area (Coffey, 2010).

The Project lies within the Goldfields Groundwater Proclamation Area under the *Rights in Water and Irrigation Act 1914* (RIWI Act).

Groundwater levels in the Project area vary between 29m below ground level (bgl) and 67m bgl. There are two distinct areas, a northern and a southern area. The division line between the two areas follows a SW-NE trend and coincides with an inferred fault that crosses the Project area. The southern area presents a steep gradient with water moving from the top of the ridge away in every direction. The northern area presents a much lower gradient with water moving from the ridge towards the northeast (SRK, 2012b).

The groundwater table in the area occurs at approximately 480 m RL (40-50 m bgl) where the Main pit will be developed. The proposed pit will be excavated down to 420 m RL, thus requiring 60 m of saturated rock to be dewatered to allow dry mining conditions. The groundwater level is below the depth of the adjacent mining pod to the south of the Main pit.

Groundwater samples were collected from four bores. The samples were analysed, and the pH of the groundwater was found to be near neutral, ranging from pH 6.8 to 8.5. Groundwater salinity was low and total dissolved solids (TDS) ranged from 507 to 1,060mg/L. Dissolved concentrations of minor and trace elements were low. Groundwater quality results are provided in Table 5.

These values provide a clear indication that recharge for this groundwater is recent or subject to rapid throughflow as opposed to the groundwater in the surrounding plains, which can have TDS values in the order of 50,000 to 100,000 mg/L (SRK, 2012b). However, prolonged pumping for dewatering purposes may lead to deterioration of the water chemistry, by the possible drawing in of saltier water from the surrounding alluvial aquifers, possibly along regional transmissive faults in the area (SRK, 2012b).

Table 5: Groundwater Quality, Mt Mason

Analyte	Units	Average	Analyte	Units	Average
pH	pH units	7.1	Conductivity	µS/cm	1124
Total Alkalinity as $CaCO_2$	mg/L	6.7	Cadmium	mg/L	<0.0001
Sulphate	mg/L	81	Chromium	mg/L	<0.001
Chloride	mg/L	237	Cobalt	mg/L	<0.001
Fluoride	mg/L	0.9	Copper	mg/L	0.004
Total Phosphorus as P	mg/L	0.4	Iron	mg/L	0.06
Calcium	mg/L	23	Lead	mg/L	0.001
Magnesium	mg/L	29	Manganese	mg/L	0.007

Analyte	Units	Average	Analyte	Units	Average
Potassium	mg/L	14	Molybdenum	mg/L	0.02
Sodium	mg/L	138	Nickel	mg/L	0.005
Aluminium	mg/L	0.01	Selenium	mg/L	<0.01
Antimony	mg/L	0.001	Silver	mg/L	<0.001
Arsenic	mg/L	<0001	Strontium	mg/L	0.15
Barium	mg/L	0.02	Tin	mg/L	<0.001
Boron	mg/L	0.6	Zinc	mg/L	0.024

Sourced: SRK (2012b).

3.5 Vegetation and Flora

3.5.1 Vegetation and Flora Surveys

The following flora and vegetation surveys have been undertaken for the Project:

- Reconnaissance survey and gap analysis, April 2021, targeted at orebody and infrastructure areas (Western Botanical, 2021) (Appendix C);
- Level 1 Flora and Vegetation Survey of the proposed Mount Mason Haul Road by Native Vegetation Solutions (NVS), May 2012 (Appendix D); and
- Mt Mason Project, Level 2 Flora and Vegetation Survey: Part 1–October 2011 & Part 2–March 2012 by NVS, Spring 2011 and Autumn 2012 (Appendix E).

Surveys were undertaken in accordance with:

- Environmental Protection Authority (EPA) *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016) (2021 survey only);
- Environmental Protection Authority (EPA) Position Statement No. 3 *Terrestrial Biological Surveys as an Element of Biodiversity Protection* (Environmental Protection Authority, 2002); and
- EPA Guidance Statement No. 51 *Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (Environmental Protection Authority, 2004a).

The Final Report, Review of Flora and Vegetation of the Mt Mason and Yunndaga Siding Study Areas has been submitted to IBSA (Ref: IBSA-2021-0303).

3.5.2 Vegetation

Vegetation of the area is dominated by Mulga woodlands and is often rich in ephemerals, hummock grasslands, saltbush shrublands and *Halosarcia* shrublands (McKenzie, May, & McKenna, 2003).

The Project lies within the following Beard (1975) vegetation units (NVS, 2012b):

- Vegetation Association 18: Low woodland; mulga (*Acacia aneura*);
- Vegetation Association 483 Hummock grassland, mixed sandplain and open Mallee;
- Vegetation Association 202: Shrublands; mulga and *Acacia quadrimarginea* scrub; and
- Vegetation Association 484: Shrublands; jam thicket.

A summary of the current extent and representation of these associations is presented in the Table 6.

Table 6: Extent and Representation of Vegetation Associations at a Regional Scale

Beard Vegetation Association	Description	Pre-European Extent, WA (ha)*	Remaining (%)
484	Shrublands; jam thicket	70,235	100%
202	Shrublands; mulga & *Acacia quadrimarginea* scrub	365,344	100%
483	Hummock grasslands, mixed sandplain - open Mallee over sparse dwarf shrubs with *spinifex*; red Mallee & mixed sparse dwarf shrubs over *Triodia basedowii*	395,106	100%
18	Lowwoodland; mulga (*Acacia aneura*)	22,029,557	100%
Total		**22,860,242**	

* Source: Shepherd (2002).

There are thirty-four recognised vegetation associations at the NVIS Level V Association where three dominant species in each stratum is used to define vegetation associations. Of these (Western Botanical, 2021):

- 23 are Mulga Woodlands, ranging from tops of BIF ridges to low lying drainage tracts;
- 1 is a Casuarina Woodland on outcropping calcrete over basalt;
- 5 are Eucalyptus woodlands with either calcrete influenced soils or on clay;
- 1 represents a tall *Allocasuarina* shrubland on duricrust outcrop; and
- 4 represent low shrublands with emergent Acacia on Archaean granite plateaux or duricrust outcrops.

A full list of the vegetation associations and maps are provided in the flora survey report in Appendix C.

The April 2021 survey identified 135 species, the majority of which are well known and widespread in the region and are not considered significant species. A species list from the 2021 survey is provided in Appendix C.

In respect of the haul road survey, a total of 41 Families, 108 Genera and 231 Species were recorded within the area surveyed (NVS, 2012a). The 2011 Level 2 Spring survey of the Mt Mason tenement identified a total of 83 flora species, representing 54 Genera and 28 Families while the 2011 Autumn survey identified a total of 97 flora species, representing 59 Genera and 31 Families. The 2011 Spring survey identified 8 vegetation groups and an additional 2 vegetation groups were identified in the 2011 Autumn survey.

3.5.3 Threatened and Priority Ecological Communities

No Federally or State Listed Threatened Ecological Communities (TEC) have been identified within the Project area (Western Botanical, 2021).

The orebody areas and northern parts of the proposed haul road and the camp area all lie within the Priority 1 Perrinvale/Walling vegetation assemblages (banded ironstone formation) Priority Ecological Community (PEC) (Figure 6). It is expected that some vegetation associations of the Study Area may be regionally restricted, particularly those associated with the geology of the BIF ranges and associated laterite caps and the erosion products from these ranges. These will most likely however be widespread within similar landforms of the Mt Mason / Mt Ida area (Western Botanical, 2021).

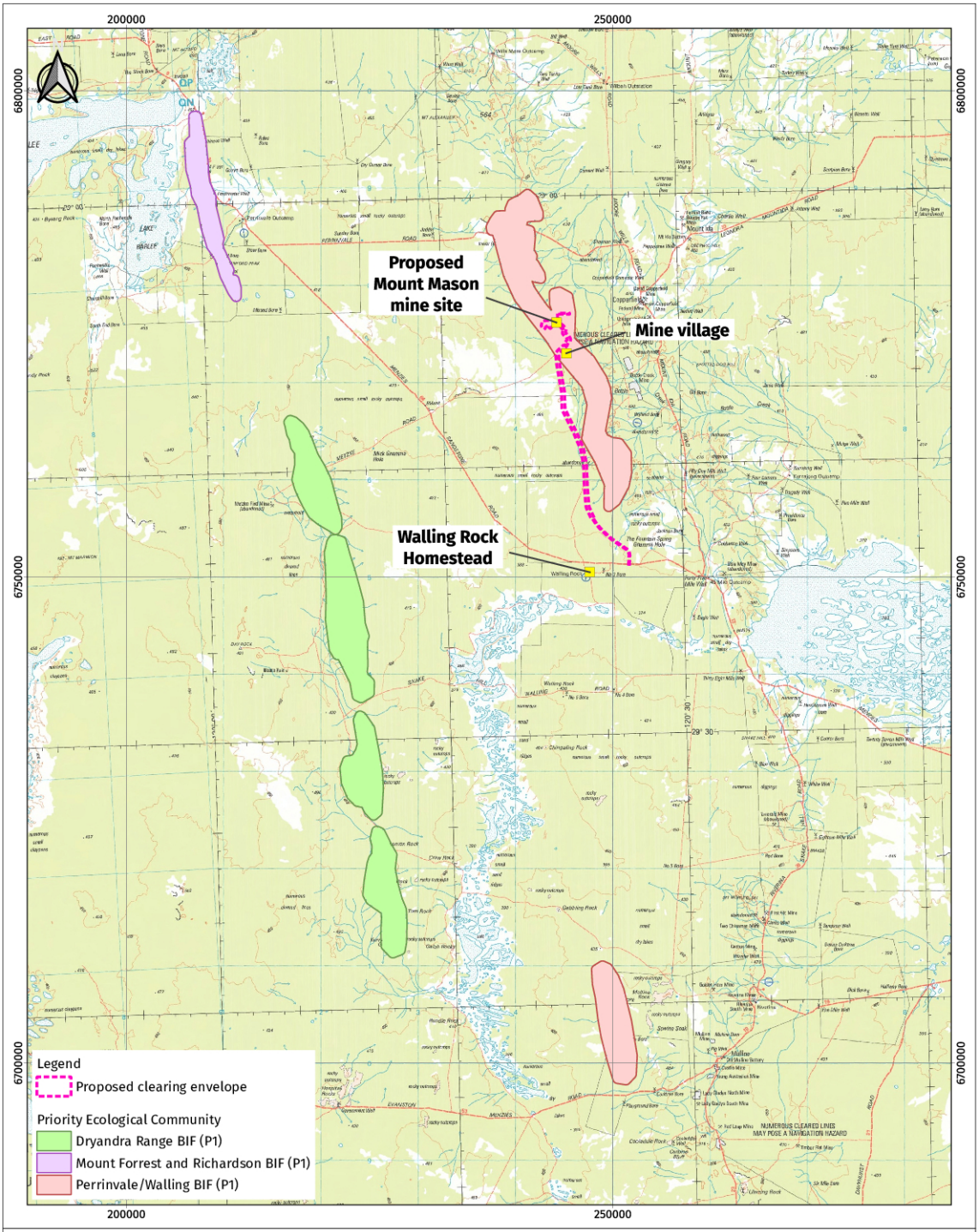


Figure 6

Priority Ecological Communities Overview

Priority ecological communities: DBCA (WA).
Base imagery: Copernicus Sentinel data 2021, processed by ESA. Capture date 19 June 2021.
Roads: OpenStreetMap.

CRS: GDA94 / MGA zone 51
Produced 30/07/2021 ©Juno Minerals

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Figure 6: Threatened and Priority Ecological Communities

3.5.4 Conservation Significant Flora

No Federally EPBC Listed Threatened Flora are known within or in the immediate vicinity of the Project area.

Further, the Level 1 and Level 2 flora surveys undertaken by NVS in 2011 and 2012 did not record any threatened species.

Four (4) species listed as Threatened Flora in Western Australia have been recorded within a 20km radius of the Project area. Three (3) of these (*Eucalyptus crucis* subsp. *Crucis, Myriophyllum lapidicola, and Ricinocarpos brevis)* are considered 'unlikely to occur within the Project area' (Western Botanical, 2021).

The fourth species (*Seringia exastia)* is listed as a Threatened Flora taxon due to a recent (2020) revision of taxonomy of species but it is widespread within central and northern Western Australia and will be removed from the Threatened Flora List following a pending meeting of the Threatened Species Scientific Committee (Western Botanical, 2021).

There are one (1) Priority 1 species and three (3) Priority 3 species that have known records of occurrence on the Project area (Table 7). There are thirty-two (32) other Priority species that have been recorded on the broader tenements (outside the Project area) or may possibly occur on the Project area as they have been recorded on nearby study areas (Appendix C).

Figure 7 and Figure 8 show the location of the priority species listed in Table 7 as having been recorded at the Mount Mason Project area.

Table 7: Conservation Significant Flora Known Occurrences at Mount Mason Area

Taxon	Conservation Code	Comment
*Drosera eremaea (*inclusive of *Drosera* aff. *eremaea)*	P1	*Drosera eremaea* P1 is known within and in close proximity to the proposed disturbance footprint within the orebody area. One record of *Drosera* aff. *eremaea* is known within the current Exploration Camp area. Based on the regional distribution of similar species, this is likely to be *D. eremaea* P1, however, the accuracy of the position has not been verified.
Calytrix hislopii	P3	Populations lie well outside area of proposed development.
Philotheca brevifolia subsp. *deserti*	P3	Present on L 29/079. Populations lie well outside area of proposed development.
Pterostylis virens	P3	Associated with granitoid landforms, outside disturbance footprints.

Whilst *Hibiscus* sp. Perrinvale Station is a widely regionally collected Priority 3 species and could likely occur on the upper to lower slopes of the BIF ranges and associated duricrust outcrops within the area, it has not been recorded at the Project area. It is, however, a cryptic species and is difficult to assess in seasons outside those with favourable rainfall.

Juno therefore proposes a targeted spring survey of the Project area for both *Drosera eremaea* and *Hibiscus* sp. Perrinvale Station in more favourable conditions after winter rainfall, nominally in August/September 2021.

Hysterobaeckea longipes has also been reported through a specimen notionally recorded as adjacent to the Haul Road alignment approximately 7.75km south of the Mt Mason orebody area (NVS, 2013). It is, however, not a threatened species, and the location information is questionable as the associated species noted with the specimen do not occur in the Mount Mason area and this also represents a disjunct occurrence of this species being some 375km east of its known range in the northern Avon Wheatbelt (Western Botanical, 2021).

Similarly, *Calotis sp. Perrinvale Station* (P3) and *Chrysocephalum apiculatum* subsp. *Norsemanense* (P3) have been recorded on tenement L29/100 but are both suspected of being positionally reported errors.

3.5.5 Vegetation Condition

Vegetation (excluding areas that have been previously cleared for Pastoral management and or mining exploration) is considered to be in Pristine Condition and displaying normal characteristics for the prevailing seasonal conditions during the field survey in 2021 (Western Botanical, 2021).

Areas previously cleared for exploration have been rehabilitated and casual observations during the 2021 field survey indicated excellent recruitment of a wide range of local native species of representing all strata of the surrounding vegetation. Inclusive of tracks and rehabilitated drill pads, the entire Study Area would be considered to be in Excellent Condition (Western Botanical, 2021).

3.5.6 Introduced Flora Species

No introduced flora species were recorded in or around the Project area during the 2021 review (Western Botanical, 2021) nor the previous Level 2 survey (NVS, 2012a).

However, the following five weed species have previously been found along the proposed haul road alignment (NVS, 2012b):

- *Asphodelus fistulosus* (Wild Onion, Onion Weed);
- *Cleretum papulosum* subsp. *papulosum*;
- *Lysimachia arvensis* (Scarlet Pimpernel);
- *Pentameris airoides* subsp. *airoides*; and
- *Portulaca oleracea* (Wild Portulaca, Pigweed).

The majority of these species were found along existing side tracks and disturbed sites. None of these species are considered declared plants as defined by the Department of Agriculture WA.

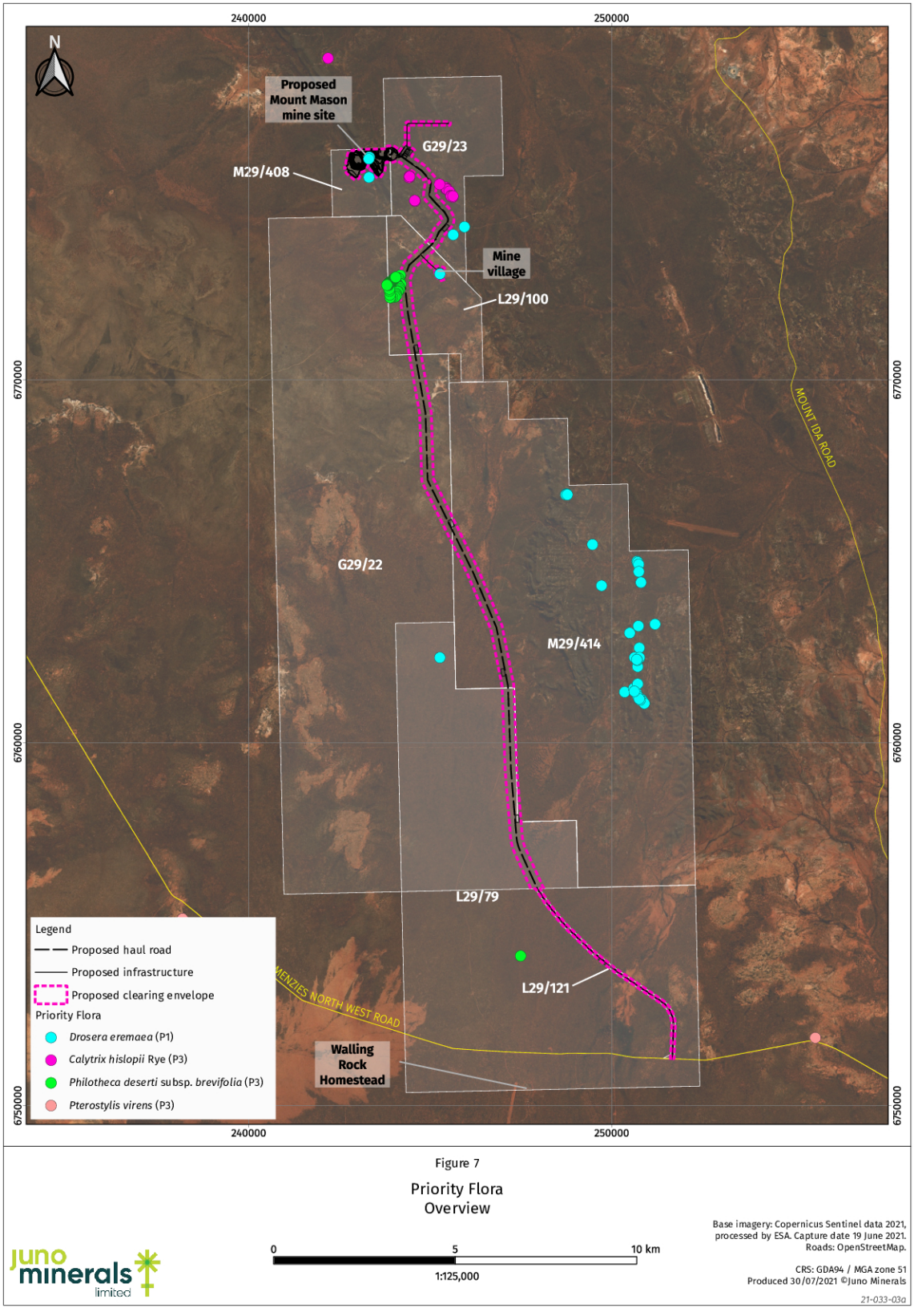

Figure 7: Priority Flora – Overview

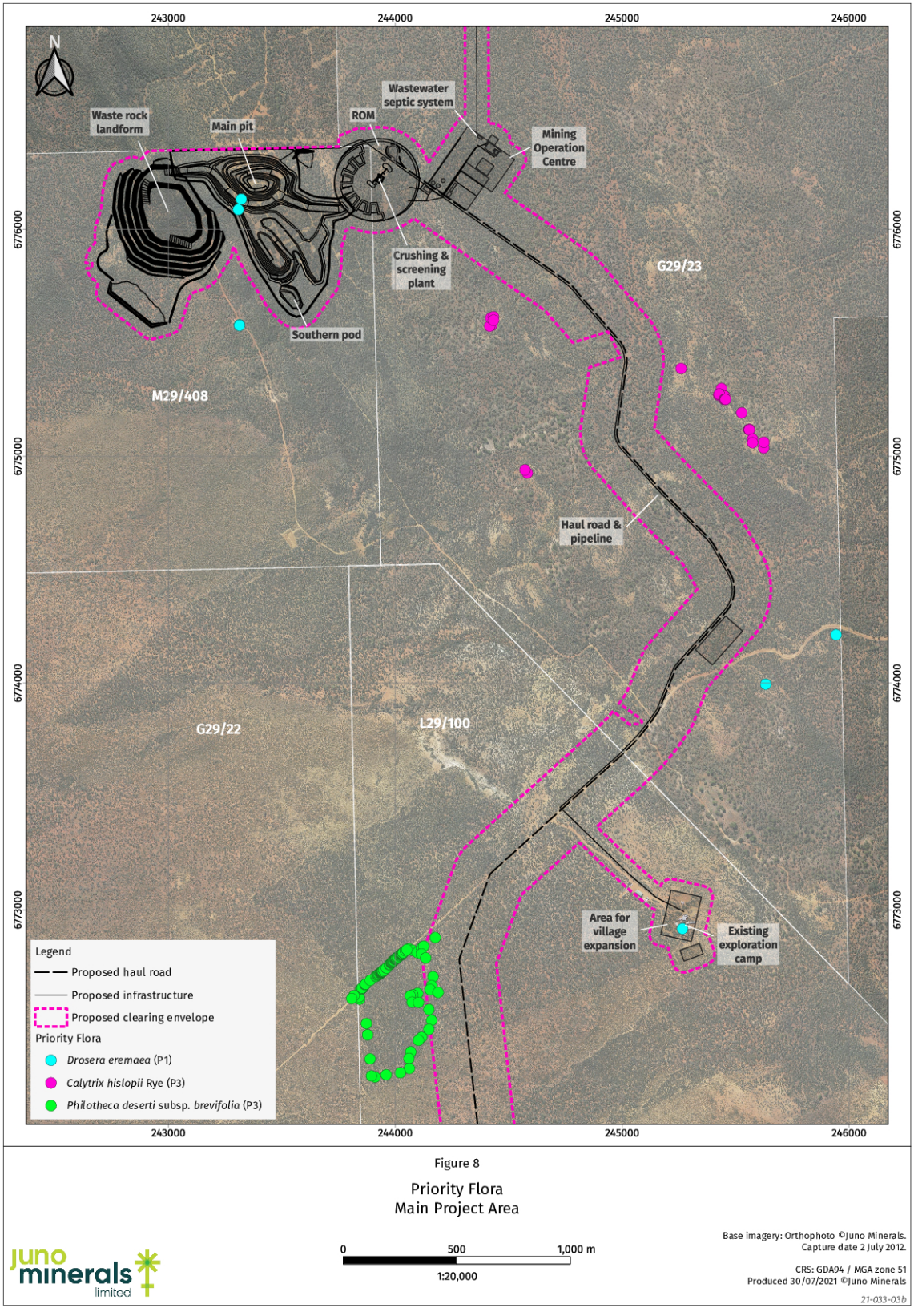

Figure 8

Priority Flora
Main Project Area

Figure 8: Priority Flora - Main Project Area

3.6 Fauna

3.6.1 Fauna Surveys

The following fauna surveys relevant to the Project and the wider area have been undertaken:

- Targeted Fauna Survey June 2021 for Malleefowl, Long-tailed Dunnart, Night Parrot and the Arid Bronze Azure Butterfly (Appendix F);
- Level 2 Fauna Survey of the Mt Mason Mining Tenement (M29/408) by Keith Lindbeck Associates in Spring 2011 and Autumn 2012 (Appendix G);
- Targeted EPBC Survey by Keith Lindbeck Associates in Autumn 2012 (Appendix H);
- Targeted Malleefowl Survey of Non-process Infrastructure Areas by GHD in Spring 2012;
- Central Yilgarn Iron Project, Terrestrial Short-Range Endemic Invertebrate Survey by Outback Ecology 2011; and
- Central Yilgarn Iron Project, Subterranean Fauna Pilot Study at Mt Mason by Rockwater 2012.

The 2021 Targeted Fauna Survey was completed in accordance with the following EPA, DBCA and DAWE requirements for the environmental surveying and reporting of fauna surveys in WA, where relevant and practical, and as documented in:

- EPA Technical Guidance – Terrestrial vertebrate fauna surveys for environmental impact assessment (EPA 2020);
- Interim Guideline for preliminary surveys of Night Parrot (*Pezoporus occidentalis*) in Western Australia (WA Department of Parks and Wildlife [DPaW] 2017);
- Survey Guidelines for Australia's Threatened Birds. EPBC Act survey guidelines 6.2 (2010) (DSEWPaC);
- National Recovery Plan for Malleefowl (*Leipoa ocellata*), Department for Environment and Heritage (Benshemesh 2007); and
- Guideline for the survey of arid bronze azure butterfly (ABAB) in Western Australia (DBCA 2020).

3.6.2 Fauna

A total of 59 vertebrate fauna species were recorded in the Level 2 surveys, comprising 13 reptile species, 5 native terrestrial mammal species and 1 non-native terrestrial mammal species, 6 species of bats and 34 bird species (KLA, 2012d).

A targeted Short Range Endemic (SRE) survey was conducted in 2008 in the Mt Mason area with sample sites all located within the BIF. Results indicate that of the specimens collected only one species *Aganippe* 'MYG224' (Family *Idiopidae*) is an SRE (KLA, 2012b).

A targeted invertebrate survey was undertaken by Keith Lindbeck Associates in 2012. Of the 19 species identified, the classification of six species could not be determined. It is also noted that one of the six, while the sample collected could not be identified, is likely to belong to a genus in which all species are considered to be SREs. The remaining 13 species are not considered to be SREs. No evidence of the species *Aganippe* 'MYG224' was recorded or collected during this survey (KLA, 2012b). The potential SRE habitat supported by these ranges is extensive and is not limited to the area of proposed impact at Mt Mason (KLA, 2012d).

A subterranean fauna sampling programme (pilot study) was undertaken within the survey area by Rockwater Pty Ltd (2012) from November 2011 to May 2012, in accordance with the relevant EPA guidelines (Environmental Protection Authority, 2003). Results indicate the stygofauna community within the Project area are represented by only one stygal group (*Nematoda*), suggesting a depauperate complexity for arid parts of WA. Nematodes are a widespread group with few representatives confined to subterranean environments. It is considered unlikely that the Project will affect their conservation status and they do not warrant further investigation (Rockwater, 2012).

Dedicated troglofauna sampling by trapping and netting yielded no troglobitic fauna within the Project area. The sampling intensity implemented in the Project area exceeded that set by the EPA for a pilot troglofauna survey and further sampling is not required. It is therefore concluded that troglofauna is not a relevant environmental factor for the Project (Rockwater, 2012).

3.6.3 Conservation Significant Fauna

No invertebrate species of conservation significance are listed for the Project area under the EPBC Act, the *Wildlife Conservation Act 1950* (WC Act) or in the DPaW Threatened and Priority Fauna Database.

Searches of DPaW's Threatened and Priority Fauna Database and the EPBC Act list a potential for 11 vertebrate species of conservation significance to occur in the Project area. A summary of the potential fauna species of conservation significance is presented in Table 8, including reference to the Long-tailed Dunnart, which did not appear in desktop searches but was recorded during the Spring 2011 survey.

Table 8: Presence of Conservation Significant Fauna

Common Name Scientific Name	Likelihood of Occurrence	Conservation Status	
		EPBC	WA
Invertebrates			
Arid Bronze Azure Butterfly *Ogyris subterrestris petrina*	May occur	Critically Endangered	
Mammals			
Long-tailed Dunnart *Sminthopsis longicaudata*	Confirmed		Priority 4
Reptiles			
Woma *Aspidites ramsayi*	Not likely to occur		Schedule 4
Birds			
Slender-billed Thornbill *Acanthiza iredalei iredalei*	Not likely to occur[1]	Vulnerable	
Fork-tailed Swift *Apus pacificus*	May occur	Migratory	
Great Egret *Ardea alba modesta*	Not likely to occur	Migratory	
Peregrine Falcon *Falco peregrinus*	Not likely to occur		Schedule 4

[1] KLA (2012a).

Common Name Scientific Name	Likelihood of Occurrence	Conservation Status	
		EPBC	WA
Australian Bustard *Ardeotis australis*	Not likely to occur		Priority 4
Hooded Plover *Thinornis rubricollis*	Not likely to occur		Priority 4
Rainbow Bee-eater *Merops ornatus*	Confirmed	Migratory	
White-browed Babbler *Pomatostomus superciliosus*	Confirmed		Priority 4
Crested Bellbird *Oreoica gutturalis* subsp. *gutturalis*	Confirmed		Priority 4
Malleefowl *Leipoa ocellata*	Confirmed	Vulnerable	Schedule 1
Night Parrot *Pezoporus occidentalis*	Not likely to occur	Endangered	

3.6.3.1 Malleefowl

Malleefowl (*Leipoa ocellata*) is listed as vulnerable under the EPBC Act and Schedule 1 (rare and likely to become extinct) under the WC Act. The Project was referred by Jupiter to the Department of Sustainability, Environment, Water, Population and Community (DSEWPaC) in May 2013 and was assessed as 'Not a Controlled Action if undertaken in a particular manner' (Appendix I).

Malleefowl are large ground dwelling birds belonging to the Megapodiidae family. The Malleefowl is omnivorous and typically has a large home range in woodlands or shrublands that have a deep layer of leaf litter which is used in building nesting mounds. It occupies semi-arid to arid regions of WA, inhabiting dense shrublands and thickets of Mallee (*Eucalyptus* spp.), Boree (*Melaleuca lanceolata*) and Bowgada (*Acacia linophylla*) (Johnstone, R.E. and Storr, G.M., 1998).

Two Malleefowl were observed in the June 2021 Targeted Fauna Survey, one near the beginning of the haul road and inside the project area and one near the bottom of the haul road, but just outside the project area. Malleefowl mounds were recorded at eight locations during the survey (Figure 9 and10), however only three of these were within the proposed clearing area, and all three were old and disused. Only one mound near the southern end of the haul road, outside of the proposed clearing area was considered under construction (Figure 9) (Western Ecological, 2021).

Historic surveys in 2011 and 2012 by KLA and GHD, and another by Jupiter of the explosives magazine and associated access track and the camp expansion, found 54 Malleefowl mounds, some of which were found outside the Project footprint. Surveys relevant to the Project identified 6 active mounds, and 2 inactive mounds considered to be less than 20 years old (Figure 9 and Figure 10). The density of active mounds varies dependent on the terrain and between tenements. There are no active Malleefowl mounds within the surveyed area of the Mason pits (M29/408) which is likely to be directly related to the terrain with the BIF outcrop (main pit area) being unsuitable nesting habitat. The sandy plain areas to the south of the pits provide more appropriate habitat (KLA, 2012a).

3.6.3.2 Night Parrot

The June 2021 Targeted Fauna Survey did not record any Night Parrot calls on any of the three SM4s that were placed out at Mount Mason (two units) and in the haul road (one unit). There is no habitat for Night Parrots in the Mount Mason and haul road sections of the project area (Western Ecological, 2021).

3.6.3.3 Long-tailed Dunnart

The Long-tailed Dunnart (*Sminthopsis longicaudata*) was recorded at the base of rocky scree in the Mount Mason section of the project area in 2011 (one individual) and 2012 (one individual) (KLA 2012). This species was not recorded in the project area during the June 2021 Targeted Fauna Survey on any of the five camera traps that were placed out in Mulga shrubland on rocky ridges and rocky hill slopes.

Given the limited number of captures during the historic survey and no captures on camera traps during the 2021 survey, the Long-tailed Dunnart is likely to occur in very low densities in this area (Western Ecological, 2021).

3.6.3.4 Arid Bronze Azure Butterfly

There were no records of the Arid Bronze Azure Butterfly (ABAB) in three database searches conducted in June 2021, as this species is known from only two locations. The Project lies within the very large area that has been very broadly mapped as the potential distribution of the Sugar Ant which is the Arid Bronze Azure Butterfly host.

There are two small patches of potentially suitable habitat in the Mount Mason and haul road section of the Project area. However, as the ABAB is currently only known from two populations, both of which are hundreds of kilometres from the project area, and there is only limited potential habitat in the project area, this species is unlikely to be present (Western Ecological, 2021).

3.6.4 Introduced Fauna Species

The EPBC Protected Matters Search Tool lists four invasive species that are likely to occur in the Project area, *Capra hircus* (Goat), *Felis catus* (Cat), Oryctolagus cuniculus (Rabbit) and *Vulpes vulpes* (Fox). Evidence of *F. catus* and *O. cuniculus* was recorded during the 2012 survey. Canid faeces were noted but were unable to be attributed to *Canis lupis* sp. being either a Dingo or a non-native Dog. Anecdotal sightings of *Equus asinus* (Donkey) were also reported.

3.7 Biodiversity

The Project was referred for assessment under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) in May 2013 (EPBC Ref 2013/6870). Notification was received on 24 June 2013 that the proposed action was not a controlled action, provided it is undertaken in accordance with the manner described in the decision document (Appendix I):

- Clearing must not exceed 115ha;
- Construction activities must not be undertaken within 250m buffer radius of active Malleefowl mounds;
- Inactive Malleefowl mounds outside the development footprint to be retained with a buffer of 50m;

- Prior to construction the development footprint must contain fire trails for the safe transit of fire fighting vehicles to mitigate the effects of advancing fires; and
- Prior to construction “Malleefowl Ahead” warning signs and advisory speed limit signs, must be installed along main access roads within the development footprint.

Western Ecological (2021) reports that the presence of the Arid Bronze Azure Butterfly and the Night Parrot are unlikely due to there being limited habitat, or no habitat, on the Project area for these species. The same report suggests that the Long-tailed Dunnart is likely to occur in very low densities in this area, and that there are also a relatively large number of records of the Long-tailed Dunnart to the south of the Project area associated with rocky areas at Mount Ida (Western Ecological, 2021).

The 2021 flora review searched similar landforms and geology to those of the Project area within other relevant Western Botanical survey reports (Appendix C). The search found that:

- *Drosera* sp. in the *macrantha – D. eremaea* complex (noted then as *Drosera macrantha* subsp. *macrantha*) were recorded at the Brooking Hills and Mt Richardson survey sites (these may in fact reflect *Drosera eremaea)*; and
- *Hibiscus sp. Perrinvale Station was also reported at the Churchill survey east of Leonora (Western Botanical, 2021).*

The proposal is unlikely to have any significant impact on the biodiversity attributed through these species.

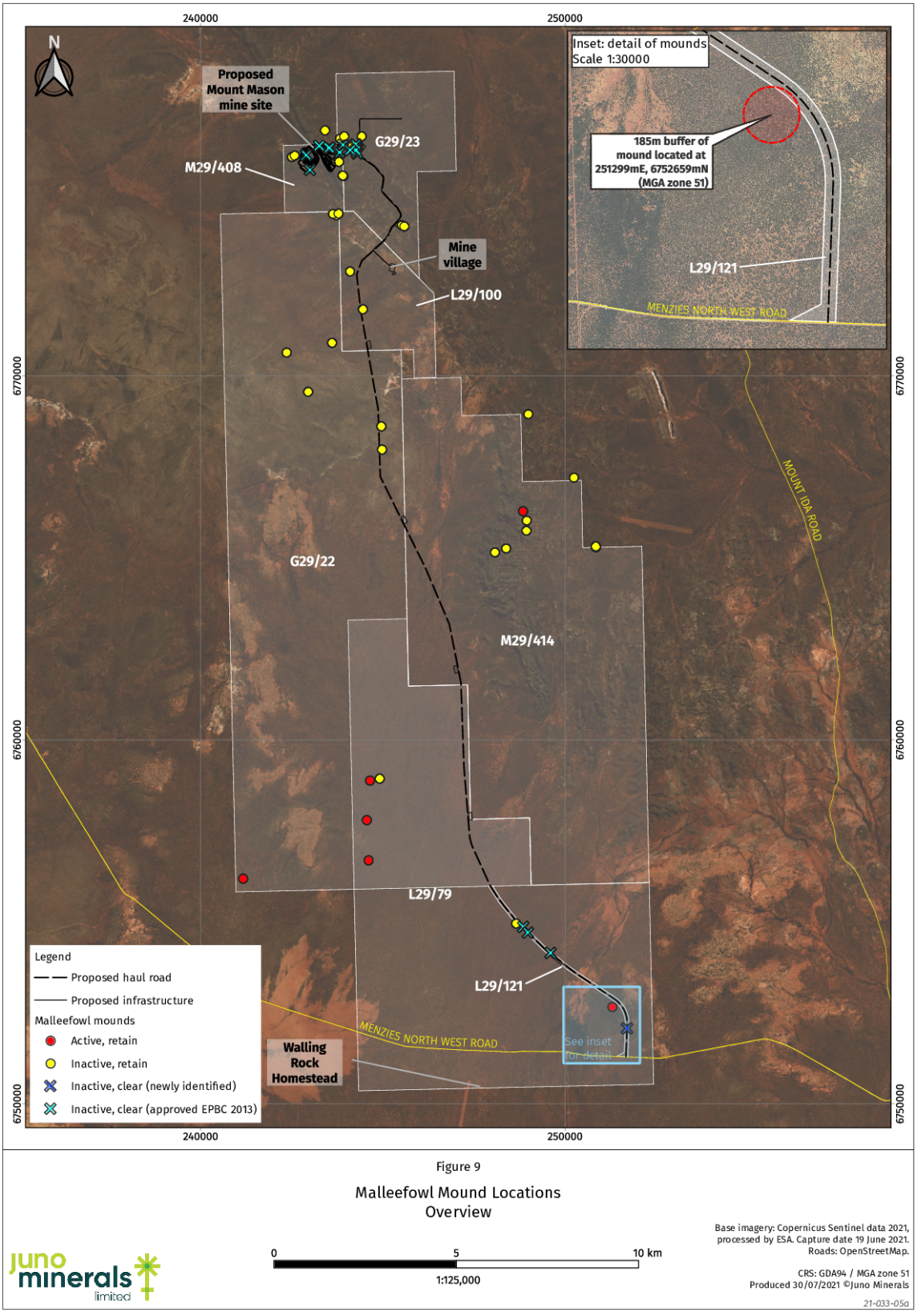

Figure 9

Malleefowl Mound Locations
Overview

0 5 10 km

1:125,000

Base imagery: Copernicus Sentinel data 2021, processed by ESA. Capture date 19 June 2021. Roads: OpenStreetMap.

CRS: GDA94 / MGA zone 51
Produced 30/07/2021 ©Juno Minerals

21-033-05a

Figure 9: Malleefowl Mound Locations – Overview

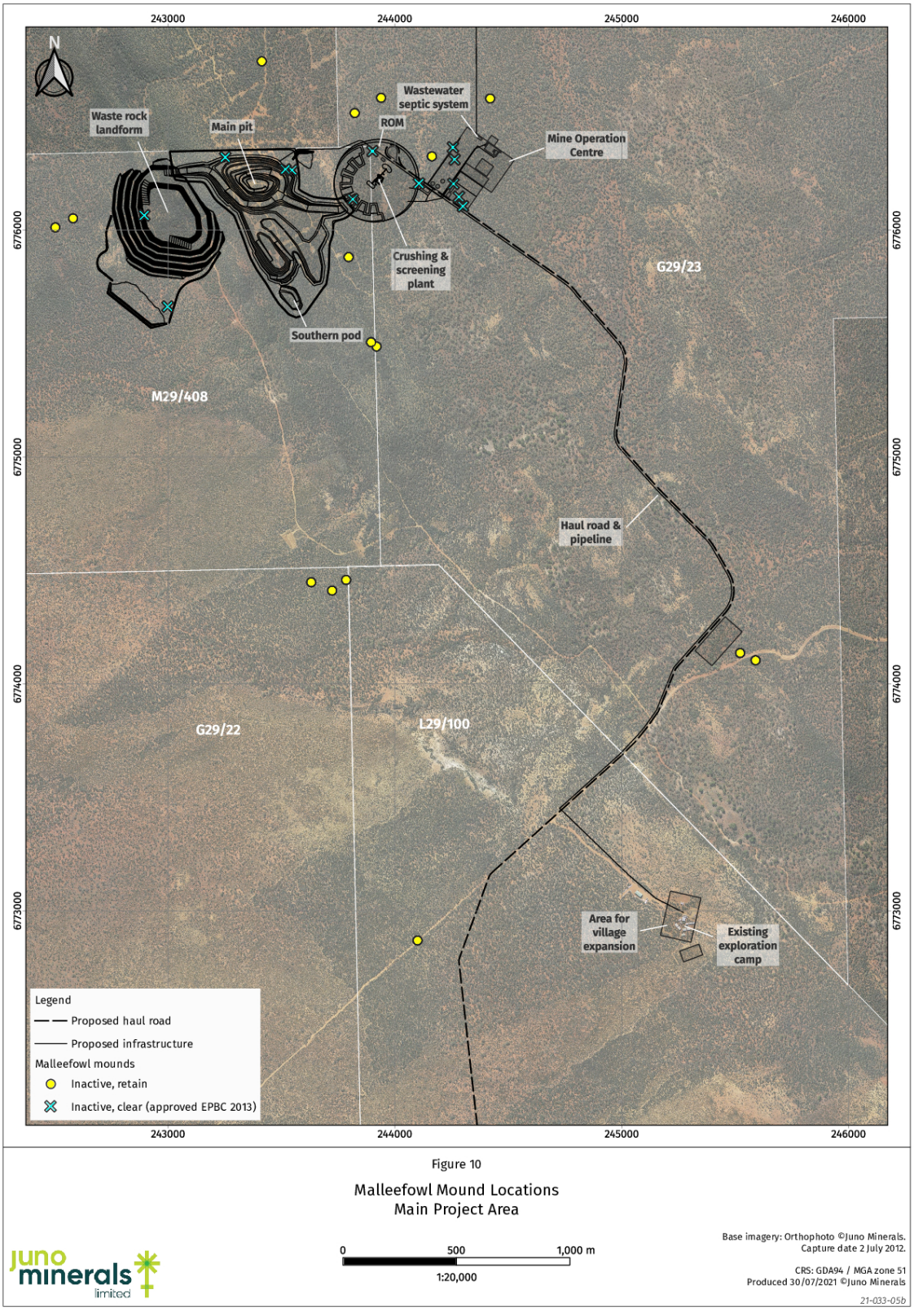

Figure 10

Malleefowl Mound Locations
Main Project Area

Figure 10: Malleefowl Mound Locations - Main Project Area

4 ENVIRONMENTAL IMPACTS MANAGEMENT

4.1 Groundwater

4.1.1 Potential Impacts

It is not expected that land clearing for this Project will have any impacts on groundwater resources. This is due to the fact that Juno does not intend to dewater until the 2nd year of the 5-year mine life. Juno intends to monitor water use and manage any impacts that may occur and apply appropriate contingency measures to mitigate drawdown impacts in consultation with affected landowners and the DWER as necessary. Potential impacts to groundwater quality resulting from mining activity relate primarily to migration of pollutants from the surface into the groundwater system through infiltration. Such impacts are unlikely to occur due to the depth of water beneath the ground surface. The water table in the area occurs at 482m RL (40-50 m bgl).

4.1.2 Management Strategies

Regular groundwater level measurements and sampling will be conducted to assess seasonal variations, recharge response to intense rainfall events and establish a baseline of groundwater levels. Extracted groundwater will be monitored as required by the conditions of the DWER Water Licence.

Following the commencement of dewatering, and in the event that groundwater levels in pastoral bores are deemed to have significantly declined at rates over and above seasonal variation, Juno will compensate the station owner and provide a mitigation alternative to satisfy their water supply requirements. These alternatives could include:

- Deepening of bores in which groundwater level drops;
- Drilling and construction of replacement bores in areas not affected by dewatering activities; and
- Supply of required water demand from alternative source (dewatering, external make-up water, etc.)

Currently, water levels have been established in existing pastoral bores around the project and therefore, any impact resulting from dewatering activities will be identified in a timely manner. The proposed mitigation alternatives will be evaluated at the time when any impact to the pastoral bores is identified. The most appropriate alternative will be selected and implemented, with the objective of providing a long-term source of water supply.

Maximum groundwater level drawdown will be achieved at the end of the dewatering period. As soon as the dewatering operations cease, it is anticipated that groundwater levels will start to recover. Any pastoral bore in operation during dewatering will continue to be operational after mining operations with possible increases in groundwater levels due to water table recovery (SRK, 2013).

Notwithstanding the above, Juno will develop a Groundwater Management Plan within 6 months of commencement of dewatering that will define detailed monitoring and contingency measures should an unacceptable drawdown in groundwater level is identified.

4.2 Surface Water

4.2.1 Potential Impacts

Potential risks to surface water as a result of the proposal are not significant given the absence of surface water bodies in and around the Project area, the proposed drainage design, the treatment of wastewater and the management of solid wastes by disposal to a licensed off-site landfill.

No flooding is expected to affect the Project area if the access road is designed to cater for the 24 hour, 100 year flood event (SRK, 2012a). In general surface water management at the site will consist of diverting clean run-off from upstream and the collection of potentially impacted water downstream of the facilities (SRK, 2012a).

During operations, surface water runoff from around the plant area could also contain substances such as process chemicals or hydrocarbons that may be harmful to the environment. Runoff from around the stockpiles and active areas of the mine may also contain suspended solids, if unmanaged.

4.2.2 Management Strategies

The surface water strategy for the site consists of diversion channels and bunds, which will be constructed to divert surface water drainage away from the Project infrastructure.

To minimise the potential impact on surface water and groundwater resources, Juno will implement the following management strategies:

- Where practicable retain vegetation between Project components during construction to reduce erosion;
- Maintain existing drainage patterns as far as practicable;
- Ensure there is no release of surface water within the Project area that contains sediment levels which may impact on downstream ecosystems;
- Direct clean surface water runoff to dispersion channels;
- Establish and maintain a bunding system to collect run-off from the waste dump and direct it to a sedimentation pond before release;
- Design channels to convey a 1 in 100-year, 24 hour storm event;
- Design sedimentation ponds to contain at least the 24-hour, 10 year storm event;
- Construct two pollution control sumps (sump 1 and 2) to collect the first flush from the mine operation control area and the stockpile, process plant and ROM pad areas. The sumps have been designed to contain the 24-hour 10 year storm event;
- Manage the treatment of sewage and the disposal of effluent in accordance with the DER's requirements under Part V of the EP Act; and
- Ensure personnel and contractors undergo appropriate training and inductions to inform them of requirements relevant to their roles to prevent and manage surface water and groundwater impacts.

4.3 Vegetation Degradation

4.3.1 Potential Impacts

It is recognised that the direct clearing of vegetation results in some impacts on vegetation communities, including reducing and fragmenting vegetation communities and increasing the potential for the spread of weeds. The potential impacts of the Project are not considered to be significant as the clearing footprint is limited to approximately 141ha and the vegetation communities are well represented outside of the Project.

The development and operation of the Project may potentially generate localised dust emissions due to general traffic and earth moving activities. Dust emissions may have a localised impact on surrounding vegetation where high levels of dust can be associated with a reduction in plant growth resulting in the degradation of the overall ecosystem and the increased risk of disease in plants.

4.3.2 Management Strategies

Juno will seek to undertake the following actions to reduce the direct and indirect impacts on vegetation:

- Maintain a 10m 'no-go' buffer around the known locations of *Drosera eremaea* in the interim to prevent disturbance, until a spring targeted flora survey can be undertaken to provide further information to enable a management strategy to be formulated if required (Figure 11);
- Ensure that the 10m 'no-go' buffer around known *Drosera eremaea* locations is clearly demarked in the field prior to clearing outside of the buffer area commencing;
- Take all clearing equipment operators through an orientation in the field to ensure they are aware of the locations of *Drosera eremaea* and the demarcation of the 'no-go' buffer area;
- Design the Project layout to minimise clearing;
- Ensure proposed clearing areas are clearly demarcated and communicated to operators and contractors involved in clearing;
- Directly place vegetation on rehabilitation areas, or mulched and stockpile for use during later rehabilitation;
- Monitor clearing activities, recording actual disturbance footprints;
- Undertake post-clearing inspections to verify appropriate areas have been cleared;
- Implement progressive rehabilitation of the Project area including access tracks or roads that are no longer required;
- Restrict the use of vehicles to established access roads and tracks;
- All disturbed and rehabilitated areas will be checked for weeds (particularly after rainfall events);
- Treat weed infested areas and implement appropriate weed hygiene procedures;
- Educate employees of the impacts of their activities on the native flora and vegetation through an Environmental Induction programme;
- Obtain approval from the DPaW prior to disturbance of any species of significance; and
- Implement adequate dust suppression measures during construction and operation to reduce the effects of dust on vegetation.

4.4 Land Degradation

4.4.1 Potential Impacts

Unmanaged, the clearing of vegetation has the potential to result in land degradation, including soil erosion, water-logging and flooding. Vegetation cover across the tenement is not dense, with the exception of a few areas of specific vegetation types and it is unlikely that there will be widespread degradation.

The land clearing required for establishment of the Project is defined in Table 2 and Figure 2. Total clearing over the Project will be approximately 141ha.

4.4.2 Management Strategies

The following measures are proposed to manage potential impacts from clearing. The measures are in accordance with the Land Development and Clearing Procedure (Appendix A):

- Baseline data collation through comprehensive field surveys to identify potential constraints and sensitive areas;
- Implementation of an integrated mine planning process with the environment department;
- Obtaining a Native Vegetation Clearing Permit from the Native Vegetation Branch of the DMIRS in accordance with the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* prior to any clearing of native vegetation.
- Definition of authorised clearing boundaries via spatially accurate GIS systems and field pegging and delineation; and
- Verification of clearing boundaries prior to and following clearing.

Juno will undertake the following actions to minimise the risk of land degradation:

- Careful site planning to avoid and minimise impacts from required clearing of flora and vegetation;
- Areas of vegetation between Project components will be retained to reduce scouring and soil erosion, wherever possible;
- Prior to commencement of works, areas to be disturbed will be clearly demarcated in the field to minimise disturbance and ‘no-go’ areas will be flagged;
- Post-clearing inspections will be undertaken to verify appropriate areas have been cleared;
- Topsoil and vegetation from all clearance activity will be separately stockpiled in dedicated stockpile areas;
- Where practicable, for any temporary clearance required, raised blade disturbance will be conducted to minimise vegetation removal;
- Weed dispersal will be controlled through establishment of weed hygiene inspection and cleaning procedures;
- All disturbed and rehabilitated areas will be checked for weeds (particularly after rainfall events) and infested areas will be treated;
- Rehabilitation will be undertaken as soon as practicable after land disturbance with the implementation of a progressive rehabilitation program; and

- Personnel will be provided with training to assist in their general awareness and understanding of the importance of minimising vegetation clearing and disturbance.

4.5 Biodiversity

4.5.1 Potential Impacts

If not appropriately managed the Project has the potential to impact on biodiversity through impacts on the local Malleefowl nesting sites.

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4.5.2 Management Strategies

Potential impact to the Malleefowl will be minised through the vegetation and land degradation management strategies listed in sections 4.3 and 4.4.

In addition (and in accordance with the Jupiter CYIP Malleefowl Management Plan approved by the Commonwealth Department of Agriculture, Water and the Environment), Juno will undertake the following actions to reduce the direct and indirect impacts on Malleefowl:

- Implementing where practicable a 250m buffer around active mounds and a 50m buffer around inactive mounds;
- Ensuring appropriate speed limits on haul roads in locations where Malleefowl have been identified through historic surveys;
- Erecting Malleefowl warning signs wherever required;
- An appropriately trained person shall walk previously inaccessible areas of the haul road prior to clearing to identify any Malleefowl moulds; and
- The haul road was originally designed to avoid Malleefowl mounds, however, should new mounds appear Juno shall, where practicable and within the approved clearing envelope, reroute the haul road to provide the buffer.

5 REHABILITATION

The objective of the rehabilitation program for the Project is to rehabilitate the affected areas to ensure that soil erosion and subsequent sedimentation is minimised and endemic plant species are re-established. It is anticipated that the rehabilitation program will result in the establishment of a self-sustaining vegetation complex into which local fauna will be able to return.

To facilitate the closure process, the Completion Criteria derived for Juno from the post-closure land use, closure objectives and closure design criteria have been broken down into several phases as shown below (Table 9 (Bluetongue Environmental, 2013)):

- Site-Wide Safety and Compliance Completion Criteria;
- Phase 1 – Closure and Rehabilitating Planning;
- Phase 2 – Landform Construction and Rehabilitation Implementation;
- Phase 3 – Ecosystem Establishment and Monitoring; and
- Phase 4 – Land Management and Relinquishment.

The rehabilitation of the Project site will be guided by the following principles:

- Ensure that vegetation clearing is kept to the minimum;
- Minimise soil erosion, particularly on the batters of the waste dump;
- Revegetation research and trials;
- Collect and correctly stockpile vegetative material and topsoil, where available, for later use at selected sites;
- Progressively rehabilitate completed areas as soon as practicable;
- Only using local native plant species on selected areas of the project site; and
- Rehabilitation performance monitoring and improvement/refinement.

Rehabilitation and decommissioning of the project will involve:

- All infrastructure will be removed on final closure;
- All hazardous materials will be removed from site;
- In accordance with the *Contaminated Sites Act 2003* appropriate assessments will be undertaken to identify, assess and manage any contamination associated with these sites.
- Surfaces shall be re-contoured to facilitate free-draining of surface runoff;
- Re-spreading of stockpiled topsoil to depth of 0.1–0.3 m and then covering with stockpiled vegetation; and
- Deep ripping of disturbed areas on the contour and seed with local provenance native seed.

The status of rehabilitation and results of any monitoring undertaken at site will be reported to DMIRS and DWER in the Annual Environmental Report (AER).

The Closure Criteria will be monitored post-closure and will cover the areas shown in Table 9. As required by tenement conditions, Juno will report on the status of in the Annual Environment Report (AER).

Table 9: Application of Closure Objectives across Closure Phases

Applicable Closure Phase					
Aspect	Safety and Compliance	Rehabilitation			
		Phase 1	Phase 2	Phase 3	Phase 4
Compliance					
Safety and Health					
Decommissioning, Demolition and Disposal					
Stakeholders and Community					
Post Mining Land Use					
Visual Amenity					
Structural Stability					
Topography and Drainage					
Managing Wastes					
Final Surface Characteristics					
Vegetation					
Fauna Habitat					
Long-term Sustainability					
Access and Land Management					

The Mining Proposal – Mount Mason DSO Hematite Project was approved by DMIRS on 31 July 2014. It provides further information on rehabilitation for the Project including:

- Soil and waste rock characterisation;
- Waste rock landform design and geotechnical assessment;
- Waste rock landform surface water management;
- Scheduling of materials movements to support progressive rehabilitation; and
- Topsoil management.

The Jupiter Mines Mt Mason and Yunndaga Mine Closure Plan (the Closure Plan) was submitted to DMIRS in November 2019. The Closure Plan provides the specific details around rehabilitation of the final closed mining area and infrastructure. The Closure Plan will be reviewed and updated every 3 years as required by DMIRS and EPA guidance.

Conceptual closure designs will be the subject of further discussions, consultation with stakeholders and will continue to be researched and trialed where necessary in the years leading up to final closure (Bluetongue Environmental, 2013).

6 CONSULTATION

Table 10 lists consultation and communications with stakeholders relevant to the Mount Mason Project.

Table 10: Project Stakeholder Consultation

Stakeholder Group	Date	Stakeholder Contact	Issues Discussed	Outcomes
NATIVE TITLE				
Wongatha Indigenous Group	November 2019	Greg Stubbs	Invitation to attend public presentation evening in Kalgoorlie and/or meet to discuss current care and maintenance status of project and confirm end land use strategy as proposed in approved MCP	After Jupiter followed up invitation via email and phone, the stakeholder reverted and queried the update. Jupiter advised it was conducting an analysis to assess economic viability and possible development date and would advise him if any change to the project development status was likely. It was reiterated that although it was likely to be some time away and subject to potential changes in stakeholder preferences, Jupiter was still committed to the same end land use and associated closure criteria for removal of infrastructure and rehabilitation to pastoral and grazing which he endorsed.
Goldfields Land and Sea Council*	2019	Office of GLSC	Invitation to attend public presentation evening in Kalgoorlie and/or meet to discuss current care and maintenance status of project and confirm end land use strategy as proposed in approved MCP	GLSC Now not recognized as Goldfields representative body for native title. Jupiter propose to engage with Native Titles Services group subject to confirmation of representative status.
Wongatha Indigenous Group	June 2012 to present (ongoing)	Ron Harrington Smith and Aubrey Lynch	Numerous discussions regarding survey logistics and potential employment opportunities. Wongatha have no objection to the Project if ongoing relationship maintained to manage heritage. No Section 18 required due to avoidance of all sites.	Heritage Survey Reports. No Section 18 required due to avoidance of all sites. Commitment to continued consultation and Project updates.
Wutha Indigenous Group	June 2012 to present (ongoing)	Greg Stubbs	Numerous discussions regarding survey logistics and potential employment opportunities. Wongatha have no	Heritage Agreement. Heritage Survey Reports. No Section 18 required due to avoidance of all sites.

Stakeholder Group	Date	Stakeholder Contact	Issues Discussed	Outcomes
			objection to the Project if ongoing relationship maintained to manage heritage. No Section 18 required due to avoidance of all sites. Also discussion regarding access to northern water tenements as relates to active Native Title Claim.	Commitment to continued consultation and Project updates.
Goldfields Land and Sea Council	11 Sept 2012	Daniel Jacobs	Discussion regarding potential new Native Title Claim – Lungkatharra – which would affect the Yunndaga portion of the Project area. The Lungkatharra Claim is a few months off being formed. However, the Wongatha Native Title Claimants make up a large portion of the claim, so the main representatives are already being consulted with on a regular basis.	Confirmation that Jupiter is consulting with the appropriate people and that the upcoming survey can be conducted by the Wongatha representatives in the interim while the Native Title Claim is being developed.
PASTORALISTS AND NEARBY TENEMENT HOLDERS				
Zenith Australia Group, Perrinvale and Riverina Pastoral leases	August 2020 and ongoing	Andrew Farson, General Manger and Mark Huang	Carbon credits on pastoral leases and tenement intersects, need agreement to be able to claim	Agreement currently underway, Zenith will support the Project and assist, supply of water bores, roads etc.
Morapai Station	November 2019	Greg Stubbs	Invitation to attend public presentation evening in Kalgoorlie and/or meet to discuss current care and maintenance status of project and confirm end land use strategy as proposed in approved MCP	As above with regards to Wongatha Group
Norilsk Nickel Cawse Pty Ltd	November 2019	Corporate	No interim consultation required access agreement still current	Ongoing access agreement still in place
Perrinvale Station	October 2019	Andrew Farson	Personal invitation to meet and discuss current care and maintenance status of project and confirm end land use strategy as proposed in approved MCP	Meeting confirmed status as new lease owner management representative. Responsible agency remains Pastoral Lands Board. Discussed opportunities for post mine rehabilitation with native vegetation conducive to stock feed consumption.
Riverina Station	October 2019	Andrew Farson	Personal invitation to meet and discuss current care and maintenance status of project and confirm end land use strategy as proposed in approved MCP	Meeting confirmed status as new lease owner management representative. Responsible agency remains Pastoral Lands Board. Discussed potential residential site development at northern end of Riverina lease and potential station residence access road.

Stakeholder Group	Date	Stakeholder Contact	Issues Discussed	Outcomes
Walling Rock Station	October 2019	Keith Mader	Personal invitation to meet and discuss current care and maintenance status of project and confirm end land use strategy as proposed in approved MCP	Meeting at residence. Discussed current project status and status of surrounding station leases. Still keen to pursue employment or contractor opportunities.
Sturt Meadows	October 2019	Paul Axford	Personal invitation to meet and discuss current care and maintenance status of project and confirm end land use strategy as proposed in approved MCP	Meeting conducted. Advised signatory status to management of land for carbon credit program. No changes requested of Jupiter in respect to proposed end- land use criteria.
Perrinvale Station	June to December July 2013	Ian Ridley	Numerous discussions and letters predominantly as per notification of activities/access agreement to operate within lease boundaries. Discussions re Mt Mason Mining Proposal	Able to access lease boundaries with notification letter detailing activities. Ongoing Employment Opportunities.
Walling Rock Station	June 2012 to June 2013	Keith Mader	Numerous discussions and liaison regarding access agreement. Correspondence primarily involved compensation agreement negotiations in return for tenure over pastoral land. Discussions re Mt Mason Mining Proposal.	Able to access lease boundaries with notification letter detailing activities. Compensation agreement. Ongoing Employment Opportunities (subject to Project status). In principle agreement to lift objections to L29/119 and L29/121.
Riverina Station	June 2012 to June 2013	Don North	Several discussions regarding access agreement with no issues raised. Able to access lease as required with notification by letter/email. Discussions re Mt Mason Mining Proposal and haul road access to Menzies - Sandstone Rd	Able to access lease boundaries with notification letter detailing activities. Jupiter agreement to discuss fencing and cattle grid requirements prior to construction of road intersection.
Sturt Meadows	September to November 2012	Paul Axford	Several discussions notifying Spring surveys/work occurring within lease boundaries. No issues. Able to access lease as required with notification by letter/email.	Able to access lease boundaries with notification letter detailing activities.
Morapai Station	13 February 2012	Greg Stubbs	Gave background on Project and potential upcoming work with fauna surveys.	Morapai representative were involved in the Level 2 fauna surveys and targeted surveys for field assistance.
Melita Station	28 Sept 2012	Jack Burton	Proposed gravity survey within lease boundaries.	Notification letter sent.
Norilsk Nickel Cawse Pty Ltd	August to September 2012	Michael Behrendt (Western Tenement Services)	Several discussions regarding access agreement for area of overlapping tenement.	Access arrangement developed.

Stakeholder Group	Date	Stakeholder Contact	Issues Discussed	Outcomes
Orabanda Mining	9 Jul 2021	Peter Nicholson, CEO Orabanda Mining	Occupancy of the Mt Ida caretaker/exploration camp, which is ~ 10 km east of the Project	No permanent presence of personnel at the Mt Ida camp.
REGULATORS				
DMIRS - Resource Industries, Regulatory Services	16 July 2021	Richard Smetana	Confirmation of NVCP - Purpose Permit approach, clarification on rehabilitation/regrowth inclusion etc.	Confirmation NVCP approach and requirement to include rehabilitated and regrowth areas in the total areas.
DWER - Resource Industries, Regulatory Services	2 July 2021	Carmen Standring Sh anuka Palamure	Scoping meeting for Mt Mason Works Approval Application. Discussed Project characteristics, existing approvals, and emissions, discharges and waste.	Confirmation of Work Approval Application requirements for the Project
DWER – Water Licensing, Swan Avon Region	6 July 2021	Andrew Naskos	Discussed process to transfer GWL174647(3) from Jupiter Mines to Juno Minerals, and to amend the Licence to increase the current abstraction limit.	Agreed plan in place on how to proceed with transfer and amendment of GWL174647(3)
DMIRS	3 June 2021	Damien Montague Richard Smetana	Scoping meeting to discuss existing approved Mining Proposals, Mine Closure Plan and Project Management Plan, and resubmission of NVCP applications, including biological survey requirements	Confirmation on status of existing Mining Act approvals, and approach to be taken for NVCP biological surveys
Department of Mines, Industry Regulation and Safety (DMIRS)	June 2021	Matt Cann	Discussion regarding the Mine Closure Plan assessment status and Mining Proposal	Advice provided that MCP Reg ID 83817 is 'pending' assessment subject to DMIRS resources, and as long as the project is developed in line with existing approvals then no further approvals would be required
Former Department of Indigenous Affairs	As at November 2019	Department of Premier and Cabinet	No interim consultation regarding native title undertaken to date	No change in native title claimants.
Department of the Environment and Energy	October 2019	Kahli Beisser	Advice in respect of care and maintenance status of project seeking confirmation that applicable conditions prevail.	Confirmed that Jupiter is cognisant of conditions in respect of EPBC assessment and will implement in accordance with advice.
Department of Mines Industry Regulation and Safety	September 2019	Matt Cann	Discussion regarding MCP update content requirements	Advice given in respect of update in accordance with 2015 MCP Guidelines noting no material changes to MCP under care and maintenance conditions. Include reference to timeline approach to closure obligations. Reference to

Stakeholder Group	Date	Stakeholder Contact	Issues Discussed	Outcomes
				WABSI framework acknowledged and noted in 2019 MCP submission.
Department of Mines, Industry Regulation and Safety (Kalgoorlie Branch)	May 2019	Matt Cann	Initial consultation regarding requirements for MCP update to address MCP REG ID: 75964 – Mt Mason Project and Yunndaga Siding – Refusal of Mine Closure Plan During Assessment	Submission of revised plan by November 30, 2019 as per discussions and in accordance with MCP Guidelines.
Department of Water and Environmental Regulation	Feb 2018	Andrew Naskos	Application of extension of water licence.	Water licence extension granted: GWL 174647(3)
Department of Mines Industry Regulation and Safety	25 October 2012	Julie Futter / Neville Hauge	Presentation: Project update on exploration activities to date.	Commitment to provide Project updates and potentially site visit in the future.
	19 Dec 2012	Nick Galton-Fenzi	Presentation: Draft Mount Mason Mining Proposal.	Query regarding water monitoring being undertaken for baselines level, confirmed that Jupiter have a groundwater monitoring program in place.
Department of Mines and Petroleum	25 October 2012	Julie Futter / Neville Hauge	Presentation: Project update on exploration activities to date.	Commitment to provide Project updates and potentially site visit in the future.
	19 Dec 2012	Nick Galton-Fenzi	Presentation: Draft Mount Mason Mining Proposal.	Query regarding water monitoring being undertaken for baselines level, confirmed that Jupiter have a groundwater monitoring program in place.
Department of Indigenous Affairs	25 January 2012	Simon Keanon	Project update. DIA suggested consultation with Goldfields Land and Sea Council.	Confirmation that correct heritage groups are being consulted.
Department of Sustainability, Environment, Water, Population and Communities	3 February 2012	Nicole Matthews (Perth), Mark Hill (Canberra)	CYIP Project background/initial determination of whether referral under the EPBC Act required.	Potential impact appears manageable, so unlike to be a controlled action, but advised to refer.
	21 March 2012	Nicole Matthews	Project update and more detailed discussion related to the EPBC Act approval process.	Mount Mason to be referred, although unlikely to be considered a Controlled Action.
	25 March 2013	Con Voutas	Mt Mason presentation and submission of EPBC referral document, including Malleefowl Management Plan	Likely not Controlled Action, possibly in a prescribed manner after some mapping amendments to include an age on mounds –and try to achieve a 50 m buffer for inactive mounds <20 years old along with 250 m buffer for active mounds (unless suitable justification).
Department of Mines and Petroleum	28 June 2013		Final Mt Mason Mining Proposal presentation 28 June 2013	No issues arising
Department of Mines, Industry Regulation and Safety	28 June 2013	Various Representatives	Final Mt Mason Mining Proposal presentation 28th June 2013	No issues arising

Stakeholder Group	Date	Stakeholder Contact	Issues Discussed	Outcomes
Department of Environment Regulation	28 June 2013	Various Representatives	Presentation: Draft Mt Mason Mining Proposal 19 December 2012 Final Mt Mason Mining Proposal presentation 28 June 2013	Discussed status of Priority Ecological Community and agreed to provide advice for submission.
Department of Environment Regulation	28 June 2013		Presentation: Draft Mt Mason Mining Proposal 19 December 2012 Final Mt Mason Mining Proposal presentation 28 June 2013	Discussed status of Priority Ecological Community and agreed to provide advice for submission.
NON-GOVERNMENT ORGANISATION				
Yongergnow Australian Malleefowl Centre	July 2021	Stevi Filitowski – Zoologist: Malleefowl Preservation Group	Discussions re potential involvement in malleefowl management and monitoring program at Mt Mason	Agreed to maintain contact with project zoologist and further discuss opportunities for involvement.
Malleefowl Preservation Group	October 2019	Susanne Dennings	No interim consulation undertaken to date	Invitation to personal meeting extended and pending.
Malleefowl Preservation Group	June 2012 to April 2013	Susanne Dennings	Project background/updates and discussion relating to potential involvement/scoping for Malleefowl surveys. Also numerous discussions regarding setting up a sponsorship/financial contribution towards Lotterywest grant funded CEO position.	An agreement has been made, with the first payment of $20,000 presented in April 2013 – with commitment to ongoing contribution (subject to Project status)
INFRASTRUCTURE PROVIDERS				
Southern Ports	30 June 2021	Dale Lindkvist, Logistics and Supply Chain	Southern Ports presentation on the Arc GIS tool that they have built to understand the location of mines, minerals and infrastructure	Arc GIS tool being used to develop Southern Ports' long-term masterplan
Southern Ports	23 June 2021	Scott Bates, Southern Ports Regional Manager and Dave McGrinder, Client Liaison Officer	Juno introduction and Berth 2 and Berth 3 capacity. Utilisation of Shed 4 the multiuser Shed to direct tip from HHCs and then use the bulk loading system on Berth 3	Highlighted preference to utilise Shed 4 and Berth 3 highlighted, Shed 4 only being used for one cargo per month, 40 000 tonnes of spodumene, want to utilise for Panamax sized shipments. Will take up with Steve Lewis and the leadership team the following week.
Arc Infrastructure	18 June 2021	Simon Gilders, Head of Development	Juno introduction, development plans on getting DSO out of the Esperance Port, potential for additional rail paths	Fully supportive of the Project and approach, potential for additional rail paths during the summer period. Currently spending $200m on the Kalgoorlie to Esperance line to increase the number of sidings

Stakeholder Group	Date	Stakeholder Contact	Issues Discussed	Outcomes
Shire of Menzies	4 March 2021	Brian Joiner, CEO	Juno introduction and outline of the required use of Shire Roads, and the new planned Menzies bypass to Yunndaga	Appreciated the outline, Shire Roads OK to use, but on the basis of you-damage you-fix. Happy to assist Juno to progress its Project.
Main Roads WA, Kalgoorlie-Boulder	3 March 2021	Sardar Khan Shane Power	Access onto the Goldfields Highway through the planned Yunndaga Rail Siding, in order to haul south to Kalgoorlie	Submit application on preferred access points based upon LTK position, and Main Roads will review and advise, and, if suitable, approve
Southern Ports	27 Feb 2021	Steve Lewis, CEO	Juno introduction, access to Port capacity to export a DSO Fines	
Menzies Shire	14 July 2021	Greg Dwyer, President and Brian Joiner, CEO	The possibility to utilize the Menzies Rail Siding as an interim bulk DSO loadout location.	Positive discussions, would prefer routes that avoided coming through the centre of town, offered up a southern access possibility. What benefits will be in it for the town? Greg Durack invited to present to full Shire Council on 29 July.
Shire of Menzies	October 2019	Greg Dwyer (Shire President), Peter Money (CEO). Jill Dwyer (Councillor)	Presentation CYIP update and discussion regarding Jupiter project development issues and timeline and discussion regarding mine closure and end land use objectives, particularly for haul road and Yunndaga Siding infrastructure.	Discussion confirmed previous arrangements where final land use objectives will be determined during life of project and finalised in consultation with Shire closer to the conclusion of the mining phase.
Arc Infrastructure	Ongoing regular liaison during 2019	Murray Cook, Paul Larsen, Nathan Speed.	Project development update and commercial in confidence discussions regarding costing and availability of rail services.	Commercial in Confidence-ground rail services
Southern Ports	Ongoing regular liaison 2018 to 2019	Jared Brotherston, Scott Bates	Project development update and commercial in confidence discussions regarding costing and availability of port services.	Commercial in Confidence-port storage and shipping services.
Various Yilgarn iron ore explorers/producers	2013-2017	Various	Continuous discussions with Yilgarn iron ore exporers or producers to consolidate infrastructure to reduce footprint and achieve cost synergies.	Discussions ongoing, no agreements in place yet.
Shire of Menzies	22 October 2012	Shire President, Gregory Dwyer / Council Meeting	Presentation by Jupiter giving CYIP update and discussion regarding issues, progress and challenges – particularly transportation to port and related port access.	Initial meeting with new staff members and commitment to project update in future.
	April 2014	Shire President, Gregory Dwyer / Council Meeting	Presentation to confirm road use agreement and any secondary approvals/licensed required for Mt Mason Project.	Agreement in principle.

Stakeholder Group	Date	Stakeholder Contact	Issues Discussed	Outcomes
Shire of Menzies	22 October 2012	Shire President, Gregory Dwyer / Council Meeting	Presentation by Jupiter giving Project update and discussion regarding issues, progress and challenges – particularly transportation to port and related port access.	Initial meeting with new staff members and commitment to Project update in future.
	Proposed April 2014	Shire President, Gregory Dwyer / Council Meeting	Presentation to confirm road use agreement and any secondary approvals/licensed required for Mt Mason Project.	Proposed meeting
Brookfield Rail	7 Sept 2012	Laura Adair	Preliminary enquiry and request response to queries regarding proposed rail crossing at Menzies 52.	Referred to Aurizon for above-ground rail services.

** As of 1 July 2019, the Goldfields Land and Sea Council are no longer funded as a Native Title Service Provider and as such no longer provide this service*

7 ASSESSMENT AGAINST CLEARING PRINCIPLES

a) Native vegetation should not be cleared if it comprises of a high level of biological diversity

The proposal is not likely to be at variance to this Principle.

The Mount Mason Project area has relatively simple flora with moderate diversity for the region and reflecting that of similar landforms in the region (Western Botanical, 2021).

The Project does not occur within any of the Biodiversity Hotspots as identified by the Threatened Species Scientific Committee for the Australian Government.

There are no Threatened Ecological Communities (TEC), as defined under the EPBC Act, recorded in or within 50 km of the Project area (Western Botanical, 2021) (DSEWPaC, 2012).

The orebody areas, northern parts of the proposed haul road, and the camp area lie within the Priority 1 Perrinvale/Walling vegetation assemblages (banded ironstone formation) Priority Ecological Community (PEC) (Figure 5). It is expected that some vegetation associations of the area may be regionally restricted, particularly those associated with the geology of the BIF ranges and associated laterite caps and the erosion products from these ranges. These will most likely be widespread within similar landforms of the Mt Mason / Mt Ida area (Western Botanical, 2021).

Figure6 shows the Perrinvale/Walling PEC extends over 10km to both the north and the south of the Project area and is also recorded further south near Mulline. It is therefore not expected that the disturbance associated with the Project will significantly impact on the vegetation in the area in terms of fragmentation or loss of vegetation associations or species that may be unique (NVS, 2012b).

Western Botanical (2021) reports that majority of vegetation associations within which the proposed clearing area lies, are represented in more than one location within the area surveyed, or with some portion of the association outside of the proposed clearing area.

The geology and Land Systems that occur within the proposed clearing area are also represented outside of the area (Western Botanical, 2021).

The April 2021 survey identified 135 flora species. The majority of which are well known and widespread in the region and are not considered significant species. A total of 41 Families, 108 Genera and 231 Species were recorded within the area surveyed along the haul road (NVS, 2012a). The 2011 Level 2 Spring survey of the Mt Mason tenement identified a total of 83 flora species, representing 54 Genera and 28 Families while the 2011 Autumn survey identified a total of 97 flora species, representing 59 Genera and 31 Families. The 2011 Spring survey identified 8 vegetation groups and an additional 2 vegetation groups were identified in the 2011 Autumn survey.

The Project area is not within a Bush Forever Site or an ecological link or corridor.

Vegetation is also considered to be in Pristine Condition in areas outside of those proposed to be cleared for the Project (Western Botanical, 2021). There are no declared weed species in the Project area.

b) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia.

The proposal is not likely to be at variance to this Principle.

In total 9 vertebrate fauna species of conservation significance are confirmed to be present or be likely to occur, including:

- Malleefowl (*Leipoa ocellata*) (P1) - confirmed;
- Long-tailed Dunnart (*Sminthopsis longicaudata*) (P4) - confirmed;
- Slender-billed Thornbill (*Acanthiza iredalei iredalei*) (Vulnerable)- not likely to occur;
- Fork-tailed Swift (*Apus pacificus*) (Migratory) - may occur;
- Rainbow Bee-eater (*Merops ornatus*) (Migratory) - confirmed;
- White-browed Babbler (*Pomatostomus superciliosus*) (P4)- confirmed;
- Crested Bellbird (*Oreoica gutturalis*) (P4)- confirmed;
- Night Parrot (*Pezoporus occidentalis*); and
- Arid Bronze Azure Butterfly (*Ogyris subterrestris petrina*) (Critically Endangered).

None of these species are likely to be solely reliant on habitat patches within the Project area (Western Ecological, 2021).

Malleefowl (*Leipoa ocellata*) is listed as vulnerable under EPBC Act and Schedule 1 (rare and likely to become extinct) under the WC Act. The Project was referred by Jupiter to the DSEWPaC in May 2013 and was assessed as 'Not a Controlled Action if undertaken in a particular manner'. Strategies to manage potential impact listed in the notification are incorporated into the Malleefowl Management Plan (Appendix B) and Land Disturbance and Clearing Procedure (Appendix A).

The majority of vegetation groups within the Project footprint identified during the flora surveys comprise potential habitat for Malleefowl breeding or foraging. The majority of the inactive Malleefowl mounds recorded were located on (KLA, 2012a):

- Mulga over *Eremophila*;
- Mulga over *Eremophila forrestii* (on flats and undulating hills);
- Mulga shrubland with occasional Eucalypts;
- *A.effusiola*/Eucalyptus Mallee and other mixed shrublands burnt sandplain; and
- *Callitris* with Eucalyptus woodland – sandplain.

There are extensive areas of habitat suitable for Malleefowl in and adjacent to the Project and the habitat is not restricted to the Project area (KLA, 2012a).

The Project has been designed through an iterative process, particularly the haul road, in order to avoid the location of known active mounds. The proposed Project layout avoids direct disturbance of known active mounds and the Project will be undertaken in accordance with the Jupiter Malleefowl Management Plan (MMP) (Appendix B), as well as DSEWPaC requirements. DSEWPaC require the following measures to be taken to avoid significant impacts on:

Malleefowl occurrence throughout the Project is likely to be dynamic due to the mobile nature of the species. Juno's commitment to ongoing monitoring and data collection regarding Malleefowl mounds is set out in the

MMP developed by Jupiter. Juno also commits to undertaking a pre-construction targeted survey to confirm local distribution.

A single Long-tailed Dunnart (*Sminthopsis longicaudata*), a Priority 4 species, was captured at one site at the base of an area of a rocky scree during both the Spring 2011 and Autumn 2012 surveys. These records represent the southernmost extent of this species and extend its distribution range. There were no records from the 2021 Targeted Fauna Survey.

Surveys in the region have also recorded this species in open, flat, mulga woodland with no Spinifex, low shrubs and little ground cover. The habitat occupied by these specimens suggests that there is no obvious habitat attribute particularly associated with the species. Given this, the conservation status of the Long-tailed Dunnart is not likely to be compromised by the proposed mining activity at Mt Mason (KLA, 2012d).

The preferred habitat of the Slender-billed Thornbill (*Acanthiza iredalei iredalei*) is chenopod shrublands that are dominated by Samphire and occasionally adjacent shrublands and mangroves. Given the lack of this habitat in the Project area, it is unlikely that this species would be present (KLA, 2012a).

The Fork-tailed Swift (*Apus pacificus*) was not recorded during the surveys undertaken in the Project area. Due to the wide range and ecology of this species, the conservation status is unlikely to be altered by the proposed mining activity at Mt Mason (KLA, 2012d).

Rainbow Bee-eaters (*Merops ornatus*) were heard and a total of seven individuals were seen in the Project area during the EPBC survey and recorded opportunistically during the Autumn 2012 survey. As the Bee-eater is a migratory bird that can travel vast distances within the landscape and given the extensive landscape available to this species, its conservation status is not likely to be altered by any proposed works in the area (KLA, 2012d).

White-browed Babbler (*Pomatostomus superciliosus*) (Priority 4) was recorded at one site and opportunistically, with 3 individuals recorded during the systematic sampling during the Spring 2011 survey. Advice from the Office of the EPA indicates that the conservation status of this species refers to the western populations particularly in the agricultural zone where clearing and fragmentation of native vegetation has impacted on this species habitat. Given the location of the Project and the large areas of intact, undisturbed, remnant vegetation regionally, the conservation status of this species is not likely to be altered by the proposed mining activity (KLA, 2012d).

Crested Bellbird (*Oreoica gutteralis*) was recorded at all sites during the seasonal surveys and also opportunistically. The conservation classification refers principally to areas where the preferred habitat of the Crested Bellbird has been disturbed, particularly by clearing of native vegetation and resultant fragmentation. The area proposed to be impacted is relatively undisturbed and large tracts of undisturbed native vegetation are present and will remain intact adjacent to the mining operations. The large home range and mobility of the Crested Bellbird strongly suggests that its conservation classification will not be compromised by the proposed mining activity (KLA, 2012d).

Western Ecological (2021) reports that the Arid Bronze Azure Butterfly and the Night Parrot are unlikely to be present due to there being limited habitat, or no habitat, on the Project area for these species.

The BIF range at Mt Mason lies in a north to south orientation for approximately 10km and appears to be well connected to the BIF range at Mt Ida (approximately 8.6 km in length) (Outback Ecology Services,

2011). The potential SRE habitat supported by these ranges is extensive and is not limited to the area of proposed impact at Mt Mason (KLA, 2012d).

c) Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora.

The proposal is not likely to be at variance to this Principle.

No plant taxa located in the survey area are gazetted as Declared Rare Flora (DRF) pursuant to Subsection 2 of Section 23F of the WC Act or listed as Threatened pursuant to Schedule 1 of the EPBC Act.

Flora species of conservation significance known to occur at the Project area include:

- *Drosera eremaea* (inclusive of *Drosera* aff*. Eremaea)* (P1)
- *Calytrix hislopii* (P3);
- *Philotheca brevifolia* subsp*. Deserti* (P3); *and*
- *Pterostylis virens* (P3).

According to the Department of Biodiversity, Conservation and Attractions NatureMap database *Drosera eremaea* has been recorded at other locations in the region including approximately 60km south-west of the Project area, and around the Cue area (approximately 200km north-west of the Project Area).

Juno proposes to implement a 'No Go' area around known locations of *Drosera eremaea* within the proposed clearing area to ensure they are not impacted by clearing prior to a further targeted survey in spring 2021 to provide more information to enable development of a management strategy if required.

Hibiscus sp. Perrinvale Station (P1) is likely to occur on the upper to lower slopes of the BIF ranges and associated duricrust outcrops within the area. *Hibiscus* sp. Perrinvale Station will also be part of the targeted survey in spring 2021. The species has been recorded outside of the proposed clearing area, during the Churchill survey east of Leonora (Western Botanical, 2021).

Corchorus sp. was reported by Native Vegetation Solutions (2012), associated with the western flank of the BIF ridge within the orebody area. This species is pending review of taxonomy and distribution within the area.

Calotis sp Perrinvale Range was recorded in one location, the BIF ridge on the western edge of the survey area with an estimated population of 15 plants. This species is not restricted to the Project area with Florabase showing records of known locations of this species with the closest approximately 5km to the southwest of the survey area, and the furthest 351km west of the survey area.

d) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of a threatened ecological community.

The proposalis not likely to be at variance to this Principle.

The vegetation communities within the Project area are not considered to be analogous to any TECs.

The orebody areas and northern parts of the proposed haul road and the camp area lie within the Priority 1 Perrinvale/Walling vegetation assemblages (banded ironstone formation) Priority Ecological Community (PEC). The PEC extends in both a north and southern direction for approximately 20km each way beyond the Project Area. The PEC has also been recorded further south in the region, and it is also expected that some vegetation associations associated with the geology of the BIF ranges and associated laterite caps and the erosion products from these ranges will most likely be widespread within similar landforms of the Mt Mason / Mt Ida area (Western Botanical, 2021).

e) Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.

The proposal is not likely to be at variance to this Principle.

Native vegetation has been heavily cleared in WA, especially in the Southwest. Remaining remnant vegetation is important in helping preserve native vegetation and fauna habitat. Areas with less than 30% of their pre-European extent generally experience exponentially accelerated species loss and areas with less than 10% are considered "endangered" (Shepherd, D.J, 2002).

The Project is located within four remnant vegetation groups as described by Beard (1990):

- Low woodland; mulga (*Acacia aneura*) (vegetation association 18);
- Shrublands; mulga & *Acacia quadrimarginea* scrub (vegetation association 202);
- Hummock grasslands, mixed sandplain (vegetation association 483); and
- Shrublands, jam thicket (vegetation association 484).

A summary of the current extent and representation of these associations in the proposed clearing footprint is presented in the table below (NVS, 2012b). At a regional scale (WA) the proposed disturbance for the Project represents approximately <0.02% of each of the four vegetation groups present (Table 11).

Table 11: Vegetation Associations with Proposed Disturbance

Beard Vegetation Association	Description	Pre-European Extent, WA (ha)*	Remaining (%)	Mt Mason proposed clearing (ha)*	Clearing as % of Current Extent (WA)
484	Shrublands; jam thicket	70,235	100%	1	0.00014%
202	Shrublands; mulga & *Acacia quadrimarginea* scrub	365,344	100%	64	0.0175%
483	Hummock grasslands, mixed sandplain - open Mallee over sparse dwarf shrubs with spinifex; red Mallee & mixed sparse dwarf shrubs over *Triodia basedowii*	395,106	100%	6	0.0015%
18	Low woodland; mulga (*Acacia aneura*)	22,029,557	100%	69	0.0003%
Total		**22,860,242**		**140**	

** Approximate value*

f) Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.

The proposal is not likely to be at variance with this Principle.

There are no lakes, rivers or other significant water bodies within the Project area. The nearest significant wetland, Lake Ballard, is more than 30km away.

There are ephemeral drainage lines within the application area, which may flow following seasonal rainfall. The vegetation associated with these drainage lines is described as:

- *Allocasuarina* over *Calytrix* Shrubland; in minor drainage lines and Laterite breakaways; and
- *Acacia burkittii* shrubland within drainage lines.

g) Native vegetation should not be cleared if clearing of the vegetation is likely to cause appreciable land degradation.

The proposal is not likely to be at variance with this Principle.

The Project area occurs within the Brocking land system which is described as prominent ridges of banded iron formation supporting mulga shrublands and occasional minor halophytic communities. Stone mantles provide effective protection against soil erosion. Disturbance or removal of stone mantles may initiate soil erosion (Pringle et al, 1994).

The description above indicates some areas may be moderately susceptible to soil erosion, particularly where protective mantles and drainage zones are disturbed or cleared. However, clearing of the vegetation is not considered likely to cause appreciable land degradation. Juno commits to maintaining existing drainage paths where possible and will mitigate erosion through appropriate management measures, as detailed in Section 4 of this report and in the Mining Proposal.

Cleared areas shall also be progressively rehabilitated wherever practicable as per the Mine Closure Plan (refer to Section 5).

h) Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.

The proposal is not likely to be at variance with this Principle.

The Project area does not lie within any conservation areas or DPaW managed lands. The nearest conservation reserves to the Project are:

- Mt Manning Range Nature Reserve – approximately 95km southeast; and
- Wanjarri Nature Reserve – approximately 185km north.

The Project area is not located within an Environmentally Sensitive Area as declared in Environmental Protection (Environmentally Sensitive Areas) Notice 2005, Government Gazette No. 55.

i) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.

The Proposal is not likely to be at variance with this Principle.

The Project area is not located within a Public Drinking Water Source Area (PDSWA) and there are no significant watercourses or wetlands within the Project area. There are several ephemeral drainage lines that run through the area; however, the average evaporation rate exceeds the average rainfall for every month of the year. Therefore, during normal rainfall events the proposed clearing would be unlikely to cause deterioration in the quality of surface water, particularly given the proposed surface water management measures to be implemented by Juno.

Substantial rainfall events may create surface sheet flow. These events will be managed through the implementation of appropriate mitigation measures, including diversion of clean run-off upstream of the pit and waste rock landform, surface water bunds and sedimentation basins, as detailed in Section 4 of this report and in the Mining Proposal.

Groundwater salinity is low, and TDS ranged from 507mg/L to 1,060mg/L. The proposed clearing is not likely to cause salinity levels in groundwater to increase.

j) Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence or intensity of flooding.

The proposal is not likely to be at variance with this Principle.

The average annual evaporation rate exceeds the average rainfall for every month of the year with an annual average evaporation rate of 3,433mm and annual average rainfall of 284mm (SRK, 2012a). During normal seasonal rains there is limited surface flow and the proposed clearing is not likely to cause or increase the incidence or intensity of flooding. SRK (2012a) recommend that if the access road is designed to cater for the 24-hour, 100-year flood event, it will protect the mine operation control area against flooding and additional flood protection measures will be unnecessary.

8 PLANNING INSTRUMENTS AND OTHER RELEVANT MATTERS

8.1 Planning Instruments

8.1.1 National Recovery Plan for Malleefowl Leipoa ocellata

Nationally, the Malleefowl is listed as Vulnerable under the *Environment Protection and Biodiversity Conservation (EPBC) Act 1999*. In Western Australia it is listed as Fauna that is rare or is likely to become extinct under Schedule 1 of the Wildlife Conservation (Specially Protected Fauna) Notice 2005. In addition to the national and state listings, Malleefowl qualify as Vulnerable by international criteria for threatened species (IUCN 2001, criteria VU A1c,e and A2b,c,e).

The National Recovery Plan for Malleefowl *Leipoa ocellata's* primary objectives are to secure existing populations across the species' range and achieve de-listing of Malleefowl under the EPBC Act within 20 years.

Specific objectives on managing Malleefowl populations in the National Recovery Plan include:
1: Reduce permanent habitat loss;
2: Reduce the threat of grazing pressure on Malleefowl populations;
3: Reduce fire threats;
4: Reduce predation;
5: Reduce isolation of fragmented populations;
6: Promote Malleefowl-friendly agricultural practices; and
7: Reduce mortality on roads.

The Project is not likely to conflict with any of these specific objectives. Clearing for the Project will be limited to that required for the safe operation of the Project and active Malleefowl mounds will be avoided. Malleefowl will be managed in accordance with the Jupiter Malleefowl Management Plan which is aligned with the National Recovery Plan (Appendix B).

8.1.2 Shire of Menzies Local Planning Strategy

The Shire of Menzies Local Planning Strategy is a high-level strategic document that in accordance with the Planning and Development (Local Planning Schemes) Regulations 2015 sets out the long-term planning directions for the local government, applies state or regional planning policy that is relevant to the strategy, and provides the rationale for any zoning or classification of land under the local planning scheme.

The overarching objectives for the Shire include:

- Land development: adequate land for commercial, industrial and residential purposes;
- Increased capacity and diversity of housing choice: appropriate residential zoning and density to allow diverse residential development opportunities that address affordable housing demand, and for aged persons;
- Facilitate commercial and industrial growth: develop partnerships with the mining industry for business and employment opportunities to assist with population retention. Respond to changes to the pastoral industry and provide for value-add opportunities where appropriate;
- Tourism opportunities: support Menzies as a place to visit through capacity building in events, arts, walk ways and cultural experiences;
- Preservation of Aboriginal culture and heritage: working with Menzies Aboriginal Corporation and the Tjuntjuntjara community;
- Provision of adequate health and emergency services: provision of aged care services and accommodation, and appropriate services and facilities for people with disabilities;

- Heritage preservation and protection of the built environment: a built environment that protects and restores buildings of historical value in Menzies, Kookynie and Goongarrie; and
- Sustainability through regional and government partnerships: informed resource decisions for the community good.

The Project is not likely to conflict with any of the objectives of the Shire of Menzies Local Planning Strategy.

8.2 Other Relevant Matters

8.2.1 Land Use Impacts

8.2.1.1 Pastoral

Consultation has been ongoing with relevant Pastoralists (Section 6). Fencing will be maintained to prevent impacts on livestock, and access to pastoral tracks will be maintained.

There is not expected to be any significant impact on pastoral land use.

8.2.1.2 Heritage

Jupiter initially consulted with the Goldfields Land and Sea Council (GLSC) regarding the Project, and was referred to both Wongatha and Wutha Native Title Claimant Groups for heritage assessments and the ongoing consultation process.

The following heritage surveys have been completed for the Project area:

- Jupiter Mines Ltd Archaeological Survey 2012 (Appendix J);
- Wutha at JR Mt Ida in Aug 2012;
- Mt Mason Ethno Survey E29/495 Gendenning Feb 2007;
- Wutha Jupiter August 2011; and
- LAS Heritage Desktop June 2011.

Initial searches of the Department of Indigenous Affairs' (DIA) heritage database indicated no known heritage sites in the Project area.

Jupiter commissioned heritage surveys across the CYIP for exploration purposes between 2006 and 2010; with follow up clearance surveys for mining approval purposes in 2012. The intensive 2012 surveys involved an independent archaeologist and the Native Title Claimant Groups, incorporating six representatives from both Wongatha (with Anthropologist Rory O'Connor) and Wutha (with Anthropologist John Gleason). All groups have recorded the same sites in the same survey areas.

Around the Project area, there have been 16 sites recorded, consisting of 12 archaeological sites and 4 sites of ethnographic value (Figures 11 and 12). All sites have been avoided through re-designed infrastructure placement outside of agreed site boundaries (but within surveyed areas) in consultation with Traditional Owners.

It should be noted that the pipeline from the MOC to the Mine Village (shown on Figure 12) is indicative only, and will be routed within the road corridor, or buried under the village access road if required, to avoid impact on the heritage sites in this location.

Ongoing consultation with Traditional Owners will continue throughout the project. Any new sites or material found will be managed in accordance with the *Aboriginal Heritage Act 1972*.

There are no expected impacts to any heritage sites, and it is anticipated there will be no requirement for a Section 18 Consent to Disturb under the *Aboriginal Heritage Act 1972*.

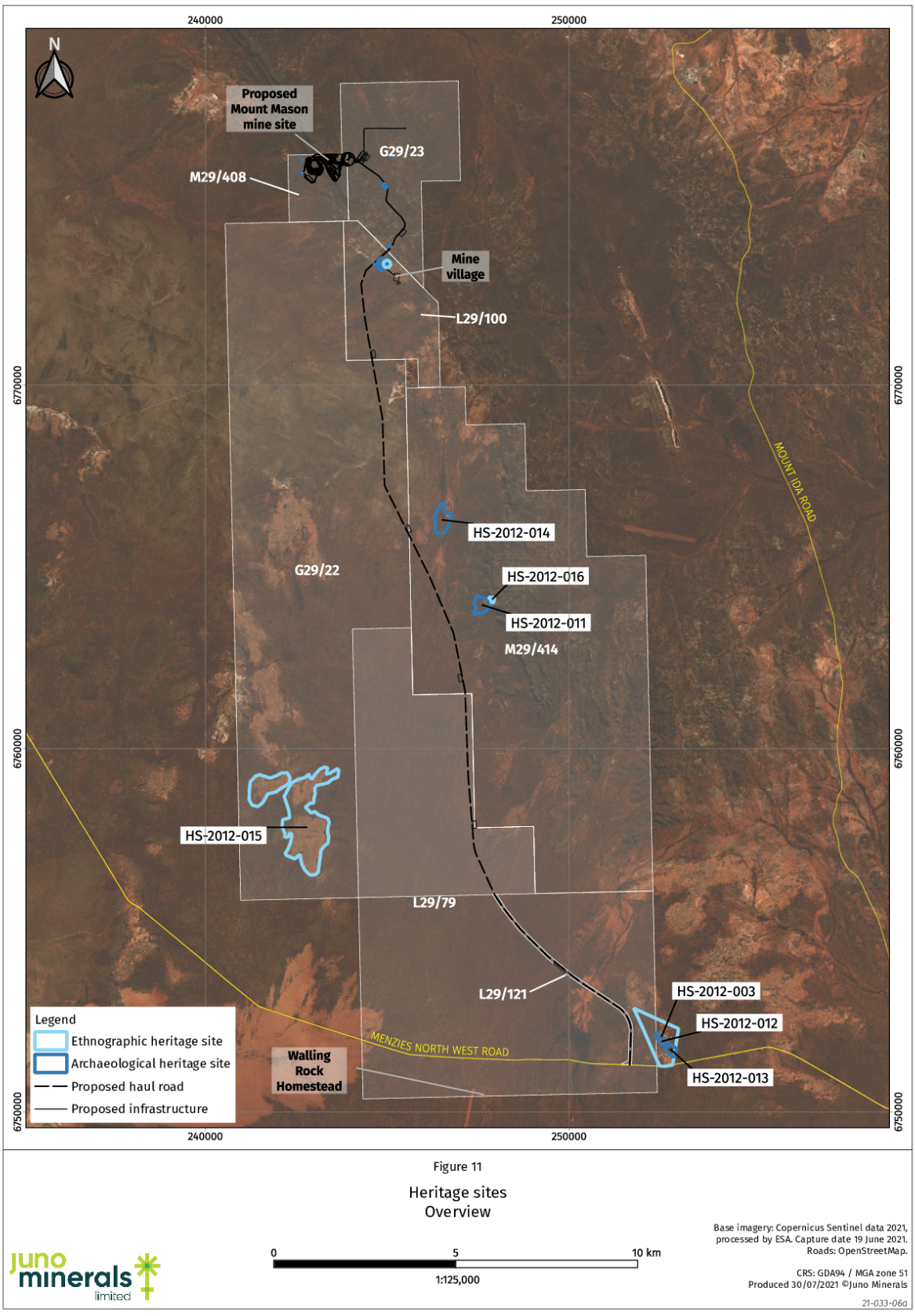

Figure 11

Heritage sites
Overview

0 5 10 km

1:125,000

Base imagery: Copernicus Sentinel data 2021, processed by ESA. Capture date 19 June 2021.
Roads: OpenStreetMap.

CRS: GDA94 / MGA zone 51
Produced 30/07/2021 ©Juno Minerals

21-033-06a

Figure 11: Heritage Sites – Overview

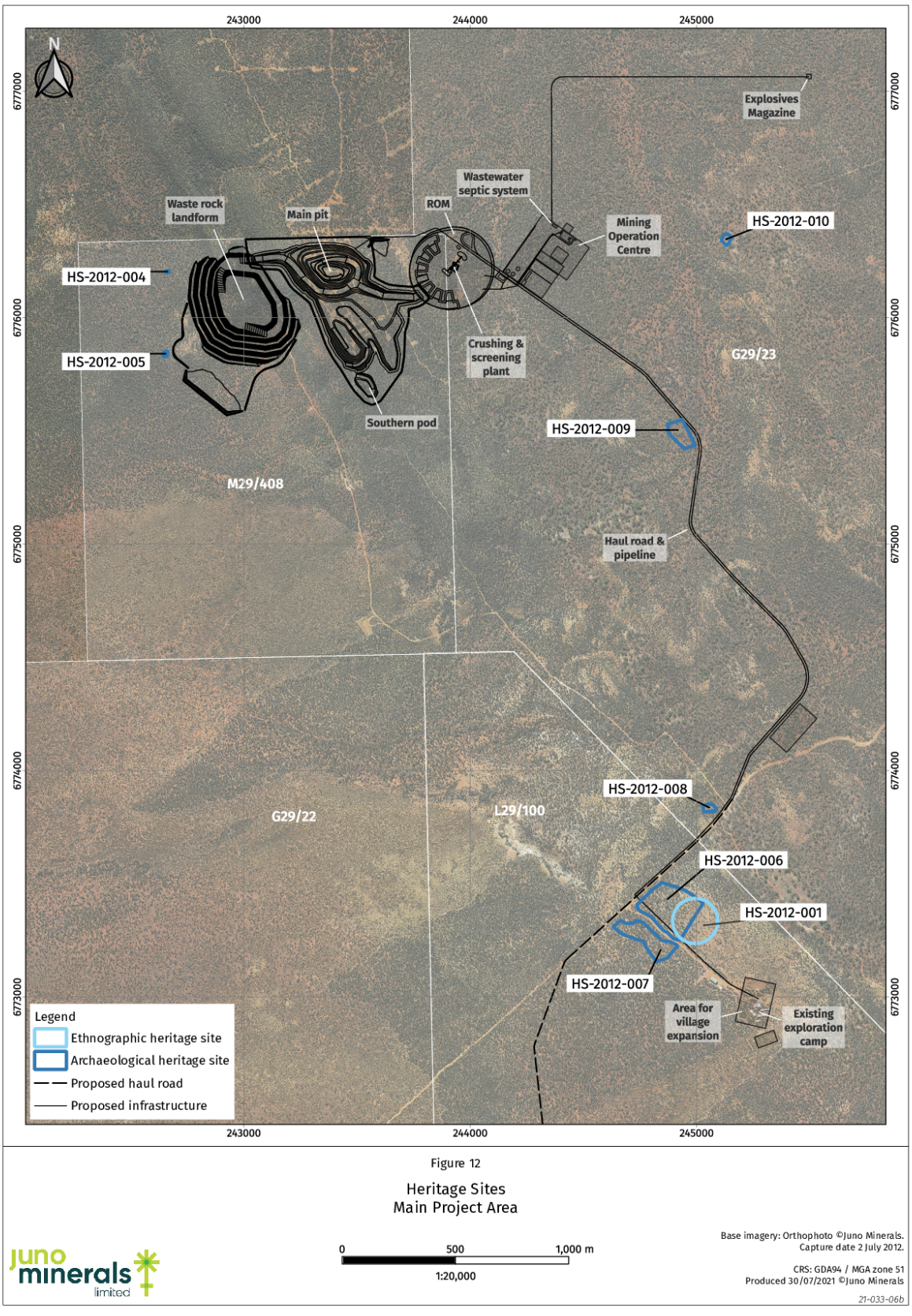

Figure 12

Heritage Sites
Main Project Area

Figure 12: Heritage Sites – Main Project Area

The Heritage Council's Inherit database shows no known record of European heritage sites on or near the Project Area.

8.2.2 Previous Decisions

8.2.2.1 Native Vegetation Clearing Permit

The Project was previously granted a permit to clear native vegetation (CPS 5764/2) under s.51M of the *Environmental Protection Act 1986* on 24 September 2015 (Appendix K). Due to the expiry of the permit before commencement of clearing, and a change in owner ship from Jupiter to Juno, Juno was advised that a new permit would be required.

The location of the area for clearing for this current NVCP application is the same as was previously approved. The size of the area for clearing has been increased to approximately 141ha (from 115ha previously approved) to include areas for stockpiling of topsoil and to extend the haul road corridor width slightly to include area for drainage and maintenance requirements for safe operation of the haul road.

This permit application is also requesting an 'envelope' be approved within which the actual area to be cleared may be conducted. This is to allow for slight flexibility in the exact location (particularly of the southern portion of the haul road where it meets the Menzies-Sandstone Road) to allow for avoidance of any active Malleefowl mounds prior to clearing.

8.2.2.2 EPBC Act referral

The Project was referred under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) in May 2013. On 24 June 2013, the decision on referral was received from the Department of Sustainability, Environment, Water, Population and Communities that the proposed action is "not a controlled action, if undertaken in a particular manner" (EPBC Ref: 2013/6870) (Appendix I).

The 2021 Targeted Fauna Survey identified a Malleefowl mound under construction to the south of the proposed haul road near where it meets the Menzies-Sandstone Road (noted as 'Active' on Figure 9). Juno is currently in consultation with the Referral Branch of the Australian Government Department of the Environment regarding provision of a 185m buffer around the mound to allow for alignment of the proposed haul road to remain within the boundaries on the Miscellaneous Lease L29/121.

The decision on referral did allow for a reduced (185m) buffer around the Malleefowl mound to the west of the haul road near the proposed Mine Village, which was reported as active in 2013. The 2021 Targeted Fauna Survey noted that this Malleefowl mound is no longer active.

8.2.2.3 Mining Proposal Approval

The Mount Mason DSO Hematite Project Mining Proposal (2014) was approved by DMIRS on 31 July 2014. Locations for the mining operations and associated infrastructure and haul roads were provided in the Mining Proposal.

8.2.3 Legislative Requirements

The Project does not require any other approval under the EP Act, *Rights in Water and Irrigation Act 1914*, or the *Aboriginal Heritage Act 1972.*

8.2.4 Necessity

The proposed native vegetation clearing for the Project follows the impact mitigation sequence, as shown in Table 12.

Table 12: Native Vegetation Clearing Impact Mitigation

Mitigation Sequence	
Avoid	Where possible the Project has been aligned with previously cleared areas to avoid the requirement to clear vegetation (e.g. along existing access roads).
Minimise	The area of land to be cleared for the Project has been limited to that necessary for the safe construction and operation of the Project.
Rehabilitate	On completion of the Project cleared areas will be rehabilitated (refer to Section 5);
Offset	The Project has not been determined to require any offset (refer to Section 9).

8.2.5 Environmental Protection Policies

There is no Environmental Protection Policy (EPP) relevant to this Project.

8.2.6 Agreements to Reserve, Conservation Covenants and Soil Conservation Notices

The Project area is not land subject to an agreement to reserve, a conservation covenant, nor a soil conservation notice under the *Soil and Land Conservation Act 1945*.

9 OFFSETS

Under Part V Division 2 (Clearing of native vegetation) of the EP Act, a native vegetation clearing permit may be subject to a condition requiring an offset to “establish and maintain vegetation on land other than land cleared under the [clearing] permit in order to offset the loss of the cleared vegetation or make monetary contributions to a fund maintained for the purpose of establishing or maintaining vegetation”.

In accordance with the Residual Impact Significance Model (Figure 3 of the DWER WA Environmental Offsets Guidelines 2014), environmental offsets are only to be applied where the residual impacts of a project are determined to be significant, after avoidance, minimisation and rehabilitation have been pursued.

In general, significant residual impacts include those that affect rare and endangered plants and animals (such as declared rare flora and threatened species that are protected by statute), areas within the formal conservation reserve system, important environmental systems and species that are protected under international agreements (such as Ramsar listed wetlands) and areas that are already defined as being critically impacted in a cumulative context. Impacts may also be significant if, for example, they could cause plants or animals to become rare or endangered, or they affect vegetation which provides important ecological functions.

Assessment of this Project against the Residual Impact Significance Model suggests that the residual impacts are not significant, and no environmental offsets are required.

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APPENDICES

Appendix A: Land Development and Clearing Procedure

Land Disturbance and Clearing Procedure

August 2021

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VERSION CONTROL	Doc ID: JM 001	Doc Title:	Land Disturbance and Clearing Procedure		
V3	Final	JP	GO & GK	GD	06/08/21
V2	Final Draft	JP	GO & GK	GD	30/7/2021
V1	Draft	JP	GO & GK	GD	08/06/21
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1 PURPOSE

The purpose of this procedure is to:

- Manage the potential impacts of land disturbance and clearing on vegetation and fauna;
- Minimising impact to:
    - Malleefowl (*Leipoa ocellata)* which is listed as 'vulnerable' under the Environmental Protection and Biodiversity Conservation Act (Cth) and 'rare and likely to become extinct' under the *Biodiversity Conservation Regulations 2018* (WA); and
    - *Drosera eremeae* which is listed as a Priority 1 species.
- Ensure compliance with legislative requirements.

2 SCOPE

This procedure applies to all Juno Minerals Limited ('Juno') land clearing or vegetation disturbance activities. This includes contractors undertaking land disturbance or clearing on Juno's behalf.

3 RELEVANT LEGISLATION AND JUNO COMMITMENTS

- *Environmental Protection Act 1986;*
- *Environmental Protection (Clearing of Native Vegetation) Regulations 2004;*
- *Biodiversity Conservation Regulations 2018* (WA);
- *Environmental Protection and Biodiversity Act 1999* (Cth);
- *Aboriginal Heritage Act 1972;*
- EPBC Decision on Referral (EPBC Ref: as issued and current);
- Native Vegetation Clearing Permits as issued by DMIRS and currentJupiter Central Yilgarn Iron Project - Malleefowl Management Plan (current version).

4 RESPONSIBILITIES

Resident Manager:

- Ensure persons undertaking any land disturbance or clearing activities are aware of the requirements of this procedure prior to commencing works;
- Ensure appropriate supervision of land disturbance and clearing activities is provided; and
- Ensure no impact to any environmental significant areas (Malleefowl mounds, populations of *Drosera eremaea,* or Aboriginal Heritage Site).
- Ensure consultation with relevant stakeholders has been conducted where required.

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Environmental Officer:

- Assess Juno Ground or Vegetation Disturbance Permits (GVDP) to ensure the area requested to be cleared/disturbed has been authorised and meets the requirements under the relevant Department of Mines, Industry Regulation and Safety native vegetation clearing permit (CPS 5765/2 or CPS 5764/2).
- Determine if a Department of Parks and Wildlife (DPaW) Licence to Take flora is required for the disturbance/clearing.
- Determine any 'No-go' areas with regards to:
    - Active Malleefowl mounds or mounds that are inactive <20yrs to be retained (ensure appropriate approved buffer),
    - *Drosera eremaea* plants or populations, and
    - Aboriginal Heritage Sites.
- Ensure a pre-clearing survey is completed (no earlier than 1 week prior to the commencement of ground disturbance) in the field by an appropriately qualified and Juno authorised person to identify any previously unrecorded active Malleefowl mounds, or a change in status of an old Malleefowl mound.
- Audit/inspect land disturbance and clearing activities to ensure they are being performed in accordance with this procedure.
- Ensure that soil stockpiles are numerically identified and the date/s of stripping recorded on a site Topsoil and Overburden GIS register.
- Ensuring any non-conformance with the procedure is reported, investigated and any potential impact mitigated.
- Ensure areas cleared/disturbed are accurately surveyed, recorded and reported as required by legislative requirements (e.g. Annual Environmental Report, Mine Rehabilitation Fund Report).
- Ensure consultations with relevant stakeholders are documented/recorded where required and the Juno Stakeholder Consultation Register is updated.

Field Surveyor:

- Ensure survey, ground truthing and flagging all ground clearing/disturbance areas in accordance with the issued Juno Ground or Vegetation Disturbance Permits (GVDP); and
- Ensure Environmentally Sensitive Areas and Heritage Sites are clearly demarcated as 'No-go' areas in the field.

Site Supervisor:

- Ensure all clearing boundaries and 'No-go' Areas are clearly demarcated in the field prior to disturbance/clearing commencing;
- Provide all Earthworks Machinery Operators with an 'orientation' of the area to be cleared ensuring they are familiar with the clearing area boundaries and any 'No-go' areas;
- Provide supervision during disturbance/clearing to ensure activities comply with all legislative requirements and the requirements of this procedure.

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Earthworks Machinery Operator:

- Ensure ground disturbance or clearing is conducted in accordance with all approvals, permits and this procedure.
- Ensure they have sighted all relevant approvals/permits and are satisfied they are complying with an approved GVDP prior to the commencement of any land and vegetation disturbance (refer to the relevant Juno Ground or Vegetation Disturbance Permits (GVDP);
- Clear/disturb only within the approved, demarcated areas (this includes not driving/parking on vegetation outside the approved area) as defined by the GVDP;
- Ensure a GPS record is obtained that records clearing activity during the works (preferably equipment based), and provide the Juno Environmental Officer with the GIS polygon/shape file after clearing; and
- If in doubt, STOP Work, and seek assistance to clarify clearing or 'No-go' Area requirements before proceeding with any land disturbance/clearing activities.

Database Manager:

- Maintain GIS environmental impact assessment layers (shape files) including the Threatened Flora, Threatened Fauna, Baseline Surveys and Archaeological or Potential Sites, and Archaeological sites, and 'No-go' buffer layers;
- Maintain data on cleared/disturbed areas as provided by the persons undertaking the disturbance/clearing.

5 PROCEDURE

5.1 Planning and Requesting Authorisation to Clear

For long term project planning purposes, a project Ground or Vegetation Disturbance 5 year plan should be developed which takes into account the potential for seasonal nesting in used and unused Malleefowl mounds.

As Malleefowl nesting activity occurs during July to March, clearing planning and initial surveying for disturbance should ideally be conducted up to 9 months preceeding the required clearing disturbance, with clearing taking place in April to June.

At the time of disturbance, the person requesting clearing/disturbance is then required to complete a Juno Ground or Vegetation Disturbance Permit (GVDP) request form (Appendix) and provide the Environmental Officer with all maps, shape files of all proposed disturbance areas, the method of clearing, the method of topsoil removal and stockpiles.

GVDP request forms need to be submitted to the site Environmental Officer at least 7 working days in advance of the proposed disturbance/clearing to allow sufficient time to ensure an assessment can be completed and all legislative requirements/notifications of relevant Government agencies can be met in consultation with relevant Government agencies.

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When requesting a GVDP the following are required to be considered:

- Previously disturbed or cleared areas are to be used as a preference over disturbing/clearing new areas.
- The area to be cleared shall be kept as the minimum area required for the safe installation and operation of plant/equipment and associated activities;
- 'Active' Malleefowl mounds are to be avoided and 'inactive' mounds to be retained (ensure appropriate approved buffers), unless otherwise approved under the current EPBC 'action';
- *Drosera eremaea* plants and populations are to be avoided (with a 10m buffer);
- Aboriginal Heritage Sites are to be avoided (minimum 10m buffer); and
- Locations for topsoil stockpiles are to be identified with the assistance of the Environmental Officer (locations must not be impacted by vehicle traffic, surface water flow, weeds etc).

No ground or vegetation disturbing activities may commence without an authorised GVDP.

5.2 Assessment of Request to Clear

Upon receiving the request for a Juno Ground or Vegetation Disturbance Permit (GVDP), the Environmental Officer is required to conduct a desktop assessment to:

- Ensure the proposed clearing/disturbance area is authorised under a current DMIRS Clearing Permit.
- Identify any Declared Rare or Protected Flora and Fauna (DRF, Priority 1 etc) as gazetted under the *Biodiversity Conservation Act 2016* (WA) or under the *Environmental Protection and Biodiversity Act 1999* (Cth);
- Ensure that if any Priority flora species are required to be removed, authorisation is obtained from the relevant Government Department (e.g. DPaW for a Licence to Take Flora);
- Identify any 'active' Malleefowl mounds (to be avoided with a 250m buffer);
- Identify any 'inactive' mounds to be retained (with approved buffer). Note that some 'inactive' mounds have been approved for clearing under EPBC referral decision; and
- Identify any Aboriginal or European Heritage or Cultural sites (to be avoided with a minimum 10m buffer for artifact scatters; additional buffer requirements for other types of sites as per Juno agreements with Traditional Owners).

Clearing should only be approved after reasonable access alternatives have been considered as not practicable.

The Environmental Officer is also responsible for ensuring the planned land disturbance/clearing has been discussed with relevant stakeholders who may be impacted by, or have a vested interest in, the activities.

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This may include:

- Communities living in close proximity to the area or work that may be impacted by noise, dust, vibration or visual amenity.
- Pastoralists, particularly where there are impacts in relation to stock watering areas, fences, gates or other property infrastructure.
- Traditional Owners or Native Title parties who have a registered cultural or legal interest in the area.

The Environmental Officer is responsible for documenting and recording the consultation with relevant stakeholders and ensuring the updating of the Juno Stakeholder Consultation Register .

Any complaints from stakeholders are to be reported to the Resident Manager or Environmental Manager and work suspended until approval to continue has been given.

Once the desktop assessment has been completed, and all external approvals have been received, the Environmental Officer is to complete a Juno GVDP and forward a copy to the Manager (or authorised delegate) of the person requesting clearing/disturbance for countersigning.

A copy shall also be kept, scanned and filed, by the Environmental Officer.

5.3 Ground Truthing and Demarcation

5.3.1 Pre-clearing Malleefowl Mound Survey

A pre-clearing survey must be completed (no earlier than 7 working days prior to the commencement of ground disturbance) in the field by an appropriately qualified and Juno authorised person to identify any previously unrecorded ‘active’ Malleefowl mounds, or a change in the status of an old ‘inactive’ Malleefowl mound to ‘active’.

The results of the survey are to be entered into the relevant section of the GVDP and signed off by the person who completed the survey.

GPS coordinates of any new/status changed ‘active’ mounds are to be added to the database, and appropriate clearing control measures are to be in place to protect the ‘active’ mound(s).

5.3.2 Demarcation of Clearing Area

The authorised area to be disturbed/cleared (as outlined in the GVDP) is to be clearly pegged and demarked/flagged by Field Assistants using the following materials/methods:

Clearing boundary (Figure 1):

- Fluorescent pink flagging tape to be used;
- Tape is to be placed at head height; and

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- Consecutive pieces of flagging tape are to be spaced close enough together such that the next tape is visible at all times as the area is cleared.

'No-go' Areas:

- Red and yellow striped flagging tape to be used;
- Demarcation for the 'No-go' Area must include:
    - Approved buffer around 'active' Malleefowl mounds and around 'inactive <20yrs Malleefowl mounds,
    - 10m buffer around *Drosera eremaea*, and
    - 10m buffer for Aboriginal artefact scatter site (buffer size to be identified for other types of sites in consultation with Traditional Owners (e.g. for ceremonial or mythological sites).
- Tape is to be placed at head height; and
- Consecutive pieces of flagging tape are to be spaced close enough together such that the next tape is visible at all times as the adjacent approved clearing area is cleared.

Figure 1: Land Disturbance/Clearing Boundary Demarcation

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5.4 Land Disturbance and Clearing

5.4.1 Pre-clearing Orientation

The site Environmental Officer is to:

- Provide the Earthworks Machinery Operator(s) and the Land Disturbance/Clearing/Site Supervisor with a copy of the signed Juno GVDP, which must include all approved Clearing Maps;
- Go through the disturbance/clearing requirements with the Earthworks Machinery Operator(s) and the Land Disturbance/Clearing/Site Supervisor prior to land disturbance/clearing commencing to ensure they are aware of the approved clearing boundaries and any 'No-go' Areas; and
- Ensure the approved clearing area polygon/shapefile and any 'No-go' Area polygons/shapefiles are provided to the Earthworks Machinery Operator and has been uploaded into the GPS on the machinery (where installed) or to a portable GPS carried by the Operator.

Once explained and agreed the Earthworks Machinery Operator must sign off on all approved Clearing Maps signalling that they are aware of the required clearing area, 'No-go' areas, and any other conditions of clearing.

Disturbance/clearing activities must NOT commence until the Pre-clearing Orientation is completed with the Earthworks Machinery Operator(s) and the Land Disturbance/Clearing/Site Supervisor **and the authorised GVDP has been signed by the Earthworks Machinery Operator.**

5.4.2 Clearing Methodology

A daily pre-earthmoving visual assessment should be undertaken by the Land Disturbance/Clearing/Site Supervisor and the Earthworks Machinery Operator prior to commencement of clearing activity to ensure the below clearing methodology is understood and implemented:

- Disturbance/clearing shall be kept to a minimum within the approved clearing area.
- All clearing is to avoid environmentally sensitive areas i.e. there is to be no clearing within 200m from known Mallee fowl mounds or 50m away from known Drosera eremaea populations.
- Significant vegetation e.g. large trees are to be avoided, and is to favour natural clearings wherever possible to minimise damage to vegetation.
- Machinery blades shall be set above ground level to minimise disturbance to topsoil and rootstock and to reduce erosion when clearing.
- All clearing shall progress in a slow, systematic manner in order to not confuse or trap evacuating fauna.
- Fauna must be looked out for during clearing. Reptiles can be slow moving, so if fauna is sighted, all machinery is to stop to allow safe egress from the work area.

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5.4.3 Access tracks

- Access tracks, unless otherwise determined, should be as straight as practicable to minimise clearing.
- Avoid tight bends, proximity to trees and boggy areas when planning access tracks.
- Where possible low rise (<0.5m) vegetation i.e. grasses/shrubs etc. should be rolled rather than cleared.
- Taller vegetation requiring stripping shall be stockpiled on cleared ground for use in rehabilitation (i.e. not to be stockpiled on existing native vegetation as it will damage it).
- If overhanging branches (less than 5m high) need to be removed for access they should be removed in a manner that does not damage the remainder of the tree.
- The creation of windrows which have the potential to block or channel water flow along tracks causing erosion will be avoided.
- Grading of tracks should be minimised and only performed on excessively rough tracks. Where grading is necessary, the risk of erosion can be minimised by breaking windrows to allow drainage, with cambering of tracks to channel overland flow and avoiding deep cutting into the soil profile. Any damage caused during wet conditions is to be repaired when the ground has dried out.
- Vehicles must drive on existing roads i.e. no short cuts or deviations from the tracks will be tolerated. Off road access is prohibited unless in an emergency i.e. bush fire.
- During wet and boggy conditions all vehicle movement will be kept to a minimum.
- Width of access tracks to be confined to 3.5 m – 4 m.
- Discharge of water until the appropriate and approved containment facilities have been implemented or the water quality is tested and deemed acceptable for discharge.

5.4.4 Topsoil and vegetation management

- Topsoil (top 50mm), as distinct from overburden (50 – 300mm), is to be stripped from clearing areas for use in rehabilitation. If 50mm is not available to be stripped (due to skeletal soils) the Earthworks Machinery Operator(s) shall strip as much topsoil as possible and place it on a demarcated topsoil stockpile.
- Stockpiles shall be numerically identified and the date/s of stripping recorded on a Site Topsoil and Overburden GIS Register, to be maintained by the Environmental Officer.
- Topsoil removal should be planned to be stripped in dry conditions and multiple handling of topsoil should be avoided.
- Vegetation and topsoil stockpiles are to be placed in the locations approved in the GVDP (e.g. away from drainage lines and access tracks etc.)

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5.4.5 Post-clearing and Sign-off

- After the area has been cleared, and prior to the Earthworks Machinery Operator moving from the area, the Land Disturbance/Clearing Supervisor and the Environmental Officer shall inspect the cleared area to ensure all clearing requirements have been met and sign off on the completed works (i.e. sign the GVDP).

- Where the requirements have NOT been conducted in accordance with this procedure and /or there is variance in the area cleared, an Environmental Incident Form is to be raised and processed as expediently as practicable to determine if remedial works are required prior to movement of the earthmoving machinery and/ or other actions are required e.g. re-instruction of Operator.

- The Earthworks Machinery Operator shall provide the GIS polygon/shapefile of the cleared area to the Database Manager for uploading into the database

5.5 Reporting

The Environmental Officer shall ensure that survey confirmation occurs for all ground disturbance & clearing activities, and the data is made available for reporting in the Project Annual Environmental Report (AER) and Mine Rehabilitation Fund Report as submitted to DMIRS.

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Ground or Vegetation Disturbance Permit

PART A: GENERAL INFORMATION OF WORKS *(Person requesting land disturbance/clearing to complete)*	
Company Name:	Applicant Name:
Lease No.& Name:	Location Description:
Date:	Proposed Area to be Disturbed (ha):
Area Previously Disturbed: Y / N / N/A	Location Map and Co-ordinates attached (circle): Y / N / N/A
Length of tracks to be cleared (km):	
Proposed Start Date:	Proposed Finish Date:
Description / Reason for Works:	

PART B: EXTERNAL APPROVALS *(Site Environmental Officer to Complete)*	**Yes**	**N/A**
Area covered by an existing DMIRS Clearing Permit?		
DoW Approvals Required / Obtained? (*ie 26D licence)*		
Flora Taking Licence obtained (if required)?		
Pastoral Owner Permission Granted / Advised of Works?		
Other stakeholders consulted as determined and required (e.g. Traditional Owners)?		
Any other Approvals Required (ie Shire of Menzies)?		

PART C: PRE-CLEARING MALLEEFOWL MOUND SURVEY *(Qualified/approved person to complete)*	**Yes**	**N/A**
Pre-clearing field survey for 'active' Malleefowl mounds completed?		
GPS coordinates of any new mounds or changes to the 'active' mounds status entered into database?		

Date of Survey:	Surveyor Name:	Surveyor (sign):

Pre-clearing Survey Results
☐ Previously recorded 'Active' Malleefowl mound identified INSIDE the NVCP approved clearing area
☐ Previously recorded 'In-active' Malleefowl mound identified INSIDE the NVCP approved clearing area has changed status and is now 'Active'
☐ A new Malleefowl mound (not previously recorded) identified INSIDE the NVCP approved clearing area has changed status.
☐ A new Malleefowl mound (not previously recorded) identified OUTSIDE the NVCP approved clearing area has changed status.

Mound Location:	Management Action Required
☐ Mound(s) is outside clearing area (not required to be cleared) and adequate buffer area is available	No action required – ensure clearing does not disturb mound(s) or buffer area(s)

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☐ Mound(s) is outside clearing area but there is inadequate buffer area outside the clearing area,	☐ A reduced buffer area has been approved (EPBC) - clearing may proceed to the reduced buffer area. ☐ No approved reduced buffer (EPBC) - clearing may not commence inside the buffer area(s) until April-June outside the nesting and incubation period. ☐ No approved reduced buffer (EPBC) and clearing cannot be practicably delayed – Contact appropriate Regulatory Authorities for advice on management requirements to enable clearing to proceed.
☐ Mound(s) and buffer area(s) is inside the approved clearing area	Contact appropriate Regulatory Authorities for advice on management requirements.

PART D: PLANNING CONTROLS *(Site Environmental Officer to Complete)*	**Yes**	**N/A**
Disturbance >250m from known 'active' Malleefowl mounds (unless otherwise approved)?		
Disturbance >50m from a known 'inactive <20years to be retained' Malleefowl mounds?		
Disturbance >10m from known *Drosera eremaea* plants and/or populations?		
Disturbance >10m outside of Aboriginal or European cultural heritage sites?		
Topsoil stockpile locations have been identified (and are suitable)?		

PART E: PRE-START WORK CONTROLS *(Site Environmental Coordinator to complete with Land Disturbance/Clearing Supervisor)*	**Yes**	**N/A**
Disturbance Area Surveyed and clearly demarcated with correct tape?		
'No-go' Areas clearly demarcated with correct tape (and with the correct buffer requirements)?		
Weed Hygiene Certificate received for all Ground Engaging Machinery?		
Job Hazard Analysis (JHA)/Risk Assessment Prepared / Approved? *(ensure fire and emergency response is included)*		
Clearing Maps approved by all signatories?		

PART F: PERMIT APPROVAL		
Land Disturbance/Clearing/Site Supervisor	…… I confirm that that all ground disturbing activities will be undertaken strictly in accordance this Permit	…… date
Site Environmental Officer	…… I confirm that that all ground disturbing activities will be undertaken strictly in accordance this Permit	…… date
Environmental Manager	…… Authorisation is given to proceed with the Permit Application under the conditions prescribed on this Permit	…… date

PART G: PRE-START EARTHWORKS MACHINERY OPERATOR CONTROLS *(Site Environmental Officer to complete with the Earthworks Machinery Operator(s))*	**Yes**	**N/A**
Copy of this GVDP (and associated Clearing Maps) provided to the Earthworks Machinery Operator(s)?		
In field 'orientation' provided to the Earthworks Machinery Operator(s)?		

Earthworks Machinery Operator (sign off)	…… Earthworks Machinery Operator	……date
Earthworks Machinery Operator (sign off)	…… Earthworks Machinery Operator	……date
Earthworks Machinery Operator (sign off)	…… Earthworks Machinery Operator	……date

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PART H: POST DISTURBANCE CONTROLS		
Post Disturbance Inspection Completed	..... Site Environmental Officer	.....date
Post Disturbance Survey Completed (Including topsoil stockpile locations)	..... Surveyor or alternative	.....date
Disturbance Register Updated	..... Environmental Manager	.....date
Total Area Disturbed (ha):	Veg Clearing (ha):	Pre-Disturbed (ha):

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Appendix B: Central Yilgarn Iron Project Malleefowl Management Plan (Jupiter)

Jupiter Mines Limited

Central Yilgarn Iron Project
Malleefowl Management Plan

April 2013

Document Status				
Rev No	**Author**	**Status**	**Date**	**Distribution**
Draft 8.0	Keith Lindbeck & Associates	Initial draft for JML review	December 2012	
Draft 8.1	Jupiter Mines Limited	Final Draft	January 2012	
Draft 8.2	Keith Lindbeck & Associates	Review of JML Final Draft	January 2012	
Draft 8.3	Kasa Consulting	Final Review	February 2013	
Final Draft	Jupiter Mines Limited	Final draft for EPBC Referral	February 2013	DEC, MPG, SEWPaC
Final	Jupiter Mines Limited	Final, incorporating SEWPaC preliminary comments	April 2013	MPG, SEWPaC

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1.0 PROJECT BACKGROUND

Jupiter Mines Limited ('Jupiter') owns the Central Yilgarn Iron Project (CYIP) which is located approximately 100 kilometres northwest of Menzies within the Shire of Menzies, approximately 530km northeast of Perth, Western Australia (Figure 1).

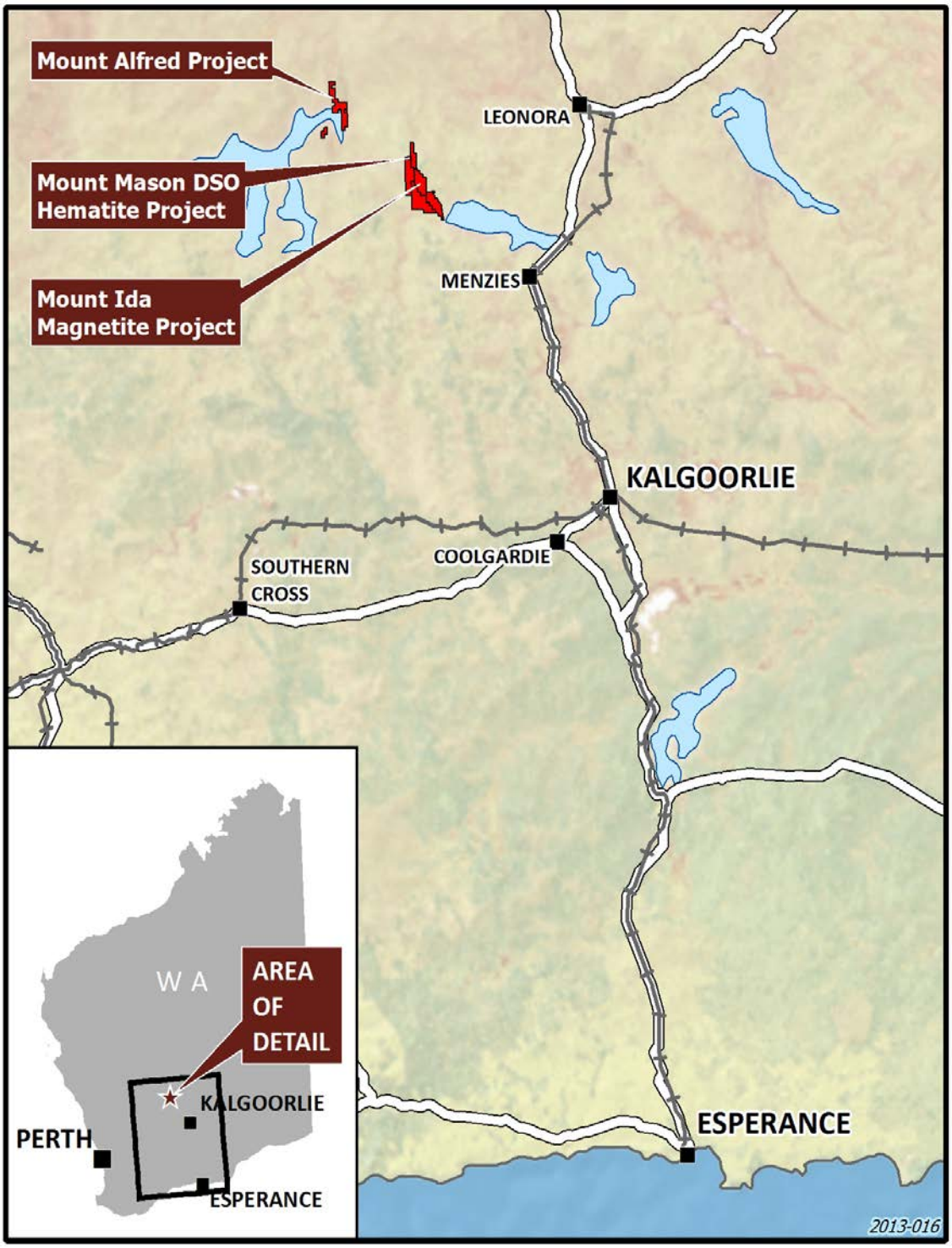

Figure 1 **– Regional location of the Central Yilgarn Iron Project (CYIP)**

The CYIP currently consists of the Mt Mason Direct Shipping Ore Hematite Project and Mount Mason and Mount Ida exploration projects. Individual tenements for these projects are listed in Table 1, including current status. Iron ore mining rights within these tenements are all owned 100% by Jupiter Mines Limited:

Table 1 - Land Tenure of the Central Yilgarn Iron Project

Project	Tenement	Size (ha)	Date Granted	Expiry Date
Mount Alfred	E29/581	10469	8/03/2006	7/03/2013
Mount Alfred	E29/726	300	19/01/2010	18/01/2015
Mount Ida	M29/414	6456	25/11/2011	24/11/2032
Mount Ida	L29120	21711	Pending	Pending
Mount Ida	E29/560	9736	8/09/2006	7/09/2013
Mount Ida	E29/777	10467	15/02/2011	14/02/2016
Mount Ida	E29/801	7532	18/08/2011	17/08/2016
Mount Ida	L29/79	6880	24/08/2010	23/08/2031
Mount Ida	G29/22	9625	06/09/2012	05/09/2033
Mount Ida	L29/106	119	20/06/2012	19/06/2033
Mount Ida	L29/122	6586	Pending	Pending
Mount Ida	L29/99	64504	24/02/2012	23/02/2033
Mount Ida	L37/203	68937	27/06/2011	26/06/2032
Mount Ida	L29/81	25987	12/09/2011	11/09/2032
Mount Ida	L29/78	6337	24/06/2010	23/06/2031
Mount Mason	**L29/121**	**65**	**Pending**	**Pending**
Mount Mason	**G29/23**	**1256**	**07/02/2013**	**06/02/2034**
Mount Mason	**M29/408**	**300.00**	**28/11/2007**	**27/11/2028**

The Mt Mason DSO Hematite Iron Ore Project (bold in Table 1) is the first project of the CYIP to be considered for further development. As such, Figure 2 focuses on the proposed Mount Mason Project which will predominantly occur within Mining Lease M29/408. The haul road traverses through associated general purpose leases as shown in Figure 2.

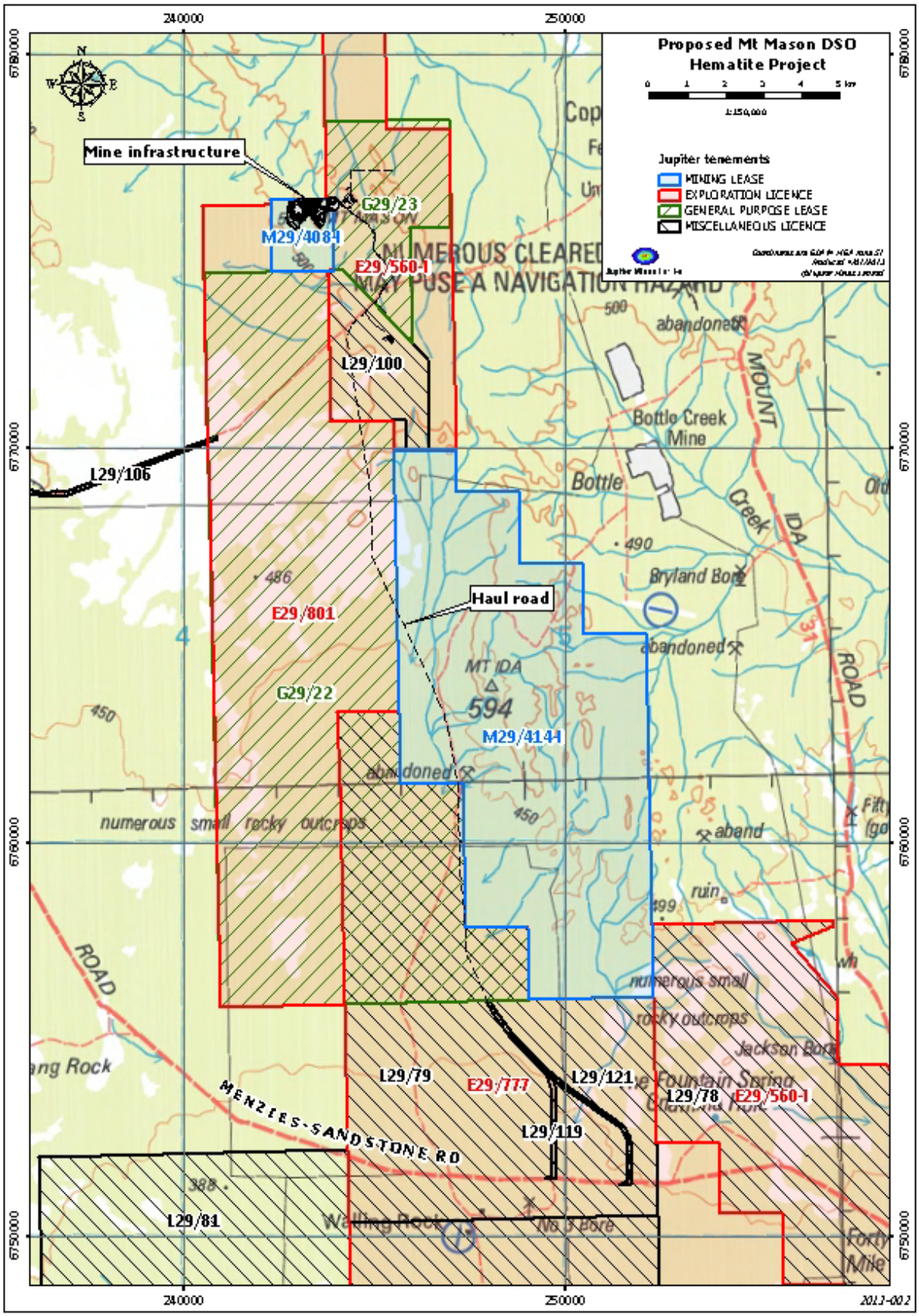

Figure 2 - Location of Mt Mason DSO Hematite Iron Ore Project

1. THE SPECIES

1.1 DESCRIPTION OF THE SPECIES

Malleefowl *Leipoa ocellata* (Gould, 1840) are large ground dwelling birds belonging to the Megapodiidae family. This species belongs to a small group of mound builders where the mound is used as an external heat source to incubate their eggs (Clark 1964). The Malleefowl is a long-lived sedentary species with an average lifespan of roughly 15 years. Reaching approximately 60cm in height and 1.5 - 2kg in weight, they are roughly the size of a small turkey (Benshemesh 2005). They have a unique appearance with a distinctly barred upper body of grey, white, black, buff and pale chestnut feathers, with a crest extending from the front of the crown to the nape which is raised when the bird is alarmed (DEWHA 2010; Pizzey and Knight 1999) (Figure 3).

Figure 3 - Adult Malleefowl *Leipoa ocellata*

1.2 CONSERVATION STATUS

Malleefowl *Leipoa ocellata* are classified under the Federal *Environmental Protection and Biodiversity Conservation Act*, 1999 (EPBC Act) as *"Vulnerable: "Taxa facing a high risk of extinction in the wild in the medium-term future".* It is also a listed species under Schedule 1 of the Western Australian *Wildlife and Conservation Act* 1950 and defined as "Rare and likely to become extinct".

The Federal Department of Sustainability, Environment, Water, Population and Communities (SEWPaC) administers the EPBC Act whilst the State Department of Environment and Conservation (DEC) administers the Wildlife Conservation Act 1950. In addition, the Malleefowl is also listed as Vulnerable on the 2007 International Union for Conservation of Nature (IUCN) Red List of Threatened Species.

1.3 GENERAL ECOLOGY

The Malleefowl is a species which occupies semi-arid to arid regions of Western Australia, inhabiting dense shrublands and thickets of Mallee (*Eucalyptus* spp.), Boree (*Melaleuca lanceolata*), Bowgada (*Acacia linophylla*), or areas which form dense leaf litter (Johnstone and Storr 1998). Malleefowl prefer habitat that is long unburnt for breeding and shelter. However Malleefowl will feed in recently burnt areas (Benshemesh 1992, Marchant and Higgins 1993).

The size of Malleefowl mounds vary. However, an average mound spans 5 metres in diameter and can be up to 1 meter high (DEC 2010) (Figure 4).

Figure 4 - Malleefowl mound

Malleefowl are usually solitary and occupy a home rage of between 0.5 and 4.6 km (Benshemesh 1992). Established monogamous breeding pairs usually inhabit a similar area throughout the year and come together for breeding. While both sexes build the mound, once the female has laid the eggs, the male usually maintains the mound on his own. Birds generally breed annually (Marchant and Higgins 1993) with the breeding season lasting 11 months. Following mound preparation, eggs are laid from mid-August to late January and hatchlings appear from November and January (Johnstone and Storr 1998). The precocial chicks are independent from hatching having no contact with either their parents or siblings (van der Waag 2007). While 50% to 85% of eggs hatch (Firth, 1959) generally more than 80% of chicks die within the first few weeks of life from predation and 'metabolic stress' (Priddel and Wheeler 1994).

Malleefowl feed opportunistically and will often feed on whatever food sources are abundant in the area (van der Waag 2007). Their omnivorous diet can consist of seeds, native herbs, flower buds, fruits and foliage of different plant species, as well

as invertebrates. This species will drink water but can easily survive during summer when surface water is unavailable (DEC 2010).

1.4 DISTRIBUTION OF THE MALLEEFOWL

Originally, Malleefowl were widespread and common across the southern arid and semi-arid zone, however the species has now become patchily distributed due to the effects of habitat clearing and fox predation (Johnstone and Storr 1998). Unlike other megapods that prefer damp forest, the Malleefowl does not inhabit the higher rainfall area of the Swan Coastal Plain and south coast of Western Australia (Figure 5).

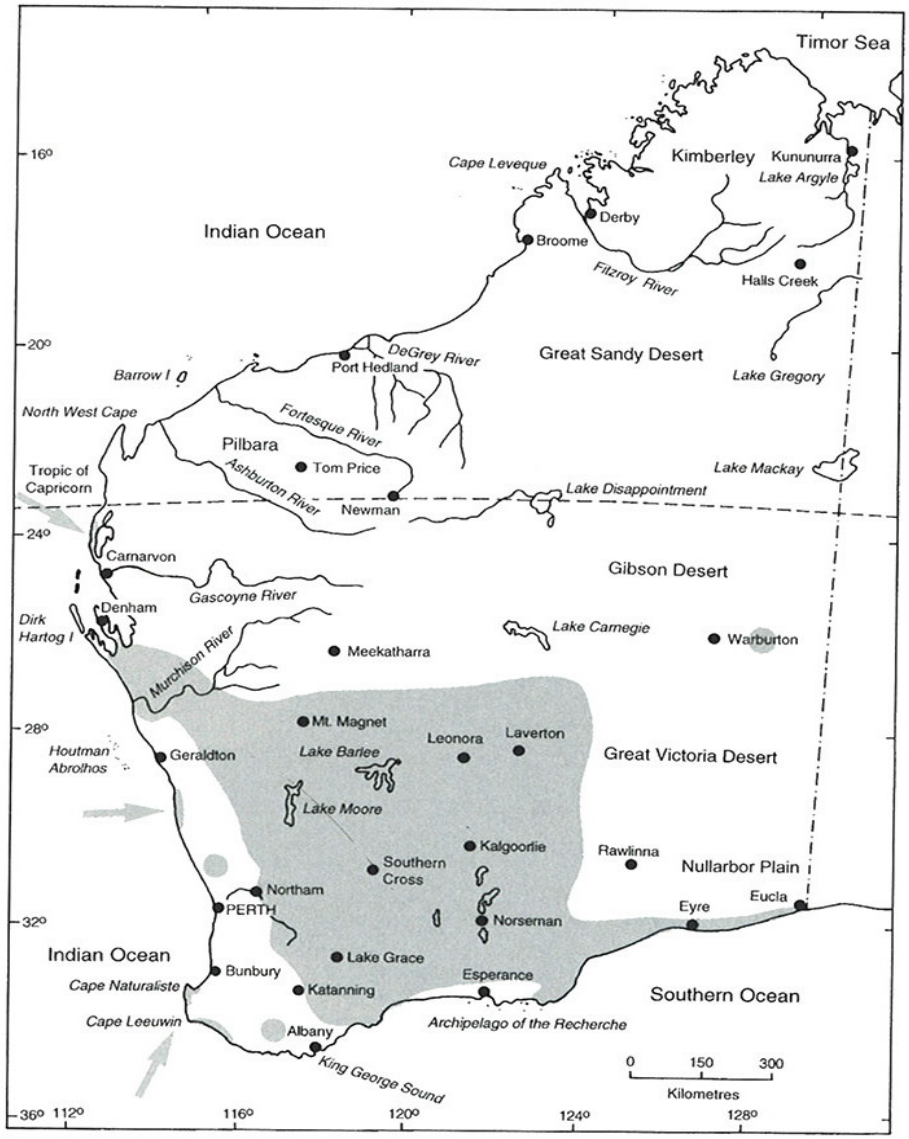

Figure 5 - Distribution of Malleefowl

1.5 OCCURANCE OF MALLEEFOWL AT THE CENTRAL YILGARN IRON PROJECT AREAS

A Level 2 fauna survey was conducted in the wider CYIP area in accordance with EPA guidelines (2002, 2004) in spring 2011 and autumn 2012 (KLA 2012a). A targeted EPBC survey, which included Malleefowl, was undertaken in March and April 2012 (KLA 2012b) of the proposed Mount Mason disturbance footprint. In addition, a targeted Malleefowl survey was undertaken by GHD in Spring 2012 (GHD 2012) of a potential haul road option (not proposed). A summary of the findings from these surveys are outlined in Table 3 below:

Table 3 – Active and Inactive Mounds recorded during fauna surveys across the CYIP

Date	Source/Report	Surveyor	Active Mounds		Inactive Mounds	
			Number of mounds located on survey	Number of mounds located within project disturbance footprint	Number of mounds located on survey	Number of mounds located within project disturbance footprint
April 2012	Mount Mason Targeted EPBC Listed Fauna Survey	Keith Lindbeck & associates (KLA)	1	0	37	11
August 2012	Central Yilgarn Iron Project (CYIP) – Mount Mason (L2) Fauna Assessment	Keith Lindbeck & Associates (KLA)	1 (note same mound MFM001 as recorded in April Survey)	0	7	0
August 2012	Central Yilgarn Iron Project (CYIP) – Mount Mason (L2) Fauna Assessment	Keith Lindbeck & Associates (KLA)	1	0	7	0
December 2012	Jupiter Mines Mount Ida non-process infrastructure areas – Malleefowl Survey	GHD	4	0	3	0

More detailed results from the above surveys are included in the table in Appendix 1.

Figure 6a & 6b show the current known locations of the active and inactive mounds in the vicinity of the Mt Mason Project which were recorded in baseline surveys. Any mounds found outside the above surveys (eg; through observations, monitoring), or which have appeared to have changed status through monitoring records will be re-recorded by professional prior to construction phase the project to ensure the most accurate information is used to allow avoidance as primary management strategy.

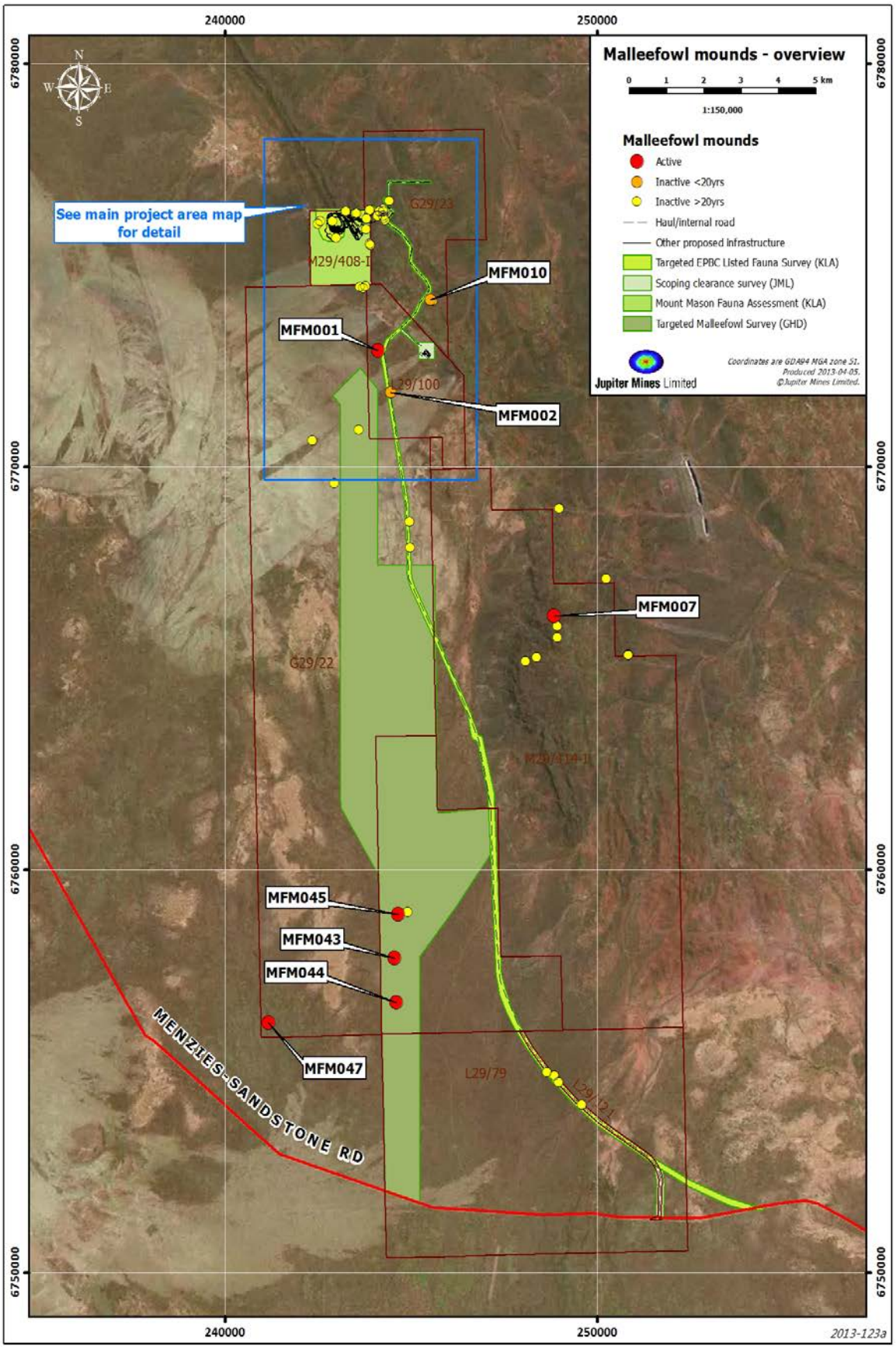

Figure 6a - Malleefowl mounds within the CYIP survey area

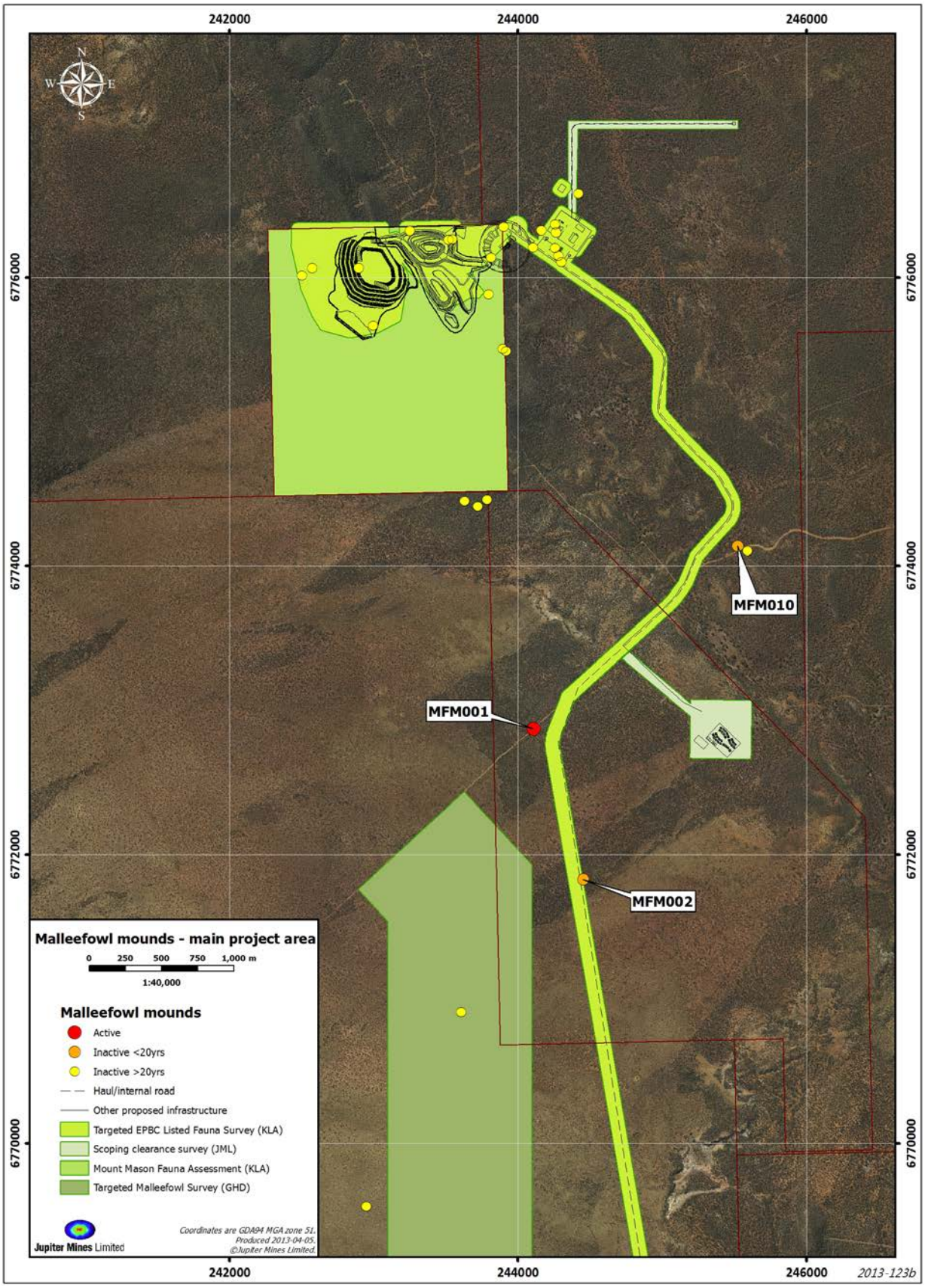

Figure 6b – Malleefowl mounds within Mount Mason Main Project Area

Figure 6a & 6b show that the proposed Mt Mason Hematite DSO Project has carefully been designed to avoid all known active Malleefowl mounds based on current data. Wherever practicable, a 250m buffer will be maintained around active mound and a 50m buffer from inactive mounds <20 years old.

However, note that MFM001 is currently the closest active mound to the proposed infrastructure at 185m away (closest point) from the proposed haul road alignment and it is not practicable to move the proposed haul any further due to nearby heritage site boundaries. Incidentally, MFM001 is located less than 5 metres from the edge of a pre-existing track (Metzke Road) and has been active for at least two years during exploration with no known detrimental impacts from current traffic. However, a reduced speed of 40km/hr will be imposed in the vicinity of MFM001 along with Malleefowl signage to further reduce potential impact.

Malleefowl occurrence throughout CYIP will likely be dynamic due to the mobile nature of the species. However Jupiter is committed to ongoing monitoring and data collection of both active and inactive mounds, which will be recorded through the Malleefowl portal of Jupiter's Environmental Database, an example of which is included in Appendix 2.

This should allow adaptive management actions (detailed in section 6) to be implemented to ensure that current minimal level of impact to the species throughout all CYIP's phases is maintained.

1.6 THREATS TO THE MALLEEFOWL

Benshemesh (2005) clearly states that the national major threats to the Malleefowl include clearing and burning of native vegetation, the introduction and spread of predatory species, grazing, starvation and road deaths.

1.6.1 Clearing

Widespread clearing of native vegetation in agricultural areas has removed and fragmented much of the Malleefowl habitat, resulting in localised extinctions and fragmented populations. New clearing threats that also target Malleefowl habitat include mining, harvesting of mallee eucalypts, waste containment facilities and harvesting of Broombrush (*Melaleuca uncinata*) for building materials (Benshemesh 2008).

This clearing has not only removed habitat for the Malleefowl, but also threatens remaining habitat due to agricultural species invasion and dispersal, fragmentation and associated edge effects and dryland salinity (Benshemesh 2008). Remnant patches of vegetation may not be sufficiently large and/or diverse to sustain a viable population of Malleefowl and the lack of corridors between patches for resources or dispersal further reduces viability of even small populations.

1.6.2 Fire

Fire of native and remnant vegetation poses a major threat to the Malleefowl. While fire is a natural part of the ecology of Malleefowl preferred habitat (i.e. Mallee), large and frequent fires can remove vast areas of Malleefowl habitat in a short period of time, leading to temporary or permanent local extinctions This includes both wildfire

and prescribed burning. Depending on the vegetation type, the leaf litter required for mound building may take many years to build up.

While Malleefowl will feed in recently burnt areas, they require long-unburnt areas for breeding and shelter (Benshemesh 1992, Marchant and Higgins 1993).

1.6.3 Predation

Predation by introduced species such as the Fox (*Vulpes vulpes*) and to a lesser extent the Cat (*Felis catus*) is a major cause of mortality of Malleefowl. Foxes are known to take Malleefowl at all ages from eggs to adult birds and are also a major threat to captive-reared Malleefowl released into the wild (Benshemesh 2008).

The relationship between fox baiting and Malleefowl remains unclear as a reduction in fox numbers does not appear to decrease the mortality of predator-taken Malleefowl. Feral dogs and Dingoes are also known predators of the Malleefowl, as well as predatory birds.

1.6.4 Grazing and starvation

Grazing by stock, and other feral herbivores threaten Malleefowl populations in several ways. Primarily, their grazing activities can alter the structure and diversity of vegetation that provides suitable habitat for Malleefowl populations. Additionally, they may also compete with Malleefowl for available food resources, which can lead to starvation (Benshemesh 2005).

Rabbits, kangaroos, feral goats, feral camels etc. may have a deleterious impact on Malleefowl habitat and resources.

1.6.5 Road Deaths

Malleefowl are slow moving, ground dwelling birds which makes them more susceptible to road deaths. This is particularly evident in areas where new roads are constructed with an increase in traffic flow.

2. CONSULTATION

This management plan has been prepared following discussions with relevant stakeholder groups, including the DEC and the Malleefowl Preservation Group (MPG).

The management actions in this plan are specifically relevant to the CYIP area (including the Mt Mason DSO Hematite Project). All mining and exploration personnel require mandatory induction and training and they potentially may be involved in monitoring and management of the Malleefowl population within the area. However community involvement will not be detailed in this Management Plan due to the location and isolation of the CYIP areas.

All information obtained as a result of the actions undertaken pursuant to this Management Plan will be made available to the MPG with whom Jupiter currently have a sponsorship agreement (Appendix 3) to assist in achieving regional conservation objectives for the species.

3. STRATEGIES FOR MANAGEMENT

The strategy and key objectives of this management plan have been established in accordance with the EPA's *Guidelines for the protection of terrestrial fauna* and the *National Recovery Plan for Malleefowl* (Benshemesh 2000).

The Environmental Protection Authority's (EPA) objective for terrestrial fauna is to maintain the abundance, species diversity and geographical distribution of terrestrial fauna and protect specially protected fauna consistent with the provision of the *Wildlife Conservation Act* 1950.

The National Recovery Plan for Malleefowl lists National management actions for Malleefowl populations, whilst some of the initiatives and proposals in the national plan are not relevant at the local scale. The following strategies have been selected by Jupiter to incorporate into key objectives for CYIP:

Securing existing population
- Securing habitat
- Reducing fire threat
- Reducing predation
- Reducing road deaths of Malleefowl

Obtain information for adequate management of the species
- Determine current and future distribution
- Monitor trends in species abundance
- Describe habitat requirements in the local area for the Malleefowl

These strategies have been broken down into objectives within the Management Program Summary in Section 6 and used as the foundation of management actions to ensure that the CYIP has no significant impacts on any population of Malleefowl occurring in the project areas.

3.1 PRIMARY MANGEMENT OBJECTIVES

Avoidance of impacts is Jupiter's primary objective for management of threatened species. Numerous baseline surveys and an iterative design process will help Jupiter to achieve this objective. Notwithstanding this, and in light of the significance of the species, Jupiter has prepared this Malleefowl Management Plan with the following primary management objectives:

1. Ensure no significant impacts occur to the local population status as a result of Jupiter's CYIP activities; and
2. To document ongoing Malleefowl management and monitoring commitments throughout the CYIP.

4. Management Program Summary

The Specific objectives and actions detailed below in Table 4 are based on those identified in the National Malleefowl Recovery Plan (2000) and aim to:

Table 4 – Mt Mason Project Malleefowl Management Plan

Key Issue	Objective	Management Action	Responsibility
Secure existing population	Identify Malleefowl mounds and Malleefowl habitat and minimise impact in these areas	• Targeted Malleefowl surveys will occur for all proposed disturbance areas prior to construction • A clearance survey will be conducted across the project disturbance areas prior to commencement of clearing (including already surveyed areas) to record new active mounds • A minimum 250m buffer around known active mounds will be maintained within which there will be no works (including vehicles, clearing for drilling) where practicable: with the exception of MFM001 which has been allocated a 185m buffer due to avoidance of other constraints in the area such as heritage sites. • In the vicinity of the buffer of MFM001 (towards Metzke Road tie-in), a 40km speed limit will be imposed on the proposed haul /access road. • A 50m buffer from inactive mounds <20years in age will be maintain within which there will be no works where practicable. • The following hierarchy of management will occur to manage the presence of active mounds: 1. Avoid – through engineering/redesign in infrastructure 2. If unavoidable, then clearing may occur within 250m buffer of active mound between April-June (outside of nesting & incubation period) 3. If impracticable to delay clearing to when nest becomes inactive, then the appropriate regulatory authorities will be contacted and advice sought on best management practice in the context of the specific circumstance.	Environmental Coordinator

Key Issue	Objective	Management Action	Responsibility
		• Lighting will be directed onto construction or operational areas, away from surrounding fauna habitat to minimise impact to Malleefowl activity • Ongoing monitoring of all inactive and active mounds to occur as per Monitoring Plan and information regularly updated in the Malleefowl Portal of the Environmental Database (Appendix 2)	
Secure existing population	Educate employees and contractors of the importance of conserving Malleefowl and their habitat	• Maintain a component on Malleefowl protection and management within the site environmental induction. All site personal and contractors to undergo induction. • Environmental training to be provided to all personnel on site including conservation significance of fauna, relevant environmental conditions and commitments and incident reporting system. • All fauna injuries of mortalities will be reported to the Site Environmental Coordinator within 24 hours in accordance with the incident reporting system.	Environmental Coordinator
Fire threat	Reduce the occurrence of large fires to protect Malleefowl habitat	• Develop and implement a Fire Management Plan in consultation with Fire and Emergency Services (FESA) and/or DEC. The Fire Management Plan will outline appropriate fire prevention and fire management strategies that prevent and reduce the risk of large scale fires starting and spreading due to the activities associated with the Mt Mason DSO Hematite mining operations • Minimise risk of fire occurring by implementing the management strategies outlined in the Fire Management Plan.	OHS/Environmental Manager
Predation	Monitor and reduce feral predator numbers	• Develop and implement a predator control program aimed at reducing Malleefowl predator numbers in the project areas • Include information on feral species management and control in the on-site environmental inductions for all employees and contractors. Inductions will be completed prior to staff or contractors commencing work on site. Inductions will include how to report any sightings of feral animals.	Environmental Coordinator

Key Issue	Objective	Management Action	Responsibility
Vehicle interaction	Minimise risk of vehicle and Malleefowl interactions	• Warning signs (e.g. road signs) will be erected at least 100 m from active Malleefowl mounds and will indicate possible presence of the species. • Vehicle access and vehicle speed will be limited around known active Malleefowl mounds. For example, in the vicinity of MFM001, a 40km/hr speed limit will be imposed. • All project vehicles will remain on designated tracks and no new tracks will be created without approval. • Site personnel will be directed to record and report all sightings of, or interactions involving Malleefowl. All site personnel to be educated on these requirements via the compulsory site induction and onsite training. • Night time vehicle movements will be restricted wherever possible to minimise potential of fauna strikes (including Malleefowl) • Malleefowl deaths and injuries due to vehicle incidents will be recorded and reported to DEC.	Environmental Coordinator Environmental Coordinator
Monitoring	Monitor trends in Malleefowl abundance and distribution and assess threats	• Maintain a Malleefowl Monitoring Procedure to monitor active mounds and breeding activities of local populations. Monitoring to be undertaken at a minimum annually during breeding season (i.e. September). Monitoring will be conducted as outlined in the Jupiter Mines Limited Malleefowl Monitoring Procedure (Appendix 4) • Establish a protocol for recording sightings of live Malleefowl and mounds on the site. Details of the protocol will be included in the staff and contractors' induction programs. Data from these recordings will be included in the annual reporting to DEC • Maintain existing and add new data to the Malleefowl Portal of the Environmental Database – example shown in Appendix 2	Environmental Coordinator

Key Issue	Objective	Management Action	Responsibility
		• Report Malleefowl monitoring results to DEC on an annual basis (to be included in annual environmental report)	
Community/Monitoring	Document ongoing Malleefowl management and monitoring commitments	• Share data obtained with relevant stakeholders including Malleefowl Preservation Group (MPG) & DEC to contribute to regional conservation of the species • Continue to liaise with MPG and relevant conservation groups regarding Malleefowl Management and where practicable, involve in monitoring activities or training.	Environmental Coordinator
Malleefowl habitat requirements	Maintain existing habitat and minimise loss of potential Malleefowl habitat	• Undertake a pre-construction targeted Malleefowl survey and monitoring program (as outlined in the Jupiter Mines Limited Malleefowl Monitoring Procedure) thereafter to confirm local distribution and any local habitat "hot spots" • All exploration activity related clearing will avoid Malleefowl Mounds (minimum 100m buffer) and buffer clearly demarcated • Implement the Land Clearing Management Strategy (Appendix 5) and related procedures to ensure no clearing of Malleefowl habitat occurs without the necessary approvals. • Clearing for the project for construction and operation purposes will be restricted to those areas that are strictly necessary for the development and operation of the project. • Approved clearing boundaries will be marked in field and recorded on GPS. • All vegetation clearing within the vicinity of known active mounds will occur between April and June (outside nesting and incubation period). • Rehabilitation will be undertaken in accordance with relevant conditions/Rehabilitation Plan, and tailored to relevant surrounding vegetation communities/potential Malleefowl habitat to be replaced • Provide monitoring data and reports to all interested parties on an annual basis to assist with monitoring species abundance and distribution	Environmental Coordinator Environmental Coordinator

Key Issue	Objective	Management Action	Responsibility
Project coordination and review	Project coordination and review	• A compliance audit of the management plan and actions performed under the plan will be undertaken annually. A review of the management plan will be undertaken at the completion of the construction phase of the project and every two subsequent years	Environmental Coordinator
Contingency	Contingency measures	• In the event that performance indicators are not being met, implement contingency measures in consultation with the DEC.	Environmental Manager

5. PERFORMANCE INDICATORS

Jupiter's performance will be reviewed against the following indicators:

- Monitoring results of Malleefowl mortality due to road deaths; and
- Workforce awareness of Malleefowl conservation measures.

6. RESPONSIBILITY

The Environmental Manager will be responsible for ensuring that the Malleefowl Management Plan is implemented, and reviewed when required.

The Site Environmental Officer will be responsible for the ongoing monitoring of Malleefowl and implementation of the Management Plan.

7. DECOMMISSIONING PHASE

Any rehabilitation or decommissioning activity within the Malleefowl habitat areas will be undertaken in a manner that is consistent with this Management Plan and the Closure Plan submitted to the Department of Mines and Petroleum (DMP).

8. AUDITING

Jupiter will conduct compliance audits against commitments in this Management Plan annually.

The Management Plan will be regularly reviewed and modified as necessary in the light of new information, monitoring results and progress on management actions. Jupiter, in consultation with the DEC, will review and update the plan two years after project commencement. The timing of subsequent reviews will be determined after the initial review but will occur no later than at two yearly intervals.

9. REPORTING

9.1 JUPITER INTERNAL REPORTING

All employees and contractors will be required to report any evidence of Malleefowl populations in the project area to the Site Environmental Officer, via their supervisor. This includes sightings, mounds, road kills and other evidence of their presence, for example tracks and feathers.

9.2 EXTERNAL REPORTING

All environmental reporting will be completed in accordance with statutory requirements and submitted to the appropriate authorities when required.

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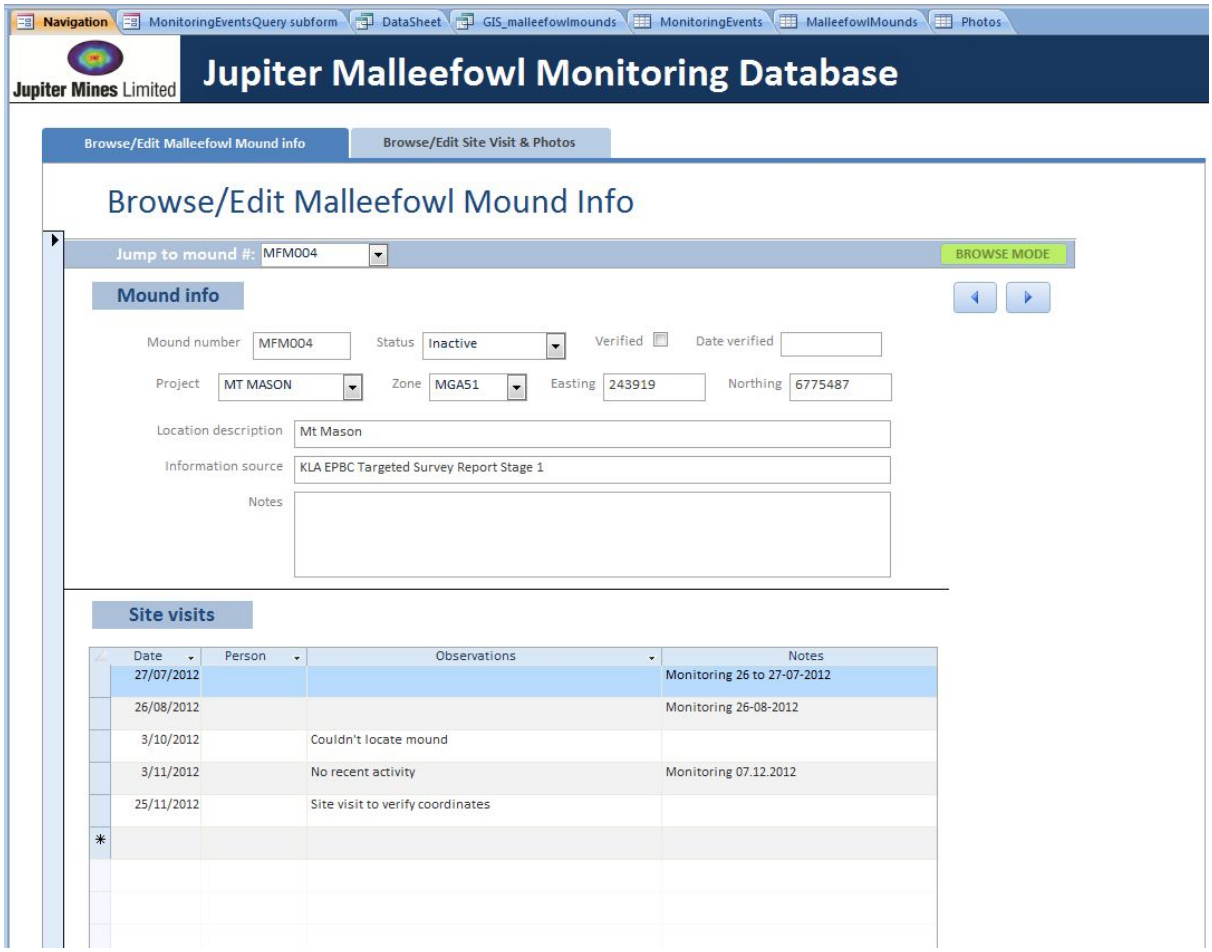
Appendix 1

Jupiter Mines Limited Survey Summary Results Table

MoundID	Project	Location	Easting	Northing	Zone	Status	Approx age (yrs)	st monitored da	InfoSource	Date verified
MFM001	MT MASON	Metzke Rd	244107	6772871	MGA51	Active	<2	07-Dec-12	KLA Mount Mason Level 2 Fauna Assessment & KLA Targeted EPBC survey	Apr-12
MFM002	MT MASON	near haul access L29/100	244454	6771833	MGA51	Inactive	<5	07-Dec-12	KLA EPBC Targeted Survey	Apr-12
MFM003	MT MASON	Mt Mason at MMWB005	243523	6776262	MGA51	Inactive	>30	07-Dec-12	KLA Mount Mason Level 2 Fauna Assessment & KLA Targeted EPBC survey	Mar-12
MFM004	MT MASON	Mt Mason	243919	6775487	MGA51	Inactive	>100	25-Nov-12	KLA Mount Mason Level 2 Fauna Assessment & KLA Targeted EPBC Survey	Apr-12
MFM006	MT IDA	Mt Ida at 11MIRC178	248946	6766024	MGA51	Inactive	>50	09-Dec-12	CYIP - Mt Ida - Level 2 Fauna Assessment	Apr-12
MFM007	MT IDA	Mt Ida near 11MIRC192	248847	6766280	MGA51	*Active	>50	09-Dec-12	CYIP - Mt Ida - Level 2 Fauna Assessment	requires verification
MFM009	MT IDA	Mt Ida Access Road	250251	6767189	MGA51	Inactive	>50	12-Dec-12	CYIP - Mt Ida - Level 2 Fauna Assessment	Apr-12
MFM010	MT MASON	Off Metzke Rd	245522	6774136	MGA51	Inactive	<20	24-Nov-12	Targeted EPBC Survey	Apr-12
MFM011	MT MASON	Off Metzke Rd	245590	6774104	MGA51	Inactive	undetermined	24-Nov-12	Outback Ecology Report Jan 2007 & KLA March 2012 (unable to locate)	Jan-07
MFM012	MT MASON	Off Mt Mason Rd near Callup Point 3	243723	6774411	MGA51	Inactive	>100	24-Nov-12	KLA Mount Mason Level 2 Fauna Assessment & KLA Targeted EPBC survey	Apr-12
MFM013	MT MASON	Off Mt Mason Rd near Callup Point 3	243631	6774448	MGA51	Inactive	>100	24-Nov-12	KLA Mount Mason Level 2 Fauna Assessment & KLA Targeted EPBC survey	Apr-12
MFM014	MT MASON	Off Mt Mason Rd near Callup Point 3	243785	6774458	MGA51	Inactive	>100	24-Nov-12	KLA Mount Mason Level 2 Fauna Assessment & KLA Targeted EPBC survey	Apr-12
MFM015	MT MASON	Mt Mason close to MFM004	243895	6775506	MGA51	Inactive	>100	25-Nov-12	KLA Mount Mason Level 2 Fauna Assessment & KLA Targeted EPBC survey	Apr-12
MFM016	MT IDA	Mt Ida, off track past MIMON 05	250846	6765291	MGA51	Inactive	>50	09-Dec-12	CYIP - Mt Ida - Level 2 Fauna Assessment	Apr-12
MFM017	MT IDA	Mt Ida, off track past MIMON 05	250844	6765318	MGA51	Inactive	>50	09-Dec-12	CYIP - Mt Ida - Level 2 Fauna Assessment	Apr-12
MFM020	MT IDA	Mt Ida near 11MIRC160	248940	6765745	MGA51	Inactive	>50	25-Nov-12	CYIP - Mt Ida - Level 2 Fauna Assessment	Apr-12
MFM021	MT IDA	Close to track, closest hole is 11MIRC108	248076	6765150	MGA51	Inactive	>50	27-Nov-12	CYIP - Mt Ida - Level 2 Fauna Assessment	Apr-12
MFM022	MT IDA	could note locate	248470	6765246	MGA52	Inactive	undetermined		CYIP - Mt Ida - Level 2 Fauna Assessment	Apr-12
MFM023	MT IDA	Close to track off Pipeline Rd	248988	6768947	MGA51	Inactive	>50	07-Dec-12	CYIP - Mt Ida - Level 2 Fauna Assessment	Apr-12
MFM024	MT MASON	near MOC pipeline	244106	6776206	MGA51	Inactive	>100	14-Jan-13	KLA EPBC Targeted Survey Report	Mar-12
MFM025	MT MASON	near MOC	244163	6776325	MGA51	Inactive	>100	14-Jan-13	KLA EPBC Targeted Survey Report	Mar-12
MFM026	MT MASON	MOC	244256	6776365	MGA51	Inactive	>100	14-Jan-13	KLA EPBC Targeted Survey Report	Mar-12
MFM027	MT MASON	ROM (outer edge)	243901	6776348	MGA51	Inactive	>100	14-Jan-13	KLA EPBC Targeted Survey Report	Mar-12
MFM028	MT MASON	ROM (stockpile)	243814	6776136	MGA51	Inactive	>150	14-Jan-13	KLA EPBC Targeted Survey Report	Mar-12
MFM029	MT MASON	MOC	243546	6776264	MGA51	Inactive	>100	14-Jan-13	KLA EPBC Targeted Survey Report	Mar-12
MFM030	MT MASON	MOC	244263	6776311	MGA51	Inactive	>50	14-Jan-13	KLA EPBC Targeted Survey Report	Mar-12
MFM031	MT MASON	MOC	244258	6776204	MGA51	Inactive	>150	14-Jan-13	KLA EPBC Targeted Survey Report	Mar-12
MFM032	MT MASON	MOC	244300	6776105	MGA51	Inactive	>150	14-Jan-13	KLA EPBC Targeted Survey Report	Mar-12
MFM033	MT MASON	MOC	244282	6776147	MGA51	Inactive	>150	14-Jan-13	KLA EPBC Targeted Survey Report	Mar-12
MFM034	MT MASON	outside pit	243796	6775881	MGA51	Inactive	>150	14-Jan-13	KLA EPBC Targeted Survey Report	Mar-12
MFM035	MT MASON	main pit (northern edge)	243252	6776321	MGA51	Inactive	>50	14-Jan-13	KLA EPBC Targeted Survey Report	Mar-12
MFM036	MT MASON	waste rock area	242895	6776065	MGA51	Inactive	>50	14-Jan-13	KLA EPBC Targeted Survey Report	Mar-12
MFM037	MT MASON	west of waste rock area	242574	6776064	MGA51	Inactive	>50	14-Jan-13	KLA EPBC Targeted Survey Report	Mar-12
MFM038	MT MASON	near waste rock drainage	242998	6775688	MGA51	Inactive	>150	14-Jan-13	KLA EPBC Targeted Survey Report	Mar-12
MFM039	MT MASON	west of waste rock area	242503	6776012	MGA51	Inactive	>100	14-Jan-13	KLA EPBC Targeted Survey Report	Mar-12
MFM040	MT IDA	Haul Road	243606	6770906	MGA51	Inactive	undetermined	14-Jan-13	Glen Gaikhorst & Tim Moulds (GHD)	Mar-12
MFM041	MT IDA	Haul Road	242360	6770639	MGA51	Inactive	undetermined	14-Jan-13	Glen Gaikhorst & Tim Moulds (GHD)	Mar-12
MFM042	MT IDA	Haul Road	242949	6769562	MGA51	Inactive	undetermined	26-Jan-13	Glen Gaikhorst & Tim Moulds (GHD)	Mar-12
MFM043	MT IDA	Haul Road	244560	6757792	MGA51	Active	<20	26-Jan-13	Glen Gaikhorst & Tim Moulds (GHD)	Nov-12
MFM044	MT IDA	Haul Road	244608	6756687	MGA51	Active	<20	26-Jan-13	Glen Gaikhorst & Tim Moulds (GHD)	Nov-12
MFM045	MT IDA	Haul Road	244647	6758880	MGA51	Active	<20	26-Jan-13	Glen Gaikhorst & Tim Moulds (GHD)	Nov-12
MFM046	MT IDA	Haul Road	244912	6758932	MGA51	Inactive	undetermined	14-Jan-13	Glen Gaikhorst & Tim Moulds (GHD)	Nov-12
MFM047	MT IDA	Haul Road	241166	6756184	MGA51	Active	<20	26-Jan-13	Glen Gaikhorst & Tim Moulds (GHD)	Nov-12
MFM049	MT MASON	Near explosives track	244420	6776580	MGA51	Inactive	undetermined	10-Feb-13	Merri Bartlett (Jupiter Site Environmental Officer)	requires verification
MFM050	MT MASON	near Haul Road G29/22	244958	6768612	MGA51	Inactive	>50	n/a	KLA EPBC Targeted Survey Report	Apr-12
MFM051	MT MASON	near Haul Road G29/23	244977	6767975	MGA51	Inactive	>50	n/a	KLA EPBC Targeted Survey Report	Apr-12
MFM052	MT MASON	near Haul Road L29/121	248656	6754952	MGA51	Inactive	>50	n/a	KLA EPBC Targeted Survey Report	Apr-12
MFM053	MT MASON	near Haul Road L29/121	248852	6754862	MGA51	Inactive	>100	n/a	KLA EPBC Targeted Survey Report	Apr-12
MFM054	MT MASON	near haul road L29/121	248977	6754701	MGA51	Inactive	>100	n/a	KLA EPBC Targeted Survey Report	Apr-12
MFM055	MT MASON	near Haul Road L29/121	249655	6754132	MGA51	Inactive	>100	n/a	KLA EPBC Targeted Survey Report	Apr-12
MFM056	MT MASON	near Haul Road L29/121	249923	6753883	MGA51	Inactive	>100	n/a	KLA EPBC Targeted Survey Report	Apr-12
MFM057	MT MASON	near Haul Road L29/121	250227	6753693	MGA51	Inactive	>100	n/a	KLA EPBC Targeted Survey Report	Apr-12
MFM058	MT MASON	near Haul Road L29/121	250204	6753620	MGA51	Inactive	>100	n/a	KLA EPBC Targeted Survey Report	Apr-12
MFM059	MT MASON	near original tie in	253603	6751822	MGA51	Inactive	>100	n/a	KLA EPBC Targeted Survey Report	Apr-12

* appears to have changed status (from recent monitoring data)and requires verification by professional prior to accurate status to be proclaimed

Appendix 2
Jupiter Mines Limited Environmental Database – Malleefowl Portal Example



Appendix 3
Jupiter Mines Limited CYIP Malleefowl Monitoring Procedure

Jupiter Mines Limited

MALLEEFOWL MONITORING PROCEDURE

PURPOSE: The purpose of this procedure is to outline the Malleefowl monitoring requirements for Jupiter Mines Limited Tenements (JMT) in accordance with relative legislation and Jupiter's internal Management Plans

The objectives are to:

- Ensure legal compliance within the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act 1999) and the 2007 IUCN Red List of Threatened Species.
- Comply with the Jupiter Mines Limited Malleefowl Management Plan
- Increase data and knowledge of Malleefowl habitat and breeding areas in the JMT
- Monitor and manage mining & exploration impacts on Malleefowl populations within the JMT

SCOPE: This procedure shall apply to all Jupiter Mines Limited ('Jupiter') exploration activities.

RELEVANT LEGISLATION:

- *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act 1999)
- *Wildlife Conservation Act* 1950
- The 2007 IUCN Red List of Threatened Species.

RESPONSIBILITIES

Environmental Manager - Ensure compliance is maintained against relative legislation and the JML Malleefowl Management Plan

Environmental Coordinator - Manage and review the collection, collaboration, reporting and review of Malleefowl monitoring data

Site Environmental Officer - Undertake the monitoring of Malleefowl mounds as outlined in this procedure

EQUIPMENT

- Monitoring clipboard folder & pen
- GPS with all Malleefowl mound locations pre-loaded
- ENV-FRM-007 Malleefowl Monitoring Field Sheet
- Digital Camera for optical monitoring
- Motion Sensing Camera for filmic monitoring
- Wooden stake, hammer, rope & cable ties
- General PPE

MONITORING FREQUENCY

- Inactive Malleefowl Mounds (Optical Monitoring) is to be conducted annually
- Active Malleefowl Mounds (Filmic Monitoring) is to be conducted on a quarterly basis

PROCEDURE

1.0 OPTICAL MONITORING	• Locate each "inactive" Malleefowl Mound using the GPS cords (pre-load GPS) provided in appendix one displayed in the map appendix two • Once you have arrived at your first "inactive" mound, the mound is to be assessed for signs of recent activities including, but not restricted to, the presence of scratching in the substrate, moulted feathers or signs of recent egg hatching, changes in mound size. Please record your findings on ENV-FRM-007.

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	• Once all comments have been recorded a photo(s) of each mound are to be taken and the following data is to be documented on ENV-FRM-007 form: Mound ID, GPS coordinates of photo(s), bearing of photo(s), time photo(s) were taken.
2.0 FILMIC MONITORING	• Locate each "active" Malleefowl Mound using the GPS cords provided in appendix one and displayed in appendix two. Please be careful when working in the area for Malleefowl birds (please park all vehicles at least 50 meters away from known active mounds and walk to the mound). • Prior to setting up motion camera please complete a manual monitoring record (as per optical method) for the active mound (please complete form ENV-FRM-007) • Once you have completed the manual record of the active mound, find an appropriate location approximately 15 meters away from the active mound to set the motion sensor camera up. The camera must be set up (if possible) facing either north or south top reduce sun glare. Please also ensure the selected location has a clear view of the mound (no trees in view as this will set the motion camera off all the time). • Hammer the stake into the ground. Turn the camera on and ensure the camera is set to video mode and video length is set to 20 seconds and that the SD card is present in the camera. Hold the camera against the stake and ensure selected location has appropriate view of the mound (view through camera). Once happy mount the camera onto the stake using the ties on the camera and secure it with cable ties • Carefully leave the site making sure not to walk in front of the camera. • The cameras are to be left monitoring a mound for two weeks • At the completion of the two week monitoring period head back to the monitoring site remove camera from stake and turn the camera off • Take the camera back to the office for downloading of data
3.0 DATA MANAGEMENT	All field monitoring data sheets (for both optical and filmic monitoring) to be entered into the Malleefowl Monitoring data base "JupiterMalleefowlMonitoringDB.accdb" located under *N:\ENVIRONMENT\8_Monitoring\JupiterMalleefowlMonitoringDB.* All photos must be downloaded and labelled Year-Month-Day- Mound ID-Photo Number (e.g. 2012-07-27_MFM001_01.jpg) and saved under *N:\ENVIRONMENT\8_Monitoring\JupiterMalleefowlMonitoringDB\Photos.* The photos must be linked into the database when entering the field monitoring forms
4.0 REPORTING	Reference to this procedure should be included in the Annual Environmental Report (AER) and the Malleefowl Management Plan to be submitted to the Department of Sustainability, Environment, Water, Population and Communities (DSEWPC).
5.0 RELEVANT DOCUMENTS	• ENV-FRM-007 Malleefowl Monitoring Field Sheet • Database "JupiterMalleefowlMonitoringDB.accdb" • Central Yilgarn Iron Project Malleefowl Management Plan
7.0 ATTACHMENTS	• List of Malleefowl Mound Coordinates Map displaying inactive and active Malleefowl Mound locations

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ATTACHMENT ONE

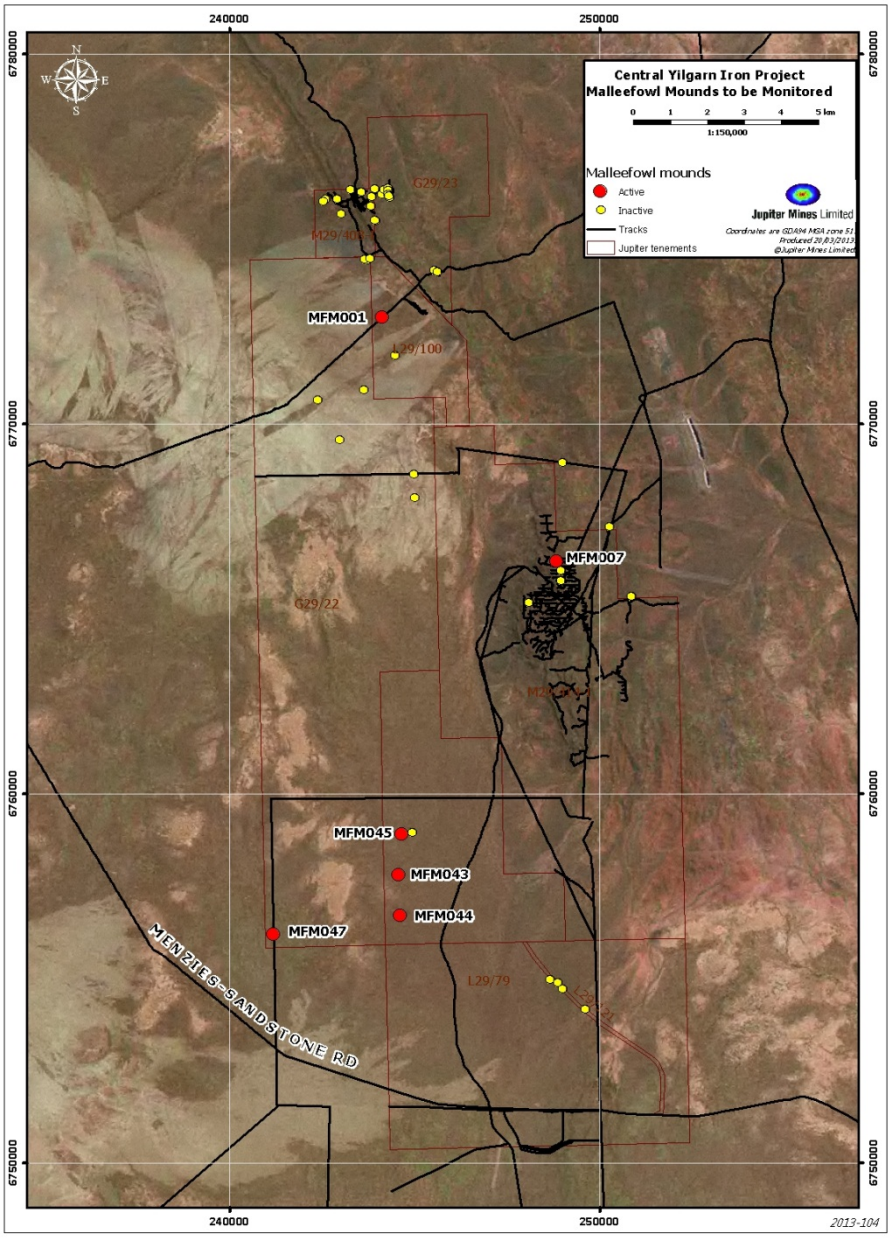
Table 1: Table of all known Inactive and active Malleefowl mounds within the Central Yilgarn Iron Project Area that require monitoring

MoundID	Project	Easting	Northing
MFM001	MT MASON	244107	6772871
MFM002	MT MASON	244454	6771833
MFM003	MT MASON	243523	6776262
MFM004	MT MASON	243919	6775487
MFM006	MT IDA	248946	6766024
MFM007	MT IDA	248847	6766280
MFM009	MT IDA	250251	6767189
MFM010	MT MASON	245522	6774136
MFM011	MT MASON	245590	6774104
MFM012	MT MASON	243723	6774411
MFM013	MT MASON	243631	6774448
MFM014	MT MASON	243785	6774458
MFM015	MT MASON	243895	6775506
MFM016	MT IDA	250846	6765291
MFM017	MT IDA	250844	6765318
MFM020	MT IDA	248940	6765745
MFM021	MT IDA	248076	6765150
MFM022	MT IDA	248470	6765246
MFM023	MT IDA	248988	6768947
MFM024	MT MASON	244106	6776206
MFM025	MT MASON	244163	6776325
MFM026	MT MASON	244256	6776365
MFM027	MT MASON	243901	6776348
MFM028	MT MASON	243814	6776136
MFM029	MT MASON	243546	6776264
MFM030	MT MASON	244263	6776311
MFM031	MT MASON	244258	6776204
MFM032	MT MASON	244300	6776105
MFM033	MT MASON	244282	6776147
MFM034	MT MASON	243796	6775881
MFM035	MT MASON	243252	6776321
MFM036	MT MASON	242895	6776065
MFM037	MT MASON	242574	6776064
MFM038	MT MASON	242998	6775688
MFM039	MT MASON	242503	6776012
MFM040	MT IDA	243606	6770906
MFM041	MT IDA	242360	6770639
MFM042	MT IDA	242949	6769562

MFM043	MT IDA	244560	6757792
MFM044	MT IDA	244608	6756687
MFM045	MT IDA	244647	6758880
MFM046	MT IDA	244912	6758932
MFM047	MT IDA	241166	6756184
MFM049	MT MASON	244420	6776580
MFM050	MT MASON	244958	6768612
MFM051	MT MASON	244977	6767975
MFM052	MT MASON	248656	6754952
MFM053	MT MASON	248852	6754862
MFM054	MT MASON	248977	6754701
MFM055	MT MASON	249655	6754132
MFM056	MT MASON	249923	6753883
MFM057	MT MASON	250227	6753693
MFM058	MT MASON	250204	6753620
MFM059	MT MASON	253603	6751822

ATTACHMENT TWO

Map 1: Map displaying the location of all known Inactive and active Malleefowl mounds within the Central Yilgarn Iron Project Area that require monitoring



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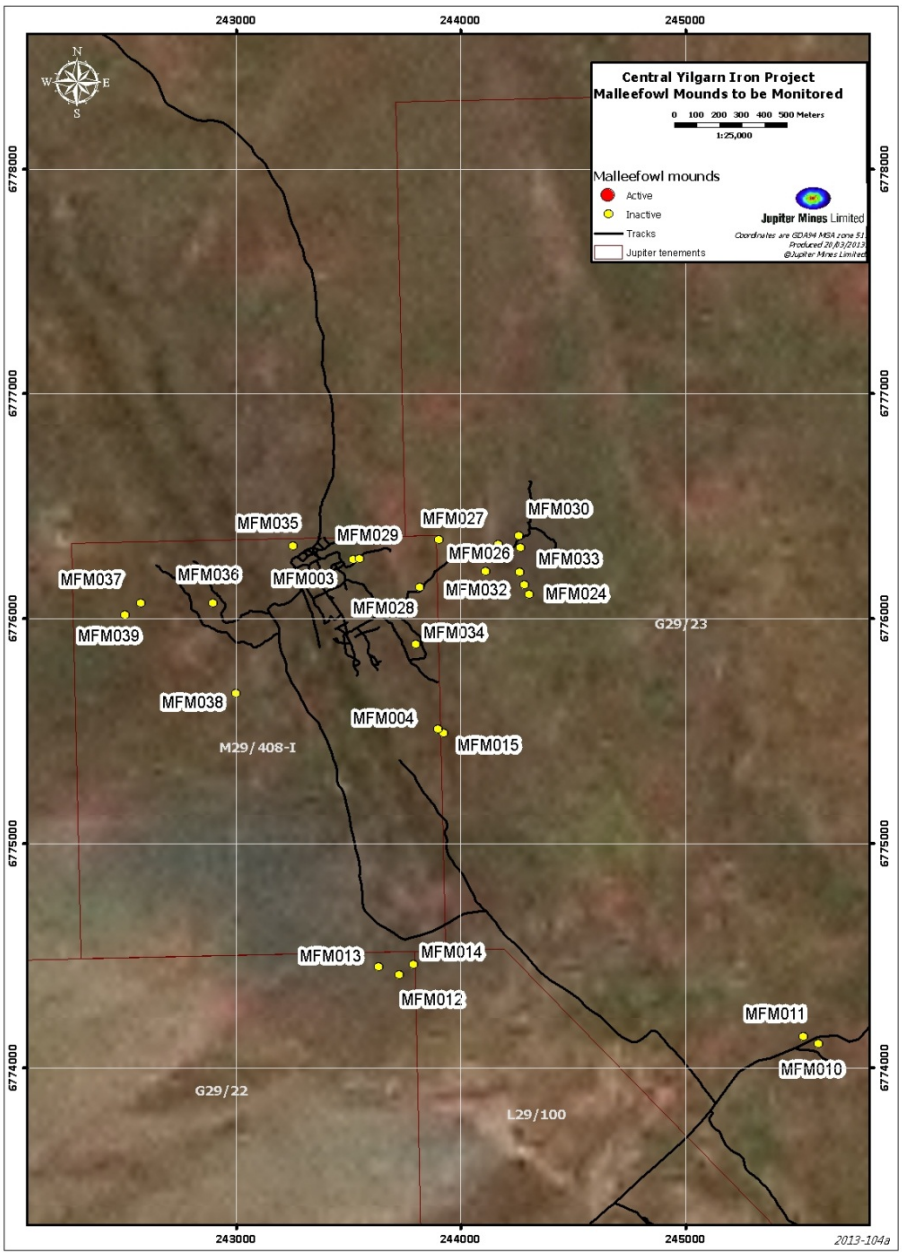
Map 2: Map displaying the location all active and inactive mounds on tenements M29/4081-1, G29/22, L29/100 & G29/23



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Appendix 4

Jupiter Mines Limited Malleefowl Preservation Group Sponsorship Agreement

MALLEEFOWL
Preservation Group Inc.

9 April 2013

Mr Greg Kaeding
Manager Environment
Jupiter Mines Ltd
P Box Z5117
Perth WA 6000

Dear Greg,

Re: Sponsorship 2012-2013

Please find attached our receipt no 3535 for your 2012-2013 Sponsorship, for which we are extremely grateful.

Alan and Susanne Dennings will continue liaising with you to organise public acknowledgement of your support.

Regards,

Claudine Deering
Office Manager

"It's gnow or never"

MALLEEFOWL PRESERVATION GROUP INC.
P.O. Box 29, Ongerup 6336, Western Australia - Phone: (08) 9828 2007, Fax: (08) 9828 2018
email: malleefowl.wa@wn.com.au - www.malleefowl.com.au

MALLEEFOWL PRESERVATION GROUP INC.

P.O. Box 29, Ongerup, W.A. 6336
Phone (08) 9828 2007, Fax (08) 9828 2018

RECEIPT
3535

Date 09.04.13

Received from Jupiter Mines Ltd

the sum of Twenty two thousand dollars

cents

Being for Inv. 213-648 - 2012-13 Sponsorship.

$ 22,000.00

Signature

Appendix 5

Jupiter Mines Limited CYIP Land Clearing and Ground Disturbance Procedure

Jupiter Mines Limited

GROUND DISTURBANCE PROCEDURE

PURPOSE: The purpose of this procedure is to mitigate compliance breaches during exploration activities arising from vegetation clearing and ground disturbance associated with access and drilling site preparation.

SCOPE: This procedure shall apply to all Jupiter Mines Limited ('Jupiter') exploration activities.

RELEVANT LEGISLATION:

- *Environmental Protection Act 1986.*
- *Environmental Protection (Clearing of Native Vegetation) Regulations 2004.*

RESPONSIBILITIES

Exploration Manager shall be accountable for ensuring the requirements of this procedure are adhered to and that all Project Geologists are trained or supervised on the requirements of this procedure. They shall also ensure that:

- each **Exploration Proposal** (whether Drilling and sampling or work proposals) complies with JML procedures, environmental and heritage management plans and all statutory requirements such as, but not limited to tenement conditions and POW requirements
- Sign of the final **Exploration Proposal** authorising the implementation of the program

Environmental Manager will facilitate the development of any Exploration Environmental Management Plans where required and liaise with Government Departments to ensure that the management plans meet their requirements.

Environmental Coordinator: shall

- Conduct (and document) a desktop environmental Impact Assessments (EIA's) of proposed Exploration Proposal work areas
- compile all external regulatory approval documents (e.g. POWs) and ensure they meet JML and DMP requirements prior to submission
- Provide advice and support where approvals in addition to POWs are required,
- Provide advice and manage environmental surveys required to ensure legal obligations relating to ground disturbance, land clearing, and pertaining to threatened species protection can be met, and
- Resources are available to manage the GIS layer used to ensure compliance with exploration approvals

Project Geologist is responsible for:

- Responsible for compiling Exploration Proposals
- Ensuring that all relevant approvals are obtained prior to the commencement of any land and vegetation disturbance
- Ensuring that all ground disturbance is conducted in accordance with all approvals and implemented as outlined in the authorised documented work/drill proposal

Senior Field Technician: is responsible for ground truthing and flagging all ground disturbance proposals under the supervision of the Project Geologist, track logging all cleared access tracks and sending through GIS/track log data to the Database Manager

Site Environmental Advisor: is responsible for supervising all machine operators and ensuring they are aware of all program requirements & approval conditions prior to ground disturbance commencing

Database Manager shall:

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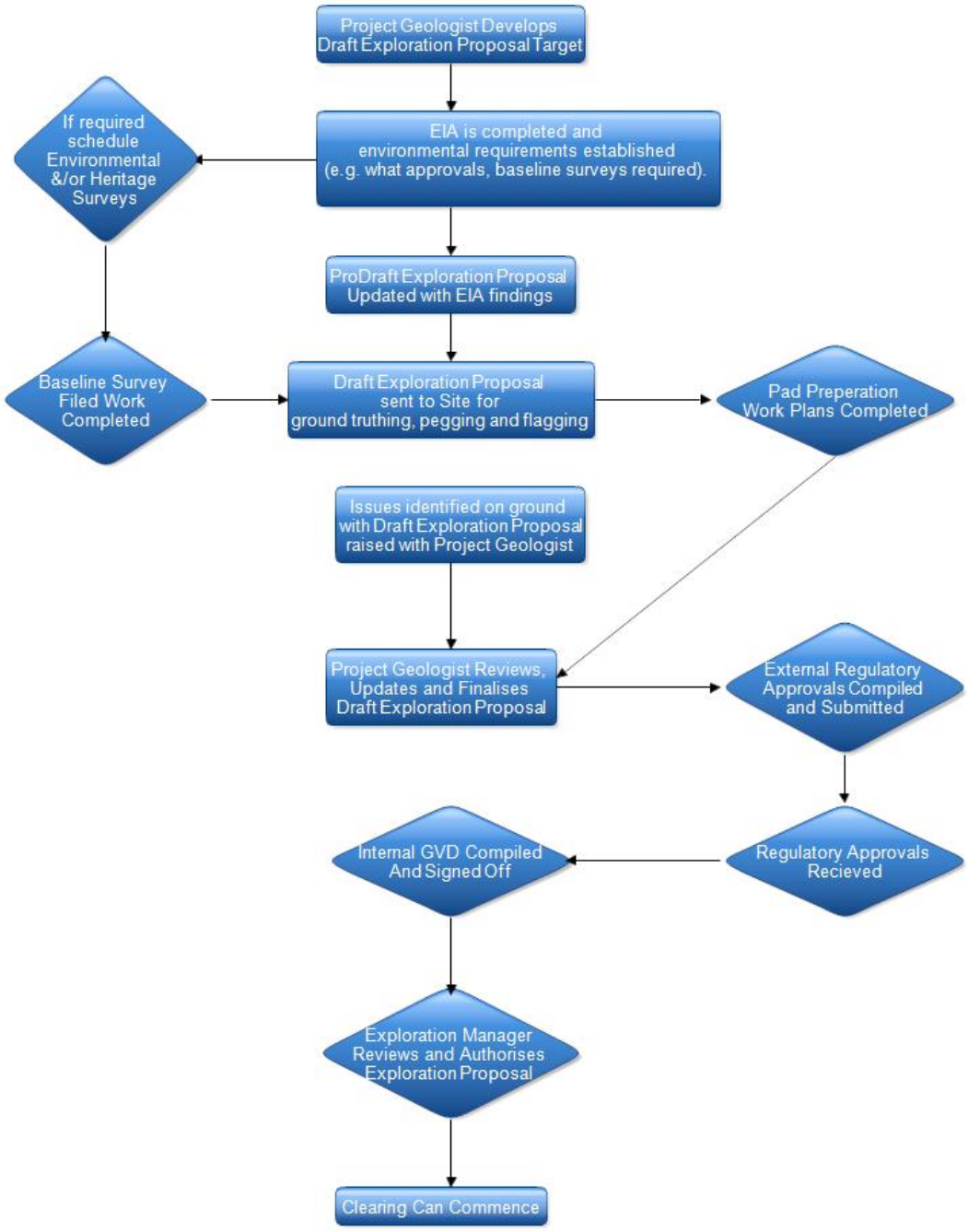
- Maintain GIS layers including the Threatened Flora, Threatened Fauna, Baseline Surevys and Archaeological or Potential Sites, and Archaeological sites buffer layers
- Ensure that the proposed drill holes are included in the Drilling Database.

Machine Operators shall conduct the clearing as per JML procedures and as outlined in the authorised *Exploration Proposal*

Image 1: Ground Disturbance Work Flow



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PROCEDURE	
1.0 PLANNING	**1.1** Project Geologist is to provide Environmental Coordinator with details of **proposed** *Exploration Proposal* (wether drilling & sampling or work proposals). Project geologist to provide Environmental Coordinator with maps of proposed work/drill program, shape files of all proposed disturbance areas, GPS cords of all drill site and any other additional information. **1.2** Upon receiving proposed program data, the Environmental Coordinator is to conduct a desktop assessment and provide a written EIA summary. The EIA will identify any of the following in the proposed disturbance area and these will be clearly communicated to field personnel and equipment operators and if necessary demarcated prior to the commencement of any disturbance activity: - Declared Rare or Specially Protected Flora and Fauna (DRF) that are gazetted under the WA Wildlife Conservation Act 1950 - Threatened Flora and Fauna that are listed under the Commonwealth Environmental Protection and Biodiversity Act 1999 - Aboriginal and Non-aboriginal Heritage or Cultural sites - Sites of environmental conservation significance **1.3** Project geologists are to compile a *Draft Exploration Proposal* document. The proposal will document: - GIS coordinates of drill holes - Map of proposed clearing programme - Include the EIA that environmental department have completed - Any work/drill program specific information **1.4** The *Draft Exploration Proposal* is to be provided to Senior Field Technician, Site Geologist &/or Site Environmental Personnel, and the proposed work program is to be ground truthed and flagged (as outlined under Section 4.0 below). Any access or potential operational issues (e.g. cut and fill drill pads need, proposed access not achievable) **MUST** be identified and alternatives suggested (GPS cords provide of new drill/disturbance sites and alternative access tracks provided in the form of track logs). All alternatives are to be pegged and flagged (as per the flagging standard outlined in Section 4.0 of this procedure). **1.5** The Project Geologist is to update the *Draft Exploration Proposal* document with any suggested changes from the pegging/ground truthing phase. **1.6** Once updated the Exploration Manager is to authorise and sign off on the *Exploration Proposal* and circulate to all required parties **Please note: No ground or vegetation disturbing activities can commence until the all external approvals have been obtained from the necessary regulatory and third parties.**
2.0 EXTERNAL APPROVALS	**2.1** The Environmental Coordinator is to submit & obtain a Programme of Work approval from the required regulatory body (and any other environmental approvals required for the work/drilling program that were identified in the desktop EIA). **2.2** The Environmental Coordinator is responsible for ensuring the planned exploration work is discussed with stakeholders who may be impacted by, or have a vested interest in, the activities. This may include: - Communities living in close proximity to the area or work that may be impacted by noise, dust or visual amenity. - Pastoralists, particularly where there are impacts in relation to stock watering areas, fences, gates or other property infrastructure. - Traditional owners or native title parties who may have a cultural or legal interest in the area.

	Any complaints from stakeholders are to be reported to the Exploration and or Environmental Manager and work ceased until approval to continue has been given.
3.0 INTERNAL APPROVALS	**3.1** Once all external approvals have been received the Environmental Coordinator is to complete a JML Ground Vegetation Disturbance (GVD) Permit for the authorised drill/work program and circulate to all required parties **3.2** The Project Geologist is responsible for obtaining all necessary signatures for the internal GVD permit **Ground clearing/disturbance can only occur once all of the following has occurred:** - **Exploration Manager has authorised the final Exploration Proposal document** - **All signatures have been received on the GVD Permit (must include signed site preparation plans if for drilling)** - **The work area has been ground truthed and flagged as per the authorised Exploration Proposal**
4.0 GROUND TRUTHING AND FLAGGING STANDARD	The proposed area to be cleared (as outlined in the draft Exploration Proposal is to be pegged and flagged by Field Assistants and/or project Geologist using the flagging standard below: **4.1** All access tracks are to be walked to ensure accessibility is possible and demarcated with pink flagging tape. The flagging tape is to be placed at head height and flagging should be visible at all times as the access is walked (see *Figure 1*). If the track is to continue beyond a drill pad, 3 flags of pink tape are to be shown in the required direction in quick succession (see *Figure 1*). If the track is not to continue beyond the drill pad pink tape is to be strung in a horizontal line to display the end of the required clearing (see *Figure 2*). **4.2** Drill Hole locations are to be pegged as per the drill/work proposal document. Each hole peg is to be flagged with yellow and blue flagging and contain the following information clearly on the peg: - Drill Hole Number - Drill Hole Coordinates - The azimuth of the planned hole - The dip of the planned hole - The approximate end of hole All drill hole data is to be obtained from the *Exploration Proposal* **4.3** Drill pads are measured out (when preparing RC or Diamond drills) as per the dimensions in the Exploration Proposal, and one peg with blue and yellow flagging placed in each corner. Yellow and blue flagging is then to be placed at regular intervals along each boundary of the pad at head height, clearly demarcating the boundary of the drill pad (see *Figure 3*). **4.4** Sensitive areas, including priority flora and heritage areas, are to be demarcated with orange and red flagging tape as per the instructions in the Exploration Proposal document. **4.5** At the completion of pegging each drill site (access track, hole collar and drill pad boundaries), and prior to continuing onto the next drill site/access track, a Site Preparation Work plan (see Attachment Two) is to be filled out (whilst ground truthing the access tracks/drill pads). Each drill hole/pad MUST have a Site Preparation Work Plan. Each Site Preparation Work Plan must clearly display: - Hole location - Proposed sample storage area (and core rack location if applicable) - Topsoil storage area - Vegetation topsoil area

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	- Sump location - Proposed drill rig location - Support and water truck location - Location of cyclone - Location of any mud tanks - Location of any other work equipment **4.6** Once confirmed each Site Preparation Work Plan needs to be signed off by the Geologist, Site Environmental Advisor and the Senior Driller. It is strongly advised that the drilling supervisor/senior driller inspects the proposed drill sites prior to any ground disturbance so alterations to Site Work Plans can be made if required **4.7** Any access or potential operational issues (e.g. cut and fill drill pads need, proposed access not achievable) **MUST** be identified and alternatives suggested to the Project Geologist asap (GPS cords of new drill/disturbance sites are required and alternative access tracks must be provided in the form of track logs. All alternatives are to be pegged and flagged
5.0 IMPLEMENTATION	**5.1** The *Draft Exploration Proposal* is to be updated to incorporate any alternatives suggested from section 4.0 of the procedure. **5.2** The Exploration Manager is to review and sign off on the *Exploration Proposal* (which must contain all required internal and external approval documents) and circulate for all required parties for Implementation. **5.3** All work is to be conducted and implemented on the ground as outlined and in accordance with the authorised *Exploration Proposal* document under the supervision of the Project Geologist/Site Environmental Advisor. **5.4** The Earthworks Operator is to be provided with a copy of the signed internal GVD Permit which must include all signed Site Preparation Work Plans. The Site Environmental Advisor is responsible for going through each individual Site Preparation Work Plan with the machine operator prior to ground disturbance commencing. Once explained and agreed the machine operator is to sign off on all Site Preparation Plans signalling that they are aware of what is required and aware of any restrictions. **Once the above steps have been completed only then can clearing commence.** **5.5** After the area has been cleared, and prior to the operator moving from the area, the Senior Driller needs to revisit the cleared pad to sign off on the completed works (on each Site Preparation Work Plan. **5.6** At the completion of clearing the Field Technicians are to drive and track log all installed tracks and provide the track logs to the Database Manager for uploading into the database
6.0 Clearing Methodology	▪ Clearing should be kept to a minimum. ▪ Use of existing cleared areas and tracks should be used where available. ▪ Clearing should only be approved after reasonable access alternatives have been considered not practicable. ▪ All clearing is to avoid environmentally sensitive areas i.e. there is to be no clearing within 200m from known Malleefowl mounds or 50m away from known *Drosera* populations. ▪ Significant vegetation e.g. large trees are to be avoided, and favour natural clearings wherever possible to minimise damage to vegetation. ▪ Machinery blades shall be set above ground level so as to minimise disturbance to topsoil and rootstock and to reduce erosion when clearing. ▪ All clearing shall progress in a slow, systematic manner so as to not confuse or trap

	evacuating fauna. ▪ Fauna must be looked out for during clearing. If fauna is sighted, all machinery is to stop to allow safe egress from the work area.
6.1 Access Tracks	▪ Access tracks should be as straight as practicable to minimise clearing. ▪ Avoid tight bends, close proximity to trees and boggy areas when planning access tracks. ▪ Where possible low rise (<0.5m) vegetation i.e. grasses/shrubs etc. should be rolled rather than cleared. Taller vegetation requiring stripping shall be stockpiled on cleared ground for use in rehabilitation (i.e. do not stockpile on native vegetation as it will damage it). ▪ If overhanging branches (less than 5m high) need to be removed for access they should be removed in a manner that does not damage the remainder of the tree. ▪ The creation of windrows which have the potential to block or channel water flow along tracks causing erosion will be avoided. ▪ Grading of tracks should be minimised and only performed on excessively rough tracks. Where grading is necessary, the risk of erosion can be minimised by breaking windrows to allow drainage, cambering tracks to channel overland flow and avoiding deep cutting into the soil profile. Any damage caused during wet conditions will be repaired when the ground has dried out. ▪ Vehicles must drive on existing roads i.e. no short cuts or deviations from the tracks will be tolerated. Off road access is prohibited unless in an emergency i.e. bush fire. ▪ During wet and boggy conditions all vehicle movement will be kept to a minimum. ▪ Width of access tracks to be confined to 3.5 m – 4 m.
6.2 Drill Site Preparation	▪ Drill pad sizes must be in compliance with the area as specified on the approved PoW and in accordance with the GVD specifications. Jupiter standard pad sizes are: o Reverse Circulation (RC) and Diamond drillholes - 25m x 20m. o Aircore (AC) drillholes - on existing tracks (see *Figure 3*). o Water exploration boreholes - case dependant.
6.3 Drilling Sumps	▪ Sumps are to be located away from significant vegetation and water courses. ▪ Sumps are appropriate size/design to contain all drilling fluids during drilling, i.e. o RC and Diamond (situated on the drill pad) – 2m x 2m x 1m. o AC are case dependent, if required – 2m x 2m x 1m (situated on the drill pad). o Water exploration boreholes – case dependent. ▪ Any loss of containment of drilling fluids outside of the sump and/or works limit must be reported to the Environmental Department. ▪ Should groundwater be intercepted whilst drilling, appropriate measures must be taken to contain the material being discharged (i.e. into sumps or tanks). Drilling must cease immediately upon discharge of water until the appropriate and approved containment facilities have been implemented or the water quality is tested and deemed acceptable for discharge.
6.4 Topsoil and Vegetation Management	▪ All clearing and stockpiling of topsoil and vegetation must occur within the approved drill pad (within the pegs). No disturbance is to occur outside this area. ▪ Vegetation and topsoil stockpiles are to be located away from drainage lines and access tracks. ▪ Topsoil (top 50mm) is to be stripped from drill pads and stockpiled separately on the pad (preferably uphill) for use in rehabilitation. (Note: Avoid over handling topsoil. Any

	additional subsoil from sump excavation not used in windrows should be stockpiled separately to topsoil).

7.0 REPORTING:

- All ground disturbance & Exploration Activities (including PoWs submitted) are to be included in the Annual Environmental Report (AER) and submitted to the DMP.
- Rehabilitation reports are to be generated against each POW approval at the completion of rehabilitation (6 months from completing the Exploration Proposal work)
- If Priority flora species are required to be removed, authorisation will be sort from the Department of Environment and Conservation (DEC) reporting requirements will be discussed during the consultation phase of obtaining there approval. At a minimum the DEC will be provided with details of Priority flora that is to be been removed (number, size of population) and information on other known populations to allow an assessment of the impacts on the conservation significance of the species by the disturbance.

8.0 ATTACHMENTS:

Figure 1 - 3

Site Preparation Work Plan

Ground and Vegetation Disturbance Permit

ATTACHMENT ONE: Figures 1 – 4.

Figure 1: Access track clearly flagged at head height

Document Name & Number		ENV-PRC-007 Ground Disturbance Procedure			Version 1
Original Author	P Bouteloiup	Last Reviewed By	P Bouteloup	Last Approved by	G Kaeding
Issue Date	20/12/12	Last Review Date	20/12/12	Next Review Date	20/12/13
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Figure 2: Pink tape demonstrating end of required clearing.

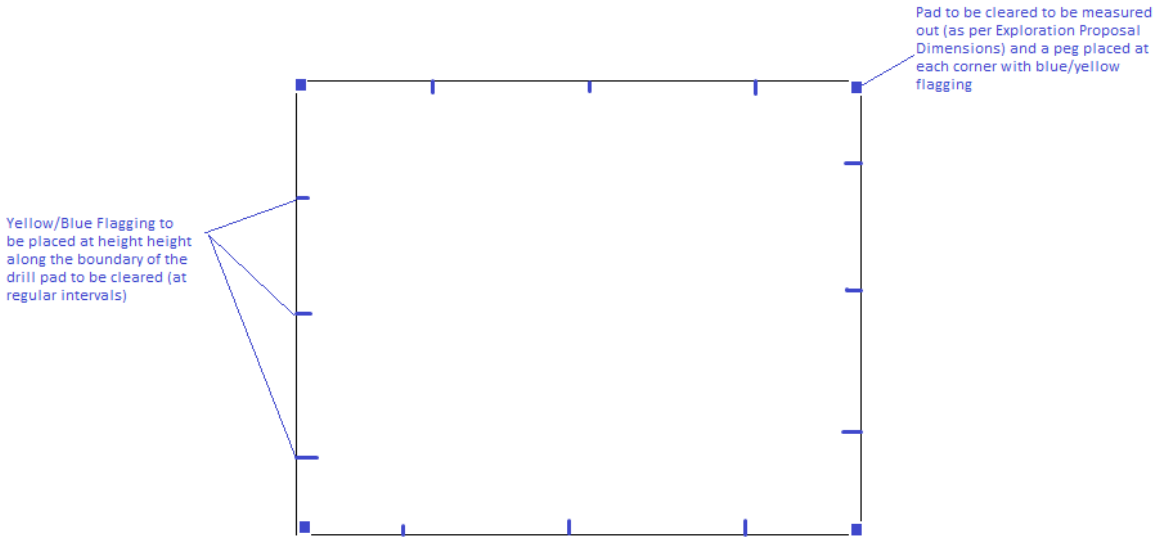

Figure 3: Pegging and flagging layout/standard for RC/Diamond drill pads

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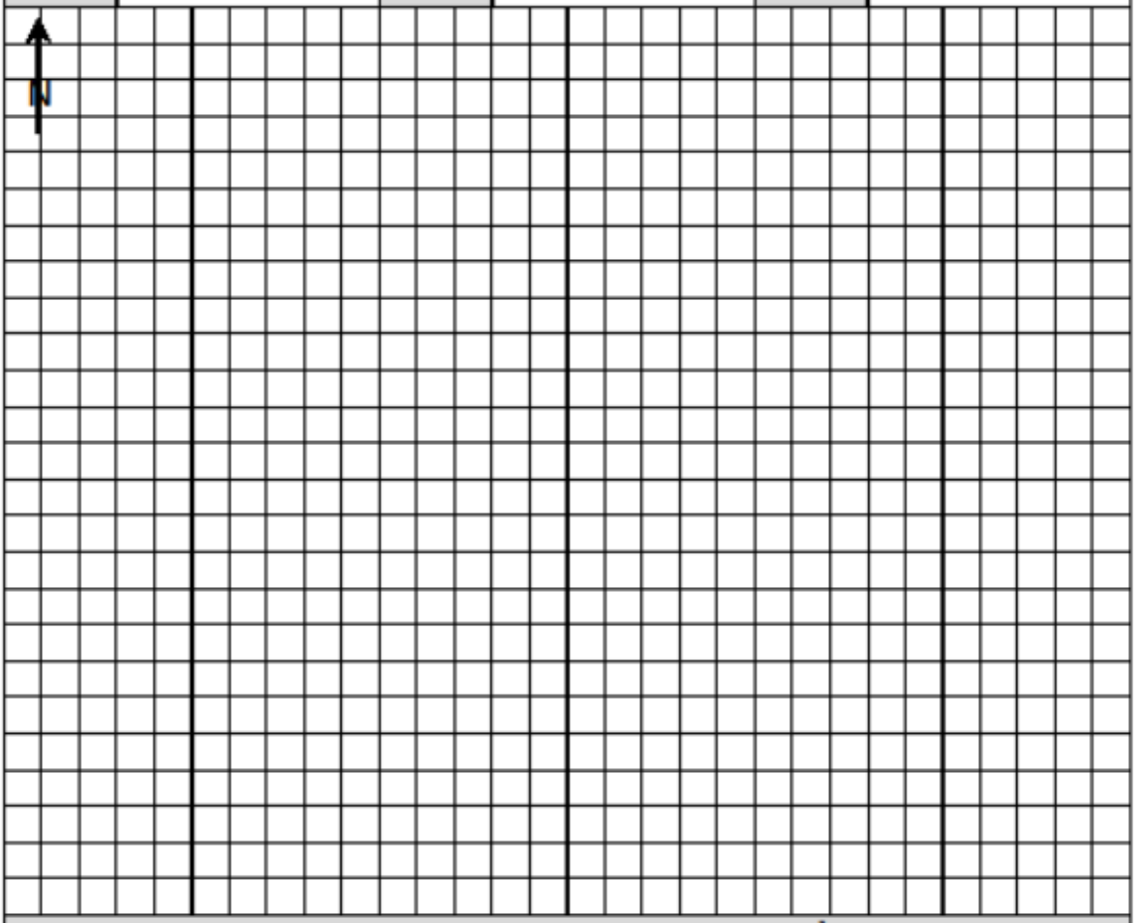
ATTACHMENT TWO: Site Preparation Work Plan

SITE PREPARATION WORK PLAN

HOLE ID:		DATE:		AUTHOR:	
DIP:		AZIMUTH:		DEPTH:	



SITE PLAN INCLUSIONS				NB. Scale: 1 grid square = $1m^2$ / Drill pad not to exceed 20x25m	
Collar peg		Sighter pegs		Boundary pegs	
Rig		Support truck		Humpy (diamond only)	
Mud tank (diamond) / cyclone (RC)		Sump(s), including windrow		Vegetation stockpile	
Rod truck (diamond) / compressor (RC)		Core racks (diamond) / sample bags (RC)		Topsoil stockpile	

COMMENTS

APPROVALS	Signature	Date
Drilling Supervisor		
Earthworks Contractor		
Company Environmental Representative		
Senior Geologist		

Document No. GEO-FRM-001
Date Issued: 5/10/11
Revision Date: 5/10/12

Version No: 1
Page 1 of 1

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Jupiter Mines Limited

ATTACHMENT THREE: Ground Vegetation Disturbance Permit

GROUND AND VEGETATION DISTURBANCE PERMIT

PART A: GENERAL INFORMATION OF WORKS *(Geologist to complete)*	
Company Name:	Applicant Name:
Lease No.& Name:	Location Description:
Date:	Proposed Area to be Disturbed (ha):
Area Previously Disturbed: Y / N / N/A	Location Map and Co-ordinates attached (circle): Y / N / N/A
No. of Pads to be Cleared?	Length of tracks to be cleared (km):
Proposed Start Date:	Proposed Finish Date:
Description / Reason for Works:	

PART B: EXTERNAL APPROVALS *(Site Environmental Coordinator to Complete)*	**Yes**	**N/A**
DMP PoW Approval Required / Obtained?		
DoW Approvals Required / Obtained? (*ie 26D licence)*		
Pastoral Owner Permission Granted / Advised of Works?		
Any other Approvals Required? (*ie DEC/Shire*) ……		

PART C: PLANNING CONTROLS *(Site Environmental Coordinator to Complete)*	**Yes**	**N/A**
Disturbance >200m from known active mallefowl nests?		
Disturbance >50m from known Drosera populations?		
Disturbance outside of cultural heritage sites?		
Applicant work procedures comply with the Exploration Environmental Performance Standards and any PoW?		

PART D: PRE-START WORK CONTROLS *(Site Environmental Coordinator to complete with Geologist)*	**Yes**	**N/A**
Disturbance Area Surveyed and Demarcated?		
Weed Hygiene Certificate received for all Ground Engaging Machinery?		
Job Hazard Analysis (JHA)/Risk Assessment Prepared / Approved? *(ensure fire and emergency response is included)*		
Site Preparation Work Plan(s) Approved by all Signatories?		

PART E: PERMIT APPROVAL		
Geologist	…… I confirm that that all ground disturbing activities will be undertaken strictly in accordance this Permit	…….…….. date
Environmental Site Coordinator	…… I confirm that that all ground disturbing activities will be undertaken strictly in accordance this Permit	…….…….. date
Environmental Manager	…… Authorisation is given to proceed with the Permit Application under the conditions prescribed on this Permit	…….…….. date
Exploration Manager	…… Authorisation is given to proceed with the Permit Application under the conditions prescribed on this Permit	…….…….. date

PART F: POST DISTURBANCE CONTROLS			**Yes**	**N/A**
Post Disturbance Inspection Completed	…… Site Environmental Coordinator	…….…….. date		
Post Disturbance Survey Completed	…… Surveyor or alternative	…….…….. Date		
Disturbance Register Updated	…… Environmental Manager	…….…….. date		

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Total Area Disturbed (ha):	Veg Clearing (ha):	Pre Disturbed (ha):

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Appendix C: Review of Flora and Vegetation of the Mount Mason and Yunndaga Study Areas (July 2021)

Western Botanical

Final Report, Review of Flora and Vegetation of the Mount Mason and Yunndaga Study Areas

July 2021

Prepared for: Juno Minerals Pty Ltd

Report Ref: WB962

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Report No: WB962

Client Name: Juno Minerals Pty Ltd

Client Address: Level 10, 16 St Georges Tce, PERTH WA 6000

Version	Prepared By	Approved for Issue	Issue Date
1	G. Cockerton & J. Warden	5th July 2021	5th July 2021
1.1	G. Cockerton & J. Warden	8th July 2021	8th July 2021
2 Incorporating feedback	G. Cockerton & J. Warden	12th July 2021	12th July 2021

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This report has been designed for double-sided printing

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1. Executive Summary

Juno Minerals Pty Ltd (Juno) hold the Mount Mason hematite project, located approximately 12km NW from the Mount Ida magnetite project, 96 km south-west of Leonora and 90 km north-west of Menzies, Western Australia. The project also includes planned development of a rail siding at Yunndaga Siding, at the Menzies townsite.

The Mount Mason and Yunndaga Siding project received development approval by the Department of Mining and Petroleum Resources in July 2014. Jupiter Mines Pty Ltd was granted a Clearing Permit (CP) 5765/2 on 24/9/2015 with an expiry date of 30/11/2018. The tenements were subsequently transferred to Juno Minerals Pty Ltd. Given the former CP has expired, a new Clearing Permit meeting the current Department of Mines, Industry Regulation and Safety (DMIRS) regulations and Environmental Protection Authority (EPA, 2016) Guidance is required.

In order to further the project, Juno engaged Western Botanical to review the existing information on the flora and vegetation of the Mt Mason and Yunndaga Study Areas, identify any gaps that may exist, and to develop and implement a works program to address the gaps, meeting the current EPA Guidance requirements.

A desktop review confirmed previous works and identified a range of significant flora known within and nearby both Study Areas (Western Botanical 2021a). A reconnoitre survey of both the Mount Mason and Yunndaga Study Areas was implemented in mid April 2021 where previous consultant's reports and mapping were referred to in reviewing the flora, vegetation and significant flora of the Study Areas. This review identified some gaps that were required to bring the project into compliance with EPA Guidance 2016 requirements (Western Botanical 2021b).

As current studies of flora and vegetation for the Mount Mason and Yunndaga Siding Study Areas have not been completed and revised data is not available, it is premature to attempt to assess the entire project against the EPA's 10 Clearing Principles. However, the following can be stated for each site:

Mount Mason Study Area

- A six day vegetation mapping exercise was undertaken in April 2021, focusing on the orebody and infrastructure areas with one of these spent on the haul road alignment.
- The Mount Mason Study Area has relatively simple flora with moderate diversity for the region and reflecting that of similar landforms in the region. Vegetation is in Pristine Condition outside areas of previous direct disturbance. Inclusive of tracks and rehabilitated drill pads, the entire Study Area would be considered in Excellent Condition. Rehabilitation of previous exploration areas has progressed well.
- The works presented in Native Vegetation Solutions (2012 and 2013), while limited to Disturbance Footprints with minimal buffers, is valuable and mostly accurate with only

minor amendments to species identifications and no additional Priority Flora have been noted within proposed those Disturbance Footprints previously surveyed.

- Targeted Surveys for Priority Flora recognised at that time had not been implemented in the Native Vegetation Solutions (2012 and 2013) works.

- The Mount Mason Study Area supports three Priority Flora: *Drosera eremaea* P1 (inclusive of *Drosera* aff. *eremaea*), *Calytrix hislopii* P3, *Philotheca brevifolia* subsp. *deserti* P3. Of these:

    - *Calytrix hislopii* P3, *Philotheca brevifolia* subsp. *deserti* P3 populations lie well outside area of proposed development.

    - *Drosera eremaea* P1 is known within and in close proximity to the proposed disturbance footprint within the orebody area.

    - One record of *Drosera* aff. *eremaea* is known within the Exploration Camp area. Based on the regional distribution of similar species, this is likely to be *D. eremaea* P1, however, the accuracy of the position mapped has not been verified.

    - One record of *Hysterobaeckea longipes* is noted adjacent to the Haul Road alignment approximately 7.75km south of the Mt Mason orebody area. This represents a 350 km eastwards disjunct occurrence. An error in the locational information accompanying this specimen is suspected.

- The northern portion of the Mount Mason Study Area, inclusive of the orebody area and part of the haul road, lies within the Perrinvale/Walling vegetation assemblages (banded ironstone formation) Priority 1 Priority Ecological Community.

- Other areas of proposed development (haul road, proposed explosives magazine, access road from the Mt Ida road) are not known to support any species with conservation listing. Given the landforms, soil and vegetation associations present in these areas, no Priority Flora are known, nor are they expected to occur, within proposed development footprints outside the orebody area and the northern portion of the haul road alignment. Similarly, pending verification of the *Drosera* aff. *eremaea* record, no significant flora are expected at the Exploration Camp area.

Yunndaga Siding Study Area

- Only a brief 1 day on-site reconnaissance was undertaken in April 2021.

- The Yunndaga Siding Study Area is reported in Paul Armstrong & Associates (2012) and Outback Ecology Services (OES) (2013). Vegetation Mapping presented within these documents was found to be inaccurate and requires major revision.

- Flora identifications presented within OES (2013) are considered largely accurate and the weed mapping is likely similarly of high value.

- The Yunndaga Rail Siding Study Area includes many areas of historical disturbance, numerous weed species (including Opuntioid cacti, Weeds of National Significance)

- No Priority or Threatened Flora are noted, nor are they expected, at the Yunndaga Siding Study Area.

- No Priority Ecological Communities or Threatened Ecological Communities are known within or adjacent to the Yunndaga Siding Study Area.

2. Introduction

Juno Minerals Pty Ltd (Juno) hold the Mount Mason hematite project, located approximately 12km NW from the Mount Ida magnetite project, 96 km south-west of Leonora and 90 km north-west of Menzies, Western Australia. The project also includes planned development of a rail siding at Yunndaga Siding, at the Menzies townsite. The project lies near the south-western margin of the Eastern Murchison (MUR01) biogeographic subregion which is dominated by Mulga woodlands on stony hills and hardpan plains, *Acacia* shrublands on yellow sandplains, Spinifex hummocked grasslands on orange sandplains and Chenopod plains on saline margins of salt lakes.

The Mount Mason and Yunndaga Siding project received development approval by the Department of Mining and Petroleum Resources in July 2014. Jupiter Mines Pty Ltd was granted a Clearing Permit (CP) 5765/2 on 24/9/2015 with an expiry date of 30/11/2018. The tenements were subsequently transferred to Juno Minerals Pty Ltd. Given the former CP has expired, a new Clearing Permit meeting the current Department of Mines, Industry Regulation and Safety (DMIRS) regulations and Environmental Protection Authority (EPA, 2016) Guidance is required.

In order to further the project, Juno engaged Western Botanical to review the existing information on the flora and vegetation of the Mt Mason and Yunndaga Study Areas, identify any gaps that may exist and to develop and implement a works program to address the gaps, meeting the current EPA Guidance requirements.

A reconnoitre survey of both the Mount Mason and Yunndaga Study Areas was implemented in mid-April 20201 where previous consultant's reports and mapping were referred to in reviewing the flora, vegetation and significant flora of the Study Areas. This review identified the following matters:

- The previous flora and vegetation assessments at both sites were limited to the proposed disturbance footprints at both sites with minimal (approximately 100m) buffers around planned development.
- Previous Detailed level survey vegetation mapping and flora assessments at Mount Mason were reasonably accurate, however, previous Reconnoitre level survey for the Yunndaga Siding site was inaccurate.
- Neither dataset was compliant with current EPA Guidance requirements, specifically requiring (i) a minimum 500m buffer around infrastructure, (ii) adequate quadrat representation to validate vegetation mapping, and (iii) targeted surveys for conservation-significant flora.
- Minor amendments to flora nomenclature and conservation status updates were required.

- While records of a few Priority Flora had been reported, Targeted Surveys within and adjacent to the Mount Mason Study Area for conservation-listed significant species had not been implemented. Targeted Survey within the former limited Yunndaga Siding Study Area had been conducted.

- No Threatened Flora were known, nor were expected, within or nearby the two Study Areas.

2.1. Project Background

2.2. Previous Surveys

The following reports provided by Juno Minerals (as Jupiter Mines), assessing the flora and vegetation of tenements now held by Juno Minerals were reviewed in the course of this desktop assessment. These should be read in conjunction with report as provide results of previous surveys within proposed disturbance envelopes at both Mount Mason and Yunndaga Siding.

Mount Mason Study Area

- P.G. Armstrong & Associates (2008) Vegetation Survey and Rare Flora Search of the Mt Mason and Mt Ida Exploration Project May-Sept 2007. Consultant's report to Jupiter Mines Ltd and Hardrock Mining.

- Native Vegetation Solutions (2012) Level 2 Flora and Vegetation Survey. Consultant's report to Jupiter Mines Ltd.

- Native Vegetation Solutions (2013) Level 1 Flora and Vegetation Survey of the Proposed Mount Mason Haul Road (M29/414, M29/408, G29/22, G29/23, L29/79, L29/100). Consultant's report to Jupiter Mines Ltd.

Yunndaga Siding Study Area

- Paul Armstrong & Associates (2012) Vegetation Survey and Rare Flora Search at the Menzies Railhead for Mt Mason Project, Conducted June 2011. Consultant's report to Jupiter Mines Ltd.

- Outback Ecology Services (2013) Level 1 Flora and Fauna Assessment Menzies Bypass and Yunndaga Rail Siding. Consultant's report to Jupiter Mines Ltd.

In order to gain some contextual information, three reports dealing with the flora and vegetation of adjacent Banded Ironstone Formation (BIF) ranges west and north-west of the Study Area were reviewed (Western Botanical 2010, 2011a, 2011b). Additional information on *Hibiscus* sp. Perrinvale Station (J. Warden & E. Ager WB 10581) P1 was taken from Western Botanical 2019.

2.3. Current Survey

The current study was scoped as a Reconnaissance Survey and gap analysis for the Mount Mason and Yunndaga Siding Study Areas with a view to recommending and implementing supplementary assessments in 2021 as required to bring the current works in line with EPA Guidance (2016) requirements. Vegetation mapping was to be extended to the limits of the 500m buffer now applied at both Study Areas.

2.4. Physical Environment

2.4.1. Climate

Long term climatological information is presented in Native Vegetation Solutions (2013) and is not reproduced here.

Rainfall prior to the April 2021 Reconnaissance Survey included a 35mm in one day in mid February 2021 from a decaying tropical low. Monthly totals of 3.4mm in January, 60.2mm in February, 39.6mm in March and 7.2mm to mid April 2021 were recorded at Walling Rock (BOM Station 12318) (Bureau of Meteorology). The response in vegetation observed in the April 2021 Reconnaissance Survey was that vegetation had been sustained over summer as foliage was healthy and leaves extended (plants not aestivating) but that insufficient rainfall had occurred to stimulate germination of annuals except in low lying moisture gaining sites with clayey soils and few species were in flower.

2.4.2. Geology

Geology of the Mount Mason Study Area is relatively simple with the orebody area laying within Metamorphosed banded iron formation and chert strike aligned NNW-SSE with metabasalt dominating on the eastern side of the BIF ridge and granites on the western side, Figure 1.

Geology of the Yunndaga Siding Study Area is far more complex but is dominated by sandplain with lateritic pizolites, gabbros, sedimentary rocks with felsic and mafic schists and laterites with silcrete caps, Figure 2.

Figure 1. Geology of the Mt Mason Study Area

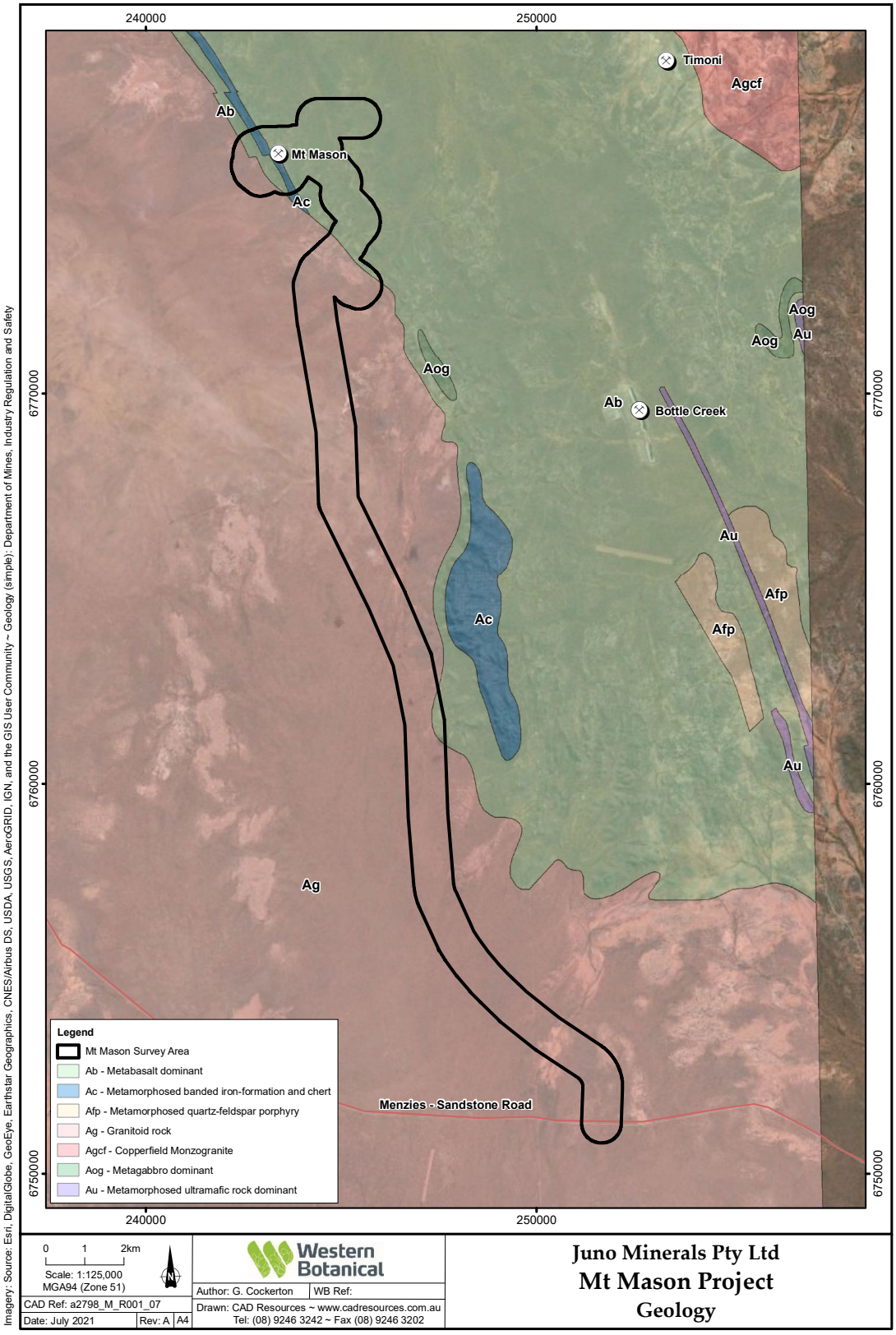
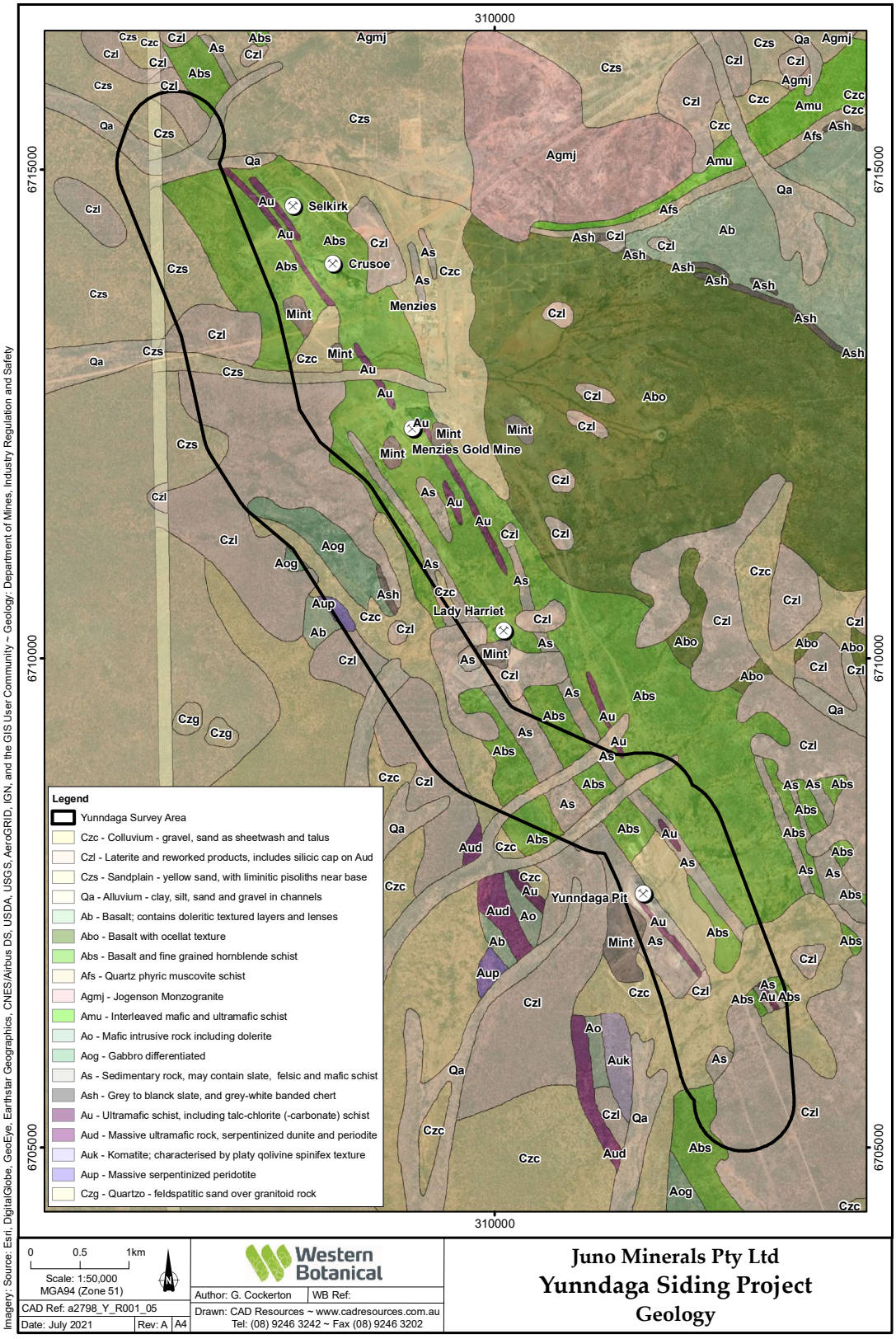


Figure 2. Geology of the Yunndaga Siding Study Area



2.5. Biological Environment

2.5.1. Interim Biogeographic Regionalisation of Australia

The setting of the Study Area within the IBRA regions is presented Native Vegetation Solutions (2012 and 2013) and is not reproduced here.

2.5.2. Land Systems

Land Systems of the Mt Mason Study Area are presented in Table 1.

Table 1. Land Systems of the Mt Mason Study Area

Land System Name	Characteristics
Rainbow	Hardpan plains supporting Mulga on alluvial plains subject to sheet flow; frequently with fine ironstone gravel mantles, and sparse, generally narrow and unincised concentrated drainage tracts.
Bevon	Irregular low hills supporting Mulga and Low shrubs on ?Tertiary limonite, minor Archaean greenstone and banded iron formation, extensive Quaternary colluvium and restricted areas of Quaternary alluvium and eluvium.
Brooking	Mulga shrublands, occasional minor halophytic shrublands on Archaean banded iron formation, locally quartzite, slate, shale and greywacke, with Quaternary colluvium and minor alluvium.
Waguin	*Acacia* shrublands and minor halophytic shrublands on very low breakaways (relief usually less than 4 m) with short footslopes above erosional plains and minor alluvial plains. This system usually occurs within large areas of sandplain, often occurring in parallel series.
Marmion	Gently undulating sandplains with mixed shrublands and hummock grasslands on Gently undulating sandplains with surface drainage features confined to areas fringing occasional exposures of granite.
Sherwood	Mulga shrublands, occasional minor halophytic shrublands on low breakaways (5 to 20 m relief), with pallid zone upper footslopes, depositional lower footslopes; extensive, level to gently undulating plains with pebble mantles; and lower alluvial plains and drainage floors receiving concentrated £low. Occasional low hills and tors.

Land System Name	Characteristics
Yowie	Mulga and Bowgada shrublands and patchy wanderrie grasslands on Quaternary sand and minor cemented alluvium.

Land Systems of the Yunndaga Study Area are presented in Table 2.

Table 2. Land Systems of the Yunndaga Study Area

Land System Name	Characteristics
Bunyip	Hardpan plains supporting Mulga on alluvial plains subject to sheet flow; frequently with fine ironstone gravel mantles, and sparse, generally narrow and unincised concentrated drainage tracts.
Moriarty	Chenopod Shrublands with patchy occurrences of eucalypts on low rises to 20 m relief, locally with ferruginous duricrust, gently undulating lower plains with pebble mantles and level to very gently inclined alluvial plains; poorly defined, sparse drainage patterns.
Yowie	Mulga and Bowgada shrublands and patchy wanderrie grasslands on Quaternary sand and minor cemented alluvium.
Rainbow	Hardpan plains supporting Mulga on alluvial plains subject to sheet flow; frequently with fine ironstone gravel mantles, and sparse, generally narrow and unincised concentrated drainage tracts.
Graves	Eucalypt woodlands with prominent saltbush and bluebush on deeply weathered, low rounded Archaean basalt and greenstone hills and rises, very gently inclined footslopes with pebble mantles and narrow alluvial tracts receiving tributary flow off higher units. Relief up to 40 m.

Figure 3. Land Systems of the Mount Mason Study Area

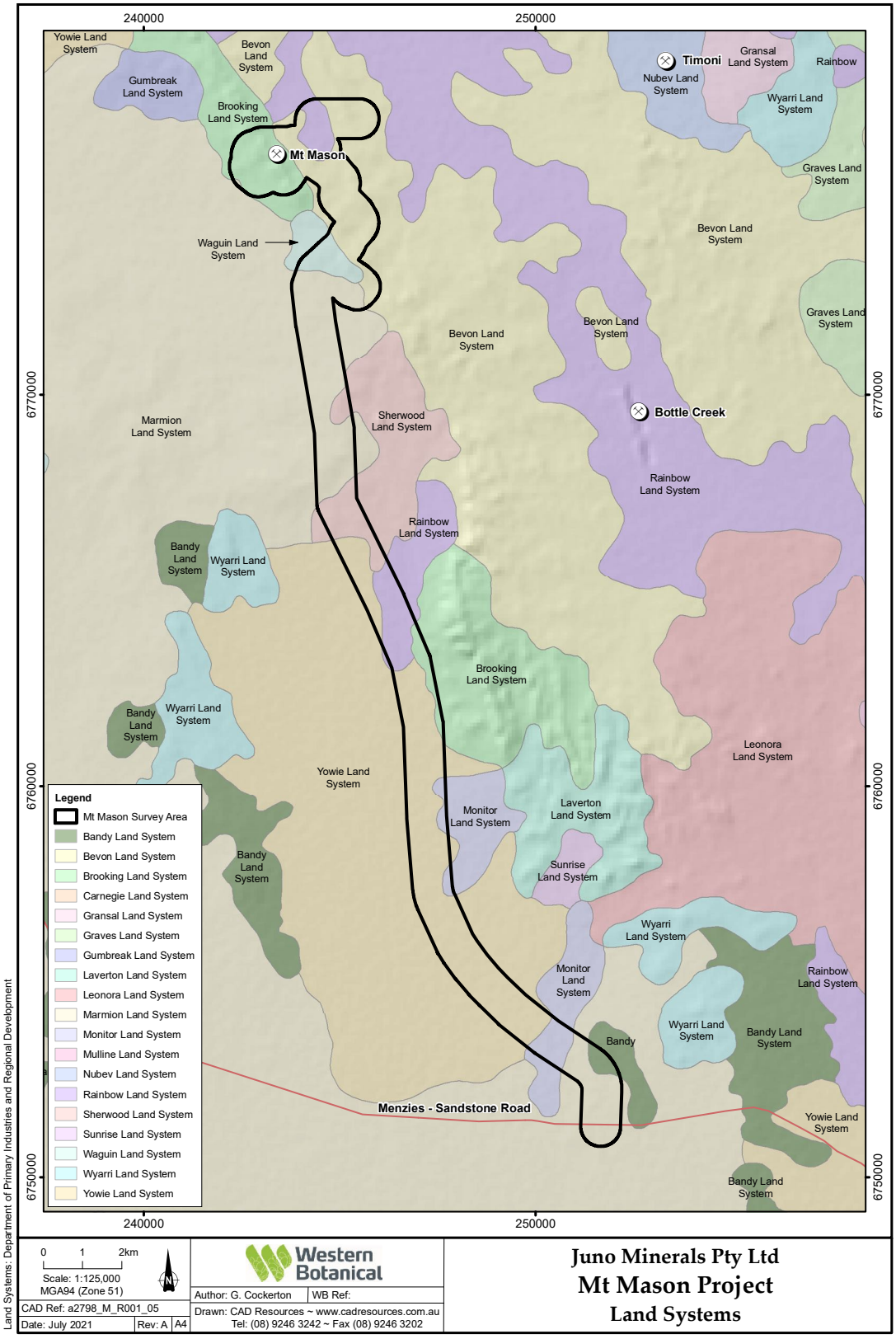
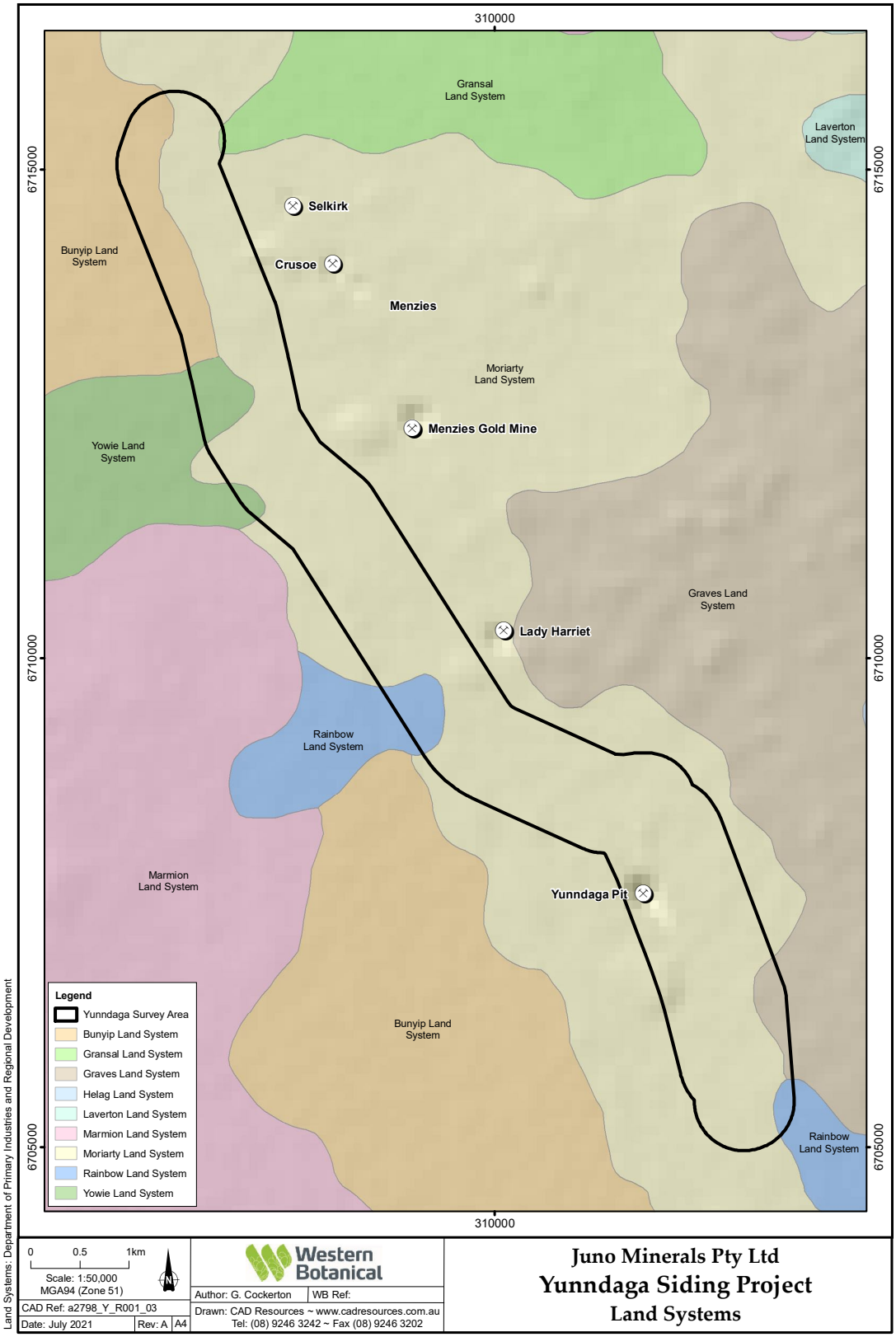


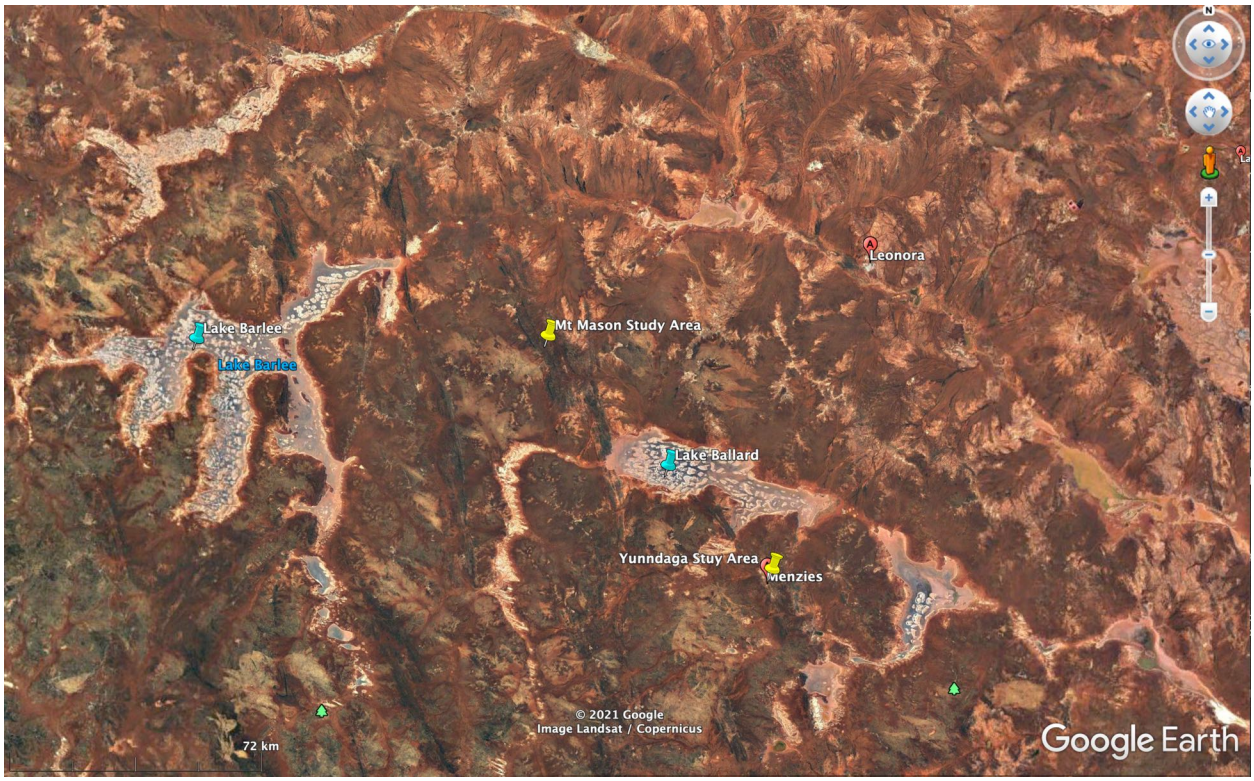
Figure 4. Land Systems of the Yunndaga Siding Study Area



2.5.3. Beard Pre-European Vegetation

The setting of the Study Area within Beard's Pre-European vegetation mapping is presented Native Vegetation Solutions (2012 and 2013) and is not reproduced here.

2.6. Site location map



The location of the two Study Areas is presented in greater detail in Figure 6 and Figure 7.

3. Methods

3.1. Desktop Assessment

This report incorporates the findings of a Desktop Assessment undertaken prior to field the April 2021 works as reported in Western Botanical (2021).

A query of the Department of Biodiversity, Conservation and Attractions' (DBCA's) Threatened and Priority Flora (TPFL) and WA Herbarium (WAHERB) databases (15-1120FL) and the Threatened and Priority Ecological Communities (TEC/PEC) databases (41-1020EC) was undertaken and the results analysed for likelihood of occurrence of conservation significant flora species within the Study Area.

The Department of Agriculture, Water and Environment's Protected Matters Search Tool was used to identify any Federally listed species or Threatened Ecological Communities within or nearby the Study Area.

Reports supplied by Juno are summarised in Table 3.

Table 3. Previous Consultant's Reports Reviewed

Reference	Brief Description
Mount Mason Study Area	
P.G. Armstrong & Associates (2008) Vegetation Survey and Rare Flora Search of the Mt Mason and Mt Ida Exploration Project May-Sept 2007. Consultant's report to Jupiter Mines Ltd and Hardrock Mining.	Level 1 Reconnaissance and Targeted Survey of Orebody Area
Native Vegetation Solutions (2012) Level 2 Flora and Vegetation Survey. Consultant's report to Jupiter Mines Ltd.	Level 2 Detailed Survey of Orebody Areas (lacking Targeted Survey component)
Native Vegetation Solutions (2013) Level 1 Flora and Vegetation Survey of the Proposed Mount Mason Haul Road (M29/414, M29/408, G29/22, G29/23, L29/79, L29/100). Consultant's report to Jupiter Mines Ltd.	Level 1 Targeted Survey of Proposed Haul Road from Orebody Areas to Menzies
Yunndaga Siding Study Area	
Paul Armstrong & Associates (2012) Vegetation Survey and Rare Flora Search at the Menzies Railhead for Mt Mason Project, Conducted June 2011. Consultant's report to Jupiter Mines Ltd.	Level 1 Reconnaissance and Targeted Survey of Rail Siding and associated Laydown Areas
Outback Ecology Services (2013) Level 1 Flora and Fauna Assessment Menzies Bypass and Yunndaga Rail Siding. Consultant's report to Jupiter Mines Ltd.	Level 1 Targeted Flora and Fauna Assessment of Proposed Haulage Route Bypass, Rail Siding and associated Laydown Areas; includes review of all reports to date

Relevant reports prepared by Western Botanical on adjacent BIF ranges were reviewed and information added to that presented in the DBCA databases.

3.2. Field Survey

The current Reconnaissance field survey was undertaken by two botanist and one field assistant over the period 14th to 22nd April 2021. Survey involved utilising vegetation mapping prepared by previous consultants which were either validated or amended in the field.

- In a six day period, vegetation mapping was extended beyond previous mapping limits, to a buffer of 500m around all planned infrastructure at Mount Mason and the proposed haul road to the Menzies – Sandstone Road. Not all areas within the expanded buffer were able to be assessed in the timeframe available and completion of mapping will be required at a later date.

- A one day reconnaissance review of vegetation was undertaken at Yunndaga when significant inaccuracies were observed, indicating that a complete revision of mapping at this site was required to be undertaken at a later date.

At both sites, the following was undertaken:

- Vegetation was assessed on foot at sites representative of homogeneous reflectance as shown on (i) laminated colour satellite imagery field maps at 1:10,000 scale and (ii) on Google Earth imagery on laptops. Field maps were annotated with vegetation types and boundaries drawn where this could be done reasonably confidently.

- Vegetation descriptions inclusive of species present, landform, soil and any significant flora were documented at representative sites.

- All flora encountered was recorded and reference specimens of most species were taken for compilation of a field herbarium, future reference and to meet license conditions.

3.3. Flora Specimen Identification

Specimens of flora were confirmed using resources at Western Botanical, the WA Herbarium's Reference Herbarium and Research Collection where required, and on-line resources. Where full identification could not be achieved, specimens were marked for recollection at a later date.

3.4. Significant Flora

Specimens of significant flora were added to the Western Botanical Specimen Database and have been prepared for vouchering at the WA Herbarium.

3.5. Weeds

Weed species were recorded in a similar fashion to native flora and specimens retained for verification of identification and vouchering at the WA Herbarium as required.

3.6. Vegetation Condition

Vegetation Condition was scored utilising the Vegetation Condition Scale presented in EPA Guidance (2016), Appendix 1.

4. Results and Discussion

4.1. Desktop Assessment – adapted from Western Botanical (2021a)

4.1.1. Flora and Vegetation

The flora of the tenements is likely to reflect that of the eastern Murchison Biogeographic region more-so than that of the north-eastern Coolgardie biogeographic region to the south. The flora of the BIF ranges is expected to be dominated by Mulga (*Acacia aneura* and its allies), *Acacia quadrimarginea* (Granite Mulga), and a range of *Thryptomene*, *Prostanthera* and *Eremophila* species in the mid-shrub stratum and grasses in the lower stratum likely dominated by *Eragrostis, Enneapogon* and *Aristida* species. Sandplains are likely to support *Acacia* shrublands over *Triodia basedowii* hummocked Spinifex Grasslands with occasional emergent eucalypts in a mature state and a wide range of relatively short-lived shrubs in a recent post-fire state.

The flora recorded was typical for the landscapes intercepted in the southern portion of the Murchison biogeographic region. While no significant range extensions were reported, one species, *Hysterobaeckea longipes,* is part of a complex and its occurrence within the Study Area represents a disjunct occurrence from the main range of the species. An error in plotting the location of this species is suspected.

4.1.2. Conservation-Significant Flora

The review of publicly available DBCA databases (15-1120FL) returned sixty one species with conservation significance with records in a 20km radius of a centroid within the Study Area,

Table 5 and Figure 5. Within this, ten Priority 1, 11 Priority 2, 27 Priority 3 and nine Priority 4 species were returned. The list also returned four species listed as Threatened Flora in Western Australia. No Federally EPBC Listed Threatened Flora are known within or in the immediate vicinity of the Study Area.

Of the four Threatened Flora species returned:

- *Eucalyptus crucis* subsp. *crucis* is a granite rock endemic and is known from several populations considerably south of the Study Area and is considered unlikely to occur within the Study Area.

- *Myriophyllum lapidicola* is an aquatic annual herb known from granite outcrops in the eastern Avon Wheatbelt and is unlikely to occur in the Study Area.

- *Ricinocarpos brevis* is a Banded Ironstone Formation (BIF) endemic known within reasonable proximity to the Study Area with populations at the Windarling Range, Johnson Range and Perrinvale Station. This species and suitable potential habitat has been extensively surveyed in the region by Western Botanical and is therefore considered unlikely to occur within the Study Area.

- *Seringia exastia* is listed as a Threatened Flora taxon due to a recent (2020) revision of taxonomy of species but is widespread within central and northern Western Australia and will be removed from the Threatened Flora List following a pending meeting of the Threatened Species Scientific Committee (pers. comm. Melanie Smith, DBCA).

Of the 57 Priority Flora returned:

Twenty-six Priority Flora species are considered Unlikely to occur within the Study Area due to either (i) their known ranges being at considerable distance from the Study Area, and/or (ii) the habitats which they occupy are considered unlikely to occur within the Study Area. These species can be discounted from further consideration.

- Of these, two are database errors:
    - *Acacia effusa* P3 has a Pilbara distribution. The one point on ex-Cashmere Downs (PERTH 07737742), is likely either a taxonomic or data entry error at WAHERB and has since been reviewed (B. Maslin pers. comm.).
    - *Eremophila dendritica* P2 has a western Nullarbor distribution and its inclusion in the database search results is in error and has since been reviewed by WAHERB.
- Twenty-nine Priority Flora species are considered as Possibly occurring within the Study Area, either due to (i) close proximity of known populations to the Study Area and/or (ii) habitats supporting the species are known to, or are likely to, occur within the Study Area.
    - Of these, the newly recognised *Hibiscus* sp. Perrinvale Station (J. Warden & E. Ager WB 10581) P1 is likely to occur on the upper to lower slopes of the BIF ranges and associated duricrust outcrops within the Study Area. Given its discovery in the region in 2019 by Western Botanical, it is unlikely to have been surveyed in previous botanical assessments within tenements. It is a cryptic species and is difficult to assess in seasons outside those with favourable rainfall.
- Five Priority species have records plotted within tenements: *Calotis* sp. Perrinvale Station (R.J. Cranfield 7096) P3, *Chrysocephalum apiculatum* subsp. *norsemanense* P3, *Drosera eremaea* P1, *Philotheca deserti* subsp. *brevifolia* P3 and *Pterostylis virens* P3. Of these:
    - *Chrysocephalum apiculatum* subsp. *norsemanense* P3 and *Philotheca deserti* subsp. *brevifolia* P3 are species found on gravely sandplains with *Acacia* shrublands and *Triodia* hummocked grassland (Spinifex). Both species are fire responsive, being particularly abundant after fire and numbers diminish as vegetation matures. The location of *Chrysocephalum apiculatum* subsp. *norsemanense* P3 may not be accurately plotted.
    - *Calotis* sp. Perrinvale Station (R.J. Cranfield 7096) P3 is found in non-saline red-brown loamy to clayey soils, often under *Eucalyptus ravida*, *E. salubris* (Gimlet) or *E. salmonophloia* (Salmon Gum) trees in winter wet depressions. The location of this site may not be accurately plotted.

- The small perennial geophyte *Drosera eremaea* P1 (and *Drosera* aff. *eremaea*) is known on mid slopes of BIF ranges, creeklines in granitoid landforms and most records on site are considered accurately plotted.

- The small perennial geophyte *Pterostylis virens* P3 are associated with shallow sandy deposits on and around granite outcrops. Locations of these are plotted using GPS and are likely accurate.

A correlation of Priority Flora records plotted with Tenements in presented in Table 4 and an assessment of the likelihood of Conservation-Significant Flora occurring within the Study Areas is presented in Table 5.

Table 4. Correlation of Priority Flora with Known Occurrences Within Tenements

Taxon	Cons_Code	Presence within Tenements	Grid	Easting	Northing	Comment
Calotis sp. Perrinvale Station (R.J. Cranfield 7096)	P3	Present on L 29/100	51J	240635	6770606	Positional error suspected
Chrysocephalum apiculatum subsp. norsemanense	P3	Present on L 29/079	51J	247490	6754123	Positional error suspected
Drosera eremaea	P1	Present on M 29/408	51J	243320	6776133	Within and adjacent to disturbance footprints
Philotheca deserti subsp. brevifolia	P3	Present on L 29/100	51J	247490	6754123	Outside proposed disturbance envelopes
Pterostylis virens	P3	Present on L 29/078	51J	255611	6751867	Outside proposed disturbance envelopes

Distributions of Priority Flora known within and adjacent to the Study Area are presented in Figure 5, Figure 6 and Figure 7.

Table 5. Analysis of Conservation Significant Flora Known in the Region

Taxon	Cons_Code	TPFL	WAHERB	WB	Habitat	Likelihood	Comment
Acacia effusa	P3		1		Ironstone Hills	Unlikely	Acacia effusa P3 has a Pilbara distribution. The one point on ex-Cashmere Downs (PERTH 07737742), is likely either a taxonomic or data entry error at WAHERB and is being reviewed (B. Maslin pers. comm.).
Acacia subrigida	P2		1		Sandplains	Possible	Widespread, poorly collected
Aluta teres	P1	1	1		Sandplains	Possible	Known nearby Study Area, Cashmere Downs, Bulga Downs, Ida Valley, dependant on suitable habitat
Banksia arborea	P4	1	1		Ironstone Hills	Unlikely	Known from BIF ranges west of tenements, different vegetation association to that within Study Area
Beyeria lapidicola	P1	1	1		Ironstone Hills	Possible	Known nearby Study Area, Mount Richardson, dependant on suitable habitat
Calandrinia kalanniensis	P2		1		Granite outcrops	Unlikely	Main distribution significantly south-west of Study Area
Calandrinia quartzitica	P1		1		Quartz outcrops	Possible	Known from quartz outcrops near slat lakes east of Study Area
Calandrinia sp. Menzies (F. Hort et al. FH 4100)	P3		1		Red loamy plains	Possible	Known nearby Study Area, dependant on suitable habitat
Calotis sp. Perrinvale Station (R.J. Cranfield 7096)	P3		1		Red loamy plains	Known within tenements	Present on L 29/100 though positional error suspected
Calytrix hislopii	P3		1		Lateritic breakaways	Possible	Known from north of tenements
Calytrix praecipua	P3		1		Archaean granite breakaways	Unlikely	Main distribution significantly east and north of Study Area
Chrysocephalum apiculatum subsp. norsemanense	P3		1		Sandplains	Known within tenements	Present on L 29/079 though positional error suspected

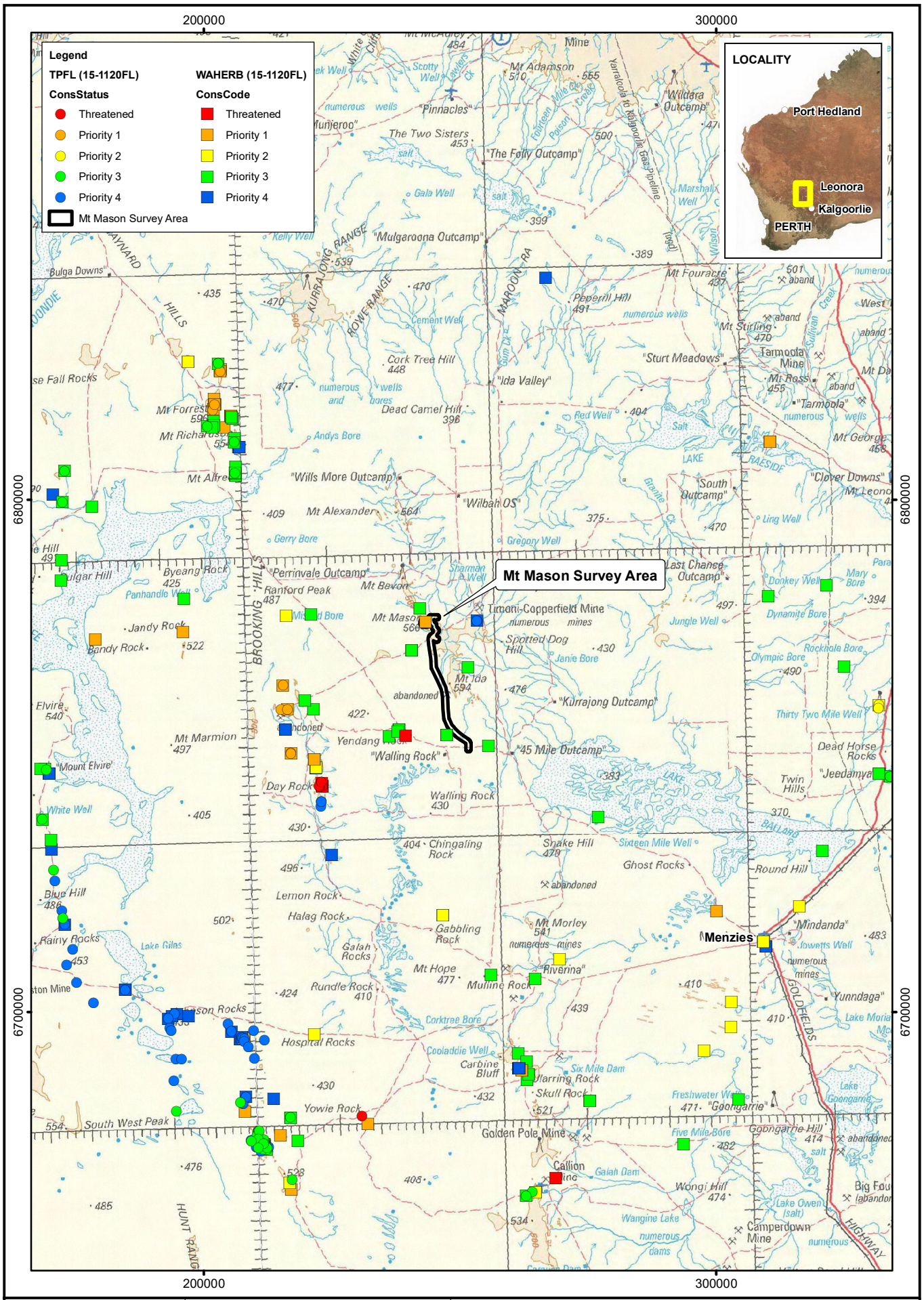
Taxon	Cons_Code	TPFL	WAHERB	WB	Habitat	Likelihood	Comment
Drosera eremaea	P1		1		Granite outcrops, BIF ranges	Known within tenements	Present on M 29/408, within orebody and adjacent to haul road areas
Eremophila dendritica	P2	1			Stony plains	Unlikely	Database positional error
Eremophila mirabilis	P2	1	1		Archaean granite breakaways	Unlikely	Main distribution significantly east of Study Area
Eremophila veronica	P3		1		Lateritic breakaways	Unlikely	Main distribution significantly south of Study Area
Eucalyptus crucis subsp. crucis	T		1		Granite outcrops	Unlikely	Well surveyed, granite rock endemic, main distribution significantly south of Study Area
Eucalyptus educta	P2		1		Granite outcrops	Possible	Main distribution significantly south-west of Study Area
Eucalyptus formanii	P4	1	1		Sandplains	Possible	Main distribution west of the Study Area
Eucalyptus jutsonii subsp. jutsonii	P4		1		Sandplains and sand dunes	Unlikely	Main distribution significantly south-east of Study Area
Euryomyrtus recurva	P3	1	1		Sandplains, gravely soils	Unlikely	Main distribution significantly west of Study Area
Eutaxia nanophylla	P3		1		Red loamy plains	Unlikely	Main distribution significantly south of Study Area
Eutaxia rubricarina	P3		1		Red loamy plains	Unlikely	Main distribution significantly south-west of Study Area
Goodenia berringbinensis	P4		1		Red loamy plains, water courses	Possible	Main distribution significantly north-west of Study Area
Grevillea erectiloba	P4	1	1		Red loamy plains	Possible	Main distribution significantly south-west of Study Area, positional error of record near Menzies is highly likely
Grevillea georgeana	P3	1	1		Ironstone Hills, laterite gravel rises	Possible	Main distribution significantly south-west of Study Area
Grevillea inconspicua	P4		1		Red loams over subcropping greenstone	Possible	Main distribution significantly north-east of Study Area
Grevillea secunda	P4		1		Sandplains and sand dunes	Possible	Main distribution significantly south-east of Study Area
Grevillea sp. Yerilgee Hills (T. Laslett TL 025)	P1		1		Sandplains	Unlikely	Main distribution significantly south of Study Area

Taxon	Cons_Code	TPFL	WAHERB	WB	Habitat	Likelihood	Comment
Grevillea subterlineata	P3		1		Gravely sand	Unlikely	Highly disjunct distribution, significantly south and north-west of the Study Area
Hemigenia exilis	P4	1	1		Duricrust outcrops	Possible	Main distribution north-west of the Study Area
Hibbertia lepidocalyx subsp. tuberculata	P3	1	1		Ironstone Hills	Unlikely	Main distribution significantly south of Study Area
Hibiscus krichauffianus	P3		1		Red loamy plains, stony hills	Possible	Widely distributed, poorly collected
Hibiscus sp. Perrinvale Station (J. Warden & E. Ager WB 10581)	P3		1	1	Ironstone Hills	Possible	Widely distributed, poorly collected, a BIF and duricrust remnant Endemic
Homalocalyx grandiflorus	P3		1		Sandplains	Possible	Main distribution significantly south of Study Area
Hyalosperma stoveae	P2		1		Sandplains	Possible	Main distribution significantly west of Study Area
Hysterobaeckea ochropetala subsp. cometes	P3		1		Sandplains	Unlikely	Main distribution significantly south of Study Area, positional error of record near Menzies is highly likely
Jacksonia lanicarpa	P1	1	1		Sandplains	Possible	Known nearby Study Area, dependent on suitable habitat
Labichea eremaea	P3	1	1		Sandplains	Possible	Known nearby Study Area, dependent on suitable habitat
Malleostemon sp. Adelong (G.J. Keighery 11825)	P2		1		Sandplains and sand dunes	Possible	Known nearby Study Area, dependent on suitable habitat
Menkea draboides	P3		1		Red sand, loam, granite rocks	Possible	Known nearby Study Area, dependent on suitable habitat
Micromyrtus serrulata	P3	1	1		Sandy clayey soils over granite	Possible	Known nearby Study Area, dependent on suitable habitat
Mirbelia ferricola	P3	1	1		Ironstone Hills	Possible	Main distribution significantly south of Study Area
Myriophyllum lapidicola	T	1			Granite outcrops	Unlikely	An annual growing in rock pools on granite outcrops

Taxon	Cons_Code	TPFL	WAHERB	WB	Habitat	Likelihood	Comment
Newcastelia insignis	P2		1		Sandplains	Possible	Known nearby Study Area, dependent on suitable habitat. positional error of record near Menzies is highly likely
Notisia intonsa	P3		1		Red clay, winter wet depressions	Possible	Main distribution significantly south of Study Area, dependent on suitable habitat
Phebalium sp. Yerilgee Sandplain (J. Jackson 223)	P2		1		Sandplains	Unlikely	Main distribution significantly south of Study Area
Philotheca coateana	P3	1	1		Sandplains	Possible	Known nearby Study Area, dependent on suitable habitat
Philotheca deserti subsp. brevifolia	P3	1	1		Sandplains	Known within tenements	Present on L 29/079, outside proposed disturbance envelopes
Phyllanthus baeckeoides	P3	1	1		Drainage lines associated with BIF Ranges	Possible	Known in region nearby Study Area, dependent on suitable habitat
Pterostylis elegantissima	P1		1		Winter wet clay soil	Unlikely	Known distribution significantly south-east of Study Area
Pterostylis virens	P3		1		Granite outcrops	Known within tenements	Present on L 29/078, , outside proposed disturbance envelopes
Pterostylis xerampelina	P1		1		Granite outcrops	Unlikely	Main distribution significantly south of Study Area, dependent on suitable habitat
Ricinocarpos brevis	T	1	1		Ironstone Hills	Unlikely	Has been extensively surveyed
Seringia exastia	T*		1		Sandplains	Probable	Known nearby, Listed as Threatened due to technicality, abundant and widespread species
Tecticornia mellarium	P1		1		Salt lake margins	Possible	Suitable habitat may be present on L29/081
Thryptomene eremaea	P2		1		Sandplains	Unlikely	Main distribution significantly south-east of Study Area, dependent on suitable habitat, positional error of record near Menzies is highly likely.
Thryptomene sp. Leinster (B.J. Lepschi & L.A. Craven 4362)	P3		1		Archaean granite breakaways	Unlikely	Main distribution significantly east of Study Area, close to Thryptomene decussata

Taxon	Cons_Code	TPFL	WAHERB	WB	Habitat	Likelihood	Comment
Thysanotus brachyantherus	P2		1		Limestone	Unlikely	Main distribution significantly south of Study Area
Thysanotus sp. Ennuin (N. Gibson & M. Lyons 2665)	P1		1		Loamy soils, winter wet depressions	Unlikely	Main distribution significantly south-west of Study Area
Wurmbea murchisoniana	P4		1		Granite rocks, wet depressions	Unlikely	Widespread, poorly collected, main distribution significantly west of Study Area

Figure 5. Species With Conservation Significance Returned in DBCA Database Query 15-1120FL.



Ref: Flora (Department of Biodiversity, Conservation and Attractions)

0 10 20km

Scale: 1:1,000,000
MGA94 (Zone 51)

CAD Ref: a2798_M_R001_01

Date: July 2021 | Rev: A | A4

Western Botanical

Author: G. Cockerton | WB Ref:

Drawn: CAD Resources ~ www.cadresources.com.au
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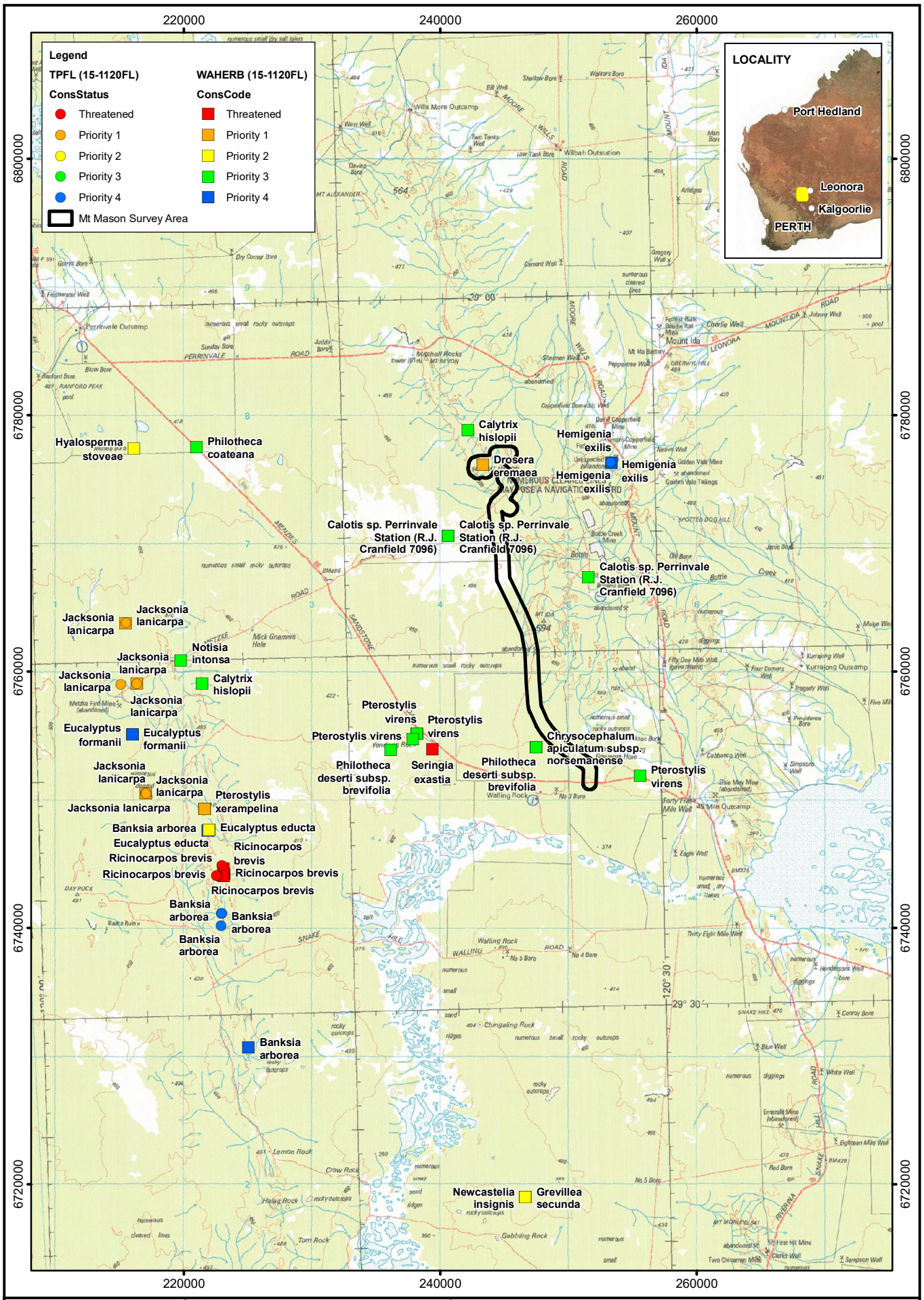
Mt Mason Project
DBCA Flora Search Results

Figure 6. Species With Conservation Significance Within and in Close Proximity to the Mount Mason Study Area



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Scale: 1:400,000
MGA94 (Zone 51)

CAD Ref: a2798_M_R001_02

Date: July 2021 | Rev: A | A4

Western Botanical

Author: G. Cockerton | WB Ref:

Drawn: CAD Resources ~ www.cadresources.com.au
Tel: (08) 9246 3242 ~ Fax (08) 9246 3202

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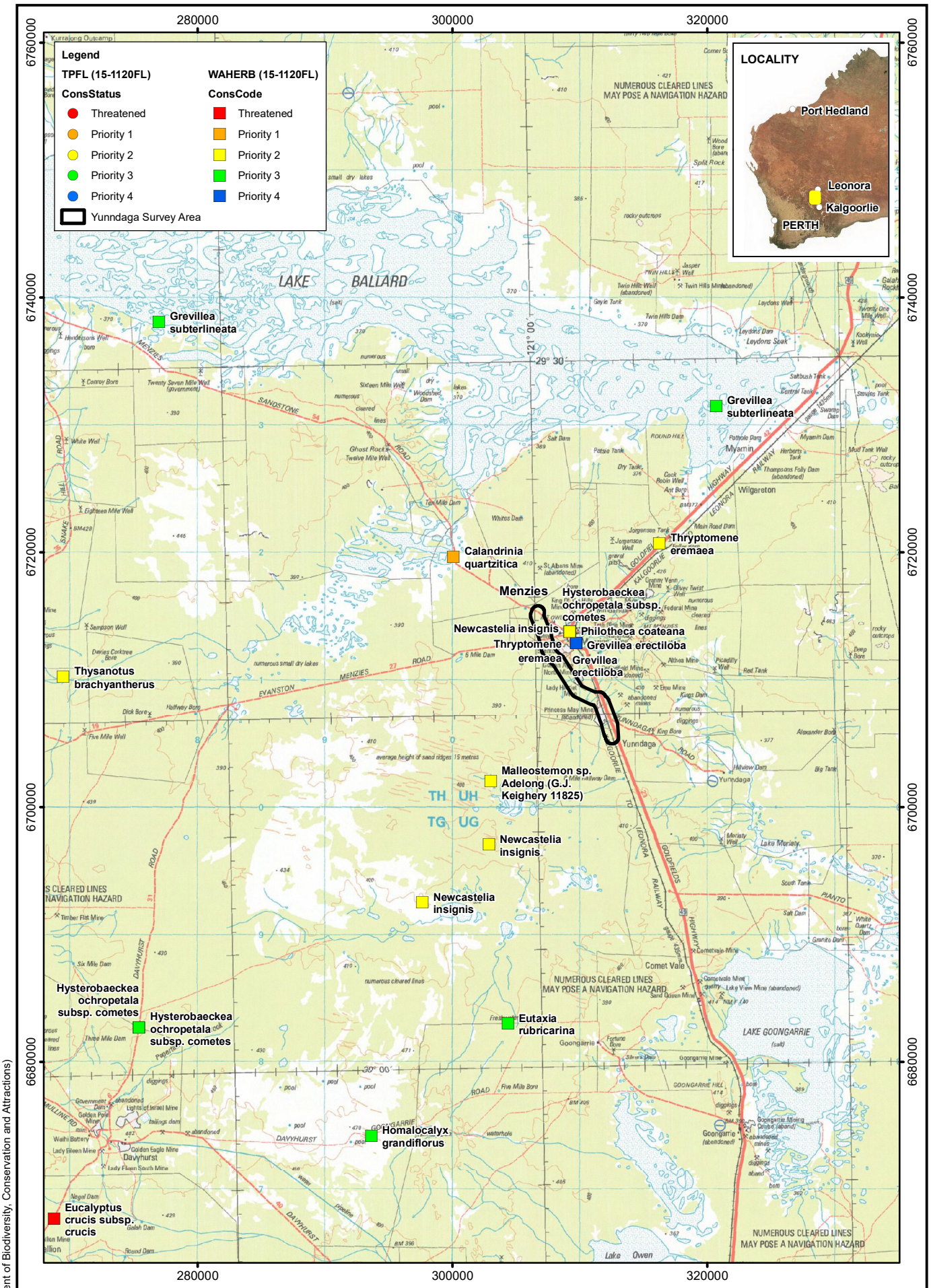
Ref: Flora (Department of Biodiversity, Conservation and Attractions)

Figure 7. Species With Conservation Significance Near Yunndaga Siding



Ref: Flora (Department of Biodiversity, Conservation and Attractions)

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Scale: 1:400,000
MGA94 (Zone 51)

CAD Ref: a2798_Y_R001_02

Date: July 2021 | Rev: A | A4

Western Botanical

Author: G. Cockerton | WB Ref:

Drawn: CAD Resources ~ www.cadresources.com.au
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Yunndaga Siding Project
DBCA Flora Search Results

A review of relevant Western Botanical reports for sites with similar landforms and geology to those of the Study Area within a 100km radius of the Study Area was also undertaken, Figure 8, Table 3. Western Botanical reports for the Brooking Hills (Western Botanical 2010), Mt Richardson (Western Botanical 2011a) and Churchill Polygon (Western Botanical 2011b) were reviewed. Species with conservation significance reported within WB reports or subsequently recognised at each Adjacent Study Site are presented in Table 7.

Figure 8. Adjacent Study Sites Assessed by Western Botanical

Table 6. Relevant WB Adjacent Study Site Reports Reviewed

Site	Distance and Direction from Study Area	Landforms, Geology	Indicative Coordinate		
Brooking Hills	55 km NW	BIF, debris slopes, outwash plains	51J	208100	6788700
Churchill Polygon	55km WNW	BIF, debris slopes, outwash plains, drainage systems	50J	782000	6780000
Mt Richardson	74km NW	BIF, debris slopes, outwash plains, sandplains	50J	790000	6816000

Table 7. Conservation-Significant Species Correlation with WB Adjacent Study Sites

	Brooking Hills	Churchill Polygon	Mt Richardson
Aluta teres P1		1	
Beyeria lapidicola P1			1
Calytrix creswellii P3			1
Calytrix verruculosa P3			1
Hibiscus sp. Perrinvale Station P1[1]		1	
Philotheca coateana P3		1	
Phyllanthus baeckeoides P3			1
Drosera sp. in the D. macrantha[2] – D. eremaea complex	1		1

While species with conservation significance recorded at these sites are useful in developing a regional context for some species, the sites covered by Western Botanical previous surveys do not overlap the current Study Area and are at somewhat (55 to 74 km) disjunct. No species with Conservation Significance were recorded at the Brooking Hills while the Churchill Polygon supports three Priority species and Mt Richardson supports four taxa with conservation significance. There is no overlap in the Priority species present at the two sites.

Drosera sp. in the *macrantha – D. eremaea* complex (noted then as *Drosera macrantha* subsp. *macrantha*) were recorded at the Brooking Hills and Mt Richardson sites. These may in fact reflect *Drosera eremaea*.

[1] *Hibiscus* sp. Perrinvale was recognised after the WB report was produced.
[2] Reported as *Drosera macrantha* subsp. *macrantha*

At Mt Richardson, *Calytrix uncinata* recorded (Western Botanical 2011a) and reported as Priority 4 has subsequently been removed from the Priority Flora list and *Calytrix* sp. Triangles (J. Warden & E. Ager WB19712) reported was subsequently identified as *Calytrix erosipetala* which has also recently been removed from the Priority Flora list.

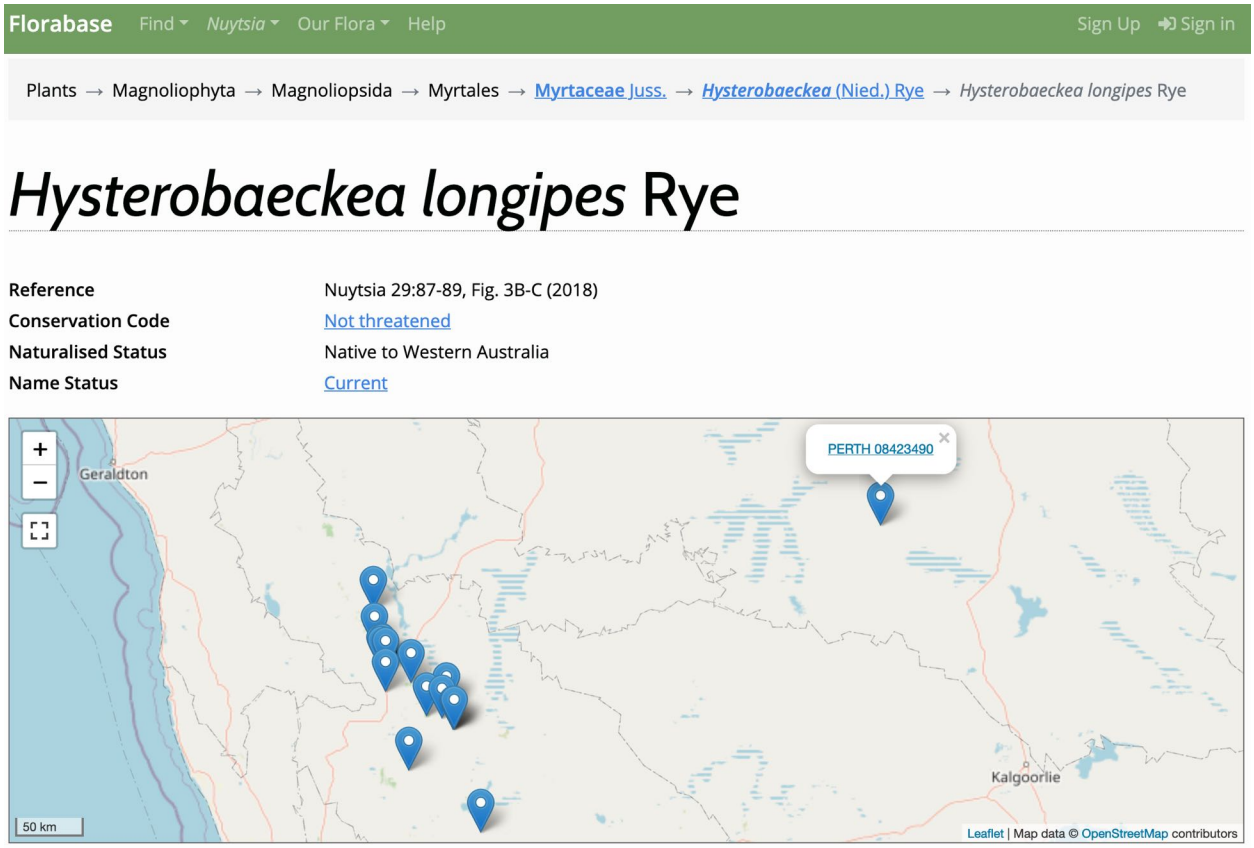
At the Churchill Polygon, *Hibiscus* sp. Perrinvale Station was recognised as a new species following surveys east of Leonora (Western Botanical, 2019) and was listed as Priority 1 by DBCA in 2019.

4.1.3. Disjunct Occurrences and Range Extensions

No significant range extensions were reported in previous consultant's reports.

One species, reported in Native Vegetation Solutions (2013) as *Baeckea* sp. Wubin, now *Hysterobaeckea longipes*, represents a disjunct occurrence of this species, some 375 km east of its known range in the northern Avon Wheatbelt west of Mongers Lake, north of Wubin, Figure 9. While no voucher from the Mt Mason project area is reported, a specimen of the species from within the proposed haul road alignment is vouchered (PERTH 8423490, P. Knapton 47, 9/4/2018). The identification of this specimen has been reviewed and is not in doubt (Dr. Barbara Rye, pers. comm.). However, the location information is queried as the associated species noted with the specimen do not occur within the Mt Mason Study Area. It is suggested that the location notes accompanying the specimen and the coordinate given are inaccurate, Figure 9.

Figure 9. *Hysterobaeckea longipes* records in WA



4.1.4. Species Not Fully Identified

Previous reports on flora and vegetation of tenements held by Jupiter Mines also reported the following species which have not been fully identified, Table 8. While these have not been fully identified due to unavailability of suitable material following survey, the majority of these may not represent species with conservation significance, however, some require review.

Table 8. Species Previously Reported but Not Fully Identified

Species	P.G. Armstrong & Associates (2008)	Native Vegetation Solutions (2012)	Paul Armstrong & Associates (2012)	Native Vegetation Solutions (2013)	Outback Ecology Services (2013)	Issue
Corchorus sp.	1					No Corchorus in this region, specimen not vouchered at WAHERB
Liliaceae sp.	1					Not vouchered at WAHERB
Poaceae (Poa) sp. PA07/506	1					Not vouchered at WAHERB
Drosera sp. (P.G. Armstrong 07/545)	1					Specimen at WAHERB (PERTH 07801823)
Apocynaceae sp.		1				Not vouchered at WAHERB
Corchorus sp.		1				No Corchorus known in the region. Not vouchered at WAHERB
Eucalyptus sp. (sterile)		1				Not vouchered at WAHERB
Podolepis sp. (ATQ14-6)				1		Not vouchered at WAHERB
Eucalyptus sp. (sterile)				1		Not vouchered at WAHERB
Goodenia sp.				1		Not vouchered at WAHERB
Myrtaceae sp. #3 (ATQ120-7)				1		Not vouchered at WAHERB
Unknown sp. (unknown family).				1		Not vouchered at WAHERB
Haloragis sp.				1		Not vouchered at WAHERB
Eucalyptus sp.				1		Not vouchered at WAHERB
Alectryon oleifolius				1		Not vouchered at WAHERB, NO SUBSP noted, likely subsp. canescens

Species	P.G. Armstrong & Associates (2008)	Native Vegetation Solutions (2012)	Paul Armstrong & Associates (2012)	Native Vegetation Solutions (2013)	Outback Ecology Services (2013)	Issue
Frankenia sp.				1		Not vouchered at WAHERB
Sclerolaena sp.				1		Not vouchered at WAHERB
Psydrax sp.,				1		Not vouchered at WAHERB
Calandrinia sp.				1		Not vouchered at WAHERB
Sida sp.				1		Not vouchered at WAHERB
Hibiscus sp.				1		Not vouchered at WAHERB
Eremophila sp. YUNGVEG06				1		Missing from Species List
Abutilon sp. YUNGVEG10				1		Missing from Sp. List
Acacia sp. YUNGVEG21				1		Missing from Sp. List

Given the high endemism of flora of the BIF ranges in the region, there is some risk that one or more of these species may represent species with either taxonomic or conservation significance. In particular, the *Corchorus* sp. and *Hibiscus* sp. reported should be addressed in future targeted surveys.

4.1.5. Possible Mis-identifications of Flora

Four species previously reported represent possibly mis-identifications of flora, Table 9. None of these have conservation significance.

Table 9. Potential Misidentifications of Flora within Previous Consultants' Reports

Species Reported	Likely Correct Corrected Identification	P.G. Armstrong & Associates (2008)	Native Vegetation Solutions (2012)	Paul Armstrong & Associates (2012)	Native Vegetation Solutions (2013)	Outback Ecology Services (2013)
Acacia ramulosa	Acacia cockertoniana (BIF endemic)	1				
Minuria cunninghamii	Olearia humilis (Occurs on BIF and Laterite)	1				
Eucalyptus lesouefii	Eucalyptus lesouefii pruinose adult leaf form (G & S Cockerton WB40262) – newly recognised species, widespread	1				
Solanum hystrix (Weed)	Solanum hoplopetalum (a native species)					1

The possible misidentification of *Acacia cockertoniana* and *Olearia humilis* in PG Armstrong & Associates (2008) is corrected in Native Vegetation Solutions (2012). *Eucalyptus lesouefii* pruinose adult leaf form (G & S Cockerton WB40262) is a recently recognized species (mid 2020) which is widespread in the northern portion of the range of *E. lesouefii* (Malcolm French, pers. comm.) and not considered to warrant conservation listing. It is also common for *Solanum hoplopetalum* (a native species) to be misidentified as *Solanum hystrix* (a weed) and *S. hoplopetalum* is common and widespread in the region.

4.1.6. Declared Pests

Three species representing Declared Pests have been reported within or adjacent to the Yunndaga Rail Siding: C*arthamnus lanatus* (Saffron Thistle), *Opuntia* sp. (Prickly Pear) and *Heliotropium europaeum* (Common Heliotrope). These and other weed species should be addressed in any development proposal at this site.

4.1.7. Weeds of National Significance (WONS)

Opuntia species (Prickly Pears) are listed as Weeds of National Significance (WONS). Notes on control of Prickly Pear are presented in Appendix 5. Opuntioid cacti were previously recorded near the Yunndaga Study Area.

4.1.8. Threatened and Priority Ecological Communities

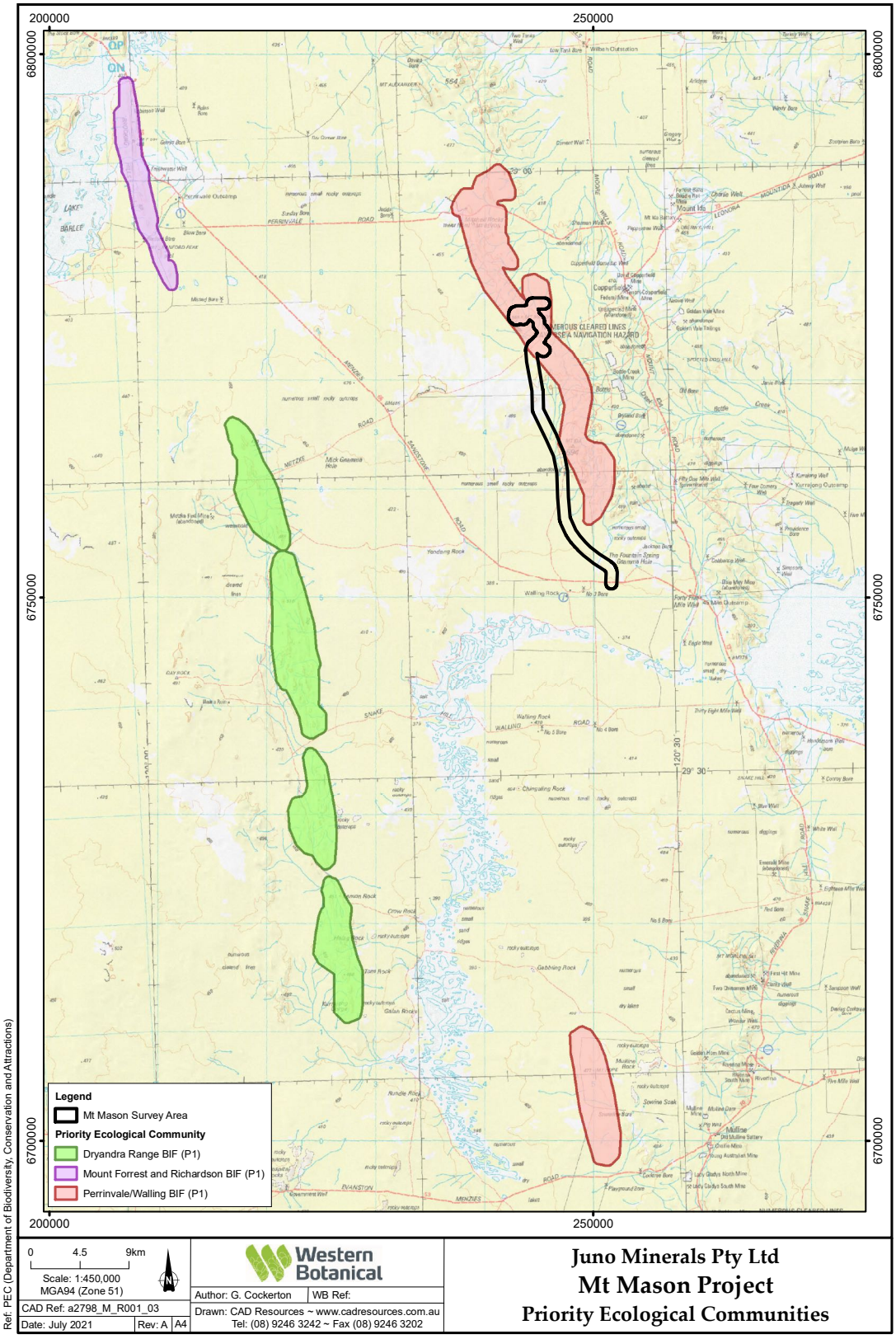
No Federally or State Listed Threatened Ecological Communities were identified within the Study Area.

The orebody areas and northern parts of the proposed haul road and the camp area all lie within the Perrinvale/Walling vegetation assemblages (banded ironstone formation) Priority 1 Priority Ecological Community. Tenements held by Juno Minerals are located within the central and southern parts of this PEC, Figure 10.

It is expected, upon evaluation, that some vegetation associations of the Study Area may be regionally restricted, particularly those associated with the geology of the BIF ranges and associated laterite caps and the erosion products from these ranges. These will most likely be widespread within similar landforms of the Mt Mason / Mt Ida area.

It is not expected that vegetation associations associated with (i) Archaean granite breakaways, (ii) aeolian sandplains or (iii) broad drainage tracts would be considered to fall within the definition of the PEC.

Figure 10. Priority Ecological Communities of the Region



4.2. Field Survey – Mt Mason

4.2.1. Landforms

The Mt Mason Study Area includes the following landforms.

- Low banded ironstone formation (haematite) hills (two to three parallel series) of moderate relief, estimated at 20 to 75m above the surrounding plains, with moderate outcrop and small areas of tallus slopes;
- Colluvial slopes with laterite gravel, angular BIF colluvium and minor outcrop;
- Lower slopes with lateritic gravely and sandy lateritic gravely textures, colluvium and alluvium;
- Small, disjunct low rises of weathered ferruginous duricrust;
- Subcropping weathered, fractured basalt and gabbro with associated calcrete concretion;
- Aeolian yellow sandplain west of the orebody area;
- Aeolian orange sandplain on top of weathered Archaean granite plateaux;
- Weathered Archaean granite plateaux, low breakaway cliffs of 2 to 5m relief, kaolinitic footslopes and associated saline plains with coarse silty sand soils; and
- Narrow to broad drainage lines, extensive alluvial floodplains and areas subject to sheet flow, often with a mantle of shallow red silty sand.

4.2.2. Vegetation Mapping

Field survey at Mt Mason to date has recognised thirty four vegetation associations at the NVIS Level V *Association* where three dominant species in each stratum is used to define vegetation associations. Of these:

- 23 are Mulga Woodlands, ranging from tops of BIF ridges to low lying drainage tracts;
- 1 is a *Casuarina* Woodland on outcropping calcrete over basalt;
- 5 are *Eucalyptus* woodlands with either calcrete influenced soils or on clay;
- 1 represents a tall *Allocasuarina* shrubland on duricrust outcrop; and
- 4 represent low shrublands with emergent *Acacia* on Archaean granite plateaux or duricrust outcrops.

These are summarised in Table 10.

Table 10. Draft Vegetation Associations of the Mount Mason Study Area

Structural Formation	Vegetation Association Code	Vegetation Association Name
Acacia (Mulga) Woodlands	A1	Mulgas over Acacia cockertoniana A. quadrimarginea
Acacia (Mulga) Woodlands	A1.1	Acacia quadrimarginea, A. incurvaneura, A. mulganeura, A. caesaneura (narrow phyllode form) over Prostanthera althoferi subsp. althoferi, Hibbertia arcuata, Olearia humilis on BIF Ridge tops
Acacia (Mulga) Woodlands	A1.2	Acacia cockertoniana, A. mulganeura over Thryptomene decussata Shrubland
Acacia (Mulga) Woodlands	A2	Acacia incurvaneura over Philotheca brucei
Acacia (Mulga) Woodlands	A3	Mulga over Prostanthera althoferi subsp. althoferi, Olearia humilis, Eremophila forrestii subsp. forrestii
Acacia (Mulga) Woodlands	A4	Mulga over Acacia ramulosa subsp. ramulosa over Eremophila forrestii
Acacia (Mulga) Woodlands	A4	Acacia incurvaneura, A. cockertoniana, A. ramulosa, Eremophila forrestii subsp. forrestii
Acacia (Mulga) Woodlands	A4	Acacia incurvaneura, A. cockertoniana, A. ramulosa, Eremophila forrestii subsp. forrestii
Acacia (Mulga) Woodlands	A6	Acacia sibirica shrubland
Acacia (Mulga) Woodlands	A6	Acacia sibirica, A. ramulosa subsp. ramulosa shrubland
Acacia (Mulga) Woodlands	A7	Acacia sibirica over Dodonaea lobulata
Acacia (Mulga) Woodlands	A9	Acacia sibirica over Ptilotus obovatus (Upright form, G Cockerton et. al. 15206)
Acacia (Mulga) Woodlands	A10	Mulga, Acacia effusifolia, Eremophila forrestii subsp. forrestii
Acacia (Mulga) Woodlands	A11	Mulga over Acacia cockertoniana over Philotheca brucei
Acacia (Mulga) Woodlands	A12	Acacia incurvaneura over Acacia ramulosa subsp. ramulosa
Acacia (Mulga) Woodlands	A14	Acacia quadrimarginea, Acacia ramulosa subsp. ramulosa over Thryptomene costata
Acacia (Mulga) Woodlands	A15	Acacia quadrimarginea on granite outcrop
Acacia (Mulga) Woodlands	A16	Acacia incurvaneura, A mulganeura, A. caesaneura over Eremophila forrestii
Acacia (Mulga) Woodlands	A17	Callitris columellaris, Acacia ramulosa subsp. ramulosa, Eucalyptus leptopoda subsp. leptopoda
Acacia (Mulga) Woodlands	A18	Acacia incurvaneura, A. ramulosa subsp. ramulosa, A. tetragonophylla, A. mulganeura over Ptilotus obovatus (typical Goldfields form)
Acacia (Mulga) Woodlands	A19	Acacia cockertoniana over Eremophila forrestii subsp. forrestii
Acacia (Mulga) Woodlands	BRX-P	Granite Breakaway with Acacia cockertoniana, A. ramulosa subsp. ramulosa, Calytrix desolata
Acacia (Mulga) Woodlands	DRMS	Drainage line Mulga Shrubland
Acacia Shrubland with Mallees	A13	Acacia effusifolia with emergent Mallees
Casuarina woodland	C1	Casuarina pauper over Ptilotus obovatus (Upright form, G Cockerton et. al. 15206)
Eucalypt woodlands	E1	Eucalyptus lesouefii Woodland over Eremophila pantonii shrubland
Eucalypt woodlands	E2	Eucalyptus salubris woodland

Structural Formation	Vegetation Association Code	Vegetation Association Name
Eucalypt woodlands	E3	Eucalyptus oleosa over Acacia incurvaneura and Acacia cockertoniana
Eucalypt woodlands	E4	Eucalyptus oleosa, Acacia incurvaneura, Acacia tetragonophylla
Eucalypt woodlands	E5	Eucalyptus sp. (mallee) over Acacia ramulosa, A. hemiteles, Senna artemisioides subsp. filifolia
Low Shrublands	S1	Hibbertia arcuata, Myrtaceae sp. Shrubland on Duricrust outcrop
Low Shrublands	S2	Acacia cockertoniana over Thryptomene decussata
Low Shrublands	S4	Calytrix hislopii P3, Calytrix desolata Shrubland with emergent Acacia cockertoniana on Duricrust outcrop
Low Shrublands	S5	Frankenia sp. Shrubland on saline plains
Tall Shrublands	S3	Allocasuarina acutivalvis, A. cockertoniana, A. quadrimarginea Tall Shrubland (lacking Calytrix) on Duricrust outcrop

Clearer definition of these vegetation associations will be available following the completion of vegetation assessment at a later date where data from quadrats and subsequent statistical validation will be presented.

A draft vegetation map is presented in

Appendix 2. Areas for which vegetation association information is lacking have been left blank and will need to be addressed at a later date.

4.2.3. Flora

The majority (82%) of flora apparent on site were confidently identified in the field. The total species count for the April survey was 135 species, of which 24 (18%) are earmarked for re-collection with flowers / fruits to enable identification to species level.

The majority of these are well known and widespread in the region and are not considered significant species. Two species encountered were confirmed as Priority Flora: *Calytrix hislopii* P3 and *Philotheca deserti* subsp. *brevifolia* P3.

A systematic Species List for the Mt Mason Study Area as recorded in April 2021 is presented in Appendix 3.

4.2.4. Significant Flora

Significant flora of the Study Area include conservation listed species, potentially novel taxa, records representing significant range extensions. Cumulatively, six significant flora are known within the Study Area:

- *Drosera eremaea* P1 – found on mid slopes of the BIF Range with one record of *Drosera* aff. *eremaea* P1 (PERTH 8600074) near the existing mine camp, both within and outside potential disturbance footprints.
- *Calytrix hislopii* P3 – found on low duricrust outcrops on low rises east of the orebody area, outside disturbance footprints.
- *Philotheca deserti* subsp. *brevifolia* P3 – found on gravely sandplains west of the proposed camp and haul road alignment, outside disturbance footprints.
- *Hysterobaeckea longipes* (PERTH 8423490), pending review of taxonomy and distribution within the Study Area – associated with Mulga woodlands within the haul road alignment.
- *Pterostylis virens* P3 – associated with granitoid landforms, outside disturbance footprints.
- *Corchorus* sp. reported by Native Vegetation Solutions (2012) – associated with the western flank of the BIF ridge within the orebody area - pending review of taxonomy and distribution within the Study Area as discussed above.

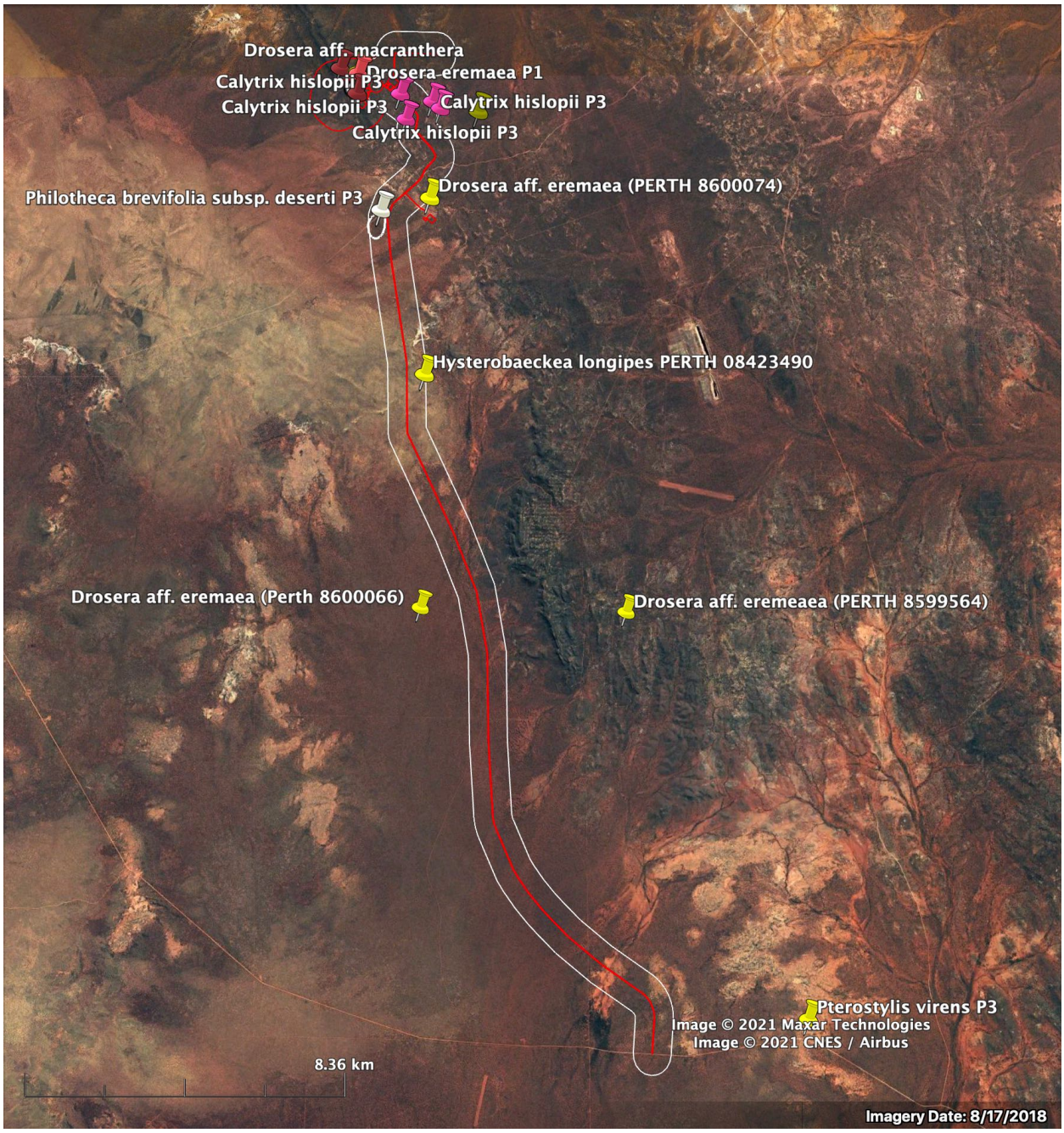
Locations of records of these combined datasets of Priority species are presented in Figure 11 and Figure 12. Locations of Priority Flora recorded during the April 2021 survey are presented on the draft vegetation maps for Mount Mason on maps 1, 2 and 3 in

Appendix 2.

Of these six species, *Drosera eremaea* P1 poses a management challenge as it has not yet been fully surveyed within the Study Area, a record lies within the proposed disturbance footprint and the species is poorly known regionally. The management of *Drosera eremaea* has been robustly been discussed with Juno Minerals management with the following strategy proposed to manage the impacts to this species:

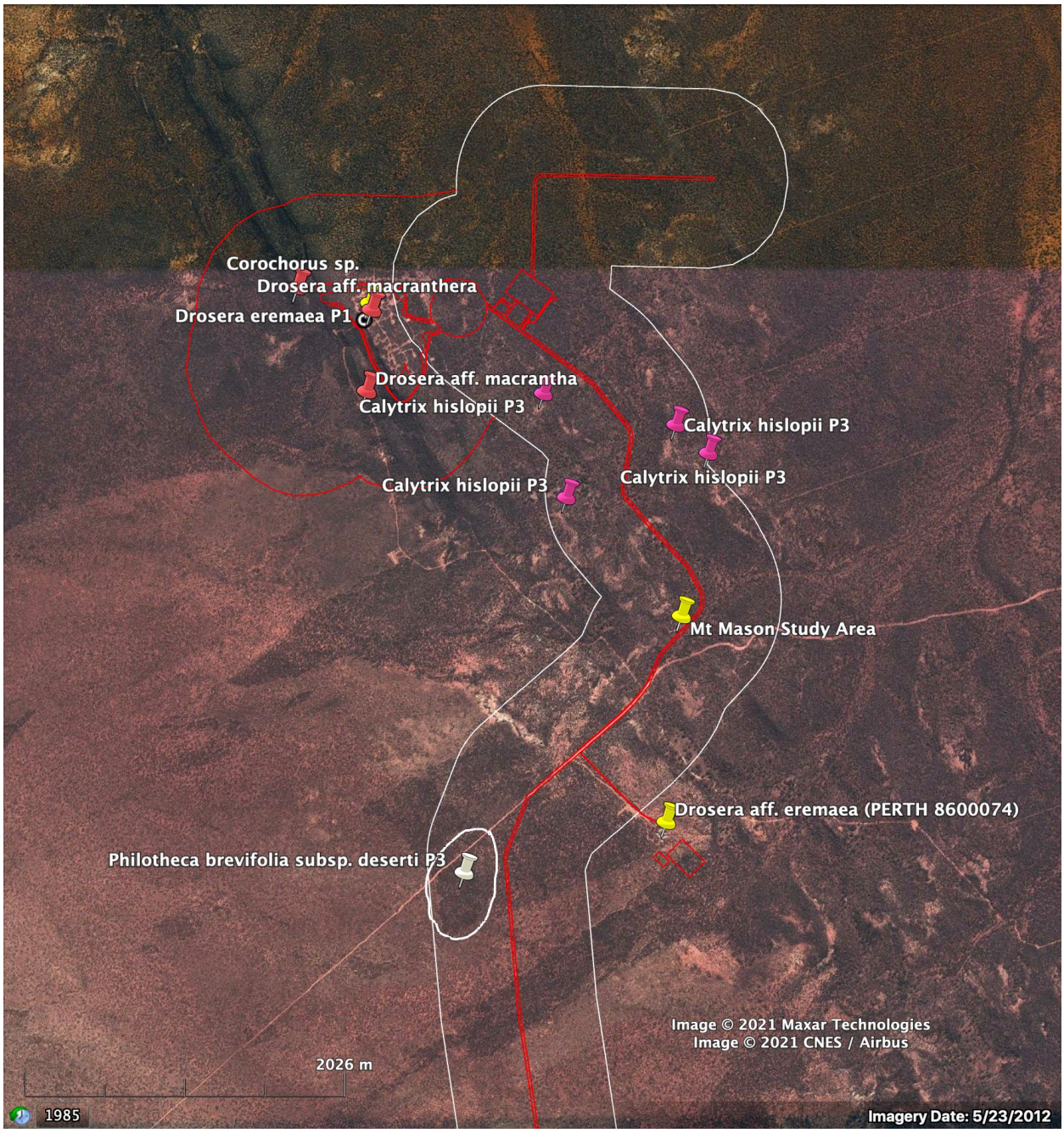
Hibiscus sp. Perrinvale Station (P1) was not observed, however, the dry seasonal conditions in April 2021 would not have been conducive to this species being readily recognised if it was present.

Figure 11. Overview of Locations of Significant Flora within and Adjacent to the Mt Mason Study Area.



Western Botanical

Figure 12. Enlargement of the orebody and Camp Area showing Significant Flora



4.2.5. Weeds

No weeds were recorded at the Mt Mason Study Area in April 2021 and few are expected.

4.2.6. Vegetation Condition

Vegetation Condition excluding areas that have been previously cleared for Pastoral management and or mining exploration are considered to be in Pristine Condition and displaying normal

characteristics for the prevailing seasonal conditions. While not specifically assessed, areas previously cleared for exploration have been rehabilitated and casual observations indicated excellent recruitment of a wide range of local native species of representing all strata of the surrounding vegetation. Inclusive of tracks and rehabilitated drill pads, the entire Study Area would be considered in Excellent Condition.

4.3. Field Survey – Yunndaga Siding

The single day spent at the Yunndaga Siding area in April 2021 was inadequate to gather more than a cursory overview of the vegetation and flora of the site. It was sufficient though to identify that the previous vegetation mapping of the siding area near the existing railway line was inadequate and needed to be redefined. With only partial coverage of this Study Area, eight vegetation associations were observed and described, Table 11.

Table 11. Vegetation Associations of the Yunndaga Siding Study Area (incomplete)

Veg Code	Description
YA1	Acacia aptaneura 7m, A. craspedocarpa 2.5m, PFC 10 to 15% over A. ramulosa 2m, PFC 5 to 8% on gently inclined alluvial washplain on clayey hard setting sand.
YA2	Acacia sibirica 3 to 5m, occasional Casuarina pauper 3 to 5m, PFC 5% over Acacia sibirica 2m, Senna artemisioides subsp. filifolia 1.7m, Eremophila pantonii 1.8m, PFC 10 15% over scattered Atriplex bunburyana 0.5m, Ptilotus obovatus (typical Goldfields form) 0.5m, PFC 2%. Soil is a hard setting sandy clay, relatively level, overlying carbonate and basalt rocks (observed in costene), can have discontinuous weathered granite and quartz stony mantle.
YA3	Acacia sibirica 3 to 5m, PFC 5% over very scattered Scaevola spinescens (Narrow leaf, spiny form) 1.5m, occasional Maireana sedifolia 1m, Dodonaea lobulata 1m, Dodonaea rigida 1m, Eremophila latrobei subsp. latrobei 1.5m, Ptilotus obovatus (typical Goldfields form) 0.5m, PFC 2%. Site represents a gentle slope and has a continuous sub-rounded ironstone pisolitic gravel over a red silty sand over calcrete.
YA4	Eucalyptus oleosa 12m, PFC 5% over Acacia sibirica 3 to 6m, PFC 5 to 10% over Senna artemisioides subsp. filifolia 1.5m, Scaevola spinescens (narrow leaf, spiny form) 1m, PFC 2 to 5% over Ptilotus obovatus (typical Goldfields form) 0.5m, PFC 1 to 5% and annual grasses. Soil is firm clayey sand. A drainage area with the region south of the Menzies - Evanston Rd having been affected by surface drainage interruption.
YA5	Mulga shrubland on hardpan plain. A. caesaneura 2 to 6m, A. aneura 2 to 6m, occasional Dodonaea rigida 1.5m, Scaevola spinescens (narrow leaf, spiny form) 1.5m, PFC 1 to 2%. An area subject to sheet flow and which support a wide range of annuals in appropriate season.
YE1	Eucalyptus cylindrica 8 to 10m, Casuarina pauper 8m, PFC 10 to 15% over Dodonaea viscosa subsp. angustissima 1.8m, Senna artemisioides subsp. filifolia 1.5m, PFC 15 to 20%. Soil is a red-brown silty sand, hard setting.

Veg Code	Description
YE2	Eucalyptus oleosa 12m, E. concinna 8m, PFC 5% over Acacia sibirica 3 to 6m, PFC 5 to 10&% over Senna artemisioides subsp. filifolia 1.5m, Scaevola spinescens (narrow leaf, spiny form) 1m, PFC 2 to 5%. Soil is firm clayey sand.
YS1	Chenopod shrubland with emergent Eremophila longifolia and Casuarina pauper. Maireana sedifolia, M. pyramidata 1.2m, PFC 5% with Ptilotus obovatus (typical Goldfields form) 0.4m, annual grasses on calcrete plain with a thin veneer of fine sandy clay soil

The vegetation associations at Yunndaga Siding are not considered directly comparable with those at Mount Mason.

Sixty eight species were recorded, including two weed species. No priority Flora were recorded and, based on the Desktop Assessment, no Conservation-Significant Flora are expected at Yunndaga Siding. A draft systematic species list observed in April 2021 for the Yunndaga Siding area is presented in Appendix 4.

4.4. Statistical Analysis of Vegetation Associations

Not applicable at this stage.

5. Assessment Against the 10 Clearing Principles

As current studies of flora and vegetation for the Mount Mason and Yunndaga Siding Study Areas have not been completed and revised data is not available, it is premature to attempt to assess the project against the EPA's 10 Clearing Principles. However, the following can be stated for each site:

Mount Mason Study Area

- The Mount Mason Study Area has relatively simple flora with moderate diversity for the region and reflecting that of similar landforms in the region. Vegetation is in Pristine Condition outside areas of direct disturbance.

- The works presented in Native Vegetation Solutions (NVS) (2012), while limited to Disturbance Footprints with minimal buffers, is valuable and mostly accurate with only minor amendments to species identifications and no additional Priority Flora have been noted within proposed Disturbance Footprints.

- Targeted Surveys for Priority Flora had not been implemented in the NVS (2012) works.

- The Mount Mason Study Area supports three Priority Flora: (*Drosera eremaea* P1, *Calytrix hislopii* P3, *Philotheca brevifolia* subsp. *deserti* P3. Of these:

    - *Calytrix hislopii* P3, *Philotheca brevifolia* subsp. *deserti* P3 populations lie well outside area of proposed development.

    - *Drosera eremaea* P1 is known within and in close proximity to the proposed disturbance footprint within the orebody area.

    - One record of *Drosera* aff. *eremaea* is known within the Exploration Camp area. Based on the regional distribution of similar species, this is likely to be *D. eremaea* P1.

    - One record of *Hysterobaeckea longipes* is noted adjacent to the Haul Road alignment approximately 7.75km south of the Mt Mason orebody area. This represents a 350 km disjunct occurrence. A misidentification of this specimen is suspected and a review of this specimen has been instigated.

- Other areas of proposed development (haul road, proposed explosives magazine, access road from the Mt Ida road) are not known to support any species with conservation listing. Given the landforms, soil and vegetation associations present in these areas, no Priority Flora are known, nor are they expected to occur, within proposed development footprints outside the orebody area.

Yunndaga Siding Study Area

- The Yunndaga Siding Study Area is reported in Paul Armstrong & Associates (2012) and Outback Ecology Services (OES) (2013). Vegetation Mapping presented within these documents was found to be inaccurate and requiring major revision.

- Flora identifications presented within OES (2013) are considered largely accurate and the weed mapping is likely similarly of high value.

- No Priority or Threatened Flora are noted, nor are they expected, at the Yunndaga Siding Study Area.

6. Limitations

6.1. Desktop Assessment

Substantial information in the form of previous consultant's reports was available on the flora, vegetation and conservation significant flora of the Study Areas. Information gathered from Western Botanical reports covering adjacent BIF ranges was assimilated where appropriate. Publicly available data from the DBCA and DAWE were incorporated in the desktop review.

Few specimens from any of the previous flora surveys appear to have been vouchered at the WA Herbarium, meaning queries on the identification of some taxa that appear to be anomalous records could not be verified.

6.2. Field Assessment – Autumn 2021 Works

Limitation	Discussion
Available sources of contextual information	Reasonable contextual information was available for the Mount Mason and Yunndaga Siding Study Areas. Previous Consultant's reports and publicly available data was useful in preparing for field operations in Autumn 2021. This is not a Limitation for the proposal
The Scope of the survey	The survey was scoped as a Reconnoitre, Gap Analysis and extrapolation of Vegetation Mapping to bring the project in-line with EPA Guidance 2016 requirements. This has not allowed for detailed assessment of vegetation throughout the expanded Study Area and therefore is a Limitation for the proposal.
Proportion of flora collected and identified	Perennial flora of the Mount Mason has been reasonably well addressed in April 2021 though 19 specimens of perennials require verification following collection of adequate at a later date. Annuals have not been adequately reviewed. This is a Limitation for the Mount Mason Study Area. Only a small proportion of the Yunndaga Siding flora has been reassessed in April 2021. This is a Limitation for the Yunndaga Siding Study Area

Limitation	Discussion
Completeness and further work which may be needed	**Mount Mason** While previous botanical assessments have been conducted at Mt Mason, the areas assessed do not comply with EPA Guidance 2016 requirements. The Gap Analysis at the Mount Mason Study Area identified the following are required: • Finalisation of vegetation mapping within the 500m buffer around proposed Development Envelopes. • Establishment of additional quadrats for adequate representation and subsequent statistical analysis of data. • Finalisation of flora collections and identifications of some species within the Study Area and Development Envelopes. • Targeted survey for *Drosera eremaea* P1 within the Study Area inclusive of the deposit area, northern part of the haul road and camp area following suitable winter seasonal rainfall. This is a Limitation for the proposal. **Yunndaga Siding** While previous botanical assessments have been conducted at the Yunndaga Siding Study Area, the areas assessed do not comply with EPA Guidance 2016 requirements. The Gap Analysis at the Yunndaga Siding Study Area identified the following are required: • Mapping the vegetation at NVIS Level 5 *Association* level of detail throughout the Study Area. • Establishment of quadrats for adequate representation and subsequent statistical analysis of data. • Finalisation of flora collections and identifications of some species within the Study Area and Development Envelopes. This is a Limitation for the proposal.
Mapping reliability	**Mount Mason** Though vegetation mapping has not been completed, pending some gaps being addressed, quadrat establishment and scoring and subsequent statistical validation, the descriptions and boundaries of communities are considered sufficiently accurate to define the Vegetation Associations of the Study Area. Full descriptions have not been reported in this document, pending finalisation of the points above. This is a Limitation for the proposal. **Yunndaga Siding** The Autumn 2021 review of previous vegetation mapping at Yunndaga Siding was found to be inaccurate is requiring revision. This is a Limitation for the proposal.

Limitation	Discussion
Timing: weather, season	The Autumn 2021 surveys at both Mount Mason and Yunndaga Siding Study Areas were undertaken under dry seasonal conditions. This allowed most perennial species to be accurately identified, though some gaps remain at the Mt Mason site where flowering material is required to confidently identify 19 perennial species. The Autumn 2021 survey did not allow for annuals or geophytes to be addressed. Similarly, the review of *Drosera eremaea* P1 within the orebody and mine camp areas at Mount Mason could not be reassessed, verified or discounted due to dry seasonal conditions. This is a Limitation for the proposal.
Disturbances	Disturbances at Mount Mason were limited to previously rehabilitated exploration areas and to currently serviceable tracks. This is not a Limitation for the proposal. The Yunndaga Siding Study Area includes many areas that have been historically disturbed. While this has had an impact on the quality of vegetation, particularly around previous mining activities and infrastructure, and numerous weeds are known to be present, vegetation and flora of this Study Area can still be adequately assessed. The review of vegetation and flora at Yunndaga Siding is yet to be undertaken. This is not a Limitation for the proposal.
Intensity	**Mount Mason** While vegetation mapping within the Mount Mason Study Area inclusive of a 500m buffer around planned Development Envelopes has been implemented at adequate intensity to define communities and map approximate boundaries, the establishment of representative quadrats has not been implemented at adequate intensity to comply with EPA Guidance (2016) requirements. Targeted Surveys for *Drosera eremaea* P1 have not yet been undertaken under favourable seasonal conditions. This is a Limitation for the proposal. **Yunndaga Siding** Studies complying with EPA Guidance (2016) have not yet been undertaken at Yunndaga Siding. Previous vegetation mapping needs revision and adequate quadrat representation within the Study Area is yet to be implemented. This is a Limitation for the proposal
Resources	Adequate resources were available for the Autumn 2021 assessment at the Mount Mason Study Area, however, inadequate time was available to map the revise the vegetation mapping at the Yunndaga Siding site. This is a Limitation for the proposal

Limitation	Discussion
Access	**Mount Mason** Access within the Mount Mason orebody and infrastructure areas was readily available. Access within the proposed Haul Road was limited and allowed only limited access to the central and southern portions. However, both these regions have relatively uniform vegetation communities as demonstrated on aerial photography and satellite imagery of the area and the limited access here is not considered a material limitation to the vegetation mapping of these areas. This is a minor Limitation for vegetation mapping within the Study Area. **Yunndaga Siding** Good access is available at Yunndaga Siding. This is not a limitation for the proposal
Experience levels	Geoff Cockerton, Principal Botanist, has 30 years experience in assessment of flora and vegetation in the Murchison biogeographic region of Western Australia, and specifically over 16 years assessing the flora and vegetation of the Banded Ironstone formation ranges of the Yilgarn region. Jonathan Warden, Senior Botanist, has 13 years experience in assessing flora and vegetation of similar landscape to those at Mount Mason and Yunndaga Siding. Jason Paterson has 2 years experience in flora survey and has worked on several projects in the Menzies region in this timeframe. Experience levels of Senior botanists is not considered a limitation for this project.

7. List of Participants

Staff Member	Field Surveys	Specimen Identification	Data Analysis	Report Preparation
Geoff Cockerton B.Sc. (Biology) Flora Taking (Biological Assessment) License No. – FB62000046	**1**	**1**	**1**	**1**
Jason Paterson B.Sc. Hons (Environmental Science) Flora Taking (Biological Assessment) License No. – FB62000299	**1**	**1**		
Steven Cockerton Flora Taking (Biological Assessment) License No. –FB62000300	**1**			
Jonathan Warden Flora Taking (Biological Assessment) License No. – FB6200044		**1**		

8. Acknowledgements

- Mr. Malcolm French is thanked for his comments on *Eucalyptus lesouefii* pruinose adult leaf form (G & S Cockerton WB40262).

- Dr Barbara Rye, WA Herbarium, for review of specimen of *Hysterobaeckea longipes* reportedly collected near Mt Mason.

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Appendix 1. EPA Vegetation Condition Scale

Table 2: Vegetation Condition Scale (adapted from Keighery 1994 and Trudgen 1988)

Vegetation Condition	South West and Interzone Botanical Provinces	Eremaean and Northern Botanical Provinces
Pristine	Pristine or nearly so, no obvious signs of disturbance or damage caused by human activities since European settlement.	
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species. Damage to trees caused by fire, the presence of non-aggressive weeds and occasional vehicle tracks.	Pristine or nearly so, no obvious signs of damage caused by human activities since European settlement.
Very Good	Vegetation structure altered, obvious signs of disturbance. Disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.	Some relatively slight signs of damage caused by human activities since European settlement. For example, some signs of damage to tree trunks caused by repeated fire, the presence of some relatively non-aggressive weeds, or occasional vehicle tracks.
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.	More obvious signs of damage caused by human activity since European settlement, including some obvious impact on the vegetation structure such as that caused by low levels of grazing or slightly aggressive weeds.
Poor		Still retains basic vegetation structure or ability to regenerate it after very obvious impacts of human activities since European settlement, such as grazing, partial clearing, frequent fires or aggressive weeds.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds at high density, partial clearing, dieback and grazing.	Severely impacted by grazing, very frequent fires, clearing or a combination of these activities. Scope for some regeneration but not to a state approaching good condition without intensive management. Usually with a number of weed species present including very aggressive species.
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 and shrubs.	Areas that are completely or almost completely without native species in the structure of their vegetation; i.e. areas that are cleared or 'parkland cleared' with their flora comprising weed or crop species with isolated native trees or shrubs.

10 **Technical Guidance** – Flora and Vegetation Surveys for Environmental Impact Assessment

Appendix 2. Draft Vegetation Map for the Mount Mason Study Area

Legend

Acacia (Mulga) Woodlands

- A1 - Acacia quadrimarginea, A. incurvaneura, A. mulganeura, A. caesaneura (narrow phyllode form) over Prostanthera althoferi subsp. althoferi, Hibbertia arcuata, Olearia humilis, may contain Thryptomene decussata, on BIF Ridge tops
- A2 - Acacia incurvaneura over Philotheca brucei
- A3 - Mulga over Prostanthera althoferi subsp. althoferi, Olearia humilis, Eremophila forrestii subsp. forrestii
- A4 - Acacia incurvaneura, A. cockertoniana, A. ramulosa, Eremophila forrestii subsp. forrestii
- A6 - Acacia sibirica, A. ramulosa subsp. ramulosa shrubland
- A7 - Acacia sibirica over Dodonaea lobulata
- A9 - Acacia sibirica over Ptilotus obovatus (upright form)
- A10 - Mulga, Acacia effusifolia, Eremophila forrestii subsp. forrestii
- A11 - Mulga over Acacia cockertoniana over Philotheca brucei
- A12 - Acacia incurvaneura over Acacia ramulosa subsp. ramulosa
- A14 - Acacia quadrimarginea, Acacia ramulosa subsp. ramulosa over Thryptomene costata
- A15 - Acacia quadrimarginea on granite outcrop
- A17 - Callitris columellaris, Acacia ramulosa subsp. ramulosa, Eucalyptus leptopoda subsp. leptopoda
- A18 - Acacia incurvaneura, A. ramulosa subsp. ramulosa, A. tetragonophylla, A. mulganeura over Ptilotus obovatus (typical Goldfields form)
- A19 - Acacia cockertoniana over Eremophila forrestii subsp. forrestii
- DRMS - Drainage line Mulga Shrubland

Acacia Shrubland with Mallees

- A13 - Acacia effusifolia with emergent Mallees
- A13 (Recent Fire) - Acacia effusifolia with emergent Mallees

Casuarina woodland

- C1 - Casuarina pauper over Ptilotus obovatus (Upright form)

Eucalypt woodlands

- E1 - Eucalyptus lesouefii (pruinose leaf form) Woodland over Eremophila pantonii shrubland
- E2 - Eucalyptus salubris woodland
- E3 - Eucalyptus oleosa over Acacia incurvaneura and Acacia cockertoniana
- E4 - Eucalyptus oleosa, Acacia incurvaneura, Acacia tetragonophylla
- E5 - Eucalyptus spp. (mallee) over Acacia ramulosa, A. hemiteles, Senna artemisioides subsp. filifolia

Low Shrublands

- S1 - Hibbertia arcuata, Myrtaceae sp. Shrubland on Duricrust outcrop
- S2 - Acacia cockertoniana over Thryptomene decussata
- S4 - Calytrix hislopii P3, Calytrix ?desolata Shrubland with emergent Acacia cockertoniana on Duricrust outcrop
- S5 - Frankenia sp. Shrubland on saline plains

Tall Shrublands

- S3 - Allocasuarina acutivalvis, A. cockertoniana, A. quadrimarginea (lacking Calytrix) on Duricrust outcrop

Other

- D - Disturbed

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Date: Jul 2021 | Rev: A | A3

Western Botanical

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Drawn: CAD Resources ~ www.cadresources.com.au
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Mt Mason Project

Vegetation Legend

Image Source: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

Survey Area

Calytrix hislopii

Sheet Layout

0 100 200m

Scale: 1:10,000

MGA94 (Zone 50)

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Vegetation: Sheet 1 of 13

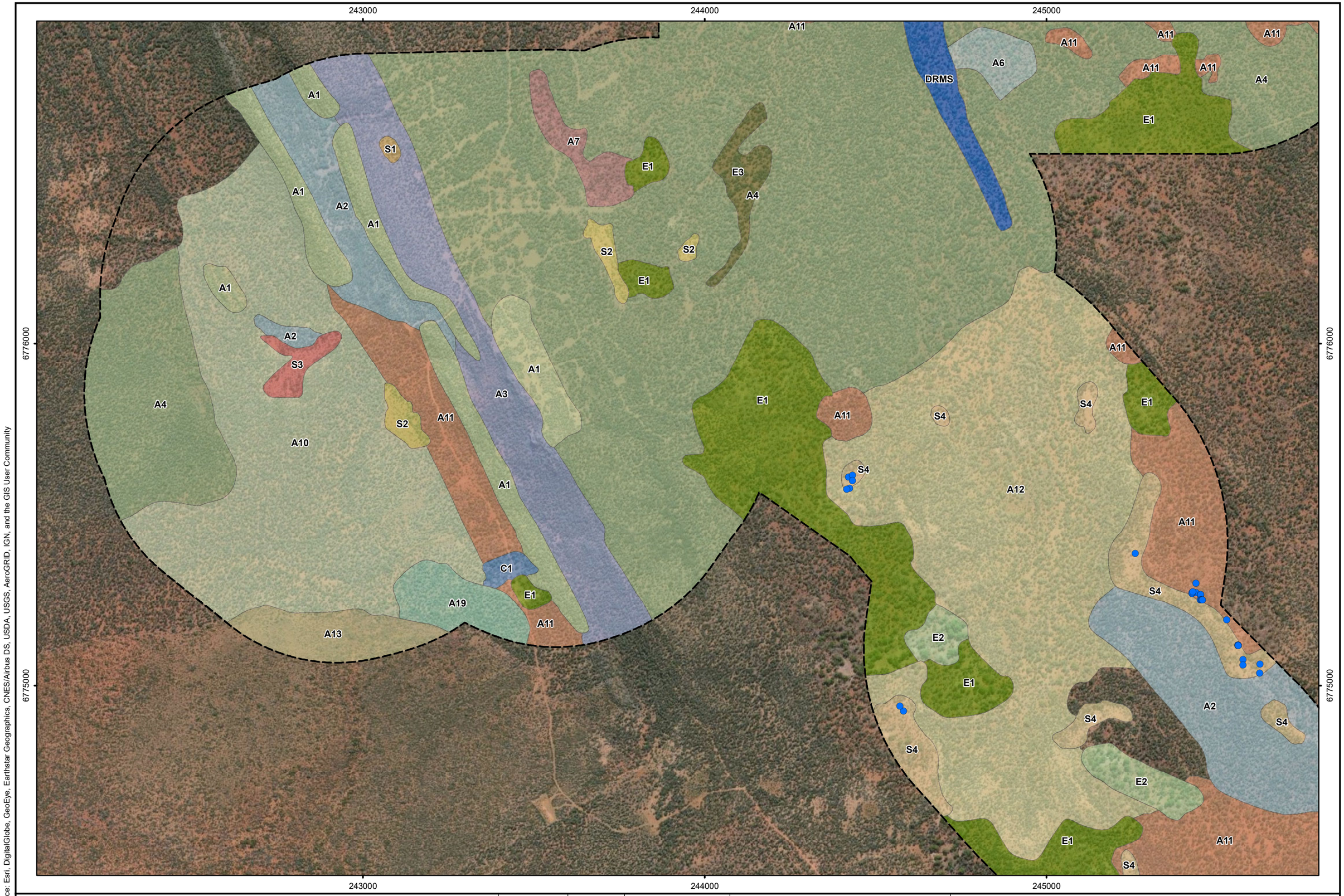

Image Source: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

Survey Area

Calytrix hislopii

Sheet Layout

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Scale: 1:10,000
MGA94 (Zone 50)

CAD Ref: a2798_M_R001_08

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Vegetation: Sheet 2 of 13

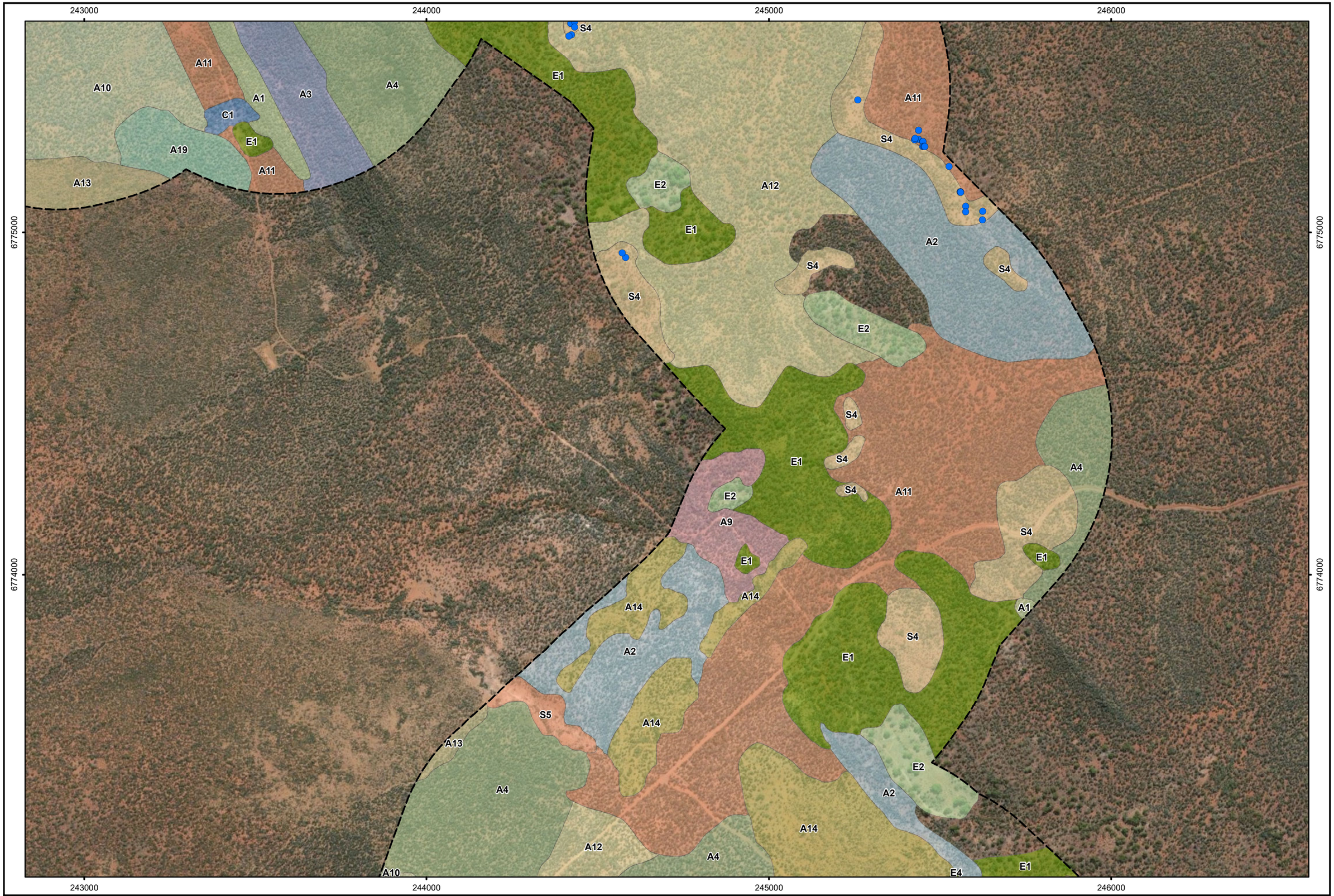

Image Source: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

Survey Area

Calytrix hislopii

Sheet Layout

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Scale: 1:10,000

MGA94 (Zone 50)

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Vegetation: Sheet 3 of 13

243000
244000
245000
246000
6773000
6772000
6771000

A11
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A2
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A14
E1
S4
E2
A4
A10
E4
A17
A13
A15
A17
A17
A13 (Recent Fire)
A13

Image Source: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

Survey Area

Philotheca deserti subsp. *brevifolia*

Sheet Layout

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Scale: 1:10,000
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Vegetation: Sheet 4 of 13

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Image Source: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

Survey Area

Sheet Layout

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Scale: 1:10,000
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Vegetation: Sheet 5 of 13

244000 245000 246000 247000

6768000

6767000

6766000

A17

A17

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Image Source: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

Survey Area

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MGA94 (Zone 50)

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Vegetation: Sheet 6 of 13

245000 246000 247000

6766000 6765000 6764000

A13 A18 A4 A19

Image Source: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

Survey Area

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Vegetation: Sheet 7 of 13

245000 246000 247000 248000

6763000

6762000

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A18

A4

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Legend

Survey Area

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Vegetation: Sheet 8 of 13

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6760000

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A18

Image Source: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

Survey Area

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Vegetation: Sheet 9 of 13

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248000
249000
6758000
6757000

A4
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A18
A4

Image Source: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

Survey Area

Sheet Layout

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Scale: 1:10,000
MGA94 (Zone 50)

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Mt Mason Project
Vegetation: Sheet 10 of 13

248000
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6755000
A4
Image Source: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

Survey Area

Sheet Layout

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MGA94 (Zone 50)

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Mt Mason Project
Vegetation: Sheet 11 of 13

249000 250000 251000 252000

6754000 6753000 6752000

A18 A4 A14 A14 A10 E5

Image Source: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

Survey Area

Sheet Layout

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0 100 200m

Scale: 1:10,000
MGA94 (Zone 50)

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Mt Mason Project
Vegetation: Sheet 12 of 13

250000 251000 252000 253000

6752000

6751000

A4

A14

A10

D

E5

Image Source: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

Survey Area

Sheet Layout

N

0 100 200m

Scale: 1:10,000
MGA94 (Zone 50)

CAD Ref: a2798_M_R001_08

Date: Jul 2021 | Rev: A | A3

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Mt Mason Project
Vegetation: Sheet 13 of 13

Appendix 3. Interim Systematic Species List for the Mount Mason Study Area

Family	Taxon	Recollection Required ?
Amaranthaceae	Ptilotus obovatus (typical Goldfields form)	
Amaranthaceae	Ptilotus obovatus (upright calcrete form)	
Amaranthaceae	Ptilotus polystachyus	
Amaranthaceae	Ptilotus ?aervoides / roei	Recol
Apocynaceae	Alyxia buxifolia	
Apocynaceae	Marsdenia australis	
Asteraceae	? Pluchea dentex	Recol
Asteraceae	Chrysocephalum puteale	
Asteraceae	Olearia humilis	
Asteraceae	Olearia muelleri	
Caryophyllaceae	Indet.	Recol
Casuarinaceae	Allocasuarina acutivalvis subsp. acutivalvis	
Casuarinaceae	Casuarina pauper	
Chenopodiaceae	Atriplex bunburyana	
Chenopodiaceae	Maireana ?radiata	Recol
Chenopodiaceae	Maireana georgei	
Chenopodiaceae	Maireana glomerifolia	
Chenopodiaceae	Maireana pyramidata	
Chenopodiaceae	Maireana sedifolia	
Chenopodiaceae	Maireana triptera	
Chenopodiaceae	Maireana sp. BRX-FOL	Recol
Chenopodiaceae	Rhagodia drummondii	
Chenopodiaceae	Rhagodia eremaea	
Dilleniaceae	Hibbertia ?exasperata (lignotuberous)	Recol
Dilleniaceae	Hibbertia arcuata	
Euphorbiaceae	Ptilotus drummondii	
Euphorbiaceae	Euphorbia drummondii	
Euphorbiaceae	Phyllanthus erwinii	
Fabaceae	Acacia aneura sens. str.	
Fabaceae	Acacia burkittii	
Fabaceae	Acacia caesaneura (narrow phyllode form)	
Fabaceae	Acacia caesaneura (typical phyllode form)	
Fabaceae	Acacia cockertoniana	
Fabaceae	Acacia colletioides	
Fabaceae	Acacia craspedocarpa	
Fabaceae	Acacia effusifolia	
Fabaceae	Acacia incurvaneura	
Fabaceae	Acacia kempeana	
Fabaceae	Acacia mulganeura	
Fabaceae	Acacia murrayana sens. str.	
Fabaceae	Acacia quadrimarginea	
Fabaceae	Acacia ramulosa subsp. ramulosa	
Fabaceae	Acacia rhodophloia	
Fabaceae	Acacia sibirica	

Family	Taxon	Recollection Required ?
Fabaceae	Acacia aff. rigens	Recol
Fabaceae	Acacia tetragonophylla	
Fabaceae	Acacia aff. rigens	Recol
Fabaceae	Mirbelia sp. Indet	Recol
Fabaceae	Senna aff. manicula	Recol
Fabaceae	Senna artemisioides subsp. filifolia	
Fabaceae	Senna sp. Meekatharra (E. Bailey 1-26)	
Frankeniaceae	Frankenia sp. Indet	Recol
Goodeniaceae	Scaevola spinescens (non-spiny, broad leaf form)	
Goodeniaceae	Scaevola spinescens (spiny, narrow leaf form)	
Haloragaceae	Haloragis odontocarpa	
Haloragaceae	Haloragis trigonocarpa	
Lamiaceae	Prostanthera althoferi subsp. althoferi	
Lamiaceae	Microcorys sp. Mt Gibson (SJ Patrick 2098)	
Lamiaceae	Teucrium teucriflora	
Loranthaceae	Amyema banksii (on Grevillea ?nematophylla)	
Loranthaceae	Amyema benthamii (on Brachychiton gregorii)	
Loranthaceae	Amyema miquellii (on Eucalyptus oleosa)	
Malvaceae	Abutilon sp.	Recol
Malvaceae	Abutilon cryptopetalum	
Malvaceae	Abutilon otocarpum subsp. prostratum	
Malvaceae	Brachychiton gregorii	
Malvaceae	Sida aff. calyxhymenia	Recol
Malvaceae	Sida ectogamma	
Malvaceae	Sida sp. dark green fruits ((S. van Leeuwen 2260)	
Malvaceae	Sida sp. golden calyces pubescent (GJ Leach 1966)	
Myrtaceae	Myrtaceae sp. (BRX-P)	Recol
Myrtaceae	Myrtaceae sp. (with A. effusifolia 19/4/21)	Recol
Myrtaceae	Myrtaceae sp. (with A. effusifolia 19/4/21)	Recol
Myrtaceae	Calytrix hislopii PRIORITY 3	
Myrtaceae	Calytrix desolata	Recol
Myrtaceae	Eucalyptus ewartiana	
Myrtaceae	Eucalyptus leptopoda subsp. elevata	
Myrtaceae	Eucalyptus lesouefii (pruinose adult leaf form) (G & S Cockerton WB40262)	
Myrtaceae	Eucalyptus oleosa subsp. ?	
Myrtaceae	Eucalyptus salubris	
Myrtaceae	Eucalyptus sp. Indet.	Recol
Myrtaceae	Euryomyrtus patrickiae	
Myrtaceae	Melaleuca leiocarpa (sandplain form)	
Myrtaceae	Micromyrtus chrysodema P1 / flaviflora	Recol
Myrtaceae	Myrtaceae sp. Indet	Recol
Myrtaceae	Myrtaceae sp. Indet	Recol
Myrtaceae	Myrtaceae sp. Indet	Recol
Myrtaceae	Thryptomene costata	
Myrtaceae	Thryptomene decussata	
Pittosporaceae	Bursaria occidentalis	
Poaceae	Neurachne minor	

Family	Taxon	Recollection Required ?
Poaceae	Aristida contorta	
Poaceae	Austrostipa sp. Indet	Recol
Poaceae	Austrostipa elegantissima	
Poaceae	Austrostipa sp.	
Poaceae	Enneapogon caerulescens	
Poaceae	Eragrostis eriopoda	
Poaceae	Eriachne helmsii	
Poaceae	Eriachne pulchella subsp. pulchella	
Poaceae	Eriachne mucronata Desert form glabrous (WB40048)	
Poaceae	Paspalidium basicladum	
Poaceae	Triodia rigidissima	Recol
Portulacaceae	Calandrinia sp. Indet.	Recol
Portulacaceae	Portulaca intraterranea	Recol
Proteaceae	Grevillea extorris	
Proteaceae	Grevillea nematophylla	
Proteaceae	Grevillea sarissa subsp. sarissa	
Proteaceae	Hakea arida subsp., arida	
Proteaceae	Hakea lorea subsp. Lorea	
Rhamnaceae	Cryptandra connata	
Rubiaceae	Psydrax latifolia	
Rubiaceae	Psydrax suaveolens	
Rubiaceae	Solanum cleistogamum	
Rubiaceae	Solanum lasiophyllum	
Rutaceae	Phebalium filifolium	
Rutaceae	Philotheca brucei subsp. brucei	
Rutaceae	Philotheca deserti subsp. brevifolia PRIORITY 3	
Sapindaceae	Dodonaea lobulata	
Sapindaceae	Dodonaea petiolaris	
Sapindaceae	Dodonaea rigida	
Sapindaceae	Dodonaea viscosa subsp. spatulata	
Scrophulariaceae	Eremophila forrestii subsp. forrestii	
Scrophulariaceae	Eremophila granitica	Recol
Scrophulariaceae	Eremophila georgei	
Scrophulariaceae	Eremophila latrobei subsp. latrobei	
Scrophulariaceae	Eremophila longifolia (green leaf form)	
Scrophulariaceae	Eremophila oldfieldii subsp. angustifolia	
Scrophulariaceae	Eremophila pantonii	
Scrophulariaceae	Eremophila platycalyx subsp. granites (DJ Edinger & G Marsh DJE4788)	
Solanaceae	Nicotiana sp.	Recol
Solanaceae	Solanum ferocissimum	
Stylidiaceae	Stylidium longibracteatum	
Thymelaeaceae	Pimelea microcephala	
Thymelaeaceae	Pimelea sp. Indet	Recol
Zygophyllaceae	Tribulus asterocarpus	

Appendix 4. Interim Systematic Species List for the Yunndaga Siding Study Area, recorded April 2021.

Family	Genus	Species
Amaranthaceae	Ptilotus	obovatus (typical Goldfields form)
Apocynaceae	Alyxia	buxifolia
Apocynaceae	Marsdenia	australis
Asteraceae	Olearia	muelleri
Chenopodiaceae	Atriplex	bunburyana
Chenopodiaceae	Enchylaena	lanata
Chenopodiaceae	Maireana	georgei
Chenopodiaceae	Maireana	pyramidata
Chenopodiaceae	Maireana	sedifolia
Chenopodiaceae	Rhagodia	drummondii
Chenopodiaceae	Rhagodia	preissii
Chenopodiaceae	Salsola	tragus
Euphorbiaceae	Euphorbia	drummondii
Euphorbiaceae	Phyllanthus	irwinii
Fabaceae	Acacia	aneura sens. str.
Fabaceae	Acacia	aptaneura
Fabaceae	Acacia	burkittii
Fabaceae	Acacia	caesaneura
Fabaceae	Acacia	craspedocarpa
Fabaceae	Acacia	effusifolia
Fabaceae	Acacia	hemiteles
Fabaceae	Acacia	incurvaneura
Fabaceae	Acacia	ligulata
Fabaceae	Acacia	murrayana
Fabaceae	Acacia	oswaldii
Fabaceae	Acacia	ramulosa subsp. ramulosa
Fabaceae	Acacia	sibirica
Fabaceae	Acacia	tetragonophylla
Fabaceae	Casuarina	pauper
Fabaceae	Senna	artemisioides subsp. filifolia
Fabaceae	Senna	artemisioides subsp. artemisioides
Goodeniaceae	Scaevola	spinescens (broad leaf, non-spiny form)
Goodeniaceae	Scaevola	spinescens (narrow leaf, spiny form)
Haloragaceae	Haloragis	odontocarpa
Lamiaceae	Salvia	verbenaca (Wild Sage) *
Loranthaceae	Amyema	Fitzgeraldii (on Mulga)
Loranthaceae	Lysiana	casuarinae (on Acacia sibirica)

Family	Genus	Species
Malvaceae	? Sida	calyxhymenia
Malvaceae	Abutilon	otocarpum subsp. prostratum
Malvaceae	Sida	ectogamma
Myrtaceae	Eucalyptus	? concinna / cylindrica
Myrtaceae	Eucalyptus	oleosa
Poaceae	Cenchrus	ciliaris (Buffel Grass) *
Poaceae	Chloris	truncata
Poaceae	Enneapogon	avenaceus
Poaceae	Enneapogon	caerulescens
Poaceae	Paspalidium	sp. Indet.
Proteaceae	Grevillea	?berryana / nematophylla
Proteaceae	Hakea	lorea subsp. lorea
Proteaceae	Hakea	preissii
Pteridaceae	Cheilanthes	sieberi subsp. sieberi
Rubiaceae	Alectryon	oleifolius subsp. canescens
Rubiaceae	Psydrax	suaveolens
Santalaceae	Santalum	spicatum
Sapindaceae	Dodonaea	lobulata
Sapindaceae	Dodonaea	rigida
Sapindaceae	Dodonaea	viscosa subsp. angustissima
Scrophulariaceae	Eremophila	alternifolia
Scrophulariaceae	Eremophila	georgei
Scrophulariaceae	Eremophila	latrobei subsp. latrobei
Scrophulariaceae	Eremophila	longifolia (green leaf form)
Scrophulariaceae	Eremophila	decipiens subsp. decipiens
Scrophulariaceae	Eremophila	pantonii
Solanaceae	Solanum	lasiophyllum
Solanaceae	Solanum	nummularium
Thymelaeaceae	Pimelea	microcephala

Appendix 5. Management of Opuntioid Cacti

Taken from Atlas of Living Australia: https://profiles.ala.org.au/opus/weeds-australia/profile/Opuntia%20spp.

Best practice management

When controlling *Opuntia* Prickly Pear species, an integrated weed management approach is usually desirable especially for larger infestations.

Chemical control: While several herbicides are recommended for managing Prickly Pears, chemical control is not always effective, as many species occur on rocky slopes, and infested areas must be checked and resprayed over several years if necessary (Parsons & Cuthbertson 2001). Methods used are:

- Foliar spray covering all pads
- Stem injection (includes drill and fill method on every 2-3 pads)
- Basal bark and cut stump (not normally used or considered best practice).

However, plants are extremely hardy and follow up and monitoring may be required for 1-2 years to ensure plant do not re-sprout. Registered herbicides, techniques and on-label instruction should always be followed in your state or territory. A variety of herbicides (chemicals) are known to be effective. Please see Sheehan & Potter (2017) for an overview. Also see the Australian Pesticides and Veterinary Medicines Authority for chemical information http://www.apvma.gov.au. Permits from state or territory Environment Protection Authorities may be required if herbicides are to be sprayed on riverbanks.

Non-chemical control: Physical control: Physical control either by manual (hand) or mechanical (machine) removal can be feasible and cost-effective for all species of *Opuntia* (Prickly Pears).

Manual (hand) removal appears to be one of the most effective control methods for scattered and small infestations (Sheehan & Potter 2017). However, the spines make manual removal of these species difficult (Parsons & Cuthbertson 2001). Using tools and avoiding spines and glochids is a top health and safety concern when working with Prickly Pears. Personal Protective Equipment (PPE) must (should) be worn, and tools used that eliminate or significantly reducing handling of plants with spines and glochids used.

Mechanical (machine removal) is useful for large dense impenetrable stands (Sheehan & Potter 2017). This method is useful for removing bio-mass and increases accessibility for other follow-up control methods. Machine removal with front end loaders causes high levels of disturbance and will require planning and long-term follow-up using an integrated weed management techniques for cacti and other weeds that could colonise the area. Normally mechanical control should be carried out when conditions are dry to avoid damaging soil reducing soil disturbance, reducing likely spread of plants. However, caution should be employed as some species have glochids that are airborne and are more likely to dislodges and injure workers with PPE like masks or respirators worn with eye protection

Disposal: Care must also be taken to remove and properly dispose of plants parts. Pads, flowers, fruits and even small sections of stems if left on the soil surface can produce roots and grow into a new plant. If one larges plant is uprooted, broken up, and left on the soil surface, each pad will take root and form a new plant. Where one plant was present there would now be many plants.

The root system must also be dug out to prevent regrowth (Parsons & Cuthbertson 2001). Plant can be buried at a depth of 1 metre on or off site. Burning plants (all vegetative, flowering and fruiting parts) with other dry materials for plants that have dried out over summer can also be used to kill plants. However, you should consult your local fire service for advice and permissions.

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Appendix D: Level 1 Flora and Vegetation Survey of the Proposed Mount Mason Haul Road (NVS)

Level 1
Flora and Vegetation Survey of the Proposed Mount Mason Haul Road

(M29/414, M29/408, G29/22, G29/23, L29/79, L29/100)

Prepared for

Jupiter Mines Limited

Final
January 2013

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1 INTRODUCTION

Jupiter Mines Limited (Jupiter) is a publicly listed company with iron ore operations in both the Mt Mason and Mt Ida Projects north-west of Menzies, in the Central Yilgarn of Western Australia. Once approvals are granted, Jupiter intends on transporting iron ore along the Menzies-Sandstone Rd to a rail siding south of the town of Menzies which is located approximately 121 km north of Kalgoorlie, Western Australia (Figure 1).

In order to access the Menzies Sandstone Road Jupiter has proposed to construct a haul road on the western side of proposed infrastructure at Mt Ida, connecting the Menzies-Sandstone Rd with the Mt Mason Ore Deposit. The proposed Haul Road intersects Mining Tenements M29/414 and M29/408, General Purpose Tenements G29/22 and G29/23 as well as Miscellaneous Tenements L29/79 and L29/100. Jupiter commissioned Native Vegetation Solutions (NVS), on the 29th of May 2012, to conduct a Level 1 Flora Survey in this area.

This survey area covers 707.76ha along approximately 30kms of road (Appendix 5, Map 1), beginning at the Mt Mason project area, also including an expansion of previous survey areas and the current Camp Cassini. The proposed haul road then heads south-southwest of the proposed camp and Mt Mason project area to meet with the Sandstone-Menzies Rd approximately 70km northwest of Menzies.

A 200m wide strip was surveyed along the proposed route, despite the requirements of the haul road being 20m wide. This allowed for deviations of the haul road within the survey area, to avoid species of conservation significance.

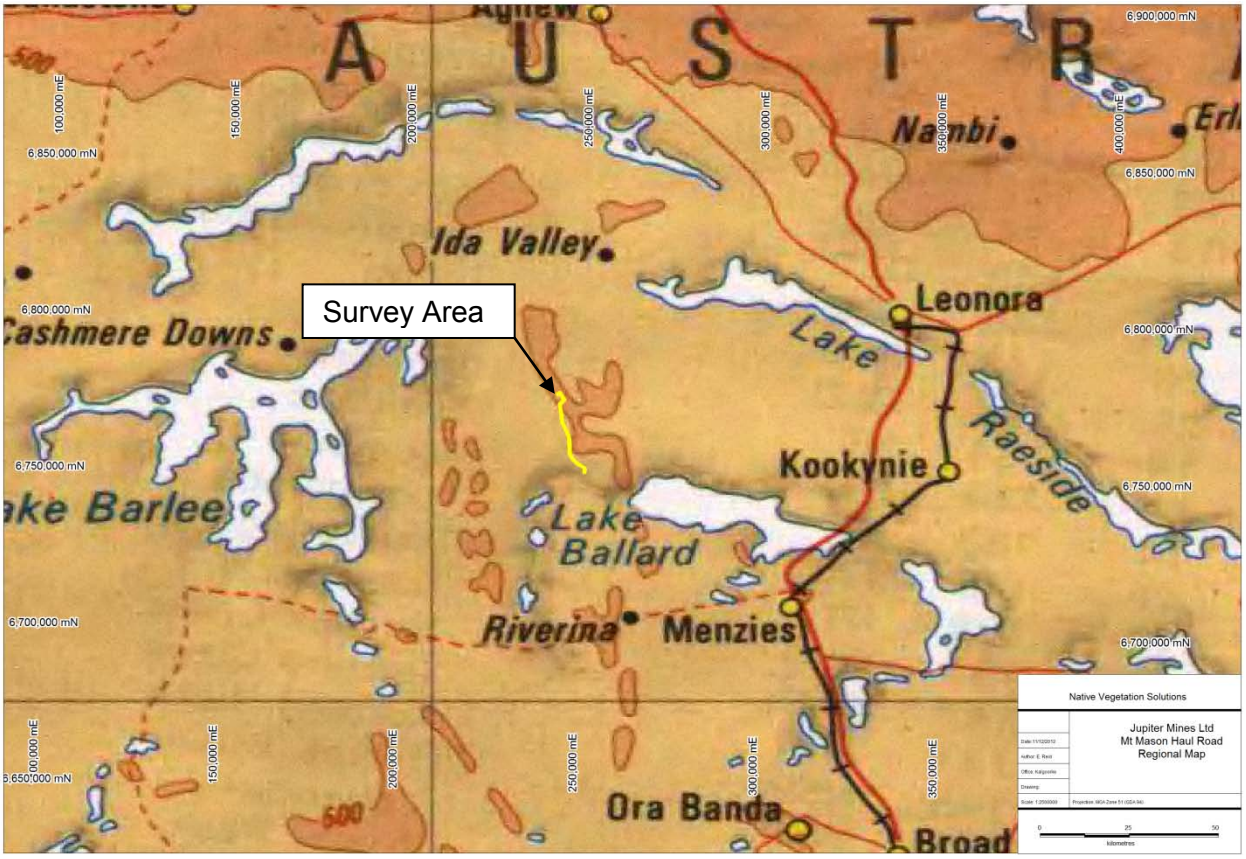

Figure 1: Regional map of survey location

1.1 Objectives

The objective of this report is to document the results of the flora and vegetation component of a Level 1 survey conducted in accordance with the Environmental Protection Authority (EPA) "*Terrestrial Biological Surveys as an Element of Biodiversity Protection; Position Statement No 3*" (EPA 2002) and *Guidance Statement No. 51 "Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (EPA 2004)", for the purpose of mining.

A Level 1 survey has two components:
1) Desktop study which includes a literature review and a search of the relevant databases; and

2) Reconnaissance survey of the subject area to verify the desktop survey, to define vegetation units present in the area, search for species of conservation significance and to determine potential sensitivity to impact.

As part of the reporting for the Level 1 assessment, NVS has conducted a Flora and Vegetation Survey which includes broad-scale vegetation mapping and vegetation condition mapping of the survey area.

Therefore, the scope of work for the Flora and Vegetation Survey was to:
- conduct a desktop study that includes a literature review and search of the relevant databases;
- generally describe the vegetation associations in the study area;
- prepare an inventory of species occurring in the study area;
- identify any vegetation or flora of particular conservation significance; and
- provide recommendations, including the management of perceived impacts to flora and vegetation within the survey area.

1.2 Geology and Vegetation

The survey area lies in the Murchison (MUR) bioregion within the Eastern Murchison (MUR1) subregion which totals over 7.8 million hectares (CALM, 2002). The MUR1 subregion lies on the Yilgarn Craton's 'Southern Cross' and 'Eastern Goldfields' Terrains. Red desert sandplains are elevated and characterise this region, covering broad areas. Plains of red brown soils are wide ranging with breakaway ridges occurring throughout. Salt lake systems associated with the closed Paleodrainage system are also a characteristic feature of this region. Mulga Woodlands are dominant over the area which supports an abundance of ephemerals including: Halosarcia shrublands, saltbush shrublands and hummock grasslands.

1.3 Climate

Climate is arid with the majority of rainfall (250mm average annually) received in the winter months, and summer thunderstorms (CALM, 2002). The nearest official meteorological weather station is Menzies. However Leonora weather station, located 98kms northeast of the survey area, has the most complete and up to date information.

1.3.1 Temperature

Mean annual minimum temperature at Menzies is 12.6°C and mean annual maximum temperature is 26.3°C. The coldest temperatures are attained in July (mean minimum temperature 5.3°C), the hottest is January (mean maximum temperature 35.1°C) with diurnal temperature variations are relatively consistent throughout the year (Figure 2).

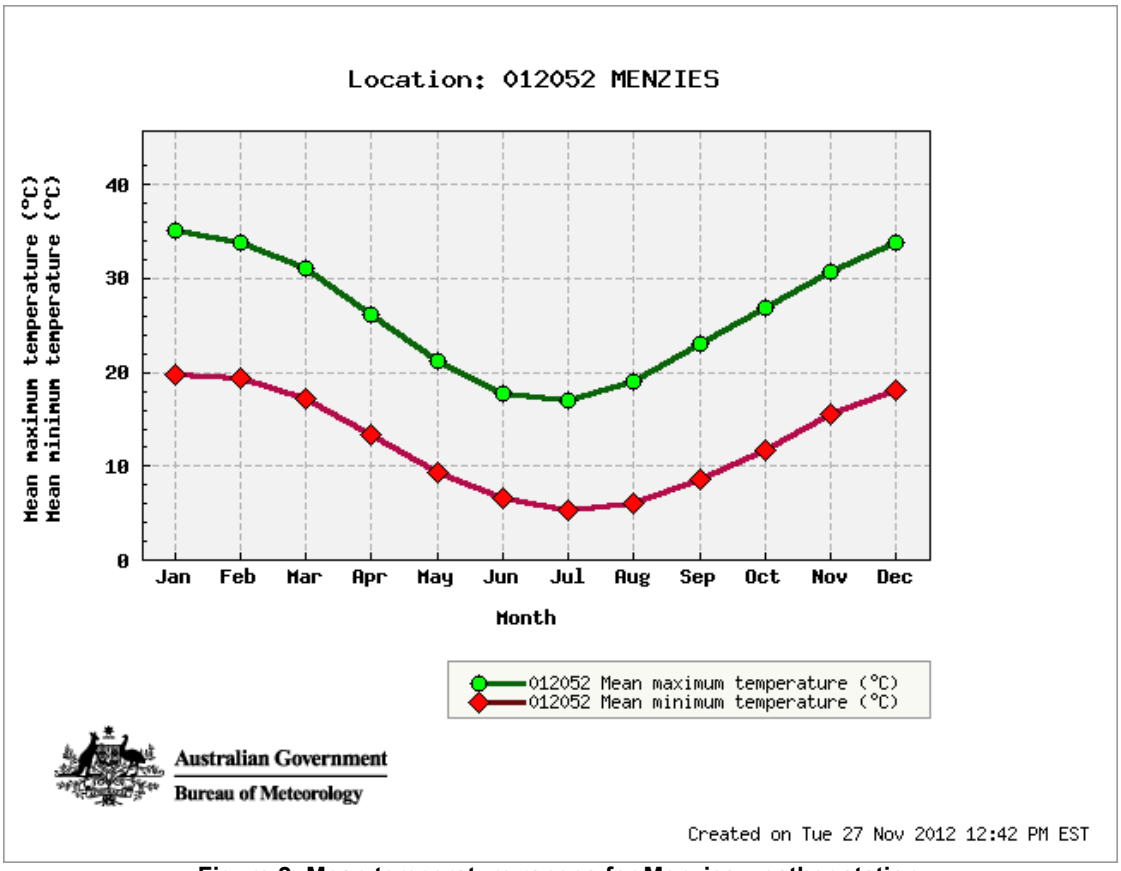

Figure 2: Mean temperature ranges for Menzies weather station

1.3.2 Rainfall

The area is arid and the annual average rainfall at Menzies is 250.3 mm, which falls (>1 mm) on an average of 32.1 rain-days. Most of the rain usually falls between January and August and this amount varies greatly both seasonally and annually (Figure 3). Prior to this survey being undertaken rainfall at Menzies had not been recorded in 2012 for the months of January, February, March or April. However rainfall for June, July, August, September and October show rainfall below the monthly averages for these months.

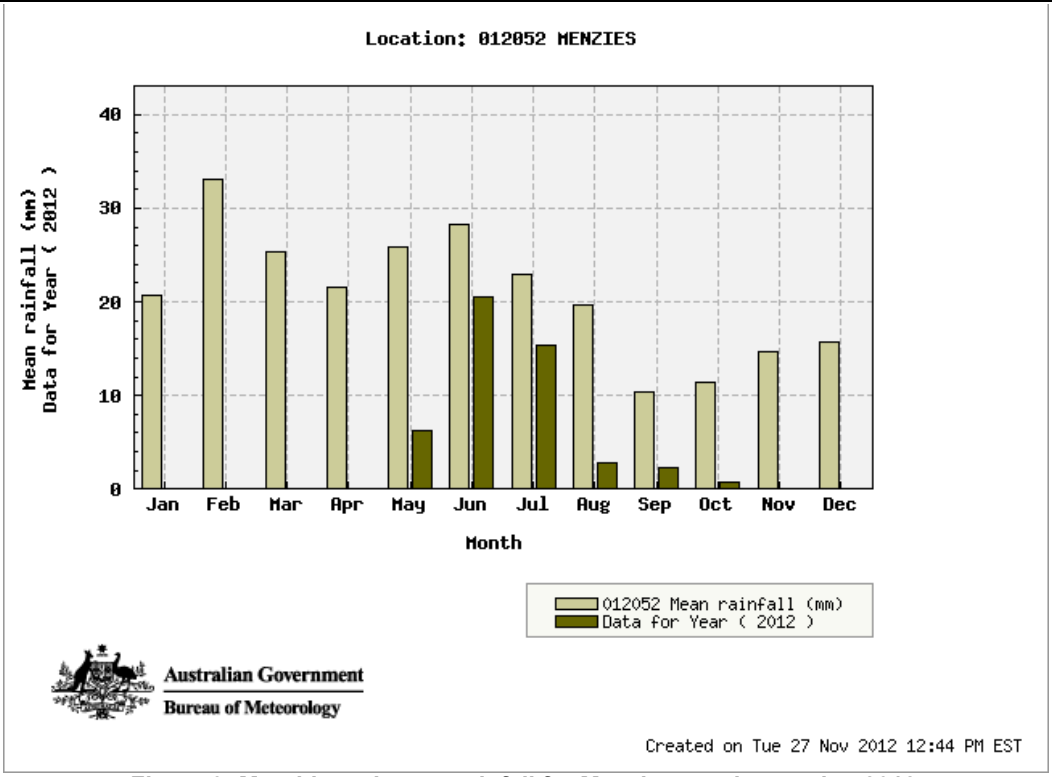

Figure 3: Monthly and mean rainfall for Menzies weather station 2012

For comparison purposes, rainfall data from the Leonora weather station Located 96km east of the survey area has been provided. In 2012, 221.4mm of rainfall has been recorded in 2012 prior to the survey. This graph demonstrates rainfall being greater than the average figures for January and March. Figure 4 also demonstrates that rainfall in Leonora has been below the average rainfall data during the rest of the 2012 period.

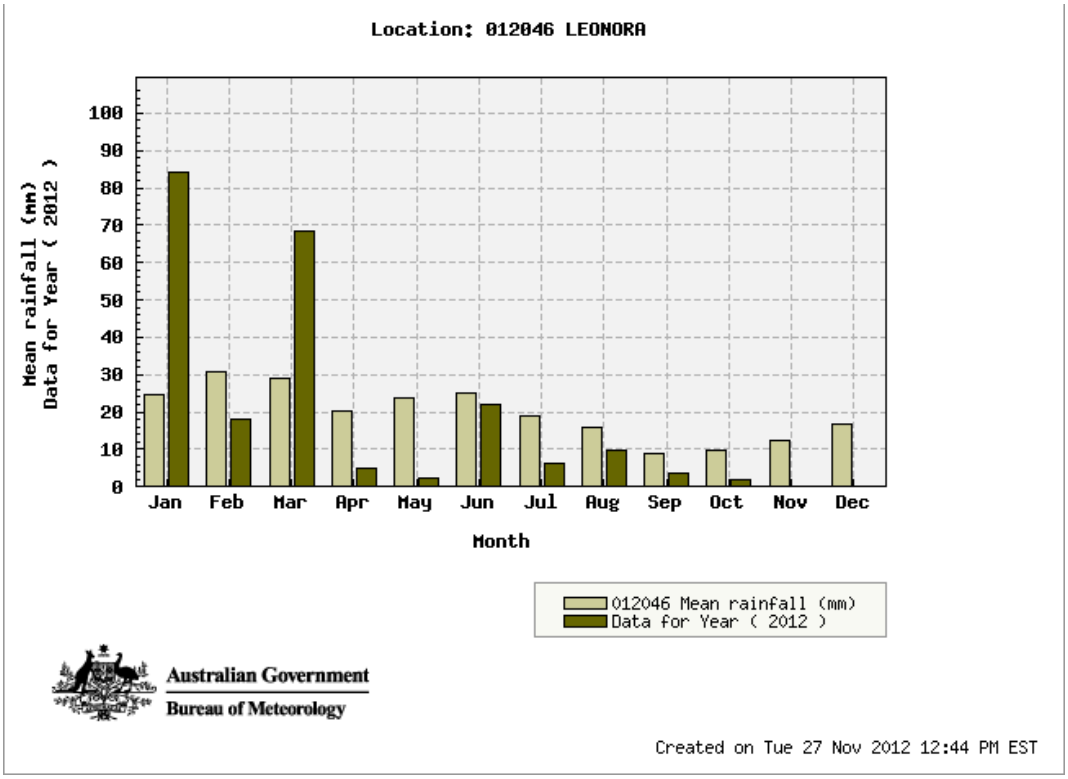

Figure 4: Monthly and mean rainfall for Leonora weather station 2012

In 2012, 221.4mm of rain was recorded at Leonora, with 84.2mm of that rainfall received in January. Mean monthly rainfall for January to June is between 20.4mm and 30.9mm; this is lower in the second part of the year (July to December), ranging from 8.9mm to 16.8mm. A similar pattern is seen in the mean rainfall at Menzies.

2. ASSESSMENT METHODOLOGY

2.1 Preliminary Desktop Study

A preliminary assessment of the survey area and its potential constraints was undertaken by reviewing a number of government agency managed databases (see Appendix 1) and consulting where necessary. The following sections provide a summary of the methodology used for each potential environmental aspect associated with the project.

2.1.1 *Environmental Protection and Biodiversity Conservation Act* Protected Matters

The *Environmental Protection and Biodiversity Conservation (EPBC) Act 1999* Protected Matters Search tool was utilised to provide results for matters of National Environmental Significance within the survey area.
(http://www.environment.gov.au/arcgis-framework/apps/pmst/pmst-coordinate.jsf)

2.1.2 Threatened Flora and Communities

The Species and Communities Branch of the Department of Environment and Conservation (DEC) was contacted for a search of their databases containing known populations of threatened flora (Reference: 76-1011FL) (DEC, 2011).

The presence of Threatened Ecological Communities and Priority Ecological Communities (TECs & PECs) was determined by examining Geographic Information System (GIS) data supplied by the DEC upon request (Reference: 53-1011EC) (DEC, 2011a).

2.1.3 Environmentally Sensitive Areas and Conservation Reserves

DEC's Native Vegetation Map Viewer was used to determine the location of any Environmentally Sensitive Areas (ESAs) (http://maps.dec.wa.gov.au/idelve/nv/index.jsp)

The location of any Conservation Reserves was determined by examining GIS data available from the DEC website and consulting with the local DEC office where necessary.

2.1.4 Vegetation Type, Extent and Status

Vegetation extent and status data was sourced from the Department of Agriculture and Food (DAFWA) report "Land-Use and Vegetation in Western Australia- National Land and Water Resources Audit Report" and its associated GIS file (Shepherd *et al*, 2002).

Note: This data was provided to Native Vegetation Solutions via a license agreement with the DAFWA.

2.1.5 Wetlands

The location of wetlands within the project area was determined by examining DAFWA's Wetland Base (http://spatial.agric.wa.gov.au/wetlands/)

2.1.6 Dieback

Dieback is only considered a potential issue for the project if both the mean annual rainfall of the area is >400mm, and if the project area resides below the 26th parallel.

2.2 Site Investigation

A site visit was carried out by Botanists Eren Reid and Ashley Owen from Native Vegetation Solutions from the 29th May to 31st May 2012, to examine the flora and vegetation groups contained within the survey area. A total of 23 hours was spent on site traversing the survey area, by Kawasaki Mule and on foot.
The survey was conducted in accordance with relevant EPA's Statements and Guidelines (Section 1.1).

EPA's *Position Statement No. 3* (EPA 2002) provides indicative levels of biological survey in relation to the scale and nature of the impact and the sensitivity of the receiving environment. The EPA uses the Interim Biogeographic Regionalisation of Australia (IBRA) as the largest unit for Environmental Impact Assessment decision making in relation to the conservation of biodiversity. Given the scale and nature of the proposed disturbance as well as the existing disturbance, and that the survey area is located within the Murchison IBRA region, a Level 1 flora and vegetation survey was required.

2.2.1 Licenses

Flora was collected for identification under the Scientific Collection License SL010070 held by Mr E. R. Reid with expiry 28/06/2013.

2.3 Personnel and Reporting

The following personnel were involved in the preparation of this report;

- Eren Reid *BSc (Biological Science),* Principal Botanist, Native Vegetation Solutions, undertook the survey and preparation of report;
- Ashley Owen *DipSc*, Botanist/Consultant, Native Vegetation Solutions, undertook data collation and preparation of report;
- Tim Wrigley BAppSc (Environmental Science), Consultant, Native Vegetation Solutions, preparation of report.
- Mr. Frank Obbens *BSc*, Consultant Botanist/Plant Taxonomist, undertook identification of unknown specimens collected during fieldwork

2.4 Limitations

Table 1 lists potential limitations that may have affected the survey. These are based on the listing given in the *Guidance Statement No. 51 Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (EPA, 2004). As shown, this survey was not limited by any factors listed below.

Table 1: List of potential survey limitations

Potential Limitations	Constraint (Y/N)	Comment
Competency and experience of the consultants undertaking the survey	N	Mr Eren Reid is an experienced botanist who has conducted many flora and vegetation surveys in the Goldfields, Pilbara and South-west regions of WA.
Proportion of flora identified during survey	N	As the survey was planned to identify flora within a small linear survey area, a complete census of the species present was attempted (Approx. 95%). Sufficient identifications were made to allow vegetation descriptions to be made.
Sources of information	N	DRF and Priority Flora GIS information was available from DEC.
Proportion of the task achieved	N	All tasks completed
Timing/Season	N	The targeted survey was conducted in Autumn 2012. Due to the above average rainfall in January and March 2012, many species were in flower with emergent annuals.
Disturbance in survey area	N	Disturbance was present in the form of grazing, historic tracks and clearing.
Intensity of survey effort	N	Transects were walked through the survey area with all parts visited
Resources	N	Adequate resources were available
Access problems	N	No problems with access
Availability of contextual information on the region	N	Information on the Murchison Bioregion is readily available.

3. RESULTS

3.1 Preliminary Desktop Assessment

3.1.1 EPBC Act Protected Matters

The EPBC Protected Matters database search revealed a potential for 2 invasive plant species, *Carrichtera annua* (Ward's Weed) and *Cenchrus ciliaris* (Buffel Grass), to occur within the survey area based on suitable habitat. Search results included in Appendix 1 (DSEWPC, 2012).

3.1.2 Threatened Flora and Communities

The DEC database searches revealed that 1 Threatened Flora and 25 Priority Flora species occur within a 50km radius of the survey area (DEC, 2011) and have the potential to occur within the survey area. None of these known locations of Priority Flora occur within the survey area, while the closest location occurs 3.2km west of the survey area.

Results of the threatened flora database search are included in Appendix 2.

The PEC/TEC search revealed that the survey area contains no TECs, however lies within the buffer zone of a PEC location (Appendix 4). The centre point for this buffer zone does occur within the survey area (DEC, 2011a). The buffer zone relates to the PEC known as the Bulga Downs/Perinvale/Walling/vegetation complexes (banded ironstone formation) (Priority 1). This community has not yet been described by the DEC on their list of PECs (DEC, 2012a). The DEC were contacted for information regarding this PEC, however no information was available to provide an adequate description or boundary definition, The DEC response however,

suggested that the PEC relates to the vegetation specifically occurring on the banded ironstone formations.

Vegetation related to the Banded Ironstone Formations are vegetation groups 1g and parts of 1n. These vegetation groups are included below in section 3.2.2. The total area covered by Banded Ironstone formations includes approximately 6.12 ha which is 0.86% of the total survey area.

Priority 1 PECs are defined to be poorly known 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. 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.

3.1.3 Environmentally Sensitive Areas and Conservation Reserves

The survey area does not lie within or contain any ESA's or Conservation Reserves (DEC, 2012).

3.1.4 Vegetation Type, Extent and Status

Information relating to known vegetation within the survey area has been summarised in Table 2, 3, 4 and 5 below. This information has been compiled through both desktop assessments and the field assessment.

Table 2: Summary of information regarding Pre-European and current vegetation extent of Vegetation Association 18 within the survey area

Factor	Value				
Beard Vegetation Association*	18				
Vegetation Association Description*	Low woodland; mulga (Acacia aneura)				
% of survey area within this Beard Association	70.28%				
Pre-European Extent (ha)	Scale				
	By Association *(WA)*	***By Association*** *(WA)*	***By IBRA Region*** *(MUR)*	***By IBRA Sub-region*** *(MUR1)*	***By Shire*** *(Shire of Menzies)*
	22,029,557*	19,926,085**	12,422,396**	10,285,290**	2,013,390**
% Pre-European Extent Remaining*	100%	100%	100%	100%	100%
Surrounding Land Use***	Mining, Exploration, Pastoral Lease				
Weed prevalence***	Low				

* Source: Shepherd *et al.* (2002) Appendix 2
**Source: Shepherd *et al.* (2002) Associated GIS data
***Source: Field Assessment

Table 3: Summary of information regarding Pre-European and current vegetation extent of Vegetation Association 202 within the survey area

Factor	Value				
Beard Vegetation Association*	202				
Vegetation Association Description*	Shrublands; mulga & Acacia quadrimarginea scrub				
% of survey area within this Beard Association	23.59%				
Pre-European Extent (ha)	Scale				
	By Association *(WA)*	***By Association*** *(WA)*	***By IBRA Region*** *(MUR)*	***By IBRA Sub-region*** *(MUR1)*	***By Shire*** *(Shire of Menzies)*
	365,344*	449,227**	340,257**	279,020**	143,358**
% Pre-European Extent Remaining*	100%	100%	100%	100%	100%
Surrounding Land Use***	Mining, Exploration, Pastoral Lease				
Weed prevalence***	Low				

* Source: Shepherd *et al.* (2002) Appendix 2
**Source: Shepherd *et al.* (2002) Associated GIS data
***Source: Field Assessment

Table 4: Summary of information regarding Pre-European and current vegetation extent of Vegetation Association 483 within the survey area

Factor	Value				
Beard Vegetation Association*	483				
Vegetation Association Description*	Hummock grasslands, mixed sandplain - open mallee over sparse dwarf shrubs with spinifex ; red mallee mallee & mixed sparse dwarf shrubs over *Triodia basedowii*				
% of survey area within this Beard Association	5.24%				
Pre-European Extent (ha)	Scale				
	By Association *(WA)*	***By Association*** *(WA)*	***By IBRA Region*** *(MUR)*	***By IBRA Sub-region*** *(MUR1)*	***By Shire*** *(Shire of Menzies)*
	395,106*	440,120**	238,896**	238,896**	366,441**
% Pre-European Extent Remaining*	100%	100%	100%	100%	100%
Surrounding Land Use***	Mining, Exploration, Pastoral Lease				
Weed prevalence***	Low				

* Source: Shepherd *et al.* (2002) Appendix 2
**Source: Shepherd *et al.* (2002) Associated GIS data
***Source: Field Assessment

Table 5: Summary of information regarding Pre-European and current vegetation extent of Vegetation Association 484 within the survey area

Factor	Value				
Beard Vegetation Association*	484				
Vegetation Association Description*	Shrublands; jam thicket				
% of survey area within this Beard Association	0.89%				
Pre-European Extent (ha)	Scale				
	By Association *(WA)*	***By Association*** *(WA)*	***By IBRA Region*** *(MUR)*	***By IBRA Sub-region*** *(MUR1)*	***By Shire*** *(Shire of Menzies)*
	70,235*	70,751**	69,487**	69,487**	57,719**
% Pre-European Extent Remaining*	100%	100%	100%	100%	100%
Surrounding Land Use***	Mining, Exploration, Pastoral Lease				
Weed prevalence***	Low				

* Source: Shepherd *et al.* (2002) Appendix 2
**Source: Shepherd *et al.* (2002) Associated GIS data
***Source: Field Assessment

3.1.5 Wetlands

No wetlands which are recorded on the DAFWA WetlandBase occur within the survey area (DAFWA, 2012). Results are displayed in Appendix 1.

3.1.6 Dieback

The survey area lies south of the 26th parallel, however receives average annual rainfall of between 236mm and 250mm (BoM, 2012), below the 400mm threshold level. There is no record of *Phytophthora cinnamomi* establishing in natural ecosystems in regions receiving <400mm rainfall per annum (CALM, 2003).
Therefore Dieback is not considered an issue for this survey area, however all measures should be taken to prevent any possible soil contamination (seeds of non-native species *etc*.) which poses a risk in the survey area during seasonally favourable conditions.

3.2 Field Assessment

3.2.1 Threatened Flora

No plant taxa located in the survey area are gazetted as DRF pursuant to subsection 2 of Section 23F of the *Wildlife Conservation Act 1950*. No plant taxa listed as Threatened pursuant to Schedule 1 of the *Environmental Protection and Biodiversity Conservation Act 1999* were located in the survey area.

3.2.2 Vegetation Type, Extent and Status

A total of 41 Families, 108 Genera and 231 Species were recorded within the survey area. Five major vegetation groups were recorded in the survey area, which were split into 12 subgroups. The vegetation subgroups are considered to be in Very Good, Good or Degraded condition (using the scale of Keighery 1994, see Appendix 3). Maps of the survey area can be seen in Appendix 5.

The vegetation groups are described in more detail below.

3.2.2.1 Mulga Shrubland with occasional Eucalypts (1a)

This vegetation group consisted of 24 Families, 43 Genera and 68 Species. The vegetation group was approximately 148.29 ha which makes up 20.95% of the survey area.

Dominant species were *Acacia incurvaneura, Acacia mulganeura*, *Acacia aneura var aneura, Acacia caesaneura, Eucalyptus oleosa subsp oleosa, Eucalyptus leptopoda subsp elevata, Spartothamnella teucriiflora,* and *Waitzia acuminata,*

Figure 5: Mulga Shrubland with occasional Eucalypts within the survey area

3.2.2.2 Mulga woodland- floodplain (1b)

This vegetation group consisted of 24 Families, 40 Genera and 55 Species. The vegetation group was approximately 143.58 ha which makes up 20.29% of the survey area.

Dominant species were *Acacia aneura var aneura*, *Acacia ramulosa var ramulosa, Ptilotus obovatus, Acacia tetragonophylla* and *Acacia mulganeura*.

Figure 6: Mulga woodland- floodplain within the survey area

3.2.2.3 Mulga shrubland with *Philotheca brucei subsp brucei* (1g)

This vegetation group consisted of 15 Families, 19 Genera and 27 Species. The vegetation group was approximately 4.73 ha which makes up 0.67% of the survey area. The entirety of this vegetation groups occurs on Banded Ironstone Formations.

Dominant species were *Acacia aneura var aneura, Acacia mulganeura, Acacia cockertoniana, Philotheca brucei subsp brucei* and *Ptilotus obovatus.*

Figure 7: Mulga shrubland with Philotheca brucei subsp brucei within the survey area

3.2.2.4 Mulga open shrubland- drainage (1k)

This vegetation group consisted of 24 Families, 41 Genera and 60 Species. The vegetation group was approximately 6.08 ha which makes up 0.86% of the survey area.

Dominant species were *Acacia aneura var aneura, Acacia mulganeura, Acacia tetragonophylla* and *Ptilotus obovatus*.

Figure 8: Mulga open shrubland- drainage within the survey area

3.2.2.5 Mulga with *Acacia cockertoniana* and *Acacia ramulosa var ramulosa* tall shrubland over *Olearia humilis* and/or *Hibbertia arcuata* and/or *Prostanthera althoferi subsp. althoferi* and/or *Eremophila forrestii subsp. forrestii* low shrubland (1n)

This vegetation group consisted of 21 Families, 31 Genera and 51 Species. The vegetation group was approximately 219.74 ha which makes up 31.05% of the survey area. The approximate total area of this vegetation group occurring on Banded Ironstone Formations is 1.39ha.

Dominant species were *Acacia cockertoniana*, *Acacia ramulosa var ramulosa*, *Olearia humilis, Hibbertia arcuata, Prostanthera althoferi subsp. althoferi* and *Eremophila forrestii subsp. forrestii*.

Figure 9: Mulga with *Acacia cockertoniana* and *Acacia ramulosa var ramulosa* tall shrubland over *Olearia humilis* and/or *Hibbertia arcuata* and/or Prostanthera althoferi subsp. althoferi and/or *Eremophila forrestii subsp. forrestii* low shrubland within the survey area

3.2.2.6 Mulga over mixed shrubland (1o)

This vegetation group consisted of 15 Families, 18 Genera and 26 Species. The vegetation group was approximately 3.75 ha which makes up 0.53% of the survey area.

Dominant species were *Acacia caesaneura, Acacia ramulosa var ramulosa, Acacia aneura var aneura, Senna artemisioides subsp filifolia, Solanum lasiophyllum* and *Ptilotus obovatus*.

Figure 10: Mulga over mixed shrubland within the survey area

3.2.2.7 *Acacia quadrimarginea*/*A. cockertoniana* open shrubland (2g)

This vegetation group consisted of 16 Families, 20 Genera and 28 Species. The vegetation group was approximately 24.28 ha which makes up 3.43% of the survey area.

Dominant species were *Acacia quadrimarginea, Acacia cockertoniana* and *Thryptomene costata*.

Figure 11: *Acacia quadrimarginea/A. cockertoniana* open shrubland within the survey area

3.2.2.8 *Acacia effusifolia*/*Eucalyptus* mallee and other mixed shrublands burnt-sandplain (3b)

This vegetation group consisted of 22 Families, 53 Genera and 99 Species. The vegetation group was approximately 127.83 ha which makes up 18.06% of the survey area.

Dominant species were *Acacia effusifolia, Eucalyptus rigidula, Micromyrtus flaviflora, Micromyrtus clavata, Melaleuca hamata* and *Triodia irritans.*

Figure 12: *Acacia effusifolia*/*Eucalyptus* mallee and other mixed shrublands burnt- within the survey area

3.2.2.9 *Acacia effusifolia* Shrubland- transitional (3c)

This vegetation group consisted of 10 Families, 12 Genera and 18 Species. The vegetation group was approximately 7.41 ha which makes up 1.05% of the survey area.

Dominant species were *Acacia effusifolia, Eremophila georgei and Eremophila forrestii subsp forrestii.*

Figure 13: *Acacia effusifolia* Shrubland- transitional within the survey area

3.2.2.10 *Callitris* with scattered Eucalypt woodland- sandplain (4)

This vegetation group consisted of 24 Families, 40 Genera and 66 Species. The vegetation group was approximately 10.27 ha which makes up 1.45% of the survey area.

Dominant species were *Callitris columellaris, Acacia ramulosa var ramulosa* and *Eucalyptus leptopoda subsp leptopoda.*

Figure 14: *Callitris* with scattered Eucalypt woodland- sandplain within the survey area

3.2.2.11 *Eucalyptus lesouefii* open woodland (9a)

This vegetation group consisted of 11 Families, 17 Genera and 23 Species. The vegetation group was approximately 6.89 ha which makes up 0.97% of the survey area.

Dominant species were *Eucalyptus lesouefii, Eremophila pantonii,* and *Ptilotus obovatus*.

Figure 15: *Eucalyptus lesouefii* open woodland within the survey area

3.2.2.12 *Eucalyptus salubris* woodland (9b)

This vegetation group consisted of 14 Families, 17 Genera and 24 Species. The vegetation group was approximately 4.92 ha which makes up 0.70% of the survey area.

Dominant species were *Eucalyptus salubris, Acacia erinacea, Eremophila pantonii* and *Ptilotus obovatus*.

Figure 16: *Eucalyptus salubris* woodland within the survey area

3.2.3 Weeds

Five weed species were recorded within the survey area; *Asphodelus fistulosus*, *Cleretum papulosum subsp. papulosum*, *Lysimachia arvensis, Pentameris airoides subsp. airoides and Portulaca oleracea.*

- *Asphodelus fistulosus* (Onion Weed) is abundant from Exmouth to Eucla, preferring coastal areas along roads and rail tracks. It invades bushland, pastoral areas and occasionally horticultural areas near Perth. It is a native to India and southern Europe.
- *Cleretum papulosum,* previously *Micropterum papulosum*, is native to South America and is abundant from Carnarvon to Esperance. Flowering occurs during spring and prefers arid areas, salt lake margins and estuaries of granite rock.
- *Lysimachia arvensis* (Pimpernel), previously named *Anagallis arvensis*, is native of Europe. It is spread throughout the south-west over granite rocks and disturbed bushland, as well as in crops, horticultural areas, pastures, paddocks and gardens.
- *Pentaschistis airoides* (False Hair Grass) and its subsp. *airoides* are widespread throughout Carnarvon to Kalgoorlie and Balladonia. This native of South Africa is very common in disturbed areas as well as in woodlands, shrublands and over granite rocks.
- *Portulaca oleracea* (Pigweed) is a common annual succulent that grows and flowers in summer. It can be found throughout Western Australia and is widespread among paddocks, horticulture and gardens.

The majority of these species were found along existing track sides and disturbance. None of these species are considered declared plants as defined by the Department of Agriculture WA (DAFWA, 2012a). However *Carrichtera annua* and *Cenchrus ciliaris* are listed as invasive weed species in the EPBC Protected Matters search results (Appendix 1).

3.2.4 Vegetation Condition

The condition of the vegetation was determined to be “Excellent” with areas where there were existing roads and tracks or fire scar areas in “Good” condition due to grazing and historic disturbances (Appendix 5, Map 3).

4. DISCUSSION

The EPA (2002) indicated that an ecological assessment of a site must consider its ecological value at the ecosystem level and its biodiversity value at the genetic, species and ecosystem level.

The survey area is located within the East Murchison subregion which has been recognised as a centre of endemism with high ecosystem and species diversity (Cowan 2001). However, Cowan also explains that while the flora of the East Murchison subregion is a rich and varied one, most species are wide ranging and often occur in one or more adjacent subregions. This survey established that mostly, the flora within the project area is not unique, and is in fact common throughout the East Murchison, however the composition of these flora on the BIF ranges is unique and relatively unknown, and could be considered restricted habitats.

No DRF or TECs were recorded in the survey area. There were also no Priority Species recorded within the survey area.

Although no TECs are present within the areas proposed for clearing, one PEC plausibly occurs within survey area. This community is the P1 Bulga Downs/Perrinvale/Walling/vegetation complex (banded ironstone formations). Given that Banded Ironstone formations are mapped as PECs based on the substrate not necessarily on the vegetation, and the fact that no vegetation description or delineation is provided by the DEC as yet, it is assumed this PEC covers entire areas where Banded Ironstone protrudes from the surface.

Vegetation condition was generally 'Very Good' to "Excellent" (Keighery 1994). Disturbance was present within the survey area mostly attributed to access tracks, exploration related activities and fire scars.

It is therefore not expected that the disturbance associated with the Mt Mason Haul Road will significantly negatively impact on the vegetation in the area in terms of fragmentation or loss of vegetation associations or species that may be unique. This is partially due to the overall size and linear nature of the survey area as well as the similar vegetation and habitat outside of the survey area.

5. IMPACT ASSESSMENT

5.1 THREATENING PROCESSES

The major processes likely to impact the Flora within the Survey area, if the haul road was to proceed include:

- Vegetation clearing and the associated removal of fauna habitat which would result in the loss of local vertebrate assemblages, a reduction in biodiversity and a loss of ecological function locally, as well as displacement of local fauna into adjacent areas;
- Vehicle impacts on uncleared vegetation could increase if the haul road driving is not adhered to;
- An increase in the area of disturbed land could result in an increase in alien species taking advantage of the lack of competition from native species;
- Dust generated during clearing of native vegetation and haulage may settle on adjacent native vegetation, causing possible stress and perhaps death, especially during drier months; and
- Accidental fire arising from clearing and haulage may affect vegetation in surrounding areas.

6. CONCLUSIONS AND RECOMMENDATIONS

This report incorporates and summarises the results of a Level 1 flora and vegetation survey.

The survey established that the condition of the vegetation in the proposed disturbance area is overall 'Good', to 'Excellent' condition. No Declared Rare Flora Priority Flora or Threatened Ecological Communities were recorded in the area.

The proposed clearing of vegetation will result in the loss of some individuals from the local area; however, the impact will not be great enough to remove whole communities or populations. Most of the species and communities recorded during this survey are widespread throughout the Murchison Bioregion and therefore the loss of a small proportion from this area will not be significant.

The EPA objective for flora and vegetation is to maintain the abundance, species diversity and geographical distribution of flora and vegetation as well as protect Threatened flora consistent with the provisions of the *Wildlife Conservation Act 1950*.

The following generic recommendations arise from the current flora survey:

- Any disturbance/clearing be minimised in extent to reduce the loss of individuals and impact on populations;
- Weed control measures must be implemented and followed during and after clearing and construction activities;
- A rehabilitation plan is developed that progressively rehabilitates areas not related to the haul road as soon as they are no longer required;
- Driving restrictions, ensuring that off-road driving is minimised; and
- All staff to be educated on the importance of fire prevention, and equipment provided for use in the event of fire.

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Appendix 1

Relevant Government Database Search Results

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information about the EPBC Act including significance guidelines, forms and application process details can be found at http://www.environment.gov.au/epbc/assessmentsapprovals/index.html

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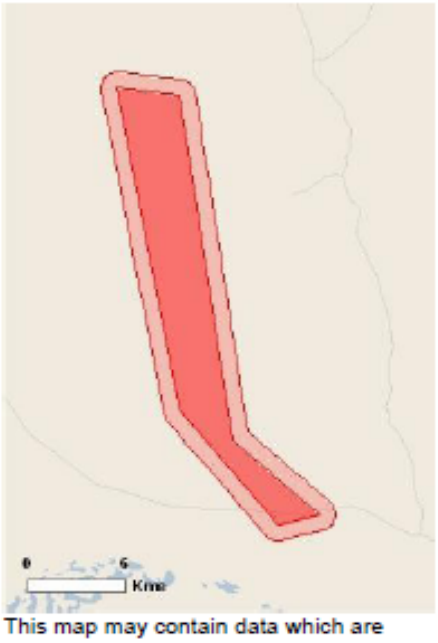
Summary
Details
- Matters of NES
- Other Matters Protected by the EPBC Act
- Extra Information

Caveat
Acknowledgements



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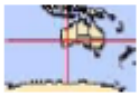

Summary

Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance - see http://www.environment.gov.au/epbc/assessmentsapprovals/guidelines/index.html

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Areas:	None
Threatened Ecological Communities:	None
Threatened Species:	2
Migratory Species:	5

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place and the heritage values of a place on the Register of the National Estate. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage/index.html

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species. Information on EPBC Act permit requirements and application forms can be found at http://www.environment.gov.

Commonwealth Lands:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	3
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have

Place on the RNE:	None
State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	6
Nationally Important Wetlands:	None

Details

Matters of National Environmental Significance

Threatened Species		[Resource Information]
Name	Status	Type of Presence
BIRDS		
Acanthiza iredalei iredalei		
Slender-billed Thornbill (western) [25967]	Vulnerable	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Leipoa ocellata		
Malleefowl [934]	Vulnerable	Species or species habitat may occur within area

Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat may occur within area
Migratory Terrestrial Species		
Leipoa ocellata		
Malleefowl [934]	Vulnerable	Species or species habitat may occur within area
Merops ornatus		
Rainbow Bee-eater [670]		Species or species habitat may occur within area
Migratory Wetlands Species		
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat may occur within area
Merops ornatus		
Rainbow Bee-eater [670]		Species or species habitat may occur within area

Extra Information

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit,

Name	Status	Type of Presence
Mammals		
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Carrichtera annua Ward's Weed [9511]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area

Coordinates

-29.1059 120.3505,-29.1101 120.3854,-29.302 120.4152,-29.3439 120.4637,-29.3494 120.4404,-29.2857 120.3857,-29.1059 120.3505

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World Heritage and Register of National Estate properties, Wetlands of International Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants

- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Department of Environment, Climate Change and Water, New South Wales
-Department of Sustainability and Environment, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment and Natural Resources, South Australia
-Parks and Wildlife Service NT, NT Dept of Natural Resources, Environment and the Arts
-Environmental and Resource Management, Queensland
-Department of Environment and Conservation, Western Australia
-Department of the Environment, Climate Change, Energy and Water
-Birds Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-SA Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Atherton and Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
-State Forests of NSW
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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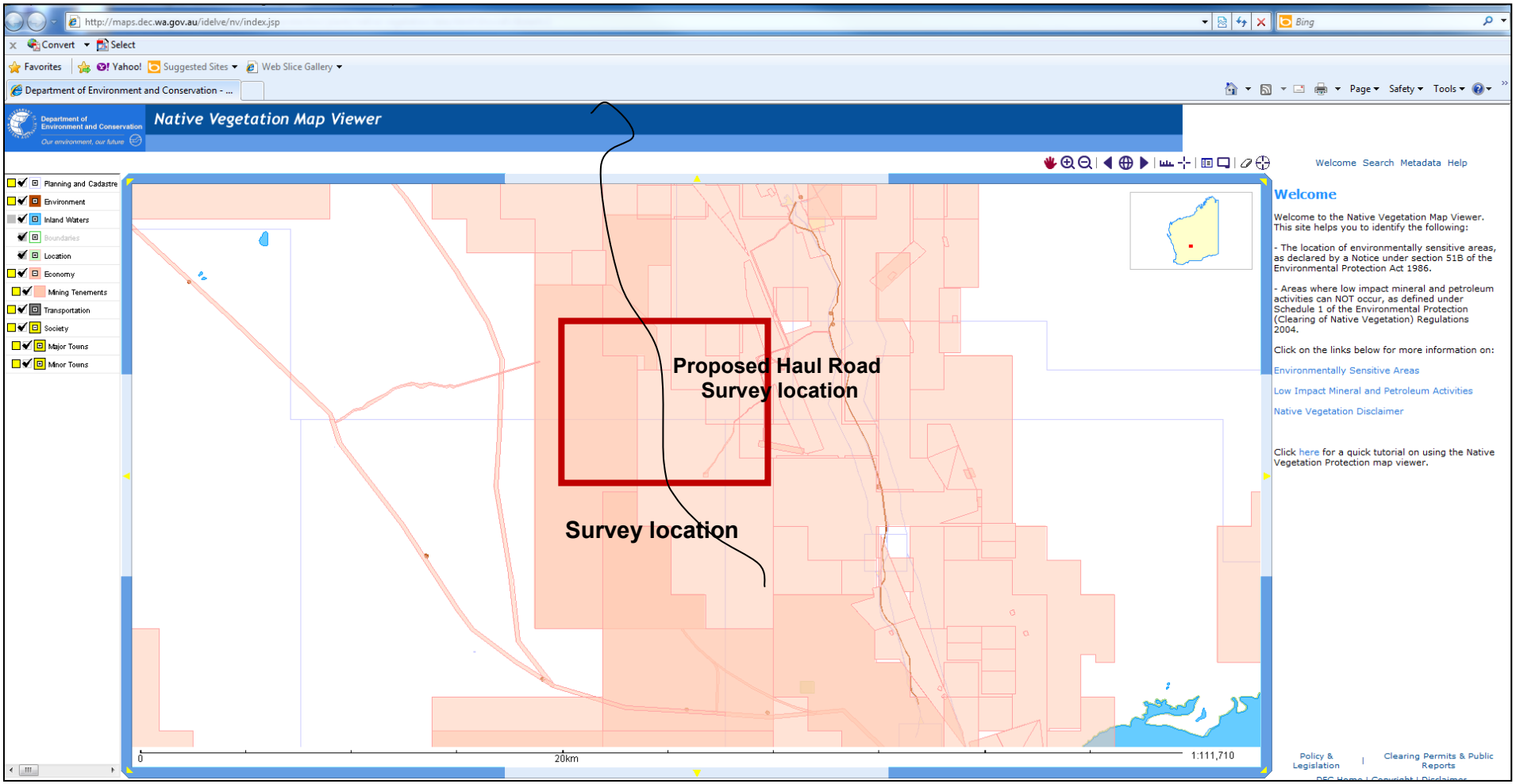
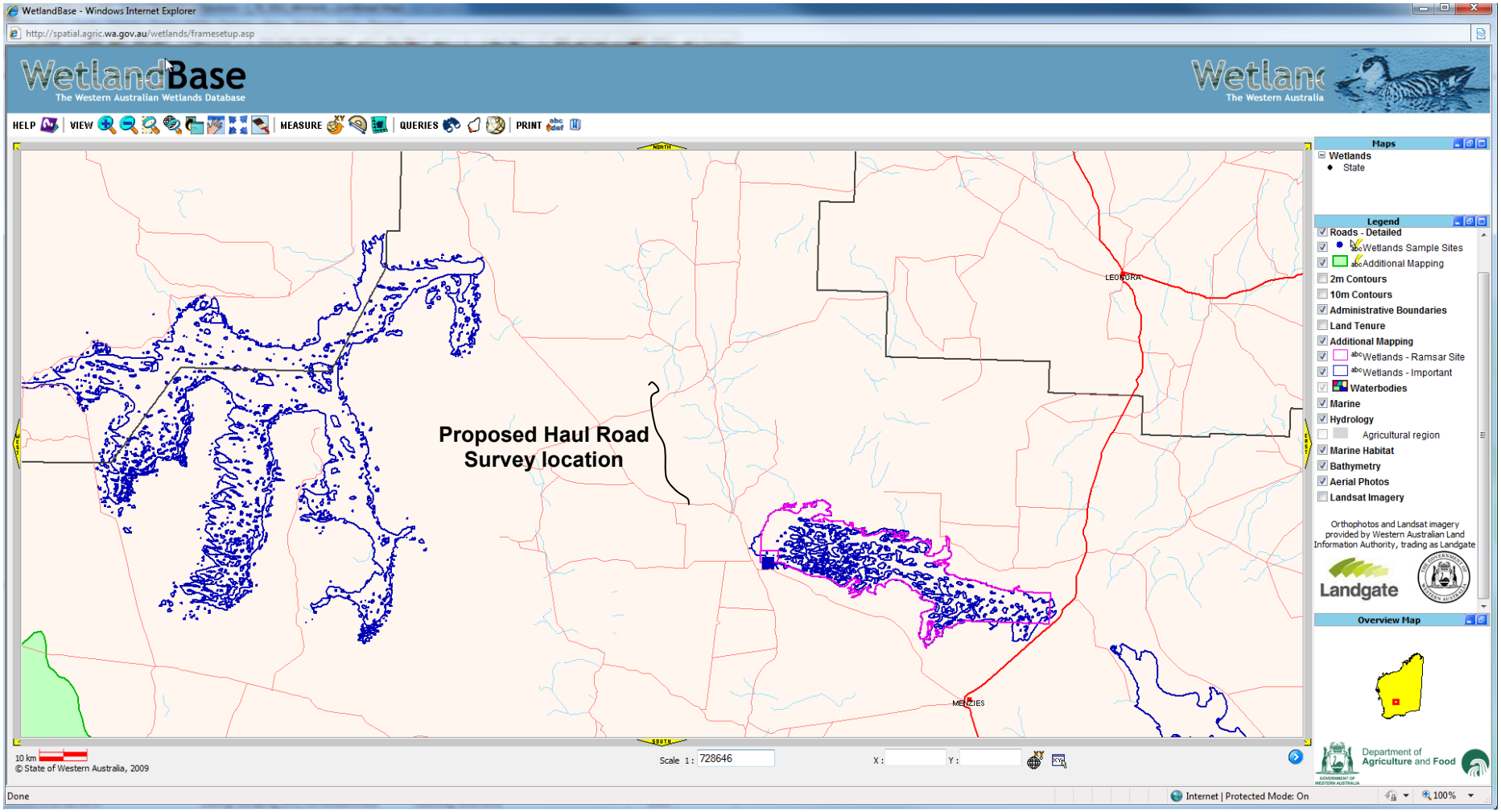


DEC's Native Vegetation Map Viewer showing no ESA's (dark green shaded areas) within the survey area (DEC, 2012)



DAFWA Wetland Database showing no wetland areas within the survey area (DAFWA, 2012).

Appendix 2

Threatened Flora Databases Search Results

Listed below are the Priority Flora identified from the DEC searches for the general Survey area and surrounds (Reference: 76-1011FL).

Note – One Threatened species was identified with all known locations approximately 28km southwest of the survey area.

31/10/2011 **DEPARTMENT OF ENVIRONMENT AND CONSERVATION** Page 1
DECLARED RARE AND PRIORITY FLORA LIST
16 September 2010

SPECIES / TAXON	CONS CODE	DEC REGION	DISTRIBUTION	FLOWER PERIOD
Calotis sp. Perrinvale Station (R.J. Cranfield 7906)	3	MW,GLD	Cue, Blue Hills, Perrinvale Stn	
Calytrix praecipua	3	GLD,P	Melita Station, Laverton, Youno Downs, Wanjarri, Marymia, Erong Hmstd, Niagara Dam	Jun-Nov
Cratystylis centralis	3	GLD	Barwidgee Stn, Leonora	Aug-Nov
Eremophila annosocaulis	3	GLD	Mt Morgans Mine (South of Leonora-Laverton Rd), Von Treuer Tableland	
Eremophila mirabilis	2	GLD,MW	Niagara, Morapoi, Kookynie, Woolgorong, Menzies	Aug-Sep
Eremophila simulans subsp. megacalyx	3	MW,GLD	Mt Narryer, Boolardy Stn, Leonora	Aug-Sep
Eucalyptus jutsonii subsp. jutsonii	4	GLD	Comet Vale, Binti Binti Rocks, Menzies, Jeedamya Stn	Nov
Gunniopsis propinqua	3	GLD	Laverton, Mt Margaret, Lake Carnegie, Windidda, Mt Eureka, Mt James, Menzies	Aug-Sep
Hemigenia exilis	4	GLD	Lake Darlot, Yakabindie, Leinster, Leonora, Mt Keith	Apr,May, Aug
Hyalosperma stoveae	2	GLD,MW,*	Perrinvale Station, Burnabinmah	-
Hybanthus floribundus subsp. chloroxanthus	3	GLD	Leonora, Laverton	Aug-Oct
Malleostemon sp. Adelong (GJ Keighery 11825)	2	GLD	Adelong Stn, Mt Manning, Johnston Range	Oct
Micromyrtus serrulata	3	GLD	Karonie, Coonana, Melita, Jeedamya, Niagara Dam NR, Cardunia Rocks, Queen Victoria Spring NR	Mar,Jun,Nov
Newcastelia insignis	2	GLD,SC	Adelong Stn, Comet Vale, Queen Victoria Spring, Norseman	Sep-Nov
Persoonia leucopogon	1	GLD	Between Coolgardie & Laverton, Comet Vale (Menzies)	-
Philotheca coateana	3	GLD,MW	Menzies, Gidgee, Cashmere Downs, Walling Rock	Aug-Oct
Philotheca deserti subsp. brevifolia	1	GLD	Menzies	
Sauropus ramosissimus	3	GLD	Carnegie Stn, Laverton, Warburton, Leonora	
Spartothamnella sp. Helena & Aurora Range (PG Armstrong 155-109)	3	GLD,MW,WB	Helena & Aurora Range, Blue Hill Range, Remlap, Koolyanobbing, Mt Jackson Range, Windarling Hill, Die Hardy Range, Johnston Range, Perrinvale Stn., Yendilberin Hills, Mt Finnerty	
Thryptomene eremaea	2	GLD	Menzies, Queen Victoria Spring, Comet Vale, Edjudina Station, Kirgella Rocks	Jul-Sep

Additional species provided in the GIS results are listed below:

- *Banksia arborea* (P4);
- *Gnephosis intonsa* (P1);
- *Grevillea secunda* (P4);
- *Grevillea subterlineata* (P3);
- *Jacksonia lanicarpa* (P1); and
- *Ricinocarpos brevis* (T).

Appendix 3

Vegetation Condition Scale (Keighery, 1994)

Pristine (1). Pristine or nearly so, no obvious signs of disturbance.

Excellent (2). Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.

Very Good (3). Vegetation structure altered obvious signs of disturbance.
For example, disturbance to vegetation structure caused by repeating fires, the presence of some more aggressive weeds, dieback, logging and grazing.

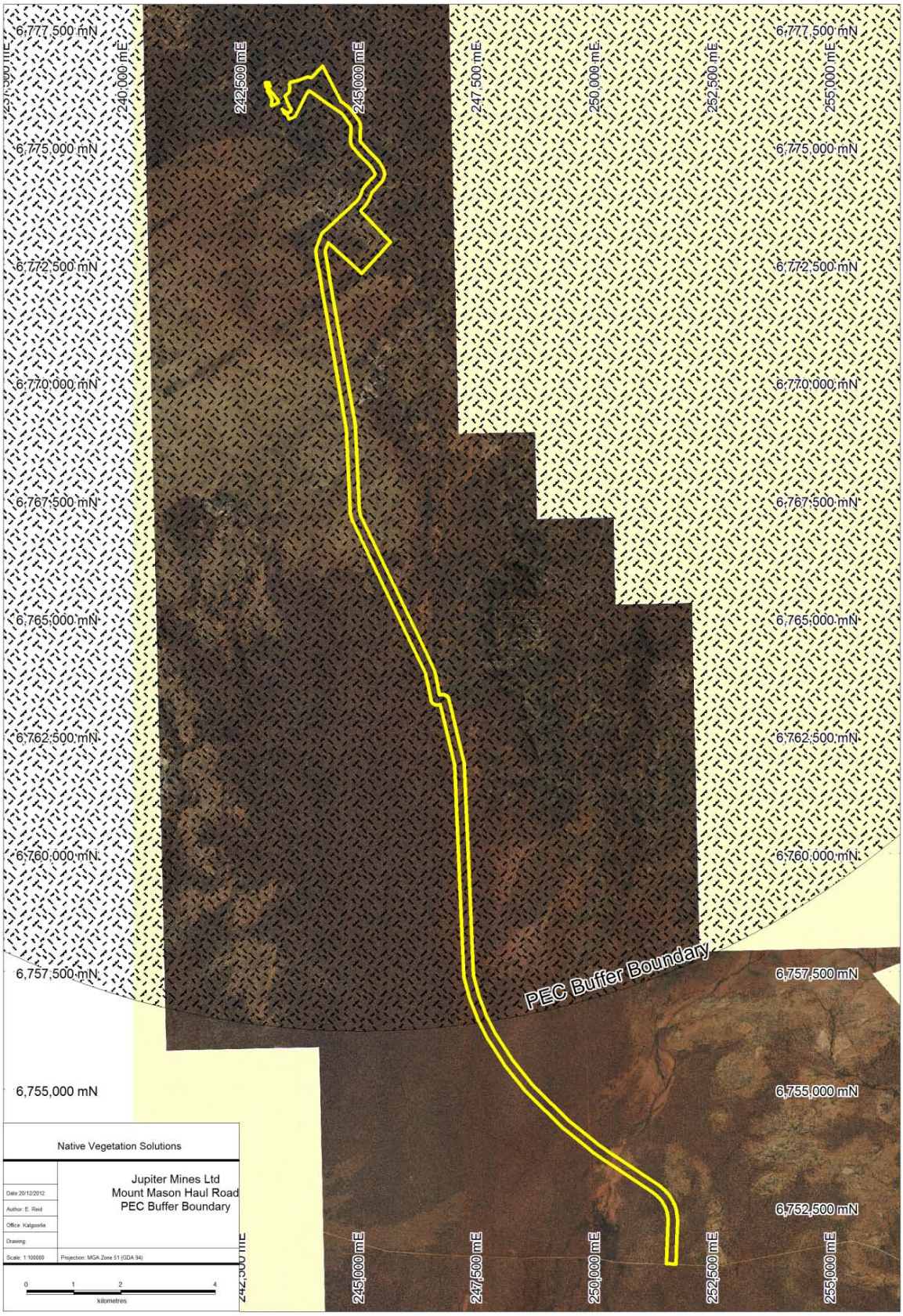
Good (4). Vegetation structure significantly altered by very obvious signs of multiple disturbance.
Retains basic vegetation structure or ability to regenerate it.
For example, disturbance to vegetation structure caused by frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.

Degraded (5). 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 (6). 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 compromising weed or crop species with isolated trees or shrubs.

Appendix 4

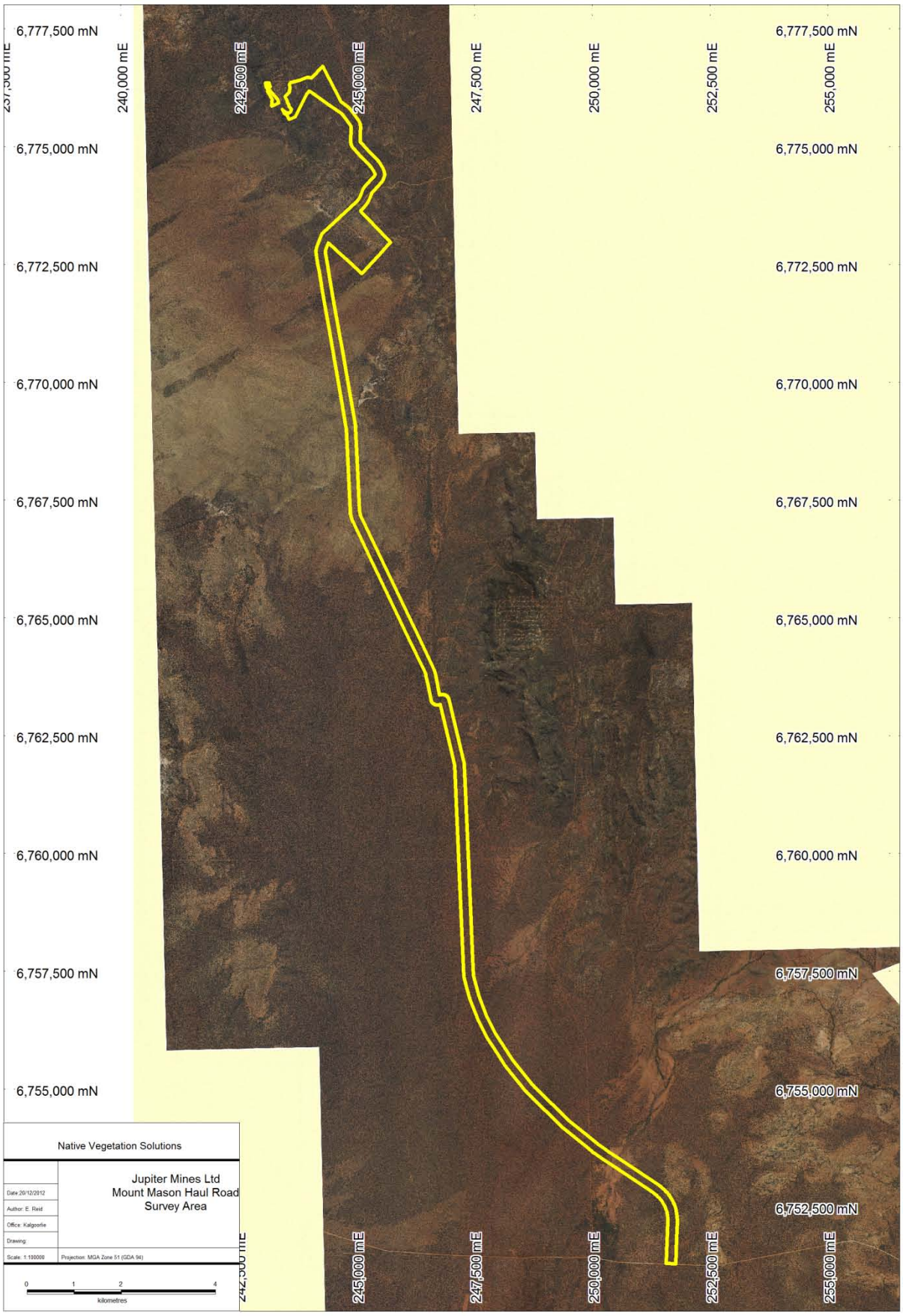
DEC Search Results revealing PEC locations (Reference: 53-1011EC)



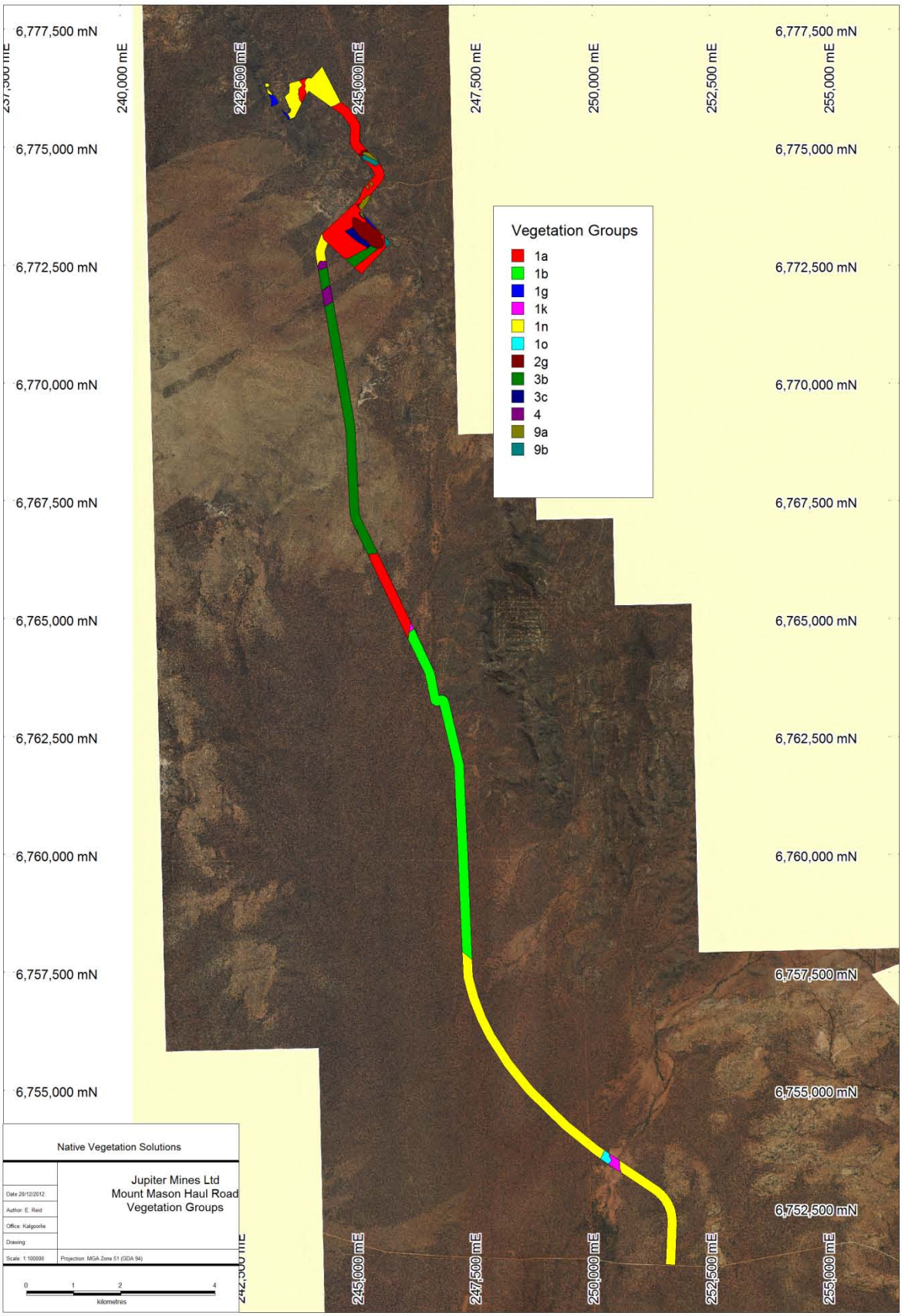
PEC Buffer Location

Appendix 5

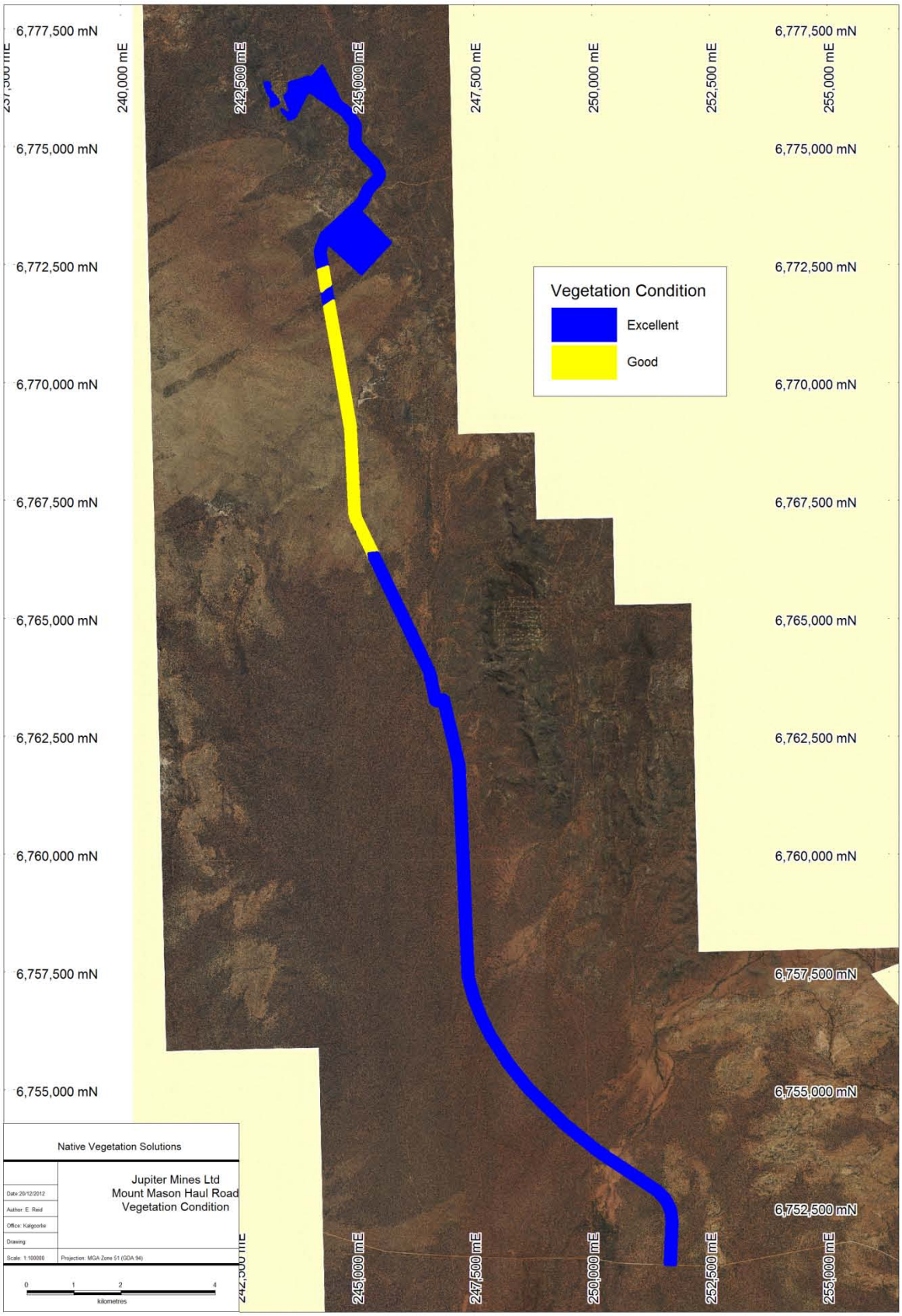
Vegetation Mapping



Map 1 - Survey Area



Map 2 - Vegetation Groups



Map 3 – Vegetation Condition

Appendix 6

Species List

Family	Genus	Species	P/A, NN	1a	1b	1f	1i	1k	1n	1o	2g	3b	3c	4	9a	9b
Aizoaceae	*Cleretum*	*papulosum subsp. papulosum*	A, NN		*											
Aizoaceae	*Tetragonia*	*eremaea*	A					*								
Amaranthaceae	*Ptilotus*	*divaricatus*	P				*									
Amaranthaceae	*Ptilotus*	*gaudichaudii subsp. gaudichaudii*	A		*											
Amaranthaceae	*Ptilotus*	*nobilis (previously exaltatus)*	P	*				*								*
Amaranthaceae	*Ptilotus*	*obovatus*	P	*	*	*	*	*	*	*		*		*	*	*
Amaranthaceae	*Ptilotus*	*schwartzii*	P				*									
Apiaceae	*Daucus*	*glochidiatus*	A		*											
Apocynaceae	*Alyxia*	*buxifolia*	P											*		*
Apocynaceae	*Marsdenia*	*australis*	P	*	*	*	*	*	*	*		*		*	*	
Asparagaceae	*Arthropodium*	*sp. Goldfields*	?P		*			*								
Asparagaceae	*Dichopogon*	*capillipes*	P		*											
Asparagaceae	*Laxmannia*	*arida*	P									*				
Asparagaceae	*Thyridolepis*	*multiculmis*	P									*				
Asparagaceae	*Thysanotus*	*manglesianus*	P									*		*		
Asparagaceae	*Triodia*	*irritans*	P									*		*		
Asphodelaceae	*Asphodelus*	*fistulosus*	A, NN		*			*								
Asteraceae	*Brachyscome*	*ciliaris*	A		*											
Asteraceae	*Calotis*	*hispidula*	A		*											
Asteraceae	*Cephalipterum*	*drummondii*	A	*	*	*		*	*	*						
Asteraceae	*Chrysocephalum*	*apiculatum*	P									*				
Asteraceae	*Gnephosis*	*tenuissima*	A	*			*	*				*		*		
Asteraceae	*Helipterum*	*craspedioides*	A		*			*								
Asteraceae	*Lawrencella*	*rosea*	A											*		
Asteraceae	*Myriocephalus*	*guerinae*	A		*											
Asteraceae	*Olearia*	*humilis*	P						*		*			*		
Asteraceae	*Olearia*	*muelleri*	P													*
Asteraceae	*Olearia*	*pimeleoides*	P	*								*		*		
Asteraceae	*Olearia*	*sp.*	P											*		
Asteraceae	*Olearia*	*subspicata*	P									*				
Asteraceae	*Podolepis*	*canescens*	A		*		*									
Asteraceae	*Podolepis*	*capillaris*	A				*	*				*				
Asteraceae	*Podolepis*	*lessonii*	A	*				*								
Asteraceae	*Podolepis*	*sp. (ATQ14-6)*	A									*				
Asteraceae	*Rhodanthe*	*battii*	A		*											
Asteraceae	*Rhodanthe*	*charsleyae*	A		*			*								
Asteraceae	*Triptilodiscus*	*pygmaeus*	A					*								
Asteraceae	*Vittadinia*	*sulcata*	A		*											
Asteraceae	*Vittadinia*	*sulcata*	A	*												
Asteraceae	*Waitzia*	*acuminata var. acuminata*	A	*	*	*	*		*			*	*	*		
Boraginaceae	*Halgania*	*cyanea var. Allambi Stn*	P									*				
Boraginaceae	*Halgania*	*cyanea var. Charleville*	P									*				
Brassicaceae	*Lepidium*	*oxytrichum*	A		*	*		*								
Brassicaceae	*Stenopetalum*	*anfractum*	A	*		*	*							*		
Brassicaceae	*Stenopetalum*	*lineare*	A					*								
Campanulaceae	*Lobelia*	*heterophylla subsp. heterophylla*	A									*				
Campanulaceae	*Lobelia*	*winfridae*	A	*								*	*			
Campanulaceae	*Wahlenbergia*	*tumidifructa*	A	*	*	*	*						*			

Family	Genus	Species	P/A, NN	1a	1b	1f	1i	1k	1n	1o	2g	3b	3c	4	9a	9b
Casuarinaceae	*Allocasuarina*	*acutivalvis subsp. acutivalvis*	P								*					
Celastraceae	*Stackhousia*	*muricata*	A						*							
Chenopodiaceae	*Atriplex*	*? vesicaria (sterile)*	P												*	
Chenopodiaceae	*Atriplex*	*bunburyana*	P													*
Chenopodiaceae	*Enchylaena*	*tomentosa*	P											*	*	
Chenopodiaceae	*Maireana*	*georgei*	P											*	*	
Chenopodiaceae	*Maireana*	*glomerifolia*	P					*								
Chenopodiaceae	*Maireana*	*pentatropis*	P		*											
Chenopodiaceae	*Maireana*	*planifolia*	P		*			*		*						
Chenopodiaceae	*Maireana*	*pyramidata*	P					*								
Chenopodiaceae	*Maireana*	*sedifolia*	P							*					*	
Chenopodiaceae	*Maireana*	*tomentosa*	P												*	
Chenopodiaceae	*Maireana*	*trichoptera*	P													*
Chenopodiaceae	*Rhagodia*	*drummondii*	P	*		*		*		*				*	*	
Chenopodiaceae	*Rhagodia*	*eremaea*	P					*						*		
Chenopodiaceae	*Salsola*	*australis*	A					*							*	
Chenopodiaceae	*Sclerolaena*	*cuneata*	P					*								*
Chenopodiaceae	*Sclerolaena*	*diacantha*	P	*				*							*	*
Chenopodiaceae	*Sclerolaena*	*eriacantha*	P												*	
Crassulaceae	*Crassula*	*colorata var. acuminata*	A	*	*			*								
Cupressaceae	*Callitris*	*columellaris*	P											*		
Dilleniaceae	*Hibbertia*	*arcuata*	P			*			*		*	*				
Fabaceae	*Acacia*	*aneura var. aneura*	P	*	*	*	*	*	*	*				*	*	
Fabaceae	*Acacia*	*burkittii*	P	*				*				*			*	
Fabaceae	*Acacia*	*caesaneura*	P	*	*	*	*		*	*				*		
Fabaceae	*Acacia*	*cockertoniana*	P		*	*			*		*			*		
Fabaceae	*Acacia*	*colletioides*	P									*		*		
Fabaceae	*Acacia*	*craspedocarpa*	P	*				*	*			*				
Fabaceae	*Acacia*	*effusifolia*	P	*								*	*	*		
Fabaceae	*Acacia*	*erinacea*	P													*
Fabaceae	*Acacia*	*heteroneura var. prolixa*	P									*				
Fabaceae	*Acacia*	*incurvaneura*	P	*			*	*	*	*						
Fabaceae	*Acacia*	*ligulata*	P									*				
Fabaceae	*Acacia*	*longispinea*	P									*				
Fabaceae	*Acacia*	*mulganeura*	P	*					*			*	*	*		
Fabaceae	*Acacia*	*murrayana*	P									*		*		
Fabaceae	*Acacia*	*prainii*	P									*				
Fabaceae	*Acacia*	*pteraneura*	P					*	*	*						
Fabaceae	*Acacia*	*quadrimarginea*	P								*		*		*	*
Fabaceae	*Acacia*	*ramulosa var ramulosa*	P	*	*		*	*	*	*		*	*	*		
Fabaceae	*Acacia*	*sibirica*	P	*					*		*	*				*
Fabaceae	*Acacia*	*tetragonophylla*	P	*	*	*	*	*	*	*	*		*	*		*
Fabaceae	*Indigofera*	*brevidens*	P									*				
Fabaceae	*Mirbelia*	*microphylla*	P	*												
Fabaceae	*Senna*	*artemisioides subsp. filifolia*	P	*		*	*	*	*	*		*		*	*	*
Fabaceae	*Senna*	*artemisioides subsp. x artemisioides*	P		*			*				*				
Fabaceae	*Senna*	*glutinosa subsp chatelainiana*	P										*			
Geraniaceae	*Erodium*	*crinitum*	P											*		
Goodeniaceae	*Dampiera*	*roycei*	P									*		*		
Goodeniaceae	*Goodenia*	*mimuloides*	A	*	*				*		*					

Family	Genus	Species	P/A, NN	1a	1b	1f	1i	1k	1n	1o	2g	3b	3c	4	9a	9b
Goodeniaceae	*Goodenia*	*occidentalis*	A	*			*	*	*	*						
Goodeniaceae	*Goodenia*	*sp.*	A					*								
Goodeniaceae	*Goodenia*	*xanthosperma*	P									*				
Goodeniaceae	*Scaevola*	*spinescens*	P	*		*	*		*		*	*		*	*	*
Goodeniaceae	*Velleia*	*rosea*	A	*	*		*	*						*		
Haloragaceae	*Haloragis*	*? odontocarpa forma rugosa*	A		*											
Haloragaceae	*Haloragis*	*trigonocarpa*	A					*				*		*		
Hemerocallidaceae	*Dianella*	*revoluta var. divaricata*	P	*	*		*	*				*	*	*		
Hemerocallidaceae	*Dianella*	*revoluta var. revoluta*	P	*					*	*		*		*		
Lamiaceae	*Prostanthera*	*albiflora*	P						*							
Lamiaceae	*Prostanthera*	*althoferi subsp. althoferi*	P	*					*			*	*	*		
Lamiaceae	*Prostanthera*	*prostantheroides*	P											*		
Lamiaceae	*Spartothamnella*	*teucriiflora*	P	*	*		*	*	*	*		*		*		
Lamiaceae	*Westringia*	*cephalantha var. cephalantha*	P									*				
Lamiaceae	*Westringia*	*rigida*	P											*		
Loranthaceae	*Amyema*	*gibberula var. gibberula*	P	*										*		
Loranthaceae	*Amyema*	*miquelii*	P						*							
Loranthaceae	*Amyema*	*preissii*	P				*									
Loranthaceae	*Lysiana*	*casuarinae*	P								*					
Malvaceae	*Abutilon*	*cryptopetalum*	P	*	*					*						
Malvaceae	*Abutilon*	*oxycarpum subsp. prostratum*	P		*			*								
Malvaceae	*Brachychiton*	*gregorii*	P	*		*	*	*	*		*	*			*	
Malvaceae	*Commersonia*	*magniflora subsp. oblongifolia*	P									*				
Malvaceae	*Hannafordia*	*bissillii subsp. latifolia*	P									*				
Malvaceae	*Hannafordia*	*quadrivalvis subsp. quadrivalvis*	P									*				
Malvaceae	*Keraudrenia*	*velutina subsp. elliptica*	P									*				
Malvaceae	*Keraudrenia*	*velutina subsp. velutina*	P									*				
Malvaceae	*Sida*	*calyxhymenia*	P	*	*	*	*		*			*				
Malvaceae	*Sida*	*ectogama*	P	*										*		*
Malvaceae	*Sida*	*fibulifera*	P					*								
Malvaceae	*Sida*	*intricata*	P		*			*								
Malvaceae	*Sida*	*sp dark green fruits*	P	*	*		*				*	*		*		
Malvaceae	*Sida*	*sp. golden calyces glabrous*	P	*				*	*							
Myrtaceae	*Aluta*	*aspera subsp. aspera*	P									*				
Myrtaceae	*Baeckea*	*sp. Wubin*	P									*		*		
Myrtaceae	*Enekbatus*	*cryptandroides*	P									*				
Myrtaceae	*Eucalyptus*	*concinna*	P								*	*		*		
Myrtaceae	*Eucalyptus*	*ewartiana*	P						*							
Myrtaceae	*Eucalyptus*	*griffithsii*	P									*				
Myrtaceae	*Eucalyptus*	*leptopoda*	A						*			*				
Myrtaceae	*Eucalyptus*	*leptopoda subsp. elevata*	A	*								*				
Myrtaceae	*Eucalyptus*	*leptopoda subsp. leptopoda*	A											*		
Myrtaceae	*Eucalyptus*	*leptopoda subsp. leptopoda*	P						*							
Myrtaceae	*Eucalyptus*	*leptopoda subsp. subluta*	A						*			*				
Myrtaceae	*Eucalyptus*	*lesouefii*	P												*	
Myrtaceae	*Eucalyptus*	*lucasii*	P				*									
Myrtaceae	*Eucalyptus*	*moderata*	P											*		
Myrtaceae	*Eucalyptus*	*oldfieldii subsp. oldfieldii*	P									*		*		
Myrtaceae	*Eucalyptus*	*oleosa subsp. oleosa*	P	*					*					*		*
Myrtaceae	*Eucalyptus*	*rigidula*	P									*				

Family	Genus	Species	P/A, NN	1a	1b	1f	1i	1k	1n	1o	2g	3b	3c	4	9a	9b
Myrtaceae	*Eucalyptus*	*salubris*	P								*					
Myrtaceae	*Eucalyptus*	*sp. (sterile)*	P									*				
Myrtaceae	*Eucalyptus*	*transcontinentalis*	P									*		*		
Myrtaceae	*Eucalyptus*	*youngiana*	P									*				
Myrtaceae	*Euryomyrtus*	*maidenii*	P	*					*			*				
Myrtaceae	*Euryomyrtus*	*patrickiae*	P						*					*		
Myrtaceae	*Homalocalyx*	*thryptomenoides*	P									*				
Myrtaceae	*Leptospermum*	*fastigiatum*	P									*				
Myrtaceae	*Melaleuca*	*hamata*	P									*				
Myrtaceae	*Melaleuca*	*leiocarpa*	P									*				
Myrtaceae	*Micromyrtus*	*flaviflora*	P									*				
Myrtaceae	*Thryptomene*	*costata*	P										*			
Myrtaceae	*Unknown sp. 3*	*(ATQ12-7)*	?									*				
Phyllanthaceae	*Poranthera*	*leiosperma*	A									*				
Plantaginaceae	*Plantago*	*turrifera*	A		*											
Poaceae	*Amphipogon*	*caricinus var. caricinus*	P									*				
Poaceae	*Aristida*	*contorta*	P									*				
Poaceae	*Austrostipa*	*elegantissima*	P		*			*								*
Poaceae	*Austrostipa*	*nitida*	P		*			*		*						
Poaceae	*Austrostipa*	*trichophylla*	P	*	*	*	*		*		*				*	
Poaceae	*Enneapogon*	*caerulescens*	P					*								
Poaceae	*Eragrostis*	*eriopoda*	P	*			*		*	*		*		*		
Poaceae	*Eriachne*	*pulchella subsp. pulchella*	A					*			*					
Poaceae	*Grevillea*	*teretifolia*	P						*							
Poaceae	*Lachnagrostis*	*filiformis*	A		*											
Poaceae	*Monachather*	*paradoxus*	P	*			*		*			*	*	*		
Poaceae	*Paspalidium*	*gracile*	P		*											
Poaceae	*Pentameris*	*airoides subsp. airoides*	NN		*											
Poaceae	*Rytidosperma*	*setaceum*	P					*								
Poaceae	*Triodia*	*rigidissima*	P									*		*		
Poaceae	*Tripogon*	*loliiformis*	A					*								
Portulacaceae	*Calandrinia*	*eremaea*	A	*	*			*		*				*		
Portulacaceae	*Portulaca*	*oleracea*	A, NN	*					*							*
Primulaceae	*Lysimachia*	*arvensis*	NN		*			*						*		
Proteaceae	*Grevillea*	*acacioides*	P									*				
Proteaceae	*Grevillea*	*berryana*	P								*					
Proteaceae	*Grevillea*	*didymobotrya subsp. didymobotrya*	P									*				
Proteaceae	*Grevillea*	*extorris*	P									*				
Proteaceae	*Grevillea*	*juncifolia subsp. juncifolia*	P									*				
Proteaceae	*Grevillea*	*nematophylla subsp. supraplana*	P									*				
Proteaceae	*Grevillea*	*sarissa subsp. sarissa*	P								*					
Proteaceae	*Grevillea*	*stenobotrya*	P	*							*	*		*		
Proteaceae	*Hakea*	*francisiana*	P									*				
Proteaceae	*Hakea*	*lorea subsp. lorea*	P							*						
Proteaceae	*Hakea*	*minyma*	P									*				
Proteaceae	*Hakea*	*preissii*	P					*						*		
Proteaceae	*Hakea*	*recurva*	P	*			*									
Proteaceae	*Hakea*	*recurva subsp. recurva*	P								*					
Pteridaceae	*Cheilanthes*	*sieberi subsp. sieberi*	P	*	*		*	*	*		*		*			
Rhamnaceae	*Cryptandra*	*connata*	P	*			*		*	*						

Family	Genus	Species	P/A, NN	1a	1b	1f	1i	1k	1n	1o	2g	3b	3c	4	9a	9b
Rubiaceae	*Psydrax*	*suaveolens*	P	*		*	*		*			*		*		
Rutaceae	*Phebalium*	*canaliculatum*	P									*				
Rutaceae	*Philotheca*	*brucei subsp. brucei*	P			*			*		*					
Santalaceae	*Santalum*	*acuminatum*	P											*		
Santalaceae	*Santalum*	*spicatum*	P	*											*	*
Sapindaceae	*Dodonaea*	*lobulata*	P	*		*						*				*
Sapindaceae	*Dodonaea*	*petiolaris*	P													
Sapindaceae	*Dodonaea*	*rigida*	P	*		*	*		*		*	*			*	
Sapindaceae	*Dodonaea*	*viscosa subsp mucronata*	P			*										
Scrophulariaceae	*Eremophila*	*caperata*	P									*				
Scrophulariaceae	*Eremophila*	*clarkei*	P	*												
Scrophulariaceae	*Eremophila*	*forrestii subsp. forrestii*	P	*			*		*	*		*	*	*		
Scrophulariaceae	*Eremophila*	*georgei*	P	*	*	*	*		*		*	*		*		
Scrophulariaceae	*Eremophila*	*glutinosa*	P				*	*		*						
Scrophulariaceae	*Eremophila*	*granitica*	P													
Scrophulariaceae	*Eremophila*	*homoplastica*	P				*									
Scrophulariaceae	*Eremophila*	*latrobei subsp. filiformis*	P									*	*			
Scrophulariaceae	*Eremophila*	*latrobei subsp. latrobei*	P	*	*	*	*		*		*	*	*	*		
Scrophulariaceae	*Eremophila*	*longifolia*	P	*												
Scrophulariaceae	*Eremophila*	*mackinlayi subsp. spathulata*	P									*				
Scrophulariaceae	*Eremophila*	*metallicorum*	P	*							*			*		*
Scrophulariaceae	*Eremophila*	*oldfieldii subsp. angustifolia*	P	*		*									*	*
Scrophulariaceae	*Eremophila*	*pantonii*	P	*		*									*	*
Scrophulariaceae	*Eremophila*	*serrulata*	P					*						*		
Solanaceae	*Duboisia*	*hopwoodii*	P									*				
Solanaceae	*Nicotiana*	*rotundifolia*	A		*											
Solanaceae	*Solanum*	*ferocissimum*	P	*	*		*		*	*		*		*		
Solanaceae	*Solanum*	*lasiophyllum*	P	*	*		*	*	*	*	*	*	*	*		
Solanaceae	*Solanum*	*nummularium*	P		*							*		*		
Solanaceae	*Solanum*	*orbiculatum*	P									*				
Unknown	*Unknown*	*sp*	A					*			*					
Zygophyllaceae	*Zygophyllum*	*eremaeum*	A					*								*
Zygophyllaceae	*Zygophyllum*	*iodocarpum*	A					*								

P – Perennial
A – Annual
NN – Not native/ weed species

Appendix E: Mt Mason Project Level 2 Flora and Vegetation Survey (NVS)

Jupiter Mines Limited

MT MASON PROJECT

LEVEL 2 FLORA AND VEGETATION SURVEY

Part 1- October 2011
&
Part 2- March 2012

Prepared for: Jupiter Mines Limited

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Final Version
May 2012

EXECUTIVE SUMMARY

Jupiter Mines Limited (Jupiter) is a is a publicly listed company with iron ore interests in both the Mt Mason and Mt Ida Projects in the Central Yilgarn of Western Australia. The Mt Mason project is located approximately 560 kilometres north-east of Perth, 216 kilometres north of Kalgoorlie and 80 kilometres west of Leonora.

Jupiter is currently conducting exploration within the Mt Mason and Mt Ida Projects, proposing to initially establish mining operations in the Mt Mason area.

The Mt Mason project area lies within mining tenement M29/408. Jupiter proposes to establish mining infrastructure estimated between 50-70 hectares within this tenement. The proposed infrastructure areas include an open pit, crushing facility with stockpile, explosives magazine, administration/workshop, haul road and topsoil stockpiles.

The survey area, for the purposes of this report totalling approximately 71.81ha encompasses the above mentioned infrastructure areas

The Mt Mason project area is located in the Austin Botanical District of Beard (1990). The Austin Botanical District (Murchison) vegetation also comprises predominantly mulga low woodlands on plains, with the vegetation reduced to scrub on hills. Like the Helms District, *Eucalyptus* spp. forms a tree steppe over (commonly) *Triodia basedowii.* The vegetation is dominated by *Acacia* forests and woodlands, *Acacia* shrublands, hummock grasslands and chenopod and samphire shrublands, with other shrublands also occurring and small areas of *Eucalyptus* woodlands and open woodlands (ANRA, 2012).

The search undertaken with the Environment Protection and Biodiversity Conservation's (EPBC's) Protected Matters Search Tool reported that no Threatened Ecological Communities (TECs) were present in the region (DSEWPC, 2012a).

The Department of Environment and Conservation (DEC) database searches revealed a potential for 1 Threatened Flora and 25 Priority Flora species to occur within a 50km radius of the survey area (DEC, 2011). No database records of Threatened or Priority Flora occur within the survey area, while the closest location occurs 5.3km southwest of the survey area.

The Priority Ecological Community and Threatened Ecological Community (PEC & TEC) search revealed that the survey area contains no TECs, however lies within the buffer zone of a Priority Ecological Community location (Appendix E). The centre point for this buffer zone does not occur within the survey area, however lies approximately 1.5km southeast of the survey area (DEC, 2011a). The buffer zone relates to the PEC known as the Bulga Downs/Perinvale/Walling/vegetation complexes (banded ironstone formation) (Priority 1). This community has not yet been described by the DEC on their list of PECs, however it is inferred that the PEC relates to the vegetation specifically occurring on the banded ironstone formations.

The survey area does not lie within or contain any Environmentally Sensitive Areas (ESA's) or Conservation Reserves (DEC, 2012).

No wetlands which are recorded on the DAFWA WetlandBase occur within the survey area (DAFWA, 2012).

The survey area lies south of the 26th parallel, however receives average annual rainfall between 236mm and 250mm (BoM, 2012), below the 400mm threshold mark. There is no record of *Phytophthora cinnamomi* establishing in natural ecosystems in regions receiving <400mm rainfall per annum (CALM, 2003). Therefore Dieback is not considered an issue for this survey area, however all measures should be taken to prevent any possible soil contamination (seeds of non-

native species *etc*.) which poses a risk within the survey area during seasonally favourable conditions.

Ten vegetation groups were described during this survey, largely following topographical features and dominant upper storey species. Although the quadrats encompassed up 10 vegetation groups, only nine of these occurred within the survey area boundary. Mapping of these 9 vegetation groups, as well as the quadrat locations can be seen in Appendix F.

Ninety seven species were recorded from 59 genera and 31 families. These are listed in Appendix G per Quadrat as well as per vegetation group. Of the native species, Fabaceae had the highest representation, with 16 species from 2 genera dominated by *Acacia.* Asteraceae was the next best represented family with 12 species from 10 genera.

Of the 97 taxa recorded there were no introduced weed species.

Vegetation in the area has been subjected to exploration activities, however due to the timing, ephemerals and annuals were present to assess as part of this two staged survey.

All of the sites/quadrats inspected were in Excellent condition (Keighery 1994). At many of the sites/quadrats there were existing vehicle tracks due to mine exploration activities. The vegetation more than 0.5m off these tracks was mostly in a Very Good to Excellent condition (Keighery 1994).

One species of conservation significance was recorded during the survey. *Calotis sp* Perrinvale Range (Priority 3) was recorded from one location, the Banded Ironstone Formation (BIF) ridge on the western edge of the survey area (Quadrat 5) with an estimated population of 15 plants. A specimen of this taxon will be forwarded to the Western Australian Herbarium along with a Rare Flora Report Form. The location is recorded in Appendix H and shown in Figure 11. The closest previously recorded population was from approximately 5.97 km south west of the location in the survey area.

Previous surveys by Paul Armstrong and Associates (PAA, 2008) located the species *Drosera aff macrantha* (Figure 12). All previous PAA records of this species at Mt Mason were searched by Native Vegetation Solutions (NVS), however it was not located. This species is only visible and flowering in a short period between May and August.

One such particular survey was completed by Paul Armstrong with Allan Lawry a *Drosera* expert from Perth and he determined this in the field as well as with comparison to other samples to be a new species most closely related to *Drosera macrantha,* of which it is quite possibly a subspecies.

However, the single sample collected and lodged with the Western Australian Herbarium (WAHERB) (Sheet Number PERTH 07801823) has been deemed to be too sterile to identify to a species level. Advice from Karina Knight at the WAHERB is that this sample has been renamed from *Drosera aff macrantha* to *Drosera sp.*

Given the uncertainty regarding the identification of the sample at the WAHERB, as well as the expert opinion from Allan Lawry, it is recommended to treat this plant as new species and avoid areas where it has previously been recorded. It is also recommended that targeted surveys be completed for this species at the previously recorded locations between May and August, in order to provide better sample material to the WAHERB for identification, and determination of its relevant conservation code.

The proposed clearing of vegetation will result in the loss of some individuals from the local area; however, the impact will not be great enough to remove whole communities or populations. Most of the species and communities recorded during this survey are widespread throughout the

Murchison Bioregion and therefore the loss of a small proportion from this area will not be significant.

The single Priority 3 species recorded during this survey, *Calotis sp* Perrinvale Range, was restricted in distribution to a small population. Removal of this population is not likely to compromise the conservation status or short and medium term viability of the species regionally.

Areas where the possible new *Drosera sp.* are known to occur should be avoided until better sample material can be collected and provided to the WAHERB for identification and determination of its conservation status.

The Environmental Protection Authority's (EPAs) objective for flora and vegetation is to maintain the abundance, species diversity and geographical distribution of flora and vegetation as well as protect Threatened flora consistent with the provisions of the *Wildlife Conservation Act 1950.*

This report has been expanded to incorporate and summarise the results of Stage 1 (October 2011) and Stage 2 (March 2012) surveys.

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1 INTRODUCTION

1.1 BACKGROUND

Jupiter Mines Limited (Jupiter) is a is a publicly listed company with iron ore interests in both the Mt Mason and Mt Ida Projects in the Central Yilgarn of Western Australia. The Mt Mason project is located approximately 560 kilometres north-east of Perth, 216 kilometres north of Kalgoorlie and 80 kilometres west of Leonora (Figure 1).

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The survey area, for the purposes of this report totalling 71.81 ha encompasses the above mentioned infrastructure sites.

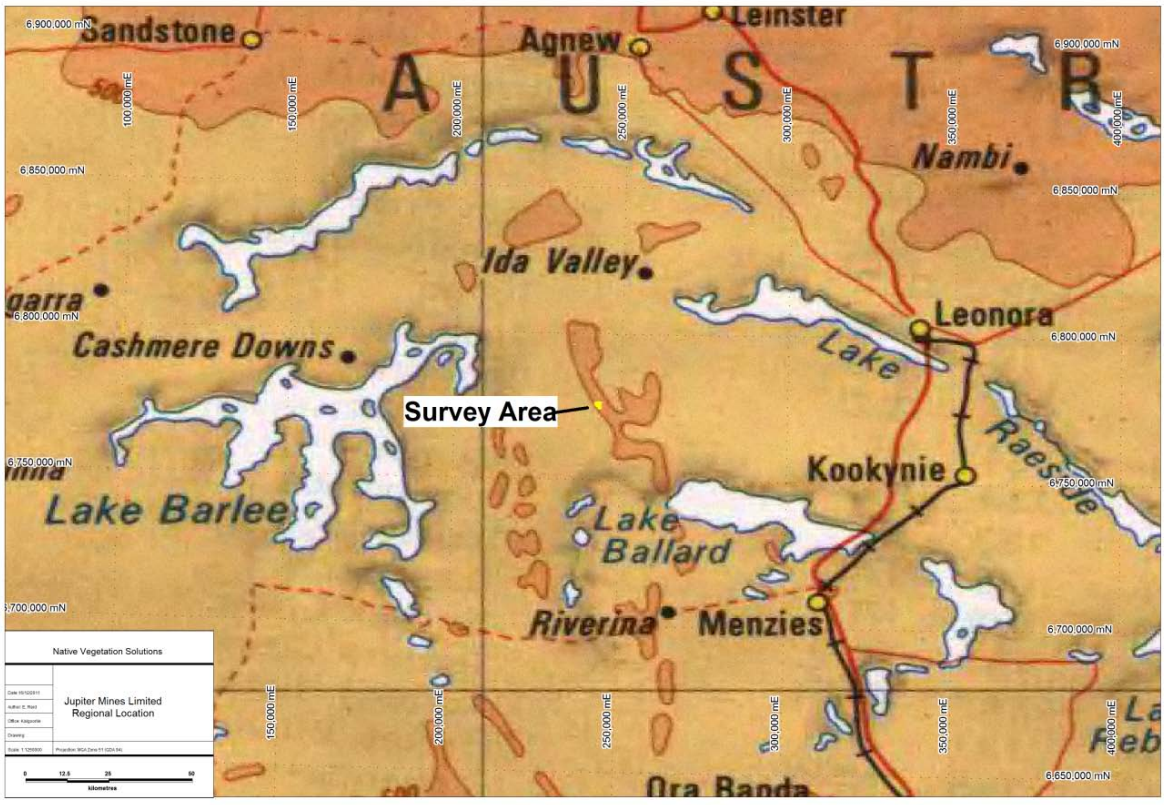

Figure 1: Location of the Mt Mason project

1.2 PURPOSE AND SCOPE

The objective of this report is to document the results of the flora and vegetation component of a Level 2 assessment conducted in accordance with the Environmental Protection Authority's (EPA) "*Terrestrial Biological Surveys as an Element of Biodiversity Protection; Position Statement No 3*" (EPA, 2002) and *Guidance Statement No. 51 "Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (EPA 2004), for the purpose of describing the flora and vegetation of the survey area, and potential impacts on the environment from the Mt Mason project area.

2 EXISTING ENVIRONMENT

2.1 CLIMATE

The climate of the region is subtropical to warm temperate, typically characterised by hot dry summers and cold winters.

The nearest official meteorological station is located at Menzies, approximately 91 km south of the survey area. Recordings of the local climatic conditions commenced at Menzies in 1896 (rainfall) and 1898 (temperature) (BoM, 2012) and the data collected at this station was used for this report.

2.1.1 Temperature

Mean annual minimum temperature is 12.6°C and mean annual maximum temperature is 26.3°C. The coldest month is July (mean minimum temperature 5.3°C), the hottest is January (mean maximum temperature 35.1°C) and diurnal temperature variations are relatively consistent throughout the year (Figure 2).

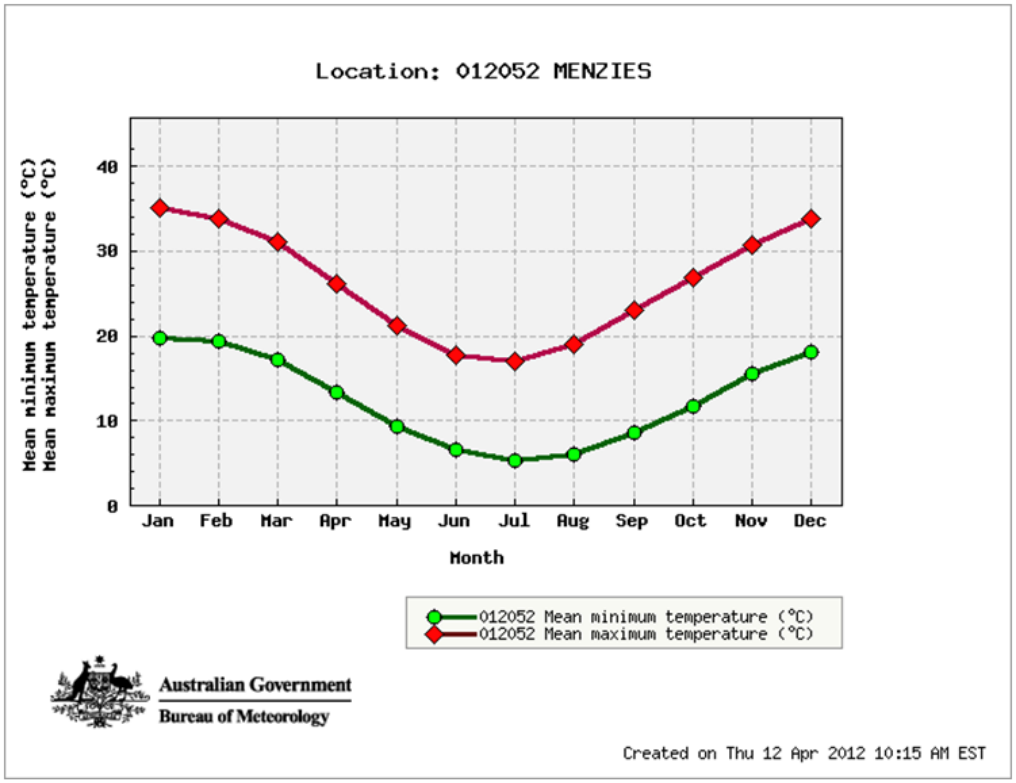

Figure 2: Mean maximum and minimum temperatures at Menzies

2.1.2 Rainfall

The area is arid and the annual average rainfall at Menzies is 250.3 mm, which falls (>1 mm) on

an average of 32.1 rain-days. Most of the rain usually falls between January and August and this amount varies greatly both seasonally and annually (Figure 3). Prior to this survey being undertaken rainfall at Menzies had not been recorded in 2011 for the months of January, February, April, August and September, as well as for all months in 2012. However 2011 rainfall for June, July and October showed greater rainfall than their respective averages.

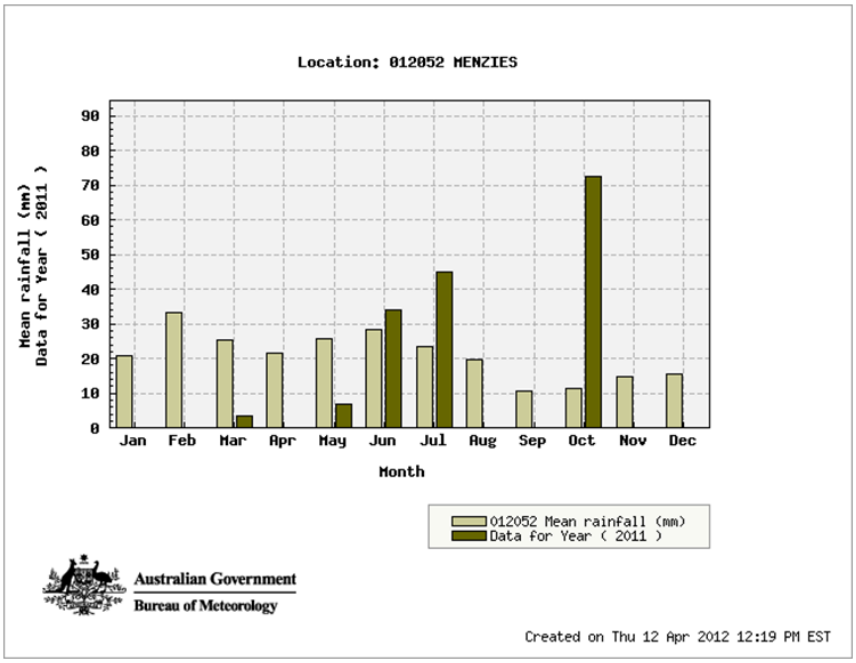

Figure 3: Rainfall data for the Menzies Meteorological Station

For comparison purposes, average rainfall data from the Leonora weather station Located 98km east of the survey area has been provided. This graph (Figure 4) demonstrates a similar pattern of rainfall for Menzies and Leonora.

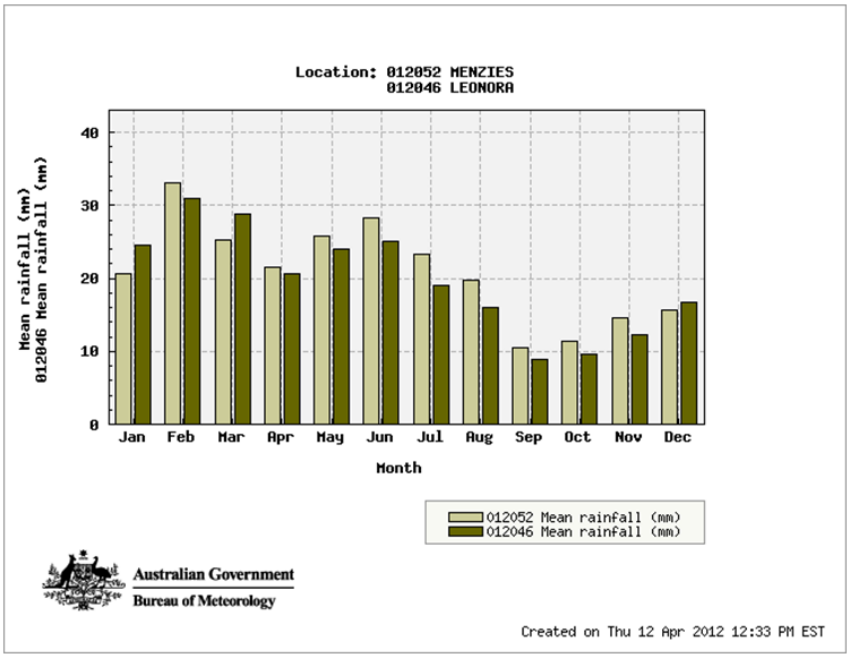

Figure 4: Average Rainfall data for Menzies and Leonora

Additionally, the Leonora rainfall station also shows rainfall being greater than the average figures for June, July and October for 2011. Figure 5 also highlights the rainfall received in 2012 which was above average in January and March.

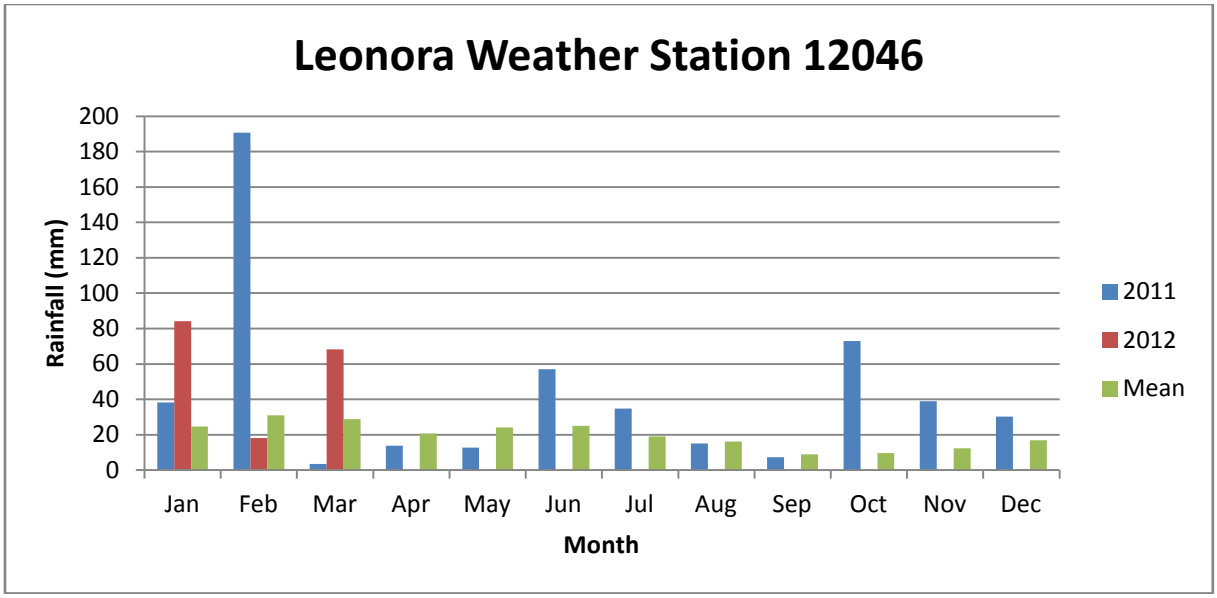

Figure 5: Rainfall data for the Leonora Meteorological Station

2.2 INTERIM BIOGEOGRAPHIC REGIONALISATION OF AUSTRALIA (IBRA) REGION

The IBRA recognises 85 bioregions within Australia and 403 subregions (DSEWPC, 2012). The Mt Mason project is located in the East Murchison IBRA subregion (MUR1) which totals over 7 million hectares (CALM, 2002). The East Murchison subregion lies on the Yilgarn Craton's "Eastern Goldfields" and "Southern Cross" Terranes. This area is characterised by:

- Internal drainage;
- Extensive areas of elevated red desert sandplains with minimal dune development;
- Salt lake systems that are associated with the occluded Paleodrainage system; and
- Broad plains of red-brown soils and breakaway complexes as well as red sandplains (CALM, 2002).

The dominant land use of the MUR1 subregion is grazing, while only 1.4% was in conservation reserves in 2001 (CALM, 2002).

2.3 LANDFORMS AND SOILS

The soils of the MUR1 IBRA region are summarised above. Beard (1990) describes the landform of the eastern Murchison as 'less dissected' than the western part and resembling the Wheatbelt Region, albeit with different soils. The most important types he describes as:

- Shallow stony earthy loams on hills and ranges;
- Red earthy sands on upland sandplains, with red sands on occasional dunes;
- Earthy loams overlying red-brown hardpan, often with a surface stony layer, on undulating terrain;
- Shallow acid or neutral red earths in intimate mosaics with earthy loams on extensive flat and gently sloping plains; and
- Saline soils associated with salt lakes.

2.4 BOTANICAL DISTRICTS AND EXISTING VEGETATION

The Mt Mason project area is located in the Austin Botanical District of Beard (1990).

The Austin Botanical District (Murchison) vegetation also comprises predominantly mulga low woodlands on plains, with the vegetation reduced to scrub on hills. Like the Helms District, *Eucalyptus* spp. forms a tree steppe over (commonly) *Triodia basedowii.* The vegetation is

dominated by *Acacia* forests and woodlands, *Acacia* shrublands, hummock grasslands, chenopod and samphire shrublands, with other shrublands also occurring and small areas of *Eucalyptus* woodlands and open woodlands (ANRA, 2012).

3 METHODS

3.1 LEVEL OF SURVEY

The survey was conducted in accordance with EPA's Position Statement No. 3: *Terrestrial Biological Surveys as an Element of Biodiversity Protection* (EPA, 2002) and *Guidance for the Assessment of Environmental Factors No. 51: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA, 2004).

In designing this survey, note was taken of Tables 2 and 3 of EPA Guidance Statement 51 (pp 39-45). Using the Table 3 criterion on 'Size/scale of the proposal/impact' it is determined that the impact of this mining proposal is High, although other criteria (for example 'Degree of degradation or clearing within region' and 'Rarity of vegetation') may mitigate this by showing Low impact. This survey, however, is designed to accommodate the High impact and as such, in the Murchison bioregion, a Level 2 survey is required.

The flora and vegetation aspect of a Level 2 study has two components:

1a. Desktop study which includes a literature review and a search of the relevant databases; and

1b. Reconnaissance survey of the subject area to verify the desktop survey, undertake low impact sampling, define flora and vegetation values present in the area and to determine potential sensitivity to impact. These together comprise a Level 1 survey.

and

2a. Detailed survey, comprising multiple visits in different seasons and replication of plots in vegetation units incorporating greater coverage than a reconnaissance survey; and

2b. Comprehensive survey when necessary, to enhance the level of knowledge at the locality or sub-regional scale, to provide wider context for the local scale.

Therefore, the scope of work for the flora and vegetation survey was to:

- Conduct a desktop study that includes a literature review and search of relevant databases;
- Conduct a plot-based survey of the proposed area of impact including multiple visits in different seasons;
- Prepare an inventory of species occurring in the study area;
- Identify any conservation significant vegetation or flora within the study area;
- Provide an impact risk assessment for both threatening processes and for flora of conservation significance; and
- Provide recommendations, including the management of perceived impacts to flora and vegetation, particularly flora of conservation significance, within the study area.

3.2 PRELIMINARY DESKTOP STUDY

A preliminary assessment of the survey area and its potential constraints was undertaken by reviewing a number of government agency managed databases and consulting where necessary. The following sections provide a summary of the methodology used for each potential environmental aspect associated with the survey area.

3.2.1 EPBC Protected Matters Search Tool

A search was completed on the EPBC Protected Matters Search website for known records of important environmental significance (DSEWPC, 2012a).

3.2.2 Threatened Flora and Communities

The Species and Communities Branch of the DEC was contacted for a search of their databases containing known populations of threatened flora (Reference: 76-1011FL, DEC, 2011).

The presence of TECs & PECs was determined by examining Geographic Information System (GIS) data supplied by the DEC upon request. (Reference: 53-1011EC, DEC, 2011a).

3.2.3 Environmentally Sensitive Areas and Conservation Reserves

DEC's Native Vegetation Map Viewer was used to determine the location of any ESA's (http://maps.dec.wa.gov.au/idelve/nv/index.jsp).

The location of any Conservation Reserves was determined by examining Geographical Information System (GIS) data available from the DEC website and consulting with the local DEC office where necessary.

3.2.4 Vegetation Type, Extent and Status

Vegetation extent and status data was sourced from the Department of Agriculture and Food (DAFWA) report "Land-Use and Vegetation in Western Australia- National Land and Water Resources Audit Report" and it's associated GIS file.
Note: This data was provided to Native Vegetation Solutions via a license agreement with the DAFWA.

3.2.5 Wetlands

The location of wetlands within the survey area was determined by examining DAFWA's Wetland Base (http://spatial.agric.wa.gov.au/wetlands/).

3.2.6 Dieback

Dieback is only considered a potential issue if both the mean annual rainfall of the area is >400mm, and if the project area resides below the 26th parallel.

3.3 FIELD SURVEY

The first stage of the field survey was conducted by Mr. Eren Reid and Ms. Ana Storey, Botanists of NVS from the 3rd to 7th October 2011.

The second stage of the field survey was conducted by Mr. Eren Reid and Ms. Ashley Owen, Botanists from NVS from the 12th to 14th March 2012.

3.3.1 Field Methods

3.3.1.1 Stage 1 Field work (Spring 2011)

Prior to the Stage 1 field work, the aerial photography was examined and representative sample sites for quadrats were chosen to provide coverage over all visible vegetation types. Nineteen sites were chosen by this method. Locations were planned to target mainly within the survey area as well as the distribution of the BIF outside the survey area, for comparison purposes.

In the field, these sites were visited and 20 x 20m quadrats established in appropriate locations, taking into account representativeness of the site to surrounding vegetation and vegetation boundaries.

Each quadrat was marked in all corners with a 97cm aluminium fence dropper and was defined by tape measures. The location of the north-west corner was captured on a TwoNav Aventura GPS at ±4m accuracy, using Universal Transverse Mercator location on GDA94 datum. Digital photographs were taken of each site.

Data collected at each site included:

- Species Present;
- Topography;
- Rock Type;
- Soil Colour and Type;
- Aspect;
- % Bare Ground and Litter;
- Disturbance Level; and
- Condition.

As well as a complete list of all species encountered the average height and estimated coverage of the species was recorded.

Specimens of taxa not recognised by the Botanists were collected and pressed along with specimens of taxa recognised as, or thought to be, conservation-significant species.

The condition of each quadrat was assessed using the method developed by Keighery (1994). Definitions of the condition scale are presented in Appendix A.

3.3.1.2 Stage 2 Field work (Autumn 2012)

In March 2012, NVS was commissioned to complete stage 2 of the Level 2 flora and vegetation survey at Mt Mason. Prior to field work NVS was advised that additional areas were required to be surveyed due to actual footprints being refined. Therefore 5 additional quadrats were planned and installed within the additional area, totalling 24 quadrats with the complete survey area of 71.81ha. Methods as mentioned in section 3.3.1.1 were utilised for the total 24 quadrats in March 2012.

3.3.2 Post-Field Methods

Specimens were identified by a consultant Botanist Frank Obbens with reference to published keys and samples held in the Reference Section of the WAHERB.

Species information was transferred into Microsoft Excel worksheets in preparation for PATN analysis, via Bray and Curtis Flexible UPGMA.

Previous survey plot results (20m x 20m quadrats) completed by Paul Armstrong and Associates (PAA, 2008) within the Mt Mason area were also examined and included for Species Accumulation Analysis.

3.4 PERSONNEL AND REPORTING

The following personnel were involved in the preparation of this report:

- Mr Eren Reid (*BSc- Biological Science*), Principal Botanist of NVS, planned and conducted stages 1 and 2 of the field survey and prepared the report;
- Ms Ana Storey (BSc- Botany), Botanist of NVS, participated in the stage 1 field survey;
- Ms Ashley Owen (Dip of Science), Botanist/Consultant of NVS, participated in the stage 2 field survey and prepared parts of the report; and
- Mr Frank Obbens *BSc*, Consultant Botanist/Plant Taxonomist, undertook identification of unknown specimens collected during fieldwork.

3.5 LICENCE AND PERMITS

A License to take flora for scientific purposes was held by Mr ER Reid SL009444 which is due for expiry on17/05/2012.

3.6 NOMENCLATURE AND TAXONOMY

Nomenclature follows that used by the WAHERB.

Recently the WAHERB has updated its sequence and arrangement of collections to conform to the systematic sequence of the Angiosperm Phylogeny Group (APGIII), with the result that many Families and Genera have been moved or renamed. This report attempts to follow those changes in relation to species recorded during this survey. Definitions of Threatened Flora are also included in Appendix B.

3.7 LIMITATIONS

A number of limitations are suggested by the EPA (2004) as potentially impacting on the completeness or accuracy of surveys such as these. Table 1 lists these and addresses them in terms of their constraint on this survey.

Table 1: Summary of possible Flora and Vegetation Survey limitations

Possible Limitation	Constraint	Comment
Competency/experience of the consultant carrying out the survey	No	Experienced and competent personnel conducted the survey. Eren Reid has over 7 years experience in botanical surveys in a variety of environments across Western Australia including the Murchison region.
Scope	No	The Scope of work was adequately defined.
Proportion of flora identified, recorded and/or collected	No	All taxa not identified in the field were collected and pressed, and later identified by a consultant Botanist at the WAHERB. See also Species Accumulation Curves in section 4.2.2.2.
Sources of information	No	Information on flora and vegetation of the region and local area was available from publicly available databases, books and reports.
Proportion of the task achieved	No	All tasks completed.
Timing/season	Yes/No	The surveys were undertaken in October 2011 and March 2012. Rainfall averages were exceeded in June and July with later rainfall remaining in line with monthly averages, stimulating germination and growth of annual species in 2011, as well as prolonging the flowering period of other perennials. Rainfall previous to the March 2012 field work was above average for January and March. However timing was not consistent with the flowering period of the *Drosera sp* for the collection of this species for positive identification.
Disturbance in survey area	No	There has been disturbance from exploration activities, however, the structural dominants of the vegetation persist and, despite invasion by some significant weeds, the vegetation remains in Good to Very Good condition.
Intensity of survey effort	No	The intensity of the survey is sufficient to provide adequate coverage and recognition of vegetation units.
Resources	No	Adequate resources were available.
Remoteness and/or access problems	No	All the areas in need of survey were easily accessible from existing tracks, or by foot.
Availability of contextual information for the region`	No	Contextual information regarding vegetation and flora around the east Murchison is readily available.

4 RESULTS

4.1 PRELIMINARY DESKTOP ASSESSMENT

4.1.1 EPBC Protected Matters Search Tool

The search undertaken with the EPBC's Protected Matters Search Tool reported that no TECs were present in the region (DSEWPC, 2012a). The search also revealed that the survey area may contain habitat for the following two invasive weed species *Carrichtera annua* (Ward's Weed) and *Cenchrus ciliaris* (Buffel Grass).

Results of the EPBC Protected Matters Search Tool are included in Appendix C.

4.1.2 Threatened Flora and Communities

The DEC database searches revealed a potential for 1 Threatened Flora and 25 Priority Flora species to occur within a 50km radius of the survey area (DEC, 2011). No known locations of Priority Flora occur within the survey area, while the closest location occurs 5.3km southwest of the survey area.

Results of the threatened flora database search are included in Appendix D.

The PEC/TEC search revealed that the survey area contains no TECs, however lies within the buffer zone of a PEC location (Appendix E). The centre point for this buffer zone does not occur within the survey area, however lies approximately 1.5km southeast of the survey area (DEC, 2011a). The buffer zone relates to the PEC known as the Bulga Downs/Perinvale/Walling/vegetation complexes (banded ironstone formation) (Priority 1). This community has not yet been described by the DEC on their list of PECs, however it is inferred that the PEC relates to the vegetation specifically occurring on the banded ironstone formations.

Priority 1 PECs are defined to be poorly known 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. 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.

The main threat to this community is considered to be mining.

4.1.3 Environmentally Sensitive Areas and Conservation Reserves

The survey area does not lie within or contain any ESA's or Conservation Reserves (DEC, 2012).

4.1.4 Vegetation Type, Extent and Status

Information relating to known vegetation within the survey area has been summarised in Table 2 and Table 3 below. This information has been compiled through both desktop assessments and the field survey.

Table 2: Summary of information regarding Pre-European and current vegetation extent of vegetation association 18 within the survey area

Factor	Value				
Beard Vegetation Association*	18				
Vegetation Association Description*	Low woodland; mulga (Acacia aneura)				
Extent (ha)	Scale				
	By Association*	***By Association****	***By IBRA Region**** *(Murchison-MUR)*	***By IBRA Sub-region**** *(East Murchison-MUR1)*	***By Shire**** *(Shire of Menzies)*
	22,029,557	19,926,084	12,422,396	10,285,290	2,013,390
% Pre-European Extent Remaining*	*100.00%*	*100.00%*	*100.00%*	*100.00%*	*100.00%*
Surrounding Land Use	Exploration, Mining				
Weed prevalence	Low				

* Source: Shepherd *et al*. (2002) Appendix 2
**Source: Shepherd *et al.* (2002) Associated GIS data

Table 3: Summary of information regarding Pre-European and current vegetation extent of vegetation association 202 within the survey area

Factor	Value				
Beard Vegetation Association*	202				
Vegetation Association Description*	Shrublands; mulga & Acacia quadrimarginea scrub				
Extent (ha)	Scale				
	By Association*	***By Association****	***By IBRA Region**** *(Murchison-MUR)*	***By IBRA Sub-region**** *(East Murchison-MUR1)*	***By Shire**** *(Shire of Menzies)*
	365,344	449,227	340,257	279,020	143,358
% Pre-European Extent Remaining*	*100.00%*	*100.00%*	*100.00%*	*100.00%*	*100.00%*
Surrounding Land Use	Exploration, Mining				
Weed prevalence	Low				

* Source: Shepherd *et al*. (2002) Appendix 2
**Source: Shepherd *et al.* (2002) Associated GIS data

4.1.5 Wetlands

No wetlands which are recorded on the DAFWA WetlandBase occur within the survey area (DAFWA, 2012).

4.1.6 Dieback

The survey area lies south of the 26th parallel, however receives average annual rainfall between 236mm and 250mm (BoM, 2012), below the 400mm threshold mark. There is no record of *Phytophthora cinnamomi* establishing in natural ecosystems in regions receiving <400mm rainfall per annum (CALM, 2003). Therefore Dieback is not considered an issue for this survey area, however all measures should be taken to prevent any possible soil contamination (seeds of non-native species *etc*.) which poses a risk within the survey area during seasonally favourable conditions.

4.2 FIELD ASSESSMENT

4.2.1 Vegetation of the Survey Area

Beard's vegetation associations are very broad and are used over large areas in which there is also a large amount of variation at a more local level. The vegetation groups described below for the survey area fit into the broader Beard descriptions.

The vegetation groups described below were determined visually from the descriptions taken at the time of the field survey.

Descriptions of all 24 sites/quadrats are presented in Appendix I. For each site the physical features, vegetation description and unit, along with the species lists for the 20 x 20m plots with typical canopy cover are provided.

4.2.1.1 Vegetation Groups

Ten vegetation groups were described during this survey, largely following topographical features and dominant upper storey species. Although 10 vegetation groups were captured within the quadrat only 9 vegetation groups occur within the survey area. Mapping of the 9 vegetation groups, as well as the quadrat locations can be seen in Appendix F. Descriptions of vegetation groups are listed below.

***1. Thryptomene* Shrubland**

Thryptomene costata or *Thryptomene decussata* low open shrubland with emergent *Acacia quadrimarginea* over scattered mixed shrubs and herbs on low hillslopes and ridges.

Quadrats: 4 and16.

2. Open Mulga woodland over Laterite

Acacia effusifolia low open forest over *Acacia incurvaneura, Eremophila forrestii subsp forrestii* over *Hibbertia arcuata and Prostanthera althoferi subsp althoferi and* scattered mixed shrubs and herbs on Laterite hills.

Quadrat: 13.

3. Acacia shrubland (fire scar- no longer in survey area)

Acacia effusifolia low open shrubland over scattered mixed shrubs and herbs on flats.

Quadrats: 17, 18 and 19.

***4. Allocasuarina* over *Calytrix* shrubland**

Allocasuarina acutivalvis subsp acutivalvis and *Acacia incurvaneura* low woodland/tall shrubland over *Acacia balsamea* and *Philotheca brucei subsp brucei* open shrubland over scattered mixed shrubs and herbs in minor drainage lines and Laterite breakaways.

Quadrats: 3, 20 and 21.

5. Mulga over *Eremophila forrestii susbsp forrestii* on hills and ridges

Acacia incurvaneura woodland over *Eremophila forrestii subsp forrestii* shrubland over scattered mixed low shrubs and herbs on undulating hills and ridges.

Quadrats: 1, 8, 9, 10 and 11.

6. Mulga over *Prostanthera althoferi subsp althoferi* on hills and ridges

Acacia incurvaneura shrubland to tall open scrub over *Prostanthera althoferi subsp althoferi* shrubland over scattered mixed shrubs and herbs on hills and ridges.

Quadrat: 7

7. Mulga over *Philotheca brucei subsp brucei* on hills and ridges

Acacia incurvaneura with *Acacia quadrimarginea* tall shrubland/ low woodland over *Philotheca brucei subsp brucei* with *Acacia balsamea shrubland* over *Eremophila latrobei subsp latrobei* and *Hibbertia exasperata* over mixed herbs and shrubs on hills and ridges.

Quadrats: 2, 5, 6, 12 and 23.

***8. Mulga over Eremophila forrestii subsp forrestii* on flats**

Acacia incurvaneura with *Acacia mulganeura* tall shrubland over *Eremophila forrestii subsp forrestii and Acacia effusifolia* low shrubland over *Waitzia acuminata* and mixed herbs on flat plains.

Quadrats: 14 and 15.

***9. Acacia burkittii* shrubland within drainage lines**

Acacia burkittii and *Acacia quadrimarginea* tall shrubland over *Senna artemisioides subsp artemisioides* over *Ptilotus obovatus* and mixed shrubs within drainage lines.

Quadrat: 22

***10. Acacia cockertoniana* over *Eremophila oldfieldii* and *Eremophila pantonii* on flats**

Acacia cockertoniana tall shrubland over *Eremophila oldfieldii subsp angustifolia* over *Eremophila pantonii* and mixed shrubs on flats.

Quadrat: 24

4.2.1.2 PATN Analysis of Quadrat Data

PATN Analysis was completed on both the dominant species and all species recorded within each quadrat. The results are supplied below in Figure 6 and Figure 7. The PATN analysis of the dominant species shows a similar correlation of grouped quadrats as described in section 4.2.1.1, with the exception of outliers, Q4, Q6, Q7, Q9, Q13, Q17 and Q23. As expected these outliers occur due to the slight variations of dominant species present within each quadrat of its related vegetation group, suggesting some overlapping of vegetation borders. Vegetation Groups 2 and 6 above are not accounted for in the PATN Analysis as Quadrats 7 and 13 have been grouped with other vegetation groups. These quadrats are single quadrats representing their respective vegetation groups due to spatial size limitations. It is expected that if space was available and additional quadrats were installed in these vegetation groups, then they would be grouped according to those included in section 4.2.1.1.

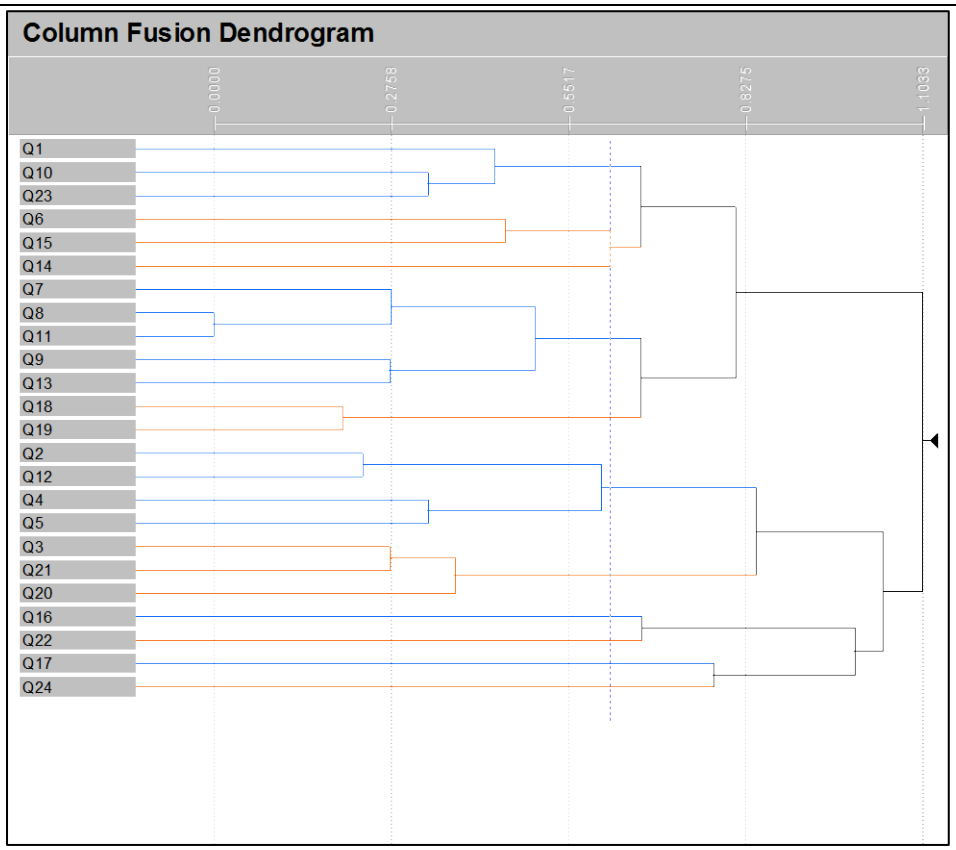

Figure 6: PATN Analysis of Dominant Species into 10 groups

The dendogram below (Figure 7) of the analysis of all species shows a strong correlation of pre-grouped quadrats described in section 4.2.1.1, with the only outliers being Q3, Q4, Q6, Q7, Q13 and Q23 . These outliers occur due to the slight variations of species present within each quadrat of its related vegetation group, suggesting some overlapping of vegetation borders. Once again Vegetation groups 2 and 6 are not accounted for as separate vegetation groups as these quadrats are single quadrats representing their respective vegetation groups due to spatial size limitations. It is expected that if space was available and additional quadrats were installed in these vegetation groups, then they would be grouped according to those included in section 4.2.1.1.

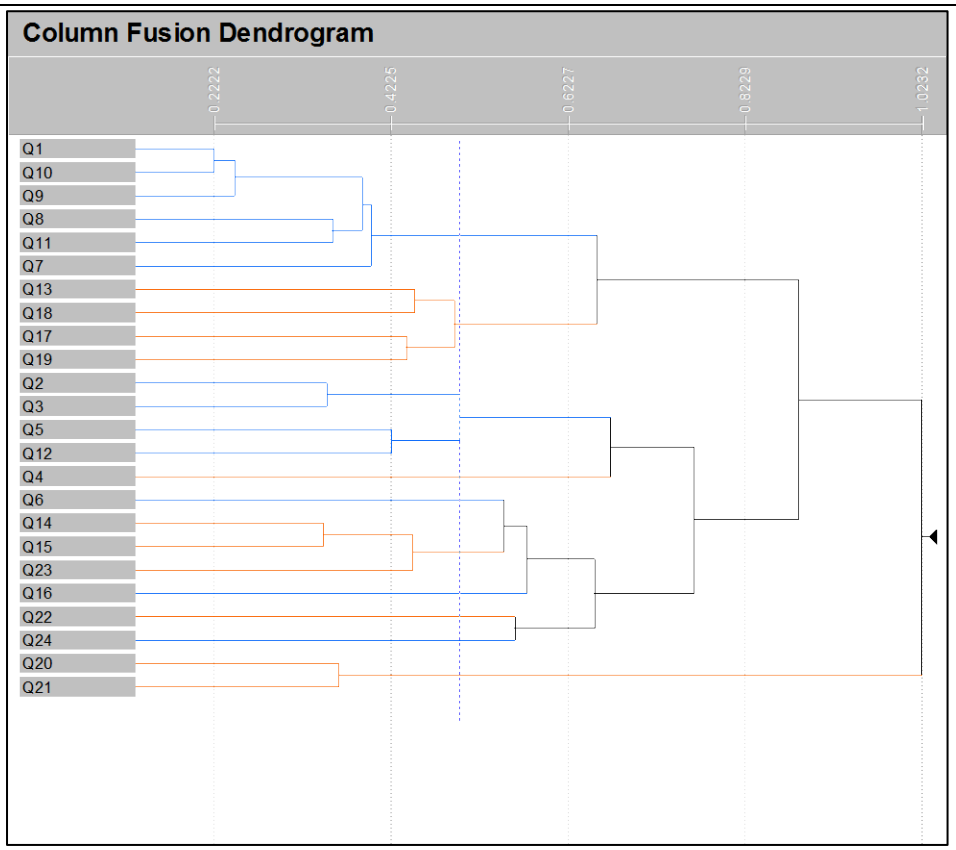

Figure 7: PATN Analysis of All Species into 10 groups

4.2.1.3 Vegetation Condition

Vegetation in the survey area has been subjected to exploration activities, however due to the timing, ephemerals and annuals were present to assess as part of this survey.

According to Keighery (1994) most of the Sites/quadrats inspected were in Very Good to Excellent condition (Figure 8). At many of the Sites there were existing vehicle tracks due to mine exploration activities. The vegetation more than 0.5m off these tracks was mostly in a Very Good to Excellent condition (Keighery, 1994).

As discussed in Section 4.3.3, there were no species of weeds observed during the survey.

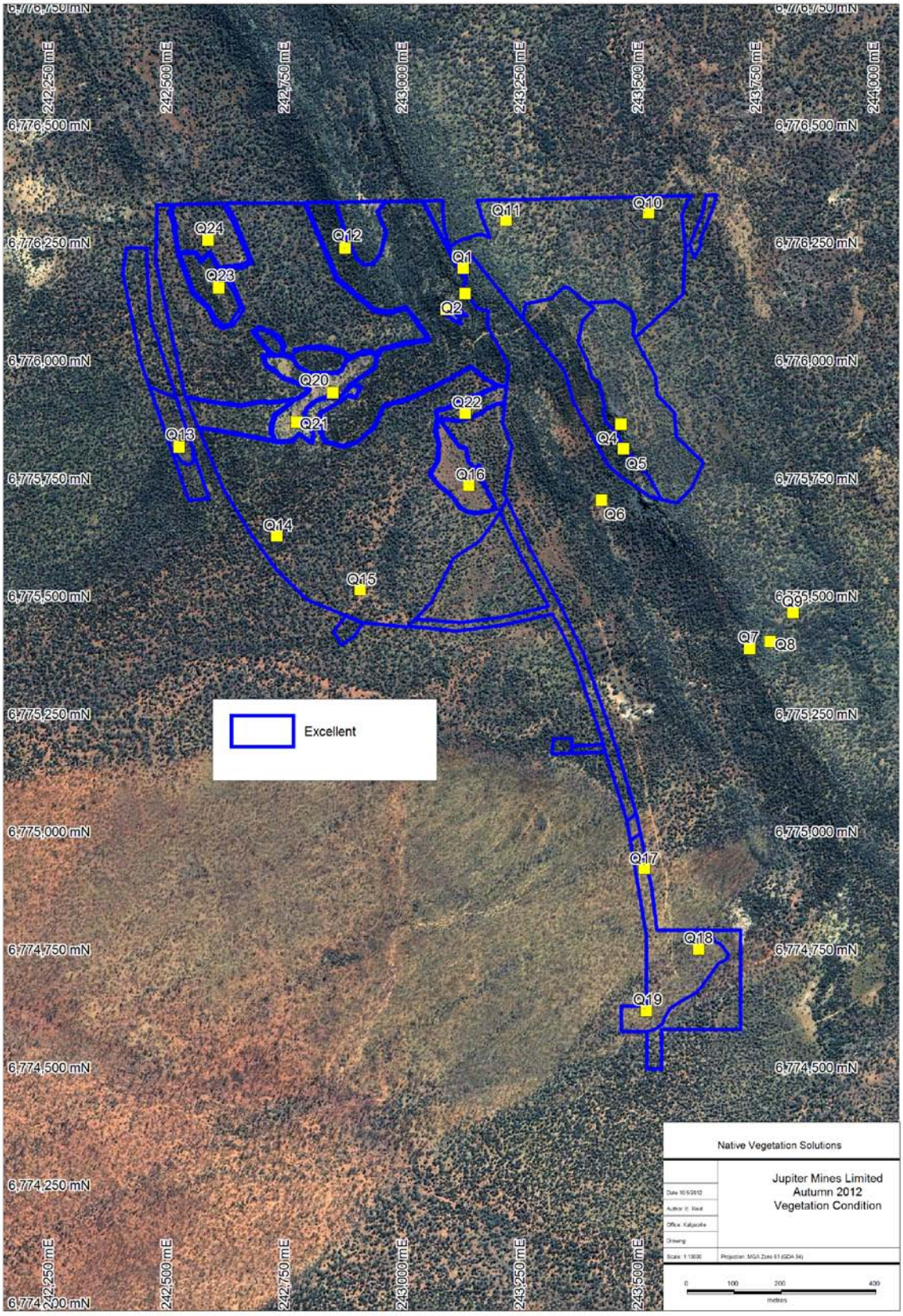

Figure 8: Vegetation condition of the Mt Mason survey area

4.2.2 Flora of the Survey Area

4.2.2.1 General

Ninety seven species were recorded from 59 genera and 31 families. These are listed in Appendix G per Quadrat as well as per vegetation group. Of the native species, Fabaceae had the highest representation, with 16 species from 2 genera dominated by *Acacia.* Asteraceae was the next best represented family with 12 species from 10 genera.

Of the 97 taxa recorded there were no introduced weed species.

The most common and widespread species was *Cheilanthes sieberi subsp sieberi* recorded from 18 quadrats. Its canopy cover was low and never more than 1%. The next most common and widespread species was *Waitzia acuminata, with a canopy cover less than 1%.* As would be anticipated from a mulga dominated area, the next species most common and widespread was *Acacia incurvaneura*, which was recorded from 16 quadrats with canopy cover varied between 10% and 30%. Also sharing 16 quadrat occurrences were *Trachymene ornata* and *Prostanthera althoferi subsp althoferi*. The next most common species were *Philotheca brucei subsp brucei, Olearia humilis* and *Sida sp Golden calyces Glaborous* from 14 Sites, then *Marsdenia australis and Goodenia occidentalis* from 12, *Eremophila georgei and Eremophila forrestii subsp forrestii* from 11 and *Ptilotus obovatus, Goodenia macroplectra, Monachather paradoxus* and *Solanum lasiophyllum* from 9 Sites.

There were 31 taxa recorded from only a single site (Q14). Of these, all were native species and none were weed species.

There were three specimens collected that could not be confirmed, either beyond family or genus. Taxa with unsure determinations were:

- Apocynaceae- *Unknown sp (sterile);*
- *Corchorus sp; and*
- *Eucalyptus sp (sterile)*

As noted in the Biodiversity Audit of Western Australia's 53 Biogeographical Subregions (CALM, 2002), the East Murchison subregion is rich and diverse in both its flora and fauna. CALM (2002) also reports that most species are wide ranging and usually occur in at least one, and often several, adjoining subregions.

4.2.2.2 Species Accumulation Curves

According to the Species Accumulation Curve below, the R^2 value (0.9676) shows a good fit for a logarithmic curve of the total accumulated species per number of quadrats established (Figure 9). Sufficient sampling was inferred via the effort of intensity (number of quadrats established) versus the return of species collected (total accumulated species). The logarithmic trend line and R^2 values were generated in Excel®. From this fitted logarithmic curve formula, the asymptote was calculated where the gain of new species was less than 1% for every new quadrat established. Based on this reasoning, the asymptote was reached at 28 quadrats, at which the extrapolated total accumulated number of species is 95.45. Therefore the 96 species collected within the 24 established quadrats represents approximately 100.58% of the projected asymptote.

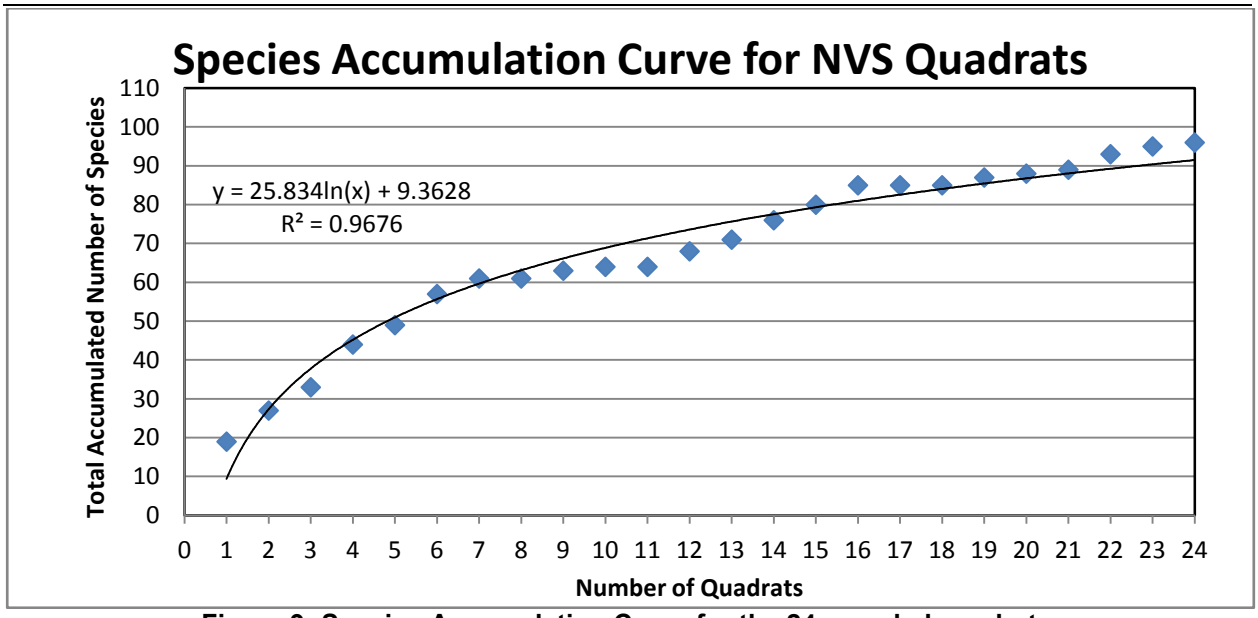

Figure 9: Species Accumulation Curve for the 24 sampled quadrats

Similarly when results from Paul Armstrong and Associates' (PAA) quadrats, which were located within the survey area, were included in the Species Accumulation Curve analysis, the R^2 value (0.9743) below shows a good fit for a logarithmic curve of the total accumulated species per quadrats established (Figure 10). Once again the logarithmic trend line formula and R^2 values were generated in Excel®.

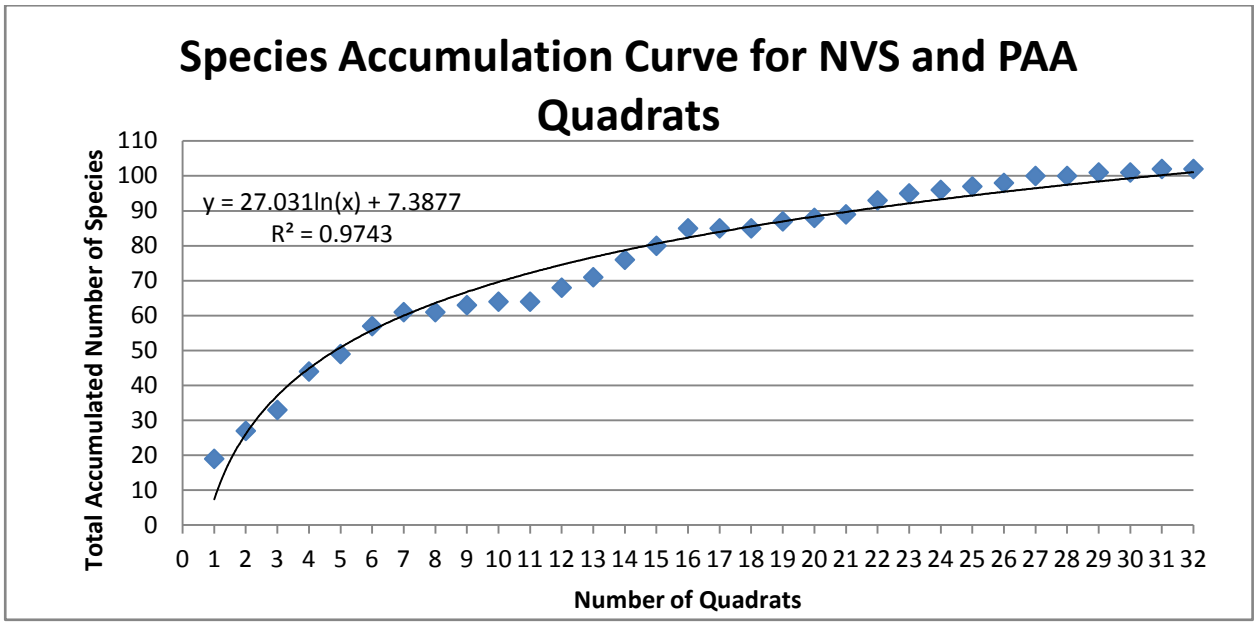

Figure 10: Species Accumulation Curve utilising NVS and PAA Quadrats within the survey area

From this fitted logarithmic curve formula, the asymptote was calculated where the gain of new species was less than 1% for every new quadrat established. Based on this reasoning, the asymptote was reached at 29 quadrats, at which the extrapolated total accumulated number of species is 98.41. Therefore the 102 species collected within the 32 quadrats represents approximately 103.65% of the projected asymptote.

Furthermore, this suggests that 96 species collected within the 24 quadrats represents 97.55% of the projected asymptote calculated using NVS and PAA additional quadrats.

4.2.2.3 Conservation significant species

One species of conservation significance was recorded during the survey.

Calotis sp Perrinvale Range (Priority 3) was recorded from one location, the BIF ridge on the western edge of the survey area (Q5) with an estimated population of 15 plants. A specimen of this taxon will be forwarded to the Western Australian Herbarium along with a Rare Flora Report Form. The location is recorded in Appendix H and shown in Figure 11. The closest previously recorded population was from approximately 3.91 km south west of the survey area.

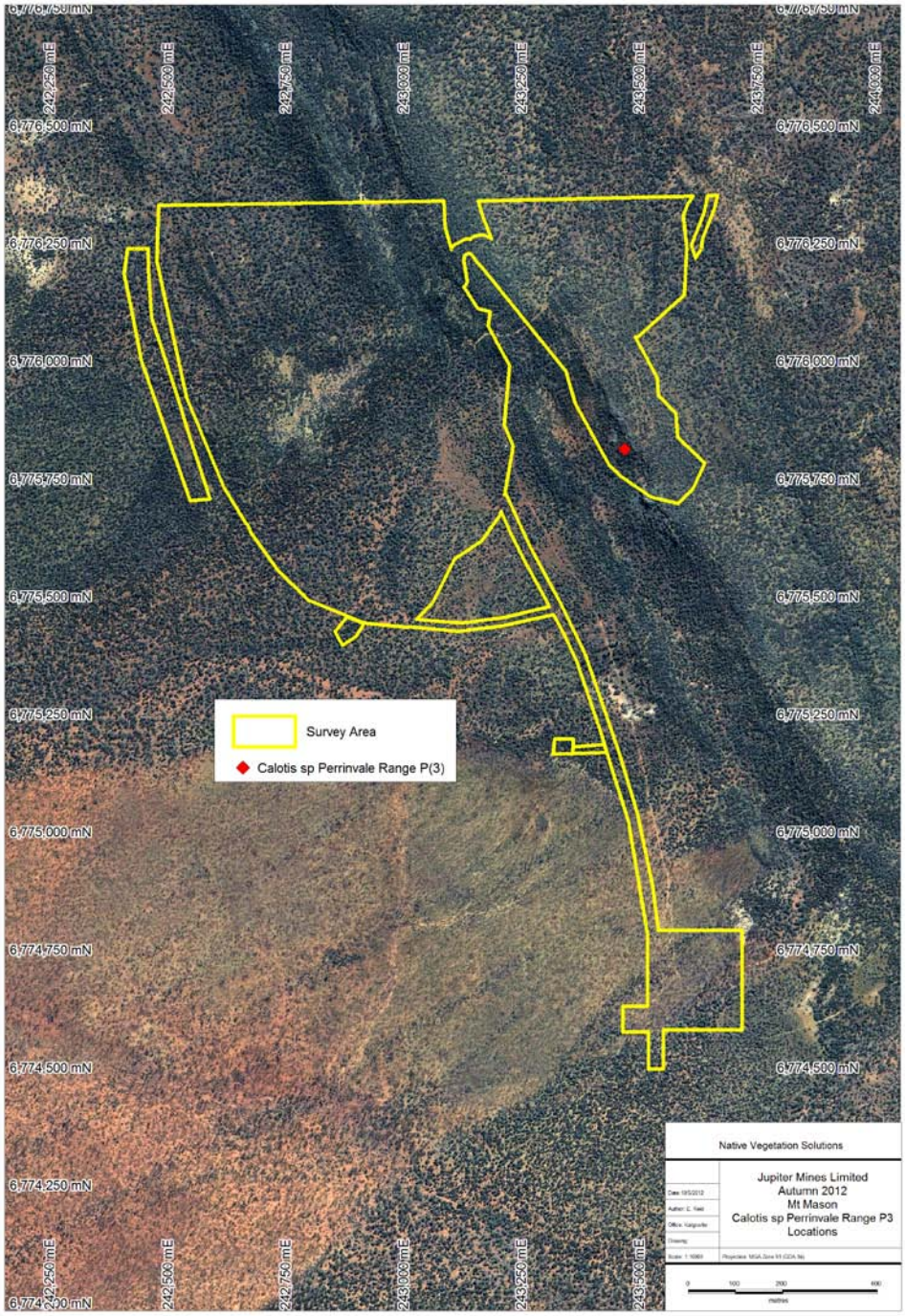

Figure 11: Location of *Calotis sp* Perrinvale Range (P3) recorded within the Mt Mason Survey area.

Previous surveys by Paul Armstrong and Associates (PAA, 2008) located the species *Drosera aff macrantha* (Figure 12). All previous PAA records of this species at Mt Mason were searched by NVS; however this species was not located. This species is only visible and flowering in a short period between May and August.

One such particular survey was completed by Paul Armstrong with Allan Lawry the *Drosera* expert from Perth and he determined this in the field as well as with comparison to other samples to be a new species most closely related to *Drosera macrantha,* of which it is quite possibly a subspecies.

However, the single sample collected and lodged with the WAHERB (Sheet Number PERTH 07801823) has been deemed to be too sterile to identify to a species level. Advice from Karina Knight at the WAHERB is that this sample has been renamed from *Drosera aff macrantha* to *Drosera sp.*

Given the uncertainty regarding the identification of the sample at the WAHERB, as well as the expert opinion from Allan Lawry, it is recommended to treat this plant as a new species and avoid areas where it has previously been recorded. It is also recommended that targeted surveys be completed for this species at the previously recorded locations between May and August, in order to provide better sample material to the WAHERB for identification, and determination of its relevant conservation code.

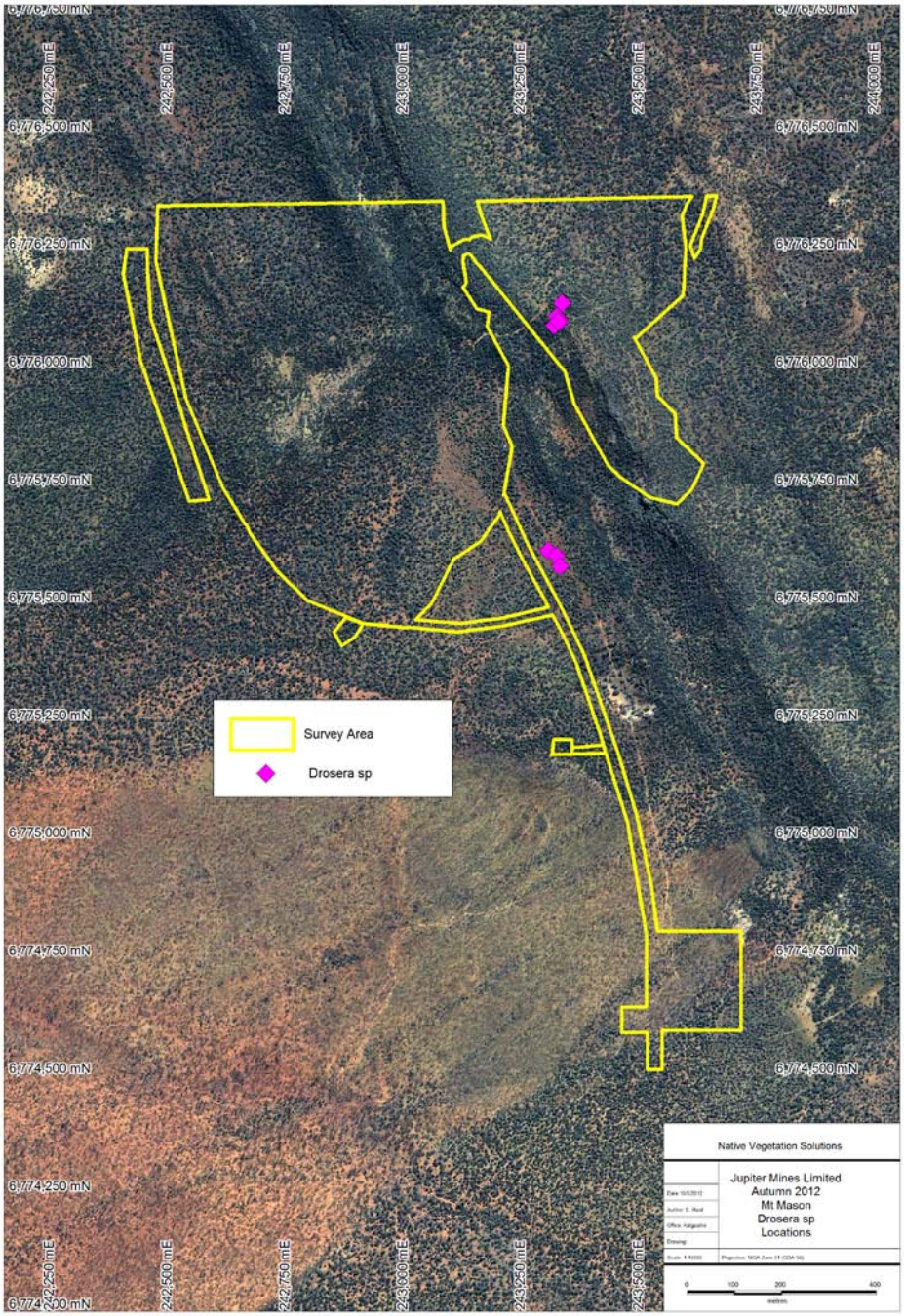

Figure 12: Locations of *Drosera aff macrantha (Drosera sp*) recorded by PAA in the Mt Mason Area.

4.2.2.4 Introduced species

No introduced species were recorded in and around the survey area.

5 DISCUSSION

The EPA (2002) indicated that an ecological assessment of a site must consider its ecological value at the ecosystem level and its biodiversity value at the genetic, species and ecosystem level.

The survey area is located within the East Murchison subregion which has been recognised as a centre of endemism with high ecosystem and species diversity (Cowan 2001). However, Cowan also explains that while the flora of the East Murchison subregion is a rich and varied one, most species are wide ranging and often occur in one or more adjacent subregions. This survey established that mostly, the flora within the project area is not unique, and is in fact common throughout the East Murchison, however the composition of these flora on the BIF ranges is unique and relatively unknown, and could be considered restricted habitats.

No DRF were recorded during the survey; however one Priority 3 species, *Calotis sp* Perrinvale Range, was recorded. The population of *Calotis sp* Perrinvale Range, located on the BIF within and around Q5, requires removal (taken) if the Mt Mason project goes ahead as currently planned. This was the only population of this species observed during the current survey. The FloraBase map of this species shows approximately 19 other known locations of this species with the closest approximately 4.91km to the southwest of the survey area, and the furthest 351km west of the survey area.

Areas where the possible new *Drosera sp.* are known to occur should be avoided until better sample material can be collected and provided to the WAHERB, for identification and determination of its conservation status.

No TECs are present within the areas proposed for clearing. However, one PEC plausibly occurs within survey area. This community is the P1 Bulga Downs/Perrinvale/Walling/vegetation complex (banded ironstone formations). Given that Banded Ironstone formations are mapped as PECs based on the substrate not necessarily on the vegetation, and the fact that no vegetation description or delineation is provided by the DEC as yet, it is assumed this PEC covers entire areas where Banded Ironstone protrudes from the surface.

Vegetation condition was generally 'Very Good' to "Excellent" (Keighery 1994). Disturbance was present within the survey area mostly attributed to access tracks and exploration related activities.

It is therefore not expected that the disturbance associated with the Mt Mason project area will significantly negatively impact on the vegetation in the area in terms of fragmentation or loss of vegetation associations or species that may be unique. This is partially due to the overall size of the survey area as well as the similar vegetation and habitat outside of the survey area.

6 IMPACT ASSESSMENT

6.1 THREATENING PROCESSES

The major processes likely to impact the Flora within the Survey area, if mine operations were to proceed include:

- Vegetation clearing and the associated removal of fauna habitat which would result in the loss of local vertebrate assemblages, a reduction in biodiversity and a loss of ecological function locally, as well as displacement of local fauna into adjacent areas;
- The loss of population numbers to a potentially new species;
- Vehicle impacts on uncleared vegetation could increase if tracks are not adhered to;
- An increase in the area of disturbed land could result in an increase in alien species taking advantage of the lack of competition from native species;
- Dust generated during clearing of native vegetation and mining activities may settle on adjacent native vegetation, causing possible stress and perhaps death, especially during drier months; and
- Accidental fire arising from clearing and mining activities may affect vegetation in surrounding areas.

7 CONCLUSIONS AND RECOMMENDATIONS

This report incorporates and summarises the results of the first and second stages of the Level 2 flora and vegetation survey.

The survey established that the condition of the vegetation in the proposed disturbance area is overall 'Very Good', to 'Excellent' condition. No Declared Rare Flora or Threatened Ecological Communities were recorded in the area.

The proposed clearing of vegetation will result in the loss of some individuals from the local area; however, the impact will not be great enough to remove whole communities or populations. Most of the species and communities recorded during this survey are widespread throughout the Murchison Bioregion and therefore the loss of a small proportion from this area will not be significant.

The one Priority 3 species recorded during this survey, *Calotis sp Perrinvale Range*, was restricted in distribution to a small population. Removal of this population is not likely to compromise the conservation status or short and medium term viability of the species regionally.

Areas where the possible new *Drosera sp.* are known to occur should be avoided until better sample material can be collected and provided to the WAHERB, for identification and determination of its conservation status.

The EPA objective for flora and vegetation is to maintain the abundance, species diversity and geographical distribution of flora and vegetation as well as protect Threatened flora consistent with the provisions of the *Wildlife Conservation Act 1950.*

The following generic recommendations arise from the current flora survey:

- Any disturbance/clearing be minimised in extent to reduce the loss of individuals and impact on populations;
- Weed control measures must be implemented and followed during and after construction activities;
- A rehabilitation plan is developed that progressively rehabilitates areas as soon as they are no longer required;
- Driving restrictions, ensuring that off-road driving is minimised; and
- All staff to be educated on the importance of fire prevention, and equipment provided for use in the event of fire.

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Appendix A - Vegetation Condition Scale (Keighery, 1994)

Pristine (1). Pristine or nearly so, no obvious signs of disturbance.

Excellent (2). Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.

Very Good (3). Vegetation structure altered obvious signs of disturbance.
For example, disturbance to vegetation structure caused by repeating fires, the presence of some more aggressive weeds, dieback, logging and grazing.

Good (4). Vegetation structure significantly altered by very obvious signs of multiple disturbance.
Retains basic vegetation structure or ability to regenerate it.
For example, disturbance to vegetation structure caused by frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.

Degraded (5). 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 (6). 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 compromising weed or crop species with isolated trees or shrubs.

Appendix B - Categories of Conservation Status

IUCN categories (based on review by Mace and Stuart 1994) as used for the Environmental Protection and Biodiversity Conservation (EPBC) Act 1999 and the WA Wildlife Conservation Act 1950.

Extinct. Taxa not definitely located in the wild during the past 50 years.

Extinct in the Wild. Taxa known to survive only in captivity.

Critically Endangered. Taxa facing an extremely high risk of extinction in the wild in the immediate future.

Endangered. Taxa facing a very high risk of extinction in the wild in the near future.

Vulnerable. Taxa facing a high risk of extinction in the wild in the medium-term future.

Near Threatened. Taxa that risk becoming Vulnerable in the wild.

Conservation Dependent. Taxa whose survival depends upon ongoing conservation measures. Without these measures, a conservation dependent taxon would be classed as Vulnerable or more severely threatened.

Data Deficient (Insufficiently known). Taxa suspected of being Rare, Vulnerable or Endangered, but whose true status cannot be determined without more information.

Least Concern. Taxa that are not Threatened.

Schedules used in the WA Wildlife Conservation Act 1950.

Schedule 1. Rare and Likely to become Extinct.

Schedule 2. Extinct.

Schedule 3. Migratory species listed under international treaties.

Schedule 4. Other Specially Protected Fauna.

Department of Environment and Conservation Priority Species

(species not listed under the Conservation Act, but for which there is some concern)

Priority 1. Taxa with few, poorly known population on threatened lands.

Priority 2. Taxa with few, poorly known populations on threatened lands, or taxa with several, poorly known populations not on conservation lands.

Priority 3. Taxa with several, poorly known populations, some on conservation lands.

Priority 4. Taxa in need of monitoring. Taxa which are considered to have been adequately surveyed, or for which sufficient knowledge is available, and which are considered not currently threatened or in need of special protection, but could be if present circumstances change.

Priority 5. Taxa in need of monitoring. Taxa which are not considered threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years (IUCN Conservation Dependent).

JAMBA The agreement between the Government of Australia and the Government of Japan for the Protection of Migratory Birds in Danger of Extinction and their Environment. Australian Treaty Series 1981 No 6.

CAMBA The agreement between the Government of Australia and the Government of the People's Republic of China for the Protection of Migratory Birds and their Environment. Australian Treaty Series 1988 No 22.

ROKAMBA The agreement between the Government of Australia and the Government of the Republic of Korea on the Protection of Migratory Birds and their Environment. Australian Treaty Series 2007 ATS 24.

Appendix C - EPBC Protected Matters Search Results

Australian Government
Department of Sustainability, Environment, Water, Population and Communities

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

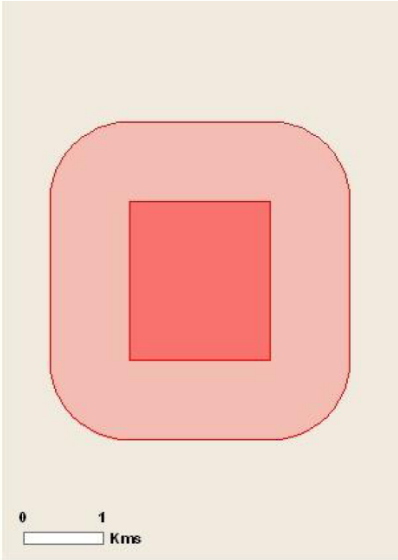
Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information about the EPBC Act including significance guidelines, forms and application process details can be found at http://www.environment.gov.au/epbc/assessmentsapprovals/index.html

Report created: 05/01/12 13:21:34

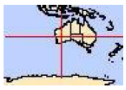
Summary
Details
- Matters of NES
- Other Matters Protected by the EPBC Act
- Extra Information

Caveat
Acknowledgements



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

Coordinates
Buffer: 1.0Km



Summary

Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance - see http://www.environment.gov.au/epbc/assessmentsapprovals/guidelines/index.html

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Areas:	None
Threatened Ecological Communities:	None
Threatened Species:	2
Migratory Species:	5

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place and the heritage values of a place on the Register of the National Estate. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage/index.html

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species. Information on EPBC Act permit requirements and application forms can be found at http://www.environment.gov.

Commonwealth Lands:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	3
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have

Place on the RNE:	None
State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	6
Nationally Important Wetlands:	None

Details

Matters of National Environmental Significance

Threatened Species		[Resource Information]
Name	Status	Type of Presence
BIRDS		
Acanthiza iredalei iredalei		
Slender-billed Thornbill (western) [25967]	Vulnerable	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Leipoa ocellata		
Malleefowl [934]	Vulnerable	Species or species habitat may occur within area

Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat may occur within area
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat may occur within area
Migratory Terrestrial Species		
Leipoa ocellata		
Malleefowl [934]	Vulnerable	Species or species habitat may occur within area
Merops ornatus		
Rainbow Bee-eater [670]		Species or species habitat may occur within area
Migratory Wetlands Species		
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat may occur within area
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat may occur within area
Merops ornatus		
Rainbow Bee-eater [670]		Species or species habitat may occur within area

Extra Information

Invasive Species		[Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit,

Name	Status	Type of Presence
Mammals		
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Carrichtera annua Ward's Weed [9511]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area

Coordinates

-29.114584 120.35123,-29.114584 120.367337,-29.132832 120.367337,-29.132832 120.35123, -29.114584 120.35123

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World Heritage and Register of National Estate properties, Wetlands of International Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants

- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Department of Environment, Climate Change and Water, New South Wales
-Department of Sustainability and Environment, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment and Natural Resources, South Australia
-Parks and Wildlife Service NT, NT Dept of Natural Resources, Environment and the Arts
-Environmental and Resource Management, Queensland
-Department of Environment and Conservation, Western Australia
-Department of the Environment, Climate Change, Energy and Water
-Birds Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-SA Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Atherton and Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
-State Forests of NSW
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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Appendix D - DEC Threatened and Priority Flora Search Results

Listed below are the Priority Flora identified from the DEC searches for the general Survey area and surrounds (Reference: 76-1011FL).

Note – One Threatened species was identified with all known locations approximately 35km southwest of the survey area.

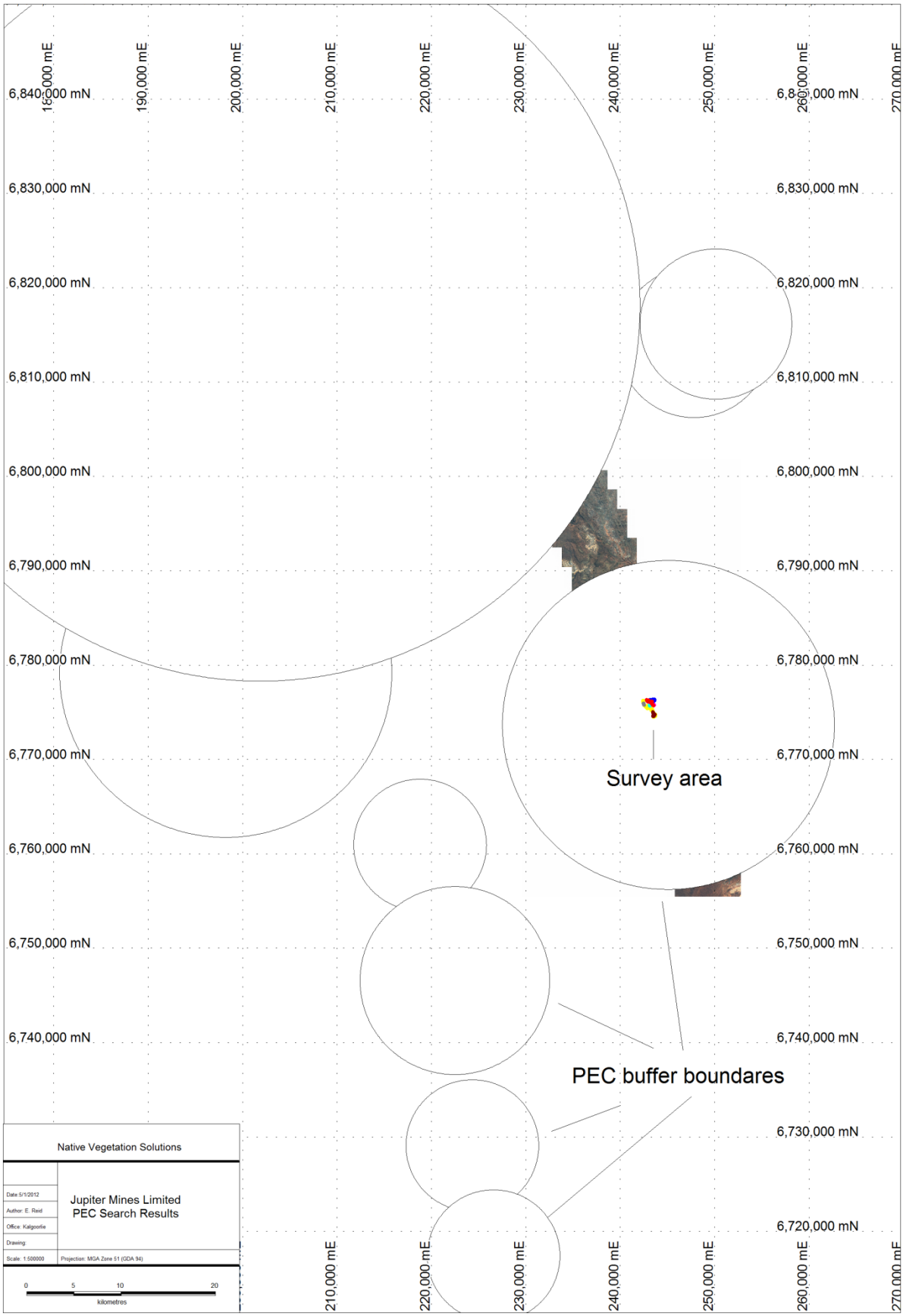
31/10/2011 **DEPARTMENT OF ENVIRONMENT AND CONSERVATION** Page 1
DECLARED RARE AND PRIORITY FLORA LIST
16 September 2010

SPECIES / TAXON	CONS CODE	DEC REGION	DISTRIBUTION	FLOWER PERIOD
Calotis sp. Perrinvale Station (R.J. Cranfield 7906)	3	MW,GLD	Cue, Blue Hills, Perrinvale Stn	
Calytrix praecipua	3	GLD,P	Melita Station, Laverton, Youno Downs, Wanjarri, Marymia, Erong Hmstd, Niagara Dam	Jun-Nov
Cratystylis centralis	3	GLD	Barwidgee Stn, Leonora	Aug-Nov
Eremophila annosocaulis	3	GLD	Mt Morgans Mine (South of Leonora-Laverton Rd), Von Treuer Tableland	
Eremophila mirabilis	2	GLD,MW	Niagara, Morapoi, Kookynie, Woolgorong, Menzies	Aug-Sep
Eremophila simulans subsp. megacalyx	3	MW,GLD	Mt Narryer, Boolardy Stn, Leonora	Aug-Sep
Eucalyptus jutsonii subsp. jutsonii	4	GLD	Comet Vale, Binti Binti Rocks, Menzies, Jeedamya Stn	Nov
Gunniopsis propinqua	3	GLD	Laverton, Mt Margaret, Lake Carnegie, Windidda, Mt Eureka, Mt James, Menzies	Aug-Sep
Hemigenia exilis	4	GLD	Lake Darlot, Yakabindie, Leinster, Leonora, Mt Keith	Apr,May, Aug
Hyalosperma stoveae	2	GLD,MW,*	Perrinvale Station, Burnabinmah	-
Hybanthus floribundus subsp. chloroxanthus	3	GLD	Leonora, Laverton	Aug-Oct
Malleostemon sp. Adelong (GJ Keighery 11825)	2	GLD	Adelong Stn, Mt Manning, Johnston Range	Oct
Micromyrtus serrulata	3	GLD	Karonie, Coonana, Melita, Jeedamya, Niagara Dam NR, Cardunia Rocks, Queen Victoria Spring NR	Mar,Jun,Nov
Newcastelia insignis	2	GLD,SC	Adelong Stn, Comet Vale, Queen Victoria Spring, Norseman	Sep-Nov
Persoonia leucopogon	1	GLD	Between Coolgardie & Laverton, Comet Vale (Menzies)	-
Philotheca coateana	3	GLD,MW	Menzies, Gidgee, Cashmere Downs, Walling Rock	Aug-Oct
Philotheca deserti subsp. brevifolia	1	GLD	Menzies	
Sauropus ramosissimus	3	GLD	Carnegie Stn, Laverton, Warburton, Leonora	
Spartothamnella sp. Helena & Aurora Range (PG Armstrong 155-109)	3	GLD,MW,WB	Helena & Aurora Range, Blue Hill Range, Remlap, Koolyanobbing, Mt Jackson Range, Windarling Hill, Die Hardy Range, Johnston Range, Perrinvale Stn., Yendilberin Hills, Mt Finnerty	
Thryptomene eremaea	2	GLD	Menzies, Queen Victoria Spring, Comet Vale, Edjudina Station, Kirgella Rocks	Jul-Sep

Additional species provided in the GIS results are listed below:

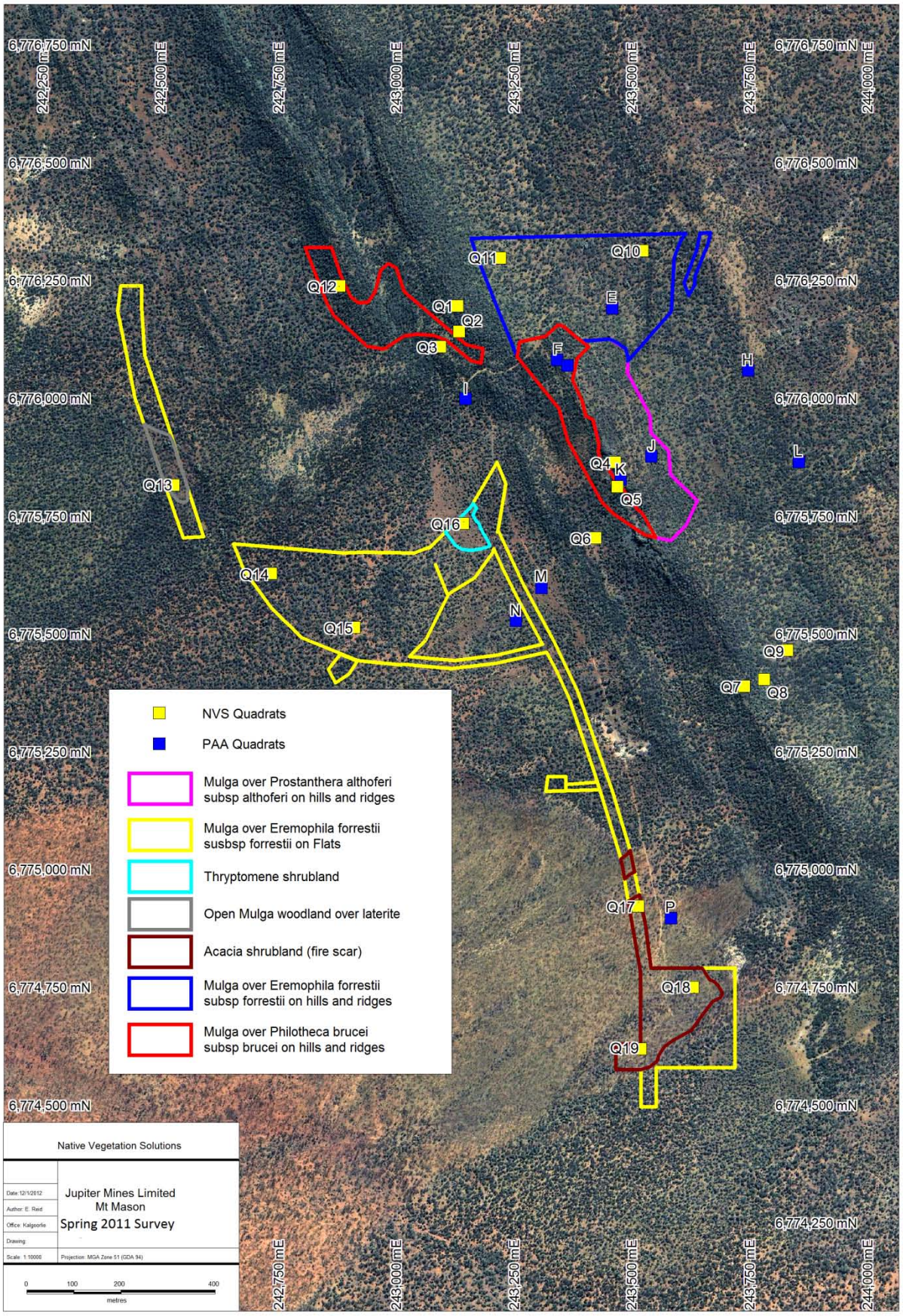
- *Banksia arborea* (P4);
- *Gnephosis intonsa* (P1);
- *Grevillea secunda* (P4);
- *Grevillea subterlineata* (P3);
- *Jacksonia lanicarpa* (P1); and
- *Ricinocarpos brevis* (T).

Appendix E - DEC TEC and PEC Search Results



DEC Search Results revealing only PEC locations (Reference: 53-1011EC)

Appendix F - Map of Vegetation Groups and Quadrat Locations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Q1
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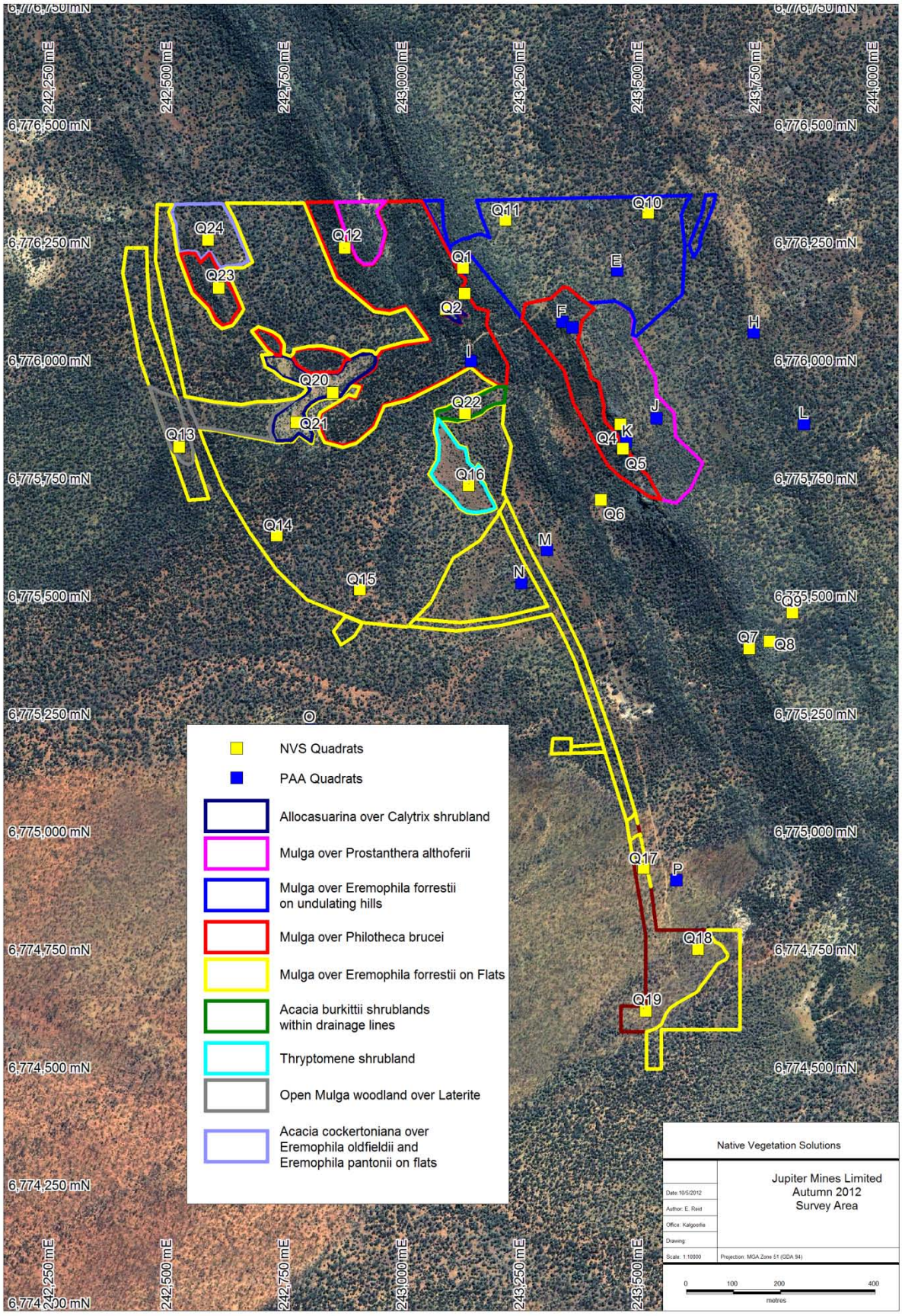
P
NVS Quadrats
PAA Quadrats
Mulga over Prostanthera althoferi subsp althoferi on hills and ridges
Mulga over Eremophila forrestii susbsp forrestii on Flats
Thryptomene shrubland
Open Mulga woodland over laterite
Acacia shrubland (fire scar)
Mulga over Eremophila forrestii subsp forrestii on hills and ridges
Mulga over Philotheca brucei subsp brucei on hills and ridges
Native Vegetation Solutions
Jupiter Mines Limited
Mt Mason
Spring 2011 Survey
Date: 12/1/2012
Author: E. Reid
Office: Kalgoorlie
Drawing:
Scale: 1:10000
Projection: MGA Zone 51 (GDA 94)
0
100
200
400
metres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6,774,750 mN
6,774,500 mN
6,774,250 mN
6,774,000 mN
Q1
Q2
Q4
Q5
Q6
Q7
Q8
Q9
Q10
Q11
Q12
Q13
Q14
Q15
Q16
Q17
Q18
Q19
Q20
Q21
Q22
Q23
Q24
E
F
H
I
J
K
L
M
N
O
P
NVS Quadrats
PAA Quadrats
Allocasuarina over Calytrix shrubland
Mulga over Prostanthera althoferii
Mulga over Eremophila forrestii on undulating hills
Mulga over Philotheca brucei
Mulga over Eremophila forrestii on Flats
Acacia burkittii shrublands within drainage lines
Thryptomene shrubland
Open Mulga woodland over Laterite
Acacia cockertoniana over Eremophila oldfieldii and Eremophila pantonii on flats
Native Vegetation Solutions
Jupiter Mines Limited
Autumn 2012
Survey Area
Date: 10/5/2012
Author: E. Reid
Office: Kalgoorlie
Drawing:
Scale: 1:10000
Projection: MGA Zone 51 (GDA 94)
0
100
200
400
metres

Appendix G - Species Recorded During the Stage 1 and Stage 2 Surveys

Species List per Quadrat

Family	Genus	Species	Code	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22	Q23	Q24
Amaranthaceae	*Ptilotus*	*obovatus*					*	*	*						*		*	*	*						*	*	*
Apiaceae	*Daucus*	*glochidiatus*							*																		
Apocynaceae	*Apocynaceae*	*sp (sterile)*			*																						
Apocynaceae	*Marsdenia*	*australis*					*	*	*	*	*				*		*		*				*		*	*	*
Araliaceae	*Trachymene*	*ornata*		*	*	*	*	*	*	*	*	*	*	*	*		*	*	*							*	
Asparagaceae	*Thysanotus*	*manglesianus*								*	*																
Asteraceae	*Brachyscome*	*ciliocarpa*															*	*									
Asteraceae	*Calocephalus*	*multiflorus*				*																					
Asteraceae	*Calotis*	*hispidula*							*																		
Asteraceae	*Calotis*	*sp. Perrinvale Station*	*(P3)*					*																			
Asteraceae	*Gilberta*	*tenuifolia*										*	*					*									
Asteraceae	*Lawrencella*	*rosea*		*	*	*					*	*	*		*												
Asteraceae	*Myriocephalus*	*guerinae*		*				*	*			*	*			*			*			*					
Asteraceae	*Olearia*	*humilis*		*	*	*		*		*	*	*	*	*	*	*				*	*	*					
Asteraceae	*Podolepis*	*canescens*															*										
Asteraceae	*Podolepis*	*lessonii*			*																						
Asteraceae	*Rhodanthe*	*battii*					*	*											*								
Asteraceae	*Waitzia*	*acuminata*		*	*	*		*	*	*	*	*	*	*	*	*	*	*		*	*	*					
Brassicaceae	*Stenopetalum*	*anfractum*													*		*	*	*								
Campanulaceae	*Isotoma*	*hypocrateriformis*														*	*		*								
Campanulaceae	*Isotoma*	*petraea*					*																				
Campanulaceae	*Lobelia*	*winfridae*				*																					
Campanulaceae	*Wahlenbergia*	*tumidifructa*					*																				
Casuarinaceae	*Allocasuarina*	*acutivalvis subsp acutivalvis*				*																	*	*			
Celastraceae	*Stackhousia*	*muricata*																	*								
Chenopodiaceae	*Dysphania*	*saxatilis*					*																				
Chenopodiaceae	*Gunniopsis*	*septifraga*					*	*																			
Chenopodiaceae	*Rhagodia*	*eremaea*						*																			
Crassulaceae	*Crassula*	*colorata var acuminata*		*		*	*	*																			
Dilleniaceae	*Hibbertia*	*arcuata*								*		*		*		*					*		*			*	
Dilleniaceae	*Hibbertia*	*exasperata*			*											*					*						
Fabaceae	*Acacia*	*aneura var aneura*																				*					
Fabaceae	*Acacia*	*balsamea*			*	*		*							*	*	*			*							
Fabaceae	*Acacia*	*burkittii*																							*		
Fabaceae	*Acacia*	*caesaneura*								*																	
Fabaceae	*Acacia*	*caesaneura x incurvaneura*													*					*							
Fabaceae	*Acacia*	*cockertoniana*																								*	*
Fabaceae	*Acacia*	*craspedocarpa*											*							*							
Fabaceae	*Acacia*	*effusifolia*														*	*			*	*	*	*	*			
Fabaceae	*Acacia*	*incurvaneura*		*	*	*		*	*	*	*	*	*	*	*	*	*	*						*		*	
Fabaceae	*Acacia*	*mulganeura*		*									*				*	*		*	*					*	
Fabaceae	*Acacia*	*quadrimarginea*		*	*	*	*		*	*									*					*	*		
Fabaceae	*Acacia*	*ramulosa var ramulosa*							*						*		*	*		*		*			*		*
Fabaceae	*Acacia*	*tetragonophylla*							*						*		*								*		
Fabaceae	*Senna*	*artemisioides subsp artemisioides*																							*		
Fabaceae	*Senna*	*artemisioides subsp filifolia*																								*	*
Fabaceae	*Senna*	*cardiosperma*																	*								

Family	Genus	Species	Code	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22	Q23	Q24
Geraniaceae	*Erodium*	*crinitum*				*																					
Geraniaceae	*Erodium*	*cygnorum*			*		*	*	*						*												
Goodeniaceae	*Brunonia*	*australis*														*	*					*					
Goodeniaceae	*Goodenia*	*macroplectra*		*						*	*	*	*	*	*	*				*					*		
Goodeniaceae	*Goodenia*	*mimuloides*							*		*						*	*	*						*	*	
Goodeniaceae	*Goodenia*	*occidentalis*			*	*			*		*			*	*	*	*		*	*						*	*
Goodeniaceae	*Scaevola*	*spinescens*															*	*							*	*	*
Goodeniaceae	*Velleia*	*hispida*							*																		
Goodeniaceae	*Velleia*	*rosea*																*	*								
Haloragaceae	*Haloragis*	*trigonocarpa*																	*								
Lamiaceae	*Hemigenia*	*sp. Yalgoo*		*																	*						
Lamiaceae	*Prostanthera*	*althoferi subsp althoferi*		*		*				*	*	*	*	*	*	*	*	*		*	*	*			*	*	
Malvaceae	*Brachychiton*	*gregorii*															*										
Malvaceae	*Corchorus*	*sp*																							*		
Malvaceae	*Sida*	*calyxhymenia*																*									
Malvaceae	*Sida*	*sp. dark green fruits*													*												
Malvaceae	*Sida*	*sp. Golden calyces glabrous*		*			*			*	*	*	*	*		*	*	*	*	*	*	*					
Myrtaceae	*Calytrix*	*erosipetala*				*																	*	*		*	
Myrtaceae	*Eucalyptus*	*leptopoda subsp arctata*																*									
Myrtaceae	*Eucalyptus*	*oleosa*													*												
Myrtaceae	*Eucalyptus*	*sp.(sterile)*																				*					
Myrtaceae	*Thryptomene*	*costata*																	*								
Myrtaceae	*Thryptomene*	*decussata*			*	*	*	*							*											*	
Poaceae	*Austrostipa*	*elegantissima*						*	*						*												
Poaceae	*Austrostipa*	*variabilis*				*									*		*	*							*	*	*
Poaceae	*Eragrostis*	*eriopoda*															*										
Poaceae	*Eriachne*	*pulchella subsp pulchella*																	*				*	*			*
Poaceae	*Monachather*	*paradoxus*								*	*	*	*		*	*	*	*	*							*	
Poaceae	*Thyridolepis*	*multiculmis*					*		*			*		*			*	*								*	
Portulacaceae	*Calandrinia*	*eremaea*					*	*	*						*			*	*							*	*
Proteaceae	*Grevillea*	*berryana*																						*			
Pteridaceae	*Cheilanthes*	*sieberi subsp sieberi*		*	*	*	*	*	*	*		*		*	*		*	*	*	*				*	*	*	*
Rubiaceae	*Psydrax*	*attenuata*																*									
Rubiaceae	*Psydrax*	*suaveolens*			*					*																	
Rutaceae	*Philotheca*	*brucei subsp brucei*		*	*	*	*	*	*	*		*	*		*		*						*	*		*	
Sapindaceae	*Dodonaea*	*amblyophylla*					*																				
Sapindaceae	*Dodonaea*	*lobulata*																							*		
Sapindaceae	*Dodonaea*	*petiolaris*						*																			
Sapindaceae	*Dodonaea*	*rigida*						*							*	*									*		
Sapindaceae	*Dodonaea*	*viscosa subsp spatulata*							*	*													*			*	
Scrophulariaceae	*Eremophila*	*forrestii subsp forrestii*		*					*		*	*	*	*		*	*	*	*		*						
Scrophulariaceae	*Eremophila*	*georgei*		*	*	*		*		*			*		*		*	*	*							*	
Scrophulariaceae	*Eremophila*	*latrobei subsp filiformis*										*			*	*	*		*				*	*	*	*	
Scrophulariaceae	*Eremophila*	*latrobei subsp latrobei*		*	*	*				*	*	*	*		*		*										
Scrophulariaceae	*Eremophila*	*oldfieldii subsp angustifolia*							*																*	*	*
Scrophulariaceae	*Eremophila*	*pantonii*																									*
Solanaceae	*Nicotiana*	*rosulata*					*																				
Solanaceae	*Solanum*	*lasiophyllum*		*		*		*			*	*				*			*	*		*		*			
Stylidiaceae	*Stylidium*	*longibracteatum*																					*	*			

Species List per Vegetation Group

Family	Genus	Species	Code	Mulga over Prostanthera althoferi subsp althoferi on hills and ridges	Mulga over Eremophila forrestii subsp forrestii on Flats	Thryptomene Shrubland	Open Mulga Woodland over Laterite	Acacia shrubland (fire scar)	Mulga over Eremophila forrestii subsp forrestii on hills and ridges	Mulga over Philotheca brucei subsp brucei on hills and ridges	Allocasuarina acutivalvis over Calytrix erosipetala	Acacia burkittii shrubland	Acacia cockertoniana over Eremophila oldfieldii over Eremophila pantonii
Amaranthaceae	*Ptilotus*	*obovatus*		*	*	*				*		*	*
Apiaceae	*Daucus*	*glochidiatus*								*			
Apocynaceae	*Apocynaceae*	*sp (sterile)*								*			
Apocynaceae	*Marsdenia*	*australis*		*	*	*			*	*	*	*	*
Araliaceae	*Trachymene*	*ornata*		*	*	*			*	*			
Asparagaceae	*Thysanotus*	*manglesianus*		*					*				
Asteraceae	*Brachyscome*	*ciliocarpa*			*								
Asteraceae	*Calocephalus*	*multiflorus*								*			
Asteraceae	*Calotis*	*hispidula*								*			
Asteraceae	*Calotis*	*sp. Perrinvale Station*	*(P3)*							*			
Asteraceae	*Gilberta*	*tenuifolia*			*				*				
Asteraceae	*Lawrencella*	*rosea*							*	*			
Asteraceae	*Myriocephalus*	*guerinae*				*	*	*	*	*			
Asteraceae	*Olearia*	*humilis*		*			*	*	*	*			
Asteraceae	*Podolepis*	*canescens*			*								
Asteraceae	*Podolepis*	*lessonii*								*			
Asteraceae	*Rhodanthe*	*battii*		*		*				*			
Asteraceae	*Waitzia*	*acuminata*		*	*		*	*	*	*			
Brassicaceae	*Stenopetalum*	*anfractum*			*	*				*			
Campanulaceae	*Isotoma*	*hypocrateriformis*			*	*	*						
Campanulaceae	*Isotoma*	*petraea*		*									
Campanulaceae	*Lobelia*	*winfridae*								*			
Campanulaceae	*Wahlenbergia*	*tumidifructa*		*									
Casuarinaceae	*Allocasuarina*	*acutivalvis subsp acutivalvis*									*		
Casuarinaceae	*Casuarina*	*pauper*											*
Celastraceae	*Stackhousia*	*muricata*				*							
Chenopodiaceae	*Dysphania*	*saxatilis*		*									
Chenopodiaceae	*Gunniopsis*	*septifraga*		*						*			
Chenopodiaceae	*Rhagodia*	*eremaea*								*			
Crassulaceae	*Crassula*	*colorata var acuminata*		*					*	*			
Dilleniaceae	*Hibbertia*	*arcuata*		*			*	*	*	*	*		
Dilleniaceae	*Hibbertia*	*exasperata*						*	*	*			
Fabaceae	*Acacia*	*aneura var aneura*						*					
Fabaceae	*Acacia*	*balsamea*			*			*	*	*			
Fabaceae	*Acacia*	*burkittii*										*	
Fabaceae	*Acacia*	*caesaneura*		*									
Fabaceae	*Acacia*	*caesaneura x incurvaneura*						*		*			
Fabaceae	*Acacia*	*cockertoniana*								*			*
Fabaceae	*Acacia*	*craspedocarpa*						*	*				
Fabaceae	*Acacia*	*effusifolia*			*		*	*			*		
Fabaceae	*Acacia*	*incurvaneura*		*	*		*		*	*	*		
Fabaceae	*Acacia*	*mulganeura*			*			*	*	*			
Fabaceae	*Acacia*	*quadrimarginea*		*		*			*	*	*	*	
Fabaceae	*Acacia*	*ramulosa var ramulosa*			*			*		*		*	*
Fabaceae	*Acacia*	*tetragonophylla*			*					*		*	
Fabaceae	*Senna*	*artemisioides subsp artemisioides*								*		*	
Fabaceae	*Senna*	*artemisioides subsp filifolia*								*			*
Fabaceae	*Senna*	*cardiosperma*				*							

Family	Genus	Species	Code	Mulga over Prostanthera althoferi subsp althoferi on hills and ridges	Mulga over Eremophila forrestii subsp forrestii on Flats	Thryptomene Shrubland	Open Mulga Woodland over Laterite	Acacia shrubland (fire scar)	Mulga over Eremophila forrestii subsp forrestii on hills and ridges	Mulga over Philotheca brucei subsp brucei on hills and ridges	Allocasuarina acutivalvis over Calytrix erosipetala	Acacia burkittii shrubland	Acacia cockertoniana over Eremophila oldfieldii over Eremophila pantonii
Geraniaceae	*Erodium*	*crinitum*								*			
Geraniaceae	*Erodium*	*cygnorum*		*						*			
Goodeniaceae	*Brunonia*	*australis*			*		*	*					
Goodeniaceae	*Goodenia*	*macroplectra*		*			*	*	*	*		*	
Goodeniaceae	*Goodenia*	*mimuloides*			*	*			*	*		*	
Goodeniaceae	*Goodenia*	*occidentalis*			*	*	*	*	*	*			*
Goodeniaceae	*Scaevola*	*spinescens*			*					*		*	*
Goodeniaceae	*Velleia*	*hispida*								*			
Goodeniaceae	*Velleia*	*rosea*			*	*							
Haloragaceae	*Haloragis*	*trigonocarpa*				*							
Lamiaceae	*Hemigenia*	*sp. Yalgoo*						*	*				
Lamiaceae	*Prostanthera*	*althoferi subsp althoferi*		*	*		*	*	*	*		*	
Malvaceae	*Brachychiton*	*gregorii*			*								
Malvaceae	*Corchorus*	*sp*								*		*	
Malvaceae	*Sida*	*calyxhymenia*			*								
Malvaceae	*Sida*	*sp. dark green fruits*								*			
Malvaceae	*Sida*	*sp. Golden calyces glabrous*		*	*	*	*	*	*				
Myrtaceae	*Calytrix*	*erosipetala*								*	*		
Myrtaceae	*Eucalyptus*	*leptopoda subsp arctata*			*			*	*	*			
Myrtaceae	*Eucalyptus*	*oleosa*								*			
Myrtaceae	*Eucalyptus*	*sp.(sterile)*						*					
Myrtaceae	*Thryptomene*	*costata*				*							
Myrtaceae	*Thryptomene*	*decussata*		*						*			
Poaceae	*Austrostipa*	*elegantissima*								*			
Poaceae	*Austrostipa*	*variabilis*			*					*		*	*
Poaceae	*Eragrostis*	*eriopoda*			*								
Poaceae	*Eriachne*	*pulchella subsp pulchella*				*					*		*
Poaceae	*Monachather*	*paradoxus*		*	*	*	*		*	*			
Poaceae	*Thyridolepis*	*multiculmis*		*	*				*	*		*	
Portulacaceae	*Calandrinia*	*eremaea*		*	*	*				*			*
Proteaceae	*Grevillea*	*berryana*									*		
Pteridaceae	*Cheilanthes*	*sieberi subsp sieberi*		*	*	*		*	*	*	*	*	*
Rubiaceae	*Psydrax*	*attenuata*			*								
Rubiaceae	*Psydrax*	*suaveolens*		*						*			
Rutaceae	*Philotheca*	*brucei subsp brucei*		*	*				*	*	*		
Sapindaceae	*Dodonaea*	*amblyophylla*		*									
Sapindaceae	*Dodonaea*	*lobulata*										*	
Sapindaceae	*Dodonaea*	*petiolaris*								*			
Sapindaceae	*Dodonaea*	*rigida*					*			*		*	
Sapindaceae	*Dodonaea*	*viscosa subsp spatulata*		*						*	*	*	
Scrophulariaceae	*Eremophila*	*forrestii subsp forrestii*			*	*	*	*	*	*			
Scrophulariaceae	*Eremophila*	*georgei*		*	*	*			*	*			
Scrophulariaceae	*Eremophila*	*latrobei subsp filiformis*			*	*	*		*	*	*	*	
Scrophulariaceae	*Eremophila*	*latrobei subsp latrobei*		*	*				*	*			
Scrophulariaceae	*Eremophila*	*oldfieldii subsp angustifolia*								*		*	*
Scrophulariaceae	*Eremophila*	*pantonii*											*
Solanaceae	*Nicotiana*	*rosulata*		*									
Solanaceae	*Solanum*	*lasiophyllum*				*	*	*	*	*	*		
Stylidiaceae	*Stylidium*	*longibracteatum*									*		

Appendix H - Locations of Priority Flora and Flora of Environmental Significance

Priority Flora and Flora of Significance recorded during Stage 1 and Stage 2 surveys. Locations in UTM using datum GDA '94 in cell 51J

Priority Flora

***Calotis sp* Perrinvale Range P3**

Overall population estimated at 10 to 15 plants

mE	mN
243455	6775824

Flora of Significance

Drosera sp.

Overall population estimated at 250 to 350 plants (yet to be confirmed)

mE	mN
243308	6776088
243325	6776135
243316	6776103
243315	6776101
243315	6776107
243314	6776107
243317	6776096
243320	6776096
243316	6776097
243317	6776096
243295	6775610
243313	6775599
243321	6775577

Appendix I - Site Descriptions

Date: 4/10/2011 & 12/03/2012	**Botanist:** ER & AS & AO	
Location: Mount Mason	**Quadrat:** 1	
Quadrat size: 20x20		
WP: 1	**Vegetation group:**	
Photo number: 1 & 2		
Landform: C, T, HCR		
Land surface/disturbance: 0		
Coarse fragments on the surface (abundance/size/shape):		6, 6, S
Rock outcrop (abundance/runoff):		5, 3
Soil (profile/field texture/soil surface):		U, CL, C
%Cover leaf litter:		20
%Cover bare ground:		45

Tallest stratum	Mid-stratum	Lower stratum
Growth form: Shrub Mallee	**Growth form:** Shrub	**Growth form:** Shrub
Height: 3-6m	**Height:** 1-3m	**Height:** 0.5-1m
Crown cover %: 10-30	**Crown cover %:** 10-30	**Crown cover %:** 30-70
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Acacia incurvaneura	*Acacia quadrimarginea*	*Prostanthera althoferi subsp althoferi*
Acacia mulganeura	*Acacia mulganeura*	*Eremophila latrobei subsp latrobei*
Acacia quadrimarginea		*Philotheca brucei subsp brucei*

ALL SPECIES
Acacia incurvaneura
Acacia mulganeura
Acacia quadrimarginea
Cheilanthes sieberi subsp sieberi
Crassula colorata var *acuminata*
Eremophila forrestii subsp forrestii
Eremophila georgei
Eremophila latrobei subsp latrobei
Goodenia macroplectra
Hemigenia sp. *Yalgoo*
Lawrencella rosea
Myriocephalus guerinae
Olearia humilis
Philotheca brucei subsp brucei
Prostanthera althoferi subsp althoferi
Sida sp. Golden calyces glabrous
Solanum lasiophyllum
Trachymene ornata
Waitzia acuminata

Vegetation Description

Acacia incurvaneura woodland over Eremophila forrestii subsp forrestii shrubland over scattered mixed low shrubs and herbs on undulating hills and ridges.

Date: 4/10/2011 & 12/03/2012	**Botanist:** ER & AS & AO	
Location: Mount Mason	**Quadrat:** 2	
Quadrat size: 20x20		
WP: 2	**Vegetation group:**	
Photo number: 3		
Landform: M, M BAN		
Land surface/disturbance: 0		
Coarse fragments on the surface (abundance/size/shape):		5, 5, S
Rock outcrop (abundance/runoff):		4, 4
Soil (profile/field texture/soil surface):		U, CL
%Cover leaf litter:		45
%Cover bare ground:		60

Tallest stratum	Mid-stratum	Lower stratum
Growth form: Shrub Mallee	**Growth form:**	**Growth form:**
Height: 3-6	**Height:**	**Height:**
Crown cover %: 10-30	**Crown cover %:**	**Crown cover %:**
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Acacia incurvaneura	Thryptomene decussata	*Eremophila latrobei subsp latrobei*
Acacia quadrimarginea	*Philotheca brucei subsp brucei*	*Hibbertia exasperata*
	Acacia balsamea	

ALL SPECIES
Acacia incurvaneura
Acacia balsamea
Acacia quadrimarginea
Apocynaceae sp (sterile)
Cheilanthes sieberi subsp sieberi
Eremophila georgei
Eremophila latrobei subsp latrobei
Erodium cygnorum
Goodenia occidentalis
Hibbertia exasperata
Lawrencella rosea
Olearia humilis
Philotheca brucei subsp brucei
Podolepis lessonii
Psydrax suaveolens
Thryptomene decussata
Trachymene ornata
Waitzia acuminata

Vegetation Description

Acacia incurvaneura with Acacia quadrimarginea tall shrubland/ low woodland over Philotheca brucei subsp brucei with Acacia balsamea shrubland over Eremophila latrobei subsp latrobei and Hibbertia exasperata over mixed herbs and shrubs on hills and ridges.

Date: 4/10/2011 & 12/03/2012	**Botanist:** ER & AS & AO	
Location: Mount Mason	**Quadrat:** 3	
Quadrat size: 20x20		
WP: 3	**Vegetation group:**	
Photo number: 4		
Landform: L, B, BAN		
Land surface/disturbance: 0		
Coarse fragments on the surface (abundance/size/shape):		6, 4, S
Rock outcrop (abundance/runoff):		4, 4
Soil (profile/field texture/soil surface):		U, SCL, H,C
%Cover leaf litter:		45
%Cover bare ground:		40

Tallest stratum	**Mid-stratum**	**Lower stratum**
Growth form: Shrub Mallee	**Growth form:** Shrub	**Growth form:** Shrub
Height: 3-6m	**Height:** 1-3	**Height:** 0.25-0.5m
Crown cover %: 10-30	**Crown cover %:** 10-30	**Crown cover %:** <10
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Allocasuarina acutivalvis subsp acutivalvis	*Acacia balsamea*	*Calytrix erosipetala*
Acacia incurvaneura	*Philotheca brucei subsp brucei*	
Acacia quadrimarginea		

ALL SPECIES
Acacia balsamea
Acacia incurvaneura
Acacia quadrimarginea
Allocasuarina acutivalvis subsp acutivalvis
Austrostipa variabilis
Calocephalus multiflorus
Calytrix erosipetala
Cheilanthes sieberi subsp sieberi
Crassula colorata var acuminata
Eremophila georgei
Eremophila latrobei subsp latrobei
Erodium crinitum
Goodenia occidentalis
Lawrencella rosea
Lobelia winfridae
Olearia humilis
Philotheca brucei subsp brucei
Prostanthera althoferi subsp althoferi
Solanum lasiophyllum
Thryptomene decussata
Trachymene ornata
Waitzia acuminata

Vegetation Description

Allocasuarina acutivalvis subsp acutivalvis and Acacia incurvaneura low woodland/tall shrubland over Acacia balsamea and Philotheca brucei subsp brucei open shrubland over scattered mixed shrubs and herbs in minor drainage lines

Date: 4/10/2011 & 12/03/2012	**Botanist:** ER & AS & AO	
Location: Mount Mason	**Quadrat:** 4	
Quadrat size: 20x20		
WP: 4	**Vegetation group:**	
Photo number: 5-6		
Landform: C, T, HCR		
Land surface/disturbance: 0		
Coarse fragments on the surface (abundance/size/shape):		6, 4, S
Rock outcrop (abundance/runoff):		5, 5
Soil (profile/field texture/soil surface):		U, CL, C
%Cover leaf litter:		40
%Cover bare ground:		65
Tallest stratum	**Mid-stratum**	**Lower stratum**
Growth form: Shrub	**Growth form: Shrub**	**Growth form: Shrub**
Height: 1-3m	**Height: 0.5-1m**	**Height: 0.25-0.5m**
Crown cover %: <10	**Crown cover %: <10**	**Crown cover %: <10**
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Thryptomene decussata	*Dodonaea amblyophylla*	*Ptilotus obovatus*
	Philotheca brucei subsp brucei	*Thryptomene decussata*
ALL SPECIES		
Acacia quadrimarginea		
Calandrinia eremaea		
Cheilanthes sieberi subsp sieberi		
Crassula colorata var acuminata		
Dodonaea amblyophylla		
Dysphania saxatilis		
Erodium cygnorum		
Gunniopsis septifraga		
Isotoma petraea		
Marsdenia australis		
Nicotiana rosulata		
Philotheca brucei subsp brucei		
Ptilotus obovatus		
Rhodanthe battii		
Sida sp. Golden calyces glabrous		
Thryptomene decussata		
Thyridolepis multiculmis		
Trachymene ornata		
Wahlenbergia tumidifructa		

Vegetation Description

Acacia incurvaneura shrubland to tall open scrub over Prostanthera althoferi subsp althoferi shrubland over scattered mixed shrubs and herbs on hills and ridges.

Date: 4/10/2011 & 12/03/2012	**Botanist:** ER & AS & AO	
Location: Mount Mason	**Quadrat:** 5	
Quadrat size: 20x20		
WP: 5	**Vegetation group:**	
Photo number: 7		
Landform: M, M, BAN		
Land surface/disturbance: 0		
Coarse fragments on the surface (abundance/size/shape):		4, 4, A
Rock outcrop (abundance/runoff):		4, 5
Soil (profile/field texture/soil surface):		U, CL, H
%Cover leaf litter:		55
%Cover bare ground:		40

Tallest stratum	Mid-stratum	Lower stratum
Growth form: Shrub Mallee	**Growth form: Shrub**	**Growth form: Shrub**
Height: 6-12m	**Height: 1-3m**	**Height: 0.25-0.5m**
Crown cover %: 10-30	**Crown cover %: 10-30**	**Crown cover %: 10-30**
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Acacia incurvaneura	*Thryptomene decussata*	*Ptilotus obovatus*
	Philotheca brucei subsp brucei	*Dodonaea petiolaris*
	Dodonaea petiolaris	

ALL SPECIES
Acacia balsamea
Acacia incurvaneura
Austrostipa elegantissima
Calandrinia eremaea
Calotis sp. Perrinvale Station (P3)
Cheilanthes sieberi subsp sieberi
Crassula colorata var acuminata
Dodonaea petiolaris
Dodonaea rigida
Eremophila georgei
Erodium cygnorum
Gunniopsis septifraga
Marsdenia australis
Myriocephalus guerinae
Olearia humilis
Philotheca brucei subsp brucei
Ptilotus obovatus
Rhagodia eremaea
Rhodanthe battii
Solanum lasiophyllum
Thryptomene decussata
Trachymene ornata
Waitzia acuminata

Vegetation Description

Acacia incurvaneura with Acacia quadrimarginea tall shrubland/ low woodland over Philotheca brucei subsp brucei with Acacia balsamea shrubland over Eremophila latrobei subsp latrobei and Hibbertia exasperata over mixed herbs and shrubs on hills and ridges.

Date: 4/10/2011 & 12/03/2012	**Botanist:** ER & AS & AO	
Location: Mount Mason	**Quadrat:** 6	
Quadrat size: 20x20		
WP: 6	**Vegetation group:**	
Photo number: 8		
Landform: L, B, BAN		
Land surface/disturbance: 0		
Coarse fragments on the surface (abundance/size/shape):		6, 3, A
Rock outcrop (abundance/runoff):		1, 4
Soil (profile/field texture/soil surface):		U, CL, H
%Cover leaf litter:		55
%Cover bare ground:		30
Tallest stratum	**Mid-stratum**	**Lower stratum**
Growth form: Tree Mallee	**Growth form:** Shrub	**Growth form:** Shrub
Height: 6-12m	**Height:** 1-3m	**Height:** 0.5-1m
Crown cover %: 10-30	**Crown cover %:** 30-70	**Crown cover %: 10-30**
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Acacia incurvaneura	*Acacia incurvaneura*	*Eremophila forrestii subsp forrestii*
Acacia quadrimarginea	*Acacia ramulosa var. ramulosa*	*Philotheca brucei subsp brucei*

ALL SPECIES
Acacia incurvaneura
Acacia quadrimarginea
Acacia ramulosa var. ramulosa
Acacia tetragonophylla
Austrostipa elegantissima
Calandrinia eremaea
Calotis hispidula
Cheilanthes sieberi subsp sieberi
Daucus glochidiatus
Dodonaea viscosa subsp spatulata
Eremophila forrestii subsp forrestii
Eremophila oldfieldii subsp angustifolia
Erodium cygnorum
Goodenia mimuloides
Goodenia occidentalis
Marsdenia australis
Myriocephalus guerinae
Philotheca brucei subsp brucei
Ptilotus obovatus
Thyridolepis multiculmis
Trachymene ornata
Velleia hispida
Waitzia acuminata

Vegetation Description

Acacia incurvaneura with Acacia quadrimarginea tall shrubland/ low woodland over Philotheca brucei subsp brucei with Acacia balsamea shrubland over Eremophila latrobei subsp latrobei and Hibbertia exasperata over mixed herbs and shrubs on hills and ridges.

Date: 4/10/2011 & 12/03/2012	**Botanist:** ER & AS & AO	
Location: Mount Mason	**Quadrat:** 7	
Quadrat size: 20x20		
WP: 8	**Vegetation group:**	
Photo number: 11 & 12		
Landform: C, T, HCR		
Land surface/disturbance: 0		
Coarse fragments on the surface (abundance/size/shape):		4, 4, A
Rock outcrop (abundance/runoff):		5, 2
Soil (profile/field texture/soil surface):		U, CL, C
%Cover leaf litter:		70
%Cover bare ground:		55
Tallest stratum	**Mid-stratum**	**Lower stratum**
Growth form: Shrub Mallee	**Growth form:** Shrub	**Growth form:** Shrub
Height: 3-6m	**Height:** 0.5-1m	**Height:** 0.25-0.5m
Crown cover %: 10-30	**Crown cover %:** 10-30	**Crown cover %:** 10-30
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Acacia incurvaneura	*Philotheca brucei subsp brucei*	*Prostanthera althoferi subsp althoferi*
		Olearia humilis
ALL SPECIES		
Acacia caesaneura		
Acacia incurvaneura		
Acacia quadrimarginea		
Cheilanthes sieberi subsp sieberi		
Dodonaea viscosa subsp spatulata		
Eremophila georgei		
Eremophila latrobei subsp latrobei		
Goodenia macroplectra		
Hibbertia arcuata		
Marsdenia australis		
Monachather paradoxus		
Olearia humilis		
Philotheca brucei subsp brucei		
Prostanthera althoferi subsp althoferi		
Psydrax suaveolens		
Sida sp. Golden calyces glabrous		
Thysanotus manglesianus		
Trachymene ornata		
Waitzia acuminata		

Vegetation Description

Acacia incurvaneura shrubland to tall open scrub over Prostanthera althoferi subsp althoferi shrubland over scattered mixed shrubs and herbs on hills and ridges.

Date: 4/10/2011 & 12/03/2012	**Botanist:** ER & AS & AO	
Location: Mount Mason	**Quadrat:** 8	
Quadrat size: 20x20		
WP: 9	**Vegetation group:**	
Photo number: 13		
Landform: M, M, HSL		
Land surface/disturbance: 0		
Coarse fragments on the surface (abundance/size/shape):		5, 3, A
Rock outcrop (abundance/runoff):		0, 2
Soil (profile/field texture/soil surface):		U, CL, C
%Cover leaf litter:		70
%Cover bare ground:		65

Tallest stratum	**Mid-stratum**	**Lower stratum**
Growth form: Shrub Mallee	**Growth form:** Shrub	**Growth form:** Shrub
Height: 6-12	**Height:** 1-3	**Height:** 1-3m
Crown cover %: 10-30	**Crown cover %: 10-30**	**Crown cover %: 10-30**
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Acacia incurvaneura	*Eremophila forrestii subsp forrestii*	*Prostanthera althoferi subsp althoferi*
	Olearia humilis	

ALL SPECIES
Acacia incurvaneura
Eremophila forrestii subsp forrestii
Eremophila latrobei subsp latrobei
Goodenia macroplectra
Goodenia occidentalis
Lawrencella rosea
Marsdenia australis
Monachather paradoxus
Olearia humilis
Prostanthera althoferi subsp althoferi
Sida sp. Golden calyces glabrous
Solanum lasiophyllum
Thysanotus manglesianus
Trachymene ornata
Velleia glabrata
Waitzia acuminata

Vegetation Description

Acacia incurvaneura woodland over Eremophila forrestii subsp forrestii shrubland over scattered mixed low shrubs and herbs on undulating hills and ridges

Date: 4/10/2011 & 12/03/2012	**Botanist:** ER & AS & AO	
Location: Mount Mason	**Quadrat:** 9	
Quadrat size: 20x20		
WP: 10	**Vegetation group:**	
Photo number: 14		
Landform: L, B, HSL		
Land surface/disturbance: 0		
Coarse fragments on the surface (abundance/size/shape):		6, 3, A
Rock outcrop (abundance/runoff):		1, 2
Soil (profile/field texture/soil surface):		U, CL, C
%Cover leaf litter:		80
%Cover bare ground:		65

Tallest stratum	Mid-stratum	Lower stratum
Growth form: Shrub Mallee	**Growth form:** Shrub	**Growth form:** Fern
Height: 6-12m	**Height:** 0.5-1m	**Height:** 0.25-0.5m
Crown cover %: 10-30	**Crown cover %:** 10-30	**Crown cover %:** <1
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Acacia incurvaneura	*Eremophila forrestii subsp forrestii*	*Waitzia acuminata*
	Hibbertia arcuata	*Sida sp. Golden calyces glabrous*
	Prostanthera althoferi subsp althoferi	

ALL SPECIES
Acacia incurvaneura
Cheilanthes sieberi subsp sieberi
Eremophila forrestii subsp forrestii
Eremophila latrobei subsp filiformis
Eremophila latrobei subsp latrobei
Gilberta tenuifolia
Goodenia macroplectra
Hibbertia arcuata
Lawrencella rosea
Monachather paradoxus
Myriocephalus guerinae
Olearia humilis
Philotheca brucei subsp brucei
Prostanthera althoferi subsp althoferi
Sida sp. Golden calyces glabrous
Solanum lasiophyllum
Thyridolepis multiculmis
Trachymene ornata
Waitzia acuminata

Vegetation Description

Acacia incurvaneura woodland over Eremophila forrestii subsp forrestii shrubland over scattered mixed low shrubs and herbs on undulating hills and ridges

Date: 4/10/2011 & 12/03/2012	**Botanist:** ER & AS & AO	
Location: Mount Mason	**Quadrat:** 10	
Quadrat size: 20x20		
WP: 7	**Vegetation group:**	
Photo number: 16		
Landform: S, HSL		
Land surface/disturbance: 0		
Coarse fragments on the surface (abundance/size/shape):		5, 4, S
Rock outcrop (abundance/runoff):		0, 2
Soil (profile/field texture/soil surface):		U, CL
%Cover leaf litter:		50
%Cover bare ground:		40

Tallest stratum	Mid-stratum	Lower stratum
Growth form: Shrub Mallee	**Growth form:** Shrub	**Growth form:** Shrub
Height: 6-12m	**Height:** 1-3m	**Height:** 0.5-1m
Crown cover %: 10-30	**Crown cover %:** 10-30	**Crown cover %:** 10-30
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Acacia incurvaneura	*Eremophila forrestii subsp forrestii*	*Olearia humilis*
Acacia mulganeura		*Philotheca brucei subsp brucei*

ALL SPECIES
Acacia craspedocarpa
Acacia incurvaneura
Acacia mulganeura
Eremophila forrestii subsp forrestii
Eremophila georgei
Eremophila latrobei subsp latrobei
Gilberta tenuifolia
Goodenia macroplectra
Lawrencella rosea
Monachather paradoxus
Myriocephalus guerinae
Olearia humilis
Philotheca brucei subsp brucei
Prostanthera althoferi
Sida sp. Golden calyces glabrous
Trachymene ornata
Waitzia acuminata

Vegetation Description

Acacia incurvaneura woodland over Eremophila forrestii subsp forrestii shrubland over scattered mixed low shrubs and herbs on undulating hills and ridges.

Date: 4/10/2011 & 12/03/2012	**Botanist:** ER & AS & AO	
Location: Mount Mason	**Quadrat:** 11	
Quadrat size: 20x20		
WP: 18	**Vegetation group:**	
Photo number: 17		
Landform: S, HSL		
Land surface/disturbance: 0		
Coarse fragments on the surface (abundance/size/shape):		6, 3, S
Rock outcrop (abundance/runoff):		0, 3
Soil (profile/field texture/soil surface):		U, CL, C
%Cover leaf litter:		40
%Cover bare ground:		80

Tallest stratum	Mid-stratum	Lower stratum
Growth form: Shrub Mallee	**Growth form:** Shrub	**Growth form:** Shrub
Height: 3-6m	**Height:** 0.5-1m	**Height:** 0.25-0.5m
Crown cover %: 10-30	**Crown cover %:** 10-30	**Crown cover %:** <1
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Acacia incurvaneura	*Eremophila forrestii subsp forrestii*	*Olearia humilis*
	Prostanthera althoferi susbsp althoferi	

ALL SPECIES
Acacia incurvaneura
Cheilanthes sieberi subsp sieberi
Eremophila forrestii subsp forrestii
Goodenia macroplectra
Goodenia occidentalis
Hibbertia arcuata
Olearia humilis
Prostanthera althoferi susbsp althoferi
Sida sp. Golden calyces glabrous
Thyridolepis multiculmis
Trachymene ornata
Waitzia acuminata

Vegetation Description

Acacia incurvaneura woodland over Eremophila forrestii subsp forrestii shrubland over scattered mixed low shrubs and herbs on undulating hills and ridges

Date: 4/10/2011 & 12/03/2012	**Botanist:** ER & AS & AO	
Location: Mount Mason	**Quadrat:** 12	
Quadrat size: 20x20		
WP: 20	**Vegetation group:**	
Photo number: 18 & 19		
Landform: M, M, HSL		
Land surface/disturbance: 0		
Coarse fragments on the surface (abundance/size/shape):		5, 4, A
Rock outcrop (abundance/runoff):		4, 3
Soil (profile/field texture/soil surface):		U, CL, C
%Cover leaf litter:		90
%Cover bare ground:		30

Tallest stratum	Mid-stratum	Lower stratum
Growth form: Shrub Mallee	**Growth form:** Shrub	**Growth form:** Shrub
Height: 3-6m	**Height:** 1-3m	**Height:** 0.25-0.5m
Crown cover %: 10-30	**Crown cover %:** 30-70	**Crown cover %:** 10-30
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Acacia incurvaneura	*Acacia balsamea*	*Eremophila latrobei subsp latrobei*
	Philotheca brucei subsp brucei	*Cheilanthes sieberi subsp sieberi*
	Thryptomene decussata	

ALL SPECIES
Acacia balsamea
Acacia caesaneura x incurvaneura
Acacia incurvaneura
Acacia ramulosa var *ramulosa*
Acacia tetragonophylla
Austrostipa elegantissima
Austrostipa variabilis
Calandrinia eremaea
Cheilanthes sieberi subsp sieberi
Dodonaea rigida
Eremophila georgei
Eremophila latrobei subsp filiformis
Eremophila latrobei subsp latrobei
Erodium cygnorum
Eucalyptus oleosa
Goodenia macroplectra
Goodenia occidentalis
Lawrencella rosea
Marsdenia australis
Monachather paradoxus
Olearia humilis
Philotheca brucei subsp brucei
Prostanthera althoferi subsp althoferi
Ptilotus obovatus
Sida sp. dark green fruits
Stenopetalum anfractum
Thryptomene decussata
Trachymene ornata
Waitzia acuminata

Vegetation Description

Acacia incurvaneura with Acacia quadrimarginea tall shrubland/ low woodland over Philotheca brucei subsp brucei with Acacia balsamea shrubland over Eremophila latrobei subsp latrobei and Hibbertia exasperata over mixed herbs and shrubs on hills and ridges.

Date: 4/10/2011 & 12/03/2012	**Botanist:** ER & AS & AO	
Location: Mount Mason	**Quadrat:** 13	
Quadrat size: 20x20		
WP: 23	**Vegetation group:**	
Photo number: 20 & 21		
Landform: C, HCR		
Land surface/disturbance: 0		
Coarse fragments on the surface (abundance/size/shape):		6, 2, R
Rock outcrop (abundance/runoff):		0, 1
Soil (profile/field texture/soil surface):		U, CL, H
%Cover leaf litter:		40
%Cover bare ground:		60

Tallest stratum	Mid-stratum	Lower stratum
Growth form: Shrub Mallee	**Growth form:** Shrub	**Growth form:** Shrub
Height: 3-6m	**Height:** 1-3m	**Height:** 0.5-1m
Crown cover %: 10-30	**Crown cover %:** 10-30	**Crown cover %:** 10-30
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Acacia effusifolia	*Acacia incurvaneura*	*Hibbertia arcuata*
	Eremophila forrestii subsp forrestii	*Prostanthera althoferi subsp althoferi*
	Acacia effusifolia	

ALL SPECIES
Acacia balsamea
Acacia effusifolia
Acacia incurvaneura
Brunonia australis
Dodonaea rigida
Eremophila forrestii subsp forrestii
Eremophila latrobei subsp filiformis
Goodenia macroplectra
Goodenia occidentalis
Hibbertia arcuata
Hibbertia arcuata
Isotoma hypocrateriformis
Monachather paradoxus
Myriocephalus guerinae
Olearia humilis
Prostanthera althoferi subsp althoferi
Sida sp. Golden calyces glabrous
Solanum lasiophyllum
Waitzia acuminata

Vegetation Description

Acacia effusifolia low open forest over Acacia incurvaneura, Eremophila forrestii subsp forrestii over Hibbertia arcuata and Prostanthera althoferi subsp althoferi and scattered mixed shrubs and herbs on Laterite hills.

Date: 4/10/2011 & 12/03/2012	**Botanist:** ER & AS & AO	
Location: Mount Mason	**Quadrat:** 14	
Quadrat size: 20x20		
WP: 25	**Vegetation group:**	
Photo number: 22-23		
Landform: F, PLA		
Land surface/disturbance: 0		
Coarse fragments on the surface (abundance/size/shape):		6, 3, S
Rock outcrop (abundance/runoff):		0, 0
Soil (profile/field texture/soil surface):		U, CL, H & C
%Cover leaf litter:		65
%Cover bare ground:		60

Tallest stratum	Mid-stratum	Lower stratum
Growth form: Shrub Mallee	**Growth form:** Shrub	**Growth form:** Shrub
Height: 3-6m	**Height:** 1-3m	**Height:** 0.25-0.5m
Crown cover %: 10-30	**Crown cover %:** 10-30	**Crown cover %:** <10
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Acacia incurvaneura	*Acacia effusifolia*	*Waitzia acuminata*
Acacia mulganeura	*Scaevola spinescens*	
	Eremophila forrestii subsp forrestii	

ALL SPECIES
Acacia balsamea
Acacia effusifolia
Acacia incurvaneura
Acacia mulganeura
Acacia ramulosa var ramulosa
Acacia tetragonophylla
Austrostipa variabilis
Brachychiton gregorii
Brachyscome ciliocarpa
Brunonia australis
Cheilanthes sieberi subsp sieberi
Eragrostis eriopoda
Eremophila forrestii subsp forrestii
Eremophila georgei
Eremophila latrobei subsp filiformis
Eremophila latrobei subsp latrobei
Goodenia mimuloides
Goodenia occidentalis
Isotoma hypocrateriformis
Marsdenia australis
Monachather paradoxus
Philotheca brucei subsp brucei
Podolepis canescens
Prostanthera althoferi subsp althoferi
Ptilotus obovatus
Scaevola spinescens
Sida sp. Golden calyces glabrous?
Stenopetalum anfractum
Thyridolepis multiculmis
Trachymene ornata
Waitzia acuminata

Vegetation Description

Acacia incurvaneura with Acacia mulganeura tall shrubland over Eremophila forrestii subsp forrestii and Acacia effusifolia low shrubland over Waitzia acuminata and mixed herbs on flat plains

Date: 4/10/2011 & 12/03/2012	**Botanist:** ER & AS & AO	
Location: Mount Mason	**Quadrat:** 15	
Quadrat size: 20x20		
WP: 29	**Vegetation group:**	
Photo number: 24-25		
Landform: S, HSL		
Land surface/disturbance: 0		
Coarse fragments on the surface (abundance/size/shape):		3, 3, A
Rock outcrop (abundance/runoff):		0, 1
Soil (profile/field texture/soil surface):		U, CL, H & C
%Cover leaf litter:		65
%Cover bare ground:		50

Tallest stratum	**Mid-stratum**	**Lower stratum**
Growth form: Tree Mallee	**Growth form:** Shrub	**Growth form:** Shrub
Height: 3-6m	**Height:** 1-3m	**Height:** 0.25-0.5m
Crown cover %: 10-30	**Crown cover %:** 10-30	**Crown cover %:** 10-30
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Eucalyptus leptopoda subsp arctata	*Eremophila forrestii subsp forrestii*	*Waitzia acuminata*
Acacia incurvaneura	*Acacia ramulosa* var *ramulosa*	*Psydrax attenuata*

ALL SPECIES
Acacia incurvaneura
Acacia mulganeura
Acacia ramulosa var *ramulosa*
Austrostipa variabilis
Brachyscome ciliocarpa
Calandrinia eremaea
Cheilanthes sieberi subsp sieberi
Eremophila forrestii subsp forrestii
Eremophila georgei
Eucalyptus leptopoda subsp arctata
Gilberta tenuifolia
Goodenia mimuloides
Monachather paradoxus
Prostanthera althoferi subsp althoferi
Psydrax attenuata
Ptilotus obovatus
Scaevola spinescens
Sida calyxhymenia
Sida sp Golden calyces glabrous
Stenopetalum anfractum
Thyridolepis multiculmis
Trachymene ornata
Velleia rosea
Waitzia acuminata

Vegetation Description

Acacia incurvaneura with Acacia mulganeura tall shrubland over Eremophila forrestii subsp forrestii and Acacia effusifolia low shrubland over Waitzia acuminata and mixed herbs on flat plains

Date: 4/10/2011 & 12/03/2012	**Botanist:** ER & AS & AO	
Location: Mount Mason	**Quadrat:** 16	
Quadrat size: 20x20		
WP: 30	**Vegetation group:**	
Photo number: 26		
Landform: S, HSL		
Land surface/disturbance: 0		
Coarse fragments on the surface (abundance/size/shape):		5, 3, A
Rock outcrop (abundance/runoff):		3, 2
Soil (profile/field texture/soil surface):		U, CL, H&C
%Cover leaf litter:		25
%Cover bare ground:		75

Tallest stratum	**Mid-stratum**	**Lower stratum**
Growth form: Shrub	**Growth form:** Shrub	**Growth form:** Shrub
Height: 3-6m	**Height:** 1-3m	**Height:** 0.25-0.5m
Crown cover %: 10-30	**Crown cover %:** 10-30	**Crown cover %:** 10-30
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Acacia quadrimarginea	*Thryptomene costata*	*Thryptomene costata*

ALL SPECIES
Acacia quadrimarginea
Calandrinia eremaea
Cheilanthes sieberi subsp sieberi
Eremophila forrestii subsp forrestii
Eremophila georgei
Eremophila latrobei subsp filiformis
Eriachne pulchella subsp *pulchella*
Goodenia mimuloides
Goodenia occidentalis
Haloragis trigonocarpa
Isotoma hypocrateriformis
Marsdenia australis
Monachather paradoxus
Myriocephalus guerinae
Ptilotus obovatus
Rhodanthe battii
Senna cardiosperma
Sida sp Golden calyces glabrous
Solanum lasiophyllum
Stackhousia muricata
Stenopetalum anfractum
Thryptomene costata
Trachymene ornata
Velleia rosea

Vegetation Description

Thryptomene costata low open shrubland with emergent Acacia quadrimarginea over scattered mixed shrubs and herbs on low hill slopes.

Date: 4/10/2011 & 12/03/2012	**Botanist:** ER & AS & AO	
Location: Mount Mason	**Quadrat:** 17	
Quadrat size: 20x20		
WP: 32	**Vegetation group:**	
Photo number: 27		
Landform: S, FOO		
Land surface/disturbance: 0		
Coarse fragments on the surface (abundance/size/shape):		5-6, 3, A
Rock outcrop (abundance/runoff):		0, 1
Soil (profile/field texture/soil surface):		U, CL
%Cover leaf litter:		10
%Cover bare ground:		70

Tallest stratum	Mid-stratum	Lower stratum
Growth form:	**Growth form:**	**Growth form:**
Height:	**Height:**	**Height:**
Crown cover %:	**Crown cover %:**	**Crown cover %:**
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
BURNT	*Acacia caesaneura x incurvaneura*	*Olearia humilis*

ALL SPECIES
Acacia balsamea
Acacia caesaneura x incurvaneura
Acacia effusifolia
Acacia mulganeura
Acacia ramulosa var *ramulosa*
Cheilanthes sieberi subsp sieberi
Goodenia macroplectra
Goodenia occidentalis
Olearia humilis
Prostanthera althoferi subsp althoferi
Sida sp. Golden calyces glabrous
Solanum lasiophyllum
Waitzia acuminata
Acacia craspedocarpa

Vegetation Description

Acacia effusifolia low open shrubland over scattered mixed shrubs and herbs on flats

Date: 4/10/2011 & 12/03/2012	**Botanist:** ER & AS & AO	
Location: Mount Mason	**Quadrat:** 18	
Quadrat size: 20x20		
WP: 33	**Vegetation group:**	
Photo number: 28-30		
Landform: S, FOO		
Land surface/disturbance: 0		
Coarse fragments on the surface (abundance/size/shape):		5, 2, A
Rock outcrop (abundance/runoff):		0, 1
Soil (profile/field texture/soil surface):		U, CL, H&C
%Cover leaf litter:		25
%Cover bare ground:		70
Tallest stratum	**Mid-stratum**	**Lower stratum**
Growth form:	**Growth form:**	**Growth form:**
Height:	**Height:**	**Height:**
Crown cover %:	**Crown cover %:**	**Crown cover %:**
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
BURNT	*Acacia effusifolia*	*Prostanthera althoferi subsp althoferi*
ALL SPECIES		
Acacia effusifolia		
Acacia mulganeura		
Hemigenia sp Yalgoo		
Hibbertia arcuata		
Hibbertia exasperata		
Olearia humilis		
Prostanthera althoferi subsp althoferi		
Sida sp Golden calyces glabrous		
Waitzia acuminata		

Vegetation Description

Acacia effusifolia low open shrubland over scattered mixed shrubs and herbs on flats

Date: 4/10/2011 & 12/03/2012	**Botanist:** ER & AS & AO	
Location: Mount Mason	**Quadrat:** 19	
Quadrat size: 20x20		
WP: 34	**Vegetation group:**	
Photo number: 31		
Landform: F, PLA		
Land surface/disturbance: 0		
Coarse fragments on the surface (abundance/size/shape):		4, 3, A
Rock outcrop (abundance/runoff):		0, 1
Soil (profile/field texture/soil surface):		U, SCL, L
%Cover leaf litter:		40
%Cover bare ground:		40

Tallest stratum	**Mid-stratum**	**Lower stratum**
Growth form:	**Growth form:** Shrub	**Growth form:** Shrub
Height:	**Height:** 1-3m	**Height:** 0.25-0.5m
Crown cover %:	**Crown cover %:** 10-30	**Crown cover %:** 10-30
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
BURNT	*Acacia effusifolia*	*Eremophila forrestii subsp forrestii*
		Prostanthera althoferi subsp althoferi

ALL SPECIES
Acacia aneura var aneura
Acacia effusifolia
Acacia ramulosa var *ramulosa*
Brunonia australis
Eremophila forrestii subsp forrestii
Eucalyptus sp.(sterile)
Olearia humilis
Prostanthera althoferi subsp althoferi
Sida sp. Golden calyces glabrous
Waitzia acuminata
Solanum lasiophyllum
Myriocephalus guerinae

Vegetation Description

Acacia effusifolia low open shrubland over scattered mixed shrubs and herbs on flats

Date: 13/03/2012	**Botanist:** ER & AO	
Location: Mount Mason	**Quadrat:** 20	
Quadrat size: 20x20		
WP: 15	**Vegetation group:**	
Photo number: 1-3		
Landform: C, T, HCR		
Land surface/disturbance: 0		
Coarse fragments on the surface (abundance/size/shape):		5,5,U
Rock outcrop (abundance/runoff):		3,2
Soil (profile/field texture/soil surface):		U, SCL, C
%Cover leaf litter:		20
%Cover bare ground:		92
Tallest stratum	**Mid-stratum**	**Lower stratum**
Growth form: Shrub	**Growth form:** Shrub	**Growth form:** Shrub
Height: 3-6m	**Height:** 1-3m	**Height:** 0.25-0.5m
Crown cover %: <10	**Crown cover %:** <10	**Crown cover %:** <10
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Allocasuarina acutivalvis subsp acutivalvis	*Acacia effusifolia 15-1*	*Calytrix erosipetala*
		Philotheca brucei subsp brucei
ALL SPECIES		
Acacia effusifolia		
Allocasuarina acutivalvis subsp acutivalvis		
Calytrix erosipetala		
Dodonaea viscosa subsp spatulata		
Eremophila latrobei filiformis		
Eriachne pulchella		
Stylidium longibracteatum		
Hibbertia arcuata		
Marsdenia australis		
Philotheca brucei subsp brucei		

Vegetation Description

***Allocasuarina acutivalvis subsp acutivalvis* and *Acacia incurvaneura* low woodland/tall shrubland over *Acacia balsamea* and *Philotheca brucei subsp brucei* open shrubland over scattered mixed shrubs and herbs in minor drainage lines and Laterite breakaways.**

Date: 12/03/2012	**Botanist:** ER & AO	
Location: Mount Mason	**Quadrat:** 21	
Quadrat size: 20x20		
WP: 16	**Vegetation group:**	
Photo number: 4-6		
Landform: C,T HCR		
Land surface/disturbance: 0		
Coarse fragments on the surface (abundance/size/shape):		5,3,U
Rock outcrop (abundance/runoff):		4,2
Soil (profile/field texture/soil surface):		U,SCL,C
%Cover leaf litter:		5
%Cover bare ground:		92

Tallest stratum	**Mid-stratum**	**Lower stratum**
Growth form: Shrub	**Growth form:** Shrub	**Growth form:** Shrub
Height: 3-6m	**Height:** 0.5-1m	**Height:** 0.25-0.5m
Crown cover %: <10	**Crown cover %:** <10	**Crown cover %:** <10
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Allocasuarina acutivalvis subsp acutivalvis	*Allocasuarina acutivalvis subsp acutivalvis*	*Calytrix erosipetala*
Acacia quadrimarginea	*Philotheca brucei subsp brucei*	
	Eremophila latrobei subsp filiformis	

ALL SPECIES
Acacia effusifolia
Acacia incurvaneura
Acacia quadrimarginea
Allocasuarina acutivalvis subsp acutivalvis
Calytrix erosipetala
Cheilanthes sieberi subsp sieberi
Eremophila latrobei subsp filiformis
Eriachne pulchella
Stylidium longibracteatum
Grevillea berryana
Philotheca brucei subsp brucei
Solanum lasiophyllum

Vegetation Description

***Allocasuarina acutivalvis subsp acutivalvis* and *Acacia incurvaneura* low woodland/tall shrubland over *Acacia balsamea* and *Philotheca brucei subsp brucei* open shrubland over scattered mixed shrubs and herbs in minor drainage lines and Laterite breakaways.**

Date: 13/03/2012	**Botanist:** ER & AO	
Location: Mount Mason	**Quadrat:** 22	
Quadrat size: 20x20		
WP: 27	**Vegetation group:**	
Photo number: 9-11		
Landform: V,B,DDE		
Land surface/disturbance: 0		
Coarse fragments on the surface (abundance/size/shape):		4,4,ST
Rock outcrop (abundance/runoff):		1,3
Soil (profile/field texture/soil surface):		U, SCL, C
%Cover leaf litter:		40
%Cover bare ground:		70
Tallest stratum	**Mid-stratum**	**Lower stratum**
Growth form: Shrub Mallee (<8m)	**Growth form:** Shrub	**Growth form:** Shrub
Height: 3-6m	**Height:** 0.5-1m	**Height:** 0.25-0.5m
Crown cover %: 10-30	**Crown cover %:** 10-30	**Crown cover %:** <10
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Acacia burkittii	*Senna artemisioides subsp artemisioides*	*Ptilotus obovatus*
Acacia quadrimarginea		

ALL SPECIES
Acacia burkittii
Acacia quadrimarginea
Acacia ramulosa var ramulosa
Acacia tetragonophylla
Austrostipa variabilis
Cheilanthes sieberi subsp sieberi
Corchorus sp
Dodonaea rigida
Dodonaea lobulata
Eremophila latrobei subsp filiformis
Eremophila oldfieldii subsp angustifolia
Goodenia macroplectra
Goodenia mimuloides
Marsdenia australis
Prostanthera althoferi subsp althoferi
Ptilotus obovatus
Scaevola spinescens
Senna artemisioides subsp artemisioides
Thyridolepis multiculmis

Vegetation Description

***Acacia burkittii* and *Acacia quadrimarginea* tall shrubland over *Senna artemisioides subsp artemisioides* over *Ptilotus obovatus* and mixed shrubs within drainage lines.**

Date: 13/03/2012	**Botanist:** ER & AO	
Location: Mount Mason	**Quadrat:** 23	
Quadrat size: 20x20		
WP: 30	**Vegetation group:**	
Photo number: 12-14		
Landform: C,T,HCR		
Land surface/disturbance: 0		
Coarse fragments on the surface (abundance/size/shape):		4,4,S
Rock outcrop (abundance/runoff):		3,2
Soil (profile/field texture/soil surface):		U, SCL, C
%Cover leaf litter:		20
%Cover bare ground:		70
Tallest stratum	**Mid-stratum**	**Lower stratum**
Growth form: Shrub Mallee (<8m)	**Growth form:** Shrub	**Growth form:** Shrub
Height: 3-6m	**Height:** 1-3m	**Height:** 0.5-1m
Crown cover %: 10-30	**Crown cover %:** 10-30	**Crown cover %: <**10
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Acacia incurvaneura	*Acacia cockertoniana*	*Philotheca brucei subsp brucei*
Acacia mulganeura		

ALL SPECIES
Acacia cockertoniana
Acacia incurvaneura
Acacia mulganeura
Austrostipa variabilis
Calandrinia eremaea
Calytrix erosipetala
Cheilanthes sieberi subsp sieberi
Dodonaea viscosa subsp spatulata
Eremophila georgei
Eremophila latrobei subsp filiformis
Eremophila oldfieldii subsp angustifolia
Goodenia occidentalis
Goodenia mimuloides
Hibbertia arcuata
Marsdenia australis
Monachather paradoxus
Philotheca brucei subsp brucei
Prostanthera althoferi subsp althoferi
Ptilotus obovatus
Scaevola spinescens
Senna artemisioides subsp filifolia
Thryptomene decussata
Thyridolepis multiculmis
Trachymene ornata

Vegetation Description

***Acacia incurvaneura* with *Acacia quadrimarginea* tall shrubland/ low woodland over *Philotheca brucei subsp brucei* with *Acacia balsamea shrubland* over *Eremophila latrobei subsp latrobei* and *Hibbertia exasperata* over mixed herbs and shrubs on hills and ridges.**

Date: 13/03/2012	**Botanist:** ER & AO	
Location: Mount Mason	**Quadrat:** 24	
Quadrat size: 20x20		
WP: 31	**Vegetation group:**	
Photo number: 15-17		
Landform: F,B,PLA		
Land surface/disturbance: 0		
Coarse fragments on the surface (abundance/size/shape):		5,4,S
Rock outcrop (abundance/runoff):		0, 1
Soil (profile/field texture/soil surface):		U, SCL, C
%Cover leaf litter:		30
%Cover bare ground:		60
Tallest stratum	**Mid-stratum**	**Lower stratum**
Growth form: Shrub	**Growth form:** Shrub	**Growth form:** Shrub
Height: 3-6m	**Height:** 1-3m	**Height:** 0.5-1m
Crown cover %: 10-30	**Crown cover %:** 10-30	**Crown cover %:** 10-30
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Acacia cockertoniana	*Eremophila oldfieldii subsp angustifolia*	*Ptilotus obovatus*
	Acacia ramulosa var ramulosa	*Senna artemisioides subsp filifolia*
	Eremophila pantonii	
ALL SPECIES		
Acacia cockertoniana		
Acacia ramulosa var ramulosa		
Austrostipa variabilis		
Calandrinia eremaea		
Cheilanthes sieberi subsp sieberi		
Eremophila oldfieldii subsp angustifolia		
Eremophila pantonii		
Eriachne pulchella		
Goodenia occidentalis		
Marsdenia australis		
Ptilotus obovatus		
Scaevola spinescens		
Senna artemisioides subsp filifolia		

Vegetation Description

Acacia cockertoniana tall shrubland over *Eremophila oldfieldii subsp angustifolia* over *Eremophila pantonii* and mixed shrubs on flats.

Appendix F: Targeted Fauna Survey – Mount Mason Project (2021)

Targeted Fauna Survey – Mount Mason Project

Prepared for Juno Minerals Limited

July 2021

Limitations

Scope of services

This report ("the report") has been prepared by Western Ecological Pty Ltd (WE) in accordance with the scope of services set out in the contract, or as otherwise agreed, between the Client and WE. In some circumstances, a range of factors such as time, budget, access and/or site disturbance constraints may have limited the scope of services. This report is strictly limited to the matters stated in it and is not to be read as extending, by implication, to any other matter in connection with the matters addressed in it.

Reliance on data

In preparing the report, WE have relied upon data and other information provided by the Client and other individuals and organisations, most of which are referred to in the report ("the data"). Except as otherwise expressly stated in the report, WE have not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report ("conclusions") are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. WE have also not attempted to determine whether any material matter has been omitted from the data. WE will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to WE. The making of any assumption does not imply that WE have made any enquiry to verify the correctness of that assumption.

The report is based on conditions encountered and information received at the time of preparation of this report or the time that site investigations were carried out. WE disclaim responsibility for any changes that may have occurred after this time. This report and any legal issues arising from it are governed by and construed in accordance with the law of Western Australia as at the date of this report.

Report Version	Revision No.	Purpose	Author/reviewer	Submitted to Client	
				Form	Date
Draft Report	1	For client review	Western Ecological / Juno Minerals	Electronic	14/07/2021
Final Report	2	Client submission	Western Ecological	Electronic	03/08/2021

Executive Summary

Western Ecological was commissioned by Juno Minerals Limited to undertake a desktop assessment and targeted survey for the Malleefowl and Night Parrot associated with their Mount Mason project. The Mount Mason section of the project is located about 90 km north west of Menzies and includes a haul road through the Mount Ida tenements to the Menzies-Sandstone Road. A second section of the project includes the Yunndaga Siding and proposed Menzies bypass route which has its northern end beginning approximately 2.5 km north west of Menzies and its southern end finishing about 7.5 km south east of Menzies. The Long-tailed Dunnart had also previously been recorded at Mount Mason and a secondary assessment was undertaken to detect them in the Mount Mason section.

In early June, after the field component of the targeted fauna survey was complete, Juno notified Western Ecological about discussions they had with the Western Australian Department of Mines, Industry Regulation and Safety, and that they mentioned the potential occurrence of the Arid Bronze Azure Butterfly in the project area. Consequently, this species was also considered as part of the assessment, with the potential for it to occur in the project area based on its current known distribution, habitat in the project area and database search results.

Searches of the Western Australian Department of Biodiversity, Conservation and Attractions threatened fauna database, NatureMap, and the Commonwealths Protected Matters Search Tool were undertaken to identify if the four species (Malleefowl, Night Parrot, Long-tailed Dunnart and ABAB) of conservation significance being targeted during this assessment had been recorded in and or near the survey area in the past.

During the survey a large series of systematic tracks were traversed in suitable habitat to look for Malleefowl and its signs. Two Malleefowl were sighted during the survey, one near the beginning of the haul road and inside the project area and the second near the bottom of the haul road, but just outside the project area. Malleefowl mounds were recorded at eight locations during the survey. Of these eight, only three were recorded inside the project area, the remaining five were outside the project area, but in relatively close proximity. Of these eight mounds, five were considered very old and disused as was evident due to a lack of material in the mound and their weathered state. Mound 6 was considered old and disused and was in the haul road at the southern end. Mound 7 is categorised as old and disused and is out of the project area, but was active during the 2012 survey. Mound 8 was also out of the project area, near the southern end of the haul road but was considered under construction. This was evident by the mound depression in the sand and there and there was scrapping of leaf litter near the mound, with scrape marks caused by the feet of the Malleefowl in the sand.

No Night Parrot calls were recorded on the three SM4s that were placed out at Mount Mason (two units) and in the haul road (one unit). There is no habitat for Night Parrots in the Mount Mason and haul road sections of the project area or the Yunndaga Siding and proposed Menzies bypass route.

Camera traps were placed out in order to detect the Long-tailed Dunnart, but none were captured on the five cameras placed out in the Mount Mason section of the project area. No camera traps were placed in the Yunndaga siding and proposed Menzies bypass section of the project area given the extent of disturbance, close proximity to Menzies and the absence of suitable rocky habitat.

There were no records of the Arid Bronze Azure Butterfly in the three database searches as this species is known from only two locations. The project area does fall into this very large area that has been very broadly mapped as the potential distribution of the Sugar Ant which is the Arid Bronze Azure Butterfly host. There are a two small patches of potentially suitable habitat in the Mount Mason and haul road section of the project area. However, as the Arid Bronze Azure Butterfly is currently only known from two populations, both of which are hundreds of kilometres from the project area, and there is only limited potential habitat in the project area, this species is unlikely to be present.

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1. Introduction

1.1 Background

Western Ecological (WE) was commissioned by Juno Minerals Limited (Juno) to undertake a desktop assessment and targeted survey for the Malleefowl associated with their Mount Mason project ("the project"). The Mount Mason section of the project is located about 90 km north west of Menzies (Figure 1). The project will include various mine infrastructure (mine pit, waster rock dump, ROM, mining operation centre and explosives magazine), camp expansion (including a sewer spray field) and a haul road and pipeline. The survey also assessed a haul road through the Mount Ida tenements to the Menzies-Sandstone Road (Figure 1). The haul road from Mount Mason to the Menzies-Sandstone Road is likely to be a 20 m wide corridor, however, the corridor examined during the assessment was 200 m wide (100 m either side of the centre line). The Yunndaga Siding and proposed Menzies bypass route which has its northern end beginning approximately 2.5 km north west of Menzies and its southern end finishing about 7.5 km south east of Menzies was also assessed (Figure 1).

In addition to the Malleefowl survey we undertook a preliminary survey for the Night Parrot (*Pezoporus occidentalis*). The Western Australian Department of Biodiversity, Conservation and Attractions (DBCA) recommends that Night Parrot surveys should be undertaken if there is suitable Night Parrot habitat present in an area proposed to be disturbed. The survey area falls close to the boundary that the DBCA considers a high to medium priority area for the species (DPaW 2017).

We understand that fauna surveys at Mount Mason and along the proposed haul road have previously been undertaken for the project in 2011 and 2012 by Keith Lindbeck & Associates (KLA 2012 & 2013). These surveys identified a number of species, including one species of conservation significance listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), the Malleefowl (*Leipoa ocellata*) which is listed as Vulnerable under the EPBC Act and is the focus of this current survey work. At the time these two surveys were undertaken, the Night Parrot (listed as Endangered under the EPBC Act) was considered almost extinct and surveys for proposed developments did not consider this species.

The KLA (2012) survey also recorded one Long-tailed Dunnart (*Sminthopsis longicaudata*) in Spring 2011 and Autumn 2012. This species is listed as Priority 4 (P4) by the DBCA and as a result we decided to place out camera traps in an attempt to record the species again (noting that this was not the primary objective of the survey).

Jupiter Mines Pty Ltd (now Juno Minerals Limited) was granted a Native Vegetation Clearing Permit (NVCP) 5765/2 for the project on 24/9/2015 with an expiry date of 30/11/2018. Given this NVCP has expired, a new NVCP, from the Department of Mines, Industry Regulation and Safety (DMIRS) is required. This report provides supplementary and updated information in order to support the current NVCP application. In addition, Juno Minerals also have a Malleefowl Management Plan that has been approved by the Commonwealth Department of Agriculture, Water and the Environment (DAWE – previously known as DSEWPaC at the time) (Juno Minerals Limited 2013).

In early June, after the field component of the targeted fauna survey was complete, Juno notified WE about discussions they had with DMIRS, and that DMIRS mentioned the potential occurrence of the Arid Bronze Azure Butterfly (ABAB) (*Ogyris subterrestris petrina*) in the project area. This species is listed as Critically Endangered under the EPBC Act. Consequently, this species was also considered as part of the assessment, with the potential for it to occur in the project area based on its current known distribution, habitat in the project area and database search results.

1.2 Scope and Objectives

The scope of work (SoW) to be undertaken for the targeted fauna survey was as follows:

- Primary objective was desktop assessment and targeted Malleefowl and Night Parrot survey
- Secondary objective was to undertake a cursory survey for the Long-tailed Dunnart
- Assess the potential for the ABAB to occur in the project area
- Document the above in a report that is supplementary to the previous fauna surveys.

1.3 Legislative context

Fauna in Western Australia is protected formally and informally by various legislative and non-legislative measures, which are as follows:

- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) – Australian Government
- *Biodiversity Conservation Act 2016* (BC Act) – WA State Government.

Non-legislative measures:

- WA Department of Biodiversity, Conservation and Attractions (DBCA) Priority lists for flora, ecological communities and fauna
- Recognition of locally significant populations by DBCA.

A short description of each is given below. Other definitions, including species conservation categories, are provided in Appendix 1.

Environment Protection and Biodiversity Conservation Act (EPBC Act)

The EPBC Act aims to protect matters of national environmental significance, which are detailed in Appendix 1. Under the EPBC Act, the Commonwealth Department of Agriculture, Water and the Environment (DAWE) lists protected species and Threatened Ecological Communities (TECs) by criteria set out in the Act. Species are conservation significant if they are listed as Threatened (i.e., Critically Endangered, Endangered and Vulnerable) or Migratory.

Bird species protected as Migratory under the EPBC Act include those listed under international migratory bird agreements relating to the protection of birds, which migrate between Australia and other countries, for which Australia has agreed. This includes the Japan-Australia Migratory Bird Agreement (JAMBA), the China-Australia Migratory Bird Agreement (CAMBA), the Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA) and the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention).

Some marine fauna or terrestrial fauna that use marine habitats are listed as Marine under the EPBC Act. These species are only considered conservation significant when a proposed development occurs in a Commonwealth marine area (i.e., any Commonwealth Waters or Commonwealth Marine Protected Area). Outside of such areas, the EPBC Act does not consider these species to be matters of national environmental significance, so are not protected under the Act.

Biodiversity Conservation Act (BC Act)

The BC Act replaced both the *Wildlife Conservation Act 1950* and the *Sandalwood Act 1929* and came into effect on 1 January 2019. The aim of the new Act is to conserve and protect biodiversity and to promote the ecologically sustainable use of biodiversity components in the State, and will bring more activities within the scope of biodiversity laws.

Taxa listed as Threatened in the category of critically endangered, endangered or vulnerable under section 19(1a, 1b, and 1c), or is a rediscovered species to be regarded as threatened species under section 26(2) of the BC Act. Other categories include extinct or extinct in the wild and they are listed under section 23 (1) of the BC Act (Appendix 1).

If species meet one or more of the following categories: species of special conservation interest; migratory species; cetaceans; species subject to international agreement; or species otherwise in need of special protection, they are covered under section 13(1) of the BC Act and are called specially protected species. Species that are listed as threatened species (critically endangered, endangered or vulnerable) or extinct species under the BC Act can't also be listed as Specially Protected species (see Appendix 1 for a more detailed description of each threat category).

Threatened Ecological Communities (TECs) are also covered under the BC Act and are placed into three categories of critically endangered, endangered or vulnerable under section 27(1a, 1b, and 1c) depending on their threat status.

DBCA Priority Species and Communities

DBCA lists species that are possibly threatened but that do not meet criteria for listing under the BC Act, or are otherwise data deficient, and adds them to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened fauna or flora. Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring. Consideration of Priority codes is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations (see Appendix 1 for more detail of the priority codes).

The DBCA also has a list of Priority Ecological Communities (PECs) that have scant information available to be considered a TEC, or which are rare but not currently threatened. Ecological communities that do not meet survey criteria or that are not sufficiently defined are added to the PEC 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 a TEC. 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.

Informal Recognition of Threatened Fauna

Certain populations or communities of fauna may be of local significance or interest because of their patterns of distribution and abundance. For example, fauna may be locally significant because they are range extensions to the previously known distribution or are newly discovered species (and have the potential to be of conservation significance). In addition, many species are in decline as a result of threatening processes (land clearing, grazing, and changed fire regimes) and relict populations of such species assume local importance for DBCA. It is not uncommon for DBCA to make comment on these species of interest.

Figure 1: Project Location

0 10 20 km

Scale 1:700,000

GDA94 - MGA Zone 51

Legend

Survey Areas

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2. Methods

2.1 Survey Guidance

The fauna assessment was completed in accordance with the following EPA, DBCA and DAWE requirements for the environmental surveying and reporting of fauna surveys in WA, where relevant and practical, and as documented in:

- EPA Technical Guidance – Terrestrial vertebrate fauna surveys for environmental impact assessment (EPA 2020)
- Interim Guideline for preliminary surveys of Night Parrot (*Pezoporus occidentalis*) in Western Australia (WA Department of Parks and Wildlife [DPaW] 2017).
- Survey Guidelines for Australia's Threatened Birds. EPBC Act survey guidelines 6.2 (2010) (DSEWPaC)
- National Recovery Plan for Malleefowl (*Leipoa ocellata*), Department for Environment and Heritage (Benshemesh 2007)
- Guideline for the survey of arid bronze azure butterfly (ABAB) in Western Australia (DBCA 2020).

2.2 Desktop Assessment

Searches of the DBCA threatened fauna database, NatureMap, and the EPBC Protected Matters Search Tool (EPBC PMST) were undertaken to identify if the four species (Malleefowl, Night Parrot, Long-tailed Dunnart and ABAB) of conservation significance being targeted during this assessment had been recorded in and or near the survey area in the past (DBCA 2021, DBCA 2021, DAWE 2021) (Appendix 2). The DBCA threatened fauna search was centred on coordinates 29°15' 39" S and 120° 25' 31" E and a 100 km radial search was applied. NatureMap and PMST database searches were centred on coordinates (29° 07' 50" S and 120° 22' 05" E) but with a 40 km radial search area for NatureMap (maximum search area) and 100 km for the PMST.

2.3 Field Assessment

The field assessment was undertaken from the 13-19 May 2021 by two qualified Zoologist (Dr Ron Firth and Laura Stevens). The following survey methods were undertaken in the project area.

2.3.1 Malleefowl Survey

The Malleefowl survey methods undertaken in the project area were consistent with relevant guidelines, conservation advice and current practices where relevant and practical and were as follows:

- Systematic transects were primarily walked on foot, but in some limited cases where possible driven by car at low speeds (approximately 10 km/h) as there are some tracks and old exploration drill lines
- These transects were traversed in habitat that was deemed suitable with this based mostly on the density of vegetation in the midstorey and groundstorey i.e., not being too dense in order for birds to construct mounds or too open i.e., not enough cover from the sun and or potential predators and the substrate (very rocky areas such as steep slopes and rocky ridges were excluded as mounds can not be constructed)
- Recording evidence of Malleefowl activity while walking the transects such as:
    - Malleefowl tracks
    - Malleefowl nesting mounds including status (inactive/ active) and activity according to the following criteria:
        - Nest in preparation – eggs not laid (evidence of litter trail)
        - Mound is in progress/ maintenance – eggs assumed to be laid
        - Evidence of chicks leaving nest – chicks fledging site / egg shell fragments
        - Decommissioned – spreading and returning of mound soil
- Malleefowl individual sightings and assessment of age (chick/ adult)
- Opportunistic observations of Malleefowl evidence (tracks, mounds, feathers and or individual sightings) in the project area while not assessing the systematic transects.

Some of the transects were walked outside of areas proposed to be disturbed in order to provide some broader context, while other areas, particularly along the Mount Mason haul road were not walked because of limited access and distance

from vehicle tracks (and because habitat was unsuitable because it had been burnt or was in drainage channels or floodplains where mounds are not built).

Systematic transects were not walked in the Yunndaga siding and proposed Menzies bypass route section of the project area because of an absence of suitable habitat (see results and discussion sections below).

2.3.2 Night Parrot Survey

The Night Parrot survey methods undertaken in the project area were consistent with relevant guidelines where relevant and practical and were as follows:

- Three Song Meter 4 (SM4) acoustic recoding units (ARUs) were placed out for five nights at three locations at Mount Mason (two locations) and the Haul Road (one location) (see Plate 1)
- No SM4s were setup in the Yunndaga siding and proposed Menzies bypass section of the project area (see results and discussion sections below)
- Any recordings on the ARUs were analysed by Bob Bullen (Bat Call WA).

Plate 1. Example of SM4 setup in the project area to detect the calls of the Night Parrot.

2.3.3 Camera Traps

Five camera traps were placed out for four nights in rocky areas at Mount Mason where the Long-tailed Dunnart might occur based on their known ecology and previous captures in the area in 2011 and 2012 (KLA 2012). Camera traps had universal bait (peanut butter, sardines, oats and water) placed in bait stations in the cameras field of view (approximately 1.5 m away) (see Plate 2). No camera traps were placed out in the Yunndaga siding and proposed Menzies bypass section of the project area (see results and discussion sections below).

Plate 2. Example of Camera trap setup in the project area to detect the Long-tailed Dunnart (bait station on the left and camera on right side of the image).

2.3.4 Fauna Habitat Assessment

A number of habitat assessments were undertaken throughout the project area to define and delineate the main broad habitats present. The habitat assessment included an evaluation of the potential for habitats to support the three species of conservation significance being examined during the field survey (noting that the ABAB was not being considered at this stage). The ABAB and its likelihood to occur in the project area will be dealt with in the Discussion.

Each habitat description includes the following information where relevant:

- GPS co-ordinate will be recorded
- habitat condition will be assessed as 'completely degraded through to pristine, based on the scale given in Keighery (1994)
- landscape position
- dominant vegetation and structure e.g., number of vegetation strata
- hollow-bearing trees and dead stags (e.g., average size and abundance of hollows – should they be present)
- description of any rock and rocky outcrops
- logs (e.g., abundance and size)
- substrate (e.g., leaf litter)

- wetlands, creeks, rivers, dams and other water bodies
- description of any observed nests and roosts
- associated fauna species observed using the habitat
- disturbance e.g., cattle grazing, fire, and historic mining.

It is important to note that habitat types have previously been described for the Mount Mason and haul road section of the project area, though the names previously used to describe these may be somewhat different to those described here, they are very similar and broadly based on dominant flora species and to a lesser extent landscape position.

3. Results

3.1 Fauna Survey limitations

Survey limitations are sometimes difficult to predict prior to undertaking an assessment, as is the extent to which they influence survey effort and results. Broad limitations that might have impacted the survey are outlined below in Table 1.

Table 1. Broad limitations that might have impacted the survey.

Limitations	Impact on the assessment
Qualifications and survey experience	The Zoologists that undertook the survey are qualified and experienced and have undertaken numerous targeted surveys for the species being examined in this report. Dr Ron Firth has over 20 years of experience designing, managing and undertaking biodiversity and ecological surveys throughout Western Australia, the Northern Territory, Queensland, New South Wales and Victoria. He has written over 100 consultant reports and has authored or co-authored 15 papers that have been published in peer reviewed scientific journals and has made other contributions to published Books. Laura Stevens has over 8 years of experience undertaking fauna surveys in WA and has written more than 25 consultant reports. Therefore, no perceived limitations associated with qualifications and experience.
Timing - Weather, season	The field assessment was undertaken from the 13-19 May 2021. The survey was primarily a targeted assessment of species (Malleefowl, Night Parrot) that are active all year, consequently, weather and season are not deemed a prime consideration (noting however that Malleefowl mound construction may not have commenced yet as this tends to occur this in June and August [Jones & Goth 2008], but see further below in results section which indicates otherwise).
Scope - Life forms sampled	The primary objective of the assessment was to undertake a targeted survey and broadly describe fauna habitats and this was achieved.
Sources of information	Sources of information included the DBCA threatened fauna database search with a search radius of 100 km centred on the survey area (DBCA 2021a), NatureMap (40 km search radius) and the EPBC Protected Matters Search Tool (EPBC PMST) with a 100 km search radius (DBCA 2021b, DAWE 2021). Other sources of local information included past surveys undertaken in the project area (KLA 2012 and 2013).
Completeness	The main objective of the survey was to undertake a targeted survey for Malleefowl and the Night Parrot and undertake an assessment of habitat for these species. This was for the most part achieved. However, some sections of the haul road were not assessed, in part because access and time was limited, habitats were considered unsuitable and the previous surveys failed to record them in those areas despite significant survey effort.
Disturbance	The project area is split into two sections - Mount Mason and the haul road and Yunndaga siding and proposed Menzies bypass route. Disturbance at Mount Mason and along the haul road is primarily a result of exploration activity (some vegetation clearing for exploration drill lines and drill pads, access tracks), pastoral activity i.e., cattle, tracks and fences and fire, particularly in long sections of the haul road. Disturbance in the Yunndaga siding and proposed Menzies bypass is far more extensive and is primarily a result of is close proximity to Menzies. The area has been disturbed and cleared of vegetation as a result of mining activity that dates back over 100 years and consists of mine pits, waste rock dumps, explorations tracks, access tracks (historic and current), rubbish and weeds. This disturbance has no doubt resulted in it being unsuitable for Malleefowl and this is partially reflected in an absence of recent database records.

3.2 Database Search Results

Results of the three databases searches can be seen in Appendix 2. Malleefowl were present in all three databases, while the Night Parrot was only present in the PMST. The Long-tailed Dunnart was present in the DBCA threatened fauna database and NatureMap. The ABAB was not present in any of the three database searches.

It is important to note that the PMST is not entirely based on point records, but also on broader information, including bioclimatic distribution models, whereas the DBCA threatened fauna database and NatureMap are based on point records. Consequently, the results of the PMST are in some cases less accurate, particularly at a local scale. As a result, the PMST can include species that do not occur in the survey area because, for example, there is no habitat available or they are now

known to be locally extinct. In addition, fauna is not distributed evenly across the landscape, are more abundant in some places than others, and consequently more detectable (Currie 2007).

It is important to note that several other species of conservation significance were present in the database searches, however, these species are considered not to occur in the project area because there is no habitat e.g., no wetland habitat for waterbird species and others have already been considered and dealt with in previous reports (KLA 2012 and 2013).

3.2.1 Number of Database Records

Please note that there were a relatively large number of Malleefowl records (74) and Long-tailed Dunnart records (43) present in the DBCA threatened fauna database. Given this we needed to somewhat reduce the number of records in order to consider those relevant. We did this by removing those Malleefowl records from between 1968 to 1998, given that these are older than 20 years (any birds recorded then are dead and any active mounds observed from then will no longer be used), which accounted for 19 records. The remaining 55 Malleefowl records are from between 2001 and 2020.

All of the Long-tailed Dunnart records that were present in the DBCA threatened fauna database were from 2011 (26), 2012 (15) and two from 2013, consequently none of them were removed (Figure 2). There are also a relatively large number of records to the east of the haul road and these are associated with rocky areas at Mount Ida (Figure 2).

Please note that not all the Malleefowl and Long-tailed Dunnart DBCA threatened fauna database records can be seen on the figure as some fall outside of the are being illustrated, while other records are very close and so the symbols are overlapping each other and therefore represent more than one record.

It is also important to note that there are two records in the DBCA threatened fauna database that when mapped are very close to Menzies (Figure 2). Both of these records are from 2007, both localities are given as Menzies. One has its site listed as 10 km North of pub on Davyhurst Road and the records accuracy is given as 50,000 m (50 km). I checked where Davyhurst Road is and it begins about 27 km south west of Menzies (it comes off the Evanston-Menzies Road), and ends in Davyhurst which was an old gold mining town that no longer exists. Therefore, this record can be dismissed as occurring in Menzies and near the project area. The second record has its site listed as Riverina Station and the records accuracy is given as 1,000 m (1 km). However, Riverina station is at least 45 km to the west of Menzies, again another record we can dismiss as being near the project area.

Figure 2: Threatened Fauna Records

0 10 20 km

Scale 1:700,000

GDA94 - MGA Zone 51

Legend

Threatened Fauna

Long-tailed Dunnart

Malleefowl

Survey Area

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3.3 Field Survey Results

3.3.1 Malleefowl Survey Results

During the survey a large series of systematic transects and tracks were traversed in the Mount Mason and haul road sections of the project area to look for Malleefowl and its signs (mounds and tracks) (Figure 3). These systematic transects were mostly undertaken in suitable habitat, but also in some areas considered unsuitable in order to ground truth habitats, and in areas outside of the project area, if the habitat was deemed suitable in order to provide some context (Figure 3). Further to this some areas inside the project area were not assessed because there are no plans to disturb vegetation i.e., only the area proposed for the sewer spray field and camp extension (and immediate surrounds) were walked as the other areas around the existing camp are not planned to be cleared of vegetation.

Two Malleefowl were sighted during the survey, number one near the beginning of the haul road and inside the project area and number two near the bottom of the haul road, but just outside the project area (Figure 3 and Table 2).

Table 2. Malleefowl sightings and their coordinates.

Malleefowl Sightings	Coordinates in UTMs (GDA94)
Malleefowl 1	244406, 6773149 (in project area)
Malleefowl 2	251427, 6752659 (out of project area)

Malleefowl mounds were recorded at eight locations during the survey (Figure 3 and Table 3). Of these eight, only three were recorded inside the project area, the remaining five were outside the project area, but in relatively close proximity. Of these eight mounds, five were considered very old and disused as was evident due to a lack of material in the mound and their weathered state (Plate 3). Mound 6 was considered old and disused and was in the haul road at the southern end. Mound 7 is categorised as old and disused and is out of the project area (Figure 3, Table 3, and Plate 4). This mound was active during the 2012 survey – see figure 18 and 19 on page 28 in KLA (2013). Mound 8 was also out of the project area, near the southern end of the haul road but was considered under construction (Plate 5). This was evident by the mound depression in the sand and there was scrapping of leaf litter near the mound, with scrape marks caused by the feet of the Malleefowl in the sand (Plate 6).

Table 3. Malleefowl mounds recorded during the assessment, their status and location and whether they were in or out of the project area.

Malleefowl Mound Status	Coordinates in UTMs (GDA94)	In or Out of Project Area
Mound 1 – Very old and disused	242581, 6776052	In
Mound 2 – Very old and disused	243413, 6776744	Out
Mound 3 – Very old and disused	243823, 6776516	Out
Mound 4 – Very old and disused	243939, 6776583	Out
Mound 5 – Very old and disused	243517, 6776267	In
Mound 6 – Old and disused	251697, 6752072	In
Mound 7 – Old and disused	244100, 6772869	Out
Mound 8 – Under construction	251299, 6752659	Out

Plate 3. Malleefowl mound 5 is an example of a very old and disused mound in the project area.

Plate 4. Malleefowl mound 7 is an example of an old and disused mound that is just outside of the project area. Note that this mound was active in 2012 (KLA 2013).

Plate 5. Malleefowl mound 8 is an example of a mound being built - it was recorded just outside of the haul road.

Plate 6. The scrapping of material associated with the building of mound 8 (scrape marks from Malleefowl feet can be seen in the image).

Malleefowl tracks were also recorded during the survey at the southern end of the haul road at five locations, of which four were in the project area (tracks 1, 2 3 and 4) and one set of tracks (tracks 5) were outside of the haul road (Figure 3 and Table 4). Tracks were most likely recorded in this section of the haul road as the substrate was sandy and as a result tracks were more obvious to the observer.

Table 4. Malleefowl tracks and their coordinates.

Malleefowl Tracks	Coordinates in UTMs (GDA94)	Tracks in or out of the Project Area
Tracks 1	251698, 6751564	In
Tracks 2	251655, 6751820	In
Tracks 3	251649, 6752108	In
Tracks 4	251751, 6751449	In
Tracks 5	251803, 6751408	Out

No systematic transects were walked in the Yunndaga siding and proposed Menzies bypass section of the project area given the extent of disturbance, close proximity to Menzies and the absence of suitable habitat (see fauna habitat section below).

3.3.2 Night Parrot Survey Results

No Night Parrot calls were recorded on the three SM4s that were placed out at Mount Mason (two units) and in the haul road (one unit). There is no habitat for Night Parrots in the Mount Mason and haul road sections of the project area (see habitat section discussion sections below). The location of the SM4s can be seen on figure 3 and their coordinates below in table 5.

Table 5. SM4 unit number and its location in the project area.

SM4 Number	Coordinates in UTMs (GDA94)
1	243287, 6776135
2	245668, 6773140
3	249936, 6753824

No SM4 units were placed in the Yunndaga siding and proposed Menzies bypass section of the project area given the extent of disturbance, close proximity to Menzies and the absence of suitable habitat (see fauna habitat section below).

3.3.3 Camera Trap Survey Results

Camera traps were placed out in order to detect the Long-tailed Dunnart, but none were captured on the five cameras placed out in the Mount Mason section of the project area. The location of the camera traps can be seen on figure 3 and their coordinates below in table 6.

Table 6. Camera trap number Malleefowl sightings and their coordinates.

Camera Trap Number	Coordinates in UTMs (GDA94)
1	243389, 6775976
2	243223, 6776083
3	243213, 6775871
4	243504, 6775329
5	245204, 6773508

No camera traps were placed in the Yunndaga siding and proposed Menzies bypass section of the project area given the extent of disturbance, close proximity to Menzies and the absence of suitable rocky habitat (see fauna habitat section below).

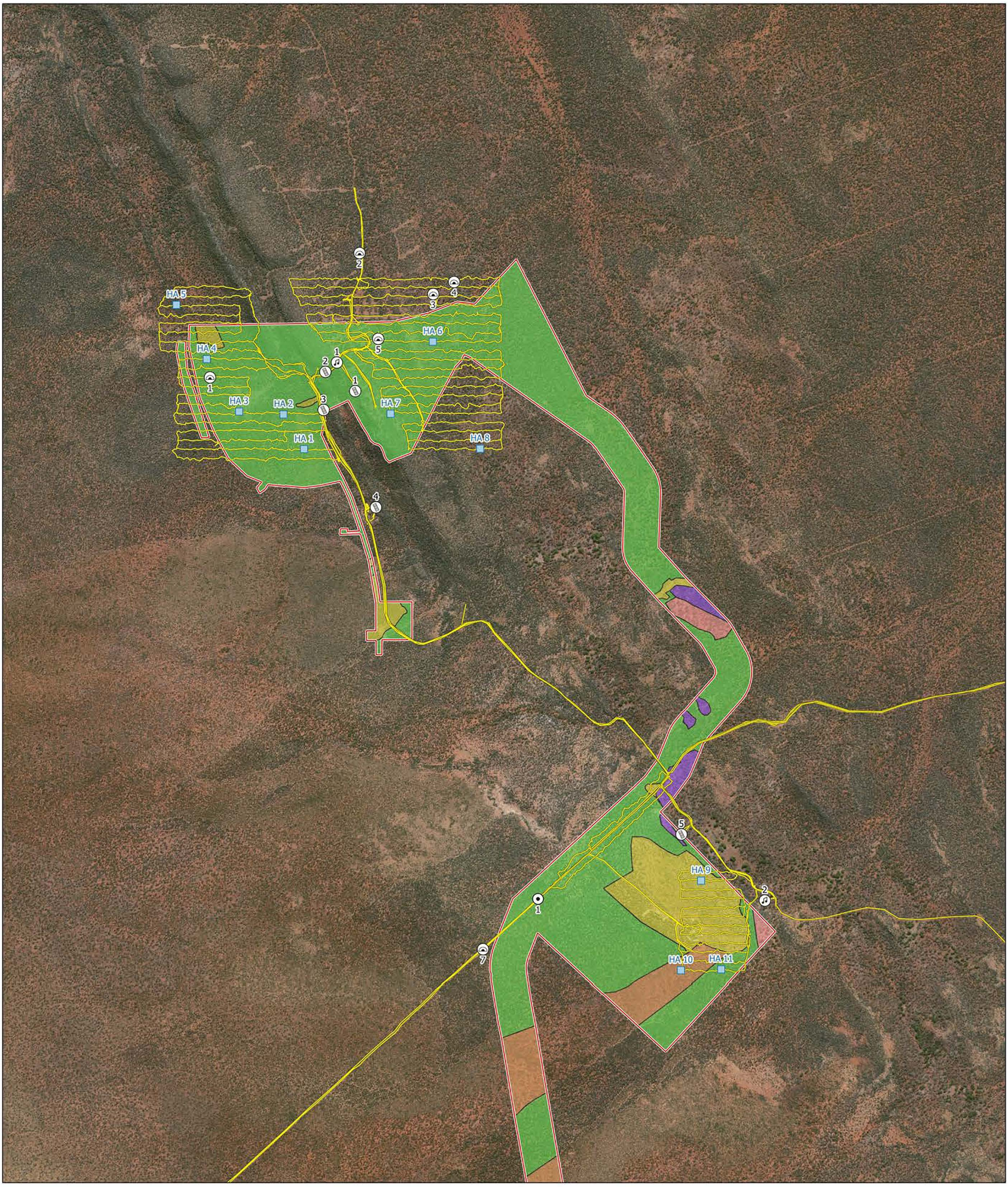

Figure 3: Fauna Habitat and Assessment Sites - Mount Mason and Haul Road

0 250 500 750 m

GDA94 - MGA Zone 51

1:20,000

Legend

- Malleefowl Mounds
- Camera
- SM4
- Malleefowl Tracks
- Malleefowl
- Habitat Assessment
- Tracks
- Survey Area

Habitat

- Acacia Shrubland
- Acacia Shrubland (Burnt)
- Eucalyptus salubris Open Woodland
- Eucalyptus lesouefii Open woodland
- Mulga Shrubland

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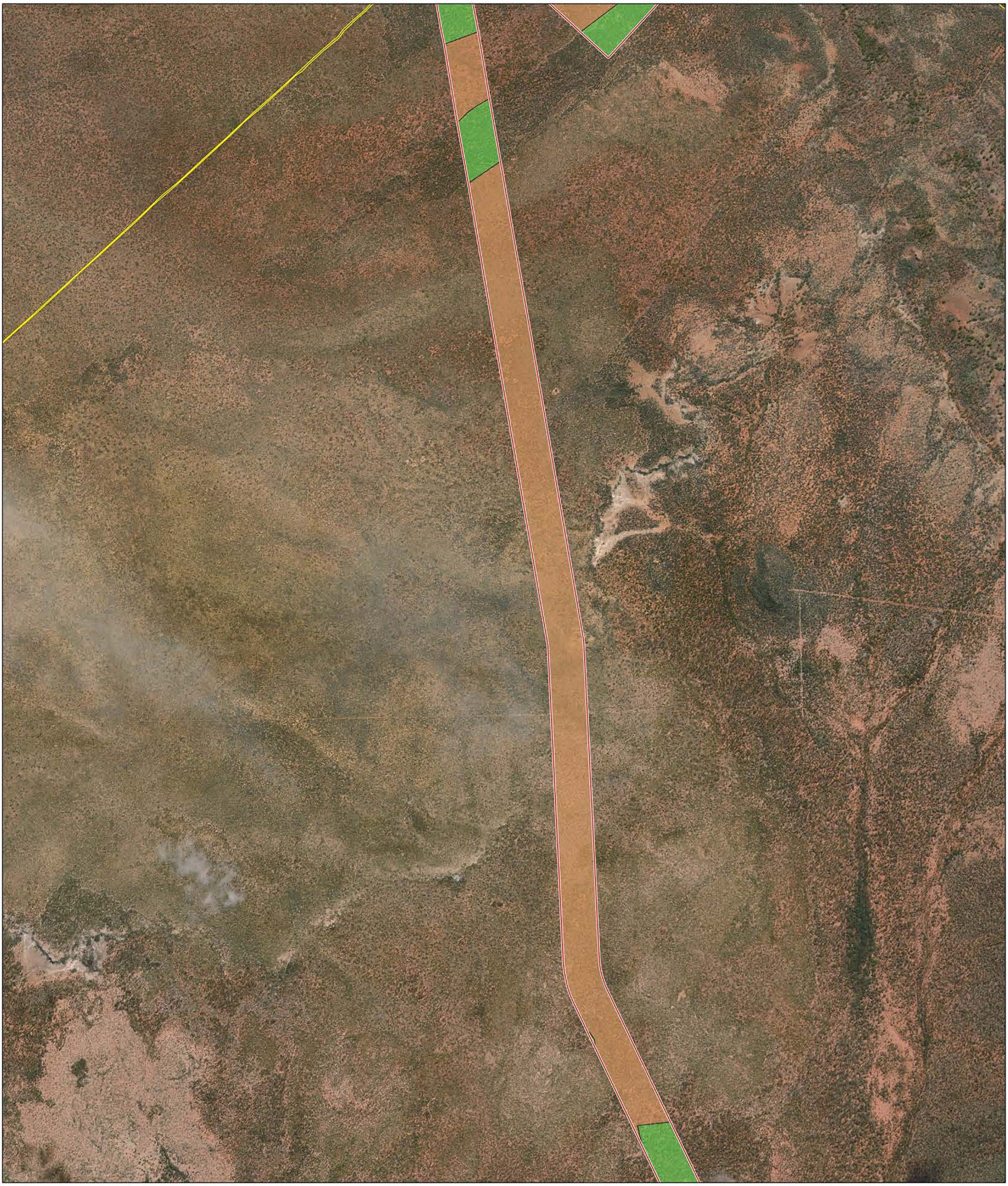

Figure 3: Fauna Habitat and Assessment Sites - Mount Mason and Haul Road

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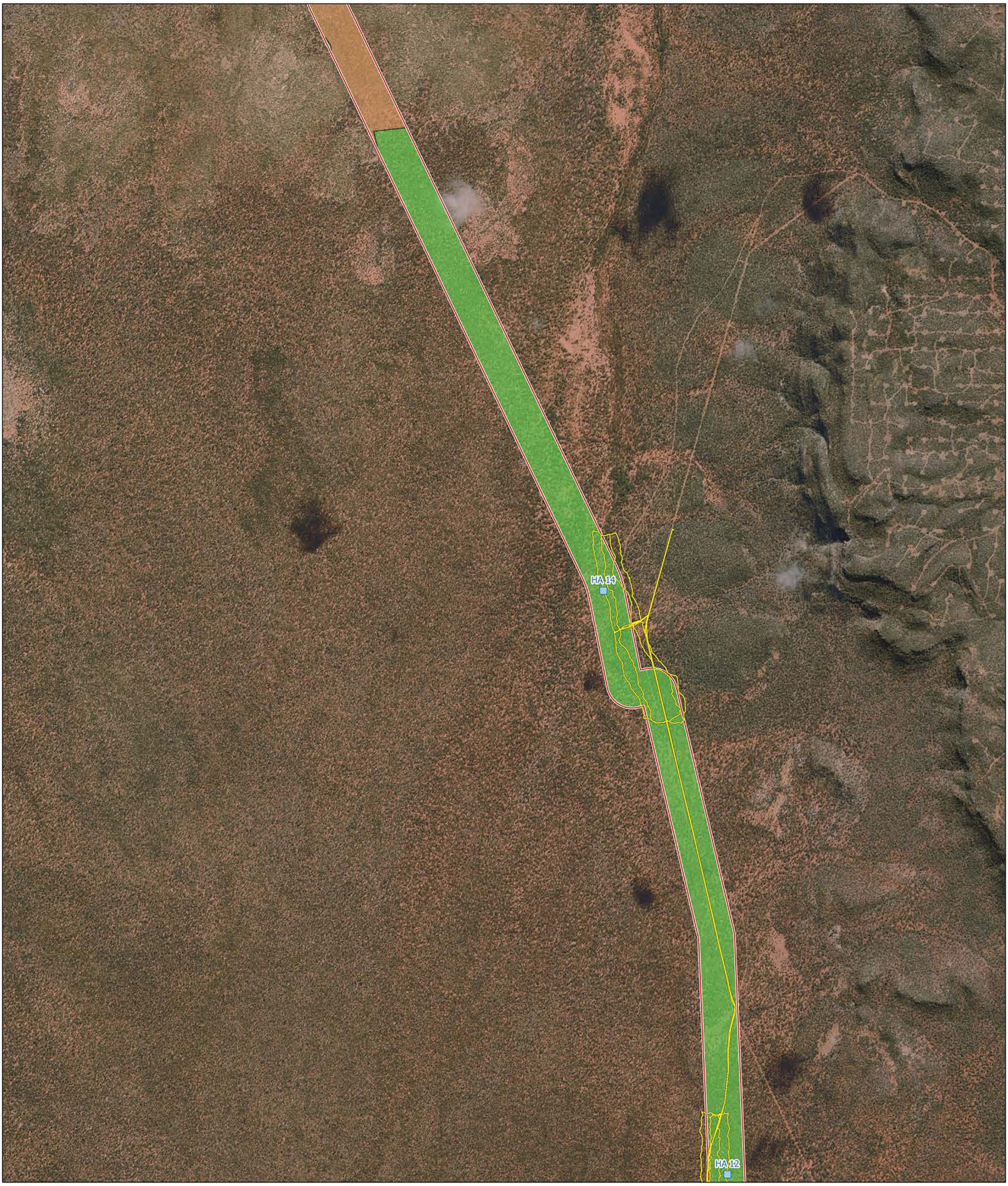

Figure 3: Fauna Habitat and Assessment Sites - Mount Mason and Haul Road

0 250 500 750 m

GDA94 - MGA Zone 51

1:20,000

Legend

- Malleefowl Mounds
- Camera
- SM4
- Mallefowl Tracks
- Malleefowl
- Habitat Assessment
- Tracks
- Survey Area

Habitat

- Acacia Shrubland
- Acacia Shrubland (Burnt)
- Eucalyptus salubris Open Woodland
- Eucalyptus lesouefii Open woodland
- Mulga Shrubland

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Figure 3: Fauna Habitat and Assessment Sites - Mount Mason and Haul Road

0 250 500 750 m

GDA94 - MGA Zone 51

1:20,000

Legend

- Malleefowl Mounds
- Camera Trap
- SM4
- Malleefowl Tracks
- Malleefowl
- Habitat Assessment
- Tracks
- Survey Area

Habitat

- Acacia Shrubland
- Acacia Shrubland (Burnt)
- Eucalyptus salubris Open Woodland
- Eucalyptus lesouefii Open woodland
- Mulga Shrubland

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Figure 3: Fauna Habitat and Assessment Sites - Mount Mason and Haul Road

0 250 500 750 m

GDA94 - MGA Zone 51

1:20,000

Legend

- Malleefowl Mounds
- Camera Trap
- SM4
- Malleefowl Tracks
- Malleefowl
- Habitat Assessment
- Tracks
- Survey Area

Habitat

- Acacia Shrubland
- Acacia Shrubland (Burnt)
- Eucalyptus salubris Open Woodland
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3.4 Fauna Habitat

3.4.1 Fauna Habitat Mount Mason and Haul Road

At Mount Mason and along the haul road we identified, described and mapped five broad fauna habitat types and undertook 17 habitat assessments (Figure 3 and Appendix 3). The five broad habitat types are named as follows:

- Mulga Shrubland – Mulga dominates this habitat and occurs in a variety of landscape positions i.e., rocky hills and slopes, in drainage channels and floodplains, and on flats with a sandy substrate
- Acacia Shrubland (burnt) – this habitat is a result of an extensive fire that occurred in 2006/2007 (KLA 2012), and it comprises a number of Acacia species including Mulga and tends to occur on the flats for the most part, but also on slopes
- Acacia Shrubland – very similar to above but it has not been burnt and also occurred on slopes with a rocky/ stony substrate
- *Eucalyptus lesouefii* Open woodland – occurred on stony slopes with gravelly soil with an open midstorey with mixed shrubs
- *Eucalyptus salubris* Open Woodland – found on stony slopes with gravelly soil with an open midstorey with mixed shrubs.

These five habitat types are widespread and common in areas adjacent to the project area and, more broadly, across the region. The extent of each habitat type in the survey area is presented below in Table 7 (note that there has been some very minor rounding of the numbers).

Table 7. Fauna habitat type and extent in the project area (Mount Mason and haul road).

Broad Habitat Type	Habitat Extent in the Project Area (ha)	Habitat Extent in the Project Area (%)
Mulga Shrubland	613.96	77.69
Acacia Shrubland (burnt)	127.76	16.17
Acacia Shrubland	36.72	4.65
Eucalyptus lesouefii Open woodland	6.89	0.87
Eucalyptus salubris Open Woodland	4.92	0.62
Total	**790.25**	**100**

Of the five broad habitat types, Mulga Shrubland is by far the most extensive, followed by Acacia Shrubland (burnt), then Acacia Shrubland, followed by *Eucalyptus lesouefii* Open woodland and the least extensive habitat type described was *Eucalyptus salubris* Open Woodland. For examples of most of these habitat types see photos in Appendix 3.

Habitat condition was scored as mostly excellent at the habitat assessments sites (Appendix 3). Disturbance at Mount Mason and along the haul road is primarily a result of exploration activity (some vegetation clearing for exploration drill lines and drill pads, access tracks), pastoral activity i.e., cattle, tracks and fences and fire, particularly in long sections of the haul road (Figure 3).

None of the habitats are suitable for Night Parrots as there are no areas with large spinifex (Triodia) hummocks.

It is important to note that habitat types have previously been described for the Mount Mason and haul road section of the project area (KLA 2012, 2013), though the names previously used to describe these may be somewhat different to those described here, they are very similar and for the most part based on dominant flora species and to a lesser extent landscape position.

3.4.2 Fauna Habitat Yunndaga Siding and Menzies Bypass

In the Yunndaga Siding and Menzies Bypass we have identified, described and mapped three broad fauna habitat types (and mapped areas that were for the most part cleared of native vegetation) and undertook seven habitat assessments (Figure 4 and Appendix 3). The three broad habitat types are named as follows:

- Mulga Shrubland – occurs in a variety of landscape positions i.e., small rocky hills and rises, in drainage channels and floodplains, and on flats (noting that much of this section of the project area displays little relief in elevation)
- Scattered Low Shrubland – this habitat consists of chenopods, other low shrubs and Buffel Grass
- Eucalypt Open woodland – we have called it scattered *Eucalyptus lesouefii* (not entirely sure it is this species) with little midstorey (mixed shrubs) and understorey in relatively flat areas.

These three habitat types are widespread and common in areas adjacent to the survey area and, more broadly, across the region. The extent of each habitat type in the survey area is presented below in Table 8 (note that there has been some very minor rounding of the numbers).

Table 8. Fauna habitat type and extent in the project area (Yunndaga siding and Menzies bypass).

Broad Habitat Type	Habitat Extent in the Project Area (ha)	Habitat Extent in the Project Area (%)
Mulga Shrubland	181.36	69.35
Low Scattered Shrubland	43.64	16.53
Eucalypt Open Woodland	7.36	2.81
Cleared	29.66	11.31
Total	**262.23**	**100**

Of the three broad habitat types, Mulga Shrubland is by far the most extensive, followed by Low Scattered Shrubland, then the least extensive is Eucalypt Open woodland. Cleared areas are the third most extensive area, however, here they are not considered habitat. For examples of most of these habitat types see photos in Appendix 3.

The habitat has been extensively disturbed as a result of historic mining activity and is now deemed unsuitable for Malleefowl, as it has limited canopy cover in many areas and lacks a diverse shrub layer throughout much of the project area. During our habitat assessments, short walks and while driving tracks we did not see any Malleefowl, their mounds or tracks. None of the habitats are suitable for Night Parrots as there are no areas with large spinifex (Triodia) hummocks. There are also no rocky ridges with boulders that is preferred habitat for the Long-tailed Dunnart.

Habitat condition was deemed as very good to good at the habitat assessments sites (Appendix 3). Much of the habitat is open with limited canopy cover and there is little to no cover of shrubs in the midstorey. Disturbance in the Yunndaga siding and proposed Menzies bypass is far more extensive than the Mount Mason and haul road section of the project area. Disturbance is primarily a result of its close proximity to Menzies. The area has been disturbed and cleared of vegetation in many areas as a result of mining activity that dates back over 100 years and consists of mine pits, waste rock dumps, explorations tracks, drill pads, access tracks (historic and current), rubbish and weeds such as Buffel Grass.

Figure 4: Fauna Habitat and Assessment Sites - Yunndaga Siding and Bypass Route

0 250 500 m

GDA94 - MGA Zone 51

1:13,000

Legend

- Habitat Assessment
- Tracks
- Survey Area

Habitat

- Cleared
- Low Scattered Shrubland
- Mulga Shrubland
- Eucalypt Open Woodland

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Figure 4: Fauna Habitat and Assessment Sites - Yunndaga Siding and Bypass Route

0 250 500 m

GDA94 - MGA Zone 51

1:13,000

Legend

- Habitat Assessment
- Tracks
- Survey Area

Habitat

- Cleared
- Low Scattered Shrubland
- Mulga Shrubland
- Eucalypt Open Woodland

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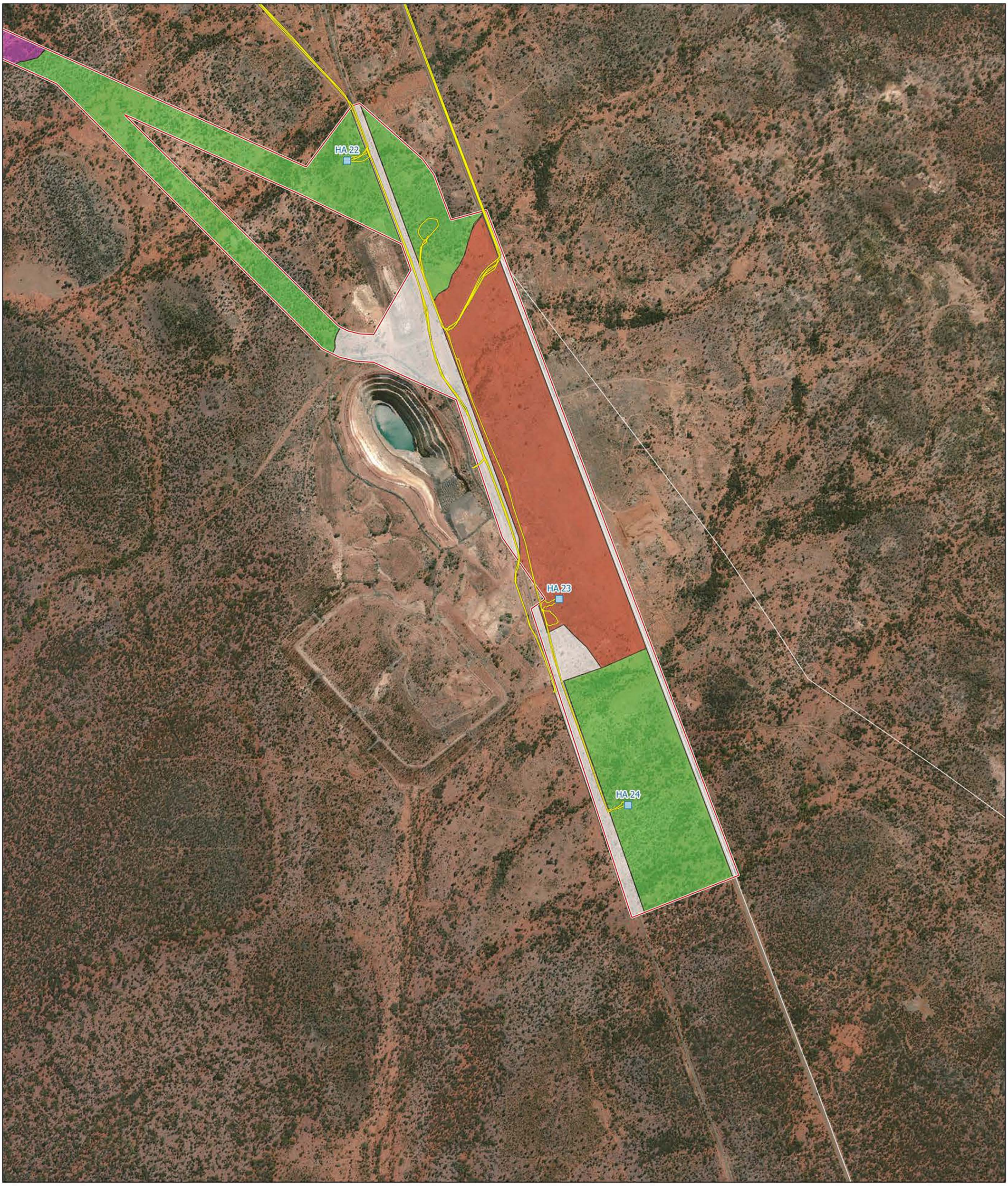

Figure 4: Fauna Habitat and Assessment Sites - Yunndaga Siding and Bypass Route

0 250 500 m

GDA94 - MGA Zone 51

1:13,000

Legend

- Habitat Assessment
- Tracks
- Survey Area

Habitat

- Cleared
- Low Scattered Shrubland
- Mulga Shrubland
- Eucalypt Open Woodland

© 2021. Whilst every care has been taken to prepare this map, Western Ecological makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.Date printed: 2021-06-24.

4. Discussion

4.1 Malleefowl

Based on this current survey and previous surveys we know that Malleefowl have built mounds and likely nested in them in the Mount Mason and haul road sections of the project area, however, all of the mounds recorded during this assessment in the project area are either very old and disused or considered old and disused (see Plates 3 and 4). One Mound being built was recorded just outside of the haul road at the southern end (see Plates 5 and 6). Further to this two Malleefowl were sighted, one in the project area at the northern end of the Mount Mason section, and the other just outside of the haul road at the southern end (in relatively close proximity to the mound under construction). Malleefowl tracks were also recorded at the southern end of the haul road at five locations during the survey, of which four were in the project area and one set of tracks were outside of the haul road. Tracks were most likely recorded in this section of the haul road as the substrate was sandy and as a result tracks were more obvious to the observer.

We have not attempted to assign broad categories of age to old mounds as the rate of mound weathering is not known for this area and would change, with this being dependent to some extent on the material from which the mound is constructed (stones or sand), its location in the landscape (surrounding vegetation) and weather (i.e., rainfall quantities and how much occurs during a particular rainfall event, wind and extreme storm events).

Studies have shown that a wide range of food shrubs, rather than an abundance of any one species is probably important for Malleefowl during for example droughts (Harlen & Priddel 1996). This is supported by other studies showing that Malleefowl are more abundant in areas where shrubs are more diverse (Woinarski 1989).

Malleefowl prefer habitat with a dense canopy and an open ground layer in which they can construct their mounds (Benshemesh 2007). Benshemesh (1992) also found that dense canopy cover was the most important feature associated with high breeding densities at sites in Victoria. Fire history is also important with Malleefowl birds preferring old growth (i.e., long unburnt) mallee. Fire has a major influence on the structure and floristic composition of habitats that Malleefowl occupy.

Given the Malleefowls preference for habitat with a diverse shrub layer and areas that are long unburnt, the Acacia Shrubland (burnt) is unlikely to be preferred habitat, particularly for foraging and mound construction as there is little to no canopy. No mounds have been recorded in this habitat in the project area during this survey or previous surveys. However, these birds have a relatively large home range that can be up to 4 km^2 in low rainfall areas (Booth 1987). Given this relatively large home range, Malleefowl could traverse all areas in the Mount Mason and haul road section of the project area. Mound construction is unlikely to occur in some sections of Mulga Shrubland where there are drainage channels or floodplains as their mounds could potentially be washed away or at least inundated with water (further to this none were recorded in such areas during this survey or past surveys).

As outlined in the background section, fauna surveys at Mount Mason and along the proposed haul road were previously undertaken for the project in 2011 and 2012 by Keith Lindbeck & Associates (KLA 2012 & 2013). These previous surveys and this current survey identified many Malleefowl mounds of which most were disused and many were outside of the proposed disturbance footprint (Table 9). One mound was found to be active in 2012, but it was outside of the proposed disturbance footprint (KLA 2013) (Table 9).

Table 9. Active and disused Malleefowl mounds recorded during surveys for the Mount Mason project (this includes the proposed haul road).

Note this table is a modified version of Table 3 that can be found in the Central Yilgarn Iron Project (CYIP) Malleefowl Management Plan (2013).

Date	Report	Active Mounds		Disused Mounds	
		Number of mounds located on survey	Number of mounds located within project disturbance footprint	Number of mounds located on survey	Number of mounds located within project disturbance footprint
April 2012	Mount Mason Targeted EPBC Listed Fauna Survey (KLA 2013)	1	0	36	29
August 2012	Central Yilgarn Iron Project (CYIP) – Mount Mason (L2) Fauna Assessment (KLA 2012)	1 (note same mound MFM001 as recorded in April Survey)	0	7	0
May 2021	Targeted Fauna Survey – Mount Mason Project (Western Ecological)	1 – under construction	0	4	3

As a consequence of the Malleefowl survey results from 2012, the Project was subsequently referred by Jupiter Mines (now Juno Minerals) to DSEWPaC (now DAWE) in May 2013 and was assessed as 'Not a Controlled Action if undertaken in a particular manner'. As part of that submission, Jupiter Mines (now Juno Minerals) also submitted a Malleefowl Management Plan and a Malleefowl Monitoring Procedure that detailed the manner in which Juno Minerals will monitor and manage Malleefowl activity at the Mt Mason site for the duration of the project.

It should be noted in the context of this recent 2021 targeted survey, that there are no active Malleefowl mounds within the proposed mine pits, and this is most likely a result of the rocky and relatively steep terrain of the banded iron formation (BIF outcrop) which is unsuitable for mound construction.

Furthermore, the Malleefowl mounds recorded during this survey (see Table 3 in Section 3.3.1 above) provide supplementary and updated information that should be added to the Malleefowl Management Plan and Malleefowl Monitoring Plan data as previously submitted to DSEWPaC (now DAWE) (Jupiter Mines Limited 2013), and should be considered as an addendum to that information.

There are no Malleefowl records in close proximity to the Yunndaga siding and Menzies bypass section of the project area. The habitat has been extensively disturbed as a result of historic mining activity and is deemed unsuitable for Malleefowl, as it has limited canopy cover in many areas and lacks a diverse shrub layer throughout much of the project area. During our habitat assessments, short walks and while driving tracks we did not see any Malleefowl, their mounds or tracks.

4.2 Night Parrot

The Night Parrot is an enigmatic species thought possibly to be extinct until the recent recoveries of two dead specimens from Queensland (and new locations more recently). The type specimen and many early sightings, however, came from WA (Johnstone et al. 2013). Night Parrots are cryptic, nocturnal and endemic to Australia's arid interior. Until the late 19th century, they were widespread and relatively easily found at least at some locations. For instance, 14 of the 25 museum specimens in existence came from the Gawler Ranges in South Australia between 1871 and 1881 (Murphy et al. 2017). The last Night Parrot collected intentionally was in Western Australia in 1912 (Wilson 1937). Then followed 78 years of unconfirmed reports spanning all mainland states and the Northern Territory, until in 1990 a desiccated bird was found by a roadside in western Queensland (Boles et al. 1994, Murphy et al. 2017). In 2006, another dead bird was discovered by a Ranger 200 km to the south-east of the 1990 specimen (McDougall et al. 2009, Murphy et al. 2017). In 2013, the first photographs of a living night parrot were captured close to the site of the 2006 specimen (Dooley 2013, Murphy et al. 2017). Their cryptic nature, remote distribution and apparently rapid decline means that there is scant ecological information about night parrots.

A more recent sighting of the Night Parrot in WA comes from the Pilbara (12 April 2005) at a well near the Fortescue Marshes (Davis & Metcalf 2008). There was also a sighting near Matuwa (Lorna Glen), which is about 160 km north-east of Wiluna, in 2009 (Hamilton et al. 2017).

This species was present only in the PMST database (there were no records in the DBCA threatened fauna database or NatureMap), and there are limitations with this PMST as outlined above in section 3.2. None of their calls were recorded on the SM4s. There is very limited ecological information available for this species such as its preferred habitat (only very broad information). However, with increasing conservation focus being given to this species, more information is likely to become available, e.g., the discovery of Night Parrot nests in large Spinifex hummocks in Queensland (Murphy *et al*. 2017) which is a common and widespread habitat type throughout much of south-east Queensland and WA. There is no suitable habitat in the form of large spinifex hummocks in either section of the project area, as a result this species is highly unlikely to occur in the project area.

4.3 Long-tailed Dunnart

Records of the Long-tailed Dunnart come from widely scattered localities in the arid zone where it inhabits rugged, rocky areas. Little is known of the life history of long-tailed dunnarts, but available evidence suggests that this widely scattered species is restricted to rugged, rocky areas (Burbidge et al. 2008). Habitat includes plateaus composed of boulders and stones, with fine red sand sparsely vegetated with Mulga and miniritchie (*Acacia sp.*) shrubs over spinifex and areas of open woodland of Mulga (Van Dyck & Strahan 2008). The striated foot-pad and long strongly muscular tail of the Long-tailed Dunnart suggest it is an active and capable climber.

This species was recorded at the base of rocky scree in the Mount Mason section of the project are in 2011 (one individual) and 2012 (one individual) (KLA 2012). This species was not recorded in the project area during this survey on the five camera traps that were placed out in Mulga shrubland on rocky ridges and rocky hill slopes. Given the limited number of captures during the previous survey and no captures on camera traps during this survey, the Long-tailed Dunnart is likely to occur in very low densities in this area. There are also relatively large number of records to the south associated with rocky areas at Mount Ida (Figure 2).

There is no suitable habitat in the form of rugged rocky ridges along the haul road or in the Yunndaga siding and Menzies bypass section. Given this the species is highly unlikely to occur in these sections of the project area.

4.4 Arid Bronze Azure Butterfly

The Arid Bronze Azure Butterfly (ABAB) is known from only two existing subpopulations in WA. One occurs at Barbalin Nature Reserve (BNR), and at a second site ~100 km from Barbalin (DBCA 2020). There was a population at Lake Douglas, 12 km south west of Kalgoorlie, however, this population is reported to have become extinct in about 1993 as no ABAB have been recorded there since then (CA 2015, DBCA 2020).

The ABAB has an obligate association with a Sugar Ant (host) *Camponotus* terebrans and the ABAB larvae live entirely within the ant's nest during their development. The larvae are cryptic and extremely difficult to detect and only two have ever been seen (CA 2015, DBCA 2020). The most critical factor for habitat occupancy by the butterfly is the presence of large colonies of the host ant; only large colonies can support the ABAB because, being a parasitic species, it requires large numbers of hosts (CA 2015, DBCA 2020).

At the ABABs two known sites, the vegetation is mature mixed Gimlet *Eucalyptus salubris* / Salmon Gum *E. salmonophloia* woodlands on red-brown loam soils, with an open understorey (DBCA 2020). In addition to Gimlet and Salmon Gum, other smooth-barked Eucalypts at these sites which have basal ant colonies include Wandoo *E. wandoo*, smooth-barked York Gum E. loxophleba lissophloia and Ribbon-barked Mallee *E. sheathiana*. The habitat at the extinct Lake Douglas site differs from the other sites but is also dominated by mature smooth-barked Eucalypt woodland, particularly Victoria Desert mallee *E. concinna* (DBCA 2020).

Given the ABABs obligate association with the Sugar Ant, the potential distribution of the ant may also reflect the distribution of the ABAB. The potential distribution of the Sugar Ant has been mapped and is illustrated in the DBCA Guideline for the survey of (ABAB) (DBCA 2020). This potential distribution encompasses a very large area of WA where rainfall is less than 325 mm and south of 26° S and where vegetation has been mapped as woodland and where the vegetation description includes Eucalypt ((DBCA 2020).

There were of course no records of ABAB in the three database searches (Appendix 2) as this species is known from only two locations. The project area does fall into this very large area that has been very broadly mapped as the potential distribution of the Sugar Ant which is the ABABs host. There are a two small patches of *Eucalyptus salubris* in the Mount Mason and haul road section of the project area which account for 4.92 ha or 0.62% of the total habitat. As the ABAB is currently only known from two populations, both of which are hundreds of kilometres from the project area, and there is only limited potential habitat in the project area, this species is unlikely to be present.

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APPENDICES

Appendix 1: Conservation Categories

CONSERVATION CODES

For Western Australian Fauna and Flora

Threatened, Extinct and Specially Protected fauna or flora[1] are species[2] which have been adequately searched for and are deemed to be, in the wild, threatened, extinct or in need of special protection, and have been gazetted as such.

The *Wildlife Conservation (Specially Protected Fauna) Notice 2018* and the *Wildlife Conservation (Rare Flora) Notice 2018* have been transitioned under regulations 170, 171 and 172 of the *Biodiversity Conservation Regulations 2018* to be the lists of Threatened, Extinct and Specially Protected species under Part 2 of the *Biodiversity Conservation Act 2016.*

Categories of Threatened, Extinct and Specially Protected fauna and flora are:

T **Threatened species**

Listed by order of the Minister as Threatened in the category of critically endangered, endangered or vulnerable under section 19(1), or is a rediscovered species to be regarded as threatened species under section 26(2) of the *Biodiversity Conservation Act 2016* (BC Act).

Threatened fauna is that subset of 'Specially Protected Fauna' listed under schedules 1 to 3 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for Threatened Fauna.

Threatened flora is that subset of 'Rare Flora' listed under schedules 1 to 3 of the *Wildlife Conservation (Rare Flora) Notice 2018* for Threatened Flora.

The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria as detailed below.

CR **Critically endangered species**

Threatened species considered to be "*facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines*".

Listed as critically endangered under section 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines. Published under schedule 1 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for critically endangered fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for critically endangered flora.

EN **Endangered species**

Threatened species considered to be "*facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines*".

Listed as endangered under section 19(1)(b) of the BC Act in accordance with the criteria set out in section 21 and the ministerial guidelines. Published under schedule 2 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for endangered fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for endangered flora.

VU **Vulnerable species**

Threatened species considered to be "*facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines*".

Listed as vulnerable under section 19(1)(c) of the BC Act in accordance with the criteria set out in section 22 and the ministerial guidelines. Published under schedule 3 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for vulnerable fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for vulnerable flora.

Extinct species

Listed by order of the Minister as extinct under section 23(1) of the BC Act as extinct or extinct in the wild.

EX Extinct species

Species where "*there is no reasonable doubt that the last member of the species has died*", and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act).

Published as presumed extinct under schedule 4 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for extinct fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for extinct flora.

EW Extinct in the wild species

Species that *"is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form*", and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act).

Currently there are no threatened fauna or threatened flora species listed as extinct in the wild. If listing of a species as extinct in the wild occurs, then a schedule will be added to the applicable notice.

Specially protected species

Listed by order of the Minister as specially protected under section 13(1) of the BC Act. Meeting one or more of the following categories: species of special conservation interest; migratory species; cetaceans; species subject to international agreement; or species otherwise in need of special protection.

Species that are listed as threatened species (critically endangered, endangered or vulnerable) or extinct species under the BC Act cannot also be listed as Specially Protected species.

MI Migratory species

Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines (section 15 of the BC Act).

Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and fauna subject to the *Convention on the Conservation of Migratory Species of Wild Animals* (Bonn Convention), an environmental treaty under the United Nations Environment Program. Migratory species listed under the BC Act are a subset of the migratory animals, that are known to visit Western Australia, protected under the international agreements or treaties, excluding species that are listed as Threatened species.

Published as migratory birds protected under an international agreement under schedule 5 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.

CD Species of special conservation interest (conservation dependent fauna)

Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened, and listing is otherwise in accordance with the ministerial guidelines (section 14 of the BC Act).

Published as conservation dependent fauna under schedule 6 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.

OS Other specially protected species

Fauna otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines (section 18 of the BC Act).

Published as other specially protected fauna under schedule 7 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.

P Priority species

Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened fauna or flora.

Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring.

Assessment of Priority codes is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.

1 Priority 1: Poorly-known species

Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.

2 Priority 2: Poorly-known species

Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.

3 Priority 3: Poorly-known species

Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.

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

(a) Rare. Species 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 species are usually represented on conservation lands.
(b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent.
(c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

[1] The definition of flora includes algae, fungi and lichens
[2]Species includes all taxa (plural of taxon - a classificatory group of any taxonomic rank, e.g. a family, genus, species or any infraspecific category i.e. subspecies or variety, or a distinct population).

Categories of Threatened Fauna Species under the EPBC Act.

Conservation Code	Description
Ex	Extinct Taxa which at a particular time if, at the time, there is no reasonable doubt that the last member of the species has died.
ExW	Extinct in the Wild Taxa which are known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
Cr	Critically Endangered Taxa which at a particular time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
En	Endangered Taxa which is not critically endangered and it is facing a very high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
Vu	Vulnerable Taxa which is not critically endangered or endangered and is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.

Source: Environment Protection and Biodiversity Conservation Act 1999.

Appendix 2: Database Searches

SCI_NAME	COM_NAME	CLASS	WA_LISTING	WA_status	EPBCstatus	Date	DAY	MONTH	YEAR	SOURCE_ID	SOURCE	CERTAINTY	OBS_METHOD	OBS_TYPE	COUNT	LOCALITY	SITE	ACCURACY_M	LONG_GDA	LAT_GDA	NAME_ID	FAMILY	GENUS	SPECIES	SUBSPECIES	KINGDOM
Branchinella simplex	a fairy shrimp (inland WA)	INVERTEBRATE	Priority	P1		16/10/2007	16	10	2007	90801	AP_SUBREG_INVERTS				0	Lake Moriaty	Lake Moriaty	30	121.17480000000	-29.83630000000	33935	Thamnocephalidae	Branchinella	simplex		Animalia
Actitis hypoleucos	Common Sandpiper	BIRD	Specially Protected - n	MI	MI	16/10/2007	16	10	2007	1227412|157	BIRDATA				0	Niagara Dam	Niagara Dam	100	121.42580000000	-29.40720000000	41323	Scolopacidae	Actitis	hypoleucos		Animalia
Falco peregrinus	Peregrine falcon	BIRD	Specially Protected - o	OS		11/01/2013	11	1	2013	1356932|237	BIRDATA				0	Ullaring Rock	Ullaring Rock	100	120.55030000000	-29.92780000000	25624	Falconidae	Falco	peregrinus		Animalia
Tringa glareola	Wood sandpiper	BIRD	Specially Protected - n	MI	MI	20/01/2015	20	1	2015	1548040|154	BIRDATA				0	Leonora WWTP	Leonora WWTP	0	121.32250000000	-28.88780000000	24806	Scolopacidae	Tringa	glareola		Animalia
Tringa glareola	Wood sandpiper	BIRD	Specially Protected - n	MI	MI	15/03/2015	15	3	2015	1548041|154	BIRDATA				0	Leonora WWTP	Leonora WWTP	0	121.32250000000	-28.88780000000	24806	Scolopacidae	Tringa	glareola		Animalia
Falco peregrinus	Peregrine falcon	BIRD	Specially Protected - o	OS		22/07/1978	22	7	1978	44463|237	BIRDATLAS1				0	LEONORA	LEONORA	18000	121.08470000000	-28.74870000000	25624	Falconidae	Falco	peregrinus		Animalia
Falco peregrinus	Peregrine falcon	BIRD	Specially Protected - o	OS		12/07/1979	12	7	1979	66913|237	BIRDATLAS1				0	ULARRING	ULARRING	108000	119.50140000000	-29.49870000000	25624	Falconidae	Falco	peregrinus		Animalia
Tringa nebularia	Common greenshank, greens	BIRD	Specially Protected - n	MI	MI	29/04/1979	29	4	1979	66915|158	BIRDATLAS1				0	ULARRING	ULARRING	108000	120.50140000000	-29.49870000000	24808	Scolopacidae	Tringa	nebularia		Animalia
Thinornis rubricollis	Hooded plover, hooded dotte	BIRD	Priority	P4		2/10/1980	2	10	1980	90616|138	BIRDATLAS1				0			108000	119.50140000000	-29.49870000000	48135	Charadriidae	Thinornis	rubricollis		Animalia
Falco peregrinus	Peregrine falcon	BIRD	Specially Protected - o	OS		2/10/1980	2	10	1980	90616|237	BIRDATLAS1				0	ULARRING	ULARRING	108000	119.50140000000	-29.49870000000	25624	Falconidae	Falco	peregrinus		Animalia
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerab	VU	VU	27/06/2001	27	6	2001	165605|7	BIRDATLAS2				0	Perrinvale Outstatic	Perrinvale Outstatic	100	120.17170000000	-28.97870000000	24557	Megapodiidae	Leipoa	ocellata		Animalia
Falco peregrinus	Peregrine falcon	BIRD	Specially Protected - o	OS		31/03/2002	31	3	2002	266442|237	BIRDATLAS2				0	Ularring Rock	Ularring Rock	100	120.55110000000	-29.92570000000	25624	Falconidae	Falco	peregrinus		Animalia
Falco peregrinus	Peregrine falcon	BIRD	Specially Protected - o	OS		20/08/1999	20	8	1999	28936|237	BIRDATLAS2				0	Near Whitewell, Mt	Near Whitewell, Mt	100	119.56700000000	-29.43480000000	25624	Falconidae	Falco	peregrinus		Animalia
Actitis hypoleucos	Common Sandpiper	BIRD	Specially Protected - n	MI	MI	26/09/2004	26	9	2004	432019|157	BIRDATLAS2				0	Niagara Dam	Niagara Dam	100	121.42640000000	-29.40370000000	41323	Scolopacidae	Actitis	hypoleucos		Animalia
Jalmenus aridus	Inland hairstreak, desert blue	INVERTEBRATE	Priority	P1		31/10/1997	31	10	1997	15284	BUGBASE				0	MENZIES	Lake Douglas, near	0	121.00140000000	-29.99870000000	33979	Lycaenidae	Jalmenus	aridus		Animalia
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerab	VU	VU	7/09/2011	7	9	2011	CDFN_734	BUSHBLITZ				0			30	120.59270000000	-29.87940000000	24557	Megapodiidae	Leipoa	ocellata		Animalia
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerab	VU	VU	7/09/2011	7	9	2011	23978	COWANSURVEYS	Very Certain	Survey	Sighting	1	ULARRING	Credo Station	30	120.59270000000	-29.87940000000	24557	Megapodiidae	Leipoa	ocellata		Animalia
Sminthopsis longicaudata	Long-tailed dunnart	MAMMAL	Priority	P4		19/05/2011	19	5	2011	257363	FAUNASURVEY	Certain	Survey	Unknown	1	ULARRING	Mount Forrest, Min	100	119.96470000000	-28.67440000000	24115	Dasyuridae	Sminthopsis	longicaudata		Animalia
Sminthopsis longicaudata	Long-tailed dunnart	MAMMAL	Priority	P4		22/05/2011	22	5	2011	257366	FAUNASURVEY	Certain	Survey	Unknown	1	ULARRING	Mount Forrest, Min	100	119.96420000000	-28.67520000000	24115	Dasyuridae	Sminthopsis	longicaudata		Animalia
Sminthopsis longicaudata	Long-tailed dunnart	MAMMAL	Priority	P4		18/05/2011	18	5	2011	257369	FAUNASURVEY	Certain	Survey	Unknown	1	ULARRING	Mount Forrest, Min	100	119.96440000000	-28.67510000000	24115	Dasyuridae	Sminthopsis	longicaudata		Animalia
Sminthopsis longicaudata	Long-tailed dunnart	MAMMAL	Priority	P4		23/05/2011	23	5	2011	257370	FAUNASURVEY	Certain	Survey	Unknown	1	ULARRING	Mount Forrest, Min	100	119.96440000000	-28.67510000000	24115	Dasyuridae	Sminthopsis	longicaudata		Animalia
Sminthopsis longicaudata	Long-tailed dunnart	MAMMAL	Priority	P4		24/05/2011	24	5	2011	257371	FAUNASURVEY	Certain	Survey	Unknown	1	ULARRING	Mount Forrest, Min	100	119.96440000000	-28.67510000000	24115	Dasyuridae	Sminthopsis	longicaudata		Animalia
Sminthopsis longicaudata	Long-tailed dunnart	MAMMAL	Priority	P4		20/05/2011	20	5	2011	257374	FAUNASURVEY	Certain	Survey	Unknown	1	ULARRING	Mount Forrest, Min	100	119.96460000000	-28.67460000000	24115	Dasyuridae	Sminthopsis	longicaudata		Animalia
Sminthopsis longicaudata	Long-tailed dunnart	MAMMAL	Priority	P4		22/05/2011	22	5	2011	257375	FAUNASURVEY	Certain	Survey	Unknown	1	ULARRING	Mount Forrest, Min	100	119.96920000000	-28.67320000000	24115	Dasyuridae	Sminthopsis	longicaudata		Animalia
Sminthopsis longicaudata	Long-tailed dunnart	MAMMAL	Priority	P4		25/05/2011	25	5	2011	257381	FAUNASURVEY	Certain	Survey	Unknown	1	ULARRING	Mount Forrest, Min	100	119.96930000000	-28.67360000000	24115	Dasyuridae	Sminthopsis	longicaudata		Animalia
Sminthopsis longicaudata	Long-tailed dunnart	MAMMAL	Priority	P4		18/05/2011	18	5	2011	257382	FAUNASURVEY	Certain	Survey	Unknown	1	ULARRING	Mount Forrest, Min	100	119.96920000000	-28.67340000000	24115	Dasyuridae	Sminthopsis	longicaudata		Animalia
Sminthopsis longicaudata	Long-tailed dunnart	MAMMAL	Priority	P4		24/05/2011	24	5	2011	257383	FAUNASURVEY	Certain	Survey	Unknown	1	ULARRING	Mount Forrest, Min	100	119.96920000000	-28.67340000000	24115	Dasyuridae	Sminthopsis	longicaudata		Animalia
Sminthopsis longicaudata	Long-tailed dunnart	MAMMAL	Priority	P4		22/05/2011	22	5	2011	257396	FAUNASURVEY	Certain	Survey	Unknown	1	ULARRING	Mount Forrest, Min	100	119.94410000000	-28.73370000000	24115	Dasyuridae	Sminthopsis	longicaudata		Animalia
Sminthopsis longicaudata	Long-tailed dunnart	MAMMAL	Priority	P4		23/05/2011	23	5	2011	257409	FAUNASURVEY	Certain	Survey	Unknown	1	ULARRING	Mount Forrest, Min	100	119.93770000000	-28.72710000000	24115	Dasyuridae	Sminthopsis	longicaudata		Animalia
Sminthopsis longicaudata	Long-tailed dunnart	MAMMAL	Priority	P4		1/09/2011	1	9	2011	284843	FAUNASURVEY	Certain	Survey	Unknown	1	ULARRING	Goldfields, Mt Masc	100	120.36140000000	-29.12110000000	24115	Dasyuridae	Sminthopsis	longicaudata		Animalia
Sminthopsis longicaudata	Long-tailed dunnart	MAMMAL	Priority	P4		30/10/2011	30	10	2011	284968	FAUNASURVEY	Certain	Survey	Unknown	1	ULARRING	Goldfields, Mt Ida	100	120.42280000000	-29.21240000000	24115	Dasyuridae	Sminthopsis	longicaudata		Animalia
Sminthopsis longicaudata	Long-tailed dunnart	MAMMAL	Priority	P4		16/11/2011	16	11	2011	364406	FAUNASURVEY	Certain	Survey	Unknown	1	ULARRING	Mount Forrest, Min	100	119.96920000000	-28.67320000000	24115	Dasyuridae	Sminthopsis	longicaudata		Animalia
Sminthopsis longicaudata	Long-tailed dunnart	MAMMAL	Priority	P4		17/11/2011	17	11	2011	364463	FAUNASURVEY	Certain	Survey	Unknown	1	ULARRING	Mount Forrest, Min	100	119.96930000000	-28.67380000000	24115	Dasyuridae	Sminthopsis	longicaudata		Animalia
Sminthopsis longicaudata	Long-tailed dunnart	MAMMAL	Priority	P4		17/11/2011	17	11	2011	364464	FAUNASURVEY	Certain	Survey	Unknown	1	ULARRING	Mount Forrest, Min	100	119.96930000000	-28.67360000000	24115	Dasyuridae	Sminthopsis	longicaudata		Animalia
Sminthopsis longicaudata	Long-tailed dunnart	MAMMAL	Priority	P4		17/11/2011	17	11	2011	364465	FAUNASURVEY	Certain	Survey	Unknown	1	ULARRING	Mount Forrest, Min	100	119.94480000000	-28.73280000000	24115	Dasyuridae	Sminthopsis	longicaudata		Animalia
Sminthopsis longicaudata	Long-tailed dunnart	MAMMAL	Priority	P4		18/11/2011	18	11	2011	364527	FAUNASURVEY	Certain	Survey	Unknown	1	ULARRING	Mount Forrest, Min	100	119.96930000000	-28.67360000000	24115	Dasyuridae	Sminthopsis	longicaudata		Animalia
Sminthopsis longicaudata	Long-tailed dunnart	MAMMAL	Priority	P4		18/11/2011	18	11	2011	364528	FAUNASURVEY	Certain	Survey	Unknown	1	ULARRING	Mount Forrest, Min	100	119.96920000000	-28.67330000000	24115	Dasyuridae	Sminthopsis	longicaudata		Animalia
Sminthopsis longicaudata	Long-tailed dunnart	MAMMAL	Priority	P4		19/11/2011	19	11	2011	364583	FAUNASURVEY	Certain	Survey	Unknown	1	ULARRING	Mount Forrest, Min	100	119.96420000000	-28.67530000000	24115	Dasyuridae	Sminthopsis	longicaudata		Animalia
Sminthopsis longicaudata	Long-tailed dunnart	MAMMAL	Priority	P4		19/11/2011	19	11	2011	364584	FAUNASURVEY	Certain	Survey	Unknown	1	ULARRING	Mount Forrest, Min	100	119.96920000000	-28.67320000000	24115	Dasyuridae	Sminthopsis	longicaudata		Animalia
Sminthopsis longicaudata	Long-tailed dunnart	MAMMAL	Priority	P4		20/11/2011	20	11	2011	364625	FAUNASURVEY	Certain	Survey	Unknown	1	ULARRING	Mount Forrest, Min	100	119.96440000000	-28.67490000000	24115	Dasyuridae	Sminthopsis	longicaudata		Animalia
Sminthopsis longicaudata	Long-tailed dunnart	MAMMAL	Priority	P4		21/11/2011	21	11	2011	364716	FAUNASURVEY	Certain	Survey	Unknown	1	ULARRING	Mount Forrest, Min	100	119.96460000000	-28.67460000000	24115	Dasyuridae	Sminthopsis	longicaudata		Animalia
Sminthopsis longicaudata	Long-tailed dunnart	MAMMAL	Priority	P4		21/11/2011	21	11	2011	364717	FAUNASURVEY	Certain	Survey	Unknown	1	ULARRING	Mount Forrest, Min	100	119.96420000000	-28.67530000000	24115	Dasyuridae	Sminthopsis	longicaudata		Animalia
Sminthopsis longicaudata	Long-tailed dunnart	MAMMAL	Priority	P4		21/11/2011	21	11	2011	364718	FAUNASURVEY	Certain	Survey	Unknown	1	ULARRING	Mount Forrest, Min	100	119.96420000000	-28.67530000000	24115	Dasyuridae	Sminthopsis	longicaudata		Animalia
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerab	VU	VU	21/10/2011	21	10	2011	385481	FAUNASURVEY	Certain	Survey	Unknown	1	ULARRING	LAKE GILES - MCM S	100	119.99190000000	-29.82970000000	24557	Megapodiidae	Leipoa	ocellata		Animalia
Sminthopsis longicaudata	Long-tailed dunnart	MAMMAL	Priority	P4		2/03/2012	2	3	2012	441214	FAUNASURVEY	Certain	Survey	Unknown	1	ULARRING	Goldfields, Mt Masc	100	120.36140000000	-29.12110000000	24115	Dasyuridae	Sminthopsis	longicaudata		Animalia
Sminthopsis longicaudata	Long-tailed dunnart	MAMMAL	Priority	P4		27/03/2012	27	3	2012	441263	FAUNASURVEY	Certain	Survey	Unknown	1	ULARRING	Goldfields, Mt Ida	100	120.40820000000	-29.20840000000	24115	Dasyuridae	Sminthopsis	longicaudata		Animalia
Sminthopsis longicaudata	Long-tailed dunnart	MAMMAL	Priority	P4		29/03/2012	29	3	2012	441297	FAUNASURVEY	Certain	Survey	Unknown	1	ULARRING	Goldfields, Mt Ida	100	120.39660000000	-29.22120000000	24115	Dasyuridae	Sminthopsis	longicaudata		Animalia
Dasycercus blythi	Brush-tailed mulgara	MAMMAL	Priority	P4		27/10/2012	27	10	2012	553062	FAUNASURVEY	Certain	Survey	Unknown	1	ULARRING	Ularring , Mt Masor	100	120.51600000000	-29.03500000000	30903	Dasyuridae	Dasycercus	blythi		Animalia
Dasycercus blythi	Brush-tailed mulgara	MAMMAL	Priority	P4		29/10/2012	29	10	2012	553063	FAUNASURVEY	Certain	Survey	Unknown	1	ULARRING	Ularring , Mt Masor	100	120.51740000000	-29.03720000000	30903	Dasyuridae	Dasycercus	blythi		Animalia
Sminthopsis longicaudata	Long-tailed dunnart	MAMMAL	Priority	P4		13/12/2012	13	12	2012	564876	FAUNASURVEY	Certain	Survey	Unknown	1	ULARRING	Mount Forrest, Min	100	119.95480000000	-28.71590000000	24115	Dasyuridae	Sminthopsis	longicaudata		Animalia
Falco peregrinus	Peregrine falcon	BIRD	Specially Protected - o	OS		14/12/2012	14	12	2012	564986	FAUNASURVEY	Certain	Survey	Unknown	1	ULARRING	Mount Forrest, Min	10000	119.95700000000	-28.70590000000	25624	Falconidae	Falco	peregrinus		Animalia
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerab	VU	VU	14/12/2012	14	12	2012	564989	FAUNASURVEY	Certain	Survey	Unknown	1	ULARRING	Mount Forrest, Min	10000	119.95700000000	-28.70590000000	24557	Megapodiidae	Leipoa	ocellata		Animalia
Sminthopsis longicaudata	Long-tailed dunnart	MAMMAL	Priority	P4		19/10/2012	19	10	2012	649852	FAUNASURVEY	Certain	Survey	Unknown	1	ULARRING	Mt Richardson, RICC	100	119.99090000000	-28.79240000000	24115	Dasyuridae	Sminthopsis	longicaudata		Animalia
Sminthopsis longicaudata	Long-tailed dunnart	MAMMAL	Priority	P4		23/10/2012	23	10	2012	649853	FAUNASURVEY	Certain	Survey	Unknown	1	ULARRING	Mt Richardson, RICC	100	119.99090000000	-28.79240000000	24115	Dasyuridae	Sminthopsis	longicaudata		Animalia
Sminthopsis longicaudata	Long-tailed dunnart	MAMMAL	Priority	P4		23/10/2012	23	10	2012	649854	FAUNASURVEY	Certain	Survey	Unknown	1	ULARRING	Mt Richardson, RICC	100	119.99090000000	-28.79240000000	24115	Dasyuridae	Sminthopsis	longicaudata		Animalia
Sminthopsis longicaudata	Long-tailed dunnart	MAMMAL	Priority	P4		23/10/2012	23	10	2012	649855	FAUNASURVEY	Certain	Survey	Unknown	1	ULARRING	Mt Richardson, RICC	100	119.98550000000	-28.75760000000	24115	Dasyuridae	Sminthopsis	longicaudata		Animalia
Sminthopsis longicaudata	Long-tailed dunnart	MAMMAL	Priority	P4		17/03/2013	17	3	2013	649856	FAUNASURVEY	Certain	Survey	Unknown	1	ULARRING	Mt Richardson, RICC	100	119.97260000000	-28.80890000000	24115	Dasyuridae	Sminthopsis	longicaudata		Animalia
Sminthopsis longicaudata	Long-tailed dunnart	MAMMAL	Priority	P4		23/10/2012	23	10	2012	649857	FAUNASURVEY	Certain	Survey	Unknown	1	ULARRING	Mt Richardson, RICC	100	119.99250000000	-28.80100000000	24115	Dasyuridae	Sminthopsis	longicaudata		Animalia
Sminthopsis longicaudata	Long-tailed dunnart	MAMMAL	Priority	P4		28/10/2012	28	10	2012	649858	FAUNASURVEY	Certain	Survey	Unknown	1	ULARRING	Mt Richardson, RICC	100	119.99250000000	-28.80100000000	24115	Dasyuridae	Sminthopsis	longicaudata		Animalia
Sminthopsis longicaudata	Long-tailed dunnart	MAMMAL	Priority	P4		24/10/2012	24	10	2012	649859	FAUNASURVEY	Certain	Survey	Unknown	1	ULARRING	Mt Richardson, RICC	100	119.97700000000	-28.76800000000	24115	Dasyuridae	Sminthopsis	longicaudata		Animalia
Sminthopsis longicaudata	Long-tailed dunnart	MAMMAL	Priority	P4		19/10/2012	19	10	2012	649860	FAUNASURVEY	Certain	Survey	Unknown	1	ULARRING	Mt Richardson, RICC	100	119.94590000000	-28.76000000000	24115	Dasyuridae	Sminthopsis	longicaudata		Animalia
Sminthopsis longicaudata	Long-tailed dunnart	MAMMAL	Priority	P4		22/10/2012	22	10	2012	649861	FAUNASURVEY	Certain	Survey	Unknown	1	ULARRING	Mt Richardson, RICC	100	119.94590000000	-28.76000000000	24115	Dasyuridae	Sminthopsis	longicaudata		Animalia
Sminthopsis longicaudata	Long-tailed dunnart	MAMMAL	Priority	P4		23/10/2012	23	10	2012	649862	FAUNASURVEY	Certain	Survey	Unknown	1	ULARRING	Mt Richardson, RICC	100	119.94590000000	-28.76000000000	24115	Dasyuridae	Sminthopsis	longicaudata		Animalia
Sminthopsis longicaudata	Long-tailed dunnart	MAMMAL	Priority	P4		23/10/2012	23	10	2012	649863	FAUNASURVEY	Certain	Survey	Unknown	1	ULARRING	Mt Richardson, RICC	100	119.94590000000	-28.76000000000	24115	Dasyuridae	Sminthopsis	longicaudata		Animalia
Sminthopsis longicaudata	Long-tailed dunnart	MAMMAL	Priority	P4		18/03/2013	18	3	2013	649864	FAUNASURVEY	Certain	Survey	Unknown	1	ULARRING	Mt Richardson, RICC	100	119.99070000000	-28.79070000000	24115	Dasyuridae	Sminthopsis	longicaudata		Animalia
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerab	VU	VU	23/10/2012	23	10	2012	650221	FAUNASURVEY	Certain	Survey	Secondary sig	1	ULARRING	Mt Richardson, RICC	10000	119.97860000000	-28.77770000000	24557	Megapodiidae	Leipoa	ocellata		Animalia
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerab	VU	VU	24/10/2012	24	10	2012	650222	FAUNASURVEY	Certain	Survey	Secondary sig	1	ULARRING	Mt Richardson, RICC	10000	119.97860000000	-28.77770000000	24557	Megapodiidae	Leipoa	ocellata		Animalia
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerab	VU	VU	25/10/2012	25	10	2012	650223	FAUNASURVEY	Certain	Survey	Secondary sig	1	ULARRING	Mt Richardson, RICC	10000	119.97860000000	-28.77770000000	24557	Megapodiidae	Leipoa	ocellata		Animalia
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerab	VU	VU	26/10/2012	26	10	2012	650224	FAUNASURVEY	Certain	Survey	Secondary sig	1	ULARRING	Mt Richardson, RICC	10000	119.97860000000	-28.77770000000	24557	Megapodiidae	Leipoa	ocellata		Animalia
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerab	VU	VU	27/10/2012	27	10	2012	650225	FAUNASURVEY	Certain	Survey	Secondary sig	1	ULARRING	Mt Richardson, RICC	10000	119.97860000000	-28.77770000000	24557	Megapodiidae	Leipoa	ocellata		Animalia
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerab	VU	VU	28/10/2012	28	10	2012	650226	FAUNASURVEY	Certain	Survey	Secondary sig	1	ULARRING	Mt Richardson, RICC	10000	119.97860000000	-28.77770000000	24557	Megapodiidae	Leipoa	ocellata		Animalia
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerab	VU	VU	28/10/2012	28	10	2012	650227	FAUNASURVEY	Certain	Survey	Secondary sig	1	ULARRING	Mt Richardson, RICC	10000	119.97860000000	-28.77770000000	24557	Megapodiidae	Leipoa	ocellata		Animalia
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerab	VU	VU	25/05/2013	25	5	2013	665493	FAUNASURVEY	Certain	Survey	Unknown	1	ULARRING	Mount Forrest, Min	10000	119.95700000000	-28.70590000000	24557	Megapodiidae	Leipoa	ocellata		Animalia
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerab	VU	VU	30/05/2013	30	5	2013	665494	FAUNASURVEY	Certain	Survey	Unknown	1	ULARRING	Mount Forrest, Min	100	119.93320000000	-28.73770000000	24557	Megapodiidae	Leipoa	ocellata		Animalia
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerab	VU	VU	8/06/2013	8	6	2013	665495	FAUNASURVEY	Certain	Survey	Unknown	1	ULARRING	Mount Forrest, Min	100	119.93500000000	-28.73910000000	24557	Megapodiidae	Leipoa	ocellata		Animalia
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerab	VU	VU	9/06/2013	9	6	2013	665496	FAUNASURVEY	Certain	Survey	Unknown	1	ULARRING	Mount Forrest, Min	100	119.93320000000	-28.73770000000	24557	Megapodiidae	Leipoa	ocellata		Animalia
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerab	VU	VU	10/06/2013	10	6	2013	665497	FAUNASURVEY	Certain	Survey	Unknown	1	ULARRING	Mount Forrest, Min	100	119.93320000000	-28.73770000000	24557	Megapodiidae	Leipoa	ocellata		Animalia
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerab	VU	VU	10/06/2013	10	6	2013	665498	FAUNASURVEY	Certain	Survey	Unknown	1	ULARRING	Mount Forrest, Min	100	119.93500000000	-28.73910000000	24557	Megapodiidae	Leipoa	ocellata		Animalia
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerab	VU	VU	10/06/2013	10	6	2013	665499	FAUNASURVEY	Certain	Survey	Unknown	1	ULARRING	Mount Forrest, Min	100	119.93360000000	-28.74110000000	24557	Megapodiidae	Leipoa	ocellata		Animalia
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerab	VU	VU	11/06/2013	11	6	2013	665500	FAUNASURVEY	Certain	Survey	Unknown	1	ULARRING	Mount Forrest, Min	100	119.93360000000	-28.74110000000	24557	Megapodiidae	Leipoa	ocellata		Animalia
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerab	VU	VU	17/06/2013	17	6	2013	665501	FAUNASURVEY	Certain	Survey	Unknown	1	ULARRING	Mount Forrest, Min	100	119.94100000000	-28.73460000000	24557	Megapodiidae	Leipoa	ocellata		Animalia
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerab	VU	VU	17/06/2013	17	6	2013	665502	FAUNASURVEY	Certain	Survey	Unknown	1	ULARRING	Mount Forrest, Min	100	119.93320000000	-28.73770000000	24557	Megapodiidae	Leipoa	ocellata		Animalia
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerab	VU	VU	25/07/2013	25	7	2013	665503	FAUNASURVEY	Certain	Survey	Unknown	1	ULARRING	Mount Forrest, Min	100	119.93320000000	-28.73770000000	24557	Megapodiidae	Leipoa	ocellata		Animalia
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerab	VU	VU	10/08/2013	10	8	2013	665504	FAUNASURVEY	Certain	Survey	Unknown	1	ULARRING	Mount Forrest, Min	100	119.93360000000	-28.74110000000	24557	Megapodiidae	Leipoa	ocellata		Animalia
Leipoa ocellata	malleefowl	BIRD	Threatened - Vulnerab	VU	VU	6/01/1998	6	1	1998	1500	TFAUNA	Certain	Opportunistic sig	Day sighting	1	Leonora		1000	121.03503190000	-29.01870160000	24557	Megapodiidae	Leipoa	ocellata		Animalia
Falco peregrinus	peregrine falcon	BIRD	Specially Protected - o	OS		15/10/1999	15	10	1999	3630	TFAUNA	Certain	Survey	Day sighting	2	Mount Elvire	Mount Elvire Stn	10000	119.60142810000	-29.36537610000	25624	Falconidae	Falco	peregrinus		Animalia
Thinornis rubricollis	hooded plover, hooded dotte	BIRD	Priority	P4		3/06/1992	3	6	1992	7023	TFAUNA	Certain	Survey	Sighting	0	Lake Ballard	Lake Ballard	50000	120.83333830000	-29.45000171000	48135	Charadriidae	Thinornis	rubricollis		Animalia
Falco peregrinus	peregrine falcon	BIRD	Specially Protected - o	OS		1/06/1974	1	6	1974	10352	TFAUNA	Certain	Opportunistic sig	Day sighting	1	Leonora	Leonora District	50000	121.33200100000	-28.89039938000	25624	Falconidae	Falco	peregrinus		Animalia
Thinornis rubricollis	hooded plover, hooded dotte	BIRD	Priority	P4		1/09/1980	1	9	1980	10739	TFAUNA	Certain	Opportunistic sig	Day sighting	0	Mount Elvire	Mt Elvire	50000	119.59800040000	-29.36299838000	48135	Charadriidae	Thinornis	rubricollis		Animalia
Aspidites ramsayi (southwest s	woma (southwest subpop.)	REPTILE	Priority	P1		11/02/1966	11	2	1966	12053	TFAUNA	Certain	Historical (writte	Dead	1	Menzies	south of Menzies - 1	1000	121.03333560000	-29.69999676000	47673	Boidae	Aspidites	ramsayi	(southwest subpop.	Animalia
Leipoa ocellata	malleefowl	BIRD	Threatened - Vulnerab	VU	VU	14/08/2007	14	8	2007	13142	TFAUNA	Certain	Opportunistic sig	Day sighting	1	Ularring	on edge of road	1000	119.82672660000	-29.66288945000	24557	Megapodiidae	Leipoa	ocellata		Animalia
Leipoa ocellata	malleefowl	BIRD	Threatened - Vulnerab	VU	VU	26/10/2007	26	10	2007	14448	TFAUNA	Certain	Opportunistic sig	Day sighting	1	Menzies	10km North of pub	50000	121.03808430000	-29.69281330000	24557	Megapodiidae	Leipoa	ocellata		Animalia
Leipoa ocellata	malleefowl	BIRD	Threatened - Vulnerab	VU	VU	2/07/2009	2	7	2009	16733	TFAUNA	Certain	Opportunistic sig	Day sighting	2	Menzies	110km north of Goo	50000	121.32229740000	-29.18450073000	24557	Megapodiidae	Leipoa	ocellata		Animalia
Leipoa ocellata	malleefowl	BIRD	Threatened - Vulnerab	VU	VU	21/07/2009	21	7	2009	16734	TFAUNA	Certain	Opportunistic sig	Day sighting	1	Ularring	Walling Rock Pastor	1000	120.21549830000	-29.30845083000	24557	Megapodiidae	Leipoa	ocellata		Animalia
Leipoa ocellata	malleefowl	BIRD	Threatened - Vulnerab	VU	VU	20/03/2011	20	3	2011	19192	TFAUNA	Certain	Opportunistic sig	Day sighting	1		NE Credo Station	1000	120.24166290000	-30.11472565000	24557	Megapodiidae	Leipoa	ocellata		Animalia
Leipoa ocellata	malleefowl	BIRD	Threatened - Vulnerab	VU	VU	25/01/2011	25	1	2011	19201	TFAUNA	Certain	Opportunistic sig	Day sighting	2		Hospital Rocks	1000	120.13112510000	-29.83675614000	24557

Leipoa ocellata	malleefowl	BIRD	Threatened - Vulnerab	VU	VU	6/01/1994	6	1	1994	89815	TFAUNA	Moderately cer	Opportunistic si	Sighting	1	ULARRING	1.3 km Sth of Elvire	0	119.60000000000	-29.51666667000	24557	Megapodiidae	Leipoa	ocellata	Animalia
Leipoa ocellata	malleefowl	BIRD	Threatened - Vulnerab	VU	VU	23/06/1980	23	6	1980	89838	TFAUNA	Moderately cer	Opportunistic si	Sighting	1	ULARRING	10 km South of Can	10000	119.60000000000	-29.55000000000	24557	Megapodiidae	Leipoa	ocellata	Animalia
Leipoa ocellata	malleefowl	BIRD	Threatened - Vulnerab	VU	VU	30/03/1975	30	3	1975	89850	TFAUNA	Moderately cer	Opportunistic si	Sighting	2	MENZIES	10 miles South of M	1000	121.06670000000	-29.81660000000	24557	Megapodiidae	Leipoa	ocellata	Animalia
Leipoa ocellata	malleefowl	BIRD	Threatened - Vulnerab	VU	VU	19/07/1974	19	7	1974	89866	TFAUNA	Moderately cer	Opportunistic si	Secondary sig	0	MENZIES	11 miles South of M	1000	121.08330000000	-29.83330000000	24557	Megapodiidae	Leipoa	ocellata	Animalia
Leipoa ocellata	malleefowl	BIRD	Threatened - Vulnerab	VU	VU	13/08/1967	13	8	1967	89867	TFAUNA	Moderately cer	Historical (writte	Secondary sig	1	MENZIES	11 miles South of M	1000	121.10285800000	-29.85865000000	24557	Megapodiidae	Leipoa	ocellata	Animalia
Leipoa ocellata	malleefowl	BIRD	Threatened - Vulnerab	VU	VU	24/05/1969	24	5	1969	89896	TFAUNA	Moderately cer	Historical (writte	Secondary sig	0	MENZIES	13 miles South of M	1000	121.08330000000	-29.86660000000	24557	Megapodiidae	Leipoa	ocellata	Animalia
Leipoa ocellata	malleefowl	BIRD	Threatened - Vulnerab	VU	VU	19/07/1974	19	7	1974	89901	TFAUNA	Moderately cer	Opportunistic si	Secondary sig	0	MENZIES	12 miles South of M	1000	121.08330000000	-29.85000000000	24557	Megapodiidae	Leipoa	ocellata	Animalia
Leipoa ocellata	malleefowl	BIRD	Threatened - Vulnerab	VU	VU	7/01/1994	7	1	1994	89929	TFAUNA	Moderately cer	Opportunistic si	Sighting	2	MENZIES	17 km west of Men	0	120.86666670000	-29.71666667000	24557	Megapodiidae	Leipoa	ocellata	Animalia
Leipoa ocellata	malleefowl	BIRD	Threatened - Vulnerab	VU	VU	27/09/1990	27	9	1990	90056	TFAUNA	Moderately cer	Opportunistic si	Sighting	1	ULARRING	29 km east of Menz	0	120.73333330000	-29.73333333000	24557	Megapodiidae	Leipoa	ocellata	Animalia
Leipoa ocellata	malleefowl	BIRD	Threatened - Vulnerab	VU	VU	9/03/1981	9	3	1981	90065	TFAUNA	Moderately cer	Opportunistic si	Secondary sig	0	ULARRING	3 km South "main g	1000	119.58330000000	-29.53330000000	24557	Megapodiidae	Leipoa	ocellata	Animalia
Leipoa ocellata	malleefowl	BIRD	Threatened - Vulnerab	VU	VU	13/05/1964	13	5	1964	90191	TFAUNA	Moderately cer	Historical (writte	Sighting	1	ULARRING	5 miles West North	1000	120.50000000000	-30.10000000000	24557	Megapodiidae	Leipoa	ocellata	Animalia
Leipoa ocellata	malleefowl	BIRD	Threatened - Vulnerab	VU	VU	1/09/1979	1	9	1979	90245	TFAUNA	Moderately cer	Opportunistic si	Secondary sig	0	MENZIES	70 mile peg	10000	121.08330000000	-29.86660000000	24557	Megapodiidae	Leipoa	ocellata	Animalia
Leipoa ocellata	malleefowl	BIRD	Threatened - Vulnerab	VU	VU	20/11/1993	20	11	1993	90410	TFAUNA	Moderately cer	Opportunistic si	Sighting	1	ULARRING	Between Mt Elvire S	0	119.53333330000	-29.58333333000	24557	Megapodiidae	Leipoa	ocellata	Animalia
Leipoa ocellata	malleefowl	BIRD	Threatened - Vulnerab	VU	VU	1/03/1981	1	3	1981	90728	TFAUNA	Moderately cer	Opportunistic si	Sighting	1	ULARRING	Elvire Rock at Mt Elv	10000	119.59722220000	-29.50500000000	24557	Megapodiidae	Leipoa	ocellata	Animalia
Leipoa ocellata	malleefowl	BIRD	Threatened - Vulnerab	VU	VU	1/09/1980	1	9	1980	91018	TFAUNA	Moderately cer	Opportunistic si	Sighting	1	ULARRING	Lake Barlee on Mt E	0	119.66472220000	-29.51638889000	24557	Megapodiidae	Leipoa	ocellata	Animalia
Leipoa ocellata	malleefowl	BIRD	Threatened - Vulnerab	VU	VU	16/04/2002	16	4	2002	91125	TFAUNA	Moderately cer	Opportunistic si	Sighting	2	MENZIES	Menzies Sandstone	0	121.00000000000	-29.50000000000	24557	Megapodiidae	Leipoa	ocellata	Animalia
Leipoa ocellata	malleefowl	BIRD	Threatened - Vulnerab	VU	VU	1/01/1995	1	1	1995	91262	TFAUNA	Moderately cer	Opportunistic si	Sighting	1	MENZIES	Near intersection of	0	121.10000000000	-29.86666667000	24557	Megapodiidae	Leipoa	ocellata	Animalia
Leipoa ocellata	malleefowl	BIRD	Threatened - Vulnerab	VU	VU	6/07/1994	6	7	1994	91379	TFAUNA	Moderately cer	Opportunistic si	Sighting	2	ULARRING	Nr Hospital Rocks	0	120.10000000000	-29.83333333000	24557	Megapodiidae	Leipoa	ocellata	Animalia
Leipoa ocellata	malleefowl	BIRD	Threatened - Vulnerab	VU	VU	1/01/2001	1	1	2001	91552	TFAUNA	Moderately cer	Opportunistic si	Sighting	1	ULARRING	Perrinvale Outstatic	500	120.17027000000	-28.98000000000	24557	Megapodiidae	Leipoa	ocellata	Animalia
Leipoa ocellata	malleefowl	BIRD	Threatened - Vulnerab	VU	VU	10/06/1995	10	6	1995	91814	TFAUNA	Moderately cer	Opportunistic si	Sighting	1	ULARRING	Walling Rock Statio	0	120.38333330000	-29.26666667000	24557	Megapodiidae	Leipoa	ocellata	Animalia
Leipoa ocellata	malleefowl	BIRD	Threatened - Vulnerab	VU	VU	6/09/2017	6	9	2017	92523	TFAUNA	Certain	Opportunistic si	Day sighting	1	Credo	ex-Credo Ucl - Dept	1000	120.48820000000	-29.94830000000	24557	Megapodiidae	Leipoa	ocellata	Animalia
Leipoa ocellata	malleefowl	BIRD	Threatened - Vulnerab	VU	VU	5/04/2018	5	4	2018	94510	TFAUNA	Very Certain (pl	Survey	Day sighting	1	Ularring	UCL, b/w Walling R	50	119.81534720000	-29.57646355000	24557	Megapodiidae	Leipoa	ocellata	Animalia
Leipoa ocellata	malleefowl	BIRD	Threatened - Vulnerab	VU	VU	1/01/2013	1	1	2013	96058	TFAUNA	Certain	Opportunistic si	Day sighting	0	Mount Ida Range	Mount Ida Range, a	1000	120.40250000000	-29.22860000000	24557	Megapodiidae	Leipoa	ocellata	Animalia
Leipoa ocellata	malleefowl	BIRD	Threatened - Vulnerab	VU	VU	20/03/2007	20	3	2007	96658	TFAUNA	Certain	Opportunistic	sighting	1	Menzies	Riverina Station, me	1000	121.02850000000	-29.69360000000	24557	Megapodiidae	Leipoa	ocellata	Animalia
Leipoa ocellata	malleefowl	BIRD	Threatened - Vulnerab	VU	VU	20/08/2007	20	8	2007	96677	TFAUNA	Certain	Opportunistic	sighting	0	Menzies	Walling Rock Statio	1000	120.39990000000	-29.34960000000	24557	Megapodiidae	Leipoa	ocellata	Animalia
Leipoa ocellata	malleefowl	BIRD	Threatened - Vulnerab	VU	VU	12/07/2012	12	7	2012	96755	TFAUNA	Certain	Opportunistic si	Day sighting	1	Goongarrie	Goongarrie Station	1000	121.04490000000	-29.96800000000	24557	Megapodiidae	Leipoa	ocellata	Animalia
Leipoa ocellata	malleefowl	BIRD	Threatened - Vulnerab	VU	VU	18/04/2012	18	4	2012	96769	TFAUNA	Certain	Opportunistic	sighting	0	Menzies	Northern end of Cre	1000	120.58500000000	-29.86833333000	24557	Megapodiidae	Leipoa	ocellata	Animalia
Leipoa ocellata	malleefowl	BIRD	Threatened - Vulnerab	VU	VU	25/09/2008	25	9	2008	96810	TFAUNA	Certain	Opportunistic	sighting	0	Menzies	approx. 2.6km nortl	1000	120.41671510000	-29.20726171000	24557	Megapodiidae	Leipoa	ocellata	Animalia
Leipoa ocellata	malleefowl	BIRD	Threatened - Vulnerab	VU	VU	20/10/2008	20	10	2008	96813	TFAUNA	Certain	Opportunistic si	Day sighting	1	Menzies	approx. 2km west o	1000	121.08656820000	-29.84788566000	24557	Megapodiidae	Leipoa	ocellata	Animalia
Leipoa ocellata	malleefowl	BIRD	Threatened - Vulnerab	VU	VU	15/05/2008	15	5	2008	96818	TFAUNA	Certain	Opportunistic	sighting	1	Menzies	track of the Daryhu	1000	120.51833330000	-29.91833333000	24557	Megapodiidae	Leipoa	ocellata	Animalia
Leipoa ocellata	malleefowl	BIRD	Threatened - Vulnerab	VU	VU	8/06/2008	8	6	2008	96821	TFAUNA	Certain	Opportunistic	sighting	2	Goongarrie	Goongarrie station	1000	121.04160000000	-29.97800000000	24557	Megapodiidae	Leipoa	ocellata	Animalia
Leipoa ocellata	malleefowl	BIRD	Threatened - Vulnerab	VU	VU	29/01/2008	29	1	2008	96867	TFAUNA	Certain	Opportunistic	sighting	3	Menzies	Mount Ida Rd - 100	1000	120.38631860000	-29.14293058000	24557	Megapodiidae	Leipoa	ocellata	Animalia
Leipoa ocellata	malleefowl	BIRD	Threatened - Vulnerab	VU	VU	5/11/2009	5	11	2009	96887	TFAUNA	Certain	Opportunistic	sighting	2	Menzies	Mt Elvire proposed	1000	119.70972220000	-29.58555556000	24557	Megapodiidae	Leipoa	ocellata	Animalia
Leipoa ocellata	malleefowl	BIRD	Threatened - Vulnerab	VU	VU	19/10/2010	19	10	2010	96978	TFAUNA	Certain	Opportunistic	sighting	1	Menzies	1km NE of Goongar	10000	121.06277520000	-29.95166274000	24557	Megapodiidae	Leipoa	ocellata	Animalia
Leipoa ocellata	malleefowl	BIRD	Threatened - Vulnerab	VU	VU	12/08/2011	12	8	2011	97004	TFAUNA	Certain	Opportunistic	sighting	1	Ularring	Evanston-Menzies R	10000	120.30769520000	-29.85299561000	24557	Megapodiidae	Leipoa	ocellata	Animalia
Leipoa ocellata	malleefowl	BIRD	Threatened - Vulnerab	VU	VU	13/12/2011	13	12	2011	97319	TFAUNA	Certain	Opportunistic si	Sighting	2	Northern Goldfields	HWY	1000	121.25870000000	-29.44750000000	24557	Megapodiidae	Leipoa	ocellata	Animalia
Leipoa ocellata	malleefowl	BIRD	Threatened - Vulnerab	VU	VU	13/07/2013	13	7	2013	97324	TFAUNA	Certain	Opportunistic si	Dusk sighting	1	Menzies	14km west of Menz	1000	120.88240000000	-29.71630000000	24557	Megapodiidae	Leipoa	ocellata	Animalia
Leipoa ocellata	malleefowl	BIRD	Threatened - Vulnerab	VU	VU	3/03/2019	3	3	2019	98456	TFAUNA	Very Certain (pl	Opportunistic si	Day sighting	1	Davyhurst Road, Menzies		500	120.66999850000	-29.97749635000	24557	Megapodiidae	Leipoa	ocellata	Animalia
Leipoa ocellata	malleefowl	BIRD	Threatened - Vulnerab	VU	VU	21/09/2019	21	9	2019	103002	TFAUNA	Certain	Opportunistic si	Sighting	1	Goongarrie Station	150m from the stat	50	120.82680000000	-30.04870000000	24557	Megapodiidae	Leipoa	ocellata	Animalia
Leipoa ocellata	malleefowl	BIRD	Threatened - Vulnerab	VU	VU	23/01/2020	23	1	2020	133006	TFAUNA	Very Certain (pl	Opportunistic si	Dead	1	Credo	Davyhurst-Mulline F	50	120.54119140000	-29.93688872000	24557	Megapodiidae	Leipoa	ocellata	Animalia
Leipoa ocellata	malleefowl	BIRD	Threatened - Vulnerab	VU	VU	29/04/2020	29	4	2020	140171	TFAUNA	Certain	Opportunistic si	Day sighting	1	Lake Guilies PEC	Macarthur Minerals	50	120.03305560000	-30.01722222000	24557	Megapodiidae	Leipoa	ocellata	Animalia
Calonectris leucomelas	Streaked shearwater	BIRD	Specially Protected - n	MI	MI	20/03/2012	20	3	2012	AVIF:37771	WAM_BIRDS	WAM Vouchere	Collection	Specimen	1	ULARRING	Camp Lake Ida mine	50000	120.47000000000	-29.11670000000	24686	Procellariidae	Calonectris	leucomelas	Animalia
Calonectris leucomelas	Streaked shearwater	BIRD	Specially Protected - n	MI	MI	20/03/2012	20	3	2012	AVIF:37782	WAM_BIRDS	WAM Vouchere	Collection	Specimen	1	ULARRING	Camp Lake Ida mine	50000	120.47000000000	-29.11670000000	24686	Procellariidae	Calonectris	leucomelas	Animalia
Calonectris leucomelas	Streaked shearwater	BIRD	Specially Protected - n	MI	MI	20/03/2012	20	3	2012	AVIF:37783	WAM_BIRDS	WAM Vouchere	Collection	Specimen	1	ULARRING	Camp Lake Ida mine	50000	120.47000000000	-29.11670000000	24686	Procellariidae	Calonectris	leucomelas	Animalia
Calonectris leucomelas	Streaked shearwater	BIRD	Specially Protected - n	MI	MI	20/03/2012	20	3	2012	urn:lsid:taxonomy.c	WAM_BIRDS	WAM Vouchere	Collection	Specimen	1		Camp Lake Ida mine	50000	120.47000000000	-29.11670000000	24686	Procellariidae	Calonectris	leucomelas	Animalia
Calonectris leucomelas	Streaked shearwater	BIRD	Specially Protected - n	MI	MI	20/03/2012	20	3	2012	urn:lsid:taxonomy.c	WAM_BIRDS	WAM Vouchere	Collection	Specimen	1		Camp Lake Ida mine	50000	120.47000000000	-29.11670000000	24686	Procellariidae	Calonectris	leucomelas	Animalia
Calonectris leucomelas	Streaked shearwater	BIRD	Specially Protected - n	MI	MI	20/03/2012	20	3	2012	urn:lsid:taxonomy.c	WAM_BIRDS	WAM Vouchere	Collection	Specimen	1		Camp Lake Ida mine	50000	120.47000000000	-29.11670000000	24686	Procellariidae	Calonectris	leucomelas	Animalia

NatureMap
Mapping Western Australia's biodiversity

NatureMap Species Report

Created By Guest user on 03/05/2021

Kingdom	Animalia
Current Names Only	Yes
Core Datasets Only	Yes
Method	'By Circle'
Centre	120° 22' 05" E,29° 07' 50" S
Buffer	40km
Group By	Conservation Status

Conservation Status	Species	Records
Non-conservation taxon	103	655
Priority 4	1	5
Protected under international agreement	1	3
Rare or likely to become extinct	1	4
TOTAL	**106**	**667**

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Rare or likely to become extinct					
1.	24557	*Leipoa ocellata (Malleefowl)*		T	
Protected under international agreement					
2.	24686	*Calonectris leucomelas (Streaked Shearwater)*		IA	
Priority 4					
3.	24115	*Sminthopsis longicaudata (Long-tailed Dunnart)*		P4	
Non-conservation taxon					
4.	24559	*Acanthagenys rufogularis (Spiny-cheeked Honeyeater)*			
5.	24260	*Acanthiza apicalis (Broad-tailed Thornbill, Inland Thornbill)*			
6.	24261	*Acanthiza chrysorrhoa (Yellow-rumped Thornbill)*			
7.	24264	*Acanthiza robustirostris (Slaty-backed Thornbill)*			
8.	24265	*Acanthiza uropygialis (Chestnut-rumped Thornbill)*			
9.		*Aname tepperi*			
10.	25448	*Antaresia stimsoni (Stimson's Python)*			
11.	24561	*Anthochaera carunculata (Red Wattlebird)*			
12.	25528	*Aphelocephala leucopsis (Southern Whiteface)*			
13.	24285	*Aquila audax (Wedge-tailed Eagle)*			
14.	25566	*Artamus cinereus (Black-faced Woodswallow)*			
15.		*Barnardius zonarius*			
16.	24251	*Bos taurus (European Cattle)*	Y		
17.		*Cethegus fugax*			
18.	24377	*Charadrius ruficapillus (Red-capped Plover)*			
19.	47909	*Cheramoeca leucosterna (White-backed Swallow)*			
20.	25580	*Cinclosoma castaneothorax (Chestnut-breasted Quail-thrush)*			
21.	25675	*Colluricincla harmonica (Grey Shrike-thrush)*			
22.	25568	*Coracina novaehollandiae (Black-faced Cuckoo-shrike)*			
23.	24416	*Corvus bennetti (Little Crow)*			
24.	25592	*Corvus coronoides (Australian Raven)*			
25.	25593	*Corvus orru (Torresian Crow)*			
26.	24420	*Cracticus nigrogularis (Pied Butcherbird)*			
27.	25595	*Cracticus tibicen (Australian Magpie)*			
28.	25596	*Cracticus torquatus (Grey Butcherbird)*			
29.	24886	*Ctenophorus reticulatus (Western Netted Dragon)*			
30.	24889	*Ctenophorus scutulatus (Lozenge-marked Dragon)*			
31.	25052	*Ctenotus leonhardii*			
32.	25054	*Ctenotus mimetes*			
33.	25074	*Ctenotus schomburgkii*			
34.	25673	*Daphoenositta chrysoptera (Varied Sittella)*			
35.	25468	*Demansia psammophis (Yellow-faced Whipsnake)*			
36.	24940	*Diplodactylus pulcher*			
37.	24470	*Dromaius novaehollandiae (Emu)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
38.	25092	*Egernia depressa (Southern Pygmy Spiny-tailed Skink)*			
39.		*Eolophus roseicapillus*			
40.	24570	*Epthianura tricolor (Crimson Chat)*			
41.	25109	*Eremiascincus richardsonii (Broad-banded Sand Swimmer)*			
42.		*Eucyrtops eremaea*			
43.	24368	*Eurostopodus argus (Spotted Nightjar)*			
44.	25622	*Falco cenchroides (Australian Kestrel, Nankeen Kestrel)*			
45.	24959	*Gehyra variegata*			
46.		*Geogarypus taylori*			
47.	24443	*Grallina cyanoleuca (Magpie-lark)*			
48.	24961	*Heteronotia binoei (Bynoe's Gecko)*			
49.	24491	*Hirundo neoxena (Welcome Swallow)*			
50.		*Hoggicosa castanea*			
51.		*Lampona ampeinna*			
52.		*Lampona quinqueplagiata*			
53.	25661	*Lichmera indistincta (Brown Honeyeater)*			
54.	25489	*Macropus robustus (Euro, Biggada)*			
55.	25652	*Malurus leucopterus (White-winged Fairy-wren)*			
56.	25654	*Malurus splendens (Splendid Fairy-wren)*			
57.	24583	*Manorina flavigula (Yellow-throated Miner)*			
58.	47997	*Melanodryas cucullata (Hooded Robin)*			
59.	25663	*Melithreptus brevirostris (Brown-headed Honeyeater)*			
60.	25184	*Menetia greyii*			
61.	24598	*Merops ornatus (Rainbow Bee-eater)*			
62.		*Missulena occatoria*			
63.	25190	*Morethia butleri*			
64.	24223	*Mus musculus (House Mouse)*	Y		
65.	25427	*Neobatrachus sutor (Shoemaker Frog)*			
66.	25497	*Nephrurus levis*			
67.	24967	*Nephrurus levis subsp. levis*			
68.	24971	*Nephrurus vertebralis*			
69.	24094	*Ningaui ridei (Wongai Ningaui)*			
70.	24224	*Notomys alexis (Spinifex Hopping-mouse)*			
71.	24407	*Ocyphaps lophotes (Crested Pigeon)*			
72.	24618	*Oreoica gutturalis (Crested Bellbird)*			
73.	24085	*Oryctolagus cuniculus (Rabbit)*	Y		
74.	24619	*Pachycephala inornata (Gilbert's Whistler)*			
75.	25680	*Pachycephala rufiventris (Rufous Whistler)*			
76.	25682	*Pardalotus striatus (Striated Pardalote)*			
77.	24659	*Petroica goodenovii (Red-capped Robin)*			
78.	24409	*Phaps chalcoptera (Common Bronzewing)*			
79.		*Pilbarascutigera incola*			
80.	25510	*Pogona minor (Dwarf Bearded Dragon)*			
81.	24683	*Pomatostomus superciliosus (White-browed Babbler)*			
82.	24106	*Pseudantechinus woolleyae (Woolley's Pseudantechinus)*			
83.	25262	*Pseudechis butleri (Spotted Mulga Snake)*			
84.	24237	*Pseudomys hermannsburgensis (Sandy Inland Mouse)*			
85.	25263	*Pseudonaja modesta (Ringed Brown Snake)*			
86.	25434	*Pseudophryne occidentalis (Western Toadlet)*			
87.	42344	*Purnella albifrons (White-fronted Honeyeater)*			
88.	24278	*Pyrrholaemus brunneus (Redthroat)*			
89.	48096	*Rhipidura albiscapa (Grey Fantail)*			
90.	25614	*Rhipidura leucophrys (Willie Wagtail)*			
91.		*Scolopendra laeta*			
92.		*Selenotholus foelschei*			
93.	30948	*Smicrornis brevirostris (Weebill)*			
94.	24109	*Sminthopsis dolichura (Little long-tailed Dunnart)*			
95.	24114	*Sminthopsis hirtipes (Hairy-footed Dunnart)*			
96.	25597	*Strepera versicolor (Grey Currawong)*			
97.	24923	*Strophurus assimilis (Goldfields Spiny-tailed Gecko)*			
98.	24946	*Strophurus strophurus*			
99.		*Synsphyronus mimulus*			
100.	24207	*Tachyglossus aculeatus (Short-beaked Echidna)*			
101.	30870	*Taeniopygia guttata (Zebra Finch)*			
102.	25211	*Varanus caudolineatus*			
103.	25218	*Varanus gouldii (Bungarra or Sand Monitor)*			
104.	25524	*Varanus panoptes (Yellow-spotted Monitor)*			
105.	25526	*Varanus tristis (Racehorse Monitor)*			
106.		*Zebraplatys fractivittata*			

Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area

Conservation Codes
T - Rare or likely to become extinct
X - Presumed extinct
IA - Protected under international agreement
S - Other specially protected fauna
1 - Priority 1
2 - Priority 2
3 - Priority 3
4 - Priority 4
5 - Priority 5

[1] For NatureMap's purposes, species flagged as endemic are those whose records are wholely contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

Australian Government

Department of Agriculture, Water and the Environment

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

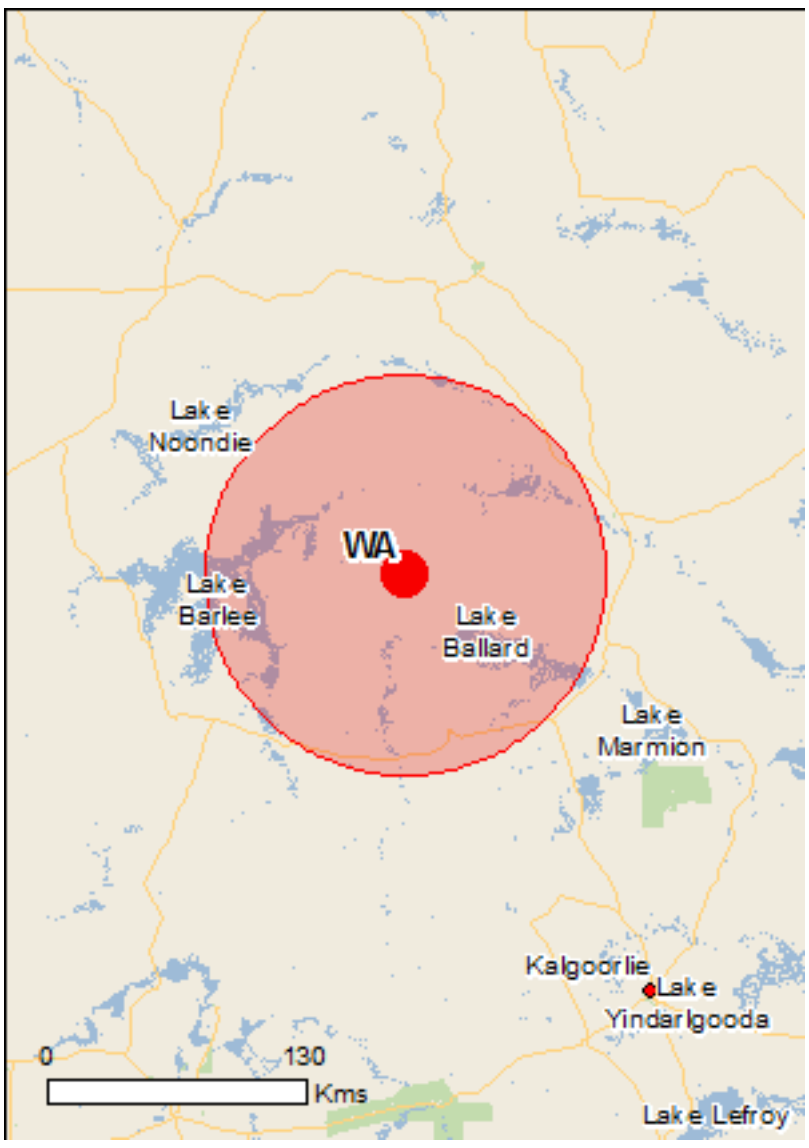
Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 12/07/21 12:23:36

Summary
Details
- Matters of NES
- Other Matters Protected by the EPBC Act
- Extra Information

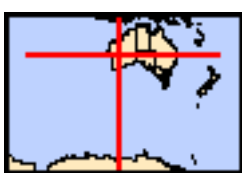
Caveat
Acknowledgements



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2015

Coordinates

Buffer: 100.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	8
Listed Migratory Species:	7

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	11
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	3
Regional Forest Agreements:	None
Invasive Species:	15
Nationally Important Wetlands:	2
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat may occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat known to occur within area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat may occur within area
Polytelis alexandrae Princess Parrot, Alexandra's Parrot [758]	Vulnerable	Species or species habitat likely to occur within area
Mammals		
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat may occur within area
Plants		
Myriophyllum lapidicola Chiddarcooping Myriophyllum [55940]	Endangered	Species or species habitat known to occur within area
Ricinocarpos brevis [82879]	Endangered	Species or species habitat known to occur within area
Tetratheca paynterae Paynter's Tetratheca [66451]	Endangered	Species or species habitat may occur within area

Listed Migratory Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Motacilla flava		
Yellow Wagtail [644]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat likely to occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat may occur within area
Tringa nebularia		
Common Greenshank, Greenshank [832]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land -

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat likely to occur within area
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat may occur within area
Chrysococcyx osculans		
Black-eared Cuckoo [705]		Species or species habitat known to occur within area
Merops ornatus		
Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea		
Grey Wagtail [642]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Motacilla flava		
Yellow Wagtail [644]		Species or species habitat may occur within area
Thinornis rubricollis		
Hooded Plover [59510]		Species or species habitat known to occur within area
Tringa nebularia		
Common Greenshank, Greenshank [832]		Species or species habitat may occur within area

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Bulga Downs & Cashmere Downs Pastoral leases portions	WA
Credo	WA
Mount Manning Range	WA

Invasive Species	[Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Columba livia		
Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Streptopelia senegalensis		
Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Mammals		
Camelus dromedarius		
Dromedary, Camel [7]		Species or species habitat likely to occur within area
Canis lupus familiaris		
Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus		
Goat [2]		Species or species habitat likely to occur within area
Equus asinus		
Donkey, Ass [4]		Species or species habitat likely to occur within area
Equus caballus		
Horse [5]		Species or species habitat likely to occur within area
Felis catus		
Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Carrichtera annua Ward's Weed [9511]		Species or species habitat likely to occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Cylindropuntia spp. Prickly Pears [85131]		Species or species habitat likely to occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area

Nationally Important Wetlands	[Resource Information]
Name	State
Lake Ballard	WA
Lake Barlee	WA

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-29.13056 120.36806

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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Appendix 3: Habitat Assessments

FAUNA HABITAT ASSESSMENT SHEET

Mid-west

Location: Mount Mason	**Site Number: HA1**
Project Number:	

Date: 14/5/21	**Easting: 243104**	**Aspect**	N	NE	SW	NW
Quadrat Size: 50 x 50 m	**Northing: 6775653**		E	SE	**W**	N/A

Soil Texture	sand	**sandy-loam**	loam	cracking clay	clay

VEGETATION

Vegetation Description				Average Height in metres	Cover				
	Hummock Grassland	Other: **Mulga Shrubland**							
	Acacia Shrubland	**Stratum**			**Scattered Plants**	**Sparse**	**Moderate**	**Thick**	
	Riverine Woodland	**Overstorey**	*Acacia aneura*	**4**	0 <5%	**1 <20%**	2 20-60%	3 60-100%	
	Other Grassland	**Midstorey**	*Eremophila sp.*	**1**	0 <5%	**1 <20%**	2 20-60%	3 60-100%	
	Euc Woodland	**Ground Cover**			0 <5%	1 <20%	2 20-60%	3 60-100%	

CONDITION							**LAST FIRE**		
Scale:	5 Pristine	**4 Excellent**	3 Very Good	2 Good	1 Degraded	0 Completely Degraded	0 <1 year	1 1 -3 Yr	2 4-5 Yr	**3 >5 Yr**

	(general)			**DISTURBANCE**			**(cattle)**		
	0 heavy	1 medium*	2 mild	3 none		0 heavy	1 medium	2 mild	3 none

GROUND COVER

Bare Ground	0 <5%	1 <20%	2 20-60%	**3 60-100%**	**Hummock Grass**	**0 <5%**	1 <20%	2 20-60%	3 60-100%
Rock	0 <5%	1 <20%	2 20-60%	**3 60-100%**	**Other Grass**	**0 <5%**	1 <20%	2 20-60%	3 60-100% *
Leaf Litter	**0 <5%**	1 <20%	2 20-60%	3 60-100%	**Herbs**	**0 <5%**	1 <20%	2 20-60%	3 60-100%
Logs >10cm	**0 <5%**	1 <20%	2 20-60%	3 60-100%	**Other**	**0 <5%**	1 <20%	2 20-60%	3 60-100%

MICROHABITATS

Burrowing Suitability	0 Rock	**1 Stony**	2 Sandy Loam	3 Sand	**Peeling Bark**	0 none	**1 rare**	2 moderate	3 common
Pebbles Stones	0 none	1 0-30%	**2 30-70%**	3 70-100%	**Large Hollows**	**0 none**	1 rare	2 moderate	3 common
Exfoliating Slabs	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Small Hollows**	**0 none**	1 rare	2 moderate	3 common
Rock Crevices	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Water Prescence**	**0 none**	1 rare	2 moderate	3 common
Boulders	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Distance to Water**	**0 >5km**	1 2-5km	2 500m - 2km	3 <500m
Suitability for Bats	YES		**NO**		**Termite Mounds**	**0 none**	1 rare	2 moderate	3 common
Caves	**Absent**	Present			**Woody Debris**	0 none	**1 rare**	2 moderate	3 common

SPECIES

Malleefowl	**YES**	NO	DETAILS	**Could forage in area given nearby records, old mounds and recent sighting.**
Night Parrot	YES	**NO**		
Long-tailed Dunnart	YES	**NO**		

Birds	**Mammals**	**Reptiles**

FAUNA HABITAT ASSESSMENT SHEET

Mid-west

Location: Mount Mason	**Site Number: HA2**
Project Number:	

Date: 14/5/21	**Easting: 242990**	**Aspect**	N	NE	SW	NW
Quadrat Size: 50 x 50 m	**Northing: 6775846**		E	SE	**W**	N/A

Soil Texture	sand	**sandy-loam**	loam	cracking clay	clay

VEGETATION

Vegetation Description				Average Height in metres	Cover				
	Hummock Grassland	Other:**Mulga Shrubland**							
	Acacia Shrubland	**Stratum**			**Scattered Plants**	**Sparse**	**Moderate**	**Thick**	
	Riverine Woodland	**Overstorey**	*Acacia aneura*	**4**	0 <5%	**1 <20%**	2 20-60%	3 60-100%	
	Other Grassland	**Midstorey**	*Eremophila sp.*	**1**	0 <5%	**1 <20%**	2 20-60%	3 60-100%	
	Euc Woodland	**Ground Cover**			0 <5%	1 <20%	2 20-60%	3 60-100%	

CONDITION							**LAST FIRE**		
Scale:	5 Pristine	**4 Excellent**	3 Very Good	2 Good	1 Degraded	0 Completely Degraded	0 <1 year	1 1 -3 Yr	2 4-5 Yr	**3 >5 Yr**

	(general)			**DISTURBANCE**			**(cattle)**		
	0 heavy	1 medium*	2 mild	**3 none**		0 heavy	1 medium	2 mild	**3 none**

GROUND COVER

Bare Ground	0 <5%	1 <20%	2 20-60%	**3 60-100%**	**Hummock Grass**	**0 <5%**	1 <20%	2 20-60%	3 60-100%
Rock	0 <5%	1 <20%	2 20-60%	**3 60-100%**	**Other Grass**	**0 <5%**	1 <20%	2 20-60%	3 60-100% *
Leaf Litter	**0 <5%**	1 <20%	2 20-60%	3 60-100%	**Herbs**	**0 <5%**	1 <20%	2 20-60%	3 60-100%
Logs >10cm	**0 <5%**	1 <20%	2 20-60%	3 60-100%	**Other**	**0 <5%**	1 <20%	2 20-60%	3 60-100%

MICROHABITATS

Burrowing Suitability	0 Rock	**1 Stony**	2 Sandy Loam	3 Sand	**Peeling Bark**	0 none	**1 rare**	2 moderate	3 common
Pebbles Stones	0 none	1 0-30%	2 30-70%	**3 70-100%**	**Large Hollows**	**0 none**	1 rare	2 moderate	3 common
Exfoliating Slabs	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Small Hollows**	**0 none**	1 rare	2 moderate	3 common
Rock Crevices	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Water Prescence**	**0 none**	1 rare	2 moderate	3 common
Boulders	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Distance to Water**	**0 >5km**	1 2-5km	2 500m - 2km	3 <500m
Suitability for Bats	YES		**NO**		**Termite Mounds**	**0 none**	1 rare	2 moderate	3 common
Caves	**Absent**	Present			**Woody Debris**	0 none	**1 rare**	2 moderate	3 common

SPECIES

Malleefowl	**YES**	NO	DETAILS	**Could forage in area given nearby records, old mounds and recent sighting.**
Night Parrot	YES	**NO**		
Long-tailed Dunnart	YES	**NO**		

Birds	**Mammals**	**Reptiles**

FAUNA HABITAT ASSESSMENT SHEET

Mid-west

Location: Mount Mason	**Site Number: HA3**
Project Number:	

Date: 14/5/21	**Easting: 242743**	**Aspect**	N	NE	SW	NW
Quadrat Size: 50 x 50 m	**Northing: 6775862**		E	SE	**W**	N/A

Soil Texture	sand	sandy-loam	loam	cracking clay	clay

VEGETATION

Vegetation Description				**Average Height in metres**	**Cover**				
	Hummock Grassland	Other: **Mulga Shrubland**							
	Acacia Shrubland	**Stratum**			**Scattered Plants**	**Sparse**	**Moderate**	**Thick**	
	Riverine Woodland	**Overstorey**	*Acacia aneura, Allocasuartina sp.*	**2.5**	0 <5%	**1 <20%**	2 20-60%	3 60-100%	
	Other Grassland	**Midstorey**	*Eremophila sp.*	**1**	0 <5%	**1 <20%**	2 20-60%	3 60-100%	
	Euc Woodland	**Ground Cover**			0 <5%	1 <20%	2 20-60%	3 60-100%	

	CONDITION					**LAST FIRE**			
Scale:	5 Pristine	**4 Excellent**	3 Very Good	2 Good	1 Degraded	0 Completely Degraded	0 <1 year	1 1 -3 Yr	2 4-5 Yr	**3 >5 Yr**

	(general)			**DISTURBANCE**		**(cattle)**			
	0 heavy	1 medium*	2 mild	**3 none**		0 heavy	1 medium	2 mild	**3 none**

GROUND COVER

Bare Ground	0 <5%	1 <20%	2 20-60%	**3 60-100%**	**Hummock Grass**	**0 <5%**	1 <20%	2 20-60%	3 60-100%
Rock	0 <5%	1 <20%	2 20-60%	**3 60-100%**	**Other Grass**	**0 <5%**	1 <20%	2 20-60%	3 60-100% *
Leaf Litter	**0 <5%**	1 <20%	2 20-60%	3 60-100%	**Herbs**	**0 <5%**	1 <20%	2 20-60%	3 60-100%
Logs >10cm	**0 <5%**	1 <20%	2 20-60%	3 60-100%	**Other**	**0 <5%**	1 <20%	2 20-60%	3 60-100%

MICROHABITATS

Burrowing Suitability	**0 Rock**	1 Stony	2 Sandy Loam	3 Sand	**Peeling Bark**	0 none	**1 rare**	2 moderate	3 common
Pebbles Stones	0 none	1 0-30%	2 30-70%	**3 70-100%**	**Large Hollows**	**0 none**	1 rare	2 moderate	3 common
Exfoliating Slabs	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Small Hollows**	**0 none**	1 rare	2 moderate	3 common
Rock Crevices	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Water Prescence**	**0 none**	1 rare	2 moderate	3 common
Boulders	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Distance to Water**	**0 >5km**	1 2-5km	2 500m - 2km	3 <500m
Suitability for Bats	YES		**NO**		**Termite Mounds**	**0 none**	1 rare	2 moderate	3 common
Caves	Absent	Present			**Woody Debris**	0 none	**1 rare**	2 moderate	3 common

SPECIES

Malleefowl	**YES**	NO	DETAILS	**Could forage in area given nearby records, old mounds and recent sighting.**
Night Parrot	YES	**NO**		
Long-tailed Dunnart	YES	**NO**		

Birds	**Mammals**	**Reptiles**

FAUNA HABITAT ASSESSMENT SHEET

Mid-west

Location: Mount Mason	**Site Number: HA4**
Project Number:	

Date: 14/5/21	**Easting: 242563**	**Aspect**	N	NE	SW	NW
Quadrat Size: 50 x 50 m	**Northing: 6776154**		E	SE	**W**	N/A

Soil Texture	sand	**sandy-loam**	loam	cracking clay	clay	

VEGETATION

Vegetation Description				Average Height in metres	Cover				
	Hummock Grassland	Other: **Mulga Shrubland**							
	Acacia Shrubland	**Stratum**			**Scattered Plants**	**Sparse**	**Moderate**	**Thick**	
	Riverine Woodland	**Overstorey**	*Acacia aneura*	**3**	0 <5%	**1 <20%**	2 20-60%	3 60-100%	
	Other Grassland	**Midstorey**	*Eremophila sp.*	**1**	0 <5%	**1 <20%**	2 20-60%	3 60-100%	
	Euc Woodland	**Ground Cover**	Herbs	**0.05**	**0 <5%**	1 <20%	2 20-60%	3 60-100%	

	CONDITION						**LAST FIRE**		
Scale:	5 Pristine	**4 Excellent**	3 Very Good	2 Good	1 Degraded	0 Completely Degraded	0 <1 year	1 1 -3 Yr	2 4-5 Yr	**3 >5 Yr**

	(general)			**DISTURBANCE**			**(cattle)**		
	0 heavy	1 medium*	2 mild	**3 none**		0 heavy	1 medium	2 mild	**3 none**

GROUND COVER

Bare Ground	0 <5%	1 <20%	2 20-60%	**3 60-100%**	**Hummock Grass**	**0 <5%**	1 <20%	2 20-60%	3 60-100%
Rock	0 <5%	1 <20%	**2 20-60%**	3 60-100%	**Other Grass**	**0 <5%**	1 <20%	2 20-60%	3 60-100% *
Leaf Litter	0 <5%	**1 <20%**	2 20-60%	3 60-100%	**Herbs**	**0 <5%**	1 <20%	2 20-60%	3 60-100%
Logs >10cm	**0 <5%**	1 <20%	2 20-60%	3 60-100%	**Other**	**0 <5%**	1 <20%	2 20-60%	3 60-100%

MICROHABITATS

Burrowing Suitability	**0 Rock**	1 Stony	2 Sandy Loam	3 Sand	**Peeling Bark**	0 none	**1 rare**	2 moderate	3 common
Pebbles Stones	0 none	1 0-30%	2 30-70%	**3 70-100%**	**Large Hollows**	**0 none**	1 rare	2 moderate	3 common
Exfoliating Slabs	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Small Hollows**	**0 none**	1 rare	2 moderate	3 common
Rock Crevices	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Water Prescence**	**0 none**	1 rare	2 moderate	3 common
Boulders	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Distance to Water**	**0 >5km**	1 2-5km	2 500m - 2km	3 <500m
Suitability for Bats	YES		**NO**		**Termite Mounds**	**0 none**	1 rare	2 moderate	3 common
Caves	**Absent**	Present			**Woody Debris**	0 none	**1 rare**	2 moderate	3 common

SPECIES

Malleefowl	**YES**	NO	DETAILS	**Could forage in area given nearby records, old mounds and recent sighting.**
Night Parrot	YES	**NO**		
Long-tailed Dunnart	YES	**NO**		

Birds	**Mammals**	**Reptiles**

FAUNA HABITAT ASSESSMENT SHEET

Mid-west

Location: Mount Mason	**Site Number: HA5**
Project Number:	

Date: 15/5/21	**Easting: 242394**	**Aspect**	N	NE	SW	NW
Quadrat Size: 50 x 50 m	**Northing: 6776456**		E	SE	**W**	N/A

Soil Texture	sand	**sandy-loam**	loam	cracking clay	clay	

VEGETATION

Vegetation Description				Average Height in metres	Cover				
	Hummock Grassland	Other:**Mulga Shrubland**							
	Acacia Shrubland	**Stratum**			**Scattered Plants**	**Sparse**	**Moderate**	**Thick**	
	Riverine Woodland	**Overstorey**	*Acacia aneura*	**4**	0 <5%	**1 <20%**	2 20-60%	3 60-100%	
	Other Grassland	**Midstorey**	*Acacia aneura*	**1**	**0 <5%**	1 <20%	2 20-60%	3 60-100%	
	Euc Woodland	**Ground Cover**			0 <5%	1 <20%	2 20-60%	3 60-100%	

CONDITION							**LAST FIRE**		
Scale:	5 Pristine	**4 Excellent**	3 Very Good	2 Good	1 Degraded	0 Completely Degraded	0 <1 year	1 1 -3 Yr	2 4-5 Yr	**3 >5 Yr**

(general)			**DISTURBANCE**			**(cattle)**			
	0 heavy	1 medium*	2 mild	**3 none**		0 heavy	1 medium	2 mild	**3 none**

GROUND COVER

Bare Ground	0 <5%	1 <20%	2 20-60%	**3 60-100%**	**Hummock Grass**	**0 <5%**	1 <20%	2 20-60%	3 60-100%
Rock	0 <5%	1 <20%	2 20-60%	**3 60-100%**	**Other Grass**	**0 <5%**	1 <20%	2 20-60%	3 60-100% *
Leaf Litter	0 <5%	**1 <20%**	2 20-60%	3 60-100%	**Herbs**	**0 <5%**	1 <20%	2 20-60%	3 60-100%
Logs >10cm	**0 <5%**	1 <20%	2 20-60%	3 60-100%	**Other**	**0 <5%**	1 <20%	2 20-60%	3 60-100%

MICROHABITATS

Burrowing Suitability	**0 Rock**	1 Stony	2 Sandy Loam	3 Sand	**Peeling Bark**	0 none	**1 rare**	2 moderate	3 common
Pebbles Stones	0 none	1 0-30%	2 30-70%	**3 70-100%**	**Large Hollows**	**0 none**	1 rare	2 moderate	3 common
Exfoliating Slabs	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Small Hollows**	**0 none**	1 rare	2 moderate	3 common
Rock Crevices	0 none	**1 0-30%**	2 30-70%	3 70-100%	**Water Prescence**	**0 none**	1 rare	2 moderate	3 common
Boulders	0 none	**1 0-30%**	2 30-70%	3 70-100%	**Distance to Water**	**0 >5km**	1 2-5km	2 500m - 2km	3 <500m
Suitability for Bats	YES		**NO**		**Termite Mounds**	**0 none**	1 rare	2 moderate	3 common
Caves	**Absent**	Present			**Woody Debris**	0 none	**1 rare**	2 moderate	3 common

SPECIES

Malleefowl	**YES**	NO	DETAILS	**Could forage in area given nearby records, old mounds and recent sighting.**
Night Parrot	YES	**NO**		
Long-tailed Dunnart	**YES**	NO		**Could occur as the area is a small ridge with some small boulders for shelter.**

Birds	**Mammals**	**Reptiles**

FAUNA HABITAT ASSESSMENT SHEET

Mid-west

Location: Mount Mason	**Site Number: HA6**
Project Number:	

Date: 15/5/21	**Easting: 243821**	**Aspect**	N	NE	SW	NW
Quadrat Size: 50 x 50 m	**Northing: 6776251**		**E**	SE	W	N/A

Soil Texture	sand	**sandy-loam**	loam	cracking clay	clay	

VEGETATION

Vegetation Description				**Average Height in metres**	**Cover**				
	Hummock Grassland	Other: **Mulga Shrubland**							
	Acacia Shrubland	**Stratum**			**Scattered Plants**	**Sparse**	**Moderate**	**Thick**	
	Riverine Woodland	**Overstorey**	*Acacia aneura*	**4**	0 <5%	**1 <20%**	2 20-60%	3 60-100%	
	Other Grassland	**Midstorey**	*Eremophila sp.*	**1**	0 <5%	**1 <20%**	2 20-60%	3 60-100%	
	Euc Woodland	**Ground Cover**			0 <5%	1 <20%	2 20-60%	3 60-100%	

CONDITION							**LAST FIRE**		
Scale:	5 Pristine	**4 Excellent**	3 Very Good	2 Good	1 Degraded	0 Completely Degraded	0 <1 year	1 1 -3 Yr	2 4-5 Yr	**3 >5 Yr**

	(general)			**DISTURBANCE**			**(cattle)**		
	0 heavy	1 medium*	**2 mild**	3 none		0 heavy	1 medium	2 mild	**3 none**

GROUND COVER

Bare Ground	0 <5%	1 <20%	2 20-60%	**3 60-100%**	**Hummock Grass**	**0 <5%**	1 <20%	2 20-60%	3 60-100%
Rock	**0 <5%**	**1 <20%**	2 20-60%	3 60-100%	**Other Grass**	**0 <5%**	1 <20%	2 20-60%	3 60-100% *
Leaf Litter	**0 <5%**	**1 <20%**	2 20-60%	3 60-100%	**Herbs**	**0 <5%**	1 <20%	2 20-60%	3 60-100%
Logs >10cm	**0 <5%**	1 <20%	2 20-60%	3 60-100%	**Other**	**0 <5%**	1 <20%	2 20-60%	3 60-100%

MICROHABITATS

Burrowing Suitability	0 Rock	**1 Stony**	2 Sandy Loam	3 Sand	**Peeling Bark**	0 none	**1 rare**	2 moderate	3 common
Pebbles Stones	0 none	1 0-30%	2 30-70%	**3 70-100%**	**Large Hollows**	**0 none**	1 rare	2 moderate	3 common
Exfoliating Slabs	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Small Hollows**	**0 none**	1 rare	2 moderate	3 common
Rock Crevices	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Water Prescence**	**0 none**	1 rare	2 moderate	3 common
Boulders	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Distance to Water**	**0 >5km**	1 2-5km	2 500m - 2km	3 <500m
Suitability for Bats	YES		**NO**		**Termite Mounds**	**0 none**	1 rare	2 moderate	3 common
Caves	**Absent**	Present			**Woody Debris**	0 none	**1 rare**	2 moderate	3 common

SPECIES

Malleefowl	**YES**	NO	DETAILS	**Could forage in area given nearby records, old mounds and recent sighting.**
Night Parrot	YES	**NO**		
Long-tailed Dunnart	YES	**NO**		

Birds	**Mammals**	**Reptiles**

FAUNA HABITAT ASSESSMENT SHEET

Mid-west

Location: Mount Mason	**Site Number: HA7**
Project Number:	

Date: 16/5/21	**Easting: 243586**	**Aspect**	N	NE	SW	NW
Quadrat Size: 50 x 50 m	**Northing: 6775850**		E	**SE**	W	N/A

Soil Texture	sand	**sandy-loam**	loam	cracking clay	clay	

VEGETATION

Vegetation Description				Average Height in metres	Cover				
	Hummock Grassland	Other: **Mulga Shrubland**							
	Acacia Shrubland	**Stratum**			**Scattered Plants**	**Sparse**	**Moderate**	**Thick**	
	Riverine Woodland	**Overstorey**	*Acacia aneura*	**4**	0 <5%	**1 <20%**	2 20-60%	3 60-100%	
	Other Grassland	**Midstorey**	*Acacia sp., Eremophila sp.*	**2**	0 <5%	**1 <20%**	2 20-60%	3 60-100%	
	Euc Woodland	**Ground Cover**			0 <5%	1 <20%	2 20-60%	3 60-100%	

CONDITION							**LAST FIRE**		
Scale:	5 Pristine	4 Excellent	3 Very Good	**2 Good**	1 Degraded	0 Completely Degraded	0 <1 year	1 1 -3 Yr	2 4-5 Yr	**3 >5 Yr**

	(general)			**DISTURBANCE**			**(cattle)**		
	0 heavy	**1 medium**	2 mild	3 none		0 heavy	1 medium	2 mild	**3 none**	

GROUND COVER

Bare Ground	0 <5%	1 <20%	2 20-60%	**3 60-100%**	**Hummock Grass**	**0 <5%**	1 <20%	2 20-60%	3 60-100%	
Rock	**0 <5%**	1 <20%	2 20-60%	3 60-100%	**Other Grass**	**0 <5%**	1 <20%	2 20-60%	3 60-100% *	
Leaf Litter	**0 <5%**	1 <20%	2 20-60%	3 60-100%	**Herbs**	**0 <5%**	1 <20%	2 20-60%	3 60-100%	
Logs >10cm	**0 <5%**	1 <20%	2 20-60%	3 60-100%	**Other**	**0 <5%**	1 <20%	2 20-60%	3 60-100%	

MICROHABITATS

Burrowing Suitability	0 Rock	**1 Stony**	2 Sandy Loam	3 Sand	**Peeling Bark**	0 none	**1 rare**	2 moderate	3 common
Pebbles Stones	0 none	1 0-30%	2 30-70%	**3 70-100%**	**Large Hollows**	**0 none**	1 rare	2 moderate	3 common
Exfoliating Slabs	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Small Hollows**	**0 none**	1 rare	2 moderate	3 common
Rock Crevices	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Water Prescence**	**0 none**	1 rare	2 moderate	3 common
Boulders	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Distance to Water**	**0 >5km**	1 2-5km	2 500m - 2km	3 <500m
Suitability for Bats	YES		**NO**		**Termite Mounds**	**0 none**	1 rare	2 moderate	3 common
Caves	**Absent**	Present			**Woody Debris**	0 none	1 rare	**2 moderate**	3 common

SPECIES

Malleefowl	**YES**	NO	DETAILS	**Could forage in area given nearby records, old mounds and recent sighting.**
Night Parrot	YES	**NO**		
Long-tailed Dunnart	**YES**	NO		**Could occur as the area is a near ridge with boulders for shelter.**

Birds	**Mammals**	**Reptiles**

FAUNA HABITAT ASSESSMENT SHEET

Mid-west

Location: Mount Mason	**Site Number: HA8**
Project Number:	

Date: 16/5/21	**Easting: 244084**	**Aspect**	N	NE	SW	NW
Quadrat Size: 50 x 50 m	**Northing: 6775655**		E	**SE**	W	N/A

Soil Texture	sand	**sandy-loam**	loam	cracking clay	clay

VEGETATION

Vegetation Description									
	Hummock Grassland	Other:		**Average Height in metres**	**Cover**				
	Acacia Shrubland	**Stratum**			**Scattered Plants**	**Sparse**	**Moderate**	**Thick**	
	Riverine Woodland	**Overstorey**	*Eucalyptus lesouefii*	**5**	0 <5%	**1 <20%**	2 20-60%	3 60-100%	
	Other Grassland	**Midstorey**	*Acacia aneura, Eremophila sp.*	**1**	0 <5%	**1 <20%**	2 20-60%	3 60-100%	
	Euc Woodland	**Ground Cover**			0 <5%	1 <20%	2 20-60%	3 60-100%	

CONDITION							**LAST FIRE**		
Scale:	5 Pristine	**4 Excellent**	3 Very Good	2 Good	1 Degraded	0 Completely Degraded	0 <1 year	1 1 -3 Yr	2 4-5 Yr	**3 >5 Yr**

(general)			**DISTURBANCE**			**(cattle)**			
	0 heavy	1 medium*	2 mild	**3 none**		0 heavy	1 medium	2 mild	**3 none**

GROUND COVER

Bare Ground	0 <5%	1 <20%	2 20-60%	**3 60-100%**	**Hummock Grass**	**0 <5%**	1 <20%	2 20-60%	3 60-100%
Rock	0 <5%	**1 <20%**	2 20-60%	3 60-100%	**Other Grass**	**0 <5%**	1 <20%	2 20-60%	3 60-100% *
Leaf Litter	0 <5%	**1 <20%**	2 20-60%	3 60-100%	**Herbs**	**0 <5%**	1 <20%	2 20-60%	3 60-100%
Logs >10cm	**0 <5%**	1 <20%	2 20-60%	3 60-100%	**Other**	**0 <5%**	1 <20%	2 20-60%	3 60-100%

MICROHABITATS

Burrowing Suitability	0 Rock	**1 Stony**	2 Sandy Loam	3 Sand	**Peeling Bark**	0 none	1 rare	**2 moderate**	3 common
Pebbles Stones	0 none	1 0-30%	2 30-70%	**3 70-100%**	**Large Hollows**	**0 none**	1 rare	2 moderate	3 common
Exfoliating Slabs	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Small Hollows**	0 none	**1 rare**	2 moderate	3 common
Rock Crevices	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Water Prescence**	**0 none**	1 rare	2 moderate	3 common
Boulders	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Distance to Water**	**0 >5km**	1 2-5km	2 500m - 2km	3 <500m
Suitability for Bats	**YES**		NO		**Termite Mounds**	**0 none**	1 rare	2 moderate	3 common
Caves	**Absent**	Present			**Woody Debris**	0 none	**1 rare**	2 moderate	3 common

SPECIES

Malleefowl	**YES**	NO	DETAILS	**Could forage in area given nearby records, old mounds and recent sighting.**
Night Parrot	YES	**NO**		
Long-tailed Dunnart	YES	**NO**		

Birds	**Mammals**	**Reptiles**

FAUNA HABITAT ASSESSMENT SHEET

Mid-west

Location: Mount Mason	**Site Number: HA9**
Project Number:	

Date: 16/5/21	**Easting: 245313**	**Aspect**	N	NE	**SW**	NW
Quadrat Size: 50 x 50 m	**Northing: 6773251**		E	SE	W	N/A

Soil Texture	sand	**sandy-loam**	loam	cracking clay	clay	

VEGETATION

Vegetation Description				Average Height in metres	Cover				
	Hummock Grassland	Other:							
	Acacia Shrubland	**Stratum**			**Scattered Plants**	**Sparse**	**Moderate**	**Thick**	
	Riverine Woodland	**Overstorey**	Mixed *Acacia sp* (including Mulga)	**4**	0 <5%	**1 <20%**	2 20-60%	3 60-100%	
	Other Grassland	**Midstorey**	*Eremophila sp.*	**1**	0 <5%	**1 <20%**	2 20-60%	3 60-100%	
	Euc Woodland	**Ground Cover**			0 <5%	1 <20%	2 20-60%	3 60-100%	

CONDITION							**LAST FIRE**		
Scale:	5 Pristine	4 Excellent	**3 Very Good**	2 Good	1 Degraded	0 Completely Degraded	0 <1 year	1 1 -3 Yr	2 4-5 Yr	**3 >5 Yr**

	(general)			**DISTURBANCE**			**(cattle)**		
	0 heavy	1 medium*	2 mild	**3 none**		0 heavy	1 medium	2 mild	**3 none**

GROUND COVER

Bare Ground	0 <5%	1 <20%	2 20-60%	3 60-100%	**Hummock Grass**	**0 <5%**	1 <20%	2 20-60%	3 60-100%
Rock	0 <5%	1 <20%	2 20-60%	3 60-100%	**Other Grass**	**0 <5%**	1 <20%	2 20-60%	3 60-100% *
Leaf Litter	0 <5%	1 <20%	2 20-60%	3 60-100%	**Herbs**	**0 <5%**	1 <20%	2 20-60%	3 60-100%
Logs >10cm	0 <5%	1 <20%	2 20-60%	3 60-100%	**Other**	**0 <5%**	1 <20%	2 20-60%	3 60-100%

MICROHABITATS

Burrowing Suitability	0 Rock	**1 Stony**	2 Sandy Loam	3 Sand	**Peeling Bark**	0 none	**1 rare**	2 moderate	3 common
Pebbles Stones	0 none	1 0-30%	**2 30-70%**	3 70-100%	**Large Hollows**	**0 none**	1 rare	2 moderate	3 common
Exfoliating Slabs	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Small Hollows**	**0 none**	1 rare	2 moderate	3 common
Rock Crevices	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Water Prescence**	**0 none**	1 rare	2 moderate	3 common
Boulders	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Distance to Water**	**0 >5km**	1 2-5km	2 500m - 2km	3 <500m
Suitability for Bats	YES		**NO**		**Termite Mounds**	**0 none**	1 rare	2 moderate	3 common
Caves	**Absent**	Present			**Woody Debris**	0 none	**1 rare**	2 moderate	3 common

SPECIES

Malleefowl	**YES**	NO	DETAILS	**Could forage in area given nearby records, old mounds and recent sighting.**
Night Parrot	YES	**NO**		
Long-tailed Dunnart	YES	**NO**		

Birds	**Mammals**	**Reptiles**

FAUNA HABITAT ASSESSMENT SHEET

Mid-west

Location: Mount Mason	**Site Number: HA10**
Project Number:	

Date: 16/5/21	**Easting: 245201**	**Aspect**	N	NE	**SW**	NW
Quadrat Size: 50 x 50 m	**Northing: 6772752**		E	SE	W	N/A

Soil Texture	sand	**sandy-loam**	loam	cracking clay	clay	

VEGETATION

Vegetation Description				**Average Height in metres**	**Cover**				
	Hummock Grassland	Other:							
	Acacia Shrubland	**Stratum**			**Scattered Plants**	**Sparse**	**Moderate**	**Thick**	
	Riverine Woodland	**Overstorey**			0 <5%	1 <20%	2 20-60%	3 60-100%	
	Other Grassland	**Midstorey**	Mixed *Acacia sp* (including Mulga)		0 <5%	1 <20%	**2 20-60%**	3 60-100%	
	Euc Woodland	**Ground Cover**			0 <5%	1 <20%	2 20-60%	3 60-100%	

CONDITION							**LAST FIRE**		
Scale:	5 Pristine	4 Excellent	**3 Very Good**	2 Good	1 Degraded	0 Completely Degraded	0 <1 year	1 1 -3 Yr	2 4-5 Yr	**3 >5 Yr**

(general)			**DISTURBANCE**			**(cattle)**			
	0 heavy	**1 medium***	2 mild	3 none		0 heavy	1 medium	2 mild	**3 none**

GROUND COVER

Bare Ground	0 <5%	1 <20%	**2 20-60%**	3 60-100%	**Hummock Grass**	**0 <5%**	1 <20%	2 20-60%	3 60-100%
Rock	**0 <5%**	1 <20%	2 20-60%	3 60-100%	**Other Grass**	**0 <5%**	1 <20%	2 20-60%	3 60-100% *
Leaf Litter	0 <5%	**1 <20%**	2 20-60%	3 60-100%	**Herbs**	**0 <5%**	1 <20%	2 20-60%	3 60-100%
Logs >10cm	**0 <5%**	1 <20%	2 20-60%	3 60-100%	**Other**	**0 <5%**	1 <20%	2 20-60%	3 60-100%

MICROHABITATS

Burrowing Suitability	0 Rock	1 Stony	**2 Sandy Loam**	3 Sand	**Peeling Bark**	**0 none**	1 rare	2 moderate	3 common
Pebbles Stones	0 none	**1 0-30%**	2 30-70%	3 70-100%	**Large Hollows**	**0 none**	1 rare	2 moderate	3 common
Exfoliating Slabs	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Small Hollows**	**0 none**	1 rare	2 moderate	3 common
Rock Crevices	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Water Prescence**	**0 none**	1 rare	2 moderate	3 common
Boulders	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Distance to Water**	**0 >5km**	1 2-5km	2 500m - 2km	3 <500m
Suitability for Bats	YES		**NO**		**Termite Mounds**	**0 none**	1 rare	2 moderate	3 common
Caves	**Absent**	Present			**Woody Debris**	0 none	**1 rare**	2 moderate	3 common

SPECIES

Malleefowl	**YES**	NO	DETAILS	**Could forage in area given nearby records, old mounds and recent sighting.**
Night Parrot	YES	**NO**		
Long-tailed Dunnart	YES	**NO**		

Birds	**Mammals**	**Reptiles**

FAUNA HABITAT ASSESSMENT SHEET

Mid-west

Location: Mount Mason	**Site Number: HA11**
Project Number:	

Date: 16/5/21	**Easting: 245425**	**Aspect**	N	NE	SW	NW
Quadrat Size: 50 x 50 m	**Northing: 6772757**		E	SE	W	**S**

Soil Texture	sand	**sandy-loam**	loam	cracking clay	clay	

VEGETATION

Vegetation Description				Average Height in metres	Cover				
	Hummock Grassland	Other: **Mulga Shrubland**							
	Acacia Shrubland	**Stratum**			**Scattered Plants**	**Sparse**	**Moderate**	**Thick**	
	Riverine Woodland	**Overstorey**	*Acacia aneura*	**4**	0 <5%	1 <20%	**2 20-60%**	3 60-100%	
	Other Grassland	**Midstorey**			0 <5%	1 <20%	2 20-60%	3 60-100%	
	Euc Woodland	**Ground Cover**			0 <5%	1 <20%	2 20-60%	3 60-100%	

	CONDITION					LAST FIRE			
Scale:	5 Pristine	**4 Excellent**	3 Very Good	2 Good	1 Degraded	0 Completely Degraded	0 <1 year	1 1 -3 Yr	2 4-5 Yr	**3 >5 Yr**

	(general)			DISTURBANCE		(cattle)			
	0 heavy	1 medium*	2 mild	**3 none**		0 heavy	1 medium	2 mild	**3 none**

GROUND COVER

Bare Ground	0 <5%	1 <20%	**2 20-60%**	3 60-100%	**Hummock Grass**	**0 <5%**	1 <20%	2 20-60%	3 60-100%
Rock	**0 <5%**	1 <20%	2 20-60%	3 60-100%	**Other Grass**	**0 <5%**	1 <20%	2 20-60%	3 60-100% *
Leaf Litter	0 <5%	1 <20%	**2 20-60%**	3 60-100%	**Herbs**	**0 <5%**	1 <20%	2 20-60%	3 60-100%
Logs >10cm	**0 <5%**	1 <20%	2 20-60%	3 60-100%	**Other**	**0 <5%**	1 <20%	2 20-60%	3 60-100%

MICROHABITATS

Burrowing Suitability	0 Rock	1 Stony	**2 Sandy Loam**	3 Sand	**Peeling Bark**	0 none	**1 rare**	2 moderate	3 common
Pebbles Stones	0 none	**1 0-30%**	2 30-70%	3 70-100%	**Large Hollows**	**0 none**	1 rare	2 moderate	3 common
Exfoliating Slabs	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Small Hollows**	**0 none**	1 rare	2 moderate	3 common
Rock Crevices	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Water Prescence**	**0 none**	1 rare	2 moderate	3 common
Boulders	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Distance to Water**	**0 >5km**	1 2-5km	2 500m - 2km	3 <500m
Suitability for Bats	YES		**NO**		**Termite Mounds**	**0 none**	1 rare	2 moderate	3 common
Caves	**Absent**	Present			**Woody Debris**	0 none	1 rare	**2 moderate**	3 common

SPECIES

Malleefowl	**YES**	NO	DETAILS	**Could forage in area given nearby records, old mounds and recent sighting.**
Night Parrot	YES	**NO**		
Long-tailed Dunnart	YES	**NO**		

Birds	**Mammals**	**Reptiles**

FAUNA HABITAT ASSESSMENT SHEET

Mid-west

Location: Mount Mason Haul Road	**Site Number: HA12**
Project Number:	
Date: 17/5/21	**Easting: 247246**
Quadrat Size: 50 x 50 m	**Northing: 6760556**

Aspect				
N	NE	SW	NW	
E	SE	W	**S**	

Soil Texture	sand	**sandy-loam**	loam	cracking clay	clay

VEGETATION

Vegetation Description				**Average Height in metres**	**Cover**				
	Hummock Grassland	Other: **Mulga Shrubland**							
	Acacia Shrubland	**Stratum**			**Scattered Plants**	**Sparse**	**Moderate**	**Thick**	
	Riverine Woodland	**Overstorey**	*Acacia aneura*		0 <5%	**1 <20%**	2 20-60%	3 60-100%	
	Other Grassland	**Midstorey**	*Eremophila sp.*		0 <5%	**1 <20%**	2 20-60%	3 60-100%	
	Euc Woodland	**Ground Cover**	Grass		**0 <5%**	1 <20%	2 20-60%	3 60-100%	

	CONDITION						**LAST FIRE**			
Scale:	5 Pristine	4 Excellent	**3 Very Good**	2 Good	1 Degraded	0 Completely Degraded	0 <1 year	1 1 -3 Yr	2 4-5 Yr	**3 >5 Yr**

	(general)			**DISTURBANCE**			**(cattle)**			
	0 heavy	1 medium*	2 mild	**3 none**		0 heavy	1 medium	**2 mild**	3 none	

GROUND COVER

Bare Ground	0 <5%	1 <20%	2 20-60%	3 60-100%	**Hummock Grass**	**0 <5%**	1 <20%	2 20-60%	3 60-100%	
Rock	0 <5%	1 <20%	2 20-60%	3 60-100%	**Other Grass**	**0 <5%**	1 <20%	2 20-60%	3 60-100% *	
Leaf Litter	0 <5%	1 <20%	2 20-60%	3 60-100%	**Herbs**	**0 <5%**	1 <20%	2 20-60%	3 60-100%	
Logs >10cm	0 <5%	1 <20%	2 20-60%	3 60-100%	**Other**	**0 <5%**	1 <20%	2 20-60%	3 60-100%	

MICROHABITATS

Burrowing Suitability	0 Rock	1 Stony	**2 Sandy Loam**	3 Sand	**Peeling Bark**	0 none	**1 rare**	2 moderate	3 common
Pebbles Stones	0 none	**1 0-30%**	2 30-70%	3 70-100%	**Large Hollows**	**0 none**	1 rare	2 moderate	3 common
Exfoliating Slabs	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Small Hollows**	**0 none**	1 rare	2 moderate	3 common
Rock Crevices	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Water Prescence**	**0 none**	1 rare	2 moderate	3 common
Boulders	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Distance to Water**	**0 >5km**	1 2-5km	2 500m - 2km	3 <500m
Suitability for Bats	YES		**NO**		**Termite Mounds**	**0 none**	1 rare	2 moderate	3 common
Caves	**Absent**	Present			**Woody Debris**	0 none	**1 rare**	2 moderate	3 common

SPECIES

Malleefowl	**YES**	NO	DETAILS	**Could forage in area given nearby records, old mounds and recent sighting.**
Night Parrot	YES	**NO**		
Long-tailed Dunnart	YES	**NO**		

Birds	**Mammals**	**Reptiles**

FAUNA HABITAT ASSESSMENT SHEET

Mid-west

Location: Mount Mason Haul Road	**Site Number: HA13**
Project Number:	

Date: 17/5/21	**Easting: 247254**	**Aspect**	N	NE	SW	NW
Quadrat Size: 50 x 50 m	**Northing: 6759372**		E	SE	W	**S**

Soil Texture	sand	**sandy-loam**	loam	cracking clay	clay

VEGETATION

Vegetation Description				Average Height in metres	Cover				
	Hummock Grassland	Other:**Mulga Shrubland**							
	Acacia Shrubland	**Stratum**			**Scattered Plants**	**Sparse**	**Moderate**	**Thick**	
	Riverine Woodland	**Overstorey**	*Acacia aneura*		0 <5%	**1 <20%**	2 20-60%	3 60-100%	
	Other Grassland	**Midstorey**	*Eremophila sp.*		0 <5%	**1 <20%**	2 20-60%	3 60-100%	
	Euc Woodland	**Ground Cover**			0 <5%	1 <20%	2 20-60%	3 60-100%	

CONDITION							**LAST FIRE**		
Scale:	5 Pristine	4 Excellent	**3 Very Good**	2 Good	1 Degraded	0 Completely Degraded	0 <1 year	1 1 -3 Yr	2 4-5 Yr	**3 >5 Yr**

	(general)			**DISTURBANCE**			**(cattle)**		
	0 heavy	1 medium*	2 mild	**3 none**		0 heavy	1 medium	**2 mild**	3 none	

GROUND COVER

Bare Ground	0 <5%	1 <20%	2 20-60%	**3 60-100%**	**Hummock Grass**	**0 <5%**	1 <20%	2 20-60%	3 60-100%	
Rock	**0 <5%**	1 <20%	2 20-60%	3 60-100%	**Other Grass**	**0 <5%**	1 <20%	2 20-60%	3 60-100% *	
Leaf Litter	0 <5%	**1 <20%**	2 20-60%	3 60-100%	**Herbs**	**0 <5%**	1 <20%	2 20-60%	3 60-100%	
Logs >10cm	**0 <5%**	1 <20%	2 20-60%	3 60-100%	**Other**	**0 <5%**	1 <20%	2 20-60%	3 60-100%	

MICROHABITATS

Burrowing Suitability	0 Rock	1 Stony	**2 Sandy Loam**	3 Sand	**Peeling Bark**	0 none	**1 rare**	2 moderate	3 common
Pebbles Stones	0 none	**1 0-30%**	2 30-70%	3 70-100%	**Large Hollows**	**0 none**	1 rare	2 moderate	3 common
Exfoliating Slabs	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Small Hollows**	**0 none**	1 rare	2 moderate	3 common
Rock Crevices	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Water Prescence**	**0 none**	1 rare	2 moderate	3 common
Boulders	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Distance to Water**	**0 >5km**	1 2-5km	2 500m - 2km	3 <500m
Suitability for Bats	YES		**NO**		**Termite Mounds**	**0 none**	1 rare	2 moderate	3 common
Caves	**Absent**	Present			**Woody Debris**	0 none	**1 rare**	2 moderate	3 common

SPECIES

Malleefowl	**YES**	NO	DETAILS	**Could forage in area given nearby records, old mounds and recent sighting.**
Night Parrot	YES	**NO**		
Long-tailed Dunnart	YES	**NO**		

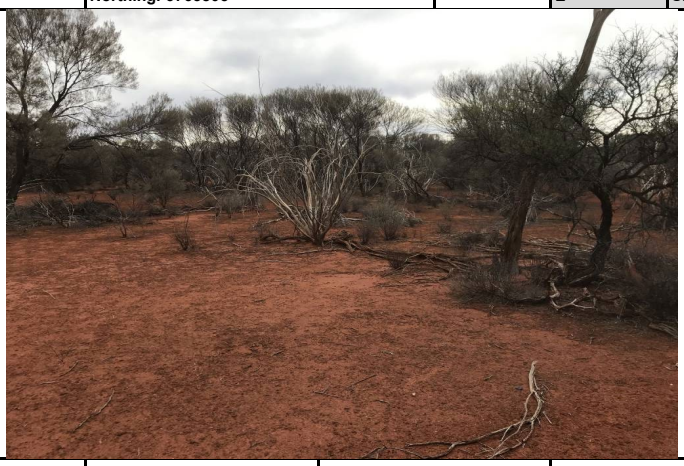
Birds	**Mammals**	**Reptiles**

FAUNA HABITAT ASSESSMENT SHEET

Mid-west

Location: Mount Mason Haul Road	**Site Number: HA14**
Project Number:	

Date: 17/5/21	**Easting: 246556**	**Aspect**	N	NE	SW	NW
Quadrat Size: 50 x 50 m	**Northing: 6763803**		E	SE	W	N/A



Soil Texture	sand	**sandy-loam**	loam	cracking clay	clay

VEGETATION

Vegetation Description				**Average Height in metres**	**Cover**				
	Hummock Grassland	Other:**Mulga Shrubland**							
	Acacia Shrubland	**Stratum**			**Scattered Plants**	**Sparse**	**Moderate**	**Thick**	
	Riverine Woodland	**Overstorey**	*Acacia aneura*		0 <5%	**1 <20%**	2 20-60%	3 60-100%	
	Other Grassland	**Midstorey**	*Acacia aneura*		**0 <5%**	1 <20%	2 20-60%	3 60-100%	
	Euc Woodland	**Ground Cover**			0 <5%	1 <20%	2 20-60%	3 60-100%	

CONDITION							**LAST FIRE**		
Scale:	5 Pristine	4 Excellent	**3 Very Good**	2 Good	1 Degraded	0 Completely Degraded	0 <1 year	1 1 -3 Yr	2 4-5 Yr	**3 >5 Yr**

	(general)			**DISTURBANCE**			**(cattle)**		
	0 heavy	1 medium*	2 mild	**3 none**		0 heavy	1 medium	**2 mild**	3 none	

GROUND COVER

Bare Ground	0 <5%	1 <20%	2 20-60%	**3 60-100%**	**Hummock Grass**	**0 <5%**	1 <20%	2 20-60%	3 60-100%	
Rock	**0 <5%**	1 <20%	2 20-60%	3 60-100%	**Other Grass**	**0 <5%**	1 <20%	2 20-60%	3 60-100% *	
Leaf Litter	0 <5%	**1 <20%**	2 20-60%	3 60-100%	**Herbs**	**0 <5%**	1 <20%	2 20-60%	3 60-100%	
Logs >10cm	**0 <5%**	1 <20%	2 20-60%	3 60-100%	**Other**	**0 <5%**	1 <20%	2 20-60%	3 60-100%	

MICROHABITATS

Burrowing Suitability	0 Rock	1 Stony	**2 Sandy Loam**	3 Sand	**Peeling Bark**	0 none	**1 rare**	2 moderate	3 common
Pebbles Stones	0 none	**1 0-30%**	2 30-70%	3 70-100%	**Large Hollows**	**0 none**	1 rare	2 moderate	3 common
Exfoliating Slabs	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Small Hollows**	**0 none**	1 rare	2 moderate	3 common
Rock Crevices	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Water Prescence**	**0 none**	1 rare	2 moderate	3 common
Boulders	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Distance to Water**	**0 >5km**	1 2-5km	2 500m - 2km	3 <500m
Suitability for Bats	YES		**NO**		**Termite Mounds**	**0 none**	1 rare	2 moderate	3 common
Caves	**Absent**	Present			**Woody Debris**	0 none	1 rare	**2 moderate**	3 common

SPECIES

Malleefowl	**YES**	NO	DETAILS	**Could forage in area given nearby records, old mounds and recent sighting.**
Night Parrot	YES	**NO**		
Long-tailed Dunnart	YES	**NO**		

Birds	**Mammals**	**Reptiles**

FAUNA HABITAT ASSESSMENT SHEET

Mid-west

Location: Mount Mason Haul Road	**Site Number: HA15**
Project Number:	
Date: 17/5/21	**Easting: 251649**
Quadrat Size: 50 x 50 m	**Northing: 6751598**

Aspect				
N	NE	SW	NW	
E	SE	W	N/A	

Soil Texture	**sand**	sandy-loam		loam	cracking clay	clay

VEGETATION

Vegetation Description				**Average Height in metres**	**Cover**				
	Hummock Grassland	Other:							
	Acacia Shrubland	**Stratum**			**Scattered Plants**	**Sparse**	**Moderate**	**Thick**	
	Riverine Woodland	**Overstorey**	*Acacia aneura*		0 <5%	**1 <20%**	2 20-60%	3 60-100%	
	Other Grassland	**Midstorey**	*Eremophila sp.*		0 <5%	**1 <20%**	2 20-60%	3 60-100%	
	Euc Woodland	**Ground Cover**			0 <5%	**1 <20%**	2 20-60%	3 60-100%	

CONDITION							**LAST FIRE**			
Scale:	5 Pristine	**4 Excellent**	3 Very Good	2 Good	1 Degraded	0 Completely Degraded	0 <1 year	1 1 -3 Yr	2 4-5 Yr	**3 >5 Yr**

DISTURBANCE										
	(general)						**(cattle)**			
	0 heavy	1 medium*	2 mild	**3 none**		0 heavy	1 medium	**2 mild**	3 none	

GROUND COVER

Bare Ground	0 <5%	1 <20%	**2 20-60%**	3 60-100%	**Hummock Grass**	0 <5%	**1 <20%**	2 20-60%	3 60-100%	
Rock	**0 <5%**	1 <20%	2 20-60%	3 60-100%	**Other Grass**	0 <5%	**1 <20%**	2 20-60%	3 60-100% *	
Leaf Litter	0 <5%	1 <20%	**2 20-60%**	3 60-100%	**Herbs**	0 <5%	**1 <20%**	2 20-60%	3 60-100%	
Logs >10cm	**0 <5%**	1 <20%	2 20-60%	3 60-100%	**Other**	0 <5%	**1 <20%**	2 20-60%	3 60-100%	

MICROHABITATS

Burrowing Suitability	0 Rock	1 Stony	2 Sandy Loam	**3 Sand**	**Peeling Bark**	0 none	**1 rare**	2 moderate	3 common
Pebbles Stones	0 none	**1 0-30%**	2 30-70%	3 70-100%	**Large Hollows**	**0 none**	1 rare	2 moderate	3 common
Exfoliating Slabs	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Small Hollows**	**0 none**	1 rare	2 moderate	3 common
Rock Crevices	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Water Prescence**	**0 none**	1 rare	2 moderate	3 common
Boulders	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Distance to Water**	**0 >5km**	1 2-5km	2 500m - 2km	3 <500m
Suitability for Bats	YES		**NO**		**Termite Mounds**	**0 none**	1 rare	2 moderate	3 common
Caves	**Absent**	Present			**Woody Debris**	0 none	**1 rare**	2 moderate	3 common

SPECIES

Malleefowl	**YES**	NO	DETAILS	**Could forage and construct mounds given sightings, mounds and tracks in area.**
Night Parrot	YES	**NO**		
Long-tailed Dunnart	YES	**NO**		

Birds	**Mammals**	**Reptiles**

FAUNA HABITAT ASSESSMENT SHEET

Mid-west

Location: Mount Mason Haul Road	**Site Number: HA16**
Project Number:	

Date: 17/5/21	**Easting: 250399**	**Aspect**	N	NE	SW	**NW**
Quadrat Size: 50 x 50 m	**Northing: 6753592**		E	SE	W	N/A

Soil Texture	sand	**sandy-loam**	loam	cracking clay	clay

VEGETATION

Vegetation Description				Average Height in metres	Cover				
	Hummock Grassland	Other: **Mulga Shrubland**							
	Acacia Shrubland	**Stratum**			**Scattered Plants**	**Sparse**	**Moderate**	**Thick**	
	Riverine Woodland	**Overstorey**	*Acacia aneura*		**0 <5%**	1 <20%	2 20-60%	3 60-100%	
	Other Grassland	**Midstorey**			0 <5%	1 <20%	2 20-60%	3 60-100%	
	Euc Woodland	**Ground Cover**	Sedges		**0 <5%**	1 <20%	2 20-60%	3 60-100%	

CONDITION							**LAST FIRE**		
Scale:	5 Pristine	4 Excellent	**3 Very Good**	2 Good	1 Degraded	0 Completely Degraded	0 <1 year	1 1 -3 Yr	2 4-5 Yr	**3 >5 Yr**

	(general)			**DISTURBANCE**			**(cattle)**		
	0 heavy	1 medium*	2 mild	**3 none**		0 heavy	1 medium	**2 mild**	3 none	

GROUND COVER

Bare Ground	0 <5%	1 <20%	2 20-60%	**3 60-100%**	**Hummock Grass**	**0 <5%**	1 <20%	2 20-60%	3 60-100%	
Rock	**0 <5%**	1 <20%	2 20-60%	3 60-100%	**Other Grass**	**0 <5%**	1 <20%	2 20-60%	3 60-100% *	
Leaf Litter	0 <5%	**1 <20%**	2 20-60%	3 60-100%	**Herbs**	**0 <5%**	1 <20%	2 20-60%	3 60-100%	
Logs >10cm	**0 <5%**	1 <20%	2 20-60%	3 60-100%	**Other**	**0 <5%**	1 <20%	2 20-60%	3 60-100%	

MICROHABITATS

Burrowing Suitability	0 Rock	1 Stony	**2 Sandy Loam**	3 Sand	**Peeling Bark**	**0 none**	1 rare	2 moderate	3 common
Pebbles Stones	0 none	**1 0-30%**	2 30-70%	3 70-100%	**Large Hollows**	**0 none**	1 rare	2 moderate	3 common
Exfoliating Slabs	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Small Hollows**	**0 none**	1 rare	2 moderate	3 common
Rock Crevices	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Water Prescence**	**0 none**	1 rare	2 moderate	3 common
Boulders	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Distance to Water**	**0 >5km**	1 2-5km	2 500m - 2km	3 <500m
Suitability for Bats	YES		**NO**		**Termite Mounds**	**0 none**	1 rare	2 moderate	3 common
Caves	**Absent**	Present			**Woody Debris**	0 none	**1 rare**	2 moderate	3 common

SPECIES

Malleefowl	YES	**NO**	DETAILS	
Night Parrot	YES	**NO**		
Long-tailed Dunnart	YES	**NO**		

Birds	**Mammals**	**Reptiles**

FAUNA HABITAT ASSESSMENT SHEET

Mid-west

Location: Mount Mason Haul Road	**Site Number: HA17**
Project Number:	

Date: 18/5/21	**Easting: 249297**	**Aspect**	N	NE	**SW**	NW
Quadrat Size: 50 x 50 m	**Northing: 6754317**		E	SE	W	N/A

Soil Texture	sand	**sandy-loam**	loam	cracking clay	clay

VEGETATION

Vegetation Description				**Average Height in metres**	**Cover**				
	Hummock Grassland	Other: **Mulga Shrubland**							
	Acacia Shrubland	**Stratum**			**Scattered Plants**	**Sparse**	**Moderate**	**Thick**	
	Riverine Woodland	**Overstorey**	*Acacia aneura*		0 <5%	**1 <20%**	2 20-60%	3 60-100%	
	Other Grassland	**Midstorey**	*Eremophila sp.*		0 <5%	**1 <20%**	2 20-60%	3 60-100%	
	Euc Woodland	**Ground Cover**			0 <5%	1 <20%	2 20-60%	3 60-100%	

CONDITION							**LAST FIRE**		
Scale:	5 Pristine	**4 Excellent**	3 Very Good	2 Good	1 Degraded	0 Completely Degraded	0 <1 year	1 1 -3 Yr	2 4-5 Yr	**3 >5 Yr**

	(general)			**DISTURBANCE**			**(cattle)**		
	0 heavy	1 medium*	2 mild	**3 none**		0 heavy	1 medium	**2 mild**	3 none	

GROUND COVER

Bare Ground	0 <5%	1 <20%	2 20-60%	**3 60-100%**	**Hummock Grass**	**0 <5%**	1 <20%	2 20-60%	3 60-100%	
Rock	**0 <5%**	1 <20%	2 20-60%	3 60-100%	**Other Grass**	**0 <5%**	1 <20%	2 20-60%	3 60-100% *	
Leaf Litter	0 <5%	**1 <20%**	2 20-60%	3 60-100%	**Herbs**	**0 <5%**	1 <20%	2 20-60%	3 60-100%	
Logs >10cm	**0 <5%**	1 <20%	2 20-60%	3 60-100%	**Other**	**0 <5%**	1 <20%	2 20-60%	3 60-100%	

MICROHABITATS

Burrowing Suitability	0 Rock	1 Stony	**2 Sandy Loam**	3 Sand	**Peeling Bark**	0 none	**1 rare**	2 moderate	3 common
Pebbles Stones	0 none	**1 0-30%**	2 30-70%	3 70-100%	**Large Hollows**	**0 none**	1 rare	2 moderate	3 common
Exfoliating Slabs	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Small Hollows**	**0 none**	1 rare	2 moderate	3 common
Rock Crevices	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Water Prescence**	**0 none**	1 rare	2 moderate	3 common
Boulders	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Distance to Water**	**0 >5km**	1 2-5km	2 500m - 2km	3 <500m
Suitability for Bats	YES		**NO**		**Termite Mounds**	**0 none**	1 rare	2 moderate	3 common
Caves	**Absent**	Present			**Woody Debris**	0 none	**1 rare**	2 moderate	3 common

SPECIES

Malleefowl	**YES**	NO	DETAILS	**Could forage in area given nearby records, old mounds and recent sighting.**
Night Parrot	YES	**NO**		
Long-tailed Dunnart	YES	**NO**		

Birds	**Mammals**	**Reptiles**

FAUNA HABITAT ASSESSMENT SHEET

Mid-west

Location: Yunndaga Siding & Bypass Route	**Site Number: HA18**
Project Number:	

Date: 19/5/21	**Easting: 306721**	**Aspect**	N	NE	**SW**	NW
Quadrat Size: 50 x 50 m	**Northing: 6715157**		E	SE	W	N/A

Soil Texture	sand	**sandy-loam**	loam	cracking clay	clay

VEGETATION

Vegetation Description				**Average Height in metres**	**Cover**				
	Hummock Grassland	Other: **Mulga Shrubland**							
	Acacia Shrubland	**Stratum**			**Scattered Plants**	**Sparse**	**Moderate**	**Thick**	
	Riverine Woodland	**Overstorey**	*Acacia aneura*	**4**	0 <5%	**1 <20%**	2 20-60%	3 60-100%	
	Other Grassland	**Midstorey**			0 <5%	1 <20%	2 20-60%	3 60-100%	
	Euc Woodland	**Ground Cover**			0 <5%	1 <20%	2 20-60%	3 60-100%	

	CONDITION						**LAST FIRE**			
Scale:	5 Pristine	4 Excellent	**3 Very Good**	2 Good	1 Degraded	0 Completely Degraded	0 <1 year	1 1 -3 Yr	2 4-5 Yr	**3 >5 Yr**

	(general)			**DISTURBANCE**			**(cattle)**			
	0 heavy	1 medium*	**2 mild**	3 none		0 heavy	1 medium	2 mild	**3 none**	

GROUND COVER

Bare Ground	0 <5%	1 <20%	**2 20-60%**	3 60-100%	**Hummock Grass**	**0 <5%**	1 <20%	2 20-60%	3 60-100%	
Rock	**0 <5%**	1 <20%	2 20-60%	3 60-100%	**Other Grass**	**0 <5%**	1 <20%	2 20-60%	3 60-100% *	
Leaf Litter	0 <5%	1 <20%	**2 20-60%**	3 60-100%	**Herbs**	**0 <5%**	1 <20%	2 20-60%	3 60-100%	
Logs >10cm	**0 <5%**	1 <20%	2 20-60%	3 60-100%	**Other**	**0 <5%**	1 <20%	2 20-60%	3 60-100%	

MICROHABITATS

Burrowing Suitability	0 Rock	1 Stony	**2 Sandy Loam**	3 Sand	**Peeling Bark**	0 none	**1 rare**	2 moderate	3 common
Pebbles Stones	0 none	**1 0-30%**	2 30-70%	3 70-100%	**Large Hollows**	**0 none**	1 rare	2 moderate	3 common
Exfoliating Slabs	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Small Hollows**	**0 none**	1 rare	2 moderate	3 common
Rock Crevices	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Water Prescence**	**0 none**	1 rare	2 moderate	3 common
Boulders	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Distance to Water**	**0 >5km**	1 2-5km	2 500m - 2km	3 <500m
Suitability for Bats	YES		**NO**		**Termite Mounds**	0 none	**1 rare**	2 moderate	3 common
Caves	**Absent**	Present			**Woody Debris**	0 none	1 rare	**2 moderate**	3 common

SPECIES

Malleefowl	YES	**NO**	DETAILS	
Night Parrot	YES	**NO**		
Long-tailed Dunnart	YES	**NO**		

Birds	**Mammals**	**Reptiles**

FAUNA HABITAT ASSESSMENT SHEET

Mid-west

Location: Yunndaga Siding & Bypass Route	**Site Number: HA19**
Project Number:	

Date: 19/5/21	**Easting: 307154**	**Aspect**	N	NE	SW	NW
Quadrat Size: 50 x 50 m	**Northing: 6713863**		E	SE	W	**N/A**

Soil Texture	sand	**sandy-loam**	loam	cracking clay	clay	

VEGETATION

Vegetation Description				Average Height in metres	Cover				
	Hummock Grassland	Other:**Mulga Shrubland**							
	Acacia Shrubland	**Stratum**			**Scattered Plants**	**Sparse**	**Moderate**	**Thick**	
	Riverine Woodland	**Overstorey**	*Acacia aneura*	**4**	0 <5%	**1 <20%**	2 20-60%	3 60-100%	
	Other Grassland	**Midstorey**	*Eremophila sp.*	**1**	0 <5%	**1 <20%**	2 20-60%	3 60-100%	
	Euc Woodland	**Ground Cover**			0 <5%	1 <20%	2 20-60%	3 60-100%	

CONDITION							**LAST FIRE**		
Scale:	5 Pristine	4 Excellent	**3 Very Good**	2 Good	1 Degraded	0 Completely Degraded	0 <1 year	1 1 -3 Yr	2 4-5 Yr	**3 >5 Yr**

	(general)			**DISTURBANCE**			**(cattle)**		
	0 heavy	1 medium*	**2 mild**	3 none		0 heavy	1 medium	2 mild	**3 none**

GROUND COVER

Bare Ground	0 <5%	1 <20%	2 20-60%	**3 60-100%**	**Hummock Grass**	**0 <5%**	1 <20%	2 20-60%	3 60-100%
Rock	**0 <5%**	1 <20%	2 20-60%	3 60-100%	**Other Grass**	**0 <5%**	1 <20%	2 20-60%	3 60-100% *
Leaf Litter	0 <5%	**1 <20%**	2 20-60%	3 60-100%	**Herbs**	**0 <5%**	1 <20%	2 20-60%	3 60-100%
Logs >10cm	**0 <5%**	1 <20%	2 20-60%	3 60-100%	**Other**	**0 <5%**	1 <20%	2 20-60%	3 60-100%

MICROHABITATS

Burrowing Suitability	0 Rock	1 Stony	**2 Sandy Loam**	3 Sand	**Peeling Bark**	0 none	**1 rare**	2 moderate	3 common
Pebbles Stones	0 none	**1 0-30%**	2 30-70%	3 70-100%	**Large Hollows**	**0 none**	1 rare	2 moderate	3 common
Exfoliating Slabs	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Small Hollows**	**0 none**	1 rare	2 moderate	3 common
Rock Crevices	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Water Prescence**	**0 none**	1 rare	2 moderate	3 common
Boulders	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Distance to Water**	**0 >5km**	1 2-5km	2 500m - 2km	3 <500m
Suitability for Bats	YES		**NO**		**Termite Mounds**	**0 none**	1 rare	2 moderate	3 common
Caves	**Absent**	Present			**Woody Debris**	0 none	**1 rare**	2 moderate	3 common

SPECIES

Malleefowl	YES	**NO**	DETAILS	
Night Parrot	YES	**NO**		
Long-tailed Dunnart	YES	**NO**		

Birds	**Mammals**	**Reptiles**

FAUNA HABITAT ASSESSMENT SHEET

Mid-west

Location: Yunndaga Siding & Bypass Route	**Site Number: HA20**
Project Number:	

Date: 19/5/21	**Easting: 307400**	**Aspect**	N	NE	SW	NW
Quadrat Size: 50 x 50 m	**Northing: 6712572**		E	SE	**W**	N/A

Soil Texture	sand	**sandy-loam**	loam	cracking clay	clay	

VEGETATION

Vegetation Description				**Average Height in metres**	**Cover**				
	Hummock Grassland	Other: **Mulga Shrubland**							
	Acacia Shrubland	**Stratum**			**Scattered Plants**	**Sparse**	**Moderate**	**Thick**	
	Riverine Woodland	**Overstorey**	*Acacia aneura*		0 <5%	**1 <20%**	2 20-60%	3 60-100%	
	Other Grassland	**Midstorey**			0 <5%	1 <20%	2 20-60%	3 60-100%	
	Euc Woodland	**Ground Cover**			0 <5%	1 <20%	2 20-60%	3 60-100%	

	CONDITION						**LAST FIRE**			
Scale:	5 Pristine	4 Excellent	**3 Very Good**	2 Good	1 Degraded	0 Completely Degraded	0 <1 year	1 1 -3 Yr	2 4-5 Yr	**3 >5 Yr**

	(general)			**DISTURBANCE**			**(cattle)**			
	0 heavy	1 medium*	**2 mild**	3 none		0 heavy	1 medium	2 mild	**3 none**	

GROUND COVER

Bare Ground	0 <5%	1 <20%	2 20-60%	**3 60-100%**	**Hummock Grass**	**0 <5%**	1 <20%	2 20-60%	3 60-100%	
Rock	**0 <5%**	1 <20%	2 20-60%	3 60-100%	**Other Grass**	**0 <5%**	1 <20%	2 20-60%	3 60-100% *	
Leaf Litter	0 <5%	**1 <20%**	2 20-60%	3 60-100%	**Herbs**	**0 <5%**	1 <20%	2 20-60%	3 60-100%	
Logs >10cm	**0 <5%**	1 <20%	2 20-60%	3 60-100%	**Other**	**0 <5%**	1 <20%	2 20-60%	3 60-100%	

MICROHABITATS

Burrowing Suitability	0 Rock	1 Stony	**2 Sandy Loam**	3 Sand	**Peeling Bark**	0 none	**1 rare**	2 moderate	3 common
Pebbles Stones	0 none	**1 0-30%**	2 30-70%	3 70-100%	**Large Hollows**	**0 none**	1 rare	2 moderate	3 common
Exfoliating Slabs	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Small Hollows**	**0 none**	1 rare	2 moderate	3 common
Rock Crevices	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Water Prescence**	**0 none**	1 rare	2 moderate	3 common
Boulders	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Distance to Water**	**0 >5km**	1 2-5km	2 500m - 2km	3 <500m
Suitability for Bats	YES		**NO**		**Termite Mounds**	**0 none**	1 rare	2 moderate	3 common
Caves	**Absent**	Present			**Woody Debris**	0 none	**1 rare**	2 moderate	3 common

SPECIES

Malleefowl	YES	**NO**	DETAILS	
Night Parrot	YES	**NO**		
Long-tailed Dunnart	YES	**NO**		

Birds	**Mammals**	**Reptiles**

FAUNA HABITAT ASSESSMENT SHEET

Mid-west

Location: Yunndaga Siding & Bypass Route	**Site Number: HA21**
Project Number:	

Date: 19/5/21	**Easting: 308881**	**Aspect**	N	NE	SW	NW
Quadrat Size: 50 x 50 m	**Northing: 6710584**		E	SE	W	**S**

Soil Texture	sand	**sandy-loam**	loam	cracking clay	clay	

VEGETATION

Vegetation Description				Average Height in metres	Cover				
	Hummock Grassland	Other:							
	Acacia Shrubland	**Stratum**			**Scattered Plants**	**Sparse**	**Moderate**	**Thick**	
	Riverine Woodland	**Overstorey**	*Acacia aneura*		0 <5%	**1 <20%**	2 20-60%	3 60-100%	
	Other Grassland	**Midstorey**	*Eremophila sp.*		0 <5%	**1 <20%**	2 20-60%	3 60-100%	
	Euc Woodland	**Ground Cover**			0 <5%	1 <20%	2 20-60%	3 60-100%	

CONDITION							**LAST FIRE**		
Scale:	5 Pristine	4 Excellent	**3 Very Good**	2 Good	1 Degraded	0 Completely Degraded	0 <1 year	1 1 -3 Yr	2 4-5 Yr	**3 >5 Yr**

	(general)			**DISTURBANCE**			**(cattle)**		
	0 heavy	**1 medium**	2 mild	3 none		0 heavy	1 medium	2 mild	**3 none**	

GROUND COVER

Bare Ground	0 <5%	1 <20%	2 20-60%	**3 60-100%**	**Hummock Grass**	**0 <5%**	1 <20%	2 20-60%	3 60-100%	
Rock	**0 <5%**	1 <20%	2 20-60%	3 60-100%	**Other Grass**	**0 <5%**	1 <20%	2 20-60%	3 60-100% *	
Leaf Litter	0 <5%	**1 <20%**	2 20-60%	3 60-100%	**Herbs**	**0 <5%**	1 <20%	2 20-60%	3 60-100%	
Logs >10cm	**0 <5%**	1 <20%	2 20-60%	3 60-100%	**Other**	**0 <5%**	1 <20%	2 20-60%	3 60-100%	

MICROHABITATS

Burrowing Suitability	0 Rock	1 Stony	**2 Sandy Loam**	3 Sand	**Peeling Bark**	0 none	**1 rare**	2 moderate	3 common
Pebbles Stones	0 none	1 0-30%	**2 30-70%**	3 70-100%	**Large Hollows**	**0 none**	1 rare	2 moderate	3 common
Exfoliating Slabs	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Small Hollows**	**0 none**	1 rare	2 moderate	3 common
Rock Crevices	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Water Prescence**	**0 none**	1 rare	2 moderate	3 common
Boulders	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Distance to Water**	**0 >5km**	1 2-5km	2 500m - 2km	3 <500m
Suitability for Bats	YES		**NO**		**Termite Mounds**	**0 none**	1 rare	2 moderate	3 common
Caves	**Absent**	Present			**Woody Debris**	0 none	**1 rare**	2 moderate	3 common

SPECIES

Malleefowl	YES	**NO**	DETAILS	
Night Parrot	YES	**NO**		
Long-tailed Dunnart	YES	**NO**		

Birds	**Mammals**	**Reptiles**

FAUNA HABITAT ASSESSMENT SHEET

Mid-west

Location: Yunndaga Siding & Bypass Route	**Site Number: HA22**
Project Number:	

Date: 19/5/21	**Easting: 311359**	**Aspect**	N	NE	SW	NW
Quadrat Size: 50 x 50 m	**Northing: 6708560**		E	SE	W	**N/A**

Soil Texture	sand	**sandy-loam**	loam	cracking clay	clay

VEGETATION

Vegetation Description				Average Height in metres	Cover				
	Hummock Grassland	Other:**Mulga Shrubland**							
	Acacia Shrubland	**Stratum**			**Scattered Plants**	**Sparse**	**Moderate**	**Thick**	
	Riverine Woodland	**Overstorey**	*Acacia aneura*		0 <5%	**1 <20%**	2 20-60%	3 60-100%	
	Other Grassland	**Midstorey**	*Acacia sp., Eremophila sp.*		0 <5%	**1 <20%**	2 20-60%	3 60-100%	
	Euc Woodland	**Ground Cover**	Buffel Grass		0 <5%	**1 <20%**	2 20-60%	3 60-100%	

CONDITION							**LAST FIRE**		
Scale:	5 Pristine	4 Excellent	3 Very Good	**2 Good**	1 Degraded	0 Completely Degraded	0 <1 year	1 1 -3 Yr	2 4-5 Yr	**3 >5 Yr**

	(general)			**DISTURBANCE**			**(cattle)**		
	0 heavy	**1 medium***	2 mild	3 none		0 heavy	1 medium	2 mild	**3 none**	

GROUND COVER

Bare Ground	0 <5%	1 <20%	2 20-60%	**3 60-100%**	**Hummock Grass**	**0 <5%**	1 <20%	2 20-60%	3 60-100%	
Rock	**0 <5%**	1 <20%	2 20-60%	3 60-100%	**Other Grass**	0 <5%	**1 <20%**	2 20-60%	3 60-100% *	
Leaf Litter	0 <5%	**1 <20%**	2 20-60%	3 60-100%	**Herbs**	**0 <5%**	1 <20%	2 20-60%	3 60-100%	
Logs >10cm	**0 <5%**	1 <20%	2 20-60%	3 60-100%	**Other**	**0 <5%**	1 <20%	2 20-60%	3 60-100%	

MICROHABITATS

Burrowing Suitability	0 Rock	1 Stony	**2 Sandy Loam**	3 Sand	**Peeling Bark**	0 none	**1 rare**	2 moderate	3 common
Pebbles Stones	0 none	1 0-30%	**2 30-70%**	3 70-100%	**Large Hollows**	**0 none**	1 rare	2 moderate	3 common
Exfoliating Slabs	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Small Hollows**	**0 none**	1 rare	2 moderate	3 common
Rock Crevices	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Water Prescence**	**0 none**	1 rare	2 moderate	3 common
Boulders	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Distance to Water**	**0 >5km**	1 2-5km	2 500m - 2km	3 <500m
Suitability for Bats	YES		**NO**		**Termite Mounds**	**0 none**	1 rare	2 moderate	3 common
Caves	**Absent**	Present			**Woody Debris**	0 none	**1 rare**	2 moderate	3 common

SPECIES

Malleefowl	YES	**NO**	DETAILS	
Night Parrot	YES	**NO**		
Long-tailed Dunnart	YES	**NO**		

Birds	**Mammals**	**Reptiles**

FAUNA HABITAT ASSESSMENT SHEET

Mid-west

Location: Yunndaga Siding & Bypass Route	**Site Number: HA23**
Project Number:	
Date: 19/5/21	**Easting: 312100**
Quadrat Size: 50 x 50 m	**Northing: 6706973**

Aspect				
N	NE	SW	NW	
E	SE	W	**N/A**	

Soil Texture	sand	**sandy-loam**	loam	cracking clay	clay

VEGETATION

Vegetation Description				**Average Height in metres**	**Cover**				
	Hummock Grassland	Other:**Low Scattered Shrubland**							
	Acacia Shrubland	**Stratum**			**Scattered Plants**	**Sparse**	**Moderate**	**Thick**	
	Riverine Woodland	**Overstorey**			0 <5%	1 <20%	2 20-60%	3 60-100%	
	Other Grassland	**Midstorey**	*Acacia sp.*		**0 <5%**	1 <20%	2 20-60%	3 60-100%	
	Euc Woodland	**Ground Cover**	Chenopods, Buffel Grass		0 <5%	1 <20%	**2 20-60%**	3 60-100%	

	CONDITION						**LAST FIRE**			
Scale:	5 Pristine	4 Excellent	3 Very Good	**2 Good**	1 Degraded	0 Completely Degraded	0 <1 year	1 1 -3 Yr	2 4-5 Yr	**3 >5 Yr**

	(general)			**DISTURBANCE**		**(cattle)**			
	0 heavy	**1 medium***	2 mild	3 none		0 heavy	1 medium	2 mild	**3 none**	

GROUND COVER

Bare Ground	0 <5%	1 <20%	**2 20-60%**	3 60-100%	**Hummock Grass**	**0 <5%**	1 <20%	2 20-60%	3 60-100%	
Rock	0 <5%	**1 <20%**	2 20-60%	3 60-100%	**Other Grass**	0 <5%	**1 <20%**	2 20-60%	3 60-100% *	
Leaf Litter	0 <5%	1 <20%	2 20-60%	3 60-100%	**Herbs**	**0 <5%**	1 <20%	2 20-60%	3 60-100%	
Logs >10cm	**0 <5%**	1 <20%	2 20-60%	3 60-100%	**Other**	**0 <5%**	1 <20%	2 20-60%	3 60-100%	

MICROHABITATS

Burrowing Suitability	0 Rock	1 Stony	**2 Sandy Loam**	3 Sand	**Peeling Bark**	**0 none**	1 rare	2 moderate	3 common
Pebbles Stones	0 none	1 0-30%	**2 30-70%**	3 70-100%	**Large Hollows**	**0 none**	1 rare	2 moderate	3 common
Exfoliating Slabs	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Small Hollows**	**0 none**	1 rare	2 moderate	3 common
Rock Crevices	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Water Prescence**	**0 none**	1 rare	2 moderate	3 common
Boulders	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Distance to Water**	**0 >5km**	1 2-5km	2 500m - 2km	3 <500m
Suitability for Bats	YES		**NO**		**Termite Mounds**	**0 none**	1 rare	2 moderate	3 common
Caves	**Absent**	Present			**Woody Debris**	0 none	**1 rare**	2 moderate	3 common

SPECIES

Malleefowl	YES	**NO**	DETAILS	
Night Parrot	YES	**NO**		
Long-tailed Dunnart	YES	**NO**		

Birds	**Mammals**	**Reptiles**

FAUNA HABITAT ASSESSMENT SHEET

Mid-west

Location: Yunndaga Siding & Bypass Route	**Site Number: HA24**
Project Number:	

Date: 19/5/21	**Easting: 312355**	**Aspect**	N	NE	SW	NW
Quadrat Size: 50 x 50 m	**Northing: 6706227**		E	SE	W	**N/A**

Soil Texture	sand	**sandy-loam**	loam	cracking clay	clay

VEGETATION

Vegetation Description				Average Height in metres	Cover				
	Hummock Grassland	Other:**Mulga Shrubland**							
	Acacia Shrubland	**Stratum**			**Scattered Plants**	**Sparse**	**Moderate**	**Thick**	
	Riverine Woodland	**Overstorey**	*Acacia aneura*		0 <5%	**1 <20%**	2 20-60%	3 60-100%	
	Other Grassland	**Midstorey**	*Acacia sp., Eremophila sp.*		0 <5%	**1 <20%**	2 20-60%	3 60-100%	
	Euc Woodland	**Ground Cover**			0 <5%	1 <20%	2 20-60%	3 60-100%	

CONDITION							**LAST FIRE**		
Scale:	5 Pristine	4 Excellent	**3 Very Good**	2 Good	1 Degraded	0 Completely Degraded	0 <1 year	1 1 -3 Yr	2 4-5 Yr	**3 >5 Yr**

	(general)			**DISTURBANCE**			**(cattle)**		
	0 heavy	1 medium*	**2 mild**	3 none		0 heavy	1 medium	2 mild	**3 none**	

GROUND COVER

Bare Ground	0 <5%	1 <20%	2 20-60%	**3 60-100%**	**Hummock Grass**	**0 <5%**	1 <20%	2 20-60%	3 60-100%	
Rock	**0 <5%**	1 <20%	2 20-60%	3 60-100%	**Other Grass**	**0 <5%**	1 <20%	2 20-60%	3 60-100% *	
Leaf Litter	0 <5%	**1 <20%**	2 20-60%	3 60-100%	**Herbs**	**0 <5%**	1 <20%	2 20-60%	3 60-100%	
Logs >10cm	**0 <5%**	1 <20%	2 20-60%	3 60-100%	**Other**	**0 <5%**	1 <20%	2 20-60%	3 60-100%	

MICROHABITATS

Burrowing Suitability	0 Rock	**1 Stony**	2 Sandy Loam	3 Sand	**Peeling Bark**	0 none	1 rare	2 moderate	3 common
Pebbles Stones	0 none	1 0-30%	2 30-70%	**3 70-100%**	**Large Hollows**	0 none	1 rare	2 moderate	3 common
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Rock Crevices	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Water Prescence**	0 none	1 rare	2 moderate	3 common
Boulders	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Distance to Water**	0 >5km	1 2-5km	2 500m - 2km	3 <500m
Suitability for Bats	YES		**NO**		**Termite Mounds**	0 none	1 rare	2 moderate	3 common
Caves	**Absent**	Present			**Woody Debris**	0 none	1 rare	2 moderate	3 common

SPECIES

Malleefowl	YES	**NO**	DETAILS	
Night Parrot	YES	**NO**		
Long-tailed Dunnart	YES	**NO**		

Birds	**Mammals**	**Reptiles**

Appendix G: Mt Mason Level 2 Fauna Assessment (KLA)

Keith Lindbeck and Associates
Environmental Management Consultants
ABN 36 150 274 469

JUPITER MINES LIMITED

CENTRAL YILGARN IRON PROJECT (CYIP) MT MASON

FAUNA ASSESSMENT

Prepared for: **Jupiter Mines Limited**

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August 2012

EXECUTIVE SUMMARY

Jupiter Mines Limited (Jupiter) is engaged in the exploration and development of mineral resources in Australia. In particular, Jupiter holds interest in the Central Yilgarn Iron Project (CYIP) area located within the western edge of the Mt Ida greenstone belt.

The CYIP area is located approximately 530 km northeast of Perth, 100 km northwest of Menzies and 200 north-northwest of Kalgoorlie**.** Collectively, the tenements that make up the CYIP area cover approximately 27,500 ha. The two main project areas in the CYIP include Mt Mason and Mt Ida which are 100% owned by Jupiter.

Mt Mason, in particular, is reported to have an Inferred Mineral Resource of 5.90 million tonnes of iron ore at 60.1% Fe. In order to further pursue mining opportunities in the Mt Mason area, Jupiter commissioned Keith Lindbeck and Associates (KLA) to undertake a comprehensive Level 2 fauna assessment of the area proposed for mining activities in the Mt Mason tenement area.

In accordance with the Environmental Protection Authority (EPA) Statement and Guidelines, multiple seasonal surveys are required. KLA has completed a 'Spring 2011' survey and an 'Autumn 2012' survey to satisfy these requirements. Five trapping sites were established in the screes and flats adjacent to five smaller satellite sites that were located within areas of Banded Iron Formation (BIF).

Results

Pitfall traps, aluminium box traps, funnel traps and cage traps were open collectively for a total of 4613 trap nights.

The systematic surveys recorded 13 reptile species, five native terrestrial mammal species and one non-native terrestrial mammal species, six species of bats and 34 bird species, giving a total of 59 vertebrate fauna species.

The reptiles captured comprised three dragon species (Agamidae), two diplodactylid species (Diplodactylidae), two gecko species (Gekkonidae), four species of skink (Scincidae) and two varanids (Varanidae) totalling 36 individuals.

Nine species of reptiles were captured in each of the seasonal surveys. However, one agamid (*Pogona minor*) two diplodactilids (*Diplodactylus pulcher, Strophurus assimilis*) and one skink (*Ctenotus schomburgkii*) were captured during the Spring survey that were not captured during the Autumn survey and conversely, two geckos (*Gehyra variegata, Heteronotia bynoei*) one skink (*Ctenotus leonhardii*) and one varanid (*Varanus panoptes*) were captured during the Autumn survey that were not captured during the Spring survey.

Aberrant maxima and minima temperatures results in less reptiles (n = 22) being captured (trap rate = 1.0%) during the purported warmer temperatures of spring and more reptiles (n = 36) being captured (trap rate – 1.5%) in the purported cooler autumn temperatures. The overall trap rate of 1.25% across both seasonal surveys was considered low indicating that the habitat at the time did not support many reptiles.

The numbers of reptile captures between sites did differ but not consistently across seasons. During the Spring 2011 survey more reptiles were captured in the 'Mulga over *Eremophila forrestii* on undulating hills' and during the Autumn 2012 survey more reptiles were captured in the regenerating *Acacia* shrubland. While there were no captures of reptiles in the smaller satellite sites in the BIF areas during the Spring 2011 survey, one individual (*Heteronotia binoei*) was captured in one of the satellite sites during the Autumn 2012 survey.

No reptile species of conservation significance were recorded.

For the terrestrial mammals, five species of native terrestrial mammals representing two families and totalling 28 individuals were captured. During the Spring 2011 survey seven native mammals were captured represented by two species from the Family Dasyuridae: *Sminthopsis longicaudata* Long-tailed Dunnart and *S. dolichura* Little Long-tailed Dunnart. While not listed to occur in the area, *S. longicaudata* is a Priority 4 species on the Department of Environment and Conservation (DEC) Threatened and Priority Fauna Database. This capture represents the southernmost extent of this species and extends its distribution range. No other mammals species of conservation significance were recorded during either of the seasonal surveys.

Many more native mammals (n = 21) were captured during the Autumn 2012 survey. In addition to the above two species, a third dasyurid (*Pseudantechinus woolleyae* Woolley's Pseudantechinus) was captured being the only mammal captured in the smaller satellite sites located in areas of BIF. In addition, *Notomys alexis* Spinifex Hopping Mouse and *Pseudomys hermannsburgensis* Sandy Inland Mouse represented native Muridae species captured.

For the non-native mammals, a total of 44 *Mus musculus* House Mouse (Family: Muridae) were captured with ten captured during the Spring 2011 survey and 34 captured during the Autumn 2012 survey, with only two captured in the smaller satellite sites in the BIF areas. *Mus musculus* populations are known to fluctuate enormously depending on resources and rain. This is consistent with the large increase in numbers from those captured during the Spring 2011 survey to the great number captured during the Autumn 2012 survey.

The capture of 28 individual native mammals during the two seasonal surveys translates into a trap rate of 0.6%, which suggests that at the time of the surveys the area supported very low numbers of mammals. While the trap rate for *Mus musculus* was higher (1.0), the combined trap rate for all mammals (1.6) indicates a low abundance of mammals in the area.

Consistent with the reptile captures, more mammals were captured in the habitat described as ‘Mulga over *Eremophila forrestii* on undulating hills’.

Anabat detectors record the presence of bats, rather than the numbers present. Bats were recorded at all of the five trapping grid sites with between five and six species recorded at each site. While some calls were positively identified, others require confirmation and some could be one of two species. Notwithstanding this, it is reasonable to assume that the diversity of bats present extends throughout the Mt Mason area.

Systematic bird surveys yielded a total of 507 individuals of 34 species from 16 Families. For the Spring 2011 survey, the 12 Families comprised three non-passerine Families (n = eight species with 129 individual birds recorded) and nine passerine Families (n = 21 species with 178 individual birds recorded). While the numbers of birds recorded in each category suggest that the area supports marginally more passerines (58% of total number of birds) than non-passerines (42%), analysis of the results indicates that *Nymphicus hollandicus* Cockatiel (n = 40) and *Melopsittacus undulatus* Budgerigar (n = 45) were responsible for weighting of the non-passerine figures.

Within the passerines, 52% of the total number of passerines (n = 178) was represented by three species with the Malurid *Malurus splendens* Splendid Fairy-wren being the most ubiquitous (n = 35). *Acanthiza robustirostris* Slaty-backed Thornbill was the next most numerous bird (n = 33) followed by *Oreoica gutturalis* Crested Bellbird (n = 25).

For the Autumn 2012 survey, three non-passerine species from three Families accounted for only 17 birds whereas the 16 passerines species numbered 183 individuals from eight Families. Two species (*Malurus splendens* Splendid Fairy-wren (n = 45) and *Acanthiza apicalis* Inland Thornbill (n = 66)) accounted for 61% of all passerines during this seasonal survey. Thus, the percentage of passerines (91.5%) heavily outweighed the percentage of non-passerines (8.5%).

Overall, the number of birds recorded during the systematic sampling suggests that resources and/or habitat required were adequate to maintain the numbers and diversity present.

The distribution of birds throughout the Mt Mason area was not remarkably different between sites for the Spring 2011 survey. These results suggest that there was no significant correlation between distribution of birds across the length of the area surveyed and the vegetation communities in the areas surveyed. However, these results were not consistent for the Autumn 2012 survey period in which there was a marked difference in the species distribution across the sites. Given that all sites except the regenerating *Acacia* shrubland are dominated by a mulga upper story, it may be assumed that resource availability differs substantially in the cooler months in relation to topography and understorey species.

Of the birds considered of conservation significance listed for the area, evidence of *Leipoa ocellata* Malleefowl was found, *Oreoica gutteralis* Crested Bellbird was recorded at every site and opportunistically and *Pomatostomus superciliosus* White-browed Babbler was recorded at one site and opportunistically. Of four reportedly known Malleefowl mounds in the general area only three very old inactive mounds were located, and an additional four old, inactive mounds were identified during the surveys. Seven of the eight were located on the edge of or outside of the Mt Mason tenement. One new, active Malleefowl mound was identified 1.7 km south of the southern boundary of the Mt Mason tenement. Given the location of the proposed disturbance in the Mt Mason area and the presence of large areas of intact, undisturbed, remnant vegetation regionally, the conservation status of the Malleefowl, Crested Bellbird and White-browed Babbler is not likely to be altered by the proposed mining activity.

Of the invertebrate fauna collected, 101 individuals were identified and represented five Classes and nine Orders. Within the Arachnida, nine species totalling 26 individuals represented five Families, three Chilopoda accounted for three Families with one species from each, Diplopoda accounted for one species and Crustacea seven species from one Family. Five species of Gastropoda were identified representing three families and accounting for 64 specimens. Given the lack of taxonomic knowledge and reference collections, the results from the Western Australian Museum were often inconclusive depending on the families or genera. Up to 13 of the 19 species were considered not Short-range Endemic Invertebrates (SREs) whereas lack of knowledge preventing a conservation status to be determined for five of the species. For the remaining species (Family: Paradoxosomatidae), one single damaged female millipede did not facilitate identification. However all species in the presumed genus are known to be SREs.

The overall condition of the vegetation within the survey area can generally be described as “Very Good” to “Excellent” with almost all disturbances within the area directly related to recent exploration activity and associated tracks. No unique, restricted or fauna-specific habitat types for terrestrial vertebrate fauna were identified within the Mt Mason or local area. The BIF range at Mt Mason lies in a north to south orientation for approximately 10 km and appears to be well connected to the BIF range at Mt Ida (approximately 8.6 km in length). The potential invertebrate habitat supported by these ranges is extensive and is not limited to the area of proposed impact at Mt Mason. Thus, while the removal of up to approximately 220 ha of native vegetation and BIF will impact

on indigenous fauna, the vegetation cannot be considered to be significant habitat in a regional context.

Recommendations

The following general recommendations apply in the case of any major disturbance to large areas of native vegetation, as a consequence of the proposed development for the Mt Mason Project:

- Any clearing be minimised in extent given that the abundance and diversity of species lost will be proportional to the amount of habitat cleared;
- Where possible, all infrastructure associated with the development of the mining operation be aligned preferentially to areas of existing disturbance;
- Where possible, access routes be aligned to existing tracks and other barriers or follow the boundaries of broad-scale intact native vegetation;
- A rehabilitation plan is developed that progressively rehabilitates areas as soon as they are no longer required; and
- All members of the work force on site attend an environmental induction to ensure they are familiar with the value of native vegetation to fauna indigenous to Western Australia. This should include awareness of driving restrictions, ensuring that off-road driving is minimised, fire prevention is actively practised, and appropriate responses are followed in the event of an accident involving fauna.

In addition, specific recommendations are made in relation to the Malleefowl:

- A targeted Malleefowl survey should be undertaken by a suitably qualified team in the areas proposed for disturbance as soon as detailed boundaries of these areas have been confirmed.
- Given the evidence of Malleefowl within the zone of impact, a referral should be submitted to the Federal Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) for approval in accordance with the EPBC Act 1999.
- Pending the results of the targeted Malleefowl survey in the confirmed areas for disturbance and outcome of the DSEWPaC referral, a Malleefowl Management Plan should be developed and implemented immediately post approval.

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1.0 INTRODUCTION

1.1 BACKGROUND

Jupiter Mines Limited (Jupiter) is engaged in the exploration and development of mineral resources in Australia. In particular, Jupiter holds an interest in the Central Yilgarn Iron Project (CYIP) area located within the western edge of the Mt Ida greenstone belt. The Ida fault, a large scale regional structure, marks the boundary between the Southern Cross Granite-Greenstone and Eastern Goldfields.

The CYIP area is located approximately 530 km northeast of Perth, 100 km northwest of Menzies and 200 north-northwest of Kalgoorlie. Collectively, the tenements that make up the CYIP area cover approximately 27,500 ha. The two main project areas in the CYIP include Mt Mason and Mt Ida (Figure 1). Both projects are 100% owned by Jupiter.

Mt Mason, in particular, is reported to have an Inferred Mineral Resource of 5.90 million tonnes of iron ore at 60.1% Fe. In order to further pursue mining opportunities in the Mt Mason area, Jupiter commissioned Keith Lindbeck and Associates (KLA) to assist in the government approvals process.

1.2 SCOPE OF STUDY

As part of the government approval requirements, KLA was commissioned in July 2011 to undertake a comprehensive Level 2 fauna assessment of the vegetated areas encompassing the proposed mine and associated infrastructure related to the Mt Mason Project. The survey was planned and implemented in accordance with Environmental Protection Authority (EPA) Position Statement No 3 "*Terrestrial Biological Surveys as an Element of Biodiversity Protection*" (EPA 2002), Guidance Statement No. 56 "*Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia*" (EPA 2004), Guidance Statement No. 20 "*Sampling of Short Range Endemic Invertebrate Fauna for Environmental Impact Assessment in Western Australia*" (EPA 2009) and "*Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment*" (EPA and DEC 2010).

The EPA (2004) guidelines indicate that multiple, seasonal surveys are required for baseline information. Therefore, one Level 2 survey was conducted in Spring (August-September 2011) and a second Level 2 survey was conducted in Autumn (March 2012).

In January 2007, Jupiter commissioned a Level 1 desktop terrestrial vertebrate fauna assessment of the Mt Mason Project area (Outback Ecology Services (OES) 2007). The results of that fauna assessment were used to provide contextual data for the Level 2 survey.

The scope of work for the Level 2 fauna survey was to:

- generally describe the vegetation associations in the study area;
- identify habitat that may be of significance to fauna indigenous to Western Australia;
- identify any habitats of particular conservation significance for fauna within the study area;
- develop an inventory (baseline information) of terrestrial vertebrate fauna species and terrestrial Short-range Endemic invertebrate (SRE) species identified from within the survey area using a combined approach of desk-top research including a review of existing literature and site specific, seasonal fauna surveys comprising a suite of established survey techniques;
- assess the inventory in the regional context by comparisons with available data from other localities within the region;

- identify fauna of conservation significance in the area, including SRE species;
- provide a risk assessment to determine potential impacts to fauna of conservation significance; and
- provide recommendations, including the management of perceived impacts to fauna habitats and fauna of conservation significance within the study area.

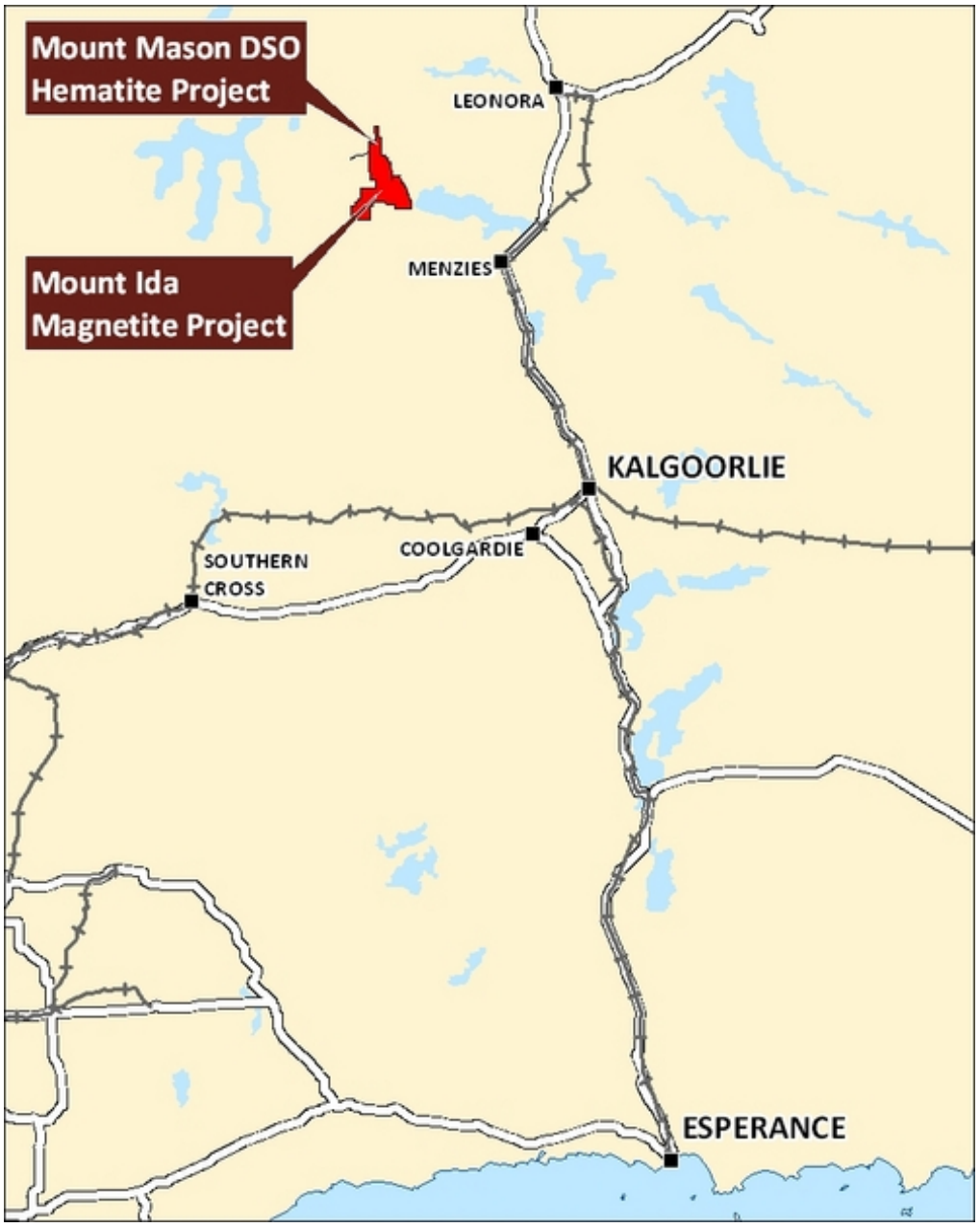

Figure 1 - Location of Mt Mason and Mt Ida

1.3 PURPOSE OF THIS REPORT

This report describes the methodology employed for two seasonal fauna surveys of the area encompassing the proposed mine and associated infrastructure relating to the Mt Mason Project. It documents the current knowledge of the potentially-occurring and surveyed fauna in the broader area and provides the results of the Spring 2011 and Autumn 2012 surveys conducted in the subject area. The report also provides recommendations that include minimising impacts of the proposed project on fauna habitat and assemblages.

This report is intended as a supporting document to accompany Jupiter's mining approvals submissions to satisfy statutory requirements.

This survey is subject to limitations and these are discussed in more detail in the appropriate sections.

2.0 EXISTING ENVIRONMENT

The Mt Mason Project area lies approximately 100 km northwest of Menzies, approximately 35 km northwest of Lake Ballard (an ephemeral salt lake) and 65 km east of Lake Barlee (an intermittent salt lake) in the Goldfields district of Western Australia (Figure 2). The operations will be carried out on M29/408 which is located on the Perrinvale Pastoral Lease (H91304) (Figure 3).

The Mt Mason Project area extends within the eastern aspect of M29/408 which measures approximately 1.9 km long and approximately 1.6 km wide and covers 300 ha (Figure 2 and Figure 3).

2.1 CLIMATE

The area encompassing Mt Mason is located close to the delineation between the Desert-Intermediate and Semi-Desert Mediterranean bioclimatic regions which are also described as semi-arid (Beard 1990). The area is dry for the majority of the year and beneficial rains fall in late summer to early winter (Beard 1990).

The nearest official meteorological station is located at Menzies, approximately 100 km southeast of the survey area. Recordings of the local climatic conditions commenced at Menzies in 1896, and although the station is still open, availability of data is limited (Bureau of Meteorology (BOM) 2012). The next closest station is Leonora, approximately 100 km northeast of Mt Mason which has records from 1898 and continues to monitor climatic conditions to date (BOM 2012). Data from both stations is presented in this report.

2.1.1 Temperature

For Menzies, the mean annual minimum temperature is 12.6^{o}C and the mean annual maximum temperature is 26.3^{o}C (Figure 4). The coldest month is July (mean minimum temperature 5.3^{o}C), the hottest is January (mean maximum temperature 35.1^{o}C), and diurnal temperature variations are relatively consistent throughout the year (Figure 4). Diurnal temperature variations for Leonora mirror those of Menzies. However, Leonora recorded overall slightly higher temperatures with the mean annual minimum being 14°C, mean annual maximum 27.9^{o}C, coldest temperature 6.1^{o}C also in July and hottest also in January at 37.1^{o}C (Figure 5).

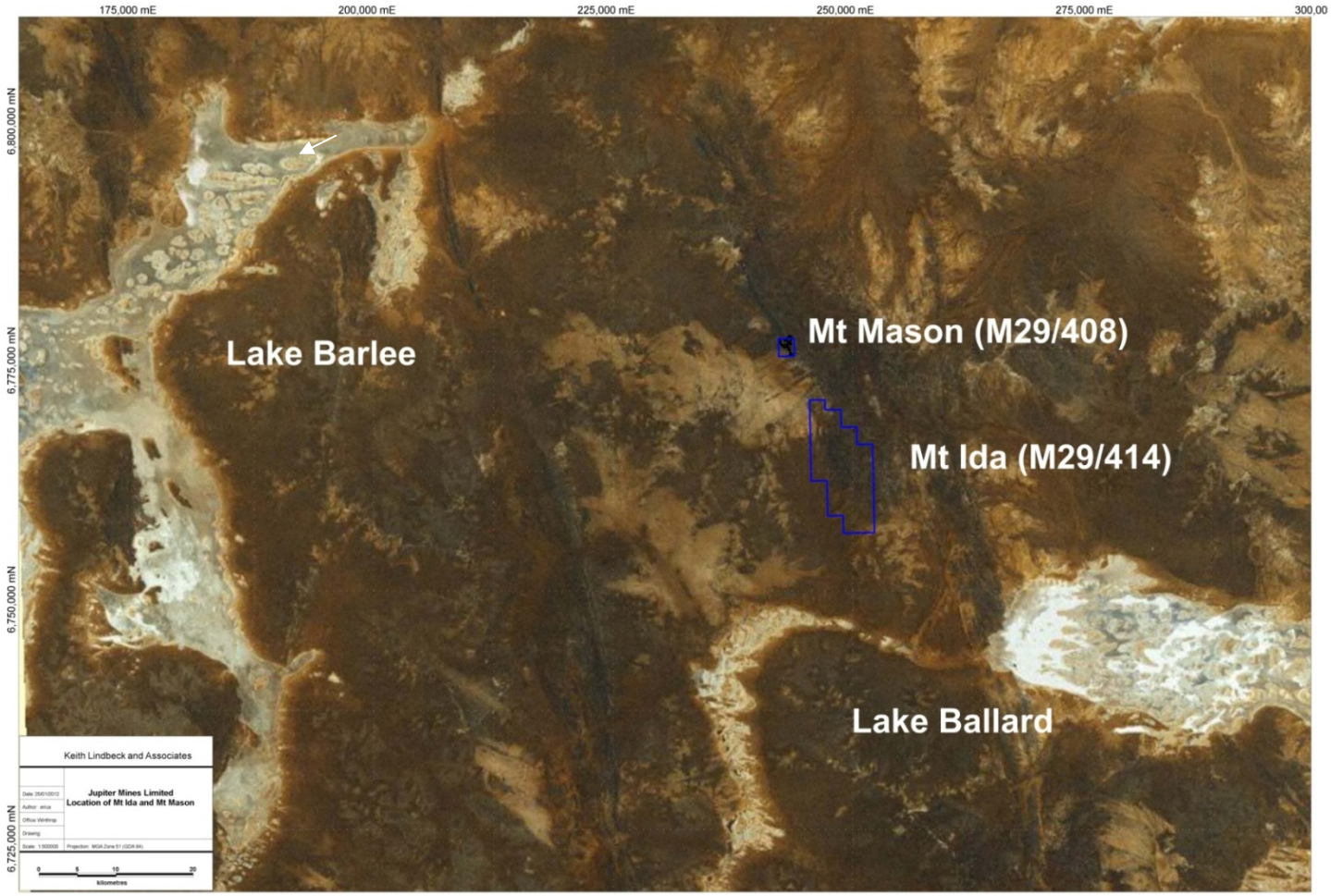

Figure 2 - Location of Mt Mason Project area

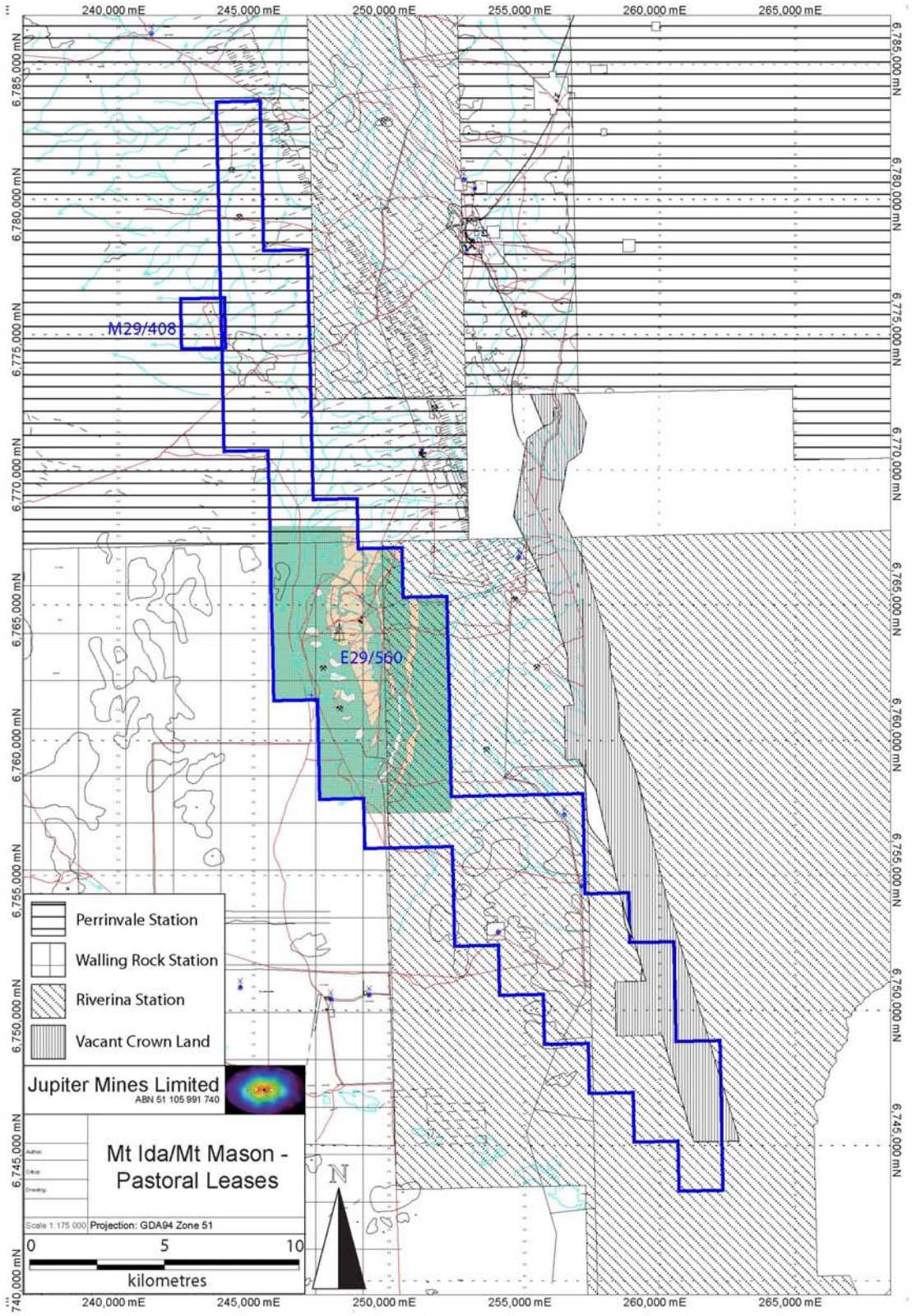

Figure 3 - Pastoral Leases of the Mt Mason project area

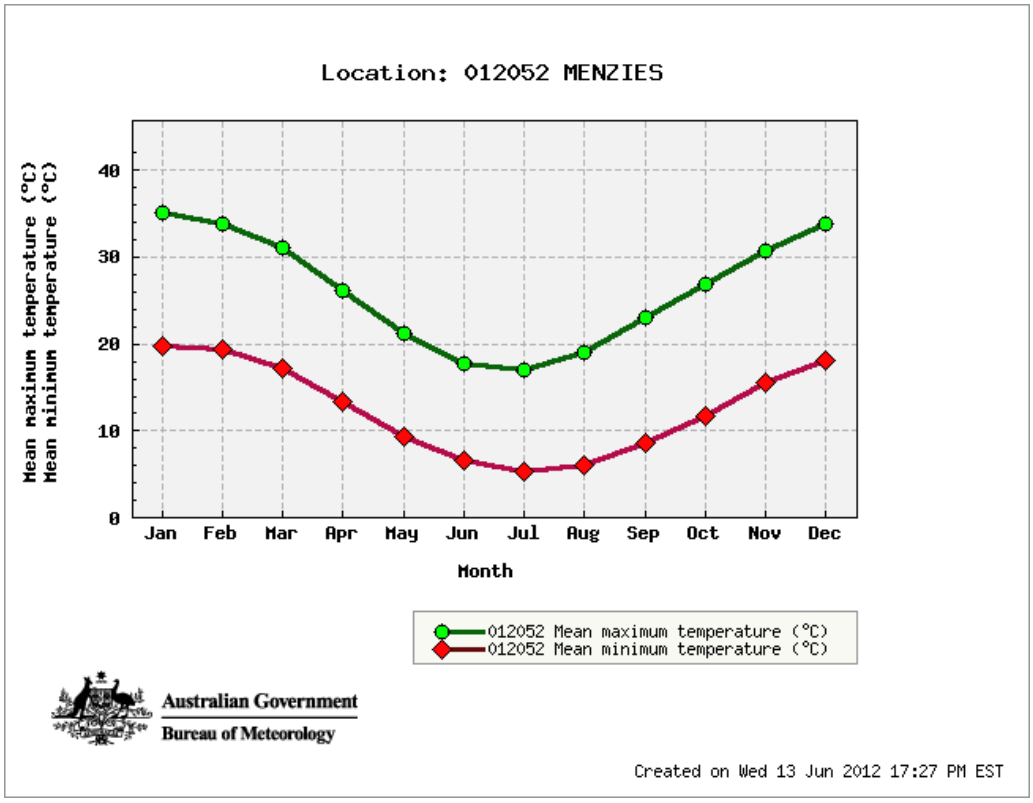

Figure 4 - Mean maximum and minimum temperatures at Menzies Meteorological Station

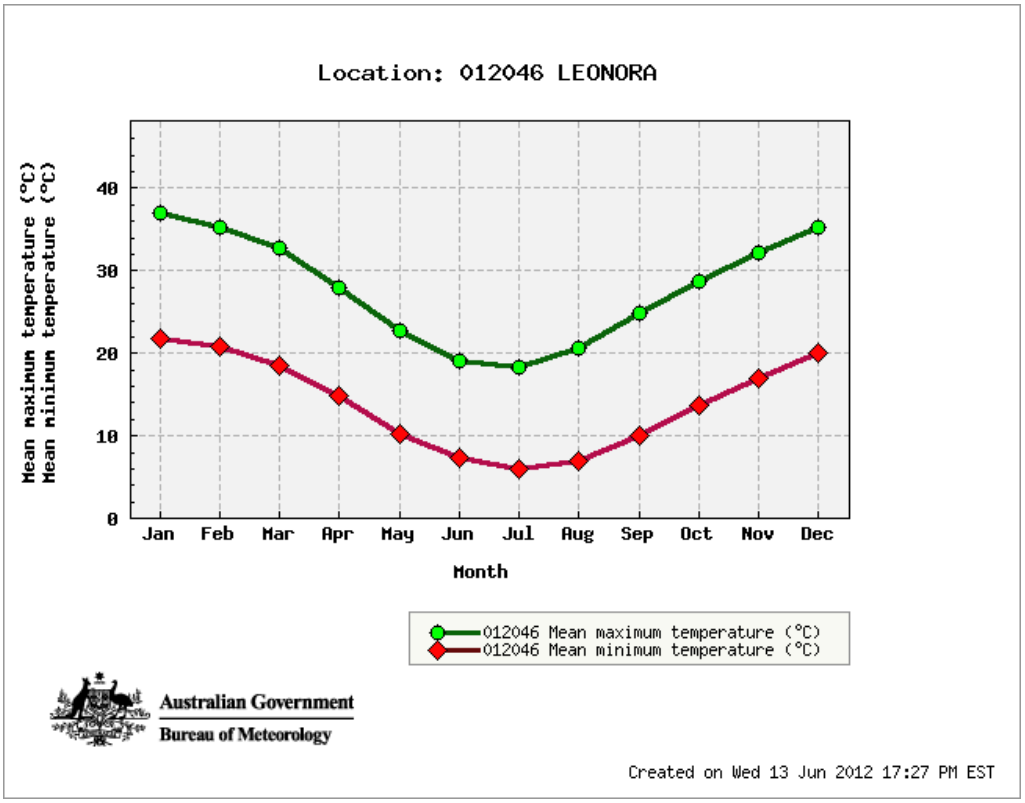

Figure 5 - Mean maximum and minimum temperatures at Leonora Meteorological Station

Mean minimum and maximum temperatures for the August and September 2011 survey period were considerably warmer than the historic mean, while those for the March 2012 survey period were slightly cooler.

The mean minimum temperature for the August-September 2011 survey period was 11.4°C, compared to 7°C for August and 10°C for September recorded over the last 63 years for the area. The mean maximum temperature for that survey period was warmer (26.4°C) than the long-term average of 20.6°C for August and 24.8°C for September (BOM 2012).

For the March 2012 survey period, the mean minimum temperature was somewhat lower (15.5°C) than the historic mean of 18.6°C and the mean maximum temperature was also lower (31.3°C) than the 63 year mean (32.7°C). Table 1 lists the minimum and maximum temperature recordings and rainfall for the periods spanning both seasonal fauna surveys recorded at the Leonora Station (28 August 2011 to 3 September 2011, and 1 to 7 March 2012). During the Autumn 2012 survey period, a thermometer (and rain gauge) were erected within the survey area. The temperatures recorded during this survey period differed slightly from Leonora; the mean minimum temperature was very similar (15.2°C) whereas the mean maximum temperature was higher at 35.8°C (Table 2). The accuracy of these temperature recordings must be taken into account and regarded as an estimate only.

Table 1 - Daily temperatures and rainfall for selected dates in Spring 2011 (August-September) and Autumn 2012 (March) recorded at Leonora Meteorological Station

2011	Temperature		Rainfall
Date	**Min °C**	**Max °C**	**mm**
28-Aug	9.1	28.7	0
29-Aug	9.8	27.8	0
30-Aug	15.9	28.5	0
31-Aug	12.4	27.6	0
1-Sep	12.7	28.3	0
2-Sep	13.1	25.5	0
3-Sep	6.9	18.3	4.2
Mean	**11.4**	**26.4**	**0.6**

2012	Temperature		Rainfall
Date	**Min °C**	**Max °C**	**mm**
1-Mar	14.2	26.4	0.4
2-Mar	13.7	27.8	0
3-Mar	12.9	29.1	0
4-Mar	16.7	-	0
5-Mar	-	33.6	0
6-Mar	17.4	33.9	0
7-Mar	18	37	0
Mean	**15.5**	**31.3**	**0.06**

Table 2 - Daily temperatures and rainfall recorded within the survey area at Mt Mason during the Autumn 2012 survey

2012	Temperature		Rainfall
Date	**Min °C**	**Max °C**	**mm**
29-Feb	16.0	26.0	0
1-Mar	15.0	35.0	0
2-Mar	12.0	37.0	0
3-Mar	12.0	37.0	0
4-Mar	12.5	33.0	0
5-Mar	15.0	36.0	0
6-Mar	18.0	37.5	0
7-Mar	18.0	38.0	0
8-Mar	18.0	43.0	0
Mean	**15.7**	**35.83**	**0**

2.1.2 Rainfall

The annual average rainfall at Menzies is 249.9 mm which falls (<1 mm) on approximately 32.1 rain days (BOM 2012). Leonora is located approximately 100 km north of Menzies and the annual average rainfall and number of rain days is marginally less with 236.8 mm falling on approximately 30.1 rain days. More rain (>20 mm per month) falls in the first half of the year than in the second half (<20 mm per month) and this amount does not vary greatly (Figure 6).

Rainfall preceding the spring survey was below average for the period March to May 2011, while June and July 2011 received above average rainfall. February 2011 recorded an excessive amount of rain (190.7 mm) equating to 37% of the entire annual rainfall for 2011 (Figure 6). A total of 15.1 mm of rain was recorded for August 2011, and 4.2 mm on 2 September 2011. A rain gauge at 'Mt Ida camp' located approximately 11 km east of Mt Mason recorded 11.0 mm of rain on 2 September 2011. Both August and September recorded below average rainfall for 2011.

The period prior to the autumn survey received above average rainfall from October 2011 through to January 2012. While February 2012 received below average rainfall (18.1 mm) rainfall for March 2012 (68.2 mm) far exceeded mean average for that month (28.8 mm) (BOM 2012). Only 0.4 mm of rain fell during the March 2012 survey period, and no rainfall was recorded at site.

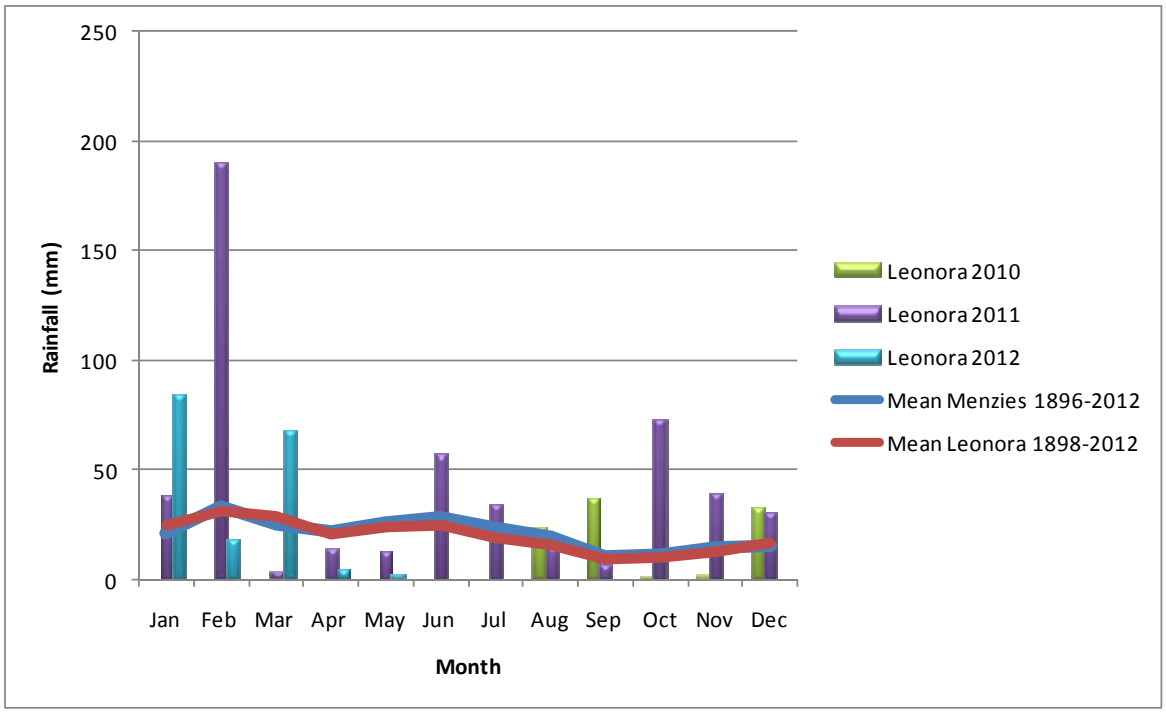

Figure 6 - Rainfall data for Menzies and Leonora Meteorological Stations

2.2 INTERIM BIOGEOGRAPHIC REGIONALISATION OF AUSTRALIA

The Interim Biogeographic Regionalisation for Australia (IBRA) divides the Australian continent into 85 bioregions and 403 subregions (Department of the Environment, Water, Heritage and the Arts 2009). The CYIP area is located within the Murchison IBRA region and (MUR1) East Murchison subregion (Cowan 2001).

The East Murchison bioregion which totals over seven million hectares is characterised by Mulga Woodlands often rich in ephemerals, hummock grasslands, saltbush shrublands and *Halosarcia* shrubland (Cowan 2001). The area is characterised by:

- internal drainage,
- extensive areas of elevated red desert sandplains with minimal dune development,
- salt lake systems that are associated with the occluded Paleodrainage system, and
- broad plains of red-brown soils and breakaway complexes as well as red sandplains (Cowan 2001).

The subregion is rich and diverse in both its flora and fauna. However, most species are wide ranging and usually occur in at least one, and often several, adjoining subregions (Cowan 2001). Notwithstanding this, known special values in relation to the landscape, ecosystem, species and genetic values in the subregion include:

- Rare Features such as calcrete aquifers in the northern parts that support a large variety of Short-range Endemic (SRE) subterranean aquatic fauna,
- Rare terrestrial species include Great Desert Skink *Egernia kintorei,* Malleefowl *Leipoa ocellata*, Alexandra's Parrot *Polytelis alexandrae*, Mulgara *Dasycercus cristicauda* and Yellow-bellied Black Snake *Pseudechis butleri*, and
- Lake Barlee which represents a most important breeding site for Banded Stilts *Cladorhynchus leucocephalus* and refugia for many other water birds (Burbidge and Fuller 1982 cited in Cowan 2001).

  Lake Barlee is usually dry but, given its importance when it is inundated, it is now recognised as an Important Bird Area (IBA) by Birdlife Australia (Birds Australia 2012). There are no other IBA's or lakes between Lake Barlee and Mt Mason.

The dominant land use for the East Murchison subregion is grazing which accounts for up to ~86% of land use, and Unallocated Crown Land and Crown Reserves account for ~11.34% (Cowan 2001). While there are many mining leases in the area, most still fall under the Land Administration Act 1997 and, as such, are still required to be stocked (Cowan 2001). Only 1.4% is located in International Union for Conservation of Nature (IUCN) 1 – 4 conservation reserves (CAR 2009).

2.3 FLORA AND VEGETATION MAPPING

The project area is located within the Austin District of the Eremaean Botanical Province (Beard 1990). The Austin Botanical District comprises predominantly mulga low woodland on plains with the vegetation reduced to scrub on hills, with tree steppe of *Eucalyptus* spp. over *Triodia basedowii*. The vegetation is dominated by *Acacia* forests and woodlands, *Acacia* shrublands, hummock grasslands and chenopod and samphire shrublands, with other shrublands also occurring and small areas of *Eucalyptus* woodlands and open woodlands (ANRA 2012).

Numerous flora and vegetation mapping surveys have previously been undertaken in the area (Paul Armstrong and Associates 2008, Meissner and Owen 2010, OES 2010). More recently, Native Vegetation Solutions (NVS) was commissioned to conduct a Level 2 flora and vegetation mapping survey of the areas proposed for disturbance in the Mt Mason area (NVS 2012).

Ten vegetation groups were described during the recent survey, largely following topographical features and dominant upper storey species (NVS 2012). While ten vegetation groups were identified via quadrat sampling, only nine were within the survey area (Figure 7):

- *Thryptomene* Shrubland: *Thryptomene costata* low open shrubland with emergent *Acacia quadrimarginea* over scattered mixed shrubs and herbs on low hillslopes and ridges
- Open Mulga woodland over laterite: *Acacia effusifolia* low open forest over *Acacia incurvaneaura, Eremophila forrestii* subsp. *forrestii* over *Hibbertia arcuata and Prostanthera althoferi* subsp. *althoferi and* scattered mixed shrubs and herbs on laterite hills.
- *Acacia* shrubland (adjacent to fire scar): *Acacia effusifolia* low open shrubland over scattered mixed shrubs and herbs on flats
- *Allocasuarina* over *Calytrix* shrubland (not in survey area): *Allocasuarina acutivalvis* subsp. *acutivalvis* and *Acacia incurvaneura* low woodland/tall shrubland over *Acacia balsamea*, *Philotheca brucei* subsp. *brucei* open shrubland over scattered mixed shrubs and herbs in minor drainage lines and Laterite breakaways
- Mulga over *Eremophila forrestii* subsp. *forrestii* on hills and ridges: *Acacia incurvaneura* woodland over *Eremophila forrestii* subsp. *forrestii* shrubland over scattered mixed low shrubs and herbs on undulating hills and ridges
- Mulga over *Prostanthera althoferi* subsp. *althoferi* on hills and ridges: *Acacia incurvaneura* shrubland to tall open scrub over *Prostanthera althoferi* subsp. *althoferi* shrubland over scattered mixed shrubs and herbs on hills and ridges
- Mulga over *Philotheca brucei* subsp. *brucei* on hills and ridges: *Acacia incurvaneura* with *Acacia quadrimarginea* tall shrubland/ low woodland over *Philotheca brucei* subsp. *brucei* with *Acacia balsamea shrubland* over *Eremophila latrobei* subsp. *latrobei* and *Hibbertia exasperata* over mixed herbs and shrubs on hills and ridges
- *Mulga over Eremophila forrestii* subsp. *forrestii* on flats: *Acacia incurvaneura* with *Acacia mulganeura* tall shrubland over *Eremophila forrestii* subsp. *forrestii and Acacia effusifolia* low shrubland over *Waitzia acuminata* and mixed herbs on flat plains
- *Acacia burkittii* shrubland within drainage lines: *Acacia burkittii* and *Acacia quadrimarginea* tall shrubland over *Senna artemisioides* subsp. *artemisioides* over *Ptilotus obovatus* and mixed shrubs within drainage lines
- *Acacia cockertoniana* over *Eremophila oldfieldii* and *Eremophila pantonii* on flats: *Acacia cockertoniana* tall shrubland over *Eremophila oldfieldii* subsp. *angustifolia* over *Eremophila pantonii* and mixed shrubs on flats.

A total of 97 vascular plant taxa from 59 plant genera and 31 plant families were recorded within the survey area (NVS 2012). The majority of taxa were recorded within the Fabaceae with 16 species from two genera, dominated by *Acacia,* followed by Asteraceae with 12 species from ten genera. No introduced weed species were recorded.

No plant taxa located in the survey area are gazetted as Declared Rare Flora (DRF) pursuant to subsection 2 of section 23F of the WCA 1950 or listed as Threatened pursuant to Schedule 1 of the EPBC Act (1999). Only one Priority species (*Calotis* sp. Perinvale Range) (Priority 3) was recorded from one location within the survey area (NVS 2012). This population was located on the western edge of the survey area is an area of Banded Ironstone Formation (BIF).

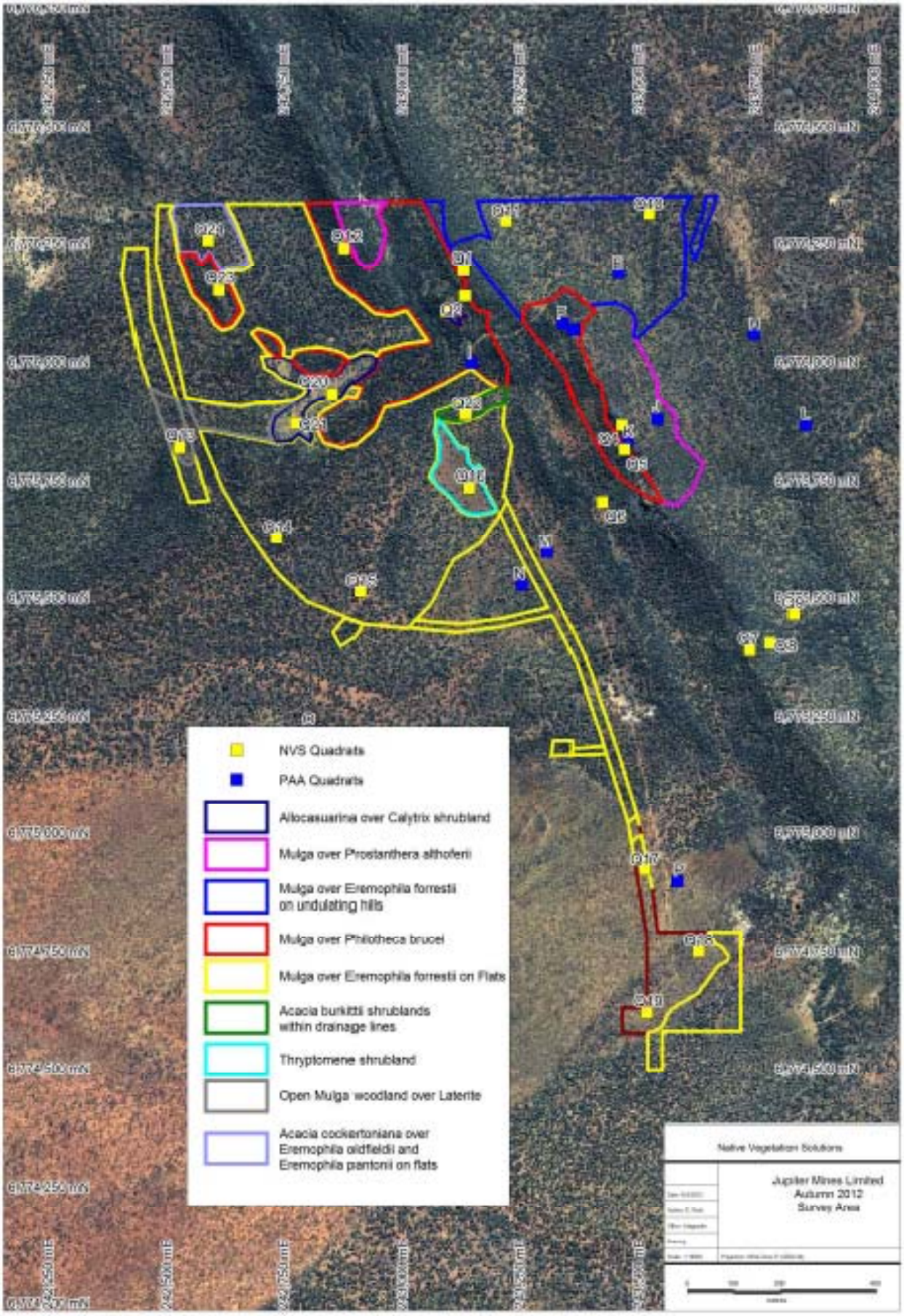

Figure 7 - Vegetation communities identified in Mt Mason Project area
after NVS (2012)

No Threatened Ecological Communities (TECs) are located in the Mt Mason area. However, the area surveyed lies within the buffer zone of a Priority Ecological Community (PEC) namely the Bulga Downs / Perinvale / Walling vegetation complex (NVS 2012). This community has not yet been described by the DEC on the list of PECs. However, it is inferred that the PEC relates to the vegetation specifically occurring on the BIF (NVS 2012).

2.3.1 Trapping site selection

Trapping site selection was undertaken prior to the receipt of the most recent flora survey and its delineation and description of vegetation communities. However, referring to previous vegetation descriptions (OES 2010), an attempt was made to sample fauna in representative vegetation communities within the area proposed for disturbance, and replicate these within the major vegetation groups where possible.

From a faunal perspective, the majority of the vegetation comprises Mulga shrubland with varied understorey and small pockets of other vegetation communities. It is also noted that a wildfire had gone through the southwestern portion of the tenement in 2006-2007 (Ian Ridley *pers. comm.* 2012).

Thus, five 'conventional' trapping grids (Sites 1 to 5) were established in Mulga shrubland within areas proposed for disturbance in the Mt Mason area (Figure 8). Site 2 was established within the fire scar that supported good regeneration. In addition, in areas of BIF which were not conducive to digging in of pitfall traps but were likely to be disturbed for mining operations, five small satellite trapping sites were established (Sites 6 to 10) (Figure 8, Plates 1 to 10). Thus, it is noted that the inability to dig pit traps into the unyielding BIF, with restricted vehicular access, was considered a limitation in terms of optimal trapping opportunities.

In accordance with the Keighery (1994) vegetation condition scales (Appendix A), and as determined by NVS (2012), the overall condition of the vegetation within the survey area can generally be described as "Very Good" to "Excellent". Almost all disturbances within the area were directly related to recent exploration activity and associated tracks. While every attempt was made to locate sampling sites in areas of least disturbance, access and practicality resulted in most sites being within close proximity to vehicular tracks or existing disturbance.

Table 3 lists the ten sampling areas and their respective vegetation associations and Plates 1 to 10 provide photographic representation of the trapping areas.

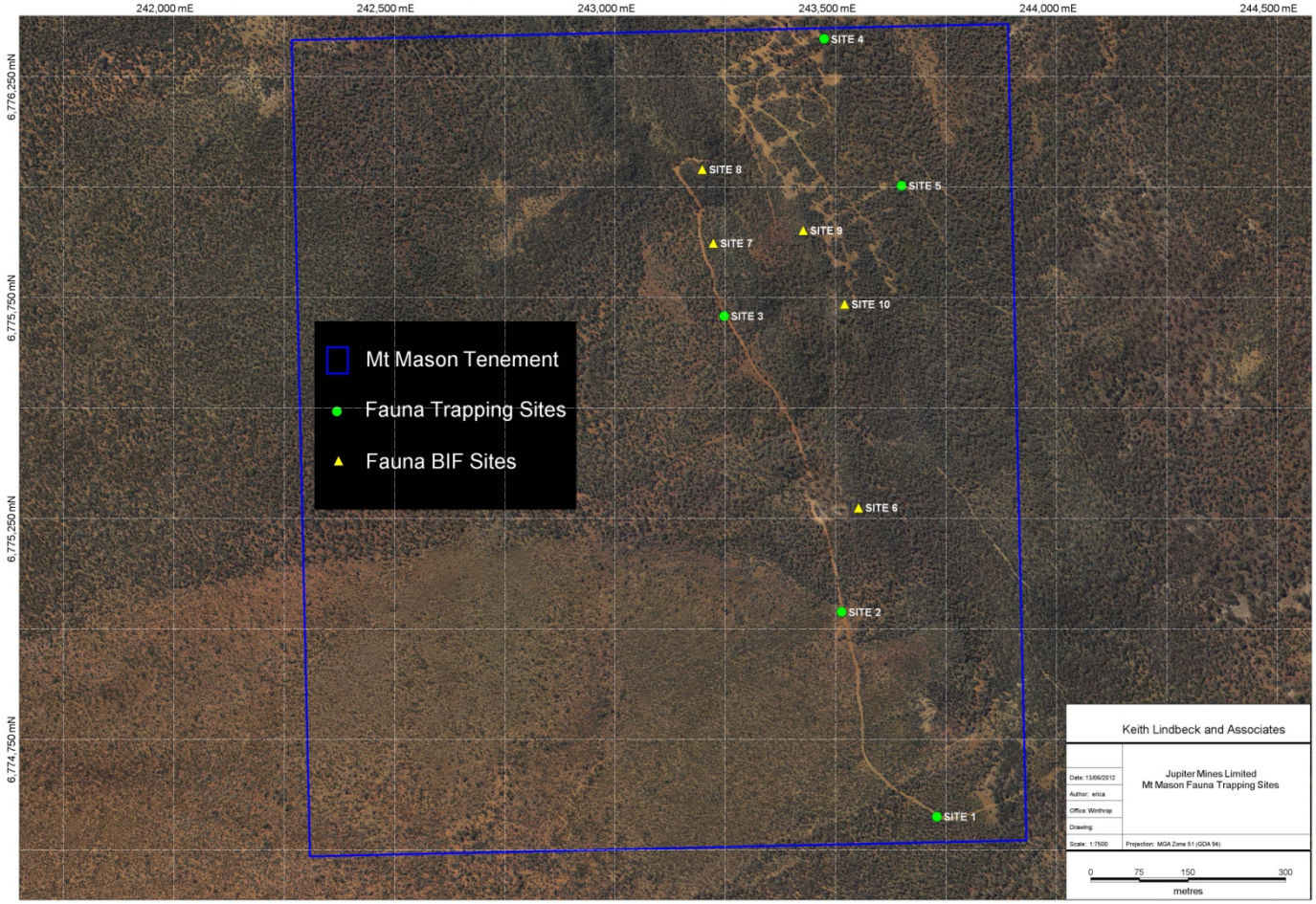

Figure 8 - Locations of trapping sites

Table 3 - Site numbers and their associated vegetation descriptions
(in accordance with NVS (2012))

Site	Vegetation description
1	Mulga over *Eremophila forrestii* on Flats
2	*Acacia* shrubland (fire scar)
3	Mulga over *Eremophila forrestii*
4	Mulga over *Eremophila forrestii* on undulating hills
5	Mulga over *Eremophila forrestii* on undulating hills
6	Mulga over *Eremophila forrestii*
7	Mulga over *Eremophila forrestii*
8	Mulga over *Philotheca brucei*
9	Mulga over *Prostanthera althoferi*
10	Mulga over *Philotheca brucei*

Plate 1 - Site 1 Mulga over *Eremophila forrestii* on Flats

Plate 2 - Site 2 *Acacia* shrubland (fire scar)

Plate 3 - Site 3 Mulga over *Eremophila forrestii*

Plate 4 - Site 4 Mulga over *Eremophila forrestii* on undulating hills

Plate 5 - Site 5 Mulga over *Eremophila forrestii* on undulating hills

Plate 6 - Site 6 Mulga over *Eremophila forrestii* associated with BIF

Plate 7 - Site 7 Mulga over *Eremophila forrestii* associated with BIF

Plate 8 - Site 8 Mulga over *Philotheca brucei* associated with BIF

Plate 9 - Site 9 Mulga over *Prostanthera althoferi* associated with BIF

Plate 10 - Site 10 Mulga over *Philotheca brucei* associated with BIF

3.0 LITERATURE REVIEW

The CYIP – Mt Mason Project area is located on a pastoral lease and is surrounded by other pastoral leases and exploration and mining operations. In addition to the Level 1 desktop fauna assessment of the Mt Mason area (OES 2007), the results of a Level 2 survey conducted at Mt Ida in Spring 2011 and Autumn 2012 have been included for comparative purposes (KLA 2012 *in prep*).

Previous vertebrate surveys have also been completed regionally as part of environmental impact assessments of operational mines and exploration projects. With reference to the Mt Mason Project area, these include fauna surveys conducted within:

- the Barlee-Menzies study area by the Biological Surveys Committee (Burbidge *et al.* 1995) and,
- Snark Project – Lake Giles Project (KLA 2011).

The locations of these studies and their descriptions are briefly summarised in Table 4. Fauna recorded from these surveys are included in Appendix B and comparisons are discussed in each section (Section 5).

Table 4 - Previous studies in and around the Mt Mason survey area

Citation	Title	Description of Study	Approximate distance from Mt Mason project area	Survey Effort
Burbidge *et al*. (1995)	The Biological Survey of the Eastern Goldfields Part 12: Barlee -Menzies Study Area	Inventory of vegetation, flora and fauna of study area prepared by the Biological Surveys Committee	Mt Manning Nature Reserve: ~95 km to southwest and Mt Elvrie: ~80 km to southwest	Sites and Quadrats with trapping, bird census and opportunistic sightings over three survey periods: Winter 1979, Spring 1980 and Late Summer 1981.
OES (2007)	Mt Mason Project. Desktop Study: Terrestrial Vertebrate Fauna	Desktop study only	Mt Mason tenement: 'EL 29/495'	Desktop assessment of fauna
KLA (2011)	Snark Project Fauna Assessment	Vertebrate fauna survey of the Snark deposit area	~80 km southwest	Level 2 autumn survey 2011
KLA (2012 *in prep*)	Jupiter Mines Limited. Central Yilgarn Iron Project (CYIP) Mt Ida: Fauna Assessment	Vertebrate and invertebrate terrestrial fauna surveys in the Mt Ida area	~10 km south of Mt Mason	Formal trapping, bird census, bat census, opportunistic recordings during spring 2011 and Autumn 2012.

4.0 SURVEY METHODOLOGY

4.1 DATABASE SEARCHES

The online EPBC Protected Matters Search Tool was used to determine any species listed under the EPBC Act 1999 for the area.

A search was commissioned of the Threatened and Priority Fauna Database held by the DEC as recognised under the Western Australian *Wildlife Conservation Act* (WCA) 1950 and considered by the DEC as species of conservation significance.

DEC's *NatureMap* was searched for records of fauna specimens vouchered at the Western Australian Museum and the Birds Australia Atlas Database was searched for bird species listed within the survey area.

A search was commissioned of the Western Australian Museum invertebrate database.

A species search was conducted of the International Union for Conservation of Nature (IUCN) database (IUCN 2001).

Categories and descriptions of the conservation status of fauna species are provided in Appendix C and the results of the databases searches are shown in Appendix B.

4.2 SURVEY TIMING

EPA Guidance Statement No. 56 states that the most important seasonal activity times for many faunal groups are related to rainfall and temperature (EPA 2004). A survey in the season that follows the season of maximum rainfall is generally the most productive and important survey time. Therefore, and conventionally, fauna surveys are conducted bi-seasonally in spring and autumn.

The climate in the Mt Mason region is generally described as semi-arid (Beard 1990). Rainfall is approximately 250 mm per annum and mostly falls between January and June (Section 2.1). Rainfall preceding both the spring and autumn surveys does not conform to long-term averages, with some below-average recordings and others above average. In 2011 seven out of 12 months received more than average rainfall and in the first few months of 2012 more than average rainfall was recorded for January and March. The timing of the surveys, therefore, was optimal inasmuch as more than average rainfall was recorded in the months immediately prior to the surveys: for the spring survey June recorded 57 mm (mean = 25.1 mm) and July recorded 34.8 mm (mean = 19.0 mm) and for the autumn survey January recorded 84.2 mm (mean = 24.6 mm) and March recorded 68.2 mm (mean = 28.8 mm).

Each survey was conducted over a ten day period with the spring fauna survey extending from 27 August to 3 September 2011 and the autumn survey from 1 March to 7 March 2012.

4.3 FAUNA SAMPLING

As per the recommendations of the EPA (2004) and EPA and DEC (2010), the nomenclature and taxonomic order presented in this report are based on the Western Australian Museum's *Checklist of the Vertebrates of Western Australia* for herpetofauna and mammals and Christidis and Boles (2008) for avifauna. The authorities used for herpetofauna are Doughty and Maryan (2010) and for mammals How *et al*. (2010).

KLA acknowledges that the taxonomy of Western Australia vertebrates is continually being revised and the taxonomy of some of the species listed in the document might have changed since the publication of this report.

4.3.1 Reconnaissance survey

In accordance with EPA Position Statement No. 3 (EPA 2004), a site visit by qualified personnel must be undertaken to satisfy the requirement of a reconnaissance survey prior to the on-site comprehensive trapping program. A reconnaissance survey was conducted by Dr Vi Saffer and Erica MacIntyre, both of KLA, to delineate key fauna values, to determine fauna habitat types and to determine trapping site locations.

Seven species of birds were identified during the reconnaissance survey and are listed in Appendix B.

4.3.2 Systematic censuring

The extensive diversity of Australia's terrestrial habitats is such that no single approach accurately samples all species within a community (Garden *et al.* 2007). It is acknowledged that surveys aimed at detecting multiple species must employ a suitable combination of survey methods (Garden *et al.* 2007).

In order to maximise the capture rate of diverse faunal species, systematic fauna sampling was undertaken using five trapping techniques:

- Pitfall traps (20 L buckets buried in the ground with the rims flush with the ground surface),
- Funnel traps,
- Elliot-type aluminium box traps (8cm x 9 cm x 32 cm),
- Medium and large cage traps, and
- Anabat detectors which detect and record ultrasonic echolocation calls emitted during bat flight (Section 4.3.4).

The systematic fauna sampling consisted of five trapping grids (Sites 1 to 5) and an additional five smaller satellite sites (Sites 6 to 10) located across the Mt Mason Project area (Figure 8). The additional smaller sites were located within areas of BIF where the use of conventional trapping grids was not achievable.

Trapping grids conventionally comprised 20 x 20L buckets, 20 funnel traps, 16 aluminium box traps and four large cage traps all approximately 25 m apart (Figure 9 and Figure 10). This pattern was achieved for four of the five trapping grid sites. However, due to the presence of disturbance from exploration and associated access tracks, the configuration of trap installation differed for Site 4. In this instance, two parallel lines of 10 trapping units 25 m apart was installed (Figure 11). A 6m x 30cm drift line fence was extended over all buckets at all sites to increase the efficacy of the pitfall traps.

During the spring survey, five smaller sites (Sites 6 to 10) consisted of one pair of traps at each site with two sites having two pairs (Site 6 and Site 9). Each pair comprised an aluminium box trap and a medium cage trap. However, during the autumn survey, Sites 6 to 10 each had three sets of traps with each set comprising an aluminium box trap, a funnel trap and a medium cage trap. The aim of these additional traps was to increase the trapping potential in areas of BIF.

In general, seven nights is the recommended effort for any particular sampling period when undertaking general inventory surveys (Moseby and Read 2001 cited in EPA and DEC 2010). All traps in the trapping grids were open for seven consecutive nights, overlapping for seven nights. The overall trapping effort is shown in Table 5 and Table 6.

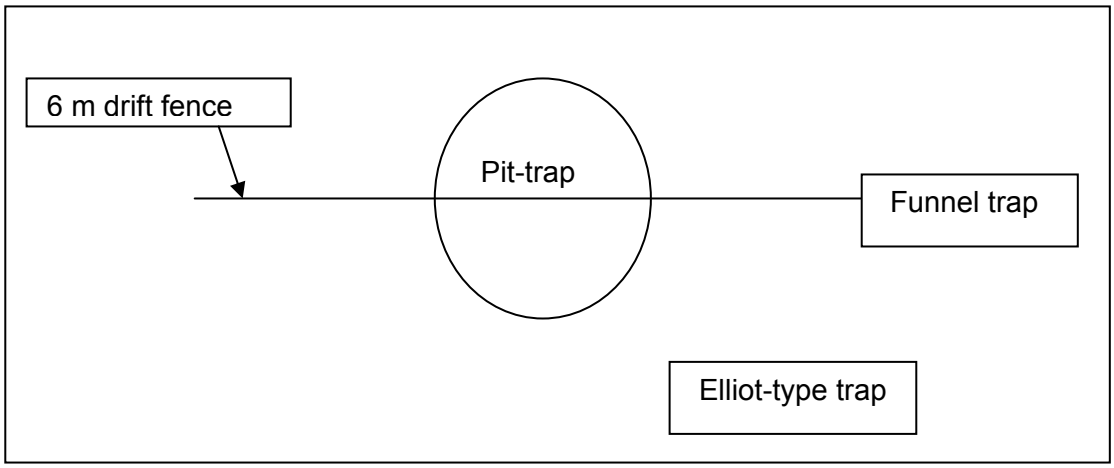

Figure 9 - Schematic diagram of trapping unit

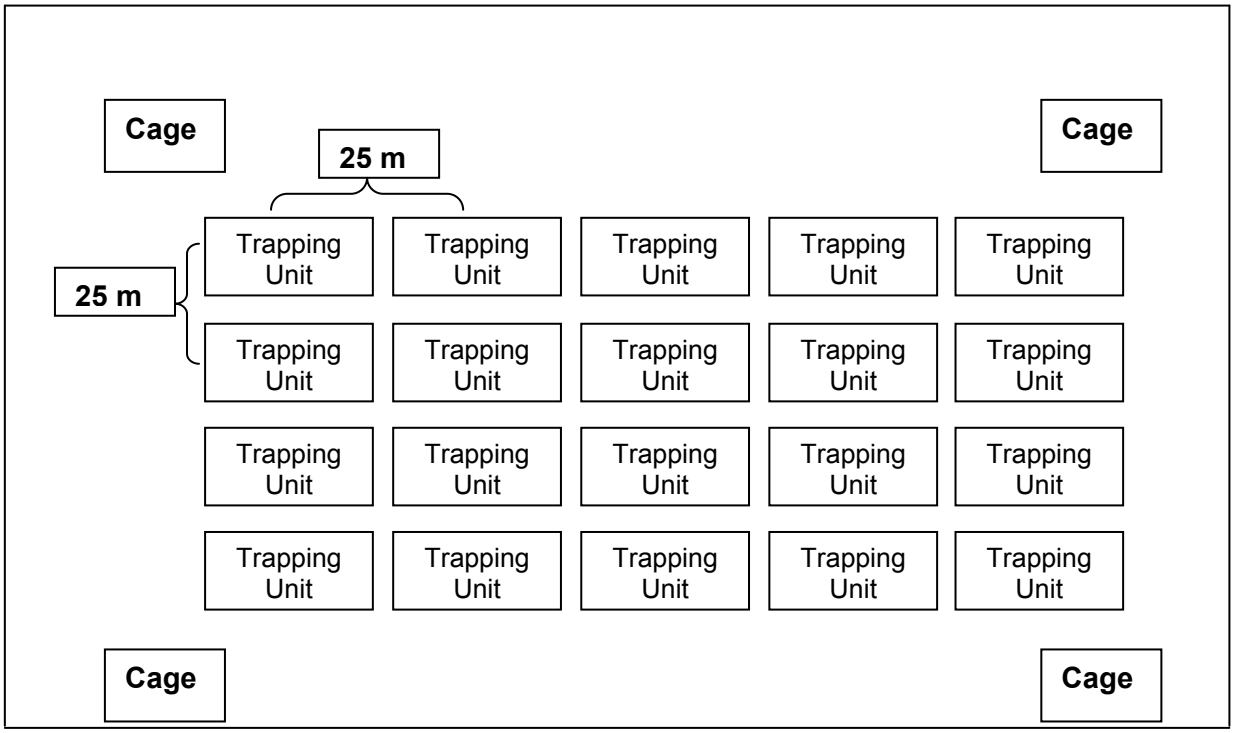

Figure 10 - Schematic diagram of trapping unit configuration for Sites 1, 2, 3 and 5

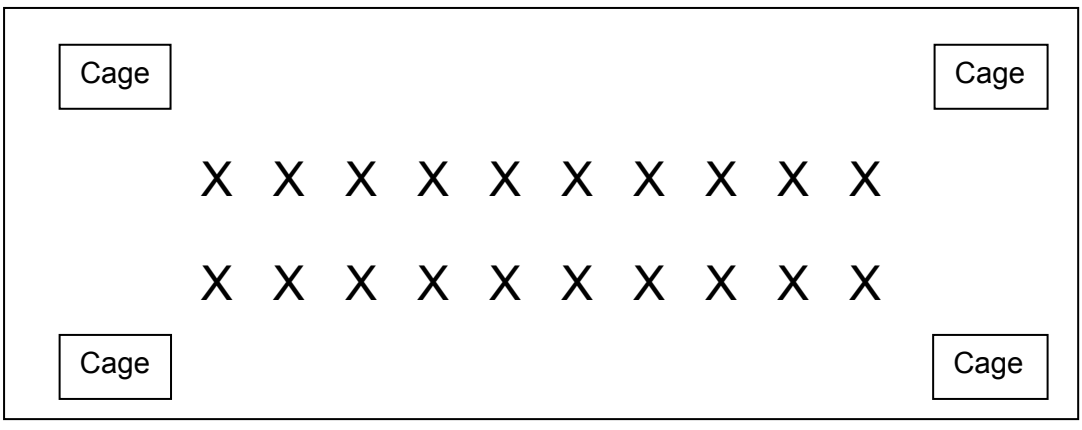

Figure 11 - Schematic diagram of trapping unit configuration for Site 4

Table 5 - Trapping grid locations and trapping effort for the Spring 2011Survey

Spring Survey (August-September 2011)					
Site	Location	Trap type	Date opened	Date closed	Total trapping effort
Site 1:	29°07'53.4"S	Pit	27-Aug	3-Sep	140
	120°21'57.7"E	Funnel	27-Aug	3-Sep	140
		Aluminium box	27-Aug	3-Sep	112
		Cage (large)	27-Aug	3-Sep	28
Site 2:	29°07'38.2"S	Pit	27-Aug	3-Sep	140
	120°21'50.1"E	Funnel	27-Aug	3-Sep	140
		Aluminium box	27-Aug	3-Sep	112
		Cage (large)	27-Aug	3-Sep	28
Site 3:	29°07'16.3"S	Pit	27-Aug	3-Sep	140
	120°21'40.9"E	Funnel	27-Aug	3-Sep	140
		Aluminium box	27-Aug	3-Sep	112
		Cage (large)	27-Aug	3-Sep	28
Site 4:	29°06'54"S	Pit	27-Aug	3-Sep	140
	120°21'46.08"E	Funnel	27-Aug	3-Sep	140
		Aluminium box	27-Aug	3-Sep	112
		Cage (large)	27-Aug	3-Sep	28
Site 5:	29°07'07.0"S	Pit	27-Aug	3-Sep	140
	120°21'55.9"E	Funnel	27-Aug	3-Sep	140
		Aluminium box	27-Aug	3-Sep	112
		Cage (large)	27-Aug	3-Sep	28
				Sub-total	**2100**

Site	Location	Trap type	Date opened	Date closed	Total trapping effort
Site 6	29°07'30.6"S	Aluminium box	27-Aug	3-Sep	14
	120°21'51.7"E	Cage (medium)	27-Aug	3-Sep	14
Site 7	29°07'10.9"S	Aluminium box	27-Aug	3-Sep	7
	120°21'40.1"E	Cage (medium)	27-Aug	3-Sep	7
Site 8	29°07'05.5"S	Aluminium box	27-Aug	3-Sep	7
	120°21'39.3"E	Cage (medium)	27-Aug	3-Sep	7
Site 9	29°07'10.1"S	Aluminium box	27-Aug	3-Sep	14
	120°21'47.6"E	Cage (medium)	27-Aug	3-Sep	14
Site 10	29°07'15.6"S	Aluminium box	27-Aug	3-Sep	7
	120°21'50.9"E	Cage (medium)	27-Aug	3-Sep	7
				Sub-total	**98**
				GRAND TOTAL	**2198**

Table 6 - Trapping grid locations and trapping effort for the Autumn 2012 Survey

Autumn Survey (March 2012)					
Site	**Location**	**Trap type**	**Date opened**	**Date closed**	**Total trapping effort**
Site 1:	29°07'53.4"S	Pit	1-Mar	7-Mar	140
	120°21'57.7"E	Funnel	1-Mar	7-Mar	140
		Aluminium box	1-Mar	7-Mar	112
		Cage (large)	1-Mar	7-Mar	28
Site 2:	29°07'38.2"S	Pit	1-Mar	7-Mar	140
	120°21'50.1"E	Funnel	1-Mar	7-Mar	140
		Aluminium box	1-Mar	7-Mar	112
		Cage (large)	1-Mar	7-Mar	28
Site 3:	29°07'16.3"S	Pit	1-Mar	7-Mar	140
	120°21'40.9"E	Funnel	1-Mar	7-Mar	140
		Aluminium box	1-Mar	7-Mar	112
		Cage (large)	1-Mar	7-Mar	28
Site 4:	29°06'56.1"S	Pit	1-Mar	7-Mar	140
	120°21'49.7"E	Funnel	1-Mar	7-Mar	140
		Aluminium box	1-Mar	7-Mar	112
		Cage (large)	1-Mar	7-Mar	28
Site 5:	29°07'07.0"S	Pit	1-Mar	7-Mar	140
	120°21'55.9"E	Funnel	1-Mar	7-Mar	140
		Aluminium box	1-Mar	7-Mar	112
		Cage (large)	1-Mar	7-Mar	28
				Sub-total	**2100**

Site	Location	Trap type	Date opened	Date closed	Total trapping effort
Site 6	29°07'30.6"S	Aluminium box	1-Mar	7-Mar	21
	120°21'51.7"E	Cage (medium)	1-Mar	7-Mar	21
		Funnel	1-Mar	7-Mar	21
Site 7	29°07'10.9"S	Aluminium box	1-Mar	7-Mar	21
	120°21'40.1"E	Cage (medium)	1-Mar	7-Mar	21
		Funnel	1-Mar	7-Mar	21
Site 8	29°07'05.5"S	Aluminium box	1-Mar	7-Mar	21
	120°21'39.3"E	Cage (medium)	1-Mar	7-Mar	21
		Funnel	1-Mar	7-Mar	21
Site 9	29°07'10.1"S	Aluminium box	1-Mar	7-Mar	21
	120°21'47.6"E	Cage (medium)	1-Mar	7-Mar	21
		Funnel	1-Mar	7-Mar	21
Site 10	29°07'15.6"S	Aluminium box	1-Mar	7-Mar	21
	120°21'50.9"E	Cage (medium)	1-Mar	7-Mar	21
		Funnel	1-Mar	7-Mar	21
				Sub-total	**315**
				GRAND TOTAL	**2415**

All traps were checked as soon after sunrise as possible each morning. Each mammal captured had a small amount of fur cut on its right rump so that it could be identified if captured a second time. For second time captures a small amount of fur was cut on the left rump for further identification. Universal bait was placed in all aluminium box traps and cage traps and renewed at least once during each seven-day survey, and when required.

In addition to the above trapping techniques, two Bushnell Trophy Cam™ Remote Cameras were deployed with each camera left *in* situ at each site for 24 hours on a rotational basis (Table 7 and Table 8). One camera was also left at the active Malleefowl mound 1.7 km south of the Mt Mason tenement boundary (Figure 8). At each of the trapping grids, the cameras were secured just above ground level to a star picket and in the BIF areas, the cameras were strategically positioned using rocks to stabilise the units. The cameras were operated in accordance with the DEC's Standard Operating Procedure for *Remote operation of cameras* (DEC 2011).

Opportunistic observations were also carried out when inspecting traps on site, when travelling between sites and when conducting bird surveys in the area.

Table 7 - Dates and Sites of remote camera placement during the Spring 2011 survey

Site	Unit 1	Unit 2
1	1-Sep	
2	28-Aug	
3	30-Aug	
4	29-Aug	
5	31-Aug	
6		1-Sep
7		29-Aug
8		28-Aug
9		30-Aug
10		31-Aug

Table 8 - Dates and Sites of remote camera placement during the Autumn 2012 survey

Site	Unit 1	Unit 2
1	3-Mar	
1	5-Mar	
2	4-Mar	
3	29-Feb	
4	1-Mar	
5	2-Mar	
6		3-Mar
7		2-Mar
8		4-Mar
9		29-Feb
10		6-Mar
MFM*	6-Mar	

* Malleefowl Mound

Hand-foraging for reptiles was conducted opportunistically and during spot-lighting forays and included turning over rocks and logs, peeling off bark, *etc.*

4.3.3 Birds surveying

Surveying of birds was carried out using a combination of techniques including:

- Four, 20 minute, 2 ha surveys at each of the five trapping grid sites in accordance with Atlas Search Methods for the Atlas of Australian Birds. Censuses were commenced as soon after sunrise as practicable and commencement was rotated through the sites to reduce time of day bias where practicable (Table 9, Table 10).
- Opportunistic observations when inspecting traps on site, when travelling between sites and in the area, and when conducting other surveys in the region.

Table 9 - Dates and times of systematic bird censuses commenced at each site during the Spring 2011 survey

Date:	29-Aug	30-Aug	31-Aug	1-Sep	2-Sep	ToTtal (mins)
Site	Time commenced (hrs)*					
1	800	920	1020		700	80
2	830	850		655	730	80
3	920	700	740	810		80
4		705	800	850	855	80
5	645	740	910	925		80
Total						**400**

* Censuses continued for 20 minutes at each site.

Table 10 - Dates and times of systematic bird censuses commenced at each site during the Autumn 2012 survey

Autumn AM 2012*							
Date:	1-Mar	2-Mar	3-Mar	4-Mar	5-Mar	6-Mar	Total (mins)
Site	Time commenced (hrs)*						
1		1015		615	735	820	80
2	930		620	705	815		80
3	830	625	710		910		80
4	625	740	800	900			80
5	715	850	845		645		80
Total							**400**

4.3.4 Bat surveying

Bat echolocation calls were recorded using Anabat SD1 detectors, which detect and record ultrasonic echolocation calls emitted during bat flight. Two Anabat detectors were used and were positioned on the ground in each trapping grid site before sunset and retrieved the following morning. Table 11 and Table 12 list the dates that bat recordings were taken at each site during the Spring and Autumn surveys respectively.

The calls were stored on a compact flash card, downloaded and sequences were examined using AnalookW software. The frequency division ratio was set to a factor of eight. Three call variables were measured on good quality search phase pulses in representative call sequences: pulse duration (milliseconds), maximum frequency (kHz) and characteristic frequency (kHz). Species were identified based on information in McKenzie and Muir (2000) and Pennay *et al*. (2004) cited in Armstrong and Konishi (2011, 2012). Details supporting the identifications are provided, as recommended by the Australasian Bat Society (2006).

Table 11 - Dates bat calls were recorded at each site during the Spring 2011 survey

Site	Unit 1	Unit 2
1	28-Aug	1-Sep
2	29-Aug	28-Aug
3	30-Aug	29-Aug
4	31-Aug	30-Aug
5	1-Sep	31-Aug

Table 12 - Dates bat calls were recorded at each site during the Autumn 2012 survey

Site	Unit 1	Unit 2
1	4-Mar	3-Mar
2	2-Mar	4-Mar
3	3-Mar	29-Feb
4	29-Feb	1-Mar
5	1-Mar	2-Mar

4.3.5 Spotlighting survey

Spotlighting was conducted on three evenings during each of the seasonal surveys. A total of 15 hours and 30 minutes was spent spotlighting during the Spring 2011 survey (Table 13) and 11 hours and 30 minutes during the Autumn 2012 survey (Table 14).

Spotlighting was conducted from a slow-moving vehicle (less than 10 km/hr) using high-powered hand-held spotlights and commenced at least one hour after sunset. In addition, spotlighting forays with head-torches were conducted twice on foot for approximately 15 minutes each during all spotlighting evenings. A 390nm Ultraviolet Lantern was also used to detect and collect scorpions that fluoresce under UV light (Section 4.3.6). Spotlighting was conducted immediately adjacent to and within 10 km of all sites.

Table 13 - Dates and duration of spotlighting forays, including numbers of personnel involved, during the Spring 2011 survey

Date	Time commenced (hrs)	Duration	Number of observers, including driver	Total (hrs)
28-Aug	1920	1 hr 45 min	3	4 hr 35 min
30-Aug	1915	2 hr 15 min	3	6 hr 45 min
1-Sep	1930	1 hr 50 min	3	4 hr 50 min
TOTAL				**15 hr 30 min**

Table 14 - Dates and duration of spotlighting forays, including numbers of personnel involved, during the Autumn 2012 survey

Date	Time commenced (hrs)	Duration	Number of observers, including driver	Total (hrs)
1-Mar	1940	2hr 5 min	2	4 hr 10 min
3-Mar	1925	2hr 5 min	2	4 hr 10 min
5-Mar	1925	1 hr 35 min	2	3 hr 10 min
TOTAL				**11 hr 30 min**

4.3.6 Invertebrate sampling

In addition to vertebrate sampling, targeted searches were conducted for SRE's during the Spring 2011 survey.

Invertebrate groups targeted during the survey were those considered most likely to potentially contain SRE taxa including:

- Mygalomorphae (trapdoor spiders);
- Diplopoda (millipedes);
- Pseudoscorpionida (pseudoscorpions)
- Scorpiones (scorpions); and
- Pulmonata (land snails).

In accordance with generic advice from the Office of the EPA, 10 m x 10 m quadrats were established in selected habitats and up to one hour was spent searching for invertebrates in each of these quadrats. Searches included under rocks, under bark, under logs, in hollows of logs and in other leaf litter and debris lying on the ground. At each of the trapping grids, a quadrat was established within the trapping area and outside of the trapping area and one quadrat was searched at each of the BIF sites (Figure 12).

Only one of each trapdoor species type was excavated and sent to the Western Australian Museum for identification. Once excavated, the spiders were placed in a freezer for approximately 10 minutes to sedate them. They were then placed in cold 100% Ethanol to narcotise them before the third left leg was removed and placed in a separated vial of 100% ethanol, in accordance with Western Australian Museum guidelines.

In addition to the above searches, a collection of leaf litter and soils was collected from each quadrat and transferred back to Perth for examination. Collections were made from shadowed moist areas, for example, from the south eastern aspect of the bases of tree trunks, large rocks or overhanging rocks etc. Large particles were removed and the remaining collection was examined under a 10X20 Dissecting Microscope. All invertebrate fauna or parts thereof were collected and preserved in accordance with the Western Australian Museum guidelines and sent to appropriate specialists at the Museum for identification.

Searches were also conducted for invertebrates during the spotlighting surveys (Section 4.3.5). In addition to generally searching for SRE's during spotlighting forays, a 390nm Ultraviolet Lantern was used to detect and collect scorpions that fluoresce under UV light.

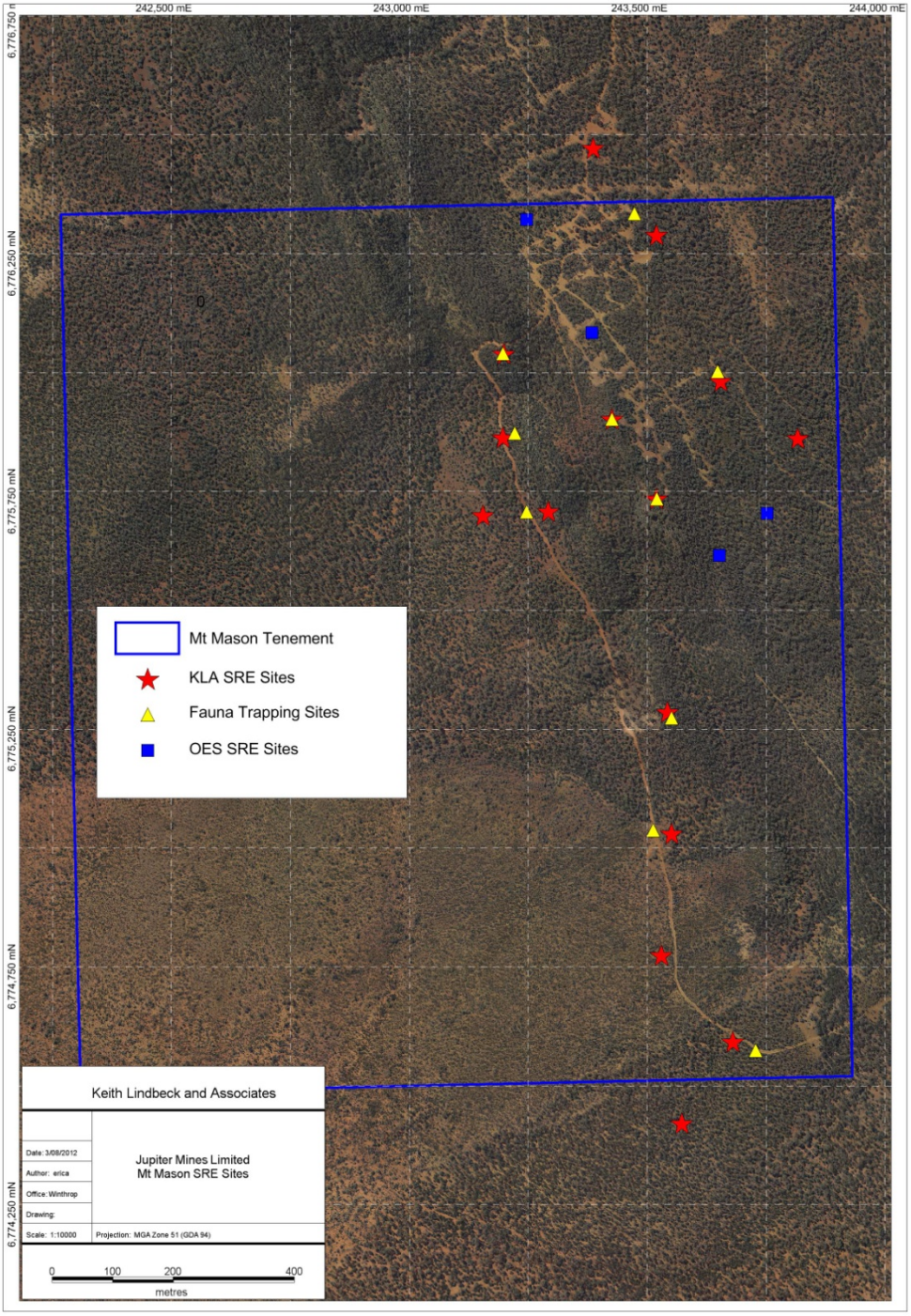

Figure 12 - Location of invertebrate survey sites at Mt Mason

While a targeted SRE survey was only conducted during the Spring survey, all opportunistic sightings and captures of invertebrates in other trapping equipment were collected during the Autumn survey. In addition, searches were also conducted during spotlighting forays and with the use of the Ultraviolet Light during the Autumn surveys.

4.4 FAUNA SURVEY TEAM

The team assisting with the establishment of the trapping grids and conducting the Spring 2011 survey comprised Dr Vi Saffer, Erica MacIntyre and Hamish Burnett from KLA. Mark Peddey from Orbit Drilling assisted with the mechanical digging of the holes for the pit traps and Cliff Ashwin, Gerard Ashwin and David Kirk of the Wutha Aboriginal Community assisted with the installation of the trapping equipment.

For the Autumn 2012 survey, Dr Vi Saffer and Erica MacIntyre from KLA conducted the survey. Adele Bonney, Guy Evans and Stephen Carr assisted with the installation of the trapping gear and Andrew Laurens and Caleb Sceghi assisted with the demobilisation of the trapping gear.

A "LICENCE TO TAKE FAUNA FOR SCIENTIFIC PURPOSES" was issued to Dr Vi Saffer as an instrument under Regulation 17 of the WCA 1950 to undertake these surveys (Appendix D). The licence number for the Spring 2011 survey was SF008183 and the authorised persons associated with that licence included Erica MacIntyre and Hamish Burnett. For the Autumn 2012 survey, the Licence number was SF008484 and the authorised persons associated with that licence included Erica MacIntyre, Dr Ronald Snook and Dr Wesley Bancroft.

Analysis of bat recordings was completed by Dr Kyle Armstrong and Yuki Konishi of 'Specialised Zoological'.

4.5 SURVEY LIMITATIONS

Not all areas of the Mt Mason Project region were ground-truthed or sampled equally for fauna. Vehicular access, road conditions and rocky terrain prevented sampling in the centre of all associations, and regular checking of fauna traps in these areas would, therefore, not have been possible. Notwithstanding this, five trapping grids were located within representative vegetation communities in the study area in addition to five sites that were located on the BIF ridges.

As indicated above, not all sites could accommodate the same trapping grid pattern. Where buckets could not be installed, other grid patterns and trapping techniques (funnels and medium-sized cages) were used so that the overall trapping effort was not compromised.

Trapping sites were selected based on information provided to KLA at the time of commissioning and in relation to the proposed footprint of disturbance. Since that time, the zone of impact has changed. Notwithstanding this, trapping was conducted along the length of the tenement in representative vegetation associations.

Other limitations are included in the relevant sections.

5.0 VETEBRATE FAUNA INVENTORY

5.1 OVERVIEW OF VERTEBRATE FAUNA OF THE SURVEY AREA

Overall, 130 individuals from 19 non-volant terrestrial species representing seven Families were captured during the systematic sampling during the Spring 2011 and Autumn 2012 surveys. Of the bird species, a total of 507 individuals representing 16 Families and 34 species were recorded over both seasonal surveys (Appendix B).

Figure 13 provides a visual representation of the number of species recorded from each major vertebrate group during the Spring 2011 and Autumn 2012 systematic surveys and Table 15 provides a summary of the number of taxa recorded for each of the five trapping grid sites and five additional sites. A summary of all species known and likely to be present in the survey areas is provided in Appendix B. This includes a summary of all the results of the database searches, all species recorded during regional surveys, all species recorded during the reconnaissance survey and all species recorded during the systematic sampling, opportunistic sightings and evidence, and spotlighting.

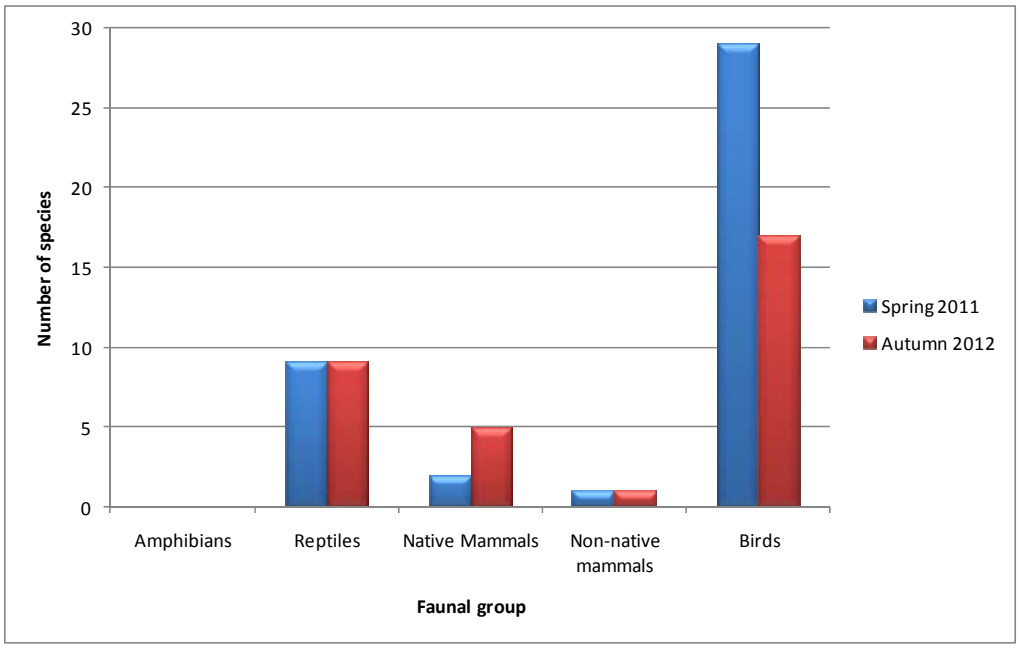

Figure 13 - Number of terrestrial vertebrate species recorded during the Spring 2011 and Autumn 2012 systematic surveys

Table 15 - Number of individual terrestrial vertebrate species recorded at each site during the Spring 2011 and Autumn 2012 systematic surveys

Faunal group	Site 1		Site 2		Site 3		Site 4		Site 5		Sub-total	
	Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn
Amphibians	0	0	0	0	0	0	0	0	0	0	0	0
Reptiles	2	5	4	13	4	8	5	4	7	5	22	35
Native mammals	1	8	1	1	1	5	1	5	3	1	7	20
Non-native mammals	0	4	0	2	0	2	7	16	2	8	9	32
Birds	62	35	44	24	65	65	89	35	47	41	307	200
Sub-total	**65**	**52**	**49**	**40**	**70**	**80**	**102**	**60**	**59**	**55**	**345**	**287**

Faunal group	Site 6		Site 7		Site 8		Site 9		Site 10		Sub-total		Grand Total	
	Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn
Amphibians	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reptiles	0	1	0	0	0	0	0	0	0	0	0	1	22	36
Native mammals	0	0	0	0	0	0	0	1	0	0	0	1	7	14
Non-native mammals	0	0	0	0	1	1	0	1	0	0	1	2	10	30
Birds	-	-	-	-	-	-	-	-	-	-	0	0	307	200
Sub-total	**0**	**1**	**0**	**0**	**1**	**1**	**0**	**2**	**0**	**0**	**1**	**4**	**346**	**280**

Grand Total	**65**	**53**	**49**	**40**	**71**	**81**	**102**	**62**	**59**	**55**

5.2 AMPHIBIANS

5.2.1 The assemblage

No frog species were captured or heard during either of the seasonal survey periods.

Searches were conducted in moister areas and opportunistically in small pools of transient standing water. However no adults or tadpoles were sighted and there was no evidence of used burrows.

5.2.2 Discussion

No amphibian species of conservation significance are listed for the area using the EPBC Protected Matters Search Tool or listed on the DEC Threatened and Priority Fauna Database.

The Mt Mason Project area has no natural water source areas or large granite outcrops that may support pockets of water. Any water on the ground as a result of episodic rainfall does not remain *in situ* for very long. The nearest lake, Lake Barlee, is approximately 60 km from the Mt Mason area and is an intermittent salt lake that fills about once in ten years after which the water persists for less than a year. Therefore, the habitat at Mt Mason and in the local area does not provide suitable habitat or conditions for most species of amphibians. Any frogs that may be in the area are likely to be burrowing species that have adapted to living in the drier conditions. These species are generally under-represented in field surveys. Burrowing species are only active following large rainfall events. Given the irregular and infrequent downpours in semi-arid and arid areas, it is not unreasonable that these frogs are not captured very often during terrestrial surveys. Testament to this scenario is the capture of one frog (*Neobatrachus sutor* Shoemaker Frog) following an above average rainfall event (25 mm on 3 October 2011) during a comprehensive Spring survey at Jupiter's Mt Ida deposit area approximately 10 km southwest, and the capture of ten frogs at the same site during an Autumn survey in March 2012 (KLA 2012 *in prep*). This latter survey was conducted one week after Cyclone Lua passed through the area resulting in a large regional rainfall event, in addition to a large rainfall event (20 mm) that occurred on site during the survey period. Eight of the ten frogs captured were *N. sutor* and the remaining two were *Pseudophryne occidentalis*, both of which are burrowing species.

That frogs are not captured very often during terrestrial surveys is exemplified by the results of regional surveys inasmuch as only two species were captured during the extensive Barlee-Menzies study (Burbidge *et al.* 1995) and none were recorded during the Lake Giles Project area study (KLA 2011).

5.3 REPTILES

5.3.1 The assemblage

Collectively, 13 species of reptiles were captured from all sites totalling 58 individuals representing five Families (Table 16 and Appendix B).

For the Spring 2011 survey, nine species of reptiles were captured totalling 22 individuals representing four Families (Table 16 and Appendix D). The reptiles captured comprised three dragon species (Agamidae), two diplodactylid species (Diplodactylidae), three species of skink (Scincidae), and one varanid (Varanidae).

The Scincidae Family had the highest number of captures (n = 10, 45%), followed by Agamidae (n = 8, 36%). Only three Diplodactylidae (n = 3, 14%) were captured and a single Varanidae (*Varanus caudolineatus*) (Plate 11) was captured at Site 1.

Plate 11 - *Varanus caudolineatus*

Within the Scincidae Family, more *Menetia greyii* were captured than the remaining two species and at only three of the ten sites with only one captured at Site 2, three at Site 4 and one at Site 5. Only one *Ctenotus schomburgkii* was captured at Site 2 and one at Site 3, and *Egernia depressa* (n = 2) was only captured at Site 5.

Within the Agamidae, four *Ctenophorus scutulatus* (Plate 12) were captured with two at Site 3 and one each at Site 4 and at Site 5. Of the two *Caimanops amphiboluroides* that were captured, one was captured at Site 3 and one at Site 5 and one *Pogona minor* was captured at Site 2 and one at Site 4.

Plate 12 - *Ctenophorus scutulatus*

Two *Diplodactylus pulcher* (Diplodactylidae) were captured with one at Site 2 and one at Site 5 and only one *Strophurus assimilis* was captured at Site 1.

Not one reptile was captured at any of the smaller satellite sites established in the areas of BIF.

For the Autumn 2012 survey, nine species of reptiles from four Families were also captured but totalling 36 individuals (Table 16 and Appendix B). However, the reptiles captured during this seasonal survey comprised two similar dragon species (Agamidae), two gecko species (Gekkonidae), three species of skink (Scincidae) of which only two were the same as those captured during the Spring survey, and one different varanid (Varanidae).

Of these species captured during the Autumn 2012 survey, once again the Scincidae Family had the highest number of captures (n = 14, 39%), followed by an equal number of Adamidae (n = 10, 28%) and Varanidae (n = 10, 28%). Only two Gekkonidae were captured representing 5% of all reptiles captured: while one species (*Gehyra variegata*) was captured at Site 5, one *Heteronotia bynoei* was the only taxa captured in one of smaller satellite sites (Site 6) positioned in the BIF.

Within the Scincidae Family, 12 of the 14 species captured were *Ctenotus leonardii* with eight captured at Site 2, two at Site 3 and one at each of Sites 1 and 4. The remaining two skinks (*Egernia depressa* and *Menetia greyii*) were captured at Site 5.

Nine of the ten Agamidae were *Ctenophorus scutulatus* with three captured at Site 2 and at Site 3, two at Site 4 and one at Site 1. The remaining specimen, *Caimanops amphiboluroides* (Plate 13), was captured at Site 3.

Plate 13 - *Caimanops amphiboluroides*

The Varanidae were represented more evenly between species with five *Varanus panoptes* and four *V. caudolineatus* captured. At least one and only up to two varanids were captured at each of the five trapping sites.

The largest number of reptiles captured during the Spring 2011 survey was at Site 5 (n = 7) followed by five at Site 4. The least number (n = 1) was captured at Site 2. For the Autumn 2012 survey, Site 2 recorded the most captures (n = 13) followed by eight at Site 3 and five each at Sites 1 and 5. Only one reptile (*Heteronotia bynoei*) was captured in

one of the smaller satellite sites (Site 6) located in the BIF. Collectively, more taxa were captured at Site 2 (n = 17) followed by 12 at both Sites 3 and 5. Nine were recorded at Site 4 with 7 at Site 1.

Collectively, pitfall traps with drift line fencing proved to be the most effective trapping apparatus for reptiles (n = 37, 64%) with 29% (n = 17) captured in funnel traps. Only four individuals were captured in cage traps (7%) and none were captured in the aluminium box traps.

Nine species of reptile were recorded opportunistically during the Spring 2011 survey and only two during the Autumn 2012 survey (Appendix B). The species recorded when temperatures were higher (Spring 2011) included two species of Agamidae (*Caimanops amphiboluroides* and *Pogona minor* (Plate 14)); three species of Scincidae (*Cryptoblepharus plagiocephalus*, *Egernia depressa* (one living and one carcass) and *Menetia greyii*), at least one species of varanidae (*Varanus panotes*) and unidentified varanid tracks and two identified Elapidae (*Pseudechis butleri* and *Pseudonaja nuchalis)* in addition to unidentified snake tracks.

Plate 14 - *Pogona minor*

Table 16 - Reptiles species recorded (including method) during the Spring 2011 and Autumn 2012 systematic surveys

Family	Species	Common Name	Site 1		Site 2		Site 3		Site 4		Site 5	
			Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn
Agamidae	*Caimanops amphiboluroides*	Mulga Dragon	0	0	0	0	1	1	0	0	1	0
	Ctenophorus scutulatus		0	1	0	3	2	3	1	2	1	0
	Pogona minor	Bearded Dragon	0	0	1	0	0	0	1	0	0	0
Diplodactylidae	*Diplodactylus pulcher*		0	0	1	0	0	0	0	0	1	0
	Strophurus assimilis	Goldfields Spiny-tailed Gecko	1	0	0	0	0	0	0	0	0	0
Gekkonidae	*Gehyra variegata*		0	0	0	0	0	0	0	0	0	1
	Heteronotia binoei	Bynoe's Gecko	0	0	0	0	0	0	0	0	0	0
Scincidae	*Ctenotus leonhardii*		0	1	0	8	0	2	0	1	0	0
	Ctenotus schomburgkii		0	0	1	0	1	0	0	0	0	0
	Egernia depressa	Spiny-tailed Skink	0	0	0	0	0	0	0	0	2	1
	Menetia greyii		0	0	1	0	0	0	3	0	2	1
Varanidae	*Varanus caudolineatus*		1	2	0	2	0	0	0	0	0	0
	Varanus panoptes	Yellow-spotted Monitor	0	1	0	0	0	2	0	1	0	2
	Trapping method	Pitfall trap	1	4	4	4	4	4	5	2	7	2
		Funnel trap	1	1	0	9	0	2	0	2	0	1
		Cage trap	0	0	0	0	0	2	0	0	0	2
		Aluminium box trap	0	0	0	0	0	0	0	0	0	0
		Total	**2**	**5**	**4**	**13**	**4**	**8**	**5**	**4**	**7**	**5**
		Cumulative Total			**6**	**18**	**10**	**26**	**15**	**30**	**22**	**35**

Family	Species	Common Name	Site 6		Site 7		Site 8		Site 9		Site 10	
			Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn
Agamidae	*Caimanops amphiboluroides*	Mulga Dragon	0	0	0	0	0	0	0	0	0	0
	Ctenophorus scutulatus		0	0	0	0	0	0	0	0	0	0
	Pogona minor	Bearded Dragon	0	0	0	0	0	0	0	0	0	0
Diplodactylidae	*Diplodactylus pulcher*		0	0	0	0	0	0	0	0	0	0
	Strophurus assimilis	Goldfields Spiny-tailed Gecko	0	0	0	0	0	0	0	0	0	0
Gekkonidae	*Gehyra variegata*		0	0	0	0	0	0	0	0	0	0
	Heteronotia binoei	Bynoe's Gecko	0	1	0	0	0	0	0	0	0	0
Scincidae	*Ctenotus leonhardii*		0	0	0	0	0	0	0	0	0	0
	Ctenotus schomburgkii		0	0	0	0	0	0	0	0	0	0
	Egernia depressa	Spiny-tailed Skink	0	0	0	0	0	0	0	0	0	0
	Menetia greyii		0	0	0	0	0	0	0	0	0	0
Varanidae	*Varanus caudolineatus*		0	0	0	0	0	0	0	0	0	0
	Varanus panoptes	Yellow-spotted Monitor	0	0	0	0	0	0	0	0	0	0
	Trapping method	Pitfall trap	-	-	-	-	-	-	-	-	-	-
		Funnel trap	0	1	0	0	0	0	0	0	0	0
		Cage trap	0	0	0	0	0	0	0	0	0	0
		Aluminium box trap	0	0	0	0	0	0	0	0	0	0
		Total	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		Cumulative Total	**22**	**36**	**22**	**36**	**22**	**36**	**22**	**36**	**22**	**36**

5.3.2 Discussion

A total of 58 individual reptiles were captured during the systematic seasonal surveys. Given the different trapping techniques and that the traps were open for a total of 4613 trap nights over both seasons, the trap rate of 1.26% was particularly low.

Being ectotherms, reptiles are most active during higher temperatures, between September and April (EPA and DEC 2010). While the Spring survey was conducted in the warmer months (end of August through to beginning September) and temperatures recorded at Leonora and Menzies for the survey period were slightly higher than long-term averages, overall temperatures may not have been high enough for long enough to stimulate reptilian activity from their winter brumation. While temperatures in the cooler months of Autumn (March April) were within long-term average range, they were higher than those for the Spring survey period. Therefore, it was not surprising that more reptiles were captured during the Autumn survey (n = 36) (trap rate 1.5%) than during the Spring survey (n = 22) (trap rate 1.0%).

While nine species of reptile were captured in each of the seasonal surveys, not all the species were the same. For example, one agamid (*Pogona minor*), two diplodactilids (*Diplodactylus pulcher, Strophurus assimilis*) and one skink (*Ctenotus schomburgkii*) were captured during the Spring survey that were not captured during the Autumn survey and conversely, two geckos (*Gehyra variegata, Heteronotia bynoei*), one skink (*Ctenotus leonhardii*) and one varanid (*Varanus panoptes*) were captured during the Autumn survey that were not captured during the Spring survey.

The numbers of reptile captures between sites did differ but not consistently across seasons. For example, more species were captured in the 'Mulga over *Eremophila forrestii* on undulating hills' (Sites 4 and 5) during the Spring 2011 survey followed by an equal number in the post-fire regenerating '*Acacia* shrubland' (Site 2) and 'Mulga over *Eremophila forrestii'* (Site 3). Only two species were captured in 'Mulga over *Eremophila forrestii* on Flats' (Site 1) and there were no captures at the smaller satellite sites located in the BIF areas.

For the Autumn 2012 survey, many more species were captured in the *Acacia* Shrubland (Site 2) which had had a further six months of regeneration since the previous survey. This was followed by the number captured in 'Mulga over *Eremophila forrestii'* (Site 3) and equal numbers in 'Mulga over *Eremophila forrestii* on Flats' (Site 1) and in 'Mulga over *Eremophila forrestii* on undulating hills' (Site 5). Marginally fewer were recorded in the same vegetation complex 'Mulga over *Eremophila forrestii* on undulating hills' (Site 4). While there were no captures of reptiles in the smaller satellite sites in the BIF areas during the Spring 2011 survey, one individual (*Heteronotia binoei*) was captured in one of the satellite sites (Site 6) during the Autumn 2012 survey.

The EPA and DEC (2010) Technical Guide suggests that pitfall trapping is particularly productive for small to medium sized reptiles. The results of these surveys add weight to this suggestion as up to 64% of all captures of reptiles were in pitfall traps. While 30% were captured in funnel traps only four individuals were captured in cage traps. It is noted however, that all four were large varanids (*Varanus panoptes*) that were too big to be captured in anything other than the larger of the cage traps. It is also noted, and not surprisingly, that no reptiles were captured in aluminium box traps.

No reptile species of conservation significance are listed for the area under the EPBC Act 1999. However, the Woma *Aspidites ramsayi* is listed under the WCA 1950 as a Schedule 4 – Other Specially Protected Fauna species. The most recent recording of this species dates back to 1966 south of Menzies. No evidence of the Woma was recorded during the surveys. Further, the habitat was not conducive to utilisation by this species inasmuch as there were no hollow logs of sufficient size to accommodate a Woma and

there were few rabbit warrens which Woma are known to use as refugia. No other reptilian species of conservation significance or evidence of their presence was recorded during the survey.

Given that the CYIP area has not been well surveyed, it is not surprising that only one reptile species, Pygmy Spiny-tailed Skink *Egernia depressa,* has been vouchered at the Western Australian Museum previously for this area (Appendix B). This species was captured twice during the Spring 2011 survey at Site 5 and both a live individual and carcass of another were sighted opportunistically. During the Autumn 2012 survey, one individual was also captured at Site 5. It is noted that none of the remaining reptile species captured have been vouchered with the Western Australian Museum for this area.

Using a log/log transformation of the accumulated number of species captured during the seven night trapping programmes per seasonal survey, a strong linear relationship occurred between sampling intensity (nights) and the number of species (R^2 = 0.9623) (Figure 14). An asymptote has not been reached, although a large majority of species present (62%) were collected after the second night and up to 77% after the third night of trapping. It is reasonable to assume that all common species are represented in the curve but rare and transient species would only be detected with a far higher sampling intensity. In general, seven nights is the recommended effort for any particular sampling period when undertaking general inventory surveys (Moseby and Read 2001 cited in EPA and DEC 2010).

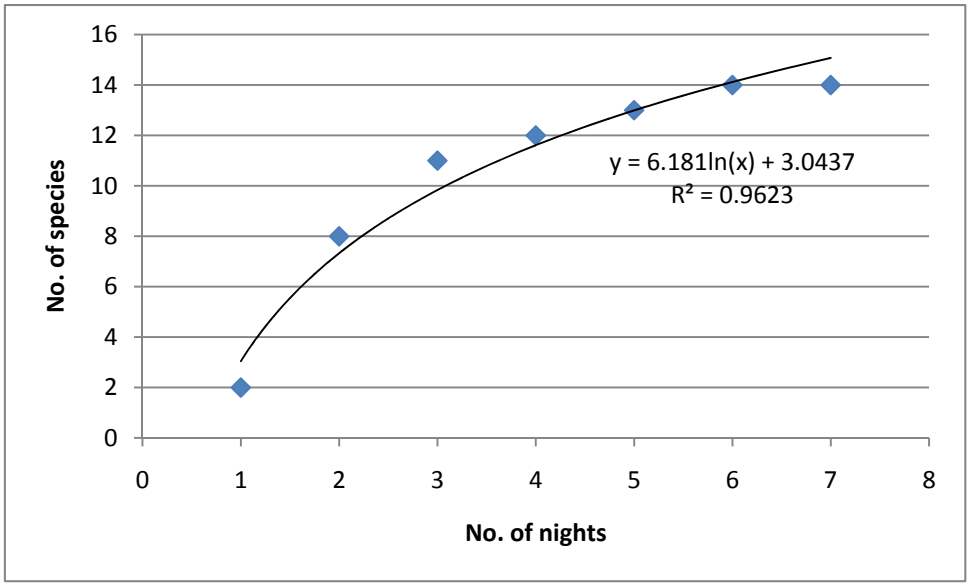

Figure 14 - Species accumulation curve for reptiles captured during the systematic fauna surveys

Seasonal trapping, conducted over many years, would be required to determine the full complement of reptiles that utilise the habitats of the Mt Mason Project area.

The many variables associated with other studies in the area make comparisons difficult. These variables include survey timing, duration and year the survey was completed; and also the trapping techniques utilised. For example, the Biological Surveys Committee study (Burbidge *et al.* 1995) was conducted over three seasons and over a three year time period from 1979 to 1981 that make taxonomic name changes since that time difficult to trace (Burbidge *et al.* 1995). Notwithstanding this, 51 species were recorded during that survey and up to 12 were captured during a Level 2 survey approximately 80 km southwest of the CYIP area (KLA 2011)(Appendix B). Of the species captured during the present survey, none are unique to the area and all have been captured elsewhere.

5.4 MAMMALS

5.4.1 The assemblage

A total of five native mammals species from two Families were captured during both seasonal surveys totalling 28 individuals (Table 17 and Appendix B). During the Spring 2011 survey native mammals (n = 7) were represented by two species from the Family Dasyuridae: *Sminthopsis longicaudata* Long-tailed Dunnart (Plate 15) and *S. dolichura* Little Long-tailed Dunnart (Plate 16) (Table 17 and Appendix B). While only one *S. longicaudata* was captured (at Site 3), six *S. dolichura* were captured with three captured at Site 5 and one at each of Sites 1, 2 and 4.

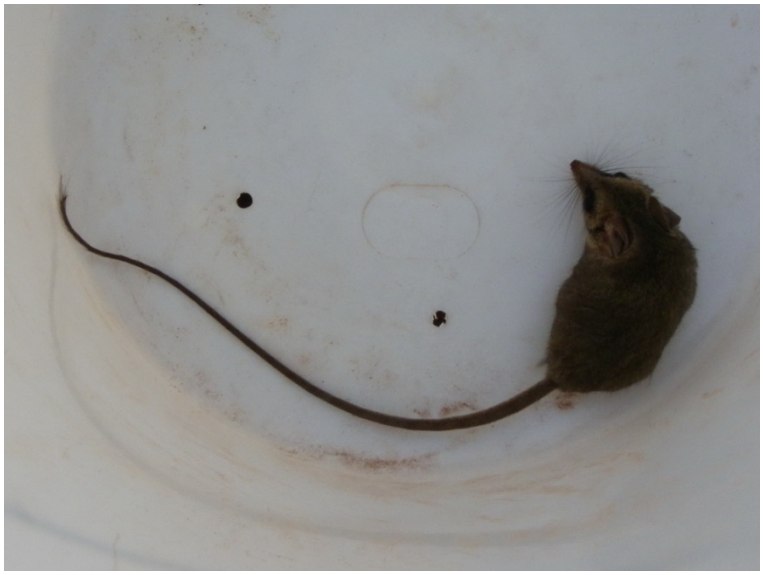

Plate 15 - *Sminthopsis longicaudata*

For the Autumn 2012 survey, a total of 21 native mammals were captured from two Families: Dasyuridae and Muridae (Table 17 and Appendix B). Once again only one *S. longicaudata* was captured at Site 3. Seven *S. dolichura* were captured with one at Site 2 and three at Site 3 and at Site 4. Within the Dasyuridae, one additional species was captured: one *Pseudantechinus woolleyae* Woolley's Pseudantechinus (Plate 17) was captured in an aluminium box trap at one of the BIF sites (Site 9). Indeed, *P. woolleyae* was the only native mammal captured in all of the BIF sites.

Plate 16 - *Sminthopsis dolichura*

Plate 17 - *Pseudantechinus woolleyae*

While no Muridae were captured during the Spring 2011 survey, two species were captured during the Autumn 2012 survey: five *Notomys alexis* Spinifex Hopping Mouse were captured at Site 1 and seven *Pseudomys hermannsburgensis* Sandy Inland Mouse were captured with three at Site 1, two at Site 4 and one at Site 3 and at Site 5.

Of the fauna species captured, *Sminthopsis longicaudata* is listed as a Priority 4 species on the DEC Threatened and Priority Fauna Database. No other mammals of conservation significance potentially occur in the area and none were captured during the Spring 2011 survey or the Autumn 2012 survey.

For the non-native mammals, a total of 44 *Mus musculus* House Mouse (Family: Muridae) were captured with ten captured during the Spring 2011 survey and 34 captured during the Autumn 2012 survey (Table 17 and Appendix B). Of the ten captured during the Spring 2011 survey, seven were captured at Site 4, two at Site 5 and one at Site 8. For the Autumn 2012 survey, Site 4 once again recorded the most (n = 16) followed by eight at Site 5. In addition, four were captured at Site 1, two at Site 2 and at Site 3 and one at Site 9. No *M. musculus* were captured at Sites 6, 7 or 10.

Collectively, all fauna were captured in two of the three types of trapping equipment with the most (n = 43, 60%) captured in aluminium box traps and only one *M. musculus* captured in a cage trap. The remaining fauna (n = 28, 39%) were captured in pitfall traps. However, for native mammals, more were captured in pitfall traps (n = 19, 68%) than in aluminium box traps (n = 9, 32%) whereas more *M. musculus* were captured in aluminium box traps (n = 34, 77%) than in pitfall traps (n = 9, 21%).

Kyle Armstrong and Yuki Konishi of Specialised Zoological analysed the bat calls recorded on the Anabats (Armstrong and Konishi 2011, 2012). The presence of six species of bats was identified with five recording unambiguous identification and one (*Nyctophilus* sp. Long-eared Bat) requiring confirmation (Table 18).

Bats were recorded at all of the five trapping grid sites with between five and six species recorded at each site. Four of the species were recorded at all five sites, whereas *Scotorepens balstoni* was recorded at all sites except for Site 5 (Table 18). Further, some species were only recorded during the Spring 2011 survey and not the Autumn 2012 survey at some sites (*Tadarida australis* White-striped Freetail-bat Site 1) and others were

recorded during the Autumn 2012 survey and not the Spring 2011 survey (*Nyctophilus* sp. Long-eared Bat, Site 1 and Site 4).

Armstrong and Konishi (2011, 2012) highlight the difficulties in distinguishing the differences in some calls. For example, the calls of the Long-eared bats *Nyctophilus* spp. are typically difficult to identify to species, and those recorded may be attributed to the Lesser Long-eared Bat *Nyctophilus geoffroyi* or the central Greater Long-eared Bat *N. major tor*. In addition, calls of *Chalinolobus gouldii* Gould's Wattled Bat are similar to those of the inland Freetail-bat *Mormopterus* sp. 3. However, positive identifications of both these species were made from other high quality diagnostic call sequences.

Evidence of native mammals seen opportunistically during the survey was limited to *Tachyglossus aculeatus* Echidna and Dunnart tracks (*Sminthopsis* spp.). However, evidence of five non-native species were recorded including *Oryctolagus cuniculus* Rabbit, *Canis* sp. Dog/Dingo, *Felis catus* Cat, *Bos taurus* European Cattle and *Equus asinus* Donkeys. All sightings are included in Appendix B.

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Table 17 - Mammal species recorded (including method) during the Spring 2011 and Autumn 2012 systematic surveys

Family	Species	Common Name	Site 1		Site 2		Site 3		Site 4		Site 5	
			Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn
Dasyuridae	*Pseudantechinus woolleyae*	Woolley's Pseudantechinus	0	0	0	0	0	0	0	0	0	0
	Sminthopsis dolichura	Little long-tailed Dunnart	1	0	1	1	0	3	1	3	3	0
	Sminthopsis longicaudata	Long-tailed Dunnart	0	0	0	0	1	1	0	0	0	0
Muridae	*Mus musculus**	House Mouse	0	4	0	2	0	2	7	16	2	8
	Notomys alexis	Spinifex Hopping Mouse	0	5	0	0	0	0	0	0	0	0
	Pseudomys hermannsburgensis	Sandy Inland Mouse	0	3	0	0	0	1	0	2	0	1
	Pitfall trap		1	3	1	1	1	6	2	9	3	1
	Funnel trap		0	0	0	0	0	0	0	0	0	0
	Cage trap		0	0	0	0	0	0	0	0	0	0
	Aluminium box trap		0	9	0	2	0	1	6	12	2	8
	Total		**1**	**12**	**1**	**3**	**1**	**7**	**8**	**21**	**5**	**9**
	Cumulative Total				**2**	**15**	**3**	**22**	**11**	**43**	**16**	**52**

Family	Species	Common Name	Site 6		Site 7		Site 8		Site 9		Site 10	
			Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn
Dasyuridae	*Pseudantechinus woolleyae*	Woolley's Pseudantechinus	0	0	0	0	0	0	0	1	0	0
	Sminthopsis dolichura	Little long-tailed Dunnart	0	0	0	0	0	0	0	0	0	0
	Sminthopsis longicaudata	Long-tailed Dunnart	0	0	0	0	0	0	0	0	0	0
Muridae	*Mus musculus**	House Mouse	0	0	0	0	1	1	0	1	0	0
	Notomys alexis	Spinifex Hopping Mouse	0	0	0	0	0	0	0	0	0	0
	Pseudomys hermannsburgensis	Sandy Inland Mouse	0	0	0	0	0	0	0	0	0	0
	Pitfall trap		0	0	0	0	0	0	0	0	0	0
	Funnel trap		0	0	0	0	0	0	0	0	0	0
	Cage trap		0	0	0	0	1	0	0	0	0	0
	Aluminium box trap		0	0	0	0	0	1	0	2	0	0
	Total		**0**	**0**	**0**	**0**	**1**	**1**	**0**	**2**	**0**	**0**
	Cumulative Total		**16**	**52**	**16**	**52**	**17**	**53**	**17**	**55**	**17**	**55**

Table 18 - Site by species matrix of bat identifications recorded during the Spring 2011 and Autumn 2012 systematic surveys

Family	Species	Common Name	Site 1		Site 2		Site 3		Site 4		Site 5	
			Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn
Vespertilionidae	*Chalinolobus gouldii*	Gould's Wattled Bat	+	+	+	+	+	+	+	+	+	+
	Nyctophilus sp.	Long-eared Bat	-	NC	NC	NC	NC	NC	-	NC	NC	NC
	Scotorepens balstoni	Inland Broad-nosed Bat	+	NC	+	NC	+	NC	+	-	-	-
	Vespadelus finlaysoni	Finlayson's Cave Bat	+	+	+	+	+	+	+	+	+	+
Molossidae	*Mormopterus sp. 3*	Freetail-bat	+	+	+	NC	+	NC	+	NC	+	NC
	Tadarida australis	White-striped Freetail-bat	+	-	+	+	+	+	+	+	+	+

Key:
NC = needs confirmation
+ = positive identification
- = not recorded

5.4.2 Discussion

Four different trap types were open for a collective total of 4613 trap nights during the seven night surveys in Spring 2011 and in Autumn 2012. The capture of 28 individual native mammals during these periods equates to a trap rate of 0.6%, which suggests that the area surveyed supported very low numbers of mammals. The trap rate for the non-native *Mus musculus* is slightly higher (1.0%), and collectively the trap rate of 1.6% for both native and non-native mammals suggests that both the abundance and diversity of mammals was low.

As mammals are homeothermic, survey timing is not constrained as it is for reptiles (EPA and DEC 2010). However, mammal species have different population cycles which are often related to climate and resource availability. During these seasonal surveys. there was a three-fold increase in the number of native mammals captured in autumn (n = 21) compared to the number captured in spring (n = 7). The scenario was similar to that of *Mus musculus,* the only non-native mammal which was captured at seven of the ten sites. *Mus musculus* populations are known to fluctuate enormously and, while they do breed opportunistically, many are born from September to April (Menkhorst and Knight 2011). This is consistent with the large increase in numbers from ten captured during the Spring 2011 survey to 34 captured during the Autumn 2012 survey. Females can produce up to nine litters a year with 4 – 6 young in each litter increasing local populations exponentially.

Given the overall low numbers of mammals captured, it is difficult to comment on any significance of spatial differences or preferred habitat. A general observation indicates that mammals were captured at all five trapping sites and at two of the smaller satellite sites in the BIF areas. For the latter, only one (*Pseudantechinus woolleyae*) was captured at Site 9 in addition to one *M. musculus* at this site, and two *M. musculus* at Site 8. *Pseudantechinus woolleyae* tend to be sparsely distributed on rocky hillsides with acacia scrub (Menkhorst and Knight 2011); its presence in the BIF site, therefore, was not unexpected. Being generalists, *M. musculus* do not appear to have any habitat preferences are can be found everywhere.

More detailed analysis indicates that more mammals were captured at Site 4 'Mulga over *Eremophila forrestii* on undulating hills' during both seasonal surveys than at all other sites. During the Spring 2011 survey this was followed by the number captured in the same vegetation group ('Mulga over *Eremophila forrestii* on undulating hills') (Site 5) followed by one captured at each of the remaining sites where animals were captured. For the Autumn 2012 survey, more mammals were captured on the flats 'Mulga over *Eremophila forrestii* on Flats' at Site 1 followed by the number captured on the undulating hills at Site 5. It is noted that five of the nine captures overall at Site 1 were *Notomys alexis.* Site 1 comprised unburnt and primarily undisturbed sandplain supporting mulga, which is consistent with the preferred habitat of this species (Menkhorst and Knight 2011). While this vegetation was not limited to this area, *N. alexis* were only captured at this site and not at any other site.

It is also noted that the only two *Sminthopsis longicaudata* (Priority 4) were captured with one in each season and in the same locale (<50 m from each other at Site 3). On site observation indicates that both species were captured at the base of an area of a rocky scree. The preferred habitat of this species is varied but does include rocky scree in addition to plateau areas, generally with little vegetation or spinifex hummock grassland, shrubs, and open Mulga woodland (Burbidge *et al.* 2008). Within its distributional range, *S. longicaudata* tends to be in low abundance, as demonstrated by the results of this survey.

Using the EPBC Protected Matters Search Tool and interrogating the DEC Threatened and Priority Fauna Database, no mammal species of conservation are listed for the area. However, as mentioned above, one *Sminthopsis longicaudata* was captured during each of the seasonal surveys and in the same area. This species is listed as a Priority 4 species on the DEC Threatened and Priority Fauna Database. This capture represents the southernmost extent of this species and extends its distribution range.

A Level 2 fauna survey was conducted recently approximately 200 km northeast of Mt Mason (Terrestrial Ecosystems 2011a). Three *S. longicaudata* were captured with one in a funnel trap and two in pitfall traps. The report suggested that their presence in this area was unexpected as they were "not normally caught in open, flat, mulga woodland with no spinifex, low shrubs and little ground cover" and certainly not that far south. Subsequently, a targeted survey for this species in that area resulted in the capture of one individual albeit over 8,400 trap nights (0.01% trap rate) (Terrestrial Ecosystems 2011b). However, it is noted that 840 box traps were used (over ten nights). Of the three *S. longicaudata* captured during the earlier Level 2 fauna survey, one was captured in a funnel trap and the remaining two were captured in pitfall traps. In this current survey at Mt Mason, both *S. longicaudata* were captured in pitfall traps. Further, three *S. longicaudata* were also captured in pitfall traps during the fauna assessment at Jupiter's Mt Ida site ~10 km south of Mt Mason (KLA 2012 *in prep*). Therefore the use of box traps for *S. longicaudata* may not be the most appropriate trapping tool for this species. Notwithstanding this, the results from these trapping programs (Terrestrial Ecosystems 2011a and b, KLA 2012 *in prep*) and the current survey suggest that the distributional range of this species is far greater than previously mapped and that they are present in low abundance over an extensive part of Western Australia, excluding the southern portion of the state. Further, the habitat occupied by these specimens suggests that there is no obvious habitat attribute particularly associated with the species. Given this, the conservation status of *S. longicaudata* is not likely to be compromised by the proposed mining activity at Mt Mason.

The EPBC Protected Matters Search Tool does list four invasive species that are likely to occur in the area namely *Capra hircus* Goat, *Felis catus* Cat, *Oryctolagus cuniculus* Rabbit and *Vulpes vulpes* Fox. Of these, evidence of *F. catus* and *O. cuniculus* was recorded. Canid faeces were noted but were unable to be attributed to *Canis lupis* sp. being either a Dingo or a non-native Dog. Anecdotal sightings of *Equus asinus* Donkey were reported and these were only seen after the completion of the survey. Nevertheless, they have been included in opportunistic sightings. Notwithstanding this, the low number of smaller mammals in the area may be attributable to a degree of predation and loss of habitat from trampling and grazing by larger ungulates.

For this and many fauna surveys, pitfall traps and aluminium box traps are generally the most effective in capturing small mammals (EPA and DEC 2010). However, some species have a penchant for particular traps. In this study, for example, all the dunnarts (*Sminthopsis dolicura* and *S. longicaudata*) were captured in pitfall traps and all the *Notomys alexis* were captured in box traps. Other than the single *M. musculus* captured in a cage trap in the BIF area, no other animals were captured in cage traps and none were captured in funnel traps.

Given the low numbers of mammals captured, a species accumulation curve may not depict mammal presence adequately. However, log/log transformation of the accumulated number of species captured during the seven night trapping programmes resulted in a strong linear relationship between sampling intensity (nights) and the number of species (R^2 = 0.9368) (Figure 15). While an asymptote has not been reached, 67% of all species were captured by the second night of trapping and 83% by the fourth night of trapping. In general, seven nights is the recommended effort for any particular sampling period when undertaking general inventory surveys (Moseby and Read 2001 cited in EPA and DEC 2010).

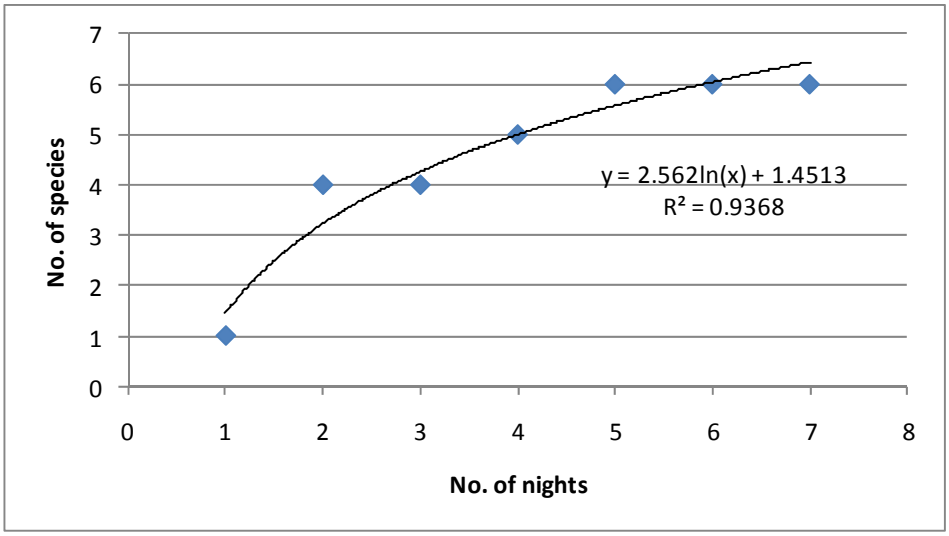

Figure 15 - Species accumulation curve for non-volant native and non-native mammals captured during the systematic fauna surveys

Anabat detectors record the presence of bats, rather than the numbers present. Bats were recorded at all of the five trapping grid sites with between five and six species recorded at each site. While some calls were positively identified, others require confirmation and some could be one of two species. Notwithstanding this, it is reasonable to assume that the diversity of bats present extends throughout the Mt Mason area.

Interestingly, not one mammal has been vouchered at Western Australian Museum for the area. As noted for the reptiles, comparisons with other studies are limited due to differences in timing, trapping programs and taxonomic changes. Notwithstanding this, other surveys have captured as few as 13 species (KLA 2011) and as many as 28 species (Burbidge *et al.* 1995) (Appendix B). It is noted that the 28 species were recorded over three seasons (winter, spring and late summer) over a three year time period (1979, 1980 and 1981) (Burbidge *et al.* 1995). This adds weight to the fact that seasonal trapping conducted over many years is required to provide a more complete representation of the assemblage of mammals that utilise the area.

5.5 BIRDS

5.5.1 The assemblages

A total of 507 individual birds representing 34 species from 16 Families were recorded during the 20 minute observations for the Spring 2011 and Autumn 2012 surveys (Table 19). The total species tally comprised 307 individuals with 29 species representing 12 Families recorded during the Spring 2011 survey and 200 individuals with 19 species representing 11 Families recorded during the Autumn 2012 survey.

For the Spring 2011 survey, the 12 Families comprised three non-passerine Families (n = 8 species with 129 individual birds recorded) and nine passerine Families (n = 21 species with 178 individual birds recorded). While the numbers of birds recorded in each category suggest that the area supports marginally more passerines (58% of total number of birds) than non-passerines (42%), analysis of the results indicates that *Nymphicus hollandicus* Cockatiel (n = 40) and *Melopsittacus undulatus* Budgerigar (n = 45) were responsible for weighting of the non-passerine figures. Large numbers of these species were recorded at most sites and many more were seen opportunistically and in flight. Of the remaining non-passerines, 18 *Barnardius zonarius* Australian Ringneck outnumbered the remaining species with less than seven individuals of each species recorded (Table 19). Interestingly, three species of cuckoo were recorded but never more than two species at any one site.

Within the passerines, 52% of the total number of passerines (n = 178) was represented by three species with the Malurid *Malurus splendens* Splendid Fairy-wren being the most ubiquitous (n = 35). Few *M. splendens* were recorded at every site. *Acanthiza robustirostris* Slaty-backed Thornbill was the next most numerous bird (n = 33) followed by *Oreoica gutturalis* Crested Bellbird (n = 25). The remaining species all recorded less than 10% each of the total number of birds recorded.

Similar numbers of species were recorded at all sites (<18, >15). However, more individual birds were recorded at Site 4 (n = 89) with similar numbers recorded at Site 3 (n= 65) and at Site 1 (n = 62) and similar numbers recorded at Site 5 (n = 47) and at Site 2 (n = 44).

For the Autumn 2012 survey, three non-passerine species from three Families accounted for only 17 birds whereas the 16 passerines species numbered 183 individuals from eight Families. Two species (*Malurus splendens* Splendid Fairy-wren (n = 45) and *Acanthiza apicalis* Inland Thornbill (n = 66)) accounted for 61% of all passerines during this seasonal survey. Thus, the percentage of passerines (91.5%) heavily outweighed the percentage of non-passerines (8.5%).

More species (n = 12) and more individual birds (n = 65) were recorded at Site 3 than at the other four sites. This was followed by Site 5 that accounted for nine species and 45 individual birds. While Sites 1 and 2 recorded the same number (n = 8) species, Sites 1 and 4 recorded the same number (n = 35) number of individual birds. The least number of species was recorded at Site 4 (n = 5) and the least number of birds (n = 24) was recorded at Site 2.

Table 19 - Avifauna species recorded (including method) during the Spring 2011 and Autumn 2012 systematic surveys

Family	Species	Common Name	Site 1		Site 2		Site 3		Site 4		Site 5	
			SPRING	AUTUMN	SPRING	AUTUMN	SPRING	AUTUMN	SPRING	AUTUMN	SPRING	AUTUMN
Columbidae	*Phaps chalcoptera*	Common Bronzewing	0	0	0	0	0	0	0	3	0	0
Aegothelidae	*Aegotheles cristatus*	Australian Owlet-nightjar	0	0	0	0	0	1	0	0	0	0
Cacatuidae	*Eolophus roseicapillus*	Galah	3	0	2	0	0	0	0	0	2	0
	Nymphicus hollandicus	Cockatiel	13	0	3	0	0	0	21	0	3	0
Psittacidae	*Platycercus zonarius*	Australian Ringneck (Ring-necked Parrot)	4	4	2	3	4	4	5	0	3	2
	Melopsittacus undulatus	Budgerigar	10	0	0	0	20	0	15	0	0	0
	Neopsephotus bourkii	Bourke's Parrot	0	0	0	0	0	0	5	0	0	0
Cuculidae	*Chalcites basalis*	Horsfield's Bronze Cuckoo	1	0	2	0	2	0	1	0	0	0
	Chalcites osculans	Black-eared Cuckoo	1	0	0	0	0	0	0	0	1	0
	Cuculus pallidus	Pallid Cuckoo	0	0	1	0	2	0	2	0	1	0
Ptilonorhynchidae	*Ptilonorhynchus guttatus*	Western Bowerbird	0	0	1	0	0	0	0	0	0	0
Maluridae	*Malurus splendens*	Splendid Fairy-wren	9	6	8	2	3	17	4	10	11	10
Acanthizidae	*Calamanthus campestris*	Rufous Fieldwren	0	0	0	0	0	0	0	0	1	0
	Pyrrholaemus brunneus	Redthroat	0	0	1	0	0	0	0	0	2	0
	Smicrornis brevirostris	Weebill	2	0	0	0	4	6	5	0	0	0
	Acanthiza robustirostris	Slaty-backed Thornbill	5	0	5	0	8	6	6	2	9	3
	Acanthiza chrysorrhoa	Yellow-rumped Thornbill	0	0	2	0	0	0	0	0	0	0
	Acanthiza apicalis	Inland Thornbill	3	16	2	8	2	16	0	11	1	15
Meliphagidae	*Lichenostomus virescens*	Singing Honeyeater	1	0	1	0	1	0	2	0	0	2
	Manorina flavigula	Yellow-throated Miner	0	0	0	0	1	0	7	0	0	0
	Acanthagenys rufogularis	Spiny-cheeked Honeyeater	1	0	1	0	5	0	1	4	6	0
	Anthochaera carunculata	Red Wattlebird	0	0	0	0	2	0	5	0	0	0

Family	Species	Common Name	Site 1		Site 2		Site 3		Site 4		Site 5	
			SPRING	AUTUMN	SPRING	AUTUMN	SPRING	AUTUMN	SPRING	AUTUMN	SPRING	AUTUMN
	Epthianura tricolor	Crimson Chat	0	0	2	0	0	0	0	0	0	0
Pomatostomidae	*Pomatostomus superciliosus*	White-browed Babbler	0	0	3	0	0	0	0	0	0	0
Campephagidae	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike	0	0	0	0	2	0	0	0	0	0
Pachycephalidae	*Pachycephala rufiventris*	Rufous Whistler	1	1	0	0	0	1	0	0	0	0
	Colluricincla harmonica	Grey Shrike-thrush	2	0	2	0	1	1	1	0	1	2
	Oreoica gutturalis	Crested Bellbird	5	1	6	2	5	1	5	0	4	1
Artamidae	*Cracticus nigrogularis*	Pied Butcherbird	0	0	0	2	1	0	2	0	1	0
	Strepera versicolor	Grey Currawong	0	3	0	1	1	4	1	0	1	3
Rhipiduridae	*Rhipidura fuliginosa*	Grey Fantail	0	1	0	0	0	0	0	0	0	0
Corvidae	*Corvus bennetti*	Little Crow	1	0	0	0	1	0	1	0	0	0
	Corvus orru	Torresian Crow	0	3	0	2	0	4	0	0	0	0
Petroicidae	*Petroica goodenovii*	Red-capped Robin	0	0	0	4	0	4	0	5	0	3
		Subtotal	**62**	**35**	**44**	**24**	**65**	**65**	**89**	**35**	**47**	**41**
		Cumulative total			**106**	**59**	**171**	**124**	**260**	**159**	**307**	**200**

Opportunistic recordings collectively accounted for 27 bird species identified during the two seasonal survey periods (Appendix B). While 18 species were recorded during the Spring 2011 survey period, a total of 15 were recorded during the Autumn 2012 survey period (Table 20). Of these, 12 were recorded during the Spring 2011 survey period that were not recorded during the Autumn 2012 survey and nine were recorded during the Autumn 2012 survey that were not recorded during the Spring 2011 survey. Only six species were common to both survey periods.

Of the birds recorded opportunistically, eight were recorded that were not recorded during the systematic bird surveys (Appendix B). Conversely, ten bird species recorded during the systematic surveys were not seen opportunistically (Appendix B).

Table 20 - Bird species recorded opportunistically during the Spring 2011 and Autumn 2012 bird surveys

Family	Species	Common Name	Spring 2011	Autumn 2012
Casuariidae	*Dromaius novaehollandiae*	Emu	√	√
Megapodiidae	*Leipoa ocellata*	Malleefowl		√
Columbidae	*Phaps chalcoptera*	Common Bronzewing	√	
Podargidae	*Podargus strigoides*	Tawny Frogmouth	□	√
Aegothelidae	*Aegotheles cristatus*	Australian Owlet-nightjar		√
Accipitridae	*Aquila audax*	Wedge-tailed Eagle	√	
Cacatuidae	*Eolophus roseicapillus*	Galah	√	
	Nymphicus hollandicus	Cockatiel	√	
Psittacidae	*Barnardius zonarius*	Australian Ringneck	√	
	Melopsittacus undulatus	Budgerigar	√	
Meropidae	*Merops ornatus*	Rainbow Bee-eater	□	√
Maluridae	*Malurus splendens*	Splendid Fairy-wren	√	√
Acanthizidae	*Acanthiza robustirostris*	Slaty-backed Thornbill		√
Meliphagidae	*Manorina flavigula*	Yellow-throated Miner	√	√
	Acanthagenys rufogularis	Spiny-cheeked Honeyeater	√	
	Anthochaera carunculata	Red Wattlebird	√	
Pomatostomidae	*Pomatostomus superciliosus*	White-browed Babbler	√	
Campephagidae	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike	√	√
Pachycephalidae	*Pachycephala rufiventris*	Rufous Whistler		√
	Colluricincla harmonica	Grey Shrike-thrush	√	
	Oreoica gutturalis	Crested Bellbird	√	√
Artamidae	*Strepera versicolor*	Grey Currawong	√	
Rhipiduridae	*Rhipidura fuliginosa*	Grey Fantail		√
	Rhipidura leucophrys	Willie Wagtail		√
Corvidae	*Corvus orru*	Torresian Crow	√	√
Petroicidae	*Petroica goodenovii*	Red-capped Robin	√	
	Melanodryas cucullata	Hooded Robin		√

Of the birds considered of conservation significance listed for the area, evidence of *Leipoa ocellata* Malleefowl was found, *Oreoica gutteralis* Crested Bellbird was recorded at every site and opportunistically and *Pomatostomus superciliosus* White-browed Babbler was recorded at Site 2 and opportunistically.

Malleefowls are listed as a Schedule 1 species under the WCA 1950. Unconfirmed reports suggested that there were up to four Malleefowl mounds in the Mt Mason area. During the survey period, an audit of these mounds established that three of the mounds were old, inactive mounds and the fourth was unable to be found (Figure 16). While on site during the Spring 2011 survey, KLA was notified of a new active mound not far from the Jupiter camp (1.7 km south of the southern boundary of the Mt Mason tenement). Table 21 provides the coordinates of all reported Malleefowl mounds including their status as of September 2011. Plate 11 provides photographic evidence of the active mound, with two Malleefowl in attendance.

Both the Crested Bellbird and the White-browed Babbler are listed as Priority 4 species on the DEC Threatened and Priority Fauna database. These species, the Malleefowl, and other species of conservation significance listed to potentially occur in the area will be discussed further in Section 7.1.

Interrogation of the Birds Australia Atlas database listed 50 species for the area (Appendix B). Of those birds recorded collectively during the survey, 21 species were listed as having been seen/heard in the area with an additional five species seen opportunistically. Eight species were seen during systematic surveys that were not on the Birds Australia list for the area and an additional one species not on the list was seen opportunistically during the reconnaissance survey (Appendix B). Conversely, 22 species were on the list from Birds Australia that were not recorded during the survey.

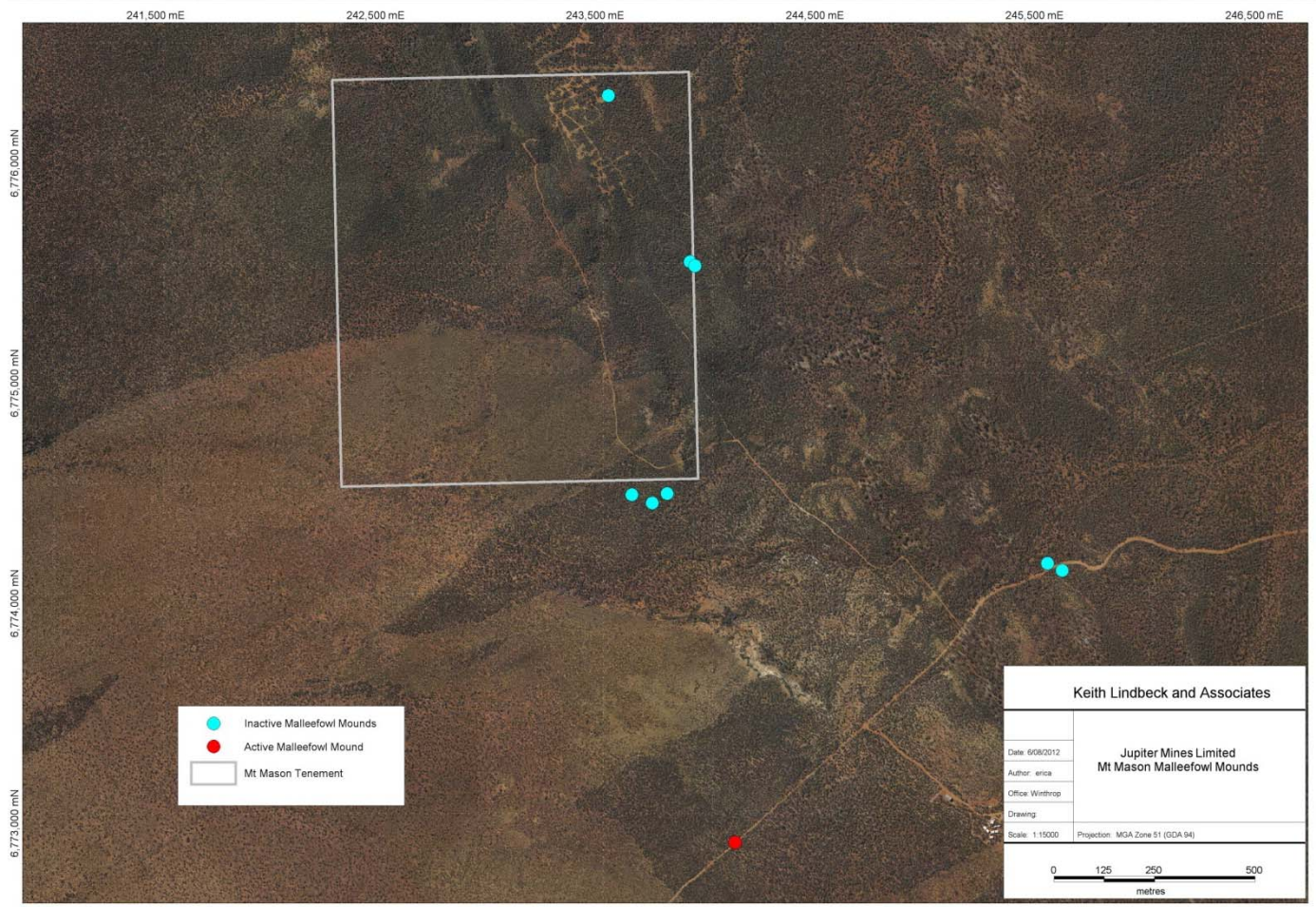

Figure 16 - Location and status of Malleefowl mounds

Table 21 - Malleefowl Mound Locations and their status

Mound Number	Location		Status of Mound		
	Easting	Northing	Active/ Inactive	Approximate Age	Approximate Size (m)
1	245522	6774136	Inactive	> 10 years	6 x 6
2	245590	6774104	Unable to locate		
3	243523	6776262	Inactive	>30 years	5 x 5
4	243917	6775489	Inactive	> 30 years	7 x 7
5	244107	6772871	Active	new	2.5 x 2.5
Other Mounds located during fauna assessment					
6	243723	6774411	Inactive	> 50 years	4 x 4
7	243631	6774448	Inactive	> 50 years	6 x 6
8	243791	6774455	Inactive	>100	5 x 5
9	243895	6775506	Inactive	>100	4 x 4

Plate 18 – Active Malleefowl Mound

5.5.2 Discussion

Season and rainfall were taken into account when planning the optimal time for conducting both these seasonal surveys. Conventionally, surveys are undertaken in spring and autumn. For the Spring 2011 survey, above average rainfall was recorded for June 2011 and July 2011. Given the recent rainfall, this survey was planned in the spring months to take advantage of the above average rainfall that fell in the previous months. Similarly, for the Autumn 2012 survey, above average rainfall was recorded from October 2011 through

to January 2012. Therefore, timing of the surveys was in accordance with suggested timelines.

For the Spring 2011 survey, the bird censuses yielded a total of 307 individuals of 29 species from 12 Families. The percentages of non-passerines (58%) to passerines (42%) were weighted due to the inordinate numbers of Cockatiels and Budgerigars. The populations of these two species are known to fluctuate based on resource availability, and the large numbers recorded were not surprising given the verdant vegetative response to the recent above average rainfall.

Excluding these species, non-passerines (20%) were outnumbered by the passerines (80%) which is a more typical scenario in the northern Goldfields at this time of the year. The non-passerines were heavily represented by the Australian Ringneck (n = 18) followed by only five other non-passerine species which collectively totalled 26 individual birds.

Three species of passerines accounted for 52% of all the passerines recorded: the Splendid Fairy-wren was the most ubiquitous of the passerines followed by the Slaty-backed Thornbill. The characteristic call of the Crested Bellbird was heard at every site and was recorded opportunistically. The Crested Bellbird is listed as a Priority 4 species on the DEC Threatened and Priority Fauna database and will be discussed in Section 7.1 that addresses species of conservation significance. Similarly, the White-browed Babbler, another of the passerines recorded at Mt Mason is also a Priority 4 species and will be discussed in Section 7.1.

For the Autumn 2012 survey, the more typical scenario of passerines (91.5%) to non-passerines (8.5%) was evident with the Splendid Fairy Wren (n = 45) and Inland Thornbill (n = 66) responsible for much of this weighting, collectively representing 61% of all passerines recorded during the survey. Of the non-passerines, the Australian Ringneck again was the dominant species accounting for 13 of the 17 non-passerines recorded. While the White-browed Babbler was not recorded during the Autumn 2012 survey, the Crested Bellbird was recorded at four of the five sites, albeit in far fewer numbers than during the warmer months of spring. As mentioned above, these Priority species will be discussed in Section 7.1, in addition to the presence of the Malleefowl.

The distribution of birds throughout the Mt Mason area was not remarkably different between sites for the Spring 2011 survey. These results suggest that there was no significant correlation between distribution of birds across the length of the area surveyed and the vegetation communities in the areas surveyed. However, these results were not consistent for the Autumn 2012 survey period in which there was a marked difference in the species distribution across the sites. Given that all sites except the regenerating *Acacia* shrubland are dominated by a mulga upperstorey, it may be assumed that resource availability differs substantially in the cooler months in relation to topography and understorey species. These results confirm the necessity of multiple seasonal surveys in order to better understand resource availability and use by avifauna of different habitats across a landscape.

A log/log transformation of the accumulated number of species recorded during the four mornings of systematic sampling resulted in a fairly strong linear relationship between sampling intensity (mornings) and the number of species (R^2 = 0.877) (Figure 17). While an asymptote has not been reached, 94% of species had been recorded by the second morning with only two more species recorded on the following two mornings. As discussed in Section 5.3.2, it is reasonable to assume that all common species are represented in the curve but rare and transient species would only be detected with a far higher sampling intensity. Based on these results and that two seasonal surveys have been undertaken, it is likely that a reasonable representation of the majority of the birds that utilise this area were sighted.

Only one bird species *Cracticus tibicen* Australian Magpie has been vouchered at the Western Australian Museum for the area (Appendix B). Interestingly this species was neither heard nor seen during the systematic sampling and was not recorded opportunistically. Results from Birds Australia identify 51 species that have been recorded in the area (Appendix B). Of these, 25 were recorded during the two seasonal surveys, 26 were not recorded that appeared on the list and nine species were recorded during the surveys that do not appear on the Birds Australia list (Appendix B)

As noted elsewhere, a comparison with other surveys is limited given the seasonal, temporal and habitat differences. Notwithstanding this and excluding species associated with water bodies, other regional surveys have listed a total of 94 additional species collectively that were not recorded during this spring survey (Appendix B). As mentioned elsewhere, seasonal surveys, conducted over many years during different seasons and climatic conditions would be required to determine the full complement of birds that utilise the habitats and adjacent areas of the Mt Mason Project.

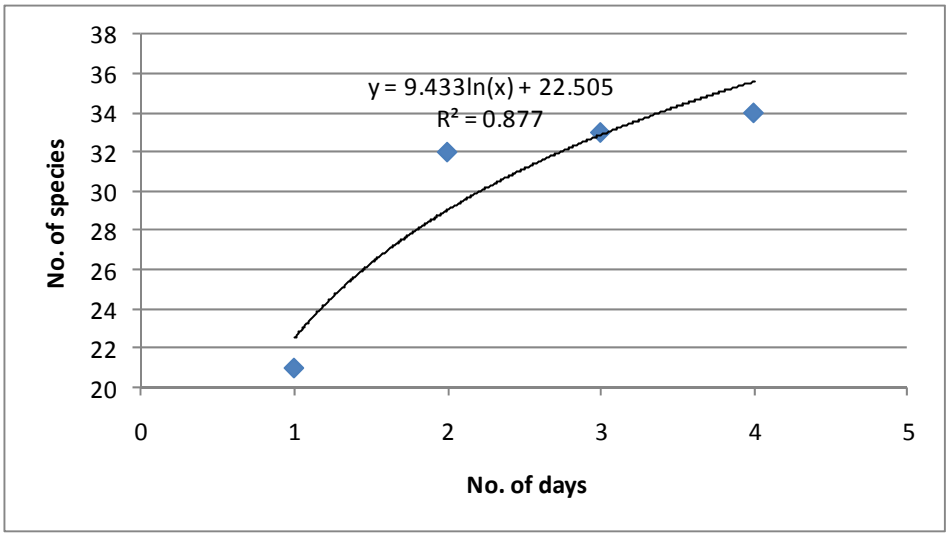

Figure 17 - Species accumulation curve for birds recorded during the systematic sampling surveys

5.6 SPOTLIGHTING

5.6.1 The assemblages

A total of 27 person hours was spent spotlighting during both seasonal surveys; five hours and fifty minutes over three evenings totalling 15.5 spotlighting hours were spent traversing the survey areas during the Spring 2011 survey and five hours and forty-five minutes over three evenings totalling 11.5 spotlighting hours were spent traversing the survey areas during the Autumn 2012 survey. Established tracks were followed within and adjacent to the survey area and the trapping grid areas were not entered so that mammals in the immediate areas of the traps would not be disturbed.

For the Spring 2011 survey, collectively, during spotlighting and head-torch searches, two *Macropus robustus* Euros were seen, one *Eurostopodus argus* Spotted Nightjar was positively identified by its call and one *Antaresia stimsoni* Stimson's Python was recorded. Two other birds were seen but unidentified as well as numerous unidentified bats flying overhead. One gecko was also seen but not captured or identified.

During the Autumn 2012 spotlighting surveys, four mammals species were recorded including one *Pseudantechinus woolleyae* Woolley's Pseudantechinus, *Macropus rufus* Red Kangaroo, unidentified bats and the non-native *Oryctolagus cuniculus* Rabbit. In addition, seven bird species were recorded that included *Phaps chalcoptera* Common Bronzewing, *Podargus strigoides* Tawny Frogmouth, *Aegotheles cristatus* Australian Owlet-nightjar, *Acanthiza apicalis* Inland Thornbill, *Pachycephala rufiventris* Rufous Whistler, *Petroica goodenovii* Red-capped Robin and a small unidentified species.

All species recorded during the spotlighting surveys are presented in Appendix B.

In addition to the vertebrates, three scorpions and two slaters were collected during the Spring 2011 survey. These were sent to the appropriate specialist at the Western Australian Museum for identification.

5.6.2 Discussion

Given the low number of small mammal and reptile species captured, it was not surprising that few were seen during the spotlighting forays.

It is interesting to note that of the vertebrate taxa identified during the spotlighting surveys only one mammal (Red Kangaroo) was not recorded during the systematic sampling or opportunistically. Albeit only one species, this highlights the value of including varied techniques when recording fauna assemblages in any one area.

All invertebrates sent to the Western Australian Museum were identified. Of the scorpions, all three belong to the Family Buthidae and included one male and one juvenile *Isometroides* ‘goldfields1’ and one juvenile *Lycas jonesae* (Volschenk 2012). The slaters that were collected were identified as *Buddelundia* sp.nov. 39 (Family: Armadillidae)(Judd and Hosie 2012). None of the species above are considered to be short-range endemics.

6.0 TARGETED INVETEBRATE FAUNA SURVEY

6.1.1 The assemblages

Of the species vouchered at the Western Australian Museum, 101 species were identified and comprised Arachnida, Chilopoda, Diplopoda, Crustacea and Gastropoda (Table 22).

Within the Arachnida, nine species totalling 26 individuals represented five Families, three Chilopoda accounted for three Families with one species from each, Diplopoda accounted for one species and Crustacea seven species from one Family. Five species of Gastropoda were identified representing three families and accounting for 64 specimens.

Given the lack of taxonomic knowledge and reference collections, the results from the Western Australian Museum were often inconclusive depending on the families or genera. For example, while the genus *Eucrytops* (Family: Idiopidae) is common throughout Western Australia, based on the females and juvenile collected, it is currently not possible to say if the *Eucyrtops* spp. represent SREs, whereas the single juvenile *Neosprassus* sp. (Family: Sparassidae) is not a SRE species (Burger *et al.* 2012).

Within the Order Pseudoscorpiones, while many species of *Synsphyronus* (Family: Garypidae) may represent SREs, the single female *Synsphyronus mimulus* collected is widespread and occurs in all Australian mainland states (Harvey 1987 cited in Burger *et al.* 2012). Similarly *Geogarypus taylorii* (Family: Geogarypidae) is extremely widespread in southern Australia. However, based on current knowledge, it is not possible to state whether the three males and one female *Austrohorus* sp. or the two female *Euryolpium* sp. from the Family Olipidae are SREs.

Three species of scorpions (Family: Buthidae) were identified and while the taxonomy of Buthidae remains problematic, the three species were identified as not being SREs (Volschenk 2012).

Three species representing three families of centipede (Chilopda) were identified (Burger *et al.* 2012). Of these, full taxonomic treatment of Chilenophilidae is required before the endemicity of the single specimen vouchered can be determined, whereas the other species (*Scolopendra laeta* Family: Scolopendridae and *Pilbarascutigera incola* Family: Scutigeridae) are not considered SREs.

A single millipede sample submitted (Family: Paradoxosomatidae) was a damaged female which did not facilitate identification beyond family level. In the Mt Mason area, the most abundant and diverse genus is *Antichiropus*. All species of the genus are known to be SREs (Burger *et al.* 2012).

Seven isopod specimens from four sites that were submitted to the Museum contained only a single species of the genus *Budddelundia* (Family: Armadillidae) (Judd and Hosie 2012). While this species remains undescribed it is not considered a SRE.

Five species of land snails were identified belonging to the Families Punctidae, Pupillidae and Succineidae (Whisson 2012). None of the species are considered SREs. Although the family Succineidae in Australia is poorly known taxonomically, species are considered to have wide distributional ranges.

Overall, similar numbers of specimens were collected from within the sites and from out of the sites. However, it is noted that many more individuals were collected from Site 3 and for the smaller satellite sites associated with BIF, Site 7 (Table 22).

Table 22 – Invertebrates collected during the Spring 2011 and Autumn 2012 surveys

Class	Family	Species	Site 1		Site 2		Site 3		Site 4		Site 5		Site 6	Site 7	Site 8	Site 9	Site 10
Order			In	Out	In	Out	In	Out	In	Out	In	Out					
Arachnida																	
Aranea																	
	Idiopidae	*Eucyrtops* 'sp female'	-	-	-	-	1	1	1	1	1	1	-	-	-	-	-
		Eucyrtops `sp juv`	-	-	-	-	-	-	1	-	-	1	-	-	-	-	-
Pseudoscorpiones																	
	Garypidae	*Synsphyronus mimulus*	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
	Geogarypidae	*Geogarypus taylori*	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-
	Olpiidae	*Eurypolpium* sp.	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-
		Austrohorus sp.	-	-	-	1	-	-	1	-	2	-	-	-	-	-	-
Scorpiones																	
	Buthidae	*Isometroides* 'goldfields1'	-	-	-	-	1	-	-	-	3	-	-	-	-	1	1
		Lychas jonesae	-	-	1	-	1	-	-	-	-	-	-	-	-	-	-
		Lychas 'splendens'	-	-	-	-	1	-	-	-	1	-	-	-	-	-	-
Chilopoda																	
Geophilomorpha																	
	Chilenophilidae	sp.	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
Scolopendromorpha																	
	Scolopendridae	*Scolopendra laeta*	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
Scutigeromorpha																	
	Scutigeridae	*Pilbarascutigera incola*	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Diplopoda																	
Polydesmida																	
	Paradoxosomatidae	sp.	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
Crustacea																	
Isopoda																	
	Armadillidae	*Buddelundia* sp. nov. 39	-	-	-	-	-	-	1	-	1	-	-	-	2	3	-

Class	**Family**	**Species**	**Site 1**		**Site 2**		**Site 3**		**Site 4**		**Site 5**		**Site 6**	**Site 7**	**Site 8**	**Site 9**	**Site 10**
Order			**In**	**Out**	**In**	**Out**	**In**	**Out**	**In**	**Out**	**In**	**Out**					
Gastropoda																	
Stylommatophora																	
	Pupillidae	*Gastrocopta bannertonensis*	-	-	6	-	2	9	3	2	-	2	-	9	-	-	5
		Gastrocopta cf. *bannertonensis*	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Gastrocopta sp. (juv.)	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-
		Pupoides cf. *adelaidae*	-	-	-	-	5	-	-	-	-	-	-	3	-	-	-
		Pupoides cf. *myoporinae*	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
	Punctidae	*Westralaoma expicta*	-	-	-	-	4	5	-	-	1	-	-	4	-	-	-
	Succineidae	*Succinea* sp.	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-

6.1.2 Discussion

Short-range endemic invertebrate fauna generally possess similar ecological and life history characteristics, especially poor powers of dispersal, confinement to discontinuous habitats, slow growth and low fecundity (EPA 2004, 2009). While there are occasional SREs among the vertebrates and insects, there are much higher numbers among molluscs, earthworms, some spider groups, particularly the mygalomorphs, millipedes and some groups of crustaceans. Mountainous terrains, freshwater habitats, caves and other subterranean cavities provide suitable habitat for a wide variety of both terrestrial and aquatic (vertebrate and invertebrate) fauna (Harvey 2002).

No invertebrate species of conservation significance are listed for the survey area under the EPBC Act 1999, the WCA 1950 or in the DEC Threatened and Priority Fauna Database. However, it is recognised that few invertebrate surveys have been undertaken in the CYIP area. While Jupiter's Mt Mason project area does not support freshwater habitats, there are mountainous terrains in the form of BIFs and subterranean areas may support invertebrate fauna. The invertebrate survey targeted only terrestrial invertebrates in potential SRE habitat.

Of the 19 species identified, the classification of six species could not be determined. It is also noted that for one of the six, while the sample collected could not be identified, it is likely to belong to a genus in which all species are considered to be SREs. The remaining 13 species are not considered to be SREs.

Within the area proposed for disturbance in the Mt Mason tenement, no unique landscape was identified and there appeared to be no unique habitat that did not occur elsewhere in the area. While most sites comprised Mulga overstorey, the differences in the number of invertebrates collected suggest subtle differences between sites most likely in relation to their aspect and understorey flora species. For example, fewer invertebrates were collected from Sites 1 and 2 which were in the southern portion of the tenement. The topography of this area was rather flat and comprised sandy areas with few outcrops and certainly no BIF. The remaining sites, however, were more closely associated with BIF with five actually located in areas of BIF. Not surprisingly, few invertebrates were collected from these areas.

There appeared to be no large differences between the number of species collected within the trapping areas and those collected outside of the trapping areas. This clearly indicates that the invertebrate fauna at Mt Mason is not limited to particular areas but may be found throughout the tenement, albeit at varying densities.

A targeted SRE survey was conducted in 2008 in the Mt Mason area that also searched areas within the potential impact footprint and in non-impact areas proposed at that time (OES (2011). Four sampling sites were selected and all were located in areas of BIF (Figure 12). Results indicate that of the specimens collected, only one species *Aganippe* 'MYG224' (Family Idiopidae) is an SRE. No evidence of this species was recorded or collected during the current survey. In addition, two species from the Mollusc database have a low-level potential for short-range endemism. These include *Pupoides adelaidae* and *Succinea* sp. It is noted that a species (*Pupoides* cf. *adelaidae*) similar to the former was identified from those collected during this survey and was determined not to be a SRE (Whisson 2012).

The BIF range at Mt Mason lies in a north to south orientation for approximately 10 km and appears to be well connected to the BIF range at Mt Ida (approximately 8.6 km in length) (OES 2011). The potential SRE habitat supported by these ranges is extensive and is not limited to the area of proposed impact at Mt Mason.

7.0 ENVIRONMENTAL IMPACTS

7.1 Fauna of Conservation Significance

Native fauna species that are rare, threatened with extinction, or have high conservation value are protected by law under the Federal EPBC Act 1999, in addition to the Western Australia WCA 1950.

The EPBC Act 1999 lists two terrestrial bird species and three migratory bird species of national importance likely to occur within the area of the proposed mining activity, and the DEC Threatened and Priority Fauna Database lists one threatened reptile and six threatened bird species, with the reptile and two bird species protected under the WCA 1950 (Table 23). A short description of each of the species follows, with the potential impact on their conservation status.

Table 23 - Conservation significant terrestrial fauna potentially occurring in the study area

SPECIES	COMMON NAME	CONSERVATION SIGNIFICANCE			PREVIOUS RECORD
		EPBC	WCA	DEC	
REPTILES					
Aspidites ramsayi	Woma		S4		1966 Menzies
AVIFAUNA					
Leipoa ocellata	Malleefowl	Vulnerable	S1		1998 Leonora
					2001, 2007 Ularring
					2007 Menzies
Apus pacificus	Fork-tailed Swift	Migratory			
Ardea alba modesta	Great Egret	Migratory			
Falco peregrinus	Peregrine Falcon		S4		1978 Leonora 1999 Ularring
Ardeotis australis	Australian Bustard			P4	1973 Leonora 1980 Menzies
Thinornis rubricollis	Hooded Plover			P4	1980 Ularring 1992 Menzies
Merops ornatus	Rainbow Bee-eater	Migratory			
Acanthiza iredalei iredalei	Slender-billed Thornbill	Vulnerable			
Pomatostomus superciliosus	White-browed Babbler			P4	1980 Ularring
Oreoica gutturalis subsp. *gutturalis*	Crested Bellbird			P4	1980 Ularring

- ***Aspidites ramsayi* Woma**

  Family: Boidae

  Conservation Status: Schedule 4: Fauna that is in need of special protection under the WCA 1950.

  Distribution: The Woma was formerly abundant in the southwestern sandplains. They are now known from four disjunct populations: a southwestern population, isolated populations on Peron Peninsula, an arid northwestern population and a Central Australian population (Storr *et al.* 2002).

  Ecology: The Woma, also colloquially known as Ramsay's Python, grows up to 2.7 m long, although the average length is 1.5 m, and it is particularly placid. It has a grey, olive,

golden brown or rich red-brown back, ringed with darker bands. Unlike most other Australian pythons, the Woma has a narrow pointed head rather than a broad head distinct from its body. It does not have the characteristic python heat-sensory pits along the lips and front of the head. These features result in it being occasionally mistaken for a venomous snake, although like all pythons the Woma is harmless to humans.

Mating probably occurs between May to August. A clutch of 5–19 eggs are laid in September and October. Once the young snakes hatch, after about two months' incubation, the female probably leaves the maternal burrow and the juveniles are independent.

During the day the Woma shelters in hollow logs, old burrows or warrens or thick vegetation. It uses its head like a shovel to dig and enlarge its burrow. The Woma emerges at night to search for food, which includes reptiles including lizards or snakes, in addition to many species of venomous snakes, small mammals and birds. The snake wiggles the end of its tail to lure its prey close enough to strike, then kills its prey by squeezing it in the coils of its body, or by squashing it against the walls of its burrow or warren.

Likelihood of occurrence: The DEC Threatened and Priority Fauna Database lists one Woma recorded for 1966 ~70 km southeast of the survey area. Given this and the current distribution of this species, it is not likely that the Woma occurs within the survey area. Further, there does not appear to be preferred habitat for this species in the area surveyed at Mt Mason.

Potential Impacts: The conservation status of this species is not likely to be altered by the proposed mining activity in the survey area.

- **Malleefowl *Leipoa ocellata***

Family: Megapodidae

Conservation Status: Vulnerable under EPBC Act 1999 and Schedule 1: Rare and likely to become extinct under the WCA 1950

Distribution: The Malleefowl was once broadly distributed across the southern half of the Australian continent, but has undergone significant range reduction and now occupy semi-arid regions of southern Australia where mallee eucalypts form the dominant vegetation (Birds Australia 2012).

Ecology: The Malleefowl is a large, ground-dwelling bird that roosts in trees but rarely flies. The species is omnivorous and typically has a large home range in woodlands or shrublands that have a deep layer of leaf litter which is used in building nesting mounds. Mounds are up to one metre in height and 3m to 5 m in diameter. Breeding occurs from September to April and chicks emerge independently, approximately seven weeks after hatching.

Clearing of habitat, fox predation and the degradation of habitat by fire and overgrazing by feral livestock has reduced Malleefowl numbers considerably.

Likelihood of occurrence: During the survey period, seven old, inactive mounds were identified within the Mt Mason area with one active mound located 1.7 km south of the southern boundary of the Mt Mason tenement. The presence of this species is addressed in the recommendations.

Potential Impacts: Given the distribution of this species and the quality and quantity of preferred habitat in the region that will not be disturbed, it is unlikely that the overall conservation status of this species will be altered by the proposed mining activity.

- ***Apus pacificus* Fork-tailed Swift**

  Family: Apodidae

  Conservation Status: Migratory Marine under EPBC Act 1999.
  This species is also listed in the CAMBA, JAMBA and ROKAMBA agreements.

  Distribution: The Fork-tailed Swift breeds in northeast and mid-east Asia and winters in south New Guinea and Australia (Johnstone and Storr 1998). It is a visitor to most parts of Western Australia beginning to arrive in the Kimberley in late September, the Pilbara and Eucla in November and in the southwest in mid-December. It leaves in late April. While it is common in the Kimberley, it is uncommon near the northwest, west and southeast coasts and rare or scare elsewhere.

  Ecology: The Fork-tailed Swift does not breed in Australia. It is almost exclusively aerial, flying from less than 1 m to at least 300 m above ground and probably much higher. They probably roost aerially, but are occasionally observed to land (Higgins 1999). The species food items within Australia are not well known, however, the species is known to be insectivorous. Studies have recorded the Swift eating small bees, wasps, termites and moths.

  Likelihood of occurrence: Given the ecology of this species, the swift may include the area within its aerial forays and migratory path.

  Potential Impacts: There are no significant threats to the Fork-tailed Swift in Australia. Potential threats include habitat destruction and predation by feral animals (Birdlife International 2012). Due to the wide range and ecology of this species, the conservation status is unlikely to be altered by the proposed mining activity at Mt Mason.

- **Great Egret *Ardea alba modesta***

  Family: Ardeidae

  Conservation Status: Migratory Species under the EPBC Act 1999

  Distribution: The Great Egret has been recorded across much of Western Australia but avoids the driest regions of the western and central deserts (McKilligan 2005).

  Ecology: The Great Egret, also known as the White Egret is common to very common in well-watered Kimberley flatlands and scarce to moderately common elsewhere. Preferred habitat includes shallow freshwaters and shallow saltwaters, and rarely dry pastures.

  Likelihood of occurrence: Given the preferred habitat of this species, it is not likely to occur within the survey area.

  Potential Impacts: The conservation status of this species is not likely to be altered by the proposed mining activity at Mt Mason.

- ***Falco peregrinus* Peregrine Falcon**

  Family: Falconidae

  Conservation Status: Schedule 4: Fauna that is in need of special protection under the WCA 1950

  Distribution: The Peregrine Falcon is uncommon but widespread in distribution. It is moderately common within the higher aspects of the Stirling Ranges in the south of Western Australia but tends to be uncommon in the hilly northwest Kimberley (Johnstone and Storr 1998).

  Ecology: This species inhabits cliff faces such as those along the coast, near rivers and ranges. The Peregrine Falcon can also be seen around wooded watercourses and lakes. It nests on ledges in cliffs as well as granite outcrops and quarries and also makes use of mine pits. This Falcon feeds almost entirely on birds including sea birds and some parrot species (Johnstone and Storr 1998).

  Likelihood of occurrence: Two dated sightings of this species were recorded in 1978 and 1999 within 20 km of the Mt Mason Project area. It was not included in the results from Birds Australia Database or the Western Museum Database searches for the area. While it is not unreasonable for this species to be seen in flight in this area, the preferred habitat of this Falcon indicates that it is not likely to utilise the habitat within the area proposed for disturbance.

  Potential Impacts: The conservation status of this species is not likely to be altered by the proposed mining activity in the Mt Mason area.

- ***Ardeotis australis* Australian Bustard**

  Family: Otitidae

  Conservation Status: Priority Four: Taxa in need of monitoring on DEC Threatened and Priority Fauna Database.

  Distribution: The Australian Bustard occurs over much of Western Australia, with the exception of the more heavily wooded southern portion of the State (Johnstone and Storr 1998). Its wider distribution includes eastern Australia and New Guinea.

  Ecology: The Australian Bustard is a large ground-dwelling bird known to occur in open or lightly wooded country. It is nomadic and ranges over very large areas, largely dependent on rainfall and hence food availability. Although not flightless, Bustards spend the greater proportion of time on the ground.

  Likelihood of occurrence: Sightings of the Bustard for this area include one in 1973 near Leonora and one in 1980 near Menzies. While some of the habitat may be considered suitable for this species, no recording of this bird has been made in the local area for ~30 years. It is therefore not likely to occur in the study area. Notwithstanding this, if it were present, given its range and mobility, the Bustard is likely to avoid disturbance and move to less disturbed areas.

  Potential Impacts: The conservation status of this species is not likely to be altered by the proposed mining activity in the Mt Mason area.

- ***Charadrius rubricollis*** **Hooded Plover**

  Family: Charadriidae

  Conservation Status: Priority Four on DEC Threatened and Priority Fauna Database

  Distribution: In Western Australia, this small plover is found along the southern coast, west of Israelite Bay and north to Jurien Bay, and on off-shore islands (Johnstone and Storr 1998).

  Ecology: This species occurs along sandy and seaweedy beaches as well as along the margins of saltlakes, estuaries and dams where it feeds on invertebrates (Johnstone and Storr 1998).

  Likelihood of occurrence: The DEC Threatened and Priority Fauna Database list two sightings, one in 1980 at Ularring and a second in 1992 at Menzies. As there are no water bodies within the area surveyed, this species is not likely to occur in the study area.

  Potential Impacts: The conservation status of this species is not likely to be altered by the proposed mining activity in the survey area.

- **Rainbow Bee-eater** ***Merops ornatus***

  Family: Meropidae

  Conservation Status: Migratory Species under the EPBC Act 1999

  Distribution: The Rainbow Bee-eater is distributed across much of mainland Australia, and is a common summer migrant to southern Australia. They range from scarce to common across their range depending on suitable habitat and breeding grounds.

  Ecology: Rainbow Bee-eaters are very social birds and when not breeding roost together in large groups in dense understorey or large trees. They generally migrate south at the beginning of spring and breed from November to January. They require open areas with loamy soft soils soft enough for nest tunneling yet firm enough to support the tunnel.

  Likelihood of occurrence: The Rainbow Bee-eater usually migrates south in late September early October and north from February to April (Johnstone and Storr 1998). It is therefore not surprising that the Bee-eater was neither seen nor heard during the Spring 2011 survey that was conducted at the end of August beginning of September, and that it was recorded during the Autumn 2012 survey that was conducted in March.

  Potential Impacts: Given the migratory status of the Rainbow Bee-eater and its ability to travel vast distances, the conservation status of this species is not likely to be altered by the proposed mining activity in the Mt Mason area.

- ***Acanthiza iredalei iredalei*** **Slender-billed Thornbill**

  Family: Acanthizidae

  Conservation Status: Vulnerable under the EPBC Act 1999

  Distribution: The Slender-billed Thornbill is sparsely distributed in disjunct populations across the southern arid and semi-arid portion of Western Australia and western South Australia.

  Ecology: The preferred habitat for this species includes chenopod shrublands, treeless or sparsely wooded flatlands and saline flats associated with salt lakes. The Thornbill forages mainly on the ground and in low vegetation, increasing its vulnerability to predation by cats and foxes.

  Likelihood of occurrence: Given the absence of preferred habitat for this species, it is not likely to be present in the area proposed for disturbance. None were identified during the comprehensive survey.

  Potential Impacts: The conservation status of this species is not likely to be altered by the proposed mining activity in the survey area.

- ***Pomatostomus superciliosis ashbyi*** **White-browed Babbler (western wheatbelt)**

  Family: Pomatostomidae

  Conservation Status: Priority Four on the DEC Threatened and Priority Fauna Database

  Distribution: The White-browed Babbler is endemic to mainland Australia and occurs mainly in the arid and semi-arid zones south of the Tropic of Capricorn. Scattered populations are found in outback Northern Territory and Western Australia, particularly in the south-western corner of Western Australia.

  Ecology: The White-Browed Babbler is a gregarious bird that travels in flocks and has a strong community affinity. It is found in dry sclerophyll woodlands with a shrubby understorey, mulga, acacias, mallee, cypress pine scrubs, timber, scrub along watercourses and saltbush, and forages on or near the ground for insects and seeds.

  Likelihood of occurrence: The White-browed Babbler was recorded on the DEC Threatened and Priority Fauna Database in 1980 at Ularring. Three individual Babblers were recorded during the systematic sampling during the Spring 2011 survey and more were recorded opportunistically during both seasonal survey periods.

  Potential Impacts: Advice from the Office of the EPA indicates that the conservation status of this species refers to the western populations particularly in the agricultural zone where clearing and fragmentation of native vegetation has impacted on this species habitat. Given the location of the proposed activity and the large areas of intact, undisturbed, remnant vegetation regionally, the conservation status of this species is not likely to be altered by the proposed mining activity in the survey area.

- ***Oreoica gutturalis gutturalis*** **Crested Bellbird (southern)**

  Family: Pachycephalidae

  Conservation Status: Priority Four on DEC Threatened and Priority Fauna Database

  Distribution: The distributional range of the Crested Bellbird extends across the greater part of the State but not the wetter regions (north and west Kimberley, Darling Range and deep South-West).

  Ecology: This sedentary and solitary species inhabits the drier mallee woodlands and heaths of the southern parts of Western Australia. It forages mainly on the ground, primarily for insects, and breeds from March through to December across the State.

  Likelihood of occurrence: The Crested Bellbird was recorded at all sites during the seasonal surveys and was also recorded opportunistically.

  Potential Impacts: The Crested Bellbird (southern) is listed as a Priority 4 species on the DEC Threatened and Priority Fauna database for the Goldfields, Midwest, Wheatbelt and South Coast. While the Mt Mason areas falls within the Goldfields region, the conservation classification refers principally to areas where the preferred habitat of the Crested Bellbird has been disturbed, particularly by clearing of native vegetation and resultant fragmentation. The area proposed to be impacted is relatively undisturbed and large tracts of undisturbed native vegetation are present and will remain intact adjacent to the mining operations. The large home range and mobility of the Crested Bellbird strongly suggests that its conservation classification will not be compromised by the proposed mining activities at Mt Mason.

7.2 Potential Impacts

The EPA objective for terrestrial fauna is to maintain the abundance, species diversity and geographical distribution of terrestrial fauna and protect specially protected (Threatened) fauna consistent with the provision of the WCA 1950.

Integral to the development of mining operations in the Mt Mason area, the clearing, removal and/or disturbance of substantial areas of BIF and adjacent areas of native vegetation is anticipated. It is inevitable that there will be some localised loss of fauna due to direct mortality arising from these activities associated with the mining operations. However, for those vertebrate taxa that cannot move away from any disturbances, and in relation to potential impacts implied in Section 7.1, it is unlikely that the loss of individuals associated with the direct mortalities and compromise of proximal habitat values would be sufficient to affect the overall conservation status of any of the species recorded from the survey area.

Similarly, the ongoing impacts from mining activities including vehicular movements, noise and associated dust generation and machinery noise are not likely to alter the conservation status of any species that may persist in adjacent areas. Any invasion and dispersal of weed species may cause deterioration of the condition of the remaining vegetation and the invasion and/or spread of non-native mammals pose a threat to indigenous species in terms of predation and resource limitation. Both elements should be managed to ensure and promote the sustainability of native fauna and their habitat locally.

7.3 Habitats of Significance to Fauna Indigenous to Western Australia

Development of mining operations and associated infrastructure will result in the loss of native vegetation, removal of faunal habitat, fragmentation of currently contiguous habitat and loss of areas for dispersal of native fauna.

The overall condition of the vegetation within the survey area can generally be described as "Very Good" to "Excellent" with almost all disturbances within the area directly related to recent exploration activity and associated tracks.

None of the vegetation groups identified have been recognised as TEC's as defined in the EPBC Act 1999. However, the area surveyed lies within the buffer zone of a PEC (Bulga Downs / Perinvale / Walling vegetation complex) that has not yet been described by the DEC on the list of PECs. However, it is inferred that the PEC relates to the vegetation specifically occurring on the BIF (NVS 2012). No DRF were identified in the survey area and only one Priority 3 species (*Calotis* sp. Perinvale Range) was recorded. The vegetation communities are generally described as Mulga over shrubland and are extensive locally. Cowan (2001) reports that most species within at least the East Murchison bioregion are wide ranging and usually occur in at least one, and often several, adjoining subregions.

Given the above, there appears to be no unique, restricted or fauna-specific habitat types for terrestrial vertebrate fauna within the Mt Mason or local area. Thus, while the removal of up to approximately 220 ha of this native vegetation will impact on indigenous fauna, the vegetation cannot be considered to be significant habitat in a regional context.

Additionally, as discussed elsewhere in this report, fauna of conservation significance that may use this habitat are unlikely to be compromised by the removal of the vegetation for the proposed mining activities.

Given the limited knowledge of invertebrate fauna and their habitat, particularly in a regional context, it is not possible to gauge a likely impact on SREs following the proposed mining activities at Mt Mason. Notwithstanding this, potential SRE habitat supported by the BIF ranges at Mt Mason is extensive and is not limited to the area of proposed impact.

7.4 Recommendations

The following general recommendations apply in the case of any major disturbance to large areas of native vegetation, as a consequence of the proposed development for the Mt Mason Project:

- Any clearing be minimised in extent given that the abundance and diversity of species lost will be proportional to the amount of habitat cleared;
- Where possible, all infrastructure associated with the development of the mining operation be aligned preferentially to areas of existing disturbance;
- Where possible, access routes be aligned to existing tracks and other barriers or follow the boundaries of broad-scale intact native vegetation;
- A rehabilitation plan is developed that progressively rehabilitates areas as soon as they are no longer required; and
- All members of the work force on site attend an environmental induction to ensure they are familiar with the value of native vegetation to fauna indigenous to Western Australia. This should include awareness of driving restrictions, ensuring that off-road driving is minimised, fire prevention is actively practised, and appropriate responses are followed in the event of an accident involving fauna.

In addition, specific recommendations are made in relation to the Malleefowl:

- A targeted Malleefowl survey should be undertaken by a suitably qualified team in the areas proposed for disturbance as soon as detailed boundaries of these areas have been confirmed.
- Given the evidence of Malleefowl within the zone of impact, a referral should be submitted to the Federal Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) for approval in accordance with the EPBC Act 1999
- Pending the results of the targeted Malleefowl survey in the confirmed areas for disturbance and outcome of the DSEWPaC referral, a Malleefowl Management Plan should be developed and implemented immediately post approval.

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APPENDIX A
Keighery, B.J. (1994) Vegetation Condition Scales

Pristine (1). Pristine or nearly so, no obvious signs of disturbance.

Excellent (2). Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.

Very Good (3). Vegetation structure altered, obvious signs of disturbance.
For example, disturbance to vegetation structure caused by repeating fires, the presence of some more aggressive weeds, dieback, logging and grazing.

Good (4). Vegetation structure significantly altered by very obvious signs of multiple disturbance.
Retains basic vegetation structure or ability to regenerate it.
For example, disturbance to vegetation structure caused by frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.

Degraded (5). 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 (6). 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 compromising weed or crop species with isolated trees or shrubs.

APPENDIX B
Species likely to occur in the area and species identified in the area

		EPBC Search	DEC data search	WAM data search	Birds Australia data search	Previous studies in and around the study area			KLA reconnaissance survey 2011	Spring Survey 2011			Autumn Survey 2012		
						Burbidge *et al.* 1995	KLA 2011	KLA 2012		Systematic Sampling	Opportunistic sightings and evidence	Spotlighting	Systematic Sampling	Opportunistic sightings and evidence	Spotlighting
AMPHIBIANS															
LIMNODYNASTIDAE															
Neobatrachus sp.		-	-	-	-	-	-	-	-	-	-	-	-	-	-
Neobatrachus sutor	Shoemaker Frog	-	-	-	-	-	-	+	-	-	-	-	-	-	-
Neobatrachus wilsmorei	Plonking Frog	-	-	-	-	+	-	-	-	-	-	-	-	-	-
MYOBATRACHIDAE															
Pseudophryne occidentalis	Western Toadlet	-	-	-	-	+	+	+	-	-	-	-	-	-	-
REPTILES															
AGAMIDAE															
Caimanops amphiboluroides		-	-	-	-	-	+	+	-	+	+	-	+	-	-
Ctenophorus cristatus	Bicycle Dragon	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Ctenophorus fordi	Mallee Sand Dragon	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Ctenophorus isolepis	Crested Dragon	-	-	-	-	-	-	+	-	-	-	-	-	-	-
Ctenophorus isolepis subsp. *gularis*	Central Military Dragon	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Ctenophorus ornatus	Ornate Cervice Dragon	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Ctenophorus reticulatus	Western Netted Dragon	-	-	-	-	+	+	+	-	-	-	-	-	-	-
Ctenophorus salinarum	Salt Pain Dragon	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Ctenophorus scutulatus		-	-	-	-	+	+	+	-	+	-	-	+	+	-
Moloch horridus	Thorny Devil	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Pogona minor		-	-	-	-	+	+	+	-	+	+	-	-	-	-
Tympanocryptis cephalus	Pebble Dragon	-	-	-	-	-	-	+	-	-	-	-	-	-	-
DIPLODACTYLIDAE															
Diplodactylus granariensis subsp. *granariensis*		-	-	-	-	+	-	-	-	-	-	-	-	-	-
Diplodactylus pulcher		-	-	-	-	+	+	+	-	+	-	-	-	-	-
Lucasium stenodactylum		-	-	-	-	-	+	-	-	-	-	-	-	-	-
Oedura reticulata		-	-	-	-	+	-	-	-	-	-	-	-	-	-
Rhynchoedura ornata	Beaked Gecko	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Strophurus assimilis	Goldfields Spiny-tailed Gecko	-	-	-	-	+	-	-	-	+	-	-	-	-	-
Strophurus elderi		-	-	-	-	+	-	-	-	-	-	-	-	-	-
Strophurus intermedius		-	-	-	-	+	-	-	-	-	-	-	-	-	-

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Strophurus strophurus		-	-	-	-	-	-	+	-	-	-	-	-	-	-
CARPHODACTYLIDAE															
Nephrurus levis subsp. *levis*		-	-	-	-	-	-	+	-	-	-	-	-	-	-
Nephrurus vertebralis		-	-	-	-	+	-	+	-	-	-	-	-	-	-
Underwoodisaurus milii	Southern Barking Gecko	-	-	-	-	+	-	-	-	-	-	-	-	-	-
GEKKONIDAE															
Gehyra purpurascens		-	-	-	-	+	-	-	-	-	-	-	-	-	-
Gehyra variegata		-	-	-	-	+	-	+	-	-	-	-	+	-	-
Heteronotia binoei	Bynoe's Gecko	-	-	-	-	+	-	+	-	-	-	-	+	-	-
PYGOPODIDAE															
Delma butleri		-	-	-	-	+	-	-	-	-	-	-	-	-	-
Lialis burtonis		-	-	-	-	+	-	-	-	-	-	-	-	-	-
SCINCIDAE															
Cryptoblepharus plagiocephalus		-	-	-	-	+	+	-	-	-	+	-	-	-	-
Ctenotus sp.		-	-	-	-	-	-	+	-	-	-	-	-	-	-
Ctenotus atlas		-	-	-	-	+	-	-	-	-	-	-	-	-	-
Ctenotus grandis		-	-	-	-	-	+	-	-	-	-	-	-	-	-
Ctenotus leonhardii		-	-	-	-	+	+	+	-	-	-	-	+	-	-
Ctenotus mimetes		-	-	-	-	+	+	+	-	-	-	-	-	-	-
Ctenotus schomburgkii		-	-	-	-	+	+	+	-	+	-	-	-	-	-
Ctenotus uber subsp. *uber*		-	-	-	-	+	-	-	-	-	-	-	-	-	-
Ctenotus xenopleura		-	-	-	-	+	-	-	-	-	-	-	-	-	-
Cyclodomorphus branchialis		-	-	-	-	+	-	-	-	-	-	-	-	-	-
Egernia depressa	Pygmy Spiny-tailed Skink	-	-	-	-	+	-	+	-	+	+	-	+	-	-
Egernia formosa		-	-	-	-	+	-		-	-	-	-	-	-	-
Eremiascincus richardsonii	Broad-banded Sand Swimmer	-	-	-	-	+	-	+	-	-	-	-	-	-	-
Hemiergis initialis subsp. *initialis*		-	-	-	-	+	-	-	-	-	-	-	-	-	-
Hemiergis millewae		-	-	-	-	+	-	-	-	-	-	-	-	-	-
Lerista macropisthopus subsp. *macropisthopus*		-	-	-	-	+	-	-	-	-	-	-	-	-	-
Lerista muelleri		-	-	-	-	+	-	-	-	-	-	-	-	-	-
Liopholis inornata		-	-	-	-	+	-	-	-	-	-	-	-	-	-

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Menetia greyii		-	-	-	-	+	+	+	-	+	+	-	+	-	-
Morethia butleri		-	-	-	-	+	-	+	-	-	-	-	-	-	-
VARANIDAE	spp.										+			+	
Varanus caudolineatus		-	-	-	-	+	-	+	-	+	-	-	+	-	-
Varanus gouldii	Bungarra or Sand Monitor	-	-	-	-	+	-	+	-	-	-	-	-	-	-
Varanus panoptes	Yellow-spotted Monitor	-	-	-	-	-	-	+	-	+	+	-	+	+	-
Varanus tristis subsp. *tristis*	Racehorse Monitor	-	-	-	-	+	-	+	-	-	-	-	-	-	-
TYPHLOPIDAE															
Ramphotyphlops bituberculatus		-	-	-	-	-	-	+	-	-	-	-	-	-	-
Ramphotyphlops hamatus		-	-	-	-	+	-	-	-	-	-	-	-	-	-
BOIDAE															
Antaresia stimsoni	Stimson's Python	-	-	-	-	-	-	+	-	-	-	+	-	-	-
Aspidites ramsayi	Woma	-	+	-	-	-	-	-	-	-	-	-	-	-	-
ELAPIDAE	spp.										+				
Demansia psammophis	Yellow-faced Whipsnake	-	-	-	-	-	-	+	-	-	-	-	-	-	-
Demansia psammophis subsp. *psammophis*		-	-	-	-	+	-	-	-	-	-	-	-	-	-
Neelaps bimaculatus	Black Naped Snake	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Parsuta monachus		-	-	-	-	+	-	-	-	-	-	-	-	-	-
Pseudechis butleri	Spotted Mulga Snake	-	-	-	-	-	-	+	-	-	+	-	-	-	-
Pseudonaja modesta	Ringed Brown Snake	-	-	-	-	+	-	+	-	-	-	-	-	-	-
Pseudonaja nuchalis	Gwardar; Northern Brown Snake	-	-	-	-	+	-	-	-	-	+	-	-	-	-
Simoselaps bertholdi	Jan's Banded Snake	-	-	-	-	+	-	-	-	-	-	-	-	-	-
MAMMALS															
TACHYGLOSSIDAE															
Tachyglossus aculeatus	Echidna	-	-	-	-	+	-	+	-	-	+	-	-	-	-
DASYURIDAE															
Ningaui ridei	Wongai Ningaui	-	-	-	-	+	-	+	-	-	-	-	-	-	-
Ningaui yvonneae	Southern Ningaui	-	-	-	-	+	-	-	-	-	-	-	-	-	-

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Pseudantechinus macdonnellensis	Fat-tailed Pseudantechinus	-	-	-	-	-	+	-	-	-	-	-	-	-	-
Pseudantechinus woolleyae	Woolley's Pseudantechinus	-	-	-	-	-	-	+	-	-	-	-	+	-	+
Sminthopsis sp.		-	-	-	-	-	-	+	-	-	-	-	-	-	-
Sminthopsis crassicaudata	Fat-tailed Dunnart	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Sminthopsis dolichura	Little long-tailed Dunnart	-	-	-	-	+	+	+	-	+	-	-	+	-	-
Sminthopsis hirtipes	Hairy-footed Dunnart	-	-	-	-	+	-	+	-	-	-	-	-	-	-
Sminthopsis longicaudata	Long-tailed Dunnart	-	-	-	-	-	-	+	-	+	-	-	+	-	-
MACROPODIDAE															
Macropus fuliginosus	Western Grey Kangaroo	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Macropus robustus erubescens	Euro	-	-	-	-	+	+	+	-	-	-	+	-	-	-
Macropus rufus	Red Kangaroo	-	-	-	-	+	-	+	-	-	-	-	-	-	+
CHIROPTERA															
Chiroptera sp.		-	-	-	-	-	-	+	-	-	-	+	-	-	+
VESPERTILIONIDAE															
Chalinolobus gouldii	Gould's Wattle Bat	-	-	-	-	+	+	+	-	+	-	-	+	-	-
Chalinolobus morio	Chocolate Wattled Bat	-	-	-	-	-	+	-	-	-	-	-	-	-	-
Nyctophilus geoffroyi	Lesser Long-eared Bat	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Nyctophilus major	Greater Long-eared Bat	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Nyctophilus sp.		-	-	-	-	-	+	+	-	+	-	-	+	-	-
Scotorepens balstoni	Inland Broad-nosed Bat	-	-	-	-	+	-	+	-	+	-	-	+	-	-
Vespadelus baverstocki	Inland Forest Bat	-	-	-	-	+	+	-	-	-	-	-	-	-	-
Vespadelus finlaysoni	Finlayson's Cave Bat	-	-	-	-	-	-	+	-	+	-	-	+	-	-
Vespadelus regulus	Southern Forest Bat	-	-	-	-	+	-	-	-	-	-	-	-	-	-
MOLOSSIDAE															
Mormopterus planiceps	Southern Freetail-bat	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Mormopterus sp. 3		-	-	-	-	-	+	-	-	+	-	-	+	-	-
Mormopterus sp. 3 / *Mormopterus* sp. 4		-	-	-	-	-	-	+	-	-	-	-	-	-	-
Tadarida australis	White-striped Freetailed-bat	-	-	-	-	+	+	+	-	+	-	-	+	-	-

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MURIDAE															
*Mus musculus**	House Mouse	-	-	-	-	+	+	+	-	+	-	-	+	-	-
Notomys alexis	Spinifex Hopping-mouse	-	-	-	-	+	+	+	-	-	-	-	+	-	-
Notomys mitchellii	Mitchell's Hopping-mouse	-	-	-	-	-	+	-	-	-	-	-	-	-	-
Pseudomys albocinereus	Ash-grey Mouse	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Pseudomys bolami	Bolam's Mouse	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Pseudomys hermannsburgensis	Sandy Inland Mouse	-	-	-	-	+	+	+	-	-	-	-	+	-	-
LEPORIDAE															
Oryctolagus cuniculus*	Rabbit	+	-	-	-	+	-	+	-	-	+	-	-	+	+
CANIDAE	sp.	-	-	-	-	-	-	-	-	-	+	-	-	+	-
Canis lupus dingo	Dingo	-	-	-	-	+	-	-	-	-	-	-	-	-	-
*Canis lupus familiaris**	Dog	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*Vulpes vulpes**	Red Fox	+	-	-	-	+	-	+	-	-	-	-	-	-	-
FELIDAE															
*Felis catus**	Cat	+	-	-	-	+	-	+	-	-	+	-	-	-	-
BOVIDAE															
*Bos taurus**	European Cattle	-	-	-	-	-	-	+	-	-	+	-	-	-	-
*Equus asinus**	Donkey	-	-	-	-	-	-	+	-	-	+	-	-	-	-
*Capra hircus**	Goat	+	-	-	-	+	-	+	-	-	-	-	-	-	-
Ovis aries	Sheep	-	-	-	-	+	-	-	-	-	-	-	-	-	-
AVIFAUNA															
CASUARIIDAE															
Dromaius novaehollandiae	Emu	-	-	-	+	+	-	+	-	-	+	-	-	+	-
MEGAPODIIDAE															
Leipoa ocellata	Malleefowl	-	+	-	+	+	-	+	-	-	+	-	-	+	-
ANATIDAE															
Cygnus atratus	Black Swan	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Tadorna tadornoides	Australian Shelduck	-	-	-	-	+	-	+	-	-	-	-	-	-	-
Chenonetta jubata	Australian Wood Duck	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Malacorhynchus membranaceus	Pink-eared Duck	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Anas gracilis	Grey Teal	-	-	-	-	+	-	-	-	-	-	-	-	-	-

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Anas superciliosa	Pacific Black Duck	-	-	-	-	+	-	+	-	-	-	-	-	-	-
Aythya australis	Hardhead	-	-	-	-	+	-	-	-	-	-	-	-	-	-
PODICIPEDIDAE															
Poliocephalus poliocephalus	Hoary-headed Grebe	-	-	-	-	+	-	-	-	-	-	-	-	-	-
COLUMBIDAE															
Phaps chalcoptera	Common Bronzewing	-	-	-	+	+	-	+	+	-	+	-	+	+	+
Ocyphaps lophotes	Crested Pigeon	-	-	-	+	+	-	+	-	-	-	-	-	-	-
PODARGIDAE															
Podargus strigoides	Tawny Frogmouth	-	-	-	-	+	-	+	-	-	-	-	-	+	+
EUROSTOPODIDAE															
Eurostopodus argus	Spotted Nightjar	-	-	-	+	+	-	+	-	-	-	+	-	-	-
AEGOTHELIDAE															
Aegotheles cristatus	Australian Owlet-nightjar	-	-	-	-	+	-	+	-	-	-	-	+	+	+
APODIDAE															
Apus pacificus	Fork-tailed Swift	+	-	-	-	-	-	-	-	-	-	-	-	-	-
ARDEIDAE															
Ardea pacifica	White-necked Heron	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Ardea modesta alba	Western Great Egret	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Egretta novaehollandiae	White-faced Heron	-	-	-	-	+	-	-	-	-	-	-	-	-	-
ACCIPITRIDAE															
Lophoictinia isura	Square-tailed Kite	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Hamirostra melanosternon	Black-breasted Buzzard	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Haliastur sphenurus	Whistling Kite	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Accipiter fasciatus	Brown Goshawk	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Accipiter cirrocephalus	Collared Sparrowhawk	-	-	-	-	+	-	+	-	-	-	-	-	-	-
Circus assimilis	Spotted Harrier	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Aquila audax	Wedge-tailed Eagle	-	-	-	+	+	-	+	-	-	+	-	-	-	-
Hieraaetus morphnoides	Little Eagle	-	-	-	-	+	-	-	-	-	-	-	-	-	-

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FALCONIDAE															
Falco cenchroides	Australian Kestrel	-	-	-	+	+	-	+	+	-	-	-	-	-	-
Falco berigora	Brown Falcon	-	-	-	-	+	-	+	+	-	-	-	-	-	-
Falco longipennis	Australian Hobby	-	-	-	+	+	-	-	-	-	-	-	-	-	-
Falco peregrinus	Peregrine Falcon	-	+	-	-	+	-	-	-	-	-	-	-	-	-
RALLIDAE															
Fulica atra	Eurasian Coot	-	-	-	-	+	-	-	-	-	-	-	-	-	-
OTIDIDAE															
Ardeotis australis	Australian Bustard	-	+	-	-	-	-	-	-	-	-	-	-	-	-
RECURVIROSTRIDAE															
Himantopus himantopus	Black-winged Stilt	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Recurvirostra novaehollandiae	Red-necked Avocet	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Cladorhynchus leucocephalus	Banded Stilt	-	-	-	-	+	-	-	-	-	-	-	-	-	-
CHARADRIIDAE															
Charadrius ruficapillus	Red-capped Plover	-	-	-	+	+	-	-	-	-	-	-	-	-	-
Elseyornis melanops	Black-fronted Dotterel	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Thinornis rubricollis	Hooded Plover	-	+	-	-	+	-	-	-	-	-	-	-	-	-
Erythrogonys cinctus	Red-kneed Dotterel	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Vanellus tricolor	Banded Lapwing	-	-	-	-	+	-	-	-	-	-	-	-	-	-
TURNICIDAE															
Turnix velox	Little Button-quail	-	-	-	-	+	-	-	-	-	-	-	-	-	-
LARIDAE															
Chroicocephalus novaehollandiae	Silver Gull	-	-	-	-	+	-	-	-	-	-	-	-	-	-
CACATUIDAE															
Eolophus roseicapillus	Galah	-	-	-	+	+	-	+	+	+	+	-	-	-	-
Nymphicus hollandicus	Cockatiel	-	-	-	-	+	-	+	-	+	+	-	-	-	-
PSITTACIFORMES															
Barnardius zonarius	Australian Ringneck	-	-	-	+	+	+	+	+	+	+	-	+	+	-
Psephotus varius	Mulga Parrot	-	-	-	-	+	+	+	-	-	-	-	-	+	-

		EPBC Search	DEC data search	WAM data search	Birds Australia data search	Previous studies in and around the study area			KLA reconnaissance survey 2011	Spring Survey 2011			Autumn Survey 2012		
						Burbidge *et al.* 1995	KLA 2011	KLA 2012		Systematic Sampling	Opportunistic sightings and evidence	Spotlighting	Systematic Sampling	Opportunistic sightings and evidence	Spotlighting
Melopsittacus undulatus	Budgerigar	-	-	-	-	+	-	+	-	+	+	-	-	-	-
Neopsephotus bourkii	Bourke's Parrot	-	-	-	-	+	-	-	-	+	-	-	-	-	-
Polytelis anthopeplus	Elegant Parrot	-	-	-	-	-	+	-	-	-	-	-	-	-	-
Neophema splendida	Scarlet-chested Parrot	-	-	-	-	+	-	-	-	-	-	-	-	-	-
CULCULIDAE															
Chalcites basalis	Horsfield's Bronze Cuckoo	-	-	-	+	+	-	+	-	+	-	-	-	-	-
Chalcites osculans	Black-eared Cuckoo	-	-	-	+	-	-	+	-	+	-	-	-	-	-
Cacomantis pallidus	Pallid Cuckoo	-	-	-	-	+	+	+	-	+	-	-	-	-	-
STRIGIDAE															
Ninox novaeseelandiae	Southern Boobook Owl	-	-	-	+	+	-	-	-	-	-	-	-	-	-
HALCYONIDAE															
Todiramphus pyrrhopygius	Red-backed Kingfisher	-	-	-	-	+	-	-	-	-	-	-	-	-	-
MEROPIDAE															
Merops ornatus	Rainbow Bee-eater	+	-	-	-	+	-	+	-	-	-	-	-	+	-
CLIMACTERIDAE															
Climacteris affinis	White-browed Treecreeper	-	-	-	-	+	+	+	-	-	-	-	-	-	-
Climacteris rufa	Rufous Treecreeper	-	-	-	-	+	-	-	-	-	-	-	-	-	-
PTILONORHYNCHIDAE															
Ptilonorhynchus guttatus	Western Bowerbird	-	-	-	-	-	-	+	-	+	-	-	-	-	-
MALURIDAE															
Malurus splendens	Splendid Fairy-wren	-	-	-	+	+	+	+	-	+	+	-	+	+	-
Malurus leucopterus	White-winged Fairy-wren	-	-	-	+	+	-	-	-	-	-	-	-	-	-
Malurus lamberti	Variegated Fairy-wren	-	-	-	-	+	+	-	-	-	-	-	-	-	-
ACANTHIZIDAE															
Calamanthus campestris	Rufous Fieldwren	-	-	-	-	-	-	-	-	+	-	-	-	-	-
Pyrrholaemus brunneus	Redthroat	-	-	-	+	+	+	+	-	+	-	-	-	-	-
Smicrornis brevirostris	Weebill	-	-	-	+	+	+	+	+	+	-	-	+	-	-
Gerygone fusca	Western Gerygone	-	-	-	-	+	+	-	-	-	-	-	-	-	-
Acanthiza sp.		-	-	-	-	-	-	+	-	-	-	-	-	-	-

		EPBC Search	DEC data search	WAM data search	Birds Australia data search	Previous studies in and around the study area			KLA reconnaissance survey 2011	Spring Survey 2011			Autumn Survey 2012		
						Burbidge *et al.* 1995	KLA 2011	KLA 2012		Systematic Sampling	Opportunistic sightings and evidence	Spotlighting	Systematic Sampling	Opportunistic sightings and evidence	Spotlighting
Acanthiza robustirostris	Slaty-backed Thornbill	-	-	-	+	-	-	+	-	+	-	-	+	+	-
Acanthiza chrysorrhoa	Yellow-rumped Thornbill	-	-	-	+	+	+	+	-	+	-	-	-	-	-
Acanthiza uropygialis	Chestnut-rumped Thornbill	-	-	-	+	+	+	+	-	-	-	-	-	-	-
Acanthiza iredalei iredalei	Slender-billed Thornbill	+	-	-	-	+	-	-	-	-	-	-	-	-	-
Acanthiza apicalis	Inland Thornbill	-	-	-	+	+	+	+	-	+	-	-	+	+	+
Aphelocephala leucopsis	Southern Whiteface	-	-	-	+	+	+	+	-	-	-	-	-	-	-
PARDALOTIDAE															
Pardalotus striatus	Striated Pardalote	-	-	-	-	+	+	+	-	-	-	-	-	-	-
MELIPHAGIDAE	sp.	-	-	-	-	-	-	+	-	-	-	-	-	-	-
Certhionyx variegatus	Pied Honeyeater	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Lichenostomus virescens	Singing Honeyeater	-	-	-	+	+	+	+	-	+	-	-	+	+	-
Lichenostomus leucotis	White-eared Honeyeater	-	-	-	-	+	+	+	-	-	-	-	-	-	-
Lichenostomus ornatus	Yellow-plumed Honeyeater	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Lichenostomus plumulus	Grey-fronted Honeyeater	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Purnella albifrons	White-fronted Honeyeater	-	-	-	+	+	-	+	-	-	-	-	-	-	-
Manorina flavigula	Yellow-throated Miner	-	-	-	+	+	-	+	-	+	+	-	-	+	-
Acanthagenys rufogularis	Spiny-cheeked Honeyeater	-	-	-	+	+	+	+	-	+	+	-	+	+	-
Anthochaera carunculata	Red Wattlebird	-	-	-	+	+	-	+	-	+	+	-	-	-	-
Epthianura tricolor	Crimson Chat	-	-	-	-	+	-	-	-	+	-	-	-	-	-
Epthianura albifrons	White-fronted Chat	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Sugomel niger	Black Honeyeater	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Lichmera indistincta	Brown Honeyeater	-	-	-	-	+	+	-	-	-	-	-	-	-	-
Melithreptus brevirostris	Brown-headed Honeyeater	-	-	-	+	+	-	+	-	-	-	-	-	-	-
POMATOSTOMIDAE															
Pomatostomus superciliosus	White-browed Babbler	-	+	-	-	+	+	+	-	+	+	-	-	+	-
PSOPHODIDAE															
Cinclosoma castanotus	Chestnut Quail-thrush	-	-	-	-	+	+	-	-	-	-	-	-	-	-
Cinclosoma castaneothorax	Chestnut-breasted Quail-thrush	-	-	-	+	-	-	+	-	-	-	-	-	-	-

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NEOSITTIDAE															
Daphoenositta chrysoptera	Varied Sittella	-	-	-	-	+	+	+	-	-	-	-	-	-	-
CAMPEPHAGIDAE															
Coracina maxima	Ground Cuckoo-shrike	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Coracina novaehollandiae	Black-faced Cuckoo-shrike	-	-	-	+	+	+	+	+	+	-	-	-	+	-
Lalage sueurii	White-winged Triller	-	-	-	-	+	+	+	-	-	-	-	-	-	-
PACHYCEPHALIDAE															
Pachycephala inornata	Gilbert's Whistler	-	-	-	-	+	+	-	-	-	-	-	-	-	-
Pachycephala rufiventris	Rufous Whistler	-	-	-	+	+	+	+	-	+	-	-	+	+	+
Colluricincla harmonica	Grey Shrike-thrush	-	-	-	+	+	+	+	-	+	+	-	+	-	-
Oreoica gutturalis	Crested Bellbird	-	+	-	+	+	+	+	-	+	+	-	+	+	-
ARTAMIDAE															
Artamus sp.		-	-	-	-	-	-	+	-	-	-	-	-	-	-
Artamus personatus	Masked Woodswallow	-	-	-	-	+	-	+	-	-	-	-	-	-	-
Artamus cinereus	Black-faced Woodswallow	-	-	-	+	+	-	+	-	-	-	-	-	-	-
Artamus cyanopterus	Dusky Woodswallow	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Artamus minor	Little Woodswallow	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Cracticus torquatus	Grey Butcherbird	-	-	-	+	+	+	+	-	-	-	-	-	-	-
Cracticus nigrogularis	Pied Butcherbird	-	-	-	+	+	-	+	-	+	-	-	+	-	-
Cracticus tibicen	Australian Magpie	-	-	+	+	+	-	+	-	-	-	-	-	-	-
Strepera versicolor	Grey Currawong	-	-	-	+	+	+	+	-	+	+	-	+	-	-
RHIPIDURIDAE															
Rhipidura albiscapa	Grey Fantail	-	-	-	+	+	+	+	-	-	-	-	+	+	-
Rhipidura leucophrys	Willie Wagtail	-	-	-	+	+	-	+	-	-	-	-	-	+	-
CORVIDAE															
Corvus coronoides	Australian Raven	-	-	-	+	-	-	-	-	-	-	-	-	-	-
Corvus bennetti	Little Crow	-	-	-	+	+	+	+	-	+	+	-	-	-	-
Corvus orru	Torresian Crow	-	-	-	-	-	-	+	-	-	-	-	+	+	-
MONARCHIDAE															
Grallina cyanoleuca	Magpie-lark	-	-	-	+	+	-	+	-	-	-	-	-	-	-

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						Burbidge *et al.* 1995	KLA 2011	KLA 2012		Systematic Sampling	Opportunistic sightings and evidence	Spotlighting	Systematic Sampling	Opportunistic sightings and evidence	Spotlighting
PETROICIDAE															
Microeca fascinans	Jacky Winter	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Petroica boodang	Scarlet Robin	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Petroica goodenovii	Red-capped Robin	-	-	-	+	+	+	+	-	-	+	-	+	+	+
Melanodryas cucullata	Hooded Robin	-	-	-	+	+	+	+	-	-	-	-	-	+	-
HIRUNDINIDAE															
Cheramoeca leucosternus	White-backed Swallow	-	-	-	+	-	-	+	-	-	-	-	-	-	-
Hirundo neoxena	Welcome Swallow	-	-	-	+	+	-	+	-	-	-	-	-	-	-
Petrochelidon ariel	Fairy Martin	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Petrochelidon nigricans	Tree Martin	-	-	-	-	+	-	-	-	-	-	-	-	-	-
MEGALURIDAE															
Cincloramphus mathewsi	Rufous Songlark	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Cincloramphus cruralis	Brown Songlark	-	-	-	-	+	-	-	-	-	-	-	-	-	-
NECTARINIIDAE															
Dicaeum hirundinaceum	Mistletoebird	-	-	-	-	+	-	+	-	-	-	-	-	-	-
ESTRILDIDAE															
Taeniopygia guttata	Zebra Finch	-	-	-	+	+	+	+	-	-	-	-	-	-	-
MOTACILLIDAE															
Anthus novaseelandiae	Australian Pipit	-	-	-	+	+	-	+	-	-	-	-	-	-	-

APPENDIX C
Categories used in the assessment of conservation status

IUCN (2001) Red List Categories

EXTINCT (EX)

A taxon is Extinct when there is no reasonable doubt that the last individual has died. A taxon is presumed Extinct when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.

EXTINCT IN THE WILD (EW)

A taxon is Extinct in the Wild when it is known only to survive in cultivation, in captivity or as a naturalized population (or populations) well outside the past range. A taxon is presumed Extinct in the Wild when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.

CRITICALLY ENDANGERED (CR)

A taxon is Critically Endangered when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered*, and it is therefore considered to be facing an extremely high risk of extinction in the wild.

ENDANGERED (EN)

A taxon is Endangered when the best available evidence indicates that it meets any of the criteria A to E for Endangered*, and it is therefore considered to be facing a very high risk of extinction in the wild.

VULNERABLE (VU)

A taxon is Vulnerable when the best available evidence indicates that it meets any of the criteria A to E for Vulnerable*, and it is therefore considered to be facing a high risk of extinction in the wild.

NEAR THREATENED (NT)

A taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.

LEAST CONCERN (LC)

A taxon is Least Concern when it has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category.

DATA DEFICIENT (DD)

A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution are lacking. Data Deficient is therefore not a category of threat. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate. It is important to make positive use of whatever data are available. In many cases great care should be exercised in choosing between DD and a threatened status. If the range of a taxon is suspected to be relatively circumscribed, and a considerable period of time has elapsed since the last record of the taxon, threatened status may well be justified.

NOT EVALUATED (NE)

A taxon is Not Evaluated when it is has not yet been evaluated against the criteria

- Refer to http://www.iucnredlist.org/documents/redlist_cats_crit_en.pdf for criteria

Schedules used in the WA Wildlife Conservation Act 1950.

Schedule 1. Rare and Likely to become Extinct.

Schedule 2. Extinct.

Schedule 3. Migratory species listed under international treaties.

Schedule 4. Other Specially Protected Fauna.

Department of Environment and Conservation Priority Species

(species not listed under the Conservation Act, but for which there is some concern)

Priority 1. Taxa with few, poorly known population on threatened lands.

Priority 2. Taxa with few, poorly known populations on threatened lands, or taxa with several, poorly known populations not on conservation lands.

Priority 3. Taxa with several, poorly known populations, some on conservation lands.

Priority 4. Taxa in need of monitoring. Taxa which are considered to have been adequately surveyed, or for which sufficient knowledge is available, and which are considered not currently threatened or in need of special protection, but could be if present circumstances change.

Priority 5. Taxa in need of monitoring. Taxa which are not considered threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years (IUCN Conservation Dependent).

JAMBA The agreement between the Government of Australia and the Government of Japan for the Protection of Migratory Birds in Danger of Extinction and their Environment. Australian Treaty Series 1981 No 6.

CAMBA The agreement between the Government of Australia and the Government of the People's Republic of China for the Protection of Migratory Birds and their Environment. Australian Treaty Series 1988 No 22.

ROKAMBA The agreement between the Government of Australia and the Government of the Republic of Korea on the Protection of Migratory Birds and their Environment. Australian Treaty Series 2007 ATS 24.

APPENDIX D
Department of Environment and Conservation Regulation 17 Permits

DEPARTMENT OF ENVIRONMENT AND CONSERVATION

Enquiries: 17 DICK PERRY AVE, KENSINGTON, WESTERN AUSTRALIA
Telephone: 08 9334 0333
Facsimile: 08 9334 0242
Correspondence: Locked Bag 30
Bentley Delivery Centre WA 6983

PAGE 2
NO. SF008183
PERSON NO. 78973

DATE OF ISSUE 18/08/2011
VALID FROM 18/08/2011
DATE OF EXPIRY 31/10/2011

LICENSING OFFICER

(VI)

LICENSEE: DR V SAFFER
ADDRESS SENIOR BIOLOGIST
KEITH LINDBECK & ASSOCIATES
P.O. BOX 144
BULLCREEK
W.A. 6149

AMENDED
6.9.2011 OPS
Date Initial

DEPARTMENT OF ENVIRONMENT AND CONSERVATION

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Bentley Delivery Centre WA 6983

PAGE 1
NO. SF008183
PERSON NO. 78973

RECEIPT NO. AMOUNT
$0.00

WILDLIFE CONSERVATION ACT 1950
REGULATION 17

LICENCE TO TAKE FAUNA FOR SCIENTIFIC PURPOSES

THE UNDERMENTIONED PERSON MAY TAKE FAUNA FOR RESEARCH OR OTHER SCIENTIFIC PURPOSES AND WHERE AUTHORISED, KEEP IT IN CAPTIVITY, SUBJECT TO THE FOLLOWING AND ATTACHED CONDITIONS, WHICH MAY BE ADDED TO, SUSPENDED OR OTHERWISE VARIED AS CONSIDERED FIT.

DIRECTOR GENERAL

CONDITIONS

1 THE LICENSEE SHALL COMPLY WITH THE PROVISIONS OF THE WILDLIFE CONSERVATION ACT AND REGULATIONS AND ANY NOTICES IN FORCE UNDER THIS ACT AND REGULATIONS.

2 UNLESS SPECIFICALLY AUTHORISED IN THE CONDITIONS OF THIS LICENCE OR OTHERWISE IN WRITING BY THE DIRECTOR GENERAL, SPECIES OF FAUNA DECLARED AS LIKELY TO BECOME EXTINCT, RARE OR OTHERWISE IN NEED OF SPECIAL PROTECTION SHALL NOT BE CAPTURED OR OTHERWISE TAKEN.

3 NO FAUNA SHALL BE TAKEN FROM ANY NATURE RESERVE, WILDLIFE SANCTUARY, NATIONAL PARK, MARINE PARK, TIMBER RESERVE OR STATE FOREST WITHOUT PRIOR WRITTEN APPROVAL OF THE DIRECTOR GENERAL. NO FAUNA SHALL BE TAKEN FROM ANY OTHER PUBLIC LAND WITHOUT THE WRITTEN APPROVAL OF THE GOVERNMENT AUTHORITY MANAGING THAT LAND.

4 NO ENTRY OR COLLECTION OF FAUNA TO BE UNDERTAKEN ON ANY PRIVATE PROPERTY OR PASTORAL LEASE WITHOUT THE CONSENT IN WRITING OF THE OWNER OR OCCUPIER, OR FROM ANY ABORIGINAL RESERVE WITHOUT THE WRITTEN APPROVAL OF THE DEPARTMENT OF INDIGENOUS AFFAIRS.

5 NO FAUNA OR THEIR PROGENY SHALL BE RELEASED IN ANY AREA WHERE IT DOES NOT NATURALLY OCCUR, NOR BE HANDED OVER TO ANY OTHER PERSON OR AUTHORITY UNLESS APPROVED BY THE DIRECTOR GENERAL, NOR SHALL THE REMAINS OF SUCH FAUNA BE DISPOSED OF IN SUCH MANNER AS TO CONFUSE THE NATURAL OR PRESENT DAY DISTRIBUTION OF THE SPECIES.

6 THIS LICENCE AND THE WRITTEN PERMISSION REFERRED TO AT CONDITIONS 3 & 4 MUST BE CARRIED BY THE LICENSEE OR AUTHORISED AGENT AT ALL TIMES FOR THE PURPOSE OF PROVING THEIR AUTHORITY TO TAKE FAUNA WHEN QUESTIONED AS TO THEIR RIGHT TO DO SO BY A WILDLIFE OFFICER, ANY OTHER STATE OR LOCAL GOVERNMENT EMPLOYEE OR ANY MEMBER OF THE PUBLIC.

7 **********ANY INTERACTION INVOLVING GAZETTED THREATENED FAUNA THAT MAY BE HARMFUL AND/OR INVASIVE MAY REQUIRE APPROVAL FROM THE COMMONWEALTH DEPT OF THE ENVIRONMENT AND WATER RESOURCES, PHONE 02 6274 1900. INTERACTION WITH SUCH SPECIES IS CONTROLLED BY THE COMMONWEALTH GOVERNMENT'S "ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999" & "ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION REGULATIONS 2000" AS WELL AS DEC'S WILDLIFE CONSERVATION ACT & REGULATIONS.**********

8 NO BIOPROSPECTING INVOLVING THE REMOVAL OF SAMPLE AQUATIC AND TERRESTRIAL ORGANISMS (BOTH FLORA AND FAUNA) FOR CHEMICAL EXTRACTION AND BIOACTIVITY SCREENING IS PERMITTED TO BE CONDUCTED WITHOUT SPECIFIC WRITTEN APPROVAL BY THE DIRECTOR GENERAL OF DEC.

9 FURTHER CONDITIONS (NUMBERED 1 TO 7) ARE ATTACHED.

PURPOSE LEVEL 2 FAUNA SURVEY USING A GRID DESIGN AT MT MASON AND MT IDA NEAR MENZIES IN THE GOLDFIELDS FOR JUPITER MINES LIMITED. FAUNA CAPTURE WILL BE VIA ASSISTED DRY PITFALL, FUNNEL, ELLIOTT AND CAGE TRAPS. FAUNA SPECIES WILL BE IDENTIFIED AND THEN RELEASED AT POINT OF CAPTURE SOME INVERTEBRATE SPECIMENS MAY BE TAKEN FOR IDENTIFICATION.

AUTHORISED PERSONS
MS ERICA MACINTYRE
MS MERRI BARTLETT
MR HAMISH BURNETT

WILDLIFE CONSERVATION REGULATIONS 1970

Regulation 17:- Licence to Take Fauna for Scientific Purposes

FURTHER CONDITIONS (OF LICENCE NUMBER SF008183)

1. The licensee shall take fauna only in the manner stated on the endorsed Regulation 17 licence application form and endorsed related correspondence.

2. Except in the case of approved lethal traps, the licensee shall ensure that measures are taken in the capture and handling of fauna to prevent injury or mortality resulting from that capture or handling. Where traps or other mechanical means or devices are used to capture fauna these shall be deployed so as to prevent exposure of trapped animals to ants and debilitating weather conditions and inspected at regular intervals throughout each day of their use. At the conclusion of research all markers etc and signs erected by the licensee and all traps shall be removed, all pitfalls shall be refilled or capped and the study area returned to the condition it was in prior to the research/capture program. During any break in research, cage traps should be removed and pitfalls either removed, capped or filled with sand.

3. No collecting is to be undertaken in areas where it would impinge on pre-existing scientific research programs.

4. Any form of colour marking of birds or bats shall only be undertaken in accordance with the requirements of the Australian Bird and Bat Banding Scheme.

5. Any inadvertently captured specimen of fauna which is declared as likely to become extinct, rare or otherwise in need of special protection is to be released immediately at the point of capture. Where such a specimen is injured or deceased, the licensee shall contact Department of Environment and Conservation licensing staff at Kensington (08 9423 2434) for advice on disposal. Records are to be kept of any fauna so captured and details included in the report required under further condition 6 below.

6. Within one month of the expiration of this licence, the holder shall submit an electronic return detailing the locality, site, geocode, date and number of each species captured, sighted or vouchered during the currency of the licence, into the Department of Environment and Conservation Fauna Survey Database (DECFSD). A copy of any paper, report or thesis resulting from the research shall on completion be lodged with the Director General. If a renewal of this licence is required, the licensee shall submit a written progress report for activities undertaken during this licence period prior to the expiry of this licence.

7. Not more than ten specimens of any one protected species shall be taken and removed from any location less than 20km apart. Where exceptional circumstances make it necessary to take large series in order to obtain adequate statistical data the collector will proceed with circumspection and justify their actions to the Director General in advance.

8. All holotypes and syntypes and a half share of paratypes of species or subspecies permitted to be permanently taken under this licence shall be donated to the Western Australian Museum. Duplicates (one pair in each case) of any species collected which represents a significant extension of geographic range shall be donated on request to the Western Australian Museum.

9. To prevent any unnecessary collecting in this State, all specimens and material collected under the authority of this license shall, on request, be loaned to the Western Australian Museum. Also, the unused portion or portions of any specimen collected under the authority of this license shall be offered for donation to the Western Australian Museum or made available to other scientific workers if so required.

DEPARTMENT OF ENVIRONMENT AND CONSERVATION

Enquiries: 17 DICK PERRY AVE, KENSINGTON, WESTERN AUSTRALIA
Telephone: 08 9334 0333
Facsimile: 08 9334 0242

Correspondence: **Locked Bag 30**
Bentley Delivery Centre WA 6983

PAGE 2
NO. SF008484
PERSON NO. 78973

DATE OF ISSUE 24/02/2012
VALID FROM 24/02/2012
DATE OF EXPIRY 09/04/2012

LICENSING OFFICER

LICENSEE: DR V SAFFER
ADDRESS SENIOR BIOLOGIST
KEITH LINDBECK & ASSOCIATES
P.O. BOX 144
BULLCREEK
W.A. 6149

(VI)

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PAGE NO. 1
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RECEIPT NO. **AMOUNT**
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WILDLIFE CONSERVATION ACT 1950
REGULATION 17

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DIRECTOR GENERAL

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1. THE LICENSEE SHALL COMPLY WITH THE PROVISIONS OF THE WILDLIFE CONSERVATION ACT AND REGULATIONS AND ANY NOTICES IN FORCE UNDER THIS ACT AND REGULATIONS.
2. UNLESS SPECIFICALLY AUTHORISED IN THE CONDITIONS OF THIS LICENCE OR OTHERWISE IN WRITING BY THE DIRECTOR GENERAL, SPECIES OF FAUNA DECLARED AS LIKELY TO BECOME EXTINCT, RARE OR OTHERWISE IN NEED OF SPECIAL PROTECTION SHALL NOT BE CAPTURED OR OTHERWISE TAKEN.
3. NO FAUNA SHALL BE TAKEN FROM ANY NATURE RESERVE, WILDLIFE SANCTUARY, NATIONAL PARK, MARINE PARK, TIMBER RESERVE OR STATE FOREST WITHOUT PRIOR WRITTEN APPROVAL OF THE DIRECTOR GENERAL. NO FAUNA SHALL BE TAKEN FROM ANY OTHER PUBLIC LAND WITHOUT THE WRITTEN APPROVAL OF THE GOVERNMENT AUTHORITY MANAGING THAT LAND.
4. NO ENTRY OR COLLECTION OF FAUNA TO BE UNDERTAKEN ON ANY PRIVATE PROPERTY OR PASTORAL LEASE WITHOUT THE CONSENT IN WRITING OF THE OWNER OR OCCUPIER, OR FROM ANY ABORIGINAL RESERVE WITHOUT THE WRITTEN APPROVAL OF THE DEPARTMENT OF INDIGENOUS AFFAIRS.
5. NO FAUNA OR THEIR PROGENY SHALL BE RELEASED IN ANY AREA WHERE IT DOES NOT NATURALLY OCCUR, NOR BE HANDED OVER TO ANY OTHER PERSON OR AUTHORITY UNLESS APPROVED BY THE DIRECTOR GENERAL, NOR SHALL THE REMAINS OF SUCH FAUNA BE DISPOSED OF IN SUCH MANNER AS TO CONFUSE THE NATURAL OR PRESENT DAY DISTRIBUTION OF THE SPECIES.
6. THIS LICENCE AND THE WRITTEN PERMISSION REFERRED TO AT CONDITIONS 3 & 4 MUST BE CARRIED BY THE LICENSEE OR AUTHORISED AGENT AT ALL TIMES FOR THE PURPOSE OF PROVING THEIR AUTHORITY TO TAKE FAUNA WHEN QUESTIONED AS TO THEIR RIGHT TO DO SO BY A WILDLIFE OFFICER, ANY OTHER STATE OR LOCAL GOVERNMENT EMPLOYEE OR ANY MEMBER OF THE PUBLIC.
7. **********ANY INTERACTION INVOLVING GAZETTED THREATENED FAUNA THAT MAY BE HARMFUL AND/OR INVASIVE MAY REQUIRE APPROVAL FROM THE COMMONWEALTH DEPT OF THE ENVIRONMENT AND WATER RESOURCES, PHONE 02 6274 1900. INTERACTION WITH SUCH SPECIES IS CONTROLLED BY THE COMMONWEALTH GOVERNMENT'S "ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999" & "ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION REGULATIONS 2000" AS WELL AS DEC'S WILDLIFE CONSERVATION ACT & REGULATIONS.**********
8. NO BIOPROSPECTING INVOLVING THE REMOVAL OF SAMPLE AQUATIC AND TERRESTRIAL ORGANISMS (BOTH FLORA AND FAUNA) FOR CHEMICAL EXTRACTION AND BIOACTIVITY SCREENING IS PERMITTED TO BE CONDUCTED WITHOUT SPECIFIC WRITTEN APPROVAL BY THE DIRECTOR GENERAL OF DEC.
9. FURTHER CONDITIONS (NUMBERED (TO 9) ARE ATTACHED.

PURPOSE LEVEL 2 FAUNA SURVEY USING CAGE TRAPS, ELLIOTT TRAPS, DRY PIT TRAPS AND FUNNEL TRAPS AT MT MASON AND MT IDA, CENTRAL YILGARN IRON PROJECT AREA (CYIP) FOR JUPITER MINES LIMITED.

AUTHORISED PERSONS
MS ERICA MACINTYRE
DR RONALD SNOOK
DR WESLEY BANCROFT

WILDLIFE CONSERVATION REGULATIONS 1970

Regulation 17:- Licence to Take Fauna for Scientific Purposes

FURTHER CONDITIONS (OF LICENCE NUMBER SF008484)

1. The licensee shall take fauna only in the manner stated on the endorsed Regulation 17 licence application form and endorsed related correspondence.

2. Except in the case of approved lethal traps, the licensee shall ensure that measures are taken in the capture and handling of fauna to prevent injury or mortality resulting from that capture or handling. Where traps or other mechanical means or devices are used to capture fauna these shall be deployed so as to prevent exposure of trapped animals to ants and debilitating weather conditions and inspected at regular intervals throughout each day of their use. At the conclusion of research all markers etc and signs erected by the licensee and all traps shall be removed, all pitfalls shall be refilled or capped and the study area returned to the condition it was in prior to the research/capture program. During any break in research, cage traps should be removed and pitfalls either removed, capped or filled with sand.

3. No collecting is to be undertaken in areas where it would impinge on pre-existing scientific research programs.

4. Any form of colour marking of birds or bats shall only be undertaken in accordance with the requirements of the Australian Bird and Bat Banding Scheme.

5. Any inadvertently captured specimen of fauna which is declared as likely to become extinct, rare or otherwise in need of special protection is to be released immediately at the point of capture. Where such a specimen is injured or deceased, the licensee shall contact Department of Environment and Conservation licensing staff at Kensington (08 9423 2434) for advice on disposal. Records are to be kept of any fauna so captured and details included in the report required under further condition 6 below.

6. Within one month of the expiration of this licence, the holder shall submit an electronic return detailing the locality, site, geocode, date and number of each species captured, sighted or vouchered during the currency of the licence, into the Department of Environment and Conservation Fauna Survey Database (DECFSD). A copy of any paper, report or thesis resulting from the research shall on completion be lodged with the Director General. If a renewal of this licence is required, the licensee shall submit a written progress report for activities undertaken during this licence period prior to the expiry of this licence.

7. Not more than ten specimens of any one protected species shall be taken and removed from any location less than 20km apart. Where exceptional circumstances make it necessary to take large series in order to obtain adequate statistical data the collector will proceed with circumspection and justify their actions to the Director General in advance.

8. All holotypes and syntypes and a half share of paratypes of species or subspecies permitted to be permanently taken under this licence shall be donated to the Western Australian Museum. Duplicates (one pair in each case) of any species collected which represents a significant extension of geographic range shall be donated on request to the Western Australian Museum.

9. To prevent any unnecessary collecting in this State, all specimens and material collected under the authority of this license shall, on request, be loaned to the Western Australian Museum. Also, the unused portion or portions of any specimen collected under the authority of this license shall be offered for donation to the Western Australian Museum or made available to other scientific workers if so required.

Appendix H: Targeted EPBC Survey (KLA; 2013)

Keith Lindbeck and Associates
Environmental Management Consultants
ABN 36 150 274 469

Jupiter Mines Limited

CENTRAL YILGARN IRON PROJECT

MT MASON PROJECT AND PROPOSED HAUL ROAD

TARGETED EPBC FAUNA SURVEY

Report Prepared for: ***Jupiter Mines Limited***

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March 2013

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1.0 INTRODUCTION

1.1 BACKGROUND

Jupiter Mines Limited (Jupiter) is engaged in the exploration and development of mineral resources at its Central Yilgarn Iron Project (CYIP) area. The CYIP area is located approximately 530 km northeast of Perth and 110 km northwest of Menzies and consists of three project areas: Mt Alfred, Mt Mason and Mt Ida (Figure 1). All three projects are 100% owned by Jupiter. The Mt Alfred project lies within the northern portion of the Illaara Greenstone Belt some 59km northwest of the Mt Mason and Mt Ida projects. The Mt Mason and Mt Ida projects lie within the northern portion of the Mount Ida Greenstone Belt which is located along the eastern boundary of the Southern Cross Granite-Greenstone Terrane.

High-grade hematite mineralisation at Mt Mason project represents a potential low cost DSO project which upon completion would lead to mining at the Mount Ida magnetite deposit. The Mt Mason DSO project will require a haul road from the Mt Mason project area to the port of Esperance via the Menzies-Sandstone Road.

The Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) Protected Matters Search Tool provides results of protected matters, including fauna species listed under the Federal *Environment Protection and Biodiversity Conservation* (EPBC) *Act 1999*. The results of the searches for the CYIP area are presented below (Table 1):

Table 1 - EPBC Protected Matters Search Tool Results for Fauna in CYIP area

Scientific Name	Common Name	Status*
Leipoa ocellata	Malleefowl	Vulnerable
Apus pacificus	Fork-tailed Swift	Migratory
Ardea alba	Great Egret	Migratory
Merops ornatus	Rainbow Bee-eater	Migratory
Acanthiza iredalei iredalei	Slender-billed Thornbill	Vulnerable

* Status defined in Appendix 1.

Jupiter commissioned Keith Lindbeck and Associates (KLA) to undertake a targeted EPBC fauna survey of Mt Mason's disturbance footprint and the associated Haul Road (Figure 2).

1.2 PURPOSE AND SCOPE

The objective of the targeted EPBC fauna survey was to ground truth the vegetation within the Mt Mason disturbance footprint and the proposed Haul Road and identify suitable habitat for the listed species.

The purpose of this report is to document the methodology and results of the targeted EPBC fauna survey conducted by KLA in March and April 2012.

The scope of work was to:

- conduct a targeted EPBC fauna survey in all uncleared areas within the footprint of proposed disturbance at Mt Mason and the associated Haul Road,
- determine areas of habitat suitable for all species listed in Table 1 in these areas,
- provide an impact risk assessment for selected targeted vertebrate fauna species, and
- provide recommendations, including the management of selected fauna of conservation significance and their habitats.

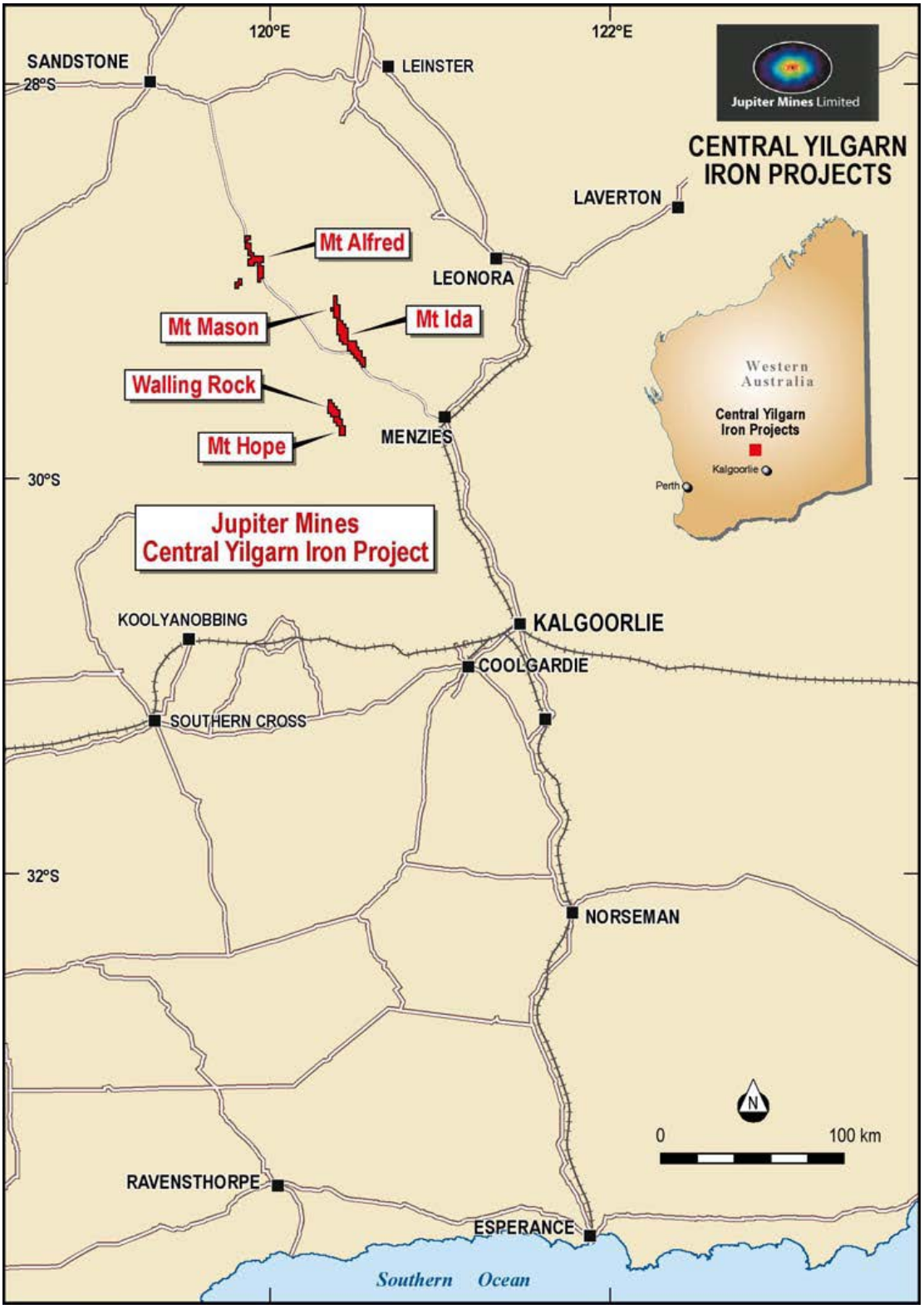

Figure 1 - Location of Jupiter's CYIP

2.0 DESCRIPTION OF THE SPECIES

2.1 MALLEEFOWL *Leipoa ocellata*

Malleefowl (*Leipoa ocellata,* Gould, 1840) are large ground dwelling birds belonging to the Megapodiidae family. This species belongs to a small group of mound builders where the mound is used as an external heat source to incubate their eggs (Clark 1964). The Malleefowl is a long-lived sedentary species with an average lifespan of roughly 15 years. Reaching approximately 60cm in height and 1.5 - 2kg in weight, they are roughly the size of a small turkey (Benshemesh 2007). They have a unique appearance with a distinctly barred upper body of grey, white, black, buff and pale chestnut feathers, with a crest extending from the front of the crown to the nape which is raised when the bird is alarmed (Pizzey and Knight 1999) (Figure 2).

Figure 2 - Adult Malleefowl *Leipoa ocellata*

2.1.1 General Ecology

The Malleefowl occupies semi-arid to arid regions of Western Australia, inhabiting dense shrublands and thickets of Mallee (*Eucalyptus spp*.), Boree (*Melaleuca lanceolata*), Bowgada (*Acacia linophylla*), or areas which form dense leaf litter (Johnstone and Storr 1998). Malleefowl prefer habitat that is long unburnt for breeding and shelter (Benshemesh 2007). However Malleefowl will feed in recently burnt areas (Benshemesh 1992, Marchant and Higgins 1993).

The Malleefowl builds mounds that utilise heat from the sun and composting vegetation to incubate their eggs (Figure 3). Most heat is generated from the fermentation of vegetative material used to create the mound, along with solar energy used later in the season as the leaf litter dries out (Johnstone and Storr 1998). The size of Malleefowl mounds vary. However, an average mound spans 5m in diameter and can be up to 1m high (Benshemesh 2007)

Figure 3 - Malleefowl Mound

Malleefowl are usually solitary and occupy a home range of between 0.5 and 4.6 km^2 (Benshemesh 1992). Individuals are known to move distances of 15 km or greater over a matter of weeks (Sims 2000, cited in Parsons *et al.* 2009). Established monogamous breeding pairs usually inhabit a similar area throughout the year and come together for breeding. While both sexes build the mound, once the female has laid the eggs, the male usually maintains the mound on his own. Birds generally breed annually (Marchant and Higgins 1993) with the breeding season lasting 11 months. Following mound preparation, eggs are laid from mid-August to late January and hatchlings appear from November (Johnstone and Storr 1998). The precocial chicks are independent from hatching having no contact with either their parents or siblings (van der Waag 2007). While 50% to 85% of eggs hatch (Frith 1959), generally more than 80% of chicks die within the first few weeks of life from predation and 'metabolic stress' (Priddel and Wheeler 1994).

Malleefowl feed opportunistically and will often feed on whatever food sources are abundant in the area (van der Waag 2007). Their omnivorous diet can consist of seeds, native herbs, flower buds, fruits and foliage of different plant species, as well as invertebrates. Malleefowl will drink water but can easily survive during summer when surface water is unavailable (DEC 2012).

2.1.2 Distribution of the Malleefowl

Originally, Malleefowl were widespread and common across the southern arid and semiarid zone. However the species has now become patchily distributed due to the effects of habitat clearing and fox predation (Johnstone and Storr 1998). Unlike other megapods that prefer damp forest, the Malleefowl does not inhabit the higher rainfall area of the Swan Coastal Plain and the wetter parts of the south coast of Western Australia (Figure 4).

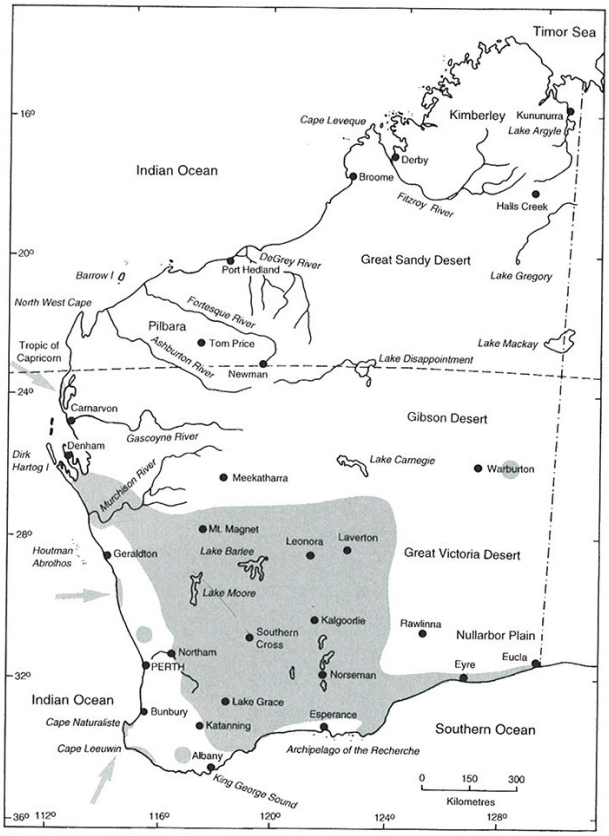

Figure 4 - Distribution of Malleefowl

2.1.3 Malleefowl Conservation Status

The Malleefowl is protected under Federal and State legislation: it is classified as Vulnerable: "Taxa facing a high risk of extinction in the wild in the medium-term future" under the EPBC Act 1999 and is also listed as Schedule 1: "Rare and likely to become extinct" under the WCA 1950. The DSEWPaC administers the EPBC Act 1999 and the Department of Environment and Conservation (DEC) administers the WCA 1950.

The Malleefowl is also listed as Vulnerable on the 2011 IUCN Red List of Threatened Species.

2.1.1 Known Presence in the CYIP Area

Numerous sightings and evidence of Malleefowl have been recorded in Jupiter's CYIP area. A list of potential mounds was provided to the zoological team and these were audited before and during the survey.

Malleefowl and evidence of their presence have been recorded regionally elsewhere (Burbidge *et al.* 1995, Chapman and Pronk 1997, Ninox 2009, Biota 2011, KLA 2011).

2.2 FORK-TAILED SWIFT *Apus pacificus*

The Fork-tailed Swift is a medium to large member of the Apodidae Family. It has a length of 18–21 cm is blackish with a pale throat, white rump and long, thin, deeply forked tail when fanned (Figure 5).

Figure 5 – Fork-tailed Swift *Apus pacificus*

2.2.1 General Ecology

The Fork-tailed Swift does not breed in Australia. It is almost exclusively aerial, flying from less than 1 m to at least 300 m above ground and probably much higher. They probably roost aerially, but are occasionally observed to land (Higgins 1999). The species food items within Australia are not well known, however, the species is known to be insectivorous. Studies have recorded the Swift eating small bees, wasps, termites and moths (Johnstone and Storr 1998).

2.2.2 Distribution of the Fork-Tailed Swift

The Fork-tailed Swift breeds in northeast and mid-east Asia and spends the northern winters in south New Guinea and most of Australia expect for a small arid inland area (Figure 6) (Johnstone and Storr 1998). It is a visitor to most parts of Western Australia (except the small arid interior extending south) beginning to arrive in the Kimberley in late September, the Pilbara and Eucla in November and in the southwest in mid-December. It leaves in late April. While it is common in the Kimberley, it is uncommon near the northwest, west and southeast coasts and rare or scare elsewhere.

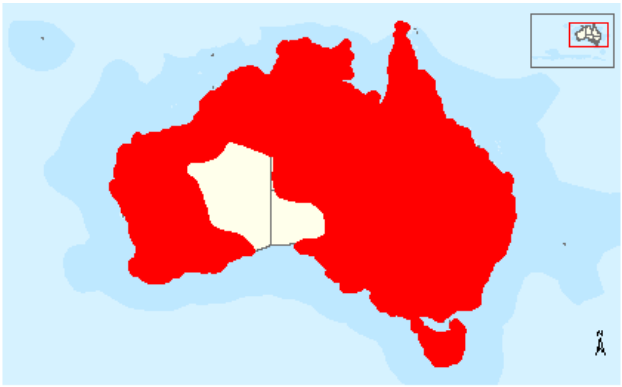

Figure 6 - Distribution of Fork-tailed Swift

2.2.3 Fork-Tailed Swift Conservation Status

The Fork-tailed Swift is listed as Migratory and Marine under the EPBC Act 1999.

It is also in international agreements between the Government of Australia and:

- the Government of Japan for the Protection of Migratory Birds in Danger of Extinction and their Environment. Australian Treaty Series 1981 No 6 (JAMBA),
- the Government of the People's Republic of China for the Protection of Migratory Birds and their Environment. Australian Treaty Series 1988 No 22 (CAMBA), and
- the Government of the Republic of Korea on the Protection of Migratory Birds and their Environment. Australian Treaty Series 2007 ATS 24 (ROKAMBA).

The Fork-tailed Swift is listed as Least Concern on the 2011 IUCN Red List of Threatened Species.

2.2.4 Known Presence in the CYIP Area

No sightings of the Fork-tailed swift were made during the recent Level 2 comprehensive surveys in the Mt Mason (KLA 2012a) and Mt Ida (KLA 2012b) areas and the species has not been recorded during other surveys conducted in the regional area (Burbidge *et al.* 1995, Chapman and Pronk 1997, Ninox 2009, Terrestrial Ecosystems 2011, Biota 2011, KLA 2011).

2.3 GREAT EGRET *Ardea alba modesta*

The Great Egret is a moderately large bird (83–103 cm in length, 700–1200 g in weight) with white plumage, a black or yellow bill and long reddish and black legs (DSWEPaC 2012) (Figure 7).

Figure 7 – Great Egret *Ardea modesta*

2.3.1 General Ecology

Great Egrets often occur solitarily, or in small groups when feeding. They roost in large flocks that may consist of hundreds of birds. The species usually nest in

colonies and rarely in solitary pairs. Colonies may be mono-specific or commonly mixed with other egrets, herons, ibises, spoonbills and/or cormorants.

The Great Egret usually frequents shallow waters and has been reported in a wide range of wetland type habitats. The Great Egret may retreat to permanent wetlands or coastal areas when other wetlands are dry. This may occur annually in some regions with regular wet and dry seasons or erratically where the availability of wetland habitat is also erratic.

In Australia, the breeding season of the Great Egret is variable, depending to some extent on rainfall but generally extends from November to April with pairs at southern latitudes breeding in spring and summer (particularly November and December), and pairs at more northerly latitudes breeding in summer and autumn (DSEWPaC 2012).

Breeding sites are usually located in wooded and shrubby swamps including mangrove forests in the Top End, Melaleuca swamps on the eastern coast of Australia and south-western Western Australia and mixed eucalypt/acacia/lignum swamps in the Channel Country and Murray-Darling Basin (DSEWPaC 2012).

Pairs construct a shallow platform-like nest of loosely woven sticks in the upper strata of trees or shrubs standing in or near water or sometimes in inundated reed beds. Females lay two to six, but usually three to five, pale blue or pale green eggs. The eggs are incubated by both parents, but mostly by the female, for a period of 23–29 days. Nestlings are fed and brooded by both parents. The young begin to clamber from the nest at 25–37 days of age. Fledged young make their final departure from the nest or colony at 55–88 days of age (DSEWPaC 2012).

The Great Egret has a diverse diet that includes fish, insects, crustaceans, molluscs, frogs, lizards, snakes and small birds and mammals.

2.3.2 Distribution of the Great Egret

In Australia, the distribution of Great Egrets is widespread (Figure 8). They occur in all states/territories of mainland Australia and in Tasmania. The Great Egret is also known as the White Egret, and distinguished from the Eastern Great Egret, the subspecies in Western Australia is referred to as *Ardea alba modesta*.

Figure 8 - Distribution of Great Egret

2.3.3 Great Egret Conservation Status

The Great Egret is listed as Migratory Wetland and Marine under the EPBC Act 1999.

It is also listed under the JAMBA and CAMBA Migratory Bird agreements.

The Great Egret is listed as Least Concern on the 2011 IUCN Red List of Threatened Species.

2.3.4 Known Presence in the CYIP Area

No sightings of the Great Egret were made during the recent Level 2 comprehensive surveys in the Mt Mason (KLA 2012a) and Mt Ida (KLA 2012b) areas, and the species has not been recorded during other previous survey in the regional area (Burbidge *et al.* 1995, Chapman and Pronk 1997, Ninox 2009, Terrestrial Ecosystems 2011, Biota 2011, KLA 2011).

2.4 RAINBOW BEE-EATER *Merops ornatus*

The Rainbow Bee-eater is a medium-sized bird and the only species of bee-eater in Australia (Figure 9).

Figure 9 – Rainbow Bee-eater *Merops ornatus*

2.4.1 General Ecology

The Rainbow Bee-eater is a migratory species whose movement patterns across Australia are not fully understood (DSEWPaC 2012). Generally, the Rainbow Bee-eater migrates north and spends the non-breeding period in northern Australia, Papua New Guinea and eastern Indonesia. In Western Australia, passage north occurs mostly from March to May and generally birds start moving south again late August and into September. In the far north some birds may be present all year.

Populations of the Rainbow Bee-eater gather together and assemble into flocks before migration. The migrating flocks, which can consist of tens to hundreds or thousands of birds often fly high above the ground when on passage.

Habitat for this species is also varied and includes open forests and woodlands, shrublands, various cleared or semi-cleared habitats, including farmland and areas of human habitation. It also occurs in inland and coastal sand dune systems, and in mangroves in northern Australia, and has been recorded in various other habitat types including heathland, sedgeland, vine forest and vine thicket, and on beaches. The Bee-eater usually nests in loose colonies that may contain up to about 50 pairs, but some pairs nest solitarily. They nest in burrows with entrances located on the ground or in banks or sandy slopes.

2.4.2 Distribution of the Rainbow Bee-Eater

The Rainbow Bee-eater is widely distributed throughout Australia and eastern Indonesia. It is distributed across much of mainland Australia, and occurs on several near-shore islands. It is not found in Tasmania, and is thinly distributed in the most arid regions of central and Western Australia.

Figure 10 - Distribution of Rainbow Bee-eater

2.4.3 Rainbow Bee-Eater Conservation Status

The Rainbow Bee-eater is listed as Migratory Terrestrial and Marine under the EPBC Act 1999.

It is also listed under the JAMBA Migratory Bird agreement.

The Rainbow Bee-eater is listed as Least Concern on the 2011 IUCN Red List of Threatened Species.

2.4.4 Known Presence in the CYIP Area

Being a migratory species, the presence of the Rainbow Bee-eater is dependent on the timing of surveys. Interestingly, the Rainbow Bee-eater was not recorded during the recent Spring 2011 or Autumn 2012 comprehensive surveys in the Mt Mason (KLA 2012a) and Mt Ida (KLA 2012b) areas of Jupiter's CYIP.

While the Rainbow Bee-eater has been recorded during some regional surveys (Burbidge *et al.* 1995, Chapman and Pronk 1997 and Biota 2011), it has not been recorded in others (Ninox 2009, Terrestrial Ecosystems 2011 and KLA 2011).

2.5 SLENDER-BILLED THORNBILL *Acanthiza iredalei iredalei*

The Slender-billed Thornbill (western) is a small passerine measuring approximately 10 cm in length (Figure 11).

Figure 11 – Slender-billed Thornbill *Acanthiza iredalei iredalei*

2.5.1 General Ecology

The Slender-billed Thornbill (western) usually occurs in pairs, or in small flocks of up to ten birds (DSEWPaC 2012). It may congregate into larger flocks from time to time, given that flocks of up to 20 and, rarely, up to 60 birds have been recorded in other subspecies of the Slender-billed Thornbill. The Slender-billed Thornbill (western) sometimes associates with other birds, such as Chestnut-rumped Thornbills *Acanthiza uropygialis*, Southern Whitefaces *Aphelocephala leucopsis* and Orange Chats *Epthianura aurifrons*. However, it breeds in solitary pairs.

The Slender-billed Thornbill (western) usually occurs in chenopod shrublands that are dominated by samphires or *Maireana* and *Atriplex* associations. It occasionally occurs in acacia shrublands and mangroves adjacent to more preferred habitat. It feeds on insects including caterpillars, grasshoppers, beetles, bees and ants and it also spiders and, occasionally, centipedes.

2.5.2 Distribution of the Slender-Billed Thornbill

The Slender-billed Thornbill (western) is a resident or sedentary subspecies that is not known to undertake any long-distance movements. The Slender-billed Thornbill (western) occurs in arid and semi-arid regions of southern Western Australia and south-western South Australia (Figure 12). Its known distribution extends from near Carnarvon in Western Australia, east though central Western Australia, and across the Nullarbor Plain to Whyalla, Port Augusta and Port Davis in South Australia.

There have not been any recent, major changes in the extent of occurrence, but the extent of occurrence does appear to have declined in the past. The distribution of the Slender-billed Thornbill (western) formerly extended to near Mullewa in south-western Western Australia a cattle station in the south of the Northern Territory, Moorilyanna Soak and Wantapella Swamp in northern South Australia, and Leigh Creek in eastern South Australia but there have been no recent records of the subspecies from any of these locations.

The Slender-billed Thornbill (western) is estimated to occur in seven subpopulations (Matthew 2006, pers. comm.) with three occurring in Western Australia. The seven subpopulations are located in the following areas:

- Carnarvon-Shark Bay region of Western Australia,
- central-southern Western Australia,
- Nullarbor Plain.

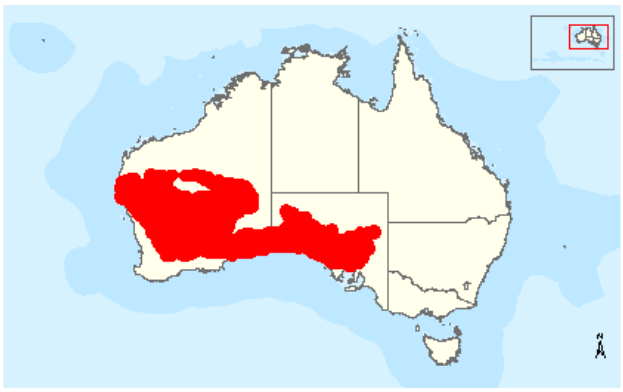

Figure 12 - Distribution of Slender-billed Thornbill

2.5.3 Slender-Billed Thornbill Conservation Status

The Slender-billed Thornbill is classified as Vulnerable: "Taxa facing a high risk of extinction in the wild in the medium-term future" under the EPBC Act 1999.

The Slender-billed Thornbill is listed as Least Concern on the 2011 IUCN Red List of Threatened Species.

2.5.4 Known Presence in the CYIP Area

No sightings of the Slender-billed Thornbill were made during the recent Level 2 comprehensive surveys in the Mt Mason (KLA 2012a) and Mt Ida (KLA 2012b) areas. This species has been recorded during at least one regional survey (Burbidge *et al.* 1995) and not in others (Chapman and Pronk 1997, Ninox 2009, Terrestrial Ecosystems 2011, Biota 2011, KLA 2011).

2.6 BIOPHYSICAL ENVIRONMENT

2.6.1 Location

The CYIP area lies approximately 30 km northwest of Lake Ballard (an ephemeral salt lake), 65 km east of Lake Barlee (an intermittent salt lake) and 110 km northwest of Menzies in the Goldfields district of Western Australia (Figure 13). The CYIP tenements cover an area of approximately 27,500 ha and are located within three different pastoral leases, Perrinvale Station to the north, Walling Rock Station to the west and Riverina Station to the east (Figure 14).

Within the CYIP, the Mt Mason tenement is located in the southern portion, although north of Mt Ida (Figure 1) and the proposed haul road extends from the eastern boundary of Mt Mason west of Mt Ida and continues south to join the existing Sandstone-Menzies Road.

2.6.2 Regional setting

The Interim Biogeographic Regionalisation for Australia (IBRA) divides the Australian continent into 85 bioregions and 403 subregions (Department of the Environment, Water, Heritage and the Arts 2009). The CYIP area is located within the Murchison IBRA region and (MUR1) East Murchison subregion (Cowan 2001).

The East Murchison bioregion which totals over seven million hectares is characterised by Mulga Woodlands often rich in ephemerals, hummock grasslands, saltbush shrublands and *Halosarcia* shrubland (Cowan 2001). The area is characterised by:

- internal drainage,
- extensive areas of elevated red desert sandplains with minimal dune development,
- salt lake systems that are associated with the occluded Palaeodrainage system, and
- broad plains of red-brown soils and breakaway complexes as well as red sandplains (Cowan 2001).

2.6.3 Vegetation and Flora

The CYIP is located within the Austin District of the Eremaean Botanical Province characterised by predominantly mulga low woodland on plains, and scrub on hills, with tree steppe of *Eucalyptus* spp. and *Triodia basedowii* on sand plains. (Beard 1990).

Numerous flora and vegetation mapping surveys have previously been undertaken in the area (Paul Armstrong and Associates 2008, Meissner and Owen 2010, Outback Ecology 2010).

Vegetation and flora surveys of the Mt Mason project area have been undertaken by Native Vegetation Solutions (NVS) and have included:

- Level 2 vegetation survey of the Mt Mason project area on 3-7 October 2011 (NVS 2012a).
- Level 1 flora survey of the proposed haul road from Mt Mason to the Sandstone-Menzies public road from 29-31 May 2012 (NVS 2012b).

These surveys were undertaken in accordance with EPA Position Statement No. 3 *Terrestrial Biological Surveys as an Element of Biodiversity Protection* (EPA 2002)

and EPA Guidance Statement No. 51 *Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (EPA, 2004).

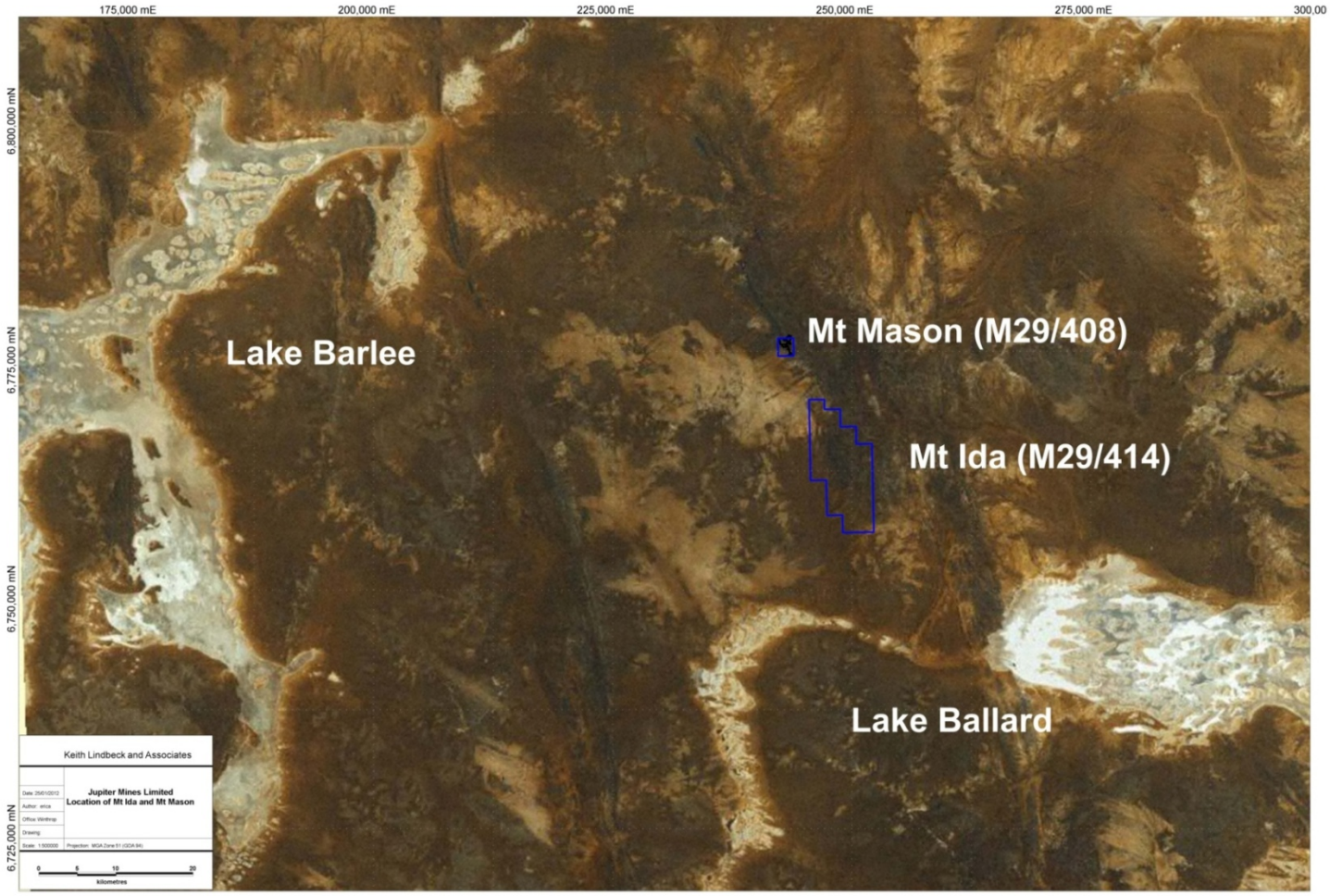

Figure 13 - Location of Mt Mason and Mt Ida Tenements

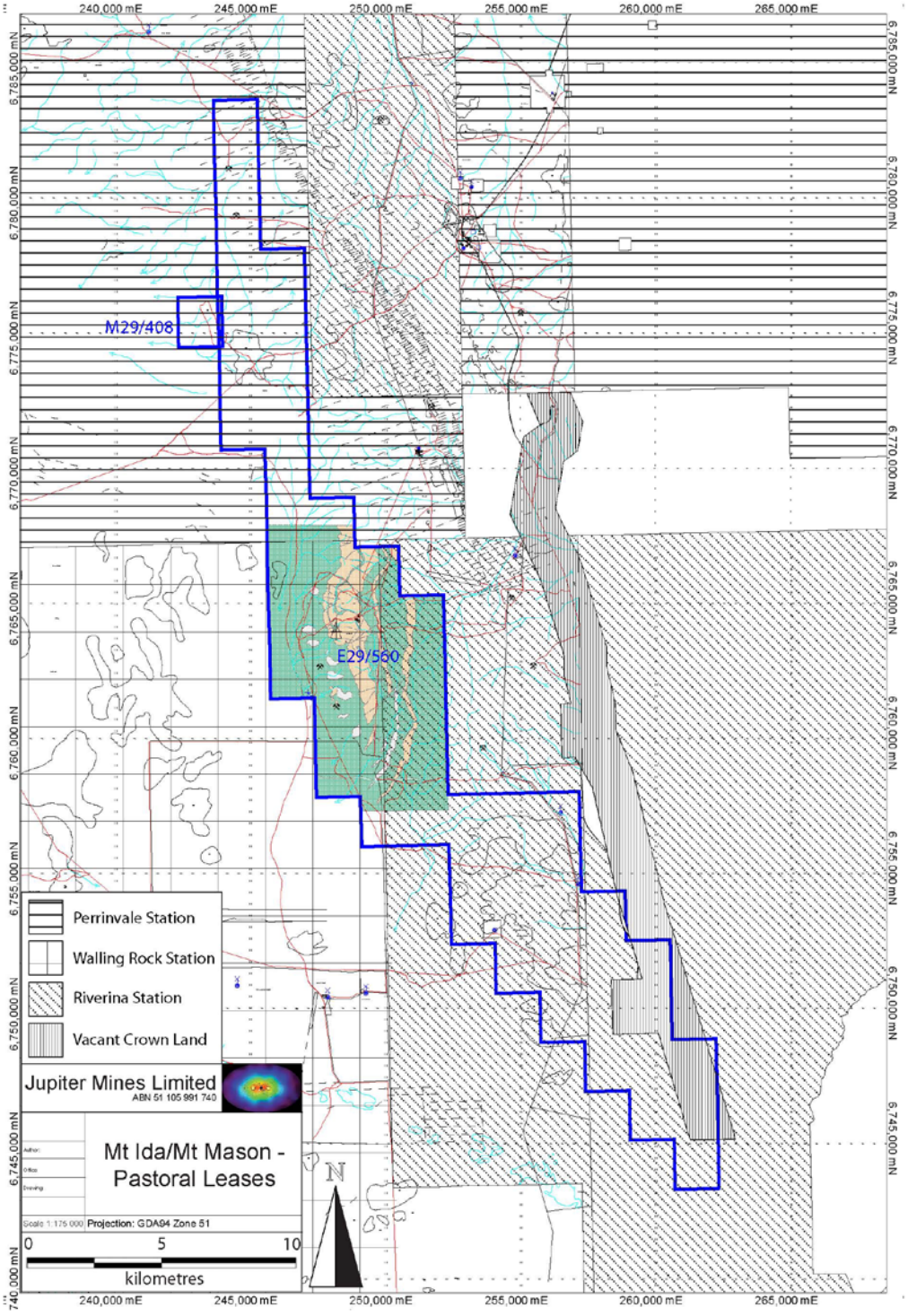

Figure 14 - Mt Mason and Mt Ida Pastoral Leases

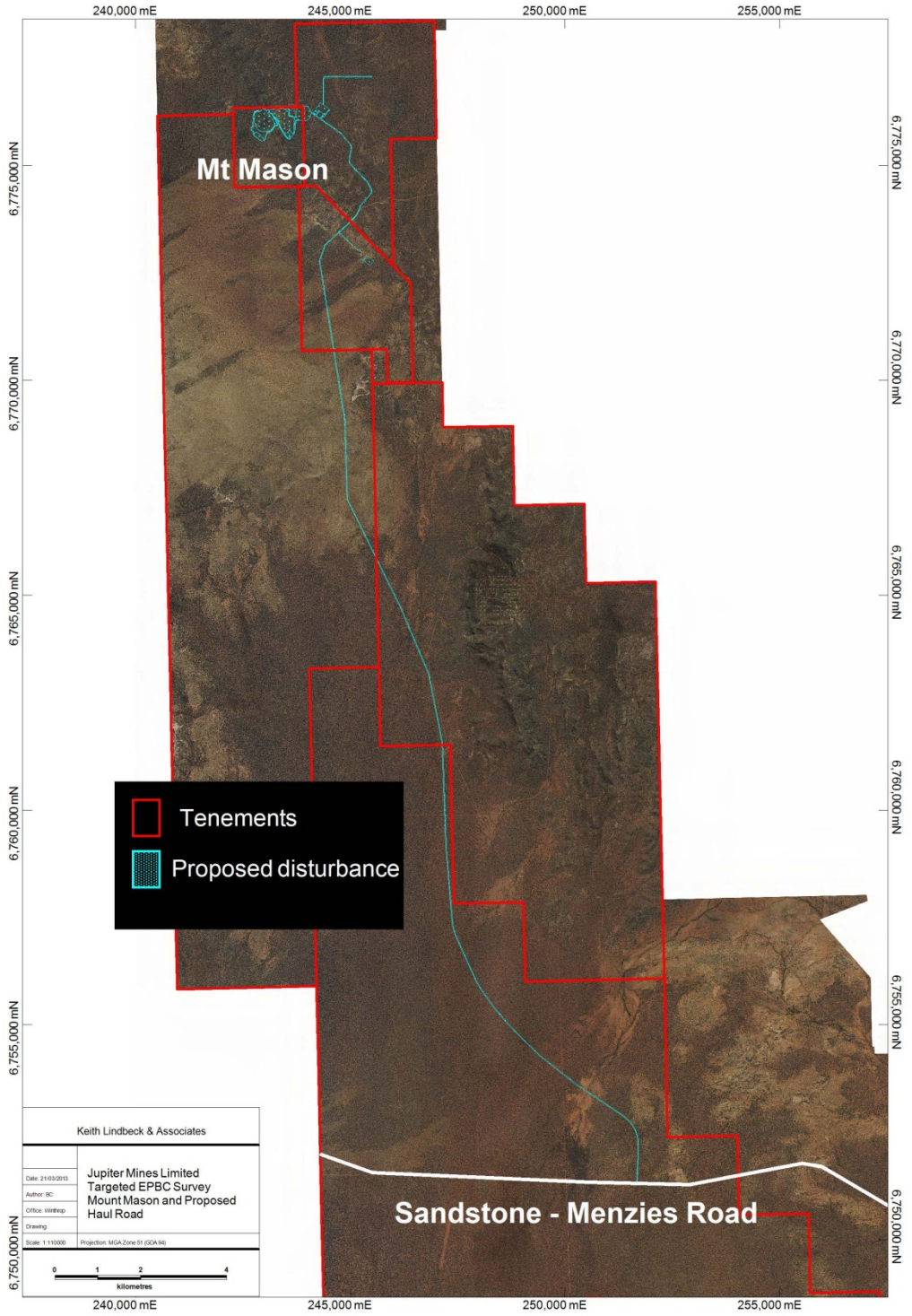

Figure 15 - Location of Mt Mason and proposed Haul Road

3.0 METHODOLOGY

3.1 TARGETED FAUNA SURVEY

Surveys were conducted in March (2, 3, 4, 5 and 8) and April (2 and 3) 2012 to:

- ground truth the vegetation communities along the survey route,
- inspect the fauna habitats along the survey route,
- determine the potential within these habitats for the targeted species to utilise these areas,
- extend these searches outside of the proposed haul road route to determine if the habitats are limited to the survey or are present elsewhere, and
- identify targeted species present at the time through direct observation and hearing of bird calls, and indirect evidence including mounds, hollows, tracks, scats, and feathers etc.

In the case of the identification of a Malleefowl mound, the following was recorded:

- GPS location
- photograph taken,
- determination of status of the mound and if inactive, approximately when last it was used, and
- approximate size (diameter in metres).

3.1.1 Targeted EPBC fauna species

Jupiter provided KLA with outlines of the areas to be surveyed.

3.1.1.1 Mt Mason footprint of disturbance

A line survey approach was adopted for the proposed footprint of disturbance at Mt Mason (Figure 16). Between two and three personnel walked in parallel lines across the areas proposed for disturbance. The distance between lines was dictated by the landform and density of vegetation inasmuch as lines were as close as 10 m apart in areas of dense vegetation and others were further apart in areas of sparse understorey and areas of Banded Iron Formation (BIF) which are not suitable habitat for any of the EPBC listed species.

3.1.1.2 Proposed Haul Road

A line survey approach was also adopted for the proposed haul road that ensured all parts of the route were surveyed (Figure 17). While the proposed haul road will only extend to approximately 20m in width, an area of 100 m was surveyed to allow for flexibility in design. Up to five qualified personnel walked in parallel straight lines approximately 20 m apart from the northern end of the proposed haul road to the southern end. GPS units were used by the personnel on the eastern and western extents of the proposed route to trace the exact route and the remaining three personnel maintained equal distances from other members of the team.

3.2 PERSONNEL AND REPORTING

The following personnel were involved in the surveys:

- Dr Vi Saffer *BSc (Biol.) Hons (Biol.) PhD (Biol.)*: Senior Zoologist, KLA,
- Ms Erica MacIntyre *BSc (Conservation and Wildlife Biol. and Env. Sci.) Hons (*in prep.): Project Ecologist, KLA
- Dr Ronald Snook *BSc BVMS*
- Ms Katherine Edwards *BSc (Conservation and Wildlife Biol.) Hons (Biol)*

- Mr Hamish Burnett, Field Assistant, TAFE Certificate II Conservation and Land Management
- Ms Polly Hammond, Environmental Coordinator (Approval) Jupiter Mines Limited.

- Mr Keith Lindbeck *BA, WDA, Dip Environ Studies;* Principal, KLA, reviewed the report.

3.3 LICENCE AND PERMITS

A license was not required for the targeted EPBC fauna survey.

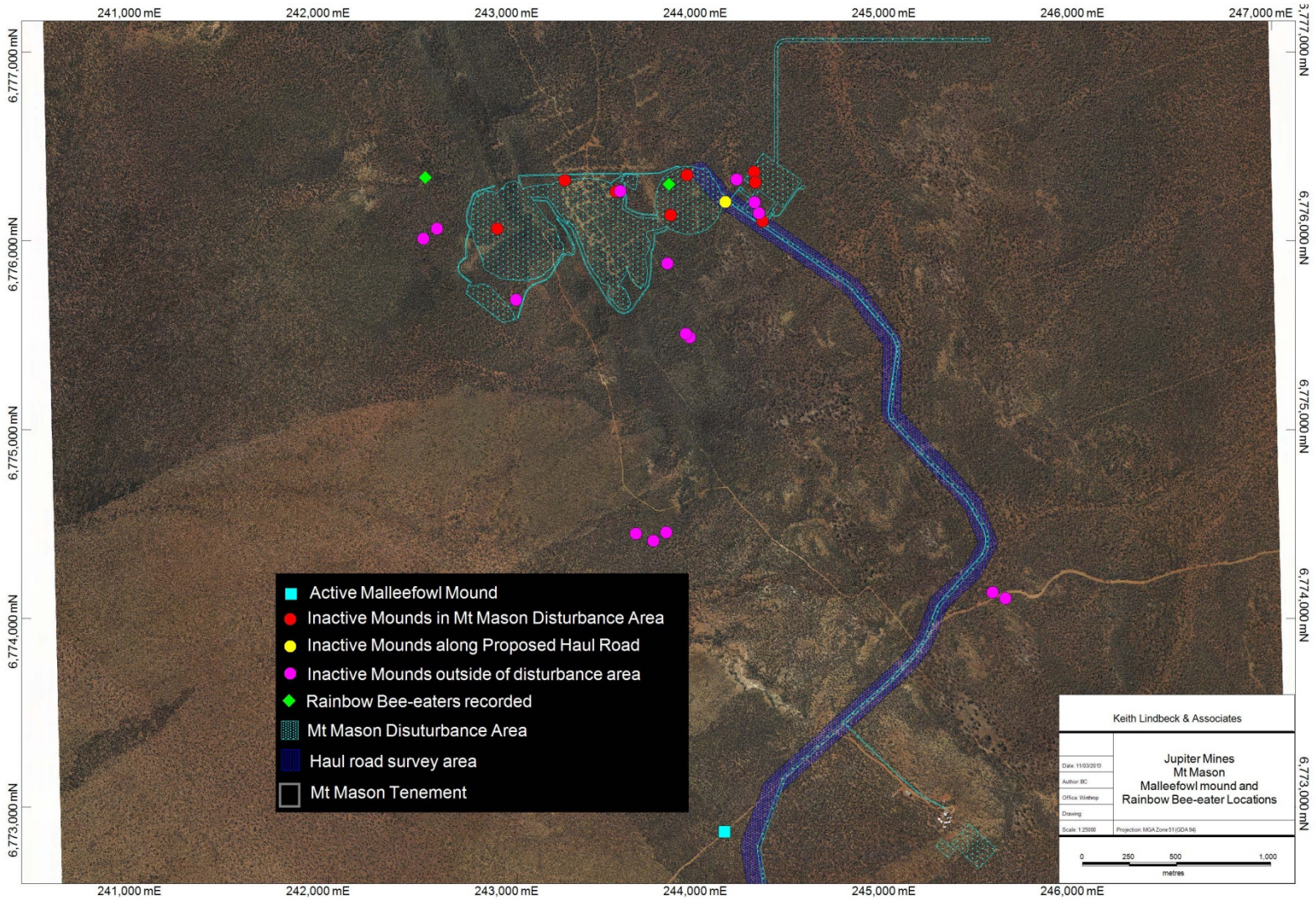

Figure 16 - Mt Mason Disturbance Area with Malleefowl Mound Locations and Rainbow Bee-eater Recordings

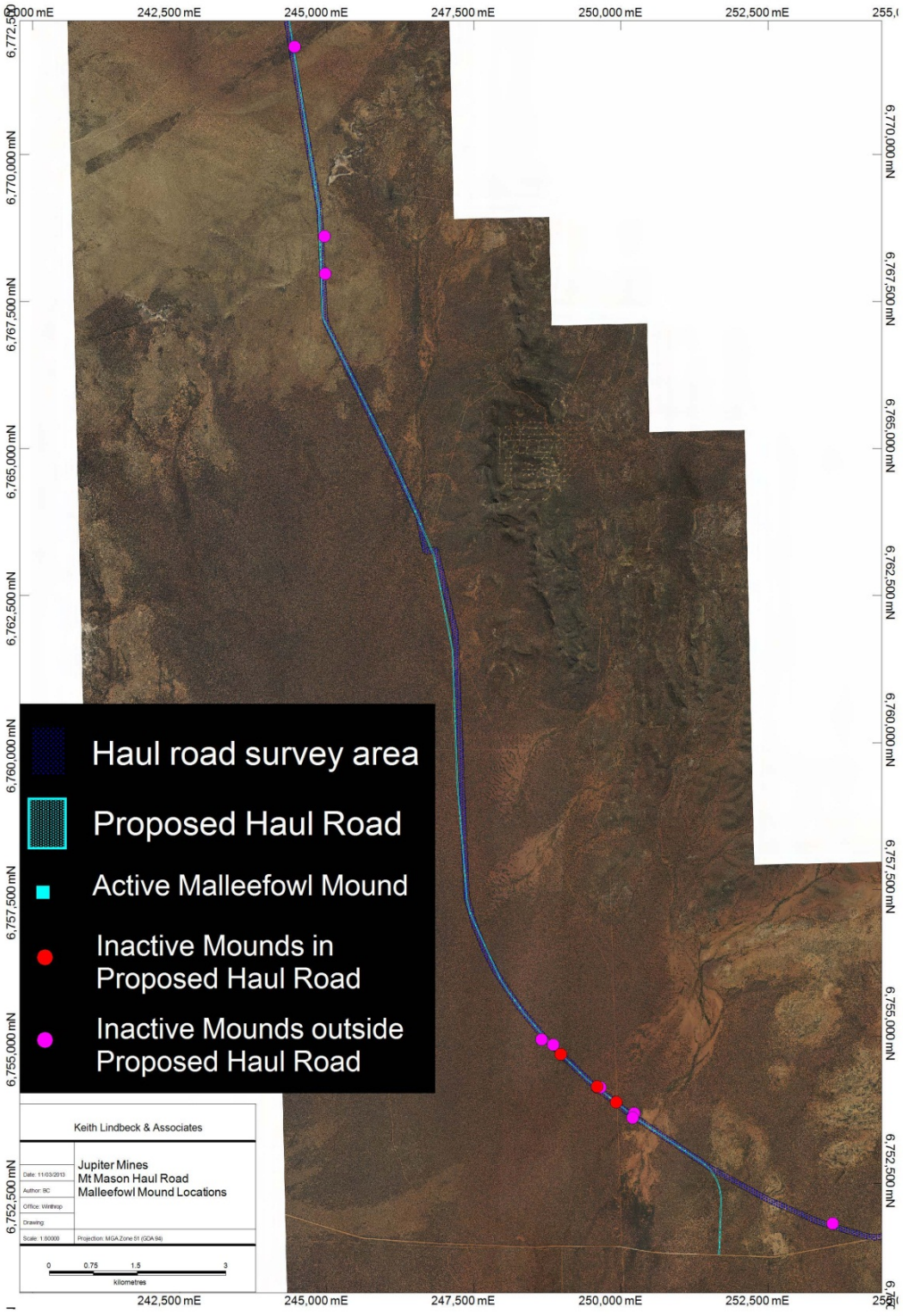

Figure 17 - Haul Road with Malleefowl Mound Locations

4.0 RESULTS AND DISCUSSION

Just under 40 person hours were spent traversing the disturbance footprint for Mt Mason (and associated infrastructure) and approximately 77 person hours were spent inspecting the area proposed for the haul road.

4.1 POTENTIAL FAUNA HABITAT

Nine vegetation groups were described in the proposed Mt Mason disturbance area during the flora survey area (NVS 2012a):

- *Thryptomene* Shrubland
- Open Mulga woodland over Laterite
- *Allocasuarina* over *Calytrix* shrubland
- Mulga over *Eremophila forrestii susbsp forrestii* on hills and ridges
- Mulga over *Prostanthera althoferi subsp althoferi* on hills and ridges
- Mulga over *Philotheca brucei subsp brucei* on hills and ridges
- *Mulga over Eremophila forrestii subsp forrestii* on flats
- *Acacia burkittii* shrubland within drainage lines
- *Acacia cockertoniana* over *Eremophila oldfieldii* and *Eremophila pantonii* on flats.

Results from the flora survey of the proposed haul road identified 12 vegetation groups (NVS 2012b).

- Mulga Shrubland with occasional Eucalypts (1a)
- Mulga woodland-floodplain (1b)
- Mulga shrubland with Philotheca brucei subsp brucei (1g)
- Mulga open shrubland-drainage (1k)
- Mulga with *Acacia cockertoniana* and *Acacia ramulosa var ramulosa* tall shrubland over *Olearia humilis* and/or *Hibbertia arcuata* and/or *Prostanthera althoferi* subsp. *althoferi* and/or *Eremophila forrestii* subsp. *forrestii* low shrubland (1n)
- Mulga over mixed shrubland (1o)
- *Acacia quadrimarginea*/*A. cockertoniana* open shrubland (2g)
- *Acacia effusifolia*/*Eucalyptus* mallee and other mixed shrublands burnt sandplain (3b)
- *Acacia effusifolia* Shrubland- transitional (3c)
- *Callitris* with scattered Eucalypt woodland- sandplain (4)
- *Eucalyptus lesouefii* open woodland (9a)
- *Eucalyptus salubris* woodland (9b).

4.1.1 Habitat for Malleefowl

Of the habitat identified during the flora surveys, the majority of the vegetation groups identified at the project comprise potential malleefowl breeding or foraging habitat. The majority of the inactive malleefowl mounds recorded were located on:

- Mulga over *Eremophila*
- Mulga over *Eremophila forrestii* (on flats and undulating hills)
- Mulga shrubland with occasional Eucalypts
- *A.effusiola*/*Eucalyptus* mallee and other mixed shrublands burnt sandplain
- *Callitris* with *Eucalyptu*s woodland – sandplain.

There are extensive areas of habitat suitable for Malleefowl in and adjacent to the Mt Mason project area.

4.1.2 Discussion

The habitats (vegetation groups) identified are not restricted to the project area. While the survey of the Mt Mason mining area was limited predominantly to the areas proposed for disturbance, the survey of the proposed haul road involved assessment of a larger area than that proposed for disturbance (Table 2).

Table 2 - Vegetation groups recorded on Mt Mason haul road

HAUL ROAD	Area to be disturbed (ha)	Area surveyed – no disturbance (ha)
Mulga Shrubland with occasional Eucalypts (1a)	14.83	133.46
Mulga woodland- floodplain (1b)	14.36	129.22
Mulga shrubland with *Philotheca brucei subsp brucei* (1g)	0.47	4.26
Mulga open shrubland- drainage (1k)	0.61	5.47
Mulga with *Acacia cockertoniana* and *Acacia ramulosa var ramulosa* tall shrubland over *Olearia humilis* and/or *Hibbertia arcuata* and/or *Prostanthera althoferi* subsp. *althoferi* and/or *Eremophila forrestii* subsp. *forrestii* low shrubland (1n)	21.97	197.77
Mulga over mixed shrubland (1o)	0.38	3.38
Acacia quadrimarginea/*A. cockertoniana* open shrubland (2g)	2.43	21.85
Acacia effusifolia/*Eucalyptus* mallee and other mixed shrublands burnt sandplain (3b)	12.78	115.05
Acacia effusifolia Shrubland- transitional (3c)	0.74	6.67
Callitris with scattered Eucalypt woodland- sandplain (4)	1.03	9.24
Eucalyptus lesouefii open woodland (9a)	0.69	6.20
Eucalyptus salubris woodland (9b)	0.49	4.43
TOTAL	**70.78**	**636.99**

At a regional scale the proposed disturbance for the project represents >0.01% of the vegetation groups present (Table 3).

Table 3 - Impact of project on vegetation at a regional scale

Veg Assoc	Description	Mount Mason proposed clearing (ha)	Current extent, WA (ha)	Pre-European Extent, WA (ha)	Remaining (%)	% of Current Extent (WA)
484	Shrublands; jam thicket	0.52	70235	70,235	100	0.0007%
202	Shrublands; mulga & *Acacia quadrimarginea* scrub	63.13	365,344	365,344	100	0.0173%
483	Hummock grasslands, mixed sandplain - open mallee over sparse dwarf shrubs with spinifex; red mallee & mixed sparse dwarf shrubs over *Triodia basedowii*	3.06	395,106	395,106	100	0.0008%
18	Low woodland; mulga (*Acacia aneura*)	47.93	22,029,557	22,029,557	100	0.0002%
	Total:	114.64	22,860,242	22,860,242		

4.2 MALLEEFOWL

4.2.1 Mt Mason footprint of disturbance

Up to 8 Malleefowl mounds were recorded with the proposed disturbance footprint in the Mt Mason area (Table 4, Figure 16). All of these mounds were identified as inactive. A subjective estimation of the number of years since the mound was last used was made and is provided in Table 4.

Table 4 - Locations of Malleefowl Mounds within the Mt Mason disturbance area

Number	Location			Size (metres)	Approximate Age (years)
	Zone	Easting	Northing		
1	51	243523	6776262	6 x 6	>30
2	51	244256	6776365	-	>100
3	51	243901	6776349	10 x 10	>100
4	51	243814	6776136	-	>150
5	51	244263	6776312	7 x 7	>50
6	51	244300	6776106	5 x 5	>150
7	51	243252	6776321	4 x 4	>50
8	51	242895	6776065	6 x 6	>50

4.2.2 Proposed Haul Road

A total of 3 Malleefowl mounds were recorded within the area proposed for the haul road (Table 5, Figure 17). All of these mounds were identified as inactive. A subjective estimation of the number of years since the mound was last used was made.

Table 5 - Locations of Malleefowl Mounds within the proposed haul road area

Number	Location			Size (metres)	Approximate Age (years)
	Zone	Easting	Northing		
1	51	248977	6754701	10 x 10	>100
2	51	249599	6754145	10 x 10	>100
3	51	249923	6753883	10 x 10	>100

4.2.3 Areas outside of Mt Mason disturbance footprint and proposed haul road

A total of 26 Malleefowl mounds were recorded outside of the proposed disturbance footprint in the Mt Mason area and the proposed haul road area (

Table 6, Figure 16 and Figure 17). Of these, one was determined to be active (Figure 18 and Figure 19) and the remainder inactive. A subjective estimation of the number of years since the mound was last used was made.

Table 6 - Locations of Malleefowl Mounds outside of the proposed areas of disturbance

Number	Location			Size (metres)	Approximate Age (years)
	Zone	Easting	Northing		
ACTIVE MOUND					
1A	51	244100	6772869	2.5 x 2.5	1
INACTIVE MOUNDS					
1	51	243917	6775489	7 x 7	>100
2	51	245522	6774136	4 x 4	>10
3	51	245590	6774104	3 x 3	?
4	51	243631	6774448	10 x 10	>100
5	51	243723	6774411	4 x 4	>100
6	51	243791	6774455	5 x 5	>100
7	51	243895	6775506	4 x 4	>100
8	51	244164	6776326	-	>100
9	51	243546	6776265	3 x 3	>100
10	51	244258	6776205	6 x 6	>150
11	51	244282	6776147	10 x 10	>150
12	51	243796	6775882	6 x 6	>150
13	51	242575	6776064	6 x 6	>50
14	51	242994	6775688	2 x 2	>150
15	51	242503	6776012	3 x 3	>100
16	51	244107	6776207	5 x 5	>100
17	51	244454	6771833	3 x 3	~1yr <5
18	51	244958	6768612	4 x 4	>50
19	51	244977	6767975	3 x 3	>50
20	51	248656	6754952	7 x 7	>50
21	51	248852	6754862	5 x 5	>100
22	51	249655	6754132	5 x 5	>100
23	51	250227	6753693	6 x 6	>100
24	51	250204	6753620	6 x 6	>100
25	51	253603	6751822	12 x 12	>100

Figure 18 - Active Malleefowl mound

Figure 19 - Malleefowl working active mound

4.2.1 Discussion

Malleefowl favour dense shrublands, Eucalypt Mallee thickets and areas that contain sufficient leaf litter for mound building. Inspection of many areas proposed for disturbance supported habitat suitable for Malleefowl mound building, as evidenced by the number of Malleefowl mounds. Malleefowl are present in the Mount Mason area and it is probable that the general area supports a breeding population.

However, only one known active Malleefowl mound was recorded during the survey. In March 2011, the Shire of Menzies graded a publically gazetted road (Metzke Road) that runs in a northeast-southwest direction south of the Mt Mason tenement. Soon after these road works were completed a pair of Malleefowl (Figure 19) established a mound (Figure 18) that is located less than 5m away from the Metzke Road and approximately 1.6 km from the south eastern corner of the tenement (Figure 16 and Figure 17). The proposed haul road runs approximately 137 m from this active mound. Jupiter has looked at the option of an alternate route to provide a larger buffer from the active mound but assessment of this route identified active mounds. The current proposed route is considered the best option to reduce the potential impacts to this species.

Albeit by subjective estimation, the majority of inactive mounds appeared to have been used a number of years ago (generally >50 years) with only two that appeared to have been used within the past five years. This suggests that Malleefowl have been in the area for many years. However, it is not possible to estimate the population that may have been present locally and historically. Any clearing of land or disturbance associated with developing the project could have an impact on individual Malleefowl. The proposed disturbance associated with the project may shift a small number of individuals into adjacent areas but it is not anticipated to have a significant impact on the population.

Threats to Malleefowl include clearing of habitat, road deaths, fire, predation and grazing and starvation. While local populations may have been subject to the effects of fire, predation and grazing and starvation, the proposed disturbance is likely to exacerbate these effects and will include the threats of clearing of native vegetation and road deaths. Further recommendations to reduce the potential impact of the proposed disturbance on the Malleefowl are addressed in Section 5.

Interestingly, a total of 11 of the 36 mounds recorded during the survey were determined to be ‘megamounds’. Megamounds appear to be extremely large Malleefowl mounds (~10 m x 10m) the origins of which remain unknown. While both megamounds and regular mounds may be re-used by Malleefowl, many of the older mounds have been and were currently being used by other fauna including varanids (Varanus spp.) and rabbits (*Oryctolagus cuniculus*).

4.3 FORK-TAILED SWIFT

No Fork-tailed Swifts were seen or heard during the survey.

Given the ecology of this species inasmuch as they are classified as Marine and Migratory, that they do not breed in Australia and they are almost exclusively aerial, it is unlikely that this species would utilise the habitat proposed for disturbance for the Mt Mason DSO Project or the associated haul road. The conservation status of this species is unlikely to be altered by the proposed mining activity in the area.

4.4 GREAT EGRET

No Great Egrets where seen or heard during the surveys and no evidence of their presence was identified.

The preferred habitat of the Great Egret is shallow waters, wetlands and swamps. As there are no such habitats within the area proposed for disturbance for the Mt Mason DSO project and associated haul road, it is not likely that this species would utilise this area. Further, the Great Egret is classified as a Migratory Wetland and Marine species.

The proposed mining operation at Mt Mason and the associated haul road therefore are unlikely to alter the conservation status of the Great Egret.

4.5 RAINBOW BEE-EATER

Rainbow Bee-eaters were heard and a total of seven individuals were seen in the Mt Mason area (Figure 16). None were seen or heard during the survey of the proposed haul road.

Rainbow Bee-eaters usually begin their northerly migration in March which is consistent with the timing of the survey. That they were recorded in the northern portion of the survey and not in the southern section exemplifies their migratory nature as they move across the Western Australia landscape, season-dependent.

Rainbow Bee-eaters usually make their breeding burrows in soft sandy banks, a feature not common in the CYIP landscape. Therefore, while the CYIP may be used within their migratory route, it is not likely to provide significant habitat for this species. The conservation status of this species, therefore, is not likely to be altered by the proposed operation at Mt Mason or the associated haul road.

4.6 SLENDER-BILLED THORNBILL

No Slender-billed Thornbills where seen or heard during the surveys and no evidence of their presence was identified.

The preferred habitat for the Slender-billed Thornbill is chenopod shrublands that are dominated by Samphire and occasionally adjacent shrublands and mangroves. Given the lack of this habitat in the Mt Mason area or associated hail road, it is unlikely that this species of Thornbill would be present.

Preferred habitat for this species is located approximately 30 km northwest at Lake Ballard and 65 km east at Lake Barlee. While movement of the Slender-billed Thornbill is likely along the edges of these large lakes in search of resources, they are not likely to move such a vast distance across the Mt Mason tenement between lakes (R. Johnstone *pers. comm.*).

The conservation status of this species is therefore not likely to be altered by the proposed mining activity in Jupiter's CYIP area.

5.0 RECOMMENDATIONS

Of the five species of fauna listed under the EPBC Act 1999 for the area, the habitat of only the Malleefowl is likely to be impacted by the proposed mining activity.

Given the presence of Malleefowl in the area, it is recommended that a Malleefowl Management Plan be developed and submitted to DSEWPaC for approval and that the approved plan be implemented immediately following approval.

Recommendations include but are not limited to the following:

- Conduct a targeted Malleefowl survey in any areas not surveyed but proposed for disturbance following realignment of the haul road;
- Clearing boundaries are to be well marked and no unnecessary clearing of native vegetation is to occur;
- Signage to be erected to alert drivers of (possible) presence of Malleefowl;
- Annual monitoring of all known mounds in the vicinity of the operational areas and haul road;
- Maintain management that reduces risk of fire;
- Implement a feral animal trapping program in consultation with DEC in the vicinity of operational areas;
- Ensure that all personnel attend inductions prior to going on site or at site and that these inductions include information about the Malleefowl, its legal status, ecology and habitat requirements;
- Encourage all personnel to report any signs of Malleefowl in the CYIP area
- All vehicles are to remain on designated tracks and speed restrictions appropriate to operational areas to be monitored.

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APPENDIX A
Categories used in the assessment of conservation status

IUCN categories (based on review by Mace and Stuart 1994) as used for the Environmental Protection and Biodiversity Conservation (EPBC) Act 1999.

EXTINCT (EX)
A taxon is Extinct when there is no reasonable doubt that the last individual has died. A taxon is presumed Extinct when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.

EXTINCT IN THE WILD (EW)
A taxon is Extinct in the Wild when it is known only to survive in cultivation, in captivity or as a naturalized population (or populations) well outside the past range. A taxon is presumed Extinct in the Wild when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.

CRITICALLY ENDANGERED (CR)
A taxon is Critically Endangered when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered*, and it is therefore considered to be facing an extremely high risk of extinction in the wild.

ENDANGERED (EN)
A taxon is Endangered when the best available evidence indicates that it meets any of the criteria A to E for Endangered*, and it is therefore considered to be facing a very high risk of extinction in the wild.

VULNERABLE (VU)
A taxon is Vulnerable when the best available evidence indicates that it meets any of the criteria A to E for Vulnerable*, and it is therefore considered to be facing a high risk of extinction in the wild.

NEAR THREATENED (NT)
A taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.

LEAST CONCERN (LC)
A taxon is Least Concern when it has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category.

DATA DEFICIENT (DD)
A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution are lacking. Data Deficient is therefore not a category of threat. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate. It is important to make positive use of whatever data are available. In many cases great care should be exercised in choosing between DD and a threatened status. If the range of a taxon is suspected

to be relatively circumscribed, and a considerable period of time has elapsed since the last record of the taxon, threatened status may well be justified**.**

NOT EVALUATED (NE)
A taxon is Not Evaluated when it is has not yet been evaluated against the criteria

- Refer to http://www.iucnredlist.org/documents/redlist_cats_crit_en.pdf for criteria

Schedules used in the WA Wildlife Conservation Act 1950.

Schedule 1. Rare and Likely to become Extinct.

Schedule 2. Extinct.

Schedule 3. Migratory species listed under international treaties.

Schedule 4. Other Specially Protected Fauna.

Department of Environment and Conservation Priority Species

(species not listed under the Conservation Act, but for which there is some concern)

Priority 1. Taxa with few, poorly known population on threatened lands.

Priority 2. Taxa with few, poorly known populations on threatened lands, or taxa with several, poorly known populations not on conservation lands.

Priority 3. Taxa with several, poorly known populations, some on conservation lands.

Priority 4. Taxa in need of monitoring. Taxa which are considered to have been adequately surveyed, or for which sufficient knowledge is available, and which are considered not currently threatened or in need of special protection, but could be if present circumstances change.

Priority 5. Taxa in need of monitoring. Taxa which are not considered threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years (IUCN Conservation Dependent).

JAMBA The agreement between the Government of Australia and the Government of Japan for the Protection of Migratory Birds in Danger of Extinction and their Environment. Australian Treaty Series 1981 No 6.

CAMBA The agreement between the Government of Australia and the Government of the People's Republic of China for the Protection of Migratory Birds and their Environment. Australian Treaty Series 1988 No 22.

ROKAMBA The agreement between the Government of Australia and the Government of the Republic of Korea on the Protection of Migratory Birds and their Environment. Australian Treaty Series 2007 ATS 24.

Appendix I: EPBC Referral Notification

EPBC Ref: 2013/6870

Mr Greg Kaeding
Environmental Manager
Jupiter Mines Ltd
PO Box Z5117
PERTH WA 6000

Dear Mr Kaeding

Decision on referral
Mt Mason Direct Shipping Ore Hematite Project, 110 km north-west of Menzies, Western Australia (EPBC 2013/6870).

Thank you for submitting a referral under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). This is to advise you of my decision regarding the proposed action to clear native vegetation for the construction of a Hematite mine, associated infrastructure and roads for the Mt Mason Direct Shipping Ore Hematite Project, 110 km north-west of Menzies, Western Australia.

As a delegate of the Minister for Sustainability, Environment, Water, Population and Communities, I have decided that the proposed action is not a controlled action, provided it is taken in accordance with the manner described in the enclosed decision document. This means that, provided that the action is undertaken in that way, it does not require further assessment and approval under the EPBC Act before it can proceed.

A copy of the document recording this decision is enclosed. This document will be published on the department's website.

Please note that this decision relates only to the specific matters protected under Chapter 2 of the EPBC Act.

This decision does not affect any requirement for separate state or local government environment assessment and approvals of the proposed action.

Please notify this department immediately if you are unable to undertake the proposed action in accordance with the measures described. Penalty provisions may apply if the referred action is undertaken in a different way to the manner specified.

Otherwise we would appreciate receiving your written advice:

- within three months of the date of this letter - reporting on your progress in implementing the measures.

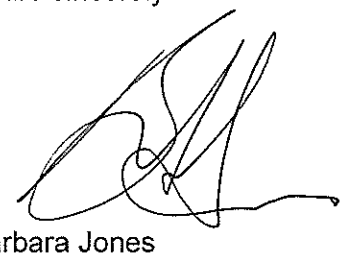
The department has an active audit program for proposals that have been referred under the EPBC Act. The audit program aims to ensure that there is a high degree of compliance with decisions made in relation to those proposals. Please note that your project may be selected for

audit by the department at any time and all related records and documents may be subject to scrutiny. Information about the department's compliance monitoring and auditing program is enclosed.

I have written separately to the Hon Gary Grey AO MP, Minister for Resources and Energy advising him of this decision.

If you have any questions about the referral process or this decision, please contact the project manager, Justin Williams, by email to justin.williams@environment.gov.au, or telephone 02 6275 9492 and quote the EPBC reference number shown at the beginning of this letter.

Yours sincerely



Barbara Jones
Assistant Secretary
North, West & Offshore Assessment Branch
24 June 2013

Notification of
REFERRAL DECISION – not controlled action if undertaken in a particular manner

Mt Mason Direct Shipping Ore Hematite Project, 110 km north-west of Menzies, Western Australia (EPBC 2013/6870).

This decision is made under sections 75 and 77A of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

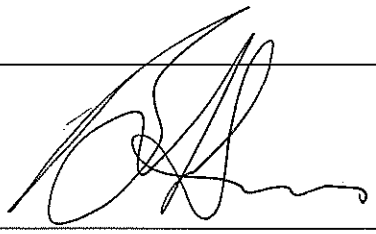
Proposed action

person named in the referral	Jupiter Mines Limited ACN 105 991 740
proposed action	To clear native vegetation for the construction of a Hematite mine, associated infrastructure and roads for the Mt Mason Direct Shipping Ore Hematite Project, 110 km north-west of Menzies, Western Australia. [See EPBC Act referral 2013/6870].

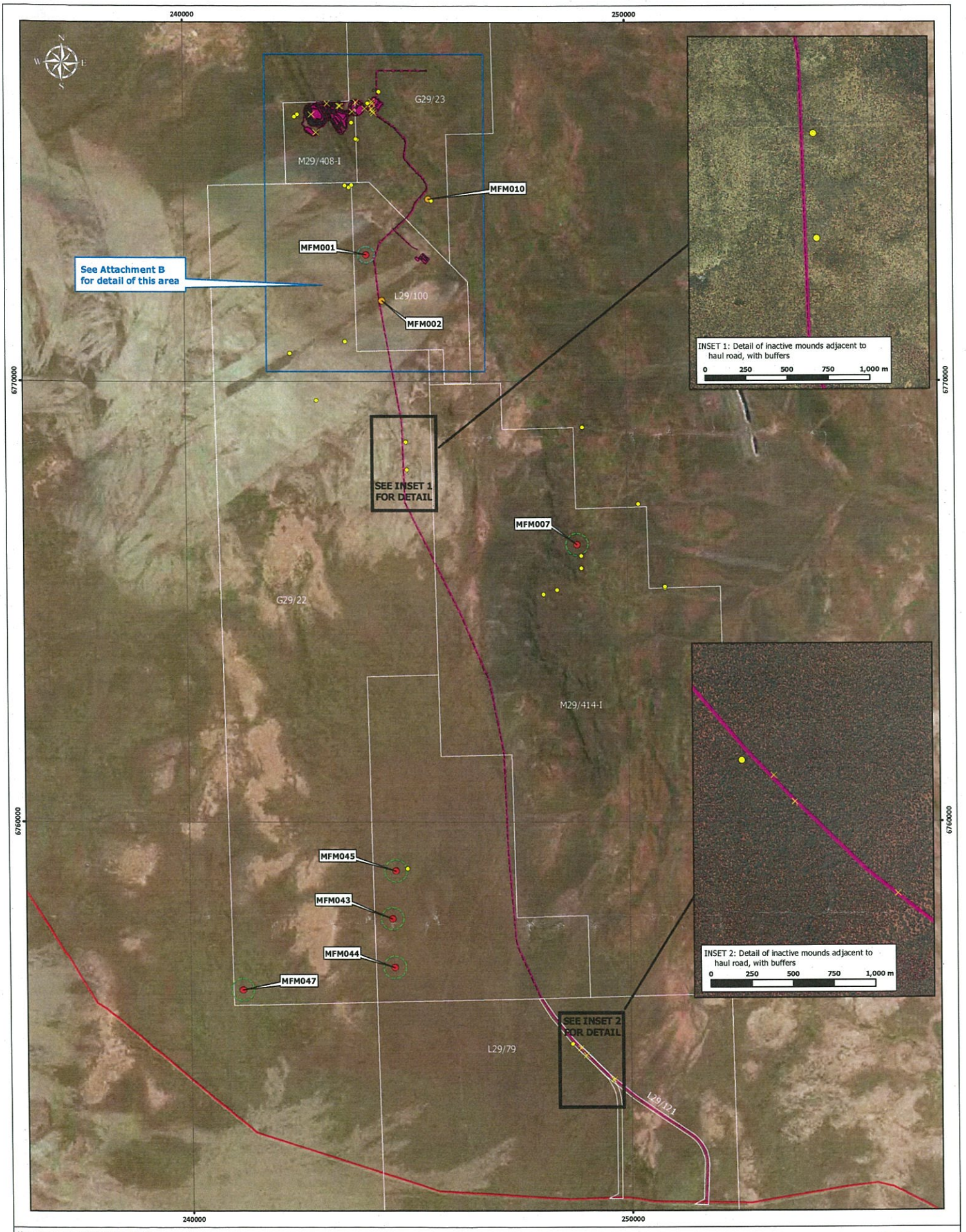
Referral decision: Not a controlled action if undertaken in a particular manner

status of proposed action	The proposed action is not a controlled action provided it is undertaken in the manner set out in this decision.

Person authorised to make decision

Name and position	Barbara Jones Assistant Secretary North, West & Offshore Assessment Branch
Signature	
date of decision	24 June 2013

manner in which proposed action must be taken	The following measures must be taken to avoid significant impacts on: • Listed threatened species and communities (sections 18 & 18A) • Listed migratory species (sections 20 & 20A) o Malleefowl (*Leipoa ocellata*) – Vulnerable 1. Clearing must not exceed 115 ha as outlined in section 1.4 of the referral at page 7. 2. **Construction** activities must not be undertaken within a 250 m buffer radius of active Malleefowl mounds (with the exception of MFM001 being 185 m) as shown in Attachment A and Attachment B. 3. Inactive Malleefowl mounds outside the **development footprint** to be retained must have a 50 m buffer radius as shown in Attachment A and Attachment B. 4. Prior to **construction** the **development footprint** must contain fire trails for the safe transit of fire fighting vehicles to mitigate the effects of advancing fires. 5. Prior to **construction** 'Malleefowl Ahead' warning signs and advisory speed limit signs, must be installed along **main access roads** within the **development footprint**.
	Definitions **Construction** - includes any preparatory works required to be undertaken including clearing vegetation, the erection of any onsite temporary structures and the use of heavy duty equipment for the purpose of breaking the ground for buildings or infrastructure relating to the mine. **Development footprint** – means areas outlined as development footprint in Attachment A and Attachment B. **Main access roads -** Any roads that are located within the development footprint, and are not public roads, and are used for the purpose of the action.



Malleefowl mounds - status (Total:50)

- Active, to be retained (6)
- Inactive <20yrs, to be retained (2) with a 50m buffer
- Inactive >20yrs, to be retained (26) with a 50m buffer
- Inactive >20yrs, to be cleared (16)

Buffers

- 250 m
- 185 m
- Development Footprint
- Proposed Haul/internal road
- Other proposed infrastructure
- Monzies-Sandstone Rd (existing)

Attachment A: Malleefowl mounds - overview

0 1 2 3 4 5 km

1:75,000

Jupiter Mines Limited

Coordinates are GDA94 MGA zone 51.
Produced 20/06/2013.
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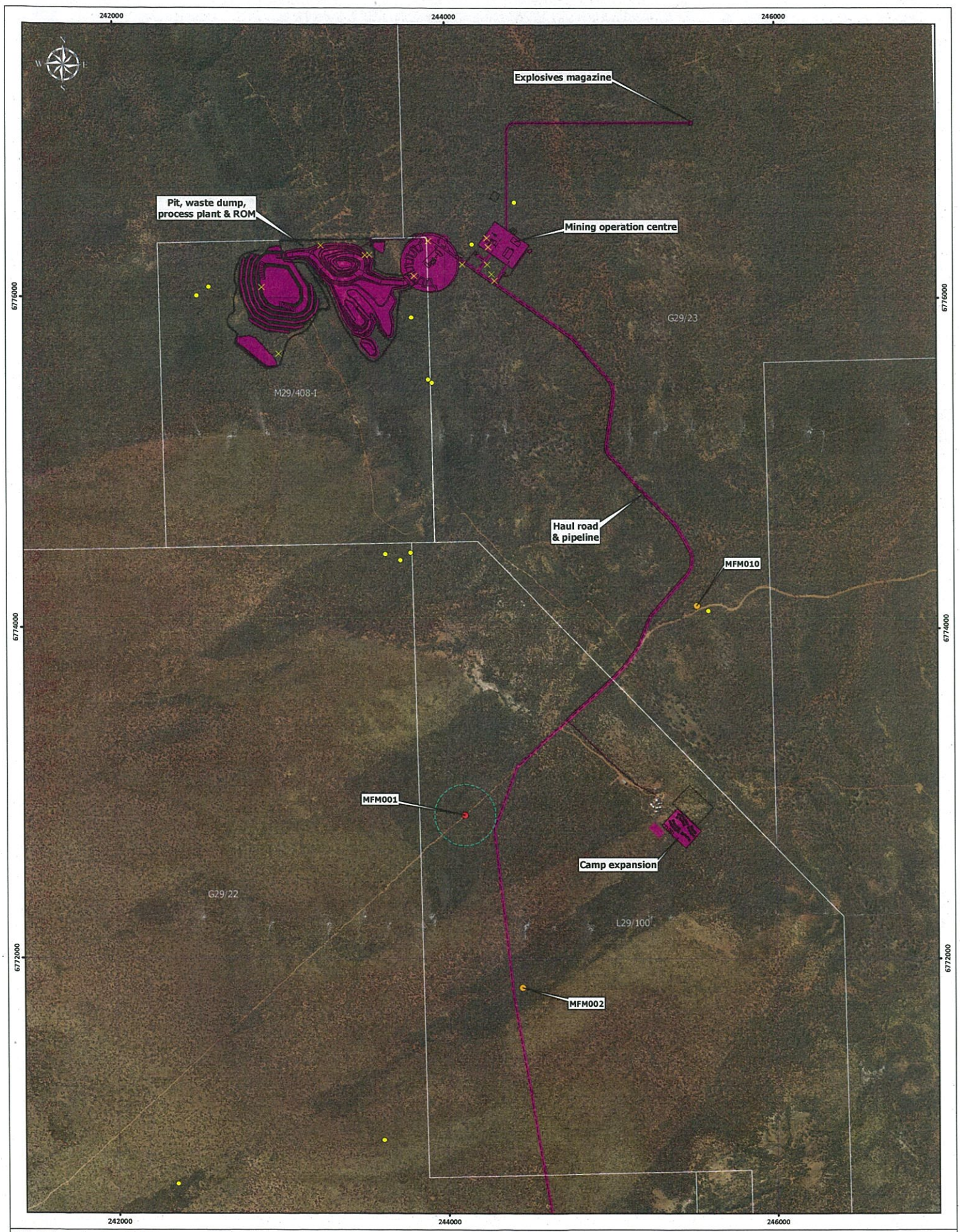
2013-153a - email version



Malleefowl mounds - status (Total:50)

- Active, to be retained (6)
- Inactive <20yrs, to be retained (2) with a 50m buffer
- Inactive >20yrs, to be retained (26) with a 50m buffer
- Inactive >20yrs, to be cleared (16)

Buffers

- 250 m
- 185 m
- Haul/internal road
- Other proposed infrastructure
- Development Footprint

Attachment B: Malleefowl mounds-main project area

0 250 500 750 1,000 m

1:20,000

Jupiter Mines Limited

Coordinates are GDA94 MGA zone 51.
Produced 20/06/2013.
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2013-153b

Australian Government
Department of Sustainability, Environment, Water, Population and Communities

December 2011

COMPLIANCE MONITORING AND AUDITING

This fact sheet provides an overview of the compliance monitoring and auditing program in place for projects referred under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and permits granted under the *Environment Protection (Sea Dumping) Act 1981* (the Sea Dumping Act).

What is the EPBC Act?

The EPBC Act is Australia's key national environment law. Under the EPBC Act, proposals which are likely to have a significant impact on matters of national environmental significance (NES) must be referred, assessed, and a decision made by the Minister or his delegate on whether to approve the proposal. For more information about the EPBC Act environment assessment process refer to www.environment.gov.au/epbc/publications/pubs/assessment-process.pdf

What is the Sea Dumping Act?

The Sea Dumping Act regulates the loading and dumping of waste at sea. The Sea Dumping Act fulfils Australia's international obligations under the London Protocol to prevent marine pollution by dumping of wastes and other matter.

Permits are required from the department for all ocean disposal activities, which include:

- dredging
- the creation of artificial reefs
- dumping of vessels, platforms or other man-made structures
- burials at sea

For more information about the Sea Dumping Act refer to www.environment.gov.au/coasts/pollution/dumping/act.html.

What is the monitoring and audit program for?

The department has implemented a program of monitoring and auditing projects that have been referred under the EPBC Act and the Sea Dumping Act to ensure they are complying with their approval/permit conditions or requirements and the legislation.

Monitoring and compliance audits aim to ensure projects with the potential to impact on nationally protected matters are implemented as planned. Monitoring and compliance audits help the Australian Government to understand how well conditions/requirements are being understood and applied, and contribute to improving the effectiveness of the department's operations.

Why monitor compliance?

The aim of monitoring compliance is to gather information on levels of compliance; to communicate the findings; and, if necessary, to recommend appropriate corrective or enforcement action.

Inspections are part of the department's monitoring regime. Monitoring also involves regular contact with project personnel to ensure projects are in line with Australian Government environmental requirements.

What is a monitoring inspection?

A monitoring inspection is less formal and less extensive than an audit and involves a site visit to ensure the project complies with the set conditions or any requirements that can be readily assessed on site. Usually a monitoring inspection will not involve a formal review of documentation and records. By intervening early it is less likely that serious non-compliance issues will arise inadvertently.

Monitoring also demonstrates to the community that there are systems in place for measuring and improving compliance, and increases community confidence in the regulatory system.

What is a compliance audit?

A compliance audit is an objective assessment of a project's compliance against selected criteria. Projects are audited against the conditions or requirements that were set when the project was approved (under the EPBC Act) or the permit granted (under the Sea Dumping Act).

A compliance audit usually takes the form of a desktop document review followed by a site inspection, if necessary. In some cases, the document review provides the department with enough information to verify that a project is compliant with conditions or requirements.

If your project is selected for an inspection or an audit, you will be contacted by a departmental officer who will outline the process and explain any requirements.

Who will be monitored and audited?

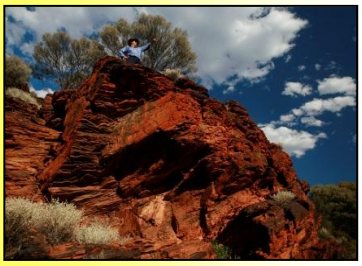
Monitoring and auditing is carried out on projects across all areas including mining and energy, government, transport, ports and marine, urban development, tourism and recreation. Projects can be chosen for audit based on either a random selection process or a risk-focused selection process. Any project that has been referred under the EPBC Act or the Sea Dumping Act can be selected for audit.

All audit report summaries are posted on the department's website. The results of audits may also be publicised through the general media. This is to encourage best practice behaviour within the regulated community.

Further information

For further information on the monitoring and audit program, please contact:

The Director, Monitoring and Audit Section
Department of Sustainability, Environment, Water, Population and Communities
GPO Box 787
CANBERRA ACT 2601
T 02 6274 1111
F 02 6274 1878
E post.approvals@environment.gov.au
W www.environment.gov.au



Jupiter Mines Limited

Mt Mason
DSO Hematite Project

EPBC Referral
and Supporting Documents

May 2013

Australian Government
Department of Sustainability, Environment, Water, Population and Communities

Referral of proposed action

What is a referral?

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides for the protection of the environment, especially matters of national environmental significance (NES). Under the EPBC Act, a person must not take an action that has, will have, or is likely to have a significant impact on any of the matters of NES without approval from the Australian Government Environment Minister or the Minister's delegate. (Further references to 'the Minister' in this form include references to the Minister's delegate.) To obtain approval from the Environment Minister, a proposed action should be referred. The purpose of a referral is to obtain a decision on whether your proposed action will need formal assessment and approval under the EPBC Act.

Your referral will be the principal basis for the Minister's decision as to whether approval is necessary and, if so, the type of assessment that will be undertaken. These decisions are made within 20 business days, provided that sufficient information is provided in the referral.

Who can make a referral?

Referrals may be made by or on behalf of a person proposing to take an action, the Commonwealth or a Commonwealth agency, a state or territory government, or agency, provided that the relevant government or agency has administrative responsibilities relating to the action.

When do I need to make a referral?

A referral must be made for actions that are likely to have a significant impact on the following matters protected by Part 3 of the EPBC Act:

- World Heritage properties (sections 12 and 15A);
- National Heritage places (sections 15B and 15C);
- Wetlands of international importance (sections 16 and 17B);
- Listed threatened species and communities (sections 18 and 18A);
- Listed migratory species (sections 20 and 20A);
- Protection of the environment from nuclear actions (sections 21 and 22A);
- Commonwealth marine environment (sections 23 and 24A);
- Great Barrier Reef Marine Park (sections 24B and 24C);
- The environment, if the action involves Commonwealth land (sections 26 and 27A), including:
  - actions that are likely to have a significant impact on the environment of Commonwealth land (even if taken outside Commonwealth land); and
  - actions taken on Commonwealth land that may have a significant impact on the environment generally.
- The environment, if the action is taken by the Commonwealth (section 28); and
- Commonwealth Heritage places outside the Australian jurisdiction (sections 27B and 27C).

You may still make a referral if you believe your action is not going to have a significant impact, or if you are unsure. This will provide a greater level of certainty that Commonwealth assessment requirements have been met.

To help you decide whether or not your proposed action requires approval (and therefore, if you should make a referral), the following guidance is available from:

- the Policy Statement titled Significant Impact Guidelines 1.1 – Matters of National Environmental Significance. Additional sectoral guidelines are also available.
- the Policy Statement titled Significant Impact Guidelines 1.2 - Actions on, or impacting upon, Commonwealth land, and actions by Commonwealth agencies.
- the interactive map tool (enter a location to obtain a report on what matters of NES may occur in that location).

Can I refer part of a larger action?

In certain circumstances, the Minister may not accept a referral for an action that is a component of a larger action and may request the person proposing to take the action to refer the larger action for consideration under the EPBC Act (Section 74A, EPBC Act). If you wish to make a referral for a staged or component referral, read 'Fact Sheet 6 Staged Developments/Split Referrals' and contact the Referral Business Entry Point (1800 803 772).

Do I need a permit?

Some activities may also require a permit under other sections of the EPBC Act or another law of the Commonwealth. Information is available on the Department's web site.

Is your action in the Great Barrier Reef Marine Park?

If your action is in the Great Barrier Reef Marine Park it may require permission under the *Great Barrier Reef Marine Park Act 1975* (GBRMP Act). If a permission is required, referral of the action under the EPBC Act is deemed to be an application under the GBRMP Act (see section 37AB, GBRMP Act). This referral will be forwarded to the Great Barrier Reef Marine Park Authority (the Authority) for the Authority to commence its permit processes as required under the Great Barrier Reef Marine Park Regulations 1983. If a permission is not required under the GBRMP Act, no approval under the EPBC Act is required (see section 43, EPBC Act). The Authority can provide advice on relevant permission requirements applying to activities in the Marine Park.

The Authority is responsible for assessing applications for permissions under the GBRMP Act, GBRMP Regulations and Zoning Plan. Where assessment and approval is also required under the EPBC Act, a single integrated assessment for the purposes of both Acts will apply in most cases. Further information on environmental approval requirements applying to actions in the Great Barrier Reef Marine Park is available from http://www.gbrmpa.gov.au/ or by contacting GBRMPA's Environmental Assessment and Management Section on (07) 4750 0700.

The Authority may require a permit application assessment fee to be paid in relation to the assessment of applications for permissions required under the GBRMP Act, even if the permission is made as a referral under the EPBC Act. Further information on this is available from the Authority:

Great Barrier Reef Marine Park Authority
2-68 Flinders Street PO Box 1379
Townsville QLD 4810
AUSTRALIA
Phone: + 61 7 4750 0700
Fax: + 61 7 4772 6093
www.gbrmpa.gov.au

Do I have to pay for my referral or assessment / what are the fees?

Currently the department does not impose fees for environmental impact assessments referred and assessed under the EPBC Act. However, fees are proposed as part of cost recovery reforms to the EPBC Act. The commencement of cost recovery is subject to an amendment Bill being passed by Parliament and the making of regulations. Further details on the proposed cost recovery arrangements can be found in the draft EPBC Act Cost Recovery Impact Statement which is available at http://www.environment.gov.au/epbc/publications/consultation-draft-cost-recovery.html.

The department will inform you of your liability for potential fees prior to the introduction of cost recovery arrangements. Cost recovery arrangements will only apply to proposed actions referred to the department after 8 May 2012.

Your proposed action may be subject to fees for environmental impact assessments if:

• Your referral is determined a controlled action and is still undergoing assessment under the EPBC Act at the commencement of cost recovery. Fees will only apply to the assessment work undertaken by the department after the commencement of cost recovery; and/or

• You submit an action management plan for approval of the Minister after the commencement of cost recovery. Please note this will only apply if an action management plan is listed as a condition of the approval decision under the EPBC Act.

There will be no retrospective charging for the stages of assessment initiated before cost recovery commences. Fees will only apply to those stages of the assessment that occur after cost recovery commences.

What information do I need to provide?

Completing all parts of this form will ensure that you submit the required information and will also assist the Department to process your referral efficiently. If a section of the referral document is not applicable to your proposal enter N/A.

You can complete your referral by entering your information into this Word file.

Instructions

Instructions are provided in blue text throughout the form.

Attachments/supporting information

The referral form should contain sufficient information to provide an adequate basis for a decision on the likely impacts of the proposed action. You should also provide supporting documentation, such as environmental reports or surveys, as attachments.

Coloured maps, figures or photographs to help explain the Project and its location should also be submitted with your referral. Aerial photographs, in particular, can provide a useful perspective and context. Figures should be good quality as they may be scanned and viewed electronically as black and white documents. Maps should be of a scale that clearly shows the location of the proposed action and any environmental aspects of interest.

Please ensure any attachments are below two megabytes (2mb) as they will be published on the Department's website for public comment. To minimise file size, enclose maps and figures as separate files if necessary. If unsure, contact the Referral Business Entry Point for advice. Attachments larger than two megabytes (2mb) may delay processing of your referral.

Note: the Minister may decide not to publish information that the Minister is satisfied is commercial-in-confidence.

How do I submit a referral?

Referrals may be submitted by mail, fax or email.

Mail to:

Referral Business Entry Point
Environment Assessment Branch
Department of Sustainability, Environment, Water, Population and Communities
GPO Box 787
CANBERRA ACT 2601

If submitting via mail, electronic copies of documentation (on CD/DVD or by email) are appreciated.

Fax to: 02 6274 1789

- Faxed documents must be of sufficiently clear quality to be scanned into electronic format.
- Address the fax to the mailing address, and clearly mark it as a 'Referral under the EPBC Act'.
- Follow up with a mailed hardcopy including copies of any attachments or supporting reports.

Email to: epbc.referrals@environment.gov.au

- Clearly mark the email as a 'Referral under the EPBC Act'.
- Attach the referral as a Microsoft Word file and, if possible, a PDF file.
- Follow up with a mailed hardcopy including copies of any attachments or supporting reports.

What happens next?

Following receipt of a valid referral (containing all required information) you will be advised of the next steps in the process, and the referral and attachments will be published on the Department's web site for public comment.

The Department will write to you within 20 business days to advise you of the outcome of your referral and whether or not formal assessment and approval under the EPBC Act is required. There are a number of possible decisions regarding your referral:

The proposed action is NOT LIKELY to have a significant impact and does NOT NEED approval

No further consideration is required under the environmental assessment provisions of the EPBC Act and the action can proceed (subject to any other Commonwealth, state or local government requirements).

The proposed action is NOT LIKELY to have a significant impact IF undertaken in a particular manner

The action can proceed if undertaken in a particular manner (subject to any other Commonwealth, state or local government requirements). The particular manner in which you must carry out the action will be identified as part of the final decision. You must report your compliance with the particular manner to the Department.

The proposed action is LIKELY to have a significant impact and does NEED approval

If the action is likely to have a significant impact a decision will be made that it is a *controlled action*. The particular matters upon which the action may have a significant impact (such as World Heritage values or threatened species) are known as the *controlling provisions*.

The controlled action is subject to a public assessment process before a final decision can be made about whether to approve it. The assessment approach will usually be decided at the same time as the controlled action decision. (Further information about the levels of assessment and basis for deciding the approach are available on the Department's web site.)

The proposed action would have UNACCEPTABLE impacts and CANNOT proceed

The Minister may decide, on the basis of the information in the referral, that a referred action would have clearly unacceptable impacts on a protected matter and cannot proceed.

Compliance audits

If a decision is made to approve a project, the Department may audit it at any time to ensure that it is completed in accordance with the approval decision or the information provided in the referral. If the Project changes, such that the likelihood of significant impacts could vary, you should write to the Department to advise of the changes. If your project is in the Great Barrier Reef Marine Park and a decision is made to approve it, the Authority may also audit it. (See "*Is your action in the Great Barrier Reef Marine Park,"* p.2, for more details).

For more information

- call the Department of Sustainability, Environment, Water, Populations and Communities Community Information Unit on 1800 803 772 or
- visit the web site www.environment.gov.au/epbc

All the information you need to make a referral, including documents referenced in this form, can be accessed from the above web site.

Referral of proposed action

Project title: **Mt Mason Hematite DSO Project**

1 Summary of proposed action

1.1 Short description

Jupiter Mines Limited's (Jupiter) Central Yilgarn Iron Ore Project (CYIP) is located approximately 110 km northwest of Menzies and covers approximately 490 km^2. The CYIP consists of three distinct project areas; Mount Ida, Mount Mason and Mount Alfred. This EPBC Act referral relates to the Mt Mason Hematite DSO Project (the Project) (Figure 1). The Project is 100% owned and managed by Jupiter.

The Project will involve mining a high grade hematite ore over approximately 5 years, with an operational footprint of approximately 120 ha, and clearing footprint of approximately 115ha. Ore will be crushed/screened at the plant on site to produce a fines-only iron ore product with a particle size of 6.3 mm. The product will be hauled by road trains from the site to a railway siding, then by train to the Esperance Port.

The project is estimated to produce 10 million tonnes of hematite, using open cut mining at two pits, during operational years. The mining method used will be conventional drill, blast, load and haul with processing being limited to crushing for size separation only. Dewatering is expected to occur in year two of operations, when groundwater is predicted to intersect the pit. Dewatering effluent will be used for dust suppression on roads around the mine.

Infrastructure requirements will include: ROM pad, workshop and hardstand areas, roads, fuel storage, explosives magazine, administrative building, laboratory, wastewater treatment facility, reverse osmosis plant, landfill facility, bioremediation plant, and camp expansion.

The scope of this EPBC Referral covers proposed mining related activities and transport up to the Menzies-Sandstone Road intersection (Figure 2).

Approvals for the rail siding and selected export option will be sought separately from relevant authorities.

1.2 Latitude and longitude

The boundary points are shown on Figure 3.

Aspect	Point	Latitude			Longitude		
		Degrees	Minutes	Seconds	Degrees	Minutes	Seconds
Mine Pit and associated infrastructure	1	-29°	5'	53.9124"	120°	23'	52.2342"
	2	-29°	8'	57.2238"	120°	23'	52.2342"
	3	-29°	8'	57.2238"	120°	21'	18.3888"
	4	-29°	5'	53.9124"	120°	21'	18.3888"
Haul Road Section 1	5	-29°	8'	57.2238"	120°	22'	12.435"
	6	-29°	8'	57.2238"	120°	22'	23.7426"
	7	-29°	11'	54.7404"	120°	22'	43.2726"
	8	-29°	11'	54.7404"	120°	22'	31.965"
Haul Road Section 2	8	-29°	11'	54.7404"	120°	22'	31.965"
	9	-29°	11'	54.7044"	120°	23'	15.9174"
	10	-29°	18'	10.0866"	120°	24'	52.7112"
	12	-29°	18'	10.0866"	120°	24'	8.7474"
Haul Road Section 3	11	-29°	20'	34.8462"	120°	26'	23.7222"
	12	-29°	18'	10.0866"	120°	24'	8.7474"
	13	-29°	18'	10.0866"	120°	25'	2.8596"
	14	-29°	20'	34.8462"	120°	27'	17.8308"

1.3 Locality and property description

The Project is situated in the Shire of Menzies, Goldfields district approximately 100 km northwest of Menzies of Western Australia (WA) (Figure 1). The Project is located within the northern portion of the Mount Ida Greenstone Belt. Land use in the area is predominantly pastoral, although exploration and mining activities occur in the vicinity of the Project area.

1.4 Size of the development footprint or work area (hectares)

The Project footprint will be approximately 120 ha.

Activity	Approximate Disturbance Area (Ha)
Main pit - (includes 10 m buffer)	20.23
Secondary pit - southern pod (includes 10 m buffer)	1.03
Waste rock dump	18.11
ROM pad	9.98
Mining Operations Centre (MOC) compound	4.40
Road corridor	51.11
Pipeline corridor	1.56
Dust suppression turkey's nest	0.02
Pit dewatering overflow pond	0.04
Explosives magazine	0.04
Camp expansion - accommodation	2.75
Camp expansion – Sewage irrigation Area*	5.45
Surface water management - ponds & bunds	3.77
Abandonment bund	1.17
TOTAL	**119.66**

*Note: No clearing required for camp sewage effluent sprayfield (5.45 ha)

1.5 Street address of the site

Not applicable.

1.6 Lot description

The Project will be located within tenements as detailed in the table below.

Tenement	Mining domain	Holder	Area (ha)	Status	Grant date	Expiry date
M29/408 - I	Pit Waste dump	Jupiter Mines Limited	300	Granted	28/11/2007	27/11/2028
M29/414	Haul Road	Jupiter Mines Limited	6,461	Granted	25/11/2011	24/11/2032
G29/22	Haul road	Jupiter Mines Limited	9.63	Granted	06/09/2012	05/09/2033
G29/23	Processing plant Mine operation centre Stockpiles Explosives magazine Access roads Power generation Power distribution Communication facilities Fuel storage and loadout Workshop Warehouse Water storage and distribution Water pipeline from borefield Solid waste disposal facilities Domestic waste water treatment Administration office Weighbridge	Jupiter Mines Limited	1,256.7	Granted	07/02/2013	06/02/2034

Tenement	Mining domain	Holder	Area (ha)	Status	Grant date	Expiry date
L29/79	Mt Mason Haul road connecting G29/22 to Menzies-Sandstone Road Haul road	Jupiter Mines Limited	6,886	Granted	24/08/2010	23/08/2031
L29/100	Camp	Jupiter Mines Limited	775	Granted	11/11/2011	10/11/2032
L29/121	Mt Mason Haul road connecting G29/22 to Menzies-Sandstone Road Haul road	Jupiter Mines Limited	64.3	Pending		
Total Area			**15,752.63**	n/a		

1.7 Local Government Area and Council contact (if known)

The Project is located within the Shire of Menzies.

Contact details:

Peter Crawford
CEO Shire of Menzies
PO Box 2, Menzies WA 6436
Ph: 9024 2041
Fax: 9024 2110
Mob: 0409 114 509
Email: ceo@menzies.wa.gov.au

1.8 Time frame

Production is scheduled to commence in quarter 2 of 2014 with a Life of Mine (LOM) of approximately 5 years.

1.9	**Alternatives to proposed action** Were any feasible alternatives to taking the proposed action (including not taking the action) considered but are not proposed?		No
		✔	Yes Alternative haul road options have been considered (see details in Section 2.2).
1.10	**Alternative time frames etc** Does the proposed action include alternative time frames, locations or activities?	✔	No
			Yes, you must also complete Section 2.3. For each alternative, location, time frame, or activity identified, you must also complete details in Sections 1.2-1.9, 2.4-2.7 and 3.3 (where relevant).
1.11	**State assessment** Is the action subject to a state or territory environmental impact assessment?	✔	No
			Yes, you must also complete Section 2.5
1.12	**Component of larger action** Is the proposed action a component of a larger action?	✔	No
			Yes, you must also complete Section 2.7

1.13	**Related actions/proposals** Is the proposed action related to other actions or proposals in the region (if known)?	✔ 	No Yes, provide details:
1.14	**Australian Government funding** Has the person proposing to take the action received any Australian Government grant funding to undertake this project?	✔ 	No Yes, provide details:
1.15	**Great Barrier Reef Marine Park** Is the proposed action inside the Great Barrier Reef Marine Park?	✔ 	No Yes, you must also complete Section 3.1 (h), 3.2 (e)

2 Detailed description of proposed action

2.1 Description of proposed action

2.1.1 Mining and Ore Processing

Hematite mineralisation at the Mt Mason Project is associated with Banded Iron Formation (BIF). Ore exploitation will involve conventional open cut mining of two open pits (Main pit and Southern pod), estimated to contain 10 Mt, using conventional drill and blast operation at anticipated 10 m bench intervals. All areas will be drilled and blasted using conventional blasting techniques and typical pattern sizes for the expected rock conditions. Through the 5 year Life of Mine (LOM), approximately 31 Mt of material will be removed from the Mt Mason pits, including 9.3 Mt of ore and 21.7 Mt of waste.

The ore material will be transferred onto a Run of Mine (ROM) pad via haul trucks and sorted into stockpiles of specific grade (primarily Fe%, SiO_2%, Al_2O_3% and P%). The ROM will include six finger shaped stockpiles (three located either side of the crusher) with a capacity of 20 kt per stockpile and a combined capacity of 120 kt. Ore will then be selectively reclaimed from the ROM stockpiles for crushing and screening.

It is predicted that by year 2 of operations, mining will occur below the water table requiring open pit dewatering. Groundwater will be abstracted from 6 - 8 dewatering bores located around the periphery of the pit. Preliminary modelling indicates that the flow into the pit will range from 7 L/s to 15 L/s. The presence of a fractured rock aquifer at Mt Mason presents confined characteristics and therefore the estimated value of 7 L/s for the long-term flow into the pit is considered representative of Mt Mason. Water from the pit-sump will be pumped directly to the turkeys nest located at the mining operations centre (MOC), which will be used for dust suppression.

Jupiter has considered a number of options for the ore handling and processing circuit. The exact design specification has yet to be finalised and will be dictated by a number of factors including supply specifications, market economics, financial and engineering feasibility considerations to be adopted in the detailed design process.

Notwithstanding, the following description presents the most likely design scenario and where the detailed design process is likely to result in modifications to the process and infrastructure, the changes are not expected to increase the potential environmental impacts, nor result in the need to increase the amount of applicable unconditional performance bonds for relevant tenements. Similarly, sufficient mine closure provisioning and resources will be presented in the Mine Closure Plan to ensure that the site is fully decommissioned and rehabilitated at the end of the mine life.

In general, ROM ore will be blended and directed to a primary crusher, then dry screened, further crushed and final screened to a fines only iron ore product with particle sizes of 6.3 mm. This crushing and screening circuit will operate up to 250 tonnes/hour to generate a nominal annual production target of 2 Mtpa.

No beneficiation process is required to achieve the desired grade for sale of product. Feed grade is expected to be a minimum of 59.9% Fe with alumina plus silica content less than 10%.

It is envisaged that the process plant will be owned and operated by a contractor following a competitive tender process.

Opportunities to increase production to 3 Mtpa will be subject to further feasibility assessments and will be the subject of an amendment to approvals if pursued. Similarly, should market opportunities arise for the generation of low grade and lump product, an addendum to approvals will be pursued.

2.1.2 Blasting

A magazine storage facility will be also required for the storage of explosives and detonators located to the north of the MOC (Figure 2).

A separate access road will be established linking the magazine to the MOC.

The magazine will be maintained in accordance with the *Dangerous Goods Safety Act 2004*, *Dangerous Goods Safety (Explosives) Regulations 2007* and the relevant Australian Standards.

2.1.3 Mining operations centre and support infrastructure

The MOC will include an administration building, emergency service facilities, crib room, ablutions and heavy and light vehicle parking.

A heavy vehicle workshop and warehouse will be located at the MOC to service the mining fleet. Heavy and light vehicle washdown facilities will be located adjacent to the heavy vehicle workshop. Surface drainage from

workshop and washdown facilities will be designed and installed to allow safe working environments and treatment of potentially contaminated runoff prior to discharge.

A bulk-fuel storage facility will be installed at the MOC with fuel stored in double-skinned, self-bunded tanks with an approximate combined capacity of 660,000 litres. Refuelling pads will be constructed adjacent to the fuel storage tanks, where applicable, and bunded accordingly. Waste oil from the site will be stored in a tank and removed from site for recycling by a licensed collection service.

2.1.4 Transport, Haul Roads and Access Roads

A haul road will be constructed from the pits to the ROM, stockpiles and waste rock dumps and from the product stockpile loading area to the Yunndaga rail siding south of Menzies. The siding is not a component of this proposed action. The haul road will have a running width of approximately 18 m (including drainage/bunds) with a distance of 120 km from stockpile to siding. A portion of the required area has been previously cleared.

The product will be hauled by road train from Mt Mason to Yunndaga siding with road trains operating on a daily basis (12 hours a day, 7 days per week) using 14 trucks to complete approximately 56 truck cycles (112 total movements) per day.

Access roads will be developed to link the accommodation and support infrastructure and will be unsealed with a running width of approximately 9 m (13 m including drains).

2.1.5 Water requirements and supply

The Project will require approximately 2.5 GL/yr for its operations. Approximately 95% of the water demand will be for dust control on the unsealed haul and access roads and at the plant, another 4% for conditioning of the product stockpile at the process plant, and the remaining 1% for mining, MOC and camp.

The primary source of water to meet the requirements for the Project will be groundwater from mine dewatering, in accordance with Groundwater Licence GWL 174647 (2). Groundwater will be pumped via a ring main and water supply pipeline (75 mm HDPE pipe) to a large capacity main header tank (200,000 L) located at the MOC.

Relatively minor quantities (70 kL/day) of potable water will be required for drinking, showering, washing and general use. A Water Treatment Plant will include ultra-violet (UV) bacterial disinfection units, to ensure the drinking water is bacteria free and suitable for human consumption.

2.1.6 Power Supply

The Project will require approximately 7 MW of power for its operations (see table below). The power to the mining operations, crushing/screening plant, MOC and expanded accommodation village will be supplied by small, discrete, locally installed diesel generator-based sets sized to suit the local power demand. All the diesel generator sets, other than the one located at the mine-pit drainage sump, will most likely be housed in small secure buildings, to provide security and reduce noise impacts.

Power requirements for the Project

USE	POWER REQUIREMENT
Mine	2 x 1 MW = 2 MW
Process Plant	2 x 1 MW = 2 MW
MOC	1 x 1 MW = 1 MW
Camp	2 x 0.5 MW = 1 MW
Reserve	2 x 0.5 MW = 1 MW
TOTAL	**7 MW**

2.1.7 Accommodation camp

The existing accommodation for 40 personnel, at Camp Cassini, currently includes administration and management offices, mess, cold storage rooms, laundry facilities, stores, accommodation units, recreation areas, power, sewage treatment facilities, parking and light vehicle refuelling areas. This accommodation will be upgraded and expanded to accommodate 140 personnel and will allow housing of construction personnel as well as operational staff.

2.1.8 Workforce

The workforce for the Project is estimated to be 140 personnel for the construction phase and approximately 100 personnel for the operations phase.

2.1.9 Wastewater Treatment

The accommodation village upgrade will include the installation of a fully reticulated sewerage system, including a standard package Waste Water Treatment Plant (WWTP). Disposal of treated grey-water will be via spray fields, located down-slope from the WWTP. Effluent disposal will be in accordance with relevant regulatory guidelines and requirements. The site will be appropriately fenced to prevent stock from entering the spray-field areas.

2.1.10 Refuse Disposal

All waste materials, generated during mining, including putrescible, inert and non-hazardous industrial waste will be disposed of at an onsite landfill facility and periodically covered with waste rock.

The designated landfill will be constructed within the waste rock dump and will be managed according to the *Environmental Protection (Rural Landfill) Regulations 2002*.

2.2 Alternatives to taking the proposed action

All mineral resource projects are constrained by the location of the identified commercially viable resource and characteristics of the orebody.

2.3 Alternative locations, time frames or activities that form part of the referred action

Alternative options for the haul road (Figure 4) have been considered and the constraints of each option are presented in the following table.

ASPECTS/CONSIDERATIONS	OPTION 1 (for assessment under EPBC Act)	OPTION 1a	OPTION 1b	OPTION 1c	OPTION 1d	OPTION 2
HERITAGE	Heritage surveys conclude no direct impacts. However any movement further east at the curve to the tie in to Metzke Road (toward camp) outside surveyed area may impact on nearby heritage site boundaries.	Unknown (not surveyed)	Unlikely impacts, however, widening to the south of the pre-existing Metzke Road may impact on artefact scatter assocaited with the heritgae site near camp.	Unknown (not surveyed)	Unknown (not surveyed)	Heritage surveys show unlikely impacts
IMPACT TO THREATENED FAUNA SPECIES	Fauna surveys show no direct Impacts, and negligible impacts through clearing.	Unknown (not surveyed) but unlikely direct impacts	1 direct impact to existing active Malleefowl mound (within 5 m) of MFM001.	Unlikely direct impacts, higher potential indirect impacts due to larger clearing footprint, although this option keeps outside of existing Malleefowl mound buffer.	Unlikely direct impacts and least indirect impacts through clearing.	3 direct impacts to active Malleefowl Mounds (MFM43, 44 &45) and within 5 m of MFM001. Also potential of indirect impacts (even though clearing area less) and a higher diversity of potential habitat.
IMPACT TO PRIORITY FLORA SPECIES	Flora surveys show unlikely direct impacts	Unknow, but unlikely to be any direct impacts	Unknown, but more likely to be potential impacts to disturbance dependant priority flora (due to pre-existing track)	Unknown, but unlikely to be any direct impacts	Unknown, but unlikely to be any direct impacts	Flora surveys indicate sand plain vegetation community (not present in option 1) presents greater potential risk to associated priority species.
CLEARING AREA (hectares)	48.8	49.1	50.8	52.2	33.5	36.9
SAFETY (qualitative ranked from 1 safest to 6 least safe option)	1	2	4	3	6	5

ASPECTS/CONSIDERATIONS	OPTION 1 (for assessment under EPBC Act)	OPTION 1a	OPTION 1b	OPTION 1c	OPTION 1d	OPTION 2
Assessment of SENSITIVE RECEIVERS for Option 1, 1a, 1b, 1c	Noise, dust & vibration modelling show negligible impact to nearby sensitive receivers (camp) Note any movement further east towards camp will likely cause unacceptable levels to camp personnel if unmitigated.	Noise, dust & vibration modelling show negligible impact to nearby sensitive receivers (camp)	Noise, dust & vibration modelling show negligible impact to nearby sensitive receivers (camp)	Noise, dust & vibration modelling show negligible impact to nearby sensitive receivers (camp)	Direct Impact (1.9 km from tie in) and trucks would go directly past residence. Also pastoralist will not allow shared access of existing track.	Direct Impact (3.9 km from tie in) and trucks would go directly past residence.
WATER (qualitative ranked form 1 least water use to 6 most water use)	1	2	4	3	5 (more dust suppression required on Menzies Sandstone especially past sensitive receiver).	6 (more dust suppression required on Menzies Sandstone especially past sensitive receiver).
FUEL EFFICIENCY /GREENHOUSE GAS EMMISIONS (qualitative ranked form 1 for least emissions to 6 most emissions)	1	2	4	3	5 (note longer distance to tie in on Menzies Sandstone and numerous curves).	6 (note longer distance to tie in on Menzies Sandstone).
OVERALL COMMENTS	Least overall impact & Preferred Option.	Curve not ideal from safety point of view, but the next most likely preferred option.	Least preferred option due to impact to Malleefowl Mound and increased safety risk with 4 way intersection on existing track.	Increased safety risk with road crossing on existing track, however outside of existing Malleefowl mound buffer. Would need to be surveyed to determine impacts accurately.	Not practicable option due to sensitive receiver. Also most undesirable safety wise. Least likely option.	Highest potential impacts overall (without mitigation). If more surveys and re-alignment undertaken this could be a viable option – however economically not viable at this stage.

2.4 Context, planning framework and state/local government requirements

Legislation	Approval
Environmental Protection Act 1986 (EP Act) (WA) And *Environmental Protection Regulations 2004*	The EP Act is the primary State environmental legislation that governs environmental impact assessment and protection in WA. Approvals are required under Part V of the EP Act (Environmental Regulation). A Works Approval and Licence will be required for the waste water treatment plant, landfill facility and crushing and screening plant from the Department of Environment and Conservation (DEC). A native vegetation clearing permit (NVCP) will be required under Part V from the Department of Mines and Petroleum (DMP).
Mining Act 1978 (WA)	The Mining Act governs mineral exploration and mining in WA. Approval of a Mining Proposal and Mine Closure Plan will be required from the DMP.
Rights in Water and Irrigation Act 1914 (RIWI Act) (WA)	The RIWI Act, administered by the Department of Water (DoW) governs the management and allocation of water resources in WA. All new groundwater bores require a 26D licence prior to construction of the bore and a 5C licence to extract water from the ore. A permit to interfere with the bed or banks of a watercourse is required for all Projects within a proclaimed surface water area. A licence has been obtained for the abstraction of groundwater (5C; Attachment 2) from the DoW. A permit to interfere with beds or banks will also be sought from the DoW where required.
Aboriginal Heritage Act 1972 (WA)	The *Aboriginal Heritage Act 1972* administered by the Department of Indigenous Affairs (DIA) provides protection for places and objects customarily used by or traditional to the original inhabitants of Australia or their descendants. The Project will be developed to avoid Aboriginal heritage sites and ethnographic sites (one identified), but should impacts be unavoidable DIA approval to disturb the site will be sought under Section 18 of the Act.
Planning and Development Act 2005 (WA)	Planning Approval and a Building Licence will be required from the Shire of Menzies.
Dangerous Goods Safety Act 2004 (WA)	A Licence from the DMP will be required for hydrocarbon, chemical and explosives storage facilities.
Health Act 1911 (WA)	A permit will be required for the construction and operation of a waste water treatment plant through the Shire of Menzies.

Other legislation that may be applicable to the Project includes:

Commonwealth legislation:

- *National Greenhouse and Energy Reporting Act 2007*; and
- *Native Title Act 1993*.

State legislation:

- *Agriculture and Related Resources Protection Act 1976*;
- *Bush Fires Act 1954*;
- *Conservation and Land Management Act 1984*;
- *Contaminated Sites Act 2003*;
- *Heritage of Western Australia Act 1990*;
- *Land Administration (Amendments) Act 1997*;
- *Local Government Act 1995*;
- *Local Government (Miscellaneous Provisions) Act 1960*;
- *Main Roads Act 1930*;
- *Mines Safety and Inspection Act 1994*;
- *Occupational Safety and Health Act 1994*;
- *Public Works Act 1902*;
- *Soil and Land Conservation Act 1945*; and
- *Wildlife Conservation Act 1950*.

A range of policies relevant to the Project and the assessment of environmental impacts include, but are not limited to:

- Australia and New Zealand Environment Conservation Council (ANZECC) and Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) Australian and New Zealand Guidelines for Fresh and Marine Water Quality, 2000;
- Department of Mines and Petroleum and Environmental Protection Authority Guidelines for preparing Mine Closure Plans, 2011;
- DSEWPaC Survey Guidelines for Australia's Threatened Mammals: EPBC Act Survey Guidelines 6.5, 2011;
- DSEWPaC Significant Impact Guidelines 1.1 Matters of National Environmental Significance, 2009;
- Environmental Protection Authority Position Statement No. 3: Terrestrial Biological Surveys as an Element of Biodiversity Protection, 2002;
- Environmental Protection Authority Position Statement No. 7: Principles of Environmental Protection, 2004;
- Environmental Protection Authority Guidance Statement No. 6: Rehabilitation of Terrestrial Ecosystems, 2006;
- Environmental Protection Authority Guidance Statement No. 8: Environmental Noise, 2007;
- Environmental Protection Authority Guidance Statement No. 41: Assessment of Aboriginal Heritage, 2004;
- Environmental Protection Authority Guidance Statement No. 51: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia, 2004;
- Environmental Protection Authority Guidance Statement No. 54: Consideration of Subterranean Fauna in Groundwater and Caves during Environmental Impact Assessment in Western Australia, 2003;
- Environmental Protection Authority Guidance Statement No. 54a (Technical Appendix to Guidance Statement No.54): Sampling Methods and Survey Considerations for Subterranean Fauna in Western Australia, 2003;
- Environmental Protection Authority Guidance Statement No. 56: Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia, 2004; and
- National manual for the Malleefowl Monitoring System: Standards, Protocols and Monitoring Procedures, National Heritage Trust (NHT) Malleefowl Monitoring Project, NHT, 2007.

2.5 Environmental impact assessments under Commonwealth, state or territory legislation

The EP Act is the primary legislation that governs environmental impact assessment and protection in WA. The criteria for referral/assessment under Part IV of the Act (Environmental Impact Assessment) are not triggered by this Project.

A number of environmental surveys and studies have been completed or are proposed to be undertaken.

Baseline Environmental Studies

Baseline Environmental Study	Date of Survey	Study Area	Environmental Consultant	Completed/ Proposed
Level 1 Flora and Vegetation Survey Mt Mason Project	May 2012	Mt Mason Project	Native Vegetation Solutions	Completed
Level 2 Flora and Vegetation Survey Mt Mason Project	October 2011 and March 2012	Mt Mason Project	Native Vegetation Solutions	Completed
Level 2 Fauna Assessment for Mt Mason Project	August/September 2011 and March 2012	Mt Mason Tenement	Keith Lindbeck Associates	Completed
Targeted EPBC Fauna Study	March and April 2012	Mt Mason Tenement and proposed Haul Road	Keith Lindbeck Associates	Completed
Non Process Infrastructure Targeted Malleefowl Survey (Alternative Haul Road option)	October 2012	Alternative Haul Road	GHD	Completed
Subterranean Fauna: Pilot Study at Mt Ida	July 2012	Central Yilgarn Iron Project	Rockwater Pty Ltd	Completed
Mt Ida Water Resources Desktop Study	April 2010	Tenement E29/560 Mt Ida	Coffey	Completed
Mt Mason Feasibility Study Hydrogeology	May 2012	Mt Mason	SRK	Completed
Mt Mason Feasibility Study Surface Water	March 2012	Mt Mason	SRK	Completed
Mt Mason Feasibility Study Surface Water	November 2012	Mt Mason	SRK	Completed
Addendum 3 Mt Mason Feasibility Study 2 Mtpa Restricted Option Update	December 2012	Mt Mason	SRK	Completed
Mt Mason Feasibility Study Geochemistry	November 2012	Mt Mason	SRK	Completed
CYIP Terrestrial Short-Range Endemic Invertebrate Study Level 1	March 2011	CYIP	Outback Ecology	Completed
Mount Mason Terrestrial Vertebrate Fauna Desktop Study	January 2007	Mt Mason	Outback Ecology	Completed
Vegetation & Flora Survey of Mount Mason	May-Sept 2007	Mt Mason	Paul Armstrong & Associates	Completed
Aboriginal Heritage Desktop Analysis – Jupiter Mines Tenements M29/408, M29/414, E29/560, E29/801 and G29/022	June 2011	CYIP	Land Access Solutions	Completed
Report of an ethnographic heritage survey (Wutha Native Title Claimants) & Section 18 consultations: Jupiter Resources Mt Ida & Mt Mason Project Area Northwest of Menzies WA	August 2012	CYIP	Gleason & Associates	Completed
Report of an ethnographic survey of tenement E29/495 Mount Mason, Near Menzies	March 2007	Mt Mason	Western Heritage Research	Completed

Baseline Environmental Study	Date of Survey	Study Area	Environmental Consultant	Completed/ Proposed
Report on a Site Identification Survey with the Wutha Native Title Claimants of Proposed Exploration Drilling around Mt Ida and Mt Mason, Western Australia	December 2006	CYIP	Australian Interaction Consultants	Completed
Report on an anthropological survey of Jupiter Mining Ltd Mount Ida, Mount Mason & haulage road in consultation with the Wongatha Group	July 2012	CYIP	John Cecchi Heritage Management/R& E O'Connor	Completed
Report on an archaeological survey of Jupiter Mining Ltd Mount Ida, Mount Mason & haulage road	August 2012	CYIP	John Cecchi Heritage Management	Completed

2.6 Public consultation (including with Indigenous stakeholders)

Jupiter has undertaken a proactive approach to consultation with both government and non-government stakeholders throughout the development and design stages and will continue to do so throughout the operations where appropriate. Jupiter has consulted with the stakeholders as detailed in the following table.

2.7 A staged development or component of a larger project

This project is not currently part of a larger project, but should development be planned in the future, appropriate environmental, social and economic assessments will be undertaken.

Jupiter is engaged in the exploration and development of mineral resources within the Central Yilgarn area, which includes the exploration and potential mining projects of Mt Mason, Mt Ida and Mt Alfred. At this stage only Mt Mason is a viable project.

Record of Stakeholder Consultation

Stakeholder	Contact	Date	Issues Discussed	Outcomes
Brookfield Rail	Laura Adair	7 September 2012	Preliminary enquiry and request response to our queries re proposed rail crossing at Menzies 52.	Referred to Aurizon for above-ground rail services.
Department of Mine Planning	Julie Futter/Neville Hauge	25 October 2012	Presentation: Project update on exploration activities to date.	Commitment to provide project updates and potentially site visit in future.
	Nick Galton-Fenzi	19 December 2012	Presentation: Draft Mt Mason Mining Proposal.	Query regarding water monitoring being undertaken for baseline levels, confirmed that Jupiter have a groundwater monitoring program in place.
Department of Indigenous Affairs	Simon Keanon	25 January 2012	Project update. DIA suggested we also consult with Goldfields Land & Sea Council.	Confirmation that correct heritage groups are being consulted with.
Department of Sustainability, Environment, Water, Population and Community	Nicole Matthews (Perth) & Mark Hill (Canberra)	3 February 2012	CYIP Project background/initial determination of whether referral under EPBC Act required.	Potential impact appears manageable, so unlikely to be a controlled action but advised to refer.
	Nicole Matthews	21 March 2012	Project update and more detailed discussion related to the EPBC approval process.	Mt Mason to be referred, although unlikely it will be assessed.
	Con Voutas	25 March 2013	Mt Mason presentation and submission of EPBC Referral document including management plan.	Likely not controlled action, possibly in a prescribed manner after some mapping amendments to include an age on mounds – and try and achieve a 50 m buffer for inactive mounds <20 yrs old along with 250 m buffer for active mounds (unless suitable justification).
Goldfields Land and Sea Council	Daniel Jacobs	11 September 2012	Discussion regarding potential new Native Title Claim - Lungkatharra which would affect the Yunndaga portion of our project area. The Lungkatharaa Claim is a few months off being formed. However, the Wongatha Native Title Claimants make up a large portion of the claim so the main representatives are already being consulted with on a regular basis.	Confirmation that Jupiter is consulting with the appropriate people and that the upcoming survey can be conducted by Wongatha representatives in the interim while the native title claim is being developed.
Local Government - Shire of Menzies	Shire President, Gregory Dwyer/Council Meeting	22 October 2012	Presentation by Jupiter giving CYIP update and discussion regarding issues, progress and challenges - particularly transportation to Port and related port access.	Initial meeting with new staff members and commitment to project update in future.
	Shire President, Gregory Dwyer/Council Meeting	Proposed April 2014	Presentation to confirm road use agreement and any secondary approvals/licences required for Mt Mason Project.	Proposed meeting.

Stakeholder	Contact	Date	Issues Discussed	Outcomes
Malleefowl Preservation Group	Susanne Dennings	June 2012 - April 2013	Project background/updates and discussion relating to potential involvement/scoping for Malleefowl surveys. Also numerous discussion regarding setting up a sponsorship/financial contribution towards Lotterywest grant funded CEO position.	An agreement has been made, first $20,000 cheque to be presented in April 2013 – with commitment to ongoing contribution (subject to project status).
Melita Station	Jack Burton	28 September 2012	Proposed gravity survey within lease boundaries.	Notification letter sent.
Morapai Station	Greg Stubbs	13 February 2012	Gave background on project and potential upcoming work with fauna surveys.	Morapai representatives were involved in the Level 2 Fauna surveys and targeted surveys for field assistance.
Norilsk Nickel Cawse Pty Ltd	Michael Behrendt Western Tenement Services)	August - September 2012	Several discussions regarding access agreement for area of overlapping tenement.	Access arrangement developed.
Pastoral Lease - Riverina Station	Don North	June - October 2012	Several discussions regarding access agreement with no issues raised. Able to access lease as required with notification by letter/email.	Able to access lease boundaries with notification letter detailing activities.
Pastoral Lease - Perrinvale Station	Ian Ridley	June - December 2012	Numerous discussions and letters predominantly as per notification of activities/access agreement to operate within lease boundaries.	Able to access lease boundaries with notification letter detailing activities. Ongoing Employment Opportunities.
Pastoral Lease - Sturt Meadows	Paul Axford	September - November 2012	Several discussions notifying Spring surveys/work occurring within lease boundaries. No issues. Able to access lease as required with notification by letter/email.	Able to access lease boundaries with notification letter detailing activities.
Pastoral Lease - Walling Rock Station	Keith Mader	June 2012 - April 2013	Numerous discussion and liaison regarding access agreement. Correspondence primarily involved compensation agreement negotiations.	Able to access lease boundaries with notification letter detailing activities. Compensation agreement. Ongoing Employment Opportunities (subject to project status).
Wongatha Native Title Claimants	Aubrey Lynch	June - March 2013	Numerous discussions regarding survey logistics and also potential employment opportunities. Wongatha have no objection to the CYIP projects if ongoing relationship to manage heritage but no Section 18 required due to avoidance of sites.	Heritage Survey Reports. No Section 18 required due to avoidance of all sites. Commitment to continued consultation and project updates.
Wutha Native Title Claimants	Ron Harrington Smith	June - February 2013	Numerous discussions regarding survey logistics and also potential employment opportunities. Wutha have no objection to the CYIP projects if ongoing relationship to manage heritage but no Section 18 required due to avoidance of sites. Also discussion regarding access to northern water tenements as relates to active Native Title Claim.	Heritage Agreement. Heritage Survey Reports. No Section 18 required due to avoidance of all sites. Commitment to continued consultation and project updates.

3 Description of environment & likely impacts

3.1 Matters of national environmental significance

3.1 (a) World Heritage Properties

Description

No World Heritage Properties occur within the vicinity of the Project.

Nature and extent of likely impact

The Project will not impact on any World Heritage Properties, either directly or indirectly.

3.1 (b) National Heritage Places

Description

No National Heritage Places occur within the vicinity of the Project.

Nature and extent of likely impact

The Project will not impact on any National Heritage Places, either directly or indirectly.

3.1 (c) Wetlands of International Importance (declared Ramsar wetlands)

Description

No Wetlands of International Importance occur within the vicinity of the Project.

Nature and extent of likely impact

The Project will not impact on any Wetlands of International Importance, either directly or indirectly.

3.1 (d) Listed threatened species and ecological communities

Description

Flora

Desktop surveys of publicly available information did not reveal the presence of any threatened flora or threatened ecological communities (TECs), listed under the EPBC Act, within the footprint of the Project.

The following flora surveys relevant to the Project have been undertaken:

- Level 1 Flora and Vegetation Survey of the proposed Mount Mason Haul Road by Native Vegetation Solutions (NVS), May 2012 (Attachment 3); and
- Mt Mason Project, Level 2 Flora and Vegetation Survey: Part 1–October 2011 & Part 2–March 2012 by NVS, Spring 2011 and Autumn 2012 (Attachment 4).

No threatened species were recorded in the Level 1 and Level 2 flora surveys undertaken by NVS in 2011 and 2012, nor were they considered likely to occur (Attachment 3 and 4).

Fauna

The following surveys relevant to the Project and the wider area have been undertaken:

- Level 2 Fauna Survey of the Mt Mason Mining Tenement (M29/408) by Keith Lindbeck Associates in Spring 2011 and Autumn 2012 (Attachment 5);
- Level 2 Fauna Survey of the Mt Ida Mining Tenement (M29/414) by Keith Lindbeck Associates in Spring 2011 and Autumn 2012;
- Targeted EPBC Survey by Keith Lindbeck Associates in Autumn 2012 (Attachment 6); and
- Targeted Malleefowl Survey of Non-process Infrastructure Areas by GHD in Spring 2012 (Attachment 7).

The Level 2 fauna surveys included database searches of publicly available information as part of the desktop survey as well as field surveys in August 2011 and March 2012. A targeted EPBC survey was undertaken by KLA with field surveys carried out in March and April 2012 and a further targeted Malleefowl survey undertaken of a potential haul road option by GHD in Spring 2012 in accordance with the Department of Sustainability, Water, Population and Community (DSEWPaC) guidelines (DSEWPaC, 2010).

The database searches identified two bird species listed as threatened under the EPBC Act and potentially occurring within the Project area. Survey results were used to assess the likelihood of occurrence in the Project area and this is summarised in the table below.

The preferred habitat of the Slender-billed Thornbill (*Acanthiza iredalei iredalei*) is chenopod shrublands that are dominated by Samphire and occasionally adjacent shrublands and mangroves. Given the lack of this habitat in the Mt Mason area or associated haul road, it is unlikely that this species of Thornbill would be present (KLA, 2012a).

Further information on the Malleefowl can be found in the following section.

Threatened Fauna Species

Species	Common Name	EPBC Act Conservation Status	Occurrence
Leipoa ocellata	Malleefowl	Vulnerable	Confirmed
Acanthiza iredalei iredalei	Slender-billed Thornbill	Vulnerable	Not likely to occur[1]

Malleefowl

Malleefowl is listed as vulnerable under EPBC Act and Schedule 1 (rare and likely to become extinct) under the *Wildlife Conservation Act 1950* (WC Act).

Malleefowl are large ground dwelling birds belonging to the Megapodiidae family. The Malleefowl is omnivorous and typically has a large home range in woodlands or shrublands that have a deep layer of leaf litter which is used in building nesting mounds. It occupies semi-arid to arid regions of WA, inhabiting dense shrublands and thickets of Mallee (*Eucalyptus* spp.), Boree (*Melaleuca lanceolata*) and Bowgada (*Acacia linophylla*) (Johnstone, R.E. and Storr, G.M, 1998).

Malleefowl build large mounds of sand, gravel and vegetation 3-5 m wide and over 1 m high in which they incubate their eggs. This is mostly done between autumn and spring as a combined effort of the pair intending to use the mound. Once completed, the male then spends most of his time tending the mound, whereas the female spends most of her time foraging. Nesting mounds utilise heat generated from the fermentation of vegetative material used to create the mound to incubate their eggs (Johnstone, R.E. and Storr, G.M, 1998). The breeding season can extend for up to 11 months. Egg laying usually begins in September and continues until mid to late summer, with eggs laid at five to 17 day intervals (Frith, H.J., 1959). The chicks are capable of leaving the breeding site upon their emergence from the nesting mound and receive no parental care after hatching (Benshemesh, J, 1992; Marchant and Higgins, 1993). They are capable of flying and feeding themselves within 24 hours of their emergence (Priddel and Wheeler, 1994). Following their emergence from nesting mounds, juvenile Malleefowl may disperse widely.

Established pairs and individuals usually remain in the same area throughout the year, and pairs tend to breed in the same general area for many years in succession. The home ranges of individual Malleefowl can vary in size from 0.5 to 4.6 km² and can overlap considerably (Benshemesh, J, 1992).

Malleefowl feed mainly on seeds and other plant material and invertebrates and will feed on locally or seasonally abundant resources.

The Malleefowl was once broadly distributed across the southern half of the Australian continent, but has undergone significant range reduction and now occupy semi-arid regions of southern Australia where mallee eucalypts form the dominant vegetation. In WA, Malleefowl occur as far north as Carnarvon, throughout most of the southwest corner, in much of the inland semi-arid areas and in the coastal strip of mallee south of the Nullabor Plain between Cocklebiddy and Eucla (Benshemesh, 2000).

Clearing of habitat, fox predation and the degradation of habitat by fire and overgrazing by feral livestock has reduced Malleefowl numbers considerably. The fragmentation and isolation of the remaining Malleefowl populations and their habitats (due to extensive clearing) is likely to increase impacts on populations as they are prevented from moving between patches of habitat (KLA, 2012a).

In addition to the 2011 and 2012 Level 2 and targeted EPBC and Malleefowl surveys by KLA and GHD, Jupiter undertook a survey of the explosives magazine and associated access track and the camp expansion areas

[1] KLA, 2012

(<8% of the total Project footprint) to ensure coverage of the entire footprint. During the surveys by KLA, GHD and Jupiter, 54 Malleefowl mounds were identified (figures 5a and 5b), some of which were found outside the Project footprint. Surveys relevant to the Project identified 6 active mounds (Figures 5a and 5b) and 2 inactive mounds that are considered to be less than 20 years old (Attachment 9). The density of active mounds varies dependent on the terrain and between tenements. In the Mt Mason mining tenement (M29/408) the density of active mounds is approximately 1 per 6,000 ha. In the general purpose leases, including the haul road, the terrain is flatter and sandier and densities are approximately 1 per 1,500 ha.

Nature and extent of likely impact

The primary threats to Malleefowl include clearing of habitat, road deaths, fire, predation and grazing and starvation. Threatening processes from the Project include:

- Habitat clearing/disturbance; and
- Disturbance to active nesting mounds.

The majority of vegetation groups within the Project area identified during the flora surveys comprise potential habitat for Malleefowl breeding or foraging. The majority of the inactive malleefowl mounds recorded were located on (KLA, 2012a):

- Mulga over *Eremophila;*
- Mulga over *Eremophila forrestii* (on flats and undulating hills);
- Mulga shrubland with occasional Eucalypts;
- *A.effusiola*/*Eucalyptus* mallee and other mixed shrublands burnt sandplain; and
- *Callitris* with *Eucalyptus* woodland – sandplain.

There are extensive areas of habitat suitable for Malleefowl in and adjacent to the Mt Mason Project and the habitat is not restricted to the Project area (KLA, 2012a). While the survey of the Mt Mason mining area was limited predominantly to the areas proposed for disturbance, the survey of the proposed haul road involved assessment of a larger area than that proposed for disturbance (table below).

Disturbance of vegetation groups along the Mt Mason Haul Road

HAUL ROAD	Area to be disturbed (ha)	Area surveyed No disturbance (ha)
Mulga Shrubland with occasional Eucalypts	14.83	133.46
Mulga woodland- floodplain	14.36	129.22
Mulga shrubland with *Philotheca brucei subsp brucei*	0.47	4.26
Mulga open shrubland- drainage	0.61	5.47
Mulga with *Acacia cockertoniana* and *Acacia ramulosa* var ramulosa tall shrubland over *Olearia humilis* and/or *Hibbertia arcuata* and/or *Prostanthera althoferi* subsp. *althoferi* and/or *Eremophila forrestii* subsp. *forrestii* low shrubland	21.97	197.77
Mulga over mixed shrubland	0.38	3.38
Acacia quadrimarginea/A. cockertoniana open shrubland	2.43	21.85
Acacia effusifolia/Eucalyptus mallee and other mixed shrublands burnt sandplain	12.78	115.05
Acacia effusifolia Shrubland- transitional	0.74	6.67
Callitris with scattered Eucalypt woodland- sandplain	1.03	9.24
Eucalyptus lesouefii open woodland (9a)	0.69	6.20
Eucalyptus salubris woodland (9b)	0.49	4.43
TOTAL	**70.78**	**636.99**

Source: (KLA, 2012a)

At a regional scale the proposed disturbance for the Project represents <0.01% of the vegetation groups present (table below).

Impact of Project on vegetation at a regional scale

Veg Assoc	Description	Mt Mason proposed clearing (ha)	Current extent, WA (ha)	Pre-European Extent, WA (ha)	Remaining (%)	% of Current Extent (WA)
484	Shrublands; jam thicket	0.52	70,235	70,235	100	0.0007%
202	Shrublands; mulga & *Acacia quadrimarginea* scrub	63.13	365,344	365,344	100	0.0173%
483	Hummock grasslands, mixed sandplain - open mallee over sparse dwarf shrubs with spinifex; red mallee & mixed sparse dwarf shrubs over *Triodia basedowii*	3.06	395,106	395,106	100	0.0008%
18	Low woodland; mulga (*Acacia aneura*)	47.93	22,029,557	22,029,557	100	0.0002%
Total		**114.64**	**22,860,242**	**22,860,242**		

Source: (KLA, 2012a)

The Project has been designed through an iterative process, particularly the haul road, in order to avoid the location of known active mounds. The proposed Project layout avoids direct disturbance of known active mounds (Figures 5a and 5b).

Wherever practicable, a 250 m buffer will be maintained around active mounds and a 50 m buffer around inactive mounds that are less than 20 years old. However, Malleefowl mound 001 (MFM001) is within 185 m of the proposed haul road alignment, but it is not practicable to move the haul road due to heritage site boundaries and road safety issues. MFM001 is located less than 5 m from the edge of a pre-existing track (Metzke Road) and has been active for at least 2 years during exploration with no known detrimental impacts from current traffic. Jupiter has sought expert opinion on the risk to active Malleefowl mound MFM001. Umwelt (2013) provides an assessment of available information and provides the expert opinion that the road will not pose additional risk to MFM001. This report is included as Attachment 10. In addition to this, , Jupiter will impose a reduced speed of 40 km/hr in the vicinity of MFM001 along with signage to further reduce potential impact.

Malleefowl occurrence throughout the Project is likely to be dynamic due to the mobile nature of the species. Jupiter's commitment to ongoing monitoring and data collection regarding Malleefowl mounds is set out in the Malleefowl Management Plan (MMP) developed by Jupiter (Attachment 9). Jupiter also commits to undertaking a pre-construction targeted survey to confirm local distribution.

3.1 (e) Listed migratory species

Description

The database searches identified two bird species listed as threatened under the EPBC Act and potentially occurring within the Project area. Survey results were used to assess the likelihood of occurrence and this is summarised in the table below. Further information on the Fork-tailed Swift and the Rainbow Bee-eater can be found in the following sections.

Species	Common Name	EPBC Act Conservation Status	Occurrence
Apus pacificus	Fork-tailed Swift	Migratory	May occur

Species	Common Name	EPBC Act Conservation Status	Occurrence
Ardea alba modesta	Great Egret	Migratory	Not likely to occur
Merops ornatus	Rainbow Bee-eater	Migratory	Confirmed

Fork-tailed Swift

The Fork-tailed Swift is almost exclusively aerial, flying from less than 1 m to at least 300 m above ground. The Fork-tailed Swift is a non-breeding visitor to all states and territories in Australia, breeding in northeast and mid-east Asia. It is a visitor to most parts of WA, arriving in the Kimberley from late September, the Pilbara and Eucla in November and in the southwest in mid-December.

Rainbow Bee-eater

Rainbow Bee-eaters are very social birds and when not breeding roost together in large groups in dense understorey or large trees. They require open areas with loamy soft soils and usually make their breeding burrows in soft sandy banks, a feature not common in the Project area (KLA, 2012a).

The Rainbow Bee-eater is distributed across much of mainland Australia and is a common summer migrant to southern Australia. They generally migrate south at the beginning of spring and breed from November to January. They range from scarce to common across their range depending on suitable habitat and breeding grounds.

Nature and extent of likely impact

The Fork-tailed Swift was not recorded during the surveys undertaken in the Project area. Due to the wide range and ecology of this species, the conservation status is unlikely to be altered by the proposed mining activity at Mt Mason (KLA, 2012a).

Rainbow Bee-eaters were heard and a total of seven individuals were seen in the Project area during the EPBC survey and recorded opportunistically during the Autumn 2012 survey. As the Bee-eater is a migratory bird that can travel vast distances within the landscape, and given the extensive landscape available to this species, its conservation status is not likely to be altered by any proposed works in the area (KLA, 2012a).

3.1 (f) Commonwealth marine area

Description

The Project is not located within a Commonwealth marine area.

Nature and extent of likely impact

The Project will not impact on any Commonwealth marine areas, either directly or indirectly.

3.1 (g) Commonwealth land

Description

The Project does not lie within or near Commonwealth land.

Nature and extent of likely impact

The Project will not impact on any Commonwealth land, either directly or indirectly.

3.1 (h) The Great Barrier Reef Marine Park

Description

The Project does not lie within or near the Great Barrier Reef Marine Park.

Nature and extent of likely impact

The Project will not impact on the Great Barrier Reef Marine Park, either directly or indirectly.

3.2 Nuclear actions, actions taken by the Commonwealth (or Commonwealth agency), actions taken in a Commonwealth marine area, actions taken on Commonwealth land, or actions taken in the Great Barrier Reef Marine Park

3.2 (a)	***Is the proposed action a nuclear action?***	✓	No
			Yes (provide details below)
	If yes, nature & extent of likely impact on the whole environment		

3.2 (b)	***Is the proposed action to be taken by the Commonwealth or a Commonwealth agency?***	✓	No
			Yes (provide details below)
	If yes, nature & extent of likely impact on the whole environment		

3.2 (c)	***Is the proposed action to be taken in a Commonwealth marine area?***	✓	No
			Yes (provide details below)
	If yes, nature & extent of likely impact on the whole environment (in addition to 3.1(f))		

3.2 (d)	***Is the proposed action to be taken on Commonwealth land?***	✓	No
			Yes (provide details below)
	If yes, nature & extent of likely impact on the whole environment (in addition to 3.1(g))		

3.2 (e)	***Is the proposed action to be taken in the Great Barrier Reef Marine Park?***	✓	No
			Yes (provide details below)
	If yes, nature & extent of likely impact on the whole environment (in addition to 3.1(h))		

3.3 Other important features of the environment

Provide a description of the project area and the affected area, including information about the following features (where relevant to the project area and/or affected area, and to the extent not otherwise addressed above). If at Section 2.3 you identified any alternative locations, time frames or activities for your proposed action, you must complete each of the details below (where relevant) for each alternative identified.

3.3 (a) Flora and fauna

Flora

A Level 1 survey, undertaken by NVS in Autumn 2012, identified the Priority 1 Bulga Downs/Perrinvale/Walling vegetation complex (banded ironstone formations) Priority Ecological Community (PEC). Given that Banded Ironstone formations are mapped as PECs based on the substrate not necessarily on the vegetation, and the fact that no vegetation description or delineation is provided by the DEC as yet, it is assumed this PEC covers entire areas where Banded Ironstone protrudes from the surface. It is therefore not expected that the disturbance associated with the Mt Mason Haul Road will significantly negatively impact on the vegetation in the area in terms of fragmentation or loss of vegetation associations or species that may be unique. This is partially due to the overall size and linear nature of the survey area as well as the similar vegetation and habitat outside of the survey area (NVS , 2012b).

A Level 2 flora and vegetation survey was undertaken by NVS in Spring 2011 and Autumn 2012 in accordance with the following guidelines:

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

The Spring survey identified a total of 83 flora species, representing 54 Genera and 28 Families while the Autumn survey identified a total of 97 flora species, representing 59 Genera and 31 Families. No threatened flora were recorded during field surveys but one Priority flora species, *Calotis sp* Perrinvale Range (WA Priority 3 species) was recorded in the Project area (NVS, 2012a).

Calotis sp Perrinvale Range was recorded in one location, the BIF ridge on the western edge of the survey area with an estimated population of 15 plants (Attachment 4 and Figure 7b). This species is not restricted to the Project area with Florabase showing records of known locations of this species with the closest approximately 4.91 km to the southwest of the survey area, and the furthest 351 km west of the survey area. Impact on this population is not likely to compromise the conservation status or short and medium term viability of the species regionally (NVS 2012a). Approval will be obtained from the DEC prior to disturbance through a Native Vegetation Clearing Permit.

Flora surveys of the area carried out by Paul Armstrong Associates (2008) recorded *Drosera aff macrantha*. Further surveys undertaken by Armstrong and Lawry (2008) and NVS (2012a) submitted samples to the WA Herbarium (WAHerb). All 3 specimens of *Drosera sp.* submitted to the WAHerb have been returned with a result of "Specimen was not viable for species level identification". The species flowers for a limited time period between May and August. Jupiter will collect specimens during the flowering period and submit to WAHerb for identification. In the meantime, Jupiter will implement the precautionary principle and avoid locations of known *Drosera sp.* where practicable.

Fauna

As previously mentioned, Level 2 surveys of the Mt Mason Project were undertaken by KLA in Spring 2011 and Autumn 2012 (Attachment 4), in accordance with the EPA Position Statements and Guidelines. The systematic surveys recorded 13 reptile species, 5 native terrestrial mammal species, 1 non-native terrestrial mammal species, 6 species of bats and 34 bird species, equating to total of 59 vertebrate fauna species (KLA, 2012a).

A summary of State conservation significant terrestrial vertebrate fauna, identified from desktop searches, is provided in the table below (KLA, 2012b). EPBC listed species have been discussed in Section 3.1.

Species	Common Name	Conservation Status WC Act/Priority List	Likelihood of Occurrence
Reptiles			
Aspidites ramsayi	Woma	S4	Not likely
Birds			

Species	Common Name	Conservation Status WC Act/Priority List	Likelihood of Occurrence
Falco peregrinus	Peregrine Falcon	S4	Not likely
Ardeotis australis	Australian Bustard	P4	Not likely
Thinornis rubricollis	Hooded Plover	P4	Not likely
Pomatostomus superciliosus	White-browed Babbler	P4	Present
Oreoica gutturalis subsp. gutturalis	Crested Bellbird	P4	Present
Mammals			
Sminthopsis longicaudata	Long-tailed Dunnart	P4	Present

Subterranean Fauna

A subterranean fauna sampling programme (pilot study) was undertaken within the Project area by Rockwater Pty Ltd (2012) from November 2011 to May 2012, in accordance with the relevant EPA guidelines (EPA, 2003).

Results indicate the stygofauna community within the Project area are represented by only one stygal group (Nematoda), suggesting a depauperate complexity for arid parts of WA. Nematodes are a widespread group with few representatives confined to subterranean environments. It is considered unlikely that the Project will affect their conservation status and they do not warrant further investigation (Rockwater, 2012).

Dedicated troglofauna sampling by trapping and netting yielded no troglobitic fauna within the Project area. The sampling intensity implemented in the Project area exceeded that set by the EPA for a pilot troglofauna survey and further sampling is not required. It is therefore concluded that troglofauna is not a relevant environmental factor for the Project (Rockwater, 2012).

Short Range Endemic Invertebrate Fauna

No invertebrate species of conservation significance are listed for the Project area under the EPBC Act, the WC Act or in the DEC Threatened and Priority Fauna Database.

A targeted Short Range Endemic survey was conducted in 2008 in the Mt Mason area with sample sites all located within the BIF. Results indicate that of the specimens collected only one species *Aganippe* 'MYG224' (Family Idiopidae) is an SRE (KLA, 2012b).

A targeted invertebrate survey was undertaken by Keith Lindbeck Associates in 2012. Of the 19 species identified, the classification of six species could not be determined. It is also noted that for one of the six, while the sample collected could not be identified, is likely to belong to a genus in which all species are considered to be SREs. The remaining 13 species are not considered to be SREs. No evidence of the species *Aganippe* 'MYG224' was recorded or collected during this survey. The potential SRE habitat supported by these ranges is extensive and is not limited to the area of proposed impact at Mt Mason (KLA, 2012b).

A gap analysis for SRE was undertaken by Outback Ecology, in November 2012, which made the following recommendations:

- Complete habitat mapping along the entire length of the BIF range in the vicinity of the Mt Mason Project to enable an assessment of the proportions of the impacted habitat; and
- Undertake wet pitfall trapping to determine whether *Eucanippe* 'MYG231' has a distribution outside of the Mt Mason Project footprint and whether the BIF range habitat is well connected.

3.3 (b) Hydrology, including water flows

Surface Water

Observations from surveys in the region indicate that significant creek systems drain from topographical highlands (greenstone belts) to areas of topographical low relief (sandplains and playa lakes). All major creeks are ephemeral in nature and experience a degree of flow as a response to major rainfall events. Less defined drainage lines are typified within sandplain areas. Sheet flow is likely to occur under major rainfall events given poor creek definition and the relatively uniform gradient that exists. Runoff from outcrops of bedrock may also collect in gnamma holes or rockholes and soaks with water holes often occurring next to rock outcrops, forming significant mechanisms of groundwater recharge in the region (Coffey, 2010).

The Project is located approximately 35 km northwest of Lake Ballard which is listed on the Directory of Important Wetlands in Australia. There are no lakes, rivers or other significant water bodies within the Project area.

Groundwater

A general assessment of the regional distribution of playa lakes from the Hydrogeological Map of Western Australia suggests that the drainage systems of the region comprise broad, structurally confined, sub parallel features with a suggested drainage direction in a south easterly direction for systems north of the township of Kalgoorlie, and an easterly direction for systems south of Kalgoorlie. The Playa lake systems mark the courses of palaeorivers that ceased to flow when the climate became arid during the Tertiary period. These palaeorivers are regionally referred to as palaeodrainages and tend to discharge into the large playa lakes that exist throughout the survey area (Coffey, 2010).

The Project lies within the Goldfields Groundwater Proclamation Area under the RIWI Act.

Groundwater samples were collected from one existing bore to the north of Jupiter's tenements, from the two test production bores and from one of the monitoring bores. The samples were analysed and the pH of the groundwater was found to be near neutral, ranging from pH 6.8 to 8.5. Groundwater salinity was low and total dissolved solids (TDS) ranged from 507 to 1,060 mg/L. Dissolved concentrations of minor and trace elements were low. These values provide a clear indication that recharge for this groundwater is recent or subject to rapid throughflow as opposed to the groundwater in the surrounding plains, which can have TDS values in the order of 50,000 to 100,000 mg/L (SRK, 2012).

3.3 (c) Soil and Vegetation characteristics

Soil

The Mt Mason project is located in the East Murchison IBRA subregion (MUR1) which totals over 7 million hectares (KLA, 2012c). The East Murchison subregion lies on the Yilgarn Craton's "Eastern Goldfields" and "Southern Cross" Terranes. Beard (1990) describes the landform of the eastern Murchison as 'less dissected' than the western part and resembling the Wheatbelt Region, albeit with different soils. The most important types, according to Beard (1990) are:

- Shallow stony earthy loams on hills and ranges;
- Red earthy sands on upland sandplains, with red sands on occasional dunes;
- Earthy loams overlying red-brown hardpan, often with a surface stony layer, on undulating terrain;
- Shallow acid or neutral red earths in intimate mosaics with earthy loams on extensive flat and gently sloping plains; and
- Saline soils associated with salt lakes.

The Project area is located in the Salinaland Plains Zone of the Murchison Province soil landscape zone.

The Salinaland Plains Zone is based on the Salinaland Plains geomorphic province (Mabbutt et al.) and the northern portion of Salinaland Plateau Section of Jennings and Mabbutt (1977). It correlates with the bulk of the Wiluna, Laverton and Barlee vegetation systems of Beard (1976) and has a preponderance of the sandplains and occasional dunes with spinifex grasslands rangeland land type (Pringle, H.J.R et al, 1994).

Tille (2006) describes this zone as 'Sandplains (with hardpan wash plains and some mesas, stony plains and salt lakes) on granitic rocks (and some greenstone) of the Yilgarn Craton. Red loamy earths, red sandy earths, red shallow loams, red deep sands and red-brown hardpan shallow loams (with some red shallow sands and red shallow sandy duplexes) are present (KLA, 2012c).

Soils in the surveyed area are relatively uniform with little change throughout the landscape. Recurring soil profiles were observed with only 4 different soil profiles being identified from 23 excavated sites. Fine sandy loams leading into light sandy clay loams are found throughout the area. A clayey alluvial soil is recorded because the site was in the vicinity of a creek line (KLA, 2012c).

In general, soils range from very rocky/stony fine sandy loams with more than 50% stones in lower horizons to fine sandy clays with <50% stones. Shallow topsoils are common throughout the area and are the result of wind and water erosion (KLA, 2012c).

According to KLA (2012c) all sites have acidic horizons down the profile with pH values below 7 and are low in:

- Nitrogen;
- Phosphorus;
- Calcium;
- Magnesium
- Sulphur;

- Potassium;
- Manganese; and
- Sodium.

Vegetation

The Level 1 survey undertaken by NVS in Autumn 2012 identified 12 vegetation groups. The 12 vegetation groups are summarised in the table below and shown on Figures 6a and 6b; details are provided in the survey reports (Attachment 3).

Vegetation Group No.	Vegetation Group	Description	Area within survey (ha)
1a	Mulga Shrubland with occasional Eucalypts	This vegetation group consisted of 24 Families, 43 Genera and 68 Species. The vegetation group was approximately 148.29 ha which makes up 20.95% of the survey area. Dominant species were *Acacia incurvaneura, Acacia mulganeura, Acacia aneura var aneura, Acacia caesaneura, Eucalyptus oleosa subsp oleosa, Eucalyptus leptopoda subsp elevata, Spartothamnella teucriiflora,* and *Waitzia acuminata.*	148.3
1b	Mulga woodland-floodplain	This vegetation group consisted of 24 Families, 40 Genera and 55 Species. The vegetation group was approximately 143.58 ha which makes up 20.29% of the survey area. Dominant species were *Acacia aneura var aneura, Acacia ramulosa var ramulosa, Ptilotus obovatus, Acacia tetragonophylla* and *Acacia mulganeura.*	143.6
1g	Mulga shrubland with *Philotheca brucei subsp brucei*	This vegetation group consisted of 15 Families, 19 Genera and 27 Species. The vegetation group was approximately 4.73 ha which makes up 0.67% of the survey area. The entirety of this vegetation groups occurs on Banded Ironstone Formations. Dominant species were *Acacia aneura var aneura, Acacia mulganeura, Acacia cockertoniana, Philotheca brucei subsp brucei* and *Ptilotus obovatus*.	4.7
1k	Mulga open shrubland-drainage	This vegetation group consisted of 24 Families, 41 Genera and 60 Species. The vegetation group was approximately 6.08 ha which makes up 0.86% of the survey area. Dominant species were *Acacia aneura var aneura, Acacia mulganeura, Acacia tetragonophylla* and *Ptilotus obovatus.*	6.1
1n	Mulga with *Acacia cockertoniana* and *Acacia ramulosa var ramulosa* tall shrubland over *Olearia humilis* and/or *Hibbertia arcuata* and/or *Prostanthera althoferi subsp. althoferi* and/or *Eremophila forrestii subsp. forrestii* low shrubland	This vegetation group consisted of 21 Families, 31 Genera and 51 Species. The vegetation group was approximately 219.74 ha which makes up 31.05% of the survey area. The approximate total area of this vegetation group occurring on Banded Ironstone Formations is 1.39 ha. Dominant species were *Acacia cockertoniana, Acacia ramulosa var ramulosa, Olearia humilis, Hibbertia arcuata, Prostanthera althoferi subsp. althoferi* and *Eremophila forrestii subsp. forrestii.*	219.7

Vegetation Group No.	Vegetation Group	Description	Area within survey (ha)
1o	Mulga over mixed shrubland	This vegetation group consisted of 15 Families, 18 Genera and 26 Species. The vegetation group was approximately 3.75 ha which makes up 0.53% of the survey area. Dominant species were *Acacia caesaneura, Acacia ramulosa var ramulosa, Acacia aneura var aneura, Senna artemisioides subsp filifolia, Solanum lasiophyllum* and *Ptilotus obovatus.*	3.7
2g	*Acacia quadrimarginea/A. cockertoniana* open shrubland	This vegetation group consisted of 16 Families, 20 Genera and 28 Species. The vegetation group was approximately 24.28 ha which makes up 3.43% of the survey area. Dominant species were *Acacia quadrimarginea, Acacia cockertoniana* and *Thryptomene costata.*	24.3
3b	*Acacia effusifolia/Eucalyptus* mallee and other mixed shrublands burnt-sandplain	This vegetation group consisted of 22 Families, 53 Genera and 99 Species. The vegetation group was approximately 127.83 ha which makes up 18.06% of the survey area. Dominant species were *Acacia effusifolia, Eucalyptus rigidula, Micromyrtus flaviflora, Micromyrtus clavata, Melaleuca hamata* and *Triodia irritans.*	127.8
3c	Acacia effusifolia Shrubland-transitional	This vegetation group consisted of 10 Families, 12 Genera and 18 Species. The vegetation group was approximately 7.41 ha which makes up 1.05% of the survey area. Dominant species were *Acacia effusifolia, Eremophila georgei* and *Eremophila forrestii subsp forrestii.*	7.4
4	*Callitris* with scattered Eucalypt woodland- sandplain	This vegetation group consisted of 24 Families, 40 Genera and 66 Species. The vegetation group was approximately 10.27 ha which makes up 1.45% of the survey area. Dominant species were *Callitris columellaris, Acacia ramulosa var ramulosa* and *Eucalyptus leptopoda subsp leptopoda.*	10.3
9a	*Eucalyptus lesouefii* open woodland	This vegetation group consisted of 11 Families, 17 Genera and 23 Species. The vegetation group was approximately 6.89 ha which makes up 0.97% of the survey area. Dominant species were *Eucalyptus lesouefii, Eremophila pantonii* and *Ptilotus obovatus.*	6.9
9b	*Eucalyptus salubris* woodland	This vegetation group consisted of 14 Families, 17 Genera and 24 Species. The vegetation group was approximately 4.92 ha which makes up 0.70% of the survey area. Dominant species were *Eucalyptus salubris, Acacia erinacea, Eremophila pantonii* and *Ptilotus obovatus*.	4.9

The Level 2 survey undertaken by NVS in Spring 2011 identified 8 vegetation groups and an additional 2 vegetation groups were identified in the autumn survey. The 10 vegetation groups are summarised in the table below and shown on Figures 6a and 6b; details are provided in the survey reports (Attachment 4).

Vegetation Group No.	Vegetation Group	Description	Area within survey (ha)
1	*Thryptomene* Shrubland	*Thryptomene costata* or *Thryptomene decussata* low open shrubland with emergent *Acacia quadrimarginea* over scattered mixed shrubs and herbs on low hillslopes and ridges.	1.2
2	Open Mulga woodland over laterite	*Acacia effusifolia* low open forest over *Acacia incurvaneaura*, *Eremophila forrestii* subsp *forrestii* over *Hibbertia arcuata* and *Prostanthera althoferi* subsp *althoferi* and scattered mixed shrubs and herbs on laterite hills.	1.8
3	Acacia shrubland (fire scar-no longer in survey area)	*Acacia effusifolia l*ow open shrubland over scattered mixed shrubs and herbs on flats.	3.1
4	*Allocasuarina* over *Calytrix* shrubland	*Allocasuarina acutivalvis* subsp *acutivalvis* and *Acacia incurvaneura* low woodland/tall shrubland over *Acacia balsamea* and *Philotheca brucei* subsp *brucei* open shrubland over scattered mixed shrubs and herbs in minor drainage lines and Laterite breakaways.	1.6
5	Mulga over *Eremophila forrestii subsp forrestii* on hills and ridges	*Acacia incurvaneura* woodland over *Eremophila forrestii* subsp *forrestii* shrubland over scattered mixed low shrubs and herbs on undulating hills and ridges.	10.3
6	Mulga over *Prostanthera althoferi subsp althoferi* on hills and ridges	*Acacia incurvaneura* shrubland to tall open scrub over *Prostanthera althoferi* subsp *alhoferi* shrubland over scattered mixed shrubs and herbs on hills and ridges.	5.9
7	Mulga over *Philotheca brucei subsp brucei* on hills and ridges	*Acacia incurvaneura* with *Acacia quadrimarginea* tall shrubland/ low woodland over *Philotheca brucei* subsp *brucei* with *Acacia balsamea* shrubland over *Eremophila latrobei* subsp *latrobei* and *Hibbertia exasperata* over mixed herbs and shrubs on hills and ridges.	13.9
8	Mulga over *Eremophila forrestii subsp forrestii* on flats	*Acacia incurvaneura* with *Acacia mulganeura* tall shrubland over *Eremophila forrestii* subsp forrestii and *Acacia effusifolia* low shrubland over *Waitzia acuminata* and mixed herbs on flat plains.	37.9
9	*Acacia burkittii* shrubland within drainage lines	*Acacia burkittii* and *Acacia quadrimarginea* tall shrubland over *Senna artemisioides* subsp *artemisioides* over *Ptilotus obovatus* and mixed shrubs within drainage lines.	0.5
10	*Acacia cockertoniana* over *Eremophila oldfieldii* and *Eremophila pantonii* on flats	*Acacia cockertoniana* tall shrubland over *Eremophila oldfieldii subsp angustifolia* over *Eremophila pantonii* and mixed shrubs on flats.	1.5

3.3 (d) Outstanding natural features

There are no outstanding natural features within the Project area.

3.3 (e) Remnant native vegetation

Native vegetation has been heavily cleared in WA, especially in the Southwest. Remaining remnant vegetation is important in helping preserve native vegetation and fauna habitat. Areas with less than 30% of their pre-European extent generally experience exponentially accelerated species loss and areas with less than 10% are considered "endangered" (Shepherd, D.J, 2002).

The Project is located within four remnant vegetation groups as described by Beard (1990):

- Low woodland; mulga (*Acacia aneura*) (vegetation association 18);
- Shrublands; mulga & *Acacia quadrimarginea* scrub (vegetation association 202);
- Shrublands, jam thicket (vegetation association 484); and
- Hummock grasslands, mixed sandplain (vegetation association 483).

A summary of the current extent and representation of these associations in DEC managed lands is presented in the table below (NVS, 2012).

VEG ASSOC	Description	Mt Mason proposed clearing	Current extent, WA (ha)	Pre-European Extent, WA (ha)	Remaining (%)	% of Current Extent (WA)
484	Shrublands; jam thicket	0.52	70,235	70,235	100	0.0007%
202	Shrublands; mulga & *Acacia quadrimarginea* scrub	68.13	365,344	365,344	100	0.0173%
483	Hummock grasslands, mixed sandplain - open mallee over sparse dwarf shrubs with spinifex; red mallee mallee & mixed sparse dwarf shrubs over *Triodia basedowii*	3.06	395,106	395,106	100	0.0008%
18	Low woodland; mulga (Acacia aneura)	47.93	22,029,557	22,029,557	100	0.0002%
	Total:	**119.64**				

3.3 (f) Gradient (or depth range if action is to be taken in a marine area)

Generally, the region is characterised by gently undulating areas of sand plain and granite outcrops, broken by northerly trending ridges controlled by the strike of greenstone belts. Low-lying broad alluviated valleys containing no permanent river systems and playa lakes are the dominant features of the regional landscape (Coffey, 2010).

3.3 (g) Current state of the environment

The Project area lies within the Brooking Land System (Pringle, H.J.R et al, 1994) which is characterised by prominent ridges of banded iron formation, supporting mulga shrublands and occasional minor halophytic communities in the southeast (KLA, 2012c).

The majority of the vegetation within the Mt Mason mining tenement was considered in "Very Good" to "Excellent" condition, in accordance with Keighery's (1994) condition rankings (NVS, 2012a). NVS (2012a) noted the occurrence of existing vehicular tracks due to mine exploration activities. No introduced flora species were recorded in and around the survey area of the Mt Mason tenement during the Level 2 survey (NVS 2012a). The condition of the vegetation along the haul road was determined to be "Excellent" with areas where there were existing roads and tracks or fire scar areas in "Good" condition due to grazing and historic disturbances. The following five weed species were found along the haul road (NVS , 2012b):

- *Asphodelus fistulosus;*
- *Cleretum papulosum subsp. papulosum;*
- *Lysimachia arvensis;*
- *Pentameris airoides subsp. airoides; and*

- *Portulaca oleracea.*

The majority of these species were found along existing track sides and disturbance. None of these species are considered declared plants as defined by the Department of Agriculture WA (DAFWA, 2012).

Evidence of five non-native species were recorded during the Level 2 fauna assessment including Rabbit *(Oryctolagus cuniculus*), Dog/Dingo (*Canis* sp.), Cat (*Felis catus),* European Cattle (*Bos Taurus)* and Donkeys (*Equus asinus)* (KLA, 2012b).

3.3 (h) Commonwealth Heritage Places or other places recognised as having heritage values

No Commonwealth Heritage Places or other places were identified within the Project area.

3.3 (i) Indigenous heritage values

The Project falls within the native title claimant areas of two indigenous groups, the Wutha and the Wongatha native title claimant groups.

An ethnographic survey was undertaken by Western Heritage Research Pty Ltd (WHR) in 2006, attended by Wongatha representatives. No ethnographic sites were identified during the survey.

A second ethnographic survey was undertaken by Australian Interaction Consultants (AIC) in 2006, attended by Wutha representatives. One ethnographic site was identified, but lies outwith the Project area.

R and E O'Connor Pty Ltd (O'Connor) were commissioned by Jupiter to undertake an Aboriginal heritage survey of Mt Mason tenements (M29/408) and the proposed Haul Road between June and July 2012 (Cecchi, 2012) (Attachment 11). The field assessment identified and recorded 48 isolated artefacts and 11 sites of Aboriginal heritage (Figure 8), including a site at the ethnographic site identified by AIC.

3.3 (j) Other important or unique values of the environment

There are no national parks, or wetlands of national significance within the Project area.

There are no conservation reserves or DEC managed lands in the Project area. The nearest conservation reserves to the Project are:

- Mt Manning Range Nature Reserve – approximately 95 km southeast; and
- Wanjarri Nature Reserve – approximately 185 km north.

3.3 (k) Tenure of the action area (eg freehold, leasehold)

The tenure of the Project is summarised in section 1.6 of this document.

3.3 (l) Existing land/marine uses of area

The surrounding land use is native vegetation, Aboriginal lands, mining and exploration activities and pastoralism. No existing land use will be impacted by the Project.

3.3 (m) Any proposed land/marine uses of area

There are no proposed land uses within the Project area.

4 Measures to avoid or reduce impacts

More general commitments (e.g. preparation of management plans or monitoring) and measures aimed at providing environmental offsets, compensation or off-site benefits CANNOT be taken into account in making the initial decision about whether the proposal is likely to have a significant impact on a matter protected under the EPBC Act. (But those commitments may be relevant at the later assessment and approval stages, including the appropriate level of assessment, if your proposal proceeds to these stages).

Potential loss of Malleefowl habitat is the most likely impact on protected matters under the EPBC Act. Jupiter proposes to manage activities within the Project area to avoid and reduce impacts to habitat and specifically the threatened Malleefowl.

Jupiter has undertaken an iterative design process in order to adopt appropriate measures to avoid and mitigate impacts. The site layout has been influenced by the requirement to avoid areas of high ecological value, where possible and by advice from ecological consultants.

A MMP has been prepared to ensure that all stages of the Project seek to avoid and reduce impacts on this protected species (Attachment 9). Jupiter prepared the MMP with the following primary management objectives:

1. To ensure no significant impacts occur to the local population status as a result of Jupiter's activities; and
2. To document ongoing Malleefowl management and monitoring commitments.

Management measures to be implemented throughout the planning, development, construction and operational stages of the Project are set out in the MMP. The key measures to be implemented include:

- Targeted Malleefowl surveys will occur for all proposed disturbance areas prior to construction;
- A clearance survey will be conducted across the Project disturbance areas prior to commencement of clearing (including already surveyed areas) to record new active mounds;
- A minimum 250 m buffer around known active mounds will be maintained within which there will be no works (including vehicles and clearing for drilling) where practicable: with the exception of MFM001 which has been allocated a 185 m buffer due to avoidance of other constraints in the area such as heritage sites;
- In the vicinity of the buffer of MFM001 (Figure 5b) a 40 km speed limit will be imposed on the proposed haul/access road;
- A 50 m buffer from inactive mounds <20 years in age will be maintain within which there will be no works where practicable;
- Ongoing monitoring of all inactive and active mounds to occur as per Monitoring Plan and information regularly updated in the Malleefowl Portal of the Environmental Database; and
- Maintain a component on Malleefowl protection and management within the site environmental induction.

Further management measures associated with the following objectives are detailed in the MMP (Attachment 9):

- Identify Malleefowl mounds and Malleefowl habitat and minimise impact in these areas;
- Educate employees and contractors of the importance of conserving Malleefowl and their habitat;
- Reduce the occurrence of large fires to protect Malleefowl habitat;
- Monitor and reduce feral predator numbers;
- Minimise risk of vehicle and Malleefowl interactions;
- Monitor trends in Malleefowl abundance and distribution and assess threats;
- Document ongoing Malleefowl management and monitoring commitments; and
- Maintain existing habitat and minimise loss of potential Malleefowl habitat.

5 Conclusion on the likelihood of significant impacts

Identify whether or not you believe the action is a controlled action (ie. whether you think that significant impacts on the matters protected under Part 3 of the EPBC Act are likely) and the reasons why.

5.1 Do you THINK your proposed action is a controlled action?

✓	No, complete section 5.2
	Yes, complete section 5.3

5.2 Proposed action IS NOT a controlled action.

Jupiter believes that provided the matters of NES are managed in accordance with the strategies and actions detailed in Section 4 the Project will not have a significant impact.

The disturbance footprint is approximately 120 ha, which is a small proportion of the total tenement footprint and Jupiter will restrict clearing to the minimum required for construction and operation. The Project will avoid currently known active Malleefowl mounds and will seek to avoid, where practicable, any new active mounds that are identified.

The conservation status of the Rainbow Bee-eater and Fork-tailed Swift are unlikely to be altered by the Project given the wide range of these species (KLA, 2012a).

5.3 Proposed action IS a controlled action

Type 'x' in the box for the matter(s) protected under the EPBC Act that you think are likely to be significantly impacted. (The 'sections' identified below are the relevant sections of the EPBC Act.)

	Matters likely to be impacted
	World Heritage values (sections 12 and 15A)
	National Heritage places (sections 15B and 15C)
	Wetlands of international importance (sections 16 and 17B)
	Listed threatened species and communities (sections 18 and 18A)
	Listed migratory species (sections 20 and 20A)
	Protection of the environment from nuclear actions (sections 21 and 22A)
	Commonwealth marine environment (sections 23 and 24A)
	Great Barrier Reef Marine Park (sections 24B and 24C)
	Protection of the environment from actions involving Commonwealth land (sections 26 and 27A)
	Protection of the environment from Commonwealth actions (section 28)
	Commonwealth Heritage places overseas (sections 27B and 27C)

Specify the key reasons why you think the proposed action is likely to have a significant adverse impact on the matters identified above.

6 Environmental record of the responsible party

NOTE: If a decision is made that a proposal needs approval under the EPBC Act, the Environment Minister will also decide the assessment approach. The EPBC Regulations provide for the environmental history of the party proposing to take the action to be taken into account when deciding the assessment approach.

		Yes	No
6.1	***Does the party taking the action have a satisfactory record of responsible environmental management?*** ***Provide details*** Jupiter is currently not responsible for any operating sites in WA. Jupiter has been conducting exploration activities in the Central Yilgarn area, in accordance with tenement conditions since 2007.	✓	
6.2	***Has either (a) the party proposing to take the action, or (b) if a permit has been applied for in relation to the action, the person making the application - ever been subject to any proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources?*** ***If yes, provide details***		✓
6.3	***If the party taking the action is a corporation, will the action be taken in accordance with the corporation's environmental policy and planning framework?*** ***If yes, provide details of environmental policy and planning framework*** See Attachment 1	✓	
6.4	***Has the party taking the action previously referred an action under the EPBC Act, or been responsible for undertaking an action referred under the EPBC Act?*** ***Provide name of proposal and EPBC reference number (if known)***		✓

7 Information sources and attachments

(For the information provided above)

7.1 References

- List the references used in preparing the referral.
- Highlight documents that are available to the public, including web references if relevant.

Armstrong, P and Associates. (2008). *Vegetation Survey and Rare Flora Search of the Mt Mason and Mt Ida Exploration Project.* Perth: Unpublished report for Jupiter Mines Limited.

Beard, J. S. (1976). *Murchison, 1:100000 vegetation series: explanatory nots to sheet 6: the vegetation of the Murchison region.* Perth: University of Western Australia Press.

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Frith, H.J. (1959). *Breeding of the Malleefowl, Leipoa ocellata Gould (Megapodiidae). CSIRO Wildlife Research 4: 31-60.* CSIRO.

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KLA. (2012a). *Mt Mason Project and proposed Haul Road: Targeted EPBC Fauna Survey.* Perth: Unpublished report for Jupiter Mines Limited.

KLA. (2012c). *Mt Mason Soil and Landform Survey Report.* Perth: Unpublished report for Jupiter Mines Ltd.

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NVS . (2012b). *Level 1 Flora and Vegetation Surveyof the proposed Mt Mason Haul Road.* Kalgoorlie: Unpublished report for Jupiter Mines Limited.

NVS. (2012a). *Level 2 Flora and Vegetation Survey.* Kalgoorlie: Unpublished report for Jupiter Mines Limited.

Priddel and Wheeler. (1994). *Mortality in captive-raised Malleefowl, Leipoa ocellata, release into a malee remnant within the wheat-belt of New South Wales; in Department of Environment, Water, Heritage and the Arts - Species profile and Threats Database.* Canberaa: Government of Australia.

Pringle, H.J.R et al. (1994). *An inventory and condition survey of the north-eastern Goldfields, Western Australia.* Perth: Department of Agriculture, Western Australia.

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Umwelt. (2013). *Addendum - Malleefowl mound advice.*

7.2 Reliability and date of information

This EPBC Act Referral was prepared by KASA Consulting Ltd on behalf of Jupiter Mines Ltd. The Environmental Baseline Studies that have been undertaken and are proposed for the Project are listed in Section 2.5.

The information contained in this referral document is considered reliable for the purposes of assessment of the potential impacts of this proposed action. The information has been obtained from flora and fauna surveys undertaken by appropriately qualified and recognised experts in their field. There are no known uncertainties with the information provided.

7.3 Attachments

Indicate the documents you have attached. All attachments must be less than two megabytes (2mb) so they can be published on the Department's website. Attachments larger than two megabytes (2mb) may delay the processing of your referral.

		✓ attached	Title of attachment(s)
You must attach	figures, maps or aerial photographs showing the Project locality (section 1)	✓	Figure 1 Regional Location Figures 2a and 2b Site Plan of Mt Mason Project Figure 3 Location of Latitude and Longitude Boundary Points Figure 4 Alternative Haul Road Options
	figures, maps or aerial photographs showing the location of the Project in respect to any matters of NES or important features of the environments (section 3)	✓	Figures 5a and 5b Location of Malleefowl Mounds at the Mt Mason Project Figures 6a and 6b Vegetation Communities of the Mt Mason Project Figures 7a and 7b Location of Priority Flora at the Mt Mason Project Figures 8a and 8b Location of Heritage Sites at the Mt Mason Project
If relevant, attach	copies of any state or local government approvals and consent conditions (section 2.5)	✓	5C Licence from DoW
	copies of any completed assessments to meet state or local government approvals and outcomes of public consultations, if available (section 2.6)		
	copies of any flora and fauna investigations and surveys (section 3)	✓	Level 1 Flora and Vegetation Survey Level 2 Flora and Vegetation Survey for Mt Mason Level 2 Fauna Assessment Mt Mason Targeted EPBC Fauna Survey Non Process Infrastructure Targeted Malleefowl Survey Malleefowl Mound Database

		✓ attached	Title of attachment(s)
	technical reports relevant to the assessment of impacts on protected matters that support the arguments and conclusions in the referral (section 3 and 4)	✓	As above Malleefowl Management Plan
	report(s) on any public consultations undertaken, including with Indigenous stakeholders (section 3)	✓	J. Cecchi Heritage report

7.3.1 List of Figures

Figure 1	Location Map
Figure 2a	Site Plan - Overview
Figure 2b	Site Plan - Main Project Area
Figure 3	Mt Mason - Boundary Point Locations
Figure 4	Alternative Haul Road Options
Figure 5a	Location of Malleefowl Mounds - Overview
Figure 5b	Location of Malleefowl Mounds - Main Project Area
Figure 6a	Vegetation Communities - Overview
Figure 6b	Vegetation Communities - Main Project Area
Figure 7a	Priority Flora - Overview
Figure 7b	Priority Flora - Main Project Area
Figure 8a	Heritage Sites - Overview
Figure 8b	Heritage Sites - Main Project Area

7.3.2 List of Attachments

Attachment 1	Environmental and Community Relations Policy (Jupiter)
Attachment 2	5C Licence from Department of Water (DoW)
Attachment 3	Level 1 Flora and Vegetation Survey of the Proposed Mount Mason Haul Road (Native Vegetation Solutions)
Attachment 4	Mt Mason Project, Level 2 Flora and Vegetation Survey: Part 1-October 2011 & Part 2-March 2012 (Native Vegetation Solutions)
Attachment 5	Level 2 Fauna Assessment Mt Mason (Keith Lindbeck Associates)
Attachment 6	Targeted EPBC Fauna Study (Keith Lindbeck Associates)
Attachment 7	Non process Infrastructure Targeted Malleefowl Survey (GHD)
Attachment 8	Malleefowl Mound Database (Jupiter)
Attachment 9	Malleefowl Management Plan (Jupiter)
Attachment 10	Addendum – Malleefowl mound advice (Umwelt)
Attachment 11	Aboriginal Heritage Report, (Cecchi)

8 Contacts, signatures and declarations

NOTE: Providing false or misleading information is an offence punishable on conviction by imprisonment and fine (s 489, EPBC Act).

Under the EPBC Act a referral can only be made by:

- the person proposing to take the action (which can include a person acting on their behalf); or
- a Commonwealth, state or territory government, or agency that is aware of a proposal by a person to take an action, and that has administrative responsibilities relating to the action[1].

Project title: Mt Mason Direct Shipping Ore (DSO) Hematite Project

8.1 *Person proposing to take action*

This is the individual, government agency or company that will be principally responsible for, or who will carry out, the proposed action.

If the proposed action will be taken under a contract or other arrangement, this is:

- the person for whose benefit the action will be taken; or
- the person who procured the contract or other arrangement and who will have principal control and responsibility for the taking of the proposed action.

The Minister may also request relevant additional information from this person.

If further assessment and approval for the action is required, any approval which may be granted will be issued to the person proposing to take the action. This person will be responsible for complying with any conditions attached to the approval.

If the Minister decides that further assessment and approval is required, the Minister must designate a person as a proponent of the action. The proponent is responsible for meeting the requirements of the EPBC Act during the assessment process. The proponent will generally be the person proposing to take the action[2].

Name	Greg Kaeding
Title	Environment Manager
Organisation	Jupiter Mines Ltd
ACN / ABN (if applicable)	51 105 991 740
Postal address	GPO Box Z5117, Perth Western Australia 6000
Telephone	08 9346 5500
Email	Gkaeding@jupitermines.com
Declaration	I declare that to the best of my knowledge the information I have given on, or attached to this form is complete, current and correct. I understand that giving false or misleading information is a serious offence. I agree to be the proponent for this action. I acknowledge that I may be liable for fees related to my proposed action following the introduction of cost recovery under the EPBC Act.
Signature	Date 3 May 2013

[1] If the proposed action is to be taken by a Commonwealth, state or territory government or agency, section 8.1 of this form should be completed. However, if the government or agency is aware of, and has administrative responsibilities relating to, a proposed action that is to be taken by another person which has not otherwise been referred, please contact the Referrals Business Entry Point (1800 803 772) to obtain an alternative contacts, signatures and declarations page.

[2] If a person other than the person proposing to take action is to be nominated as the proponent, please contact the Referrals Business Entry Point (1800 803 772) to obtain an alternative contacts, signatures and declarations page.

8.2 *Person preparing the referral information (if different from 8.1)*

Individual or organisation who has prepared the information contained in this referral form.

Name	Peter Jansen
Title	Environmental Manager
Organisation	KASA Consulting
ACN / ABN (if applicable)	54 087 465 450
Postal address	PO Box 239 Innaloo, WA 6918
Telephone	0459 222 151
Email	peterj@kasaconsulting.com.au
Declaration	I declare that to the best of my knowledge the information I have given on, or attached to this form is complete, current and correct. I understand that giving false or misleading information is a serious offence.
Signature	Date 3 May 2013

FIGURES

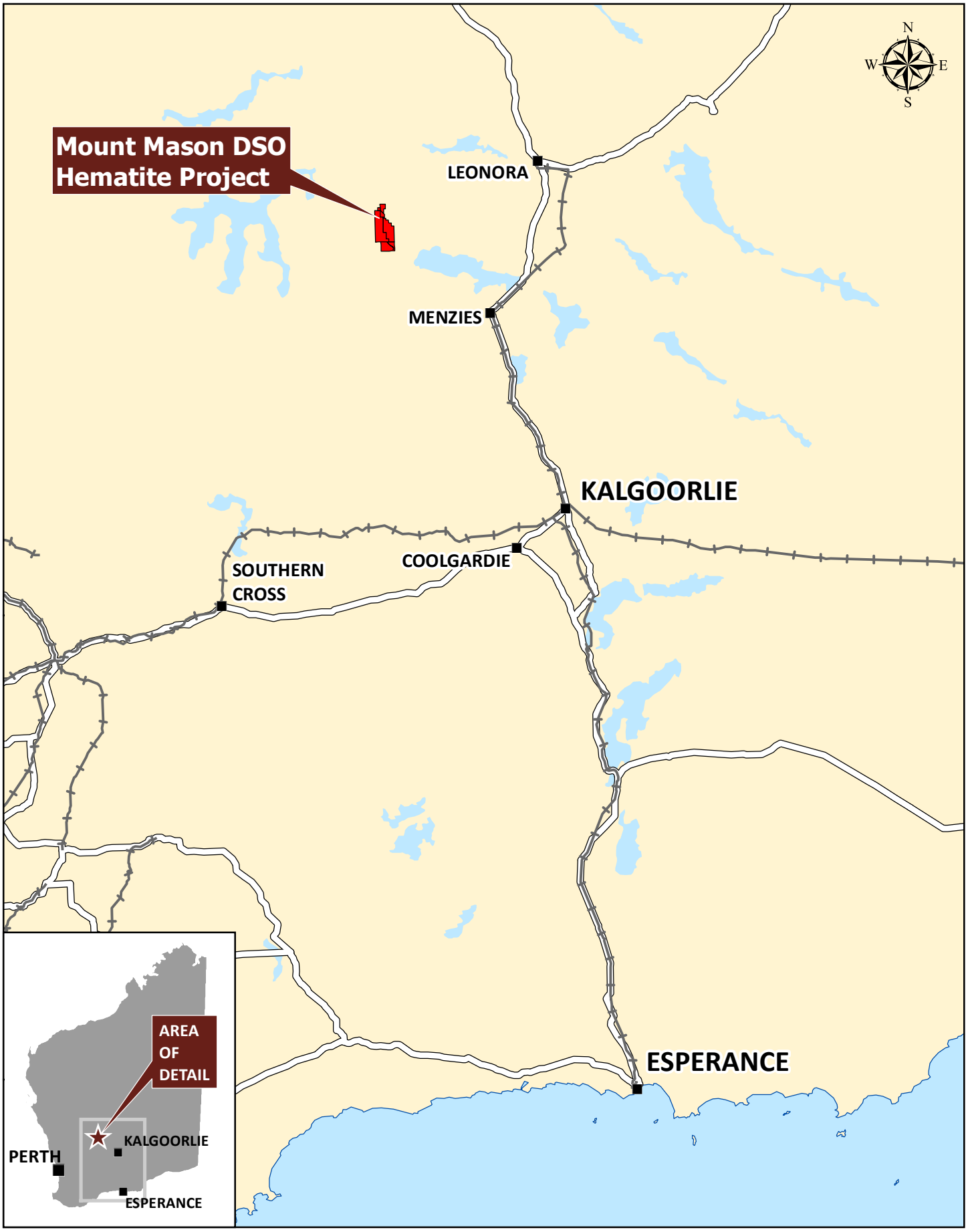

Figure 1: Mount Mason DSO Project Location Map

0 20 40 60 80 100 km

1:3,000,000

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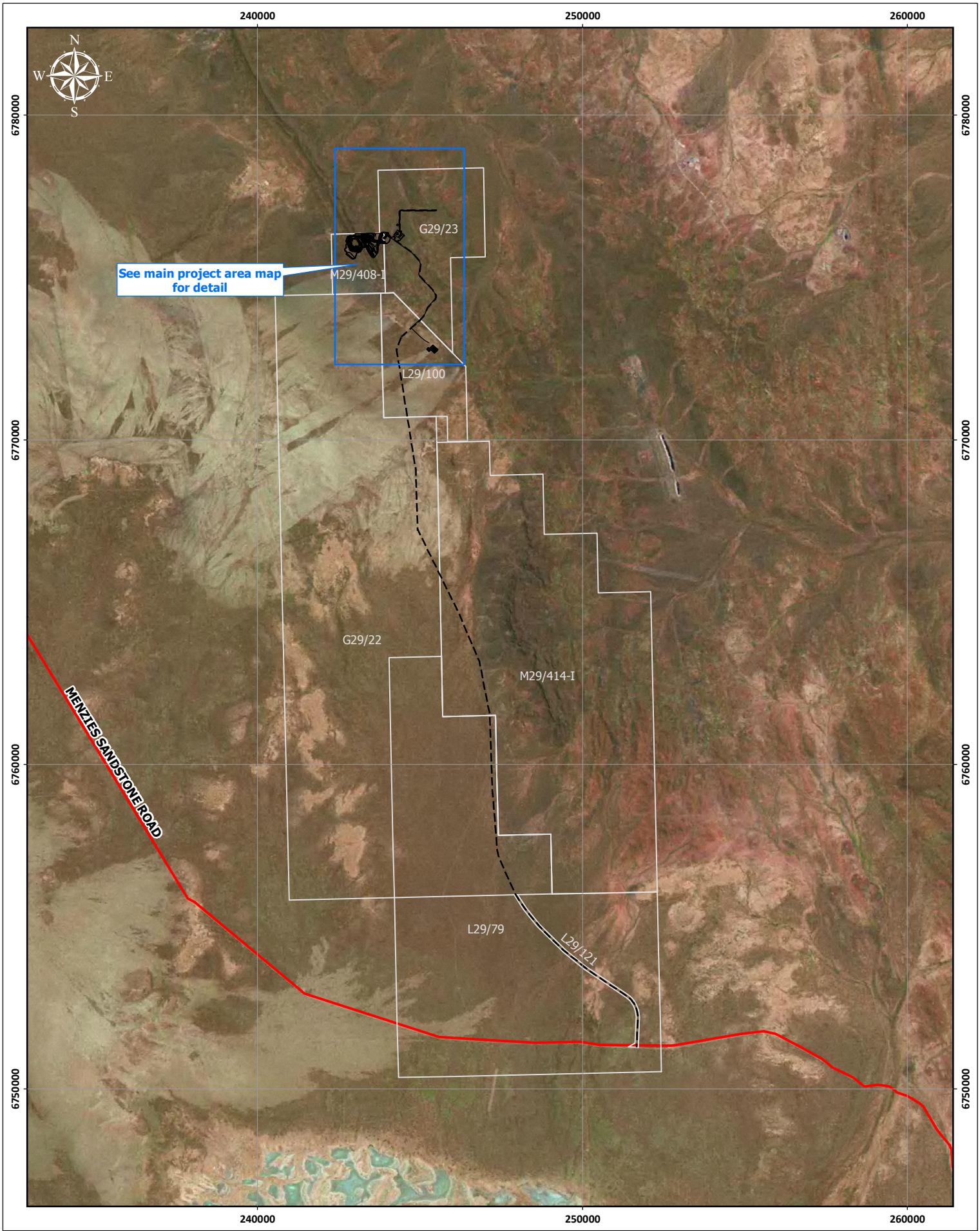

Figure 2a: Site plan - overview

0 5 10 km

1:150,000

Haul/internal road

Other proposed infrastructure

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Coordinates are GDA94 MGA zone 51.
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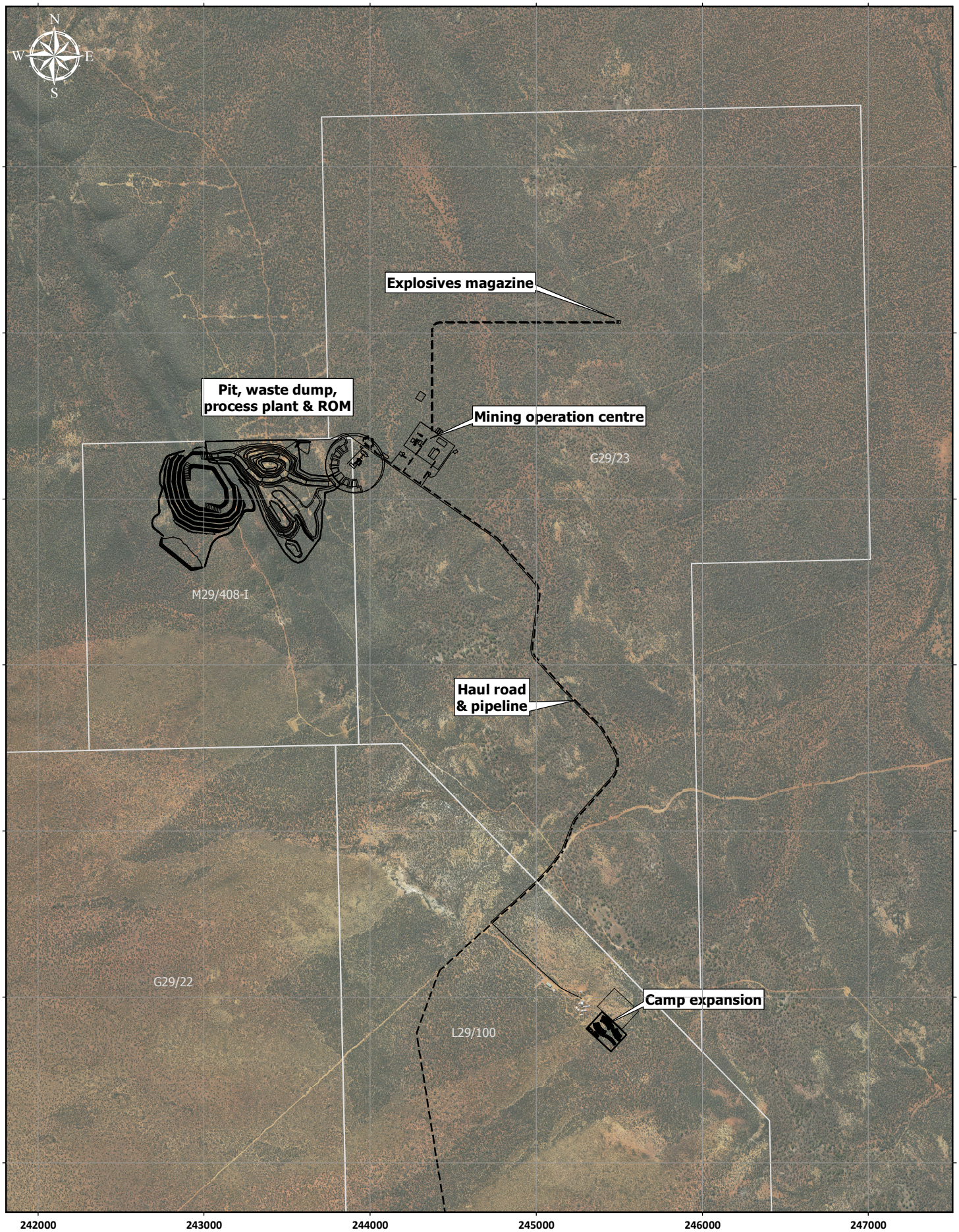

Figure 2b: Site plan - main project area

0 0.5 1 1.5 2 km

1:30,000

Haul/internal road

Other proposed infrastructure

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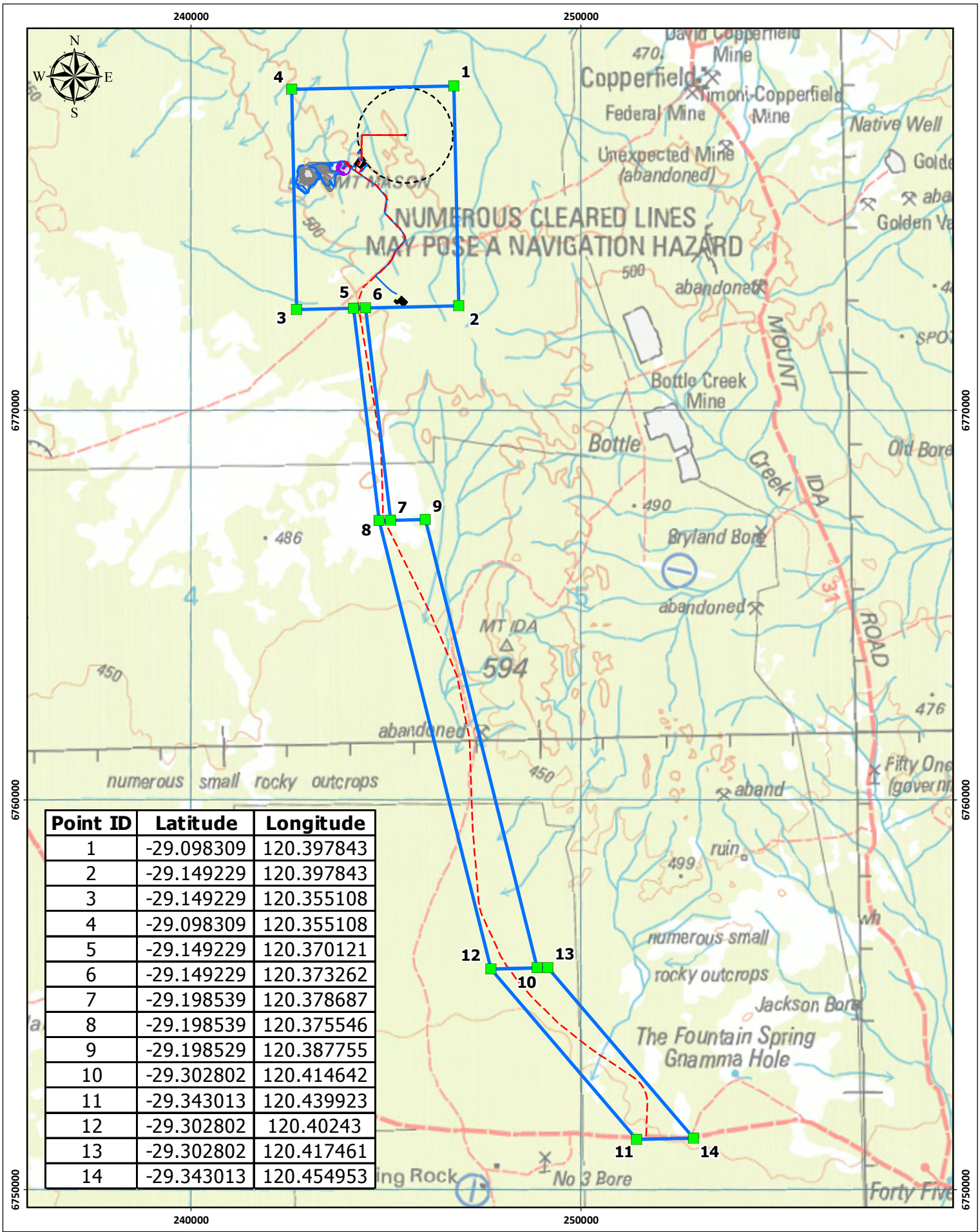

Point ID	Latitude	Longitude
1	-29.098309	120.397843
2	-29.149229	120.397843
3	-29.149229	120.355108
4	-29.098309	120.355108
5	-29.149229	120.370121
6	-29.149229	120.373262
7	-29.198539	120.378687
8	-29.198539	120.375546
9	-29.198529	120.387755
10	-29.302802	120.414642
11	-29.343013	120.439923
12	-29.302802	120.40243
13	-29.302802	120.417461
14	-29.343013	120.454953

Figure 3: Mount Mason - boundary point locations

0 1 2 3 4 5 km

1:125,000

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Coordinates are GDA 1994 MGA Zone 51.
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2012-228

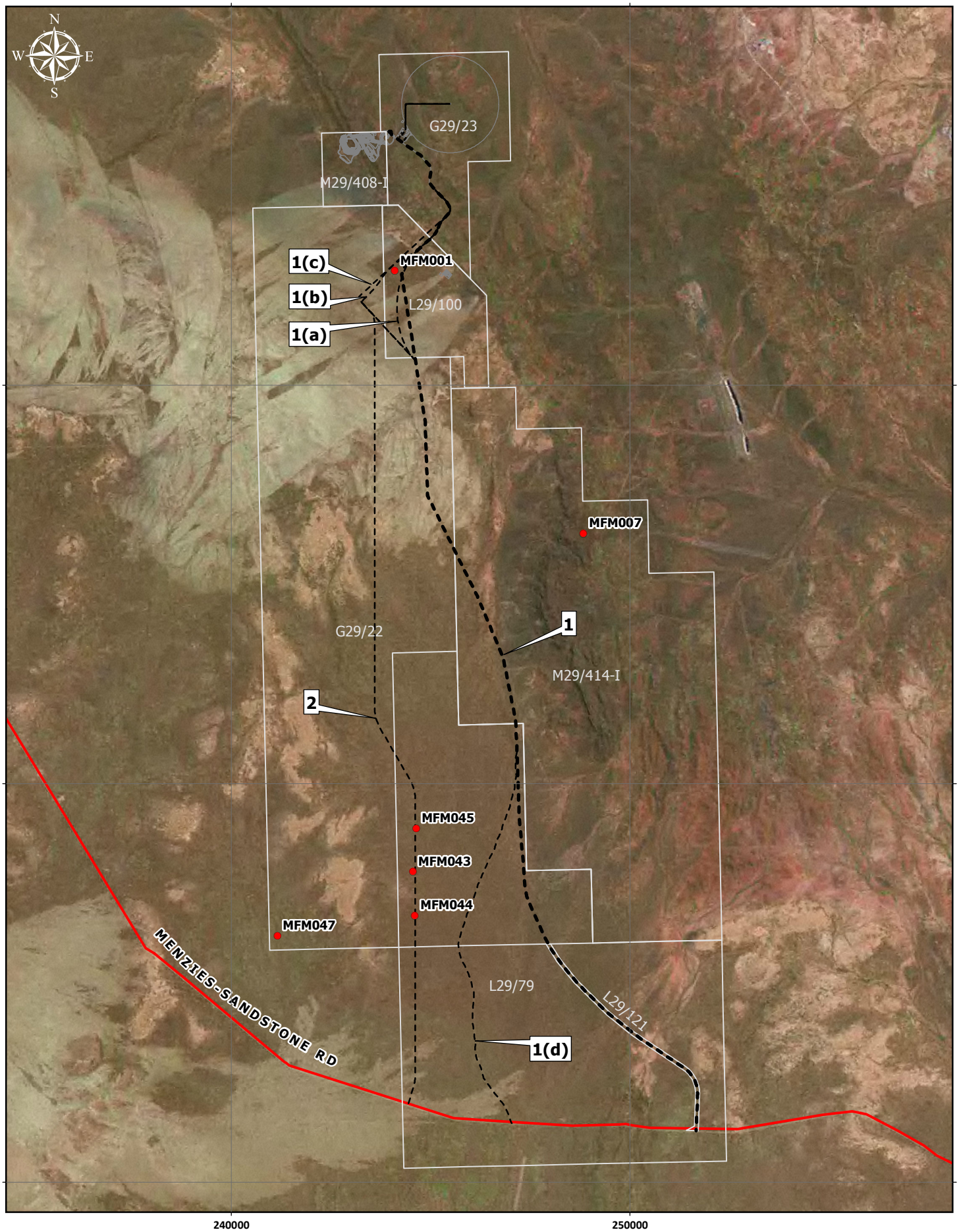

Figure 4: Alternative haul road options

0 1 2 3 4 5 km

1:125,000

● Malleefowl - active mound

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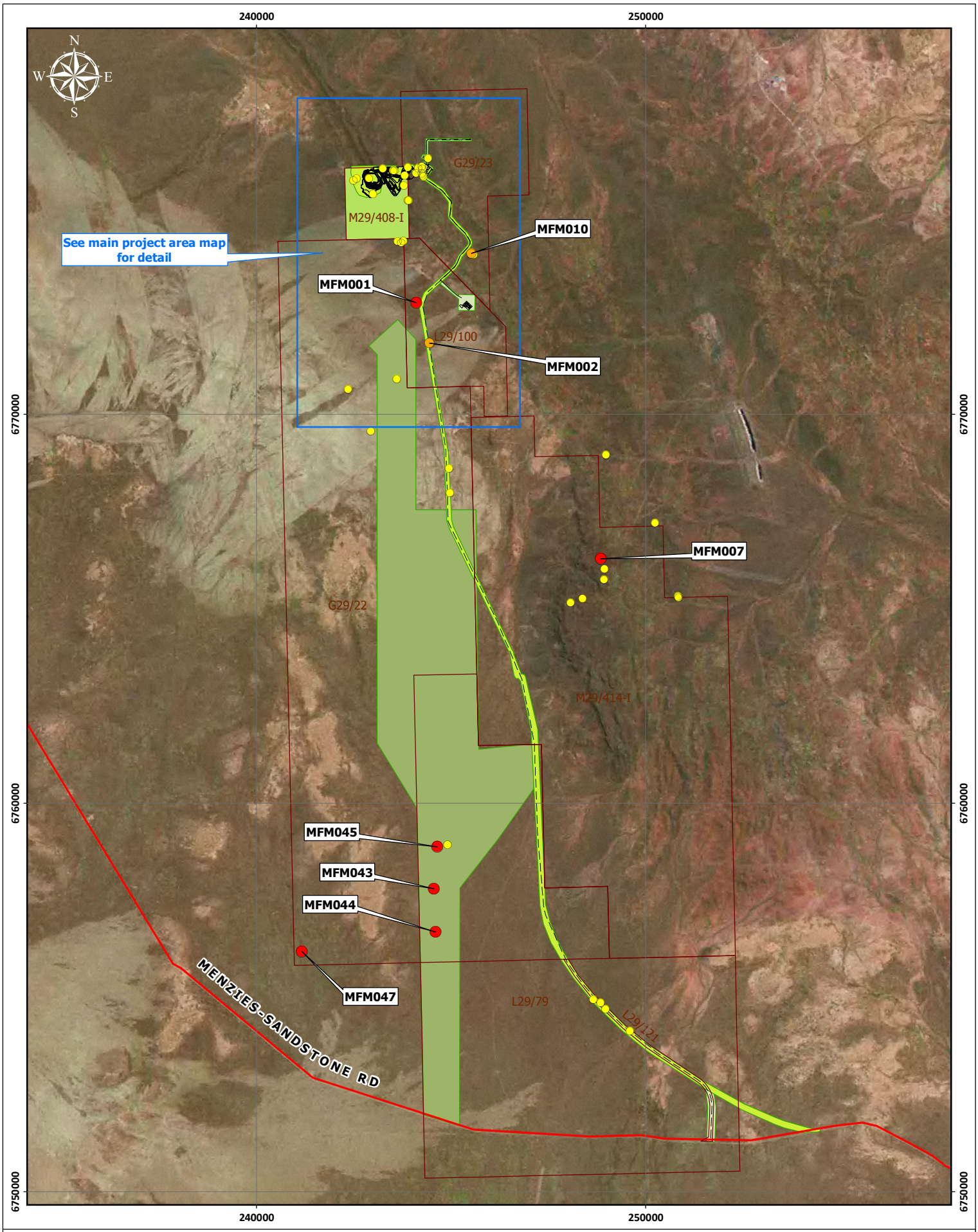
2013-020



Malleefowl mounds

- Active
- Inactive <20yrs
- Inactive >20yrs
- Haul/internal road
- Other proposed infrastructure
- Targeted EPBC Listed Fauna Survey (KLA)
- Scoping clearance survey (JML)
- Mount Mason Fauna Assessment (KLA)
- Targeted Malleefowl Survey (GHD)

Figure 5a: Malleefowl mounds - overview

0 1 2 3 4 5 km

1:125,000

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Coordinates are GDA94 MGA zone 51.
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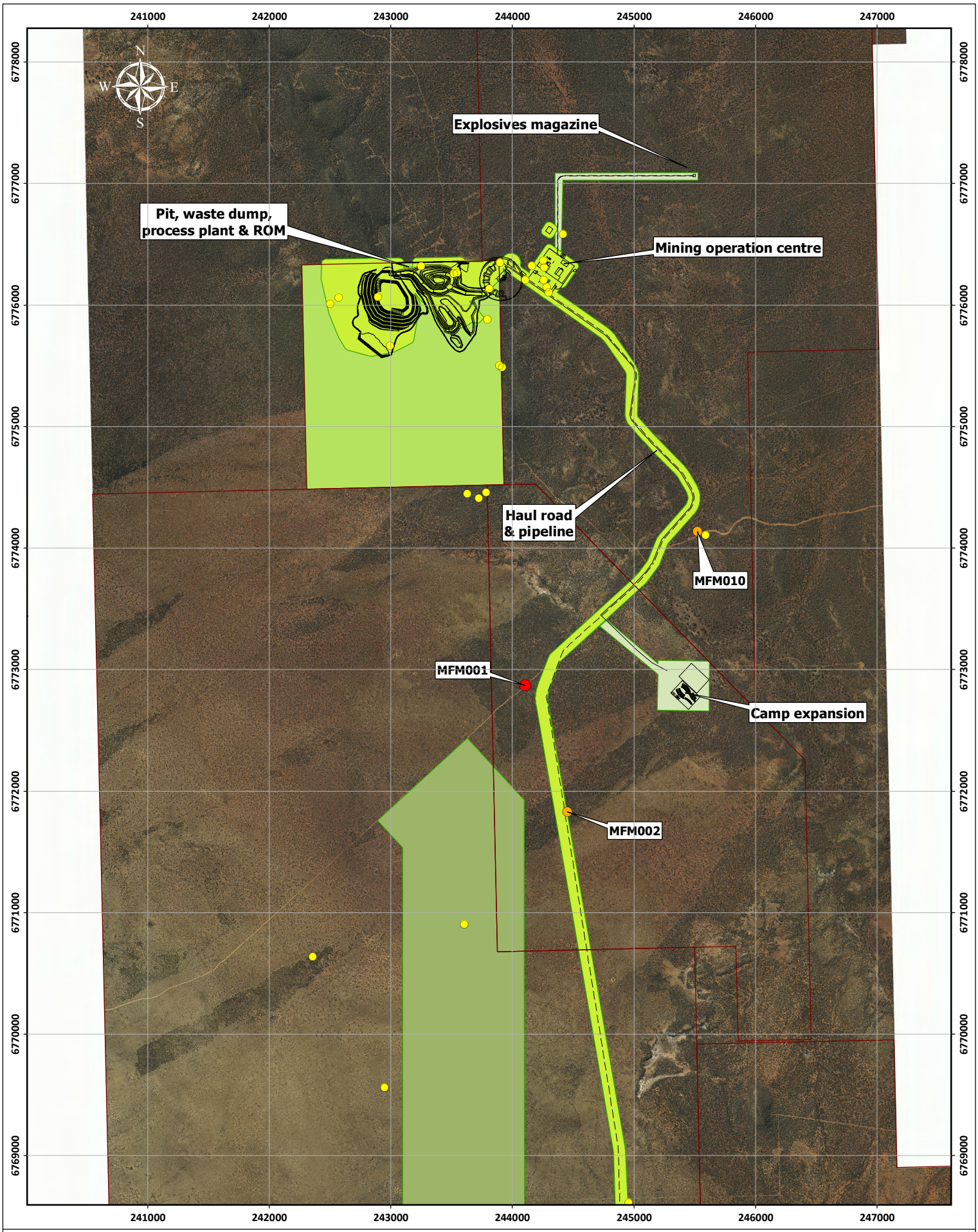

Malleefowl mounds

- Active
- Inactive <20yrs
- Inactive >20yrs
- Haul/internal road
- Other proposed infrastructure
- Targeted EPBC Listed Fauna Survey (KLA)
- Scoping clearance survey (JML)
- Mount Mason Fauna Assessment (KLA)
- Targeted Malleefowl Survey (GHD)

Figure 5b: Malleefowl mounds-main project area

0 1 2 km

1:40,000

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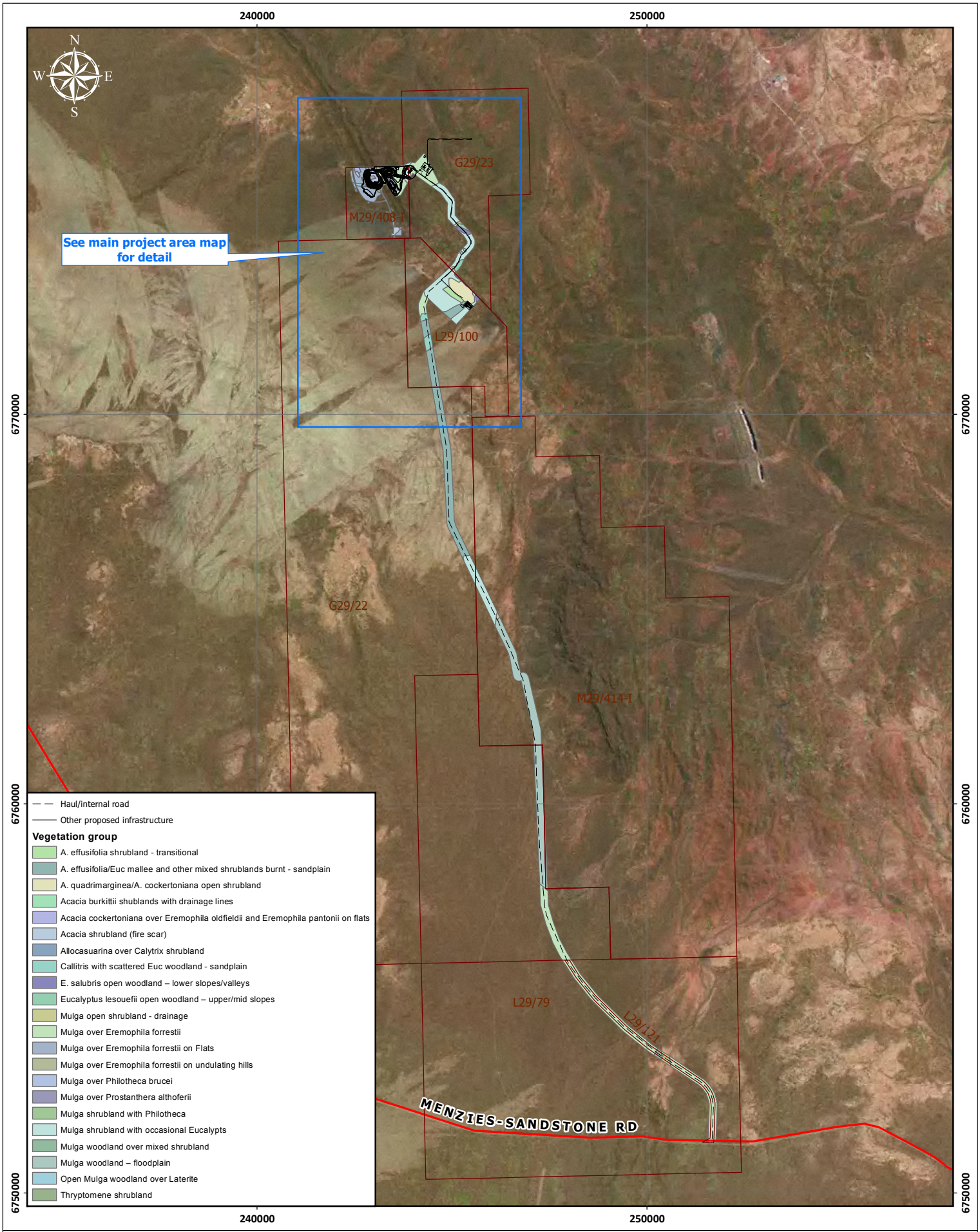

Figure 6a: Vegetation communities - overview

0 1 2 3 4 5 km

1:125,000

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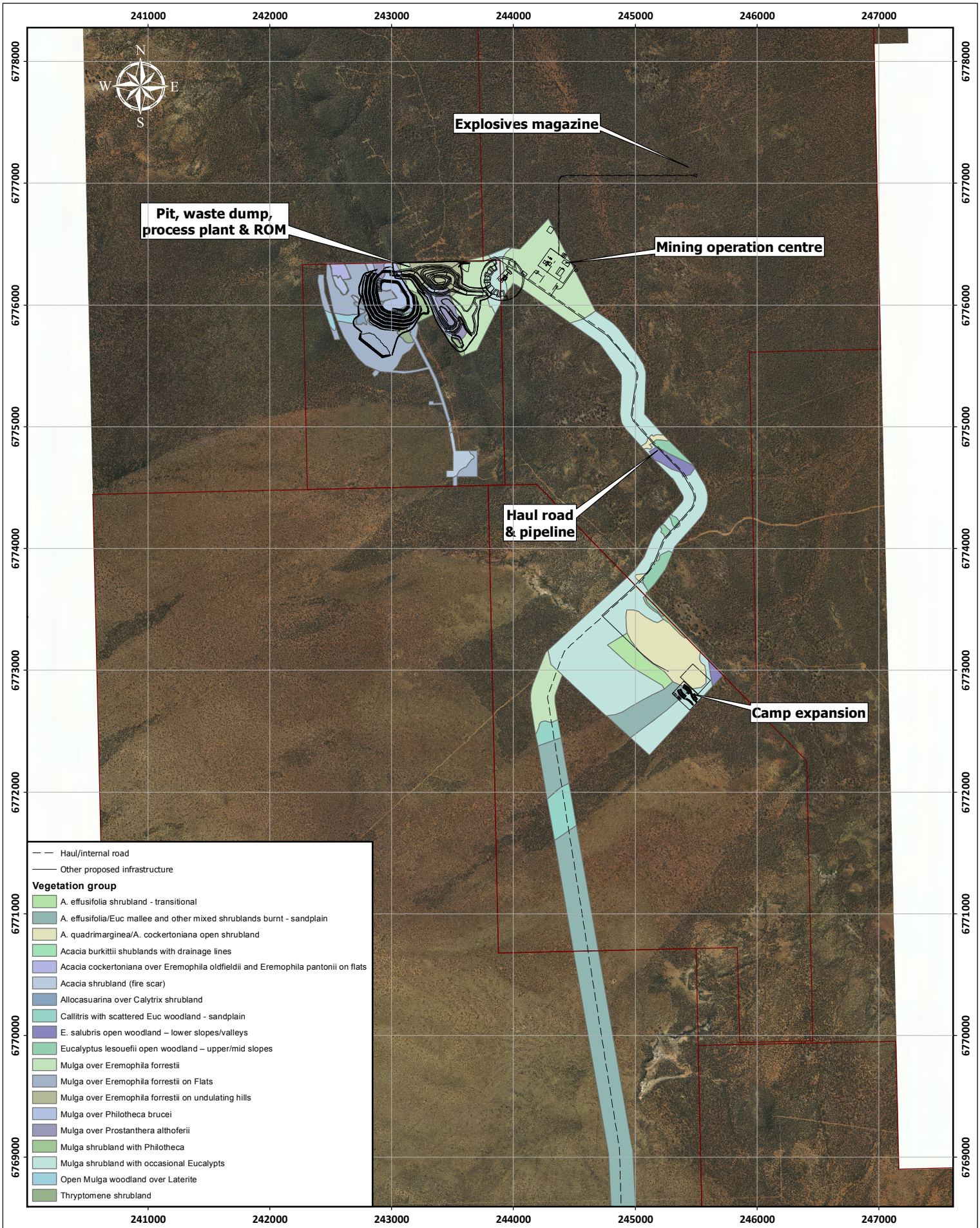

Figure 6b: Vegetation communities - main project area

0 1 2 km

1:40,000

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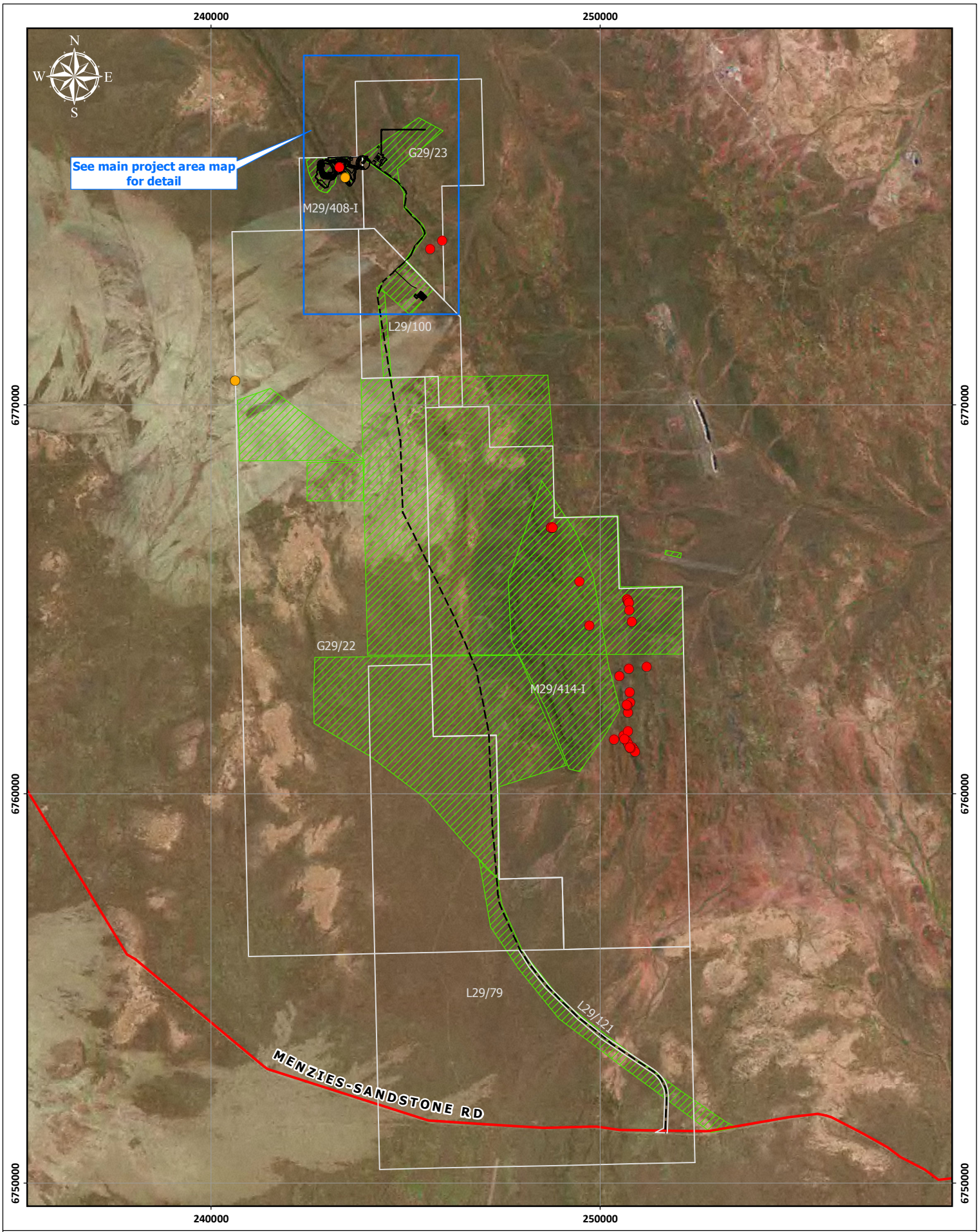

Drosera
Calotis
Haul/internal road
Other proposed infrastructure
Flora surveys

Figure 7a: Priority flora - overview

0 2 4 6 8 10 km

1:125,000

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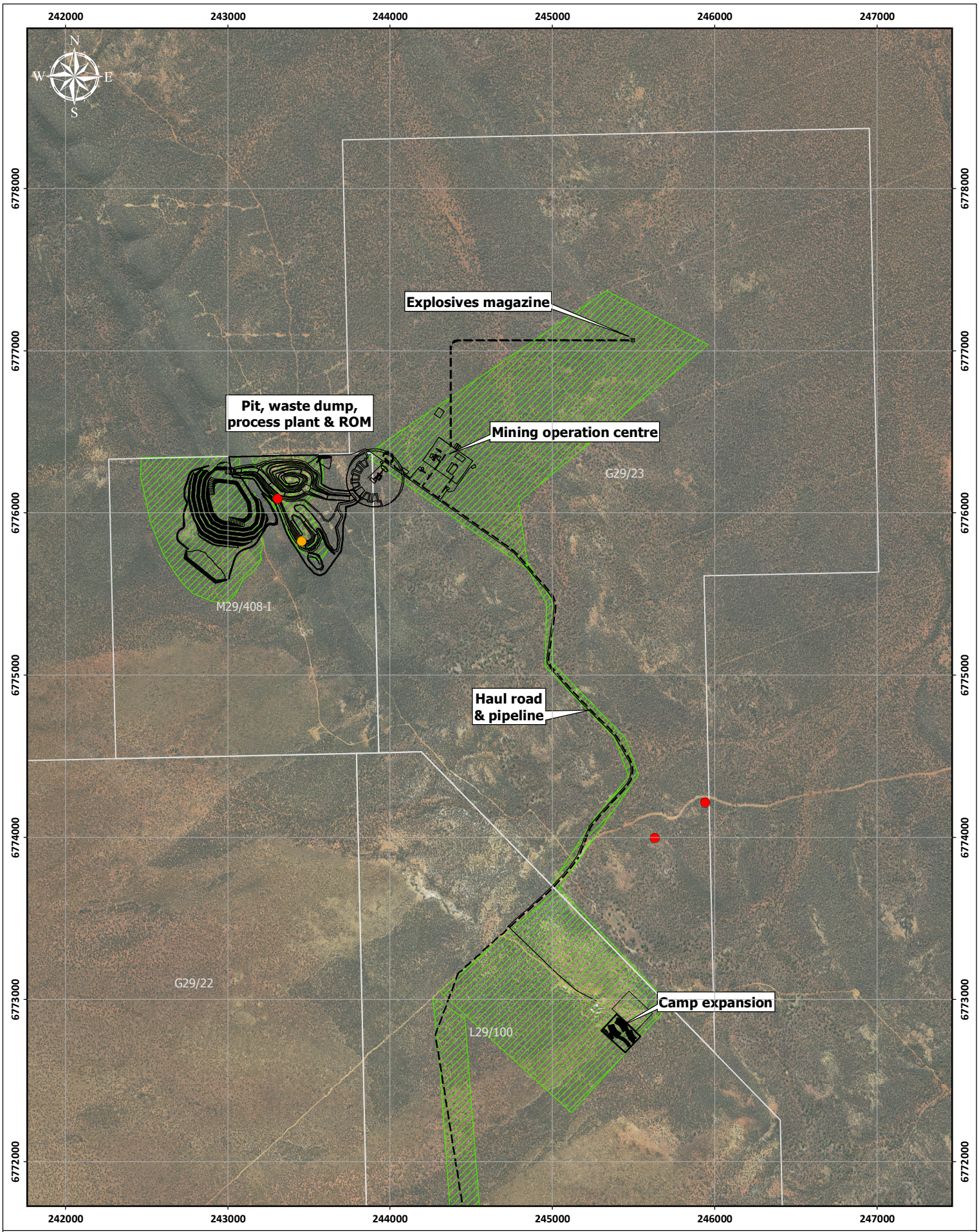

Drosera
Calotis
Haul/internal road
Other proposed infrastructure
Flora surveys

Figure 7b: Priority flora - main project area

0 1 2 km

1:30,000

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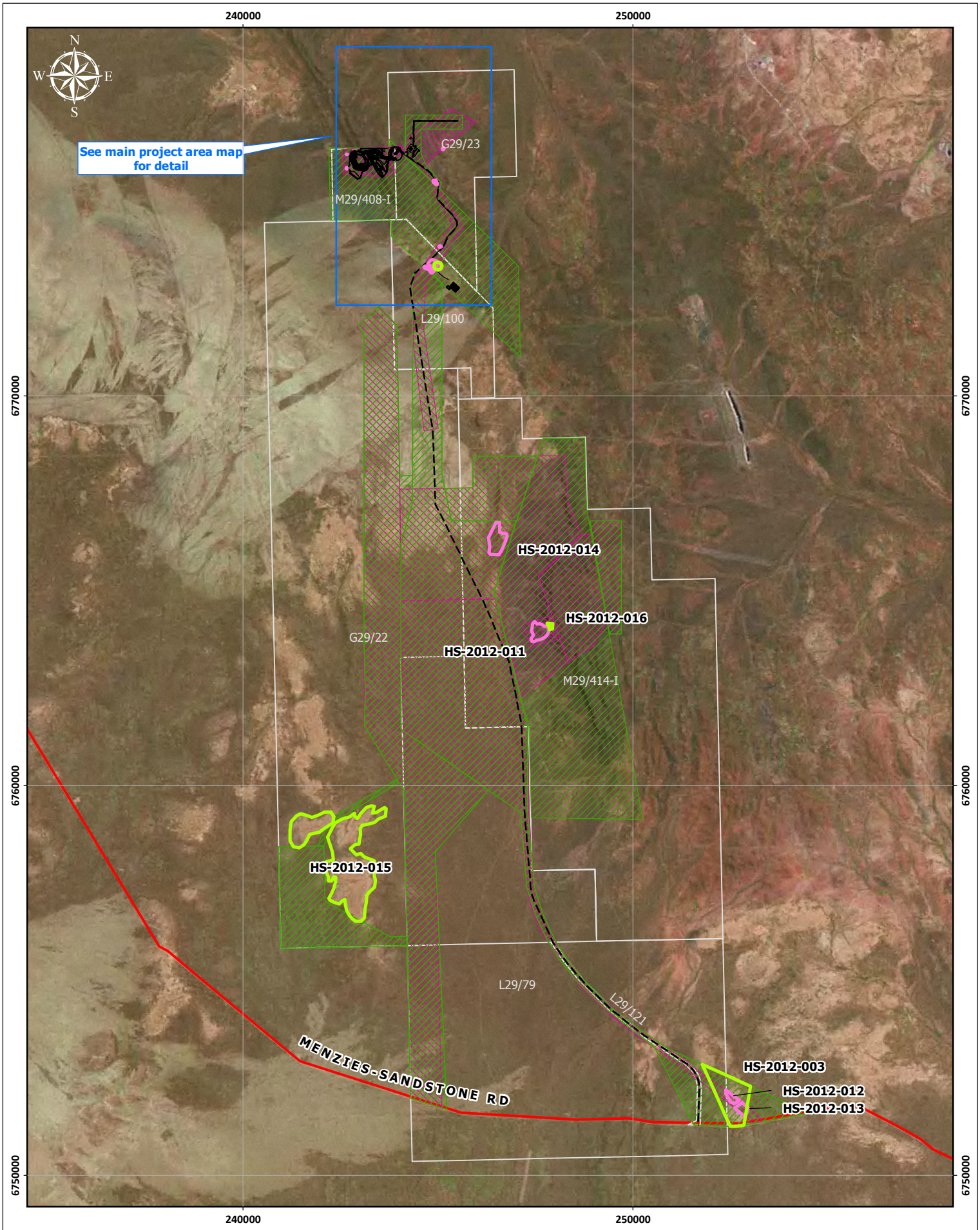

Ethnographic site
Archaeological site
Baseline surveys - Ethnographic
Baseline surveys - Archaeological
Haul/internal road
Other proposed infrastructure

Figure 8a: Heritage sites - overview

0 1 2 3 4 5 km

1:125,000

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Coordinates are GDA94 MGA zone 51.
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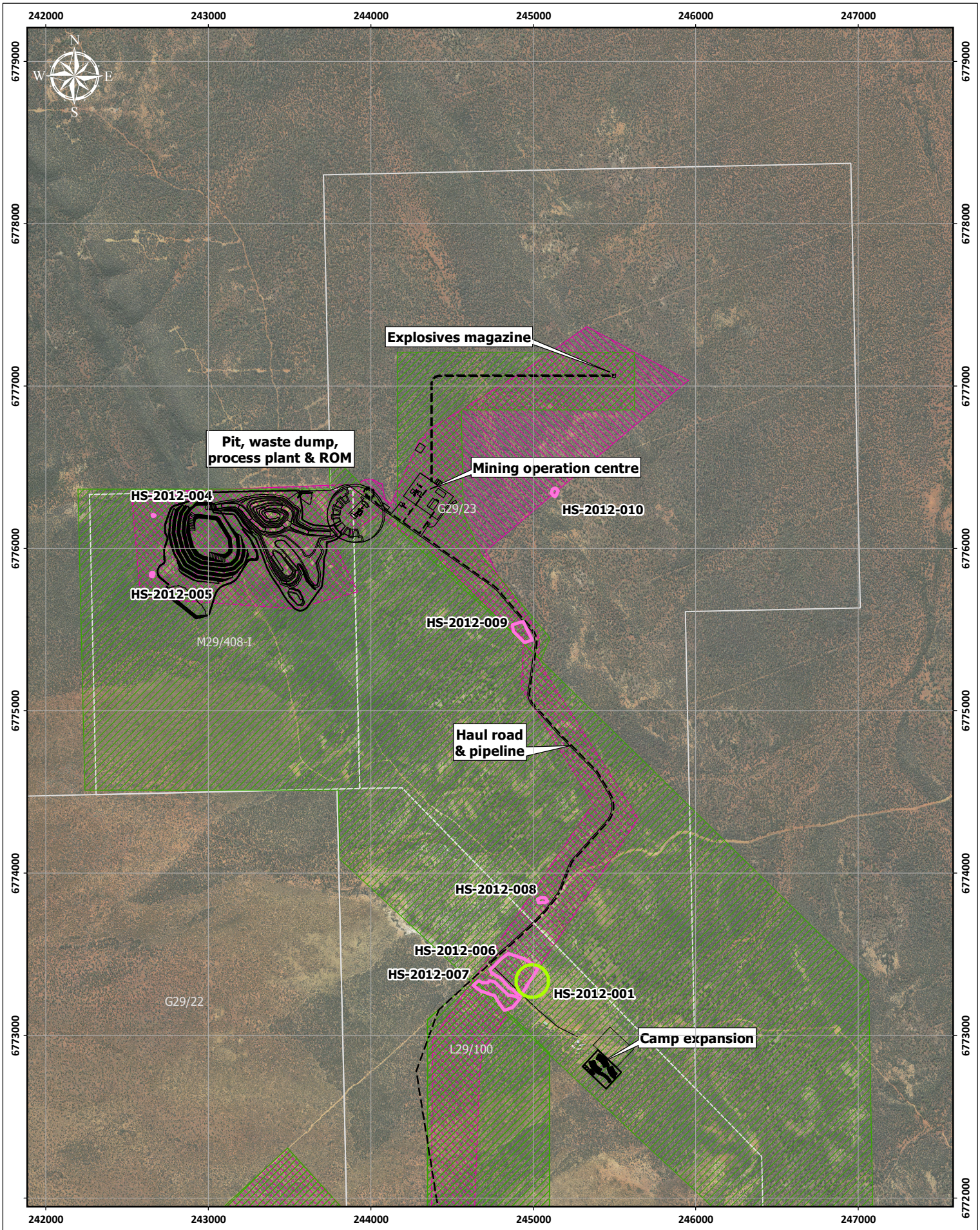
2013-011a



Ethnographic site
Archaeological site
Haul/internal road
Other proposed infrastructure
Baseline surveys - Ethnographic
Baseline surveys - Archaeological

Figure 8b: Heritage sites - main project area

0 1 2 km

1:30,000

Jupiter Mines Limited

Coordinates are GDA94 MGA zone 51.
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2013-011b

ATTACHMENTS

ATTACHMENT 1

ENVIRONMENTAL & COMMUNITY RELATIONS POLICY

Jupiter Mines Limited

VISION

Jupiter Mines is committed to sustainable development and continual improvement to minimise its impacts on the environment and benefit the community. This vision applies to all sites and all employees and contractors working on behalf of Jupiter Mines.

ACTIONS

To achieve our vision we will:

- Comply with all legal requirements
- Maintain a robust management system that drives continual improvement
- Ensure that our personnel and contractors are trained in the potential environmental and community impacts of their role and how to minimise them
- Minimise clearing of vegetation
- Manage water extraction to avoid adverse impacts on vegetation and fauna
- Improve biodiversity through progressive rehabilitation and effective property management
- Manage air, land and water emissions through the provision of effective pollution control facilities
- Remediate any spills or contamination caused by our works
- Seek opportunities to conserve resources and minimise waste
- Protect sites of cultural heritage by ensuring they remain secure and undisturbed
- Communicate openly with employees, the community and regulatory authorities and respond quickly to stakeholder concerns
- Seek opportunities to provide training and work to the local community

Greg Durack
CHIEF EXECUTIVE OFFICER

ATTACHMENT 2

Government of **Western Australia**
Department of **Water**

looking after all our water needs

Our ref: RF9240
Enquires: Yolanda Brookes
Phone: 6250 8025

Jupiter Mining Pty Ltd
Level 42
108 St Georges Tce
PERTH WA 6000

Attn: Polly Hammond

Dear Ms Hammond

Re: Your application for a licence to construct or alter well – CAW175129 (1) and CAW175339 (1)
Property: L29/81, L29/99 and L37/203, Mt Mason and Mt Ida, Ularring

Please find enclosed your licences, authorising you to construct or alter a well(s), subject to certain terms, limitations and conditions. It does not absolve you from responsibility for compliance with the requirements of all Commonwealth and State legislation.

Under section 26E of the *Rights in Water and Irrigation Act 1914, Form 2 - Information to be provided on completion of a non-artesian well* (enclosed) is to be completed and submitted by your driller to the department within one month after completing the well. The completed form is to be submitted to this office.

It is important that you read your licences carefully. If you do not understand your licences, please contact the department as soon as possible, as there are penalties for failing to comply with all of your licence terms, limitations and conditions. Please ensure your driller is also aware of all the terms, limitations and conditions of the licence before drilling commences.

These licences are for investigation of the groundwater resource only. It allows you to conduct test drilling to support the preparation of a Hydrogeological Report. Your Hydrogeolocial Report must be submitted with future applications for a Licence to Take Water. Reports submitted to the Department must follow the format of the attached guidelines and include all data from the investigation program.

Swan Avon Region
7 Ellam Street Victoria Park Western Australia 6100
Telephone (08) 6250 8000 Facsimile (08) 6250 8050
www.water.wa.gov.au
wa.gov.au

XDWAL014

ATTACHMENT – YOUR RIGHTS FOR A REVIEW

Under section 26GI of the *Rights in Water and Irrigation Act 1914*, you have a right to apply to the State Administrative Tribunal for a review of any term, limitation or condition included in a licence. You have 28 days from the date you received this letter to request that the decision be reviewed.

For further information please contact the State Administrative Tribunal:

State Administrative Tribunal
12 St Georges Terrace
PERTH WA 6000

GPO Box U1991
PERTH WA 6845

Telephone: (08) 9219 3111
Toll-free: 1300 306 017
Facsimile: (08) 9325 5099
www.sat.justice.wa.gov.au

Under section 21 of the *State Administrative Tribunal Act 2004*, you have a right to request a written statement of reasons for the decision to issue a licence to construct or alter a well. This request must be made, in writing, to the Department of Water within 28 days after receiving this letter.

The Department will accept data and reports in the electronic format. Electronic submissions should be made using the following spreadsheet and guidelines: Requirements for the Provision of Resource Information Reports and Data in the Electronic Format. These documents can be located on the Department of Water's web site www.water.wa.gov.au, under the headings of Doing Business with Us/Water licensing/Licensing publications Forms.

After completion of the investigation, should you wish to submit an application for a Licence to Take Water, a thorough assessment of the proposal and the Hydrogeological Report will be conducted by the Department. It is important to realise that the outcome of the assessment cannot be guaranteed and may not always result in a Licence to Take Water being granted.

These licences do not give you authority to trespass onto land or grant you access to any mining tenements. It is your responsibility to ensure that legal access is acquired and maintained on all land where investigation works will be conducted.

Compliance with the terms, conditions or restrictions of these licences does not absolve the licensee from responsibility for compliance with the requirements of all Commonwealth and State legislation.

Please see the attachment regarding your rights for a review of the department's decision.

For further information on water licensing, please refer to the frequently asked questions (FAQ's) series on the department's website, under the *Business with water* tab.

If you wish to discuss this further, or to arrange a meeting, please contact Yolanda Brookes by telephone on (08) 6250 8025.

Yours sincerely

Yolanda Brookes
Natural Resource Management Officer
Swan Avon Region

5 / 4 / 2012

Encl. CAW175129 (1) & CAW175339 (1)

Attachment – Your rights for a review
Form 2

Instrument No. CAW175129(1)

LICENCE TO CONSTRUCT OR ALTER WELL

Granted by the Minister under section 26D of the Rights in Water and Irrigation Act 1914

Licensee(s)	Jupiter Mining Pty Ltd	
Description of Water Resource	Goldfields Palaeochannel - Fractured Rock	
Location of Well(s)	Tenements L29/99 and L37/203	
Authorised Activities	**Activity**	**Location of Activity**
	Construct as many as required exploratory well(s). Construct as many as required non-artesian well(s).	Tenements L29/99 and L37/203
Duration of Licence	From 5 April 2012 to 5 April 2013	

This Licence is subject to the following terms, limitations and conditions:

1 The well must be constructed by a driller having a current class 1 water well drillers certificate issued by the Western Australian branch of the Australian Drilling Industry Association or other certification approved by the Department of Water as equivalent.

2 That exploratory bores are capped to the satisfaction of the Department of Water.

3 The water drawn from the bore shall be limited to well development, test pumping and sampling.

4 That water discharged during the pump test, is to be disposed of in such a manner as to cause no undesirable environmental impact.

5 That no well shall be sunk within 500 metres of an existing well without the written permission of the owner of that well.

End of terms, limitations and conditions

Instrument No. CAW175339(1)

LICENCE TO CONSTRUCT OR ALTER WELL

Granted by the Minister under section 26D of the Rights in Water and Irrigation Act 1914

Licensee(s)	Jupiter Mining Pty Ltd	
Description of Water Resource	Goldfields Palaeochannel - Fractured Rock	
Location of Well(s)	Tenement L29/81	
Authorised Activities	**Activity**	**Location of Activity**
	Construct as many as required non-artesian well(s). Construct as many as required exploratory well(s).	Tenement L29/81
Duration of Licence	From 5 April 2012 to 5 April 2013	

This Licence is subject to the following terms, limitations and conditions:

1 The well must be constructed by a driller having a current class 1 water well drillers certificate issued by the Western Australian branch of the Australian Drilling Industry Association or other certification approved by the Department of Water as equivalent.

2 That exploratory bores are capped to the satisfaction of the Department of Water.

3 The water drawn from the bore shall be limited to well development, test pumping and sampling.

4 That water discharged during the pump test, is to be disposed of in such a manner as to cause no undesirable environmental impact.

5 That no well shall be sunk within 500 metres of an existing well without the written permission of the owner of that well.

End of terms, limitations and conditions

This Licence is granted subject to the Rights in Water and Irrigation Regulations 2000.

ATTACHMENT 3

Level 1
Flora and Vegetation Survey of the Proposed Mount Mason Haul Road

(M29/414, M29/408, G29/22, G29/23, L29/79, L29/100)

Prepared for

Jupiter Mines Limited

Final
January 2013

Prepared by:
Native Vegetation Solutions
PO Box 41
KALGOORLIE
Ph: (08) 9022 2536
Mob: 0407 998 953
Email: eren@nativevegsolutions.com.au

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1 INTRODUCTION

Jupiter Mines Limited (Jupiter) is a publicly listed company with iron ore operations in both the Mt Mason and Mt Ida Projects north-west of Menzies, in the Central Yilgarn of Western Australia. Once approvals are granted, Jupiter intends on transporting iron ore along the Menzies-Sandstone Rd to a rail siding south of the town of Menzies which is located approximately 121 km north of Kalgoorlie, Western Australia (Figure 1).

In order to access the Menzies Sandstone Road Jupiter has proposed to construct a haul road on the western side of proposed infrastructure at Mt Ida, connecting the Menzies-Sandstone Rd with the Mt Mason Ore Deposit. The proposed Haul Road intersects Mining Tenements M29/414 and M29/408, General Purpose Tenements G29/22 and G29/23 as well as Miscellaneous Tenements L29/79 and L29/100. Jupiter commissioned Native Vegetation Solutions (NVS), on the 29th of May 2012, to conduct a Level 1 Flora Survey in this area.

This survey area covers 707.76ha along approximately 30kms of road (Appendix 5, Map 1), beginning at the Mt Mason project area, also including an expansion of previous survey areas and the current Camp Cassini. The proposed haul road then heads south-southwest of the proposed camp and Mt Mason project area to meet with the Sandstone-Menzies Rd approximately 70km northwest of Menzies.

A 200m wide strip was surveyed along the proposed route, despite the requirements of the haul road being 20m wide. This allowed for deviations of the haul road within the survey area, to avoid species of conservation significance.

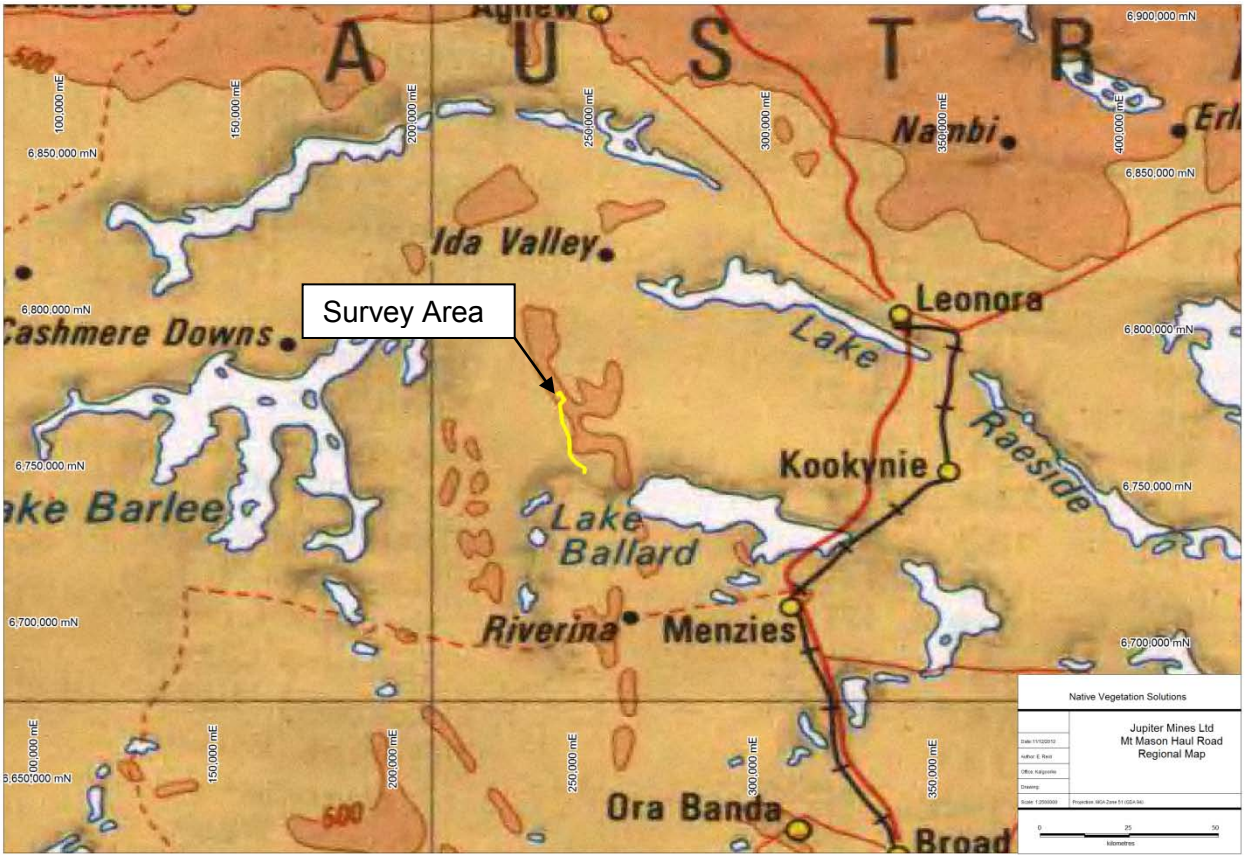

Figure 1: Regional map of survey location

1.1 Objectives

The objective of this report is to document the results of the flora and vegetation component of a Level 1 survey conducted in accordance with the Environmental Protection Authority (EPA) "*Terrestrial Biological Surveys as an Element of Biodiversity Protection; Position Statement No 3*" (EPA 2002) and *Guidance Statement No. 51 "Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (EPA 2004)", for the purpose of mining.

A Level 1 survey has two components:
1) Desktop study which includes a literature review and a search of the relevant databases; and

2) Reconnaissance survey of the subject area to verify the desktop survey, to define vegetation units present in the area, search for species of conservation significance and to determine potential sensitivity to impact.

As part of the reporting for the Level 1 assessment, NVS has conducted a Flora and Vegetation Survey which includes broad-scale vegetation mapping and vegetation condition mapping of the survey area.

Therefore, the scope of work for the Flora and Vegetation Survey was to:
- conduct a desktop study that includes a literature review and search of the relevant databases;
- generally describe the vegetation associations in the study area;
- prepare an inventory of species occurring in the study area;
- identify any vegetation or flora of particular conservation significance; and
- provide recommendations, including the management of perceived impacts to flora and vegetation within the survey area.

1.2 Geology and Vegetation

The survey area lies in the Murchison (MUR) bioregion within the Eastern Murchison (MUR1) subregion which totals over 7.8 million hectares (CALM, 2002). The MUR1 subregion lies on the Yilgarn Craton's 'Southern Cross' and 'Eastern Goldfields' Terrains. Red desert sandplains are elevated and characterise this region, covering broad areas. Plains of red brown soils are wide ranging with breakaway ridges occurring throughout. Salt lake systems associated with the closed Paleodrainage system are also a characteristic feature of this region. Mulga Woodlands are dominant over the area which supports an abundance of ephemerals including: Halosarcia shrublands, saltbush shrublands and hummock grasslands.

1.3 Climate

Climate is arid with the majority of rainfall (250mm average annually) received in the winter months, and summer thunderstorms (CALM, 2002). The nearest official meteorological weather station is Menzies. However Leonora weather station, located 98kms northeast of the survey area, has the most complete and up to date information.

1.3.1 Temperature

Mean annual minimum temperature at Menzies is 12.6°C and mean annual maximum temperature is 26.3°C. The coldest temperatures are attained in July (mean minimum temperature 5.3°C), the hottest is January (mean maximum temperature 35.1°C) with diurnal temperature variations are relatively consistent throughout the year (Figure 2).

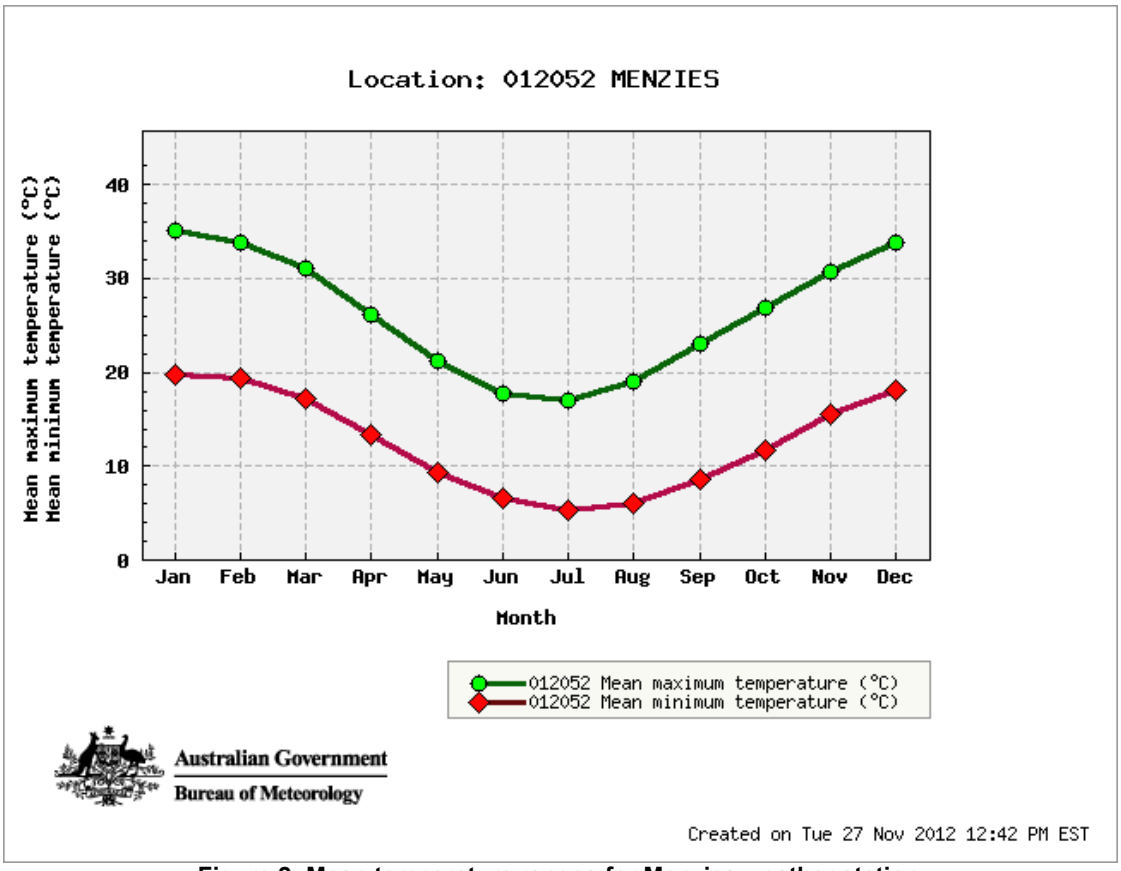

Figure 2: Mean temperature ranges for Menzies weather station

1.3.2 Rainfall

The area is arid and the annual average rainfall at Menzies is 250.3 mm, which falls (>1 mm) on an average of 32.1 rain-days. Most of the rain usually falls between January and August and this amount varies greatly both seasonally and annually (Figure 3). Prior to this survey being undertaken rainfall at Menzies had not been recorded in 2012 for the months of January, February, March or April. However rainfall for June, July, August, September and October show rainfall below the monthly averages for these months.

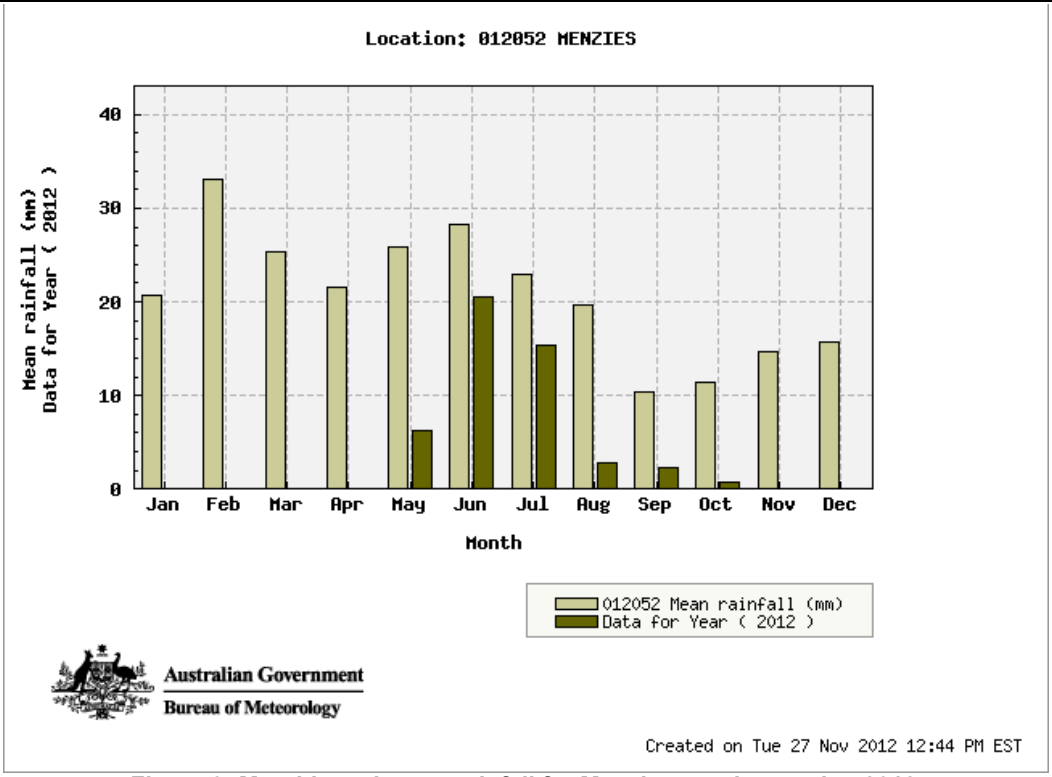

Figure 3: Monthly and mean rainfall for Menzies weather station 2012

For comparison purposes, rainfall data from the Leonora weather station Located 96km east of the survey area has been provided. In 2012, 221.4mm of rainfall has been recorded in 2012 prior to the survey. This graph demonstrates rainfall being greater than the average figures for January and March. Figure 4 also demonstrates that rainfall in Leonora has been below the average rainfall data during the rest of the 2012 period.

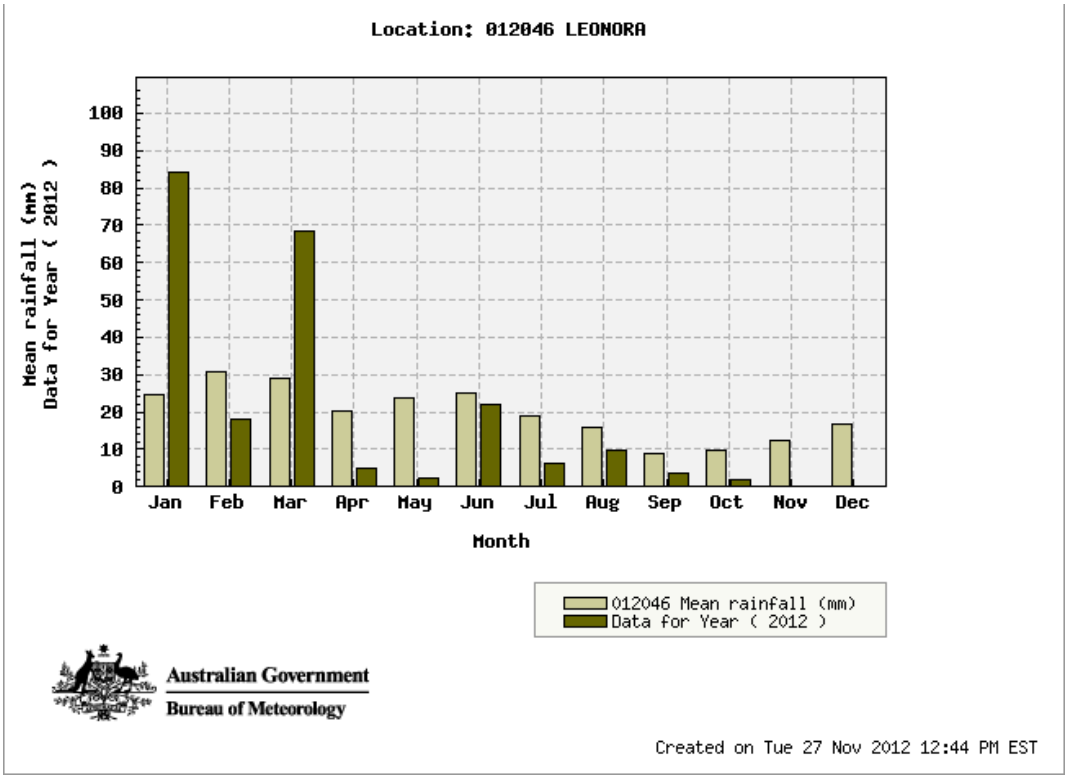

Figure 4: Monthly and mean rainfall for Leonora weather station 2012

In 2012, 221.4mm of rain was recorded at Leonora, with 84.2mm of that rainfall received in January. Mean monthly rainfall for January to June is between 20.4mm and 30.9mm; this is lower in the second part of the year (July to December), ranging from 8.9mm to 16.8mm. A similar pattern is seen in the mean rainfall at Menzies.

2. ASSESSMENT METHODOLOGY

2.1 Preliminary Desktop Study

A preliminary assessment of the survey area and its potential constraints was undertaken by reviewing a number of government agency managed databases (see Appendix 1) and consulting where necessary. The following sections provide a summary of the methodology used for each potential environmental aspect associated with the project.

2.1.1 *Environmental Protection and Biodiversity Conservation Act* Protected Matters

The *Environmental Protection and Biodiversity Conservation (EPBC) Act 1999* Protected Matters Search tool was utilised to provide results for matters of National Environmental Significance within the survey area.
(http://www.environment.gov.au/arcgis-framework/apps/pmst/pmst-coordinate.jsf)

2.1.2 Threatened Flora and Communities

The Species and Communities Branch of the Department of Environment and Conservation (DEC) was contacted for a search of their databases containing known populations of threatened flora (Reference: 76-1011FL) (DEC, 2011).

The presence of Threatened Ecological Communities and Priority Ecological Communities (TECs & PECs) was determined by examining Geographic Information System (GIS) data supplied by the DEC upon request (Reference: 53-1011EC) (DEC, 2011a).

2.1.3 Environmentally Sensitive Areas and Conservation Reserves

DEC's Native Vegetation Map Viewer was used to determine the location of any Environmentally Sensitive Areas (ESAs) (http://maps.dec.wa.gov.au/idelve/nv/index.jsp)

The location of any Conservation Reserves was determined by examining GIS data available from the DEC website and consulting with the local DEC office where necessary.

2.1.4 Vegetation Type, Extent and Status

Vegetation extent and status data was sourced from the Department of Agriculture and Food (DAFWA) report "Land-Use and Vegetation in Western Australia- National Land and Water Resources Audit Report" and its associated GIS file (Shepherd *et al*, 2002).

Note: This data was provided to Native Vegetation Solutions via a license agreement with the DAFWA.

2.1.5 Wetlands

The location of wetlands within the project area was determined by examining DAFWA's Wetland Base (http://spatial.agric.wa.gov.au/wetlands/)

2.1.6 Dieback

Dieback is only considered a potential issue for the project if both the mean annual rainfall of the area is >400mm, and if the project area resides below the 26th parallel.

2.2 Site Investigation

A site visit was carried out by Botanists Eren Reid and Ashley Owen from Native Vegetation Solutions from the 29th May to 31st May 2012, to examine the flora and vegetation groups contained within the survey area. A total of 23 hours was spent on site traversing the survey area, by Kawasaki Mule and on foot.
The survey was conducted in accordance with relevant EPA's Statements and Guidelines (Section 1.1).

EPA's *Position Statement No. 3* (EPA 2002) provides indicative levels of biological survey in relation to the scale and nature of the impact and the sensitivity of the receiving environment. The EPA uses the Interim Biogeographic Regionalisation of Australia (IBRA) as the largest unit for Environmental Impact Assessment decision making in relation to the conservation of biodiversity. Given the scale and nature of the proposed disturbance as well as the existing disturbance, and that the survey area is located within the Murchison IBRA region, a Level 1 flora and vegetation survey was required.

2.2.1 Licenses

Flora was collected for identification under the Scientific Collection License SL010070 held by Mr E. R. Reid with expiry 28/06/2013.

2.3 Personnel and Reporting

The following personnel were involved in the preparation of this report;

- Eren Reid *BSc (Biological Science),* Principal Botanist, Native Vegetation Solutions, undertook the survey and preparation of report;
- Ashley Owen *DipSc*, Botanist/Consultant, Native Vegetation Solutions, undertook data collation and preparation of report;
- Tim Wrigley BAppSc (Environmental Science), Consultant, Native Vegetation Solutions, preparation of report.
- Mr. Frank Obbens *BSc*, Consultant Botanist/Plant Taxonomist, undertook identification of unknown specimens collected during fieldwork

2.4 Limitations

Table 1 lists potential limitations that may have affected the survey. These are based on the listing given in the *Guidance Statement No. 51 Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (EPA, 2004). As shown, this survey was not limited by any factors listed below.

Table 1: List of potential survey limitations

Potential Limitations	Constraint (Y/N)	Comment
Competency and experience of the consultants undertaking the survey	N	Mr Eren Reid is an experienced botanist who has conducted many flora and vegetation surveys in the Goldfields, Pilbara and South-west regions of WA.
Proportion of flora identified during survey	N	As the survey was planned to identify flora within a small linear survey area, a complete census of the species present was attempted (Approx. 95%). Sufficient identifications were made to allow vegetation descriptions to be made.
Sources of information	N	DRF and Priority Flora GIS information was available from DEC.
Proportion of the task achieved	N	All tasks completed
Timing/Season	N	The targeted survey was conducted in Autumn 2012. Due to the above average rainfall in January and March 2012, many species were in flower with emergent annuals.
Disturbance in survey area	N	Disturbance was present in the form of grazing, historic tracks and clearing.
Intensity of survey effort	N	Transects were walked through the survey area with all parts visited
Resources	N	Adequate resources were available
Access problems	N	No problems with access
Availability of contextual information on the region	N	Information on the Murchison Bioregion is readily available.

3. RESULTS

3.1 Preliminary Desktop Assessment

3.1.1 EPBC Act Protected Matters

The EPBC Protected Matters database search revealed a potential for 2 invasive plant species, *Carrichtera annua* (Ward's Weed) and *Cenchrus ciliaris* (Buffel Grass), to occur within the survey area based on suitable habitat. Search results included in Appendix 1 (DSEWPC, 2012).

3.1.2 Threatened Flora and Communities

The DEC database searches revealed that 1 Threatened Flora and 25 Priority Flora species occur within a 50km radius of the survey area (DEC, 2011) and have the potential to occur within the survey area. None of these known locations of Priority Flora occur within the survey area, while the closest location occurs 3.2km west of the survey area.

Results of the threatened flora database search are included in Appendix 2.

The PEC/TEC search revealed that the survey area contains no TECs, however lies within the buffer zone of a PEC location (Appendix 4). The centre point for this buffer zone does occur within the survey area (DEC, 2011a). The buffer zone relates to the PEC known as the Bulga Downs/Perinvale/Walling/vegetation complexes (banded ironstone formation) (Priority 1). This community has not yet been described by the DEC on their list of PECs (DEC, 2012a). The DEC were contacted for information regarding this PEC, however no information was available to provide an adequate description or boundary definition, The DEC response however,

suggested that the PEC relates to the vegetation specifically occurring on the banded ironstone formations.

Vegetation related to the Banded Ironstone Formations are vegetation groups 1g and parts of 1n. These vegetation groups are included below in section 3.2.2. The total area covered by Banded Ironstone formations includes approximately 6.12 ha which is 0.86% of the total survey area.

Priority 1 PECs are defined to be poorly known 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. 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.

3.1.3 Environmentally Sensitive Areas and Conservation Reserves

The survey area does not lie within or contain any ESA's or Conservation Reserves (DEC, 2012).

3.1.4 Vegetation Type, Extent and Status

Information relating to known vegetation within the survey area has been summarised in Table 2, 3, 4 and 5 below. This information has been compiled through both desktop assessments and the field assessment.

Table 2: Summary of information regarding Pre-European and current vegetation extent of Vegetation Association 18 within the survey area

Factor	Value				
Beard Vegetation Association*	18				
Vegetation Association Description*	Low woodland; mulga (Acacia aneura)				
% of survey area within this Beard Association	70.28%				
Pre-European Extent (ha)	Scale				
	By Association *(WA)*	***By Association*** *(WA)*	***By IBRA Region*** *(MUR)*	***By IBRA Sub-region*** *(MUR1)*	***By Shire*** *(Shire of Menzies)*
	22,029,557*	19,926,085**	12,422,396**	10,285,290**	2,013,390**
% Pre-European Extent Remaining*	100%	100%	100%	100%	100%
Surrounding Land Use***	Mining, Exploration, Pastoral Lease				
Weed prevalence***	Low				

* Source: Shepherd *et al.* (2002) Appendix 2
**Source: Shepherd *et al.* (2002) Associated GIS data
***Source: Field Assessment

Table 3: Summary of information regarding Pre-European and current vegetation extent of Vegetation Association 202 within the survey area

Factor	Value				
Beard Vegetation Association*	202				
Vegetation Association Description*	Shrublands; mulga & Acacia quadrimarginea scrub				
% of survey area within this Beard Association	23.59%				
Pre-European Extent (ha)	Scale				
	By Association *(WA)*	***By Association*** *(WA)*	***By IBRA Region*** *(MUR)*	***By IBRA Sub-region*** *(MUR1)*	***By Shire*** *(Shire of Menzies)*
	365,344*	449,227**	340,257**	279,020**	143,358**
% Pre-European Extent Remaining*	100%	100%	100%	100%	100%
Surrounding Land Use***	Mining, Exploration, Pastoral Lease				
Weed prevalence***	Low				

* Source: Shepherd *et al.* (2002) Appendix 2
**Source: Shepherd *et al.* (2002) Associated GIS data
***Source: Field Assessment

Table 4: Summary of information regarding Pre-European and current vegetation extent of Vegetation Association 483 within the survey area

Factor	Value				
Beard Vegetation Association*	483				
Vegetation Association Description*	Hummock grasslands, mixed sandplain - open mallee over sparse dwarf shrubs with spinifex ; red mallee mallee & mixed sparse dwarf shrubs over *Triodia basedowii*				
% of survey area within this Beard Association	5.24%				
Pre-European Extent (ha)	Scale				
	By Association *(WA)*	***By Association*** *(WA)*	***By IBRA Region*** *(MUR)*	***By IBRA Sub-region*** *(MUR1)*	***By Shire*** *(Shire of Menzies)*
	395,106*	440,120**	238,896**	238,896**	366,441**
% Pre-European Extent Remaining*	100%	100%	100%	100%	100%
Surrounding Land Use***	Mining, Exploration, Pastoral Lease				
Weed prevalence***	Low				

* Source: Shepherd *et al.* (2002) Appendix 2
**Source: Shepherd *et al.* (2002) Associated GIS data
***Source: Field Assessment

Table 5: Summary of information regarding Pre-European and current vegetation extent of Vegetation Association 484 within the survey area

Factor	Value				
Beard Vegetation Association*	484				
Vegetation Association Description*	Shrublands; jam thicket				
% of survey area within this Beard Association	0.89%				
Pre-European Extent (ha)	Scale				
	By Association *(WA)*	***By Association*** *(WA)*	***By IBRA Region*** *(MUR)*	***By IBRA Sub-region*** *(MUR1)*	***By Shire*** *(Shire of Menzies)*
	70,235*	70,751**	69,487**	69,487**	57,719**
% Pre-European Extent Remaining*	100%	100%	100%	100%	100%
Surrounding Land Use***	Mining, Exploration, Pastoral Lease				
Weed prevalence***	Low				

* Source: Shepherd *et al.* (2002) Appendix 2
**Source: Shepherd *et al.* (2002) Associated GIS data
***Source: Field Assessment

3.1.5 Wetlands

No wetlands which are recorded on the DAFWA WetlandBase occur within the survey area (DAFWA, 2012). Results are displayed in Appendix 1.

3.1.6 Dieback

The survey area lies south of the 26th parallel, however receives average annual rainfall of between 236mm and 250mm (BoM, 2012), below the 400mm threshold level. There is no record of *Phytophthora cinnamomi* establishing in natural ecosystems in regions receiving <400mm rainfall per annum (CALM, 2003).
Therefore Dieback is not considered an issue for this survey area, however all measures should be taken to prevent any possible soil contamination (seeds of non-native species *etc*.) which poses a risk in the survey area during seasonally favourable conditions.

3.2 Field Assessment

3.2.1 Threatened Flora

No plant taxa located in the survey area are gazetted as DRF pursuant to subsection 2 of Section 23F of the *Wildlife Conservation Act 1950*. No plant taxa listed as Threatened pursuant to Schedule 1 of the *Environmental Protection and Biodiversity Conservation Act 1999* were located in the survey area.

3.2.2 Vegetation Type, Extent and Status

A total of 41 Families, 108 Genera and 231 Species were recorded within the survey area. Five major vegetation groups were recorded in the survey area, which were split into 12 subgroups. The vegetation subgroups are considered to be in Very Good, Good or Degraded condition (using the scale of Keighery 1994, see Appendix 3). Maps of the survey area can be seen in Appendix 5.

The vegetation groups are described in more detail below.

3.2.2.1 Mulga Shrubland with occasional Eucalypts (1a)

This vegetation group consisted of 24 Families, 43 Genera and 68 Species. The vegetation group was approximately 148.29 ha which makes up 20.95% of the survey area.

Dominant species were *Acacia incurvaneura, Acacia mulganeura*, *Acacia aneura var aneura, Acacia caesaneura, Eucalyptus oleosa subsp oleosa, Eucalyptus leptopoda subsp elevata, Spartothamnella teucriiflora,* and *Waitzia acuminata,*

Figure 5: Mulga Shrubland with occasional Eucalypts within the survey area

3.2.2.2 Mulga woodland- floodplain (1b)

This vegetation group consisted of 24 Families, 40 Genera and 55 Species. The vegetation group was approximately 143.58 ha which makes up 20.29% of the survey area.

Dominant species were *Acacia aneura var aneura*, *Acacia ramulosa var ramulosa, Ptilotus obovatus, Acacia tetragonophylla* and *Acacia mulganeura*.

Figure 6: Mulga woodland- floodplain within the survey area

3.2.2.3 Mulga shrubland with *Philotheca brucei subsp brucei* (1g)

This vegetation group consisted of 15 Families, 19 Genera and 27 Species. The vegetation group was approximately 4.73 ha which makes up 0.67% of the survey area. The entirety of this vegetation groups occurs on Banded Ironstone Formations.

Dominant species were *Acacia aneura var aneura, Acacia mulganeura, Acacia cockertoniana, Philotheca brucei subsp brucei* and *Ptilotus obovatus.*

Figure 7: Mulga shrubland with Philotheca brucei subsp brucei within the survey area

3.2.2.4 Mulga open shrubland- drainage (1k)

This vegetation group consisted of 24 Families, 41 Genera and 60 Species. The vegetation group was approximately 6.08 ha which makes up 0.86% of the survey area.

Dominant species were *Acacia aneura var aneura, Acacia mulganeura, Acacia tetragonophylla* and *Ptilotus obovatus*.

Figure 8: Mulga open shrubland- drainage within the survey area

3.2.2.5 Mulga with *Acacia cockertoniana* and *Acacia ramulosa var ramulosa* tall shrubland over *Olearia humilis* and/or *Hibbertia arcuata* and/or *Prostanthera althoferi subsp. althoferi* and/or *Eremophila forrestii subsp. forrestii* low shrubland (1n)

This vegetation group consisted of 21 Families, 31 Genera and 51 Species. The vegetation group was approximately 219.74 ha which makes up 31.05% of the survey area. The approximate total area of this vegetation group occurring on Banded Ironstone Formations is 1.39ha.

Dominant species were *Acacia cockertoniana*, *Acacia ramulosa var ramulosa*, *Olearia humilis, Hibbertia arcuata, Prostanthera althoferi subsp. althoferi* and *Eremophila forrestii subsp. forrestii*.

Figure 9: Mulga with *Acacia cockertoniana* and *Acacia ramulosa var ramulosa* tall shrubland over *Olearia humilis* and/or *Hibbertia arcuata* and/or Prostanthera althoferi subsp. althoferi and/or *Eremophila forrestii subsp. forrestii* low shrubland within the survey area

3.2.2.6 Mulga over mixed shrubland (1o)

This vegetation group consisted of 15 Families, 18 Genera and 26 Species. The vegetation group was approximately 3.75 ha which makes up 0.53% of the survey area.

Dominant species were *Acacia caesaneura, Acacia ramulosa var ramulosa, Acacia aneura var aneura, Senna artemisioides subsp filifolia, Solanum lasiophyllum* and *Ptilotus obovatus*.

Figure 10: Mulga over mixed shrubland within the survey area

3.2.2.7 *Acacia quadrimarginea*/*A. cockertoniana* open shrubland (2g)

This vegetation group consisted of 16 Families, 20 Genera and 28 Species. The vegetation group was approximately 24.28 ha which makes up 3.43% of the survey area.

Dominant species were *Acacia quadrimarginea, Acacia cockertoniana* and *Thryptomene costata*.

Figure 11: *Acacia quadrimarginea/A. cockertoniana* open shrubland within the survey area

3.2.2.8 *Acacia effusifolia*/*Eucalyptus* mallee and other mixed shrublands burnt-sandplain (3b)

This vegetation group consisted of 22 Families, 53 Genera and 99 Species. The vegetation group was approximately 127.83 ha which makes up 18.06% of the survey area.

Dominant species were *Acacia effusifolia, Eucalyptus rigidula, Micromyrtus flaviflora, Micromyrtus clavata, Melaleuca hamata* and *Triodia irritans.*

Figure 12: *Acacia effusifolia*/*Eucalyptus* mallee and other mixed shrublands burnt- within the survey area

3.2.2.9 *Acacia effusifolia* Shrubland- transitional (3c)

This vegetation group consisted of 10 Families, 12 Genera and 18 Species. The vegetation group was approximately 7.41 ha which makes up 1.05% of the survey area.

Dominant species were *Acacia effusifolia, Eremophila georgei and Eremophila forrestii subsp forrestii.*

Figure 13: *Acacia effusifolia* Shrubland- transitional within the survey area

3.2.2.10 *Callitris* with scattered Eucalypt woodland- sandplain (4)

This vegetation group consisted of 24 Families, 40 Genera and 66 Species. The vegetation group was approximately 10.27 ha which makes up 1.45% of the survey area.

Dominant species were *Callitris columellaris, Acacia ramulosa var ramulosa* and *Eucalyptus leptopoda subsp leptopoda.*

Figure 14: *Callitris* with scattered Eucalypt woodland- sandplain within the survey area

3.2.2.11 *Eucalyptus lesouefii* open woodland (9a)

This vegetation group consisted of 11 Families, 17 Genera and 23 Species. The vegetation group was approximately 6.89 ha which makes up 0.97% of the survey area.

Dominant species were *Eucalyptus lesouefii, Eremophila pantonii,* and *Ptilotus obovatus*.

Figure 15: *Eucalyptus lesouefii* open woodland within the survey area

3.2.2.12 *Eucalyptus salubris* woodland (9b)

This vegetation group consisted of 14 Families, 17 Genera and 24 Species. The vegetation group was approximately 4.92 ha which makes up 0.70% of the survey area.

Dominant species were *Eucalyptus salubris, Acacia erinacea, Eremophila pantonii* and *Ptilotus obovatus*.

Figure 16: *Eucalyptus salubris* woodland within the survey area

3.2.3 Weeds

Five weed species were recorded within the survey area; *Asphodelus fistulosus*, *Cleretum papulosum subsp. papulosum*, *Lysimachia arvensis, Pentameris airoides subsp. airoides and Portulaca oleracea.*

- *Asphodelus fistulosus* (Onion Weed) is abundant from Exmouth to Eucla, preferring coastal areas along roads and rail tracks. It invades bushland, pastoral areas and occasionally horticultural areas near Perth. It is a native to India and southern Europe.
- *Cleretum papulosum,* previously *Micropterum papulosum*, is native to South America and is abundant from Carnarvon to Esperance. Flowering occurs during spring and prefers arid areas, salt lake margins and estuaries of granite rock.
- *Lysimachia arvensis* (Pimpernel), previously named *Anagallis arvensis*, is native of Europe. It is spread throughout the south-west over granite rocks and disturbed bushland, as well as in crops, horticultural areas, pastures, paddocks and gardens.
- *Pentaschistis airoides* (False Hair Grass) and its subsp. *airoides* are widespread throughout Carnarvon to Kalgoorlie and Balladonia. This native of South Africa is very common in disturbed areas as well as in woodlands, shrublands and over granite rocks.
- *Portulaca oleracea* (Pigweed) is a common annual succulent that grows and flowers in summer. It can be found throughout Western Australia and is widespread among paddocks, horticulture and gardens.

The majority of these species were found along existing track sides and disturbance. None of these species are considered declared plants as defined by the Department of Agriculture WA (DAFWA, 2012a). However *Carrichtera annua* and *Cenchrus ciliaris* are listed as invasive weed species in the EPBC Protected Matters search results (Appendix 1).

3.2.4 Vegetation Condition

The condition of the vegetation was determined to be “Excellent” with areas where there were existing roads and tracks or fire scar areas in “Good” condition due to grazing and historic disturbances (Appendix 5, Map 3).

4. DISCUSSION

The EPA (2002) indicated that an ecological assessment of a site must consider its ecological value at the ecosystem level and its biodiversity value at the genetic, species and ecosystem level.

The survey area is located within the East Murchison subregion which has been recognised as a centre of endemism with high ecosystem and species diversity (Cowan 2001). However, Cowan also explains that while the flora of the East Murchison subregion is a rich and varied one, most species are wide ranging and often occur in one or more adjacent subregions. This survey established that mostly, the flora within the project area is not unique, and is in fact common throughout the East Murchison, however the composition of these flora on the BIF ranges is unique and relatively unknown, and could be considered restricted habitats.

No DRF or TECs were recorded in the survey area. There were also no Priority Species recorded within the survey area.

Although no TECs are present within the areas proposed for clearing, one PEC plausibly occurs within survey area. This community is the P1 Bulga Downs/Perrinvale/Walling/vegetation complex (banded ironstone formations). Given that Banded Ironstone formations are mapped as PECs based on the substrate not necessarily on the vegetation, and the fact that no vegetation description or delineation is provided by the DEC as yet, it is assumed this PEC covers entire areas where Banded Ironstone protrudes from the surface.

Vegetation condition was generally 'Very Good' to "Excellent" (Keighery 1994). Disturbance was present within the survey area mostly attributed to access tracks, exploration related activities and fire scars.

It is therefore not expected that the disturbance associated with the Mt Mason Haul Road will significantly negatively impact on the vegetation in the area in terms of fragmentation or loss of vegetation associations or species that may be unique. This is partially due to the overall size and linear nature of the survey area as well as the similar vegetation and habitat outside of the survey area.

5. IMPACT ASSESSMENT

5.1 THREATENING PROCESSES

The major processes likely to impact the Flora within the Survey area, if the haul road was to proceed include:

- Vegetation clearing and the associated removal of fauna habitat which would result in the loss of local vertebrate assemblages, a reduction in biodiversity and a loss of ecological function locally, as well as displacement of local fauna into adjacent areas;
- Vehicle impacts on uncleared vegetation could increase if the haul road driving is not adhered to;
- An increase in the area of disturbed land could result in an increase in alien species taking advantage of the lack of competition from native species;
- Dust generated during clearing of native vegetation and haulage may settle on adjacent native vegetation, causing possible stress and perhaps death, especially during drier months; and
- Accidental fire arising from clearing and haulage may affect vegetation in surrounding areas.

6. CONCLUSIONS AND RECOMMENDATIONS

This report incorporates and summarises the results of a Level 1 flora and vegetation survey.

The survey established that the condition of the vegetation in the proposed disturbance area is overall 'Good', to 'Excellent' condition. No Declared Rare Flora Priority Flora or Threatened Ecological Communities were recorded in the area.

The proposed clearing of vegetation will result in the loss of some individuals from the local area; however, the impact will not be great enough to remove whole communities or populations. Most of the species and communities recorded during this survey are widespread throughout the Murchison Bioregion and therefore the loss of a small proportion from this area will not be significant.

The EPA objective for flora and vegetation is to maintain the abundance, species diversity and geographical distribution of flora and vegetation as well as protect Threatened flora consistent with the provisions of the *Wildlife Conservation Act 1950*.

The following generic recommendations arise from the current flora survey:

- Any disturbance/clearing be minimised in extent to reduce the loss of individuals and impact on populations;
- Weed control measures must be implemented and followed during and after clearing and construction activities;
- A rehabilitation plan is developed that progressively rehabilitates areas not related to the haul road as soon as they are no longer required;
- Driving restrictions, ensuring that off-road driving is minimised; and
- All staff to be educated on the importance of fire prevention, and equipment provided for use in the event of fire.

7. REFERENCES

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Appendix 1

Relevant Government Database Search Results

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

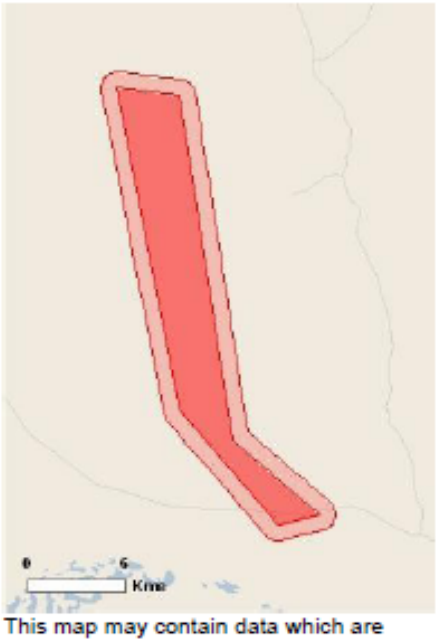
Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information about the EPBC Act including significance guidelines, forms and application process details can be found at http://www.environment.gov.au/epbc/assessmentsapprovals/index.html

Report created: 27/11/12 16:26:36

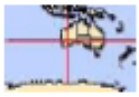
Summary
Details
- Matters of NES
- Other Matters Protected by the EPBC Act
- Extra Information

Caveat
Acknowledgements



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

Coordinates
Buffer: 1.0Km



Summary

Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance - see http://www.environment.gov.au/epbc/assessmentsapprovals/guidelines/index.html

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Areas:	None
Threatened Ecological Communities:	None
Threatened Species:	2
Migratory Species:	5

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place and the heritage values of a place on the Register of the National Estate. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage/index.html

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species. Information on EPBC Act permit requirements and application forms can be found at http://www.environment.gov.

Commonwealth Lands:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	3
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have

Place on the RNE:	None
State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	6
Nationally Important Wetlands:	None

Details

Matters of National Environmental Significance

Threatened Species		[Resource Information]
Name	Status	Type of Presence
BIRDS		
Acanthiza iredalei iredalei		
Slender-billed Thornbill (western) [25967]	Vulnerable	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Leipoa ocellata		
Malleefowl [934]	Vulnerable	Species or species habitat may occur within area

Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat may occur within area
Migratory Terrestrial Species		
Leipoa ocellata		
Malleefowl [934]	Vulnerable	Species or species habitat may occur within area
Merops ornatus		
Rainbow Bee-eater [670]		Species or species habitat may occur within area
Migratory Wetlands Species		
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat may occur within area
Merops ornatus		
Rainbow Bee-eater [670]		Species or species habitat may occur within area

Extra Information

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit,

Name	Status	Type of Presence
Mammals		
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Carrichtera annua Ward's Weed [9511]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area

Coordinates

-29.1059 120.3505,-29.1101 120.3854,-29.302 120.4152,-29.3439 120.4637,-29.3494 120.4404,-29.2857 120.3857,-29.1059 120.3505

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World Heritage and Register of National Estate properties, Wetlands of International Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants

- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Department of Environment, Climate Change and Water, New South Wales
-Department of Sustainability and Environment, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment and Natural Resources, South Australia
-Parks and Wildlife Service NT, NT Dept of Natural Resources, Environment and the Arts
-Environmental and Resource Management, Queensland
-Department of Environment and Conservation, Western Australia
-Department of the Environment, Climate Change, Energy and Water
-Birds Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-SA Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Atherton and Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
-State Forests of NSW
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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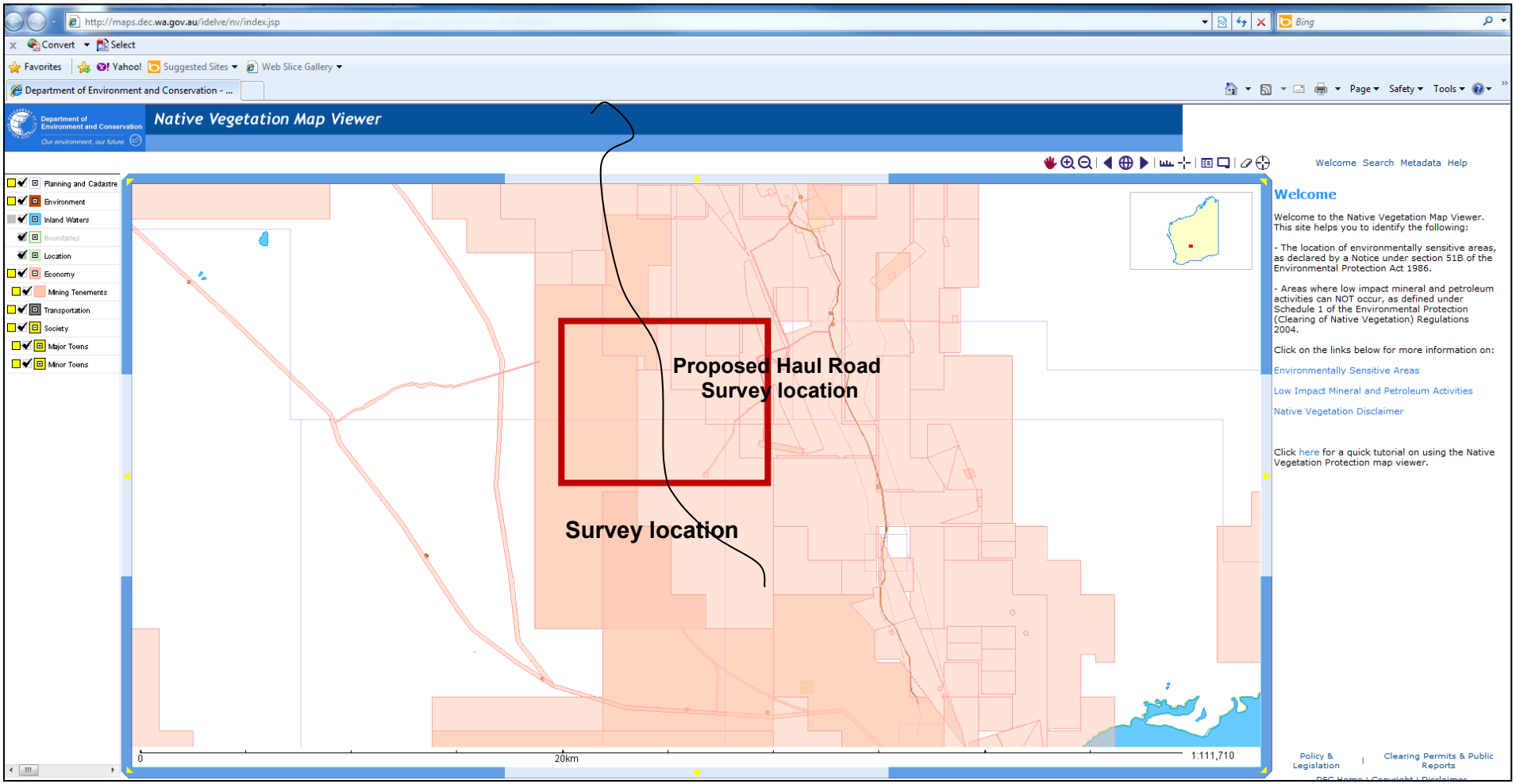
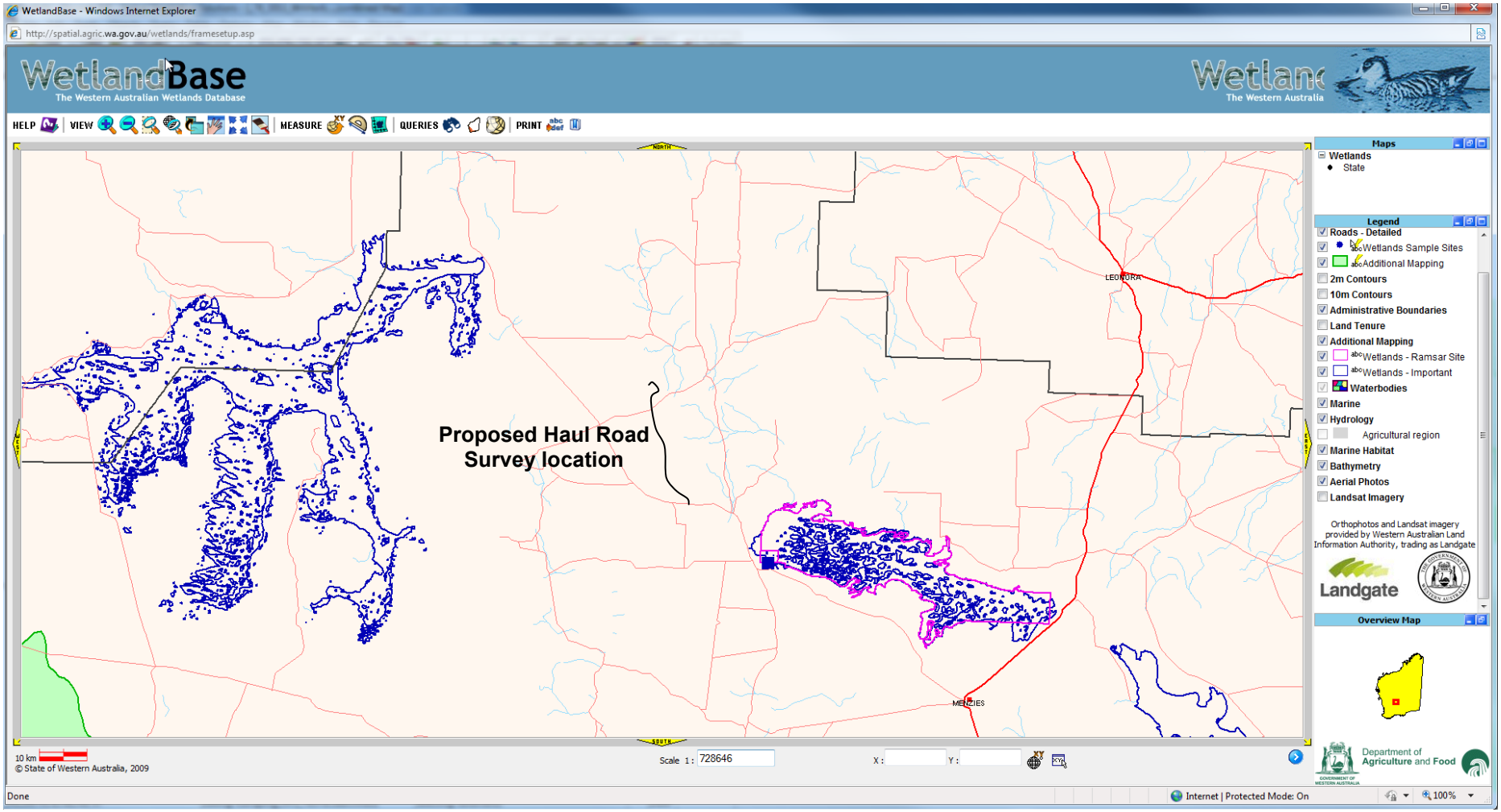


DEC's Native Vegetation Map Viewer showing no ESA's (dark green shaded areas) within the survey area (DEC, 2012)



DAFWA Wetland Database showing no wetland areas within the survey area (DAFWA, 2012).

Appendix 2

Threatened Flora Databases Search Results

Listed below are the Priority Flora identified from the DEC searches for the general Survey area and surrounds (Reference: 76-1011FL).

Note – One Threatened species was identified with all known locations approximately 28km southwest of the survey area.

31/10/2011 **DEPARTMENT OF ENVIRONMENT AND CONSERVATION** Page 1
DECLARED RARE AND PRIORITY FLORA LIST
16 September 2010

SPECIES / TAXON	CONS CODE	DEC REGION	DISTRIBUTION	FLOWER PERIOD
Calotis sp. Perrinvale Station (R.J. Cranfield 7906)	3	MW,GLD	Cue, Blue Hills, Perrinvale Stn	
Calytrix praecipua	3	GLD,P	Melita Station, Laverton, Youno Downs, Wanjarri, Marymia, Erong Hmstd, Niagara Dam	Jun-Nov
Cratystylis centralis	3	GLD	Barwidgee Stn, Leonora	Aug-Nov
Eremophila annosocaulis	3	GLD	Mt Morgans Mine (South of Leonora-Laverton Rd), Von Treuer Tableland	
Eremophila mirabilis	2	GLD,MW	Niagara, Morapoi, Kookynie, Woolgorong, Menzies	Aug-Sep
Eremophila simulans subsp. megacalyx	3	MW,GLD	Mt Narryer, Boolardy Stn, Leonora	Aug-Sep
Eucalyptus jutsonii subsp. jutsonii	4	GLD	Comet Vale, Binti Binti Rocks, Menzies, Jeedamya Stn	Nov
Gunniopsis propinqua	3	GLD	Laverton, Mt Margaret, Lake Carnegie, Windidda, Mt Eureka, Mt James, Menzies	Aug-Sep
Hemigenia exilis	4	GLD	Lake Darlot, Yakabindie, Leinster, Leonora, Mt Keith	Apr,May, Aug
Hyalosperma stoveae	2	GLD,MW,*	Perrinvale Station, Burnabinmah	-
Hybanthus floribundus subsp. chloroxanthus	3	GLD	Leonora, Laverton	Aug-Oct
Malleostemon sp. Adelong (GJ Keighery 11825)	2	GLD	Adelong Stn, Mt Manning, Johnston Range	Oct
Micromyrtus serrulata	3	GLD	Karonie, Coonana, Melita, Jeedamya, Niagara Dam NR, Cardunia Rocks, Queen Victoria Spring NR	Mar,Jun,Nov
Newcastelia insignis	2	GLD,SC	Adelong Stn, Comet Vale, Queen Victoria Spring, Norseman	Sep-Nov
Persoonia leucopogon	1	GLD	Between Coolgardie & Laverton, Comet Vale (Menzies)	-
Philotheca coateana	3	GLD,MW	Menzies, Gidgee, Cashmere Downs, Walling Rock	Aug-Oct
Philotheca deserti subsp. brevifolia	1	GLD	Menzies	
Sauropus ramosissimus	3	GLD	Carnegie Stn, Laverton, Warburton, Leonora	
Spartothamnella sp. Helena & Aurora Range (PG Armstrong 155-109)	3	GLD,MW,WB	Helena & Aurora Range, Blue Hill Range, Remlap, Koolyanobbing, Mt Jackson Range, Windarling Hill, Die Hardy Range, Johnston Range, Perrinvale Stn., Yendilberin Hills, Mt Finnerty	
Thryptomene eremaea	2	GLD	Menzies, Queen Victoria Spring, Comet Vale, Edjudina Station, Kirgella Rocks	Jul-Sep

Additional species provided in the GIS results are listed below:

- *Banksia arborea* (P4);
- *Gnephosis intonsa* (P1);
- *Grevillea secunda* (P4);
- *Grevillea subterlineata* (P3);
- *Jacksonia lanicarpa* (P1); and
- *Ricinocarpos brevis* (T).

Appendix 3

Vegetation Condition Scale (Keighery, 1994)

Pristine (1). Pristine or nearly so, no obvious signs of disturbance.

Excellent (2). Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.

Very Good (3). Vegetation structure altered obvious signs of disturbance.
For example, disturbance to vegetation structure caused by repeating fires, the presence of some more aggressive weeds, dieback, logging and grazing.

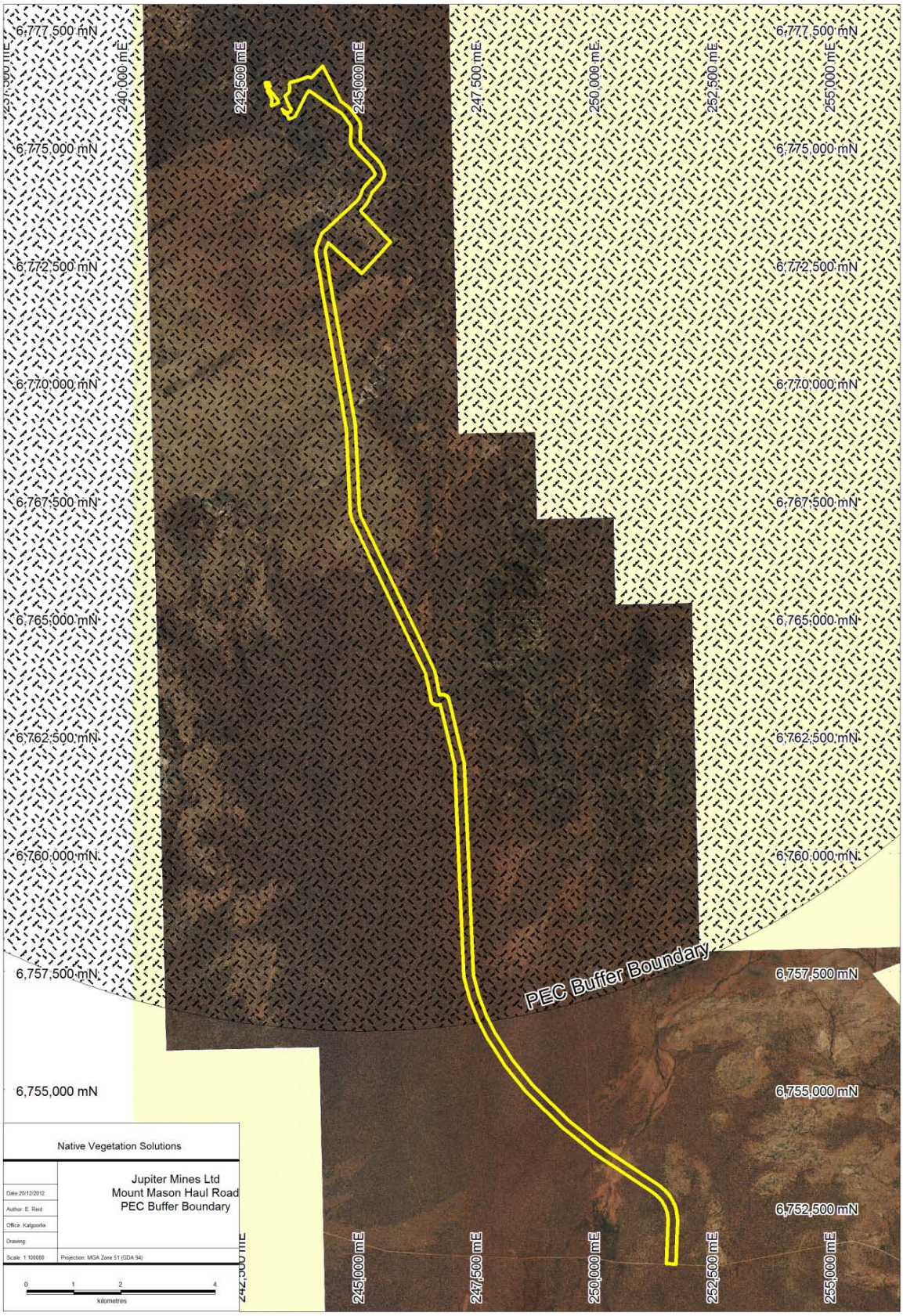
Good (4). Vegetation structure significantly altered by very obvious signs of multiple disturbance.
Retains basic vegetation structure or ability to regenerate it.
For example, disturbance to vegetation structure caused by frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.

Degraded (5). 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 (6). 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 compromising weed or crop species with isolated trees or shrubs.

Appendix 4

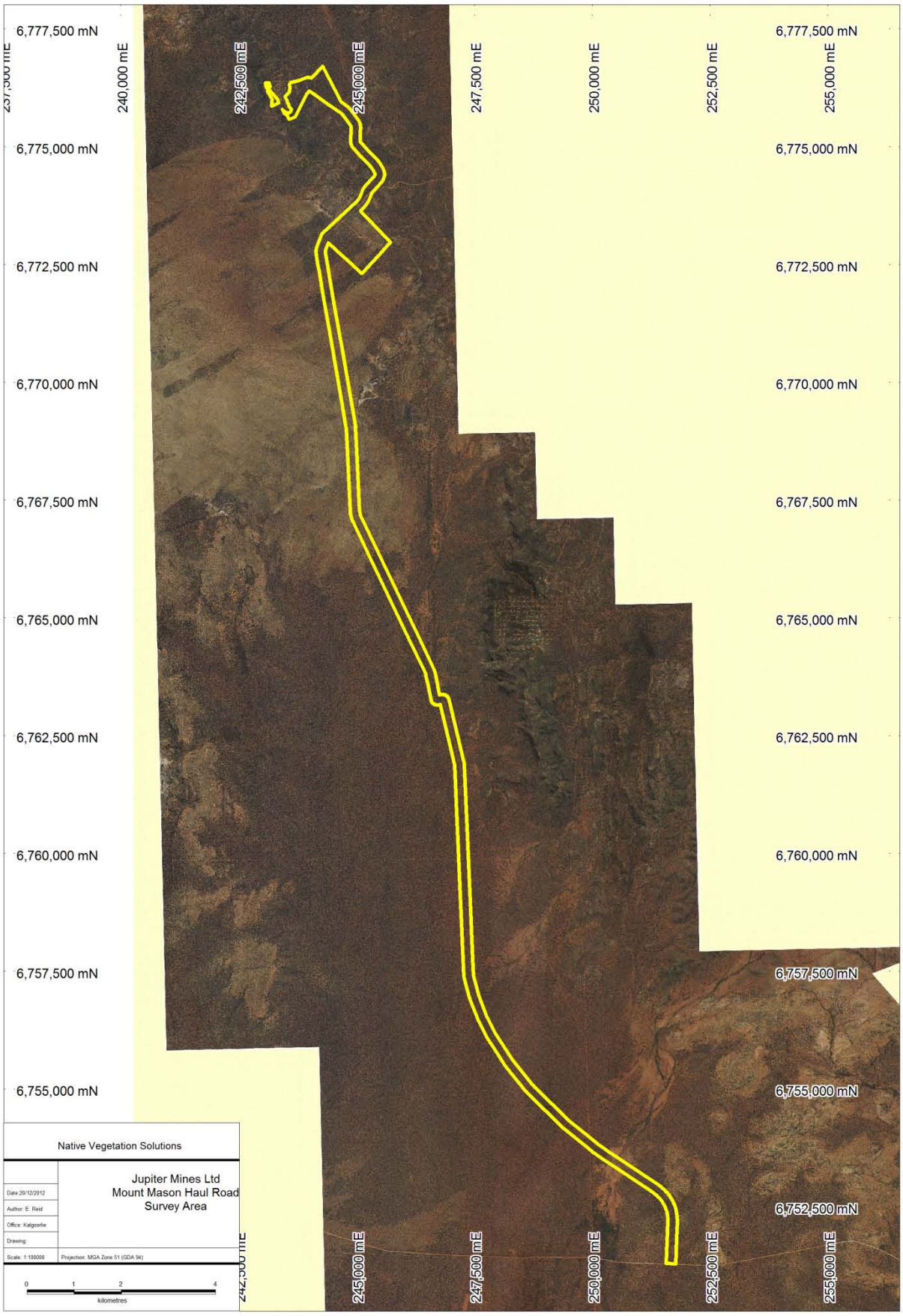
DEC Search Results revealing PEC locations (Reference: 53-1011EC)



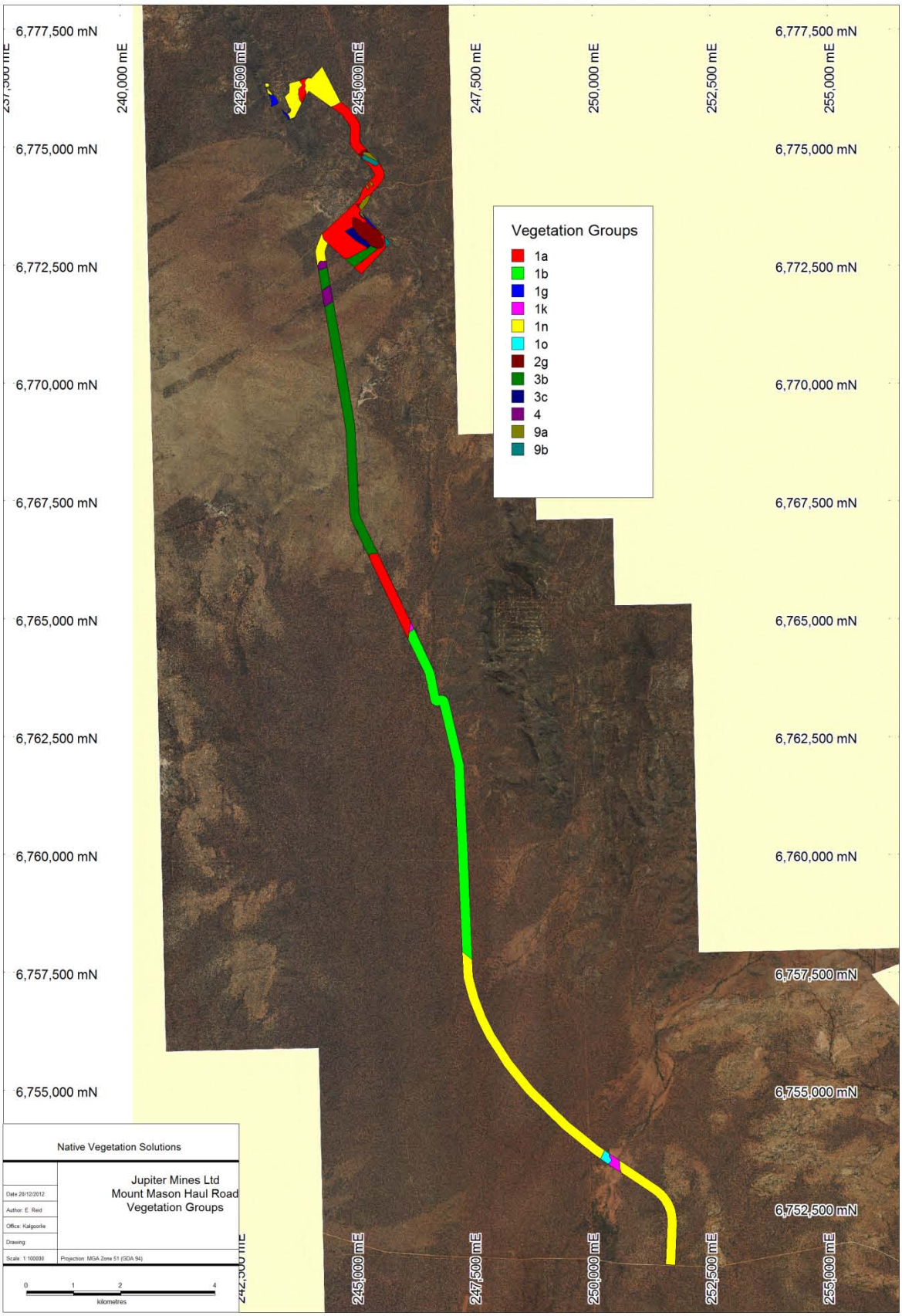
PEC Buffer Location

Appendix 5

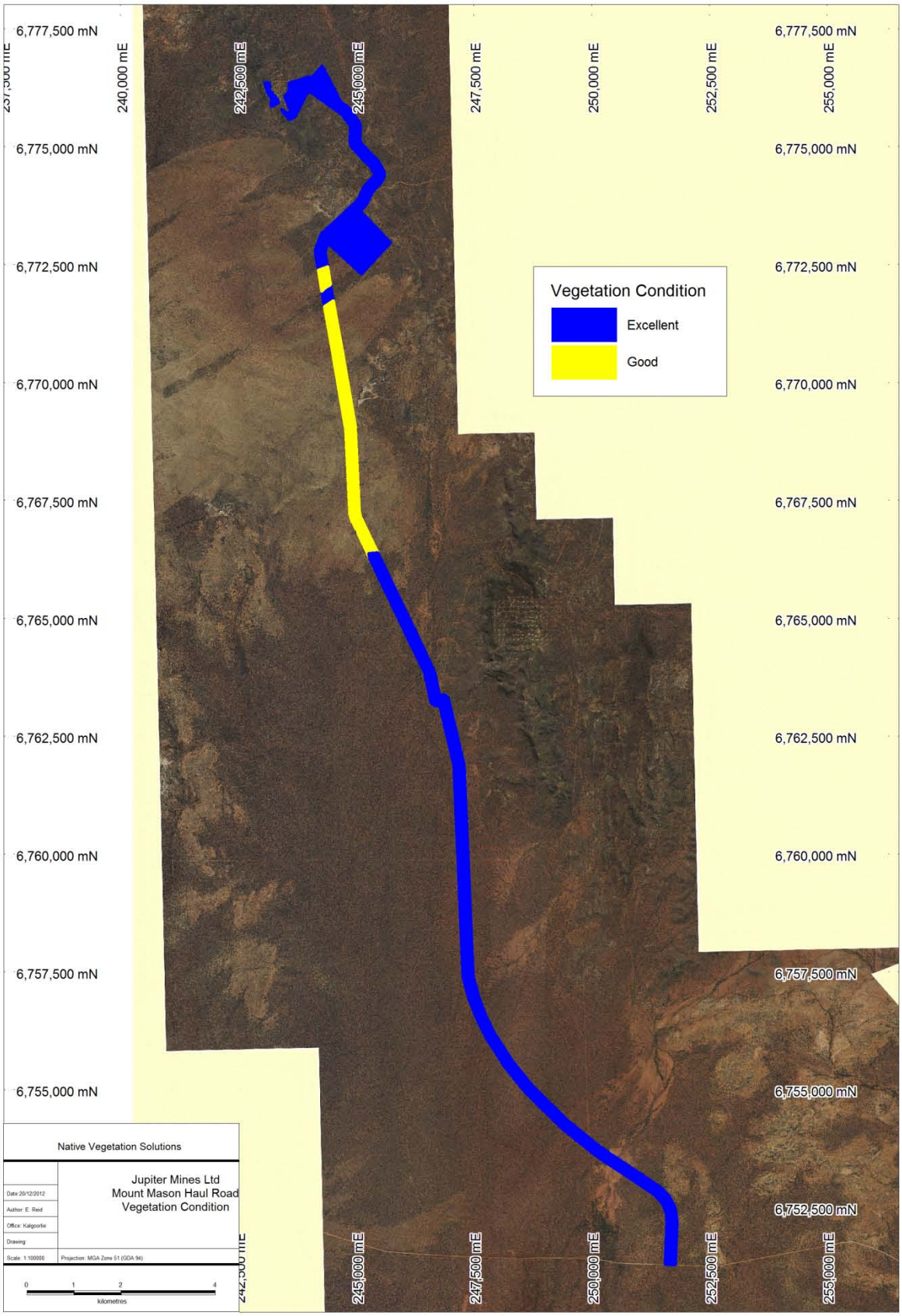
Vegetation Mapping



Map 1 - Survey Area



Map 2 - Vegetation Groups



Map 3 – Vegetation Condition

Appendix 6

Species List

Family	Genus	Species	P/A, NN	1a	1b	1f	1i	1k	1n	1o	2g	3b	3c	4	9a	9b
Aizoaceae	*Cleretum*	*papulosum subsp. papulosum*	A, NN		*											
Aizoaceae	*Tetragonia*	*eremaea*	A					*								
Amaranthaceae	*Ptilotus*	*divaricatus*	P				*									
Amaranthaceae	*Ptilotus*	*gaudichaudii subsp. gaudichaudii*	A		*											
Amaranthaceae	*Ptilotus*	*nobilis (previously exaltatus)*	P	*				*								*
Amaranthaceae	*Ptilotus*	*obovatus*	P	*	*	*	*	*	*	*		*		*	*	*
Amaranthaceae	*Ptilotus*	*schwartzii*	P				*									
Apiaceae	*Daucus*	*glochidiatus*	A		*											
Apocynaceae	*Alyxia*	*buxifolia*	P											*		*
Apocynaceae	*Marsdenia*	*australis*	P	*	*	*	*	*	*	*		*		*	*	
Asparagaceae	*Arthropodium*	*sp. Goldfields*	?P		*			*								
Asparagaceae	*Dichopogon*	*capillipes*	P		*											
Asparagaceae	*Laxmannia*	*arida*	P									*				
Asparagaceae	*Thyridolepis*	*multiculmis*	P									*				
Asparagaceae	*Thysanotus*	*manglesianus*	P									*		*		
Asparagaceae	*Triodia*	*irritans*	P									*		*		
Asphodelaceae	*Asphodelus*	*fistulosus*	A, NN		*			*								
Asteraceae	*Brachyscome*	*ciliaris*	A		*											
Asteraceae	*Calotis*	*hispidula*	A		*											
Asteraceae	*Cephalipterum*	*drummondii*	A	*	*	*		*	*	*						
Asteraceae	*Chrysocephalum*	*apiculatum*	P									*				
Asteraceae	*Gnephosis*	*tenuissima*	A	*			*	*				*		*		
Asteraceae	*Helipterum*	*craspedioides*	A		*			*								
Asteraceae	*Lawrencella*	*rosea*	A											*		
Asteraceae	*Myriocephalus*	*guerinae*	A		*											
Asteraceae	*Olearia*	*humilis*	P						*		*			*		
Asteraceae	*Olearia*	*muelleri*	P													*
Asteraceae	*Olearia*	*pimeleoides*	P	*								*		*		
Asteraceae	*Olearia*	*sp.*	P											*		
Asteraceae	*Olearia*	*subspicata*	P									*				
Asteraceae	*Podolepis*	*canescens*	A		*		*									
Asteraceae	*Podolepis*	*capillaris*	A				*	*				*				
Asteraceae	*Podolepis*	*lessonii*	A	*				*								
Asteraceae	*Podolepis*	*sp. (ATQ14-6)*	A									*				
Asteraceae	*Rhodanthe*	*battii*	A		*											
Asteraceae	*Rhodanthe*	*charsleyae*	A		*			*								
Asteraceae	*Triptilodiscus*	*pygmaeus*	A					*								
Asteraceae	*Vittadinia*	*sulcata*	A		*											
Asteraceae	*Vittadinia*	*sulcata*	A	*												
Asteraceae	*Waitzia*	*acuminata var. acuminata*	A	*	*	*	*		*			*	*	*		
Boraginaceae	*Halgania*	*cyanea var. Allambi Stn*	P									*				
Boraginaceae	*Halgania*	*cyanea var. Charleville*	P									*				
Brassicaceae	*Lepidium*	*oxytrichum*	A		*	*		*								
Brassicaceae	*Stenopetalum*	*anfractum*	A	*		*	*							*		
Brassicaceae	*Stenopetalum*	*lineare*	A					*								
Campanulaceae	*Lobelia*	*heterophylla subsp. heterophylla*	A									*				
Campanulaceae	*Lobelia*	*winfridae*	A	*								*	*			
Campanulaceae	*Wahlenbergia*	*tumidifructa*	A	*	*	*	*						*			

Family	Genus	Species	P/A, NN	1a	1b	1f	1i	1k	1n	1o	2g	3b	3c	4	9a	9b
Casuarinaceae	*Allocasuarina*	*acutivalvis subsp. acutivalvis*	P								*					
Celastraceae	*Stackhousia*	*muricata*	A						*							
Chenopodiaceae	*Atriplex*	*? vesicaria (sterile)*	P												*	
Chenopodiaceae	*Atriplex*	*bunburyana*	P													*
Chenopodiaceae	*Enchylaena*	*tomentosa*	P											*	*	
Chenopodiaceae	*Maireana*	*georgei*	P											*	*	
Chenopodiaceae	*Maireana*	*glomerifolia*	P					*								
Chenopodiaceae	*Maireana*	*pentatropis*	P		*											
Chenopodiaceae	*Maireana*	*planifolia*	P		*			*		*						
Chenopodiaceae	*Maireana*	*pyramidata*	P					*								
Chenopodiaceae	*Maireana*	*sedifolia*	P							*					*	
Chenopodiaceae	*Maireana*	*tomentosa*	P												*	
Chenopodiaceae	*Maireana*	*trichoptera*	P													*
Chenopodiaceae	*Rhagodia*	*drummondii*	P	*		*		*		*				*	*	
Chenopodiaceae	*Rhagodia*	*eremaea*	P					*						*		
Chenopodiaceae	*Salsola*	*australis*	A					*							*	
Chenopodiaceae	*Sclerolaena*	*cuneata*	P					*								*
Chenopodiaceae	*Sclerolaena*	*diacantha*	P	*				*							*	*
Chenopodiaceae	*Sclerolaena*	*eriacantha*	P												*	
Crassulaceae	*Crassula*	*colorata var. acuminata*	A	*	*			*								
Cupressaceae	*Callitris*	*columellaris*	P											*		
Dilleniaceae	*Hibbertia*	*arcuata*	P			*			*		*	*				
Fabaceae	*Acacia*	*aneura var. aneura*	P	*	*	*	*	*	*	*				*	*	
Fabaceae	*Acacia*	*burkittii*	P	*				*				*			*	
Fabaceae	*Acacia*	*caesaneura*	P	*	*	*	*		*	*				*		
Fabaceae	*Acacia*	*cockertoniana*	P		*	*			*		*			*		
Fabaceae	*Acacia*	*colletioides*	P									*		*		
Fabaceae	*Acacia*	*craspedocarpa*	P	*				*	*			*				
Fabaceae	*Acacia*	*effusifolia*	P	*								*	*	*		
Fabaceae	*Acacia*	*erinacea*	P													*
Fabaceae	*Acacia*	*heteroneura var. prolixa*	P									*				
Fabaceae	*Acacia*	*incurvaneura*	P	*			*	*	*	*						
Fabaceae	*Acacia*	*ligulata*	P									*				
Fabaceae	*Acacia*	*longispinea*	P									*				
Fabaceae	*Acacia*	*mulganeura*	P	*					*			*	*	*		
Fabaceae	*Acacia*	*murrayana*	P									*		*		
Fabaceae	*Acacia*	*prainii*	P									*				
Fabaceae	*Acacia*	*pteraneura*	P					*	*	*						
Fabaceae	*Acacia*	*quadrimarginea*	P								*		*		*	*
Fabaceae	*Acacia*	*ramulosa var ramulosa*	P	*	*		*	*	*	*		*	*	*		
Fabaceae	*Acacia*	*sibirica*	P	*					*		*	*				*
Fabaceae	*Acacia*	*tetragonophylla*	P	*	*	*	*	*	*	*	*		*	*		*
Fabaceae	*Indigofera*	*brevidens*	P									*				
Fabaceae	*Mirbelia*	*microphylla*	P	*												
Fabaceae	*Senna*	*artemisioides subsp. filifolia*	P	*		*	*	*	*	*		*		*	*	*
Fabaceae	*Senna*	*artemisioides subsp. x artemisioides*	P		*			*				*				
Fabaceae	*Senna*	*glutinosa subsp chatelainiana*	P										*			
Geraniaceae	*Erodium*	*crinitum*	P											*		
Goodeniaceae	*Dampiera*	*roycei*	P									*		*		
Goodeniaceae	*Goodenia*	*mimuloides*	A	*	*				*		*					

Family	Genus	Species	P/A, NN	1a	1b	1f	1i	1k	1n	1o	2g	3b	3c	4	9a	9b
Goodeniaceae	*Goodenia*	*occidentalis*	A	*			*	*	*	*						
Goodeniaceae	*Goodenia*	*sp.*	A					*								
Goodeniaceae	*Goodenia*	*xanthosperma*	P									*				
Goodeniaceae	*Scaevola*	*spinescens*	P	*		*	*		*		*	*		*	*	*
Goodeniaceae	*Velleia*	*rosea*	A	*	*		*	*						*		
Haloragaceae	*Haloragis*	*? odontocarpa forma rugosa*	A		*											
Haloragaceae	*Haloragis*	*trigonocarpa*	A					*				*		*		
Hemerocallidaceae	*Dianella*	*revoluta var. divaricata*	P	*	*		*	*				*	*	*		
Hemerocallidaceae	*Dianella*	*revoluta var. revoluta*	P	*					*	*		*		*		
Lamiaceae	*Prostanthera*	*albiflora*	P						*							
Lamiaceae	*Prostanthera*	*althoferi subsp. althoferi*	P	*					*			*	*	*		
Lamiaceae	*Prostanthera*	*prostantheroides*	P											*		
Lamiaceae	*Spartothamnella*	*teucriiflora*	P	*	*		*	*	*	*		*		*		
Lamiaceae	*Westringia*	*cephalantha var. cephalantha*	P									*				
Lamiaceae	*Westringia*	*rigida*	P											*		
Loranthaceae	*Amyema*	*gibberula var. gibberula*	P	*										*		
Loranthaceae	*Amyema*	*miquelii*	P						*							
Loranthaceae	*Amyema*	*preissii*	P				*									
Loranthaceae	*Lysiana*	*casuarinae*	P								*					
Malvaceae	*Abutilon*	*cryptopetalum*	P	*	*					*						
Malvaceae	*Abutilon*	*oxycarpum subsp. prostratum*	P		*			*								
Malvaceae	*Brachychiton*	*gregorii*	P	*		*	*	*	*		*	*			*	
Malvaceae	*Commersonia*	*magniflora subsp. oblongifolia*	P									*				
Malvaceae	*Hannafordia*	*bissillii subsp. latifolia*	P									*				
Malvaceae	*Hannafordia*	*quadrivalvis subsp. quadrivalvis*	P									*				
Malvaceae	*Keraudrenia*	*velutina subsp. elliptica*	P									*				
Malvaceae	*Keraudrenia*	*velutina subsp. velutina*	P									*				
Malvaceae	*Sida*	*calyxhymenia*	P	*	*	*	*		*			*				
Malvaceae	*Sida*	*ectogama*	P	*										*		*
Malvaceae	*Sida*	*fibulifera*	P					*								
Malvaceae	*Sida*	*intricata*	P		*			*								
Malvaceae	*Sida*	*sp dark green fruits*	P	*	*		*				*	*		*		
Malvaceae	*Sida*	*sp. golden calyces glabrous*	P	*				*	*							
Myrtaceae	*Aluta*	*aspera subsp. aspera*	P									*				
Myrtaceae	*Baeckea*	*sp. Wubin*	P									*		*		
Myrtaceae	*Enekbatus*	*cryptandroides*	P									*				
Myrtaceae	*Eucalyptus*	*concinna*	P								*	*		*		
Myrtaceae	*Eucalyptus*	*ewartiana*	P						*							
Myrtaceae	*Eucalyptus*	*griffithsii*	P									*				
Myrtaceae	*Eucalyptus*	*leptopoda*	A						*			*				
Myrtaceae	*Eucalyptus*	*leptopoda subsp. elevata*	A	*								*				
Myrtaceae	*Eucalyptus*	*leptopoda subsp. leptopoda*	A											*		
Myrtaceae	*Eucalyptus*	*leptopoda subsp. leptopoda*	P						*							
Myrtaceae	*Eucalyptus*	*leptopoda subsp. subluta*	A						*			*				
Myrtaceae	*Eucalyptus*	*lesouefii*	P												*	
Myrtaceae	*Eucalyptus*	*lucasii*	P				*									
Myrtaceae	*Eucalyptus*	*moderata*	P											*		
Myrtaceae	*Eucalyptus*	*oldfieldii subsp. oldfieldii*	P									*		*		
Myrtaceae	*Eucalyptus*	*oleosa subsp. oleosa*	P	*					*					*		*
Myrtaceae	*Eucalyptus*	*rigidula*	P									*				

Family	Genus	Species	P/A, NN	1a	1b	1f	1i	1k	1n	1o	2g	3b	3c	4	9a	9b
Myrtaceae	*Eucalyptus*	*salubris*	P								*					
Myrtaceae	*Eucalyptus*	*sp. (sterile)*	P									*				
Myrtaceae	*Eucalyptus*	*transcontinentalis*	P									*		*		
Myrtaceae	*Eucalyptus*	*youngiana*	P									*				
Myrtaceae	*Euryomyrtus*	*maidenii*	P	*					*			*				
Myrtaceae	*Euryomyrtus*	*patrickiae*	P						*					*		
Myrtaceae	*Homalocalyx*	*thryptomenoides*	P									*				
Myrtaceae	*Leptospermum*	*fastigiatum*	P									*				
Myrtaceae	*Melaleuca*	*hamata*	P									*				
Myrtaceae	*Melaleuca*	*leiocarpa*	P									*				
Myrtaceae	*Micromyrtus*	*flaviflora*	P									*				
Myrtaceae	*Thryptomene*	*costata*	P										*			
Myrtaceae	*Unknown sp. 3*	*(ATQ12-7)*	?									*				
Phyllanthaceae	*Poranthera*	*leiosperma*	A									*				
Plantaginaceae	*Plantago*	*turrifera*	A		*											
Poaceae	*Amphipogon*	*caricinus var. caricinus*	P									*				
Poaceae	*Aristida*	*contorta*	P									*				
Poaceae	*Austrostipa*	*elegantissima*	P		*			*								*
Poaceae	*Austrostipa*	*nitida*	P		*			*		*						
Poaceae	*Austrostipa*	*trichophylla*	P	*	*	*	*		*		*				*	
Poaceae	*Enneapogon*	*caerulescens*	P					*								
Poaceae	*Eragrostis*	*eriopoda*	P	*			*		*	*		*		*		
Poaceae	*Eriachne*	*pulchella subsp. pulchella*	A					*			*					
Poaceae	*Grevillea*	*teretifolia*	P						*							
Poaceae	*Lachnagrostis*	*filiformis*	A		*											
Poaceae	*Monachather*	*paradoxus*	P	*			*		*			*	*	*		
Poaceae	*Paspalidium*	*gracile*	P		*											
Poaceae	*Pentameris*	*airoides subsp. airoides*	NN		*											
Poaceae	*Rytidosperma*	*setaceum*	P					*								
Poaceae	*Triodia*	*rigidissima*	P									*		*		
Poaceae	*Tripogon*	*loliiformis*	A					*								
Portulacaceae	*Calandrinia*	*eremaea*	A	*	*			*		*				*		
Portulacaceae	*Portulaca*	*oleracea*	A, NN	*					*							*
Primulaceae	*Lysimachia*	*arvensis*	NN		*			*						*		
Proteaceae	*Grevillea*	*acacioides*	P									*				
Proteaceae	*Grevillea*	*berryana*	P								*					
Proteaceae	*Grevillea*	*didymobotrya subsp. didymobotrya*	P									*				
Proteaceae	*Grevillea*	*extorris*	P									*				
Proteaceae	*Grevillea*	*juncifolia subsp. juncifolia*	P									*				
Proteaceae	*Grevillea*	*nematophylla subsp. supraplana*	P									*				
Proteaceae	*Grevillea*	*sarissa subsp. sarissa*	P								*					
Proteaceae	*Grevillea*	*stenobotrya*	P	*							*	*		*		
Proteaceae	*Hakea*	*francisiana*	P									*				
Proteaceae	*Hakea*	*lorea subsp. lorea*	P							*						
Proteaceae	*Hakea*	*minyma*	P									*				
Proteaceae	*Hakea*	*preissii*	P					*						*		
Proteaceae	*Hakea*	*recurva*	P	*			*									
Proteaceae	*Hakea*	*recurva subsp. recurva*	P								*					
Pteridaceae	*Cheilanthes*	*sieberi subsp. sieberi*	P	*	*		*	*	*		*		*			
Rhamnaceae	*Cryptandra*	*connata*	P	*			*		*	*						

Family	Genus	Species	P/A, NN	1a	1b	1f	1i	1k	1n	1o	2g	3b	3c	4	9a	9b
Rubiaceae	*Psydrax*	*suaveolens*	P	*		*	*		*			*		*		
Rutaceae	*Phebalium*	*canaliculatum*	P									*				
Rutaceae	*Philotheca*	*brucei subsp. brucei*	P			*			*		*					
Santalaceae	*Santalum*	*acuminatum*	P											*		
Santalaceae	*Santalum*	*spicatum*	P	*											*	*
Sapindaceae	*Dodonaea*	*lobulata*	P	*		*						*				*
Sapindaceae	*Dodonaea*	*petiolaris*	P													
Sapindaceae	*Dodonaea*	*rigida*	P	*		*	*		*		*	*			*	
Sapindaceae	*Dodonaea*	*viscosa subsp mucronata*	P			*										
Scrophulariaceae	*Eremophila*	*caperata*	P									*				
Scrophulariaceae	*Eremophila*	*clarkei*	P	*												
Scrophulariaceae	*Eremophila*	*forrestii subsp. forrestii*	P	*			*		*	*		*	*	*		
Scrophulariaceae	*Eremophila*	*georgei*	P	*	*	*	*		*		*	*		*		
Scrophulariaceae	*Eremophila*	*glutinosa*	P				*	*		*						
Scrophulariaceae	*Eremophila*	*granitica*	P													
Scrophulariaceae	*Eremophila*	*homoplastica*	P				*									
Scrophulariaceae	*Eremophila*	*latrobei subsp. filiformis*	P									*	*			
Scrophulariaceae	*Eremophila*	*latrobei subsp. latrobei*	P	*	*	*	*		*		*	*	*	*		
Scrophulariaceae	*Eremophila*	*longifolia*	P	*												
Scrophulariaceae	*Eremophila*	*mackinlayi subsp. spathulata*	P									*				
Scrophulariaceae	*Eremophila*	*metallicorum*	P	*							*			*		*
Scrophulariaceae	*Eremophila*	*oldfieldii subsp. angustifolia*	P	*		*									*	*
Scrophulariaceae	*Eremophila*	*pantonii*	P	*		*									*	*
Scrophulariaceae	*Eremophila*	*serrulata*	P					*						*		
Solanaceae	*Duboisia*	*hopwoodii*	P									*				
Solanaceae	*Nicotiana*	*rotundifolia*	A		*											
Solanaceae	*Solanum*	*ferocissimum*	P	*	*		*		*	*		*		*		
Solanaceae	*Solanum*	*lasiophyllum*	P	*	*		*	*	*	*	*	*	*	*		
Solanaceae	*Solanum*	*nummularium*	P		*							*		*		
Solanaceae	*Solanum*	*orbiculatum*	P									*				
Unknown	*Unknown*	*sp*	A					*			*					
Zygophyllaceae	*Zygophyllum*	*eremaeum*	A					*								*
Zygophyllaceae	*Zygophyllum*	*iodocarpum*	A					*								

P – Perennial
A – Annual
NN – Not native/ weed species

ATTACHMENT 4

Jupiter Mines Limited

MT MASON PROJECT

LEVEL 2 FLORA AND VEGETATION SURVEY

Part 1- October 2011
&
Part 2- March 2012

Prepared for: Jupiter Mines Limited

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Final Version
May 2012

EXECUTIVE SUMMARY

Jupiter Mines Limited (Jupiter) is a is a publicly listed company with iron ore interests in both the Mt Mason and Mt Ida Projects in the Central Yilgarn of Western Australia. The Mt Mason project is located approximately 560 kilometres north-east of Perth, 216 kilometres north of Kalgoorlie and 80 kilometres west of Leonora.

Jupiter is currently conducting exploration within the Mt Mason and Mt Ida Projects, proposing to initially establish mining operations in the Mt Mason area.

The Mt Mason project area lies within mining tenement M29/408. Jupiter proposes to establish mining infrastructure estimated between 50-70 hectares within this tenement. The proposed infrastructure areas include an open pit, crushing facility with stockpile, explosives magazine, administration/workshop, haul road and topsoil stockpiles.

The survey area, for the purposes of this report totalling approximately 71.81ha encompasses the above mentioned infrastructure areas

The Mt Mason project area is located in the Austin Botanical District of Beard (1990). The Austin Botanical District (Murchison) vegetation also comprises predominantly mulga low woodlands on plains, with the vegetation reduced to scrub on hills. Like the Helms District, *Eucalyptus* spp. forms a tree steppe over (commonly) *Triodia basedowii.* The vegetation is dominated by *Acacia* forests and woodlands, *Acacia* shrublands, hummock grasslands and chenopod and samphire shrublands, with other shrublands also occurring and small areas of *Eucalyptus* woodlands and open woodlands (ANRA, 2012).

The search undertaken with the Environment Protection and Biodiversity Conservation's (EPBC's) Protected Matters Search Tool reported that no Threatened Ecological Communities (TECs) were present in the region (DSEWPC, 2012a).

The Department of Environment and Conservation (DEC) database searches revealed a potential for 1 Threatened Flora and 25 Priority Flora species to occur within a 50km radius of the survey area (DEC, 2011). No database records of Threatened or Priority Flora occur within the survey area, while the closest location occurs 5.3km southwest of the survey area.

The Priority Ecological Community and Threatened Ecological Community (PEC & TEC) search revealed that the survey area contains no TECs, however lies within the buffer zone of a Priority Ecological Community location (Appendix E). The centre point for this buffer zone does not occur within the survey area, however lies approximately 1.5km southeast of the survey area (DEC, 2011a). The buffer zone relates to the PEC known as the Bulga Downs/Perinvale/Walling/vegetation complexes (banded ironstone formation) (Priority 1). This community has not yet been described by the DEC on their list of PECs, however it is inferred that the PEC relates to the vegetation specifically occurring on the banded ironstone formations.

The survey area does not lie within or contain any Environmentally Sensitive Areas (ESA's) or Conservation Reserves (DEC, 2012).

No wetlands which are recorded on the DAFWA WetlandBase occur within the survey area (DAFWA, 2012).

The survey area lies south of the 26th parallel, however receives average annual rainfall between 236mm and 250mm (BoM, 2012), below the 400mm threshold mark. There is no record of *Phytophthora cinnamomi* establishing in natural ecosystems in regions receiving <400mm rainfall per annum (CALM, 2003). Therefore Dieback is not considered an issue for this survey area, however all measures should be taken to prevent any possible soil contamination (seeds of non-

native species *etc*.) which poses a risk within the survey area during seasonally favourable conditions.

Ten vegetation groups were described during this survey, largely following topographical features and dominant upper storey species. Although the quadrats encompassed up 10 vegetation groups, only nine of these occurred within the survey area boundary. Mapping of these 9 vegetation groups, as well as the quadrat locations can be seen in Appendix F.

Ninety seven species were recorded from 59 genera and 31 families. These are listed in Appendix G per Quadrat as well as per vegetation group. Of the native species, Fabaceae had the highest representation, with 16 species from 2 genera dominated by *Acacia.* Asteraceae was the next best represented family with 12 species from 10 genera.

Of the 97 taxa recorded there were no introduced weed species.

Vegetation in the area has been subjected to exploration activities, however due to the timing, ephemerals and annuals were present to assess as part of this two staged survey.

All of the sites/quadrats inspected were in Excellent condition (Keighery 1994). At many of the sites/quadrats there were existing vehicle tracks due to mine exploration activities. The vegetation more than 0.5m off these tracks was mostly in a Very Good to Excellent condition (Keighery 1994).

One species of conservation significance was recorded during the survey. *Calotis sp* Perrinvale Range (Priority 3) was recorded from one location, the Banded Ironstone Formation (BIF) ridge on the western edge of the survey area (Quadrat 5) with an estimated population of 15 plants. A specimen of this taxon will be forwarded to the Western Australian Herbarium along with a Rare Flora Report Form. The location is recorded in Appendix H and shown in Figure 11. The closest previously recorded population was from approximately 5.97 km south west of the location in the survey area.

Previous surveys by Paul Armstrong and Associates (PAA, 2008) located the species *Drosera aff macrantha* (Figure 12). All previous PAA records of this species at Mt Mason were searched by Native Vegetation Solutions (NVS), however it was not located. This species is only visible and flowering in a short period between May and August.

One such particular survey was completed by Paul Armstrong with Allan Lawry a *Drosera* expert from Perth and he determined this in the field as well as with comparison to other samples to be a new species most closely related to *Drosera macrantha,* of which it is quite possibly a subspecies.

However, the single sample collected and lodged with the Western Australian Herbarium (WAHERB) (Sheet Number PERTH 07801823) has been deemed to be too sterile to identify to a species level. Advice from Karina Knight at the WAHERB is that this sample has been renamed from *Drosera aff macrantha* to *Drosera sp.*

Given the uncertainty regarding the identification of the sample at the WAHERB, as well as the expert opinion from Allan Lawry, it is recommended to treat this plant as new species and avoid areas where it has previously been recorded. It is also recommended that targeted surveys be completed for this species at the previously recorded locations between May and August, in order to provide better sample material to the WAHERB for identification, and determination of its relevant conservation code.

The proposed clearing of vegetation will result in the loss of some individuals from the local area; however, the impact will not be great enough to remove whole communities or populations. Most of the species and communities recorded during this survey are widespread throughout the

Murchison Bioregion and therefore the loss of a small proportion from this area will not be significant.

The single Priority 3 species recorded during this survey, *Calotis sp* Perrinvale Range, was restricted in distribution to a small population. Removal of this population is not likely to compromise the conservation status or short and medium term viability of the species regionally.

Areas where the possible new *Drosera sp.* are known to occur should be avoided until better sample material can be collected and provided to the WAHERB for identification and determination of its conservation status.

The Environmental Protection Authority's (EPAs) objective for flora and vegetation is to maintain the abundance, species diversity and geographical distribution of flora and vegetation as well as protect Threatened flora consistent with the provisions of the *Wildlife Conservation Act 1950.*

This report has been expanded to incorporate and summarise the results of Stage 1 (October 2011) and Stage 2 (March 2012) surveys.

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1 INTRODUCTION

1.1 BACKGROUND

Jupiter Mines Limited (Jupiter) is a is a publicly listed company with iron ore interests in both the Mt Mason and Mt Ida Projects in the Central Yilgarn of Western Australia. The Mt Mason project is located approximately 560 kilometres north-east of Perth, 216 kilometres north of Kalgoorlie and 80 kilometres west of Leonora (Figure 1).

Jupiter is currently conducting exploration within the Mt Mason and Mt Ida Projects, proposing to initially establish mining operations in the Mt Mason area.

The Mt Mason project area lies within mining tenement M29/408. Jupiter proposes to establish mining infrastructure estimated between 50-70 hectares within this tenement. The proposed infrastructure areas include an open pit, crushing facility with stockpile, explosives magazine, administration/workshop and topsoil stockpiles.

The survey area, for the purposes of this report totalling 71.81 ha encompasses the above mentioned infrastructure sites.

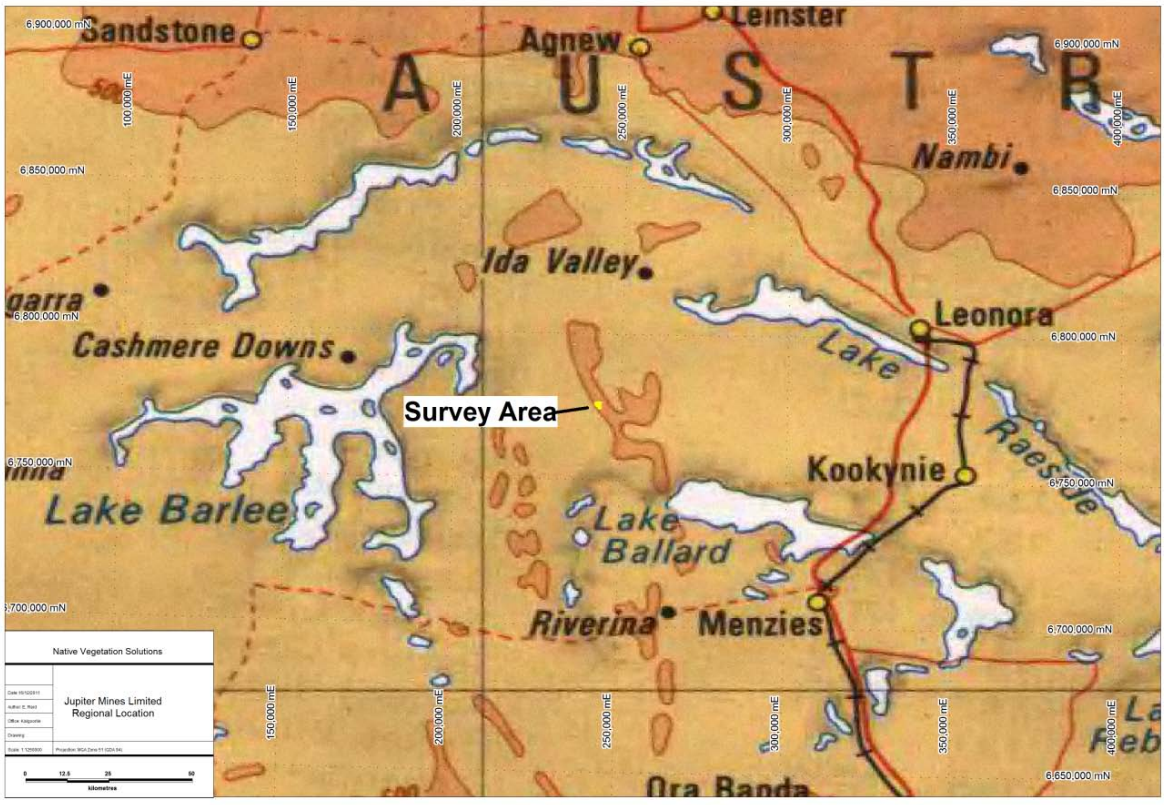

Figure 1: Location of the Mt Mason project

1.2 PURPOSE AND SCOPE

The objective of this report is to document the results of the flora and vegetation component of a Level 2 assessment conducted in accordance with the Environmental Protection Authority's (EPA) "*Terrestrial Biological Surveys as an Element of Biodiversity Protection; Position Statement No 3*" (EPA, 2002) and *Guidance Statement No. 51 "Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (EPA 2004), for the purpose of describing the flora and vegetation of the survey area, and potential impacts on the environment from the Mt Mason project area.

2 EXISTING ENVIRONMENT

2.1 CLIMATE

The climate of the region is subtropical to warm temperate, typically characterised by hot dry summers and cold winters.

The nearest official meteorological station is located at Menzies, approximately 91 km south of the survey area. Recordings of the local climatic conditions commenced at Menzies in 1896 (rainfall) and 1898 (temperature) (BoM, 2012) and the data collected at this station was used for this report.

2.1.1 Temperature

Mean annual minimum temperature is 12.6°C and mean annual maximum temperature is 26.3°C. The coldest month is July (mean minimum temperature 5.3°C), the hottest is January (mean maximum temperature 35.1°C) and diurnal temperature variations are relatively consistent throughout the year (Figure 2).

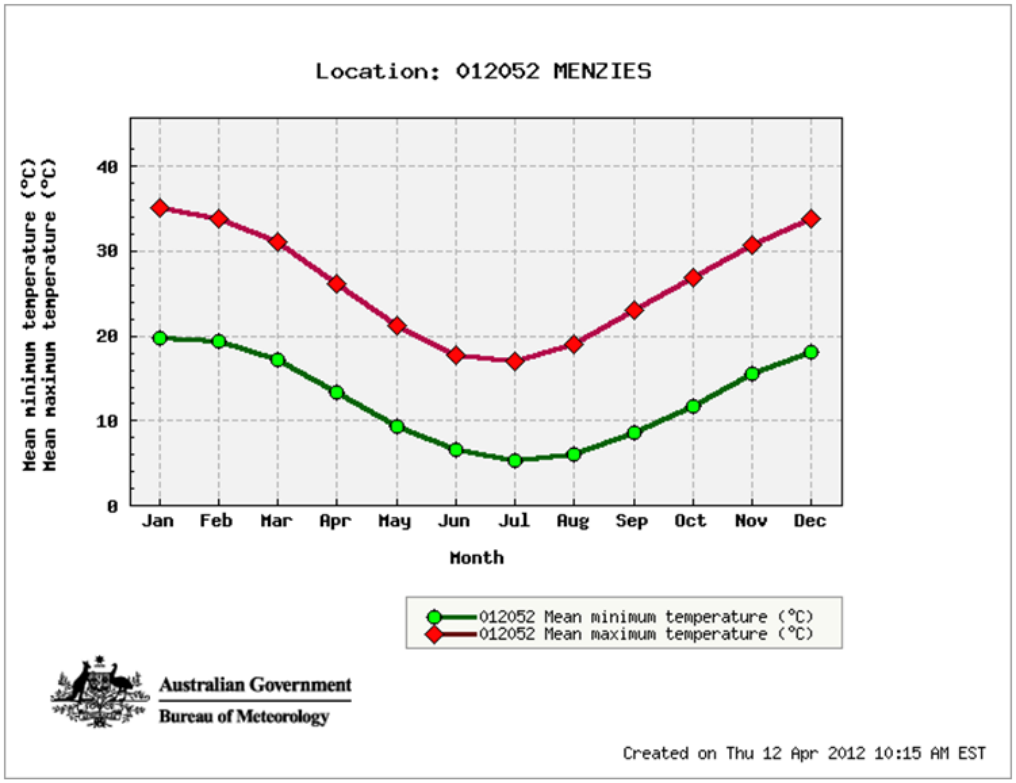

Figure 2: Mean maximum and minimum temperatures at Menzies

2.1.2 Rainfall

The area is arid and the annual average rainfall at Menzies is 250.3 mm, which falls (>1 mm) on

an average of 32.1 rain-days. Most of the rain usually falls between January and August and this amount varies greatly both seasonally and annually (Figure 3). Prior to this survey being undertaken rainfall at Menzies had not been recorded in 2011 for the months of January, February, April, August and September, as well as for all months in 2012. However 2011 rainfall for June, July and October showed greater rainfall than their respective averages.

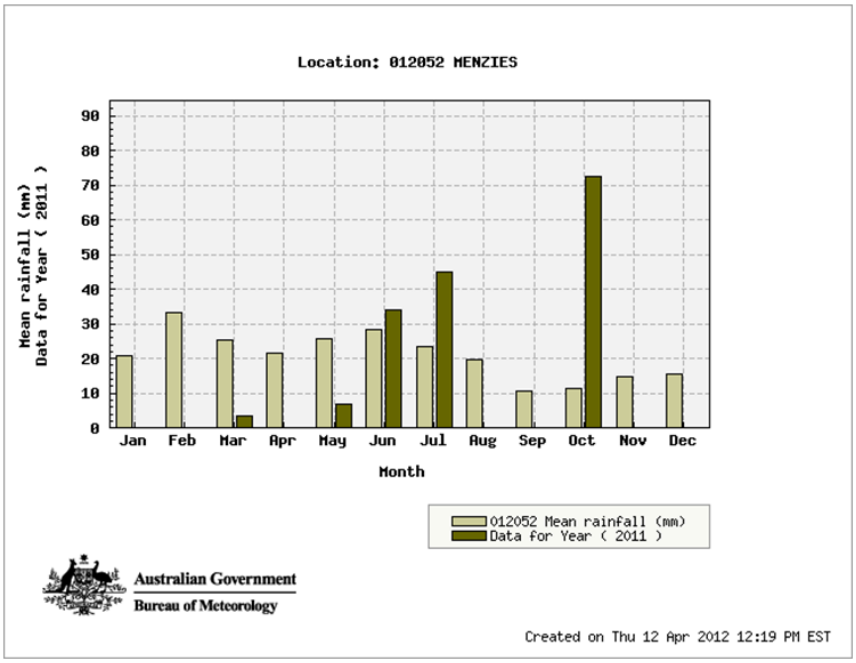

Figure 3: Rainfall data for the Menzies Meteorological Station

For comparison purposes, average rainfall data from the Leonora weather station Located 98km east of the survey area has been provided. This graph (Figure 4) demonstrates a similar pattern of rainfall for Menzies and Leonora.

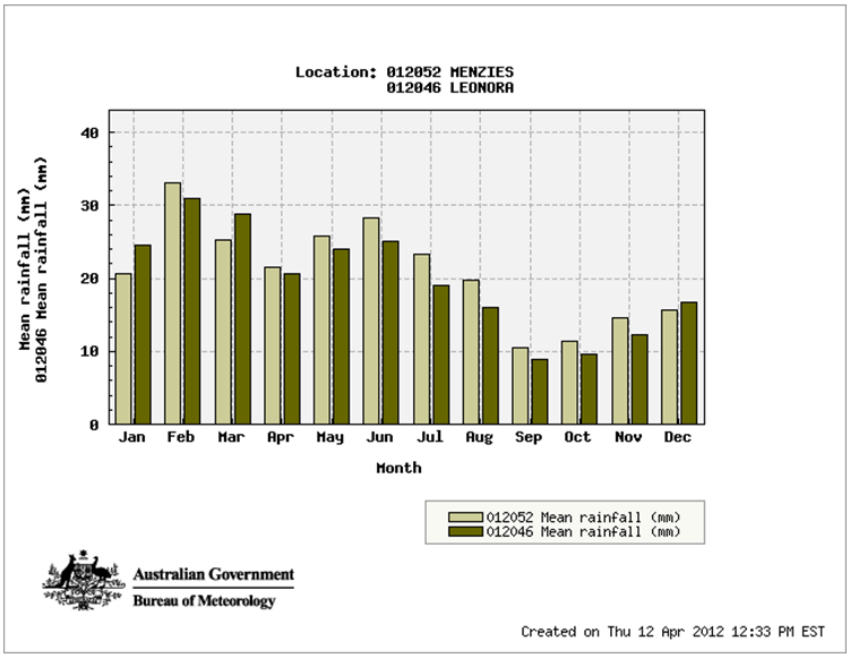

Figure 4: Average Rainfall data for Menzies and Leonora

Additionally, the Leonora rainfall station also shows rainfall being greater than the average figures for June, July and October for 2011. Figure 5 also highlights the rainfall received in 2012 which was above average in January and March.

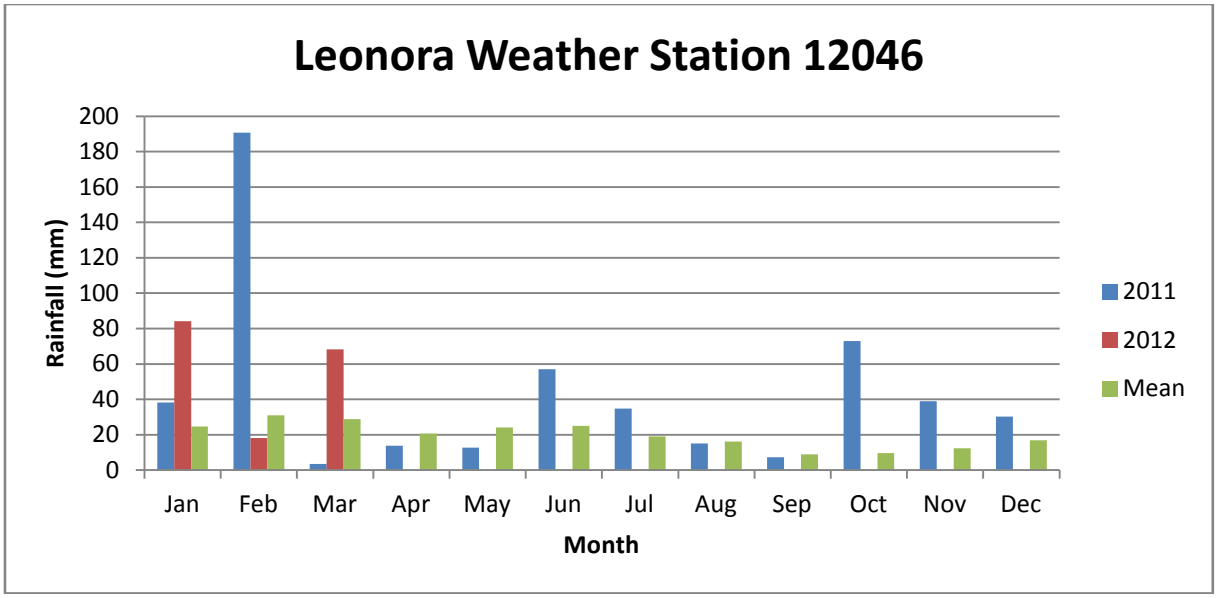

Figure 5: Rainfall data for the Leonora Meteorological Station

2.2 INTERIM BIOGEOGRAPHIC REGIONALISATION OF AUSTRALIA (IBRA) REGION

The IBRA recognises 85 bioregions within Australia and 403 subregions (DSEWPC, 2012). The Mt Mason project is located in the East Murchison IBRA subregion (MUR1) which totals over 7 million hectares (CALM, 2002). The East Murchison subregion lies on the Yilgarn Craton's "Eastern Goldfields" and "Southern Cross" Terranes. This area is characterised by:

- Internal drainage;
- Extensive areas of elevated red desert sandplains with minimal dune development;
- Salt lake systems that are associated with the occluded Paleodrainage system; and
- Broad plains of red-brown soils and breakaway complexes as well as red sandplains (CALM, 2002).

The dominant land use of the MUR1 subregion is grazing, while only 1.4% was in conservation reserves in 2001 (CALM, 2002).

2.3 LANDFORMS AND SOILS

The soils of the MUR1 IBRA region are summarised above. Beard (1990) describes the landform of the eastern Murchison as 'less dissected' than the western part and resembling the Wheatbelt Region, albeit with different soils. The most important types he describes as:

- Shallow stony earthy loams on hills and ranges;
- Red earthy sands on upland sandplains, with red sands on occasional dunes;
- Earthy loams overlying red-brown hardpan, often with a surface stony layer, on undulating terrain;
- Shallow acid or neutral red earths in intimate mosaics with earthy loams on extensive flat and gently sloping plains; and
- Saline soils associated with salt lakes.

2.4 BOTANICAL DISTRICTS AND EXISTING VEGETATION

The Mt Mason project area is located in the Austin Botanical District of Beard (1990).

The Austin Botanical District (Murchison) vegetation also comprises predominantly mulga low woodlands on plains, with the vegetation reduced to scrub on hills. Like the Helms District, *Eucalyptus* spp. forms a tree steppe over (commonly) *Triodia basedowii.* The vegetation is

dominated by *Acacia* forests and woodlands, *Acacia* shrublands, hummock grasslands, chenopod and samphire shrublands, with other shrublands also occurring and small areas of *Eucalyptus* woodlands and open woodlands (ANRA, 2012).

3 METHODS

3.1 LEVEL OF SURVEY

The survey was conducted in accordance with EPA's Position Statement No. 3: *Terrestrial Biological Surveys as an Element of Biodiversity Protection* (EPA, 2002) and *Guidance for the Assessment of Environmental Factors No. 51: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA, 2004).

In designing this survey, note was taken of Tables 2 and 3 of EPA Guidance Statement 51 (pp 39-45). Using the Table 3 criterion on 'Size/scale of the proposal/impact' it is determined that the impact of this mining proposal is High, although other criteria (for example 'Degree of degradation or clearing within region' and 'Rarity of vegetation') may mitigate this by showing Low impact. This survey, however, is designed to accommodate the High impact and as such, in the Murchison bioregion, a Level 2 survey is required.

The flora and vegetation aspect of a Level 2 study has two components:

1a. Desktop study which includes a literature review and a search of the relevant databases; and

1b. Reconnaissance survey of the subject area to verify the desktop survey, undertake low impact sampling, define flora and vegetation values present in the area and to determine potential sensitivity to impact. These together comprise a Level 1 survey.

and

2a. Detailed survey, comprising multiple visits in different seasons and replication of plots in vegetation units incorporating greater coverage than a reconnaissance survey; and

2b. Comprehensive survey when necessary, to enhance the level of knowledge at the locality or sub-regional scale, to provide wider context for the local scale.

Therefore, the scope of work for the flora and vegetation survey was to:

- Conduct a desktop study that includes a literature review and search of relevant databases;
- Conduct a plot-based survey of the proposed area of impact including multiple visits in different seasons;
- Prepare an inventory of species occurring in the study area;
- Identify any conservation significant vegetation or flora within the study area;
- Provide an impact risk assessment for both threatening processes and for flora of conservation significance; and
- Provide recommendations, including the management of perceived impacts to flora and vegetation, particularly flora of conservation significance, within the study area.

3.2 PRELIMINARY DESKTOP STUDY

A preliminary assessment of the survey area and its potential constraints was undertaken by reviewing a number of government agency managed databases and consulting where necessary. The following sections provide a summary of the methodology used for each potential environmental aspect associated with the survey area.

3.2.1 EPBC Protected Matters Search Tool

A search was completed on the EPBC Protected Matters Search website for known records of important environmental significance (DSEWPC, 2012a).

3.2.2 Threatened Flora and Communities

The Species and Communities Branch of the DEC was contacted for a search of their databases containing known populations of threatened flora (Reference: 76-1011FL, DEC, 2011).

The presence of TECs & PECs was determined by examining Geographic Information System (GIS) data supplied by the DEC upon request. (Reference: 53-1011EC, DEC, 2011a).

3.2.3 Environmentally Sensitive Areas and Conservation Reserves

DEC's Native Vegetation Map Viewer was used to determine the location of any ESA's (http://maps.dec.wa.gov.au/idelve/nv/index.jsp).

The location of any Conservation Reserves was determined by examining Geographical Information System (GIS) data available from the DEC website and consulting with the local DEC office where necessary.

3.2.4 Vegetation Type, Extent and Status

Vegetation extent and status data was sourced from the Department of Agriculture and Food (DAFWA) report "Land-Use and Vegetation in Western Australia- National Land and Water Resources Audit Report" and it's associated GIS file.
Note: This data was provided to Native Vegetation Solutions via a license agreement with the DAFWA.

3.2.5 Wetlands

The location of wetlands within the survey area was determined by examining DAFWA's Wetland Base (http://spatial.agric.wa.gov.au/wetlands/).

3.2.6 Dieback

Dieback is only considered a potential issue if both the mean annual rainfall of the area is >400mm, and if the project area resides below the 26th parallel.

3.3 FIELD SURVEY

The first stage of the field survey was conducted by Mr. Eren Reid and Ms. Ana Storey, Botanists of NVS from the 3rd to 7th October 2011.

The second stage of the field survey was conducted by Mr. Eren Reid and Ms. Ashley Owen, Botanists from NVS from the 12th to 14th March 2012.

3.3.1 Field Methods

3.3.1.1 Stage 1 Field work (Spring 2011)

Prior to the Stage 1 field work, the aerial photography was examined and representative sample sites for quadrats were chosen to provide coverage over all visible vegetation types. Nineteen sites were chosen by this method. Locations were planned to target mainly within the survey area as well as the distribution of the BIF outside the survey area, for comparison purposes.

In the field, these sites were visited and 20 x 20m quadrats established in appropriate locations, taking into account representativeness of the site to surrounding vegetation and vegetation boundaries.

Each quadrat was marked in all corners with a 97cm aluminium fence dropper and was defined by tape measures. The location of the north-west corner was captured on a TwoNav Aventura GPS at ±4m accuracy, using Universal Transverse Mercator location on GDA94 datum. Digital photographs were taken of each site.

Data collected at each site included:

- Species Present;
- Topography;
- Rock Type;
- Soil Colour and Type;
- Aspect;
- % Bare Ground and Litter;
- Disturbance Level; and
- Condition.

As well as a complete list of all species encountered the average height and estimated coverage of the species was recorded.

Specimens of taxa not recognised by the Botanists were collected and pressed along with specimens of taxa recognised as, or thought to be, conservation-significant species.

The condition of each quadrat was assessed using the method developed by Keighery (1994). Definitions of the condition scale are presented in Appendix A.

3.3.1.2 Stage 2 Field work (Autumn 2012)

In March 2012, NVS was commissioned to complete stage 2 of the Level 2 flora and vegetation survey at Mt Mason. Prior to field work NVS was advised that additional areas were required to be surveyed due to actual footprints being refined. Therefore 5 additional quadrats were planned and installed within the additional area, totalling 24 quadrats with the complete survey area of 71.81ha. Methods as mentioned in section 3.3.1.1 were utilised for the total 24 quadrats in March 2012.

3.3.2 Post-Field Methods

Specimens were identified by a consultant Botanist Frank Obbens with reference to published keys and samples held in the Reference Section of the WAHERB.

Species information was transferred into Microsoft Excel worksheets in preparation for PATN analysis, via Bray and Curtis Flexible UPGMA.

Previous survey plot results (20m x 20m quadrats) completed by Paul Armstrong and Associates (PAA, 2008) within the Mt Mason area were also examined and included for Species Accumulation Analysis.

3.4 PERSONNEL AND REPORTING

The following personnel were involved in the preparation of this report:

- Mr Eren Reid (*BSc- Biological Science*), Principal Botanist of NVS, planned and conducted stages 1 and 2 of the field survey and prepared the report;
- Ms Ana Storey (BSc- Botany), Botanist of NVS, participated in the stage 1 field survey;
- Ms Ashley Owen (Dip of Science), Botanist/Consultant of NVS, participated in the stage 2 field survey and prepared parts of the report; and
- Mr Frank Obbens *BSc*, Consultant Botanist/Plant Taxonomist, undertook identification of unknown specimens collected during fieldwork.

3.5 LICENCE AND PERMITS

A License to take flora for scientific purposes was held by Mr ER Reid SL009444 which is due for expiry on17/05/2012.

3.6 NOMENCLATURE AND TAXONOMY

Nomenclature follows that used by the WAHERB.

Recently the WAHERB has updated its sequence and arrangement of collections to conform to the systematic sequence of the Angiosperm Phylogeny Group (APGIII), with the result that many Families and Genera have been moved or renamed. This report attempts to follow those changes in relation to species recorded during this survey. Definitions of Threatened Flora are also included in Appendix B.

3.7 LIMITATIONS

A number of limitations are suggested by the EPA (2004) as potentially impacting on the completeness or accuracy of surveys such as these. Table 1 lists these and addresses them in terms of their constraint on this survey.

Table 1: Summary of possible Flora and Vegetation Survey limitations

Possible Limitation	Constraint	Comment
Competency/experience of the consultant carrying out the survey	No	Experienced and competent personnel conducted the survey. Eren Reid has over 7 years experience in botanical surveys in a variety of environments across Western Australia including the Murchison region.
Scope	No	The Scope of work was adequately defined.
Proportion of flora identified, recorded and/or collected	No	All taxa not identified in the field were collected and pressed, and later identified by a consultant Botanist at the WAHERB. See also Species Accumulation Curves in section 4.2.2.2.
Sources of information	No	Information on flora and vegetation of the region and local area was available from publicly available databases, books and reports.
Proportion of the task achieved	No	All tasks completed.
Timing/season	Yes/No	The surveys were undertaken in October 2011 and March 2012. Rainfall averages were exceeded in June and July with later rainfall remaining in line with monthly averages, stimulating germination and growth of annual species in 2011, as well as prolonging the flowering period of other perennials. Rainfall previous to the March 2012 field work was above average for January and March. However timing was not consistent with the flowering period of the *Drosera sp* for the collection of this species for positive identification.
Disturbance in survey area	No	There has been disturbance from exploration activities, however, the structural dominants of the vegetation persist and, despite invasion by some significant weeds, the vegetation remains in Good to Very Good condition.
Intensity of survey effort	No	The intensity of the survey is sufficient to provide adequate coverage and recognition of vegetation units.
Resources	No	Adequate resources were available.
Remoteness and/or access problems	No	All the areas in need of survey were easily accessible from existing tracks, or by foot.
Availability of contextual information for the region`	No	Contextual information regarding vegetation and flora around the east Murchison is readily available.

4 RESULTS

4.1 PRELIMINARY DESKTOP ASSESSMENT

4.1.1 EPBC Protected Matters Search Tool

The search undertaken with the EPBC's Protected Matters Search Tool reported that no TECs were present in the region (DSEWPC, 2012a). The search also revealed that the survey area may contain habitat for the following two invasive weed species *Carrichtera annua* (Ward's Weed) and *Cenchrus ciliaris* (Buffel Grass).

Results of the EPBC Protected Matters Search Tool are included in Appendix C.

4.1.2 Threatened Flora and Communities

The DEC database searches revealed a potential for 1 Threatened Flora and 25 Priority Flora species to occur within a 50km radius of the survey area (DEC, 2011). No known locations of Priority Flora occur within the survey area, while the closest location occurs 5.3km southwest of the survey area.

Results of the threatened flora database search are included in Appendix D.

The PEC/TEC search revealed that the survey area contains no TECs, however lies within the buffer zone of a PEC location (Appendix E). The centre point for this buffer zone does not occur within the survey area, however lies approximately 1.5km southeast of the survey area (DEC, 2011a). The buffer zone relates to the PEC known as the Bulga Downs/Perinvale/Walling/vegetation complexes (banded ironstone formation) (Priority 1). This community has not yet been described by the DEC on their list of PECs, however it is inferred that the PEC relates to the vegetation specifically occurring on the banded ironstone formations.

Priority 1 PECs are defined to be poorly known 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. 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.

The main threat to this community is considered to be mining.

4.1.3 Environmentally Sensitive Areas and Conservation Reserves

The survey area does not lie within or contain any ESA's or Conservation Reserves (DEC, 2012).

4.1.4 Vegetation Type, Extent and Status

Information relating to known vegetation within the survey area has been summarised in Table 2 and Table 3 below. This information has been compiled through both desktop assessments and the field survey.

Table 2: Summary of information regarding Pre-European and current vegetation extent of vegetation association 18 within the survey area

Factor	Value				
Beard Vegetation Association*	18				
Vegetation Association Description*	Low woodland; mulga (Acacia aneura)				
Extent (ha)	Scale				
	By Association*	***By Association****	***By IBRA Region**** *(Murchison-MUR)*	***By IBRA Sub-region**** *(East Murchison-MUR1)*	***By Shire**** *(Shire of Menzies)*
	22,029,557	19,926,084	12,422,396	10,285,290	2,013,390
% Pre-European Extent Remaining*	*100.00%*	*100.00%*	*100.00%*	*100.00%*	*100.00%*
Surrounding Land Use	Exploration, Mining				
Weed prevalence	Low				

* Source: Shepherd *et al*. (2002) Appendix 2
**Source: Shepherd *et al.* (2002) Associated GIS data

Table 3: Summary of information regarding Pre-European and current vegetation extent of vegetation association 202 within the survey area

Factor	Value				
Beard Vegetation Association*	202				
Vegetation Association Description*	Shrublands; mulga & Acacia quadrimarginea scrub				
Extent (ha)	Scale				
	By Association*	***By Association****	***By IBRA Region**** *(Murchison-MUR)*	***By IBRA Sub-region**** *(East Murchison-MUR1)*	***By Shire**** *(Shire of Menzies)*
	365,344	449,227	340,257	279,020	143,358
% Pre-European Extent Remaining*	*100.00%*	*100.00%*	*100.00%*	*100.00%*	*100.00%*
Surrounding Land Use	Exploration, Mining				
Weed prevalence	Low				

* Source: Shepherd *et al*. (2002) Appendix 2
**Source: Shepherd *et al.* (2002) Associated GIS data

4.1.5 Wetlands

No wetlands which are recorded on the DAFWA WetlandBase occur within the survey area (DAFWA, 2012).

4.1.6 Dieback

The survey area lies south of the 26th parallel, however receives average annual rainfall between 236mm and 250mm (BoM, 2012), below the 400mm threshold mark. There is no record of *Phytophthora cinnamomi* establishing in natural ecosystems in regions receiving <400mm rainfall per annum (CALM, 2003). Therefore Dieback is not considered an issue for this survey area, however all measures should be taken to prevent any possible soil contamination (seeds of non-native species *etc*.) which poses a risk within the survey area during seasonally favourable conditions.

4.2 FIELD ASSESSMENT

4.2.1 Vegetation of the Survey Area

Beard's vegetation associations are very broad and are used over large areas in which there is also a large amount of variation at a more local level. The vegetation groups described below for the survey area fit into the broader Beard descriptions.

The vegetation groups described below were determined visually from the descriptions taken at the time of the field survey.

Descriptions of all 24 sites/quadrats are presented in Appendix I. For each site the physical features, vegetation description and unit, along with the species lists for the 20 x 20m plots with typical canopy cover are provided.

4.2.1.1 Vegetation Groups

Ten vegetation groups were described during this survey, largely following topographical features and dominant upper storey species. Although 10 vegetation groups were captured within the quadrat only 9 vegetation groups occur within the survey area. Mapping of the 9 vegetation groups, as well as the quadrat locations can be seen in Appendix F. Descriptions of vegetation groups are listed below.

***1. Thryptomene* Shrubland**

Thryptomene costata or *Thryptomene decussata* low open shrubland with emergent *Acacia quadrimarginea* over scattered mixed shrubs and herbs on low hillslopes and ridges.

Quadrats: 4 and16.

2. Open Mulga woodland over Laterite

Acacia effusifolia low open forest over *Acacia incurvaneura, Eremophila forrestii subsp forrestii* over *Hibbertia arcuata and Prostanthera althoferi subsp althoferi and* scattered mixed shrubs and herbs on Laterite hills.

Quadrat: 13.

3. Acacia shrubland (fire scar- no longer in survey area)

Acacia effusifolia low open shrubland over scattered mixed shrubs and herbs on flats.

Quadrats: 17, 18 and 19.

***4. Allocasuarina* over *Calytrix* shrubland**

Allocasuarina acutivalvis subsp acutivalvis and *Acacia incurvaneura* low woodland/tall shrubland over *Acacia balsamea* and *Philotheca brucei subsp brucei* open shrubland over scattered mixed shrubs and herbs in minor drainage lines and Laterite breakaways.

Quadrats: 3, 20 and 21.

5. Mulga over *Eremophila forrestii susbsp forrestii* on hills and ridges

Acacia incurvaneura woodland over *Eremophila forrestii subsp forrestii* shrubland over scattered mixed low shrubs and herbs on undulating hills and ridges.

Quadrats: 1, 8, 9, 10 and 11.

6. Mulga over *Prostanthera althoferi subsp althoferi* on hills and ridges

Acacia incurvaneura shrubland to tall open scrub over *Prostanthera althoferi subsp althoferi* shrubland over scattered mixed shrubs and herbs on hills and ridges.

Quadrat: 7

7. Mulga over *Philotheca brucei subsp brucei* on hills and ridges

Acacia incurvaneura with *Acacia quadrimarginea* tall shrubland/ low woodland over *Philotheca brucei subsp brucei* with *Acacia balsamea shrubland* over *Eremophila latrobei subsp latrobei* and *Hibbertia exasperata* over mixed herbs and shrubs on hills and ridges.

Quadrats: 2, 5, 6, 12 and 23.

***8. Mulga over Eremophila forrestii subsp forrestii* on flats**

Acacia incurvaneura with *Acacia mulganeura* tall shrubland over *Eremophila forrestii subsp forrestii and Acacia effusifolia* low shrubland over *Waitzia acuminata* and mixed herbs on flat plains.

Quadrats: 14 and 15.

***9. Acacia burkittii* shrubland within drainage lines**

Acacia burkittii and *Acacia quadrimarginea* tall shrubland over *Senna artemisioides subsp artemisioides* over *Ptilotus obovatus* and mixed shrubs within drainage lines.

Quadrat: 22

***10. Acacia cockertoniana* over *Eremophila oldfieldii* and *Eremophila pantonii* on flats**

Acacia cockertoniana tall shrubland over *Eremophila oldfieldii subsp angustifolia* over *Eremophila pantonii* and mixed shrubs on flats.

Quadrat: 24

4.2.1.2 PATN Analysis of Quadrat Data

PATN Analysis was completed on both the dominant species and all species recorded within each quadrat. The results are supplied below in Figure 6 and Figure 7. The PATN analysis of the dominant species shows a similar correlation of grouped quadrats as described in section 4.2.1.1, with the exception of outliers, Q4, Q6, Q7, Q9, Q13, Q17 and Q23. As expected these outliers occur due to the slight variations of dominant species present within each quadrat of its related vegetation group, suggesting some overlapping of vegetation borders. Vegetation Groups 2 and 6 above are not accounted for in the PATN Analysis as Quadrats 7 and 13 have been grouped with other vegetation groups. These quadrats are single quadrats representing their respective vegetation groups due to spatial size limitations. It is expected that if space was available and additional quadrats were installed in these vegetation groups, then they would be grouped according to those included in section 4.2.1.1.

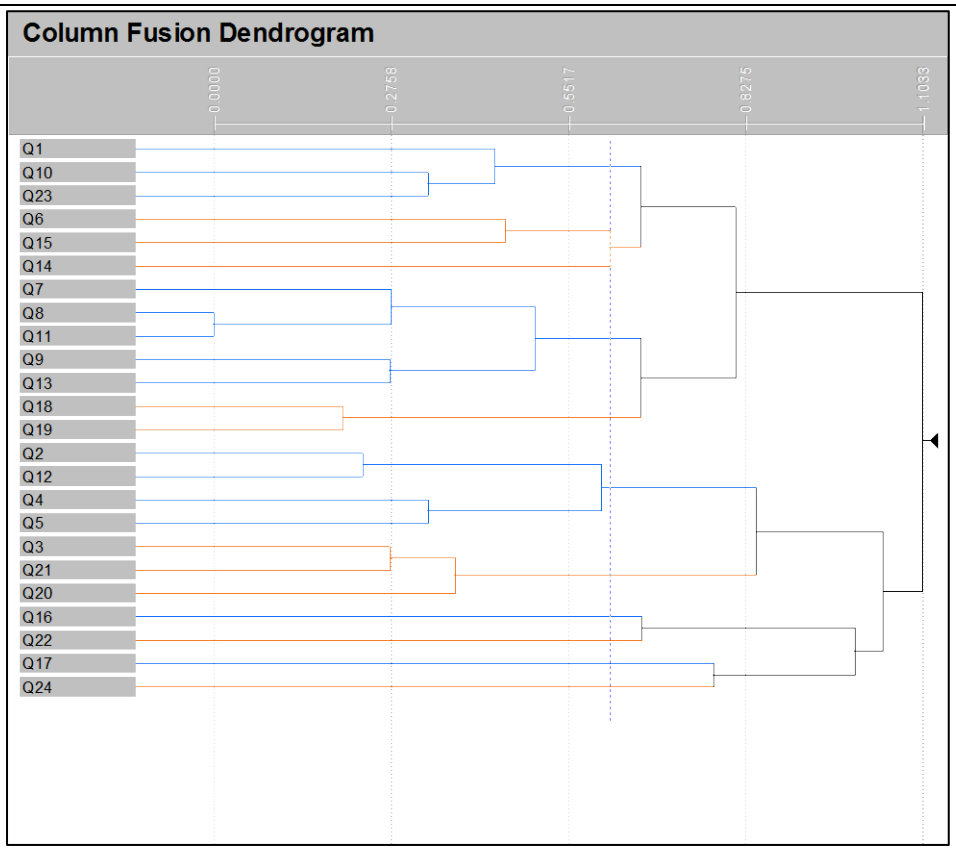

Figure 6: PATN Analysis of Dominant Species into 10 groups

The dendogram below (Figure 7) of the analysis of all species shows a strong correlation of pre-grouped quadrats described in section 4.2.1.1, with the only outliers being Q3, Q4, Q6, Q7, Q13 and Q23 . These outliers occur due to the slight variations of species present within each quadrat of its related vegetation group, suggesting some overlapping of vegetation borders. Once again Vegetation groups 2 and 6 are not accounted for as separate vegetation groups as these quadrats are single quadrats representing their respective vegetation groups due to spatial size limitations. It is expected that if space was available and additional quadrats were installed in these vegetation groups, then they would be grouped according to those included in section 4.2.1.1.

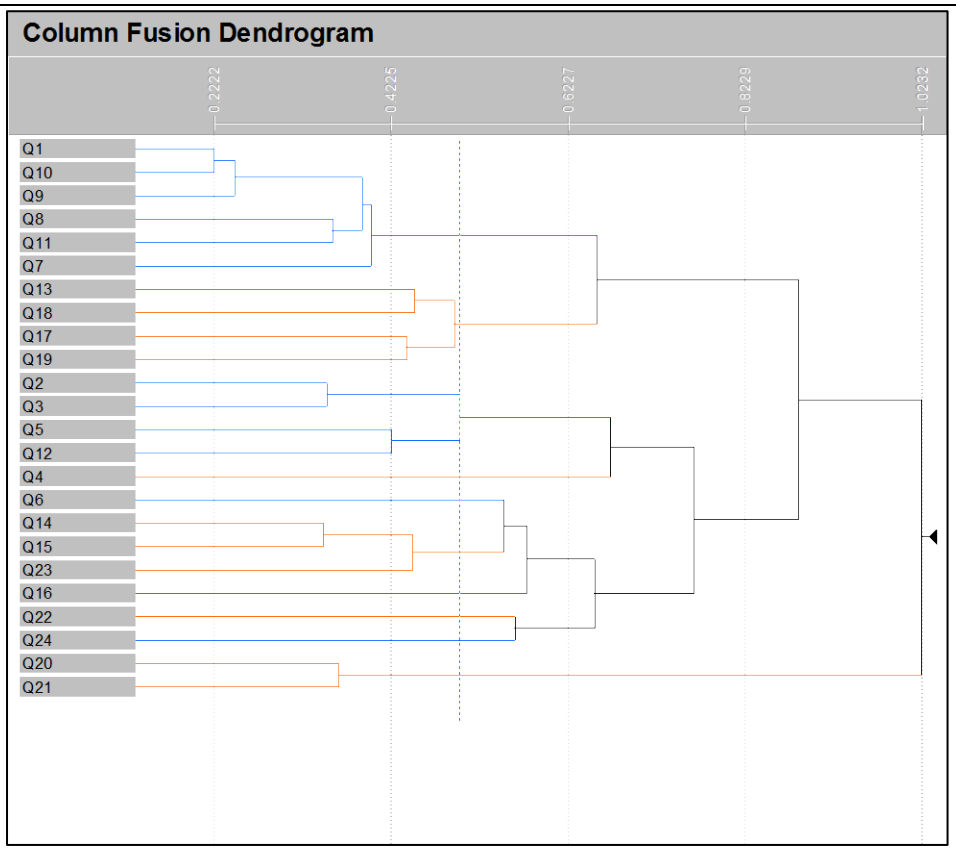

Figure 7: PATN Analysis of All Species into 10 groups

4.2.1.3 Vegetation Condition

Vegetation in the survey area has been subjected to exploration activities, however due to the timing, ephemerals and annuals were present to assess as part of this survey.

According to Keighery (1994) most of the Sites/quadrats inspected were in Very Good to Excellent condition (Figure 8). At many of the Sites there were existing vehicle tracks due to mine exploration activities. The vegetation more than 0.5m off these tracks was mostly in a Very Good to Excellent condition (Keighery, 1994).

As discussed in Section 4.3.3, there were no species of weeds observed during the survey.

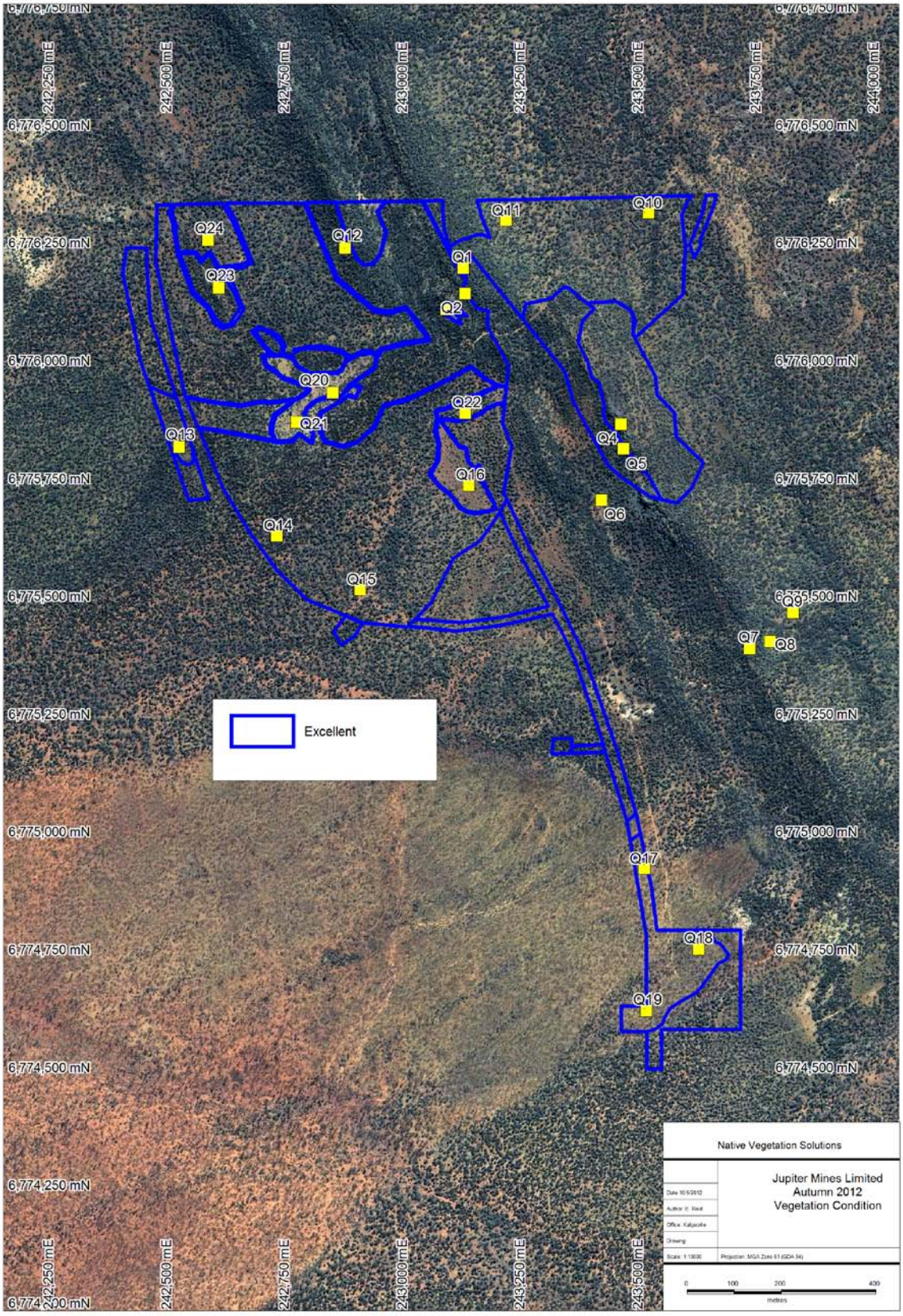

Figure 8: Vegetation condition of the Mt Mason survey area

4.2.2 Flora of the Survey Area

4.2.2.1 General

Ninety seven species were recorded from 59 genera and 31 families. These are listed in Appendix G per Quadrat as well as per vegetation group. Of the native species, Fabaceae had the highest representation, with 16 species from 2 genera dominated by *Acacia.* Asteraceae was the next best represented family with 12 species from 10 genera.

Of the 97 taxa recorded there were no introduced weed species.

The most common and widespread species was *Cheilanthes sieberi subsp sieberi* recorded from 18 quadrats. Its canopy cover was low and never more than 1%. The next most common and widespread species was *Waitzia acuminata, with a canopy cover less than 1%.* As would be anticipated from a mulga dominated area, the next species most common and widespread was *Acacia incurvaneura*, which was recorded from 16 quadrats with canopy cover varied between 10% and 30%. Also sharing 16 quadrat occurrences were *Trachymene ornata* and *Prostanthera althoferi subsp althoferi*. The next most common species were *Philotheca brucei subsp brucei, Olearia humilis* and *Sida sp Golden calyces Glaborous* from 14 Sites, then *Marsdenia australis and Goodenia occidentalis* from 12, *Eremophila georgei and Eremophila forrestii subsp forrestii* from 11 and *Ptilotus obovatus, Goodenia macroplectra, Monachather paradoxus* and *Solanum lasiophyllum* from 9 Sites.

There were 31 taxa recorded from only a single site (Q14). Of these, all were native species and none were weed species.

There were three specimens collected that could not be confirmed, either beyond family or genus. Taxa with unsure determinations were:

- Apocynaceae- *Unknown sp (sterile);*
- *Corchorus sp; and*
- *Eucalyptus sp (sterile)*

As noted in the Biodiversity Audit of Western Australia's 53 Biogeographical Subregions (CALM, 2002), the East Murchison subregion is rich and diverse in both its flora and fauna. CALM (2002) also reports that most species are wide ranging and usually occur in at least one, and often several, adjoining subregions.

4.2.2.2 Species Accumulation Curves

According to the Species Accumulation Curve below, the R^2 value (0.9676) shows a good fit for a logarithmic curve of the total accumulated species per number of quadrats established (Figure 9). Sufficient sampling was inferred via the effort of intensity (number of quadrats established) versus the return of species collected (total accumulated species). The logarithmic trend line and R^2 values were generated in Excel®. From this fitted logarithmic curve formula, the asymptote was calculated where the gain of new species was less than 1% for every new quadrat established. Based on this reasoning, the asymptote was reached at 28 quadrats, at which the extrapolated total accumulated number of species is 95.45. Therefore the 96 species collected within the 24 established quadrats represents approximately 100.58% of the projected asymptote.

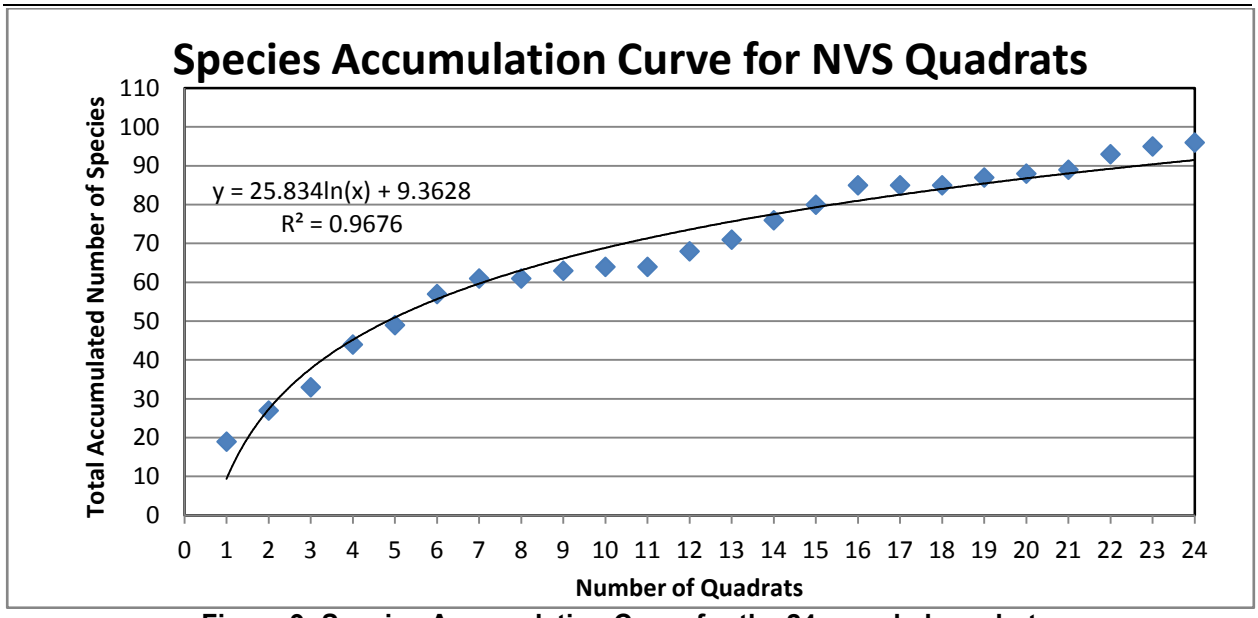

Figure 9: Species Accumulation Curve for the 24 sampled quadrats

Similarly when results from Paul Armstrong and Associates' (PAA) quadrats, which were located within the survey area, were included in the Species Accumulation Curve analysis, the R^2 value (0.9743) below shows a good fit for a logarithmic curve of the total accumulated species per quadrats established (Figure 10). Once again the logarithmic trend line formula and R^2 values were generated in Excel®.

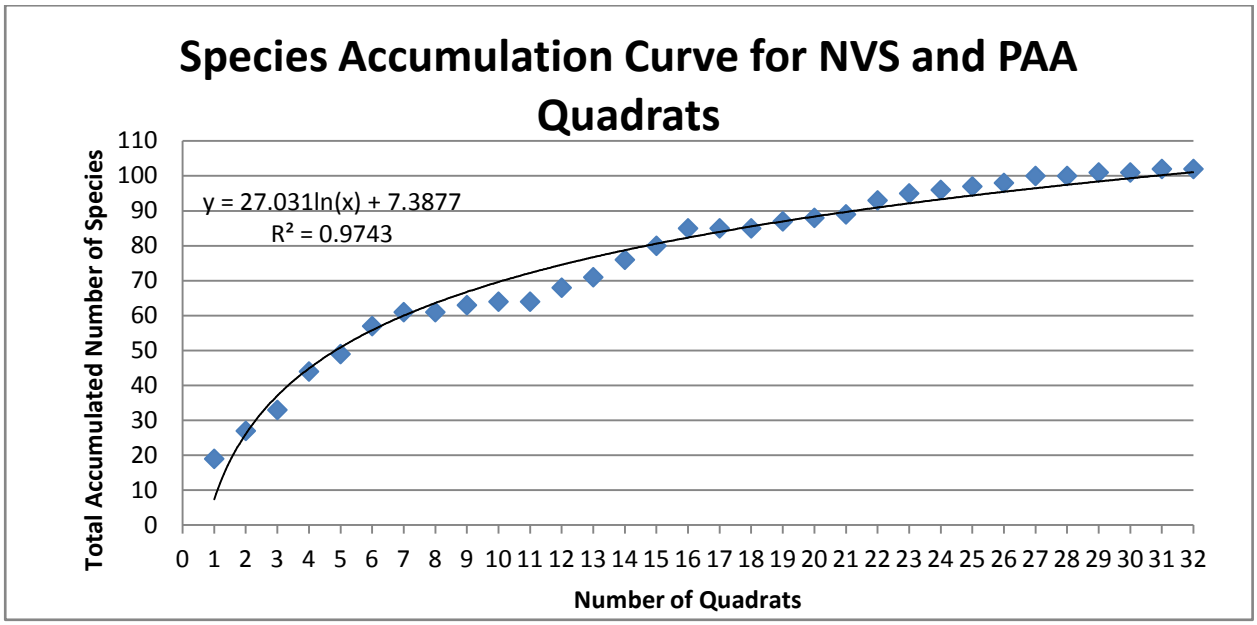

Figure 10: Species Accumulation Curve utilising NVS and PAA Quadrats within the survey area

From this fitted logarithmic curve formula, the asymptote was calculated where the gain of new species was less than 1% for every new quadrat established. Based on this reasoning, the asymptote was reached at 29 quadrats, at which the extrapolated total accumulated number of species is 98.41. Therefore the 102 species collected within the 32 quadrats represents approximately 103.65% of the projected asymptote.

Furthermore, this suggests that 96 species collected within the 24 quadrats represents 97.55% of the projected asymptote calculated using NVS and PAA additional quadrats.

4.2.2.3 Conservation significant species

One species of conservation significance was recorded during the survey.

Calotis sp Perrinvale Range (Priority 3) was recorded from one location, the BIF ridge on the western edge of the survey area (Q5) with an estimated population of 15 plants. A specimen of this taxon will be forwarded to the Western Australian Herbarium along with a Rare Flora Report Form. The location is recorded in Appendix H and shown in Figure 11. The closest previously recorded population was from approximately 3.91 km south west of the survey area.

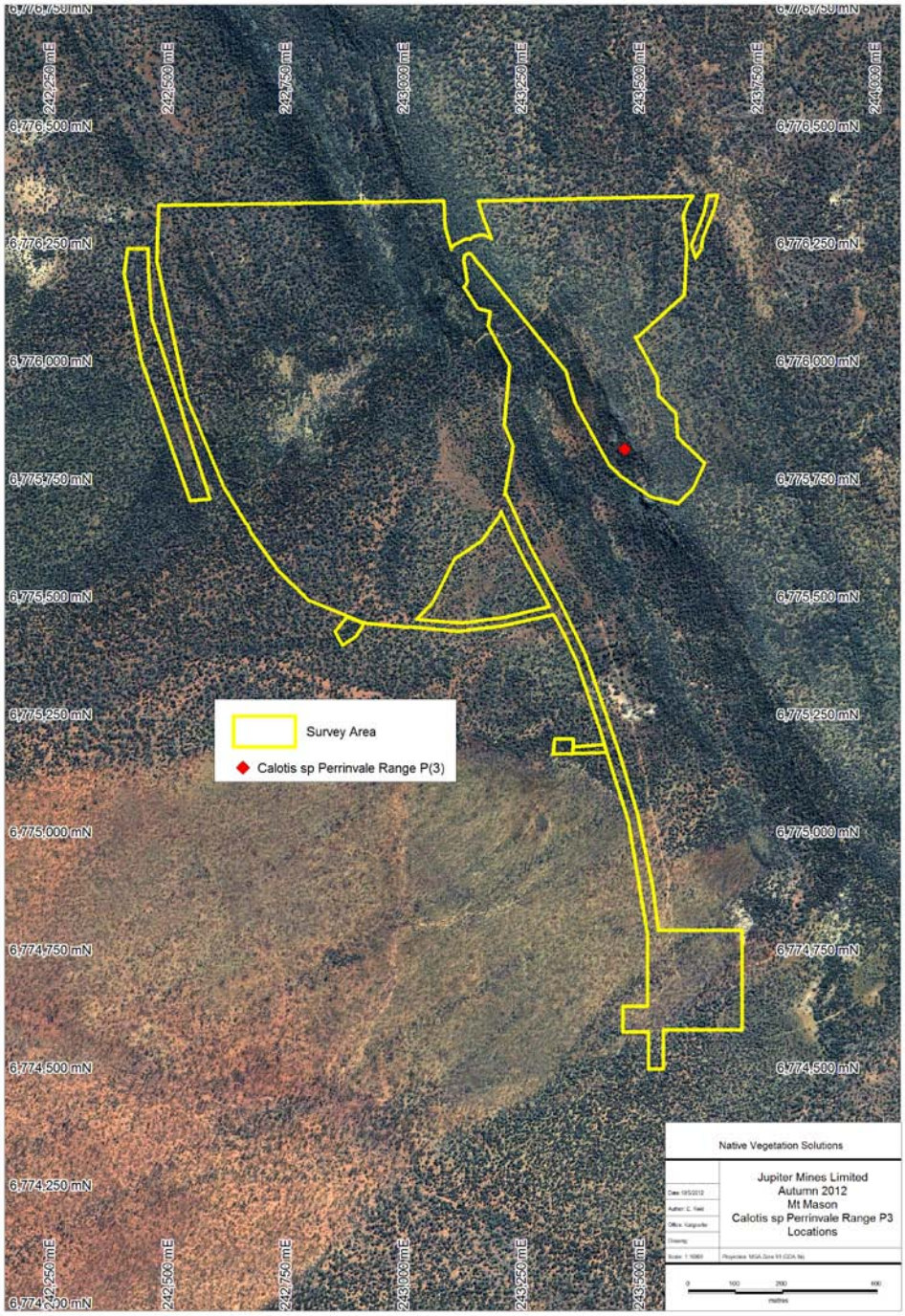

Figure 11: Location of *Calotis sp* Perrinvale Range (P3) recorded within the Mt Mason Survey area.

Previous surveys by Paul Armstrong and Associates (PAA, 2008) located the species *Drosera aff macrantha* (Figure 12). All previous PAA records of this species at Mt Mason were searched by NVS; however this species was not located. This species is only visible and flowering in a short period between May and August.

One such particular survey was completed by Paul Armstrong with Allan Lawry the *Drosera* expert from Perth and he determined this in the field as well as with comparison to other samples to be a new species most closely related to *Drosera macrantha,* of which it is quite possibly a subspecies.

However, the single sample collected and lodged with the WAHERB (Sheet Number PERTH 07801823) has been deemed to be too sterile to identify to a species level. Advice from Karina Knight at the WAHERB is that this sample has been renamed from *Drosera aff macrantha* to *Drosera sp.*

Given the uncertainty regarding the identification of the sample at the WAHERB, as well as the expert opinion from Allan Lawry, it is recommended to treat this plant as a new species and avoid areas where it has previously been recorded. It is also recommended that targeted surveys be completed for this species at the previously recorded locations between May and August, in order to provide better sample material to the WAHERB for identification, and determination of its relevant conservation code.

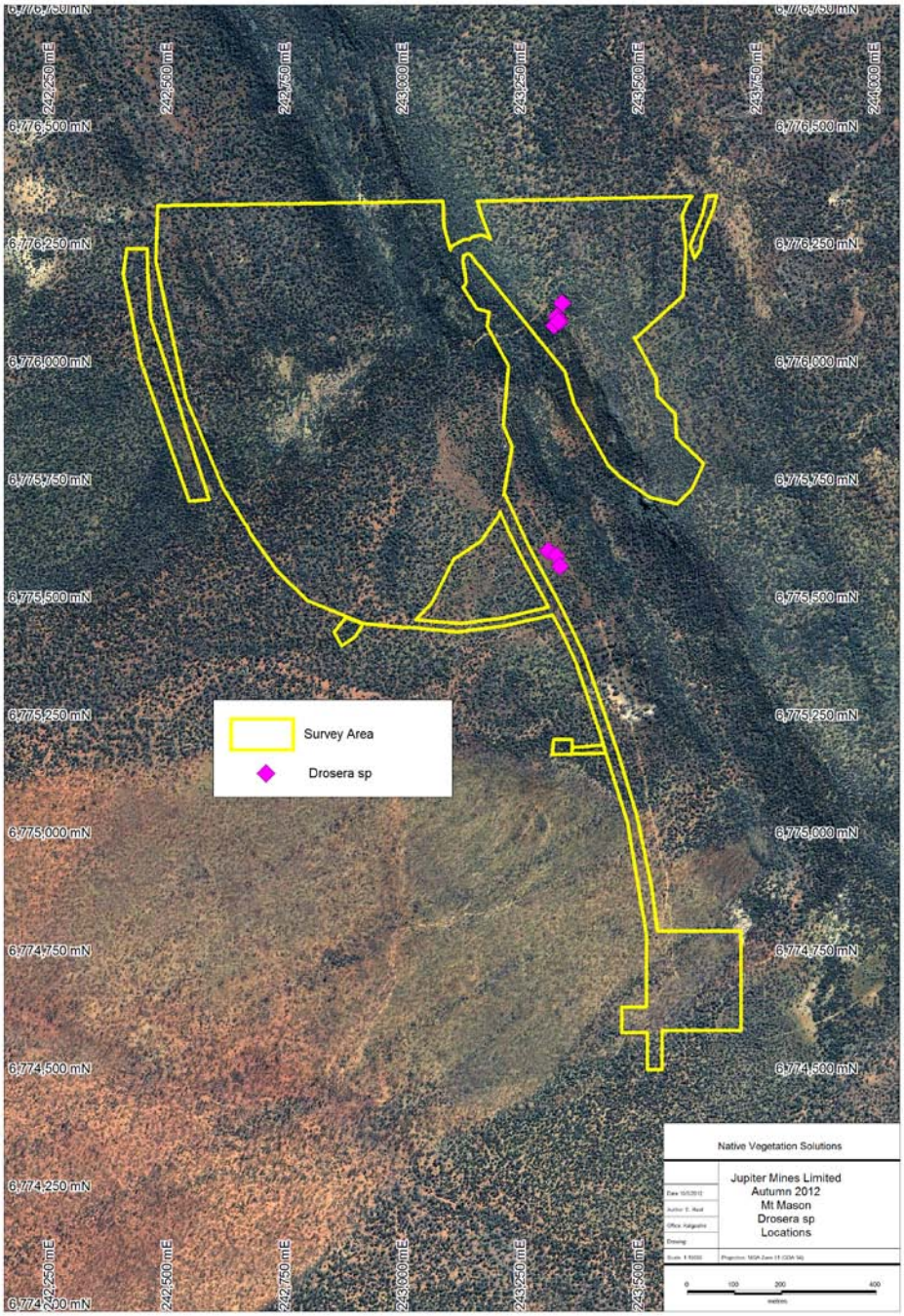

Figure 12: Locations of *Drosera aff macrantha (Drosera sp*) recorded by PAA in the Mt Mason Area.

4.2.2.4 Introduced species

No introduced species were recorded in and around the survey area.

5 DISCUSSION

The EPA (2002) indicated that an ecological assessment of a site must consider its ecological value at the ecosystem level and its biodiversity value at the genetic, species and ecosystem level.

The survey area is located within the East Murchison subregion which has been recognised as a centre of endemism with high ecosystem and species diversity (Cowan 2001). However, Cowan also explains that while the flora of the East Murchison subregion is a rich and varied one, most species are wide ranging and often occur in one or more adjacent subregions. This survey established that mostly, the flora within the project area is not unique, and is in fact common throughout the East Murchison, however the composition of these flora on the BIF ranges is unique and relatively unknown, and could be considered restricted habitats.

No DRF were recorded during the survey; however one Priority 3 species, *Calotis sp* Perrinvale Range, was recorded. The population of *Calotis sp* Perrinvale Range, located on the BIF within and around Q5, requires removal (taken) if the Mt Mason project goes ahead as currently planned. This was the only population of this species observed during the current survey. The FloraBase map of this species shows approximately 19 other known locations of this species with the closest approximately 4.91km to the southwest of the survey area, and the furthest 351km west of the survey area.

Areas where the possible new *Drosera sp.* are known to occur should be avoided until better sample material can be collected and provided to the WAHERB, for identification and determination of its conservation status.

No TECs are present within the areas proposed for clearing. However, one PEC plausibly occurs within survey area. This community is the P1 Bulga Downs/Perrinvale/Walling/vegetation complex (banded ironstone formations). Given that Banded Ironstone formations are mapped as PECs based on the substrate not necessarily on the vegetation, and the fact that no vegetation description or delineation is provided by the DEC as yet, it is assumed this PEC covers entire areas where Banded Ironstone protrudes from the surface.

Vegetation condition was generally 'Very Good' to "Excellent" (Keighery 1994). Disturbance was present within the survey area mostly attributed to access tracks and exploration related activities.

It is therefore not expected that the disturbance associated with the Mt Mason project area will significantly negatively impact on the vegetation in the area in terms of fragmentation or loss of vegetation associations or species that may be unique. This is partially due to the overall size of the survey area as well as the similar vegetation and habitat outside of the survey area.

6 IMPACT ASSESSMENT

6.1 THREATENING PROCESSES

The major processes likely to impact the Flora within the Survey area, if mine operations were to proceed include:

- Vegetation clearing and the associated removal of fauna habitat which would result in the loss of local vertebrate assemblages, a reduction in biodiversity and a loss of ecological function locally, as well as displacement of local fauna into adjacent areas;
- The loss of population numbers to a potentially new species;
- Vehicle impacts on uncleared vegetation could increase if tracks are not adhered to;
- An increase in the area of disturbed land could result in an increase in alien species taking advantage of the lack of competition from native species;
- Dust generated during clearing of native vegetation and mining activities may settle on adjacent native vegetation, causing possible stress and perhaps death, especially during drier months; and
- Accidental fire arising from clearing and mining activities may affect vegetation in surrounding areas.

7 CONCLUSIONS AND RECOMMENDATIONS

This report incorporates and summarises the results of the first and second stages of the Level 2 flora and vegetation survey.

The survey established that the condition of the vegetation in the proposed disturbance area is overall 'Very Good', to 'Excellent' condition. No Declared Rare Flora or Threatened Ecological Communities were recorded in the area.

The proposed clearing of vegetation will result in the loss of some individuals from the local area; however, the impact will not be great enough to remove whole communities or populations. Most of the species and communities recorded during this survey are widespread throughout the Murchison Bioregion and therefore the loss of a small proportion from this area will not be significant.

The one Priority 3 species recorded during this survey, *Calotis sp Perrinvale Range*, was restricted in distribution to a small population. Removal of this population is not likely to compromise the conservation status or short and medium term viability of the species regionally.

Areas where the possible new *Drosera sp.* are known to occur should be avoided until better sample material can be collected and provided to the WAHERB, for identification and determination of its conservation status.

The EPA objective for flora and vegetation is to maintain the abundance, species diversity and geographical distribution of flora and vegetation as well as protect Threatened flora consistent with the provisions of the *Wildlife Conservation Act 1950.*

The following generic recommendations arise from the current flora survey:

- Any disturbance/clearing be minimised in extent to reduce the loss of individuals and impact on populations;
- Weed control measures must be implemented and followed during and after construction activities;
- A rehabilitation plan is developed that progressively rehabilitates areas as soon as they are no longer required;
- Driving restrictions, ensuring that off-road driving is minimised; and
- All staff to be educated on the importance of fire prevention, and equipment provided for use in the event of fire.

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Appendix A - Vegetation Condition Scale (Keighery, 1994)

Pristine (1). Pristine or nearly so, no obvious signs of disturbance.

Excellent (2). Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.

Very Good (3). Vegetation structure altered obvious signs of disturbance.
For example, disturbance to vegetation structure caused by repeating fires, the presence of some more aggressive weeds, dieback, logging and grazing.

Good (4). Vegetation structure significantly altered by very obvious signs of multiple disturbance.
Retains basic vegetation structure or ability to regenerate it.
For example, disturbance to vegetation structure caused by frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.

Degraded (5). 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 (6). 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 compromising weed or crop species with isolated trees or shrubs.

Appendix B - Categories of Conservation Status

IUCN categories (based on review by Mace and Stuart 1994) as used for the Environmental Protection and Biodiversity Conservation (EPBC) Act 1999 and the WA Wildlife Conservation Act 1950.

Extinct. Taxa not definitely located in the wild during the past 50 years.

Extinct in the Wild. Taxa known to survive only in captivity.

Critically Endangered. Taxa facing an extremely high risk of extinction in the wild in the immediate future.

Endangered. Taxa facing a very high risk of extinction in the wild in the near future.

Vulnerable. Taxa facing a high risk of extinction in the wild in the medium-term future.

Near Threatened. Taxa that risk becoming Vulnerable in the wild.

Conservation Dependent. Taxa whose survival depends upon ongoing conservation measures. Without these measures, a conservation dependent taxon would be classed as Vulnerable or more severely threatened.

Data Deficient (Insufficiently known). Taxa suspected of being Rare, Vulnerable or Endangered, but whose true status cannot be determined without more information.

Least Concern. Taxa that are not Threatened.

Schedules used in the WA Wildlife Conservation Act 1950.

Schedule 1. Rare and Likely to become Extinct.

Schedule 2. Extinct.

Schedule 3. Migratory species listed under international treaties.

Schedule 4. Other Specially Protected Fauna.

Department of Environment and Conservation Priority Species

(species not listed under the Conservation Act, but for which there is some concern)

Priority 1. Taxa with few, poorly known population on threatened lands.

Priority 2. Taxa with few, poorly known populations on threatened lands, or taxa with several, poorly known populations not on conservation lands.

Priority 3. Taxa with several, poorly known populations, some on conservation lands.

Priority 4. Taxa in need of monitoring. Taxa which are considered to have been adequately surveyed, or for which sufficient knowledge is available, and which are considered not currently threatened or in need of special protection, but could be if present circumstances change.

Priority 5. Taxa in need of monitoring. Taxa which are not considered threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years (IUCN Conservation Dependent).

JAMBA The agreement between the Government of Australia and the Government of Japan for the Protection of Migratory Birds in Danger of Extinction and their Environment. Australian Treaty Series 1981 No 6.

CAMBA The agreement between the Government of Australia and the Government of the People's Republic of China for the Protection of Migratory Birds and their Environment. Australian Treaty Series 1988 No 22.

ROKAMBA The agreement between the Government of Australia and the Government of the Republic of Korea on the Protection of Migratory Birds and their Environment. Australian Treaty Series 2007 ATS 24.

Appendix C - EPBC Protected Matters Search Results

Australian Government
Department of Sustainability, Environment, Water, Population and Communities

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information about the EPBC Act including significance guidelines, forms and application process details can be found at http://www.environment.gov.au/epbc/assessmentsapprovals/index.html

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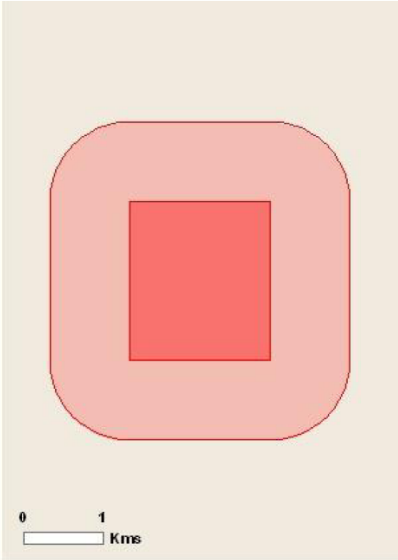
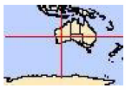
Summary
Details
- Matters of NES
- Other Matters Protected by the EPBC Act
- Extra Information

Caveat
Acknowledgements



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

Coordinates
Buffer: 1.0Km



Summary

Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance - see http://www.environment.gov.au/epbc/assessmentsapprovals/guidelines/index.html

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Areas:	None
Threatened Ecological Communities:	None
Threatened Species:	2
Migratory Species:	5

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place and the heritage values of a place on the Register of the National Estate. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage/index.html

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species. Information on EPBC Act permit requirements and application forms can be found at http://www.environment.gov.

Commonwealth Lands:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	3
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have

Place on the RNE:	None
State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	6
Nationally Important Wetlands:	None

Details

Matters of National Environmental Significance

Threatened Species		[Resource Information]
Name	Status	Type of Presence
BIRDS		
Acanthiza iredalei iredalei		
Slender-billed Thornbill (western) [25967]	Vulnerable	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Leipoa ocellata		
Malleefowl [934]	Vulnerable	Species or species habitat may occur within area

Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat may occur within area
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat may occur within area
Migratory Terrestrial Species		
Leipoa ocellata		
Malleefowl [934]	Vulnerable	Species or species habitat may occur within area
Merops ornatus		
Rainbow Bee-eater [670]		Species or species habitat may occur within area
Migratory Wetlands Species		
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat may occur within area
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat may occur within area
Merops ornatus		
Rainbow Bee-eater [670]		Species or species habitat may occur within area

Extra Information

Invasive Species		[Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit,

Name	Status	Type of Presence
Mammals		
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Carrichtera annua Ward's Weed [9511]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area

Coordinates

-29.114584 120.35123,-29.114584 120.367337,-29.132832 120.367337,-29.132832 120.35123, -29.114584 120.35123

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World Heritage and Register of National Estate properties, Wetlands of International Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants

- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Department of Environment, Climate Change and Water, New South Wales
-Department of Sustainability and Environment, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment and Natural Resources, South Australia
-Parks and Wildlife Service NT, NT Dept of Natural Resources, Environment and the Arts
-Environmental and Resource Management, Queensland
-Department of Environment and Conservation, Western Australia
-Department of the Environment, Climate Change, Energy and Water
-Birds Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-SA Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Atherton and Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
-State Forests of NSW
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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Appendix D - DEC Threatened and Priority Flora Search Results

Listed below are the Priority Flora identified from the DEC searches for the general Survey area and surrounds (Reference: 76-1011FL).

Note – One Threatened species was identified with all known locations approximately 35km southwest of the survey area.

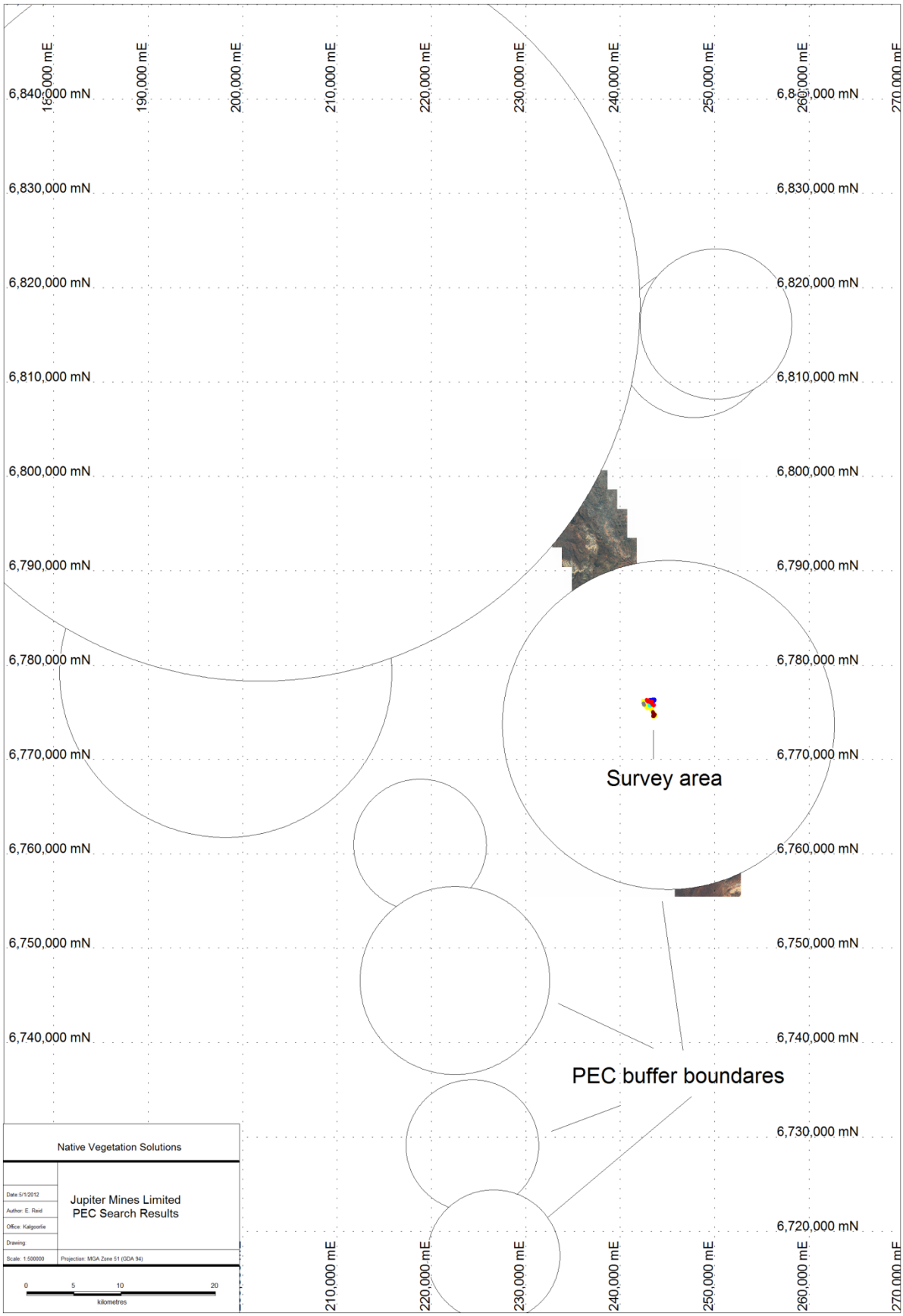
31/10/2011 **DEPARTMENT OF ENVIRONMENT AND CONSERVATION** Page 1
DECLARED RARE AND PRIORITY FLORA LIST
16 September 2010

SPECIES / TAXON	CONS CODE	DEC REGION	DISTRIBUTION	FLOWER PERIOD
Calotis sp. Perrinvale Station (R.J. Cranfield 7906)	3	MW,GLD	Cue, Blue Hills, Perrinvale Stn	
Calytrix praecipua	3	GLD,P	Melita Station, Laverton, Youno Downs, Wanjarri, Marymia, Erong Hmstd, Niagara Dam	Jun-Nov
Cratystylis centralis	3	GLD	Barwidgee Stn, Leonora	Aug-Nov
Eremophila annosocaulis	3	GLD	Mt Morgans Mine (South of Leonora-Laverton Rd), Von Treuer Tableland	
Eremophila mirabilis	2	GLD,MW	Niagara, Morapoi, Kookynie, Woolgorong, Menzies	Aug-Sep
Eremophila simulans subsp. megacalyx	3	MW,GLD	Mt Narryer, Boolardy Stn, Leonora	Aug-Sep
Eucalyptus jutsonii subsp. jutsonii	4	GLD	Comet Vale, Binti Binti Rocks, Menzies, Jeedamya Stn	Nov
Gunniopsis propinqua	3	GLD	Laverton, Mt Margaret, Lake Carnegie, Windidda, Mt Eureka, Mt James, Menzies	Aug-Sep
Hemigenia exilis	4	GLD	Lake Darlot, Yakabindie, Leinster, Leonora, Mt Keith	Apr,May, Aug
Hyalosperma stoveae	2	GLD,MW,*	Perrinvale Station, Burnabinmah	-
Hybanthus floribundus subsp. chloroxanthus	3	GLD	Leonora, Laverton	Aug-Oct
Malleostemon sp. Adelong (GJ Keighery 11825)	2	GLD	Adelong Stn, Mt Manning, Johnston Range	Oct
Micromyrtus serrulata	3	GLD	Karonie, Coonana, Melita, Jeedamya, Niagara Dam NR, Cardunia Rocks, Queen Victoria Spring NR	Mar,Jun,Nov
Newcastelia insignis	2	GLD,SC	Adelong Stn, Comet Vale, Queen Victoria Spring, Norseman	Sep-Nov
Persoonia leucopogon	1	GLD	Between Coolgardie & Laverton, Comet Vale (Menzies)	-
Philotheca coateana	3	GLD,MW	Menzies, Gidgee, Cashmere Downs, Walling Rock	Aug-Oct
Philotheca deserti subsp. brevifolia	1	GLD	Menzies	
Sauropus ramosissimus	3	GLD	Carnegie Stn, Laverton, Warburton, Leonora	
Spartothamnella sp. Helena & Aurora Range (PG Armstrong 155-109)	3	GLD,MW,WB	Helena & Aurora Range, Blue Hill Range, Remlap, Koolyanobbing, Mt Jackson Range, Windarling Hill, Die Hardy Range, Johnston Range, Perrinvale Stn., Yendilberin Hills, Mt Finnerty	
Thryptomene eremaea	2	GLD	Menzies, Queen Victoria Spring, Comet Vale, Edjudina Station, Kirgella Rocks	Jul-Sep

Additional species provided in the GIS results are listed below:

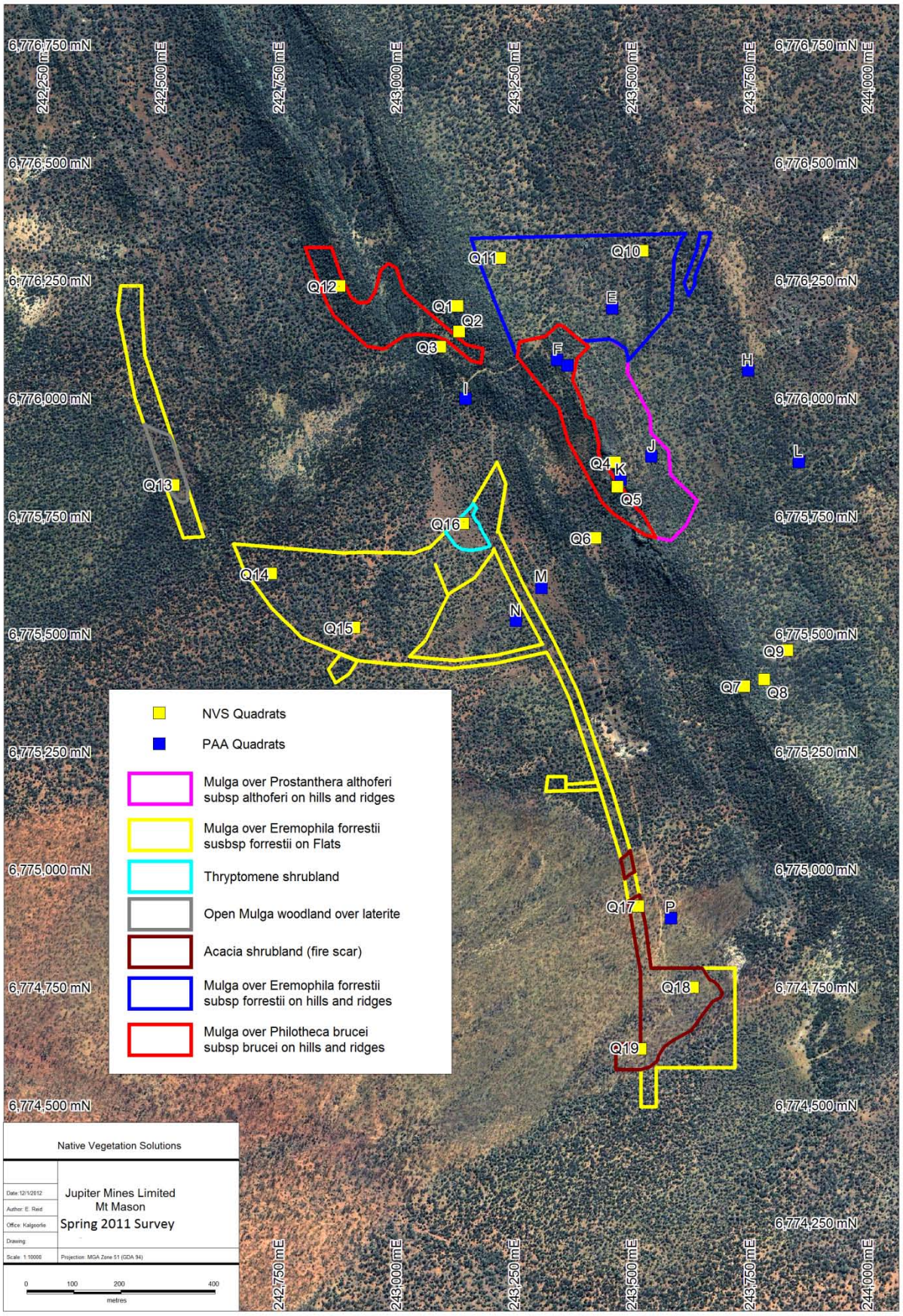
- *Banksia arborea* (P4);
- *Gnephosis intonsa* (P1);
- *Grevillea secunda* (P4);
- *Grevillea subterlineata* (P3);
- *Jacksonia lanicarpa* (P1); and
- *Ricinocarpos brevis* (T).

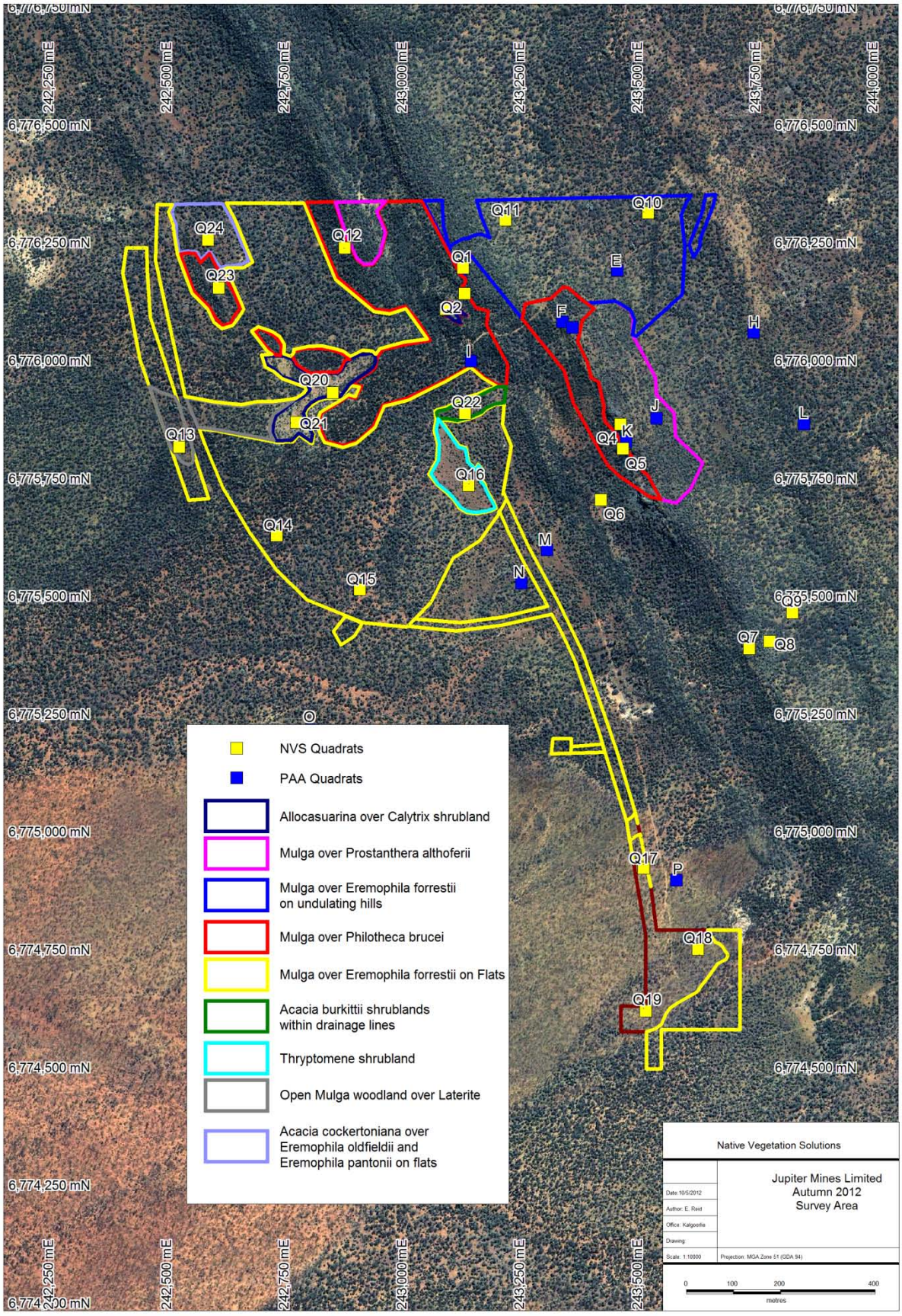
Appendix E - DEC TEC and PEC Search Results



DEC Search Results revealing only PEC locations (Reference: 53-1011EC)

Appendix F - Map of Vegetation Groups and Quadrat Locations


6,776,750 mN
242,250 mE
242,500 mE
242,750 mE
243,000 mE
243,250 mE
243,500 mE
243,750 mE
244,000 mE
6,776,500 mN
6,776,250 mN
6,776,000 mN
6,775,750 mN
6,775,500 mN
6,775,250 mN
6,775,000 mN
6,774,750 mN
6,774,500 mN
6,774,250 mN
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
Q9
Q10
Q11
Q12
Q13
Q14
Q15
Q16
Q17
Q18
Q19
E
F
H
I
J
K
L
M
N
P
NVS Quadrats
PAA Quadrats
Mulga over Prostanthera althoferi subsp althoferi on hills and ridges
Mulga over Eremophila forrestii susbsp forrestii on Flats
Thryptomene shrubland
Open Mulga woodland over laterite
Acacia shrubland (fire scar)
Mulga over Eremophila forrestii subsp forrestii on hills and ridges
Mulga over Philotheca brucei subsp brucei on hills and ridges
Native Vegetation Solutions
Jupiter Mines Limited
Mt Mason
Spring 2011 Survey
Date: 12/1/2012
Author: E. Reid
Office: Kalgoorlie
Drawing:
Scale: 1:10000
Projection: MGA Zone 51 (GDA 94)
0
100
200
400
metres


242,250 mE
242,500 mE
242,750 mE
243,000 mE
243,250 mE
243,500 mE
243,750 mE
244,000 mE
6,776,500 mN
6,776,250 mN
6,776,000 mN
6,775,750 mN
6,775,500 mN
6,775,250 mN
6,775,000 mN
6,774,750 mN
6,774,500 mN
6,774,250 mN
6,774,000 mN
Q1
Q2
Q4
Q5
Q6
Q7
Q8
Q9
Q10
Q11
Q12
Q13
Q14
Q15
Q16
Q17
Q18
Q19
Q20
Q21
Q22
Q23
Q24
E
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N
O
P
NVS Quadrats
PAA Quadrats
Allocasuarina over Calytrix shrubland
Mulga over Prostanthera althoferii
Mulga over Eremophila forrestii on undulating hills
Mulga over Philotheca brucei
Mulga over Eremophila forrestii on Flats
Acacia burkittii shrublands within drainage lines
Thryptomene shrubland
Open Mulga woodland over Laterite
Acacia cockertoniana over Eremophila oldfieldii and Eremophila pantonii on flats
Native Vegetation Solutions
Jupiter Mines Limited
Autumn 2012
Survey Area
Date: 10/5/2012
Author: E. Reid
Office: Kalgoorlie
Drawing:
Scale: 1:10000
Projection: MGA Zone 51 (GDA 94)
0
100
200
400
metres

Appendix G - Species Recorded During the Stage 1 and Stage 2 Surveys

Species List per Quadrat

Family	Genus	Species	Code	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22	Q23	Q24
Amaranthaceae	*Ptilotus*	*obovatus*					*	*	*						*		*	*	*						*	*	*
Apiaceae	*Daucus*	*glochidiatus*							*																		
Apocynaceae	*Apocynaceae*	*sp (sterile)*			*																						
Apocynaceae	*Marsdenia*	*australis*					*	*	*	*	*				*		*		*				*		*	*	*
Araliaceae	*Trachymene*	*ornata*		*	*	*	*	*	*	*	*	*	*	*	*		*	*	*							*	
Asparagaceae	*Thysanotus*	*manglesianus*								*	*																
Asteraceae	*Brachyscome*	*ciliocarpa*															*	*									
Asteraceae	*Calocephalus*	*multiflorus*				*																					
Asteraceae	*Calotis*	*hispidula*							*																		
Asteraceae	*Calotis*	*sp. Perrinvale Station*	*(P3)*					*																			
Asteraceae	*Gilberta*	*tenuifolia*										*	*					*									
Asteraceae	*Lawrencella*	*rosea*		*	*	*					*	*	*		*												
Asteraceae	*Myriocephalus*	*guerinae*		*				*	*			*	*			*			*			*					
Asteraceae	*Olearia*	*humilis*		*	*	*		*		*	*	*	*	*	*	*				*	*	*					
Asteraceae	*Podolepis*	*canescens*															*										
Asteraceae	*Podolepis*	*lessonii*			*																						
Asteraceae	*Rhodanthe*	*battii*					*	*											*								
Asteraceae	*Waitzia*	*acuminata*		*	*	*		*	*	*	*	*	*	*	*	*	*	*		*	*	*					
Brassicaceae	*Stenopetalum*	*anfractum*													*		*	*	*								
Campanulaceae	*Isotoma*	*hypocrateriformis*														*	*		*								
Campanulaceae	*Isotoma*	*petraea*					*																				
Campanulaceae	*Lobelia*	*winfridae*				*																					
Campanulaceae	*Wahlenbergia*	*tumidifructa*					*																				
Casuarinaceae	*Allocasuarina*	*acutivalvis subsp acutivalvis*				*																	*	*			
Celastraceae	*Stackhousia*	*muricata*																	*								
Chenopodiaceae	*Dysphania*	*saxatilis*					*																				
Chenopodiaceae	*Gunniopsis*	*septifraga*					*	*																			
Chenopodiaceae	*Rhagodia*	*eremaea*						*																			
Crassulaceae	*Crassula*	*colorata var acuminata*		*		*	*	*																			
Dilleniaceae	*Hibbertia*	*arcuata*								*		*		*		*					*		*			*	
Dilleniaceae	*Hibbertia*	*exasperata*			*											*					*						
Fabaceae	*Acacia*	*aneura var aneura*																				*					
Fabaceae	*Acacia*	*balsamea*			*	*		*							*	*	*			*							
Fabaceae	*Acacia*	*burkittii*																							*		
Fabaceae	*Acacia*	*caesaneura*								*																	
Fabaceae	*Acacia*	*caesaneura x incurvaneura*													*					*							
Fabaceae	*Acacia*	*cockertoniana*																								*	*
Fabaceae	*Acacia*	*craspedocarpa*											*							*							
Fabaceae	*Acacia*	*effusifolia*														*	*			*	*	*	*	*			
Fabaceae	*Acacia*	*incurvaneura*		*	*	*		*	*	*	*	*	*	*	*	*	*	*						*		*	
Fabaceae	*Acacia*	*mulganeura*		*									*				*	*		*	*					*	
Fabaceae	*Acacia*	*quadrimarginea*		*	*	*	*		*	*									*					*	*		
Fabaceae	*Acacia*	*ramulosa var ramulosa*							*						*		*	*		*		*			*		*
Fabaceae	*Acacia*	*tetragonophylla*							*						*		*								*		
Fabaceae	*Senna*	*artemisioides subsp artemisioides*																							*		
Fabaceae	*Senna*	*artemisioides subsp filifolia*																								*	*
Fabaceae	*Senna*	*cardiosperma*																	*								

Family	Genus	Species	Code	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22	Q23	Q24
Geraniaceae	*Erodium*	*crinitum*				*																					
Geraniaceae	*Erodium*	*cygnorum*			*		*	*	*						*												
Goodeniaceae	*Brunonia*	*australis*														*	*					*					
Goodeniaceae	*Goodenia*	*macroplectra*		*						*	*	*	*	*	*	*				*					*		
Goodeniaceae	*Goodenia*	*mimuloides*							*		*						*	*	*						*	*	
Goodeniaceae	*Goodenia*	*occidentalis*			*	*			*		*			*	*	*	*		*	*						*	*
Goodeniaceae	*Scaevola*	*spinescens*															*	*							*	*	*
Goodeniaceae	*Velleia*	*hispida*							*																		
Goodeniaceae	*Velleia*	*rosea*																*	*								
Haloragaceae	*Haloragis*	*trigonocarpa*																	*								
Lamiaceae	*Hemigenia*	*sp. Yalgoo*		*																	*						
Lamiaceae	*Prostanthera*	*althoferi subsp althoferi*		*		*				*	*	*	*	*	*	*	*	*		*	*	*			*	*	
Malvaceae	*Brachychiton*	*gregorii*															*										
Malvaceae	*Corchorus*	*sp*																							*		
Malvaceae	*Sida*	*calyxhymenia*																*									
Malvaceae	*Sida*	*sp. dark green fruits*													*												
Malvaceae	*Sida*	*sp. Golden calyces glabrous*		*			*			*	*	*	*	*		*	*	*	*	*	*	*					
Myrtaceae	*Calytrix*	*erosipetala*				*																	*	*		*	
Myrtaceae	*Eucalyptus*	*leptopoda subsp arctata*																*									
Myrtaceae	*Eucalyptus*	*oleosa*													*												
Myrtaceae	*Eucalyptus*	*sp.(sterile)*																				*					
Myrtaceae	*Thryptomene*	*costata*																	*								
Myrtaceae	*Thryptomene*	*decussata*			*	*	*	*							*											*	
Poaceae	*Austrostipa*	*elegantissima*						*	*						*												
Poaceae	*Austrostipa*	*variabilis*				*									*		*	*							*	*	*
Poaceae	*Eragrostis*	*eriopoda*															*										
Poaceae	*Eriachne*	*pulchella subsp pulchella*																	*				*	*			*
Poaceae	*Monachather*	*paradoxus*								*	*	*	*		*	*	*	*	*							*	
Poaceae	*Thyridolepis*	*multiculmis*					*		*			*		*			*	*								*	
Portulacaceae	*Calandrinia*	*eremaea*					*	*	*						*			*	*							*	*
Proteaceae	*Grevillea*	*berryana*																						*			
Pteridaceae	*Cheilanthes*	*sieberi subsp sieberi*		*	*	*	*	*	*	*		*		*	*		*	*	*	*				*	*	*	*
Rubiaceae	*Psydrax*	*attenuata*																*									
Rubiaceae	*Psydrax*	*suaveolens*			*					*																	
Rutaceae	*Philotheca*	*brucei subsp brucei*		*	*	*	*	*	*	*		*	*		*		*						*	*		*	
Sapindaceae	*Dodonaea*	*amblyophylla*					*																				
Sapindaceae	*Dodonaea*	*lobulata*																							*		
Sapindaceae	*Dodonaea*	*petiolaris*						*																			
Sapindaceae	*Dodonaea*	*rigida*						*							*	*									*		
Sapindaceae	*Dodonaea*	*viscosa subsp spatulata*							*	*													*			*	
Scrophulariaceae	*Eremophila*	*forrestii subsp forrestii*		*					*		*	*	*	*		*	*	*	*		*						
Scrophulariaceae	*Eremophila*	*georgei*		*	*	*		*		*			*		*		*	*	*							*	
Scrophulariaceae	*Eremophila*	*latrobei subsp filiformis*										*			*	*	*		*				*	*	*	*	
Scrophulariaceae	*Eremophila*	*latrobei subsp latrobei*		*	*	*				*	*	*	*		*		*										
Scrophulariaceae	*Eremophila*	*oldfieldii subsp angustifolia*							*																*	*	*
Scrophulariaceae	*Eremophila*	*pantonii*																									*
Solanaceae	*Nicotiana*	*rosulata*					*																				
Solanaceae	*Solanum*	*lasiophyllum*		*		*		*			*	*				*			*	*		*		*			
Stylidiaceae	*Stylidium*	*longibracteatum*																					*	*			

Species List per Vegetation Group

Family	Genus	Species	Code	Mulga over Prostanthera althoferi subsp althoferi on hills and ridges	Mulga over Eremophila forrestii subsp forrestii on Flats	Thryptomene Shrubland	Open Mulga Woodland over Laterite	Acacia shrubland (fire scar)	Mulga over Eremophila forrestii subsp forrestii on hills and ridges	Mulga over Philotheca brucei subsp brucei on hills and ridges	Allocasuarina acutivalvis over Calytrix erosipetala	Acacia burkittii shrubland	Acacia cockertoniana over Eremophila oldfieldii over Eremophila pantonii
Amaranthaceae	*Ptilotus*	*obovatus*		*	*	*				*		*	*
Apiaceae	*Daucus*	*glochidiatus*								*			
Apocynaceae	*Apocynaceae*	*sp (sterile)*								*			
Apocynaceae	*Marsdenia*	*australis*		*	*	*			*	*	*	*	*
Araliaceae	*Trachymene*	*ornata*		*	*	*			*	*			
Asparagaceae	*Thysanotus*	*manglesianus*		*					*				
Asteraceae	*Brachyscome*	*ciliocarpa*			*								
Asteraceae	*Calocephalus*	*multiflorus*								*			
Asteraceae	*Calotis*	*hispidula*								*			
Asteraceae	*Calotis*	*sp. Perrinvale Station*	*(P3)*							*			
Asteraceae	*Gilberta*	*tenuifolia*			*				*				
Asteraceae	*Lawrencella*	*rosea*							*	*			
Asteraceae	*Myriocephalus*	*guerinae*				*	*	*	*	*			
Asteraceae	*Olearia*	*humilis*		*			*	*	*	*			
Asteraceae	*Podolepis*	*canescens*			*								
Asteraceae	*Podolepis*	*lessonii*								*			
Asteraceae	*Rhodanthe*	*battii*		*		*				*			
Asteraceae	*Waitzia*	*acuminata*		*	*		*	*	*	*			
Brassicaceae	*Stenopetalum*	*anfractum*			*	*				*			
Campanulaceae	*Isotoma*	*hypocrateriformis*			*	*	*						
Campanulaceae	*Isotoma*	*petraea*		*									
Campanulaceae	*Lobelia*	*winfridae*								*			
Campanulaceae	*Wahlenbergia*	*tumidifructa*		*									
Casuarinaceae	*Allocasuarina*	*acutivalvis subsp acutivalvis*									*		
Casuarinaceae	*Casuarina*	*pauper*											*
Celastraceae	*Stackhousia*	*muricata*				*							
Chenopodiaceae	*Dysphania*	*saxatilis*		*									
Chenopodiaceae	*Gunniopsis*	*septifraga*		*						*			
Chenopodiaceae	*Rhagodia*	*eremaea*								*			
Crassulaceae	*Crassula*	*colorata var acuminata*		*					*	*			
Dilleniaceae	*Hibbertia*	*arcuata*		*			*	*	*	*	*		
Dilleniaceae	*Hibbertia*	*exasperata*						*	*	*			
Fabaceae	*Acacia*	*aneura var aneura*						*					
Fabaceae	*Acacia*	*balsamea*			*			*	*	*			
Fabaceae	*Acacia*	*burkittii*										*	
Fabaceae	*Acacia*	*caesaneura*		*									
Fabaceae	*Acacia*	*caesaneura x incurvaneura*						*		*			
Fabaceae	*Acacia*	*cockertoniana*								*			*
Fabaceae	*Acacia*	*craspedocarpa*						*	*				
Fabaceae	*Acacia*	*effusifolia*			*		*	*			*		
Fabaceae	*Acacia*	*incurvaneura*		*	*		*		*	*	*		
Fabaceae	*Acacia*	*mulganeura*			*			*	*	*			
Fabaceae	*Acacia*	*quadrimarginea*		*		*			*	*	*	*	
Fabaceae	*Acacia*	*ramulosa var ramulosa*			*			*		*		*	*
Fabaceae	*Acacia*	*tetragonophylla*			*					*		*	
Fabaceae	*Senna*	*artemisioides subsp artemisioides*								*		*	
Fabaceae	*Senna*	*artemisioides subsp filifolia*								*			*
Fabaceae	*Senna*	*cardiosperma*				*							

Family	Genus	Species	Code	Mulga over Prostanthera althoferi subsp althoferi on hills and ridges	Mulga over Eremophila forrestii subsp forrestii on Flats	Thryptomene Shrubland	Open Mulga Woodland over Laterite	Acacia shrubland (fire scar)	Mulga over Eremophila forrestii subsp forrestii on hills and ridges	Mulga over Philotheca brucei subsp brucei on hills and ridges	Allocasuarina acutivalvis over Calytrix erosipetala	Acacia burkittii shrubland	Acacia cockertoniana over Eremophila oldfieldii over Eremophila pantonii
Geraniaceae	*Erodium*	*crinitum*								*			
Geraniaceae	*Erodium*	*cygnorum*		*						*			
Goodeniaceae	*Brunonia*	*australis*			*		*	*					
Goodeniaceae	*Goodenia*	*macroplectra*		*			*	*	*	*		*	
Goodeniaceae	*Goodenia*	*mimuloides*			*	*			*	*		*	
Goodeniaceae	*Goodenia*	*occidentalis*			*	*	*	*	*	*			*
Goodeniaceae	*Scaevola*	*spinescens*			*					*		*	*
Goodeniaceae	*Velleia*	*hispida*								*			
Goodeniaceae	*Velleia*	*rosea*			*	*							
Haloragaceae	*Haloragis*	*trigonocarpa*				*							
Lamiaceae	*Hemigenia*	*sp. Yalgoo*						*	*				
Lamiaceae	*Prostanthera*	*althoferi subsp althoferi*		*	*		*	*	*	*		*	
Malvaceae	*Brachychiton*	*gregorii*			*								
Malvaceae	*Corchorus*	*sp*								*		*	
Malvaceae	*Sida*	*calyxhymenia*			*								
Malvaceae	*Sida*	*sp. dark green fruits*								*			
Malvaceae	*Sida*	*sp. Golden calyces glabrous*		*	*	*	*	*	*				
Myrtaceae	*Calytrix*	*erosipetala*								*	*		
Myrtaceae	*Eucalyptus*	*leptopoda subsp arctata*			*			*	*	*			
Myrtaceae	*Eucalyptus*	*oleosa*								*			
Myrtaceae	*Eucalyptus*	*sp.(sterile)*						*					
Myrtaceae	*Thryptomene*	*costata*				*							
Myrtaceae	*Thryptomene*	*decussata*		*						*			
Poaceae	*Austrostipa*	*elegantissima*								*			
Poaceae	*Austrostipa*	*variabilis*			*					*		*	*
Poaceae	*Eragrostis*	*eriopoda*			*								
Poaceae	*Eriachne*	*pulchella subsp pulchella*				*					*		*
Poaceae	*Monachather*	*paradoxus*		*	*	*	*		*	*			
Poaceae	*Thyridolepis*	*multiculmis*		*	*				*	*		*	
Portulacaceae	*Calandrinia*	*eremaea*		*	*	*				*			*
Proteaceae	*Grevillea*	*berryana*									*		
Pteridaceae	*Cheilanthes*	*sieberi subsp sieberi*		*	*	*		*	*	*	*	*	*
Rubiaceae	*Psydrax*	*attenuata*			*								
Rubiaceae	*Psydrax*	*suaveolens*		*						*			
Rutaceae	*Philotheca*	*brucei subsp brucei*		*	*				*	*	*		
Sapindaceae	*Dodonaea*	*amblyophylla*		*									
Sapindaceae	*Dodonaea*	*lobulata*										*	
Sapindaceae	*Dodonaea*	*petiolaris*								*			
Sapindaceae	*Dodonaea*	*rigida*					*			*		*	
Sapindaceae	*Dodonaea*	*viscosa subsp spatulata*		*						*	*	*	
Scrophulariaceae	*Eremophila*	*forrestii subsp forrestii*			*	*	*	*	*	*			
Scrophulariaceae	*Eremophila*	*georgei*		*	*	*			*	*			
Scrophulariaceae	*Eremophila*	*latrobei subsp filiformis*			*	*	*		*	*	*	*	
Scrophulariaceae	*Eremophila*	*latrobei subsp latrobei*		*	*				*	*			
Scrophulariaceae	*Eremophila*	*oldfieldii subsp angustifolia*								*		*	*
Scrophulariaceae	*Eremophila*	*pantonii*											*
Solanaceae	*Nicotiana*	*rosulata*		*									
Solanaceae	*Solanum*	*lasiophyllum*				*	*	*	*	*	*		
Stylidiaceae	*Stylidium*	*longibracteatum*									*		

Appendix H - Locations of Priority Flora and Flora of Environmental Significance

Priority Flora and Flora of Significance recorded during Stage 1 and Stage 2 surveys. Locations in UTM using datum GDA '94 in cell 51J

Priority Flora

***Calotis sp* Perrinvale Range P3**

Overall population estimated at 10 to 15 plants

mE	mN
243455	6775824

Flora of Significance

Drosera sp.

Overall population estimated at 250 to 350 plants (yet to be confirmed)

mE	mN
243308	6776088
243325	6776135
243316	6776103
243315	6776101
243315	6776107
243314	6776107
243317	6776096
243320	6776096
243316	6776097
243317	6776096
243295	6775610
243313	6775599
243321	6775577

Appendix I - Site Descriptions

Date: 4/10/2011 & 12/03/2012	**Botanist:** ER & AS & AO	
Location: Mount Mason	**Quadrat:** 1	
Quadrat size: 20x20		
WP: 1	**Vegetation group:**	
Photo number: 1 & 2		
Landform: C, T, HCR		
Land surface/disturbance: 0		
Coarse fragments on the surface (abundance/size/shape):		6, 6, S
Rock outcrop (abundance/runoff):		5, 3
Soil (profile/field texture/soil surface):		U, CL, C
%Cover leaf litter:		20
%Cover bare ground:		45

Tallest stratum	Mid-stratum	Lower stratum
Growth form: Shrub Mallee	**Growth form:** Shrub	**Growth form:** Shrub
Height: 3-6m	**Height:** 1-3m	**Height:** 0.5-1m
Crown cover %: 10-30	**Crown cover %:** 10-30	**Crown cover %:** 30-70
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Acacia incurvaneura	*Acacia quadrimarginea*	*Prostanthera althoferi subsp althoferi*
Acacia mulganeura	*Acacia mulganeura*	*Eremophila latrobei subsp latrobei*
Acacia quadrimarginea		*Philotheca brucei subsp brucei*

ALL SPECIES
Acacia incurvaneura
Acacia mulganeura
Acacia quadrimarginea
Cheilanthes sieberi subsp sieberi
Crassula colorata var *acuminata*
Eremophila forrestii subsp forrestii
Eremophila georgei
Eremophila latrobei subsp latrobei
Goodenia macroplectra
Hemigenia sp. *Yalgoo*
Lawrencella rosea
Myriocephalus guerinae
Olearia humilis
Philotheca brucei subsp brucei
Prostanthera althoferi subsp althoferi
Sida sp. Golden calyces glabrous
Solanum lasiophyllum
Trachymene ornata
Waitzia acuminata

Vegetation Description

Acacia incurvaneura woodland over Eremophila forrestii subsp forrestii shrubland over scattered mixed low shrubs and herbs on undulating hills and ridges.

Date: 4/10/2011 & 12/03/2012	**Botanist:** ER & AS & AO	
Location: Mount Mason	**Quadrat:** 2	
Quadrat size: 20x20		
WP: 2	**Vegetation group:**	
Photo number: 3		
Landform: M, M BAN		
Land surface/disturbance: 0		
Coarse fragments on the surface (abundance/size/shape):		5, 5, S
Rock outcrop (abundance/runoff):		4, 4
Soil (profile/field texture/soil surface):		U, CL
%Cover leaf litter:		45
%Cover bare ground:		60

Tallest stratum	Mid-stratum	Lower stratum
Growth form: Shrub Mallee	**Growth form:**	**Growth form:**
Height: 3-6	**Height:**	**Height:**
Crown cover %: 10-30	**Crown cover %:**	**Crown cover %:**
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Acacia incurvaneura	Thryptomene decussata	*Eremophila latrobei subsp latrobei*
Acacia quadrimarginea	*Philotheca brucei subsp brucei*	*Hibbertia exasperata*
	Acacia balsamea	

ALL SPECIES
Acacia incurvaneura
Acacia balsamea
Acacia quadrimarginea
Apocynaceae sp (sterile)
Cheilanthes sieberi subsp sieberi
Eremophila georgei
Eremophila latrobei subsp latrobei
Erodium cygnorum
Goodenia occidentalis
Hibbertia exasperata
Lawrencella rosea
Olearia humilis
Philotheca brucei subsp brucei
Podolepis lessonii
Psydrax suaveolens
Thryptomene decussata
Trachymene ornata
Waitzia acuminata

Vegetation Description

Acacia incurvaneura with Acacia quadrimarginea tall shrubland/ low woodland over Philotheca brucei subsp brucei with Acacia balsamea shrubland over Eremophila latrobei subsp latrobei and Hibbertia exasperata over mixed herbs and shrubs on hills and ridges.

Date: 4/10/2011 & 12/03/2012	**Botanist:** ER & AS & AO	
Location: Mount Mason	**Quadrat:** 3	
Quadrat size: 20x20		
WP: 3	**Vegetation group:**	
Photo number: 4		
Landform: L, B, BAN		
Land surface/disturbance: 0		
Coarse fragments on the surface (abundance/size/shape):		6, 4, S
Rock outcrop (abundance/runoff):		4, 4
Soil (profile/field texture/soil surface):		U, SCL, H,C
%Cover leaf litter:		45
%Cover bare ground:		40

Tallest stratum	**Mid-stratum**	**Lower stratum**
Growth form: Shrub Mallee	**Growth form:** Shrub	**Growth form:** Shrub
Height: 3-6m	**Height:** 1-3	**Height:** 0.25-0.5m
Crown cover %: 10-30	**Crown cover %:** 10-30	**Crown cover %:** <10
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Allocasuarina acutivalvis subsp acutivalvis	*Acacia balsamea*	*Calytrix erosipetala*
Acacia incurvaneura	*Philotheca brucei subsp brucei*	
Acacia quadrimarginea		

ALL SPECIES
Acacia balsamea
Acacia incurvaneura
Acacia quadrimarginea
Allocasuarina acutivalvis subsp acutivalvis
Austrostipa variabilis
Calocephalus multiflorus
Calytrix erosipetala
Cheilanthes sieberi subsp sieberi
Crassula colorata var acuminata
Eremophila georgei
Eremophila latrobei subsp latrobei
Erodium crinitum
Goodenia occidentalis
Lawrencella rosea
Lobelia winfridae
Olearia humilis
Philotheca brucei subsp brucei
Prostanthera althoferi subsp althoferi
Solanum lasiophyllum
Thryptomene decussata
Trachymene ornata
Waitzia acuminata

Vegetation Description

Allocasuarina acutivalvis subsp acutivalvis and Acacia incurvaneura low woodland/tall shrubland over Acacia balsamea and Philotheca brucei subsp brucei open shrubland over scattered mixed shrubs and herbs in minor drainage lines

Date: 4/10/2011 & 12/03/2012	**Botanist:** ER & AS & AO	
Location: Mount Mason	**Quadrat:** 4	
Quadrat size: 20x20		
WP: 4	**Vegetation group:**	
Photo number: 5-6		
Landform: C, T, HCR		
Land surface/disturbance: 0		
Coarse fragments on the surface (abundance/size/shape):		6, 4, S
Rock outcrop (abundance/runoff):		5, 5
Soil (profile/field texture/soil surface):		U, CL, C
%Cover leaf litter:		40
%Cover bare ground:		65
Tallest stratum	**Mid-stratum**	**Lower stratum**
Growth form: Shrub	**Growth form: Shrub**	**Growth form: Shrub**
Height: 1-3m	**Height: 0.5-1m**	**Height: 0.25-0.5m**
Crown cover %: <10	**Crown cover %: <10**	**Crown cover %: <10**
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Thryptomene decussata	*Dodonaea amblyophylla*	*Ptilotus obovatus*
	Philotheca brucei subsp brucei	*Thryptomene decussata*
ALL SPECIES		
Acacia quadrimarginea		
Calandrinia eremaea		
Cheilanthes sieberi subsp sieberi		
Crassula colorata var acuminata		
Dodonaea amblyophylla		
Dysphania saxatilis		
Erodium cygnorum		
Gunniopsis septifraga		
Isotoma petraea		
Marsdenia australis		
Nicotiana rosulata		
Philotheca brucei subsp brucei		
Ptilotus obovatus		
Rhodanthe battii		
Sida sp. Golden calyces glabrous		
Thryptomene decussata		
Thyridolepis multiculmis		
Trachymene ornata		
Wahlenbergia tumidifructa		

Vegetation Description

Acacia incurvaneura shrubland to tall open scrub over Prostanthera althoferi subsp althoferi shrubland over scattered mixed shrubs and herbs on hills and ridges.

Date: 4/10/2011 & 12/03/2012	**Botanist:** ER & AS & AO	
Location: Mount Mason	**Quadrat:** 5	
Quadrat size: 20x20		
WP: 5	**Vegetation group:**	
Photo number: 7		
Landform: M, M, BAN		
Land surface/disturbance: 0		
Coarse fragments on the surface (abundance/size/shape):		4, 4, A
Rock outcrop (abundance/runoff):		4, 5
Soil (profile/field texture/soil surface):		U, CL, H
%Cover leaf litter:		55
%Cover bare ground:		40

Tallest stratum	Mid-stratum	Lower stratum
Growth form: Shrub Mallee	**Growth form: Shrub**	**Growth form: Shrub**
Height: 6-12m	**Height: 1-3m**	**Height: 0.25-0.5m**
Crown cover %: 10-30	**Crown cover %: 10-30**	**Crown cover %: 10-30**
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Acacia incurvaneura	*Thryptomene decussata*	*Ptilotus obovatus*
	Philotheca brucei subsp brucei	*Dodonaea petiolaris*
	Dodonaea petiolaris	

ALL SPECIES
Acacia balsamea
Acacia incurvaneura
Austrostipa elegantissima
Calandrinia eremaea
Calotis sp. Perrinvale Station (P3)
Cheilanthes sieberi subsp sieberi
Crassula colorata var acuminata
Dodonaea petiolaris
Dodonaea rigida
Eremophila georgei
Erodium cygnorum
Gunniopsis septifraga
Marsdenia australis
Myriocephalus guerinae
Olearia humilis
Philotheca brucei subsp brucei
Ptilotus obovatus
Rhagodia eremaea
Rhodanthe battii
Solanum lasiophyllum
Thryptomene decussata
Trachymene ornata
Waitzia acuminata

Vegetation Description

Acacia incurvaneura with Acacia quadrimarginea tall shrubland/ low woodland over Philotheca brucei subsp brucei with Acacia balsamea shrubland over Eremophila latrobei subsp latrobei and Hibbertia exasperata over mixed herbs and shrubs on hills and ridges.

Date: 4/10/2011 & 12/03/2012	**Botanist:** ER & AS & AO	
Location: Mount Mason	**Quadrat:** 6	
Quadrat size: 20x20		
WP: 6	**Vegetation group:**	
Photo number: 8		
Landform: L, B, BAN		
Land surface/disturbance: 0		
Coarse fragments on the surface (abundance/size/shape):		6, 3, A
Rock outcrop (abundance/runoff):		1, 4
Soil (profile/field texture/soil surface):		U, CL, H
%Cover leaf litter:		55
%Cover bare ground:		30
Tallest stratum	**Mid-stratum**	**Lower stratum**
Growth form: Tree Mallee	**Growth form:** Shrub	**Growth form:** Shrub
Height: 6-12m	**Height:** 1-3m	**Height:** 0.5-1m
Crown cover %: 10-30	**Crown cover %:** 30-70	**Crown cover %: 10-30**
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Acacia incurvaneura	*Acacia incurvaneura*	*Eremophila forrestii subsp forrestii*
Acacia quadrimarginea	*Acacia ramulosa var. ramulosa*	*Philotheca brucei subsp brucei*

ALL SPECIES
Acacia incurvaneura
Acacia quadrimarginea
Acacia ramulosa var. ramulosa
Acacia tetragonophylla
Austrostipa elegantissima
Calandrinia eremaea
Calotis hispidula
Cheilanthes sieberi subsp sieberi
Daucus glochidiatus
Dodonaea viscosa subsp spatulata
Eremophila forrestii subsp forrestii
Eremophila oldfieldii subsp angustifolia
Erodium cygnorum
Goodenia mimuloides
Goodenia occidentalis
Marsdenia australis
Myriocephalus guerinae
Philotheca brucei subsp brucei
Ptilotus obovatus
Thyridolepis multiculmis
Trachymene ornata
Velleia hispida
Waitzia acuminata

Vegetation Description

Acacia incurvaneura with Acacia quadrimarginea tall shrubland/ low woodland over Philotheca brucei subsp brucei with Acacia balsamea shrubland over Eremophila latrobei subsp latrobei and Hibbertia exasperata over mixed herbs and shrubs on hills and ridges.

Date: 4/10/2011 & 12/03/2012	**Botanist:** ER & AS & AO	
Location: Mount Mason	**Quadrat:** 7	
Quadrat size: 20x20		
WP: 8	**Vegetation group:**	
Photo number: 11 & 12		
Landform: C, T, HCR		
Land surface/disturbance: 0		
Coarse fragments on the surface (abundance/size/shape):		4, 4, A
Rock outcrop (abundance/runoff):		5, 2
Soil (profile/field texture/soil surface):		U, CL, C
%Cover leaf litter:		70
%Cover bare ground:		55
Tallest stratum	**Mid-stratum**	**Lower stratum**
Growth form: Shrub Mallee	**Growth form:** Shrub	**Growth form:** Shrub
Height: 3-6m	**Height:** 0.5-1m	**Height:** 0.25-0.5m
Crown cover %: 10-30	**Crown cover %:** 10-30	**Crown cover %:** 10-30
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Acacia incurvaneura	*Philotheca brucei subsp brucei*	*Prostanthera althoferi subsp althoferi*
		Olearia humilis
ALL SPECIES		
Acacia caesaneura		
Acacia incurvaneura		
Acacia quadrimarginea		
Cheilanthes sieberi subsp sieberi		
Dodonaea viscosa subsp spatulata		
Eremophila georgei		
Eremophila latrobei subsp latrobei		
Goodenia macroplectra		
Hibbertia arcuata		
Marsdenia australis		
Monachather paradoxus		
Olearia humilis		
Philotheca brucei subsp brucei		
Prostanthera althoferi subsp althoferi		
Psydrax suaveolens		
Sida sp. Golden calyces glabrous		
Thysanotus manglesianus		
Trachymene ornata		
Waitzia acuminata		

Vegetation Description

Acacia incurvaneura shrubland to tall open scrub over Prostanthera althoferi subsp althoferi shrubland over scattered mixed shrubs and herbs on hills and ridges.

Date: 4/10/2011 & 12/03/2012	**Botanist:** ER & AS & AO	
Location: Mount Mason	**Quadrat:** 8	
Quadrat size: 20x20		
WP: 9	**Vegetation group:**	
Photo number: 13		
Landform: M, M, HSL		
Land surface/disturbance: 0		
Coarse fragments on the surface (abundance/size/shape):		5, 3, A
Rock outcrop (abundance/runoff):		0, 2
Soil (profile/field texture/soil surface):		U, CL, C
%Cover leaf litter:		70
%Cover bare ground:		65

Tallest stratum	**Mid-stratum**	**Lower stratum**
Growth form: Shrub Mallee	**Growth form:** Shrub	**Growth form:** Shrub
Height: 6-12	**Height:** 1-3	**Height:** 1-3m
Crown cover %: 10-30	**Crown cover %: 10-30**	**Crown cover %: 10-30**
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Acacia incurvaneura	*Eremophila forrestii subsp forrestii*	*Prostanthera althoferi subsp althoferi*
	Olearia humilis	

ALL SPECIES
Acacia incurvaneura
Eremophila forrestii subsp forrestii
Eremophila latrobei subsp latrobei
Goodenia macroplectra
Goodenia occidentalis
Lawrencella rosea
Marsdenia australis
Monachather paradoxus
Olearia humilis
Prostanthera althoferi subsp althoferi
Sida sp. Golden calyces glabrous
Solanum lasiophyllum
Thysanotus manglesianus
Trachymene ornata
Velleia glabrata
Waitzia acuminata

Vegetation Description

Acacia incurvaneura woodland over Eremophila forrestii subsp forrestii shrubland over scattered mixed low shrubs and herbs on undulating hills and ridges

Date: 4/10/2011 & 12/03/2012	**Botanist:** ER & AS & AO	
Location: Mount Mason	**Quadrat:** 9	
Quadrat size: 20x20		
WP: 10	**Vegetation group:**	
Photo number: 14		
Landform: L, B, HSL		
Land surface/disturbance: 0		
Coarse fragments on the surface (abundance/size/shape):		6, 3, A
Rock outcrop (abundance/runoff):		1, 2
Soil (profile/field texture/soil surface):		U, CL, C
%Cover leaf litter:		80
%Cover bare ground:		65

Tallest stratum	Mid-stratum	Lower stratum
Growth form: Shrub Mallee	**Growth form:** Shrub	**Growth form:** Fern
Height: 6-12m	**Height:** 0.5-1m	**Height:** 0.25-0.5m
Crown cover %: 10-30	**Crown cover %:** 10-30	**Crown cover %:** <1
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Acacia incurvaneura	*Eremophila forrestii subsp forrestii*	*Waitzia acuminata*
	Hibbertia arcuata	*Sida sp. Golden calyces glabrous*
	Prostanthera althoferi subsp althoferi	

ALL SPECIES
Acacia incurvaneura
Cheilanthes sieberi subsp sieberi
Eremophila forrestii subsp forrestii
Eremophila latrobei subsp filiformis
Eremophila latrobei subsp latrobei
Gilberta tenuifolia
Goodenia macroplectra
Hibbertia arcuata
Lawrencella rosea
Monachather paradoxus
Myriocephalus guerinae
Olearia humilis
Philotheca brucei subsp brucei
Prostanthera althoferi subsp althoferi
Sida sp. Golden calyces glabrous
Solanum lasiophyllum
Thyridolepis multiculmis
Trachymene ornata
Waitzia acuminata

Vegetation Description

Acacia incurvaneura woodland over Eremophila forrestii subsp forrestii shrubland over scattered mixed low shrubs and herbs on undulating hills and ridges

Date: 4/10/2011 & 12/03/2012	**Botanist:** ER & AS & AO	
Location: Mount Mason	**Quadrat:** 10	
Quadrat size: 20x20		
WP: 7	**Vegetation group:**	
Photo number: 16		
Landform: S, HSL		
Land surface/disturbance: 0		
Coarse fragments on the surface (abundance/size/shape):		5, 4, S
Rock outcrop (abundance/runoff):		0, 2
Soil (profile/field texture/soil surface):		U, CL
%Cover leaf litter:		50
%Cover bare ground:		40

Tallest stratum	Mid-stratum	Lower stratum
Growth form: Shrub Mallee	**Growth form:** Shrub	**Growth form:** Shrub
Height: 6-12m	**Height:** 1-3m	**Height:** 0.5-1m
Crown cover %: 10-30	**Crown cover %:** 10-30	**Crown cover %:** 10-30
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Acacia incurvaneura	*Eremophila forrestii subsp forrestii*	*Olearia humilis*
Acacia mulganeura		*Philotheca brucei subsp brucei*

ALL SPECIES
Acacia craspedocarpa
Acacia incurvaneura
Acacia mulganeura
Eremophila forrestii subsp forrestii
Eremophila georgei
Eremophila latrobei subsp latrobei
Gilberta tenuifolia
Goodenia macroplectra
Lawrencella rosea
Monachather paradoxus
Myriocephalus guerinae
Olearia humilis
Philotheca brucei subsp brucei
Prostanthera althoferi
Sida sp. Golden calyces glabrous
Trachymene ornata
Waitzia acuminata

Vegetation Description

Acacia incurvaneura woodland over Eremophila forrestii subsp forrestii shrubland over scattered mixed low shrubs and herbs on undulating hills and ridges.

Date: 4/10/2011 & 12/03/2012	**Botanist:** ER & AS & AO	
Location: Mount Mason	**Quadrat:** 11	
Quadrat size: 20x20		
WP: 18	**Vegetation group:**	
Photo number: 17		
Landform: S, HSL		
Land surface/disturbance: 0		
Coarse fragments on the surface (abundance/size/shape):		6, 3, S
Rock outcrop (abundance/runoff):		0, 3
Soil (profile/field texture/soil surface):		U, CL, C
%Cover leaf litter:		40
%Cover bare ground:		80

Tallest stratum	Mid-stratum	Lower stratum
Growth form: Shrub Mallee	**Growth form:** Shrub	**Growth form:** Shrub
Height: 3-6m	**Height:** 0.5-1m	**Height:** 0.25-0.5m
Crown cover %: 10-30	**Crown cover %:** 10-30	**Crown cover %:** <1
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Acacia incurvaneura	*Eremophila forrestii subsp forrestii*	*Olearia humilis*
	Prostanthera althoferi susbsp althoferi	

ALL SPECIES
Acacia incurvaneura
Cheilanthes sieberi subsp sieberi
Eremophila forrestii subsp forrestii
Goodenia macroplectra
Goodenia occidentalis
Hibbertia arcuata
Olearia humilis
Prostanthera althoferi susbsp althoferi
Sida sp. Golden calyces glabrous
Thyridolepis multiculmis
Trachymene ornata
Waitzia acuminata

Vegetation Description

Acacia incurvaneura woodland over Eremophila forrestii subsp forrestii shrubland over scattered mixed low shrubs and herbs on undulating hills and ridges

Date: 4/10/2011 & 12/03/2012	**Botanist:** ER & AS & AO	
Location: Mount Mason	**Quadrat:** 12	
Quadrat size: 20x20		
WP: 20	**Vegetation group:**	
Photo number: 18 & 19		
Landform: M, M, HSL		
Land surface/disturbance: 0		
Coarse fragments on the surface (abundance/size/shape):		5, 4, A
Rock outcrop (abundance/runoff):		4, 3
Soil (profile/field texture/soil surface):		U, CL, C
%Cover leaf litter:		90
%Cover bare ground:		30

Tallest stratum	Mid-stratum	Lower stratum
Growth form: Shrub Mallee	**Growth form:** Shrub	**Growth form:** Shrub
Height: 3-6m	**Height:** 1-3m	**Height:** 0.25-0.5m
Crown cover %: 10-30	**Crown cover %:** 30-70	**Crown cover %:** 10-30
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Acacia incurvaneura	*Acacia balsamea*	*Eremophila latrobei subsp latrobei*
	Philotheca brucei subsp brucei	*Cheilanthes sieberi subsp sieberi*
	Thryptomene decussata	

ALL SPECIES
Acacia balsamea
Acacia caesaneura x incurvaneura
Acacia incurvaneura
Acacia ramulosa var *ramulosa*
Acacia tetragonophylla
Austrostipa elegantissima
Austrostipa variabilis
Calandrinia eremaea
Cheilanthes sieberi subsp sieberi
Dodonaea rigida
Eremophila georgei
Eremophila latrobei subsp filiformis
Eremophila latrobei subsp latrobei
Erodium cygnorum
Eucalyptus oleosa
Goodenia macroplectra
Goodenia occidentalis
Lawrencella rosea
Marsdenia australis
Monachather paradoxus
Olearia humilis
Philotheca brucei subsp brucei
Prostanthera althoferi subsp althoferi
Ptilotus obovatus
Sida sp. dark green fruits
Stenopetalum anfractum
Thryptomene decussata
Trachymene ornata
Waitzia acuminata

Vegetation Description

Acacia incurvaneura with Acacia quadrimarginea tall shrubland/ low woodland over Philotheca brucei subsp brucei with Acacia balsamea shrubland over Eremophila latrobei subsp latrobei and Hibbertia exasperata over mixed herbs and shrubs on hills and ridges.

Date: 4/10/2011 & 12/03/2012	**Botanist:** ER & AS & AO	
Location: Mount Mason	**Quadrat:** 13	
Quadrat size: 20x20		
WP: 23	**Vegetation group:**	
Photo number: 20 & 21		
Landform: C, HCR		
Land surface/disturbance: 0		
Coarse fragments on the surface (abundance/size/shape):		6, 2, R
Rock outcrop (abundance/runoff):		0, 1
Soil (profile/field texture/soil surface):		U, CL, H
%Cover leaf litter:		40
%Cover bare ground:		60

Tallest stratum	Mid-stratum	Lower stratum
Growth form: Shrub Mallee	**Growth form:** Shrub	**Growth form:** Shrub
Height: 3-6m	**Height:** 1-3m	**Height:** 0.5-1m
Crown cover %: 10-30	**Crown cover %:** 10-30	**Crown cover %:** 10-30
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Acacia effusifolia	*Acacia incurvaneura*	*Hibbertia arcuata*
	Eremophila forrestii subsp forrestii	*Prostanthera althoferi subsp althoferi*
	Acacia effusifolia	

ALL SPECIES
Acacia balsamea
Acacia effusifolia
Acacia incurvaneura
Brunonia australis
Dodonaea rigida
Eremophila forrestii subsp forrestii
Eremophila latrobei subsp filiformis
Goodenia macroplectra
Goodenia occidentalis
Hibbertia arcuata
Hibbertia arcuata
Isotoma hypocrateriformis
Monachather paradoxus
Myriocephalus guerinae
Olearia humilis
Prostanthera althoferi subsp althoferi
Sida sp. Golden calyces glabrous
Solanum lasiophyllum
Waitzia acuminata

Vegetation Description

Acacia effusifolia low open forest over Acacia incurvaneura, Eremophila forrestii subsp forrestii over Hibbertia arcuata and Prostanthera althoferi subsp althoferi and scattered mixed shrubs and herbs on Laterite hills.

Date: 4/10/2011 & 12/03/2012	**Botanist:** ER & AS & AO	
Location: Mount Mason	**Quadrat:** 14	
Quadrat size: 20x20		
WP: 25	**Vegetation group:**	
Photo number: 22-23		
Landform: F, PLA		
Land surface/disturbance: 0		
Coarse fragments on the surface (abundance/size/shape):		6, 3, S
Rock outcrop (abundance/runoff):		0, 0
Soil (profile/field texture/soil surface):		U, CL, H & C
%Cover leaf litter:		65
%Cover bare ground:		60

Tallest stratum	Mid-stratum	Lower stratum
Growth form: Shrub Mallee	**Growth form:** Shrub	**Growth form:** Shrub
Height: 3-6m	**Height:** 1-3m	**Height:** 0.25-0.5m
Crown cover %: 10-30	**Crown cover %:** 10-30	**Crown cover %:** <10
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Acacia incurvaneura	*Acacia effusifolia*	*Waitzia acuminata*
Acacia mulganeura	*Scaevola spinescens*	
	Eremophila forrestii subsp forrestii	

ALL SPECIES
Acacia balsamea
Acacia effusifolia
Acacia incurvaneura
Acacia mulganeura
Acacia ramulosa var ramulosa
Acacia tetragonophylla
Austrostipa variabilis
Brachychiton gregorii
Brachyscome ciliocarpa
Brunonia australis
Cheilanthes sieberi subsp sieberi
Eragrostis eriopoda
Eremophila forrestii subsp forrestii
Eremophila georgei
Eremophila latrobei subsp filiformis
Eremophila latrobei subsp latrobei
Goodenia mimuloides
Goodenia occidentalis
Isotoma hypocrateriformis
Marsdenia australis
Monachather paradoxus
Philotheca brucei subsp brucei
Podolepis canescens
Prostanthera althoferi subsp althoferi
Ptilotus obovatus
Scaevola spinescens
Sida sp. Golden calyces glabrous?
Stenopetalum anfractum
Thyridolepis multiculmis
Trachymene ornata
Waitzia acuminata

Vegetation Description

Acacia incurvaneura with Acacia mulganeura tall shrubland over Eremophila forrestii subsp forrestii and Acacia effusifolia low shrubland over Waitzia acuminata and mixed herbs on flat plains

Date: 4/10/2011 & 12/03/2012	**Botanist:** ER & AS & AO	
Location: Mount Mason	**Quadrat:** 15	
Quadrat size: 20x20		
WP: 29	**Vegetation group:**	
Photo number: 24-25		
Landform: S, HSL		
Land surface/disturbance: 0		
Coarse fragments on the surface (abundance/size/shape):		3, 3, A
Rock outcrop (abundance/runoff):		0, 1
Soil (profile/field texture/soil surface):		U, CL, H & C
%Cover leaf litter:		65
%Cover bare ground:		50

Tallest stratum	**Mid-stratum**	**Lower stratum**
Growth form: Tree Mallee	**Growth form:** Shrub	**Growth form:** Shrub
Height: 3-6m	**Height:** 1-3m	**Height:** 0.25-0.5m
Crown cover %: 10-30	**Crown cover %:** 10-30	**Crown cover %:** 10-30
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Eucalyptus leptopoda subsp arctata	*Eremophila forrestii subsp forrestii*	*Waitzia acuminata*
Acacia incurvaneura	*Acacia ramulosa* var *ramulosa*	*Psydrax attenuata*

ALL SPECIES
Acacia incurvaneura
Acacia mulganeura
Acacia ramulosa var *ramulosa*
Austrostipa variabilis
Brachyscome ciliocarpa
Calandrinia eremaea
Cheilanthes sieberi subsp sieberi
Eremophila forrestii subsp forrestii
Eremophila georgei
Eucalyptus leptopoda subsp arctata
Gilberta tenuifolia
Goodenia mimuloides
Monachather paradoxus
Prostanthera althoferi subsp althoferi
Psydrax attenuata
Ptilotus obovatus
Scaevola spinescens
Sida calyxhymenia
Sida sp Golden calyces glabrous
Stenopetalum anfractum
Thyridolepis multiculmis
Trachymene ornata
Velleia rosea
Waitzia acuminata

Vegetation Description

Acacia incurvaneura with Acacia mulganeura tall shrubland over Eremophila forrestii subsp forrestii and Acacia effusifolia low shrubland over Waitzia acuminata and mixed herbs on flat plains

Date: 4/10/2011 & 12/03/2012	**Botanist:** ER & AS & AO	
Location: Mount Mason	**Quadrat:** 16	
Quadrat size: 20x20		
WP: 30	**Vegetation group:**	
Photo number: 26		
Landform: S, HSL		
Land surface/disturbance: 0		
Coarse fragments on the surface (abundance/size/shape):		5, 3, A
Rock outcrop (abundance/runoff):		3, 2
Soil (profile/field texture/soil surface):		U, CL, H&C
%Cover leaf litter:		25
%Cover bare ground:		75

Tallest stratum	**Mid-stratum**	**Lower stratum**
Growth form: Shrub	**Growth form:** Shrub	**Growth form:** Shrub
Height: 3-6m	**Height:** 1-3m	**Height:** 0.25-0.5m
Crown cover %: 10-30	**Crown cover %:** 10-30	**Crown cover %:** 10-30
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Acacia quadrimarginea	*Thryptomene costata*	*Thryptomene costata*

ALL SPECIES
Acacia quadrimarginea
Calandrinia eremaea
Cheilanthes sieberi subsp sieberi
Eremophila forrestii subsp forrestii
Eremophila georgei
Eremophila latrobei subsp filiformis
Eriachne pulchella subsp *pulchella*
Goodenia mimuloides
Goodenia occidentalis
Haloragis trigonocarpa
Isotoma hypocrateriformis
Marsdenia australis
Monachather paradoxus
Myriocephalus guerinae
Ptilotus obovatus
Rhodanthe battii
Senna cardiosperma
Sida sp Golden calyces glabrous
Solanum lasiophyllum
Stackhousia muricata
Stenopetalum anfractum
Thryptomene costata
Trachymene ornata
Velleia rosea

Vegetation Description

Thryptomene costata low open shrubland with emergent Acacia quadrimarginea over scattered mixed shrubs and herbs on low hill slopes.

Date: 4/10/2011 & 12/03/2012	**Botanist:** ER & AS & AO	
Location: Mount Mason	**Quadrat:** 17	
Quadrat size: 20x20		
WP: 32	**Vegetation group:**	
Photo number: 27		
Landform: S, FOO		
Land surface/disturbance: 0		
Coarse fragments on the surface (abundance/size/shape):		5-6, 3, A
Rock outcrop (abundance/runoff):		0, 1
Soil (profile/field texture/soil surface):		U, CL
%Cover leaf litter:		10
%Cover bare ground:		70

Tallest stratum	Mid-stratum	Lower stratum
Growth form:	**Growth form:**	**Growth form:**
Height:	**Height:**	**Height:**
Crown cover %:	**Crown cover %:**	**Crown cover %:**
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
BURNT	*Acacia caesaneura x incurvaneura*	*Olearia humilis*

ALL SPECIES
Acacia balsamea
Acacia caesaneura x incurvaneura
Acacia effusifolia
Acacia mulganeura
Acacia ramulosa var *ramulosa*
Cheilanthes sieberi subsp sieberi
Goodenia macroplectra
Goodenia occidentalis
Olearia humilis
Prostanthera althoferi subsp althoferi
Sida sp. Golden calyces glabrous
Solanum lasiophyllum
Waitzia acuminata
Acacia craspedocarpa

Vegetation Description

Acacia effusifolia low open shrubland over scattered mixed shrubs and herbs on flats

Date: 4/10/2011 & 12/03/2012	**Botanist:** ER & AS & AO	
Location: Mount Mason	**Quadrat:** 18	
Quadrat size: 20x20		
WP: 33	**Vegetation group:**	
Photo number: 28-30		
Landform: S, FOO		
Land surface/disturbance: 0		
Coarse fragments on the surface (abundance/size/shape):		5, 2, A
Rock outcrop (abundance/runoff):		0, 1
Soil (profile/field texture/soil surface):		U, CL, H&C
%Cover leaf litter:		25
%Cover bare ground:		70
Tallest stratum	**Mid-stratum**	**Lower stratum**
Growth form:	**Growth form:**	**Growth form:**
Height:	**Height:**	**Height:**
Crown cover %:	**Crown cover %:**	**Crown cover %:**
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
BURNT	*Acacia effusifolia*	*Prostanthera althoferi subsp althoferi*
ALL SPECIES		
Acacia effusifolia		
Acacia mulganeura		
Hemigenia sp Yalgoo		
Hibbertia arcuata		
Hibbertia exasperata		
Olearia humilis		
Prostanthera althoferi subsp althoferi		
Sida sp Golden calyces glabrous		
Waitzia acuminata		

Vegetation Description

Acacia effusifolia low open shrubland over scattered mixed shrubs and herbs on flats

Date: 4/10/2011 & 12/03/2012	**Botanist:** ER & AS & AO	
Location: Mount Mason	**Quadrat:** 19	
Quadrat size: 20x20		
WP: 34	**Vegetation group:**	
Photo number: 31		
Landform: F, PLA		
Land surface/disturbance: 0		
Coarse fragments on the surface (abundance/size/shape):		4, 3, A
Rock outcrop (abundance/runoff):		0, 1
Soil (profile/field texture/soil surface):		U, SCL, L
%Cover leaf litter:		40
%Cover bare ground:		40

Tallest stratum	**Mid-stratum**	**Lower stratum**
Growth form:	**Growth form:** Shrub	**Growth form:** Shrub
Height:	**Height:** 1-3m	**Height:** 0.25-0.5m
Crown cover %:	**Crown cover %:** 10-30	**Crown cover %:** 10-30
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
BURNT	*Acacia effusifolia*	*Eremophila forrestii subsp forrestii*
		Prostanthera althoferi subsp althoferi

ALL SPECIES
Acacia aneura var aneura
Acacia effusifolia
Acacia ramulosa var *ramulosa*
Brunonia australis
Eremophila forrestii subsp forrestii
Eucalyptus sp.(sterile)
Olearia humilis
Prostanthera althoferi subsp althoferi
Sida sp. Golden calyces glabrous
Waitzia acuminata
Solanum lasiophyllum
Myriocephalus guerinae

Vegetation Description

Acacia effusifolia low open shrubland over scattered mixed shrubs and herbs on flats

Date: 13/03/2012	**Botanist:** ER & AO	
Location: Mount Mason	**Quadrat:** 20	
Quadrat size: 20x20		
WP: 15	**Vegetation group:**	
Photo number: 1-3		
Landform: C, T, HCR		
Land surface/disturbance: 0		
Coarse fragments on the surface (abundance/size/shape):		5,5,U
Rock outcrop (abundance/runoff):		3,2
Soil (profile/field texture/soil surface):		U, SCL, C
%Cover leaf litter:		20
%Cover bare ground:		92
Tallest stratum	**Mid-stratum**	**Lower stratum**
Growth form: Shrub	**Growth form:** Shrub	**Growth form:** Shrub
Height: 3-6m	**Height:** 1-3m	**Height:** 0.25-0.5m
Crown cover %: <10	**Crown cover %:** <10	**Crown cover %:** <10
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Allocasuarina acutivalvis subsp acutivalvis	*Acacia effusifolia 15-1*	*Calytrix erosipetala*
		Philotheca brucei subsp brucei
ALL SPECIES		
Acacia effusifolia		
Allocasuarina acutivalvis subsp acutivalvis		
Calytrix erosipetala		
Dodonaea viscosa subsp spatulata		
Eremophila latrobei filiformis		
Eriachne pulchella		
Stylidium longibracteatum		
Hibbertia arcuata		
Marsdenia australis		
Philotheca brucei subsp brucei		

Vegetation Description

***Allocasuarina acutivalvis subsp acutivalvis* and *Acacia incurvaneura* low woodland/tall shrubland over *Acacia balsamea* and *Philotheca brucei subsp brucei* open shrubland over scattered mixed shrubs and herbs in minor drainage lines and Laterite breakaways.**

Date: 12/03/2012	**Botanist:** ER & AO	
Location: Mount Mason	**Quadrat:** 21	
Quadrat size: 20x20		
WP: 16	**Vegetation group:**	
Photo number: 4-6		
Landform: C,T HCR		
Land surface/disturbance: 0		
Coarse fragments on the surface (abundance/size/shape):		5,3,U
Rock outcrop (abundance/runoff):		4,2
Soil (profile/field texture/soil surface):		U,SCL,C
%Cover leaf litter:		5
%Cover bare ground:		92

Tallest stratum	**Mid-stratum**	**Lower stratum**
Growth form: Shrub	**Growth form:** Shrub	**Growth form:** Shrub
Height: 3-6m	**Height:** 0.5-1m	**Height:** 0.25-0.5m
Crown cover %: <10	**Crown cover %:** <10	**Crown cover %:** <10
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Allocasuarina acutivalvis subsp acutivalvis	*Allocasuarina acutivalvis subsp acutivalvis*	*Calytrix erosipetala*
Acacia quadrimarginea	*Philotheca brucei subsp brucei*	
	Eremophila latrobei subsp filiformis	

ALL SPECIES
Acacia effusifolia
Acacia incurvaneura
Acacia quadrimarginea
Allocasuarina acutivalvis subsp acutivalvis
Calytrix erosipetala
Cheilanthes sieberi subsp sieberi
Eremophila latrobei subsp filiformis
Eriachne pulchella
Stylidium longibracteatum
Grevillea berryana
Philotheca brucei subsp brucei
Solanum lasiophyllum

Vegetation Description

***Allocasuarina acutivalvis subsp acutivalvis* and *Acacia incurvaneura* low woodland/tall shrubland over *Acacia balsamea* and *Philotheca brucei subsp brucei* open shrubland over scattered mixed shrubs and herbs in minor drainage lines and Laterite breakaways.**

Date: 13/03/2012	**Botanist:** ER & AO	
Location: Mount Mason	**Quadrat:** 22	
Quadrat size: 20x20		
WP: 27	**Vegetation group:**	
Photo number: 9-11		
Landform: V,B,DDE		
Land surface/disturbance: 0		
Coarse fragments on the surface (abundance/size/shape):		4,4,ST
Rock outcrop (abundance/runoff):		1,3
Soil (profile/field texture/soil surface):		U, SCL, C
%Cover leaf litter:		40
%Cover bare ground:		70
Tallest stratum	**Mid-stratum**	**Lower stratum**
Growth form: Shrub Mallee (<8m)	**Growth form:** Shrub	**Growth form:** Shrub
Height: 3-6m	**Height:** 0.5-1m	**Height:** 0.25-0.5m
Crown cover %: 10-30	**Crown cover %:** 10-30	**Crown cover %:** <10
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Acacia burkittii	*Senna artemisioides subsp artemisioides*	*Ptilotus obovatus*
Acacia quadrimarginea		

ALL SPECIES
Acacia burkittii
Acacia quadrimarginea
Acacia ramulosa var ramulosa
Acacia tetragonophylla
Austrostipa variabilis
Cheilanthes sieberi subsp sieberi
Corchorus sp
Dodonaea rigida
Dodonaea lobulata
Eremophila latrobei subsp filiformis
Eremophila oldfieldii subsp angustifolia
Goodenia macroplectra
Goodenia mimuloides
Marsdenia australis
Prostanthera althoferi subsp althoferi
Ptilotus obovatus
Scaevola spinescens
Senna artemisioides subsp artemisioides
Thyridolepis multiculmis

Vegetation Description

***Acacia burkittii* and *Acacia quadrimarginea* tall shrubland over *Senna artemisioides subsp artemisioides* over *Ptilotus obovatus* and mixed shrubs within drainage lines.**

Date: 13/03/2012	**Botanist:** ER & AO	
Location: Mount Mason	**Quadrat:** 23	
Quadrat size: 20x20		
WP: 30	**Vegetation group:**	
Photo number: 12-14		
Landform: C,T,HCR		
Land surface/disturbance: 0		
Coarse fragments on the surface (abundance/size/shape):		4,4,S
Rock outcrop (abundance/runoff):		3,2
Soil (profile/field texture/soil surface):		U, SCL, C
%Cover leaf litter:		20
%Cover bare ground:		70
Tallest stratum	**Mid-stratum**	**Lower stratum**
Growth form: Shrub Mallee (<8m)	**Growth form:** Shrub	**Growth form:** Shrub
Height: 3-6m	**Height:** 1-3m	**Height:** 0.5-1m
Crown cover %: 10-30	**Crown cover %:** 10-30	**Crown cover %: <**10
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Acacia incurvaneura	*Acacia cockertoniana*	*Philotheca brucei subsp brucei*
Acacia mulganeura		

ALL SPECIES
Acacia cockertoniana
Acacia incurvaneura
Acacia mulganeura
Austrostipa variabilis
Calandrinia eremaea
Calytrix erosipetala
Cheilanthes sieberi subsp sieberi
Dodonaea viscosa subsp spatulata
Eremophila georgei
Eremophila latrobei subsp filiformis
Eremophila oldfieldii subsp angustifolia
Goodenia occidentalis
Goodenia mimuloides
Hibbertia arcuata
Marsdenia australis
Monachather paradoxus
Philotheca brucei subsp brucei
Prostanthera althoferi subsp althoferi
Ptilotus obovatus
Scaevola spinescens
Senna artemisioides subsp filifolia
Thryptomene decussata
Thyridolepis multiculmis
Trachymene ornata

Vegetation Description

***Acacia incurvaneura* with *Acacia quadrimarginea* tall shrubland/ low woodland over *Philotheca brucei subsp brucei* with *Acacia balsamea shrubland* over *Eremophila latrobei subsp latrobei* and *Hibbertia exasperata* over mixed herbs and shrubs on hills and ridges.**

Date: 13/03/2012	**Botanist:** ER & AO	
Location: Mount Mason	**Quadrat:** 24	
Quadrat size: 20x20		
WP: 31	**Vegetation group:**	
Photo number: 15-17		
Landform: F,B,PLA		
Land surface/disturbance: 0		
Coarse fragments on the surface (abundance/size/shape):		5,4,S
Rock outcrop (abundance/runoff):		0, 1
Soil (profile/field texture/soil surface):		U, SCL, C
%Cover leaf litter:		30
%Cover bare ground:		60
Tallest stratum	**Mid-stratum**	**Lower stratum**
Growth form: Shrub	**Growth form:** Shrub	**Growth form:** Shrub
Height: 3-6m	**Height:** 1-3m	**Height:** 0.5-1m
Crown cover %: 10-30	**Crown cover %:** 10-30	**Crown cover %:** 10-30
Dominant taxa:	**Dominant taxa:**	**Dominant taxa:**
Acacia cockertoniana	*Eremophila oldfieldii subsp angustifolia*	*Ptilotus obovatus*
	Acacia ramulosa var ramulosa	*Senna artemisioides subsp filifolia*
	Eremophila pantonii	
ALL SPECIES		
Acacia cockertoniana		
Acacia ramulosa var ramulosa		
Austrostipa variabilis		
Calandrinia eremaea		
Cheilanthes sieberi subsp sieberi		
Eremophila oldfieldii subsp angustifolia		
Eremophila pantonii		
Eriachne pulchella		
Goodenia occidentalis		
Marsdenia australis		
Ptilotus obovatus		
Scaevola spinescens		
Senna artemisioides subsp filifolia		

Vegetation Description

Acacia cockertoniana tall shrubland over *Eremophila oldfieldii subsp angustifolia* over *Eremophila pantonii* and mixed shrubs on flats.

ATTACHMENT 5

Keith Lindbeck and Associates
Environmental Management Consultants
ABN 36 150 274 469

JUPITER MINES LIMITED

CENTRAL YILGARN IRON PROJECT (CYIP) MT MASON

FAUNA ASSESSMENT

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August 2012

EXECUTIVE SUMMARY

Jupiter Mines Limited (Jupiter) is engaged in the exploration and development of mineral resources in Australia. In particular, Jupiter holds interest in the Central Yilgarn Iron Project (CYIP) area located within the western edge of the Mt Ida greenstone belt.

The CYIP area is located approximately 530 km northeast of Perth, 100 km northwest of Menzies and 200 north-northwest of Kalgoorlie**.** Collectively, the tenements that make up the CYIP area cover approximately 27,500 ha. The two main project areas in the CYIP include Mt Mason and Mt Ida which are 100% owned by Jupiter.

Mt Mason, in particular, is reported to have an Inferred Mineral Resource of 5.90 million tonnes of iron ore at 60.1% Fe. In order to further pursue mining opportunities in the Mt Mason area, Jupiter commissioned Keith Lindbeck and Associates (KLA) to undertake a comprehensive Level 2 fauna assessment of the area proposed for mining activities in the Mt Mason tenement area.

In accordance with the Environmental Protection Authority (EPA) Statement and Guidelines, multiple seasonal surveys are required. KLA has completed a 'Spring 2011' survey and an 'Autumn 2012' survey to satisfy these requirements. Five trapping sites were established in the screes and flats adjacent to five smaller satellite sites that were located within areas of Banded Iron Formation (BIF).

Results

Pitfall traps, aluminium box traps, funnel traps and cage traps were open collectively for a total of 4613 trap nights.

The systematic surveys recorded 13 reptile species, five native terrestrial mammal species and one non-native terrestrial mammal species, six species of bats and 34 bird species, giving a total of 59 vertebrate fauna species.

The reptiles captured comprised three dragon species (Agamidae), two diplodactylid species (Diplodactylidae), two gecko species (Gekkonidae), four species of skink (Scincidae) and two varanids (Varanidae) totalling 36 individuals.

Nine species of reptiles were captured in each of the seasonal surveys. However, one agamid (*Pogona minor*) two diplodactilids (*Diplodactylus pulcher, Strophurus assimilis*) and one skink (*Ctenotus schomburgkii*) were captured during the Spring survey that were not captured during the Autumn survey and conversely, two geckos (*Gehyra variegata, Heteronotia bynoei*) one skink (*Ctenotus leonhardii*) and one varanid (*Varanus panoptes*) were captured during the Autumn survey that were not captured during the Spring survey.

Aberrant maxima and minima temperatures results in less reptiles (n = 22) being captured (trap rate = 1.0%) during the purported warmer temperatures of spring and more reptiles (n = 36) being captured (trap rate – 1.5%) in the purported cooler autumn temperatures. The overall trap rate of 1.25% across both seasonal surveys was considered low indicating that the habitat at the time did not support many reptiles.

The numbers of reptile captures between sites did differ but not consistently across seasons. During the Spring 2011 survey more reptiles were captured in the 'Mulga over *Eremophila forrestii* on undulating hills' and during the Autumn 2012 survey more reptiles were captured in the regenerating *Acacia* shrubland. While there were no captures of reptiles in the smaller satellite sites in the BIF areas during the Spring 2011 survey, one individual (*Heteronotia binoei*) was captured in one of the satellite sites during the Autumn 2012 survey.

No reptile species of conservation significance were recorded.

For the terrestrial mammals, five species of native terrestrial mammals representing two families and totalling 28 individuals were captured. During the Spring 2011 survey seven native mammals were captured represented by two species from the Family Dasyuridae: *Sminthopsis longicaudata* Long-tailed Dunnart and *S. dolichura* Little Long-tailed Dunnart. While not listed to occur in the area, *S. longicaudata* is a Priority 4 species on the Department of Environment and Conservation (DEC) Threatened and Priority Fauna Database. This capture represents the southernmost extent of this species and extends its distribution range. No other mammals species of conservation significance were recorded during either of the seasonal surveys.

Many more native mammals (n = 21) were captured during the Autumn 2012 survey. In addition to the above two species, a third dasyurid (*Pseudantechinus woolleyae* Woolley's Pseudantechinus) was captured being the only mammal captured in the smaller satellite sites located in areas of BIF. In addition, *Notomys alexis* Spinifex Hopping Mouse and *Pseudomys hermannsburgensis* Sandy Inland Mouse represented native Muridae species captured.

For the non-native mammals, a total of 44 *Mus musculus* House Mouse (Family: Muridae) were captured with ten captured during the Spring 2011 survey and 34 captured during the Autumn 2012 survey, with only two captured in the smaller satellite sites in the BIF areas. *Mus musculus* populations are known to fluctuate enormously depending on resources and rain. This is consistent with the large increase in numbers from those captured during the Spring 2011 survey to the great number captured during the Autumn 2012 survey.

The capture of 28 individual native mammals during the two seasonal surveys translates into a trap rate of 0.6%, which suggests that at the time of the surveys the area supported very low numbers of mammals. While the trap rate for *Mus musculus* was higher (1.0), the combined trap rate for all mammals (1.6) indicates a low abundance of mammals in the area.

Consistent with the reptile captures, more mammals were captured in the habitat described as ‘Mulga over *Eremophila forrestii* on undulating hills’.

Anabat detectors record the presence of bats, rather than the numbers present. Bats were recorded at all of the five trapping grid sites with between five and six species recorded at each site. While some calls were positively identified, others require confirmation and some could be one of two species. Notwithstanding this, it is reasonable to assume that the diversity of bats present extends throughout the Mt Mason area.

Systematic bird surveys yielded a total of 507 individuals of 34 species from 16 Families. For the Spring 2011 survey, the 12 Families comprised three non-passerine Families (n = eight species with 129 individual birds recorded) and nine passerine Families (n = 21 species with 178 individual birds recorded). While the numbers of birds recorded in each category suggest that the area supports marginally more passerines (58% of total number of birds) than non-passerines (42%), analysis of the results indicates that *Nymphicus hollandicus* Cockatiel (n = 40) and *Melopsittacus undulatus* Budgerigar (n = 45) were responsible for weighting of the non-passerine figures.

Within the passerines, 52% of the total number of passerines (n = 178) was represented by three species with the Malurid *Malurus splendens* Splendid Fairy-wren being the most ubiquitous (n = 35). *Acanthiza robustirostris* Slaty-backed Thornbill was the next most numerous bird (n = 33) followed by *Oreoica gutturalis* Crested Bellbird (n = 25).

For the Autumn 2012 survey, three non-passerine species from three Families accounted for only 17 birds whereas the 16 passerines species numbered 183 individuals from eight Families. Two species (*Malurus splendens* Splendid Fairy-wren (n = 45) and *Acanthiza apicalis* Inland Thornbill (n = 66)) accounted for 61% of all passerines during this seasonal survey. Thus, the percentage of passerines (91.5%) heavily outweighed the percentage of non-passerines (8.5%).

Overall, the number of birds recorded during the systematic sampling suggests that resources and/or habitat required were adequate to maintain the numbers and diversity present.

The distribution of birds throughout the Mt Mason area was not remarkably different between sites for the Spring 2011 survey. These results suggest that there was no significant correlation between distribution of birds across the length of the area surveyed and the vegetation communities in the areas surveyed. However, these results were not consistent for the Autumn 2012 survey period in which there was a marked difference in the species distribution across the sites. Given that all sites except the regenerating *Acacia* shrubland are dominated by a mulga upper story, it may be assumed that resource availability differs substantially in the cooler months in relation to topography and understorey species.

Of the birds considered of conservation significance listed for the area, evidence of *Leipoa ocellata* Malleefowl was found, *Oreoica gutteralis* Crested Bellbird was recorded at every site and opportunistically and *Pomatostomus superciliosus* White-browed Babbler was recorded at one site and opportunistically. Of four reportedly known Malleefowl mounds in the general area only three very old inactive mounds were located, and an additional four old, inactive mounds were identified during the surveys. Seven of the eight were located on the edge of or outside of the Mt Mason tenement. One new, active Malleefowl mound was identified 1.7 km south of the southern boundary of the Mt Mason tenement. Given the location of the proposed disturbance in the Mt Mason area and the presence of large areas of intact, undisturbed, remnant vegetation regionally, the conservation status of the Malleefowl, Crested Bellbird and White-browed Babbler is not likely to be altered by the proposed mining activity.

Of the invertebrate fauna collected, 101 individuals were identified and represented five Classes and nine Orders. Within the Arachnida, nine species totalling 26 individuals represented five Families, three Chilopoda accounted for three Families with one species from each, Diplopoda accounted for one species and Crustacea seven species from one Family. Five species of Gastropoda were identified representing three families and accounting for 64 specimens. Given the lack of taxonomic knowledge and reference collections, the results from the Western Australian Museum were often inconclusive depending on the families or genera. Up to 13 of the 19 species were considered not Short-range Endemic Invertebrates (SREs) whereas lack of knowledge preventing a conservation status to be determined for five of the species. For the remaining species (Family: Paradoxosomatidae), one single damaged female millipede did not facilitate identification. However all species in the presumed genus are known to be SREs.

The overall condition of the vegetation within the survey area can generally be described as “Very Good” to “Excellent” with almost all disturbances within the area directly related to recent exploration activity and associated tracks. No unique, restricted or fauna-specific habitat types for terrestrial vertebrate fauna were identified within the Mt Mason or local area. The BIF range at Mt Mason lies in a north to south orientation for approximately 10 km and appears to be well connected to the BIF range at Mt Ida (approximately 8.6 km in length). The potential invertebrate habitat supported by these ranges is extensive and is not limited to the area of proposed impact at Mt Mason. Thus, while the removal of up to approximately 220 ha of native vegetation and BIF will impact

on indigenous fauna, the vegetation cannot be considered to be significant habitat in a regional context.

Recommendations

The following general recommendations apply in the case of any major disturbance to large areas of native vegetation, as a consequence of the proposed development for the Mt Mason Project:

- Any clearing be minimised in extent given that the abundance and diversity of species lost will be proportional to the amount of habitat cleared;
- Where possible, all infrastructure associated with the development of the mining operation be aligned preferentially to areas of existing disturbance;
- Where possible, access routes be aligned to existing tracks and other barriers or follow the boundaries of broad-scale intact native vegetation;
- A rehabilitation plan is developed that progressively rehabilitates areas as soon as they are no longer required; and
- All members of the work force on site attend an environmental induction to ensure they are familiar with the value of native vegetation to fauna indigenous to Western Australia. This should include awareness of driving restrictions, ensuring that off-road driving is minimised, fire prevention is actively practised, and appropriate responses are followed in the event of an accident involving fauna.

In addition, specific recommendations are made in relation to the Malleefowl:

- A targeted Malleefowl survey should be undertaken by a suitably qualified team in the areas proposed for disturbance as soon as detailed boundaries of these areas have been confirmed.
- Given the evidence of Malleefowl within the zone of impact, a referral should be submitted to the Federal Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) for approval in accordance with the EPBC Act 1999.
- Pending the results of the targeted Malleefowl survey in the confirmed areas for disturbance and outcome of the DSEWPaC referral, a Malleefowl Management Plan should be developed and implemented immediately post approval.

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1.0 INTRODUCTION

1.1 BACKGROUND

Jupiter Mines Limited (Jupiter) is engaged in the exploration and development of mineral resources in Australia. In particular, Jupiter holds an interest in the Central Yilgarn Iron Project (CYIP) area located within the western edge of the Mt Ida greenstone belt. The Ida fault, a large scale regional structure, marks the boundary between the Southern Cross Granite-Greenstone and Eastern Goldfields.

The CYIP area is located approximately 530 km northeast of Perth, 100 km northwest of Menzies and 200 north-northwest of Kalgoorlie. Collectively, the tenements that make up the CYIP area cover approximately 27,500 ha. The two main project areas in the CYIP include Mt Mason and Mt Ida (Figure 1). Both projects are 100% owned by Jupiter.

Mt Mason, in particular, is reported to have an Inferred Mineral Resource of 5.90 million tonnes of iron ore at 60.1% Fe. In order to further pursue mining opportunities in the Mt Mason area, Jupiter commissioned Keith Lindbeck and Associates (KLA) to assist in the government approvals process.

1.2 SCOPE OF STUDY

As part of the government approval requirements, KLA was commissioned in July 2011 to undertake a comprehensive Level 2 fauna assessment of the vegetated areas encompassing the proposed mine and associated infrastructure related to the Mt Mason Project. The survey was planned and implemented in accordance with Environmental Protection Authority (EPA) Position Statement No 3 "*Terrestrial Biological Surveys as an Element of Biodiversity Protection*" (EPA 2002), Guidance Statement No. 56 "*Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia*" (EPA 2004), Guidance Statement No. 20 "*Sampling of Short Range Endemic Invertebrate Fauna for Environmental Impact Assessment in Western Australia*" (EPA 2009) and "*Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment*" (EPA and DEC 2010).

The EPA (2004) guidelines indicate that multiple, seasonal surveys are required for baseline information. Therefore, one Level 2 survey was conducted in Spring (August-September 2011) and a second Level 2 survey was conducted in Autumn (March 2012).

In January 2007, Jupiter commissioned a Level 1 desktop terrestrial vertebrate fauna assessment of the Mt Mason Project area (Outback Ecology Services (OES) 2007). The results of that fauna assessment were used to provide contextual data for the Level 2 survey.

The scope of work for the Level 2 fauna survey was to:

- generally describe the vegetation associations in the study area;
- identify habitat that may be of significance to fauna indigenous to Western Australia;
- identify any habitats of particular conservation significance for fauna within the study area;
- develop an inventory (baseline information) of terrestrial vertebrate fauna species and terrestrial Short-range Endemic invertebrate (SRE) species identified from within the survey area using a combined approach of desk-top research including a review of existing literature and site specific, seasonal fauna surveys comprising a suite of established survey techniques;
- assess the inventory in the regional context by comparisons with available data from other localities within the region;

- identify fauna of conservation significance in the area, including SRE species;
- provide a risk assessment to determine potential impacts to fauna of conservation significance; and
- provide recommendations, including the management of perceived impacts to fauna habitats and fauna of conservation significance within the study area.

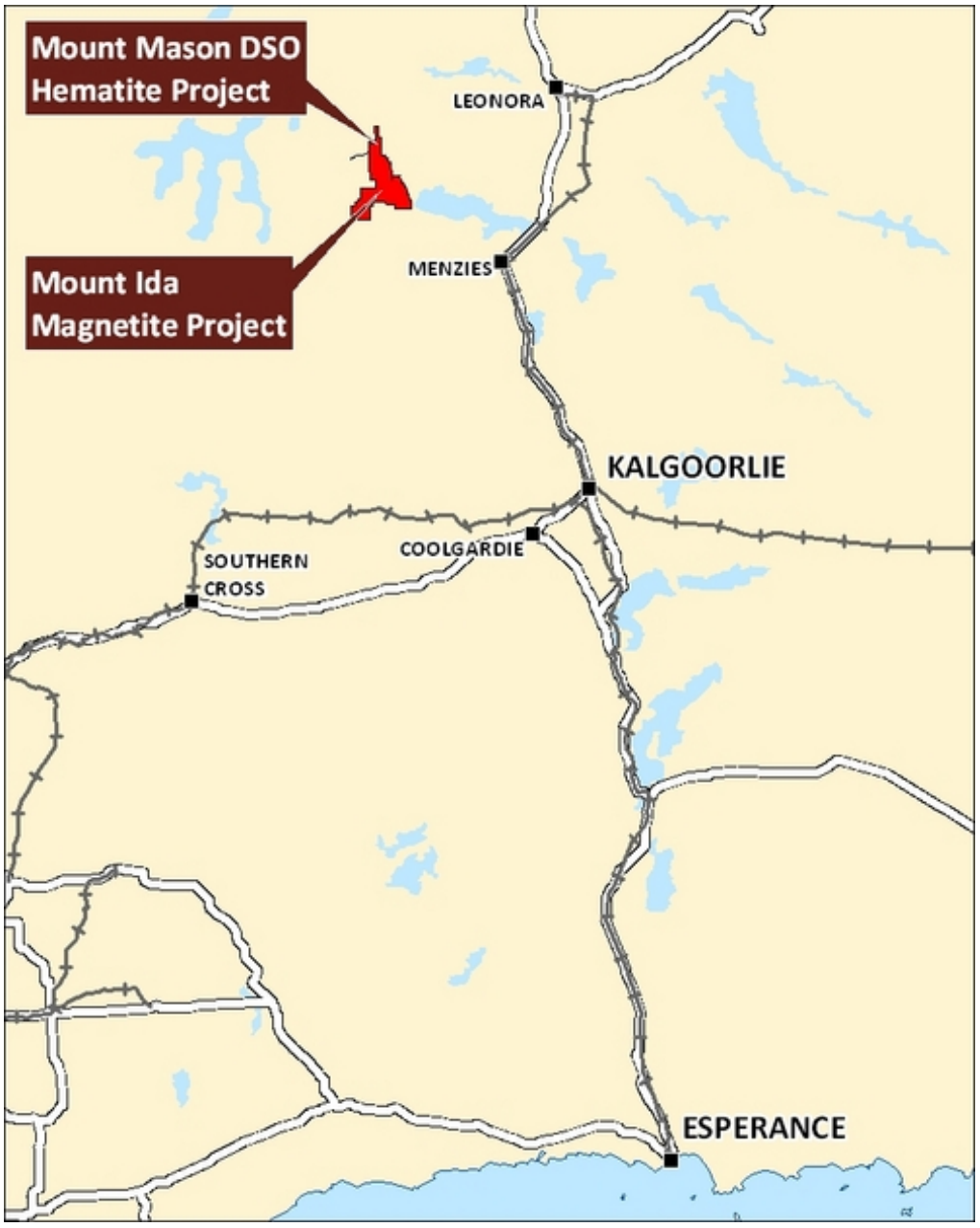

Figure 1 - Location of Mt Mason and Mt Ida

1.3 PURPOSE OF THIS REPORT

This report describes the methodology employed for two seasonal fauna surveys of the area encompassing the proposed mine and associated infrastructure relating to the Mt Mason Project. It documents the current knowledge of the potentially-occurring and surveyed fauna in the broader area and provides the results of the Spring 2011 and Autumn 2012 surveys conducted in the subject area. The report also provides recommendations that include minimising impacts of the proposed project on fauna habitat and assemblages.

This report is intended as a supporting document to accompany Jupiter's mining approvals submissions to satisfy statutory requirements.

This survey is subject to limitations and these are discussed in more detail in the appropriate sections.

2.0 EXISTING ENVIRONMENT

The Mt Mason Project area lies approximately 100 km northwest of Menzies, approximately 35 km northwest of Lake Ballard (an ephemeral salt lake) and 65 km east of Lake Barlee (an intermittent salt lake) in the Goldfields district of Western Australia (Figure 2). The operations will be carried out on M29/408 which is located on the Perrinvale Pastoral Lease (H91304) (Figure 3).

The Mt Mason Project area extends within the eastern aspect of M29/408 which measures approximately 1.9 km long and approximately 1.6 km wide and covers 300 ha (Figure 2 and Figure 3).

2.1 CLIMATE

The area encompassing Mt Mason is located close to the delineation between the Desert-Intermediate and Semi-Desert Mediterranean bioclimatic regions which are also described as semi-arid (Beard 1990). The area is dry for the majority of the year and beneficial rains fall in late summer to early winter (Beard 1990).

The nearest official meteorological station is located at Menzies, approximately 100 km southeast of the survey area. Recordings of the local climatic conditions commenced at Menzies in 1896, and although the station is still open, availability of data is limited (Bureau of Meteorology (BOM) 2012). The next closest station is Leonora, approximately 100 km northeast of Mt Mason which has records from 1898 and continues to monitor climatic conditions to date (BOM 2012). Data from both stations is presented in this report.

2.1.1 Temperature

For Menzies, the mean annual minimum temperature is 12.6^{o}C and the mean annual maximum temperature is 26.3^{o}C (Figure 4). The coldest month is July (mean minimum temperature 5.3^{o}C), the hottest is January (mean maximum temperature 35.1^{o}C), and diurnal temperature variations are relatively consistent throughout the year (Figure 4). Diurnal temperature variations for Leonora mirror those of Menzies. However, Leonora recorded overall slightly higher temperatures with the mean annual minimum being 14°C, mean annual maximum 27.9^{o}C, coldest temperature 6.1^{o}C also in July and hottest also in January at 37.1^{o}C (Figure 5).

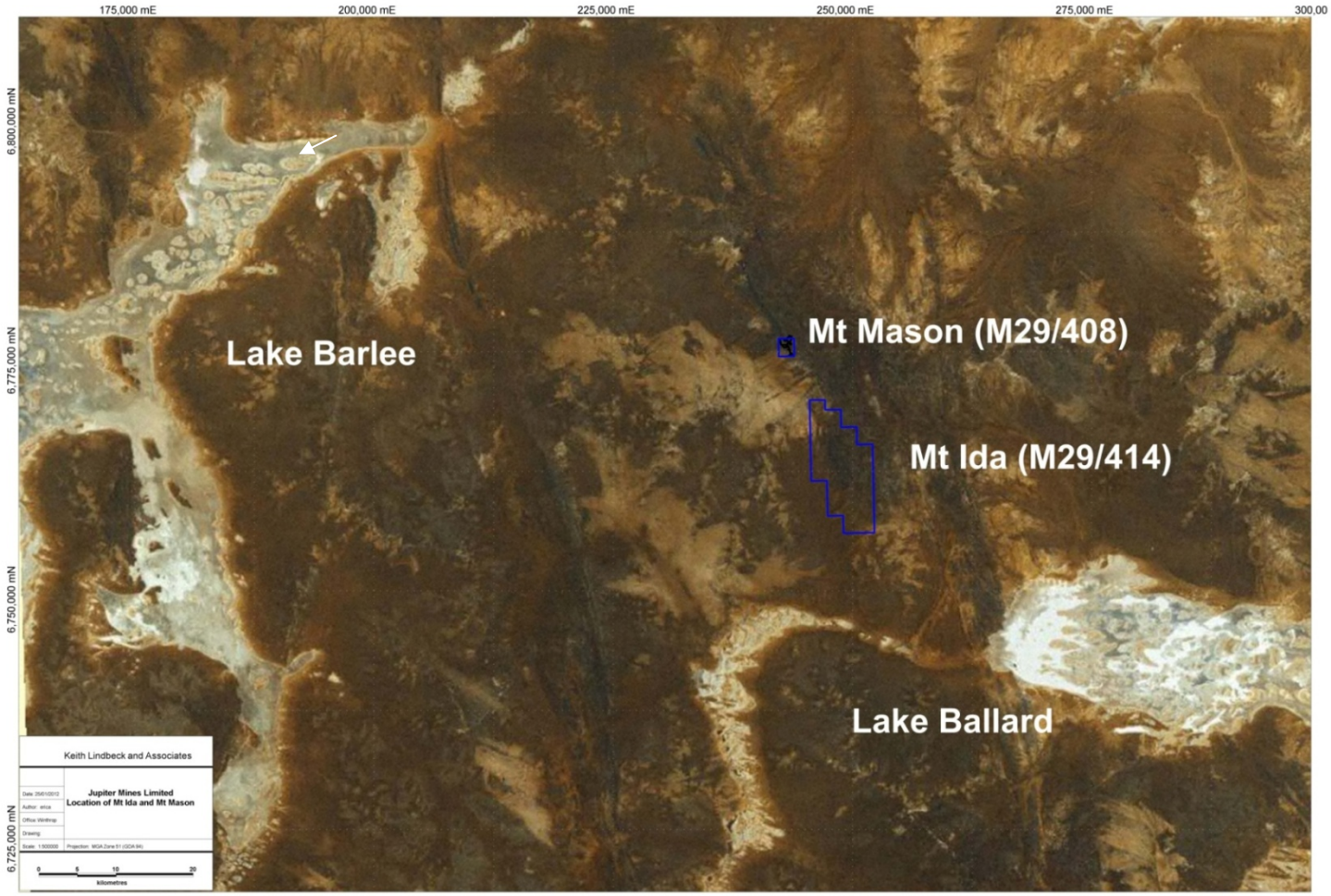

Figure 2 - Location of Mt Mason Project area

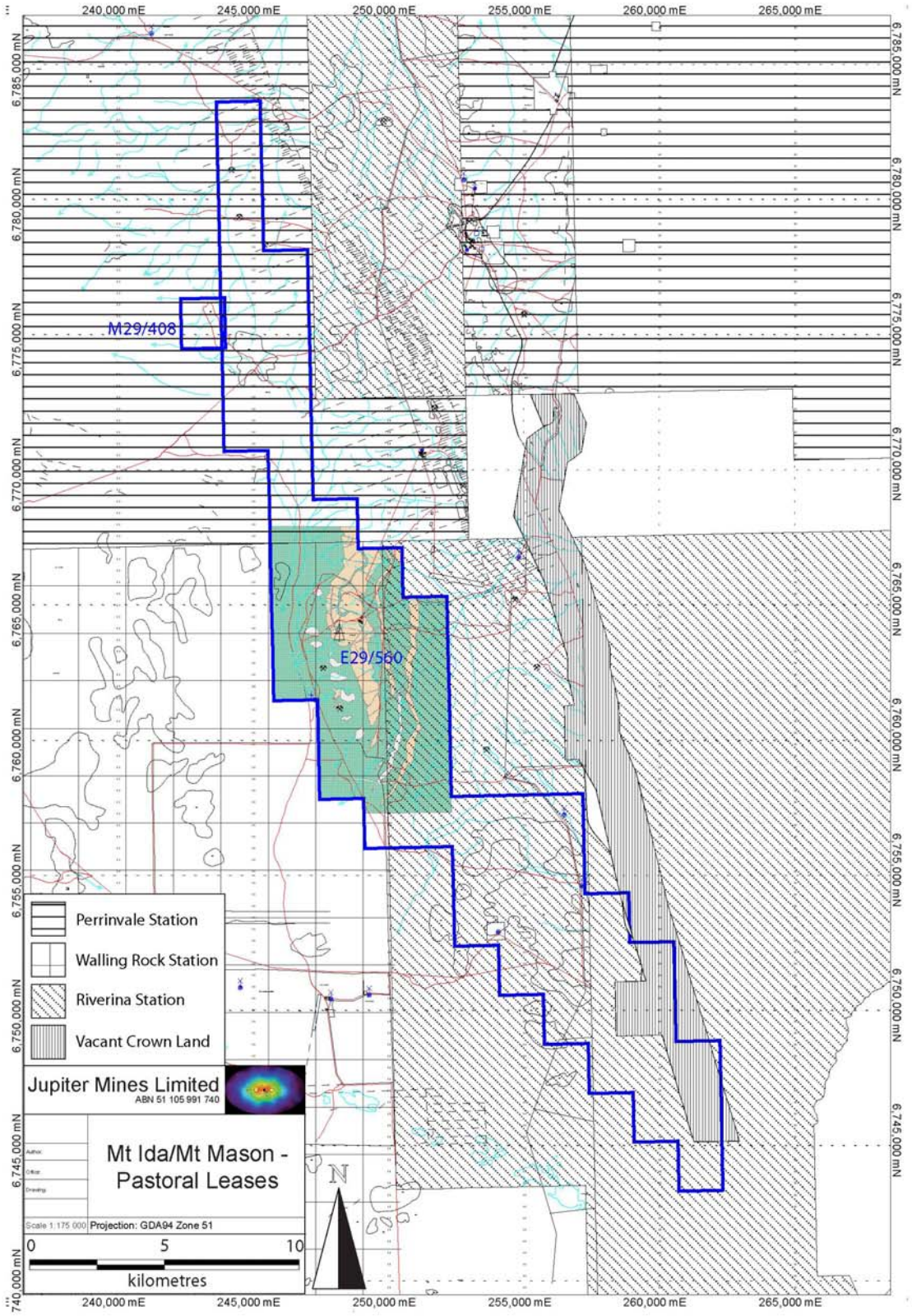

Figure 3 - Pastoral Leases of the Mt Mason project area

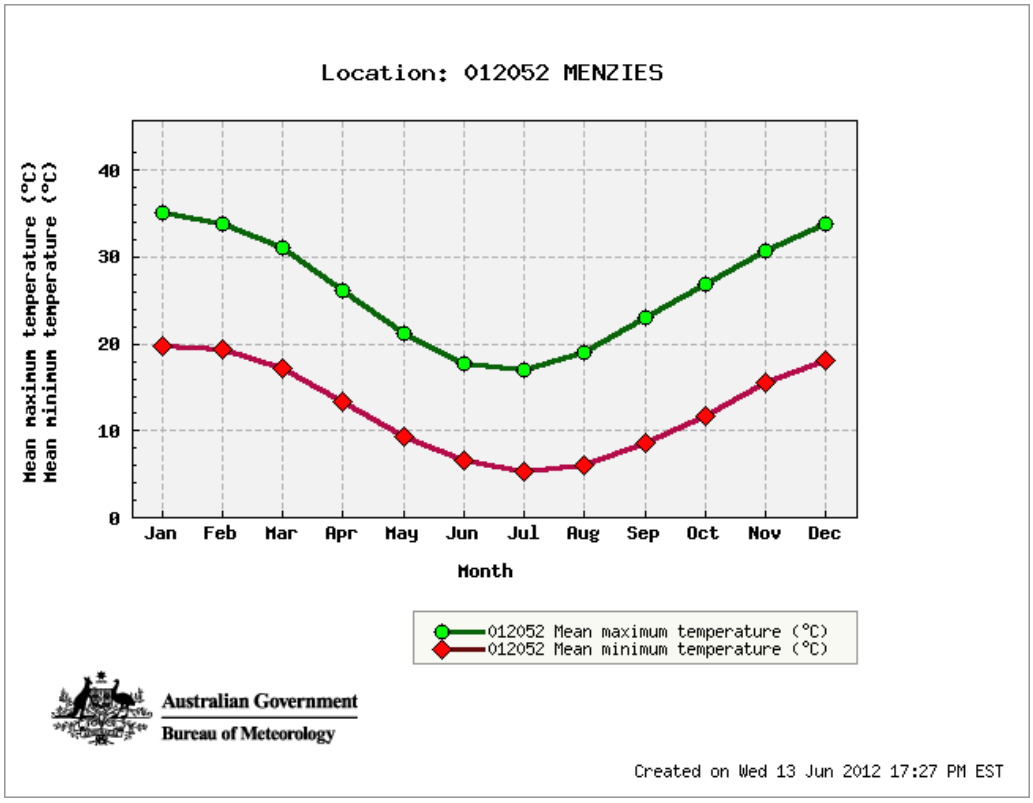

Figure 4 - Mean maximum and minimum temperatures at Menzies Meteorological Station

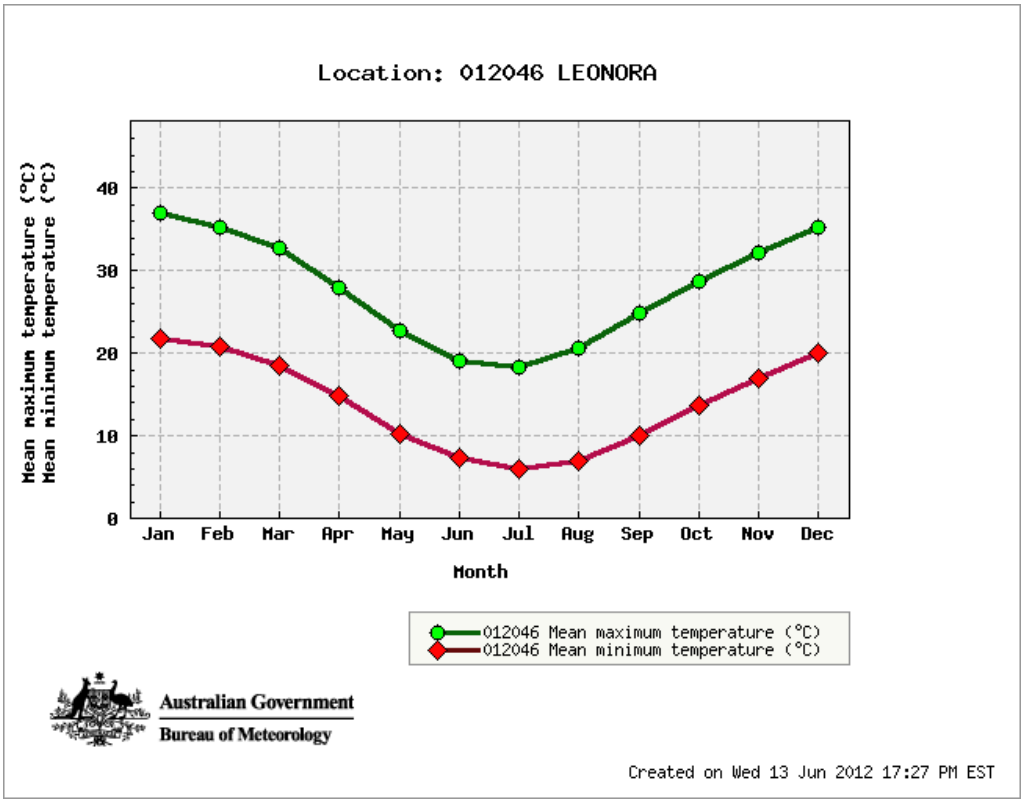

Figure 5 - Mean maximum and minimum temperatures at Leonora Meteorological Station

Mean minimum and maximum temperatures for the August and September 2011 survey period were considerably warmer than the historic mean, while those for the March 2012 survey period were slightly cooler.

The mean minimum temperature for the August-September 2011 survey period was 11.4°C, compared to 7°C for August and 10°C for September recorded over the last 63 years for the area. The mean maximum temperature for that survey period was warmer (26.4°C) than the long-term average of 20.6°C for August and 24.8°C for September (BOM 2012).

For the March 2012 survey period, the mean minimum temperature was somewhat lower (15.5°C) than the historic mean of 18.6°C and the mean maximum temperature was also lower (31.3°C) than the 63 year mean (32.7°C). Table 1 lists the minimum and maximum temperature recordings and rainfall for the periods spanning both seasonal fauna surveys recorded at the Leonora Station (28 August 2011 to 3 September 2011, and 1 to 7 March 2012). During the Autumn 2012 survey period, a thermometer (and rain gauge) were erected within the survey area. The temperatures recorded during this survey period differed slightly from Leonora; the mean minimum temperature was very similar (15.2°C) whereas the mean maximum temperature was higher at 35.8°C (Table 2). The accuracy of these temperature recordings must be taken into account and regarded as an estimate only.

Table 1 - Daily temperatures and rainfall for selected dates in Spring 2011 (August-September) and Autumn 2012 (March) recorded at Leonora Meteorological Station

2011	Temperature		Rainfall
Date	**Min °C**	**Max °C**	**mm**
28-Aug	9.1	28.7	0
29-Aug	9.8	27.8	0
30-Aug	15.9	28.5	0
31-Aug	12.4	27.6	0
1-Sep	12.7	28.3	0
2-Sep	13.1	25.5	0
3-Sep	6.9	18.3	4.2
Mean	**11.4**	**26.4**	**0.6**

2012	Temperature		Rainfall
Date	**Min °C**	**Max °C**	**mm**
1-Mar	14.2	26.4	0.4
2-Mar	13.7	27.8	0
3-Mar	12.9	29.1	0
4-Mar	16.7	-	0
5-Mar	-	33.6	0
6-Mar	17.4	33.9	0
7-Mar	18	37	0
Mean	**15.5**	**31.3**	**0.06**

Table 2 - Daily temperatures and rainfall recorded within the survey area at Mt Mason during the Autumn 2012 survey

2012	Temperature		Rainfall
Date	**Min °C**	**Max °C**	**mm**
29-Feb	16.0	26.0	0
1-Mar	15.0	35.0	0
2-Mar	12.0	37.0	0
3-Mar	12.0	37.0	0
4-Mar	12.5	33.0	0
5-Mar	15.0	36.0	0
6-Mar	18.0	37.5	0
7-Mar	18.0	38.0	0
8-Mar	18.0	43.0	0
Mean	**15.7**	**35.83**	**0**

2.1.2 Rainfall

The annual average rainfall at Menzies is 249.9 mm which falls (<1 mm) on approximately 32.1 rain days (BOM 2012). Leonora is located approximately 100 km north of Menzies and the annual average rainfall and number of rain days is marginally less with 236.8 mm falling on approximately 30.1 rain days. More rain (>20 mm per month) falls in the first half of the year than in the second half (<20 mm per month) and this amount does not vary greatly (Figure 6).

Rainfall preceding the spring survey was below average for the period March to May 2011, while June and July 2011 received above average rainfall. February 2011 recorded an excessive amount of rain (190.7 mm) equating to 37% of the entire annual rainfall for 2011 (Figure 6). A total of 15.1 mm of rain was recorded for August 2011, and 4.2 mm on 2 September 2011. A rain gauge at 'Mt Ida camp' located approximately 11 km east of Mt Mason recorded 11.0 mm of rain on 2 September 2011. Both August and September recorded below average rainfall for 2011.

The period prior to the autumn survey received above average rainfall from October 2011 through to January 2012. While February 2012 received below average rainfall (18.1 mm) rainfall for March 2012 (68.2 mm) far exceeded mean average for that month (28.8 mm) (BOM 2012). Only 0.4 mm of rain fell during the March 2012 survey period, and no rainfall was recorded at site.

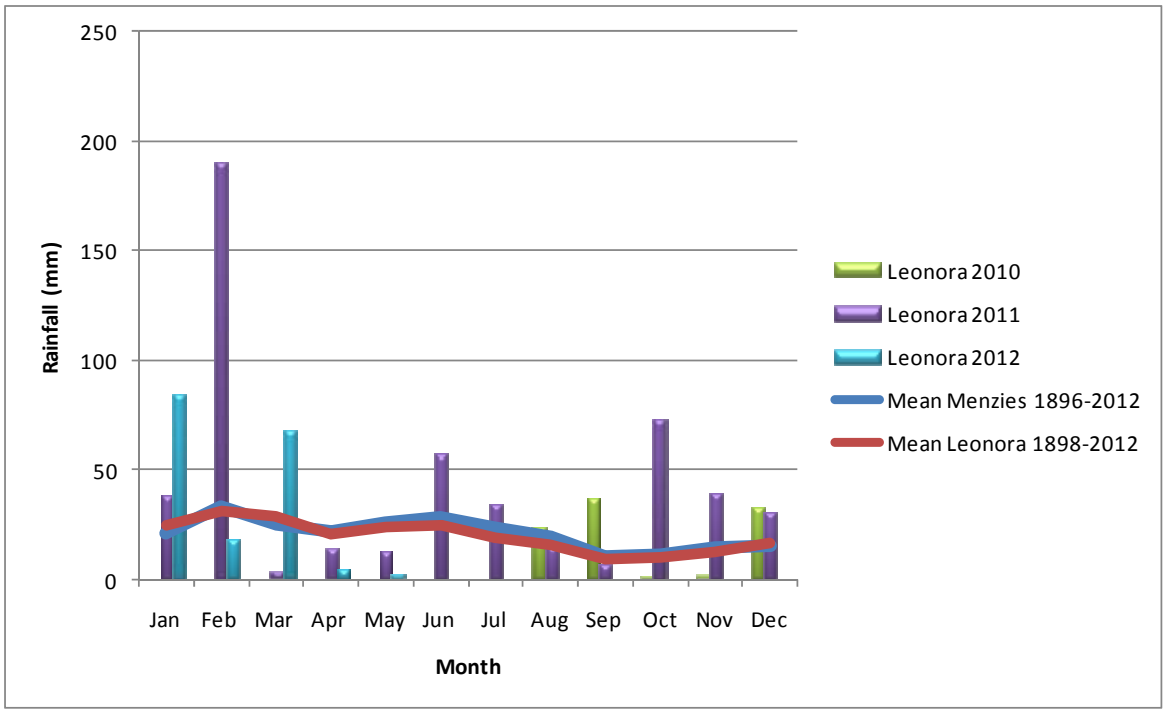

Figure 6 - Rainfall data for Menzies and Leonora Meteorological Stations

2.2 INTERIM BIOGEOGRAPHIC REGIONALISATION OF AUSTRALIA

The Interim Biogeographic Regionalisation for Australia (IBRA) divides the Australian continent into 85 bioregions and 403 subregions (Department of the Environment, Water, Heritage and the Arts 2009). The CYIP area is located within the Murchison IBRA region and (MUR1) East Murchison subregion (Cowan 2001).

The East Murchison bioregion which totals over seven million hectares is characterised by Mulga Woodlands often rich in ephemerals, hummock grasslands, saltbush shrublands and *Halosarcia* shrubland (Cowan 2001). The area is characterised by:

- internal drainage,
- extensive areas of elevated red desert sandplains with minimal dune development,
- salt lake systems that are associated with the occluded Paleodrainage system, and
- broad plains of red-brown soils and breakaway complexes as well as red sandplains (Cowan 2001).

The subregion is rich and diverse in both its flora and fauna. However, most species are wide ranging and usually occur in at least one, and often several, adjoining subregions (Cowan 2001). Notwithstanding this, known special values in relation to the landscape, ecosystem, species and genetic values in the subregion include:

- Rare Features such as calcrete aquifers in the northern parts that support a large variety of Short-range Endemic (SRE) subterranean aquatic fauna,
- Rare terrestrial species include Great Desert Skink *Egernia kintorei,* Malleefowl *Leipoa ocellata*, Alexandra's Parrot *Polytelis alexandrae*, Mulgara *Dasycercus cristicauda* and Yellow-bellied Black Snake *Pseudechis butleri*, and
- Lake Barlee which represents a most important breeding site for Banded Stilts *Cladorhynchus leucocephalus* and refugia for many other water birds (Burbidge and Fuller 1982 cited in Cowan 2001).

  Lake Barlee is usually dry but, given its importance when it is inundated, it is now recognised as an Important Bird Area (IBA) by Birdlife Australia (Birds Australia 2012). There are no other IBA's or lakes between Lake Barlee and Mt Mason.

The dominant land use for the East Murchison subregion is grazing which accounts for up to ~86% of land use, and Unallocated Crown Land and Crown Reserves account for ~11.34% (Cowan 2001). While there are many mining leases in the area, most still fall under the Land Administration Act 1997 and, as such, are still required to be stocked (Cowan 2001). Only 1.4% is located in International Union for Conservation of Nature (IUCN) 1 – 4 conservation reserves (CAR 2009).

2.3 FLORA AND VEGETATION MAPPING

The project area is located within the Austin District of the Eremaean Botanical Province (Beard 1990). The Austin Botanical District comprises predominantly mulga low woodland on plains with the vegetation reduced to scrub on hills, with tree steppe of *Eucalyptus* spp. over *Triodia basedowii*. The vegetation is dominated by *Acacia* forests and woodlands, *Acacia* shrublands, hummock grasslands and chenopod and samphire shrublands, with other shrublands also occurring and small areas of *Eucalyptus* woodlands and open woodlands (ANRA 2012).

Numerous flora and vegetation mapping surveys have previously been undertaken in the area (Paul Armstrong and Associates 2008, Meissner and Owen 2010, OES 2010). More recently, Native Vegetation Solutions (NVS) was commissioned to conduct a Level 2 flora and vegetation mapping survey of the areas proposed for disturbance in the Mt Mason area (NVS 2012).

Ten vegetation groups were described during the recent survey, largely following topographical features and dominant upper storey species (NVS 2012). While ten vegetation groups were identified via quadrat sampling, only nine were within the survey area (Figure 7):

- *Thryptomene* Shrubland: *Thryptomene costata* low open shrubland with emergent *Acacia quadrimarginea* over scattered mixed shrubs and herbs on low hillslopes and ridges
- Open Mulga woodland over laterite: *Acacia effusifolia* low open forest over *Acacia incurvaneaura, Eremophila forrestii* subsp. *forrestii* over *Hibbertia arcuata and Prostanthera althoferi* subsp. *althoferi and* scattered mixed shrubs and herbs on laterite hills.
- *Acacia* shrubland (adjacent to fire scar): *Acacia effusifolia* low open shrubland over scattered mixed shrubs and herbs on flats
- *Allocasuarina* over *Calytrix* shrubland (not in survey area): *Allocasuarina acutivalvis* subsp. *acutivalvis* and *Acacia incurvaneura* low woodland/tall shrubland over *Acacia balsamea*, *Philotheca brucei* subsp. *brucei* open shrubland over scattered mixed shrubs and herbs in minor drainage lines and Laterite breakaways
- Mulga over *Eremophila forrestii* subsp. *forrestii* on hills and ridges: *Acacia incurvaneura* woodland over *Eremophila forrestii* subsp. *forrestii* shrubland over scattered mixed low shrubs and herbs on undulating hills and ridges
- Mulga over *Prostanthera althoferi* subsp. *althoferi* on hills and ridges: *Acacia incurvaneura* shrubland to tall open scrub over *Prostanthera althoferi* subsp. *althoferi* shrubland over scattered mixed shrubs and herbs on hills and ridges
- Mulga over *Philotheca brucei* subsp. *brucei* on hills and ridges: *Acacia incurvaneura* with *Acacia quadrimarginea* tall shrubland/ low woodland over *Philotheca brucei* subsp. *brucei* with *Acacia balsamea shrubland* over *Eremophila latrobei* subsp. *latrobei* and *Hibbertia exasperata* over mixed herbs and shrubs on hills and ridges
- *Mulga over Eremophila forrestii* subsp. *forrestii* on flats: *Acacia incurvaneura* with *Acacia mulganeura* tall shrubland over *Eremophila forrestii* subsp. *forrestii and Acacia effusifolia* low shrubland over *Waitzia acuminata* and mixed herbs on flat plains
- *Acacia burkittii* shrubland within drainage lines: *Acacia burkittii* and *Acacia quadrimarginea* tall shrubland over *Senna artemisioides* subsp. *artemisioides* over *Ptilotus obovatus* and mixed shrubs within drainage lines
- *Acacia cockertoniana* over *Eremophila oldfieldii* and *Eremophila pantonii* on flats: *Acacia cockertoniana* tall shrubland over *Eremophila oldfieldii* subsp. *angustifolia* over *Eremophila pantonii* and mixed shrubs on flats.

A total of 97 vascular plant taxa from 59 plant genera and 31 plant families were recorded within the survey area (NVS 2012). The majority of taxa were recorded within the Fabaceae with 16 species from two genera, dominated by *Acacia,* followed by Asteraceae with 12 species from ten genera. No introduced weed species were recorded.

No plant taxa located in the survey area are gazetted as Declared Rare Flora (DRF) pursuant to subsection 2 of section 23F of the WCA 1950 or listed as Threatened pursuant to Schedule 1 of the EPBC Act (1999). Only one Priority species (*Calotis* sp. Perinvale Range) (Priority 3) was recorded from one location within the survey area (NVS 2012). This population was located on the western edge of the survey area is an area of Banded Ironstone Formation (BIF).

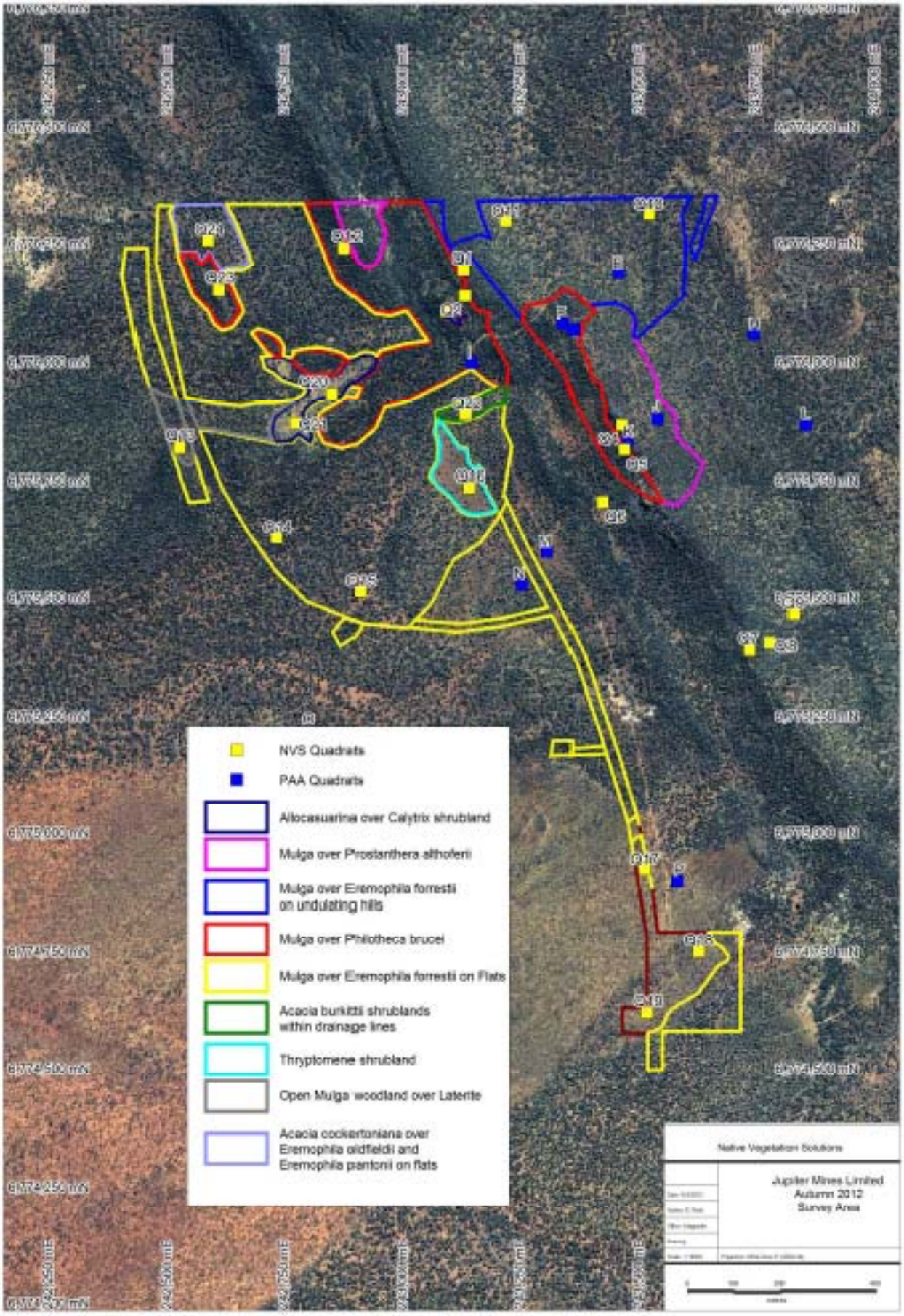

Figure 7 - Vegetation communities identified in Mt Mason Project area
after NVS (2012)

No Threatened Ecological Communities (TECs) are located in the Mt Mason area. However, the area surveyed lies within the buffer zone of a Priority Ecological Community (PEC) namely the Bulga Downs / Perinvale / Walling vegetation complex (NVS 2012). This community has not yet been described by the DEC on the list of PECs. However, it is inferred that the PEC relates to the vegetation specifically occurring on the BIF (NVS 2012).

2.3.1 Trapping site selection

Trapping site selection was undertaken prior to the receipt of the most recent flora survey and its delineation and description of vegetation communities. However, referring to previous vegetation descriptions (OES 2010), an attempt was made to sample fauna in representative vegetation communities within the area proposed for disturbance, and replicate these within the major vegetation groups where possible.

From a faunal perspective, the majority of the vegetation comprises Mulga shrubland with varied understorey and small pockets of other vegetation communities. It is also noted that a wildfire had gone through the southwestern portion of the tenement in 2006-2007 (Ian Ridley *pers. comm.* 2012).

Thus, five 'conventional' trapping grids (Sites 1 to 5) were established in Mulga shrubland within areas proposed for disturbance in the Mt Mason area (Figure 8). Site 2 was established within the fire scar that supported good regeneration. In addition, in areas of BIF which were not conducive to digging in of pitfall traps but were likely to be disturbed for mining operations, five small satellite trapping sites were established (Sites 6 to 10) (Figure 8, Plates 1 to 10). Thus, it is noted that the inability to dig pit traps into the unyielding BIF, with restricted vehicular access, was considered a limitation in terms of optimal trapping opportunities.

In accordance with the Keighery (1994) vegetation condition scales (Appendix A), and as determined by NVS (2012), the overall condition of the vegetation within the survey area can generally be described as "Very Good" to "Excellent". Almost all disturbances within the area were directly related to recent exploration activity and associated tracks. While every attempt was made to locate sampling sites in areas of least disturbance, access and practicality resulted in most sites being within close proximity to vehicular tracks or existing disturbance.

Table 3 lists the ten sampling areas and their respective vegetation associations and Plates 1 to 10 provide photographic representation of the trapping areas.

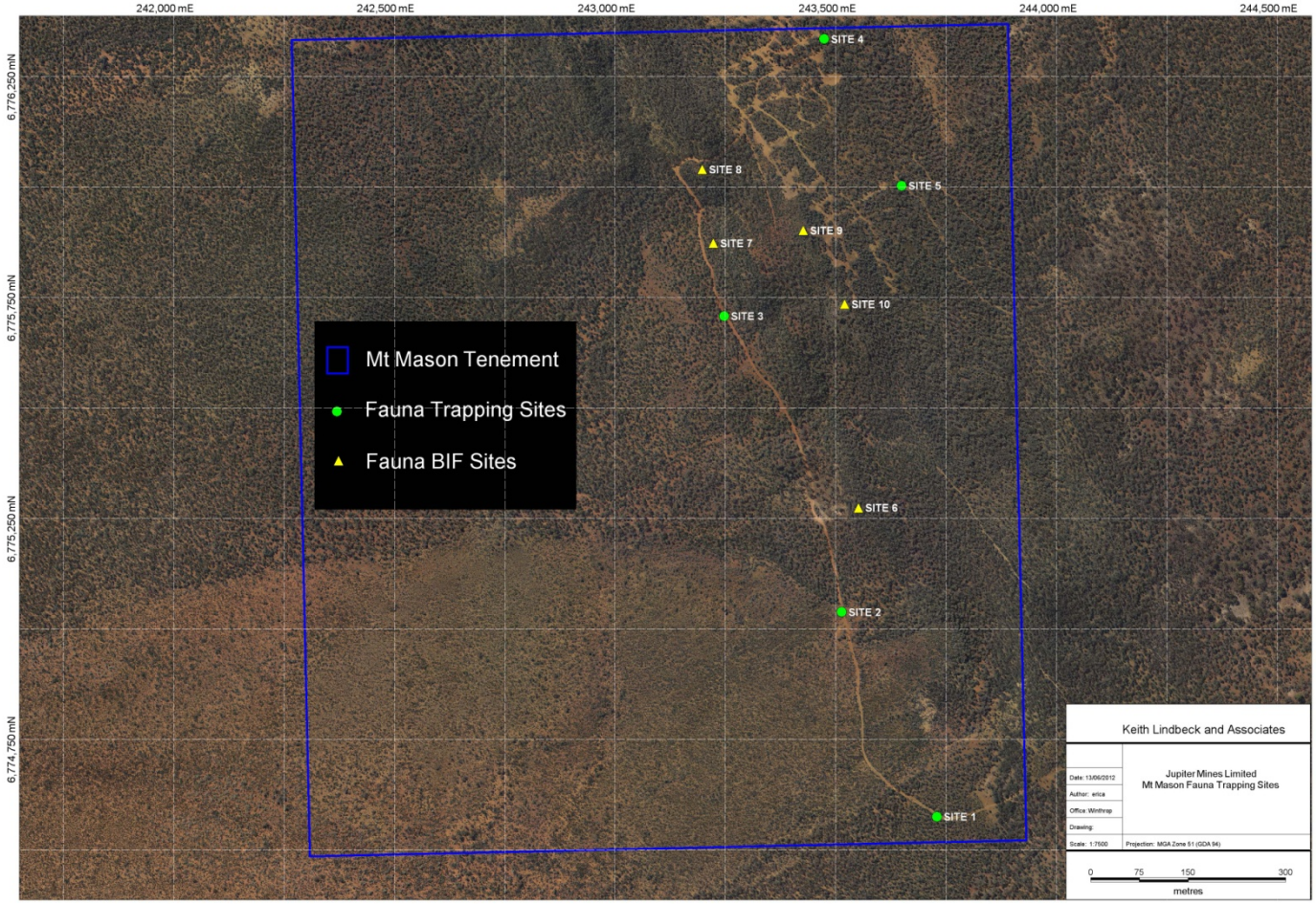

Figure 8 - Locations of trapping sites

Table 3 - Site numbers and their associated vegetation descriptions
(in accordance with NVS (2012))

Site	Vegetation description
1	Mulga over *Eremophila forrestii* on Flats
2	*Acacia* shrubland (fire scar)
3	Mulga over *Eremophila forrestii*
4	Mulga over *Eremophila forrestii* on undulating hills
5	Mulga over *Eremophila forrestii* on undulating hills
6	Mulga over *Eremophila forrestii*
7	Mulga over *Eremophila forrestii*
8	Mulga over *Philotheca brucei*
9	Mulga over *Prostanthera althoferi*
10	Mulga over *Philotheca brucei*

Plate 1 - Site 1 Mulga over *Eremophila forrestii* on Flats

Plate 2 - Site 2 *Acacia* shrubland (fire scar)

Plate 3 - Site 3 Mulga over *Eremophila forrestii*

Plate 4 - Site 4 Mulga over *Eremophila forrestii* on undulating hills

Plate 5 - Site 5 Mulga over *Eremophila forrestii* on undulating hills

Plate 6 - Site 6 Mulga over *Eremophila forrestii* associated with BIF

Plate 7 - Site 7 Mulga over *Eremophila forrestii* associated with BIF

Plate 8 - Site 8 Mulga over *Philotheca brucei* associated with BIF

Plate 9 - Site 9 Mulga over *Prostanthera althoferi* associated with BIF

Plate 10 - Site 10 Mulga over *Philotheca brucei* associated with BIF

3.0 LITERATURE REVIEW

The CYIP – Mt Mason Project area is located on a pastoral lease and is surrounded by other pastoral leases and exploration and mining operations. In addition to the Level 1 desktop fauna assessment of the Mt Mason area (OES 2007), the results of a Level 2 survey conducted at Mt Ida in Spring 2011 and Autumn 2012 have been included for comparative purposes (KLA 2012 *in prep*).

Previous vertebrate surveys have also been completed regionally as part of environmental impact assessments of operational mines and exploration projects. With reference to the Mt Mason Project area, these include fauna surveys conducted within:

- the Barlee-Menzies study area by the Biological Surveys Committee (Burbidge *et al.* 1995) and,
- Snark Project – Lake Giles Project (KLA 2011).

The locations of these studies and their descriptions are briefly summarised in Table 4. Fauna recorded from these surveys are included in Appendix B and comparisons are discussed in each section (Section 5).

Table 4 - Previous studies in and around the Mt Mason survey area

Citation	Title	Description of Study	Approximate distance from Mt Mason project area	Survey Effort
Burbidge *et al*. (1995)	The Biological Survey of the Eastern Goldfields Part 12: Barlee -Menzies Study Area	Inventory of vegetation, flora and fauna of study area prepared by the Biological Surveys Committee	Mt Manning Nature Reserve: ~95 km to southwest and Mt Elvrie: ~80 km to southwest	Sites and Quadrats with trapping, bird census and opportunistic sightings over three survey periods: Winter 1979, Spring 1980 and Late Summer 1981.
OES (2007)	Mt Mason Project. Desktop Study: Terrestrial Vertebrate Fauna	Desktop study only	Mt Mason tenement: 'EL 29/495'	Desktop assessment of fauna
KLA (2011)	Snark Project Fauna Assessment	Vertebrate fauna survey of the Snark deposit area	~80 km southwest	Level 2 autumn survey 2011
KLA (2012 *in prep*)	Jupiter Mines Limited. Central Yilgarn Iron Project (CYIP) Mt Ida: Fauna Assessment	Vertebrate and invertebrate terrestrial fauna surveys in the Mt Ida area	~10 km south of Mt Mason	Formal trapping, bird census, bat census, opportunistic recordings during spring 2011 and Autumn 2012.

4.0 SURVEY METHODOLOGY

4.1 DATABASE SEARCHES

The online EPBC Protected Matters Search Tool was used to determine any species listed under the EPBC Act 1999 for the area.

A search was commissioned of the Threatened and Priority Fauna Database held by the DEC as recognised under the Western Australian *Wildlife Conservation Act* (WCA) 1950 and considered by the DEC as species of conservation significance.

DEC's *NatureMap* was searched for records of fauna specimens vouchered at the Western Australian Museum and the Birds Australia Atlas Database was searched for bird species listed within the survey area.

A search was commissioned of the Western Australian Museum invertebrate database.

A species search was conducted of the International Union for Conservation of Nature (IUCN) database (IUCN 2001).

Categories and descriptions of the conservation status of fauna species are provided in Appendix C and the results of the databases searches are shown in Appendix B.

4.2 SURVEY TIMING

EPA Guidance Statement No. 56 states that the most important seasonal activity times for many faunal groups are related to rainfall and temperature (EPA 2004). A survey in the season that follows the season of maximum rainfall is generally the most productive and important survey time. Therefore, and conventionally, fauna surveys are conducted bi-seasonally in spring and autumn.

The climate in the Mt Mason region is generally described as semi-arid (Beard 1990). Rainfall is approximately 250 mm per annum and mostly falls between January and June (Section 2.1). Rainfall preceding both the spring and autumn surveys does not conform to long-term averages, with some below-average recordings and others above average. In 2011 seven out of 12 months received more than average rainfall and in the first few months of 2012 more than average rainfall was recorded for January and March. The timing of the surveys, therefore, was optimal inasmuch as more than average rainfall was recorded in the months immediately prior to the surveys: for the spring survey June recorded 57 mm (mean = 25.1 mm) and July recorded 34.8 mm (mean = 19.0 mm) and for the autumn survey January recorded 84.2 mm (mean = 24.6 mm) and March recorded 68.2 mm (mean = 28.8 mm).

Each survey was conducted over a ten day period with the spring fauna survey extending from 27 August to 3 September 2011 and the autumn survey from 1 March to 7 March 2012.

4.3 FAUNA SAMPLING

As per the recommendations of the EPA (2004) and EPA and DEC (2010), the nomenclature and taxonomic order presented in this report are based on the Western Australian Museum's *Checklist of the Vertebrates of Western Australia* for herpetofauna and mammals and Christidis and Boles (2008) for avifauna. The authorities used for herpetofauna are Doughty and Maryan (2010) and for mammals How *et al*. (2010).

KLA acknowledges that the taxonomy of Western Australia vertebrates is continually being revised and the taxonomy of some of the species listed in the document might have changed since the publication of this report.

4.3.1 Reconnaissance survey

In accordance with EPA Position Statement No. 3 (EPA 2004), a site visit by qualified personnel must be undertaken to satisfy the requirement of a reconnaissance survey prior to the on-site comprehensive trapping program. A reconnaissance survey was conducted by Dr Vi Saffer and Erica MacIntyre, both of KLA, to delineate key fauna values, to determine fauna habitat types and to determine trapping site locations.

Seven species of birds were identified during the reconnaissance survey and are listed in Appendix B.

4.3.2 Systematic censuring

The extensive diversity of Australia's terrestrial habitats is such that no single approach accurately samples all species within a community (Garden *et al.* 2007). It is acknowledged that surveys aimed at detecting multiple species must employ a suitable combination of survey methods (Garden *et al.* 2007).

In order to maximise the capture rate of diverse faunal species, systematic fauna sampling was undertaken using five trapping techniques:

- Pitfall traps (20 L buckets buried in the ground with the rims flush with the ground surface),
- Funnel traps,
- Elliot-type aluminium box traps (8cm x 9 cm x 32 cm),
- Medium and large cage traps, and
- Anabat detectors which detect and record ultrasonic echolocation calls emitted during bat flight (Section 4.3.4).

The systematic fauna sampling consisted of five trapping grids (Sites 1 to 5) and an additional five smaller satellite sites (Sites 6 to 10) located across the Mt Mason Project area (Figure 8). The additional smaller sites were located within areas of BIF where the use of conventional trapping grids was not achievable.

Trapping grids conventionally comprised 20 x 20L buckets, 20 funnel traps, 16 aluminium box traps and four large cage traps all approximately 25 m apart (Figure 9 and Figure 10). This pattern was achieved for four of the five trapping grid sites. However, due to the presence of disturbance from exploration and associated access tracks, the configuration of trap installation differed for Site 4. In this instance, two parallel lines of 10 trapping units 25 m apart was installed (Figure 11). A 6m x 30cm drift line fence was extended over all buckets at all sites to increase the efficacy of the pitfall traps.

During the spring survey, five smaller sites (Sites 6 to 10) consisted of one pair of traps at each site with two sites having two pairs (Site 6 and Site 9). Each pair comprised an aluminium box trap and a medium cage trap. However, during the autumn survey, Sites 6 to 10 each had three sets of traps with each set comprising an aluminium box trap, a funnel trap and a medium cage trap. The aim of these additional traps was to increase the trapping potential in areas of BIF.

In general, seven nights is the recommended effort for any particular sampling period when undertaking general inventory surveys (Moseby and Read 2001 cited in EPA and DEC 2010). All traps in the trapping grids were open for seven consecutive nights, overlapping for seven nights. The overall trapping effort is shown in Table 5 and Table 6.

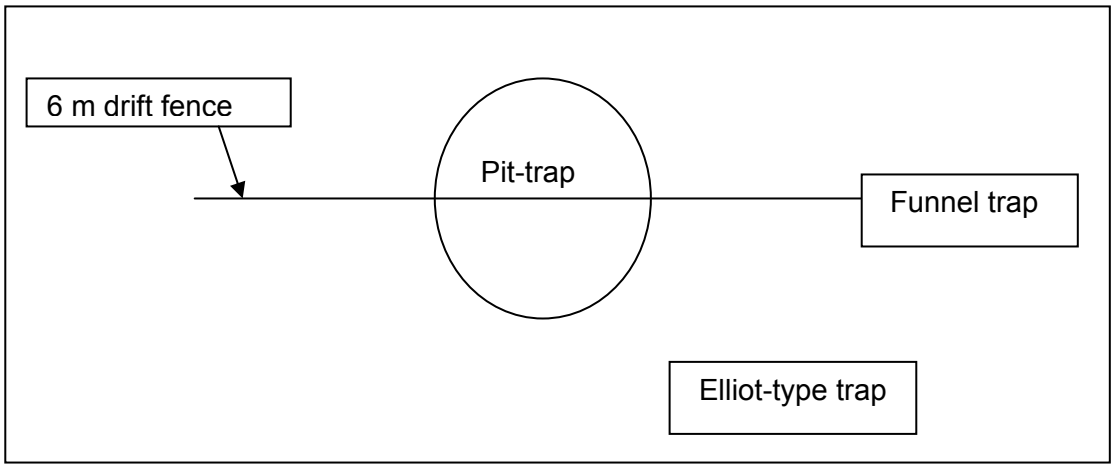

Figure 9 - Schematic diagram of trapping unit

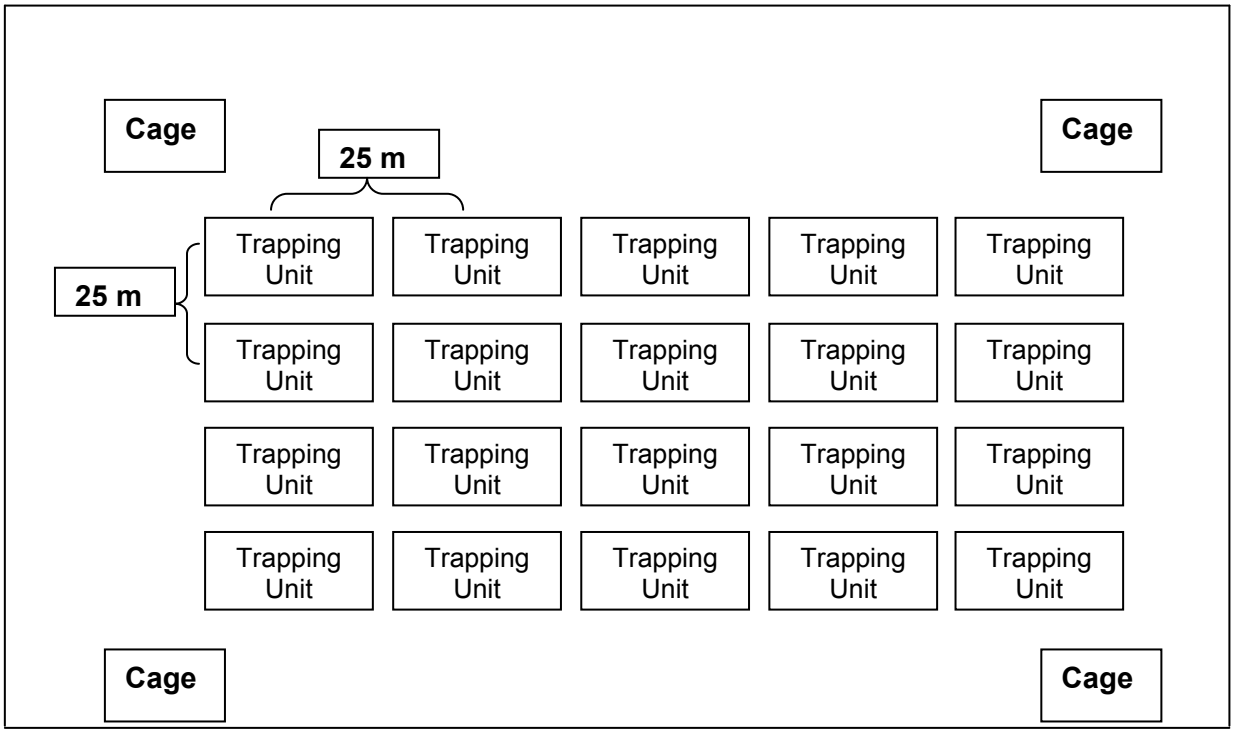

Figure 10 - Schematic diagram of trapping unit configuration for Sites 1, 2, 3 and 5

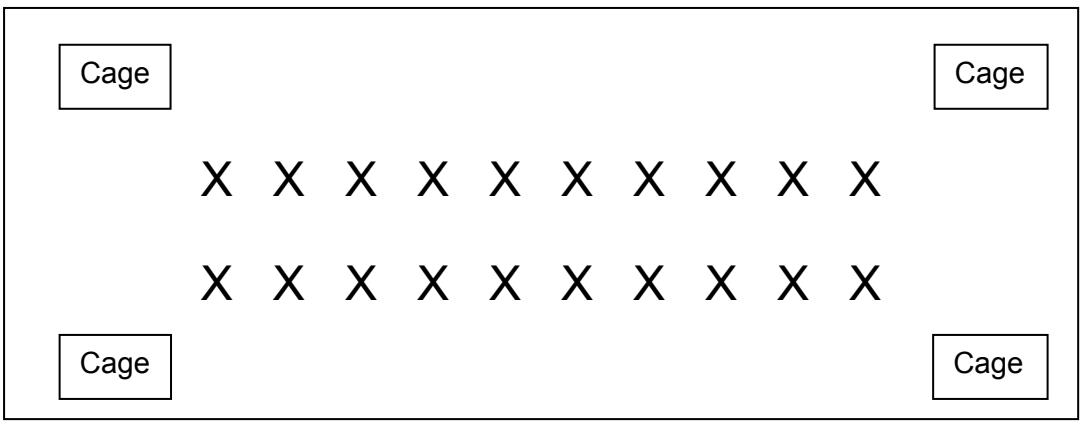

Figure 11 - Schematic diagram of trapping unit configuration for Site 4

Table 5 - Trapping grid locations and trapping effort for the Spring 2011Survey

Spring Survey (August-September 2011)					
Site	Location	Trap type	Date opened	Date closed	Total trapping effort
Site 1:	29°07'53.4"S	Pit	27-Aug	3-Sep	140
	120°21'57.7"E	Funnel	27-Aug	3-Sep	140
		Aluminium box	27-Aug	3-Sep	112
		Cage (large)	27-Aug	3-Sep	28
Site 2:	29°07'38.2"S	Pit	27-Aug	3-Sep	140
	120°21'50.1"E	Funnel	27-Aug	3-Sep	140
		Aluminium box	27-Aug	3-Sep	112
		Cage (large)	27-Aug	3-Sep	28
Site 3:	29°07'16.3"S	Pit	27-Aug	3-Sep	140
	120°21'40.9"E	Funnel	27-Aug	3-Sep	140
		Aluminium box	27-Aug	3-Sep	112
		Cage (large)	27-Aug	3-Sep	28
Site 4:	29°06'54"S	Pit	27-Aug	3-Sep	140
	120°21'46.08"E	Funnel	27-Aug	3-Sep	140
		Aluminium box	27-Aug	3-Sep	112
		Cage (large)	27-Aug	3-Sep	28
Site 5:	29°07'07.0"S	Pit	27-Aug	3-Sep	140
	120°21'55.9"E	Funnel	27-Aug	3-Sep	140
		Aluminium box	27-Aug	3-Sep	112
		Cage (large)	27-Aug	3-Sep	28
				Sub-total	**2100**

Site	Location	Trap type	Date opened	Date closed	Total trapping effort
Site 6	29°07'30.6"S	Aluminium box	27-Aug	3-Sep	14
	120°21'51.7"E	Cage (medium)	27-Aug	3-Sep	14
Site 7	29°07'10.9"S	Aluminium box	27-Aug	3-Sep	7
	120°21'40.1"E	Cage (medium)	27-Aug	3-Sep	7
Site 8	29°07'05.5"S	Aluminium box	27-Aug	3-Sep	7
	120°21'39.3"E	Cage (medium)	27-Aug	3-Sep	7
Site 9	29°07'10.1"S	Aluminium box	27-Aug	3-Sep	14
	120°21'47.6"E	Cage (medium)	27-Aug	3-Sep	14
Site 10	29°07'15.6"S	Aluminium box	27-Aug	3-Sep	7
	120°21'50.9"E	Cage (medium)	27-Aug	3-Sep	7
				Sub-total	**98**
				GRAND TOTAL	**2198**

Table 6 - Trapping grid locations and trapping effort for the Autumn 2012 Survey

Autumn Survey (March 2012)					
Site	**Location**	**Trap type**	**Date opened**	**Date closed**	**Total trapping effort**
Site 1:	29°07'53.4"S	Pit	1-Mar	7-Mar	140
	120°21'57.7"E	Funnel	1-Mar	7-Mar	140
		Aluminium box	1-Mar	7-Mar	112
		Cage (large)	1-Mar	7-Mar	28
Site 2:	29°07'38.2"S	Pit	1-Mar	7-Mar	140
	120°21'50.1"E	Funnel	1-Mar	7-Mar	140
		Aluminium box	1-Mar	7-Mar	112
		Cage (large)	1-Mar	7-Mar	28
Site 3:	29°07'16.3"S	Pit	1-Mar	7-Mar	140
	120°21'40.9"E	Funnel	1-Mar	7-Mar	140
		Aluminium box	1-Mar	7-Mar	112
		Cage (large)	1-Mar	7-Mar	28
Site 4:	29°06'56.1"S	Pit	1-Mar	7-Mar	140
	120°21'49.7"E	Funnel	1-Mar	7-Mar	140
		Aluminium box	1-Mar	7-Mar	112
		Cage (large)	1-Mar	7-Mar	28
Site 5:	29°07'07.0"S	Pit	1-Mar	7-Mar	140
	120°21'55.9"E	Funnel	1-Mar	7-Mar	140
		Aluminium box	1-Mar	7-Mar	112
		Cage (large)	1-Mar	7-Mar	28
				Sub-total	**2100**

Site	Location	Trap type	Date opened	Date closed	Total trapping effort
Site 6	29°07'30.6"S	Aluminium box	1-Mar	7-Mar	21
	120°21'51.7"E	Cage (medium)	1-Mar	7-Mar	21
		Funnel	1-Mar	7-Mar	21
Site 7	29°07'10.9"S	Aluminium box	1-Mar	7-Mar	21
	120°21'40.1"E	Cage (medium)	1-Mar	7-Mar	21
		Funnel	1-Mar	7-Mar	21
Site 8	29°07'05.5"S	Aluminium box	1-Mar	7-Mar	21
	120°21'39.3"E	Cage (medium)	1-Mar	7-Mar	21
		Funnel	1-Mar	7-Mar	21
Site 9	29°07'10.1"S	Aluminium box	1-Mar	7-Mar	21
	120°21'47.6"E	Cage (medium)	1-Mar	7-Mar	21
		Funnel	1-Mar	7-Mar	21
Site 10	29°07'15.6"S	Aluminium box	1-Mar	7-Mar	21
	120°21'50.9"E	Cage (medium)	1-Mar	7-Mar	21
		Funnel	1-Mar	7-Mar	21
				Sub-total	**315**
				GRAND TOTAL	**2415**

All traps were checked as soon after sunrise as possible each morning. Each mammal captured had a small amount of fur cut on its right rump so that it could be identified if captured a second time. For second time captures a small amount of fur was cut on the left rump for further identification. Universal bait was placed in all aluminium box traps and cage traps and renewed at least once during each seven-day survey, and when required.

In addition to the above trapping techniques, two Bushnell Trophy Cam™ Remote Cameras were deployed with each camera left *in* situ at each site for 24 hours on a rotational basis (Table 7 and Table 8). One camera was also left at the active Malleefowl mound 1.7 km south of the Mt Mason tenement boundary (Figure 8). At each of the trapping grids, the cameras were secured just above ground level to a star picket and in the BIF areas, the cameras were strategically positioned using rocks to stabilise the units. The cameras were operated in accordance with the DEC's Standard Operating Procedure for *Remote operation of cameras* (DEC 2011).

Opportunistic observations were also carried out when inspecting traps on site, when travelling between sites and when conducting bird surveys in the area.

Table 7 - Dates and Sites of remote camera placement during the Spring 2011 survey

Site	Unit 1	Unit 2
1	1-Sep	
2	28-Aug	
3	30-Aug	
4	29-Aug	
5	31-Aug	
6		1-Sep
7		29-Aug
8		28-Aug
9		30-Aug
10		31-Aug

Table 8 - Dates and Sites of remote camera placement during the Autumn 2012 survey

Site	Unit 1	Unit 2
1	3-Mar	
1	5-Mar	
2	4-Mar	
3	29-Feb	
4	1-Mar	
5	2-Mar	
6		3-Mar
7		2-Mar
8		4-Mar
9		29-Feb
10		6-Mar
MFM*	6-Mar	

* Malleefowl Mound

Hand-foraging for reptiles was conducted opportunistically and during spot-lighting forays and included turning over rocks and logs, peeling off bark, *etc.*

4.3.3 Birds surveying

Surveying of birds was carried out using a combination of techniques including:

- Four, 20 minute, 2 ha surveys at each of the five trapping grid sites in accordance with Atlas Search Methods for the Atlas of Australian Birds. Censuses were commenced as soon after sunrise as practicable and commencement was rotated through the sites to reduce time of day bias where practicable (Table 9, Table 10).
- Opportunistic observations when inspecting traps on site, when travelling between sites and in the area, and when conducting other surveys in the region.

Table 9 - Dates and times of systematic bird censuses commenced at each site during the Spring 2011 survey

Date:	29-Aug	30-Aug	31-Aug	1-Sep	2-Sep	ToTtal (mins)
Site	Time commenced (hrs)*					
1	800	920	1020		700	80
2	830	850		655	730	80
3	920	700	740	810		80
4		705	800	850	855	80
5	645	740	910	925		80
Total						**400**

* Censuses continued for 20 minutes at each site.

Table 10 - Dates and times of systematic bird censuses commenced at each site during the Autumn 2012 survey

Autumn AM 2012*							
Date:	1-Mar	2-Mar	3-Mar	4-Mar	5-Mar	6-Mar	Total (mins)
Site	Time commenced (hrs)*						
1		1015		615	735	820	80
2	930		620	705	815		80
3	830	625	710		910		80
4	625	740	800	900			80
5	715	850	845		645		80
Total							**400**

4.3.4 Bat surveying

Bat echolocation calls were recorded using Anabat SD1 detectors, which detect and record ultrasonic echolocation calls emitted during bat flight. Two Anabat detectors were used and were positioned on the ground in each trapping grid site before sunset and retrieved the following morning. Table 11 and Table 12 list the dates that bat recordings were taken at each site during the Spring and Autumn surveys respectively.

The calls were stored on a compact flash card, downloaded and sequences were examined using AnalookW software. The frequency division ratio was set to a factor of eight. Three call variables were measured on good quality search phase pulses in representative call sequences: pulse duration (milliseconds), maximum frequency (kHz) and characteristic frequency (kHz). Species were identified based on information in McKenzie and Muir (2000) and Pennay *et al*. (2004) cited in Armstrong and Konishi (2011, 2012). Details supporting the identifications are provided, as recommended by the Australasian Bat Society (2006).

Table 11 - Dates bat calls were recorded at each site during the Spring 2011 survey

Site	Unit 1	Unit 2
1	28-Aug	1-Sep
2	29-Aug	28-Aug
3	30-Aug	29-Aug
4	31-Aug	30-Aug
5	1-Sep	31-Aug

Table 12 - Dates bat calls were recorded at each site during the Autumn 2012 survey

Site	Unit 1	Unit 2
1	4-Mar	3-Mar
2	2-Mar	4-Mar
3	3-Mar	29-Feb
4	29-Feb	1-Mar
5	1-Mar	2-Mar

4.3.5 Spotlighting survey

Spotlighting was conducted on three evenings during each of the seasonal surveys. A total of 15 hours and 30 minutes was spent spotlighting during the Spring 2011 survey (Table 13) and 11 hours and 30 minutes during the Autumn 2012 survey (Table 14).

Spotlighting was conducted from a slow-moving vehicle (less than 10 km/hr) using high-powered hand-held spotlights and commenced at least one hour after sunset. In addition, spotlighting forays with head-torches were conducted twice on foot for approximately 15 minutes each during all spotlighting evenings. A 390nm Ultraviolet Lantern was also used to detect and collect scorpions that fluoresce under UV light (Section 4.3.6). Spotlighting was conducted immediately adjacent to and within 10 km of all sites.

Table 13 - Dates and duration of spotlighting forays, including numbers of personnel involved, during the Spring 2011 survey

Date	Time commenced (hrs)	Duration	Number of observers, including driver	Total (hrs)
28-Aug	1920	1 hr 45 min	3	4 hr 35 min
30-Aug	1915	2 hr 15 min	3	6 hr 45 min
1-Sep	1930	1 hr 50 min	3	4 hr 50 min
TOTAL				**15 hr 30 min**

Table 14 - Dates and duration of spotlighting forays, including numbers of personnel involved, during the Autumn 2012 survey

Date	Time commenced (hrs)	Duration	Number of observers, including driver	Total (hrs)
1-Mar	1940	2hr 5 min	2	4 hr 10 min
3-Mar	1925	2hr 5 min	2	4 hr 10 min
5-Mar	1925	1 hr 35 min	2	3 hr 10 min
TOTAL				**11 hr 30 min**

4.3.6 Invertebrate sampling

In addition to vertebrate sampling, targeted searches were conducted for SRE's during the Spring 2011 survey.

Invertebrate groups targeted during the survey were those considered most likely to potentially contain SRE taxa including:

- Mygalomorphae (trapdoor spiders);
- Diplopoda (millipedes);
- Pseudoscorpionida (pseudoscorpions)
- Scorpiones (scorpions); and
- Pulmonata (land snails).

In accordance with generic advice from the Office of the EPA, 10 m x 10 m quadrats were established in selected habitats and up to one hour was spent searching for invertebrates in each of these quadrats. Searches included under rocks, under bark, under logs, in hollows of logs and in other leaf litter and debris lying on the ground. At each of the trapping grids, a quadrat was established within the trapping area and outside of the trapping area and one quadrat was searched at each of the BIF sites (Figure 12).

Only one of each trapdoor species type was excavated and sent to the Western Australian Museum for identification. Once excavated, the spiders were placed in a freezer for approximately 10 minutes to sedate them. They were then placed in cold 100% Ethanol to narcotise them before the third left leg was removed and placed in a separated vial of 100% ethanol, in accordance with Western Australian Museum guidelines.

In addition to the above searches, a collection of leaf litter and soils was collected from each quadrat and transferred back to Perth for examination. Collections were made from shadowed moist areas, for example, from the south eastern aspect of the bases of tree trunks, large rocks or overhanging rocks etc. Large particles were removed and the remaining collection was examined under a 10X20 Dissecting Microscope. All invertebrate fauna or parts thereof were collected and preserved in accordance with the Western Australian Museum guidelines and sent to appropriate specialists at the Museum for identification.

Searches were also conducted for invertebrates during the spotlighting surveys (Section 4.3.5). In addition to generally searching for SRE's during spotlighting forays, a 390nm Ultraviolet Lantern was used to detect and collect scorpions that fluoresce under UV light.

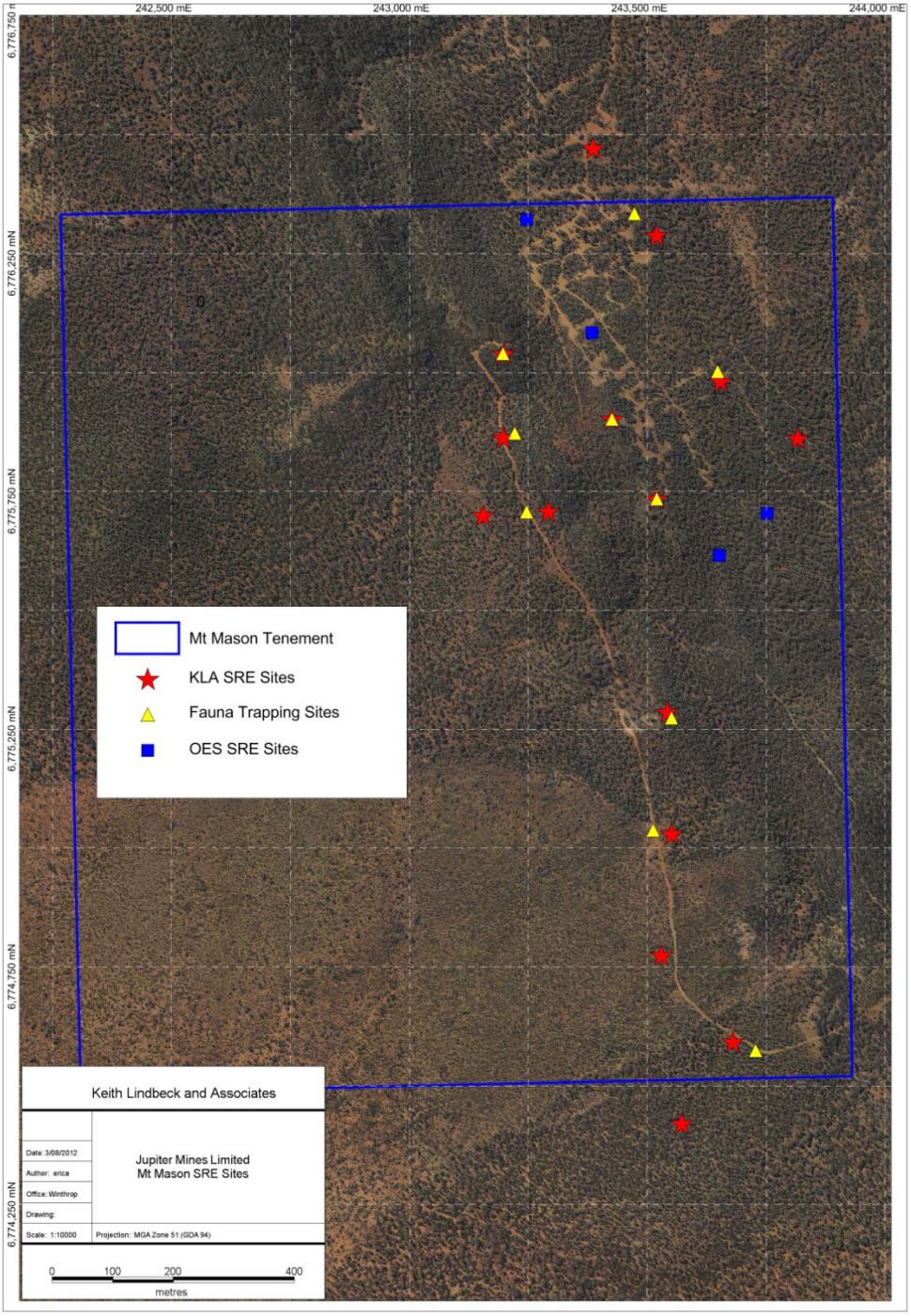

Figure 12 - Location of invertebrate survey sites at Mt Mason

While a targeted SRE survey was only conducted during the Spring survey, all opportunistic sightings and captures of invertebrates in other trapping equipment were collected during the Autumn survey. In addition, searches were also conducted during spotlighting forays and with the use of the Ultraviolet Light during the Autumn surveys.

4.4 FAUNA SURVEY TEAM

The team assisting with the establishment of the trapping grids and conducting the Spring 2011 survey comprised Dr Vi Saffer, Erica MacIntyre and Hamish Burnett from KLA. Mark Peddey from Orbit Drilling assisted with the mechanical digging of the holes for the pit traps and Cliff Ashwin, Gerard Ashwin and David Kirk of the Wutha Aboriginal Community assisted with the installation of the trapping equipment.

For the Autumn 2012 survey, Dr Vi Saffer and Erica MacIntyre from KLA conducted the survey. Adele Bonney, Guy Evans and Stephen Carr assisted with the installation of the trapping gear and Andrew Laurens and Caleb Sceghi assisted with the demobilisation of the trapping gear.

A "LICENCE TO TAKE FAUNA FOR SCIENTIFIC PURPOSES" was issued to Dr Vi Saffer as an instrument under Regulation 17 of the WCA 1950 to undertake these surveys (Appendix D). The licence number for the Spring 2011 survey was SF008183 and the authorised persons associated with that licence included Erica MacIntyre and Hamish Burnett. For the Autumn 2012 survey, the Licence number was SF008484 and the authorised persons associated with that licence included Erica MacIntyre, Dr Ronald Snook and Dr Wesley Bancroft.

Analysis of bat recordings was completed by Dr Kyle Armstrong and Yuki Konishi of 'Specialised Zoological'.

4.5 SURVEY LIMITATIONS

Not all areas of the Mt Mason Project region were ground-truthed or sampled equally for fauna. Vehicular access, road conditions and rocky terrain prevented sampling in the centre of all associations, and regular checking of fauna traps in these areas would, therefore, not have been possible. Notwithstanding this, five trapping grids were located within representative vegetation communities in the study area in addition to five sites that were located on the BIF ridges.

As indicated above, not all sites could accommodate the same trapping grid pattern. Where buckets could not be installed, other grid patterns and trapping techniques (funnels and medium-sized cages) were used so that the overall trapping effort was not compromised.

Trapping sites were selected based on information provided to KLA at the time of commissioning and in relation to the proposed footprint of disturbance. Since that time, the zone of impact has changed. Notwithstanding this, trapping was conducted along the length of the tenement in representative vegetation associations.

Other limitations are included in the relevant sections.

5.0 VETEBRATE FAUNA INVENTORY

5.1 OVERVIEW OF VERTEBRATE FAUNA OF THE SURVEY AREA

Overall, 130 individuals from 19 non-volant terrestrial species representing seven Families were captured during the systematic sampling during the Spring 2011 and Autumn 2012 surveys. Of the bird species, a total of 507 individuals representing 16 Families and 34 species were recorded over both seasonal surveys (Appendix B).

Figure 13 provides a visual representation of the number of species recorded from each major vertebrate group during the Spring 2011 and Autumn 2012 systematic surveys and Table 15 provides a summary of the number of taxa recorded for each of the five trapping grid sites and five additional sites. A summary of all species known and likely to be present in the survey areas is provided in Appendix B. This includes a summary of all the results of the database searches, all species recorded during regional surveys, all species recorded during the reconnaissance survey and all species recorded during the systematic sampling, opportunistic sightings and evidence, and spotlighting.

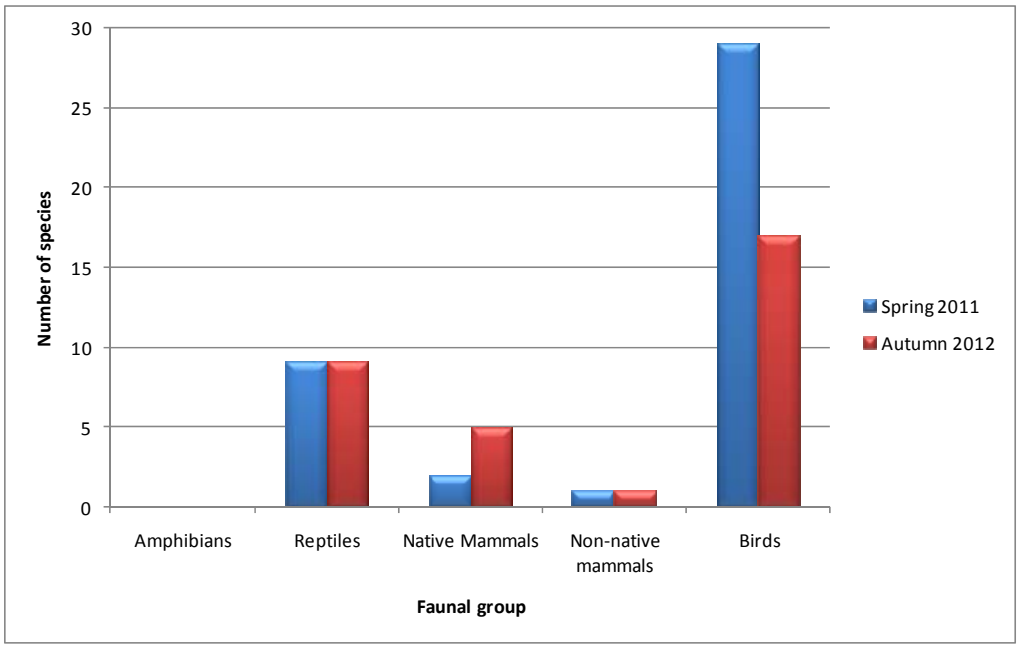

Figure 13 - Number of terrestrial vertebrate species recorded during the Spring 2011 and Autumn 2012 systematic surveys

Table 15 - Number of individual terrestrial vertebrate species recorded at each site during the Spring 2011 and Autumn 2012 systematic surveys

Faunal group	Site 1		Site 2		Site 3		Site 4		Site 5		Sub-total	
	Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn
Amphibians	0	0	0	0	0	0	0	0	0	0	0	0
Reptiles	2	5	4	13	4	8	5	4	7	5	22	35
Native mammals	1	8	1	1	1	5	1	5	3	1	7	20
Non-native mammals	0	4	0	2	0	2	7	16	2	8	9	32
Birds	62	35	44	24	65	65	89	35	47	41	307	200
Sub-total	**65**	**52**	**49**	**40**	**70**	**80**	**102**	**60**	**59**	**55**	**345**	**287**

Faunal group	Site 6		Site 7		Site 8		Site 9		Site 10		Sub-total		Grand Total	
	Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn
Amphibians	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reptiles	0	1	0	0	0	0	0	0	0	0	0	1	22	36
Native mammals	0	0	0	0	0	0	0	1	0	0	0	1	7	14
Non-native mammals	0	0	0	0	1	1	0	1	0	0	1	2	10	30
Birds	-	-	-	-	-	-	-	-	-	-	0	0	307	200
Sub-total	**0**	**1**	**0**	**0**	**1**	**1**	**0**	**2**	**0**	**0**	**1**	**4**	**346**	**280**

Grand Total	**65**	**53**	**49**	**40**	**71**	**81**	**102**	**62**	**59**	**55**

5.2 AMPHIBIANS

5.2.1 The assemblage

No frog species were captured or heard during either of the seasonal survey periods.

Searches were conducted in moister areas and opportunistically in small pools of transient standing water. However no adults or tadpoles were sighted and there was no evidence of used burrows.

5.2.2 Discussion

No amphibian species of conservation significance are listed for the area using the EPBC Protected Matters Search Tool or listed on the DEC Threatened and Priority Fauna Database.

The Mt Mason Project area has no natural water source areas or large granite outcrops that may support pockets of water. Any water on the ground as a result of episodic rainfall does not remain *in situ* for very long. The nearest lake, Lake Barlee, is approximately 60 km from the Mt Mason area and is an intermittent salt lake that fills about once in ten years after which the water persists for less than a year. Therefore, the habitat at Mt Mason and in the local area does not provide suitable habitat or conditions for most species of amphibians. Any frogs that may be in the area are likely to be burrowing species that have adapted to living in the drier conditions. These species are generally under-represented in field surveys. Burrowing species are only active following large rainfall events. Given the irregular and infrequent downpours in semi-arid and arid areas, it is not unreasonable that these frogs are not captured very often during terrestrial surveys. Testament to this scenario is the capture of one frog (*Neobatrachus sutor* Shoemaker Frog) following an above average rainfall event (25 mm on 3 October 2011) during a comprehensive Spring survey at Jupiter's Mt Ida deposit area approximately 10 km southwest, and the capture of ten frogs at the same site during an Autumn survey in March 2012 (KLA 2012 *in prep*). This latter survey was conducted one week after Cyclone Lua passed through the area resulting in a large regional rainfall event, in addition to a large rainfall event (20 mm) that occurred on site during the survey period. Eight of the ten frogs captured were *N. sutor* and the remaining two were *Pseudophryne occidentalis*, both of which are burrowing species.

That frogs are not captured very often during terrestrial surveys is exemplified by the results of regional surveys inasmuch as only two species were captured during the extensive Barlee-Menzies study (Burbidge *et al.* 1995) and none were recorded during the Lake Giles Project area study (KLA 2011).

5.3 REPTILES

5.3.1 The assemblage

Collectively, 13 species of reptiles were captured from all sites totalling 58 individuals representing five Families (Table 16 and Appendix B).

For the Spring 2011 survey, nine species of reptiles were captured totalling 22 individuals representing four Families (Table 16 and Appendix D). The reptiles captured comprised three dragon species (Agamidae), two diplodactylid species (Diplodactylidae), three species of skink (Scincidae), and one varanid (Varanidae).

The Scincidae Family had the highest number of captures (n = 10, 45%), followed by Agamidae (n = 8, 36%). Only three Diplodactylidae (n = 3, 14%) were captured and a single Varanidae (*Varanus caudolineatus*) (Plate 11) was captured at Site 1.

Plate 11 - *Varanus caudolineatus*

Within the Scincidae Family, more *Menetia greyii* were captured than the remaining two species and at only three of the ten sites with only one captured at Site 2, three at Site 4 and one at Site 5. Only one *Ctenotus schomburgkii* was captured at Site 2 and one at Site 3, and *Egernia depressa* (n = 2) was only captured at Site 5.

Within the Agamidae, four *Ctenophorus scutulatus* (Plate 12) were captured with two at Site 3 and one each at Site 4 and at Site 5. Of the two *Caimanops amphiboluroides* that were captured, one was captured at Site 3 and one at Site 5 and one *Pogona minor* was captured at Site 2 and one at Site 4.

Plate 12 - *Ctenophorus scutulatus*

Two *Diplodactylus pulcher* (Diplodactylidae) were captured with one at Site 2 and one at Site 5 and only one *Strophurus assimilis* was captured at Site 1.

Not one reptile was captured at any of the smaller satellite sites established in the areas of BIF.

For the Autumn 2012 survey, nine species of reptiles from four Families were also captured but totalling 36 individuals (Table 16 and Appendix B). However, the reptiles captured during this seasonal survey comprised two similar dragon species (Agamidae), two gecko species (Gekkonidae), three species of skink (Scincidae) of which only two were the same as those captured during the Spring survey, and one different varanid (Varanidae).

Of these species captured during the Autumn 2012 survey, once again the Scincidae Family had the highest number of captures (n = 14, 39%), followed by an equal number of Adamidae (n = 10, 28%) and Varanidae (n = 10, 28%). Only two Gekkonidae were captured representing 5% of all reptiles captured: while one species (*Gehyra variegata*) was captured at Site 5, one *Heteronotia bynoei* was the only taxa captured in one of smaller satellite sites (Site 6) positioned in the BIF.

Within the Scincidae Family, 12 of the 14 species captured were *Ctenotus leonardii* with eight captured at Site 2, two at Site 3 and one at each of Sites 1 and 4. The remaining two skinks (*Egernia depressa* and *Menetia greyii*) were captured at Site 5.

Nine of the ten Agamidae were *Ctenophorus scutulatus* with three captured at Site 2 and at Site 3, two at Site 4 and one at Site 1. The remaining specimen, *Caimanops amphiboluroides* (Plate 13), was captured at Site 3.

Plate 13 - *Caimanops amphiboluroides*

The Varanidae were represented more evenly between species with five *Varanus panoptes* and four *V. caudolineatus* captured. At least one and only up to two varanids were captured at each of the five trapping sites.

The largest number of reptiles captured during the Spring 2011 survey was at Site 5 (n = 7) followed by five at Site 4. The least number (n = 1) was captured at Site 2. For the Autumn 2012 survey, Site 2 recorded the most captures (n = 13) followed by eight at Site 3 and five each at Sites 1 and 5. Only one reptile (*Heteronotia bynoei*) was captured in

one of the smaller satellite sites (Site 6) located in the BIF. Collectively, more taxa were captured at Site 2 (n = 17) followed by 12 at both Sites 3 and 5. Nine were recorded at Site 4 with 7 at Site 1.

Collectively, pitfall traps with drift line fencing proved to be the most effective trapping apparatus for reptiles (n = 37, 64%) with 29% (n = 17) captured in funnel traps. Only four individuals were captured in cage traps (7%) and none were captured in the aluminium box traps.

Nine species of reptile were recorded opportunistically during the Spring 2011 survey and only two during the Autumn 2012 survey (Appendix B). The species recorded when temperatures were higher (Spring 2011) included two species of Agamidae (*Caimanops amphiboluroides* and *Pogona minor* (Plate 14)); three species of Scincidae (*Cryptoblepharus plagiocephalus*, *Egernia depressa* (one living and one carcass) and *Menetia greyii*), at least one species of varanidae (*Varanus panotes*) and unidentified varanid tracks and two identified Elapidae (*Pseudechis butleri* and *Pseudonaja nuchalis)* in addition to unidentified snake tracks.

Plate 14 - *Pogona minor*

Table 16 - Reptiles species recorded (including method) during the Spring 2011 and Autumn 2012 systematic surveys

Family	Species	Common Name	Site 1		Site 2		Site 3		Site 4		Site 5	
			Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn
Agamidae	*Caimanops amphiboluroides*	Mulga Dragon	0	0	0	0	1	1	0	0	1	0
	Ctenophorus scutulatus		0	1	0	3	2	3	1	2	1	0
	Pogona minor	Bearded Dragon	0	0	1	0	0	0	1	0	0	0
Diplodactylidae	*Diplodactylus pulcher*		0	0	1	0	0	0	0	0	1	0
	Strophurus assimilis	Goldfields Spiny-tailed Gecko	1	0	0	0	0	0	0	0	0	0
Gekkonidae	*Gehyra variegata*		0	0	0	0	0	0	0	0	0	1
	Heteronotia binoei	Bynoe's Gecko	0	0	0	0	0	0	0	0	0	0
Scincidae	*Ctenotus leonhardii*		0	1	0	8	0	2	0	1	0	0
	Ctenotus schomburgkii		0	0	1	0	1	0	0	0	0	0
	Egernia depressa	Spiny-tailed Skink	0	0	0	0	0	0	0	0	2	1
	Menetia greyii		0	0	1	0	0	0	3	0	2	1
Varanidae	*Varanus caudolineatus*		1	2	0	2	0	0	0	0	0	0
	Varanus panoptes	Yellow-spotted Monitor	0	1	0	0	0	2	0	1	0	2
	Trapping method	Pitfall trap	1	4	4	4	4	4	5	2	7	2
		Funnel trap	1	1	0	9	0	2	0	2	0	1
		Cage trap	0	0	0	0	0	2	0	0	0	2
		Aluminium box trap	0	0	0	0	0	0	0	0	0	0
		Total	**2**	**5**	**4**	**13**	**4**	**8**	**5**	**4**	**7**	**5**
		Cumulative Total			**6**	**18**	**10**	**26**	**15**	**30**	**22**	**35**

Family	Species	Common Name	Site 6		Site 7		Site 8		Site 9		Site 10	
			Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn
Agamidae	*Caimanops amphiboluroides*	Mulga Dragon	0	0	0	0	0	0	0	0	0	0
	Ctenophorus scutulatus		0	0	0	0	0	0	0	0	0	0
	Pogona minor	Bearded Dragon	0	0	0	0	0	0	0	0	0	0
Diplodactylidae	*Diplodactylus pulcher*		0	0	0	0	0	0	0	0	0	0
	Strophurus assimilis	Goldfields Spiny-tailed Gecko	0	0	0	0	0	0	0	0	0	0
Gekkonidae	*Gehyra variegata*		0	0	0	0	0	0	0	0	0	0
	Heteronotia binoei	Bynoe's Gecko	0	1	0	0	0	0	0	0	0	0
Scincidae	*Ctenotus leonhardii*		0	0	0	0	0	0	0	0	0	0
	Ctenotus schomburgkii		0	0	0	0	0	0	0	0	0	0
	Egernia depressa	Spiny-tailed Skink	0	0	0	0	0	0	0	0	0	0
	Menetia greyii		0	0	0	0	0	0	0	0	0	0
Varanidae	*Varanus caudolineatus*		0	0	0	0	0	0	0	0	0	0
	Varanus panoptes	Yellow-spotted Monitor	0	0	0	0	0	0	0	0	0	0
	Trapping method	Pitfall trap	-	-	-	-	-	-	-	-	-	-
		Funnel trap	0	1	0	0	0	0	0	0	0	0
		Cage trap	0	0	0	0	0	0	0	0	0	0
		Aluminium box trap	0	0	0	0	0	0	0	0	0	0
		Total	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		Cumulative Total	**22**	**36**	**22**	**36**	**22**	**36**	**22**	**36**	**22**	**36**

5.3.2 Discussion

A total of 58 individual reptiles were captured during the systematic seasonal surveys. Given the different trapping techniques and that the traps were open for a total of 4613 trap nights over both seasons, the trap rate of 1.26% was particularly low.

Being ectotherms, reptiles are most active during higher temperatures, between September and April (EPA and DEC 2010). While the Spring survey was conducted in the warmer months (end of August through to beginning September) and temperatures recorded at Leonora and Menzies for the survey period were slightly higher than long-term averages, overall temperatures may not have been high enough for long enough to stimulate reptilian activity from their winter brumation. While temperatures in the cooler months of Autumn (March April) were within long-term average range, they were higher than those for the Spring survey period. Therefore, it was not surprising that more reptiles were captured during the Autumn survey (n = 36) (trap rate 1.5%) than during the Spring survey (n = 22) (trap rate 1.0%).

While nine species of reptile were captured in each of the seasonal surveys, not all the species were the same. For example, one agamid (*Pogona minor*), two diplodactilids (*Diplodactylus pulcher, Strophurus assimilis*) and one skink (*Ctenotus schomburgkii*) were captured during the Spring survey that were not captured during the Autumn survey and conversely, two geckos (*Gehyra variegata, Heteronotia bynoei*), one skink (*Ctenotus leonhardii*) and one varanid (*Varanus panoptes*) were captured during the Autumn survey that were not captured during the Spring survey.

The numbers of reptile captures between sites did differ but not consistently across seasons. For example, more species were captured in the 'Mulga over *Eremophila forrestii* on undulating hills' (Sites 4 and 5) during the Spring 2011 survey followed by an equal number in the post-fire regenerating '*Acacia* shrubland' (Site 2) and 'Mulga over *Eremophila forrestii'* (Site 3). Only two species were captured in 'Mulga over *Eremophila forrestii* on Flats' (Site 1) and there were no captures at the smaller satellite sites located in the BIF areas.

For the Autumn 2012 survey, many more species were captured in the *Acacia* Shrubland (Site 2) which had had a further six months of regeneration since the previous survey. This was followed by the number captured in 'Mulga over *Eremophila forrestii'* (Site 3) and equal numbers in 'Mulga over *Eremophila forrestii* on Flats' (Site 1) and in 'Mulga over *Eremophila forrestii* on undulating hills' (Site 5). Marginally fewer were recorded in the same vegetation complex 'Mulga over *Eremophila forrestii* on undulating hills' (Site 4). While there were no captures of reptiles in the smaller satellite sites in the BIF areas during the Spring 2011 survey, one individual (*Heteronotia binoei*) was captured in one of the satellite sites (Site 6) during the Autumn 2012 survey.

The EPA and DEC (2010) Technical Guide suggests that pitfall trapping is particularly productive for small to medium sized reptiles. The results of these surveys add weight to this suggestion as up to 64% of all captures of reptiles were in pitfall traps. While 30% were captured in funnel traps only four individuals were captured in cage traps. It is noted however, that all four were large varanids (*Varanus panoptes*) that were too big to be captured in anything other than the larger of the cage traps. It is also noted, and not surprisingly, that no reptiles were captured in aluminium box traps.

No reptile species of conservation significance are listed for the area under the EPBC Act 1999. However, the Woma *Aspidites ramsayi* is listed under the WCA 1950 as a Schedule 4 – Other Specially Protected Fauna species. The most recent recording of this species dates back to 1966 south of Menzies. No evidence of the Woma was recorded during the surveys. Further, the habitat was not conducive to utilisation by this species inasmuch as there were no hollow logs of sufficient size to accommodate a Woma and

there were few rabbit warrens which Woma are known to use as refugia. No other reptilian species of conservation significance or evidence of their presence was recorded during the survey.

Given that the CYIP area has not been well surveyed, it is not surprising that only one reptile species, Pygmy Spiny-tailed Skink *Egernia depressa,* has been vouchered at the Western Australian Museum previously for this area (Appendix B). This species was captured twice during the Spring 2011 survey at Site 5 and both a live individual and carcass of another were sighted opportunistically. During the Autumn 2012 survey, one individual was also captured at Site 5. It is noted that none of the remaining reptile species captured have been vouchered with the Western Australian Museum for this area.

Using a log/log transformation of the accumulated number of species captured during the seven night trapping programmes per seasonal survey, a strong linear relationship occurred between sampling intensity (nights) and the number of species (R^2 = 0.9623) (Figure 14). An asymptote has not been reached, although a large majority of species present (62%) were collected after the second night and up to 77% after the third night of trapping. It is reasonable to assume that all common species are represented in the curve but rare and transient species would only be detected with a far higher sampling intensity. In general, seven nights is the recommended effort for any particular sampling period when undertaking general inventory surveys (Moseby and Read 2001 cited in EPA and DEC 2010).

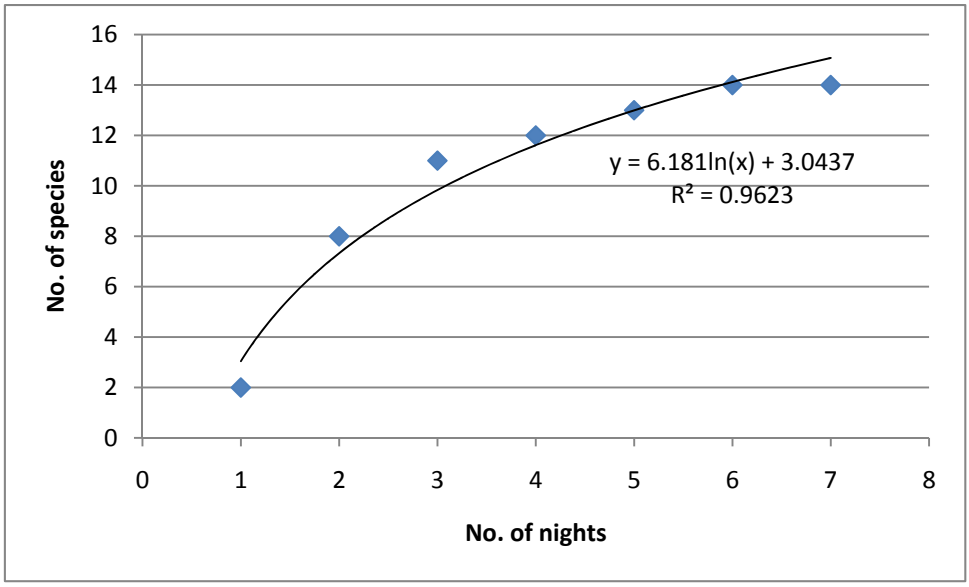

Figure 14 - Species accumulation curve for reptiles captured during the systematic fauna surveys

Seasonal trapping, conducted over many years, would be required to determine the full complement of reptiles that utilise the habitats of the Mt Mason Project area.

The many variables associated with other studies in the area make comparisons difficult. These variables include survey timing, duration and year the survey was completed; and also the trapping techniques utilised. For example, the Biological Surveys Committee study (Burbidge *et al.* 1995) was conducted over three seasons and over a three year time period from 1979 to 1981 that make taxonomic name changes since that time difficult to trace (Burbidge *et al.* 1995). Notwithstanding this, 51 species were recorded during that survey and up to 12 were captured during a Level 2 survey approximately 80 km southwest of the CYIP area (KLA 2011)(Appendix B). Of the species captured during the present survey, none are unique to the area and all have been captured elsewhere.

5.4 MAMMALS

5.4.1 The assemblage

A total of five native mammals species from two Families were captured during both seasonal surveys totalling 28 individuals (Table 17 and Appendix B). During the Spring 2011 survey native mammals (n = 7) were represented by two species from the Family Dasyuridae: *Sminthopsis longicaudata* Long-tailed Dunnart (Plate 15) and *S. dolichura* Little Long-tailed Dunnart (Plate 16) (Table 17 and Appendix B). While only one *S. longicaudata* was captured (at Site 3), six *S. dolichura* were captured with three captured at Site 5 and one at each of Sites 1, 2 and 4.

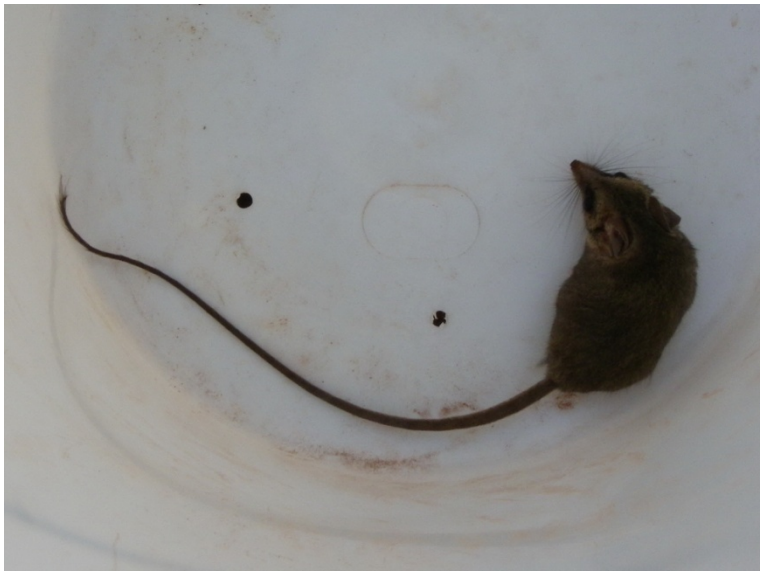

Plate 15 - *Sminthopsis longicaudata*

For the Autumn 2012 survey, a total of 21 native mammals were captured from two Families: Dasyuridae and Muridae (Table 17 and Appendix B). Once again only one *S. longicaudata* was captured at Site 3. Seven *S. dolichura* were captured with one at Site 2 and three at Site 3 and at Site 4. Within the Dasyuridae, one additional species was captured: one *Pseudantechinus woolleyae* Woolley's Pseudantechinus (Plate 17) was captured in an aluminium box trap at one of the BIF sites (Site 9). Indeed, *P. woolleyae* was the only native mammal captured in all of the BIF sites.

Plate 16 - *Sminthopsis dolichura*

Plate 17 - *Pseudantechinus woolleyae*

While no Muridae were captured during the Spring 2011 survey, two species were captured during the Autumn 2012 survey: five *Notomys alexis* Spinifex Hopping Mouse were captured at Site 1 and seven *Pseudomys hermannsburgensis* Sandy Inland Mouse were captured with three at Site 1, two at Site 4 and one at Site 3 and at Site 5.

Of the fauna species captured, *Sminthopsis longicaudata* is listed as a Priority 4 species on the DEC Threatened and Priority Fauna Database. No other mammals of conservation significance potentially occur in the area and none were captured during the Spring 2011 survey or the Autumn 2012 survey.

For the non-native mammals, a total of 44 *Mus musculus* House Mouse (Family: Muridae) were captured with ten captured during the Spring 2011 survey and 34 captured during the Autumn 2012 survey (Table 17 and Appendix B). Of the ten captured during the Spring 2011 survey, seven were captured at Site 4, two at Site 5 and one at Site 8. For the Autumn 2012 survey, Site 4 once again recorded the most (n = 16) followed by eight at Site 5. In addition, four were captured at Site 1, two at Site 2 and at Site 3 and one at Site 9. No *M. musculus* were captured at Sites 6, 7 or 10.

Collectively, all fauna were captured in two of the three types of trapping equipment with the most (n = 43, 60%) captured in aluminium box traps and only one *M. musculus* captured in a cage trap. The remaining fauna (n = 28, 39%) were captured in pitfall traps. However, for native mammals, more were captured in pitfall traps (n = 19, 68%) than in aluminium box traps (n = 9, 32%) whereas more *M. musculus* were captured in aluminium box traps (n = 34, 77%) than in pitfall traps (n = 9, 21%).

Kyle Armstrong and Yuki Konishi of Specialised Zoological analysed the bat calls recorded on the Anabats (Armstrong and Konishi 2011, 2012). The presence of six species of bats was identified with five recording unambiguous identification and one (*Nyctophilus* sp. Long-eared Bat) requiring confirmation (Table 18).

Bats were recorded at all of the five trapping grid sites with between five and six species recorded at each site. Four of the species were recorded at all five sites, whereas *Scotorepens balstoni* was recorded at all sites except for Site 5 (Table 18). Further, some species were only recorded during the Spring 2011 survey and not the Autumn 2012 survey at some sites (*Tadarida australis* White-striped Freetail-bat Site 1) and others were

recorded during the Autumn 2012 survey and not the Spring 2011 survey (*Nyctophilus* sp. Long-eared Bat, Site 1 and Site 4).

Armstrong and Konishi (2011, 2012) highlight the difficulties in distinguishing the differences in some calls. For example, the calls of the Long-eared bats *Nyctophilus* spp. are typically difficult to identify to species, and those recorded may be attributed to the Lesser Long-eared Bat *Nyctophilus geoffroyi* or the central Greater Long-eared Bat *N. major tor*. In addition, calls of *Chalinolobus gouldii* Gould's Wattled Bat are similar to those of the inland Freetail-bat *Mormopterus* sp. 3. However, positive identifications of both these species were made from other high quality diagnostic call sequences.

Evidence of native mammals seen opportunistically during the survey was limited to *Tachyglossus aculeatus* Echidna and Dunnart tracks (*Sminthopsis* spp.). However, evidence of five non-native species were recorded including *Oryctolagus cuniculus* Rabbit, *Canis* sp. Dog/Dingo, *Felis catus* Cat, *Bos taurus* European Cattle and *Equus asinus* Donkeys. All sightings are included in Appendix B.

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Table 17 - Mammal species recorded (including method) during the Spring 2011 and Autumn 2012 systematic surveys

Family	Species	Common Name	Site 1		Site 2		Site 3		Site 4		Site 5	
			Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn
Dasyuridae	*Pseudantechinus woolleyae*	Woolley's Pseudantechinus	0	0	0	0	0	0	0	0	0	0
	Sminthopsis dolichura	Little long-tailed Dunnart	1	0	1	1	0	3	1	3	3	0
	Sminthopsis longicaudata	Long-tailed Dunnart	0	0	0	0	1	1	0	0	0	0
Muridae	*Mus musculus**	House Mouse	0	4	0	2	0	2	7	16	2	8
	Notomys alexis	Spinifex Hopping Mouse	0	5	0	0	0	0	0	0	0	0
	Pseudomys hermannsburgensis	Sandy Inland Mouse	0	3	0	0	0	1	0	2	0	1
	Pitfall trap		1	3	1	1	1	6	2	9	3	1
	Funnel trap		0	0	0	0	0	0	0	0	0	0
	Cage trap		0	0	0	0	0	0	0	0	0	0
	Aluminium box trap		0	9	0	2	0	1	6	12	2	8
	Total		**1**	**12**	**1**	**3**	**1**	**7**	**8**	**21**	**5**	**9**
	Cumulative Total				**2**	**15**	**3**	**22**	**11**	**43**	**16**	**52**

Family	Species	Common Name	Site 6		Site 7		Site 8		Site 9		Site 10	
			Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn
Dasyuridae	*Pseudantechinus woolleyae*	Woolley's Pseudantechinus	0	0	0	0	0	0	0	1	0	0
	Sminthopsis dolichura	Little long-tailed Dunnart	0	0	0	0	0	0	0	0	0	0
	Sminthopsis longicaudata	Long-tailed Dunnart	0	0	0	0	0	0	0	0	0	0
Muridae	*Mus musculus**	House Mouse	0	0	0	0	1	1	0	1	0	0
	Notomys alexis	Spinifex Hopping Mouse	0	0	0	0	0	0	0	0	0	0
	Pseudomys hermannsburgensis	Sandy Inland Mouse	0	0	0	0	0	0	0	0	0	0
	Pitfall trap		0	0	0	0	0	0	0	0	0	0
	Funnel trap		0	0	0	0	0	0	0	0	0	0
	Cage trap		0	0	0	0	1	0	0	0	0	0
	Aluminium box trap		0	0	0	0	0	1	0	2	0	0
	Total		**0**	**0**	**0**	**0**	**1**	**1**	**0**	**2**	**0**	**0**
	Cumulative Total		**16**	**52**	**16**	**52**	**17**	**53**	**17**	**55**	**17**	**55**

Table 18 - Site by species matrix of bat identifications recorded during the Spring 2011 and Autumn 2012 systematic surveys

Family	Species	Common Name	Site 1		Site 2		Site 3		Site 4		Site 5	
			Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn
Vespertilionidae	*Chalinolobus gouldii*	Gould's Wattled Bat	+	+	+	+	+	+	+	+	+	+
	Nyctophilus sp.	Long-eared Bat	-	NC	NC	NC	NC	NC	-	NC	NC	NC
	Scotorepens balstoni	Inland Broad-nosed Bat	+	NC	+	NC	+	NC	+	-	-	-
	Vespadelus finlaysoni	Finlayson's Cave Bat	+	+	+	+	+	+	+	+	+	+
Molossidae	*Mormopterus sp. 3*	Freetail-bat	+	+	+	NC	+	NC	+	NC	+	NC
	Tadarida australis	White-striped Freetail-bat	+	-	+	+	+	+	+	+	+	+

Key:
NC = needs confirmation
+ = positive identification
- = not recorded

5.4.2 Discussion

Four different trap types were open for a collective total of 4613 trap nights during the seven night surveys in Spring 2011 and in Autumn 2012. The capture of 28 individual native mammals during these periods equates to a trap rate of 0.6%, which suggests that the area surveyed supported very low numbers of mammals. The trap rate for the non-native *Mus musculus* is slightly higher (1.0%), and collectively the trap rate of 1.6% for both native and non-native mammals suggests that both the abundance and diversity of mammals was low.

As mammals are homeothermic, survey timing is not constrained as it is for reptiles (EPA and DEC 2010). However, mammal species have different population cycles which are often related to climate and resource availability. During these seasonal surveys. there was a three-fold increase in the number of native mammals captured in autumn (n = 21) compared to the number captured in spring (n = 7). The scenario was similar to that of *Mus musculus,* the only non-native mammal which was captured at seven of the ten sites. *Mus musculus* populations are known to fluctuate enormously and, while they do breed opportunistically, many are born from September to April (Menkhorst and Knight 2011). This is consistent with the large increase in numbers from ten captured during the Spring 2011 survey to 34 captured during the Autumn 2012 survey. Females can produce up to nine litters a year with 4 – 6 young in each litter increasing local populations exponentially.

Given the overall low numbers of mammals captured, it is difficult to comment on any significance of spatial differences or preferred habitat. A general observation indicates that mammals were captured at all five trapping sites and at two of the smaller satellite sites in the BIF areas. For the latter, only one (*Pseudantechinus woolleyae*) was captured at Site 9 in addition to one *M. musculus* at this site, and two *M. musculus* at Site 8. *Pseudantechinus woolleyae* tend to be sparsely distributed on rocky hillsides with acacia scrub (Menkhorst and Knight 2011); its presence in the BIF site, therefore, was not unexpected. Being generalists, *M. musculus* do not appear to have any habitat preferences are can be found everywhere.

More detailed analysis indicates that more mammals were captured at Site 4 'Mulga over *Eremophila forrestii* on undulating hills' during both seasonal surveys than at all other sites. During the Spring 2011 survey this was followed by the number captured in the same vegetation group ('Mulga over *Eremophila forrestii* on undulating hills') (Site 5) followed by one captured at each of the remaining sites where animals were captured. For the Autumn 2012 survey, more mammals were captured on the flats 'Mulga over *Eremophila forrestii* on Flats' at Site 1 followed by the number captured on the undulating hills at Site 5. It is noted that five of the nine captures overall at Site 1 were *Notomys alexis.* Site 1 comprised unburnt and primarily undisturbed sandplain supporting mulga, which is consistent with the preferred habitat of this species (Menkhorst and Knight 2011). While this vegetation was not limited to this area, *N. alexis* were only captured at this site and not at any other site.

It is also noted that the only two *Sminthopsis longicaudata* (Priority 4) were captured with one in each season and in the same locale (<50 m from each other at Site 3). On site observation indicates that both species were captured at the base of an area of a rocky scree. The preferred habitat of this species is varied but does include rocky scree in addition to plateau areas, generally with little vegetation or spinifex hummock grassland, shrubs, and open Mulga woodland (Burbidge *et al.* 2008). Within its distributional range, *S. longicaudata* tends to be in low abundance, as demonstrated by the results of this survey.

Using the EPBC Protected Matters Search Tool and interrogating the DEC Threatened and Priority Fauna Database, no mammal species of conservation are listed for the area. However, as mentioned above, one *Sminthopsis longicaudata* was captured during each of the seasonal surveys and in the same area. This species is listed as a Priority 4 species on the DEC Threatened and Priority Fauna Database. This capture represents the southernmost extent of this species and extends its distribution range.

A Level 2 fauna survey was conducted recently approximately 200 km northeast of Mt Mason (Terrestrial Ecosystems 2011a). Three *S. longicaudata* were captured with one in a funnel trap and two in pitfall traps. The report suggested that their presence in this area was unexpected as they were "not normally caught in open, flat, mulga woodland with no spinifex, low shrubs and little ground cover" and certainly not that far south. Subsequently, a targeted survey for this species in that area resulted in the capture of one individual albeit over 8,400 trap nights (0.01% trap rate) (Terrestrial Ecosystems 2011b). However, it is noted that 840 box traps were used (over ten nights). Of the three *S. longicaudata* captured during the earlier Level 2 fauna survey, one was captured in a funnel trap and the remaining two were captured in pitfall traps. In this current survey at Mt Mason, both *S. longicaudata* were captured in pitfall traps. Further, three *S. longicaudata* were also captured in pitfall traps during the fauna assessment at Jupiter's Mt Ida site ~10 km south of Mt Mason (KLA 2012 *in prep*). Therefore the use of box traps for *S. longicaudata* may not be the most appropriate trapping tool for this species. Notwithstanding this, the results from these trapping programs (Terrestrial Ecosystems 2011a and b, KLA 2012 *in prep*) and the current survey suggest that the distributional range of this species is far greater than previously mapped and that they are present in low abundance over an extensive part of Western Australia, excluding the southern portion of the state. Further, the habitat occupied by these specimens suggests that there is no obvious habitat attribute particularly associated with the species. Given this, the conservation status of *S. longicaudata* is not likely to be compromised by the proposed mining activity at Mt Mason.

The EPBC Protected Matters Search Tool does list four invasive species that are likely to occur in the area namely *Capra hircus* Goat, *Felis catus* Cat, *Oryctolagus cuniculus* Rabbit and *Vulpes vulpes* Fox. Of these, evidence of *F. catus* and *O. cuniculus* was recorded. Canid faeces were noted but were unable to be attributed to *Canis lupis* sp. being either a Dingo or a non-native Dog. Anecdotal sightings of *Equus asinus* Donkey were reported and these were only seen after the completion of the survey. Nevertheless, they have been included in opportunistic sightings. Notwithstanding this, the low number of smaller mammals in the area may be attributable to a degree of predation and loss of habitat from trampling and grazing by larger ungulates.

For this and many fauna surveys, pitfall traps and aluminium box traps are generally the most effective in capturing small mammals (EPA and DEC 2010). However, some species have a penchant for particular traps. In this study, for example, all the dunnarts (*Sminthopsis dolicura* and *S. longicaudata*) were captured in pitfall traps and all the *Notomys alexis* were captured in box traps. Other than the single *M. musculus* captured in a cage trap in the BIF area, no other animals were captured in cage traps and none were captured in funnel traps.

Given the low numbers of mammals captured, a species accumulation curve may not depict mammal presence adequately. However, log/log transformation of the accumulated number of species captured during the seven night trapping programmes resulted in a strong linear relationship between sampling intensity (nights) and the number of species (R^2 = 0.9368) (Figure 15). While an asymptote has not been reached, 67% of all species were captured by the second night of trapping and 83% by the fourth night of trapping. In general, seven nights is the recommended effort for any particular sampling period when undertaking general inventory surveys (Moseby and Read 2001 cited in EPA and DEC 2010).

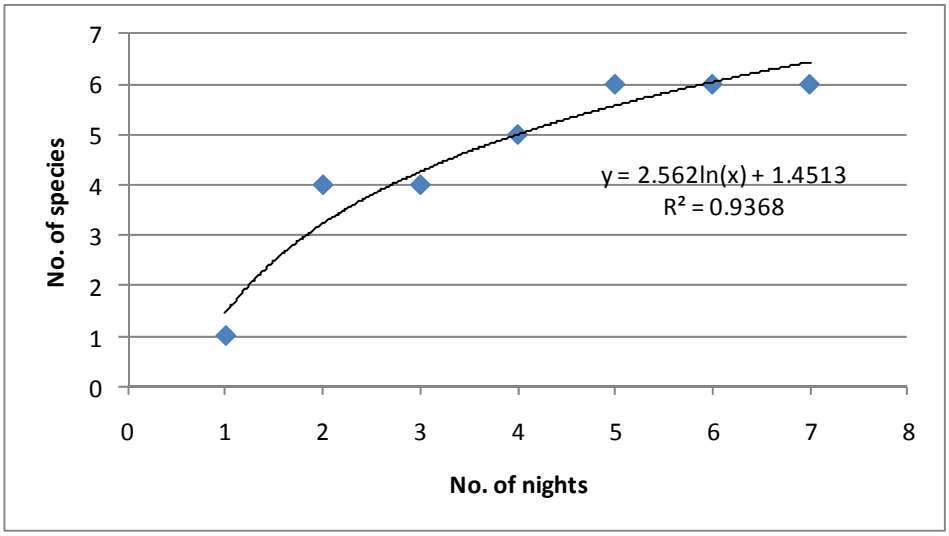

Figure 15 - Species accumulation curve for non-volant native and non-native mammals captured during the systematic fauna surveys

Anabat detectors record the presence of bats, rather than the numbers present. Bats were recorded at all of the five trapping grid sites with between five and six species recorded at each site. While some calls were positively identified, others require confirmation and some could be one of two species. Notwithstanding this, it is reasonable to assume that the diversity of bats present extends throughout the Mt Mason area.

Interestingly, not one mammal has been vouchered at Western Australian Museum for the area. As noted for the reptiles, comparisons with other studies are limited due to differences in timing, trapping programs and taxonomic changes. Notwithstanding this, other surveys have captured as few as 13 species (KLA 2011) and as many as 28 species (Burbidge *et al.* 1995) (Appendix B). It is noted that the 28 species were recorded over three seasons (winter, spring and late summer) over a three year time period (1979, 1980 and 1981) (Burbidge *et al.* 1995). This adds weight to the fact that seasonal trapping conducted over many years is required to provide a more complete representation of the assemblage of mammals that utilise the area.

5.5 BIRDS

5.5.1 The assemblages

A total of 507 individual birds representing 34 species from 16 Families were recorded during the 20 minute observations for the Spring 2011 and Autumn 2012 surveys (Table 19). The total species tally comprised 307 individuals with 29 species representing 12 Families recorded during the Spring 2011 survey and 200 individuals with 19 species representing 11 Families recorded during the Autumn 2012 survey.

For the Spring 2011 survey, the 12 Families comprised three non-passerine Families (n = 8 species with 129 individual birds recorded) and nine passerine Families (n = 21 species with 178 individual birds recorded). While the numbers of birds recorded in each category suggest that the area supports marginally more passerines (58% of total number of birds) than non-passerines (42%), analysis of the results indicates that *Nymphicus hollandicus* Cockatiel (n = 40) and *Melopsittacus undulatus* Budgerigar (n = 45) were responsible for weighting of the non-passerine figures. Large numbers of these species were recorded at most sites and many more were seen opportunistically and in flight. Of the remaining non-passerines, 18 *Barnardius zonarius* Australian Ringneck outnumbered the remaining species with less than seven individuals of each species recorded (Table 19). Interestingly, three species of cuckoo were recorded but never more than two species at any one site.

Within the passerines, 52% of the total number of passerines (n = 178) was represented by three species with the Malurid *Malurus splendens* Splendid Fairy-wren being the most ubiquitous (n = 35). Few *M. splendens* were recorded at every site. *Acanthiza robustirostris* Slaty-backed Thornbill was the next most numerous bird (n = 33) followed by *Oreoica gutturalis* Crested Bellbird (n = 25). The remaining species all recorded less than 10% each of the total number of birds recorded.

Similar numbers of species were recorded at all sites (<18, >15). However, more individual birds were recorded at Site 4 (n = 89) with similar numbers recorded at Site 3 (n= 65) and at Site 1 (n = 62) and similar numbers recorded at Site 5 (n = 47) and at Site 2 (n = 44).

For the Autumn 2012 survey, three non-passerine species from three Families accounted for only 17 birds whereas the 16 passerines species numbered 183 individuals from eight Families. Two species (*Malurus splendens* Splendid Fairy-wren (n = 45) and *Acanthiza apicalis* Inland Thornbill (n = 66)) accounted for 61% of all passerines during this seasonal survey. Thus, the percentage of passerines (91.5%) heavily outweighed the percentage of non-passerines (8.5%).

More species (n = 12) and more individual birds (n = 65) were recorded at Site 3 than at the other four sites. This was followed by Site 5 that accounted for nine species and 45 individual birds. While Sites 1 and 2 recorded the same number (n = 8) species, Sites 1 and 4 recorded the same number (n = 35) number of individual birds. The least number of species was recorded at Site 4 (n = 5) and the least number of birds (n = 24) was recorded at Site 2.

Table 19 - Avifauna species recorded (including method) during the Spring 2011 and Autumn 2012 systematic surveys

Family	Species	Common Name	Site 1		Site 2		Site 3		Site 4		Site 5	
			SPRING	AUTUMN	SPRING	AUTUMN	SPRING	AUTUMN	SPRING	AUTUMN	SPRING	AUTUMN
Columbidae	*Phaps chalcoptera*	Common Bronzewing	0	0	0	0	0	0	0	3	0	0
Aegothelidae	*Aegotheles cristatus*	Australian Owlet-nightjar	0	0	0	0	0	1	0	0	0	0
Cacatuidae	*Eolophus roseicapillus*	Galah	3	0	2	0	0	0	0	0	2	0
	Nymphicus hollandicus	Cockatiel	13	0	3	0	0	0	21	0	3	0
Psittacidae	*Platycercus zonarius*	Australian Ringneck (Ring-necked Parrot)	4	4	2	3	4	4	5	0	3	2
	Melopsittacus undulatus	Budgerigar	10	0	0	0	20	0	15	0	0	0
	Neopsephotus bourkii	Bourke's Parrot	0	0	0	0	0	0	5	0	0	0
Cuculidae	*Chalcites basalis*	Horsfield's Bronze Cuckoo	1	0	2	0	2	0	1	0	0	0
	Chalcites osculans	Black-eared Cuckoo	1	0	0	0	0	0	0	0	1	0
	Cuculus pallidus	Pallid Cuckoo	0	0	1	0	2	0	2	0	1	0
Ptilonorhynchidae	*Ptilonorhynchus guttatus*	Western Bowerbird	0	0	1	0	0	0	0	0	0	0
Maluridae	*Malurus splendens*	Splendid Fairy-wren	9	6	8	2	3	17	4	10	11	10
Acanthizidae	*Calamanthus campestris*	Rufous Fieldwren	0	0	0	0	0	0	0	0	1	0
	Pyrrholaemus brunneus	Redthroat	0	0	1	0	0	0	0	0	2	0
	Smicrornis brevirostris	Weebill	2	0	0	0	4	6	5	0	0	0
	Acanthiza robustirostris	Slaty-backed Thornbill	5	0	5	0	8	6	6	2	9	3
	Acanthiza chrysorrhoa	Yellow-rumped Thornbill	0	0	2	0	0	0	0	0	0	0
	Acanthiza apicalis	Inland Thornbill	3	16	2	8	2	16	0	11	1	15
Meliphagidae	*Lichenostomus virescens*	Singing Honeyeater	1	0	1	0	1	0	2	0	0	2
	Manorina flavigula	Yellow-throated Miner	0	0	0	0	1	0	7	0	0	0
	Acanthagenys rufogularis	Spiny-cheeked Honeyeater	1	0	1	0	5	0	1	4	6	0
	Anthochaera carunculata	Red Wattlebird	0	0	0	0	2	0	5	0	0	0

Family	Species	Common Name	Site 1		Site 2		Site 3		Site 4		Site 5	
			SPRING	AUTUMN	SPRING	AUTUMN	SPRING	AUTUMN	SPRING	AUTUMN	SPRING	AUTUMN
	Epthianura tricolor	Crimson Chat	0	0	2	0	0	0	0	0	0	0
Pomatostomidae	*Pomatostomus superciliosus*	White-browed Babbler	0	0	3	0	0	0	0	0	0	0
Campephagidae	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike	0	0	0	0	2	0	0	0	0	0
Pachycephalidae	*Pachycephala rufiventris*	Rufous Whistler	1	1	0	0	0	1	0	0	0	0
	Colluricincla harmonica	Grey Shrike-thrush	2	0	2	0	1	1	1	0	1	2
	Oreoica gutturalis	Crested Bellbird	5	1	6	2	5	1	5	0	4	1
Artamidae	*Cracticus nigrogularis*	Pied Butcherbird	0	0	0	2	1	0	2	0	1	0
	Strepera versicolor	Grey Currawong	0	3	0	1	1	4	1	0	1	3
Rhipiduridae	*Rhipidura fuliginosa*	Grey Fantail	0	1	0	0	0	0	0	0	0	0
Corvidae	*Corvus bennetti*	Little Crow	1	0	0	0	1	0	1	0	0	0
	Corvus orru	Torresian Crow	0	3	0	2	0	4	0	0	0	0
Petroicidae	*Petroica goodenovii*	Red-capped Robin	0	0	0	4	0	4	0	5	0	3
		Subtotal	**62**	**35**	**44**	**24**	**65**	**65**	**89**	**35**	**47**	**41**
		Cumulative total			**106**	**59**	**171**	**124**	**260**	**159**	**307**	**200**

Opportunistic recordings collectively accounted for 27 bird species identified during the two seasonal survey periods (Appendix B). While 18 species were recorded during the Spring 2011 survey period, a total of 15 were recorded during the Autumn 2012 survey period (Table 20). Of these, 12 were recorded during the Spring 2011 survey period that were not recorded during the Autumn 2012 survey and nine were recorded during the Autumn 2012 survey that were not recorded during the Spring 2011 survey. Only six species were common to both survey periods.

Of the birds recorded opportunistically, eight were recorded that were not recorded during the systematic bird surveys (Appendix B). Conversely, ten bird species recorded during the systematic surveys were not seen opportunistically (Appendix B).

Table 20 - Bird species recorded opportunistically during the Spring 2011 and Autumn 2012 bird surveys

Family	Species	Common Name	Spring 2011	Autumn 2012
Casuariidae	*Dromaius novaehollandiae*	Emu	√	√
Megapodiidae	*Leipoa ocellata*	Malleefowl		√
Columbidae	*Phaps chalcoptera*	Common Bronzewing	√	
Podargidae	*Podargus strigoides*	Tawny Frogmouth	□	√
Aegothelidae	*Aegotheles cristatus*	Australian Owlet-nightjar		√
Accipitridae	*Aquila audax*	Wedge-tailed Eagle	√	
Cacatuidae	*Eolophus roseicapillus*	Galah	√	
	Nymphicus hollandicus	Cockatiel	√	
Psittacidae	*Barnardius zonarius*	Australian Ringneck	√	
	Melopsittacus undulatus	Budgerigar	√	
Meropidae	*Merops ornatus*	Rainbow Bee-eater	□	√
Maluridae	*Malurus splendens*	Splendid Fairy-wren	√	√
Acanthizidae	*Acanthiza robustirostris*	Slaty-backed Thornbill		√
Meliphagidae	*Manorina flavigula*	Yellow-throated Miner	√	√
	Acanthagenys rufogularis	Spiny-cheeked Honeyeater	√	
	Anthochaera carunculata	Red Wattlebird	√	
Pomatostomidae	*Pomatostomus superciliosus*	White-browed Babbler	√	
Campephagidae	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike	√	√
Pachycephalidae	*Pachycephala rufiventris*	Rufous Whistler		√
	Colluricincla harmonica	Grey Shrike-thrush	√	
	Oreoica gutturalis	Crested Bellbird	√	√
Artamidae	*Strepera versicolor*	Grey Currawong	√	
Rhipiduridae	*Rhipidura fuliginosa*	Grey Fantail		√
	Rhipidura leucophrys	Willie Wagtail		√
Corvidae	*Corvus orru*	Torresian Crow	√	√
Petroicidae	*Petroica goodenovii*	Red-capped Robin	√	
	Melanodryas cucullata	Hooded Robin		√

Of the birds considered of conservation significance listed for the area, evidence of *Leipoa ocellata* Malleefowl was found, *Oreoica gutteralis* Crested Bellbird was recorded at every site and opportunistically and *Pomatostomus superciliosus* White-browed Babbler was recorded at Site 2 and opportunistically.

Malleefowls are listed as a Schedule 1 species under the WCA 1950. Unconfirmed reports suggested that there were up to four Malleefowl mounds in the Mt Mason area. During the survey period, an audit of these mounds established that three of the mounds were old, inactive mounds and the fourth was unable to be found (Figure 16). While on site during the Spring 2011 survey, KLA was notified of a new active mound not far from the Jupiter camp (1.7 km south of the southern boundary of the Mt Mason tenement). Table 21 provides the coordinates of all reported Malleefowl mounds including their status as of September 2011. Plate 11 provides photographic evidence of the active mound, with two Malleefowl in attendance.

Both the Crested Bellbird and the White-browed Babbler are listed as Priority 4 species on the DEC Threatened and Priority Fauna database. These species, the Malleefowl, and other species of conservation significance listed to potentially occur in the area will be discussed further in Section 7.1.

Interrogation of the Birds Australia Atlas database listed 50 species for the area (Appendix B). Of those birds recorded collectively during the survey, 21 species were listed as having been seen/heard in the area with an additional five species seen opportunistically. Eight species were seen during systematic surveys that were not on the Birds Australia list for the area and an additional one species not on the list was seen opportunistically during the reconnaissance survey (Appendix B). Conversely, 22 species were on the list from Birds Australia that were not recorded during the survey.

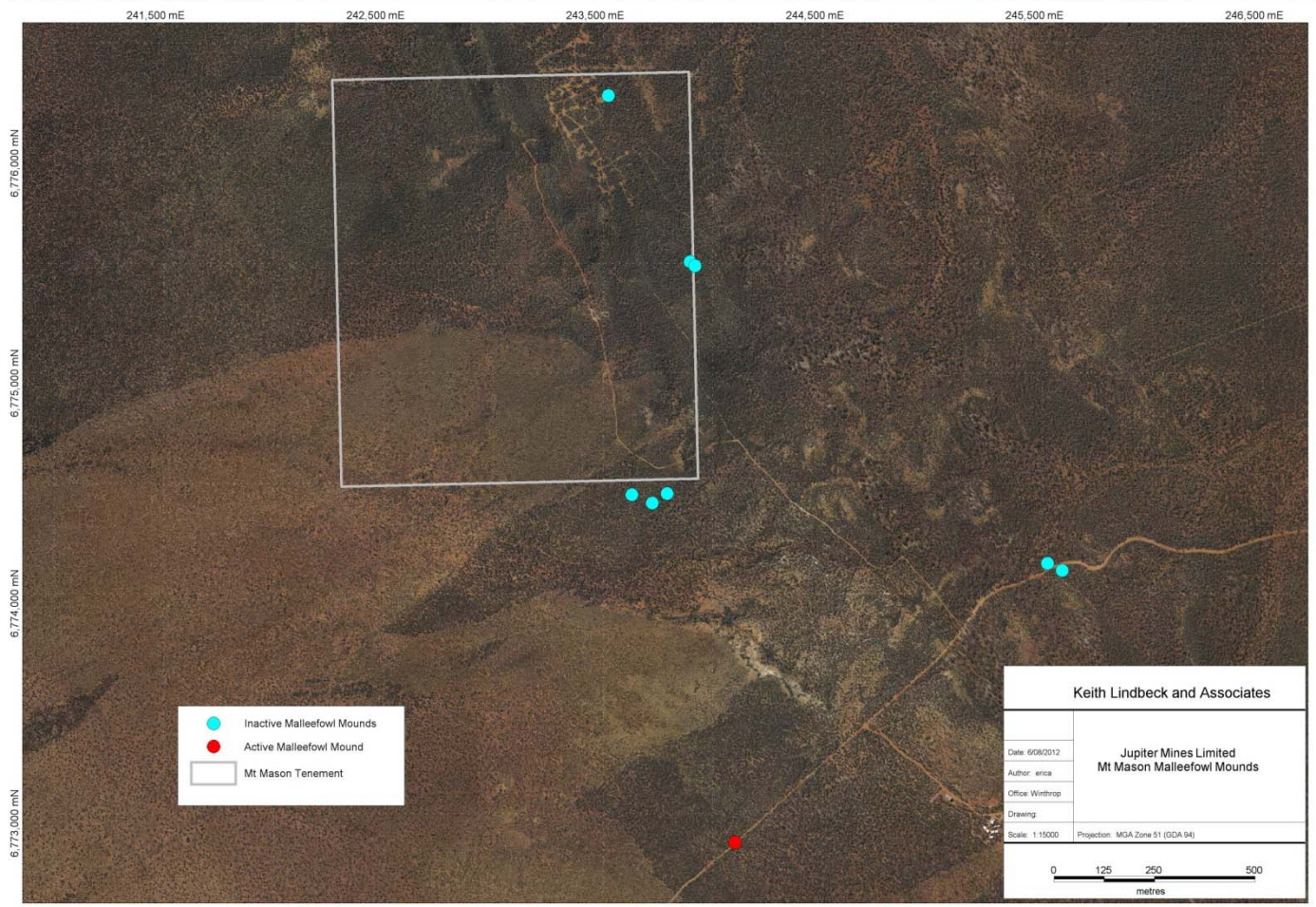

Figure 16 - Location and status of Malleefowl mounds

Table 21 - Malleefowl Mound Locations and their status

Mound Number	Location		Status of Mound		
	Easting	Northing	Active/ Inactive	Approximate Age	Approximate Size (m)
1	245522	6774136	Inactive	> 10 years	6 x 6
2	245590	6774104	Unable to locate		
3	243523	6776262	Inactive	>30 years	5 x 5
4	243917	6775489	Inactive	> 30 years	7 x 7
5	244107	6772871	Active	new	2.5 x 2.5
Other Mounds located during fauna assessment					
6	243723	6774411	Inactive	> 50 years	4 x 4
7	243631	6774448	Inactive	> 50 years	6 x 6
8	243791	6774455	Inactive	>100	5 x 5
9	243895	6775506	Inactive	>100	4 x 4

Plate 18 – Active Malleefowl Mound

5.5.2 Discussion

Season and rainfall were taken into account when planning the optimal time for conducting both these seasonal surveys. Conventionally, surveys are undertaken in spring and autumn. For the Spring 2011 survey, above average rainfall was recorded for June 2011 and July 2011. Given the recent rainfall, this survey was planned in the spring months to take advantage of the above average rainfall that fell in the previous months. Similarly, for the Autumn 2012 survey, above average rainfall was recorded from October 2011 through

to January 2012. Therefore, timing of the surveys was in accordance with suggested timelines.

For the Spring 2011 survey, the bird censuses yielded a total of 307 individuals of 29 species from 12 Families. The percentages of non-passerines (58%) to passerines (42%) were weighted due to the inordinate numbers of Cockatiels and Budgerigars. The populations of these two species are known to fluctuate based on resource availability, and the large numbers recorded were not surprising given the verdant vegetative response to the recent above average rainfall.

Excluding these species, non-passerines (20%) were outnumbered by the passerines (80%) which is a more typical scenario in the northern Goldfields at this time of the year. The non-passerines were heavily represented by the Australian Ringneck (n = 18) followed by only five other non-passerine species which collectively totalled 26 individual birds.

Three species of passerines accounted for 52% of all the passerines recorded: the Splendid Fairy-wren was the most ubiquitous of the passerines followed by the Slaty-backed Thornbill. The characteristic call of the Crested Bellbird was heard at every site and was recorded opportunistically. The Crested Bellbird is listed as a Priority 4 species on the DEC Threatened and Priority Fauna database and will be discussed in Section 7.1 that addresses species of conservation significance. Similarly, the White-browed Babbler, another of the passerines recorded at Mt Mason is also a Priority 4 species and will be discussed in Section 7.1.

For the Autumn 2012 survey, the more typical scenario of passerines (91.5%) to non-passerines (8.5%) was evident with the Splendid Fairy Wren (n = 45) and Inland Thornbill (n = 66) responsible for much of this weighting, collectively representing 61% of all passerines recorded during the survey. Of the non-passerines, the Australian Ringneck again was the dominant species accounting for 13 of the 17 non-passerines recorded. While the White-browed Babbler was not recorded during the Autumn 2012 survey, the Crested Bellbird was recorded at four of the five sites, albeit in far fewer numbers than during the warmer months of spring. As mentioned above, these Priority species will be discussed in Section 7.1, in addition to the presence of the Malleefowl.

The distribution of birds throughout the Mt Mason area was not remarkably different between sites for the Spring 2011 survey. These results suggest that there was no significant correlation between distribution of birds across the length of the area surveyed and the vegetation communities in the areas surveyed. However, these results were not consistent for the Autumn 2012 survey period in which there was a marked difference in the species distribution across the sites. Given that all sites except the regenerating *Acacia* shrubland are dominated by a mulga upperstorey, it may be assumed that resource availability differs substantially in the cooler months in relation to topography and understorey species. These results confirm the necessity of multiple seasonal surveys in order to better understand resource availability and use by avifauna of different habitats across a landscape.

A log/log transformation of the accumulated number of species recorded during the four mornings of systematic sampling resulted in a fairly strong linear relationship between sampling intensity (mornings) and the number of species (R^2 = 0.877) (Figure 17). While an asymptote has not been reached, 94% of species had been recorded by the second morning with only two more species recorded on the following two mornings. As discussed in Section 5.3.2, it is reasonable to assume that all common species are represented in the curve but rare and transient species would only be detected with a far higher sampling intensity. Based on these results and that two seasonal surveys have been undertaken, it is likely that a reasonable representation of the majority of the birds that utilise this area were sighted.

Only one bird species *Cracticus tibicen* Australian Magpie has been vouchered at the Western Australian Museum for the area (Appendix B). Interestingly this species was neither heard nor seen during the systematic sampling and was not recorded opportunistically. Results from Birds Australia identify 51 species that have been recorded in the area (Appendix B). Of these, 25 were recorded during the two seasonal surveys, 26 were not recorded that appeared on the list and nine species were recorded during the surveys that do not appear on the Birds Australia list (Appendix B)

As noted elsewhere, a comparison with other surveys is limited given the seasonal, temporal and habitat differences. Notwithstanding this and excluding species associated with water bodies, other regional surveys have listed a total of 94 additional species collectively that were not recorded during this spring survey (Appendix B). As mentioned elsewhere, seasonal surveys, conducted over many years during different seasons and climatic conditions would be required to determine the full complement of birds that utilise the habitats and adjacent areas of the Mt Mason Project.

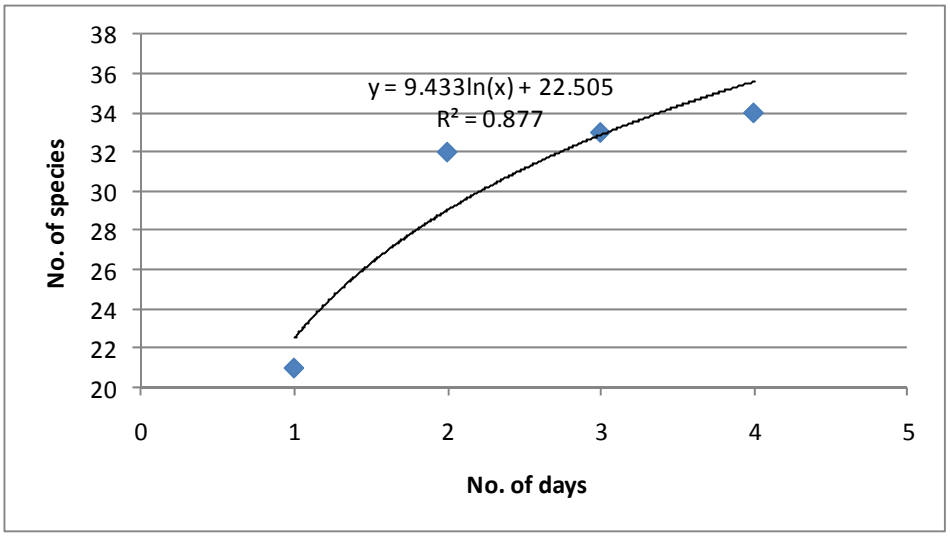

Figure 17 - Species accumulation curve for birds recorded during the systematic sampling surveys

5.6 SPOTLIGHTING

5.6.1 The assemblages

A total of 27 person hours was spent spotlighting during both seasonal surveys; five hours and fifty minutes over three evenings totalling 15.5 spotlighting hours were spent traversing the survey areas during the Spring 2011 survey and five hours and forty-five minutes over three evenings totalling 11.5 spotlighting hours were spent traversing the survey areas during the Autumn 2012 survey. Established tracks were followed within and adjacent to the survey area and the trapping grid areas were not entered so that mammals in the immediate areas of the traps would not be disturbed.

For the Spring 2011 survey, collectively, during spotlighting and head-torch searches, two *Macropus robustus* Euros were seen, one *Eurostopodus argus* Spotted Nightjar was positively identified by its call and one *Antaresia stimsoni* Stimson's Python was recorded. Two other birds were seen but unidentified as well as numerous unidentified bats flying overhead. One gecko was also seen but not captured or identified.

During the Autumn 2012 spotlighting surveys, four mammals species were recorded including one *Pseudantechinus woolleyae* Woolley's Pseudantechinus, *Macropus rufus* Red Kangaroo, unidentified bats and the non-native *Oryctolagus cuniculus* Rabbit. In addition, seven bird species were recorded that included *Phaps chalcoptera* Common Bronzewing, *Podargus strigoides* Tawny Frogmouth, *Aegotheles cristatus* Australian Owlet-nightjar, *Acanthiza apicalis* Inland Thornbill, *Pachycephala rufiventris* Rufous Whistler, *Petroica goodenovii* Red-capped Robin and a small unidentified species.

All species recorded during the spotlighting surveys are presented in Appendix B.

In addition to the vertebrates, three scorpions and two slaters were collected during the Spring 2011 survey. These were sent to the appropriate specialist at the Western Australian Museum for identification.

5.6.2 Discussion

Given the low number of small mammal and reptile species captured, it was not surprising that few were seen during the spotlighting forays.

It is interesting to note that of the vertebrate taxa identified during the spotlighting surveys only one mammal (Red Kangaroo) was not recorded during the systematic sampling or opportunistically. Albeit only one species, this highlights the value of including varied techniques when recording fauna assemblages in any one area.

All invertebrates sent to the Western Australian Museum were identified. Of the scorpions, all three belong to the Family Buthidae and included one male and one juvenile *Isometroides* ‘goldfields1’ and one juvenile *Lycas jonesae* (Volschenk 2012). The slaters that were collected were identified as *Buddelundia* sp.nov. 39 (Family: Armadillidae)(Judd and Hosie 2012). None of the species above are considered to be short-range endemics.

6.0 TARGETED INVETEBRATE FAUNA SURVEY

6.1.1 The assemblages

Of the species vouchered at the Western Australian Museum, 101 species were identified and comprised Arachnida, Chilopoda, Diplopoda, Crustacea and Gastropoda (Table 22).

Within the Arachnida, nine species totalling 26 individuals represented five Families, three Chilopoda accounted for three Families with one species from each, Diplopoda accounted for one species and Crustacea seven species from one Family. Five species of Gastropoda were identified representing three families and accounting for 64 specimens.

Given the lack of taxonomic knowledge and reference collections, the results from the Western Australian Museum were often inconclusive depending on the families or genera. For example, while the genus *Eucrytops* (Family: Idiopidae) is common throughout Western Australia, based on the females and juvenile collected, it is currently not possible to say if the *Eucyrtops* spp. represent SREs, whereas the single juvenile *Neosprassus* sp. (Family: Sparassidae) is not a SRE species (Burger *et al.* 2012).

Within the Order Pseudoscorpiones, while many species of *Synsphyronus* (Family: Garypidae) may represent SREs, the single female *Synsphyronus mimulus* collected is widespread and occurs in all Australian mainland states (Harvey 1987 cited in Burger *et al.* 2012). Similarly *Geogarypus taylorii* (Family: Geogarypidae) is extremely widespread in southern Australia. However, based on current knowledge, it is not possible to state whether the three males and one female *Austrohorus* sp. or the two female *Euryolpium* sp. from the Family Olipidae are SREs.

Three species of scorpions (Family: Buthidae) were identified and while the taxonomy of Buthidae remains problematic, the three species were identified as not being SREs (Volschenk 2012).

Three species representing three families of centipede (Chilopda) were identified (Burger *et al.* 2012). Of these, full taxonomic treatment of Chilenophilidae is required before the endemicity of the single specimen vouchered can be determined, whereas the other species (*Scolopendra laeta* Family: Scolopendridae and *Pilbarascutigera incola* Family: Scutigeridae) are not considered SREs.

A single millipede sample submitted (Family: Paradoxosomatidae) was a damaged female which did not facilitate identification beyond family level. In the Mt Mason area, the most abundant and diverse genus is *Antichiropus*. All species of the genus are known to be SREs (Burger *et al.* 2012).

Seven isopod specimens from four sites that were submitted to the Museum contained only a single species of the genus *Budddelundia* (Family: Armadillidae) (Judd and Hosie 2012). While this species remains undescribed it is not considered a SRE.

Five species of land snails were identified belonging to the Families Punctidae, Pupillidae and Succineidae (Whisson 2012). None of the species are considered SREs. Although the family Succineidae in Australia is poorly known taxonomically, species are considered to have wide distributional ranges.

Overall, similar numbers of specimens were collected from within the sites and from out of the sites. However, it is noted that many more individuals were collected from Site 3 and for the smaller satellite sites associated with BIF, Site 7 (Table 22).

Table 22 – Invertebrates collected during the Spring 2011 and Autumn 2012 surveys

Class	Family	Species	Site 1		Site 2		Site 3		Site 4		Site 5		Site 6	Site 7	Site 8	Site 9	Site 10
Order			In	Out	In	Out	In	Out	In	Out	In	Out					
Arachnida																	
Aranea																	
	Idiopidae	*Eucyrtops* 'sp female'	-	-	-	-	1	1	1	1	1	1	-	-	-	-	-
		Eucyrtops `sp juv`	-	-	-	-	-	-	1	-	-	1	-	-	-	-	-
Pseudoscorpiones																	
	Garypidae	*Synsphyronus mimulus*	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
	Geogarypidae	*Geogarypus taylori*	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-
	Olpiidae	*Eurypolpium* sp.	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-
		Austrohorus sp.	-	-	-	1	-	-	1	-	2	-	-	-	-	-	-
Scorpiones																	
	Buthidae	*Isometroides* 'goldfields1'	-	-	-	-	1	-	-	-	3	-	-	-	-	1	1
		Lychas jonesae	-	-	1	-	1	-	-	-	-	-	-	-	-	-	-
		Lychas 'splendens'	-	-	-	-	1	-	-	-	1	-	-	-	-	-	-
Chilopoda																	
Geophilomorpha																	
	Chilenophilidae	sp.	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
Scolopendromorpha																	
	Scolopendridae	*Scolopendra laeta*	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
Scutigeromorpha																	
	Scutigeridae	*Pilbarascutigera incola*	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Diplopoda																	
Polydesmida																	
	Paradoxosomatidae	sp.	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
Crustacea																	
Isopoda																	
	Armadillidae	*Buddelundia* sp. nov. 39	-	-	-	-	-	-	1	-	1	-	-	-	2	3	-

Class	**Family**	**Species**	**Site 1**		**Site 2**		**Site 3**		**Site 4**		**Site 5**		**Site 6**	**Site 7**	**Site 8**	**Site 9**	**Site 10**
Order			**In**	**Out**	**In**	**Out**	**In**	**Out**	**In**	**Out**	**In**	**Out**					
Gastropoda																	
Stylommatophora																	
	Pupillidae	*Gastrocopta bannertonensis*	-	-	6	-	2	9	3	2	-	2	-	9	-	-	5
		Gastrocopta cf. *bannertonensis*	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Gastrocopta sp. (juv.)	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-
		Pupoides cf. *adelaidae*	-	-	-	-	5	-	-	-	-	-	-	3	-	-	-
		Pupoides cf. *myoporinae*	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
	Punctidae	*Westralaoma expicta*	-	-	-	-	4	5	-	-	1	-	-	4	-	-	-
	Succineidae	*Succinea* sp.	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-

6.1.2 Discussion

Short-range endemic invertebrate fauna generally possess similar ecological and life history characteristics, especially poor powers of dispersal, confinement to discontinuous habitats, slow growth and low fecundity (EPA 2004, 2009). While there are occasional SREs among the vertebrates and insects, there are much higher numbers among molluscs, earthworms, some spider groups, particularly the mygalomorphs, millipedes and some groups of crustaceans. Mountainous terrains, freshwater habitats, caves and other subterranean cavities provide suitable habitat for a wide variety of both terrestrial and aquatic (vertebrate and invertebrate) fauna (Harvey 2002).

No invertebrate species of conservation significance are listed for the survey area under the EPBC Act 1999, the WCA 1950 or in the DEC Threatened and Priority Fauna Database. However, it is recognised that few invertebrate surveys have been undertaken in the CYIP area. While Jupiter's Mt Mason project area does not support freshwater habitats, there are mountainous terrains in the form of BIFs and subterranean areas may support invertebrate fauna. The invertebrate survey targeted only terrestrial invertebrates in potential SRE habitat.

Of the 19 species identified, the classification of six species could not be determined. It is also noted that for one of the six, while the sample collected could not be identified, it is likely to belong to a genus in which all species are considered to be SREs. The remaining 13 species are not considered to be SREs.

Within the area proposed for disturbance in the Mt Mason tenement, no unique landscape was identified and there appeared to be no unique habitat that did not occur elsewhere in the area. While most sites comprised Mulga overstorey, the differences in the number of invertebrates collected suggest subtle differences between sites most likely in relation to their aspect and understorey flora species. For example, fewer invertebrates were collected from Sites 1 and 2 which were in the southern portion of the tenement. The topography of this area was rather flat and comprised sandy areas with few outcrops and certainly no BIF. The remaining sites, however, were more closely associated with BIF with five actually located in areas of BIF. Not surprisingly, few invertebrates were collected from these areas.

There appeared to be no large differences between the number of species collected within the trapping areas and those collected outside of the trapping areas. This clearly indicates that the invertebrate fauna at Mt Mason is not limited to particular areas but may be found throughout the tenement, albeit at varying densities.

A targeted SRE survey was conducted in 2008 in the Mt Mason area that also searched areas within the potential impact footprint and in non-impact areas proposed at that time (OES (2011). Four sampling sites were selected and all were located in areas of BIF (Figure 12). Results indicate that of the specimens collected, only one species *Aganippe* 'MYG224' (Family Idiopidae) is an SRE. No evidence of this species was recorded or collected during the current survey. In addition, two species from the Mollusc database have a low-level potential for short-range endemism. These include *Pupoides adelaidae* and *Succinea* sp. It is noted that a species (*Pupoides* cf. *adelaidae*) similar to the former was identified from those collected during this survey and was determined not to be a SRE (Whisson 2012).

The BIF range at Mt Mason lies in a north to south orientation for approximately 10 km and appears to be well connected to the BIF range at Mt Ida (approximately 8.6 km in length) (OES 2011). The potential SRE habitat supported by these ranges is extensive and is not limited to the area of proposed impact at Mt Mason.

7.0 ENVIRONMENTAL IMPACTS

7.1 Fauna of Conservation Significance

Native fauna species that are rare, threatened with extinction, or have high conservation value are protected by law under the Federal EPBC Act 1999, in addition to the Western Australia WCA 1950.

The EPBC Act 1999 lists two terrestrial bird species and three migratory bird species of national importance likely to occur within the area of the proposed mining activity, and the DEC Threatened and Priority Fauna Database lists one threatened reptile and six threatened bird species, with the reptile and two bird species protected under the WCA 1950 (Table 23). A short description of each of the species follows, with the potential impact on their conservation status.

Table 23 - Conservation significant terrestrial fauna potentially occurring in the study area

SPECIES	COMMON NAME	CONSERVATION SIGNIFICANCE			PREVIOUS RECORD
		EPBC	WCA	DEC	
REPTILES					
Aspidites ramsayi	Woma		S4		1966 Menzies
AVIFAUNA					
Leipoa ocellata	Malleefowl	Vulnerable	S1		1998 Leonora
					2001, 2007 Ularring
					2007 Menzies
Apus pacificus	Fork-tailed Swift	Migratory			
Ardea alba modesta	Great Egret	Migratory			
Falco peregrinus	Peregrine Falcon		S4		1978 Leonora 1999 Ularring
Ardeotis australis	Australian Bustard			P4	1973 Leonora 1980 Menzies
Thinornis rubricollis	Hooded Plover			P4	1980 Ularring 1992 Menzies
Merops ornatus	Rainbow Bee-eater	Migratory			
Acanthiza iredalei iredalei	Slender-billed Thornbill	Vulnerable			
Pomatostomus superciliosus	White-browed Babbler			P4	1980 Ularring
Oreoica gutturalis subsp. *gutturalis*	Crested Bellbird			P4	1980 Ularring

- ***Aspidites ramsayi* Woma**

  Family: Boidae

  Conservation Status: Schedule 4: Fauna that is in need of special protection under the WCA 1950.

  Distribution: The Woma was formerly abundant in the southwestern sandplains. They are now known from four disjunct populations: a southwestern population, isolated populations on Peron Peninsula, an arid northwestern population and a Central Australian population (Storr *et al.* 2002).

  Ecology: The Woma, also colloquially known as Ramsay's Python, grows up to 2.7 m long, although the average length is 1.5 m, and it is particularly placid. It has a grey, olive,

golden brown or rich red-brown back, ringed with darker bands. Unlike most other Australian pythons, the Woma has a narrow pointed head rather than a broad head distinct from its body. It does not have the characteristic python heat-sensory pits along the lips and front of the head. These features result in it being occasionally mistaken for a venomous snake, although like all pythons the Woma is harmless to humans.

Mating probably occurs between May to August. A clutch of 5–19 eggs are laid in September and October. Once the young snakes hatch, after about two months' incubation, the female probably leaves the maternal burrow and the juveniles are independent.

During the day the Woma shelters in hollow logs, old burrows or warrens or thick vegetation. It uses its head like a shovel to dig and enlarge its burrow. The Woma emerges at night to search for food, which includes reptiles including lizards or snakes, in addition to many species of venomous snakes, small mammals and birds. The snake wiggles the end of its tail to lure its prey close enough to strike, then kills its prey by squeezing it in the coils of its body, or by squashing it against the walls of its burrow or warren.

Likelihood of occurrence: The DEC Threatened and Priority Fauna Database lists one Woma recorded for 1966 ~70 km southeast of the survey area. Given this and the current distribution of this species, it is not likely that the Woma occurs within the survey area. Further, there does not appear to be preferred habitat for this species in the area surveyed at Mt Mason.

Potential Impacts: The conservation status of this species is not likely to be altered by the proposed mining activity in the survey area.

- **Malleefowl *Leipoa ocellata***

Family: Megapodidae

Conservation Status: Vulnerable under EPBC Act 1999 and Schedule 1: Rare and likely to become extinct under the WCA 1950

Distribution: The Malleefowl was once broadly distributed across the southern half of the Australian continent, but has undergone significant range reduction and now occupy semi-arid regions of southern Australia where mallee eucalypts form the dominant vegetation (Birds Australia 2012).

Ecology: The Malleefowl is a large, ground-dwelling bird that roosts in trees but rarely flies. The species is omnivorous and typically has a large home range in woodlands or shrublands that have a deep layer of leaf litter which is used in building nesting mounds. Mounds are up to one metre in height and 3m to 5 m in diameter. Breeding occurs from September to April and chicks emerge independently, approximately seven weeks after hatching.

Clearing of habitat, fox predation and the degradation of habitat by fire and overgrazing by feral livestock has reduced Malleefowl numbers considerably.

Likelihood of occurrence: During the survey period, seven old, inactive mounds were identified within the Mt Mason area with one active mound located 1.7 km south of the southern boundary of the Mt Mason tenement. The presence of this species is addressed in the recommendations.

Potential Impacts: Given the distribution of this species and the quality and quantity of preferred habitat in the region that will not be disturbed, it is unlikely that the overall conservation status of this species will be altered by the proposed mining activity.

- ***Apus pacificus* Fork-tailed Swift**

  Family: Apodidae

  Conservation Status: Migratory Marine under EPBC Act 1999.
  This species is also listed in the CAMBA, JAMBA and ROKAMBA agreements.

  Distribution: The Fork-tailed Swift breeds in northeast and mid-east Asia and winters in south New Guinea and Australia (Johnstone and Storr 1998). It is a visitor to most parts of Western Australia beginning to arrive in the Kimberley in late September, the Pilbara and Eucla in November and in the southwest in mid-December. It leaves in late April. While it is common in the Kimberley, it is uncommon near the northwest, west and southeast coasts and rare or scare elsewhere.

  Ecology: The Fork-tailed Swift does not breed in Australia. It is almost exclusively aerial, flying from less than 1 m to at least 300 m above ground and probably much higher. They probably roost aerially, but are occasionally observed to land (Higgins 1999). The species food items within Australia are not well known, however, the species is known to be insectivorous. Studies have recorded the Swift eating small bees, wasps, termites and moths.

  Likelihood of occurrence: Given the ecology of this species, the swift may include the area within its aerial forays and migratory path.

  Potential Impacts: There are no significant threats to the Fork-tailed Swift in Australia. Potential threats include habitat destruction and predation by feral animals (Birdlife International 2012). Due to the wide range and ecology of this species, the conservation status is unlikely to be altered by the proposed mining activity at Mt Mason.

- **Great Egret *Ardea alba modesta***

  Family: Ardeidae

  Conservation Status: Migratory Species under the EPBC Act 1999

  Distribution: The Great Egret has been recorded across much of Western Australia but avoids the driest regions of the western and central deserts (McKilligan 2005).

  Ecology: The Great Egret, also known as the White Egret is common to very common in well-watered Kimberley flatlands and scarce to moderately common elsewhere. Preferred habitat includes shallow freshwaters and shallow saltwaters, and rarely dry pastures.

  Likelihood of occurrence: Given the preferred habitat of this species, it is not likely to occur within the survey area.

  Potential Impacts: The conservation status of this species is not likely to be altered by the proposed mining activity at Mt Mason.

- ***Falco peregrinus* Peregrine Falcon**

  Family: Falconidae

  Conservation Status: Schedule 4: Fauna that is in need of special protection under the WCA 1950

  Distribution: The Peregrine Falcon is uncommon but widespread in distribution. It is moderately common within the higher aspects of the Stirling Ranges in the south of Western Australia but tends to be uncommon in the hilly northwest Kimberley (Johnstone and Storr 1998).

  Ecology: This species inhabits cliff faces such as those along the coast, near rivers and ranges. The Peregrine Falcon can also be seen around wooded watercourses and lakes. It nests on ledges in cliffs as well as granite outcrops and quarries and also makes use of mine pits. This Falcon feeds almost entirely on birds including sea birds and some parrot species (Johnstone and Storr 1998).

  Likelihood of occurrence: Two dated sightings of this species were recorded in 1978 and 1999 within 20 km of the Mt Mason Project area. It was not included in the results from Birds Australia Database or the Western Museum Database searches for the area. While it is not unreasonable for this species to be seen in flight in this area, the preferred habitat of this Falcon indicates that it is not likely to utilise the habitat within the area proposed for disturbance.

  Potential Impacts: The conservation status of this species is not likely to be altered by the proposed mining activity in the Mt Mason area.

- ***Ardeotis australis* Australian Bustard**

  Family: Otitidae

  Conservation Status: Priority Four: Taxa in need of monitoring on DEC Threatened and Priority Fauna Database.

  Distribution: The Australian Bustard occurs over much of Western Australia, with the exception of the more heavily wooded southern portion of the State (Johnstone and Storr 1998). Its wider distribution includes eastern Australia and New Guinea.

  Ecology: The Australian Bustard is a large ground-dwelling bird known to occur in open or lightly wooded country. It is nomadic and ranges over very large areas, largely dependent on rainfall and hence food availability. Although not flightless, Bustards spend the greater proportion of time on the ground.

  Likelihood of occurrence: Sightings of the Bustard for this area include one in 1973 near Leonora and one in 1980 near Menzies. While some of the habitat may be considered suitable for this species, no recording of this bird has been made in the local area for ~30 years. It is therefore not likely to occur in the study area. Notwithstanding this, if it were present, given its range and mobility, the Bustard is likely to avoid disturbance and move to less disturbed areas.

  Potential Impacts: The conservation status of this species is not likely to be altered by the proposed mining activity in the Mt Mason area.

- ***Charadrius rubricollis*** **Hooded Plover**

  Family: Charadriidae

  Conservation Status: Priority Four on DEC Threatened and Priority Fauna Database

  Distribution: In Western Australia, this small plover is found along the southern coast, west of Israelite Bay and north to Jurien Bay, and on off-shore islands (Johnstone and Storr 1998).

  Ecology: This species occurs along sandy and seaweedy beaches as well as along the margins of saltlakes, estuaries and dams where it feeds on invertebrates (Johnstone and Storr 1998).

  Likelihood of occurrence: The DEC Threatened and Priority Fauna Database list two sightings, one in 1980 at Ularring and a second in 1992 at Menzies. As there are no water bodies within the area surveyed, this species is not likely to occur in the study area.

  Potential Impacts: The conservation status of this species is not likely to be altered by the proposed mining activity in the survey area.

- **Rainbow Bee-eater** ***Merops ornatus***

  Family: Meropidae

  Conservation Status: Migratory Species under the EPBC Act 1999

  Distribution: The Rainbow Bee-eater is distributed across much of mainland Australia, and is a common summer migrant to southern Australia. They range from scarce to common across their range depending on suitable habitat and breeding grounds.

  Ecology: Rainbow Bee-eaters are very social birds and when not breeding roost together in large groups in dense understorey or large trees. They generally migrate south at the beginning of spring and breed from November to January. They require open areas with loamy soft soils soft enough for nest tunneling yet firm enough to support the tunnel.

  Likelihood of occurrence: The Rainbow Bee-eater usually migrates south in late September early October and north from February to April (Johnstone and Storr 1998). It is therefore not surprising that the Bee-eater was neither seen nor heard during the Spring 2011 survey that was conducted at the end of August beginning of September, and that it was recorded during the Autumn 2012 survey that was conducted in March.

  Potential Impacts: Given the migratory status of the Rainbow Bee-eater and its ability to travel vast distances, the conservation status of this species is not likely to be altered by the proposed mining activity in the Mt Mason area.

- ***Acanthiza iredalei iredalei*** **Slender-billed Thornbill**

  Family: Acanthizidae

  Conservation Status: Vulnerable under the EPBC Act 1999

  Distribution: The Slender-billed Thornbill is sparsely distributed in disjunct populations across the southern arid and semi-arid portion of Western Australia and western South Australia.

  Ecology: The preferred habitat for this species includes chenopod shrublands, treeless or sparsely wooded flatlands and saline flats associated with salt lakes. The Thornbill forages mainly on the ground and in low vegetation, increasing its vulnerability to predation by cats and foxes.

  Likelihood of occurrence: Given the absence of preferred habitat for this species, it is not likely to be present in the area proposed for disturbance. None were identified during the comprehensive survey.

  Potential Impacts: The conservation status of this species is not likely to be altered by the proposed mining activity in the survey area.

- ***Pomatostomus superciliosis ashbyi*** **White-browed Babbler (western wheatbelt)**

  Family: Pomatostomidae

  Conservation Status: Priority Four on the DEC Threatened and Priority Fauna Database

  Distribution: The White-browed Babbler is endemic to mainland Australia and occurs mainly in the arid and semi-arid zones south of the Tropic of Capricorn. Scattered populations are found in outback Northern Territory and Western Australia, particularly in the south-western corner of Western Australia.

  Ecology: The White-Browed Babbler is a gregarious bird that travels in flocks and has a strong community affinity. It is found in dry sclerophyll woodlands with a shrubby understorey, mulga, acacias, mallee, cypress pine scrubs, timber, scrub along watercourses and saltbush, and forages on or near the ground for insects and seeds.

  Likelihood of occurrence: The White-browed Babbler was recorded on the DEC Threatened and Priority Fauna Database in 1980 at Ularring. Three individual Babblers were recorded during the systematic sampling during the Spring 2011 survey and more were recorded opportunistically during both seasonal survey periods.

  Potential Impacts: Advice from the Office of the EPA indicates that the conservation status of this species refers to the western populations particularly in the agricultural zone where clearing and fragmentation of native vegetation has impacted on this species habitat. Given the location of the proposed activity and the large areas of intact, undisturbed, remnant vegetation regionally, the conservation status of this species is not likely to be altered by the proposed mining activity in the survey area.

- ***Oreoica gutturalis gutturalis*** **Crested Bellbird (southern)**

  Family: Pachycephalidae

  Conservation Status: Priority Four on DEC Threatened and Priority Fauna Database

  Distribution: The distributional range of the Crested Bellbird extends across the greater part of the State but not the wetter regions (north and west Kimberley, Darling Range and deep South-West).

  Ecology: This sedentary and solitary species inhabits the drier mallee woodlands and heaths of the southern parts of Western Australia. It forages mainly on the ground, primarily for insects, and breeds from March through to December across the State.

  Likelihood of occurrence: The Crested Bellbird was recorded at all sites during the seasonal surveys and was also recorded opportunistically.

  Potential Impacts: The Crested Bellbird (southern) is listed as a Priority 4 species on the DEC Threatened and Priority Fauna database for the Goldfields, Midwest, Wheatbelt and South Coast. While the Mt Mason areas falls within the Goldfields region, the conservation classification refers principally to areas where the preferred habitat of the Crested Bellbird has been disturbed, particularly by clearing of native vegetation and resultant fragmentation. The area proposed to be impacted is relatively undisturbed and large tracts of undisturbed native vegetation are present and will remain intact adjacent to the mining operations. The large home range and mobility of the Crested Bellbird strongly suggests that its conservation classification will not be compromised by the proposed mining activities at Mt Mason.

7.2 Potential Impacts

The EPA objective for terrestrial fauna is to maintain the abundance, species diversity and geographical distribution of terrestrial fauna and protect specially protected (Threatened) fauna consistent with the provision of the WCA 1950.

Integral to the development of mining operations in the Mt Mason area, the clearing, removal and/or disturbance of substantial areas of BIF and adjacent areas of native vegetation is anticipated. It is inevitable that there will be some localised loss of fauna due to direct mortality arising from these activities associated with the mining operations. However, for those vertebrate taxa that cannot move away from any disturbances, and in relation to potential impacts implied in Section 7.1, it is unlikely that the loss of individuals associated with the direct mortalities and compromise of proximal habitat values would be sufficient to affect the overall conservation status of any of the species recorded from the survey area.

Similarly, the ongoing impacts from mining activities including vehicular movements, noise and associated dust generation and machinery noise are not likely to alter the conservation status of any species that may persist in adjacent areas. Any invasion and dispersal of weed species may cause deterioration of the condition of the remaining vegetation and the invasion and/or spread of non-native mammals pose a threat to indigenous species in terms of predation and resource limitation. Both elements should be managed to ensure and promote the sustainability of native fauna and their habitat locally.

7.3 Habitats of Significance to Fauna Indigenous to Western Australia

Development of mining operations and associated infrastructure will result in the loss of native vegetation, removal of faunal habitat, fragmentation of currently contiguous habitat and loss of areas for dispersal of native fauna.

The overall condition of the vegetation within the survey area can generally be described as "Very Good" to "Excellent" with almost all disturbances within the area directly related to recent exploration activity and associated tracks.

None of the vegetation groups identified have been recognised as TEC's as defined in the EPBC Act 1999. However, the area surveyed lies within the buffer zone of a PEC (Bulga Downs / Perinvale / Walling vegetation complex) that has not yet been described by the DEC on the list of PECs. However, it is inferred that the PEC relates to the vegetation specifically occurring on the BIF (NVS 2012). No DRF were identified in the survey area and only one Priority 3 species (*Calotis* sp. Perinvale Range) was recorded. The vegetation communities are generally described as Mulga over shrubland and are extensive locally. Cowan (2001) reports that most species within at least the East Murchison bioregion are wide ranging and usually occur in at least one, and often several, adjoining subregions.

Given the above, there appears to be no unique, restricted or fauna-specific habitat types for terrestrial vertebrate fauna within the Mt Mason or local area. Thus, while the removal of up to approximately 220 ha of this native vegetation will impact on indigenous fauna, the vegetation cannot be considered to be significant habitat in a regional context.

Additionally, as discussed elsewhere in this report, fauna of conservation significance that may use this habitat are unlikely to be compromised by the removal of the vegetation for the proposed mining activities.

Given the limited knowledge of invertebrate fauna and their habitat, particularly in a regional context, it is not possible to gauge a likely impact on SREs following the proposed mining activities at Mt Mason. Notwithstanding this, potential SRE habitat supported by the BIF ranges at Mt Mason is extensive and is not limited to the area of proposed impact.

7.4 Recommendations

The following general recommendations apply in the case of any major disturbance to large areas of native vegetation, as a consequence of the proposed development for the Mt Mason Project:

- Any clearing be minimised in extent given that the abundance and diversity of species lost will be proportional to the amount of habitat cleared;
- Where possible, all infrastructure associated with the development of the mining operation be aligned preferentially to areas of existing disturbance;
- Where possible, access routes be aligned to existing tracks and other barriers or follow the boundaries of broad-scale intact native vegetation;
- A rehabilitation plan is developed that progressively rehabilitates areas as soon as they are no longer required; and
- All members of the work force on site attend an environmental induction to ensure they are familiar with the value of native vegetation to fauna indigenous to Western Australia. This should include awareness of driving restrictions, ensuring that off-road driving is minimised, fire prevention is actively practised, and appropriate responses are followed in the event of an accident involving fauna.

In addition, specific recommendations are made in relation to the Malleefowl:

- A targeted Malleefowl survey should be undertaken by a suitably qualified team in the areas proposed for disturbance as soon as detailed boundaries of these areas have been confirmed.
- Given the evidence of Malleefowl within the zone of impact, a referral should be submitted to the Federal Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) for approval in accordance with the EPBC Act 1999
- Pending the results of the targeted Malleefowl survey in the confirmed areas for disturbance and outcome of the DSEWPaC referral, a Malleefowl Management Plan should be developed and implemented immediately post approval.

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APPENDIX A
Keighery, B.J. (1994) Vegetation Condition Scales

Pristine (1). Pristine or nearly so, no obvious signs of disturbance.

Excellent (2). Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.

Very Good (3). Vegetation structure altered, obvious signs of disturbance.
For example, disturbance to vegetation structure caused by repeating fires, the presence of some more aggressive weeds, dieback, logging and grazing.

Good (4). Vegetation structure significantly altered by very obvious signs of multiple disturbance.
Retains basic vegetation structure or ability to regenerate it.
For example, disturbance to vegetation structure caused by frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.

Degraded (5). 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 (6). 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 compromising weed or crop species with isolated trees or shrubs.

APPENDIX B
Species likely to occur in the area and species identified in the area

		EPBC Search	DEC data search	WAM data search	Birds Australia data search	Previous studies in and around the study area			KLA reconnaissance survey 2011	Spring Survey 2011			Autumn Survey 2012		
						Burbidge *et al.* 1995	KLA 2011	KLA 2012		Systematic Sampling	Opportunistic sightings and evidence	Spotlighting	Systematic Sampling	Opportunistic sightings and evidence	Spotlighting
AMPHIBIANS															
LIMNODYNASTIDAE															
Neobatrachus sp.		-	-	-	-	-	-	-	-	-	-	-	-	-	-
Neobatrachus sutor	Shoemaker Frog	-	-	-	-	-	-	+	-	-	-	-	-	-	-
Neobatrachus wilsmorei	Plonking Frog	-	-	-	-	+	-	-	-	-	-	-	-	-	-
MYOBATRACHIDAE															
Pseudophryne occidentalis	Western Toadlet	-	-	-	-	+	+	+	-	-	-	-	-	-	-
REPTILES															
AGAMIDAE															
Caimanops amphiboluroides		-	-	-	-	-	+	+	-	+	+	-	+	-	-
Ctenophorus cristatus	Bicycle Dragon	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Ctenophorus fordi	Mallee Sand Dragon	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Ctenophorus isolepis	Crested Dragon	-	-	-	-	-	-	+	-	-	-	-	-	-	-
Ctenophorus isolepis subsp. *gularis*	Central Military Dragon	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Ctenophorus ornatus	Ornate Cervice Dragon	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Ctenophorus reticulatus	Western Netted Dragon	-	-	-	-	+	+	+	-	-	-	-	-	-	-
Ctenophorus salinarum	Salt Pain Dragon	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Ctenophorus scutulatus		-	-	-	-	+	+	+	-	+	-	-	+	+	-
Moloch horridus	Thorny Devil	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Pogona minor		-	-	-	-	+	+	+	-	+	+	-	-	-	-
Tympanocryptis cephalus	Pebble Dragon	-	-	-	-	-	-	+	-	-	-	-	-	-	-
DIPLODACTYLIDAE															
Diplodactylus granariensis subsp. *granariensis*		-	-	-	-	+	-	-	-	-	-	-	-	-	-
Diplodactylus pulcher		-	-	-	-	+	+	+	-	+	-	-	-	-	-
Lucasium stenodactylum		-	-	-	-	-	+	-	-	-	-	-	-	-	-
Oedura reticulata		-	-	-	-	+	-	-	-	-	-	-	-	-	-
Rhynchoedura ornata	Beaked Gecko	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Strophurus assimilis	Goldfields Spiny-tailed Gecko	-	-	-	-	+	-	-	-	+	-	-	-	-	-
Strophurus elderi		-	-	-	-	+	-	-	-	-	-	-	-	-	-
Strophurus intermedius		-	-	-	-	+	-	-	-	-	-	-	-	-	-

		EPBC Search	DEC data search	WAM data search	Birds Australia data search	Previous studies in and around the study area			KLA reconnaissance survey 2011	Spring Survey 2011			Autumn Survey 2012		
						Burbidge *et al.* 1995	KLA 2011	KLA 2012		Systematic Sampling	Opportunistic sightings and evidence	Spotlighting	Systematic Sampling	Opportunistic sightings and evidence	Spotlighting
Strophurus strophurus		-	-	-	-	-	-	+	-	-	-	-	-	-	-
CARPHODACTYLIDAE															
Nephrurus levis subsp. *levis*		-	-	-	-	-	-	+	-	-	-	-	-	-	-
Nephrurus vertebralis		-	-	-	-	+	-	+	-	-	-	-	-	-	-
Underwoodisaurus milii	Southern Barking Gecko	-	-	-	-	+	-	-	-	-	-	-	-	-	-
GEKKONIDAE															
Gehyra purpurascens		-	-	-	-	+	-	-	-	-	-	-	-	-	-
Gehyra variegata		-	-	-	-	+	-	+	-	-	-	-	+	-	-
Heteronotia binoei	Bynoe's Gecko	-	-	-	-	+	-	+	-	-	-	-	+	-	-
PYGOPODIDAE															
Delma butleri		-	-	-	-	+	-	-	-	-	-	-	-	-	-
Lialis burtonis		-	-	-	-	+	-	-	-	-	-	-	-	-	-
SCINCIDAE															
Cryptoblepharus plagiocephalus		-	-	-	-	+	+	-	-	-	+	-	-	-	-
Ctenotus sp.		-	-	-	-	-	-	+	-	-	-	-	-	-	-
Ctenotus atlas		-	-	-	-	+	-	-	-	-	-	-	-	-	-
Ctenotus grandis		-	-	-	-	-	+	-	-	-	-	-	-	-	-
Ctenotus leonhardii		-	-	-	-	+	+	+	-	-	-	-	+	-	-
Ctenotus mimetes		-	-	-	-	+	+	+	-	-	-	-	-	-	-
Ctenotus schomburgkii		-	-	-	-	+	+	+	-	+	-	-	-	-	-
Ctenotus uber subsp. *uber*		-	-	-	-	+	-	-	-	-	-	-	-	-	-
Ctenotus xenopleura		-	-	-	-	+	-	-	-	-	-	-	-	-	-
Cyclodomorphus branchialis		-	-	-	-	+	-	-	-	-	-	-	-	-	-
Egernia depressa	Pygmy Spiny-tailed Skink	-	-	-	-	+	-	+	-	+	+	-	+	-	-
Egernia formosa		-	-	-	-	+	-		-	-	-	-	-	-	-
Eremiascincus richardsonii	Broad-banded Sand Swimmer	-	-	-	-	+	-	+	-	-	-	-	-	-	-
Hemiergis initialis subsp. *initialis*		-	-	-	-	+	-	-	-	-	-	-	-	-	-
Hemiergis millewae		-	-	-	-	+	-	-	-	-	-	-	-	-	-
Lerista macropisthopus subsp. *macropisthopus*		-	-	-	-	+	-	-	-	-	-	-	-	-	-
Lerista muelleri		-	-	-	-	+	-	-	-	-	-	-	-	-	-
Liopholis inornata		-	-	-	-	+	-	-	-	-	-	-	-	-	-

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Menetia greyii		-	-	-	-	+	+	+	-	+	+	-	+	-	-
Morethia butleri		-	-	-	-	+	-	+	-	-	-	-	-	-	-
VARANIDAE	spp.										+			+	
Varanus caudolineatus		-	-	-	-	+	-	+	-	+	-	-	+	-	-
Varanus gouldii	Bungarra or Sand Monitor	-	-	-	-	+	-	+	-	-	-	-	-	-	-
Varanus panoptes	Yellow-spotted Monitor	-	-	-	-	-	-	+	-	+	+	-	+	+	-
Varanus tristis subsp. *tristis*	Racehorse Monitor	-	-	-	-	+	-	+	-	-	-	-	-	-	-
TYPHLOPIDAE															
Ramphotyphlops bituberculatus		-	-	-	-	-	-	+	-	-	-	-	-	-	-
Ramphotyphlops hamatus		-	-	-	-	+	-	-	-	-	-	-	-	-	-
BOIDAE															
Antaresia stimsoni	Stimson's Python	-	-	-	-	-	-	+	-	-	-	+	-	-	-
Aspidites ramsayi	Woma	-	+	-	-	-	-	-	-	-	-	-	-	-	-
ELAPIDAE	spp.										+				
Demansia psammophis	Yellow-faced Whipsnake	-	-	-	-	-	-	+	-	-	-	-	-	-	-
Demansia psammophis subsp. *psammophis*		-	-	-	-	+	-	-	-	-	-	-	-	-	-
Neelaps bimaculatus	Black Naped Snake	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Parsuta monachus		-	-	-	-	+	-	-	-	-	-	-	-	-	-
Pseudechis butleri	Spotted Mulga Snake	-	-	-	-	-	-	+	-	-	+	-	-	-	-
Pseudonaja modesta	Ringed Brown Snake	-	-	-	-	+	-	+	-	-	-	-	-	-	-
Pseudonaja nuchalis	Gwardar; Northern Brown Snake	-	-	-	-	+	-	-	-	-	+	-	-	-	-
Simoselaps bertholdi	Jan's Banded Snake	-	-	-	-	+	-	-	-	-	-	-	-	-	-
MAMMALS															
TACHYGLOSSIDAE															
Tachyglossus aculeatus	Echidna	-	-	-	-	+	-	+	-	-	+	-	-	-	-
DASYURIDAE															
Ningaui ridei	Wongai Ningaui	-	-	-	-	+	-	+	-	-	-	-	-	-	-
Ningaui yvonneae	Southern Ningaui	-	-	-	-	+	-	-	-	-	-	-	-	-	-

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Pseudantechinus macdonnellensis	Fat-tailed Pseudantechinus	-	-	-	-	-	+	-	-	-	-	-	-	-	-
Pseudantechinus woolleyae	Woolley's Pseudantechinus	-	-	-	-	-	-	+	-	-	-	-	+	-	+
Sminthopsis sp.		-	-	-	-	-	-	+	-	-	-	-	-	-	-
Sminthopsis crassicaudata	Fat-tailed Dunnart	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Sminthopsis dolichura	Little long-tailed Dunnart	-	-	-	-	+	+	+	-	+	-	-	+	-	-
Sminthopsis hirtipes	Hairy-footed Dunnart	-	-	-	-	+	-	+	-	-	-	-	-	-	-
Sminthopsis longicaudata	Long-tailed Dunnart	-	-	-	-	-	-	+	-	+	-	-	+	-	-
MACROPODIDAE															
Macropus fuliginosus	Western Grey Kangaroo	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Macropus robustus erubescens	Euro	-	-	-	-	+	+	+	-	-	-	+	-	-	-
Macropus rufus	Red Kangaroo	-	-	-	-	+	-	+	-	-	-	-	-	-	+
CHIROPTERA															
Chiroptera sp.		-	-	-	-	-	-	+	-	-	-	+	-	-	+
VESPERTILIONIDAE															
Chalinolobus gouldii	Gould's Wattle Bat	-	-	-	-	+	+	+	-	+	-	-	+	-	-
Chalinolobus morio	Chocolate Wattled Bat	-	-	-	-	-	+	-	-	-	-	-	-	-	-
Nyctophilus geoffroyi	Lesser Long-eared Bat	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Nyctophilus major	Greater Long-eared Bat	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Nyctophilus sp.		-	-	-	-	-	+	+	-	+	-	-	+	-	-
Scotorepens balstoni	Inland Broad-nosed Bat	-	-	-	-	+	-	+	-	+	-	-	+	-	-
Vespadelus baverstocki	Inland Forest Bat	-	-	-	-	+	+	-	-	-	-	-	-	-	-
Vespadelus finlaysoni	Finlayson's Cave Bat	-	-	-	-	-	-	+	-	+	-	-	+	-	-
Vespadelus regulus	Southern Forest Bat	-	-	-	-	+	-	-	-	-	-	-	-	-	-
MOLOSSIDAE															
Mormopterus planiceps	Southern Freetail-bat	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Mormopterus sp. 3		-	-	-	-	-	+	-	-	+	-	-	+	-	-
Mormopterus sp. 3 / *Mormopterus* sp. 4		-	-	-	-	-	-	+	-	-	-	-	-	-	-
Tadarida australis	White-striped Freetailed-bat	-	-	-	-	+	+	+	-	+	-	-	+	-	-

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MURIDAE															
*Mus musculus**	House Mouse	-	-	-	-	+	+	+	-	+	-	-	+	-	-
Notomys alexis	Spinifex Hopping-mouse	-	-	-	-	+	+	+	-	-	-	-	+	-	-
Notomys mitchellii	Mitchell's Hopping-mouse	-	-	-	-	-	+	-	-	-	-	-	-	-	-
Pseudomys albocinereus	Ash-grey Mouse	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Pseudomys bolami	Bolam's Mouse	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Pseudomys hermannsburgensis	Sandy Inland Mouse	-	-	-	-	+	+	+	-	-	-	-	+	-	-
LEPORIDAE															
Oryctolagus cuniculus*	Rabbit	+	-	-	-	+	-	+	-	-	+	-	-	+	+
CANIDAE	sp.	-	-	-	-	-	-	-	-	-	+	-	-	+	-
Canis lupus dingo	Dingo	-	-	-	-	+	-	-	-	-	-	-	-	-	-
*Canis lupus familiaris**	Dog	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*Vulpes vulpes**	Red Fox	+	-	-	-	+	-	+	-	-	-	-	-	-	-
FELIDAE															
*Felis catus**	Cat	+	-	-	-	+	-	+	-	-	+	-	-	-	-
BOVIDAE															
*Bos taurus**	European Cattle	-	-	-	-	-	-	+	-	-	+	-	-	-	-
*Equus asinus**	Donkey	-	-	-	-	-	-	+	-	-	+	-	-	-	-
*Capra hircus**	Goat	+	-	-	-	+	-	+	-	-	-	-	-	-	-
Ovis aries	Sheep	-	-	-	-	+	-	-	-	-	-	-	-	-	-
AVIFAUNA															
CASUARIIDAE															
Dromaius novaehollandiae	Emu	-	-	-	+	+	-	+	-	-	+	-	-	+	-
MEGAPODIIDAE															
Leipoa ocellata	Malleefowl	-	+	-	+	+	-	+	-	-	+	-	-	+	-
ANATIDAE															
Cygnus atratus	Black Swan	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Tadorna tadornoides	Australian Shelduck	-	-	-	-	+	-	+	-	-	-	-	-	-	-
Chenonetta jubata	Australian Wood Duck	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Malacorhynchus membranaceus	Pink-eared Duck	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Anas gracilis	Grey Teal	-	-	-	-	+	-	-	-	-	-	-	-	-	-

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Anas superciliosa	Pacific Black Duck	-	-	-	-	+	-	+	-	-	-	-	-	-	-
Aythya australis	Hardhead	-	-	-	-	+	-	-	-	-	-	-	-	-	-
PODICIPEDIDAE															
Poliocephalus poliocephalus	Hoary-headed Grebe	-	-	-	-	+	-	-	-	-	-	-	-	-	-
COLUMBIDAE															
Phaps chalcoptera	Common Bronzewing	-	-	-	+	+	-	+	+	-	+	-	+	+	+
Ocyphaps lophotes	Crested Pigeon	-	-	-	+	+	-	+	-	-	-	-	-	-	-
PODARGIDAE															
Podargus strigoides	Tawny Frogmouth	-	-	-	-	+	-	+	-	-	-	-	-	+	+
EUROSTOPODIDAE															
Eurostopodus argus	Spotted Nightjar	-	-	-	+	+	-	+	-	-	-	+	-	-	-
AEGOTHELIDAE															
Aegotheles cristatus	Australian Owlet-nightjar	-	-	-	-	+	-	+	-	-	-	-	+	+	+
APODIDAE															
Apus pacificus	Fork-tailed Swift	+	-	-	-	-	-	-	-	-	-	-	-	-	-
ARDEIDAE															
Ardea pacifica	White-necked Heron	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Ardea modesta alba	Western Great Egret	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Egretta novaehollandiae	White-faced Heron	-	-	-	-	+	-	-	-	-	-	-	-	-	-
ACCIPITRIDAE															
Lophoictinia isura	Square-tailed Kite	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Hamirostra melanosternon	Black-breasted Buzzard	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Haliastur sphenurus	Whistling Kite	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Accipiter fasciatus	Brown Goshawk	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Accipiter cirrocephalus	Collared Sparrowhawk	-	-	-	-	+	-	+	-	-	-	-	-	-	-
Circus assimilis	Spotted Harrier	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Aquila audax	Wedge-tailed Eagle	-	-	-	+	+	-	+	-	-	+	-	-	-	-
Hieraaetus morphnoides	Little Eagle	-	-	-	-	+	-	-	-	-	-	-	-	-	-

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FALCONIDAE															
Falco cenchroides	Australian Kestrel	-	-	-	+	+	-	+	+	-	-	-	-	-	-
Falco berigora	Brown Falcon	-	-	-	-	+	-	+	+	-	-	-	-	-	-
Falco longipennis	Australian Hobby	-	-	-	+	+	-	-	-	-	-	-	-	-	-
Falco peregrinus	Peregrine Falcon	-	+	-	-	+	-	-	-	-	-	-	-	-	-
RALLIDAE															
Fulica atra	Eurasian Coot	-	-	-	-	+	-	-	-	-	-	-	-	-	-
OTIDIDAE															
Ardeotis australis	Australian Bustard	-	+	-	-	-	-	-	-	-	-	-	-	-	-
RECURVIROSTRIDAE															
Himantopus himantopus	Black-winged Stilt	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Recurvirostra novaehollandiae	Red-necked Avocet	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Cladorhynchus leucocephalus	Banded Stilt	-	-	-	-	+	-	-	-	-	-	-	-	-	-
CHARADRIIDAE															
Charadrius ruficapillus	Red-capped Plover	-	-	-	+	+	-	-	-	-	-	-	-	-	-
Elseyornis melanops	Black-fronted Dotterel	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Thinornis rubricollis	Hooded Plover	-	+	-	-	+	-	-	-	-	-	-	-	-	-
Erythrogonys cinctus	Red-kneed Dotterel	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Vanellus tricolor	Banded Lapwing	-	-	-	-	+	-	-	-	-	-	-	-	-	-
TURNICIDAE															
Turnix velox	Little Button-quail	-	-	-	-	+	-	-	-	-	-	-	-	-	-
LARIDAE															
Chroicocephalus novaehollandiae	Silver Gull	-	-	-	-	+	-	-	-	-	-	-	-	-	-
CACATUIDAE															
Eolophus roseicapillus	Galah	-	-	-	+	+	-	+	+	+	+	-	-	-	-
Nymphicus hollandicus	Cockatiel	-	-	-	-	+	-	+	-	+	+	-	-	-	-
PSITTACIFORMES															
Barnardius zonarius	Australian Ringneck	-	-	-	+	+	+	+	+	+	+	-	+	+	-
Psephotus varius	Mulga Parrot	-	-	-	-	+	+	+	-	-	-	-	-	+	-

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Melopsittacus undulatus	Budgerigar	-	-	-	-	+	-	+	-	+	+	-	-	-	-
Neopsephotus bourkii	Bourke's Parrot	-	-	-	-	+	-	-	-	+	-	-	-	-	-
Polytelis anthopeplus	Elegant Parrot	-	-	-	-	-	+	-	-	-	-	-	-	-	-
Neophema splendida	Scarlet-chested Parrot	-	-	-	-	+	-	-	-	-	-	-	-	-	-
CULCULIDAE															
Chalcites basalis	Horsfield's Bronze Cuckoo	-	-	-	+	+	-	+	-	+	-	-	-	-	-
Chalcites osculans	Black-eared Cuckoo	-	-	-	+	-	-	+	-	+	-	-	-	-	-
Cacomantis pallidus	Pallid Cuckoo	-	-	-	-	+	+	+	-	+	-	-	-	-	-
STRIGIDAE															
Ninox novaeseelandiae	Southern Boobook Owl	-	-	-	+	+	-	-	-	-	-	-	-	-	-
HALCYONIDAE															
Todiramphus pyrrhopygius	Red-backed Kingfisher	-	-	-	-	+	-	-	-	-	-	-	-	-	-
MEROPIDAE															
Merops ornatus	Rainbow Bee-eater	+	-	-	-	+	-	+	-	-	-	-	-	+	-
CLIMACTERIDAE															
Climacteris affinis	White-browed Treecreeper	-	-	-	-	+	+	+	-	-	-	-	-	-	-
Climacteris rufa	Rufous Treecreeper	-	-	-	-	+	-	-	-	-	-	-	-	-	-
PTILONORHYNCHIDAE															
Ptilonorhynchus guttatus	Western Bowerbird	-	-	-	-	-	-	+	-	+	-	-	-	-	-
MALURIDAE															
Malurus splendens	Splendid Fairy-wren	-	-	-	+	+	+	+	-	+	+	-	+	+	-
Malurus leucopterus	White-winged Fairy-wren	-	-	-	+	+	-	-	-	-	-	-	-	-	-
Malurus lamberti	Variegated Fairy-wren	-	-	-	-	+	+	-	-	-	-	-	-	-	-
ACANTHIZIDAE															
Calamanthus campestris	Rufous Fieldwren	-	-	-	-	-	-	-	-	+	-	-	-	-	-
Pyrrholaemus brunneus	Redthroat	-	-	-	+	+	+	+	-	+	-	-	-	-	-
Smicrornis brevirostris	Weebill	-	-	-	+	+	+	+	+	+	-	-	+	-	-
Gerygone fusca	Western Gerygone	-	-	-	-	+	+	-	-	-	-	-	-	-	-
Acanthiza sp.		-	-	-	-	-	-	+	-	-	-	-	-	-	-

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Acanthiza robustirostris	Slaty-backed Thornbill	-	-	-	+	-	-	+	-	+	-	-	+	+	-
Acanthiza chrysorrhoa	Yellow-rumped Thornbill	-	-	-	+	+	+	+	-	+	-	-	-	-	-
Acanthiza uropygialis	Chestnut-rumped Thornbill	-	-	-	+	+	+	+	-	-	-	-	-	-	-
Acanthiza iredalei iredalei	Slender-billed Thornbill	+	-	-	-	+	-	-	-	-	-	-	-	-	-
Acanthiza apicalis	Inland Thornbill	-	-	-	+	+	+	+	-	+	-	-	+	+	+
Aphelocephala leucopsis	Southern Whiteface	-	-	-	+	+	+	+	-	-	-	-	-	-	-
PARDALOTIDAE															
Pardalotus striatus	Striated Pardalote	-	-	-	-	+	+	+	-	-	-	-	-	-	-
MELIPHAGIDAE	sp.	-	-	-	-	-	-	+	-	-	-	-	-	-	-
Certhionyx variegatus	Pied Honeyeater	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Lichenostomus virescens	Singing Honeyeater	-	-	-	+	+	+	+	-	+	-	-	+	+	-
Lichenostomus leucotis	White-eared Honeyeater	-	-	-	-	+	+	+	-	-	-	-	-	-	-
Lichenostomus ornatus	Yellow-plumed Honeyeater	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Lichenostomus plumulus	Grey-fronted Honeyeater	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Purnella albifrons	White-fronted Honeyeater	-	-	-	+	+	-	+	-	-	-	-	-	-	-
Manorina flavigula	Yellow-throated Miner	-	-	-	+	+	-	+	-	+	+	-	-	+	-
Acanthagenys rufogularis	Spiny-cheeked Honeyeater	-	-	-	+	+	+	+	-	+	+	-	+	+	-
Anthochaera carunculata	Red Wattlebird	-	-	-	+	+	-	+	-	+	+	-	-	-	-
Epthianura tricolor	Crimson Chat	-	-	-	-	+	-	-	-	+	-	-	-	-	-
Epthianura albifrons	White-fronted Chat	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Sugomel niger	Black Honeyeater	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Lichmera indistincta	Brown Honeyeater	-	-	-	-	+	+	-	-	-	-	-	-	-	-
Melithreptus brevirostris	Brown-headed Honeyeater	-	-	-	+	+	-	+	-	-	-	-	-	-	-
POMATOSTOMIDAE															
Pomatostomus superciliosus	White-browed Babbler	-	+	-	-	+	+	+	-	+	+	-	-	+	-
PSOPHODIDAE															
Cinclosoma castanotus	Chestnut Quail-thrush	-	-	-	-	+	+	-	-	-	-	-	-	-	-
Cinclosoma castaneothorax	Chestnut-breasted Quail-thrush	-	-	-	+	-	-	+	-	-	-	-	-	-	-

		EPBC Search	DEC data search	WAM data search	Birds Australia data search	Previous studies in and around the study area			KLA reconnaissance survey 2011	Spring Survey 2011			Autumn Survey 2012		
						Burbidge *et al.* 1995	KLA 2011	KLA 2012		Systematic Sampling	Opportunistic sightings and evidence	Spotlighting	Systematic Sampling	Opportunistic sightings and evidence	Spotlighting
NEOSITTIDAE															
Daphoenositta chrysoptera	Varied Sittella	-	-	-	-	+	+	+	-	-	-	-	-	-	-
CAMPEPHAGIDAE															
Coracina maxima	Ground Cuckoo-shrike	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Coracina novaehollandiae	Black-faced Cuckoo-shrike	-	-	-	+	+	+	+	+	+	-	-	-	+	-
Lalage sueurii	White-winged Triller	-	-	-	-	+	+	+	-	-	-	-	-	-	-
PACHYCEPHALIDAE															
Pachycephala inornata	Gilbert's Whistler	-	-	-	-	+	+	-	-	-	-	-	-	-	-
Pachycephala rufiventris	Rufous Whistler	-	-	-	+	+	+	+	-	+	-	-	+	+	+
Colluricincla harmonica	Grey Shrike-thrush	-	-	-	+	+	+	+	-	+	+	-	+	-	-
Oreoica gutturalis	Crested Bellbird	-	+	-	+	+	+	+	-	+	+	-	+	+	-
ARTAMIDAE															
Artamus sp.		-	-	-	-	-	-	+	-	-	-	-	-	-	-
Artamus personatus	Masked Woodswallow	-	-	-	-	+	-	+	-	-	-	-	-	-	-
Artamus cinereus	Black-faced Woodswallow	-	-	-	+	+	-	+	-	-	-	-	-	-	-
Artamus cyanopterus	Dusky Woodswallow	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Artamus minor	Little Woodswallow	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Cracticus torquatus	Grey Butcherbird	-	-	-	+	+	+	+	-	-	-	-	-	-	-
Cracticus nigrogularis	Pied Butcherbird	-	-	-	+	+	-	+	-	+	-	-	+	-	-
Cracticus tibicen	Australian Magpie	-	-	+	+	+	-	+	-	-	-	-	-	-	-
Strepera versicolor	Grey Currawong	-	-	-	+	+	+	+	-	+	+	-	+	-	-
RHIPIDURIDAE															
Rhipidura albiscapa	Grey Fantail	-	-	-	+	+	+	+	-	-	-	-	+	+	-
Rhipidura leucophrys	Willie Wagtail	-	-	-	+	+	-	+	-	-	-	-	-	+	-
CORVIDAE															
Corvus coronoides	Australian Raven	-	-	-	+	-	-	-	-	-	-	-	-	-	-
Corvus bennetti	Little Crow	-	-	-	+	+	+	+	-	+	+	-	-	-	-
Corvus orru	Torresian Crow	-	-	-	-	-	-	+	-	-	-	-	+	+	-
MONARCHIDAE															
Grallina cyanoleuca	Magpie-lark	-	-	-	+	+	-	+	-	-	-	-	-	-	-

		EPBC Search	DEC data search	WAM data search	Birds Australia data search	Previous studies in and around the study area			KLA reconnaissance survey 2011	Spring Survey 2011			Autumn Survey 2012		
						Burbidge *et al.* 1995	KLA 2011	KLA 2012		Systematic Sampling	Opportunistic sightings and evidence	Spotlighting	Systematic Sampling	Opportunistic sightings and evidence	Spotlighting
PETROICIDAE															
Microeca fascinans	Jacky Winter	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Petroica boodang	Scarlet Robin	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Petroica goodenovii	Red-capped Robin	-	-	-	+	+	+	+	-	-	+	-	+	+	+
Melanodryas cucullata	Hooded Robin	-	-	-	+	+	+	+	-	-	-	-	-	+	-
HIRUNDINIDAE															
Cheramoeca leucosternus	White-backed Swallow	-	-	-	+	-	-	+	-	-	-	-	-	-	-
Hirundo neoxena	Welcome Swallow	-	-	-	+	+	-	+	-	-	-	-	-	-	-
Petrochelidon ariel	Fairy Martin	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Petrochelidon nigricans	Tree Martin	-	-	-	-	+	-	-	-	-	-	-	-	-	-
MEGALURIDAE															
Cincloramphus mathewsi	Rufous Songlark	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Cincloramphus cruralis	Brown Songlark	-	-	-	-	+	-	-	-	-	-	-	-	-	-
NECTARINIIDAE															
Dicaeum hirundinaceum	Mistletoebird	-	-	-	-	+	-	+	-	-	-	-	-	-	-
ESTRILDIDAE															
Taeniopygia guttata	Zebra Finch	-	-	-	+	+	+	+	-	-	-	-	-	-	-
MOTACILLIDAE															
Anthus novaseelandiae	Australian Pipit	-	-	-	+	+	-	+	-	-	-	-	-	-	-

APPENDIX C
Categories used in the assessment of conservation status

IUCN (2001) Red List Categories

EXTINCT (EX)

A taxon is Extinct when there is no reasonable doubt that the last individual has died. A taxon is presumed Extinct when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.

EXTINCT IN THE WILD (EW)

A taxon is Extinct in the Wild when it is known only to survive in cultivation, in captivity or as a naturalized population (or populations) well outside the past range. A taxon is presumed Extinct in the Wild when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.

CRITICALLY ENDANGERED (CR)

A taxon is Critically Endangered when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered*, and it is therefore considered to be facing an extremely high risk of extinction in the wild.

ENDANGERED (EN)

A taxon is Endangered when the best available evidence indicates that it meets any of the criteria A to E for Endangered*, and it is therefore considered to be facing a very high risk of extinction in the wild.

VULNERABLE (VU)

A taxon is Vulnerable when the best available evidence indicates that it meets any of the criteria A to E for Vulnerable*, and it is therefore considered to be facing a high risk of extinction in the wild.

NEAR THREATENED (NT)

A taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.

LEAST CONCERN (LC)

A taxon is Least Concern when it has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category.

DATA DEFICIENT (DD)

A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution are lacking. Data Deficient is therefore not a category of threat. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate. It is important to make positive use of whatever data are available. In many cases great care should be exercised in choosing between DD and a threatened status. If the range of a taxon is suspected to be relatively circumscribed, and a considerable period of time has elapsed since the last record of the taxon, threatened status may well be justified.

NOT EVALUATED (NE)

A taxon is Not Evaluated when it is has not yet been evaluated against the criteria

- Refer to http://www.iucnredlist.org/documents/redlist_cats_crit_en.pdf for criteria

Schedules used in the WA Wildlife Conservation Act 1950.

Schedule 1. Rare and Likely to become Extinct.

Schedule 2. Extinct.

Schedule 3. Migratory species listed under international treaties.

Schedule 4. Other Specially Protected Fauna.

Department of Environment and Conservation Priority Species

(species not listed under the Conservation Act, but for which there is some concern)

Priority 1. Taxa with few, poorly known population on threatened lands.

Priority 2. Taxa with few, poorly known populations on threatened lands, or taxa with several, poorly known populations not on conservation lands.

Priority 3. Taxa with several, poorly known populations, some on conservation lands.

Priority 4. Taxa in need of monitoring. Taxa which are considered to have been adequately surveyed, or for which sufficient knowledge is available, and which are considered not currently threatened or in need of special protection, but could be if present circumstances change.

Priority 5. Taxa in need of monitoring. Taxa which are not considered threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years (IUCN Conservation Dependent).

JAMBA The agreement between the Government of Australia and the Government of Japan for the Protection of Migratory Birds in Danger of Extinction and their Environment. Australian Treaty Series 1981 No 6.

CAMBA The agreement between the Government of Australia and the Government of the People's Republic of China for the Protection of Migratory Birds and their Environment. Australian Treaty Series 1988 No 22.

ROKAMBA The agreement between the Government of Australia and the Government of the Republic of Korea on the Protection of Migratory Birds and their Environment. Australian Treaty Series 2007 ATS 24.

APPENDIX D
Department of Environment and Conservation Regulation 17 Permits

DEPARTMENT OF ENVIRONMENT AND CONSERVATION

Enquiries: 17 DICK PERRY AVE, KENSINGTON, WESTERN AUSTRALIA
Telephone: 08 9334 0333
Facsimile: 08 9334 0242
Correspondence: Locked Bag 30
Bentley Delivery Centre WA 6983

PAGE 2
NO. SF008183
PERSON NO. 78973

DATE OF ISSUE 18/08/2011
VALID FROM 18/08/2011
DATE OF EXPIRY 31/10/2011

LICENSING OFFICER

(VI)

LICENSEE: DR V SAFFER
ADDRESS SENIOR BIOLOGIST
KEITH LINDBECK & ASSOCIATES
P.O. BOX 144
BULLCREEK
W.A. 6149

AMENDED
6.9.2011 OPS
Date Initial

DEPARTMENT OF ENVIRONMENT AND CONSERVATION

Enquiries: 17 DICK PERRY AVE, KENSINGTON, WESTERN AUSTRALIA
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Facsimile: 08 9334 0242

Correspondence: Locked Bag 30
Bentley Delivery Centre WA 6983

PAGE 1
NO. SF008183
PERSON NO. 78973

RECEIPT NO. AMOUNT
$0.00

WILDLIFE CONSERVATION ACT 1950
REGULATION 17

LICENCE TO TAKE FAUNA FOR SCIENTIFIC PURPOSES

THE UNDERMENTIONED PERSON MAY TAKE FAUNA FOR RESEARCH OR OTHER SCIENTIFIC PURPOSES AND WHERE AUTHORISED, KEEP IT IN CAPTIVITY, SUBJECT TO THE FOLLOWING AND ATTACHED CONDITIONS, WHICH MAY BE ADDED TO, SUSPENDED OR OTHERWISE VARIED AS CONSIDERED FIT.

DIRECTOR GENERAL

CONDITIONS

1 THE LICENSEE SHALL COMPLY WITH THE PROVISIONS OF THE WILDLIFE CONSERVATION ACT AND REGULATIONS AND ANY NOTICES IN FORCE UNDER THIS ACT AND REGULATIONS.

2 UNLESS SPECIFICALLY AUTHORISED IN THE CONDITIONS OF THIS LICENCE OR OTHERWISE IN WRITING BY THE DIRECTOR GENERAL, SPECIES OF FAUNA DECLARED AS LIKELY TO BECOME EXTINCT, RARE OR OTHERWISE IN NEED OF SPECIAL PROTECTION SHALL NOT BE CAPTURED OR OTHERWISE TAKEN.

3 NO FAUNA SHALL BE TAKEN FROM ANY NATURE RESERVE, WILDLIFE SANCTUARY, NATIONAL PARK, MARINE PARK, TIMBER RESERVE OR STATE FOREST WITHOUT PRIOR WRITTEN APPROVAL OF THE DIRECTOR GENERAL. NO FAUNA SHALL BE TAKEN FROM ANY OTHER PUBLIC LAND WITHOUT THE WRITTEN APPROVAL OF THE GOVERNMENT AUTHORITY MANAGING THAT LAND.

4 NO ENTRY OR COLLECTION OF FAUNA TO BE UNDERTAKEN ON ANY PRIVATE PROPERTY OR PASTORAL LEASE WITHOUT THE CONSENT IN WRITING OF THE OWNER OR OCCUPIER, OR FROM ANY ABORIGINAL RESERVE WITHOUT THE WRITTEN APPROVAL OF THE DEPARTMENT OF INDIGENOUS AFFAIRS.

5 NO FAUNA OR THEIR PROGENY SHALL BE RELEASED IN ANY AREA WHERE IT DOES NOT NATURALLY OCCUR, NOR BE HANDED OVER TO ANY OTHER PERSON OR AUTHORITY UNLESS APPROVED BY THE DIRECTOR GENERAL, NOR SHALL THE REMAINS OF SUCH FAUNA BE DISPOSED OF IN SUCH MANNER AS TO CONFUSE THE NATURAL OR PRESENT DAY DISTRIBUTION OF THE SPECIES.

6 THIS LICENCE AND THE WRITTEN PERMISSION REFERRED TO AT CONDITIONS 3 & 4 MUST BE CARRIED BY THE LICENSEE OR AUTHORISED AGENT AT ALL TIMES FOR THE PURPOSE OF PROVING THEIR AUTHORITY TO TAKE FAUNA WHEN QUESTIONED AS TO THEIR RIGHT TO DO SO BY A WILDLIFE OFFICER, ANY OTHER STATE OR LOCAL GOVERNMENT EMPLOYEE OR ANY MEMBER OF THE PUBLIC.

7 **********ANY INTERACTION INVOLVING GAZETTED THREATENED FAUNA THAT MAY BE HARMFUL AND/OR INVASIVE MAY REQUIRE APPROVAL FROM THE COMMONWEALTH DEPT OF THE ENVIRONMENT AND WATER RESOURCES, PHONE 02 6274 1900. INTERACTION WITH SUCH SPECIES IS CONTROLLED BY THE COMMONWEALTH GOVERNMENT'S "ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999" & "ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION REGULATIONS 2000" AS WELL AS DEC'S WILDLIFE CONSERVATION ACT & REGULATIONS.**********

8 NO BIOPROSPECTING INVOLVING THE REMOVAL OF SAMPLE AQUATIC AND TERRESTRIAL ORGANISMS (BOTH FLORA AND FAUNA) FOR CHEMICAL EXTRACTION AND BIOACTIVITY SCREENING IS PERMITTED TO BE CONDUCTED WITHOUT SPECIFIC WRITTEN APPROVAL BY THE DIRECTOR GENERAL OF DEC.

9 FURTHER CONDITIONS (NUMBERED 1 TO 7) ARE ATTACHED.

PURPOSE LEVEL 2 FAUNA SURVEY USING A GRID DESIGN AT MT MASON AND MT IDA NEAR MENZIES IN THE GOLDFIELDS FOR JUPITER MINES LIMITED. FAUNA CAPTURE WILL BE VIA ASSISTED DRY PITFALL, FUNNEL, ELLIOTT AND CAGE TRAPS. FAUNA SPECIES WILL BE IDENTIFIED AND THEN RELEASED AT POINT OF CAPTURE SOME INVERTEBRATE SPECIMENS MAY BE TAKEN FOR IDENTIFICATION.

AUTHORISED PERSONS
MS ERICA MACINTYRE
MS MERRI BARTLETT
MR HAMISH BURNETT

WILDLIFE CONSERVATION REGULATIONS 1970

Regulation 17:- Licence to Take Fauna for Scientific Purposes

FURTHER CONDITIONS (OF LICENCE NUMBER SF008183)

1. The licensee shall take fauna only in the manner stated on the endorsed Regulation 17 licence application form and endorsed related correspondence.

2. Except in the case of approved lethal traps, the licensee shall ensure that measures are taken in the capture and handling of fauna to prevent injury or mortality resulting from that capture or handling. Where traps or other mechanical means or devices are used to capture fauna these shall be deployed so as to prevent exposure of trapped animals to ants and debilitating weather conditions and inspected at regular intervals throughout each day of their use. At the conclusion of research all markers etc and signs erected by the licensee and all traps shall be removed, all pitfalls shall be refilled or capped and the study area returned to the condition it was in prior to the research/capture program. During any break in research, cage traps should be removed and pitfalls either removed, capped or filled with sand.

3. No collecting is to be undertaken in areas where it would impinge on pre-existing scientific research programs.

4. Any form of colour marking of birds or bats shall only be undertaken in accordance with the requirements of the Australian Bird and Bat Banding Scheme.

5. Any inadvertently captured specimen of fauna which is declared as likely to become extinct, rare or otherwise in need of special protection is to be released immediately at the point of capture. Where such a specimen is injured or deceased, the licensee shall contact Department of Environment and Conservation licensing staff at Kensington (08 9423 2434) for advice on disposal. Records are to be kept of any fauna so captured and details included in the report required under further condition 6 below.

6. Within one month of the expiration of this licence, the holder shall submit an electronic return detailing the locality, site, geocode, date and number of each species captured, sighted or vouchered during the currency of the licence, into the Department of Environment and Conservation Fauna Survey Database (DECFSD). A copy of any paper, report or thesis resulting from the research shall on completion be lodged with the Director General. If a renewal of this licence is required, the licensee shall submit a written progress report for activities undertaken during this licence period prior to the expiry of this licence.

7. Not more than ten specimens of any one protected species shall be taken and removed from any location less than 20km apart. Where exceptional circumstances make it necessary to take large series in order to obtain adequate statistical data the collector will proceed with circumspection and justify their actions to the Director General in advance.

8. All holotypes and syntypes and a half share of paratypes of species or subspecies permitted to be permanently taken under this licence shall be donated to the Western Australian Museum. Duplicates (one pair in each case) of any species collected which represents a significant extension of geographic range shall be donated on request to the Western Australian Museum.

9. To prevent any unnecessary collecting in this State, all specimens and material collected under the authority of this license shall, on request, be loaned to the Western Australian Museum. Also, the unused portion or portions of any specimen collected under the authority of this license shall be offered for donation to the Western Australian Museum or made available to other scientific workers if so required.

DEPARTMENT OF ENVIRONMENT AND CONSERVATION

Enquiries: 17 DICK PERRY AVE, KENSINGTON, WESTERN AUSTRALIA
Telephone: 08 9334 0333
Facsimile: 08 9334 0242

Correspondence: **Locked Bag 30**
Bentley Delivery Centre WA 6983

PAGE 2
NO. SF008484
PERSON NO. 78973

DATE OF ISSUE 24/02/2012
VALID FROM 24/02/2012
DATE OF EXPIRY 09/04/2012

LICENSING OFFICER

LICENSEE: DR V SAFFER
ADDRESS SENIOR BIOLOGIST
KEITH LINDBECK & ASSOCIATES
P.O. BOX 144
BULLCREEK
W.A. 6149

(VI)

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PAGE NO. 1
SF008484
PERSON NO. 78973

RECEIPT NO. **AMOUNT**
$0.00

WILDLIFE CONSERVATION ACT 1950
REGULATION 17

LICENCE TO TAKE FAUNA FOR SCIENTIFIC PURPOSES

THE UNDERMENTIONED PERSON MAY TAKE FAUNA FOR RESEARCH OR OTHER SCIENTIFIC PURPOSES AND WHERE AUTHORISED, KEEP IT IN CAPTIVITY, SUBJECT TO THE FOLLOWING AND ATTACHED CONDITIONS, WHICH MAY BE ADDED TO, SUSPENDED OR OTHERWISE VARIED AS CONSIDERED FIT.

DIRECTOR GENERAL

CONDITIONS

1. THE LICENSEE SHALL COMPLY WITH THE PROVISIONS OF THE WILDLIFE CONSERVATION ACT AND REGULATIONS AND ANY NOTICES IN FORCE UNDER THIS ACT AND REGULATIONS.
2. UNLESS SPECIFICALLY AUTHORISED IN THE CONDITIONS OF THIS LICENCE OR OTHERWISE IN WRITING BY THE DIRECTOR GENERAL, SPECIES OF FAUNA DECLARED AS LIKELY TO BECOME EXTINCT, RARE OR OTHERWISE IN NEED OF SPECIAL PROTECTION SHALL NOT BE CAPTURED OR OTHERWISE TAKEN.
3. NO FAUNA SHALL BE TAKEN FROM ANY NATURE RESERVE, WILDLIFE SANCTUARY, NATIONAL PARK, MARINE PARK, TIMBER RESERVE OR STATE FOREST WITHOUT PRIOR WRITTEN APPROVAL OF THE DIRECTOR GENERAL. NO FAUNA SHALL BE TAKEN FROM ANY OTHER PUBLIC LAND WITHOUT THE WRITTEN APPROVAL OF THE GOVERNMENT AUTHORITY MANAGING THAT LAND.
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7. **********ANY INTERACTION INVOLVING GAZETTED THREATENED FAUNA THAT MAY BE HARMFUL AND/OR INVASIVE MAY REQUIRE APPROVAL FROM THE COMMONWEALTH DEPT OF THE ENVIRONMENT AND WATER RESOURCES, PHONE 02 6274 1900. INTERACTION WITH SUCH SPECIES IS CONTROLLED BY THE COMMONWEALTH GOVERNMENT'S "ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999" & "ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION REGULATIONS 2000" AS WELL AS DEC'S WILDLIFE CONSERVATION ACT & REGULATIONS.**********
8. NO BIOPROSPECTING INVOLVING THE REMOVAL OF SAMPLE AQUATIC AND TERRESTRIAL ORGANISMS (BOTH FLORA AND FAUNA) FOR CHEMICAL EXTRACTION AND BIOACTIVITY SCREENING IS PERMITTED TO BE CONDUCTED WITHOUT SPECIFIC WRITTEN APPROVAL BY THE DIRECTOR GENERAL OF DEC.
9. FURTHER CONDITIONS (NUMBERED (TO 9) ARE ATTACHED.

PURPOSE LEVEL 2 FAUNA SURVEY USING CAGE TRAPS, ELLIOTT TRAPS, DRY PIT TRAPS AND FUNNEL TRAPS AT MT MASON AND MT IDA, CENTRAL YILGARN IRON PROJECT AREA (CYIP) FOR JUPITER MINES LIMITED.

AUTHORISED PERSONS
MS ERICA MACINTYRE
DR RONALD SNOOK
DR WESLEY BANCROFT

WILDLIFE CONSERVATION REGULATIONS 1970

Regulation 17:- Licence to Take Fauna for Scientific Purposes

FURTHER CONDITIONS (OF LICENCE NUMBER SF008484)

1. The licensee shall take fauna only in the manner stated on the endorsed Regulation 17 licence application form and endorsed related correspondence.

2. Except in the case of approved lethal traps, the licensee shall ensure that measures are taken in the capture and handling of fauna to prevent injury or mortality resulting from that capture or handling. Where traps or other mechanical means or devices are used to capture fauna these shall be deployed so as to prevent exposure of trapped animals to ants and debilitating weather conditions and inspected at regular intervals throughout each day of their use. At the conclusion of research all markers etc and signs erected by the licensee and all traps shall be removed, all pitfalls shall be refilled or capped and the study area returned to the condition it was in prior to the research/capture program. During any break in research, cage traps should be removed and pitfalls either removed, capped or filled with sand.

3. No collecting is to be undertaken in areas where it would impinge on pre-existing scientific research programs.

4. Any form of colour marking of birds or bats shall only be undertaken in accordance with the requirements of the Australian Bird and Bat Banding Scheme.

5. Any inadvertently captured specimen of fauna which is declared as likely to become extinct, rare or otherwise in need of special protection is to be released immediately at the point of capture. Where such a specimen is injured or deceased, the licensee shall contact Department of Environment and Conservation licensing staff at Kensington (08 9423 2434) for advice on disposal. Records are to be kept of any fauna so captured and details included in the report required under further condition 6 below.

6. Within one month of the expiration of this licence, the holder shall submit an electronic return detailing the locality, site, geocode, date and number of each species captured, sighted or vouchered during the currency of the licence, into the Department of Environment and Conservation Fauna Survey Database (DECFSD). A copy of any paper, report or thesis resulting from the research shall on completion be lodged with the Director General. If a renewal of this licence is required, the licensee shall submit a written progress report for activities undertaken during this licence period prior to the expiry of this licence.

7. Not more than ten specimens of any one protected species shall be taken and removed from any location less than 20km apart. Where exceptional circumstances make it necessary to take large series in order to obtain adequate statistical data the collector will proceed with circumspection and justify their actions to the Director General in advance.

8. All holotypes and syntypes and a half share of paratypes of species or subspecies permitted to be permanently taken under this licence shall be donated to the Western Australian Museum. Duplicates (one pair in each case) of any species collected which represents a significant extension of geographic range shall be donated on request to the Western Australian Museum.

9. To prevent any unnecessary collecting in this State, all specimens and material collected under the authority of this license shall, on request, be loaned to the Western Australian Museum. Also, the unused portion or portions of any specimen collected under the authority of this license shall be offered for donation to the Western Australian Museum or made available to other scientific workers if so required.

ATTACHMENT 6

Keith Lindbeck and Associates
Environmental Management Consultants
ABN 36 150 274 469

Jupiter Mines Limited

CENTRAL YILGARN IRON PROJECT

MT MASON PROJECT AND PROPOSED HAUL ROAD

TARGETED EPBC FAUNA SURVEY

Report Prepared for: ***Jupiter Mines Limited***

Report Prepared by: Keith Lindbeck and Associates
PO Box 144
BULLCREEK WA 6149
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March 2013

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1.0 INTRODUCTION

1.1 BACKGROUND

Jupiter Mines Limited (Jupiter) is engaged in the exploration and development of mineral resources at its Central Yilgarn Iron Project (CYIP) area. The CYIP area is located approximately 530 km northeast of Perth and 110 km northwest of Menzies and consists of three project areas: Mt Alfred, Mt Mason and Mt Ida (Figure 1). All three projects are 100% owned by Jupiter. The Mt Alfred project lies within the northern portion of the Illaara Greenstone Belt some 59km northwest of the Mt Mason and Mt Ida projects. The Mt Mason and Mt Ida projects lie within the northern portion of the Mount Ida Greenstone Belt which is located along the eastern boundary of the Southern Cross Granite-Greenstone Terrane.

High-grade hematite mineralisation at Mt Mason project represents a potential low cost DSO project which upon completion would lead to mining at the Mount Ida magnetite deposit. The Mt Mason DSO project will require a haul road from the Mt Mason project area to the port of Esperance via the Menzies-Sandstone Road.

The Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) Protected Matters Search Tool provides results of protected matters, including fauna species listed under the Federal *Environment Protection and Biodiversity Conservation* (EPBC) *Act 1999*. The results of the searches for the CYIP area are presented below (Table 1):

Table 1 - EPBC Protected Matters Search Tool Results for Fauna in CYIP area

Scientific Name	Common Name	Status*
Leipoa ocellata	Malleefowl	Vulnerable
Apus pacificus	Fork-tailed Swift	Migratory
Ardea alba	Great Egret	Migratory
Merops ornatus	Rainbow Bee-eater	Migratory
Acanthiza iredalei iredalei	Slender-billed Thornbill	Vulnerable

* Status defined in Appendix 1.

Jupiter commissioned Keith Lindbeck and Associates (KLA) to undertake a targeted EPBC fauna survey of Mt Mason's disturbance footprint and the associated Haul Road (Figure 2).

1.2 PURPOSE AND SCOPE

The objective of the targeted EPBC fauna survey was to ground truth the vegetation within the Mt Mason disturbance footprint and the proposed Haul Road and identify suitable habitat for the listed species.

The purpose of this report is to document the methodology and results of the targeted EPBC fauna survey conducted by KLA in March and April 2012.

The scope of work was to:

- conduct a targeted EPBC fauna survey in all uncleared areas within the footprint of proposed disturbance at Mt Mason and the associated Haul Road,
- determine areas of habitat suitable for all species listed in Table 1 in these areas,
- provide an impact risk assessment for selected targeted vertebrate fauna species, and
- provide recommendations, including the management of selected fauna of conservation significance and their habitats.

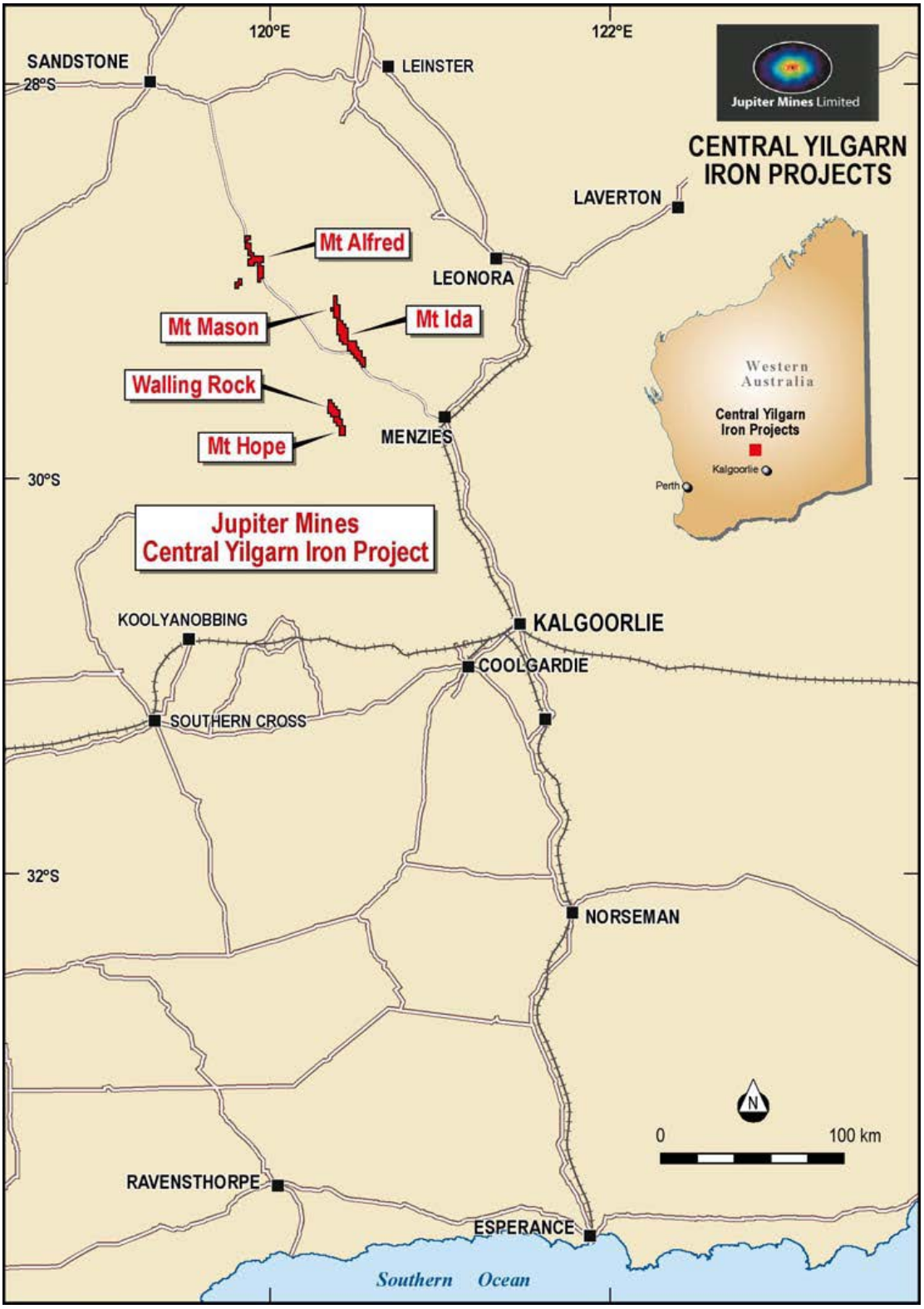

Figure 1 - Location of Jupiter's CYIP

2.0 DESCRIPTION OF THE SPECIES

2.1 MALLEEFOWL *Leipoa ocellata*

Malleefowl (*Leipoa ocellata,* Gould, 1840) are large ground dwelling birds belonging to the Megapodiidae family. This species belongs to a small group of mound builders where the mound is used as an external heat source to incubate their eggs (Clark 1964). The Malleefowl is a long-lived sedentary species with an average lifespan of roughly 15 years. Reaching approximately 60cm in height and 1.5 - 2kg in weight, they are roughly the size of a small turkey (Benshemesh 2007). They have a unique appearance with a distinctly barred upper body of grey, white, black, buff and pale chestnut feathers, with a crest extending from the front of the crown to the nape which is raised when the bird is alarmed (Pizzey and Knight 1999) (Figure 2).

Figure 2 - Adult Malleefowl *Leipoa ocellata*

2.1.1 General Ecology

The Malleefowl occupies semi-arid to arid regions of Western Australia, inhabiting dense shrublands and thickets of Mallee (*Eucalyptus spp*.), Boree (*Melaleuca lanceolata*), Bowgada (*Acacia linophylla*), or areas which form dense leaf litter (Johnstone and Storr 1998). Malleefowl prefer habitat that is long unburnt for breeding and shelter (Benshemesh 2007). However Malleefowl will feed in recently burnt areas (Benshemesh 1992, Marchant and Higgins 1993).

The Malleefowl builds mounds that utilise heat from the sun and composting vegetation to incubate their eggs (Figure 3). Most heat is generated from the fermentation of vegetative material used to create the mound, along with solar energy used later in the season as the leaf litter dries out (Johnstone and Storr 1998). The size of Malleefowl mounds vary. However, an average mound spans 5m in diameter and can be up to 1m high (Benshemesh 2007)

Figure 3 - Malleefowl Mound

Malleefowl are usually solitary and occupy a home range of between 0.5 and 4.6 km^2 (Benshemesh 1992). Individuals are known to move distances of 15 km or greater over a matter of weeks (Sims 2000, cited in Parsons *et al.* 2009). Established monogamous breeding pairs usually inhabit a similar area throughout the year and come together for breeding. While both sexes build the mound, once the female has laid the eggs, the male usually maintains the mound on his own. Birds generally breed annually (Marchant and Higgins 1993) with the breeding season lasting 11 months. Following mound preparation, eggs are laid from mid-August to late January and hatchlings appear from November (Johnstone and Storr 1998). The precocial chicks are independent from hatching having no contact with either their parents or siblings (van der Waag 2007). While 50% to 85% of eggs hatch (Frith 1959), generally more than 80% of chicks die within the first few weeks of life from predation and 'metabolic stress' (Priddel and Wheeler 1994).

Malleefowl feed opportunistically and will often feed on whatever food sources are abundant in the area (van der Waag 2007). Their omnivorous diet can consist of seeds, native herbs, flower buds, fruits and foliage of different plant species, as well as invertebrates. Malleefowl will drink water but can easily survive during summer when surface water is unavailable (DEC 2012).

2.1.2 Distribution of the Malleefowl

Originally, Malleefowl were widespread and common across the southern arid and semiarid zone. However the species has now become patchily distributed due to the effects of habitat clearing and fox predation (Johnstone and Storr 1998). Unlike other megapods that prefer damp forest, the Malleefowl does not inhabit the higher rainfall area of the Swan Coastal Plain and the wetter parts of the south coast of Western Australia (Figure 4).

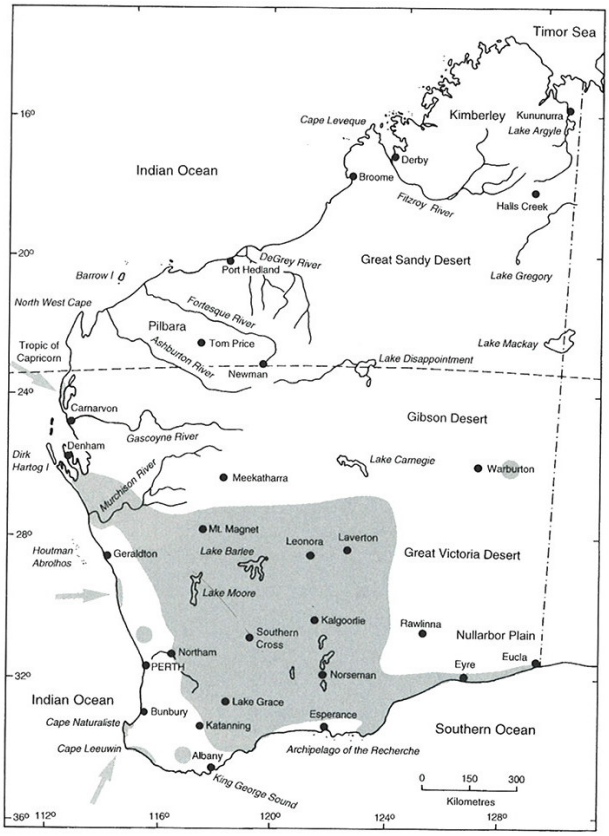

Figure 4 - Distribution of Malleefowl

2.1.3 Malleefowl Conservation Status

The Malleefowl is protected under Federal and State legislation: it is classified as Vulnerable: "Taxa facing a high risk of extinction in the wild in the medium-term future" under the EPBC Act 1999 and is also listed as Schedule 1: "Rare and likely to become extinct" under the WCA 1950. The DSEWPaC administers the EPBC Act 1999 and the Department of Environment and Conservation (DEC) administers the WCA 1950.

The Malleefowl is also listed as Vulnerable on the 2011 IUCN Red List of Threatened Species.

2.1.1 Known Presence in the CYIP Area

Numerous sightings and evidence of Malleefowl have been recorded in Jupiter's CYIP area. A list of potential mounds was provided to the zoological team and these were audited before and during the survey.

Malleefowl and evidence of their presence have been recorded regionally elsewhere (Burbidge *et al.* 1995, Chapman and Pronk 1997, Ninox 2009, Biota 2011, KLA 2011).

2.2 FORK-TAILED SWIFT *Apus pacificus*

The Fork-tailed Swift is a medium to large member of the Apodidae Family. It has a length of 18–21 cm is blackish with a pale throat, white rump and long, thin, deeply forked tail when fanned (Figure 5).

Figure 5 – Fork-tailed Swift *Apus pacificus*

2.2.1 General Ecology

The Fork-tailed Swift does not breed in Australia. It is almost exclusively aerial, flying from less than 1 m to at least 300 m above ground and probably much higher. They probably roost aerially, but are occasionally observed to land (Higgins 1999). The species food items within Australia are not well known, however, the species is known to be insectivorous. Studies have recorded the Swift eating small bees, wasps, termites and moths (Johnstone and Storr 1998).

2.2.2 Distribution of the Fork-Tailed Swift

The Fork-tailed Swift breeds in northeast and mid-east Asia and spends the northern winters in south New Guinea and most of Australia expect for a small arid inland area (Figure 6) (Johnstone and Storr 1998). It is a visitor to most parts of Western Australia (except the small arid interior extending south) beginning to arrive in the Kimberley in late September, the Pilbara and Eucla in November and in the southwest in mid-December. It leaves in late April. While it is common in the Kimberley, it is uncommon near the northwest, west and southeast coasts and rare or scare elsewhere.

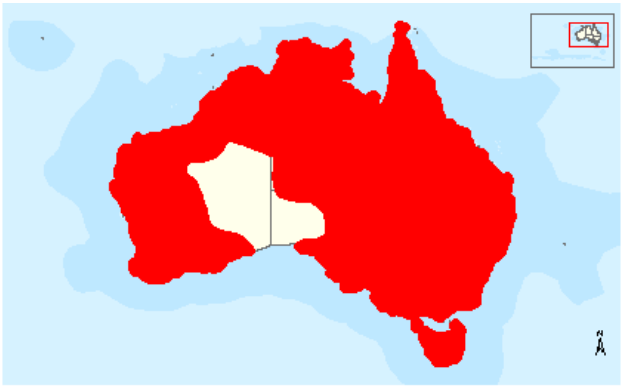

Figure 6 - Distribution of Fork-tailed Swift

2.2.3 Fork-Tailed Swift Conservation Status

The Fork-tailed Swift is listed as Migratory and Marine under the EPBC Act 1999.

It is also in international agreements between the Government of Australia and:

- the Government of Japan for the Protection of Migratory Birds in Danger of Extinction and their Environment. Australian Treaty Series 1981 No 6 (JAMBA),
- the Government of the People's Republic of China for the Protection of Migratory Birds and their Environment. Australian Treaty Series 1988 No 22 (CAMBA), and
- the Government of the Republic of Korea on the Protection of Migratory Birds and their Environment. Australian Treaty Series 2007 ATS 24 (ROKAMBA).

The Fork-tailed Swift is listed as Least Concern on the 2011 IUCN Red List of Threatened Species.

2.2.4 Known Presence in the CYIP Area

No sightings of the Fork-tailed swift were made during the recent Level 2 comprehensive surveys in the Mt Mason (KLA 2012a) and Mt Ida (KLA 2012b) areas and the species has not been recorded during other surveys conducted in the regional area (Burbidge *et al.* 1995, Chapman and Pronk 1997, Ninox 2009, Terrestrial Ecosystems 2011, Biota 2011, KLA 2011).

2.3 GREAT EGRET *Ardea alba modesta*

The Great Egret is a moderately large bird (83–103 cm in length, 700–1200 g in weight) with white plumage, a black or yellow bill and long reddish and black legs (DSWEPaC 2012) (Figure 7).

Figure 7 – Great Egret *Ardea modesta*

2.3.1 General Ecology

Great Egrets often occur solitarily, or in small groups when feeding. They roost in large flocks that may consist of hundreds of birds. The species usually nest in

colonies and rarely in solitary pairs. Colonies may be mono-specific or commonly mixed with other egrets, herons, ibises, spoonbills and/or cormorants.

The Great Egret usually frequents shallow waters and has been reported in a wide range of wetland type habitats. The Great Egret may retreat to permanent wetlands or coastal areas when other wetlands are dry. This may occur annually in some regions with regular wet and dry seasons or erratically where the availability of wetland habitat is also erratic.

In Australia, the breeding season of the Great Egret is variable, depending to some extent on rainfall but generally extends from November to April with pairs at southern latitudes breeding in spring and summer (particularly November and December), and pairs at more northerly latitudes breeding in summer and autumn (DSEWPaC 2012).

Breeding sites are usually located in wooded and shrubby swamps including mangrove forests in the Top End, Melaleuca swamps on the eastern coast of Australia and south-western Western Australia and mixed eucalypt/acacia/lignum swamps in the Channel Country and Murray-Darling Basin (DSEWPaC 2012).

Pairs construct a shallow platform-like nest of loosely woven sticks in the upper strata of trees or shrubs standing in or near water or sometimes in inundated reed beds. Females lay two to six, but usually three to five, pale blue or pale green eggs. The eggs are incubated by both parents, but mostly by the female, for a period of 23–29 days. Nestlings are fed and brooded by both parents. The young begin to clamber from the nest at 25–37 days of age. Fledged young make their final departure from the nest or colony at 55–88 days of age (DSEWPaC 2012).

The Great Egret has a diverse diet that includes fish, insects, crustaceans, molluscs, frogs, lizards, snakes and small birds and mammals.

2.3.2 Distribution of the Great Egret

In Australia, the distribution of Great Egrets is widespread (Figure 8). They occur in all states/territories of mainland Australia and in Tasmania. The Great Egret is also known as the White Egret, and distinguished from the Eastern Great Egret, the subspecies in Western Australia is referred to as *Ardea alba modesta*.

Figure 8 - Distribution of Great Egret

2.3.3 Great Egret Conservation Status

The Great Egret is listed as Migratory Wetland and Marine under the EPBC Act 1999.

It is also listed under the JAMBA and CAMBA Migratory Bird agreements.

The Great Egret is listed as Least Concern on the 2011 IUCN Red List of Threatened Species.

2.3.4 Known Presence in the CYIP Area

No sightings of the Great Egret were made during the recent Level 2 comprehensive surveys in the Mt Mason (KLA 2012a) and Mt Ida (KLA 2012b) areas, and the species has not been recorded during other previous survey in the regional area (Burbidge *et al.* 1995, Chapman and Pronk 1997, Ninox 2009, Terrestrial Ecosystems 2011, Biota 2011, KLA 2011).

2.4 RAINBOW BEE-EATER *Merops ornatus*

The Rainbow Bee-eater is a medium-sized bird and the only species of bee-eater in Australia (Figure 9).

Figure 9 – Rainbow Bee-eater *Merops ornatus*

2.4.1 General Ecology

The Rainbow Bee-eater is a migratory species whose movement patterns across Australia are not fully understood (DSEWPaC 2012). Generally, the Rainbow Bee-eater migrates north and spends the non-breeding period in northern Australia, Papua New Guinea and eastern Indonesia. In Western Australia, passage north occurs mostly from March to May and generally birds start moving south again late August and into September. In the far north some birds may be present all year.

Populations of the Rainbow Bee-eater gather together and assemble into flocks before migration. The migrating flocks, which can consist of tens to hundreds or thousands of birds often fly high above the ground when on passage.

Habitat for this species is also varied and includes open forests and woodlands, shrublands, various cleared or semi-cleared habitats, including farmland and areas of human habitation. It also occurs in inland and coastal sand dune systems, and in mangroves in northern Australia, and has been recorded in various other habitat types including heathland, sedgeland, vine forest and vine thicket, and on beaches. The Bee-eater usually nests in loose colonies that may contain up to about 50 pairs, but some pairs nest solitarily. They nest in burrows with entrances located on the ground or in banks or sandy slopes.

2.4.2 Distribution of the Rainbow Bee-Eater

The Rainbow Bee-eater is widely distributed throughout Australia and eastern Indonesia. It is distributed across much of mainland Australia, and occurs on several near-shore islands. It is not found in Tasmania, and is thinly distributed in the most arid regions of central and Western Australia.

Figure 10 - Distribution of Rainbow Bee-eater

2.4.3 Rainbow Bee-Eater Conservation Status

The Rainbow Bee-eater is listed as Migratory Terrestrial and Marine under the EPBC Act 1999.

It is also listed under the JAMBA Migratory Bird agreement.

The Rainbow Bee-eater is listed as Least Concern on the 2011 IUCN Red List of Threatened Species.

2.4.4 Known Presence in the CYIP Area

Being a migratory species, the presence of the Rainbow Bee-eater is dependent on the timing of surveys. Interestingly, the Rainbow Bee-eater was not recorded during the recent Spring 2011 or Autumn 2012 comprehensive surveys in the Mt Mason (KLA 2012a) and Mt Ida (KLA 2012b) areas of Jupiter's CYIP.

While the Rainbow Bee-eater has been recorded during some regional surveys (Burbidge *et al.* 1995, Chapman and Pronk 1997 and Biota 2011), it has not been recorded in others (Ninox 2009, Terrestrial Ecosystems 2011 and KLA 2011).

2.5 SLENDER-BILLED THORNBILL *Acanthiza iredalei iredalei*

The Slender-billed Thornbill (western) is a small passerine measuring approximately 10 cm in length (Figure 11).

Figure 11 – Slender-billed Thornbill *Acanthiza iredalei iredalei*

2.5.1 General Ecology

The Slender-billed Thornbill (western) usually occurs in pairs, or in small flocks of up to ten birds (DSEWPaC 2012). It may congregate into larger flocks from time to time, given that flocks of up to 20 and, rarely, up to 60 birds have been recorded in other subspecies of the Slender-billed Thornbill. The Slender-billed Thornbill (western) sometimes associates with other birds, such as Chestnut-rumped Thornbills *Acanthiza uropygialis*, Southern Whitefaces *Aphelocephala leucopsis* and Orange Chats *Epthianura aurifrons*. However, it breeds in solitary pairs.

The Slender-billed Thornbill (western) usually occurs in chenopod shrublands that are dominated by samphires or *Maireana* and *Atriplex* associations. It occasionally occurs in acacia shrublands and mangroves adjacent to more preferred habitat. It feeds on insects including caterpillars, grasshoppers, beetles, bees and ants and it also spiders and, occasionally, centipedes.

2.5.2 Distribution of the Slender-Billed Thornbill

The Slender-billed Thornbill (western) is a resident or sedentary subspecies that is not known to undertake any long-distance movements. The Slender-billed Thornbill (western) occurs in arid and semi-arid regions of southern Western Australia and south-western South Australia (Figure 12). Its known distribution extends from near Carnarvon in Western Australia, east though central Western Australia, and across the Nullarbor Plain to Whyalla, Port Augusta and Port Davis in South Australia.

There have not been any recent, major changes in the extent of occurrence, but the extent of occurrence does appear to have declined in the past. The distribution of the Slender-billed Thornbill (western) formerly extended to near Mullewa in south-western Western Australia a cattle station in the south of the Northern Territory, Moorilyanna Soak and Wantapella Swamp in northern South Australia, and Leigh Creek in eastern South Australia but there have been no recent records of the subspecies from any of these locations.

The Slender-billed Thornbill (western) is estimated to occur in seven subpopulations (Matthew 2006, pers. comm.) with three occurring in Western Australia. The seven subpopulations are located in the following areas:

- Carnarvon-Shark Bay region of Western Australia,
- central-southern Western Australia,
- Nullarbor Plain.

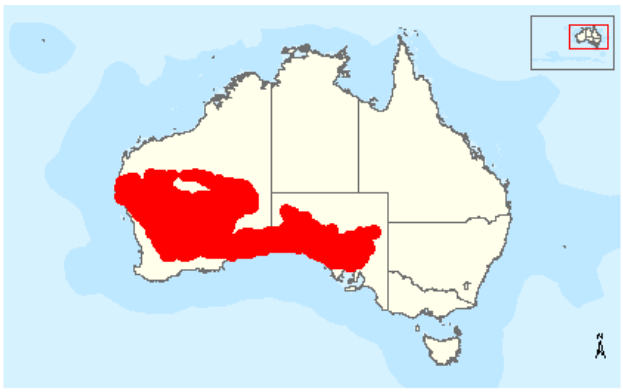

Figure 12 - Distribution of Slender-billed Thornbill

2.5.3 Slender-Billed Thornbill Conservation Status

The Slender-billed Thornbill is classified as Vulnerable: "Taxa facing a high risk of extinction in the wild in the medium-term future" under the EPBC Act 1999.

The Slender-billed Thornbill is listed as Least Concern on the 2011 IUCN Red List of Threatened Species.

2.5.4 Known Presence in the CYIP Area

No sightings of the Slender-billed Thornbill were made during the recent Level 2 comprehensive surveys in the Mt Mason (KLA 2012a) and Mt Ida (KLA 2012b) areas. This species has been recorded during at least one regional survey (Burbidge *et al.* 1995) and not in others (Chapman and Pronk 1997, Ninox 2009, Terrestrial Ecosystems 2011, Biota 2011, KLA 2011).

2.6 BIOPHYSICAL ENVIRONMENT

2.6.1 Location

The CYIP area lies approximately 30 km northwest of Lake Ballard (an ephemeral salt lake), 65 km east of Lake Barlee (an intermittent salt lake) and 110 km northwest of Menzies in the Goldfields district of Western Australia (Figure 13). The CYIP tenements cover an area of approximately 27,500 ha and are located within three different pastoral leases, Perrinvale Station to the north, Walling Rock Station to the west and Riverina Station to the east (Figure 14).

Within the CYIP, the Mt Mason tenement is located in the southern portion, although north of Mt Ida (Figure 1) and the proposed haul road extends from the eastern boundary of Mt Mason west of Mt Ida and continues south to join the existing Sandstone-Menzies Road.

2.6.2 Regional setting

The Interim Biogeographic Regionalisation for Australia (IBRA) divides the Australian continent into 85 bioregions and 403 subregions (Department of the Environment, Water, Heritage and the Arts 2009). The CYIP area is located within the Murchison IBRA region and (MUR1) East Murchison subregion (Cowan 2001).

The East Murchison bioregion which totals over seven million hectares is characterised by Mulga Woodlands often rich in ephemerals, hummock grasslands, saltbush shrublands and *Halosarcia* shrubland (Cowan 2001). The area is characterised by:

- internal drainage,
- extensive areas of elevated red desert sandplains with minimal dune development,
- salt lake systems that are associated with the occluded Palaeodrainage system, and
- broad plains of red-brown soils and breakaway complexes as well as red sandplains (Cowan 2001).

2.6.3 Vegetation and Flora

The CYIP is located within the Austin District of the Eremaean Botanical Province characterised by predominantly mulga low woodland on plains, and scrub on hills, with tree steppe of *Eucalyptus* spp. and *Triodia basedowii* on sand plains. (Beard 1990).

Numerous flora and vegetation mapping surveys have previously been undertaken in the area (Paul Armstrong and Associates 2008, Meissner and Owen 2010, Outback Ecology 2010).

Vegetation and flora surveys of the Mt Mason project area have been undertaken by Native Vegetation Solutions (NVS) and have included:

- Level 2 vegetation survey of the Mt Mason project area on 3-7 October 2011 (NVS 2012a).
- Level 1 flora survey of the proposed haul road from Mt Mason to the Sandstone-Menzies public road from 29-31 May 2012 (NVS 2012b).

These surveys were undertaken in accordance with EPA Position Statement No. 3 *Terrestrial Biological Surveys as an Element of Biodiversity Protection* (EPA 2002)

and EPA Guidance Statement No. 51 *Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (EPA, 2004).

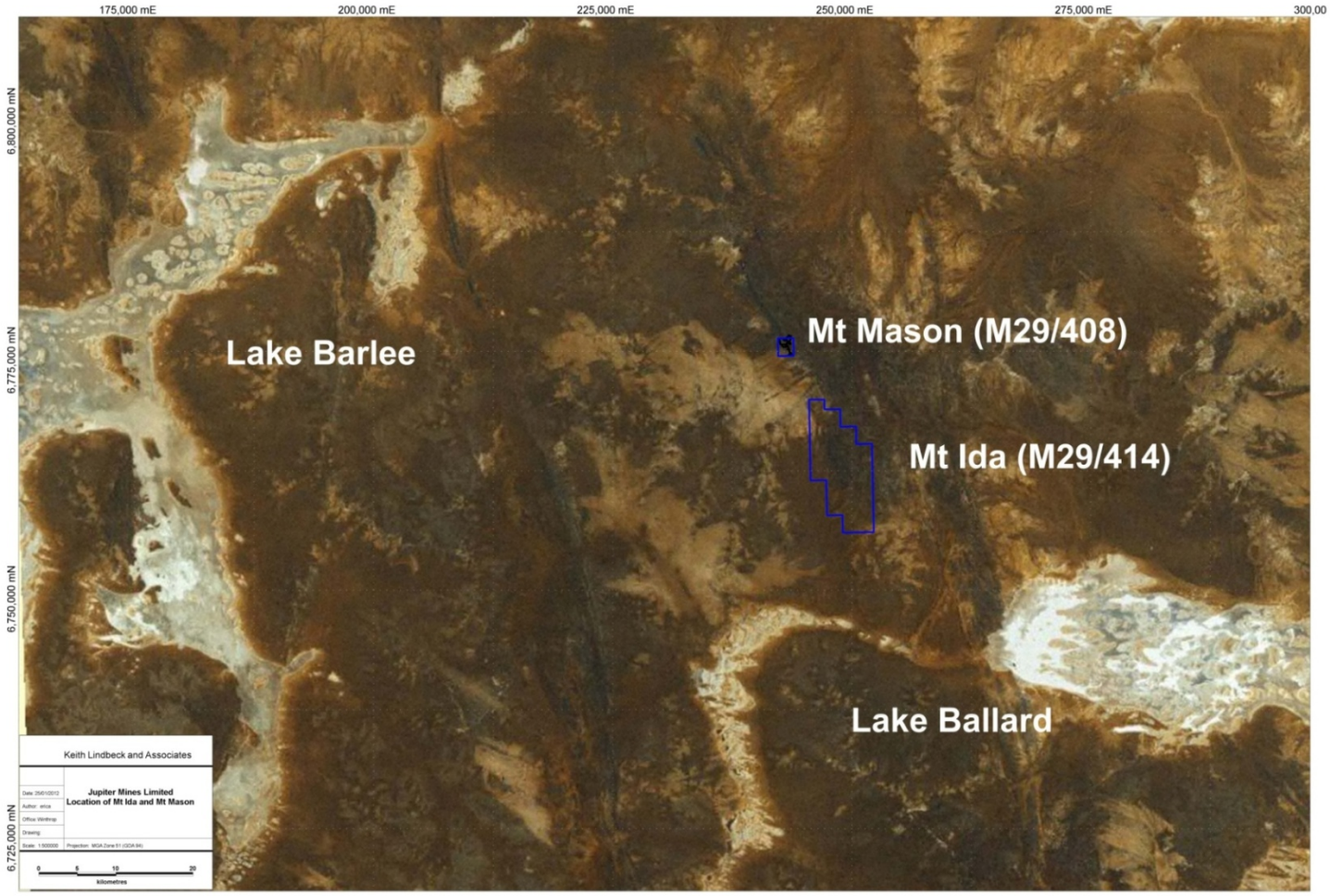

Figure 13 - Location of Mt Mason and Mt Ida Tenements

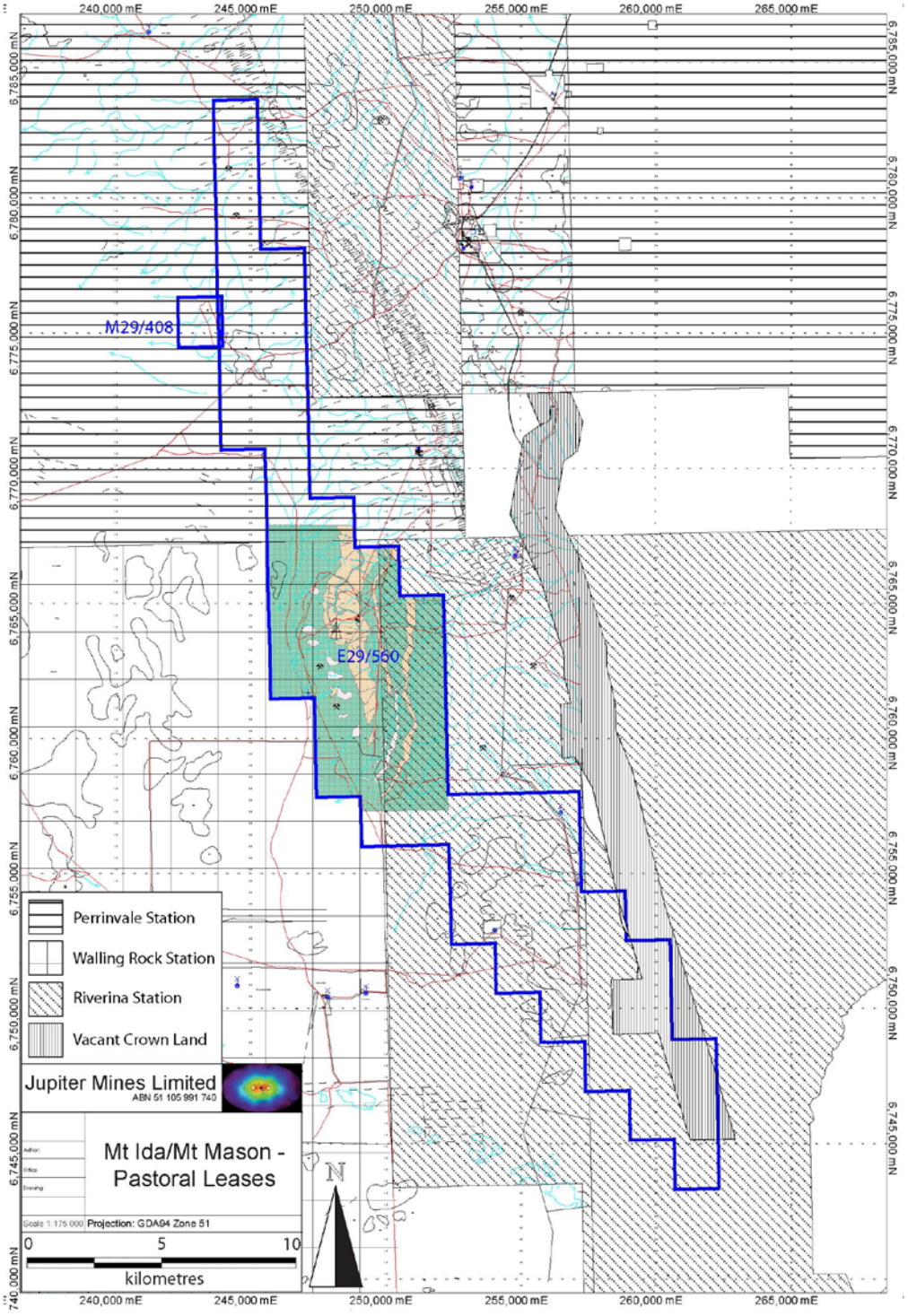

Figure 14 - Mt Mason and Mt Ida Pastoral Leases

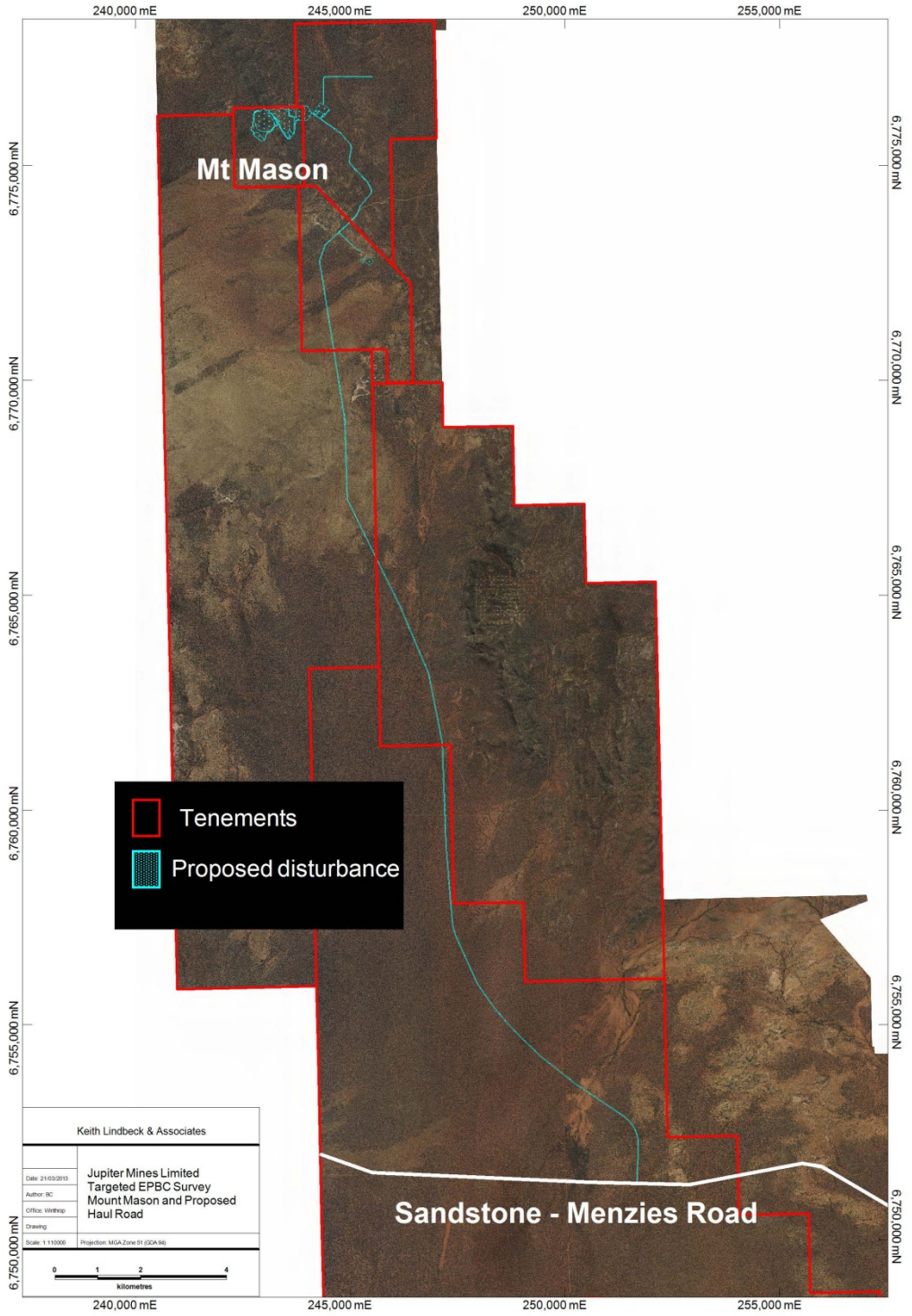

Figure 15 - Location of Mt Mason and proposed Haul Road

3.0 METHODOLOGY

3.1 TARGETED FAUNA SURVEY

Surveys were conducted in March (2, 3, 4, 5 and 8) and April (2 and 3) 2012 to:

- ground truth the vegetation communities along the survey route,
- inspect the fauna habitats along the survey route,
- determine the potential within these habitats for the targeted species to utilise these areas,
- extend these searches outside of the proposed haul road route to determine if the habitats are limited to the survey or are present elsewhere, and
- identify targeted species present at the time through direct observation and hearing of bird calls, and indirect evidence including mounds, hollows, tracks, scats, and feathers etc.

In the case of the identification of a Malleefowl mound, the following was recorded:

- GPS location
- photograph taken,
- determination of status of the mound and if inactive, approximately when last it was used, and
- approximate size (diameter in metres).

3.1.1 Targeted EPBC fauna species

Jupiter provided KLA with outlines of the areas to be surveyed.

3.1.1.1 Mt Mason footprint of disturbance

A line survey approach was adopted for the proposed footprint of disturbance at Mt Mason (Figure 16). Between two and three personnel walked in parallel lines across the areas proposed for disturbance. The distance between lines was dictated by the landform and density of vegetation inasmuch as lines were as close as 10 m apart in areas of dense vegetation and others were further apart in areas of sparse understorey and areas of Banded Iron Formation (BIF) which are not suitable habitat for any of the EPBC listed species.

3.1.1.2 Proposed Haul Road

A line survey approach was also adopted for the proposed haul road that ensured all parts of the route were surveyed (Figure 17). While the proposed haul road will only extend to approximately 20m in width, an area of 100 m was surveyed to allow for flexibility in design. Up to five qualified personnel walked in parallel straight lines approximately 20 m apart from the northern end of the proposed haul road to the southern end. GPS units were used by the personnel on the eastern and western extents of the proposed route to trace the exact route and the remaining three personnel maintained equal distances from other members of the team.

3.2 PERSONNEL AND REPORTING

The following personnel were involved in the surveys:

- Dr Vi Saffer *BSc (Biol.) Hons (Biol.) PhD (Biol.)*: Senior Zoologist, KLA,
- Ms Erica MacIntyre *BSc (Conservation and Wildlife Biol. and Env. Sci.) Hons (*in prep.): Project Ecologist, KLA
- Dr Ronald Snook *BSc BVMS*
- Ms Katherine Edwards *BSc (Conservation and Wildlife Biol.) Hons (Biol)*

- Mr Hamish Burnett, Field Assistant, TAFE Certificate II Conservation and Land Management
- Ms Polly Hammond, Environmental Coordinator (Approval) Jupiter Mines Limited.

- Mr Keith Lindbeck *BA, WDA, Dip Environ Studies;* Principal, KLA, reviewed the report.

3.3 LICENCE AND PERMITS

A license was not required for the targeted EPBC fauna survey.

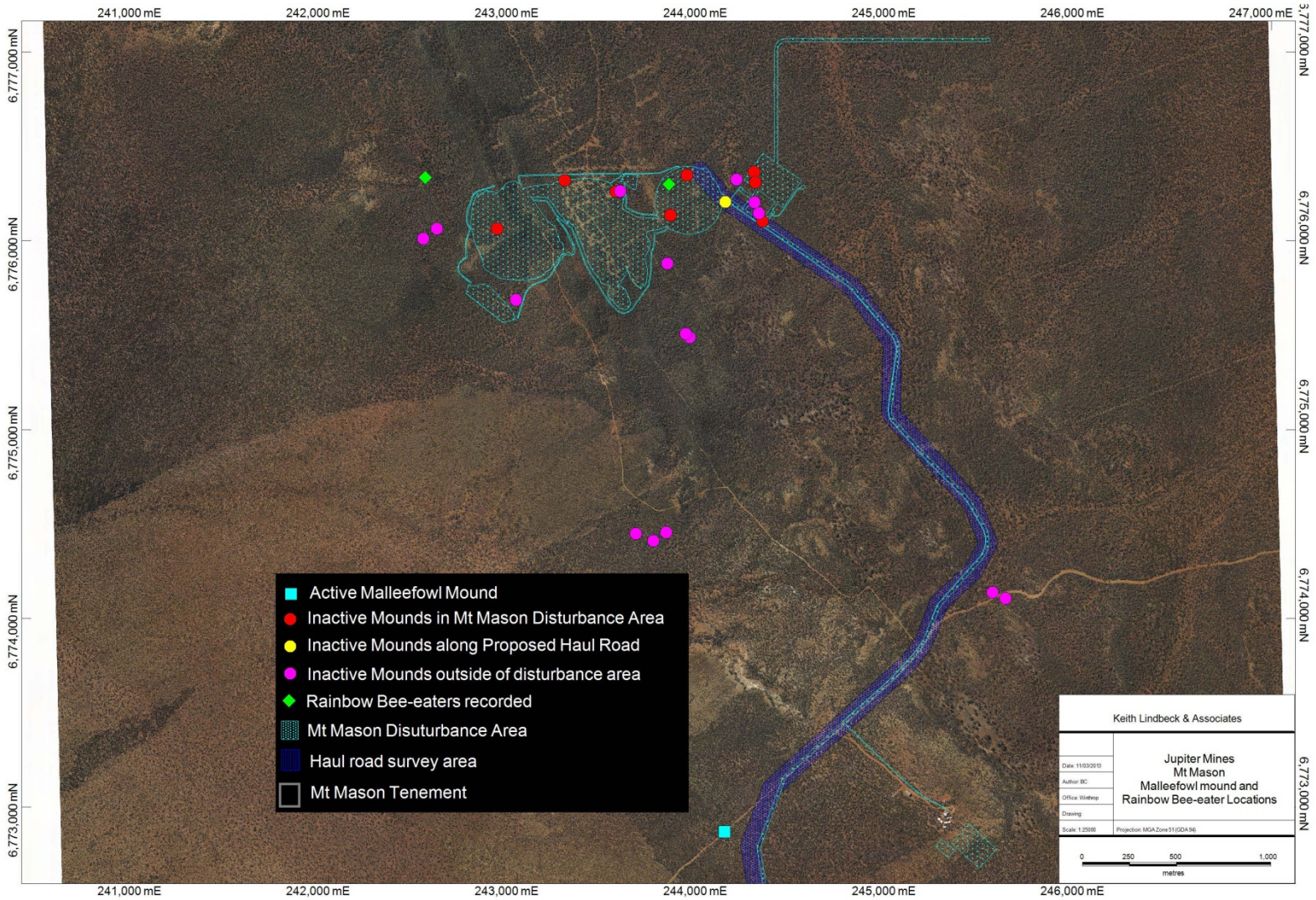

Figure 16 - Mt Mason Disturbance Area with Malleefowl Mound Locations and Rainbow Bee-eater Recordings

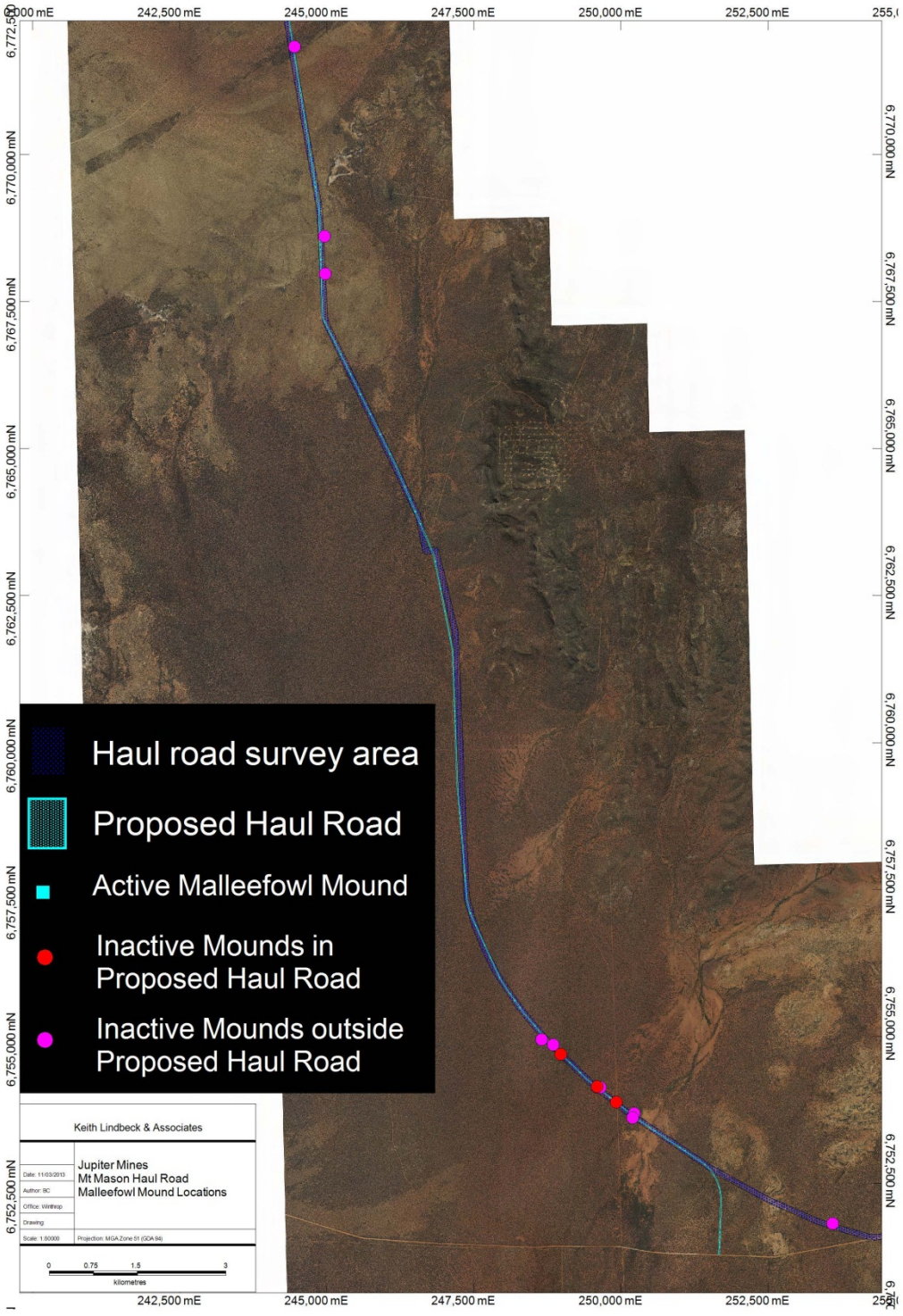

Figure 17 - Haul Road with Malleefowl Mound Locations

4.0 RESULTS AND DISCUSSION

Just under 40 person hours were spent traversing the disturbance footprint for Mt Mason (and associated infrastructure) and approximately 77 person hours were spent inspecting the area proposed for the haul road.

4.1 POTENTIAL FAUNA HABITAT

Nine vegetation groups were described in the proposed Mt Mason disturbance area during the flora survey area (NVS 2012a):

- *Thryptomene* Shrubland
- Open Mulga woodland over Laterite
- *Allocasuarina* over *Calytrix* shrubland
- Mulga over *Eremophila forrestii susbsp forrestii* on hills and ridges
- Mulga over *Prostanthera althoferi subsp althoferi* on hills and ridges
- Mulga over *Philotheca brucei subsp brucei* on hills and ridges
- *Mulga over Eremophila forrestii subsp forrestii* on flats
- *Acacia burkittii* shrubland within drainage lines
- *Acacia cockertoniana* over *Eremophila oldfieldii* and *Eremophila pantonii* on flats.

Results from the flora survey of the proposed haul road identified 12 vegetation groups (NVS 2012b).

- Mulga Shrubland with occasional Eucalypts (1a)
- Mulga woodland-floodplain (1b)
- Mulga shrubland with Philotheca brucei subsp brucei (1g)
- Mulga open shrubland-drainage (1k)
- Mulga with *Acacia cockertoniana* and *Acacia ramulosa var ramulosa* tall shrubland over *Olearia humilis* and/or *Hibbertia arcuata* and/or *Prostanthera althoferi* subsp. *althoferi* and/or *Eremophila forrestii* subsp. *forrestii* low shrubland (1n)
- Mulga over mixed shrubland (1o)
- *Acacia quadrimarginea*/*A. cockertoniana* open shrubland (2g)
- *Acacia effusifolia*/*Eucalyptus* mallee and other mixed shrublands burnt sandplain (3b)
- *Acacia effusifolia* Shrubland- transitional (3c)
- *Callitris* with scattered Eucalypt woodland- sandplain (4)
- *Eucalyptus lesouefii* open woodland (9a)
- *Eucalyptus salubris* woodland (9b).

4.1.1 Habitat for Malleefowl

Of the habitat identified during the flora surveys, the majority of the vegetation groups identified at the project comprise potential malleefowl breeding or foraging habitat. The majority of the inactive malleefowl mounds recorded were located on:

- Mulga over *Eremophila*
- Mulga over *Eremophila forrestii* (on flats and undulating hills)
- Mulga shrubland with occasional Eucalypts
- *A.effusiola*/*Eucalyptus* mallee and other mixed shrublands burnt sandplain
- *Callitris* with *Eucalyptu*s woodland – sandplain.

There are extensive areas of habitat suitable for Malleefowl in and adjacent to the Mt Mason project area.

4.1.2 Discussion

The habitats (vegetation groups) identified are not restricted to the project area. While the survey of the Mt Mason mining area was limited predominantly to the areas proposed for disturbance, the survey of the proposed haul road involved assessment of a larger area than that proposed for disturbance (Table 2).

Table 2 - Vegetation groups recorded on Mt Mason haul road

HAUL ROAD	Area to be disturbed (ha)	Area surveyed – no disturbance (ha)
Mulga Shrubland with occasional Eucalypts (1a)	14.83	133.46
Mulga woodland- floodplain (1b)	14.36	129.22
Mulga shrubland with *Philotheca brucei subsp brucei* (1g)	0.47	4.26
Mulga open shrubland- drainage (1k)	0.61	5.47
Mulga with *Acacia cockertoniana* and *Acacia ramulosa var ramulosa* tall shrubland over *Olearia humilis* and/or *Hibbertia arcuata* and/or *Prostanthera althoferi* subsp. *althoferi* and/or *Eremophila forrestii* subsp. *forrestii* low shrubland (1n)	21.97	197.77
Mulga over mixed shrubland (1o)	0.38	3.38
Acacia quadrimarginea/*A. cockertoniana* open shrubland (2g)	2.43	21.85
Acacia effusifolia/*Eucalyptus* mallee and other mixed shrublands burnt sandplain (3b)	12.78	115.05
Acacia effusifolia Shrubland- transitional (3c)	0.74	6.67
Callitris with scattered Eucalypt woodland- sandplain (4)	1.03	9.24
Eucalyptus lesouefii open woodland (9a)	0.69	6.20
Eucalyptus salubris woodland (9b)	0.49	4.43
TOTAL	**70.78**	**636.99**

At a regional scale the proposed disturbance for the project represents >0.01% of the vegetation groups present (Table 3).

Table 3 - Impact of project on vegetation at a regional scale

Veg Assoc	Description	Mount Mason proposed clearing (ha)	Current extent, WA (ha)	Pre-European Extent, WA (ha)	Remaining (%)	% of Current Extent (WA)
484	Shrublands; jam thicket	0.52	70235	70,235	100	0.0007%
202	Shrublands; mulga & *Acacia quadrimarginea* scrub	63.13	365,344	365,344	100	0.0173%
483	Hummock grasslands, mixed sandplain - open mallee over sparse dwarf shrubs with spinifex; red mallee & mixed sparse dwarf shrubs over *Triodia basedowii*	3.06	395,106	395,106	100	0.0008%
18	Low woodland; mulga (*Acacia aneura*)	47.93	22,029,557	22,029,557	100	0.0002%
	Total:	114.64	22,860,242	22,860,242		

4.2 MALLEEFOWL

4.2.1 Mt Mason footprint of disturbance

Up to 8 Malleefowl mounds were recorded with the proposed disturbance footprint in the Mt Mason area (Table 4, Figure 16). All of these mounds were identified as inactive. A subjective estimation of the number of years since the mound was last used was made and is provided in Table 4.

Table 4 - Locations of Malleefowl Mounds within the Mt Mason disturbance area

Number	Location			Size (metres)	Approximate Age (years)
	Zone	Easting	Northing		
1	51	243523	6776262	6 x 6	>30
2	51	244256	6776365	-	>100
3	51	243901	6776349	10 x 10	>100
4	51	243814	6776136	-	>150
5	51	244263	6776312	7 x 7	>50
6	51	244300	6776106	5 x 5	>150
7	51	243252	6776321	4 x 4	>50
8	51	242895	6776065	6 x 6	>50

4.2.2 Proposed Haul Road

A total of 3 Malleefowl mounds were recorded within the area proposed for the haul road (Table 5, Figure 17). All of these mounds were identified as inactive. A subjective estimation of the number of years since the mound was last used was made.

Table 5 - Locations of Malleefowl Mounds within the proposed haul road area

Number	Location			Size (metres)	Approximate Age (years)
	Zone	Easting	Northing		
1	51	248977	6754701	10 x 10	>100
2	51	249599	6754145	10 x 10	>100
3	51	249923	6753883	10 x 10	>100

4.2.3 Areas outside of Mt Mason disturbance footprint and proposed haul road

A total of 26 Malleefowl mounds were recorded outside of the proposed disturbance footprint in the Mt Mason area and the proposed haul road area (

Table 6, Figure 16 and Figure 17). Of these, one was determined to be active (Figure 18 and Figure 19) and the remainder inactive. A subjective estimation of the number of years since the mound was last used was made.

Table 6 - Locations of Malleefowl Mounds outside of the proposed areas of disturbance

Number	Location			Size (metres)	Approximate Age (years)
	Zone	Easting	Northing		
ACTIVE MOUND					
1A	51	244100	6772869	2.5 x 2.5	1
INACTIVE MOUNDS					
1	51	243917	6775489	7 x 7	>100
2	51	245522	6774136	4 x 4	>10
3	51	245590	6774104	3 x 3	?
4	51	243631	6774448	10 x 10	>100
5	51	243723	6774411	4 x 4	>100
6	51	243791	6774455	5 x 5	>100
7	51	243895	6775506	4 x 4	>100
8	51	244164	6776326	-	>100
9	51	243546	6776265	3 x 3	>100
10	51	244258	6776205	6 x 6	>150
11	51	244282	6776147	10 x 10	>150
12	51	243796	6775882	6 x 6	>150
13	51	242575	6776064	6 x 6	>50
14	51	242994	6775688	2 x 2	>150
15	51	242503	6776012	3 x 3	>100
16	51	244107	6776207	5 x 5	>100
17	51	244454	6771833	3 x 3	~1yr <5
18	51	244958	6768612	4 x 4	>50
19	51	244977	6767975	3 x 3	>50
20	51	248656	6754952	7 x 7	>50
21	51	248852	6754862	5 x 5	>100
22	51	249655	6754132	5 x 5	>100
23	51	250227	6753693	6 x 6	>100
24	51	250204	6753620	6 x 6	>100
25	51	253603	6751822	12 x 12	>100

Figure 18 - Active Malleefowl mound

Figure 19 - Malleefowl working active mound

4.2.1 Discussion

Malleefowl favour dense shrublands, Eucalypt Mallee thickets and areas that contain sufficient leaf litter for mound building. Inspection of many areas proposed for disturbance supported habitat suitable for Malleefowl mound building, as evidenced by the number of Malleefowl mounds. Malleefowl are present in the Mount Mason area and it is probable that the general area supports a breeding population.

However, only one known active Malleefowl mound was recorded during the survey. In March 2011, the Shire of Menzies graded a publically gazetted road (Metzke Road) that runs in a northeast-southwest direction south of the Mt Mason tenement. Soon after these road works were completed a pair of Malleefowl (Figure 19) established a mound (Figure 18) that is located less than 5m away from the Metzke Road and approximately 1.6 km from the south eastern corner of the tenement (Figure 16 and Figure 17). The proposed haul road runs approximately 137 m from this active mound. Jupiter has looked at the option of an alternate route to provide a larger buffer from the active mound but assessment of this route identified active mounds. The current proposed route is considered the best option to reduce the potential impacts to this species.

Albeit by subjective estimation, the majority of inactive mounds appeared to have been used a number of years ago (generally >50 years) with only two that appeared to have been used within the past five years. This suggests that Malleefowl have been in the area for many years. However, it is not possible to estimate the population that may have been present locally and historically. Any clearing of land or disturbance associated with developing the project could have an impact on individual Malleefowl. The proposed disturbance associated with the project may shift a small number of individuals into adjacent areas but it is not anticipated to have a significant impact on the population.

Threats to Malleefowl include clearing of habitat, road deaths, fire, predation and grazing and starvation. While local populations may have been subject to the effects of fire, predation and grazing and starvation, the proposed disturbance is likely to exacerbate these effects and will include the threats of clearing of native vegetation and road deaths. Further recommendations to reduce the potential impact of the proposed disturbance on the Malleefowl are addressed in Section 5.

Interestingly, a total of 11 of the 36 mounds recorded during the survey were determined to be ‘megamounds’. Megamounds appear to be extremely large Malleefowl mounds (~10 m x 10m) the origins of which remain unknown. While both megamounds and regular mounds may be re-used by Malleefowl, many of the older mounds have been and were currently being used by other fauna including varanids (Varanus spp.) and rabbits (*Oryctolagus cuniculus*).

4.3 FORK-TAILED SWIFT

No Fork-tailed Swifts were seen or heard during the survey.

Given the ecology of this species inasmuch as they are classified as Marine and Migratory, that they do not breed in Australia and they are almost exclusively aerial, it is unlikely that this species would utilise the habitat proposed for disturbance for the Mt Mason DSO Project or the associated haul road. The conservation status of this species is unlikely to be altered by the proposed mining activity in the area.

4.4 GREAT EGRET

No Great Egrets where seen or heard during the surveys and no evidence of their presence was identified.

The preferred habitat of the Great Egret is shallow waters, wetlands and swamps. As there are no such habitats within the area proposed for disturbance for the Mt Mason DSO project and associated haul road, it is not likely that this species would utilise this area. Further, the Great Egret is classified as a Migratory Wetland and Marine species.

The proposed mining operation at Mt Mason and the associated haul road therefore are unlikely to alter the conservation status of the Great Egret.

4.5 RAINBOW BEE-EATER

Rainbow Bee-eaters were heard and a total of seven individuals were seen in the Mt Mason area (Figure 16). None were seen or heard during the survey of the proposed haul road.

Rainbow Bee-eaters usually begin their northerly migration in March which is consistent with the timing of the survey. That they were recorded in the northern portion of the survey and not in the southern section exemplifies their migratory nature as they move across the Western Australia landscape, season-dependent.

Rainbow Bee-eaters usually make their breeding burrows in soft sandy banks, a feature not common in the CYIP landscape. Therefore, while the CYIP may be used within their migratory route, it is not likely to provide significant habitat for this species. The conservation status of this species, therefore, is not likely to be altered by the proposed operation at Mt Mason or the associated haul road.

4.6 SLENDER-BILLED THORNBILL

No Slender-billed Thornbills where seen or heard during the surveys and no evidence of their presence was identified.

The preferred habitat for the Slender-billed Thornbill is chenopod shrublands that are dominated by Samphire and occasionally adjacent shrublands and mangroves. Given the lack of this habitat in the Mt Mason area or associated hail road, it is unlikely that this species of Thornbill would be present.

Preferred habitat for this species is located approximately 30 km northwest at Lake Ballard and 65 km east at Lake Barlee. While movement of the Slender-billed Thornbill is likely along the edges of these large lakes in search of resources, they are not likely to move such a vast distance across the Mt Mason tenement between lakes (R. Johnstone *pers. comm.*).

The conservation status of this species is therefore not likely to be altered by the proposed mining activity in Jupiter's CYIP area.

5.0 RECOMMENDATIONS

Of the five species of fauna listed under the EPBC Act 1999 for the area, the habitat of only the Malleefowl is likely to be impacted by the proposed mining activity.

Given the presence of Malleefowl in the area, it is recommended that a Malleefowl Management Plan be developed and submitted to DSEWPaC for approval and that the approved plan be implemented immediately following approval.

Recommendations include but are not limited to the following:

- Conduct a targeted Malleefowl survey in any areas not surveyed but proposed for disturbance following realignment of the haul road;
- Clearing boundaries are to be well marked and no unnecessary clearing of native vegetation is to occur;
- Signage to be erected to alert drivers of (possible) presence of Malleefowl;
- Annual monitoring of all known mounds in the vicinity of the operational areas and haul road;
- Maintain management that reduces risk of fire;
- Implement a feral animal trapping program in consultation with DEC in the vicinity of operational areas;
- Ensure that all personnel attend inductions prior to going on site or at site and that these inductions include information about the Malleefowl, its legal status, ecology and habitat requirements;
- Encourage all personnel to report any signs of Malleefowl in the CYIP area
- All vehicles are to remain on designated tracks and speed restrictions appropriate to operational areas to be monitored.

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APPENDIX A
Categories used in the assessment of conservation status

IUCN categories (based on review by Mace and Stuart 1994) as used for the Environmental Protection and Biodiversity Conservation (EPBC) Act 1999.

EXTINCT (EX)
A taxon is Extinct when there is no reasonable doubt that the last individual has died. A taxon is presumed Extinct when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.

EXTINCT IN THE WILD (EW)
A taxon is Extinct in the Wild when it is known only to survive in cultivation, in captivity or as a naturalized population (or populations) well outside the past range. A taxon is presumed Extinct in the Wild when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.

CRITICALLY ENDANGERED (CR)
A taxon is Critically Endangered when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered*, and it is therefore considered to be facing an extremely high risk of extinction in the wild.

ENDANGERED (EN)
A taxon is Endangered when the best available evidence indicates that it meets any of the criteria A to E for Endangered*, and it is therefore considered to be facing a very high risk of extinction in the wild.

VULNERABLE (VU)
A taxon is Vulnerable when the best available evidence indicates that it meets any of the criteria A to E for Vulnerable*, and it is therefore considered to be facing a high risk of extinction in the wild.

NEAR THREATENED (NT)
A taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.

LEAST CONCERN (LC)
A taxon is Least Concern when it has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category.

DATA DEFICIENT (DD)
A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution are lacking. Data Deficient is therefore not a category of threat. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate. It is important to make positive use of whatever data are available. In many cases great care should be exercised in choosing between DD and a threatened status. If the range of a taxon is suspected

to be relatively circumscribed, and a considerable period of time has elapsed since the last record of the taxon, threatened status may well be justified**.**

NOT EVALUATED (NE)
A taxon is Not Evaluated when it is has not yet been evaluated against the criteria

- Refer to http://www.iucnredlist.org/documents/redlist_cats_crit_en.pdf for criteria

Schedules used in the WA Wildlife Conservation Act 1950.

Schedule 1. Rare and Likely to become Extinct.

Schedule 2. Extinct.

Schedule 3. Migratory species listed under international treaties.

Schedule 4. Other Specially Protected Fauna.

Department of Environment and Conservation Priority Species

(species not listed under the Conservation Act, but for which there is some concern)

Priority 1. Taxa with few, poorly known population on threatened lands.

Priority 2. Taxa with few, poorly known populations on threatened lands, or taxa with several, poorly known populations not on conservation lands.

Priority 3. Taxa with several, poorly known populations, some on conservation lands.

Priority 4. Taxa in need of monitoring. Taxa which are considered to have been adequately surveyed, or for which sufficient knowledge is available, and which are considered not currently threatened or in need of special protection, but could be if present circumstances change.

Priority 5. Taxa in need of monitoring. Taxa which are not considered threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years (IUCN Conservation Dependent).

JAMBA The agreement between the Government of Australia and the Government of Japan for the Protection of Migratory Birds in Danger of Extinction and their Environment. Australian Treaty Series 1981 No 6.

CAMBA The agreement between the Government of Australia and the Government of the People's Republic of China for the Protection of Migratory Birds and their Environment. Australian Treaty Series 1988 No 22.

ROKAMBA The agreement between the Government of Australia and the Government of the Republic of Korea on the Protection of Migratory Birds and their Environment. Australian Treaty Series 2007 ATS 24.

ATTACHMENT 7

Jupiter Mines

Jupiter Mines Mount Ida
Non- process Infrastructure Areas
Malleefowl Survey

December 2012

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Appendices

Appendix A - (Figures)

1. Introduction

1.1 Project Background

The Mount Mason Direct Shipping Ore (DSO) Hematite and Mt Ida Magnetite Projects owned by Jupiter Mines Limited (Jupiter) are part of the Central Yilgarn Iron Project (CYIP), located approximately 160 km north-west of Menzies, Western Australia.

GHD Pty Ltd (GHD) has been commissioned by Jupiter to undertake a targeted Malleefowl (*Leipoa ocellata*) assessment within the Mt Mason non-infrastructure Corridor and additional areas including a new airstrip, accommodation area and laydown. See Figure 1.

1.2 Scope

GHD has been commissioned to undertake a targeted Malleefowl searches within the non-process infrastructure (NPI) portions (corridors) of Jupiter's Mount Mason and Mount Ida Project areas – including the combined haul road and Mount Ida proposed camp & airstrip location. Other additional areas include access tracks, pipeline routes and a proposed laydown area.

1.3 Malleefowl Description

Malleefowl (*Leipoa ocellata*) are large ground-dwelling birds, well known for constructing large mounds of soil and vegetation in which they incubate their eggs. The species is a member of the Megapodes bird group (Johnstone and Storr, 1998). Megapodes comprise various large-footed, ground-dwelling birds of the Megapodiidae, found in Australia and many South Pacific islands. They are a group that build mounds or burrows of earth and fill with composting materials in which to incubate their eggs.

Within Australia the species once ranged over much of southern Australia's semi-arid region to central Australia, in areas receiving 200-450 mm of rain annually (Jones and Goth 2008). Habitat included Shrublands and low woodlands dominated by Mallee, Acacia, Broombush and Callitris (Garnett *et al* 2011, Jones and Goth 2008). The current range of the species is fragmented and appears to be restricted to areas that receive 220-300 mm of rain annually in wooded remnants (Jones and Goth 2008).

The Malleefowl's decline has been contributed to a number of factors. The main issues are habitat loss, however introduced pest species such as cats and foxes and changes in fire regimes have also impacted on the species (Jones and Goth 2008).

Individuals can grow to 55 – 60 cm height with an approximate weight of 2.5 kg for adult birds. The head and neck are grey with the body having a mottled brown, black and white plumage Plate 1. The distinct colouration provides excellent camouflage enabling the bird to blend well with its surroundings thereby evading danger and/or predators. In addition to a well camouflaged plumage, Malleefowl have good eyesight enabling individuals to detect danger well in advance, therefore, if threatened, individuals use their camouflage to move away and avoid detection. Whilst the species is a good flyer, individuals prefer to run quickly, especially if startled.

Plate 1 A Pair of Malleefowl in the Northern Goldfield's of Western Australia

1.4 Limitations

The Level 1 fauna assessment will account for those animals and mounds that can be easily seen, heard or have distinctive signs, such as tracks, scats, diggings etc. Some areas of the alignment had thick vegetation and it is possible that a mound may not have been picked up. The survey was carried out during only one season, and in one year. Complete faunal surveys often require multiple surveys, at different times of year, and over a period of a number of years, to enable full account of activity recorded.

2. Methodology

2.1 Survey Method

The targeted Malleefowl Survey was undertaken across a 100 m x 30 km survey area (300 hectares). The surveyed area was walked in transects by two people moving approximately 50 m apart, depending upon vegetation thickness and terrain. The survey was undertaken in accordance with the DSEWPC guidelines (DSEWPC 2010). The guidelines suggest Malleefowl searches require approximately 10 person hours per 50 hectares, therefore for this study area a minimum of 3 days of ground truthing for two people was undetaken. The survey was as follows:

- Six days of ground truthing searching for foot prints, mounds and birds in line with DSEWPC (2010) guidelines for Australian birds – Malleefowl. In total 208 kilometers of transects were walked with in the study area between 2 people.
- Data was collected on all observations in line with EPA, Guidance Statement 56.
- Opportunistic visual and aural observations were recorded. This accounted for bird species utilising the site during the survey period.
- The site was searched for mounds, droppings, scratchings, prints and feeding areas.
- All observations of Malleefowl were mapped.

All Malleefowl mound locations were recorded using GPS and photos taken. Other signs such as foraging scratchings and footprints were also recorded.

The alignment was surveyed at a maximum of 50 m transect spacing's, while other areas were subjected to targeted surveys based on vegetation thickness and highest likelihood of containing mounds.

All mounds located were measured in diameter and height and rated for activity and usage using the National Malleefowl Monitoring System (National Heritage Trust 2010) using a scale of 1 – 6.

Profile 1 – Crater with raised rims, typical of an inactive (dormant) mound

Profile 2 – Mound fully excavated (litter may be present)

Profile 3 – Mound with litter, thick layers of litter are evident on the surface

Profile 4 – Mounded up active 2010 (no crater)

Profile 5 – Sandy crater with peak in the centre (actively being closed by the Malleefowl)

Profile 6 – A long unused (extinct) mound.

3. Survey Results

3.1 Live Birds

No live birds were observed in the study area, however a number of other signs were recorded and these are presented below.

3.2 Mounds

Seven mounds were recorded during the field assessment and these are presented below in Table 1. Of the seven mounds one was active, with eggs present and given a mound profile of 5. The mound was approximately 5 meters in diameter and 1 meter tall from ground level to the top of the cap. Tracks of the parent bird/s were observed at the mound and surrounds. The vegetation cap was raked for thermoregulation and looked to be well maintained.

A further three mounds showed signs of recent use (Profile 2 and 3) or within the last 12 months (Profile 1). This was evident from:

- The presence of feathers (mostly down from chicks)in the crater
- Exposed shell fragments on the surface of the crater;
- Thick layers of leaf litter/vegetation present within the crater or tower; and
- Mounds were all approximately 4 meters in diameter and between 0.6 to 1 meter tall demonstrating that the tower was not eroded and unused.

The remaining three mounds were long unused with a mound profile of 6. It is considered unlikely that these mounds would be used again as nests for breeding. All mounds are presented in Figure 1.

3.3 Scratching's

In total 156 recordings of scratching evidence was observed. Observations included both fresh and old evidence. The type of scratching's recorded was mainly foraging behaviour (see Plate 2), however those recorded close to mounds reflected litter harvesting for mound composting and thermoregulation. All scratching's are presented in Figure 1.

Plate 2 Foraging scratching's recorded in the study area

3.4 Droppings and feathers

Droppings were recorded on 5 occasions within the study area (See Plate 3). Records were both fresh and old and were primarily observed in areas where scratching's were present. One record of feathers was observed. The feather was a primary and was found within a foraging area. All droppings and feathers are presented in Figure 1.

Plate 3 Malleefowl dropping recorded in the study area

3.5 Prints

Twenty five observations of prints were recorded throughout the study area (see Plate 4). Recorded prints were those where birds were observed traversing between areas, possibly looking for feeding opportunities. These prints are generally in the open and observed in sandy soils. Prints associated with scratching's were not recorded and are represented under scratching's as an observation. All prints are mapped and presented in Figure 1.

Plate 4 Prints recorded within the study area

Table 1 Malleefowl Mounds recorded during field assessment

Site ID	Easting	Northing	Diameter (meters)	Height (meters)	Profile	Description	Site Photos
Mound 1	243605	6770906	5	0.5	6	Sandy loam amongst Acacia Shrubland with emergent Mallee. Long unused mound probably abandoned due to fire. Small rim remaining.	
Mound 2	244560	6757791	4	0.6	1	Sandy loam in Acacia Woodland. Used recently, but not currently in use. Droppings present on mound and scattered feathers (down) present on rim. Large amount of leaves and woody material in crater.	

Mound 3	244608	6756686	4	0.8	2	Sandy loam Acacia Woodland. Used recently Freshly scratched sides and tower. *Varanus* diggings present inside crater. Small amount of vegetation in crater. Vegetation mostly on side of mound. Chick's feathers still in crater.	
Mound 4	244646	6758879	5	1.0	5	Sandy loam Acacia Woodland. Active mound suggesting eggs are present. Cap present, showing scratching's for temp control. Feathers, and prints present..	

Mound 5	244912	6758932	2	0.3	6	Triodia Sand plain with emergent Acacia Shrubland with emergent Mallee. Very old, abandoned pre-fire and degraded. Mound area significantly reduced with small area of rim remaining.	
Mound 6	241165	6756183	4	1.0	3	Red Sandy loam, Acacia Woodland with emergent Triodia and Mallee. Active this season with egg shell present on rim. Freshly dug out. Large amount of woody debris in crater. The area is long unburnt.	

Mound 7	242948	6769561	6	0.4	6	Red Sand Loam Acacia Woodland with emergent Mallee. Long unused and very degraded. Mound area significantly reduced with small area of rim remaining.	

4. Conclusion

Evidence of Malleefowl within the study area was observed in the form of mounds, prints, scratching's, droppings and feathers. Seven mounds were recorded, four are considered active, with the remaining three long unused. Mound 4 from Table 1 was being used and thermoregulated suggesting eggs are present. Observations of use, i.e. scratching's, droppings, prints and feathers were recorded over most of the alignment. Scratching's and prints were the most common observation. Where fire scars were present observations of use where slightly reduced.

5. References

DSEWPC (2010). Survey guidelines for Australia's threatened birds Guidelines for detecting birds listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999.*

Garnett, S.T., Szabo, J,K, and Dutson, G. (2011). The Action Plan for Australian Birds 2010. Charles Darwin University. CSIRO publishing.

Johnstone, R.E. & G.M. Storr (1998). Handbook of Western Australian Birds. Vol. 1: Non-passerines (Emu to Dollarbird). Perth, Western Australia: West Australian Museum.

Jones, D and Goth, A. (2008). Mound Builders. Australian Natural History Series. CSIRO Publishing.

National Heritage Trust (2010). National Manual for, The Malleefowl Monitoring System. Standards, Protocols and Monitoring Procedures. National Malleefowl Monitoring Project. By Victorian Malleefowl Recovery Group.

Appendices

Appendix A - (Figures)

Content

Figure 1 Study area Location Map and Malleefowl observations

240,000 242,500 245,000

6,775,000 6,772,500 6,770,000 6,767,500

Locality Map

IDA VALLEY

RIVERINA

LEGEND

GHD Survey

- Profile 1 Mound
- Profile 2 Mound
- Profile 3 Mound
- Profile 5 Mound
- Profile 6 Mound
- Scratchings
- Prints
- Feathers
- Droppings
- Rail
- Pipeline
- Mine Infrastructure

Roads

- Road
- Track

- Fauna Survey Areas (Spring 2012)
- Mine Infrastructure Footprint

1: 25,000 (at A3)

0 125 250 500 750 1,000 1,250

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

N

GHD

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Jupiter Mines Limited
Targeted Species Assessment

Job Number	61-28766
Revision	0
Date	01 May 2013

Survey Area and Malleefowl Records

Figure 1

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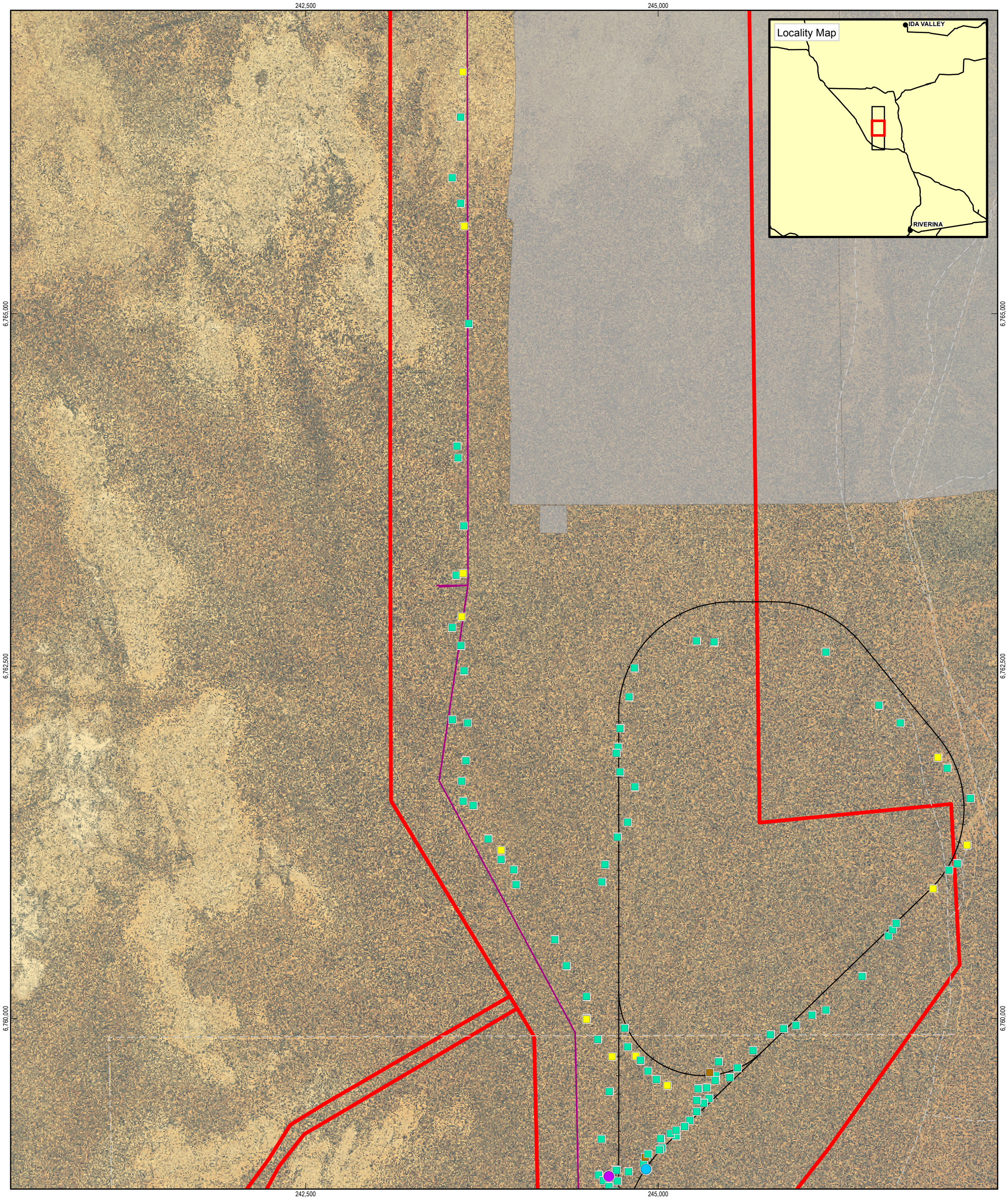
Data source: GA: Topo 250k Series3 - 2006; Landgate: Mount Mason 2010 Mosaic - 20121205, Roads - 20121114; Jupiter Mines Limited: Mine Infrastructure - 20121010, Mine Infrastructure Footprint - 20121010, Pipeline - 20121010, GHD Survey - 20121204, Rail - 20121010, Fauna Survey Areas (Spring 2012). Created by: bflorczak



LEGEND

GHD Survey
- Profile 1 Mound
- Profile 2 Mound
- Profile 3 Mound
- Profile 5 Mound
- Profile 6 Mound
- Scratchings
- Prints
- Feathers
- Droppings
- Rail
- Pipeline
- Mine Infrastructure

Roads
- Road
- Track

- Fauna Survey Areas (Spring 2012)
- Mine Infrastructure Footprint

1: 25,000 (at A3)

0 125 250 500 750 1,000 1,250

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

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Survey Area and Malleefowl Records

Figure 1

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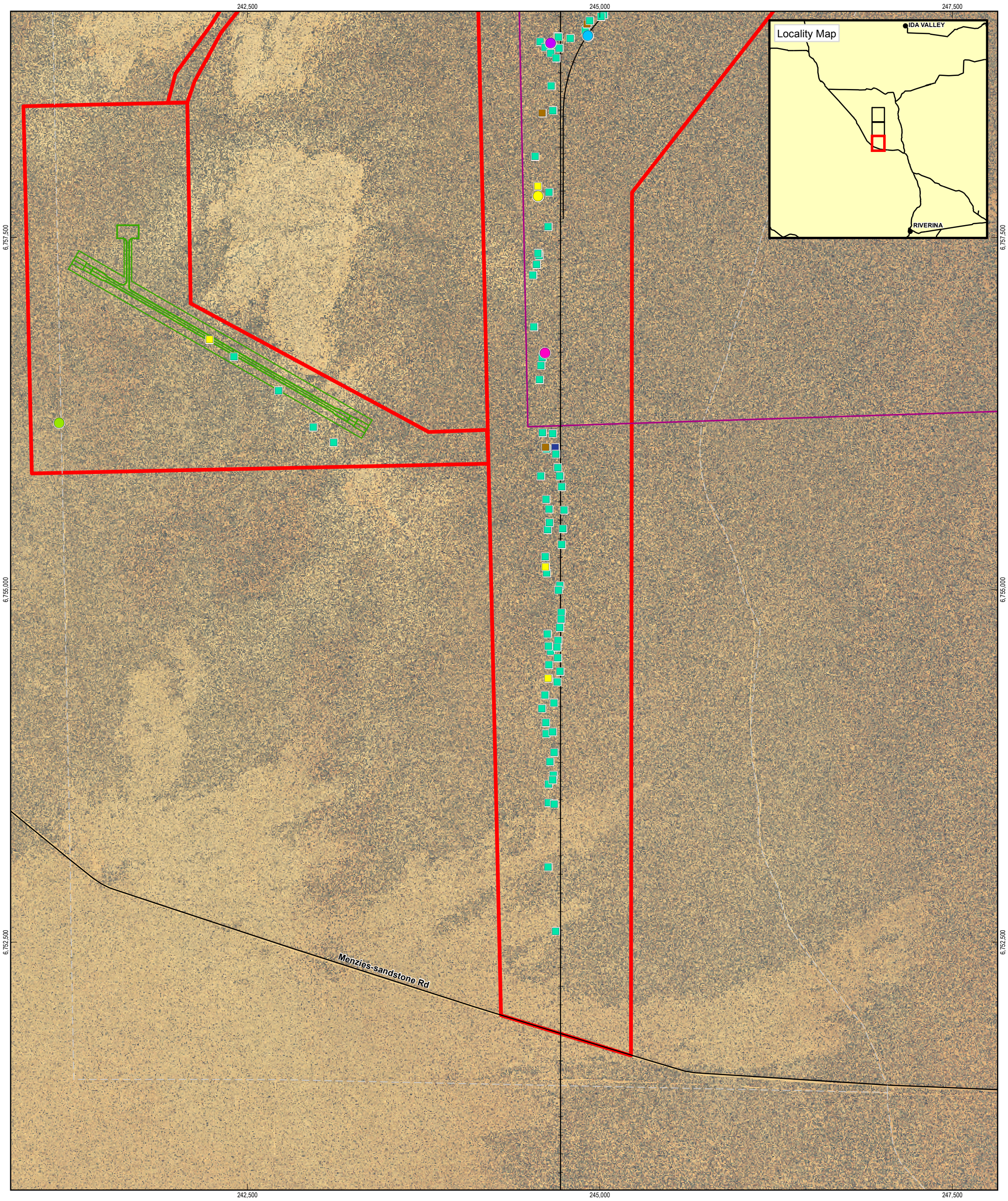
Data source: GA: Topo 250k Series3 - 2006; Landgate: Mount Mason 2010 Mosaic - 20121205, Roads - 20121114; Jupiter Mines Limited: Mine Infrastructure - 20121010, Mine Infrastructure Footprint - 20121010, Pipeline - 20121010, GHD Survey - 20121204, Rail - 20121010, Fauna Survey Areas (Spring 2012). Created by: bflorczak



LEGEND

GHD Survey
- Profile 1 Mound
- Profile 2 Mound
- Profile 3 Mound
- Profile 5 Mound
- Profile 6 Mound
- Scratchings
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- Mine Infrastructure Footprint

1: 25,000 (at A3)

0 125 250 500 750 1,000 1,250

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

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Survey Area and Malleefowl Records

Figure 1

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Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
	G.Gaikhorst	C. Grabham		C. Grabham		13/12/12

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ATTACHMENT 8

Attachment 8 MFMP appendix 1 - Malleefowl Mound Database summary

MoundID	Project	Location	Easting	Northing	Zone	Status	Approx age (yrs)	ast monitored dat	InfoSource	Date verified
MFM001	MT MASON	Metzke Rd	244107	6772871	MGA51	Active	<2	07-Dec-12	KLA Mount Mason Level 2 Fauna Assessment & KLA Targeted EPBC survey	Apr-12
MFM002	MT MASON	near haul access L29/100	244454	6771833	MGA51	Inactive	<5	07-Dec-12	KLA EPBC Targeted Survey	Apr-12
MFM003	MT MASON	Mt Mason at MMWB005	243523	6776262	MGA51	Inactive	>30	07-Dec-12	KLA Mount Mason Level 2 Fauna Assessment & KLA Targeted EPBC survey	Mar-12
MFM004	MT MASON	Mt Mason	243919	6775487	MGA51	Inactive	>100	25-Nov-12	KLA Mount Mason Level 2 Fauna Assessment & KLA Targeted EPBC Survey	Apr-12
MFM006	MT IDA	Mt Ida at 11MIRC178	248946	6766024	MGA51	Inactive	>50	09-Dec-12	CYIP - Mt Ida - Level 2 Fauna Assessment	Apr-12
MFM007	MT IDA	Mt Ida near 11MIRC192	248847	6766280	MGA51	*Active	>50	09-Dec-12	CYIP - Mt Ida - Level 2 Fauna Assessment	requires verification
MFM009	MT IDA	Mt Ida Access Road	250251	6767189	MGA51	Inactive	>50	12-Dec-12	CYIP - Mt Ida - Level 2 Fauna Assessment	Apr-12
MFM010	MT MASON	Off Metzke Rd	245522	6774136	MGA51	Inactive	<20	24-Nov-12	Targeted EPBC Survey	Apr-12
MFM011	MT MASON	Off Metzke Rd	245590	6774104	MGA51	Inactive	undetermined	24-Nov-12	Outback Ecology Report Jan 2007 & KLA March 2012 (unable to locate)	Jan-07
MFM012	MT MASON	Off Mt Mason Rd near Callup Point 3	243723	6774411	MGA51	Inactive	>100	24-Nov-12	KLA Mount Mason Level 2 Fauna Assessment & KLA Targeted EPBC survey	Apr-12
MFM013	MT MASON	Off Mt Mason Rd near Callup Point 3	243631	6774448	MGA51	Inactive	>100	24-Nov-12	KLA Mount Mason Level 2 Fauna Assessment & KLA Targeted EPBC survey	Apr-12
MFM014	MT MASON	Off Mt Mason Rd near Callup Point 3	243785	6774458	MGA51	Inactive	>100	24-Nov-12	KLA Mount Mason Level 2 Fauna Assessment & KLA Targeted EPBC survey	Apr-12
MFM015	MT MASON	Mt Mason close to MFM004	243895	6775506	MGA51	Inactive	>100	25-Nov-12	KLA Mount Mason Level 2 Fauna Assessment & KLA Targeted EPBC survey	Apr-12
MFM016	MT IDA	Mt Ida, off track past MIMON 05	250846	6765291	MGA51	Inactive	>50	09-Dec-12	CYIP - Mt Ida - Level 2 Fauna Assessment	Apr-12
MFM017	MT IDA	Mt Ida, off track past MIMON 05	250844	6765318	MGA51	Inactive	>50	09-Dec-12	CYIP - Mt Ida - Level 2 Fauna Assessment	Apr-12
MFM020	MT IDA	Mt Ida near 11MIRC160	248940	6765745	MGA51	Inactive	>50	25-Nov-12	CYIP - Mt Ida - Level 2 Fauna Assessment	Apr-12
MFM021	MT IDA	Close to track, closest hole is 11MIRC108	248076	6765150	MGA51	Inactive	>50	27-Nov-12	CYIP - Mt Ida - Level 2 Fauna Assessment	Apr-12
MFM022	MT IDA	could note locate	248470	6765246	MGA52	Inactive	undetermined		CYIP - Mt Ida - Level 2 Fauna Assessment	Apr-12
MFM023	MT IDA	Close to track off Pipeline Rd	248988	6768947	MGA51	Inactive	>50	07-Dec-12	CYIP - Mt Ida - Level 2 Fauna Assessment	Apr-12
MFM024	MT MASON	near MOC pipeline	244106	6776206	MGA51	Inactive	>100	14-Jan-13	KLA EPBC Targeted Survey Report	Mar-12
MFM025	MT MASON	near MOC	244163	6776325	MGA51	Inactive	>100	14-Jan-13	KLA EPBC Targeted Survey Report	Mar-12
MFM026	MT MASON	MOC	244256	6776365	MGA51	Inactive	>100	14-Jan-13	KLA EPBC Targeted Survey Report	Mar-12
MFM027	MT MASON	ROM (outer edge)	243901	6776348	MGA51	Inactive	>100	14-Jan-13	KLA EPBC Targeted Survey Report	Mar-12
MFM028	MT MASON	ROM (stockpile)	243814	6776136	MGA51	Inactive	>150	14-Jan-13	KLA EPBC Targeted Survey Report	Mar-12
MFM029	MT MASON	MOC	243546	6776264	MGA51	Inactive	>100	14-Jan-13	KLA EPBC Targeted Survey Report	Mar-12
MFM030	MT MASON	MOC	244263	6776311	MGA51	Inactive	>50	14-Jan-13	KLA EPBC Targeted Survey Report	Mar-12
MFM031	MT MASON	MOC	244258	6776204	MGA51	Inactive	>150	14-Jan-13	KLA EPBC Targeted Survey Report	Mar-12
MFM032	MT MASON	MOC	244300	6776105	MGA51	Inactive	>150	14-Jan-13	KLA EPBC Targeted Survey Report	Mar-12
MFM033	MT MASON	MOC	244282	6776147	MGA51	Inactive	>150	14-Jan-13	KLA EPBC Targeted Survey Report	Mar-12
MFM034	MT MASON	outside pit	243796	6775881	MGA51	Inactive	>150	14-Jan-13	KLA EPBC Targeted Survey Report	Mar-12
MFM035	MT MASON	main pit (northern edge)	243252	6776321	MGA51	Inactive	>50	14-Jan-13	KLA EPBC Targeted Survey Report	Mar-12
MFM036	MT MASON	waste rock area	242895	6776065	MGA51	Inactive	>50	14-Jan-13	KLA EPBC Targeted Survey Report	Mar-12
MFM037	MT MASON	west of waste rock area	242574	6776064	MGA51	Inactive	>50	14-Jan-13	KLA EPBC Targeted Survey Report	Mar-12
MFM038	MT MASON	near waste rock drainage	242998	6775688	MGA51	Inactive	>150	14-Jan-13	KLA EPBC Targeted Survey Report	Mar-12

Attachment 8 MFMP appendix 1 - Malleefowl Mound Database summary

MoundID	Project	Location	Easting	Northing	Zone	Status	Approx age (yrs)	ast monitored dat	InfoSource	Date verified
MFM039	MT MASON	west of waste rock area	242503	6776012	MGA51	Inactive	>100	14-Jan-13	KLA EPBC Targeted Survey Report	Mar-12
MFM040	MT IDA	Haul Road	243606	6770906	MGA51	Inactive	undetermined	14-Jan-13	Glen Gaikhorst & Tim Moulds (GHD)	Mar-12
MFM041	MT IDA	Haul Road	242360	6770639	MGA51	Inactive	undetermined	14-Jan-13	Glen Gaikhorst & Tim Moulds (GHD)	Mar-12
MFM042	MT IDA	Haul Road	242949	6769562	MGA51	Inactive	undetermined	26-Jan-13	Glen Gaikhorst & Tim Moulds (GHD)	Mar-12
MFM043	MT IDA	Haul Road	244560	6757792	MGA51	Active	<20	26-Jan-13	Glen Gaikhorst & Tim Moulds (GHD)	Nov-12
MFM044	MT IDA	Haul Road	244608	6756687	MGA51	Active	<20	26-Jan-13	Glen Gaikhorst & Tim Moulds (GHD)	Nov-12
MFM045	MT IDA	Haul Road	244647	6758880	MGA51	Active	<20	26-Jan-13	Glen Gaikhorst & Tim Moulds (GHD)	Nov-12
MFM046	MT IDA	Haul Road	244912	6758932	MGA51	Inactive	undetermined	14-Jan-13	Glen Gaikhorst & Tim Moulds (GHD)	Nov-12
MFM047	MT IDA	Haul Road	241166	6756184	MGA51	Active	<20	26-Jan-13	Glen Gaikhorst & Tim Moulds (GHD)	Nov-12
MFM049	MT MASON	Near explosives track	244420	6776580	MGA51	Inactive	undetermined	10-Feb-13	Merri Bartlett (Jupiter Site Environmental Officer)	requires verification
MFM050	MT MASON	near Haul Road G29/22	244958	6768612	MGA51	Inactive	>50	n/a	KLA EPBC Targeted Survey Report	Apr-12
MFM051	MT MASON	near Haul Road G29/23	244977	6767975	MGA51	Inactive	>50	n/a	KLA EPBC Targeted Survey Report	Apr-12
MFM052	MT MASON	near Haul Road L29/121	248656	6754952	MGA51	Inactive	>50	n/a	KLA EPBC Targeted Survey Report	Apr-12
MFM053	MT MASON	near Haul Road L29/121	248852	6754862	MGA51	Inactive	>100	n/a	KLA EPBC Targeted Survey Report	Apr-12
MFM054	MT MASON	near haul road L29/121	248977	6754701	MGA51	Inactive	>100	n/a	KLA EPBC Targeted Survey Report	Apr-12
MFM055	MT MASON	near Haul Road L29/121	249655	6754132	MGA51	Inactive	>100	n/a	KLA EPBC Targeted Survey Report	Apr-12
MFM056	MT MASON	near Haul Road L29/121	249923	6753883	MGA51	Inactive	>100	n/a	KLA EPBC Targeted Survey Report	Apr-12
MFM057	MT MASON	near Haul Road L29/121	250227	6753693	MGA51	Inactive	>100	n/a	KLA EPBC Targeted Survey Report	Apr-12
MFM058	MT MASON	near Haul Road L29/121	250204	6753620	MGA51	Inactive	>100	n/a	KLA EPBC Targeted Survey Report	Apr-12
MFM059	MT MASON	near original tie in	253603	6751822	MGA51	Inactive	>100	n/a	KLA EPBC Targeted Survey Report	Apr-12

* appears to have changed status (from recent monitoring data)and requires verification by professional prior to accurate status to be proclaimed

ATTACHMENT 9

Jupiter Mines Limited

Central Yilgarn Iron Project
Malleefowl Management Plan

April 2013

Document Status				
Rev No	**Author**	**Status**	**Date**	**Distribution**
Draft 8.0	Keith Lindbeck & Associates	Initial draft for JML review	December 2012	
Draft 8.1	Jupiter Mines Limited	Final Draft	January 2012	
Draft 8.2	Keith Lindbeck & Associates	Review of JML Final Draft	January 2012	
Draft 8.3	Kasa Consulting	Final Review	February 2013	
Final Draft	Jupiter Mines Limited	Final draft for EPBC Referral	February 2013	DEC, MPG, SEWPaC
Final	Jupiter Mines Limited	Final, incorporating SEWPaC preliminary comments	April 2013	MPG, SEWPaC

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1.0 PROJECT BACKGROUND

Jupiter Mines Limited ('Jupiter') owns the Central Yilgarn Iron Project (CYIP) which is located approximately 100 kilometres northwest of Menzies within the Shire of Menzies, approximately 530km northeast of Perth, Western Australia (Figure 1).

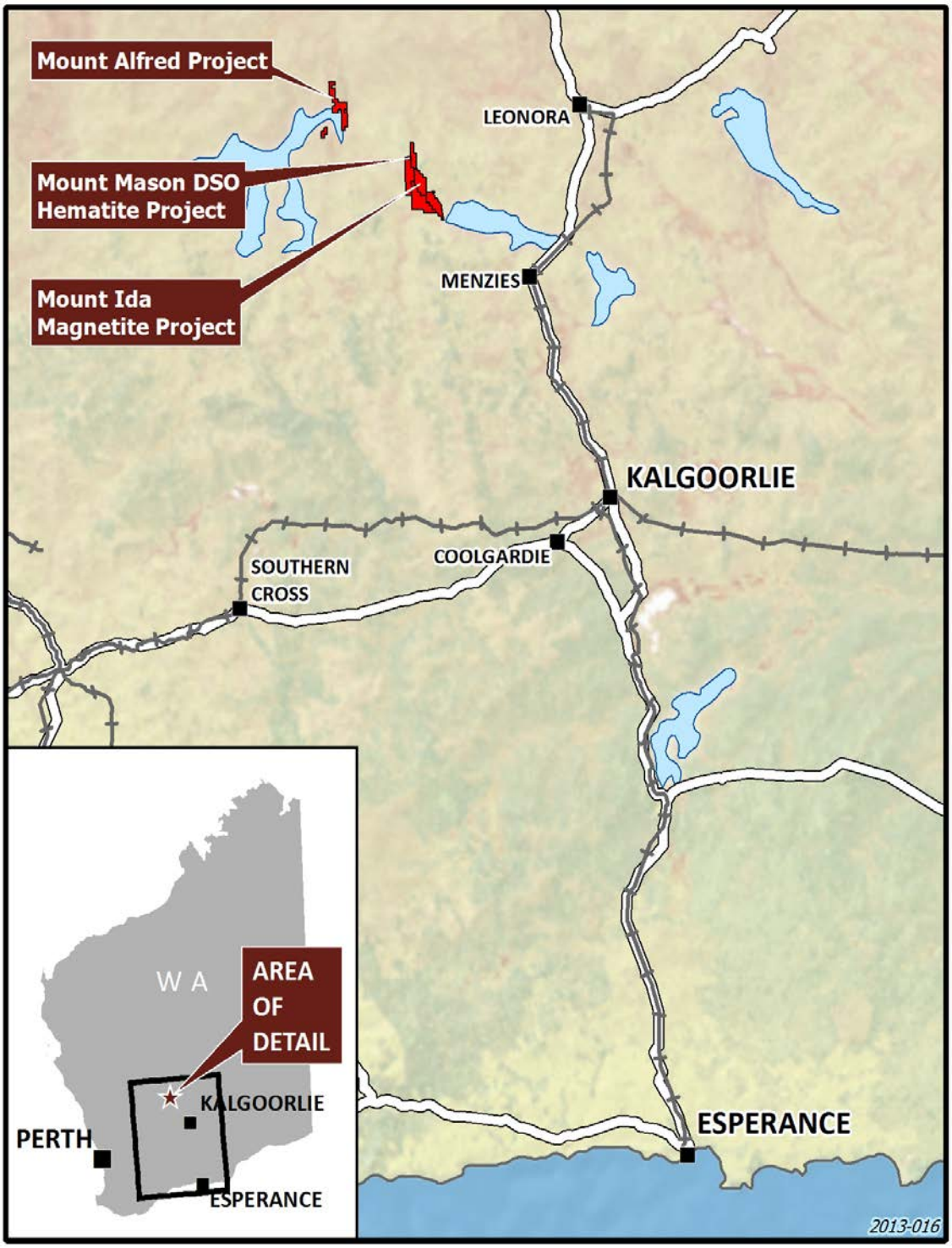

Figure 1 **– Regional location of the Central Yilgarn Iron Project (CYIP)**

The CYIP currently consists of the Mt Mason Direct Shipping Ore Hematite Project and Mount Mason and Mount Ida exploration projects. Individual tenements for these projects are listed in Table 1, including current status. Iron ore mining rights within these tenements are all owned 100% by Jupiter Mines Limited:

Table 1 - Land Tenure of the Central Yilgarn Iron Project

Project	Tenement	Size (ha)	Date Granted	Expiry Date
Mount Alfred	E29/581	10469	8/03/2006	7/03/2013
Mount Alfred	E29/726	300	19/01/2010	18/01/2015
Mount Ida	M29/414	6456	25/11/2011	24/11/2032
Mount Ida	L29120	21711	Pending	Pending
Mount Ida	E29/560	9736	8/09/2006	7/09/2013
Mount Ida	E29/777	10467	15/02/2011	14/02/2016
Mount Ida	E29/801	7532	18/08/2011	17/08/2016
Mount Ida	L29/79	6880	24/08/2010	23/08/2031
Mount Ida	G29/22	9625	06/09/2012	05/09/2033
Mount Ida	L29/106	119	20/06/2012	19/06/2033
Mount Ida	L29/122	6586	Pending	Pending
Mount Ida	L29/99	64504	24/02/2012	23/02/2033
Mount Ida	L37/203	68937	27/06/2011	26/06/2032
Mount Ida	L29/81	25987	12/09/2011	11/09/2032
Mount Ida	L29/78	6337	24/06/2010	23/06/2031
Mount Mason	**L29/121**	**65**	**Pending**	**Pending**
Mount Mason	**G29/23**	**1256**	**07/02/2013**	**06/02/2034**
Mount Mason	**M29/408**	**300.00**	**28/11/2007**	**27/11/2028**

The Mt Mason DSO Hematite Iron Ore Project (bold in Table 1) is the first project of the CYIP to be considered for further development. As such, Figure 2 focuses on the proposed Mount Mason Project which will predominantly occur within Mining Lease M29/408. The haul road traverses through associated general purpose leases as shown in Figure 2.

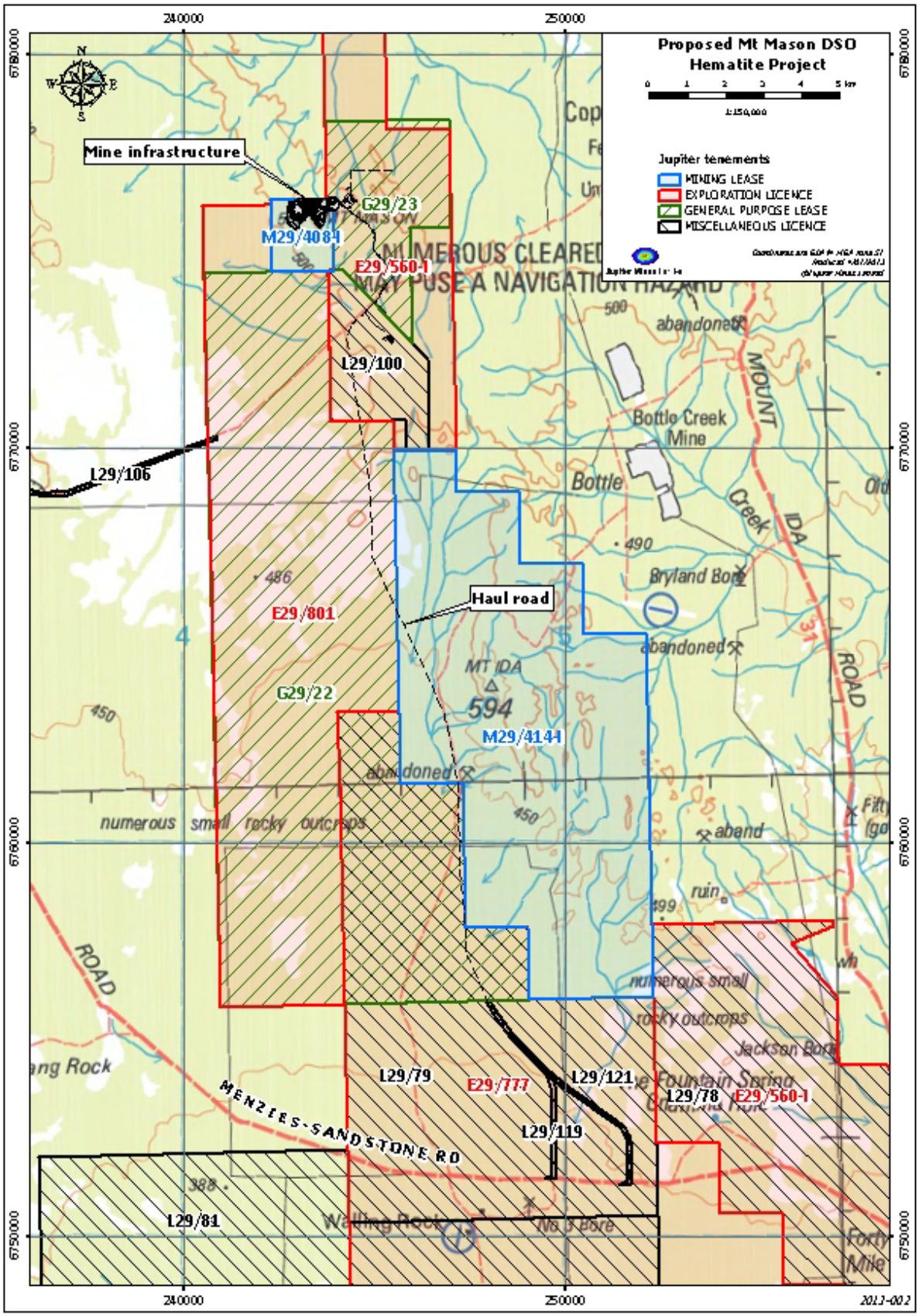

Figure 2 - Location of Mt Mason DSO Hematite Iron Ore Project

1. THE SPECIES

1.1 DESCRIPTION OF THE SPECIES

Malleefowl *Leipoa ocellata* (Gould, 1840) are large ground dwelling birds belonging to the Megapodiidae family. This species belongs to a small group of mound builders where the mound is used as an external heat source to incubate their eggs (Clark 1964). The Malleefowl is a long-lived sedentary species with an average lifespan of roughly 15 years. Reaching approximately 60cm in height and 1.5 - 2kg in weight, they are roughly the size of a small turkey (Benshemesh 2005). They have a unique appearance with a distinctly barred upper body of grey, white, black, buff and pale chestnut feathers, with a crest extending from the front of the crown to the nape which is raised when the bird is alarmed (DEWHA 2010; Pizzey and Knight 1999) (Figure 3).

Figure 3 - Adult Malleefowl *Leipoa ocellata*

1.2 CONSERVATION STATUS

Malleefowl *Leipoa ocellata* are classified under the Federal *Environmental Protection and Biodiversity Conservation Act*, 1999 (EPBC Act) as *"Vulnerable: "Taxa facing a high risk of extinction in the wild in the medium-term future".* It is also a listed species under Schedule 1 of the Western Australian *Wildlife and Conservation Act* 1950 and defined as "Rare and likely to become extinct".

The Federal Department of Sustainability, Environment, Water, Population and Communities (SEWPaC) administers the EPBC Act whilst the State Department of Environment and Conservation (DEC) administers the Wildlife Conservation Act 1950. In addition, the Malleefowl is also listed as Vulnerable on the 2007 International Union for Conservation of Nature (IUCN) Red List of Threatened Species.

1.3 GENERAL ECOLOGY

The Malleefowl is a species which occupies semi-arid to arid regions of Western Australia, inhabiting dense shrublands and thickets of Mallee (*Eucalyptus* spp.), Boree (*Melaleuca lanceolata*), Bowgada (*Acacia linophylla*), or areas which form dense leaf litter (Johnstone and Storr 1998). Malleefowl prefer habitat that is long unburnt for breeding and shelter. However Malleefowl will feed in recently burnt areas (Benshemesh 1992, Marchant and Higgins 1993).

The size of Malleefowl mounds vary. However, an average mound spans 5 metres in diameter and can be up to 1 meter high (DEC 2010) (Figure 4).

Figure 4 - Malleefowl mound

Malleefowl are usually solitary and occupy a home rage of between 0.5 and 4.6 km (Benshemesh 1992). Established monogamous breeding pairs usually inhabit a similar area throughout the year and come together for breeding. While both sexes build the mound, once the female has laid the eggs, the male usually maintains the mound on his own. Birds generally breed annually (Marchant and Higgins 1993) with the breeding season lasting 11 months. Following mound preparation, eggs are laid from mid-August to late January and hatchlings appear from November and January (Johnstone and Storr 1998). The precocial chicks are independent from hatching having no contact with either their parents or siblings (van der Waag 2007). While 50% to 85% of eggs hatch (Firth, 1959) generally more than 80% of chicks die within the first few weeks of life from predation and 'metabolic stress' (Priddel and Wheeler 1994).

Malleefowl feed opportunistically and will often feed on whatever food sources are abundant in the area (van der Waag 2007). Their omnivorous diet can consist of seeds, native herbs, flower buds, fruits and foliage of different plant species, as well

as invertebrates. This species will drink water but can easily survive during summer when surface water is unavailable (DEC 2010).

1.4 DISTRIBUTION OF THE MALLEEFOWL

Originally, Malleefowl were widespread and common across the southern arid and semi-arid zone, however the species has now become patchily distributed due to the effects of habitat clearing and fox predation (Johnstone and Storr 1998). Unlike other megapods that prefer damp forest, the Malleefowl does not inhabit the higher rainfall area of the Swan Coastal Plain and south coast of Western Australia (Figure 5).

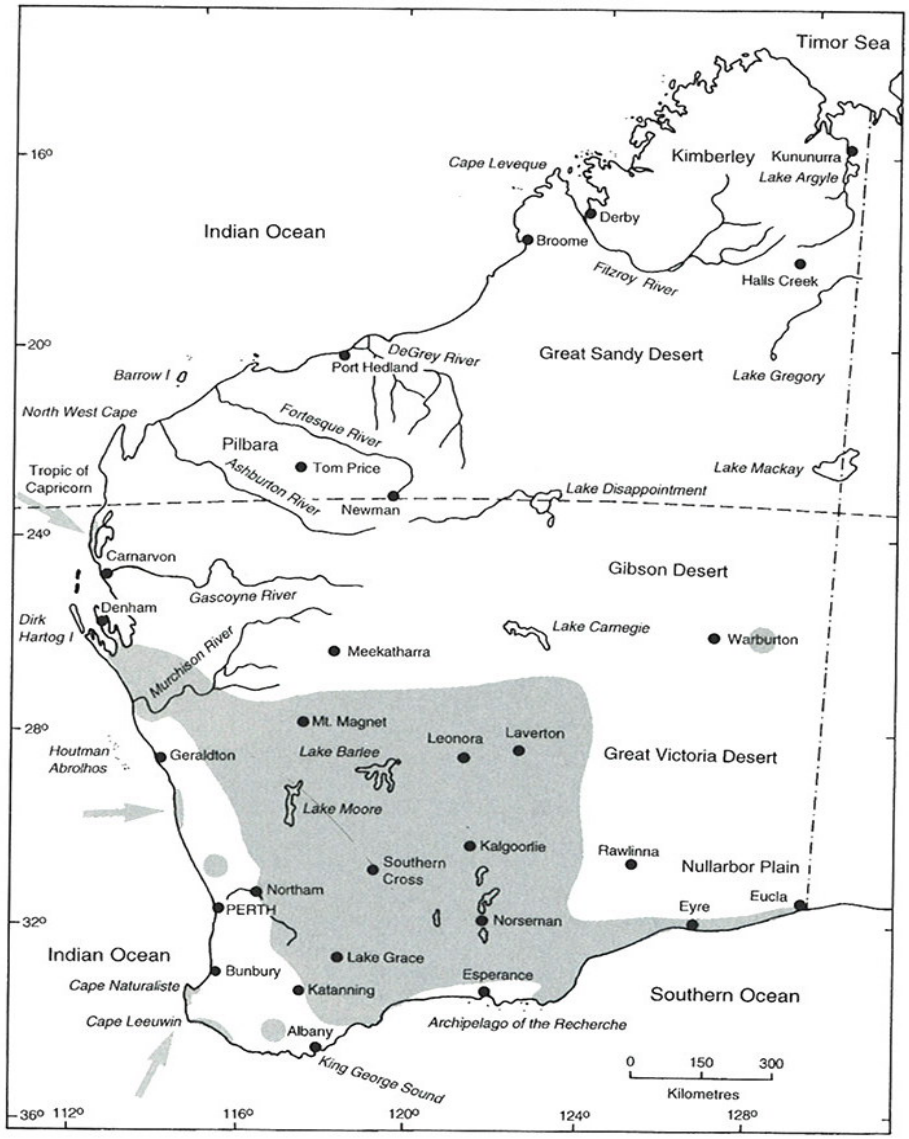

Figure 5 - Distribution of Malleefowl

1.5 OCCURANCE OF MALLEEFOWL AT THE CENTRAL YILGARN IRON PROJECT AREAS

A Level 2 fauna survey was conducted in the wider CYIP area in accordance with EPA guidelines (2002, 2004) in spring 2011 and autumn 2012 (KLA 2012a). A targeted EPBC survey, which included Malleefowl, was undertaken in March and April 2012 (KLA 2012b) of the proposed Mount Mason disturbance footprint. In addition, a targeted Malleefowl survey was undertaken by GHD in Spring 2012 (GHD 2012) of a potential haul road option (not proposed). A summary of the findings from these surveys are outlined in Table 3 below:

Table 3 – Active and Inactive Mounds recorded during fauna surveys across the CYIP

Date	Source/Report	Surveyor	Active Mounds		Inactive Mounds	
			Number of mounds located on survey	Number of mounds located within project disturbance footprint	Number of mounds located on survey	Number of mounds located within project disturbance footprint
April 2012	Mount Mason Targeted EPBC Listed Fauna Survey	Keith Lindbeck & associates (KLA)	1	0	37	11
August 2012	Central Yilgarn Iron Project (CYIP) – Mount Mason (L2) Fauna Assessment	Keith Lindbeck & Associates (KLA)	1 (note same mound MFM001 as recorded in April Survey)	0	7	0
August 2012	Central Yilgarn Iron Project (CYIP) – Mount Mason (L2) Fauna Assessment	Keith Lindbeck & Associates (KLA)	1	0	7	0
December 2012	Jupiter Mines Mount Ida non-process infrastructure areas – Malleefowl Survey	GHD	4	0	3	0

More detailed results from the above surveys are included in the table in Appendix 1.

Figure 6a & 6b show the current known locations of the active and inactive mounds in the vicinity of the Mt Mason Project which were recorded in baseline surveys. Any mounds found outside the above surveys (eg; through observations, monitoring), or which have appeared to have changed status through monitoring records will be re-recorded by professional prior to construction phase the project to ensure the most accurate information is used to allow avoidance as primary management strategy.

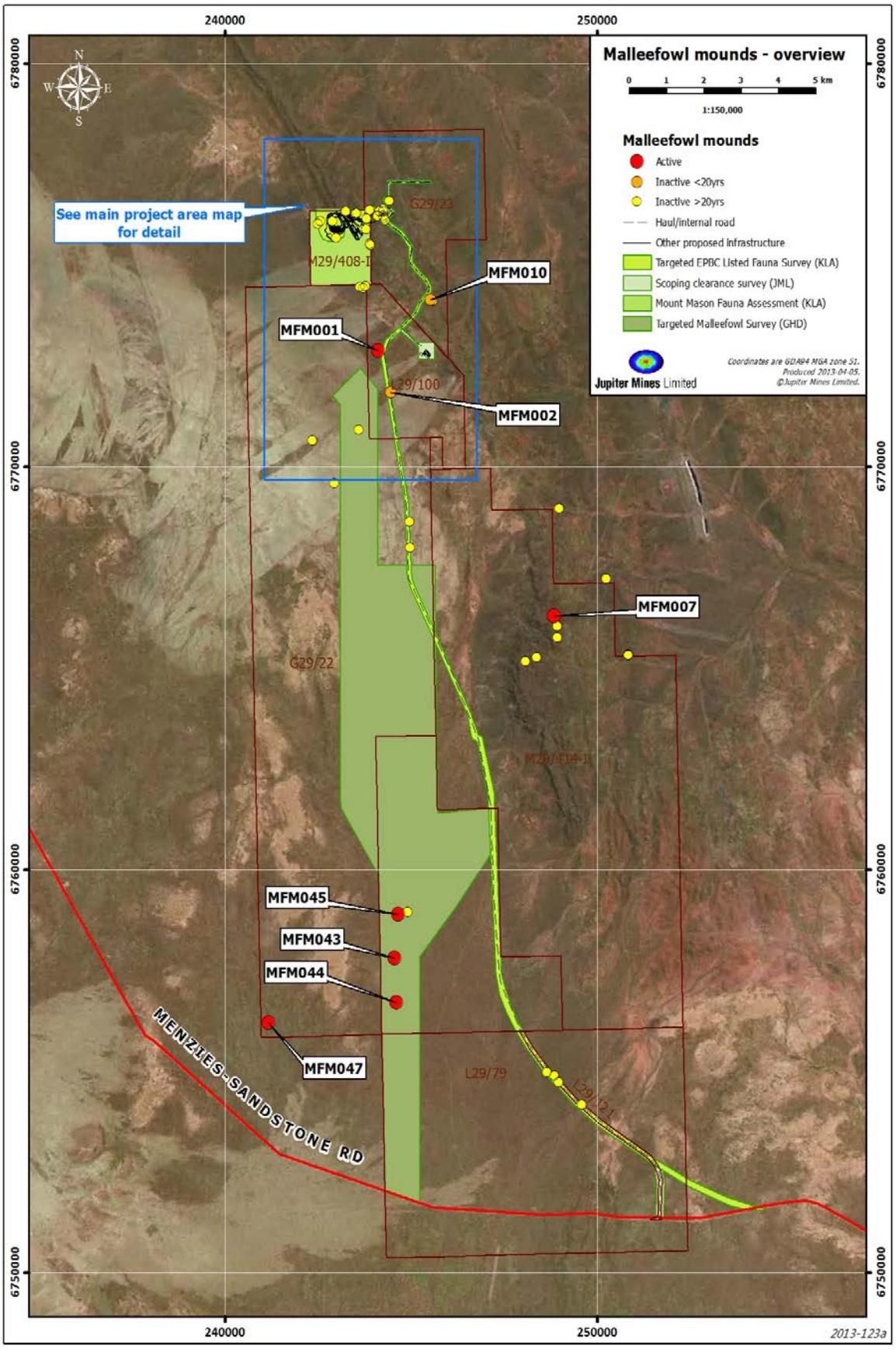

Figure 6a - Malleefowl mounds within the CYIP survey area

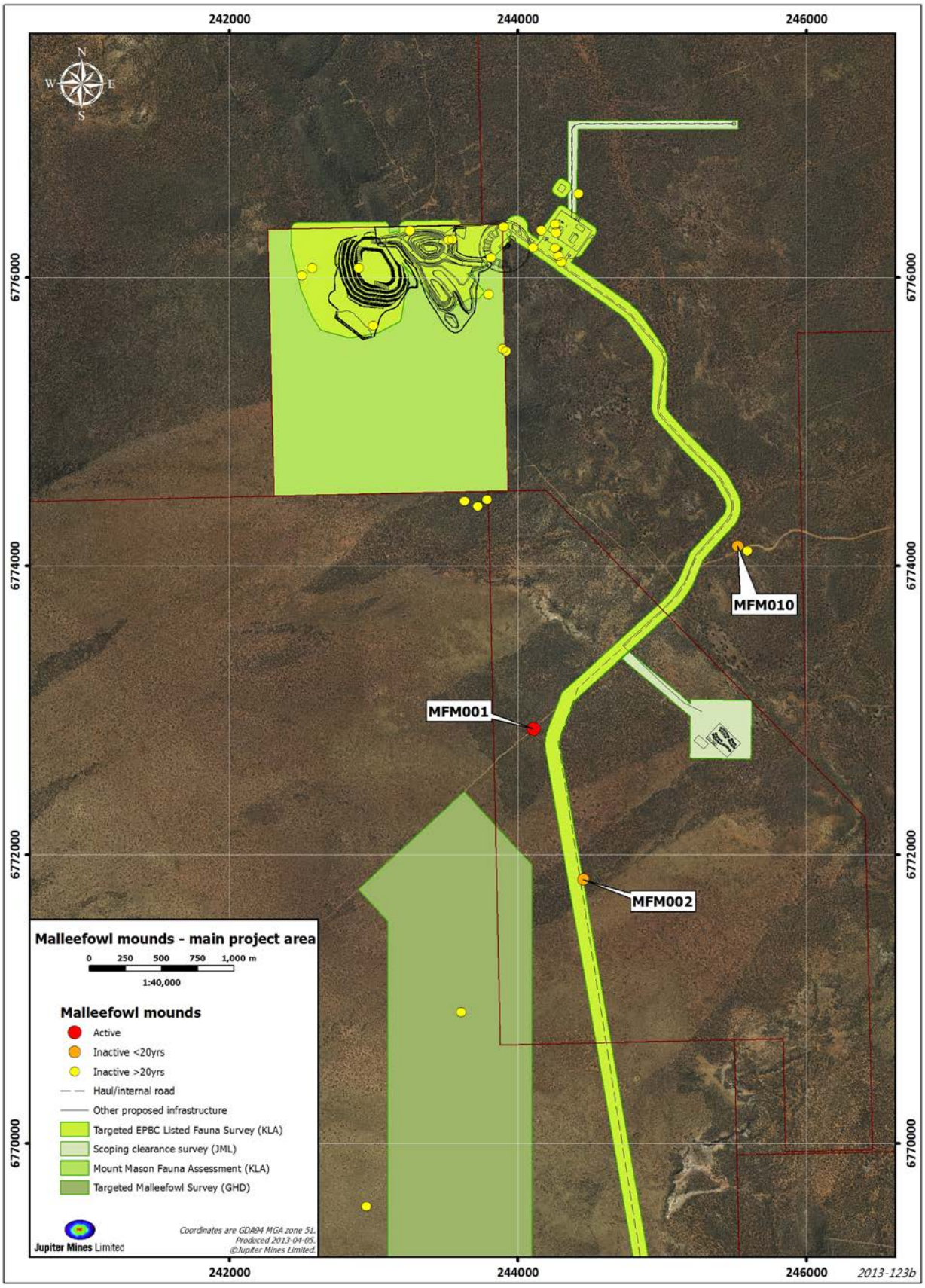

Figure 6b – Malleefowl mounds within Mount Mason Main Project Area

Figure 6a & 6b show that the proposed Mt Mason Hematite DSO Project has carefully been designed to avoid all known active Malleefowl mounds based on current data. Wherever practicable, a 250m buffer will be maintained around active mound and a 50m buffer from inactive mounds <20 years old.

However, note that MFM001 is currently the closest active mound to the proposed infrastructure at 185m away (closest point) from the proposed haul road alignment and it is not practicable to move the proposed haul any further due to nearby heritage site boundaries. Incidentally, MFM001 is located less than 5 metres from the edge of a pre-existing track (Metzke Road) and has been active for at least two years during exploration with no known detrimental impacts from current traffic. However, a reduced speed of 40km/hr will be imposed in the vicinity of MFM001 along with Malleefowl signage to further reduce potential impact.

Malleefowl occurrence throughout CYIP will likely be dynamic due to the mobile nature of the species. However Jupiter is committed to ongoing monitoring and data collection of both active and inactive mounds, which will be recorded through the Malleefowl portal of Jupiter's Environmental Database, an example of which is included in Appendix 2.

This should allow adaptive management actions (detailed in section 6) to be implemented to ensure that current minimal level of impact to the species throughout all CYIP's phases is maintained.

1.6 THREATS TO THE MALLEEFOWL

Benshemesh (2005) clearly states that the national major threats to the Malleefowl include clearing and burning of native vegetation, the introduction and spread of predatory species, grazing, starvation and road deaths.

1.6.1 Clearing

Widespread clearing of native vegetation in agricultural areas has removed and fragmented much of the Malleefowl habitat, resulting in localised extinctions and fragmented populations. New clearing threats that also target Malleefowl habitat include mining, harvesting of mallee eucalypts, waste containment facilities and harvesting of Broombrush (*Melaleuca uncinata*) for building materials (Benshemesh 2008).

This clearing has not only removed habitat for the Malleefowl, but also threatens remaining habitat due to agricultural species invasion and dispersal, fragmentation and associated edge effects and dryland salinity (Benshemesh 2008). Remnant patches of vegetation may not be sufficiently large and/or diverse to sustain a viable population of Malleefowl and the lack of corridors between patches for resources or dispersal further reduces viability of even small populations.

1.6.2 Fire

Fire of native and remnant vegetation poses a major threat to the Malleefowl. While fire is a natural part of the ecology of Malleefowl preferred habitat (i.e. Mallee), large and frequent fires can remove vast areas of Malleefowl habitat in a short period of time, leading to temporary or permanent local extinctions This includes both wildfire

and prescribed burning. Depending on the vegetation type, the leaf litter required for mound building may take many years to build up.

While Malleefowl will feed in recently burnt areas, they require long-unburnt areas for breeding and shelter (Benshemesh 1992, Marchant and Higgins 1993).

1.6.3 Predation

Predation by introduced species such as the Fox (*Vulpes vulpes*) and to a lesser extent the Cat (*Felis catus*) is a major cause of mortality of Malleefowl. Foxes are known to take Malleefowl at all ages from eggs to adult birds and are also a major threat to captive-reared Malleefowl released into the wild (Benshemesh 2008).

The relationship between fox baiting and Malleefowl remains unclear as a reduction in fox numbers does not appear to decrease the mortality of predator-taken Malleefowl. Feral dogs and Dingoes are also known predators of the Malleefowl, as well as predatory birds.

1.6.4 Grazing and starvation

Grazing by stock, and other feral herbivores threaten Malleefowl populations in several ways. Primarily, their grazing activities can alter the structure and diversity of vegetation that provides suitable habitat for Malleefowl populations. Additionally, they may also compete with Malleefowl for available food resources, which can lead to starvation (Benshemesh 2005).

Rabbits, kangaroos, feral goats, feral camels etc. may have a deleterious impact on Malleefowl habitat and resources.

1.6.5 Road Deaths

Malleefowl are slow moving, ground dwelling birds which makes them more susceptible to road deaths. This is particularly evident in areas where new roads are constructed with an increase in traffic flow.

2. CONSULTATION

This management plan has been prepared following discussions with relevant stakeholder groups, including the DEC and the Malleefowl Preservation Group (MPG).

The management actions in this plan are specifically relevant to the CYIP area (including the Mt Mason DSO Hematite Project). All mining and exploration personnel require mandatory induction and training and they potentially may be involved in monitoring and management of the Malleefowl population within the area. However community involvement will not be detailed in this Management Plan due to the location and isolation of the CYIP areas.

All information obtained as a result of the actions undertaken pursuant to this Management Plan will be made available to the MPG with whom Jupiter currently have a sponsorship agreement (Appendix 3) to assist in achieving regional conservation objectives for the species.

3. STRATEGIES FOR MANAGEMENT

The strategy and key objectives of this management plan have been established in accordance with the EPA's *Guidelines for the protection of terrestrial fauna* and the *National Recovery Plan for Malleefowl* (Benshemesh 2000).

The Environmental Protection Authority's (EPA) objective for terrestrial fauna is to maintain the abundance, species diversity and geographical distribution of terrestrial fauna and protect specially protected fauna consistent with the provision of the *Wildlife Conservation Act* 1950.

The National Recovery Plan for Malleefowl lists National management actions for Malleefowl populations, whilst some of the initiatives and proposals in the national plan are not relevant at the local scale. The following strategies have been selected by Jupiter to incorporate into key objectives for CYIP:

Securing existing population
- Securing habitat
- Reducing fire threat
- Reducing predation
- Reducing road deaths of Malleefowl

Obtain information for adequate management of the species
- Determine current and future distribution
- Monitor trends in species abundance
- Describe habitat requirements in the local area for the Malleefowl

These strategies have been broken down into objectives within the Management Program Summary in Section 6 and used as the foundation of management actions to ensure that the CYIP has no significant impacts on any population of Malleefowl occurring in the project areas.

3.1 PRIMARY MANGEMENT OBJECTIVES

Avoidance of impacts is Jupiter's primary objective for management of threatened species. Numerous baseline surveys and an iterative design process will help Jupiter to achieve this objective. Notwithstanding this, and in light of the significance of the species, Jupiter has prepared this Malleefowl Management Plan with the following primary management objectives:

1. Ensure no significant impacts occur to the local population status as a result of Jupiter's CYIP activities; and
2. To document ongoing Malleefowl management and monitoring commitments throughout the CYIP.

4. Management Program Summary

The Specific objectives and actions detailed below in Table 4 are based on those identified in the National Malleefowl Recovery Plan (2000) and aim to:

Table 4 – Mt Mason Project Malleefowl Management Plan

Key Issue	Objective	Management Action	Responsibility
Secure existing population	Identify Malleefowl mounds and Malleefowl habitat and minimise impact in these areas	• Targeted Malleefowl surveys will occur for all proposed disturbance areas prior to construction • A clearance survey will be conducted across the project disturbance areas prior to commencement of clearing (including already surveyed areas) to record new active mounds • A minimum 250m buffer around known active mounds will be maintained within which there will be no works (including vehicles, clearing for drilling) where practicable: with the exception of MFM001 which has been allocated a 185m buffer due to avoidance of other constraints in the area such as heritage sites. • In the vicinity of the buffer of MFM001 (towards Metzke Road tie-in), a 40km speed limit will be imposed on the proposed haul /access road. • A 50m buffer from inactive mounds <20years in age will be maintain within which there will be no works where practicable. • The following hierarchy of management will occur to manage the presence of active mounds: 1. Avoid – through engineering/redesign in infrastructure 2. If unavoidable, then clearing may occur within 250m buffer of active mound between April-June (outside of nesting & incubation period) 3. If impracticable to delay clearing to when nest becomes inactive, then the appropriate regulatory authorities will be contacted and advice sought on best management practice in the context of the specific circumstance.	Environmental Coordinator

Key Issue	Objective	Management Action	Responsibility
		• Lighting will be directed onto construction or operational areas, away from surrounding fauna habitat to minimise impact to Malleefowl activity • Ongoing monitoring of all inactive and active mounds to occur as per Monitoring Plan and information regularly updated in the Malleefowl Portal of the Environmental Database (Appendix 2)	
Secure existing population	Educate employees and contractors of the importance of conserving Malleefowl and their habitat	• Maintain a component on Malleefowl protection and management within the site environmental induction. All site personal and contractors to undergo induction. • Environmental training to be provided to all personnel on site including conservation significance of fauna, relevant environmental conditions and commitments and incident reporting system. • All fauna injuries of mortalities will be reported to the Site Environmental Coordinator within 24 hours in accordance with the incident reporting system.	Environmental Coordinator
Fire threat	Reduce the occurrence of large fires to protect Malleefowl habitat	• Develop and implement a Fire Management Plan in consultation with Fire and Emergency Services (FESA) and/or DEC. The Fire Management Plan will outline appropriate fire prevention and fire management strategies that prevent and reduce the risk of large scale fires starting and spreading due to the activities associated with the Mt Mason DSO Hematite mining operations • Minimise risk of fire occurring by implementing the management strategies outlined in the Fire Management Plan.	OHS/Environmental Manager
Predation	Monitor and reduce feral predator numbers	• Develop and implement a predator control program aimed at reducing Malleefowl predator numbers in the project areas • Include information on feral species management and control in the on-site environmental inductions for all employees and contractors. Inductions will be completed prior to staff or contractors commencing work on site. Inductions will include how to report any sightings of feral animals.	Environmental Coordinator

Key Issue	Objective	Management Action	Responsibility
Vehicle interaction	Minimise risk of vehicle and Malleefowl interactions	• Warning signs (e.g. road signs) will be erected at least 100 m from active Malleefowl mounds and will indicate possible presence of the species. • Vehicle access and vehicle speed will be limited around known active Malleefowl mounds. For example, in the vicinity of MFM001, a 40km/hr speed limit will be imposed. • All project vehicles will remain on designated tracks and no new tracks will be created without approval. • Site personnel will be directed to record and report all sightings of, or interactions involving Malleefowl. All site personnel to be educated on these requirements via the compulsory site induction and onsite training. • Night time vehicle movements will be restricted wherever possible to minimise potential of fauna strikes (including Malleefowl) • Malleefowl deaths and injuries due to vehicle incidents will be recorded and reported to DEC.	Environmental Coordinator Environmental Coordinator
Monitoring	Monitor trends in Malleefowl abundance and distribution and assess threats	• Maintain a Malleefowl Monitoring Procedure to monitor active mounds and breeding activities of local populations. Monitoring to be undertaken at a minimum annually during breeding season (i.e. September). Monitoring will be conducted as outlined in the Jupiter Mines Limited Malleefowl Monitoring Procedure (Appendix 4) • Establish a protocol for recording sightings of live Malleefowl and mounds on the site. Details of the protocol will be included in the staff and contractors' induction programs. Data from these recordings will be included in the annual reporting to DEC • Maintain existing and add new data to the Malleefowl Portal of the Environmental Database – example shown in Appendix 2	Environmental Coordinator

Key Issue	Objective	Management Action	Responsibility
		• Report Malleefowl monitoring results to DEC on an annual basis (to be included in annual environmental report)	
Community/Monitoring	Document ongoing Malleefowl management and monitoring commitments	• Share data obtained with relevant stakeholders including Malleefowl Preservation Group (MPG) & DEC to contribute to regional conservation of the species • Continue to liaise with MPG and relevant conservation groups regarding Malleefowl Management and where practicable, involve in monitoring activities or training.	Environmental Coordinator
Malleefowl habitat requirements	Maintain existing habitat and minimise loss of potential Malleefowl habitat	• Undertake a pre-construction targeted Malleefowl survey and monitoring program (as outlined in the Jupiter Mines Limited Malleefowl Monitoring Procedure) thereafter to confirm local distribution and any local habitat "hot spots" • All exploration activity related clearing will avoid Malleefowl Mounds (minimum 100m buffer) and buffer clearly demarcated • Implement the Land Clearing Management Strategy (Appendix 5) and related procedures to ensure no clearing of Malleefowl habitat occurs without the necessary approvals. • Clearing for the project for construction and operation purposes will be restricted to those areas that are strictly necessary for the development and operation of the project. • Approved clearing boundaries will be marked in field and recorded on GPS. • All vegetation clearing within the vicinity of known active mounds will occur between April and June (outside nesting and incubation period). • Rehabilitation will be undertaken in accordance with relevant conditions/Rehabilitation Plan, and tailored to relevant surrounding vegetation communities/potential Malleefowl habitat to be replaced • Provide monitoring data and reports to all interested parties on an annual basis to assist with monitoring species abundance and distribution	Environmental Coordinator Environmental Coordinator

Key Issue	Objective	Management Action	Responsibility
Project coordination and review	Project coordination and review	• A compliance audit of the management plan and actions performed under the plan will be undertaken annually. A review of the management plan will be undertaken at the completion of the construction phase of the project and every two subsequent years	Environmental Coordinator
Contingency	Contingency measures	• In the event that performance indicators are not being met, implement contingency measures in consultation with the DEC.	Environmental Manager

5. PERFORMANCE INDICATORS

Jupiter's performance will be reviewed against the following indicators:

- Monitoring results of Malleefowl mortality due to road deaths; and
- Workforce awareness of Malleefowl conservation measures.

6. RESPONSIBILITY

The Environmental Manager will be responsible for ensuring that the Malleefowl Management Plan is implemented, and reviewed when required.

The Site Environmental Officer will be responsible for the ongoing monitoring of Malleefowl and implementation of the Management Plan.

7. DECOMMISSIONING PHASE

Any rehabilitation or decommissioning activity within the Malleefowl habitat areas will be undertaken in a manner that is consistent with this Management Plan and the Closure Plan submitted to the Department of Mines and Petroleum (DMP).

8. AUDITING

Jupiter will conduct compliance audits against commitments in this Management Plan annually.

The Management Plan will be regularly reviewed and modified as necessary in the light of new information, monitoring results and progress on management actions. Jupiter, in consultation with the DEC, will review and update the plan two years after project commencement. The timing of subsequent reviews will be determined after the initial review but will occur no later than at two yearly intervals.

9. REPORTING

9.1 JUPITER INTERNAL REPORTING

All employees and contractors will be required to report any evidence of Malleefowl populations in the project area to the Site Environmental Officer, via their supervisor. This includes sightings, mounds, road kills and other evidence of their presence, for example tracks and feathers.

9.2 EXTERNAL REPORTING

All environmental reporting will be completed in accordance with statutory requirements and submitted to the appropriate authorities when required.

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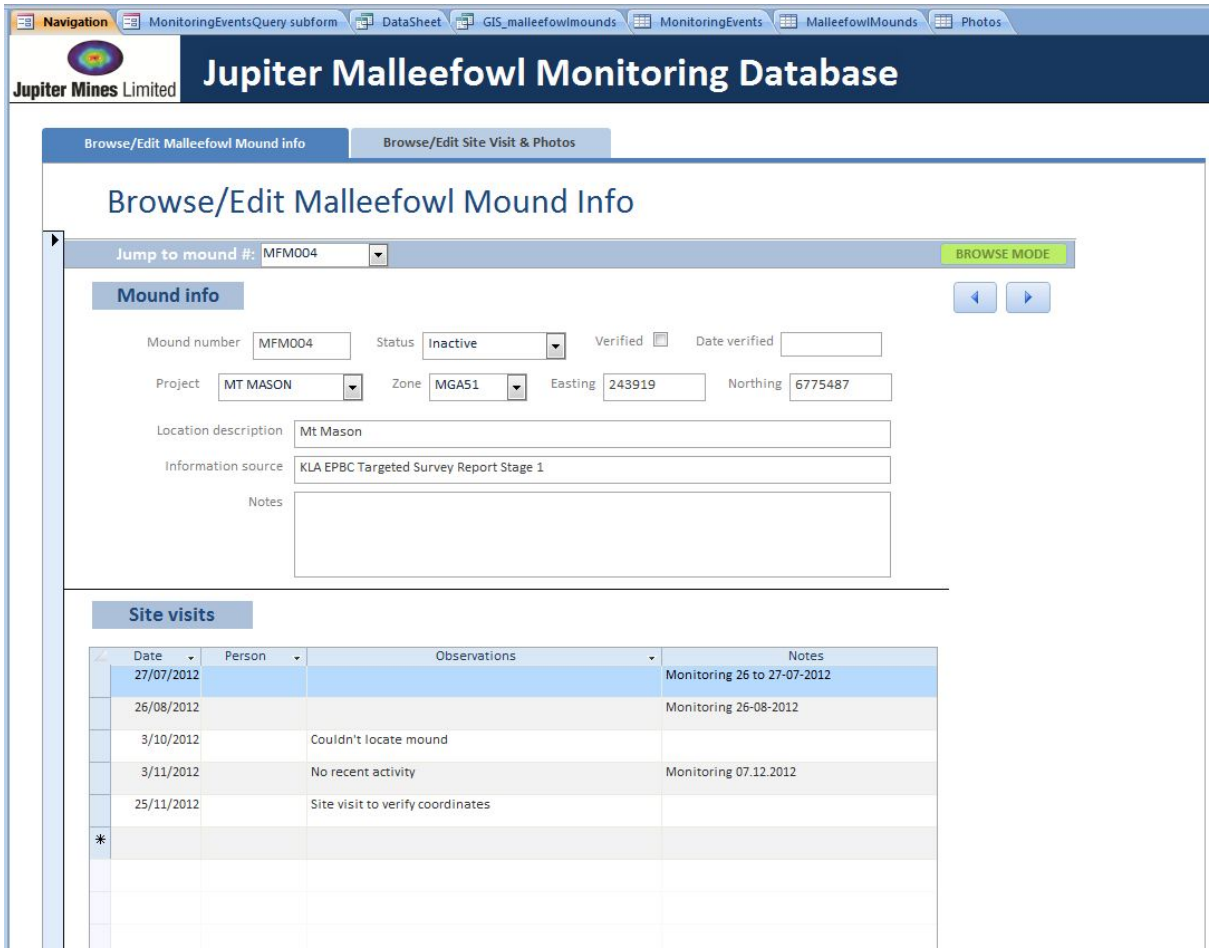
Appendix 1

Jupiter Mines Limited Survey Summary Results Table

MoundID	Project	Location	Easting	Northing	Zone	Status	Approx age (yrs)	st monitored da	InfoSource	Date verified
MFM001	MT MASON	Metzke Rd	244107	6772871	MGA51	Active	<2	07-Dec-12	KLA Mount Mason Level 2 Fauna Assessment & KLA Targeted EPBC survey	Apr-12
MFM002	MT MASON	near haul access L29/100	244454	6771833	MGA51	Inactive	<5	07-Dec-12	KLA EPBC Targeted Survey	Apr-12
MFM003	MT MASON	Mt Mason at MMWB005	243523	6776262	MGA51	Inactive	>30	07-Dec-12	KLA Mount Mason Level 2 Fauna Assessment & KLA Targeted EPBC survey	Mar-12
MFM004	MT MASON	Mt Mason	243919	6775487	MGA51	Inactive	>100	25-Nov-12	KLA Mount Mason Level 2 Fauna Assessment & KLA Targeted EPBC Survey	Apr-12
MFM006	MT IDA	Mt Ida at 11MIRC178	248946	6766024	MGA51	Inactive	>50	09-Dec-12	CYIP - Mt Ida - Level 2 Fauna Assessment	Apr-12
MFM007	MT IDA	Mt Ida near 11MIRC192	248847	6766280	MGA51	*Active	>50	09-Dec-12	CYIP - Mt Ida - Level 2 Fauna Assessment	requires verification
MFM009	MT IDA	Mt Ida Access Road	250251	6767189	MGA51	Inactive	>50	12-Dec-12	CYIP - Mt Ida - Level 2 Fauna Assessment	Apr-12
MFM010	MT MASON	Off Metzke Rd	245522	6774136	MGA51	Inactive	<20	24-Nov-12	Targeted EPBC Survey	Apr-12
MFM011	MT MASON	Off Metzke Rd	245590	6774104	MGA51	Inactive	undetermined	24-Nov-12	Outback Ecology Report Jan 2007 & KLA March 2012 (unable to locate)	Jan-07
MFM012	MT MASON	Off Mt Mason Rd near Callup Point 3	243723	6774411	MGA51	Inactive	>100	24-Nov-12	KLA Mount Mason Level 2 Fauna Assessment & KLA Targeted EPBC survey	Apr-12
MFM013	MT MASON	Off Mt Mason Rd near Callup Point 3	243631	6774448	MGA51	Inactive	>100	24-Nov-12	KLA Mount Mason Level 2 Fauna Assessment & KLA Targeted EPBC survey	Apr-12
MFM014	MT MASON	Off Mt Mason Rd near Callup Point 3	243785	6774458	MGA51	Inactive	>100	24-Nov-12	KLA Mount Mason Level 2 Fauna Assessment & KLA Targeted EPBC survey	Apr-12
MFM015	MT MASON	Mt Mason close to MFM004	243895	6775506	MGA51	Inactive	>100	25-Nov-12	KLA Mount Mason Level 2 Fauna Assessment & KLA Targeted EPBC survey	Apr-12
MFM016	MT IDA	Mt Ida, off track past MIMON 05	250846	6765291	MGA51	Inactive	>50	09-Dec-12	CYIP - Mt Ida - Level 2 Fauna Assessment	Apr-12
MFM017	MT IDA	Mt Ida, off track past MIMON 05	250844	6765318	MGA51	Inactive	>50	09-Dec-12	CYIP - Mt Ida - Level 2 Fauna Assessment	Apr-12
MFM020	MT IDA	Mt Ida near 11MIRC160	248940	6765745	MGA51	Inactive	>50	25-Nov-12	CYIP - Mt Ida - Level 2 Fauna Assessment	Apr-12
MFM021	MT IDA	Close to track, closest hole is 11MIRC108	248076	6765150	MGA51	Inactive	>50	27-Nov-12	CYIP - Mt Ida - Level 2 Fauna Assessment	Apr-12
MFM022	MT IDA	could note locate	248470	6765246	MGA52	Inactive	undetermined		CYIP - Mt Ida - Level 2 Fauna Assessment	Apr-12
MFM023	MT IDA	Close to track off Pipeline Rd	248988	6768947	MGA51	Inactive	>50	07-Dec-12	CYIP - Mt Ida - Level 2 Fauna Assessment	Apr-12
MFM024	MT MASON	near MOC pipeline	244106	6776206	MGA51	Inactive	>100	14-Jan-13	KLA EPBC Targeted Survey Report	Mar-12
MFM025	MT MASON	near MOC	244163	6776325	MGA51	Inactive	>100	14-Jan-13	KLA EPBC Targeted Survey Report	Mar-12
MFM026	MT MASON	MOC	244256	6776365	MGA51	Inactive	>100	14-Jan-13	KLA EPBC Targeted Survey Report	Mar-12
MFM027	MT MASON	ROM (outer edge)	243901	6776348	MGA51	Inactive	>100	14-Jan-13	KLA EPBC Targeted Survey Report	Mar-12
MFM028	MT MASON	ROM (stockpile)	243814	6776136	MGA51	Inactive	>150	14-Jan-13	KLA EPBC Targeted Survey Report	Mar-12
MFM029	MT MASON	MOC	243546	6776264	MGA51	Inactive	>100	14-Jan-13	KLA EPBC Targeted Survey Report	Mar-12
MFM030	MT MASON	MOC	244263	6776311	MGA51	Inactive	>50	14-Jan-13	KLA EPBC Targeted Survey Report	Mar-12
MFM031	MT MASON	MOC	244258	6776204	MGA51	Inactive	>150	14-Jan-13	KLA EPBC Targeted Survey Report	Mar-12
MFM032	MT MASON	MOC	244300	6776105	MGA51	Inactive	>150	14-Jan-13	KLA EPBC Targeted Survey Report	Mar-12
MFM033	MT MASON	MOC	244282	6776147	MGA51	Inactive	>150	14-Jan-13	KLA EPBC Targeted Survey Report	Mar-12
MFM034	MT MASON	outside pit	243796	6775881	MGA51	Inactive	>150	14-Jan-13	KLA EPBC Targeted Survey Report	Mar-12
MFM035	MT MASON	main pit (northern edge)	243252	6776321	MGA51	Inactive	>50	14-Jan-13	KLA EPBC Targeted Survey Report	Mar-12
MFM036	MT MASON	waste rock area	242895	6776065	MGA51	Inactive	>50	14-Jan-13	KLA EPBC Targeted Survey Report	Mar-12
MFM037	MT MASON	west of waste rock area	242574	6776064	MGA51	Inactive	>50	14-Jan-13	KLA EPBC Targeted Survey Report	Mar-12
MFM038	MT MASON	near waste rock drainage	242998	6775688	MGA51	Inactive	>150	14-Jan-13	KLA EPBC Targeted Survey Report	Mar-12
MFM039	MT MASON	west of waste rock area	242503	6776012	MGA51	Inactive	>100	14-Jan-13	KLA EPBC Targeted Survey Report	Mar-12
MFM040	MT IDA	Haul Road	243606	6770906	MGA51	Inactive	undetermined	14-Jan-13	Glen Gaikhorst & Tim Moulds (GHD)	Mar-12
MFM041	MT IDA	Haul Road	242360	6770639	MGA51	Inactive	undetermined	14-Jan-13	Glen Gaikhorst & Tim Moulds (GHD)	Mar-12
MFM042	MT IDA	Haul Road	242949	6769562	MGA51	Inactive	undetermined	26-Jan-13	Glen Gaikhorst & Tim Moulds (GHD)	Mar-12
MFM043	MT IDA	Haul Road	244560	6757792	MGA51	Active	<20	26-Jan-13	Glen Gaikhorst & Tim Moulds (GHD)	Nov-12
MFM044	MT IDA	Haul Road	244608	6756687	MGA51	Active	<20	26-Jan-13	Glen Gaikhorst & Tim Moulds (GHD)	Nov-12
MFM045	MT IDA	Haul Road	244647	6758880	MGA51	Active	<20	26-Jan-13	Glen Gaikhorst & Tim Moulds (GHD)	Nov-12
MFM046	MT IDA	Haul Road	244912	6758932	MGA51	Inactive	undetermined	14-Jan-13	Glen Gaikhorst & Tim Moulds (GHD)	Nov-12
MFM047	MT IDA	Haul Road	241166	6756184	MGA51	Active	<20	26-Jan-13	Glen Gaikhorst & Tim Moulds (GHD)	Nov-12
MFM049	MT MASON	Near explosives track	244420	6776580	MGA51	Inactive	undetermined	10-Feb-13	Merri Bartlett (Jupiter Site Environmental Officer)	requires verification
MFM050	MT MASON	near Haul Road G29/22	244958	6768612	MGA51	Inactive	>50	n/a	KLA EPBC Targeted Survey Report	Apr-12
MFM051	MT MASON	near Haul Road G29/23	244977	6767975	MGA51	Inactive	>50	n/a	KLA EPBC Targeted Survey Report	Apr-12
MFM052	MT MASON	near Haul Road L29/121	248656	6754952	MGA51	Inactive	>50	n/a	KLA EPBC Targeted Survey Report	Apr-12
MFM053	MT MASON	near Haul Road L29/121	248852	6754862	MGA51	Inactive	>100	n/a	KLA EPBC Targeted Survey Report	Apr-12
MFM054	MT MASON	near haul road L29/121	248977	6754701	MGA51	Inactive	>100	n/a	KLA EPBC Targeted Survey Report	Apr-12
MFM055	MT MASON	near Haul Road L29/121	249655	6754132	MGA51	Inactive	>100	n/a	KLA EPBC Targeted Survey Report	Apr-12
MFM056	MT MASON	near Haul Road L29/121	249923	6753883	MGA51	Inactive	>100	n/a	KLA EPBC Targeted Survey Report	Apr-12
MFM057	MT MASON	near Haul Road L29/121	250227	6753693	MGA51	Inactive	>100	n/a	KLA EPBC Targeted Survey Report	Apr-12
MFM058	MT MASON	near Haul Road L29/121	250204	6753620	MGA51	Inactive	>100	n/a	KLA EPBC Targeted Survey Report	Apr-12
MFM059	MT MASON	near original tie in	253603	6751822	MGA51	Inactive	>100	n/a	KLA EPBC Targeted Survey Report	Apr-12

* appears to have changed status (from recent monitoring data)and requires verification by professional prior to accurate status to be proclaimed

Appendix 2
Jupiter Mines Limited Environmental Database – Malleefowl Portal Example



Appendix 3
Jupiter Mines Limited CYIP Malleefowl Monitoring Procedure

Jupiter Mines Limited

MALLEEFOWL MONITORING PROCEDURE

PURPOSE: The purpose of this procedure is to outline the Malleefowl monitoring requirements for Jupiter Mines Limited Tenements (JMT) in accordance with relative legislation and Jupiter's internal Management Plans

The objectives are to:

- Ensure legal compliance within the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act 1999) and the 2007 IUCN Red List of Threatened Species.
- Comply with the Jupiter Mines Limited Malleefowl Management Plan
- Increase data and knowledge of Malleefowl habitat and breeding areas in the JMT
- Monitor and manage mining & exploration impacts on Malleefowl populations within the JMT

SCOPE: This procedure shall apply to all Jupiter Mines Limited ('Jupiter') exploration activities.

RELEVANT LEGISLATION:

- *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act 1999)
- *Wildlife Conservation Act* 1950
- The 2007 IUCN Red List of Threatened Species.

RESPONSIBILITIES

Environmental Manager - Ensure compliance is maintained against relative legislation and the JML Malleefowl Management Plan

Environmental Coordinator - Manage and review the collection, collaboration, reporting and review of Malleefowl monitoring data

Site Environmental Officer - Undertake the monitoring of Malleefowl mounds as outlined in this procedure

EQUIPMENT

- Monitoring clipboard folder & pen
- GPS with all Malleefowl mound locations pre-loaded
- ENV-FRM-007 Malleefowl Monitoring Field Sheet
- Digital Camera for optical monitoring
- Motion Sensing Camera for filmic monitoring
- Wooden stake, hammer, rope & cable ties
- General PPE

MONITORING FREQUENCY

- Inactive Malleefowl Mounds (Optical Monitoring) is to be conducted annually
- Active Malleefowl Mounds (Filmic Monitoring) is to be conducted on a quarterly basis

PROCEDURE

1.0 OPTICAL MONITORING	• Locate each "inactive" Malleefowl Mound using the GPS cords (pre-load GPS) provided in appendix one displayed in the map appendix two • Once you have arrived at your first "inactive" mound, the mound is to be assessed for signs of recent activities including, but not restricted to, the presence of scratching in the substrate, moulted feathers or signs of recent egg hatching, changes in mound size. Please record your findings on ENV-FRM-007.

Document Name & Number		ENV-PRC-008 Malleefowl Monitoring Procedure			Version 1
Original Author	P Bouteloup	Last Reviewed By	P Hammond	Last Approved by	G Kaeding
Issue Date	20/12/12	Last Review Date	20/12/12	Next Review Date	20/12/13
Document Location		*N:\BUSINESS MANAGEMENT\Environment\2 Procedures*			

	• Once all comments have been recorded a photo(s) of each mound are to be taken and the following data is to be documented on ENV-FRM-007 form: Mound ID, GPS coordinates of photo(s), bearing of photo(s), time photo(s) were taken.
2.0 FILMIC MONITORING	• Locate each "active" Malleefowl Mound using the GPS cords provided in appendix one and displayed in appendix two. Please be careful when working in the area for Malleefowl birds (please park all vehicles at least 50 meters away from known active mounds and walk to the mound). • Prior to setting up motion camera please complete a manual monitoring record (as per optical method) for the active mound (please complete form ENV-FRM-007) • Once you have completed the manual record of the active mound, find an appropriate location approximately 15 meters away from the active mound to set the motion sensor camera up. The camera must be set up (if possible) facing either north or south top reduce sun glare. Please also ensure the selected location has a clear view of the mound (no trees in view as this will set the motion camera off all the time). • Hammer the stake into the ground. Turn the camera on and ensure the camera is set to video mode and video length is set to 20 seconds and that the SD card is present in the camera. Hold the camera against the stake and ensure selected location has appropriate view of the mound (view through camera). Once happy mount the camera onto the stake using the ties on the camera and secure it with cable ties • Carefully leave the site making sure not to walk in front of the camera. • The cameras are to be left monitoring a mound for two weeks • At the completion of the two week monitoring period head back to the monitoring site remove camera from stake and turn the camera off • Take the camera back to the office for downloading of data
3.0 DATA MANAGEMENT	All field monitoring data sheets (for both optical and filmic monitoring) to be entered into the Malleefowl Monitoring data base "JupiterMalleefowlMonitoringDB.accdb" located under *N:\ENVIRONMENT\8_Monitoring\JupiterMalleefowlMonitoringDB.* All photos must be downloaded and labelled Year-Month-Day- Mound ID-Photo Number (e.g. 2012-07-27_MFM001_01.jpg) and saved under *N:\ENVIRONMENT\8_Monitoring\JupiterMalleefowlMonitoringDB\Photos.* The photos must be linked into the database when entering the field monitoring forms
4.0 REPORTING	Reference to this procedure should be included in the Annual Environmental Report (AER) and the Malleefowl Management Plan to be submitted to the Department of Sustainability, Environment, Water, Population and Communities (DSEWPC).
5.0 RELEVANT DOCUMENTS	• ENV-FRM-007 Malleefowl Monitoring Field Sheet • Database "JupiterMalleefowlMonitoringDB.accdb" • Central Yilgarn Iron Project Malleefowl Management Plan
7.0 ATTACHMENTS	• List of Malleefowl Mound Coordinates Map displaying inactive and active Malleefowl Mound locations

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Document Location		*N:\BUSINESS MANAGEMENT\Environment\2 Procedures*			

ATTACHMENT ONE

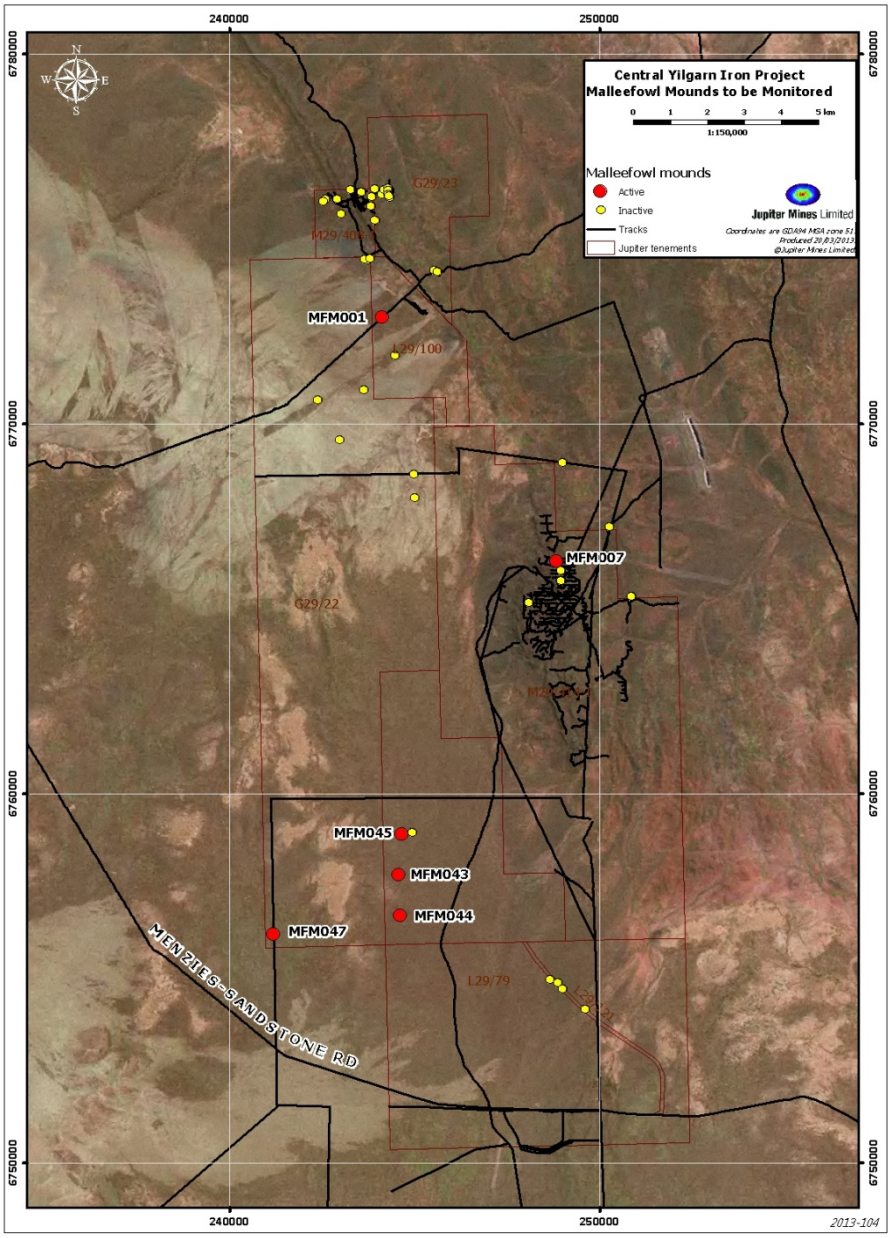
Table 1: Table of all known Inactive and active Malleefowl mounds within the Central Yilgarn Iron Project Area that require monitoring

MoundID	Project	Easting	Northing
MFM001	MT MASON	244107	6772871
MFM002	MT MASON	244454	6771833
MFM003	MT MASON	243523	6776262
MFM004	MT MASON	243919	6775487
MFM006	MT IDA	248946	6766024
MFM007	MT IDA	248847	6766280
MFM009	MT IDA	250251	6767189
MFM010	MT MASON	245522	6774136
MFM011	MT MASON	245590	6774104
MFM012	MT MASON	243723	6774411
MFM013	MT MASON	243631	6774448
MFM014	MT MASON	243785	6774458
MFM015	MT MASON	243895	6775506
MFM016	MT IDA	250846	6765291
MFM017	MT IDA	250844	6765318
MFM020	MT IDA	248940	6765745
MFM021	MT IDA	248076	6765150
MFM022	MT IDA	248470	6765246
MFM023	MT IDA	248988	6768947
MFM024	MT MASON	244106	6776206
MFM025	MT MASON	244163	6776325
MFM026	MT MASON	244256	6776365
MFM027	MT MASON	243901	6776348
MFM028	MT MASON	243814	6776136
MFM029	MT MASON	243546	6776264
MFM030	MT MASON	244263	6776311
MFM031	MT MASON	244258	6776204
MFM032	MT MASON	244300	6776105
MFM033	MT MASON	244282	6776147
MFM034	MT MASON	243796	6775881
MFM035	MT MASON	243252	6776321
MFM036	MT MASON	242895	6776065
MFM037	MT MASON	242574	6776064
MFM038	MT MASON	242998	6775688
MFM039	MT MASON	242503	6776012
MFM040	MT IDA	243606	6770906
MFM041	MT IDA	242360	6770639
MFM042	MT IDA	242949	6769562

MFM043	MT IDA	244560	6757792
MFM044	MT IDA	244608	6756687
MFM045	MT IDA	244647	6758880
MFM046	MT IDA	244912	6758932
MFM047	MT IDA	241166	6756184
MFM049	MT MASON	244420	6776580
MFM050	MT MASON	244958	6768612
MFM051	MT MASON	244977	6767975
MFM052	MT MASON	248656	6754952
MFM053	MT MASON	248852	6754862
MFM054	MT MASON	248977	6754701
MFM055	MT MASON	249655	6754132
MFM056	MT MASON	249923	6753883
MFM057	MT MASON	250227	6753693
MFM058	MT MASON	250204	6753620
MFM059	MT MASON	253603	6751822

ATTACHMENT TWO

Map 1: Map displaying the location of all known Inactive and active Malleefowl mounds within the Central Yilgarn Iron Project Area that require monitoring



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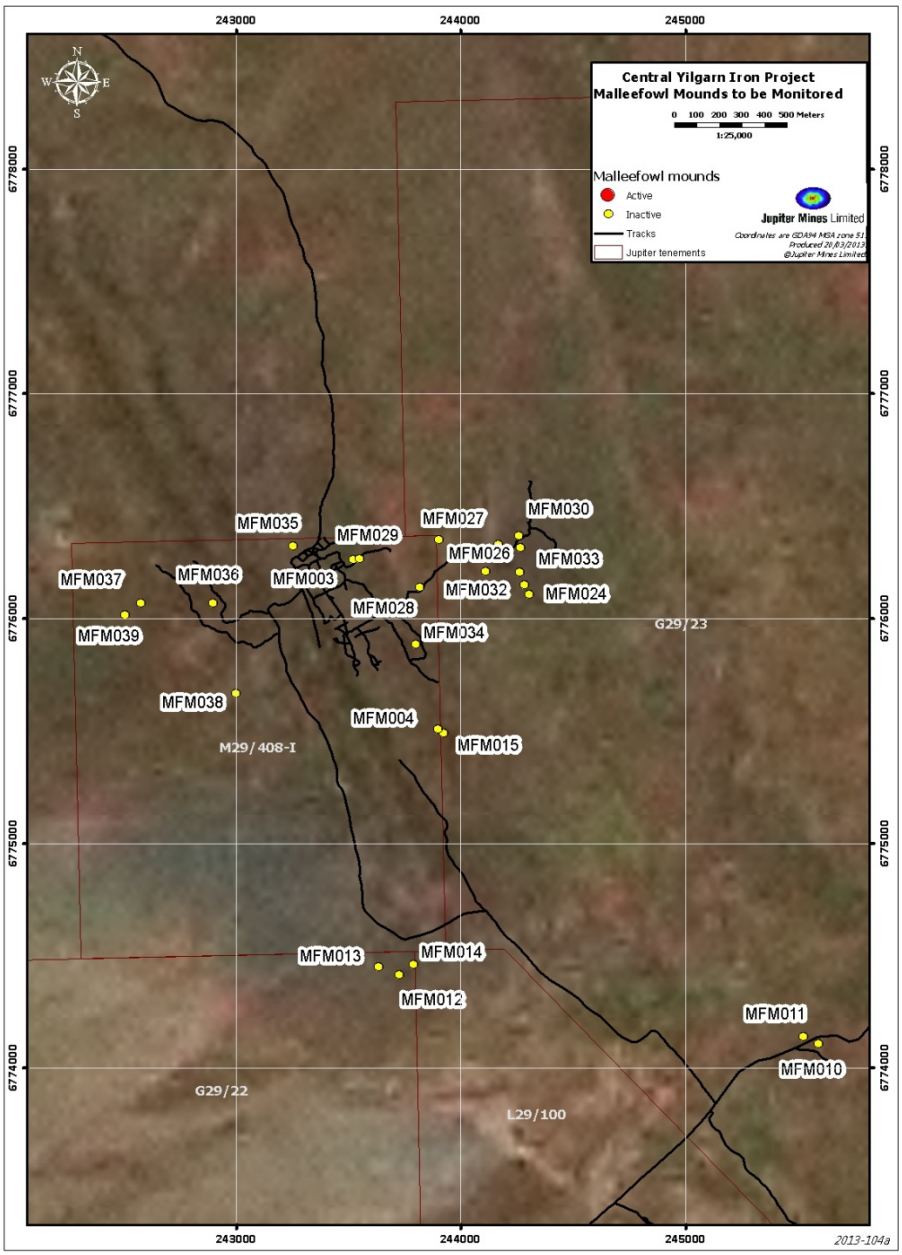
Map 2: Map displaying the location all active and inactive mounds on tenements M29/4081-1, G29/22, L29/100 & G29/23



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Appendix 4

Jupiter Mines Limited Malleefowl Preservation Group Sponsorship Agreement

MALLEEFOWL
Preservation Group Inc.

9 April 2013

Mr Greg Kaeding
Manager Environment
Jupiter Mines Ltd
P Box Z5117
Perth WA 6000

Dear Greg,

Re: Sponsorship 2012-2013

Please find attached our receipt no 3535 for your 2012-2013 Sponsorship, for which we are extremely grateful.

Alan and Susanne Dennings will continue liaising with you to organise public acknowledgement of your support.

Regards,

Claudine Deering
Office Manager

"It's gnow or never"

MALLEEFOWL PRESERVATION GROUP INC.
P.O. Box 29, Ongerup 6336, Western Australia - Phone: (08) 9828 2007, Fax: (08) 9828 2018
email: malleefowl.wa@wn.com.au - www.malleefowl.com.au

MALLEEFOWL PRESERVATION GROUP INC.

P.O. Box 29, Ongerup, W.A. 6336
Phone (08) 9828 2007, Fax (08) 9828 2018

RECEIPT
3535

Date 09.04.13

Received from Jupiter Mines Ltd

the sum of Twenty two thousand dollars

cents

Being for Inv. 213-648 - 2012-13 Sponsorship.

$ 22,000.00

Signature

Appendix 5

Jupiter Mines Limited CYIP Land Clearing and Ground Disturbance Procedure

Jupiter Mines Limited

GROUND DISTURBANCE PROCEDURE

PURPOSE: The purpose of this procedure is to mitigate compliance breaches during exploration activities arising from vegetation clearing and ground disturbance associated with access and drilling site preparation.

SCOPE: This procedure shall apply to all Jupiter Mines Limited ('Jupiter') exploration activities.

RELEVANT LEGISLATION:

- *Environmental Protection Act 1986.*
- *Environmental Protection (Clearing of Native Vegetation) Regulations 2004.*

RESPONSIBILITIES

Exploration Manager shall be accountable for ensuring the requirements of this procedure are adhered to and that all Project Geologists are trained or supervised on the requirements of this procedure. They shall also ensure that:

- each **Exploration Proposal** (whether Drilling and sampling or work proposals) complies with JML procedures, environmental and heritage management plans and all statutory requirements such as, but not limited to tenement conditions and POW requirements
- Sign of the final **Exploration Proposal** authorising the implementation of the program

Environmental Manager will facilitate the development of any Exploration Environmental Management Plans where required and liaise with Government Departments to ensure that the management plans meet their requirements.

Environmental Coordinator: shall

- Conduct (and document) a desktop environmental Impact Assessments (EIA's) of proposed Exploration Proposal work areas
- compile all external regulatory approval documents (e.g. POWs) and ensure they meet JML and DMP requirements prior to submission
- Provide advice and support where approvals in addition to POWs are required,
- Provide advice and manage environmental surveys required to ensure legal obligations relating to ground disturbance, land clearing, and pertaining to threatened species protection can be met, and
- Resources are available to manage the GIS layer used to ensure compliance with exploration approvals

Project Geologist is responsible for:

- Responsible for compiling Exploration Proposals
- Ensuring that all relevant approvals are obtained prior to the commencement of any land and vegetation disturbance
- Ensuring that all ground disturbance is conducted in accordance with all approvals and implemented as outlined in the authorised documented work/drill proposal

Senior Field Technician: is responsible for ground truthing and flagging all ground disturbance proposals under the supervision of the Project Geologist, track logging all cleared access tracks and sending through GIS/track log data to the Database Manager

Site Environmental Advisor: is responsible for supervising all machine operators and ensuring they are aware of all program requirements & approval conditions prior to ground disturbance commencing

Database Manager shall:

Document Name & Number		ENV-PRC-007 Ground Disturbance Procedure			Version 1
Original Author	P Bouteloiup	Last Reviewed By	P Bouteloup	Last Approved by	G Kaeding
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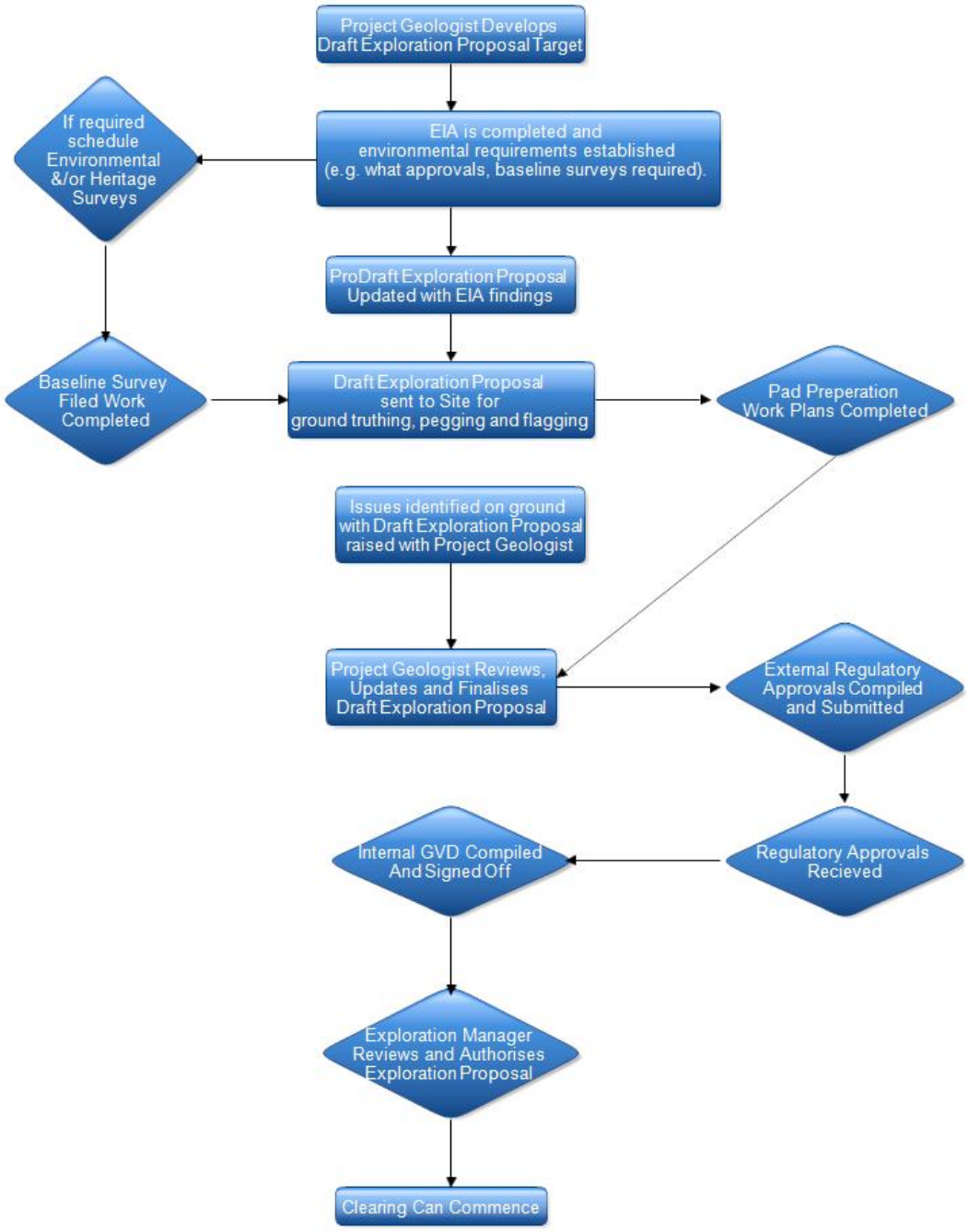
Document Location		*N:\BUSINESS MANAGEMENT\Environment\2 Procedures*			

- Maintain GIS layers including the Threatened Flora, Threatened Fauna, Baseline Surevys and Archaeological or Potential Sites, and Archaeological sites buffer layers
- Ensure that the proposed drill holes are included in the Drilling Database.

Machine Operators shall conduct the clearing as per JML procedures and as outlined in the authorised *Exploration Proposal*

Image 1: Ground Disturbance Work Flow



Document Name & Number		ENV-PRC-007 Ground Disturbance Procedure			Version 1
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PROCEDURE	
1.0 PLANNING	**1.1** Project Geologist is to provide Environmental Coordinator with details of **proposed** *Exploration Proposal* (wether drilling & sampling or work proposals). Project geologist to provide Environmental Coordinator with maps of proposed work/drill program, shape files of all proposed disturbance areas, GPS cords of all drill site and any other additional information. **1.2** Upon receiving proposed program data, the Environmental Coordinator is to conduct a desktop assessment and provide a written EIA summary. The EIA will identify any of the following in the proposed disturbance area and these will be clearly communicated to field personnel and equipment operators and if necessary demarcated prior to the commencement of any disturbance activity: - Declared Rare or Specially Protected Flora and Fauna (DRF) that are gazetted under the WA Wildlife Conservation Act 1950 - Threatened Flora and Fauna that are listed under the Commonwealth Environmental Protection and Biodiversity Act 1999 - Aboriginal and Non-aboriginal Heritage or Cultural sites - Sites of environmental conservation significance **1.3** Project geologists are to compile a *Draft Exploration Proposal* document. The proposal will document: - GIS coordinates of drill holes - Map of proposed clearing programme - Include the EIA that environmental department have completed - Any work/drill program specific information **1.4** The *Draft Exploration Proposal* is to be provided to Senior Field Technician, Site Geologist &/or Site Environmental Personnel, and the proposed work program is to be ground truthed and flagged (as outlined under Section 4.0 below). Any access or potential operational issues (e.g. cut and fill drill pads need, proposed access not achievable) **MUST** be identified and alternatives suggested (GPS cords provide of new drill/disturbance sites and alternative access tracks provided in the form of track logs). All alternatives are to be pegged and flagged (as per the flagging standard outlined in Section 4.0 of this procedure). **1.5** The Project Geologist is to update the *Draft Exploration Proposal* document with any suggested changes from the pegging/ground truthing phase. **1.6** Once updated the Exploration Manager is to authorise and sign off on the *Exploration Proposal* and circulate to all required parties **Please note: No ground or vegetation disturbing activities can commence until the all external approvals have been obtained from the necessary regulatory and third parties.**
2.0 EXTERNAL APPROVALS	**2.1** The Environmental Coordinator is to submit & obtain a Programme of Work approval from the required regulatory body (and any other environmental approvals required for the work/drilling program that were identified in the desktop EIA). **2.2** The Environmental Coordinator is responsible for ensuring the planned exploration work is discussed with stakeholders who may be impacted by, or have a vested interest in, the activities. This may include: - Communities living in close proximity to the area or work that may be impacted by noise, dust or visual amenity. - Pastoralists, particularly where there are impacts in relation to stock watering areas, fences, gates or other property infrastructure. - Traditional owners or native title parties who may have a cultural or legal interest in the area.

	Any complaints from stakeholders are to be reported to the Exploration and or Environmental Manager and work ceased until approval to continue has been given.
3.0 INTERNAL APPROVALS	**3.1** Once all external approvals have been received the Environmental Coordinator is to complete a JML Ground Vegetation Disturbance (GVD) Permit for the authorised drill/work program and circulate to all required parties **3.2** The Project Geologist is responsible for obtaining all necessary signatures for the internal GVD permit **Ground clearing/disturbance can only occur once all of the following has occurred:** - **Exploration Manager has authorised the final Exploration Proposal document** - **All signatures have been received on the GVD Permit (must include signed site preparation plans if for drilling)** - **The work area has been ground truthed and flagged as per the authorised Exploration Proposal**
4.0 GROUND TRUTHING AND FLAGGING STANDARD	The proposed area to be cleared (as outlined in the draft Exploration Proposal is to be pegged and flagged by Field Assistants and/or project Geologist using the flagging standard below: **4.1** All access tracks are to be walked to ensure accessibility is possible and demarcated with pink flagging tape. The flagging tape is to be placed at head height and flagging should be visible at all times as the access is walked (see *Figure 1*). If the track is to continue beyond a drill pad, 3 flags of pink tape are to be shown in the required direction in quick succession (see *Figure 1*). If the track is not to continue beyond the drill pad pink tape is to be strung in a horizontal line to display the end of the required clearing (see *Figure 2*). **4.2** Drill Hole locations are to be pegged as per the drill/work proposal document. Each hole peg is to be flagged with yellow and blue flagging and contain the following information clearly on the peg: - Drill Hole Number - Drill Hole Coordinates - The azimuth of the planned hole - The dip of the planned hole - The approximate end of hole All drill hole data is to be obtained from the *Exploration Proposal* **4.3** Drill pads are measured out (when preparing RC or Diamond drills) as per the dimensions in the Exploration Proposal, and one peg with blue and yellow flagging placed in each corner. Yellow and blue flagging is then to be placed at regular intervals along each boundary of the pad at head height, clearly demarcating the boundary of the drill pad (see *Figure 3*). **4.4** Sensitive areas, including priority flora and heritage areas, are to be demarcated with orange and red flagging tape as per the instructions in the Exploration Proposal document. **4.5** At the completion of pegging each drill site (access track, hole collar and drill pad boundaries), and prior to continuing onto the next drill site/access track, a Site Preparation Work plan (see Attachment Two) is to be filled out (whilst ground truthing the access tracks/drill pads). Each drill hole/pad MUST have a Site Preparation Work Plan. Each Site Preparation Work Plan must clearly display: - Hole location - Proposed sample storage area (and core rack location if applicable) - Topsoil storage area - Vegetation topsoil area

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	- Sump location - Proposed drill rig location - Support and water truck location - Location of cyclone - Location of any mud tanks - Location of any other work equipment **4.6** Once confirmed each Site Preparation Work Plan needs to be signed off by the Geologist, Site Environmental Advisor and the Senior Driller. It is strongly advised that the drilling supervisor/senior driller inspects the proposed drill sites prior to any ground disturbance so alterations to Site Work Plans can be made if required **4.7** Any access or potential operational issues (e.g. cut and fill drill pads need, proposed access not achievable) **MUST** be identified and alternatives suggested to the Project Geologist asap (GPS cords of new drill/disturbance sites are required and alternative access tracks must be provided in the form of track logs. All alternatives are to be pegged and flagged
5.0 IMPLEMENTATION	**5.1** The *Draft Exploration Proposal* is to be updated to incorporate any alternatives suggested from section 4.0 of the procedure. **5.2** The Exploration Manager is to review and sign off on the *Exploration Proposal* (which must contain all required internal and external approval documents) and circulate for all required parties for Implementation. **5.3** All work is to be conducted and implemented on the ground as outlined and in accordance with the authorised *Exploration Proposal* document under the supervision of the Project Geologist/Site Environmental Advisor. **5.4** The Earthworks Operator is to be provided with a copy of the signed internal GVD Permit which must include all signed Site Preparation Work Plans. The Site Environmental Advisor is responsible for going through each individual Site Preparation Work Plan with the machine operator prior to ground disturbance commencing. Once explained and agreed the machine operator is to sign off on all Site Preparation Plans signalling that they are aware of what is required and aware of any restrictions. **Once the above steps have been completed only then can clearing commence.** **5.5** After the area has been cleared, and prior to the operator moving from the area, the Senior Driller needs to revisit the cleared pad to sign off on the completed works (on each Site Preparation Work Plan. **5.6** At the completion of clearing the Field Technicians are to drive and track log all installed tracks and provide the track logs to the Database Manager for uploading into the database
6.0 Clearing Methodology	▪ Clearing should be kept to a minimum. ▪ Use of existing cleared areas and tracks should be used where available. ▪ Clearing should only be approved after reasonable access alternatives have been considered not practicable. ▪ All clearing is to avoid environmentally sensitive areas i.e. there is to be no clearing within 200m from known Malleefowl mounds or 50m away from known *Drosera* populations. ▪ Significant vegetation e.g. large trees are to be avoided, and favour natural clearings wherever possible to minimise damage to vegetation. ▪ Machinery blades shall be set above ground level so as to minimise disturbance to topsoil and rootstock and to reduce erosion when clearing. ▪ All clearing shall progress in a slow, systematic manner so as to not confuse or trap

	evacuating fauna. ▪ Fauna must be looked out for during clearing. If fauna is sighted, all machinery is to stop to allow safe egress from the work area.
6.1 Access Tracks	▪ Access tracks should be as straight as practicable to minimise clearing. ▪ Avoid tight bends, close proximity to trees and boggy areas when planning access tracks. ▪ Where possible low rise (<0.5m) vegetation i.e. grasses/shrubs etc. should be rolled rather than cleared. Taller vegetation requiring stripping shall be stockpiled on cleared ground for use in rehabilitation (i.e. do not stockpile on native vegetation as it will damage it). ▪ If overhanging branches (less than 5m high) need to be removed for access they should be removed in a manner that does not damage the remainder of the tree. ▪ The creation of windrows which have the potential to block or channel water flow along tracks causing erosion will be avoided. ▪ Grading of tracks should be minimised and only performed on excessively rough tracks. Where grading is necessary, the risk of erosion can be minimised by breaking windrows to allow drainage, cambering tracks to channel overland flow and avoiding deep cutting into the soil profile. Any damage caused during wet conditions will be repaired when the ground has dried out. ▪ Vehicles must drive on existing roads i.e. no short cuts or deviations from the tracks will be tolerated. Off road access is prohibited unless in an emergency i.e. bush fire. ▪ During wet and boggy conditions all vehicle movement will be kept to a minimum. ▪ Width of access tracks to be confined to 3.5 m – 4 m.
6.2 Drill Site Preparation	▪ Drill pad sizes must be in compliance with the area as specified on the approved PoW and in accordance with the GVD specifications. Jupiter standard pad sizes are: o Reverse Circulation (RC) and Diamond drillholes - 25m x 20m. o Aircore (AC) drillholes - on existing tracks (see *Figure 3*). o Water exploration boreholes - case dependant.
6.3 Drilling Sumps	▪ Sumps are to be located away from significant vegetation and water courses. ▪ Sumps are appropriate size/design to contain all drilling fluids during drilling, i.e. o RC and Diamond (situated on the drill pad) – 2m x 2m x 1m. o AC are case dependent, if required – 2m x 2m x 1m (situated on the drill pad). o Water exploration boreholes – case dependent. ▪ Any loss of containment of drilling fluids outside of the sump and/or works limit must be reported to the Environmental Department. ▪ Should groundwater be intercepted whilst drilling, appropriate measures must be taken to contain the material being discharged (i.e. into sumps or tanks). Drilling must cease immediately upon discharge of water until the appropriate and approved containment facilities have been implemented or the water quality is tested and deemed acceptable for discharge.
6.4 Topsoil and Vegetation Management	▪ All clearing and stockpiling of topsoil and vegetation must occur within the approved drill pad (within the pegs). No disturbance is to occur outside this area. ▪ Vegetation and topsoil stockpiles are to be located away from drainage lines and access tracks. ▪ Topsoil (top 50mm) is to be stripped from drill pads and stockpiled separately on the pad (preferably uphill) for use in rehabilitation. (Note: Avoid over handling topsoil. Any

	additional subsoil from sump excavation not used in windrows should be stockpiled separately to topsoil).

7.0 REPORTING:

- All ground disturbance & Exploration Activities (including PoWs submitted) are to be included in the Annual Environmental Report (AER) and submitted to the DMP.
- Rehabilitation reports are to be generated against each POW approval at the completion of rehabilitation (6 months from completing the Exploration Proposal work)
- If Priority flora species are required to be removed, authorisation will be sort from the Department of Environment and Conservation (DEC) reporting requirements will be discussed during the consultation phase of obtaining there approval. At a minimum the DEC will be provided with details of Priority flora that is to be been removed (number, size of population) and information on other known populations to allow an assessment of the impacts on the conservation significance of the species by the disturbance.

8.0 ATTACHMENTS:

Figure 1 - 3

Site Preparation Work Plan

Ground and Vegetation Disturbance Permit

ATTACHMENT ONE: Figures 1 – 4.

Figure 1: Access track clearly flagged at head height

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Figure 2: Pink tape demonstrating end of required clearing.

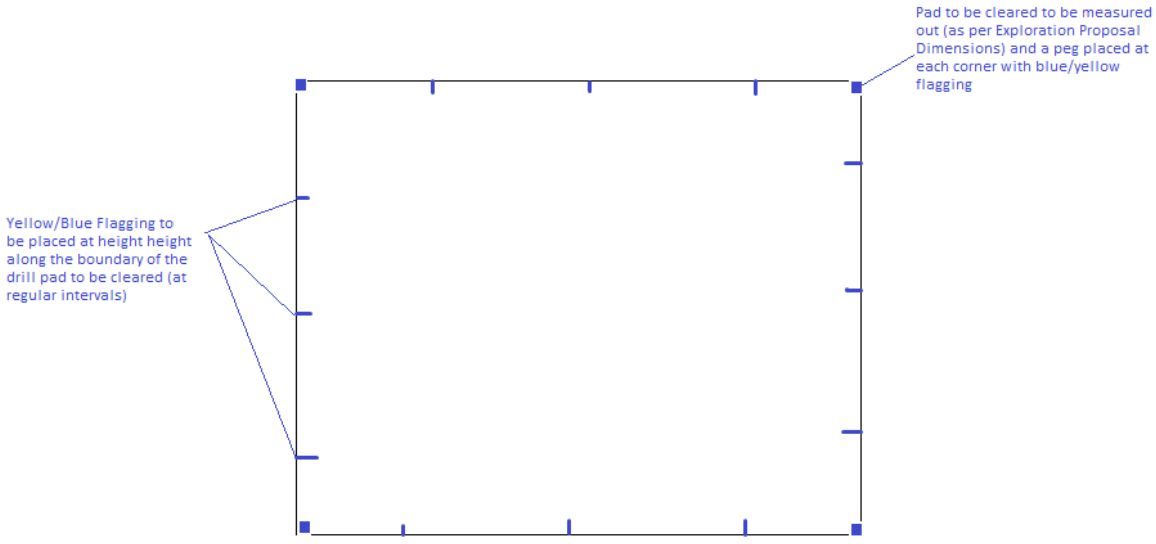

Figure 3: Pegging and flagging layout/standard for RC/Diamond drill pads

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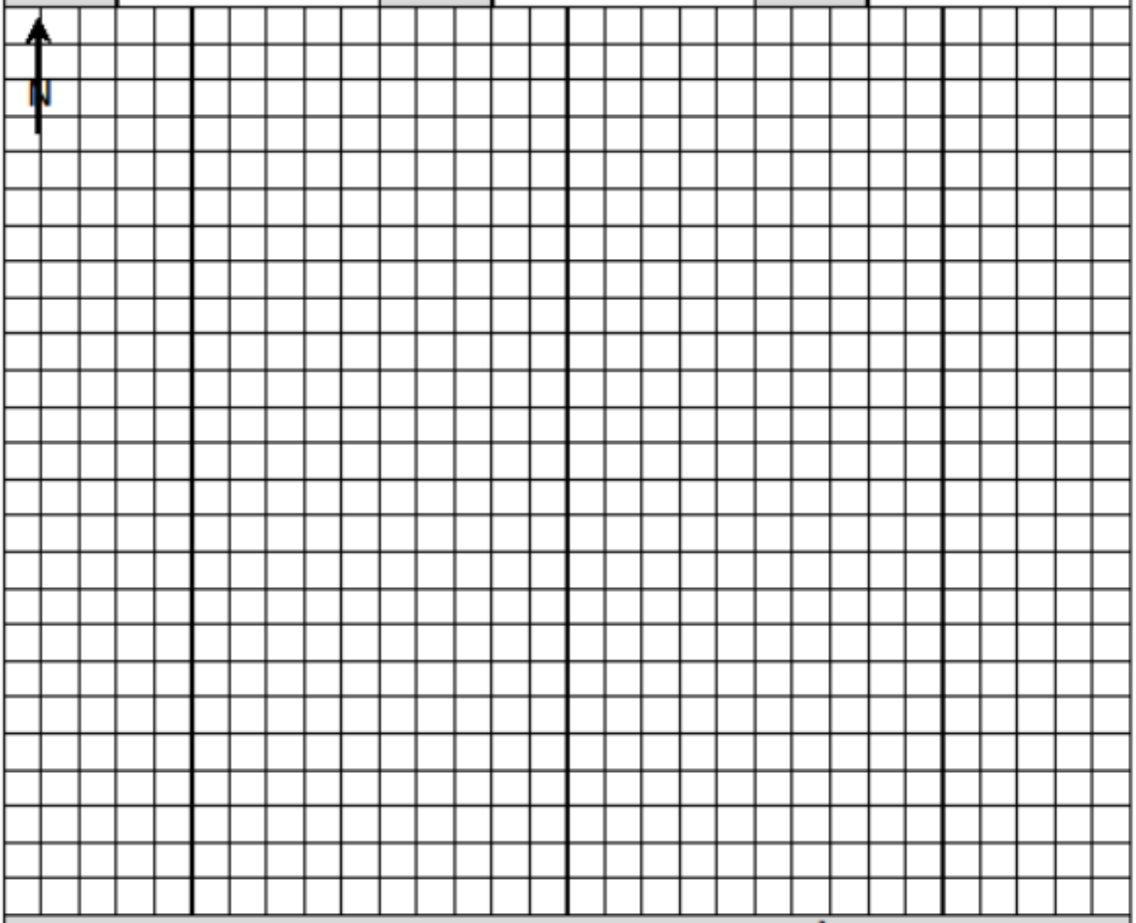
ATTACHMENT TWO: Site Preparation Work Plan

SITE PREPARATION WORK PLAN

HOLE ID:		DATE:		AUTHOR:	
DIP:		AZIMUTH:		DEPTH:	



SITE PLAN INCLUSIONS				NB. Scale: 1 grid square = $1m^2$ / Drill pad not to exceed 20x25m	
Collar peg		Sighter pegs		Boundary pegs	
Rig		Support truck		Humpy (diamond only)	
Mud tank (diamond) / cyclone (RC)		Sump(s), including windrow		Vegetation stockpile	
Rod truck (diamond) / compressor (RC)		Core racks (diamond) / sample bags (RC)		Topsoil stockpile	

COMMENTS

APPROVALS	Signature	Date
Drilling Supervisor		
Earthworks Contractor		
Company Environmental Representative		
Senior Geologist		

Document No. GEO-FRM-001
Date Issued: 5/10/11
Revision Date: 5/10/12

Version No: 1
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ATTACHMENT THREE: Ground Vegetation Disturbance Permit

GROUND AND VEGETATION DISTURBANCE PERMIT

PART A: GENERAL INFORMATION OF WORKS *(Geologist to complete)*	
Company Name:	Applicant Name:
Lease No.& Name:	Location Description:
Date:	Proposed Area to be Disturbed (ha):
Area Previously Disturbed: Y / N / N/A	Location Map and Co-ordinates attached (circle): Y / N / N/A
No. of Pads to be Cleared?	Length of tracks to be cleared (km):
Proposed Start Date:	Proposed Finish Date:
Description / Reason for Works:	

PART B: EXTERNAL APPROVALS *(Site Environmental Coordinator to Complete)*	**Yes**	**N/A**
DMP PoW Approval Required / Obtained?		
DoW Approvals Required / Obtained? (*ie 26D licence)*		
Pastoral Owner Permission Granted / Advised of Works?		
Any other Approvals Required? (*ie DEC/Shire*) ……		

PART C: PLANNING CONTROLS *(Site Environmental Coordinator to Complete)*	**Yes**	**N/A**
Disturbance >200m from known active mallefowl nests?		
Disturbance >50m from known Drosera populations?		
Disturbance outside of cultural heritage sites?		
Applicant work procedures comply with the Exploration Environmental Performance Standards and any PoW?		

PART D: PRE-START WORK CONTROLS *(Site Environmental Coordinator to complete with Geologist)*	**Yes**	**N/A**
Disturbance Area Surveyed and Demarcated?		
Weed Hygiene Certificate received for all Ground Engaging Machinery?		
Job Hazard Analysis (JHA)/Risk Assessment Prepared / Approved? *(ensure fire and emergency response is included)*		
Site Preparation Work Plan(s) Approved by all Signatories?		

PART E: PERMIT APPROVAL		
Geologist	…… I confirm that that all ground disturbing activities will be undertaken strictly in accordance this Permit	…….…….. date
Environmental Site Coordinator	…… I confirm that that all ground disturbing activities will be undertaken strictly in accordance this Permit	…….…….. date
Environmental Manager	…… Authorisation is given to proceed with the Permit Application under the conditions prescribed on this Permit	…….…….. date
Exploration Manager	…… Authorisation is given to proceed with the Permit Application under the conditions prescribed on this Permit	…….…….. date

PART F: POST DISTURBANCE CONTROLS			**Yes**	**N/A**
Post Disturbance Inspection Completed	…… Site Environmental Coordinator	…….…….. date		
Post Disturbance Survey Completed	…… Surveyor or alternative	…….…….. Date		
Disturbance Register Updated	…… Environmental Manager	…….…….. date		

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Total Area Disturbed (ha):	Veg Clearing (ha):	Pre Disturbed (ha):

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ATTACHMENT 10

ADDENDUM

Malleefowl mound advice

1.0 Background

Jupiter Mines Limited (Jupiter) owns the Central Yilgarn Iron Project (CYIP) which is located approximately 100 kilometres (km) northwest of Menzies within the Shire of Menzies, approximately 530km northeast of Perth, Western Australia (WA) (see Figure 1: Kasa Consulting 2013).

The CYIP currently consists of the Mount (Mt) Mason Direct Shipping Ore (DSO) Hematite Project and Mt Mason and Mt Ida exploration projects. The Mt Mason DSO Hematite Iron Ore is the first project of the CYIP to be considered for further development. The transport of DSO has been planned via a haul road that will extend from the north-east corner of the Mt Mason project area, along Metzke Road for a short duration and then south through to the Menzies-Sandstone Road (see Figure 6a: Kasa Consulting 2013).

Numerous sightings and evidence of Malleefowl *Leipoa ocellata* have been recorded within Jupiter's CYIP area. The Malleefowl is classified as Vulnerable: "Taxa facing a high risk of extinction in the wild in the medium-term future" under the Federal *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Given its status as a threatened species, the Malleefowl is considered a "matter of national environmental significance". Jupiter is committed not to allow any proposed mining or associated disturbances to have a significant impact of this "matter of environmental significance".

Jupiter recognises that any proposed mining and associated disturbance within the CYIP area may impact on the local Malleefowl population. As a result, Jupiter has developed a Malleefowl Management Plan (Kasa Consulting 2013) that will be implemented immediately following approval. Ongoing monitoring of mitigation measures will ensure that any potential impact on Malleefowl, Malleefowl mounds and their habitat are minimised. These mitigation measures include and are not limited to:

- erection of signage near known active mound locations to alert drivers of the possible presence of Malleefowl;
- 40 km speed zones in areas of known active Malleefowl mounds;
- establishment of well marked 250 metre (m) buffer areas around known active Malleefowl mounds,
- establishment of well marked 50 m buffer areas around known inactive Malleefowl mounds;
- ensure that all personnel attend inductions prior to going on site that include information about the Malleefowl, its legal status, ecology and habitat requirements; and
- all vehicles remain on designated tracks and off road driving is prohibited.

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Recent surveys in the CYIP area have identified five active Malleefowl mounds, one potentially active Malleefowl mound that requires clarification and 48 inactive mounds (KLA 2013, GHD 2012). Jupiter has committed to implement all mitigation measures as described above for all known Malleefowl mounds. Four of the five known active Malleefowl mounds and the single mound of unconfirmed status are not located near the proposed haul road and will not be impacted.

However, for one active Malleefowl mound (MFM001) (Figure 6b: Kasa Consulting 2013) while all other mitigation measures will be implemented, a buffer of 250 m is not possible. MFM001 was established by a pair of Malleefowl immediately adjacent to Metzke Road to the west of the entry/ exit track of the existing Jupiter camp. Metzke Road is a pre-existing track that has been maintained (graded) by the local pastoralists for their use and the occasional use by Jupiter vehicles as an alternative access route. Anecdotal reports indicate that following the grading of Metzke Road in early 2011, a pair of Malleefowl used part of the soil windrow to establish a mound immediately adjacent to the track. A subsequent survey reported that the pair returned the following season to use the mound again (GHD 2012). The eastern edge of the Malleefowl mound is approximately 180 m from the western edge of the proposed haul road. The location of a heritage area to the east of the proposed haul road prevents the haul road from being realigned further east and, therefore, further away from the mound.

2.0 Professional Opinion

I have been asked by Jupiter to provide my professional opinion in relation to the potential impact on the regional populations of Malleefowl of having a 180 m buffer between the active MFM0100 and the proposed haul road, rather than a 250 m buffer.

I have had approximately 20 years experience as an environmental scientist, gaining a Doctorate in Biological Science in 1998. Prior to commencing the Environmental Impact Assessment at Jupiter, I had completed many comprehensive vertebrate fauna surveys in WA, all in accordance with:

- WA Environmental Protection Authority (EPA) Position Statement No 3 "*Terrestrial Biological Surveys as an Element of Biodiversity Protection*" (EPA 2002);
- EPA Guidance Statement No. 56 "*Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia*" (EPA 2004); and, when published,
- "*Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment*" (EPA and DEC 2010).

In addition, I had completed at least two targeted Malleefowl/ Targeted EPBC fauna surveys prior to my environmental assessment at Jupiter and one since that time:

Company	Project	Dates
Cazaly Resources Ltd	Parker Range Iron Ore Project	October 2009, April 2010 and July 2010
Western Areas NL	Forrestania Nickel Project	September 2010
Polaris Metals Pty Ltd	Carina Iron Ore Project	November 2012

I am very familiar with the CYIP area having completed up to 56 days of surveys between March 2011 and April 2012. These surveys include:

- Reconnaissance Survey CYIP 4 March 2011;
- Level 2 comprehensive survey Mt Mason23 August 2011 to 4 September 2011;
- Level 2 comprehensive survey Mt Ida west 28 September 2011 to 7 October 2011;
- Level 2 comprehensive survey Mt Ida east 24 October 2011 to 2 November 2011;

- Level 2 comprehensive survey Mt Mason 28 February 2012 to 9 March 2012;
- Level 2 comprehensive survey Mt Ida west 23 March 2012 to 26 March 2012;
- Level 2 comprehensive survey Mt Ida east 9 April 2012 to 18 April 2012; and
- Targeted EPBC fauna survey Mt Mason and Proposed Haul Road2 April 2012 to 4 April 2012.

On the proviso that the mitigation measures committed to by Jupiter are implemented and maintained, and based on my knowledge of the area, the number of abandoned and active Malleefowl mounds and the potential preferred habitat available to Malleefowl in the area, I do not believe that the limited buffer area (180 m) of MFM001 instead of the prescribed 250 m will have a significant impact on the resident Malleefowls, on the local population of Malleefowls and certainly not on the regional population of Malleefowls.

3.0 References

Environmental Protection Authority (2002). *Terrestrial Biological Surveys as an Element of Biodiversity Protection: Positions Statement No. 3.* Environmental Protection Authority, Perth, WA.

Environmental Protection Authority (2004). *Guidance for the Assessment of Environmental Factors. Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia No. 56.* nvironmental Protection Authority, Perth, WA.

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GHD (2012). *Jupiter Mines Mount Ida Non-Process Infrastructure Areas Malleefowl Survey.* Unpublished report for Jupiter Mines Ltd, December 2012. GHD, Perth.

Kasa Consulting (2013). *Central Yilgarn Iron Project Malleefowl management Plan,* Unpublished report for Jupiter Mines Ltd, January 2013. Kasa Consulting, Perth.

KLA (2013). *Mt Mason Project and Proposed Haul Road Targeted EPBC Fauna Survey.* Unpublished Report for Jupiter Mines Ltd, July 2013. Keith Lindbeck and Associates, Perth.

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ATTACHMENT 11

JCHMC

REPORT ON AN ARCHAEOLOGICAL SURVEY OF JUPITER MINES LIMITED MOUNT MASON, MOUNT IDA WEST AND HAULAGE ROAD

AUGUST 2012

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This report does not constitute legal advice. All opinions presented in this report are the author's and do not necessarily reflect the views of the Company.

All co-ordinates given by this reports are MGA Zone 51, referenced to WGS 84, which approximates to GDA 94, or GDA 94.

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EXECUTIVE SUMMARY

R. & E. O'Connor Pty Ltd were commissioned by Jupiter Mines Limited (Jupiter Mines) to undertake an Aboriginal heritage survey of Mount Mason (M29/408) & Mount Ida (E29/560) tenements and the proposed Jupiter Haul Road. John Cecchi Heritage Management Consultancy was employed to conduct an archaeological investigation of the proposed project area in order to identify and record sites of Aboriginal heritage, and assess potential Aboriginal heritage issues relevant to the project. The current report aims to provide Jupiter with information and recommendations that will enable the company to meet the provisions of the *Aboriginal Heritage Act 1972*.

The survey area is located in the Yilgarn Region of Western Australia, eighty kilometres northwest of Menzies, west of Lake Ballard, and encompasses a twenty-three square kilometre area.

An investigation for previously registered sites situated within thirty kilometres of the survey area was undertaken via the Department of Indigenous Affairs (DIA) Site Register. As a result, three Lodged Status listings were analysed at the DIA Site Register Office in East Perth. The listings refer to zones outside the survey area that will not be impacted by the Jupiter's project and no previously recorded sites were identified within the survey area. The region's archaeological, environmental and geological background were researched, to formulate predictions about Aboriginal site patterning, and to provide the basis for the assessment of significance of archaeological sites.

The field survey employed a systematic purposive and probabilistic pedestrian transect methodology. Pedestrian transects spaced one hundred metres apart and aligned east west were carried out to survey the Mount Ida and Mount Mason tenements. Transect spacing were increased to 150 metres within areas of flat sand plain country that held

high ground visibility and lower potential for Aboriginal heritage sites. Purposive pedestrian transects, spaced eighty metres apart, were carried out along the proposed haul road route. All transects were guided by a Garmin GPS Map76CSx accurate to ten metres, employing GDA 94, referenced to MGA Zone 51. Cadastral aerial maps with GPS boundary co-ordinates, topographic maps and small and large scale aerial maps, aided in both the formulation of the methodology and during the field survey.

Archaeologist John Cecchi undertook the survey in two field trips, between June and July 2012. The field assessment identified and recorded forty-eight isolated artefacts and eleven sites of Aboriginal heritage. These sites have been recorded in detail and the information will be forwarded to the DIA Registrar. The Registrar, with the ACMC, hold the duty to determine whether these areas represent 'sites' as defined by s5 of the Aboriginal Heritage Act 1972.

The eleven Aboriginal sites recorded during the survey included the following site components: Artefact Scatter (9), Grinding Material (5), Water source (4) and Rockholes (3). The artefact scatter sites recorded are associated with ephemeral or semi-permanent water sources.

An archaeological survey of an area reported as an ethnographic site by AIC in 2006 resulted in the identification and recording of one Aboriginal heritage site with an artefact scatter, grinding material and a water source component.

In total, the field survey identified and recorded eleven archaeological sites of Aboriginal heritage. These areas should not be disturbed, unless the Minister under s18 of the Act has granted prior consent.

Sites that have been assessed as of Moderate to High archaeological significance should receive further archaeological investigation prior to being considered for use under s18 of the Act. Site Menzies Road One and Menzies Road Two, have only been partially recorded and appear to be extensive Aboriginal sites associated with water sources atop the granite outcrop. These sites should be recorded in full to properly assess their significance and extent, and determine the level of disturbance from the proposed project. If feasible Jupiter should modify the proposed haulage road route to avoid impacting the Aboriginal heritage sites recorded.

1.0 INTRODUCTION

Mount Mason Hematite and Mount Ida Magnetite Projects owned by Jupiter are part of the larger Central Yilgarn Iron Project (Figure 1). The current scope relates to Mt Mason (M29/408) and Mt. Ida (E29/560) tenements, which are located approximately 100 km northwest of Menzies. The project is currently in feasibility phase with operations expected to begin in early 2013.

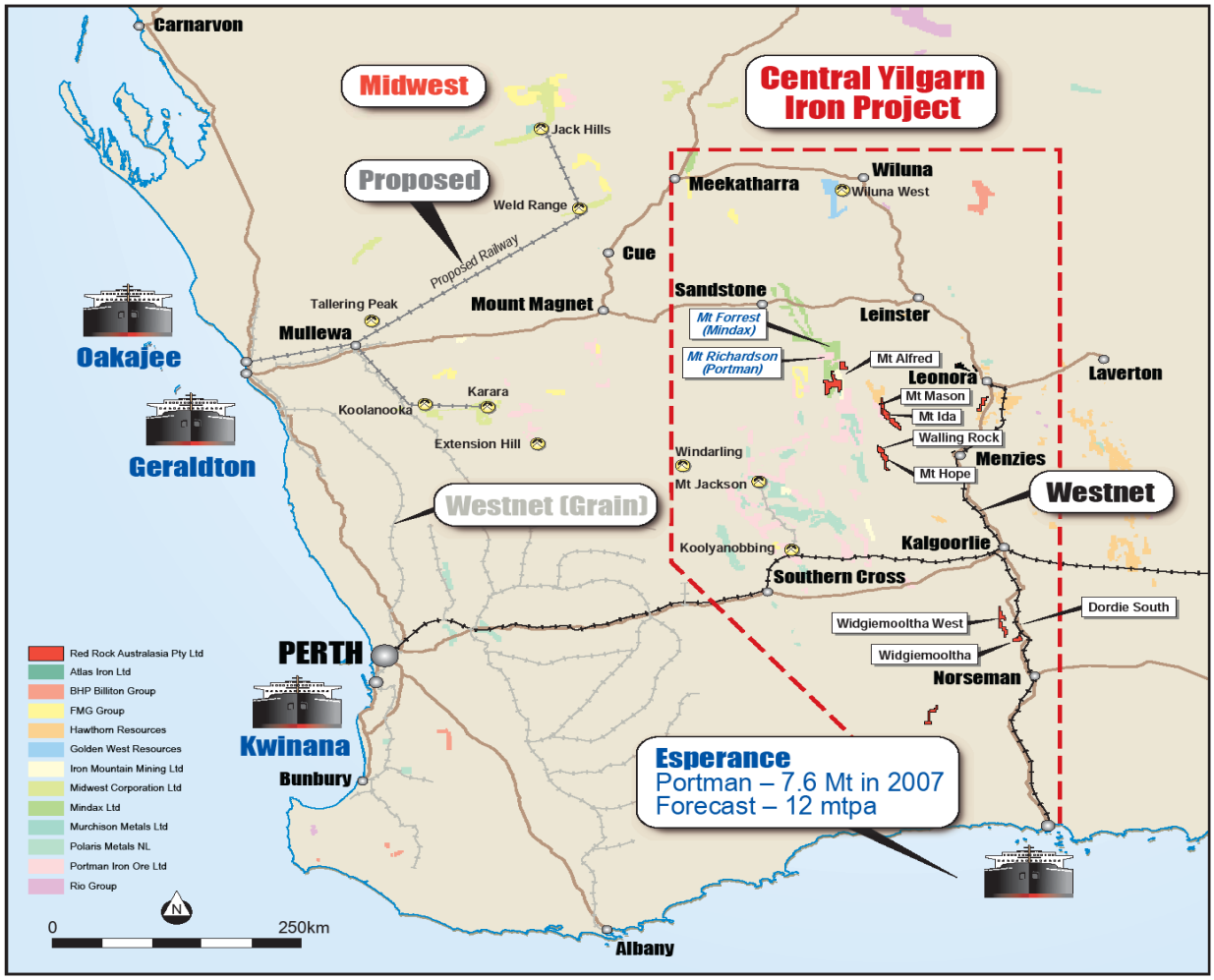

Figure 1. Locality Map

The Mt Mason survey area covers 2.2 square kilometres. The Mt. Ida survey area covers approximately 16.1 square kilometres of land, west of Mt. Ida Trig Point. The proposed haul road has been allocated a fifty metre buffer on either side of the alignment to allow for potential movement and is approximately twenty five kilometres in length (Figure 2).

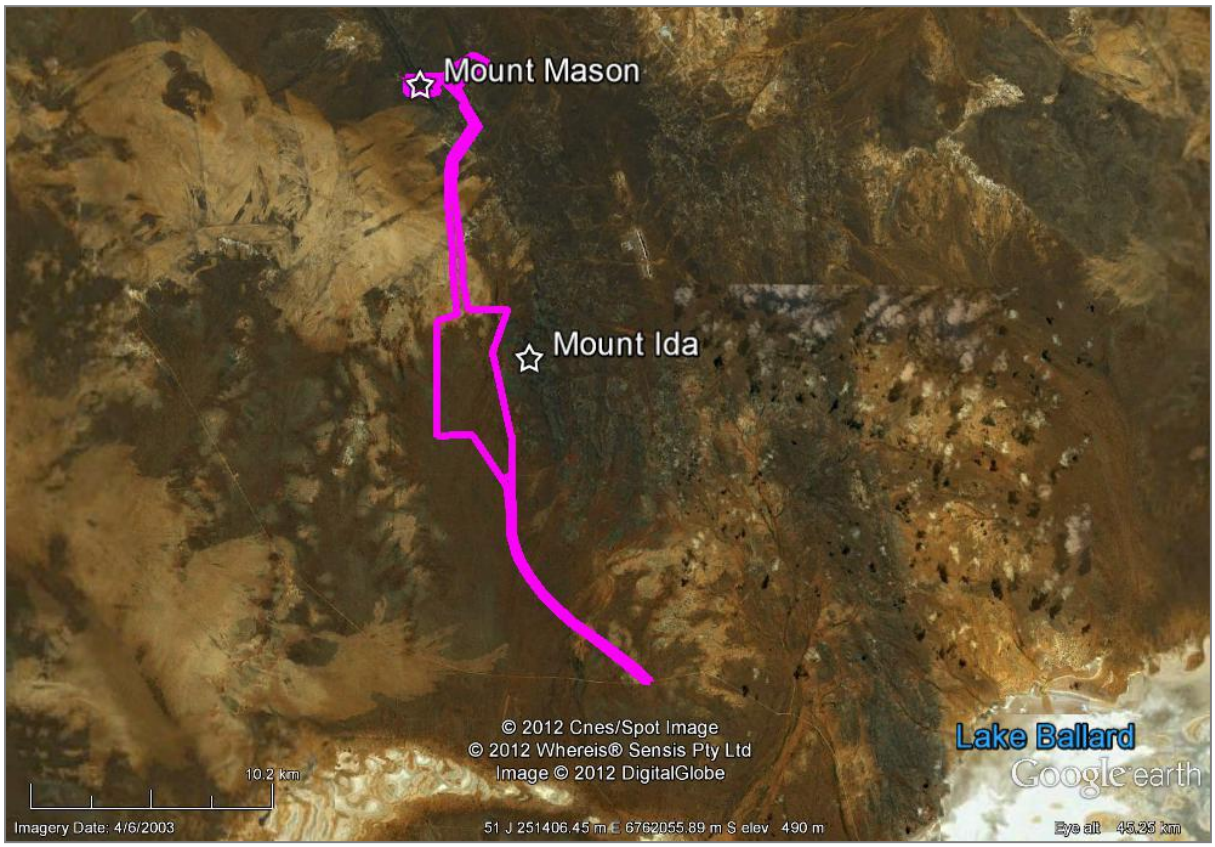

Figure 2. Mt. Mason, Mt. Ida and Haul Road Survey Area (Google Earth 2012)

1.1 Brief

Jupiter Mines commissioned R. & E. O'Connor Pty Ltd to undertake an archaeological Aboriginal heritage survey of the proposed Mount Ida, Mount Mason and haul road project.

As stated in the DIA website (DIA 2011) the aim of an archaeological Aboriginal heritage survey is to:

- *Establish whether a given piece of land contains physical evidence of past Aboriginal occupation and land use (archaeological sites).*
- *To record, assess and make recommendations regarding the management of archaeological sites.*

- *To provide a developer with sufficient information on which to base development planning decisions.*

2.0 ENVIRONMENTAL BACKGROUND

The survey area is characterised by a semi-arid Mediterranean climate, with average rainfalls of 250mm annually, precipitating over one to three months of the year (Beard 1990). Winters are mild and summers are hot and dry with maximum temperatures reaching 45°C, leading to high evaporation rates (Beard 1990). Winter rains are associated with cold fronts whilst, infrequently, thunderstorms may provide heavy falls during summer.

The survey area is located within the Yilgarn Craton, a crustal unit stable since the Proterozoic, formed by intersecting bands of granite and greenstone. The latter tend to form ridges whilst the granitoids may form monolithic or flat pavement features.

The vegetation surrounding the survey area falls within the Murchison Region of the Eremaean Province (Beard 1990). The province is characterised by low woodland or tall shrublands of mulga (*Acacia aneura*) on red loams. The undulating sandplains sustain scattered mulga and mallee (*Eucalyptus kingsmills*) over hummock grasslands. Mixed communities of low open woodlands of mulga and bowgada with heath and spinifex are characteristic of the sand plains (Payne, et. al., 1998).

3.0 HISTORICAL BACKGROUND

John Forrest was the first European to record his visit to the survey region in 1869, naming Mount Ida. An excerpt of his of his memoirs 'Explorations in Australia' (Forrest 1875) reads:

MOUNT IDA.

15th.
Saddled up at daybreak, and steered about South-East towards a high range of hills about ten miles distant. I named it Mount Ida, and from the summit I took a round of angles with my pocket sextant. On all the hills in this neighbourhood the local attraction is so great that the prismatic compass is useless. Found a fine spring of water on south side of Mount Ida, in an almost inaccessible spot. After giving the horses two hours' rest we continued our journey North 154 degrees East magnetic for eight miles to a granite range, where, after a diligent search, I found two water-holes, and bivouacked, with good feed around the rocks.

16th.
Saddled up at sunrise, and steered to some trap ranges, North 124 degrees East, about seven miles distant, from which I could see an immense lake running as far as the eye could reach to the eastward, and westerly and northerly, most probably joining Lake Barlee. Not being able to proceed farther southward, on account of the lake, I steered in a northerly direction for twenty miles, but, discovering neither feed nor water, bivouacked in a thicket, and tied up our horses.

17th.
At dawn, found that my horse Sugar, after breaking his bridle, had made off towards our bivouac of the 15th. Placing my saddle on Jemmy's horse, we followed on the track for six miles, when we came to a few granite rocks, with a little water on them, from rain that had fallen during the night. At this place Morgan was left with the horses and our guns, while Jemmy and I followed on Sugar's tracks, taking only a revolver with us. After travelling on the tracks for two miles we overtook him, and with a little trouble managed to catch him. On reaching the spot where we had left Morgan, we found him with the three double-barrelled guns on full cock, together with his revolver, in readiness. On being asked what was the matter, he stated "Nothing," but he was ready to give the natives what he called "a warm attachment." After having breakfast we steered North-North-West for about twenty miles, and reached camp at 5 p.m., and found all well. Rained a little during the day.

By 1896 Mount Ida Town was gazetted twenty-one kilometres north of Mount Ida, due to gold being discovered in the region and the subsequent influx of some 200 prospectors to the area. The Mount Ida hotel was constructed in 1908 and the town later became abandoned. Several gold and mineral mining companies currently operate in the region.

4.0 ARCHAEOLOGICAL BACKGROUND

Early aboriginal occupation of the arid and semi-arid region of Australia has been dated to 25,000 BP from sites such as the Newman Rockshelter in the Pilbara (Maynard 1980). Archaeological excavations at Puntutjarpa in the Gibson Desert (Gould 1977) and at Walga Rock (Bordes et al 1983) have yielded dates of around 10,000 BP.

Researchers (Gould 1980) have elaborated a rain-chasing model to describe the type of Aboriginal adaptation to arid and semi-arid regions. The model proposes an opportunistic water exploitation system, where ephemeral and semi-permanent water sources were utilised prior to the more reliable and permanent sources (Gould 1980, Veth 1989).

Aboriginal colonisation theories for arid and semi-arid ecosystems have been widely debated. Smith (1988) has suggested that availability of water during an earlier lacustral phase would have allowed Aboriginal occupation of the interior of Australia by 12,000 years BP. Occupation of desert lowlands before and during the last glacial maximum would have been abandoned until the amelioration in climate c.15,000 to 7,000 years BP.

Veth (2000) postulated a different model whereby the initial colonisation of the arid regions occurred during the more favourable climatic period of the late Pleistocene,

from approximately 25,000 years ago, with a retreat to less arid areas during the 22,000 to 13,000 BP period, and a re-occupation of marginal lands between 13,000 to 5,000 BP. From 5,000 to 1,500 BP all desert ecosystems are thought to have been inhabited due to a re-establishment of regional networks and an intensification of site occupation, ceremonial gatherings and long distance exchange, inferred from an increase in late Holocene dated sites and an increase in artefact densities and assemblage complexity (Veth 2000).

Several dated sites within the survey region have yielded Holocene dates in the range of 2,000 BP near Leinster (Liberman et al 1977) to 500 BP near Hyden (Bowdler 1989) and 1570 BP at Windimurra (Harris 2002).

According to previous research, the archaeological mark of a rain-chasing model of occupation includes a higher number of low-density artefact scatters around ephemeral water sources and larger sites associated with more permanent water bodies.

5.0 PREVIOUSLY RECORDED SITES

The following items listed on the DIA Site Register are located within thirty kilometres of the survey area (Results printed as Appendix B):

- DIA Site ID 20698 'Anaconda 4' is a Lodged Status listing placed under Open Access. The site is located at MGA Zone 51 236386mE 6785358mN and the co-ordinates are defined as 'Unreliable'. This listing is described as a gnamma hole east of Perrinvale Road, thirty kilometres north of Mount Ida.

- DIA Site ID 20701 'Anaconda 7' is a Lodged Status listing placed under Open Access. The DIA file held the following site description:

  "*The site is about twenty eight kilometres north of Mt. Ida. On east side of the main road is a lone detached granite boulder of large size, about three or four metres in diameter...This boulder represents a metamorphosed character of the Aboriginal creation era...The boulder is an important Aboriginal site and both it and its adjacent escarpment feature must be protected from impact'.* The area was reported in the Ngalia Heritage Research Council Document (Muir 1999) as being centred upon MGA Zone 51 237892mE 6785208mN.

- DIA Site ID 23650 'Menzies Road Soak' is reported as a mythological area centred upon MGA Zone 51 238130mE 6755640mN. This site was first reported by AIC (2005) and the Koara Native Title Claimant Groups. Geraldine Hogarth stated that the soak was connected with a story line that runs from the hills ten kilometres to the east. The soak was reported to be dry.

6.0 PREVIOUS HERITAGE SURVEYS

Jupiter has commissioned several Aboriginal heritage surveys and desktop studies in relation to previous exploration programs in the area. These following reports were made available to the archaeologist:

- Australian Interaction Consultants 2006 *"Report of a Site Identification Survey with the Wutha Native Title Claimants of a Proposed Exploration Drilling around Mt Ida and Mt Mason, Western Australia*."
- Gleason & Associates Pty Ltd 2011 *"Report of an Ethnographic Heritage Survey (Wutha Native Title Claimants) and an Archaeological Field Assessment of Jupiter*

Resources Mt Ida Project Area (portions of M29/414) southwest of Leonora, Western Australia."

- Glendenning, W. 2007a *"A Report of an Ethnographic Survey of a Proposed Mineral exploration Project at Mt Ida, near Menzies."* Western Heritage Research for Jupiter Mines
- Glendenning, W. 2007b *"A Report of an Ethnographic Survey of Tenement E29/495 at Mt Mason."* Western Heritage Research for Jupiter Mines
- Land Access Solutions 2011 *"Aboriginal Desktop Analysis – Jupiter Mines Tenements M29/408, M29/414, E29/560, E29/801 and G29/022."* Justin Cvitan & Phil Czerwinski for Jupiter Mines

Previous surveys have involved consultation with Wutha and Wongatha Aboriginal stakeholders. The desktop prepared by LAS (2011) recommended that archaeological and ethnographic surveys should be commissioned to investigate proposed disturbance zones to address the potential to disturb unrecorded Aboriginal heritage sites.

Two relevant heritage survey reports were analysed at the DIA office, both commissioned concerning mining and exploration developments by private companies (Muir 1999, Mattner 2009).

No sites of archaeological significance have been previously recorded within the survey area. One ethnographic site was reported by AIC in 2006 and this site is likely to exhibit an archaeological component, since it is associated with a fresh water source.

7.0 METHODOLOGY

The Mount Mason and Mount Ida tenements were surveyed via pedestrian transects aligned east west and spaced one hundred metres apart. When open and flat sand plain country was encountered transects spacing were adjusted to 150 metres apart, given the perceived low potential for sites and high ground visibility. The proposed haulage road was surveyed via purposive pedestrian transect along its route, with transects spaced approximately eighty metres apart.

The field survey was undertaken with the assistance of a Garmin GPS Map 76CSx, employing GDA 94 and referenced to MGA Zone 51, accurate to ten metres. The survey was also aided by small and large scale maps and aerial and cadastral maps of the survey area.

8.0 ASSESSING ARCHAEOLOGICAL SIGNIFICANCE

Assessment of site's significance forms the basis of the recommendations made by this report. The standard applied is based on a site's representativeness and research potential (Bowdler 1984). Site significance is therefore assessed on present knowledge of sites within the area, archaeological techniques, theory and method, all of which may vary in time.

During the survey, the significance of archaeological sites was analysed in regards to its potential to answer the following research questions:

-When was the region initially occupied by Aboriginal people?

-How did economies adapt to environmental and climate changes?

-How do occupational patterns reflect this?

-What stone tool technologies and reduction practices were employed in the area?

-What are the characteristics and what accounts for variables in stone tool production within assemblages and over time?

9.0 RESULTS

As a result of the field survey forty eight isolated artefacts and eleven archaeological sites of Aboriginal heritage were identified and recorded. In the next two chapters details of the results are presented.

10.0 ISOLATED FINDS

Artefact Type	Stone Type	Co-ordinates (mE mN)	Landform
Flake	Quartz	242953 6776345	Ridge
Flake	Quartz	245185 6777105	Ridge
Retouched Broken Flake	Quartz	245316 6777063	-
Core, Broken Flake, Flake Fragment	Quartz	245308 6776923	-
Flake	Chert	245308 6776923	-
Retouched Broken Flake	Basalt	245200 6776842	-
Flake Fragment	Quartz	245200 6776842	-
Retouched Broken Flake	Quartz	245203 6776849	-
Two Cores	BIF, Quartz	245114 6776800	-
Core	Chalcedony	244623 6776356	Slope
Core, Broken Flake	Quartz	244762 6776472	Creek
Retouched Broken Flake, Core	Quartz	244794 6776424	Creek

Broken Flake	Quartz	244330 6776096	-
Retouched Broken Flake, Core	BIF	244815 6776338	Creek
Two Flake Fragments	Quartz	244649 6776026	-
Two Cores	BIF	244991 6776258	-
Retouched Flake	Chert	245547 6776699	-
Broken Flake	Quartz	242585 6775869	-
Flake, Core, Flake Fragment	Quartz	242582 6775793	-
Flake	Silcrete	242582 6775793	-
Two Flakes	Quartz	242608 6775751	-
Flake	Quartz	245179 6774025	-
Core	Quartzite	245226 6774127	Near Creek
Retouched Flake	BIF	245247 6774149	Near Creek
Core	BIF	245282 6774687	-
Broken Flake, Flake	Quartz	245318 6774757	-
Three Broken Flakes	Quartz	245589 6774326	-
Flake	BIF	245589 6774326	-
Broken Flake, Flake	Quartz	45504 6774206	Near Creek
Two Flakes	BIF	245033 6773477	-
Core	BIF	245288 6773826	Near Drainage Line
Retouched Flake	BIF	245243 6773921	Near Drainage Line
Core	Granite	246215 6760888	Sandplain/Woodland
Core	Silcrete	246212 6762289	Sandplain/Woodland
Core	Silcrete	244777 6762294	Sandplain/Woodland
Core	Granite	245261 6762500	Sandplain/Woodland
Core	BIF	246499 6762489	Open Woodland
Flake	BIF	246654 6762489	Near Creek

Retouched Flake	BIF	245845 6762970	Open Woodland
Flake	BIF	245796 6763199	Floodplain
Flake	BIF	245958 6763221	Floodplain
Flake	Chalcedony	246080 6763201	Near Creek
Muller Fragment	Basalt	250375 6753563	Near Creek
Muller Fragment	Basalt	250610 6753394	Near Creek
Core	BIF	250552 6753302	Near Creek
Flake	Silcrete	244587 6763745	Sandplain/Woodland

11.0 SITES RECORDED

11. 1 Mount Mason Isolated Scatter

MGA Zone 51 242666mE 6776205mN

This area contains some thirty-five quartz artefacts on the eastern slope of a ridge running northeast-southwest. A creek line is located one hundred metres to the northwest, and a cleared track is located five metres north of the artefact scatter. The vegetation comprises acacia open woodland with scattered bushes, atop iron stone gibber soils. Ground visibility was good at approximately 60%. The artefact scatter covers an area nine metres north south by eighteen metres east west. The assemblage was analysed by placing three one metre sample squares over higher concentrations of artefacts to record artefact stone type, numbers and artefact category (Table One).

Sample Square	Stone Type	Artefact Type
1	Clear Quartz	Flake
1	Clear Quartz	Flake
1	Clear Quartz	Flake
2	Quartz	Core
2	Quartz	Core
2	Clear Quartz	Flake Fragment
3	Clear Quartz	Broken Flake
3	Clear Quartz	Flake
3	Clear Quartz	Broken Flake

Table 1 Mount Mason Isolated Scatter artefact scatter sampled.

Figure 3 Quartz Flake. Site Mount Mason Isolated Scatter.

Artefact densities sampled varied between two to three artefacts per metre square, with average site density estimated at 0.24 artefacts per square metre.

Four flakes, two cores, one flake fragment and two broken flakes were recorded via the sample squares. The assemblage is comprised exclusively of quartz that is locally available and common in artefact scatters in the region. Given the limited number of artefact and common artefact types this site is likely the result of a single reduction event.

This site is represented elsewhere and does not contain sufficient data to answer important scientific questions. Given the above analysis, this site is assessed as of negligible archaeological significance.

Boundary Point Number	mE	mN
1	242657	6776208
2	242654	6776203
3	242657	6776198
4	242665	6776199
5	242672	6776202
6	242666	6776208

Table 2 Site Mount Mason Isolated Scatter Boundary Polygon

11. 2 Mount Mason East

MGA Zone 51 245133 6776341

This site exhibits a scatter of thirty stone artefacts manufactured from dolerite, BIF and quartz. The area is located in open, undulating land with ironstone and quartz gibber soils and a patch of sparse gum trees situated on elevated ground to the north of the site. The area held good ground visibility estimated at over 65%.

The artefact scatter covers an area fifty metres north south by forty metres east west. Four one-metre square samples were undertaken at the site to assess its assemblage.

Sample Square	Stone Type	Artefact Type
1	BIF	Flake
1	Dolerite	Broken Point
2	Dolerite	Flake
2	Dolerite	Flake
2	Dolerite	Flake
2	Dolerite	Flake
2	Dolerite	Flake
2	Dolerite	Flake
3	Dolerite	Flake Fragment
3	Dolerite	Flake
3	Quartzite	Core
4	Dolerite	Core

Table 3 Artefact Sampled at Mount Mason East

Artefact densities per square metre varied from one to six artefacts, with an overall site density calculated at 0.02 artefacts per metre square. Dolerite flakes dominate the assemblage, with one broken dolerite point also recorded. This site is interpreted as a

reduction area used on a single occasion. The number of artefacts, artefact stone type and artefact types are common in the region and represented in larger, more complex assemblages. This site does not have the potential to answer significant scientific questions and consequently it is assessed as of Low archaeological significance.

Boundary Point Number	mE	mN
1	245110	6776343
2	245119	6776365
3	245134	6776370
4	245140	6776368
5	245149	6776360
6	245154	6776354
7	245147	6776339
8	245140	6776326
9	245134	6776319
10	245123	6776326

Table 4 Site Mount Mason East Boundary Polygon

Figure 4 Broken dolerite point. Site Mount Mason East

Figure 5 Quartzite Core. Site Mount Mason East

11.3 Mount Mason Rockholes

MGA Zone 51 242655mE 6775842mN

At the given co-ordinates two rockholes were recorded on a small section of granite pavement. The site is located on a south-southwest slope covered by some granite rocks and pebbles, sparsely vegetated by acacia and gum trees with 90% ground visibility.

Rockhole One exhibited a cavity fifteen centimetres by fifteen centimetres wide and twelve centimetres deep. Rockhole Two measured twenty centimetres by twelve centimetres wide by fifteen centimetres deep. Together, the rockholes can hold approximately twenty litres of water after rain, where the water would be available for a limited period of time, depending on factors such as evaporation rates, season and climate.

Rockhole sites are widely represented in the region, commonly exhibiting larger cavities and in sites that exhibit repeated and/or prolonged Aboriginal usage. This site is assessed as of Low archaeological significance.

Boundary Point Number	mE	mN
1	242644	6775829
2	242660	6775828
3	242664	6775844
4	242663	6775853
5	242650	6775851
6	242645	6775844

Table 5 Site Mount Mason Rockholes Boundary Polygon

Figure 6 Rockhole One. Site Mount Mason Rockholes.

11.4 Artefact Scatter Polly

MGA Zone 51 244944mE 6775444mN

The site consists of a low density artefact scatter with approximately seventy artefact manufactured from a variety of stone including quartz, basalt, chalcedony, BIF, chert, silcrete and ironstone. The site is located on an elevated open area, sloping downwards on its east and west boundaries. The area is vegetated by sparse gum trees and some

acacias and shrubs over gibber soils. Ground visibility at the site was very good at 70%. The site is located twenty metres west of a north-south creek and covers an area approximately 130 metres northwest-southeast, by seventy metres wide. The east, west and south boundary recorded for the site correspond to the limit of the survey area and do not necessarily reflect the full extent of this site.

Seven, one-metre sample squares were undertaken at the site to characterise the assemblage.

Sample Square	Stone Type	Artefact Type
1	Quartz	Broken Flake
1	Quartz	Broken Flake
1	Quartz	Broken Flake
2	Basalt	Retouched Flake
3	Chalcedony	Retouched Flake
3	BIF	Core
4	BIF	Core
4	Silcrete	Broken Flake
4	Silcrete	Retouched Flake
4	Quartz	Broken Flake
5	BIF	Core
6	Silcrete	Retouched Flake
6	Chert	Flake
7	Ironstone	Broken Flake

Table 6 Artefact Scatter Polly. Artefact scatter sampled

The stone types used to manufacture the artefacts are widely represented in the region, and most are available locally. The artefact densities recorded varied between one to four artefacts per metre square, with a sample average of 1.8 artefacts per square metre. From the artefact types sampled this site is interpreted as a short term camping spot associated with an ephemeral creek line, where mundane tasks were undertaken. One chalcedony and one basalt scraper indicate that wood, bone or skin working may have been undertaken at the site. The amount of retouched flakes in the assemblage is be interpreted as curation of a particular stone type, possibly of more exotic provenance or of favoured flaking characteristics. The cores present indicate flake manufacture, and the relatively high percentage of cores in the assemblage is probably related to the local availability of BIF stone in the area. Given the limited number of artefacts, artefact types and very low artefact densities, this area displays an assemblage typical of a temporary/transient camping spot, possibly occupied over several days or episodes, when water would have been available at the nearby creek. This site type is widely represented in the region and the data available is of limited research potential. Given the assessments above this site is allocated a Low level of archaeological significance.

Boundary Point Number	mE	mN
1	244871	6775529
2	244937	6775550
3	244994	6775437
4	244945	6775421
5	244877	6775488

Table 7 Site Mount Mason Artefact Scatter Polly Boundary Polygon

Table 8. Chalcedony flake. Artefact Scatter Polly.

11.5 Site MKI

MGA Zone 51 245041mE 6773832mN

A low-density artefact scatter containing an estimated seventy artefacts was recorded on a mound gently sloping downhill to the north, towards an east-west drainage line. The area's vegetation comprises an open low woodland of acacias and shrubs, over ironstone gibber soils. The site extends fifty metres east west by thirty metres north south. Ground visibility at the site was very good at 80%.

Seven one-metre sample squares were undertaken at the site to analyse the assemblage.

Sample Square	Stone Type	Artefact Type
1	Dolerite	Flake
2	Quartz	Core
2	Quartz	Core
2	Quartz	Broken Flake
2	Quartz	Flake
3	BIF	Core
4	Quartz	Flake Fragment
4	Basalt	Flake
5	Quartz	Broken Flake
5	Quartz	Broken Flake
6	BIF	Core
7	Quartz	Core

Table 9 Site MKI. Artefact scatter sampled

Quartz is the most abundant raw material used to produce artefacts, followed by BIF, dolerite and basalt. Both quartz and BIF are naturally occurring in the area and this may explain the abundance of cores present. Sample squares recorded median densities of one artefact per metre square, although overall artefact density for the site is estimated at 0.05 artefacts per square metre.

The low density of the scatter, composed of basic artefact types with no retouch or signs of usage, suggests that this was used opportunistically to manufacture/rejuvenate artefacts made from locally available stone. As such, this site is widely represented in the region and is assessed as of negligible archaeological significance.

Boundary Point Number	mE	mN
1	245027	6773842
2	245053	6773852
3	245073	6773849
4	245089	6773829
5	245073	6773818
6	245055	6773820
7	245033	6773817

Table 10. Site Mount Mason Site MKI Boundary Polygon

Figure 7. Aerial Map of Site MKI (Google Earth 2012).

11.6 Elena Site A

MGA ZONE 51 244892mE 6773371mN

This area was recorded as an artefact scatter and water source site. The site comprises ironstone and quartz gibber soils overlain by sparse mulga trees with little undergrowth and an open canopy, allowing for very good ground visibility. The scatter is located on a slightly elevated position sloping southwest.

A soak fifteen centimetres deep, 2.25 metres wide and 1.5 metres long, was recorded at MGA Zone 51 244994mE 6773335mN. The soak is located on a drainage line flowing downhill southwest. The southern part of the soak appears to have been walled with a row of granite rocks and is silted with earth. The area contains an artefact scatter that extends 270 metres east west by 220 metres north south. The site is located to the east of Metzke Road and bounded to the south by an east west road leading into Jupiter Mines' Camp Cassini.

Several thousand artefacts are estimated to be present at the site and overall site densities are estimated at 0.4 artefacts per metre square. Eleven one metre square samples were taken to characterise the artefact assemblage. Artefact densities at the site ranged from one artefact per square metre to seven per square metre with an overall sample average of 3.27 artefact per square metre.

Qartz, Chalcedony, BIF, Granite, Silcrete, Clear Quartz, Quartzite, Ironstone, Dolerite, Basalt and Chert stone artefacts are present at the site, with over half of the artefacts manufactured from BIF (33%) and Quartz (17%). Artefact types included flakes, cores, broken flakes, flake fragments and retouched/used tools. Four basal grindstones were recorded. These were manufacture from BIF and Ironstone, both locally available lithics. The basal grindstone stones exhibited flat grinding surfaces with some polishing

and glazing. This may suggest that they were left at their earlier part of the reduction sequence (see Discussion section), and given surface pitting, may have been rejuvenated or used for a variety of purposes additional to seed grinding. A high percentage of cores (20%) in the assemblage indicate that flake/tool production occurred at the site, from both local and nonlocal stone resources.

This site comprises an extensive, medium to low density, artefact scatter with notable percentages of grindstones and cores, and artefacts produced from a variety of raw materials. The area is associated with a fresh water source, and has evidence for repeated usage. Further archaeological research may lead to a greater understanding of artefact reduction strategies, group mobility and seasonality, grindstone usage and antiquity of occupation. This site is therefore assessed as of moderate archaeological significance.

Sample Square	Stone Type	Artefact Type
1	Quartzite	Core
1	Quartz	Flake
1	Chalcedony	Retouched Flake Fragment
2	Quartzite	Basal Grindstone
3	BIF	Basal Grindstone
3	Clear Quartz	Flake Fragment
3	Quartz	Broken Flake
4	Ironstone	Basal Grindstone (27x16x8)
4	Clear Quartz	Broken Flake
5	BIF	Retouched Flake
6	BIF	Basal Grindstone (8x6x4)
6	BIF	Flake
6	Quartz	Flake
7	Dolerite	Flake
7	Quartz	Broken Flake
7	Granite	Flake Fragment
8	Silcrete	Core
8	BIF	Core
9	Chert	Flake Fragment
9	Quartz	Flake
9	Silcrete	Core
9	Silcrete	Core

9	Quartz	Flake Fragment
9	Clear Quartz	Core
9	BIF	Flake
10	BIF	Broken Flake
10	BIF	Broken Flake
10	BIF	Flake
10	BIF	Flake Fragment
11	Basalt	Core
11	Silcrete	Flake
11	Chert	Retouched Flake
11	Chert	Flake
11	Ironstone	Broken Flake
11	BIF	Core
11	BIF	Flake

Table 11. Site Elena A. Artefact scatter sampled.

Boundary Point Number	mE	mN
1	244926	6773250
2	244908	6773255
3	244897	6773258
4	244871	6773285
5	244855	6773292
6	244836	6773312
7	244801	6773352
8	244742	6773385
9	244736	6773406
10	244762	6773433
11	244807	6773475
12	244847	6773505
13	244939	6773476
14	244970	6773458
15	245029	6773415

Table 12. Elena Site A Boundary Polygon

Figure 8. BIF Core. Elena Site A

Figure 9. Silcrete Flake. Elena Site A.

Figure 10. Water Soak looking North. Elena Site A.

11.7 Elena Site B

MGA ZONE 51 244740mE 6773297mN

This area consists of an artefact scatter containing a variety of artefact and stone types, associated with the fresh water source recorded under Elena Site A. Elena Site B is located to the east of Metzke Road, and to the south of the access road into Camp

Cassini. The vegetation at the site consists of Acacias trees with sparse Eremophila shrubs. The landform comprises a floodplain draining in a west-southwest direction. Visibility was very good estimated at 70%.

The site contains artefacts made of BIF, Ironstone, Quartzite, Quartz, Silcrete, Clear Quartz, Chalcedony, Chert and Jasper. Twelve, one metre sample squares were placed over the site to gain a representative sample of the assemblage. Forty-one artefacts were recorded. Artefacts at the site were produced from BIF (27%) and Quartz (22%), with smaller percentages manufactured from Silcrete, Quartzite, Jasper, Ironstone, Chert and Chalcedony. The entire sample of the chert, jasper and chalcedony artefacts (five in total) represented formal tools such as nose-edge scrapers, thumbnail scrapers and backed blades. Only one BIF flake showed signs of retouch and one Silcrete artefact was observed as being notched. One chert point was also observed at the site.

The high degree of retouch and reduction for chert, jasper and chalcedony artefacts is interpreted as curation of material either not locally available or highly prized. This would mean that artefact discard for this type of stone would be delayed until no further reductions could possibly be made. In accordance, BIF and Quartz artefacts were not heavily reduced with flakes, broken flakes and cores being represented in the sample. BIF basal grindstones were also recorded in the assemblage and these did not show signs of heavy grooving, with only some polishing and pitting.

Overall, a thousand artefacts are estimated to be present within Elena Site B. Given the sample average of 3.4 artefacts per square metre the site is likely to have been used over repeated occasions. Backed blades and backing techniques form part of Australian Small Tool Tradition and are believed to represent a technological shift dated to approximately 4,000 years ago, therefore giving this site a likely *terminus post quem*.

Figure 11. Range of artefacts present at Elena Site B.

Figure 12. Chert Point. Elena Site B.

Figure 13. Utilised Chalcedony Flake. Elena Site B.

Sample Square	Stone Type	Artefact Type
1	BIF	Flake
1	BIF	Flake
2	Ironstone	Flake
2	Ironstone	Core
3	BIF	Retouched Flake
3	BIF	Core
3	Quartzite	Broken Flake
3	BIF	Flake
3	BIF	Broken Flake
4	Quartzite	Core
4	Quartz	Core
4	Chert	Scraper
5	BIF	Broken Flake
5	Quartz	Broken Flake
5	BIF	Flake Fragment
5	Chert	Nose-edged Scraper
6	BIF	Flake Fragment
6	BIF	Core
6	Quartz	Flake
6	Quartz	Flake

6	Silcrete	Flake
7	BIF	Core
7	Jasper	Thumbnail Scraper
7	Silcrete	Core
7	Quartz	Flake
7	Quartz	Flake
7	Quartz	Broken Flake
8	Silcrete	Broken Flake
8	Silcrete	Notched Flake
9	Chalcedony	Scraper
9	Jasper	Retouched Flake
9	BIF	Flake
9	BIF	Flake
9	Clear Quartz	Flake Fragment
10	BIF	Basal Grindstone (24 x 22 x 10 cm)
11	Jasper	Backed Blade
11	Clear Quart	Flake
12	BIF	Core
12	Quartz	Flake
12	Quartz	Broken Flake
12	Quartzite	Core

Table 13. Elena Site B. Artefact scatter sampled.

Boundary Point Number	mE	mN
1	244917	6773227
2	244872	6773173
3	244822	6773156
4	244780	6773214
5	244764	6773247
6	244732	6773254
7	244722	6773260
8	244679	6773274
9	244659	6773287
10	244631	6773310
11	244663	6773337
12	244690	6773325
13	244720	6773326
14	244731	6773338
15	244762	6773330
16	244781	6773313
17	244797	6773296
18	244809	6773285
19	244824	6773273
20	244846	6773249
21	244878	6773245
22	244891	6773240

Table 14. Elena Site B Boundary Polygon

This site has an extensive artefact scatter dominated by locally available BIF and Quartz artefacts, with a high percentage of formal/utilised chert, jasper and chalcedony artefacts. Elena Site B represents a camping ground associated with Elena Site A's water soak and contains an artefact scatter similar to that recorded for Elena Site A, albeit with a more complex assemblage. From an archaeological perspective, this site has a moderate potential to contribute information regarding settlement patterns, tool making technologies and reduction strategies, stone artefact procurement, transport and use, and grinding techniques.

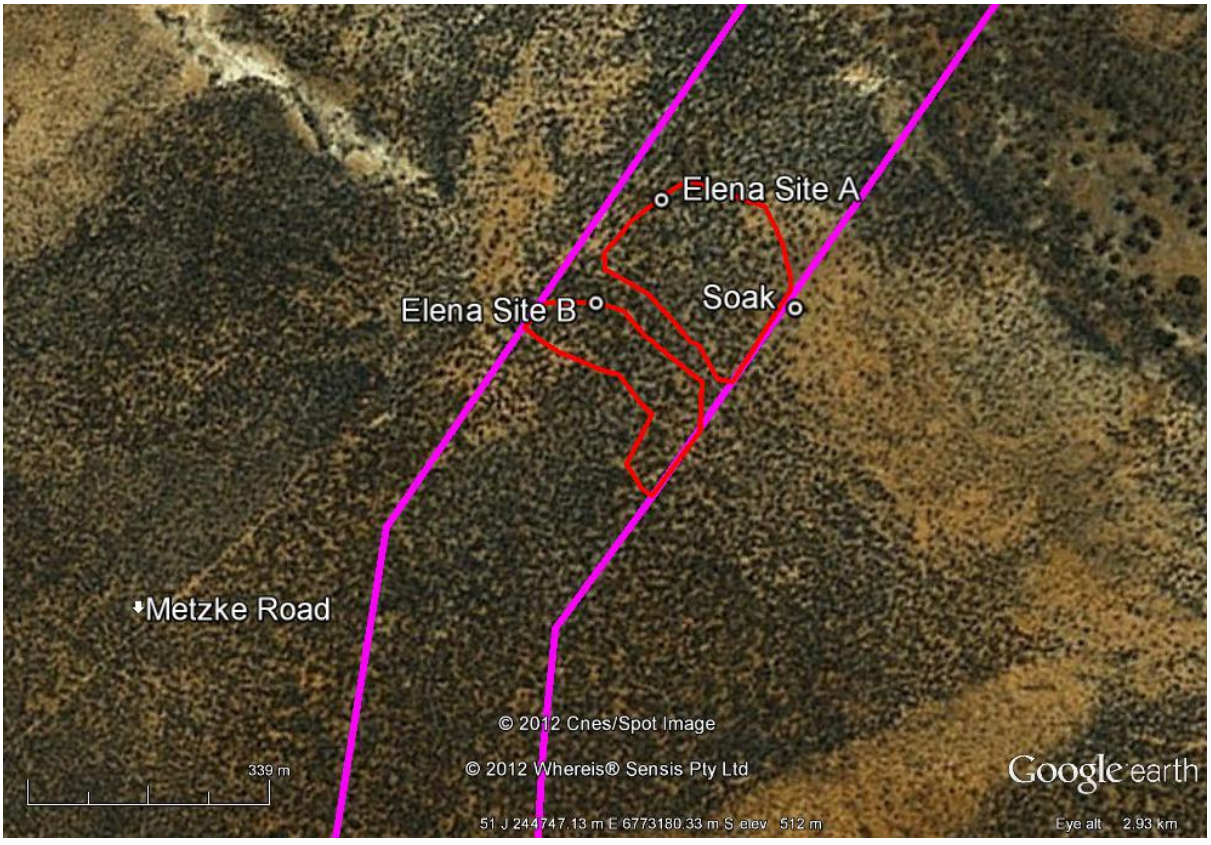

Figure 14. Aerial Map of Elena Site A and Elena Site B (Google Earth 2012).

11.8 Menzies Sandstone One

MGA Zone 51 252517mE 6752045mN

This site comprises an artefact scatter on flat sand surrounding a granite outcrop that contains several shallow pools and rockholes. The granite outcrop extends north-south with the highest point located at MGA Zone 51 252545mE 6752082mN, containing rockholes between fifteen to one metre square in area, of variable depths. Some thirty-five depressions were full of rainwater during the time of the survey on the outcrop. A lizard trap and a standing stone were observed at MGA Zone 51 252569mE 6752057mN.

Another granite outcrop was recorded at MGA Zone 51 252543mE 6751915mN. The extrusion contained over twelve rockholes between thirty to half a metre square, in size.

The land surrounding the granite extrusion is vegetated by an open woodland, with sparse shrubs and bushes covering red sands. The soils are covered by a very fine gibber of quartz and granite pebbles deriving from the weathering of the granite outcrop.

The artefact scatter is mainly situated on the flat sandy country and comprises artefacts manufactured from Chalcedony, Chert, Clear Quartz, Quartz, BIF, Dolerite and Granite.

The assemblage is characterised by artefacts like flakes, cores, broken flakes, flake fragment and formal tools such as blades, bladettes, backed blades, grindstones, scrapers and retouched flakes. The majority of formal tools and retouched flakes recorded were manufactured from Chalcedony and Chert stone. One retouched dolerite artefact was also noted. The variety of stone tool types indicates that rejuvenation and

curation of particular types of stones was undertaken in the area, with a range of tools associated with hafting for wood, bone or skin working.

Sample Square	Stone Type	Artefact Type
1	Chalcedony	Flake
1	Chalcedony	Core
1	Chalcedony	Core
1	Chalcedony	Flake Fragment
1	Chalcedony	Retouched Flake
1	Chalcedony	Flake
2	Chalcedony	Blade
2	Dolerite	Retouched Flake
3	BIF	Flake
3	Quartz	Flake Fragment
3	Chert	Flake
3	Chert	Broken Flake
3	Chert	Blade
3	Chert	Flake
3	Chalcedony	Backed Blade
3	Quartz	Flake Fragment
3	Clear Quartz	Broken Flake
3	Chert	Flake Fragment
3	Clear Quartz	Flake Fragment
3	Clear Quartz	Flake Fragment
4	Quartz	Flake
4	Chalcedony	Retouched Flake
4	Quartz	Flake
5	BIF	Flake
5	Clear Quartz	Flake
5	BIF	Flake
5	Clear Quartz	Flake
5	Dolerite	Flake
5	Quartzite	Flake
5	Chalcedony	Scraper

Table 15. Menzies Sandstone One Site Sampled Artefacts.

Boundary Point Number	mE	mN
1	252385	6752192
2	252379	6752145

3	252378	6752086
4	252415	6752049
5	252439	6751991
6	252455	6751954
7	252497	6751879
8	252588	6751844
9	252664	6751877
10	252730	6751924

Table 16. Site Menzies Sandstone One GPS Boundary Co-ordinates.

Figure 15. Photo of granite outcrop looking northeast.

Given that the site appears to extend well beyond the boundaries recorded within the survey area, no complete assessment of significance can be made at this stage. It is presumed that the site will largely relate to the extent of the granite outcrop.

Granite outcrop sites are widely represented in the region and were commonly used in historical times by pioneers, prospectors and station owners as sources of fresh water.

The author has knowledge of several granite outcrop sites in the region that are of mythological and ceremonial significance. These areas represent reliable water sources which were occupied repeatedly, and as such have a moderate to high potential to answer questions regarding Aboriginal pre-history of the region.

11.9 Menzies Sandstone Two

MGA Zone 51 252729mE 6751642mN

This site is located to the east of a large granite outcrop extending north-south and intruding into the proposed haul road path at MGA Zone 51 252704mE 6751647mN. A shallow granite outcrop and rockhole area is located approximately 200 metres northeast of a large granite outcrop at MGA Zone 51252820mE 6751803mN, and an artefact scatter was recorded in between these two features.

The landscape between these two outcrops comprises red sands covered by bushes and shrubs, with sparse trees, and good ground visibility estimated at 60%.

Eight one-metre sample squares were taken to assess the surface assemblage. Twenty-one artefacts were recorded, with artefact densities varying from one to five artefacts per square metre. Artefact types included flakes, cores, basal grindstones, mullers, retouched flakes, broken flakes and tools, including backed blades and scrapers.

Stone artefacts were manufactured from Chalcedony (28.5%), Chert (28.5%), Quartz (19%), Granite (9.6%), Clear Quartz (4.8%), BIF (4.8%) and Quartzite (4.8%).

On the granite outcrop to the west side of the haul road area a lizard trap was located at MGA Zone 51 252729mE 6751642mN. A pool measuring ten metres by four metre was also recorded at this location.

The site extends outside the survey area, both to the east and west, probably in relation to the extent of the granite extrusion.

Granite outcrops have been previously assessed in the region as significant in both archaeological and ethnographic terms, and have been widely recorded in the region as aggregation locales, reliable water sources, ceremonial grounds, places of historical significance and often of mythological significance. The full extent of this site has not been subject to archaeological investigation, although it is preliminarily assessed as of moderate to high archaeological significance based on the available sample and knowledge of similar sites.

Sample Square	Stone Type	Artefact Type
1	Quartzite	Basal Grindstone (30cm x 20cm x 9cm)
2	Quartz	Flake
2	Chert	Flake
3	Chalcedony	Retouched Flake
3	Chert	Broken Flake
3	Chalcedony	Flake
3	Quartz	Broken Flake
4	Chalcedony	Broken Flake
4	Clear Quartz	Core
4	BIF	Broken Flake
4	Chert	Backed Blade
4	Chalcedony	Backed Blade
5	Chalcedony	Scraper
5	Chert	Broken Flake
6	Granite	Broken Muller
6	Quartz	Flake
6	Chert	Flake
7	Granite	Basal Grindstone (32cm x24cm x 11cm)
8	Chalcedony	Core
8	Chert	Retouched Flake
8	Chert	Flake
8	Quartz	Flake

Table 17. Site Menzies Sandstone Two Artefacts Sampled.

Boundary Point Number	mE	mN
1	252800	6751867
2	252601	6751728
3	252881	6751499
4	252967	6751721

Table 18. Site Menzies Sandstone Two GPS Boundary Co-ordinates.

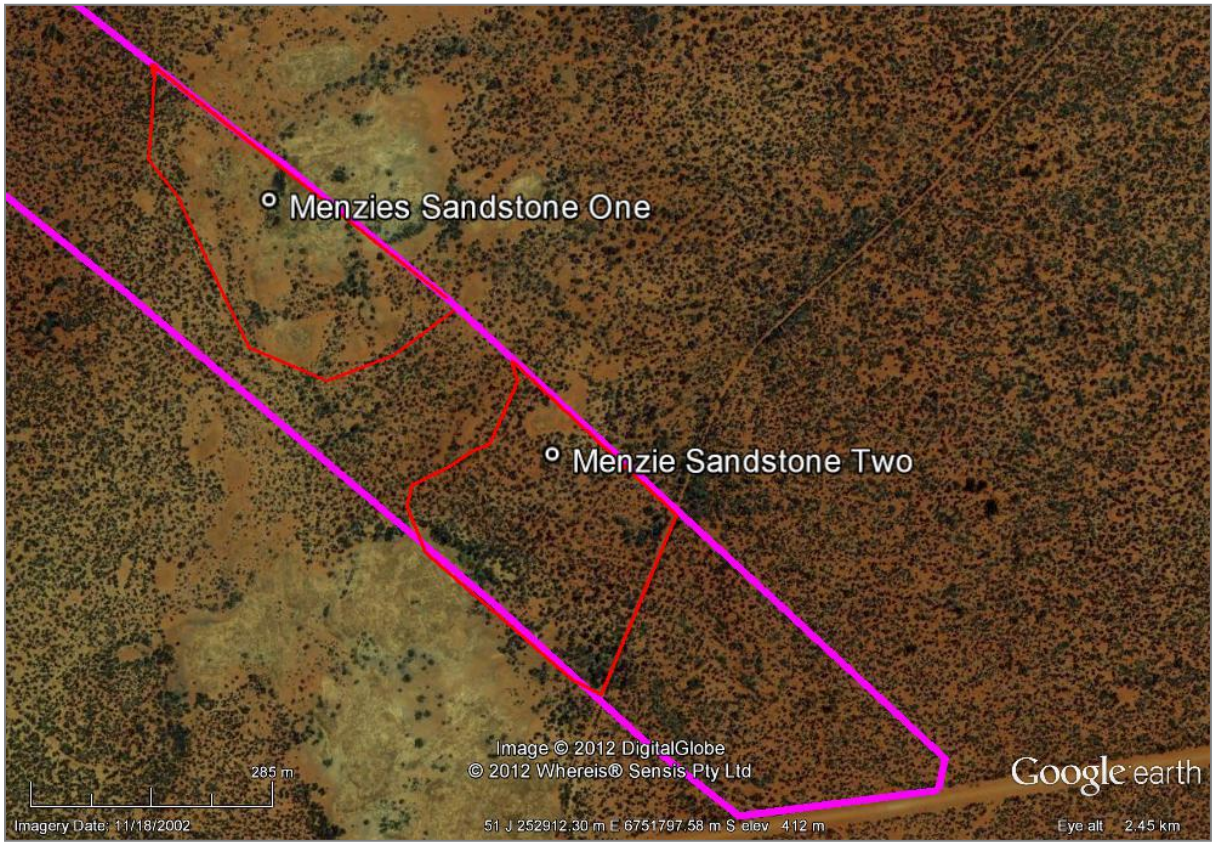

Figure 16. Aerial Map of Menzies Sandstone One and Menzies Sandstone Two (Google Earth 2012).

11.10 Place of the Grindstones

MGA Zone 51 246460mE 6766217mN

An artefact scatter was recorded within an 800-metre long area along the banks of a northeast-southwest creek. The assemblage exhibits a very high percentage of grinding implements, with over twenty grinding stones recorded. Artefacts types identified included amorphous basal grindstones, mullers, retouched flakes, flakes, broken flakes and flake fragments.

The site is situated to the west of an ephemeral creek and extends into two diverse landforms. The eastern part of the site comprises a floodplain area where vegetation is very open where sparse trees and shrub grow on red gravelly soils. This landscape is optimal for site identification as it affords very good ground visibility. To the western part of the site a mulga woodland is present. This area consists of a semi-closed canopy of trees with an undergrowth of shrubs and bushes. The mulga trees foliage and shrubs allow for moderate ground visibility. A ridgeline is located a few hundred metres west of the mulga woodland where the vegetation changes to that typical of sandplain/granite country, with occasional sparse gum trees on deeper soils and shorter trees and thicker vegetation on skeletal soils. Occasional granitic outcrops are present within this area.

The artefact scatter was assessed via thirty one metre sample squares. The artefacts were produced from stone types such as Chert, BIF and Chalcedony, with a large percentage of retouched flakes. Artefact densities averaged 1.5 artefacts per metre square, although actual artefact density is estimated to be closer to one artefact per fifty metres square.

The site exhibits a sparse artefact scatter with notably high numbers of formal implements. The majority of the grinding artefacts are located within the mulga woodland situated between the floodplain to the east and the elevated ground to the west. The basal grindstone are mainly produced from BIF or ironstone, with several mullers and muller fragments manufactured from granite and BIF. Maximum length and width recorded for the basal grindstones are in the range of 40 cm x 30 cm whilst minimum length and width recorded was in the range of 7.5 cm x 6.5 cm. Grindstone thickness averaged between 8.5 cm to 1 cm.

The majority of the basal grindstones are amorphous with few exhibiting discrete grooving or large polished patches that commonly occur as a result of the seed grinding process. Almost the entire grindstone assemblage exhibited edge flaking and pitting. Both attributes indicate that the grindstone were curated and surfaces were rejuvenated via pecking, increasing the effectiveness of the grindstone (Smith 1986, Veth 1996).

Figure 17. BIF Grindstone and Granite Muller fragments.

Figure 18. Grindstone exhibiting polish.

Figure 19. A grindstone exhibiting polish over a rejuvenated surface.

Figure 20. Two in-situ grindstones.

A large percentage of non-pitted grindstones exhibited irregular surfaces. These surfaces were naturally uneven, generally with a very rough cortex.

Figure 21. Naturally uneven surface of grindstone.

Figure 22. Example of naturally uneven and pitted grindstone surface.

The basal grindstones were manufacture exclusively from BIF and ironstone, both of which are locally available within the Mt. Ida Range, under two kilometres to the east. The grindstone assemblage sampled appears to denote a preference for grinding surfaces that exhibited naturally rough or uneven surfaces and thus can be interpreted as being more effective in grinding material.

Ethnographic studies have recorded a variety of uses for grindstones in the arid zone including pulverising lizards, bone or small animals, preparing paste from dried solanum fruit, grinding seeds and cracking and grinding nuts, sharpening or smoothing wooden artefacts and stone axes, grinding ochre, preparing bush tobacco and preparing resin (Smith 1986).

As the site is located within a mulga woodland, it is possible that mulga nuts were being processed within the site.

According to Smith (1986):

'...seedgrinding implements tend to be heavily and repetitively used. Therefore they will have well- worn surfaces and well-defined, discrete wear patterns. The ground surfaces will not be small or irregular and may often exhibit a silica polish, derived from the repetitive processing of plant material. Secondly, seedgrinders are special-purpose implements. Therefore they will often show signs of maintenance, attempts to re-use or rejuvenate the implement, and probably also evidence of deliberate manufacture"

Seed grinding is a gender related activity, as is stone tool making, and this may explain the paucity of stone artefacts and debitage in the area. In relation to this last point it is also feasible to postulate that these smaller artefacts may be present and have been silted up, as was noted to have occurred to some of the grindstone that were embedded over four centimetres into the soft sand.

This site represents evidence for traditional activities associated with the processing and production of foodstuff and has potential to address questions relating to grindstone sourcing, transportation, usage, reduction and rejuvenation. Further studies may also yield important information on the diet of Aboriginal people and the antiwuity

of occupation. This site type is not common to the region as it comprises an artefact scatter dominated by basal grindstones and fewer smaller tools and little debitage. This site has a potential to answer archaeological questions and is assessed as of Moderate archaeological significance.

Boundary Point Number	mE	mN
1	246484	6766751
2	246581	6766750
3	246575	6766609
4	246580	6766495
5	246759	6766460
6	246774	6766400
7	246732	6766264
8	246637	6766043
9	246564	6765927
10	246333	6765940
11	246309	6765977
12	246321	6766142
13	246298	6766366
14	246410	6766605

Table 19. Place of the Grindstones site boundary

Grinding Stone Recording Sheet

Stone Type	Length	Width	Thickness	Surface description	Polish level	Size of Grinding Patch/es	Bevelling or Edge Flaking
BIF	29	9	4.5	Flat	Moderate	8x4	B and E
BIF	15	20	5	Irregular	Moderate	11x2	E
BIF	7.5	9	6	Flat	High	-	B and E
BIF	18	17	7.5	Flat	Moderate	-	E
Ironstone	19	11	5.5	Grooved and Pitted	Moderate	-	E
BIF	39	29	7	Pitted/Irregular	Moderate	-	B and F
BIF	29	27	6	Irregular	Low	-	B and F
BIF	29	11	6	Pitted/Irregular	Moderate	-	B and F
BIF	11	13	5	Grooved/Pitted	Moderate	-	B and F
BIF	13	6	4	Very Irregular	Moderate	-	F
BIF	12	11	3	Grooved and Pitted	Low	-	B
BIF	36	15	8	Pitted/ Grooved	Moderate	-	F
BIF	25	14	6	Irregular/Grooved	Moderate	-	F
BIF	24	9	4	Irregular	Moderate	-	B and F
BIF	40	30	4	Irregular	Low	-	B and F
BIF	23	21	5	Grooved on both surfaces	High	-	F
Ironstone	13	8	5	Irregular	Moderate	-	B
BIF	26	27	6	Pitted	High	-	B and F
BIF	35	20	8.5	Pitted and Flat	High	-	F
BIF	14.5	7	1	Irregular and Pitted	Moderate	-	B
BIF	13	9	5	Irregular	Low	7x3	B and F
BIF	13	11	2.5	Pitted	Low	-	F
BIF	10	9	2.5	Irregular	Moderate	-	F

BIF	10	7	2	Irregular	Low	-	-
BIF	33	25	4	Grooved/Pitted	High	12x10	F
BIF	30	19	3	Irregular	Low	-	F

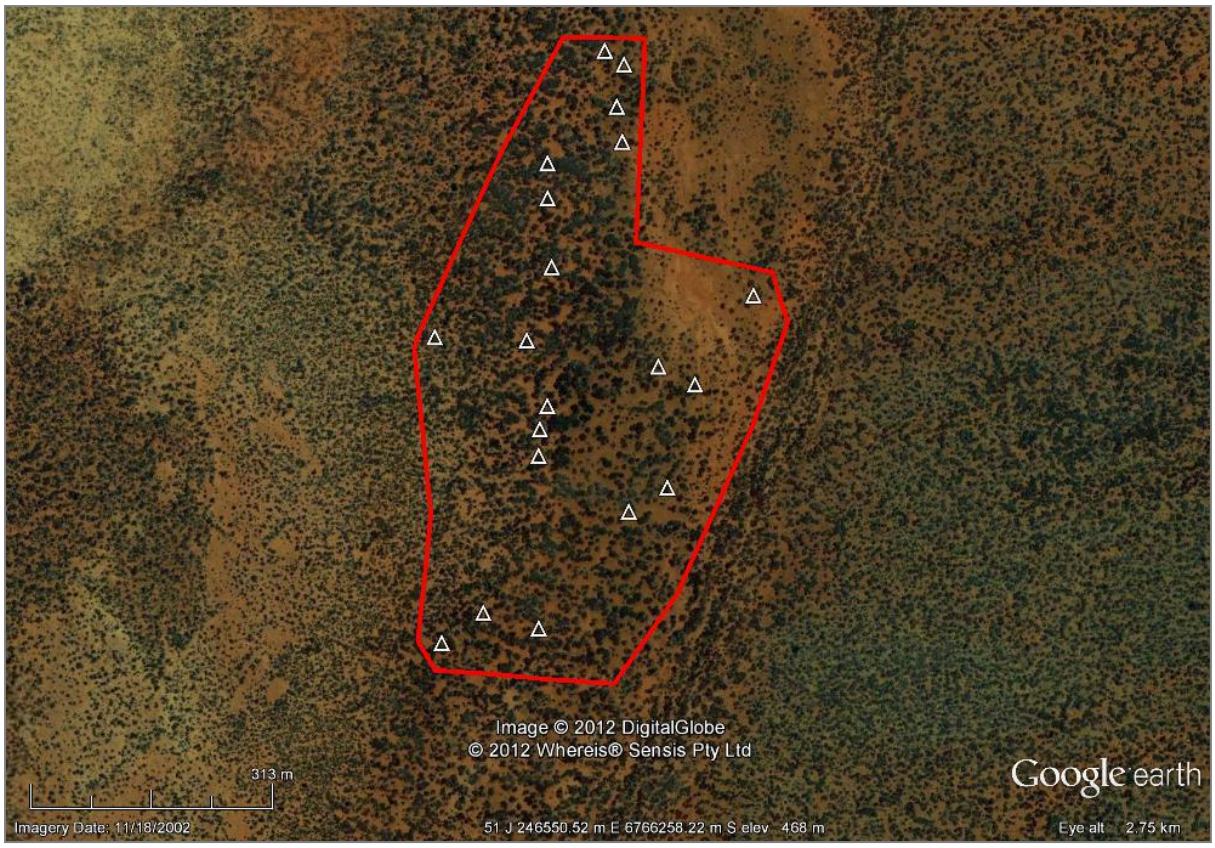

Figure 23. Place of the Grindstones Aerial Map. Triangles indicate distribution of grinding material within site.

12.0 RECORDING OF AIC SITE 2006

Following the initial report of an ethnographic site centred upon MGA Zone 51 248088mE 6764402mN by AIC in 2006, and lack of archaeological information on the site, Jupiter Mines requested an archaeological investigation of the area.

The area is situated to the west of a BIF cliff where a drainage line forms a gorge and rainwater accumulates in a concreted stone pool to the bottom of the fall. A runoff creek runs to the south west, and two hills are located adjacent to the north and south side of the creek, approximately 250 metres southwest of the pool. To the north of the creek, the hill is clear of vegetation and a mustering yard, water trough and rain water tank have been installed, with a hose connecting the trough to the water pool. On this hill an artefact scatter was recorded extending roughly 200 hundred metres west, one hundred metres north, 220 metres east and 250 metres south. The area is vegetated by acacias and small shrubs and bushes with ground visibility being good at 60%.

One hundred and forty-four artefacts were analysed via one-metre sample squares spread over the site. Artefact densities varied from a maximum of forty artefacts per metre square to one artefact per metre square. A median artefact density of 7.3 artefacts per metre square is calculated. As artefacts concentrations were observed to be variable within the site, it is estimated that the site contains approximately 590,000 artefacts. This site exhibits a large and varied artefact assemblage that represents Aboriginal occupation over a long time span, or intensive occupation of the area. The water pool at the bottom of the BIF cliff (now cemented) was said to have been present prior to its walling (Keith Mader, Walling Rock Station Owner, pers. comm.). Mr. Mader also stated that the water pool had been a reliable water source for thousands of goats, although previous white settlers/station owners had commented on its poor

capabilities as a water source (Keith Mader, Walling Rock Station Owner, pers. comm.). From this information, and the archaeological evidence, it is clear that the now man-made rock pool was once a source of water which attracted Aboriginal occupation.

The artefact assemblage is typified by flakes, retouched flakes, flake fragments, broken flakes, cores, and formal artefacts such as points, blades, scrapers, hammerstones, basal grindstones, backed blades and unifacially retouched pieces.

Material used for the production of artefacts include: Tuff, Dolerite, Quartz, Basalt, Chalcedony, Chert, Silcrete, BIF, Ironstone, Quartzite, Jasper, Clear Quartz and glass.

Several pieces of flaked glass, appearing to belong to the same vessel were observed near the stockyard. A glass shard, representing the body of an olive coloured ale glass, exhibited a unifacially flaked edge. As glass was introduced into Aboriginal toolkits during the contact period, the glass artefact indicates that Aboriginal people occupied the site post European arrival.

Sample Square	Stone Type	Artefact/s Type
1	Chert	Scraper
2	Chalcedony	Scraper
3	Chert	Core
3	Quartz	2 Broken Flakes
3	Quartz	Flake
3	Silcrete	2 Broken Flake
4	Dolerite	Flakes
4	Chert	Flake
4	Chalcedony	2 Retouched Fragments
4	Quartz	Core
4	Chalcedony	Retouched Flake
4	Basalt	Broken Flake
4	Quartz	Flake Fragment
4	Chalcedony	Flake
5	BIF	Core
5	Quartzite	Flake
5	BIF	Flake

5	Ironstone	Hammer stone
5	Silcrete	Broken Flake
5	Chalcedony	Broken Flake
5	Chalcedony	Flake
5	Jasper	Flake
5	Quartz	Broken Flake
5	Chalcedony	Core
5	Silcrete	Flake Fragment
5	Chalcedony	Retouched Flake
6	Basalt	Broken Flake
6	Silcrete	Scraper
6	Quartz	Core
6	Chalcedony	2 Retouched Flakes
6	Quartz	Flake Fragment
7	BIF	Basal Grindstone
7	Clear Quartz	Flake
7	Chert	Flake
8	Basalt	Point
8	Basalt	Broken Flake
8	Silcrete	Core
9	Chalcedony	10 Broken Flakes
9	Chalcedony	8 Flakes
9	Chalcedony	4 Retouched Flakes
9	Chalcedony	3 Flake Fragments
9	Chalcedony	8 Retouched Fragments
9	Chacedony	2 Cores
9	Quartz	3 Flake Fragments
9	Quartz	Backed Blade
9	BIF	Core
10	BIF	Basal Grindstone (44cm x 17cm x 8cm)
10	Quartz	Core
10	Chalcedony	Core
10	Chalcedony	Flake
11	BIF	Basal Grindstone (28cm x 25cm x 11cm)
11	Quartz	2 Flake Fragments
11	Quartz	2 Flakes
11	BIF	Core
12	Quartz	3 Cores
12	Quartz	2 Flakes
12	Chalcedony	Retouched Flakes
13	BIF	Basal Grindstone (27cm x 17cm x 14cm)
13	BIF	Basal Grindstone (31cm x 20cm x 7cm)
14	BIF	Basal Grindstone (29cm x 18cm x 7 cm)
14	Chalcedony	Flake
14	BIF	Core
15	Quartz	3 Cores
15	Quartz	Flake
15	Silcrete	Flake

15	Jasper	Core
15	Tuff	Point
16	Quartz	Core
16	Quartz	5 Broken Flakes
16	Quartz	3 Flakes
16	Quartz	Retouched Flake
16	Basalt	Broken Flake
16	Quartzite	Flake Fragment
17	BIF	Retouched Flake
17	Quartz	Core
17	Quartz	Flake
17	Quartz	Broken Flake
17	Chert	Flake
17	Quartz	Flake Fragment
17	Chalcedony	Broken Flake
17	Jasper	Retouched Flake
18	BIF	Core
18	BIF	2 Flake Fragmenta
18	Chalcedony	Retouched Flake
19	Chert	Core
19	BIF	2 Cores
19	BIF	2 Flake Fragments
19	Chalcedony	Flake Fragment
20	Olive Coloured Glass	Retouched Fragment
20	Clear Quartz	Retouched Flake
20	Quartz	Core
20	Quartz	2 Flake Fragments
20	Silcrete	Flake
20	Silcrete	Flake Fragment
20	Chalcedony	Flake Fragment

Table 20. AIC Site 2006. One metres sample squares results.

Boundary Point Number	mE	mN
1	247872	6764102
2	247879	6764099
3	247881	6764091
4	247873	6764083
5	247849	6764074
6	247817	6764052
7	247827	6764043
8	247846	6763976
9	247820	6763904
10	247776	6763841
11	247721	6763795
12	247631	6763746
13	247536	6763733

14	247466	6763697
15	247402	6763709
16	247386	6763771
17	247451	6763861
18	247395	6763966
19	247412	6764072
20	247427	6764159
21	247476	6764210
22	247545	6764154
23	247601	6764165
24	247682	6764133
25	247736	6764086
26	247786	6764081
27	247809	6764079

Table 21. GPS Boundary Points for AIC Site 2006.

Figure 24. Quarried Boulder. Site AIC 2006.

Figure 25. Chalcedony Blades. Site AIC 2006.

Figure 26. View East of Site.

Figure 27. Cemented Water Pool. Site AIC 2006.

Figure 28. View West of Site AIC 2006.

This site has been disturbed by the installation of the mustering yard, water trough and mining activity. Nonetheless, over half of the site's archaeological record was assessed as in-situ and unaffected by previous activities. This site provides suitable data to

conduct an empirical and qualitative study of artefacts to investigate, stone procurement and stone tool reduction, grindstone procurement, usage, curation and transportation and Aboriginal settlement patterns. The potential to answer long-term sequences of occupation/technological change is diminished by the lack of potential for stratified deposits and previous disturbance to the site. This site type is not unique in the region, although the number and range of artefacts present is not extremely common. In consideration to the above statements, this site is assessed as of Moderate archaeological significance.

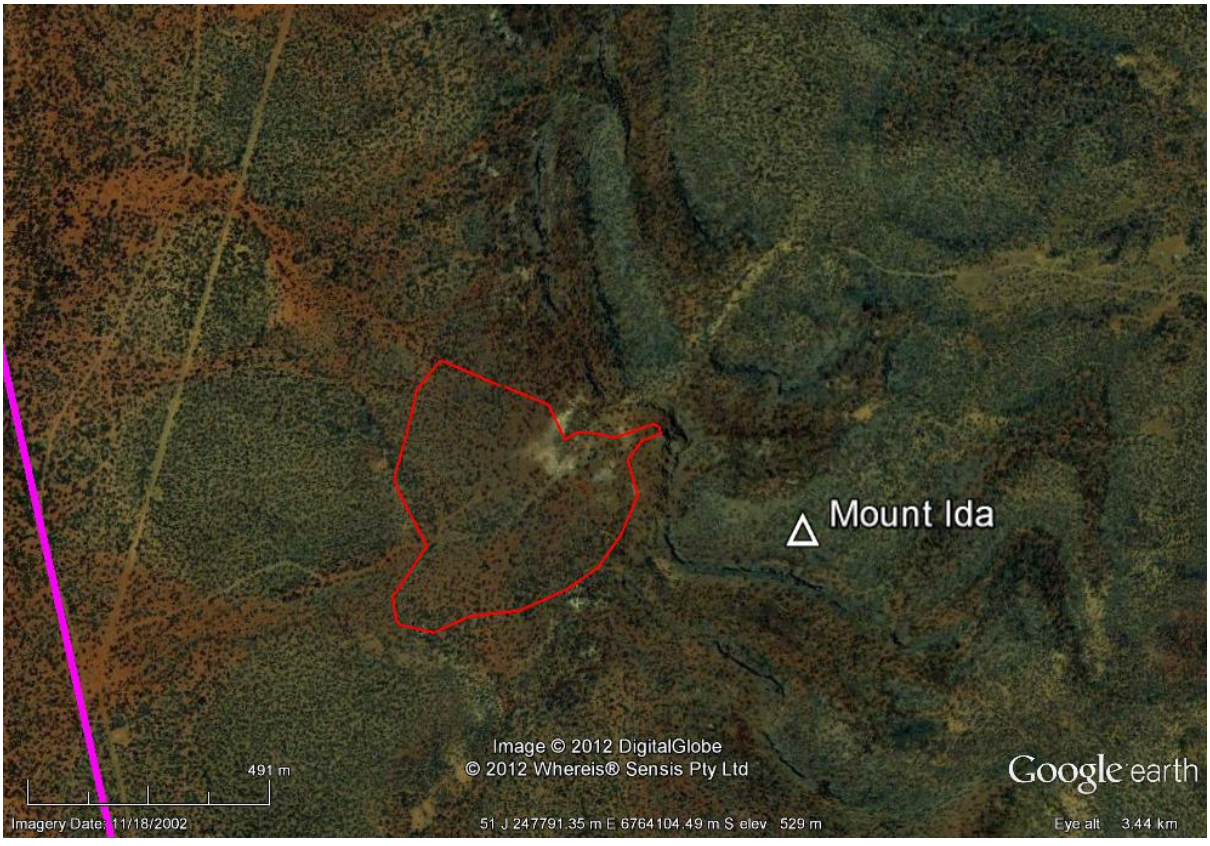

Figure 29. Aerial View of Site AIC 2006 (Google Earth 2012).

13.0 DISCUSSION

Jupiter Mines commissioned R. & E. O'Connor Pty Ltd to undertake an Aboriginal heritage survey of the proposed Mount Ida, Mount Mason and haulage road project. John Cecchi undertook the archaeological field survey between June and July 2012. As a result of the survey a total of eleven sites of Aboriginal heritage were identified and recorded. The archaeological significance of each site was assessed in order to provide suitable heritage management recommendations.

The eleven sites recorded included the following site components: Artefact Scatter (9), Grinding Material (5), Water source (4) and Rockholes (3). Most of the artefact scatter sites were identified near water sources. The assemblages near more reliable water sources exhibited significant percentages of curated items, and formal tools, including grinding basal stones, scrapers, mullers, backed blades and notched tools. Although a variety of stone resources was used to manufacture artefacts, material such as chalcedony and chert featured predominantly in the formal tool categories, whilst BIF and ironstone (both locally available) was the sole stone used for basal grindstones.

Isolated artefacts within the survey area were mainly located adjacent drainage lines that drain the elevated areas. Most of the isolated artefacts were manufactured from BIF and quartz with a notable percentage of isolated retouched flakes and cores.

Most of the basal grindstones recorded within the survey area exhibiting flat grinding surfaces. with limited polish and were not highly grooved. Veth & O'Connor (1996) have argued theories regarding the presumed functional differences between amorphous types of basal grindstones and formal grindstone that were used for the main purpose of grinding seed in the wet milling process (for example as defined by Smith 1996). The difference has been mainly associated with the grinding surface; the

latter consisting of deep groove/s whilst the other with flat surfaces. From data collected at Serpent Glen Site, northeast of Wiluna, Veth & O'Connor argue that the morphological difference between heavily grooved and flat surface grindstone is related to the availability of raw resources and not function. This assumption is based on the fact that seed grinding was an activity undertaken at Serpent Glen and most of the basal grindstones there exhibited flat grinding surfaces. Furthermore, the stone from which the grindstones were manufactured from, was locally available and grindstones were assessed to be more efficient at their earlier stages, with the grooves diminishing their grinding effectiveness. The researchers concluded that functionality of basal grindstones is not necessarily defined by their grinding surface, but on the availability of raw materials and subsequent reduction of the implement. In the context of the survey area, BIF was the preferred stone type used to manufacture grindstones, which is locally available, and with a preference for naturally uneven and rough surfaces. Further research such as residue/use wear analysis may identify starch grains, resin, cellulosic plant cells, phytoliths or other material to assess their function and/or antiquity (Veth et al 1997).

RECOMMENDATIONS

- Eleven sites of Aboriginal heritage have been identified and recorded as a result of the archaeological survey of Jupiter's Mount Ida, Mount Mason and Haul Road development.

- The Aboriginal sites recorded should not be impacted without prior Ministerial consent. Further research is recommended for sites assessed as of Moderate or High archaeological significance should Jupiter require their use.

- All sites of Aboriginal heritage are protected under the Act, whether previously registered or not. Further archaeological and ethnographic consultation may be required should any archaeological material be uncovered during the project.

- Should skeletal remain be uncovered during earth works, all works in the area should cease and the WA Police should be contacted.

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APPENDIX A DEFINITION OF ARCHAEOLOGICAL TERMS

Scarred Trees

Aboriginal scarred trees reflect several traditional activities involving the removal of bark and wood. A significant amount of Aboriginal cultural material was sourced from the bark and wood of trees to make implements such as shields, sacred boards, shelters and containers. Other scars have been recorded as toe holds made in order to climb trees, or holes within trunks used to smoke out and hunt mammals (Long 2005). Aboriginal scars occur on a variety of tree types and given the variety of purposes for which they were used, appear in a diverse range of sizes and shapes.

Scars on trees formed after the piece of bark or wood is extracted and damage to the cambium results in a drying out of the sapwood, where bark will not be able to grow back again. Overgrowth of bark surrounding the scar may occur and to such an extent to eventually close or apparently seal the wound, although this new growth will never join with the dry face underneath.

A scar on a tree can also derive from other injuries the bark receives, for example via lighting strike, fire damage, collapse of branches or other trees onto trunk, vehicle collision, surveyors marks, ring barking and faunal damage. Given these considerations, it is sometimes difficult to accurately identify a scarred tree as of Aboriginal, European or natural origin.

Long (2005) provides the following guidelines to assess the whether a scar on a tree is from natural or incidental types of scarring:

- What impacts have occurred in the vicinity of the scar?

- How old is the tree on which the scar occurs, and how long has the scar been there?

- What impacts have occurred to the tree, and can you work out the order in which they have occurred?

-Can you identify the form and size of the original scar on the tree?

An epicormic shoot or stem will be located immediately below a section of damaged trunk which interrupts the connection between the roots and the canopy and is a common feature associated with cultural scars (Long 2005).

If the scar occurs on a dead tree, an arborist could perhaps indicate when the tree died, how old the tree was at the time of death and provide an estimate of the time between scarification and death of the tree. This information would provide a possible time span for the production of the scar on the tree. C-14 dating and growth ring counting can provide accurate dates for the age of the tree.

A **Quarry** may occur wherever outcrops of suitable stone are found. These exhibit a concentration of primary flakes in the artefact assemblage with a relative dense concentration, and may contain the original quarried stone exhibiting hundreds of flake scars.

Because rocks and minerals can fracture as a result of geomorphic or other natural processes flaked stones are classified as **stone artefacts** if they exhibit one or more of the following features (Holdaway & Stern 2004: 108-9):

A positive or negative ring crack

A negative or positive bulb of percussion

An érraillure scar below the point of percussion

Negative flake scars or ridges

Flakes, Cores and Retouched flakes (Tools), are the three main categories of artefacts and their features are detailed below (Hiscock 1984: 129):

Flakes must exhibit at least one of the following traits:

A ring crack

A positive bulb of percussion

An érraillure scar below the point of percussion

Cores exhibit negative flake scars marking the place where previous flakes were struck. A core may be described as Unidirectional, Bidirectional, Bifacial or Multidirectional depending on the orientation of the flake scars and location of the striking platform (Holdaway & Stern 2004:180-2).

Retouched Flakes, also classified as Tools, are stones that show signs of flake scars across their ventral surface and display a ring crack.

Grindstone Attribute Legend

Grindstone Surface refers to the natural or manmade appearance of a grinding surface. These may be described as flat, pitted or irregular. Flat surfaces are obtained from pieces of stones that naturally exhibit flat surfaces or that have been heavily reduced. The latter can usually be recognised by polish and glazing. Further reduction through grinding will cause discrete worn surfaces described as grooves. Some stone surfaces may be irregular as they are naturally rough or uneven. Pitted surfaces are those that underwent rejuvenation via pecking. Polish level refers to the amount of visible polish on the grindstone surface. Highly polished surfaces are the result of heavily worked grinding stones where a silica residue has formed on the top surface of the grinding surface. The grinding patch refers to the area of stone that become extremely smooth as a result of grinding, that may also exhibit polish.

APPENDIX B DIA SITE REGISTER RESULTS

Appendix J: Aboriginal Heritage Survey Report

JCHMC

REPORT ON AN ARCHAEOLOGICAL SURVEY OF JUPITER MINES LIMITED MOUNT MASON, MOUNT IDA WEST AND HAULAGE ROAD

AUGUST 2012

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This report does not constitute legal advice. All opinions presented in this report are the author's and do not necessarily reflect the views of the Company.

All co-ordinates given by this reports are MGA Zone 51, referenced to WGS 84, which approximates to GDA 94, or GDA 94.

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EXECUTIVE SUMMARY

R. & E. O'Connor Pty Ltd were commissioned by Jupiter Mines Limited (Jupiter Mines) to undertake an Aboriginal heritage survey of Mount Mason (M29/408) & Mount Ida (E29/560) tenements and the proposed Jupiter Haul Road. John Cecchi Heritage Management Consultancy was employed to conduct an archaeological investigation of the proposed project area in order to identify and record sites of Aboriginal heritage, and assess potential Aboriginal heritage issues relevant to the project. The current report aims to provide Jupiter with information and recommendations that will enable the company to meet the provisions of the *Aboriginal Heritage Act 1972*.

The survey area is located in the Yilgarn Region of Western Australia, eighty kilometres northwest of Menzies, west of Lake Ballard, and encompasses a twenty-three square kilometre area.

An investigation for previously registered sites situated within thirty kilometres of the survey area was undertaken via the Department of Indigenous Affairs (DIA) Site Register. As a result, three Lodged Status listings were analysed at the DIA Site Register Office in East Perth. The listings refer to zones outside the survey area that will not be impacted by the Jupiter's project and no previously recorded sites were identified within the survey area. The region's archaeological, environmental and geological background were researched, to formulate predictions about Aboriginal site patterning, and to provide the basis for the assessment of significance of archaeological sites.

The field survey employed a systematic purposive and probabilistic pedestrian transect methodology. Pedestrian transects spaced one hundred metres apart and aligned east west were carried out to survey the Mount Ida and Mount Mason tenements. Transect spacing were increased to 150 metres within areas of flat sand plain country that held

high ground visibility and lower potential for Aboriginal heritage sites. Purposive pedestrian transects, spaced eighty metres apart, were carried out along the proposed haul road route. All transects were guided by a Garmin GPS Map76CSx accurate to ten metres, employing GDA 94, referenced to MGA Zone 51. Cadastral aerial maps with GPS boundary co-ordinates, topographic maps and small and large scale aerial maps, aided in both the formulation of the methodology and during the field survey.

Archaeologist John Cecchi undertook the survey in two field trips, between June and July 2012. The field assessment identified and recorded forty-eight isolated artefacts and eleven sites of Aboriginal heritage. These sites have been recorded in detail and the information will be forwarded to the DIA Registrar. The Registrar, with the ACMC, hold the duty to determine whether these areas represent 'sites' as defined by s5 of the Aboriginal Heritage Act 1972.

The eleven Aboriginal sites recorded during the survey included the following site components: Artefact Scatter (9), Grinding Material (5), Water source (4) and Rockholes (3). The artefact scatter sites recorded are associated with ephemeral or semi-permanent water sources.

An archaeological survey of an area reported as an ethnographic site by AIC in 2006 resulted in the identification and recording of one Aboriginal heritage site with an artefact scatter, grinding material and a water source component.

In total, the field survey identified and recorded eleven archaeological sites of Aboriginal heritage. These areas should not be disturbed, unless the Minister under s18 of the Act has granted prior consent.

Sites that have been assessed as of Moderate to High archaeological significance should receive further archaeological investigation prior to being considered for use under s18 of the Act. Site Menzies Road One and Menzies Road Two, have only been partially recorded and appear to be extensive Aboriginal sites associated with water sources atop the granite outcrop. These sites should be recorded in full to properly assess their significance and extent, and determine the level of disturbance from the proposed project. If feasible Jupiter should modify the proposed haulage road route to avoid impacting the Aboriginal heritage sites recorded.

1.0 INTRODUCTION

Mount Mason Hematite and Mount Ida Magnetite Projects owned by Jupiter are part of the larger Central Yilgarn Iron Project (Figure 1). The current scope relates to Mt Mason (M29/408) and Mt. Ida (E29/560) tenements, which are located approximately 100 km northwest of Menzies. The project is currently in feasibility phase with operations expected to begin in early 2013.

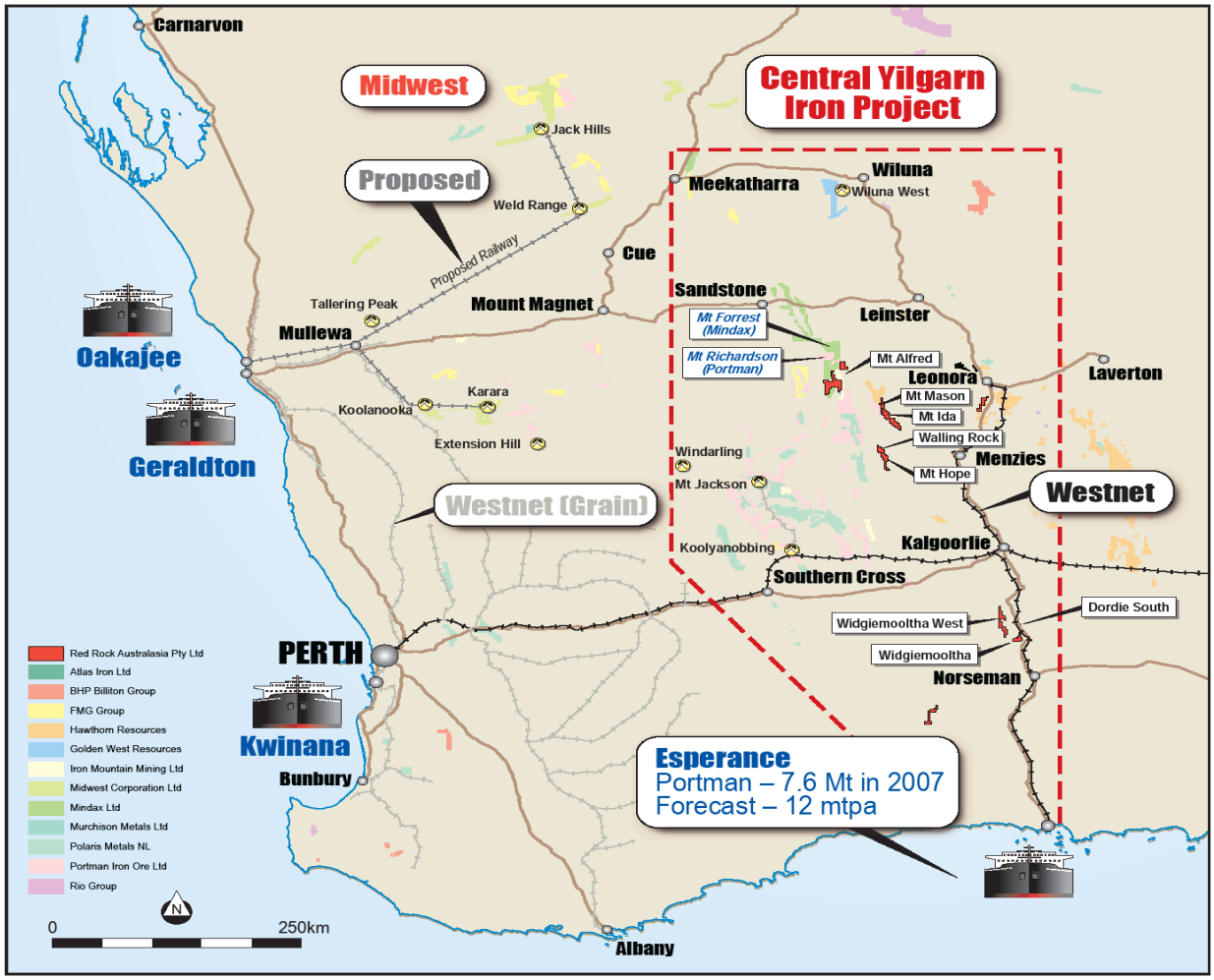

Figure 1. Locality Map

The Mt Mason survey area covers 2.2 square kilometres. The Mt. Ida survey area covers approximately 16.1 square kilometres of land, west of Mt. Ida Trig Point. The proposed haul road has been allocated a fifty metre buffer on either side of the alignment to allow for potential movement and is approximately twenty five kilometres in length (Figure 2).

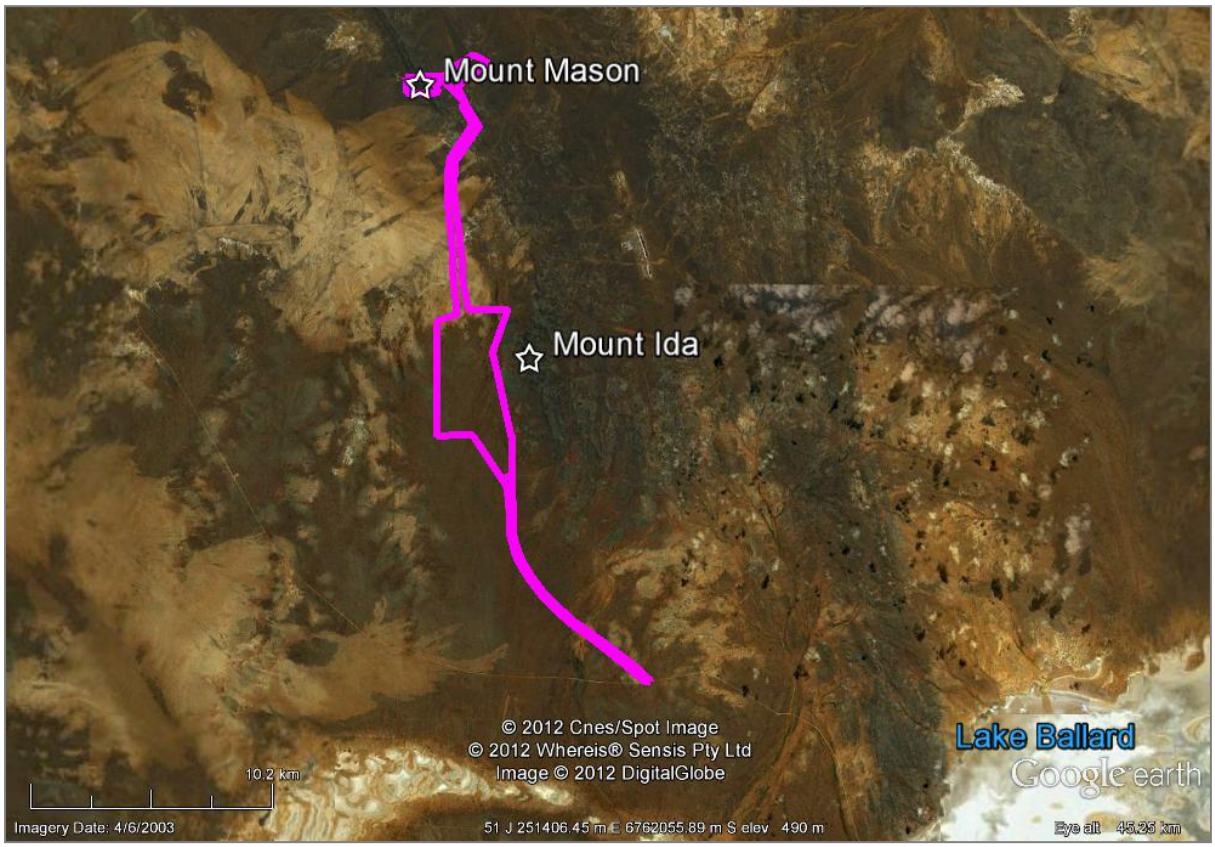

Figure 2. Mt. Mason, Mt. Ida and Haul Road Survey Area (Google Earth 2012)

1.1 Brief

Jupiter Mines commissioned R. & E. O'Connor Pty Ltd to undertake an archaeological Aboriginal heritage survey of the proposed Mount Ida, Mount Mason and haul road project.

As stated in the DIA website (DIA 2011) the aim of an archaeological Aboriginal heritage survey is to:

- *Establish whether a given piece of land contains physical evidence of past Aboriginal occupation and land use (archaeological sites).*
- *To record, assess and make recommendations regarding the management of archaeological sites.*

- *To provide a developer with sufficient information on which to base development planning decisions.*

2.0 ENVIRONMENTAL BACKGROUND

The survey area is characterised by a semi-arid Mediterranean climate, with average rainfalls of 250mm annually, precipitating over one to three months of the year (Beard 1990). Winters are mild and summers are hot and dry with maximum temperatures reaching 45°C, leading to high evaporation rates (Beard 1990). Winter rains are associated with cold fronts whilst, infrequently, thunderstorms may provide heavy falls during summer.

The survey area is located within the Yilgarn Craton, a crustal unit stable since the Proterozoic, formed by intersecting bands of granite and greenstone. The latter tend to form ridges whilst the granitoids may form monolithic or flat pavement features.

The vegetation surrounding the survey area falls within the Murchison Region of the Eremaean Province (Beard 1990). The province is characterised by low woodland or tall shrublands of mulga (*Acacia aneura*) on red loams. The undulating sandplains sustain scattered mulga and mallee (*Eucalyptus kingsmills*) over hummock grasslands. Mixed communities of low open woodlands of mulga and bowgada with heath and spinifex are characteristic of the sand plains (Payne, et. al., 1998).

3.0 HISTORICAL BACKGROUND

John Forrest was the first European to record his visit to the survey region in 1869, naming Mount Ida. An excerpt of his of his memoirs 'Explorations in Australia' (Forrest 1875) reads:

MOUNT IDA.

15th.
Saddled up at daybreak, and steered about South-East towards a high range of hills about ten miles distant. I named it Mount Ida, and from the summit I took a round of angles with my pocket sextant. On all the hills in this neighbourhood the local attraction is so great that the prismatic compass is useless. Found a fine spring of water on south side of Mount Ida, in an almost inaccessible spot. After giving the horses two hours' rest we continued our journey North 154 degrees East magnetic for eight miles to a granite range, where, after a diligent search, I found two water-holes, and bivouacked, with good feed around the rocks.

16th.
Saddled up at sunrise, and steered to some trap ranges, North 124 degrees East, about seven miles distant, from which I could see an immense lake running as far as the eye could reach to the eastward, and westerly and northerly, most probably joining Lake Barlee. Not being able to proceed farther southward, on account of the lake, I steered in a northerly direction for twenty miles, but, discovering neither feed nor water, bivouacked in a thicket, and tied up our horses.

17th.
At dawn, found that my horse Sugar, after breaking his bridle, had made off towards our bivouac of the 15th. Placing my saddle on Jemmy's horse, we followed on the track for six miles, when we came to a few granite rocks, with a little water on them, from rain that had fallen during the night. At this place Morgan was left with the horses and our guns, while Jemmy and I followed on Sugar's tracks, taking only a revolver with us. After travelling on the tracks for two miles we overtook him, and with a little trouble managed to catch him. On reaching the spot where we had left Morgan, we found him with the three double-barrelled guns on full cock, together with his revolver, in readiness. On being asked what was the matter, he stated "Nothing," but he was ready to give the natives what he called "a warm attachment." After having breakfast we steered North-North-West for about twenty miles, and reached camp at 5 p.m., and found all well. Rained a little during the day.

By 1896 Mount Ida Town was gazetted twenty-one kilometres north of Mount Ida, due to gold being discovered in the region and the subsequent influx of some 200 prospectors to the area. The Mount Ida hotel was constructed in 1908 and the town later became abandoned. Several gold and mineral mining companies currently operate in the region.

4.0 ARCHAEOLOGICAL BACKGROUND

Early aboriginal occupation of the arid and semi-arid region of Australia has been dated to 25,000 BP from sites such as the Newman Rockshelter in the Pilbara (Maynard 1980). Archaeological excavations at Puntutjarpa in the Gibson Desert (Gould 1977) and at Walga Rock (Bordes et al 1983) have yielded dates of around 10,000 BP.

Researchers (Gould 1980) have elaborated a rain-chasing model to describe the type of Aboriginal adaptation to arid and semi-arid regions. The model proposes an opportunistic water exploitation system, where ephemeral and semi-permanent water sources were utilised prior to the more reliable and permanent sources (Gould 1980, Veth 1989).

Aboriginal colonisation theories for arid and semi-arid ecosystems have been widely debated. Smith (1988) has suggested that availability of water during an earlier lacustral phase would have allowed Aboriginal occupation of the interior of Australia by 12,000 years BP. Occupation of desert lowlands before and during the last glacial maximum would have been abandoned until the amelioration in climate c.15,000 to 7,000 years BP.

Veth (2000) postulated a different model whereby the initial colonisation of the arid regions occurred during the more favourable climatic period of the late Pleistocene,

from approximately 25,000 years ago, with a retreat to less arid areas during the 22,000 to 13,000 BP period, and a re-occupation of marginal lands between 13,000 to 5,000 BP. From 5,000 to 1,500 BP all desert ecosystems are thought to have been inhabited due to a re-establishment of regional networks and an intensification of site occupation, ceremonial gatherings and long distance exchange, inferred from an increase in late Holocene dated sites and an increase in artefact densities and assemblage complexity (Veth 2000).

Several dated sites within the survey region have yielded Holocene dates in the range of 2,000 BP near Leinster (Liberman et al 1977) to 500 BP near Hyden (Bowdler 1989) and 1570 BP at Windimurra (Harris 2002).

According to previous research, the archaeological mark of a rain-chasing model of occupation includes a higher number of low-density artefact scatters around ephemeral water sources and larger sites associated with more permanent water bodies.

5.0 PREVIOUSLY RECORDED SITES

The following items listed on the DIA Site Register are located within thirty kilometres of the survey area (Results printed as Appendix B):

- DIA Site ID 20698 'Anaconda 4' is a Lodged Status listing placed under Open Access. The site is located at MGA Zone 51 236386mE 6785358mN and the co-ordinates are defined as 'Unreliable'. This listing is described as a gnamma hole east of Perrinvale Road, thirty kilometres north of Mount Ida.

- DIA Site ID 20701 'Anaconda 7' is a Lodged Status listing placed under Open Access. The DIA file held the following site description:

  "*The site is about twenty eight kilometres north of Mt. Ida. On east side of the main road is a lone detached granite boulder of large size, about three or four metres in diameter...This boulder represents a metamorphosed character of the Aboriginal creation era...The boulder is an important Aboriginal site and both it and its adjacent escarpment feature must be protected from impact'.* The area was reported in the Ngalia Heritage Research Council Document (Muir 1999) as being centred upon MGA Zone 51 237892mE 6785208mN.

- DIA Site ID 23650 'Menzies Road Soak' is reported as a mythological area centred upon MGA Zone 51 238130mE 6755640mN. This site was first reported by AIC (2005) and the Koara Native Title Claimant Groups. Geraldine Hogarth stated that the soak was connected with a story line that runs from the hills ten kilometres to the east. The soak was reported to be dry.

6.0 PREVIOUS HERITAGE SURVEYS

Jupiter has commissioned several Aboriginal heritage surveys and desktop studies in relation to previous exploration programs in the area. These following reports were made available to the archaeologist:

- Australian Interaction Consultants 2006 *"Report of a Site Identification Survey with the Wutha Native Title Claimants of a Proposed Exploration Drilling around Mt Ida and Mt Mason, Western Australia*."
- Gleason & Associates Pty Ltd 2011 *"Report of an Ethnographic Heritage Survey (Wutha Native Title Claimants) and an Archaeological Field Assessment of Jupiter*

Resources Mt Ida Project Area (portions of M29/414) southwest of Leonora, Western Australia."

- Glendenning, W. 2007a *"A Report of an Ethnographic Survey of a Proposed Mineral exploration Project at Mt Ida, near Menzies."* Western Heritage Research for Jupiter Mines
- Glendenning, W. 2007b *"A Report of an Ethnographic Survey of Tenement E29/495 at Mt Mason."* Western Heritage Research for Jupiter Mines
- Land Access Solutions 2011 *"Aboriginal Desktop Analysis – Jupiter Mines Tenements M29/408, M29/414, E29/560, E29/801 and G29/022."* Justin Cvitan & Phil Czerwinski for Jupiter Mines

Previous surveys have involved consultation with Wutha and Wongatha Aboriginal stakeholders. The desktop prepared by LAS (2011) recommended that archaeological and ethnographic surveys should be commissioned to investigate proposed disturbance zones to address the potential to disturb unrecorded Aboriginal heritage sites.

Two relevant heritage survey reports were analysed at the DIA office, both commissioned concerning mining and exploration developments by private companies (Muir 1999, Mattner 2009).

No sites of archaeological significance have been previously recorded within the survey area. One ethnographic site was reported by AIC in 2006 and this site is likely to exhibit an archaeological component, since it is associated with a fresh water source.

7.0 METHODOLOGY

The Mount Mason and Mount Ida tenements were surveyed via pedestrian transects aligned east west and spaced one hundred metres apart. When open and flat sand plain country was encountered transects spacing were adjusted to 150 metres apart, given the perceived low potential for sites and high ground visibility. The proposed haulage road was surveyed via purposive pedestrian transect along its route, with transects spaced approximately eighty metres apart.

The field survey was undertaken with the assistance of a Garmin GPS Map 76CSx, employing GDA 94 and referenced to MGA Zone 51, accurate to ten metres. The survey was also aided by small and large scale maps and aerial and cadastral maps of the survey area.

8.0 ASSESSING ARCHAEOLOGICAL SIGNIFICANCE

Assessment of site's significance forms the basis of the recommendations made by this report. The standard applied is based on a site's representativeness and research potential (Bowdler 1984). Site significance is therefore assessed on present knowledge of sites within the area, archaeological techniques, theory and method, all of which may vary in time.

During the survey, the significance of archaeological sites was analysed in regards to its potential to answer the following research questions:

-When was the region initially occupied by Aboriginal people?

-How did economies adapt to environmental and climate changes?

-How do occupational patterns reflect this?

-What stone tool technologies and reduction practices were employed in the area?

-What are the characteristics and what accounts for variables in stone tool production within assemblages and over time?

9.0 RESULTS

As a result of the field survey forty eight isolated artefacts and eleven archaeological sites of Aboriginal heritage were identified and recorded. In the next two chapters details of the results are presented.

10.0 ISOLATED FINDS

Artefact Type	Stone Type	Co-ordinates (mE mN)	Landform
Flake	Quartz	242953 6776345	Ridge
Flake	Quartz	245185 6777105	Ridge
Retouched Broken Flake	Quartz	245316 6777063	-
Core, Broken Flake, Flake Fragment	Quartz	245308 6776923	-
Flake	Chert	245308 6776923	-
Retouched Broken Flake	Basalt	245200 6776842	-
Flake Fragment	Quartz	245200 6776842	-
Retouched Broken Flake	Quartz	245203 6776849	-
Two Cores	BIF, Quartz	245114 6776800	-
Core	Chalcedony	244623 6776356	Slope
Core, Broken Flake	Quartz	244762 6776472	Creek
Retouched Broken Flake, Core	Quartz	244794 6776424	Creek

Broken Flake	Quartz	244330 6776096	-
Retouched Broken Flake, Core	BIF	244815 6776338	Creek
Two Flake Fragments	Quartz	244649 6776026	-
Two Cores	BIF	244991 6776258	-
Retouched Flake	Chert	245547 6776699	-
Broken Flake	Quartz	242585 6775869	-
Flake, Core, Flake Fragment	Quartz	242582 6775793	-
Flake	Silcrete	242582 6775793	-
Two Flakes	Quartz	242608 6775751	-
Flake	Quartz	245179 6774025	-
Core	Quartzite	245226 6774127	Near Creek
Retouched Flake	BIF	245247 6774149	Near Creek
Core	BIF	245282 6774687	-
Broken Flake, Flake	Quartz	245318 6774757	-
Three Broken Flakes	Quartz	245589 6774326	-
Flake	BIF	245589 6774326	-
Broken Flake, Flake	Quartz	45504 6774206	Near Creek
Two Flakes	BIF	245033 6773477	-
Core	BIF	245288 6773826	Near Drainage Line
Retouched Flake	BIF	245243 6773921	Near Drainage Line
Core	Granite	246215 6760888	Sandplain/Woodland
Core	Silcrete	246212 6762289	Sandplain/Woodland
Core	Silcrete	244777 6762294	Sandplain/Woodland
Core	Granite	245261 6762500	Sandplain/Woodland
Core	BIF	246499 6762489	Open Woodland
Flake	BIF	246654 6762489	Near Creek

Retouched Flake	BIF	245845 6762970	Open Woodland
Flake	BIF	245796 6763199	Floodplain
Flake	BIF	245958 6763221	Floodplain
Flake	Chalcedony	246080 6763201	Near Creek
Muller Fragment	Basalt	250375 6753563	Near Creek
Muller Fragment	Basalt	250610 6753394	Near Creek
Core	BIF	250552 6753302	Near Creek
Flake	Silcrete	244587 6763745	Sandplain/Woodland

11.0 SITES RECORDED

11. 1 Mount Mason Isolated Scatter

MGA Zone 51 242666mE 6776205mN

This area contains some thirty-five quartz artefacts on the eastern slope of a ridge running northeast-southwest. A creek line is located one hundred metres to the northwest, and a cleared track is located five metres north of the artefact scatter. The vegetation comprises acacia open woodland with scattered bushes, atop iron stone gibber soils. Ground visibility was good at approximately 60%. The artefact scatter covers an area nine metres north south by eighteen metres east west. The assemblage was analysed by placing three one metre sample squares over higher concentrations of artefacts to record artefact stone type, numbers and artefact category (Table One).

Sample Square	Stone Type	Artefact Type
1	Clear Quartz	Flake
1	Clear Quartz	Flake
1	Clear Quartz	Flake
2	Quartz	Core
2	Quartz	Core
2	Clear Quartz	Flake Fragment
3	Clear Quartz	Broken Flake
3	Clear Quartz	Flake
3	Clear Quartz	Broken Flake

Table 1 Mount Mason Isolated Scatter artefact scatter sampled.

Figure 3 Quartz Flake. Site Mount Mason Isolated Scatter.

Artefact densities sampled varied between two to three artefacts per metre square, with average site density estimated at 0.24 artefacts per square metre.

Four flakes, two cores, one flake fragment and two broken flakes were recorded via the sample squares. The assemblage is comprised exclusively of quartz that is locally available and common in artefact scatters in the region. Given the limited number of artefact and common artefact types this site is likely the result of a single reduction event.

This site is represented elsewhere and does not contain sufficient data to answer important scientific questions. Given the above analysis, this site is assessed as of negligible archaeological significance.

Boundary Point Number	mE	mN
1	242657	6776208
2	242654	6776203
3	242657	6776198
4	242665	6776199
5	242672	6776202
6	242666	6776208

Table 2 Site Mount Mason Isolated Scatter Boundary Polygon

11. 2 Mount Mason East

MGA Zone 51 245133 6776341

This site exhibits a scatter of thirty stone artefacts manufactured from dolerite, BIF and quartz. The area is located in open, undulating land with ironstone and quartz gibber soils and a patch of sparse gum trees situated on elevated ground to the north of the site. The area held good ground visibility estimated at over 65%.

The artefact scatter covers an area fifty metres north south by forty metres east west. Four one-metre square samples were undertaken at the site to assess its assemblage.

Sample Square	Stone Type	Artefact Type
1	BIF	Flake
1	Dolerite	Broken Point
2	Dolerite	Flake
2	Dolerite	Flake
2	Dolerite	Flake
2	Dolerite	Flake
2	Dolerite	Flake
2	Dolerite	Flake
3	Dolerite	Flake Fragment
3	Dolerite	Flake
3	Quartzite	Core
4	Dolerite	Core

Table 3 Artefact Sampled at Mount Mason East

Artefact densities per square metre varied from one to six artefacts, with an overall site density calculated at 0.02 artefacts per metre square. Dolerite flakes dominate the assemblage, with one broken dolerite point also recorded. This site is interpreted as a

reduction area used on a single occasion. The number of artefacts, artefact stone type and artefact types are common in the region and represented in larger, more complex assemblages. This site does not have the potential to answer significant scientific questions and consequently it is assessed as of Low archaeological significance.

Boundary Point Number	mE	mN
1	245110	6776343
2	245119	6776365
3	245134	6776370
4	245140	6776368
5	245149	6776360
6	245154	6776354
7	245147	6776339
8	245140	6776326
9	245134	6776319
10	245123	6776326

Table 4 Site Mount Mason East Boundary Polygon

Figure 4 Broken dolerite point. Site Mount Mason East

Figure 5 Quartzite Core. Site Mount Mason East

11.3 Mount Mason Rockholes

MGA Zone 51 242655mE 6775842mN

At the given co-ordinates two rockholes were recorded on a small section of granite pavement. The site is located on a south-southwest slope covered by some granite rocks and pebbles, sparsely vegetated by acacia and gum trees with 90% ground visibility.

Rockhole One exhibited a cavity fifteen centimetres by fifteen centimetres wide and twelve centimetres deep. Rockhole Two measured twenty centimetres by twelve centimetres wide by fifteen centimetres deep. Together, the rockholes can hold approximately twenty litres of water after rain, where the water would be available for a limited period of time, depending on factors such as evaporation rates, season and climate.

Rockhole sites are widely represented in the region, commonly exhibiting larger cavities and in sites that exhibit repeated and/or prolonged Aboriginal usage. This site is assessed as of Low archaeological significance.

Boundary Point Number	mE	mN
1	242644	6775829
2	242660	6775828
3	242664	6775844
4	242663	6775853
5	242650	6775851
6	242645	6775844

Table 5 Site Mount Mason Rockholes Boundary Polygon

Figure 6 Rockhole One. Site Mount Mason Rockholes.

11.4 Artefact Scatter Polly

MGA Zone 51 244944mE 6775444mN

The site consists of a low density artefact scatter with approximately seventy artefact manufactured from a variety of stone including quartz, basalt, chalcedony, BIF, chert, silcrete and ironstone. The site is located on an elevated open area, sloping downwards on its east and west boundaries. The area is vegetated by sparse gum trees and some

acacias and shrubs over gibber soils. Ground visibility at the site was very good at 70%. The site is located twenty metres west of a north-south creek and covers an area approximately 130 metres northwest-southeast, by seventy metres wide. The east, west and south boundary recorded for the site correspond to the limit of the survey area and do not necessarily reflect the full extent of this site.

Seven, one-metre sample squares were undertaken at the site to characterise the assemblage.

Sample Square	Stone Type	Artefact Type
1	Quartz	Broken Flake
1	Quartz	Broken Flake
1	Quartz	Broken Flake
2	Basalt	Retouched Flake
3	Chalcedony	Retouched Flake
3	BIF	Core
4	BIF	Core
4	Silcrete	Broken Flake
4	Silcrete	Retouched Flake
4	Quartz	Broken Flake
5	BIF	Core
6	Silcrete	Retouched Flake
6	Chert	Flake
7	Ironstone	Broken Flake

Table 6 Artefact Scatter Polly. Artefact scatter sampled

The stone types used to manufacture the artefacts are widely represented in the region, and most are available locally. The artefact densities recorded varied between one to four artefacts per metre square, with a sample average of 1.8 artefacts per square metre. From the artefact types sampled this site is interpreted as a short term camping spot associated with an ephemeral creek line, where mundane tasks were undertaken. One chalcedony and one basalt scraper indicate that wood, bone or skin working may have been undertaken at the site. The amount of retouched flakes in the assemblage is be interpreted as curation of a particular stone type, possibly of more exotic provenance or of favoured flaking characteristics. The cores present indicate flake manufacture, and the relatively high percentage of cores in the assemblage is probably related to the local availability of BIF stone in the area. Given the limited number of artefacts, artefact types and very low artefact densities, this area displays an assemblage typical of a temporary/transient camping spot, possibly occupied over several days or episodes, when water would have been available at the nearby creek. This site type is widely represented in the region and the data available is of limited research potential. Given the assessments above this site is allocated a Low level of archaeological significance.

Boundary Point Number	mE	mN
1	244871	6775529
2	244937	6775550
3	244994	6775437
4	244945	6775421
5	244877	6775488

Table 7 Site Mount Mason Artefact Scatter Polly Boundary Polygon

Table 8. Chalcedony flake. Artefact Scatter Polly.

11.5 Site MKI

MGA Zone 51 245041mE 6773832mN

A low-density artefact scatter containing an estimated seventy artefacts was recorded on a mound gently sloping downhill to the north, towards an east-west drainage line. The area's vegetation comprises an open low woodland of acacias and shrubs, over ironstone gibber soils. The site extends fifty metres east west by thirty metres north south. Ground visibility at the site was very good at 80%.

Seven one-metre sample squares were undertaken at the site to analyse the assemblage.

Sample Square	Stone Type	Artefact Type
1	Dolerite	Flake
2	Quartz	Core
2	Quartz	Core
2	Quartz	Broken Flake
2	Quartz	Flake
3	BIF	Core
4	Quartz	Flake Fragment
4	Basalt	Flake
5	Quartz	Broken Flake
5	Quartz	Broken Flake
6	BIF	Core
7	Quartz	Core

Table 9 Site MKI. Artefact scatter sampled

Quartz is the most abundant raw material used to produce artefacts, followed by BIF, dolerite and basalt. Both quartz and BIF are naturally occurring in the area and this may explain the abundance of cores present. Sample squares recorded median densities of one artefact per metre square, although overall artefact density for the site is estimated at 0.05 artefacts per square metre.

The low density of the scatter, composed of basic artefact types with no retouch or signs of usage, suggests that this was used opportunistically to manufacture/rejuvenate artefacts made from locally available stone. As such, this site is widely represented in the region and is assessed as of negligible archaeological significance.

Boundary Point Number	mE	mN
1	245027	6773842
2	245053	6773852
3	245073	6773849
4	245089	6773829
5	245073	6773818
6	245055	6773820
7	245033	6773817

Table 10. Site Mount Mason Site MKI Boundary Polygon

Figure 7. Aerial Map of Site MKI (Google Earth 2012).

11.6 Elena Site A

MGA ZONE 51 244892mE 6773371mN

This area was recorded as an artefact scatter and water source site. The site comprises ironstone and quartz gibber soils overlain by sparse mulga trees with little undergrowth and an open canopy, allowing for very good ground visibility. The scatter is located on a slightly elevated position sloping southwest.

A soak fifteen centimetres deep, 2.25 metres wide and 1.5 metres long, was recorded at MGA Zone 51 244994mE 6773335mN. The soak is located on a drainage line flowing downhill southwest. The southern part of the soak appears to have been walled with a row of granite rocks and is silted with earth. The area contains an artefact scatter that extends 270 metres east west by 220 metres north south. The site is located to the east of Metzke Road and bounded to the south by an east west road leading into Jupiter Mines' Camp Cassini.

Several thousand artefacts are estimated to be present at the site and overall site densities are estimated at 0.4 artefacts per metre square. Eleven one metre square samples were taken to characterise the artefact assemblage. Artefact densities at the site ranged from one artefact per square metre to seven per square metre with an overall sample average of 3.27 artefact per square metre.

Qartz, Chalcedony, BIF, Granite, Silcrete, Clear Quartz, Quartzite, Ironstone, Dolerite, Basalt and Chert stone artefacts are present at the site, with over half of the artefacts manufactured from BIF (33%) and Quartz (17%). Artefact types included flakes, cores, broken flakes, flake fragments and retouched/used tools. Four basal grindstones were recorded. These were manufacture from BIF and Ironstone, both locally available lithics. The basal grindstone stones exhibited flat grinding surfaces with some polishing

and glazing. This may suggest that they were left at their earlier part of the reduction sequence (see Discussion section), and given surface pitting, may have been rejuvenated or used for a variety of purposes additional to seed grinding. A high percentage of cores (20%) in the assemblage indicate that flake/tool production occurred at the site, from both local and nonlocal stone resources.

This site comprises an extensive, medium to low density, artefact scatter with notable percentages of grindstones and cores, and artefacts produced from a variety of raw materials. The area is associated with a fresh water source, and has evidence for repeated usage. Further archaeological research may lead to a greater understanding of artefact reduction strategies, group mobility and seasonality, grindstone usage and antiquity of occupation. This site is therefore assessed as of moderate archaeological significance.

Sample Square	Stone Type	Artefact Type
1	Quartzite	Core
1	Quartz	Flake
1	Chalcedony	Retouched Flake Fragment
2	Quartzite	Basal Grindstone
3	BIF	Basal Grindstone
3	Clear Quartz	Flake Fragment
3	Quartz	Broken Flake
4	Ironstone	Basal Grindstone (27x16x8)
4	Clear Quartz	Broken Flake
5	BIF	Retouched Flake
6	BIF	Basal Grindstone (8x6x4)
6	BIF	Flake
6	Quartz	Flake
7	Dolerite	Flake
7	Quartz	Broken Flake
7	Granite	Flake Fragment
8	Silcrete	Core
8	BIF	Core
9	Chert	Flake Fragment
9	Quartz	Flake
9	Silcrete	Core
9	Silcrete	Core

9	Quartz	Flake Fragment
9	Clear Quartz	Core
9	BIF	Flake
10	BIF	Broken Flake
10	BIF	Broken Flake
10	BIF	Flake
10	BIF	Flake Fragment
11	Basalt	Core
11	Silcrete	Flake
11	Chert	Retouched Flake
11	Chert	Flake
11	Ironstone	Broken Flake
11	BIF	Core
11	BIF	Flake

Table 11. Site Elena A. Artefact scatter sampled.

Boundary Point Number	mE	mN
1	244926	6773250
2	244908	6773255
3	244897	6773258
4	244871	6773285
5	244855	6773292
6	244836	6773312
7	244801	6773352
8	244742	6773385
9	244736	6773406
10	244762	6773433
11	244807	6773475
12	244847	6773505
13	244939	6773476
14	244970	6773458
15	245029	6773415

Table 12. Elena Site A Boundary Polygon

Figure 8. BIF Core. Elena Site A

Figure 9. Silcrete Flake. Elena Site A.

Figure 10. Water Soak looking North. Elena Site A.

11.7 Elena Site B

MGA ZONE 51 244740mE 6773297mN

This area consists of an artefact scatter containing a variety of artefact and stone types, associated with the fresh water source recorded under Elena Site A. Elena Site B is located to the east of Metzke Road, and to the south of the access road into Camp

Cassini. The vegetation at the site consists of Acacias trees with sparse Eremophila shrubs. The landform comprises a floodplain draining in a west-southwest direction. Visibility was very good estimated at 70%.

The site contains artefacts made of BIF, Ironstone, Quartzite, Quartz, Silcrete, Clear Quartz, Chalcedony, Chert and Jasper. Twelve, one metre sample squares were placed over the site to gain a representative sample of the assemblage. Forty-one artefacts were recorded. Artefacts at the site were produced from BIF (27%) and Quartz (22%), with smaller percentages manufactured from Silcrete, Quartzite, Jasper, Ironstone, Chert and Chalcedony. The entire sample of the chert, jasper and chalcedony artefacts (five in total) represented formal tools such as nose-edge scrapers, thumbnail scrapers and backed blades. Only one BIF flake showed signs of retouch and one Silcrete artefact was observed as being notched. One chert point was also observed at the site.

The high degree of retouch and reduction for chert, jasper and chalcedony artefacts is interpreted as curation of material either not locally available or highly prized. This would mean that artefact discard for this type of stone would be delayed until no further reductions could possibly be made. In accordance, BIF and Quartz artefacts were not heavily reduced with flakes, broken flakes and cores being represented in the sample. BIF basal grindstones were also recorded in the assemblage and these did not show signs of heavy grooving, with only some polishing and pitting.

Overall, a thousand artefacts are estimated to be present within Elena Site B. Given the sample average of 3.4 artefacts per square metre the site is likely to have been used over repeated occasions. Backed blades and backing techniques form part of Australian Small Tool Tradition and are believed to represent a technological shift dated to approximately 4,000 years ago, therefore giving this site a likely *terminus post quem*.

Figure 11. Range of artefacts present at Elena Site B.

Figure 12. Chert Point. Elena Site B.

Figure 13. Utilised Chalcedony Flake. Elena Site B.

Sample Square	Stone Type	Artefact Type
1	BIF	Flake
1	BIF	Flake
2	Ironstone	Flake
2	Ironstone	Core
3	BIF	Retouched Flake
3	BIF	Core
3	Quartzite	Broken Flake
3	BIF	Flake
3	BIF	Broken Flake
4	Quartzite	Core
4	Quartz	Core
4	Chert	Scraper
5	BIF	Broken Flake
5	Quartz	Broken Flake
5	BIF	Flake Fragment
5	Chert	Nose-edged Scraper
6	BIF	Flake Fragment
6	BIF	Core
6	Quartz	Flake
6	Quartz	Flake

6	Silcrete	Flake
7	BIF	Core
7	Jasper	Thumbnail Scraper
7	Silcrete	Core
7	Quartz	Flake
7	Quartz	Flake
7	Quartz	Broken Flake
8	Silcrete	Broken Flake
8	Silcrete	Notched Flake
9	Chalcedony	Scraper
9	Jasper	Retouched Flake
9	BIF	Flake
9	BIF	Flake
9	Clear Quartz	Flake Fragment
10	BIF	Basal Grindstone (24 x 22 x 10 cm)
11	Jasper	Backed Blade
11	Clear Quart	Flake
12	BIF	Core
12	Quartz	Flake
12	Quartz	Broken Flake
12	Quartzite	Core

Table 13. Elena Site B. Artefact scatter sampled.

Boundary Point Number	mE	mN
1	244917	6773227
2	244872	6773173
3	244822	6773156
4	244780	6773214
5	244764	6773247
6	244732	6773254
7	244722	6773260
8	244679	6773274
9	244659	6773287
10	244631	6773310
11	244663	6773337
12	244690	6773325
13	244720	6773326
14	244731	6773338
15	244762	6773330
16	244781	6773313
17	244797	6773296
18	244809	6773285
19	244824	6773273
20	244846	6773249
21	244878	6773245
22	244891	6773240

Table 14. Elena Site B Boundary Polygon

This site has an extensive artefact scatter dominated by locally available BIF and Quartz artefacts, with a high percentage of formal/utilised chert, jasper and chalcedony artefacts. Elena Site B represents a camping ground associated with Elena Site A's water soak and contains an artefact scatter similar to that recorded for Elena Site A, albeit with a more complex assemblage. From an archaeological perspective, this site has a moderate potential to contribute information regarding settlement patterns, tool making technologies and reduction strategies, stone artefact procurement, transport and use, and grinding techniques.

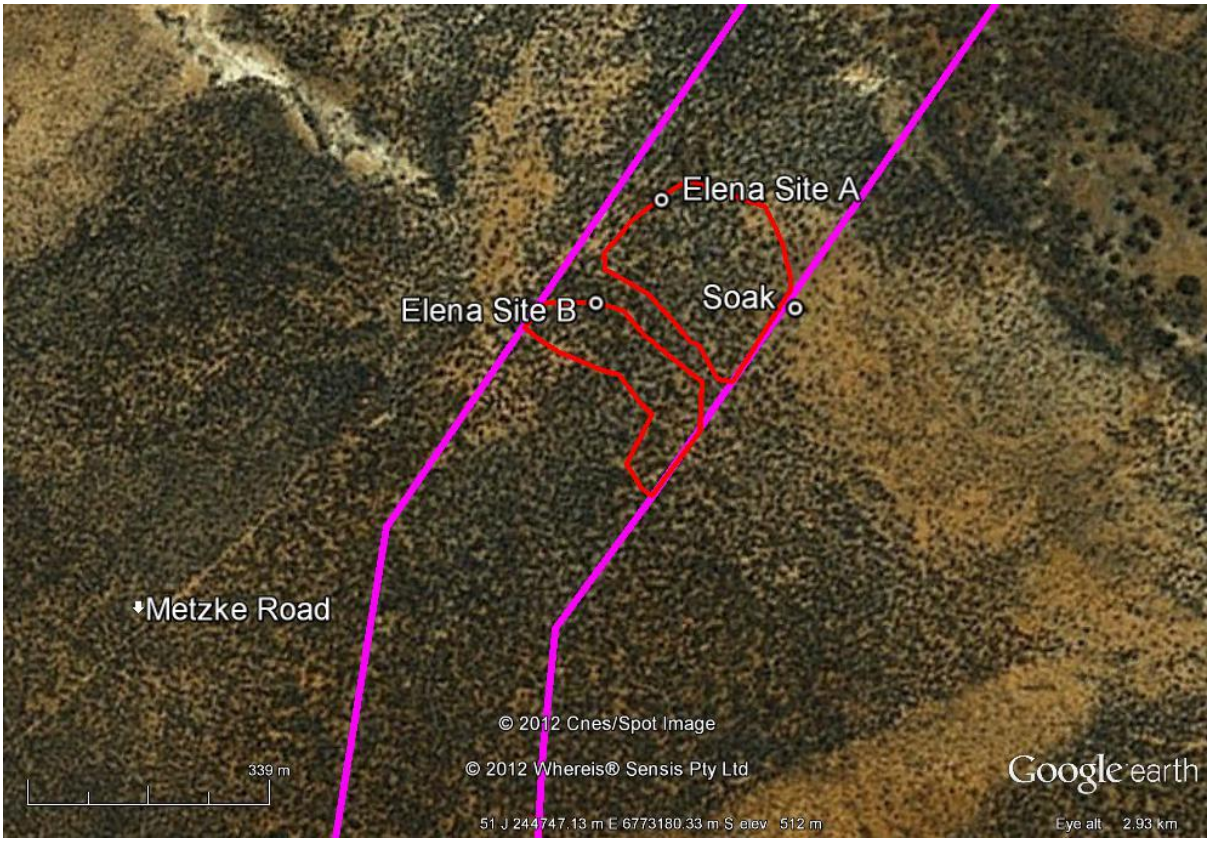

Figure 14. Aerial Map of Elena Site A and Elena Site B (Google Earth 2012).

11.8 Menzies Sandstone One

MGA Zone 51 252517mE 6752045mN

This site comprises an artefact scatter on flat sand surrounding a granite outcrop that contains several shallow pools and rockholes. The granite outcrop extends north-south with the highest point located at MGA Zone 51 252545mE 6752082mN, containing rockholes between fifteen to one metre square in area, of variable depths. Some thirty-five depressions were full of rainwater during the time of the survey on the outcrop. A lizard trap and a standing stone were observed at MGA Zone 51 252569mE 6752057mN.

Another granite outcrop was recorded at MGA Zone 51 252543mE 6751915mN. The extrusion contained over twelve rockholes between thirty to half a metre square, in size.

The land surrounding the granite extrusion is vegetated by an open woodland, with sparse shrubs and bushes covering red sands. The soils are covered by a very fine gibber of quartz and granite pebbles deriving from the weathering of the granite outcrop.

The artefact scatter is mainly situated on the flat sandy country and comprises artefacts manufactured from Chalcedony, Chert, Clear Quartz, Quartz, BIF, Dolerite and Granite.

The assemblage is characterised by artefacts like flakes, cores, broken flakes, flake fragment and formal tools such as blades, bladettes, backed blades, grindstones, scrapers and retouched flakes. The majority of formal tools and retouched flakes recorded were manufactured from Chalcedony and Chert stone. One retouched dolerite artefact was also noted. The variety of stone tool types indicates that rejuvenation and

curation of particular types of stones was undertaken in the area, with a range of tools associated with hafting for wood, bone or skin working.

Sample Square	Stone Type	Artefact Type
1	Chalcedony	Flake
1	Chalcedony	Core
1	Chalcedony	Core
1	Chalcedony	Flake Fragment
1	Chalcedony	Retouched Flake
1	Chalcedony	Flake
2	Chalcedony	Blade
2	Dolerite	Retouched Flake
3	BIF	Flake
3	Quartz	Flake Fragment
3	Chert	Flake
3	Chert	Broken Flake
3	Chert	Blade
3	Chert	Flake
3	Chalcedony	Backed Blade
3	Quartz	Flake Fragment
3	Clear Quartz	Broken Flake
3	Chert	Flake Fragment
3	Clear Quartz	Flake Fragment
3	Clear Quartz	Flake Fragment
4	Quartz	Flake
4	Chalcedony	Retouched Flake
4	Quartz	Flake
5	BIF	Flake
5	Clear Quartz	Flake
5	BIF	Flake
5	Clear Quartz	Flake
5	Dolerite	Flake
5	Quartzite	Flake
5	Chalcedony	Scraper

Table 15. Menzies Sandstone One Site Sampled Artefacts.

Boundary Point Number	mE	mN
1	252385	6752192
2	252379	6752145

3	252378	6752086
4	252415	6752049
5	252439	6751991
6	252455	6751954
7	252497	6751879
8	252588	6751844
9	252664	6751877
10	252730	6751924

Table 16. Site Menzies Sandstone One GPS Boundary Co-ordinates.

Figure 15. Photo of granite outcrop looking northeast.

Given that the site appears to extend well beyond the boundaries recorded within the survey area, no complete assessment of significance can be made at this stage. It is presumed that the site will largely relate to the extent of the granite outcrop.

Granite outcrop sites are widely represented in the region and were commonly used in historical times by pioneers, prospectors and station owners as sources of fresh water.

The author has knowledge of several granite outcrop sites in the region that are of mythological and ceremonial significance. These areas represent reliable water sources which were occupied repeatedly, and as such have a moderate to high potential to answer questions regarding Aboriginal pre-history of the region.

11.9 Menzies Sandstone Two

MGA Zone 51 252729mE 6751642mN

This site is located to the east of a large granite outcrop extending north-south and intruding into the proposed haul road path at MGA Zone 51 252704mE 6751647mN. A shallow granite outcrop and rockhole area is located approximately 200 metres northeast of a large granite outcrop at MGA Zone 51252820mE 6751803mN, and an artefact scatter was recorded in between these two features.

The landscape between these two outcrops comprises red sands covered by bushes and shrubs, with sparse trees, and good ground visibility estimated at 60%.

Eight one-metre sample squares were taken to assess the surface assemblage. Twenty-one artefacts were recorded, with artefact densities varying from one to five artefacts per square metre. Artefact types included flakes, cores, basal grindstones, mullers, retouched flakes, broken flakes and tools, including backed blades and scrapers.

Stone artefacts were manufactured from Chalcedony (28.5%), Chert (28.5%), Quartz (19%), Granite (9.6%), Clear Quartz (4.8%), BIF (4.8%) and Quartzite (4.8%).

On the granite outcrop to the west side of the haul road area a lizard trap was located at MGA Zone 51 252729mE 6751642mN. A pool measuring ten metres by four metre was also recorded at this location.

The site extends outside the survey area, both to the east and west, probably in relation to the extent of the granite extrusion.

Granite outcrops have been previously assessed in the region as significant in both archaeological and ethnographic terms, and have been widely recorded in the region as aggregation locales, reliable water sources, ceremonial grounds, places of historical significance and often of mythological significance. The full extent of this site has not been subject to archaeological investigation, although it is preliminarily assessed as of moderate to high archaeological significance based on the available sample and knowledge of similar sites.

Sample Square	Stone Type	Artefact Type
1	Quartzite	Basal Grindstone (30cm x 20cm x 9cm)
2	Quartz	Flake
2	Chert	Flake
3	Chalcedony	Retouched Flake
3	Chert	Broken Flake
3	Chalcedony	Flake
3	Quartz	Broken Flake
4	Chalcedony	Broken Flake
4	Clear Quartz	Core
4	BIF	Broken Flake
4	Chert	Backed Blade
4	Chalcedony	Backed Blade
5	Chalcedony	Scraper
5	Chert	Broken Flake
6	Granite	Broken Muller
6	Quartz	Flake
6	Chert	Flake
7	Granite	Basal Grindstone (32cm x24cm x 11cm)
8	Chalcedony	Core
8	Chert	Retouched Flake
8	Chert	Flake
8	Quartz	Flake

Table 17. Site Menzies Sandstone Two Artefacts Sampled.

Boundary Point Number	mE	mN
1	252800	6751867
2	252601	6751728
3	252881	6751499
4	252967	6751721

Table 18. Site Menzies Sandstone Two GPS Boundary Co-ordinates.

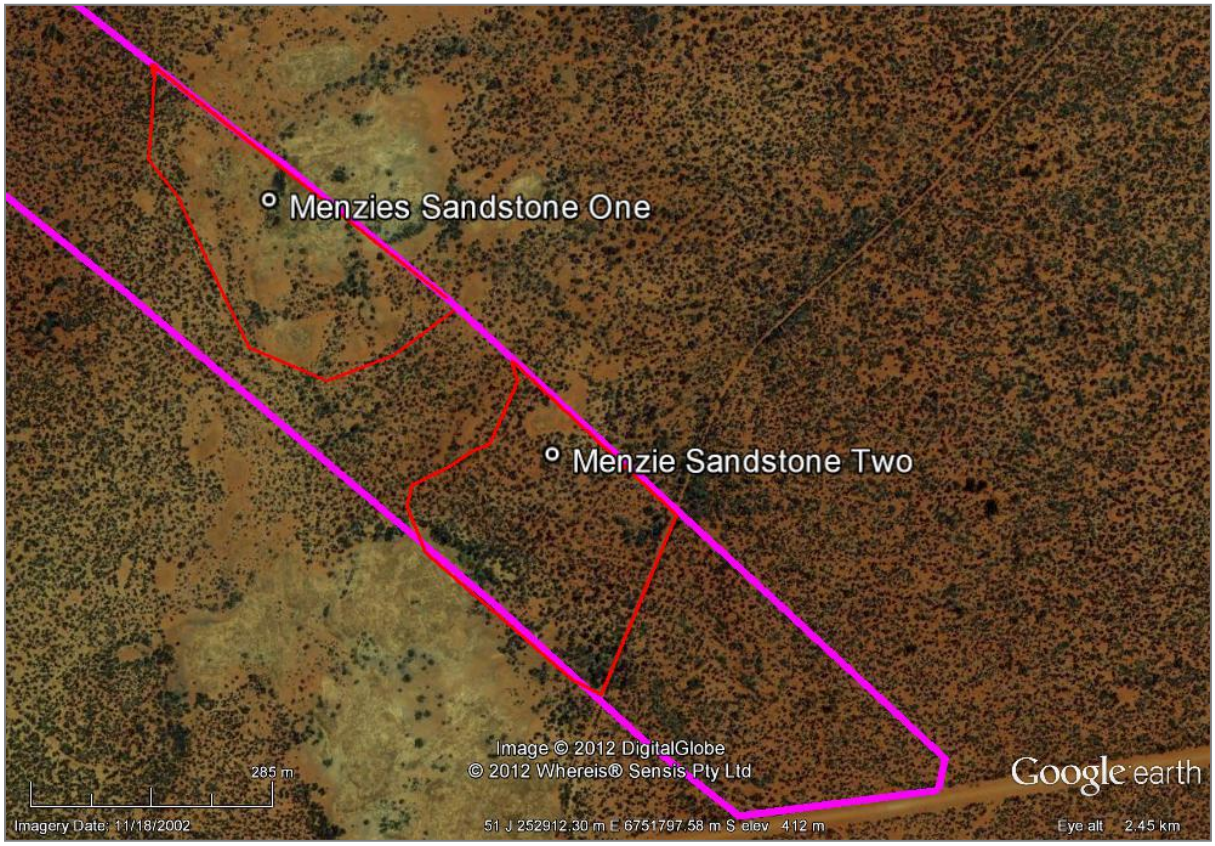

Figure 16. Aerial Map of Menzies Sandstone One and Menzies Sandstone Two (Google Earth 2012).

11.10 Place of the Grindstones

MGA Zone 51 246460mE 6766217mN

An artefact scatter was recorded within an 800-metre long area along the banks of a northeast-southwest creek. The assemblage exhibits a very high percentage of grinding implements, with over twenty grinding stones recorded. Artefacts types identified included amorphous basal grindstones, mullers, retouched flakes, flakes, broken flakes and flake fragments.

The site is situated to the west of an ephemeral creek and extends into two diverse landforms. The eastern part of the site comprises a floodplain area where vegetation is very open where sparse trees and shrub grow on red gravelly soils. This landscape is optimal for site identification as it affords very good ground visibility. To the western part of the site a mulga woodland is present. This area consists of a semi-closed canopy of trees with an undergrowth of shrubs and bushes. The mulga trees foliage and shrubs allow for moderate ground visibility. A ridgeline is located a few hundred metres west of the mulga woodland where the vegetation changes to that typical of sandplain/granite country, with occasional sparse gum trees on deeper soils and shorter trees and thicker vegetation on skeletal soils. Occasional granitic outcrops are present within this area.

The artefact scatter was assessed via thirty one metre sample squares. The artefacts were produced from stone types such as Chert, BIF and Chalcedony, with a large percentage of retouched flakes. Artefact densities averaged 1.5 artefacts per metre square, although actual artefact density is estimated to be closer to one artefact per fifty metres square.

The site exhibits a sparse artefact scatter with notably high numbers of formal implements. The majority of the grinding artefacts are located within the mulga woodland situated between the floodplain to the east and the elevated ground to the west. The basal grindstone are mainly produced from BIF or ironstone, with several mullers and muller fragments manufactured from granite and BIF. Maximum length and width recorded for the basal grindstones are in the range of 40 cm x 30 cm whilst minimum length and width recorded was in the range of 7.5 cm x 6.5 cm. Grindstone thickness averaged between 8.5 cm to 1 cm.

The majority of the basal grindstones are amorphous with few exhibiting discrete grooving or large polished patches that commonly occur as a result of the seed grinding process. Almost the entire grindstone assemblage exhibited edge flaking and pitting. Both attributes indicate that the grindstone were curated and surfaces were rejuvenated via pecking, increasing the effectiveness of the grindstone (Smith 1986, Veth 1996).

Figure 17. BIF Grindstone and Granite Muller fragments.

Figure 18. Grindstone exhibiting polish.

Figure 19. A grindstone exhibiting polish over a rejuvenated surface.

Figure 20. Two in-situ grindstones.

A large percentage of non-pitted grindstones exhibited irregular surfaces. These surfaces were naturally uneven, generally with a very rough cortex.

Figure 21. Naturally uneven surface of grindstone.

Figure 22. Example of naturally uneven and pitted grindstone surface.

The basal grindstones were manufacture exclusively from BIF and ironstone, both of which are locally available within the Mt. Ida Range, under two kilometres to the east. The grindstone assemblage sampled appears to denote a preference for grinding surfaces that exhibited naturally rough or uneven surfaces and thus can be interpreted as being more effective in grinding material.

Ethnographic studies have recorded a variety of uses for grindstones in the arid zone including pulverising lizards, bone or small animals, preparing paste from dried solanum fruit, grinding seeds and cracking and grinding nuts, sharpening or smoothing wooden artefacts and stone axes, grinding ochre, preparing bush tobacco and preparing resin (Smith 1986).

As the site is located within a mulga woodland, it is possible that mulga nuts were being processed within the site.

According to Smith (1986):

'...seedgrinding implements tend to be heavily and repetitively used. Therefore they will have well- worn surfaces and well-defined, discrete wear patterns. The ground surfaces will not be small or irregular and may often exhibit a silica polish, derived from the repetitive processing of plant material. Secondly, seedgrinders are special-purpose implements. Therefore they will often show signs of maintenance, attempts to re-use or rejuvenate the implement, and probably also evidence of deliberate manufacture"

Seed grinding is a gender related activity, as is stone tool making, and this may explain the paucity of stone artefacts and debitage in the area. In relation to this last point it is also feasible to postulate that these smaller artefacts may be present and have been silted up, as was noted to have occurred to some of the grindstone that were embedded over four centimetres into the soft sand.

This site represents evidence for traditional activities associated with the processing and production of foodstuff and has potential to address questions relating to grindstone sourcing, transportation, usage, reduction and rejuvenation. Further studies may also yield important information on the diet of Aboriginal people and the antiwuity

of occupation. This site type is not common to the region as it comprises an artefact scatter dominated by basal grindstones and fewer smaller tools and little debitage. This site has a potential to answer archaeological questions and is assessed as of Moderate archaeological significance.

Boundary Point Number	mE	mN
1	246484	6766751
2	246581	6766750
3	246575	6766609
4	246580	6766495
5	246759	6766460
6	246774	6766400
7	246732	6766264
8	246637	6766043
9	246564	6765927
10	246333	6765940
11	246309	6765977
12	246321	6766142
13	246298	6766366
14	246410	6766605

Table 19. Place of the Grindstones site boundary

Grinding Stone Recording Sheet

Stone Type	Length	Width	Thickness	Surface description	Polish level	Size of Grinding Patch/es	Bevelling or Edge Flaking
BIF	29	9	4.5	Flat	Moderate	8x4	B and E
BIF	15	20	5	Irregular	Moderate	11x2	E
BIF	7.5	9	6	Flat	High	-	B and E
BIF	18	17	7.5	Flat	Moderate	-	E
Ironstone	19	11	5.5	Grooved and Pitted	Moderate	-	E
BIF	39	29	7	Pitted/Irregular	Moderate	-	B and F
BIF	29	27	6	Irregular	Low	-	B and F
BIF	29	11	6	Pitted/Irregular	Moderate	-	B and F
BIF	11	13	5	Grooved/Pitted	Moderate	-	B and F
BIF	13	6	4	Very Irregular	Moderate	-	F
BIF	12	11	3	Grooved and Pitted	Low	-	B
BIF	36	15	8	Pitted/ Grooved	Moderate	-	F
BIF	25	14	6	Irregular/Grooved	Moderate	-	F
BIF	24	9	4	Irregular	Moderate	-	B and F
BIF	40	30	4	Irregular	Low	-	B and F
BIF	23	21	5	Grooved on both surfaces	High	-	F
Ironstone	13	8	5	Irregular	Moderate	-	B
BIF	26	27	6	Pitted	High	-	B and F
BIF	35	20	8.5	Pitted and Flat	High	-	F
BIF	14.5	7	1	Irregular and Pitted	Moderate	-	B
BIF	13	9	5	Irregular	Low	7x3	B and F
BIF	13	11	2.5	Pitted	Low	-	F
BIF	10	9	2.5	Irregular	Moderate	-	F

BIF	10	7	2	Irregular	Low	-	-
BIF	33	25	4	Grooved/Pitted	High	12x10	F
BIF	30	19	3	Irregular	Low	-	F

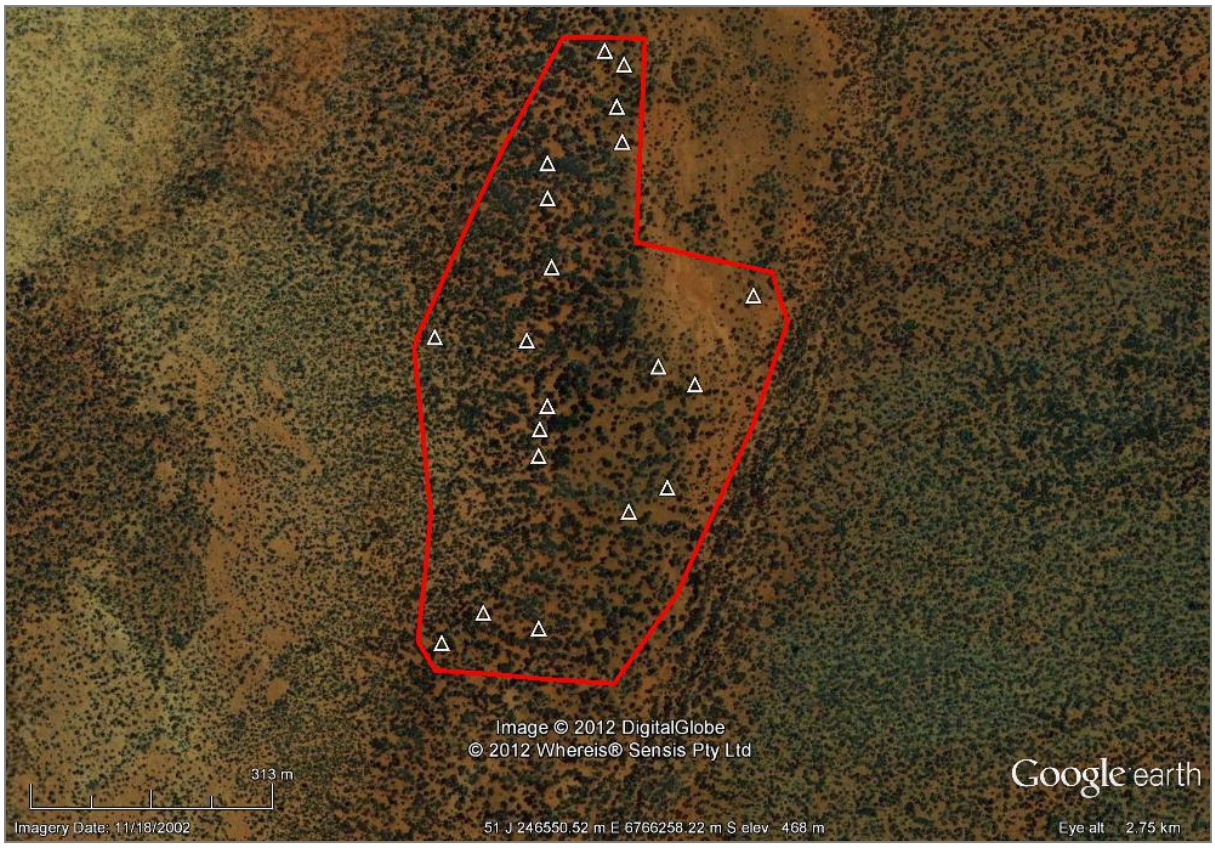

Figure 23. Place of the Grindstones Aerial Map. Triangles indicate distribution of grinding material within site.

12.0 RECORDING OF AIC SITE 2006

Following the initial report of an ethnographic site centred upon MGA Zone 51 248088mE 6764402mN by AIC in 2006, and lack of archaeological information on the site, Jupiter Mines requested an archaeological investigation of the area.

The area is situated to the west of a BIF cliff where a drainage line forms a gorge and rainwater accumulates in a concreted stone pool to the bottom of the fall. A runoff creek runs to the south west, and two hills are located adjacent to the north and south side of the creek, approximately 250 metres southwest of the pool. To the north of the creek, the hill is clear of vegetation and a mustering yard, water trough and rain water tank have been installed, with a hose connecting the trough to the water pool. On this hill an artefact scatter was recorded extending roughly 200 hundred metres west, one hundred metres north, 220 metres east and 250 metres south. The area is vegetated by acacias and small shrubs and bushes with ground visibility being good at 60%.

One hundred and forty-four artefacts were analysed via one-metre sample squares spread over the site. Artefact densities varied from a maximum of forty artefacts per metre square to one artefact per metre square. A median artefact density of 7.3 artefacts per metre square is calculated. As artefacts concentrations were observed to be variable within the site, it is estimated that the site contains approximately 590,000 artefacts. This site exhibits a large and varied artefact assemblage that represents Aboriginal occupation over a long time span, or intensive occupation of the area. The water pool at the bottom of the BIF cliff (now cemented) was said to have been present prior to its walling (Keith Mader, Walling Rock Station Owner, pers. comm.). Mr. Mader also stated that the water pool had been a reliable water source for thousands of goats, although previous white settlers/station owners had commented on its poor

capabilities as a water source (Keith Mader, Walling Rock Station Owner, pers. comm.). From this information, and the archaeological evidence, it is clear that the now man-made rock pool was once a source of water which attracted Aboriginal occupation.

The artefact assemblage is typified by flakes, retouched flakes, flake fragments, broken flakes, cores, and formal artefacts such as points, blades, scrapers, hammerstones, basal grindstones, backed blades and unifacially retouched pieces.

Material used for the production of artefacts include: Tuff, Dolerite, Quartz, Basalt, Chalcedony, Chert, Silcrete, BIF, Ironstone, Quartzite, Jasper, Clear Quartz and glass.

Several pieces of flaked glass, appearing to belong to the same vessel were observed near the stockyard. A glass shard, representing the body of an olive coloured ale glass, exhibited a unifacially flaked edge. As glass was introduced into Aboriginal toolkits during the contact period, the glass artefact indicates that Aboriginal people occupied the site post European arrival.

Sample Square	Stone Type	Artefact/s Type
1	Chert	Scraper
2	Chalcedony	Scraper
3	Chert	Core
3	Quartz	2 Broken Flakes
3	Quartz	Flake
3	Silcrete	2 Broken Flake
4	Dolerite	Flakes
4	Chert	Flake
4	Chalcedony	2 Retouched Fragments
4	Quartz	Core
4	Chalcedony	Retouched Flake
4	Basalt	Broken Flake
4	Quartz	Flake Fragment
4	Chalcedony	Flake
5	BIF	Core
5	Quartzite	Flake
5	BIF	Flake

5	Ironstone	Hammer stone
5	Silcrete	Broken Flake
5	Chalcedony	Broken Flake
5	Chalcedony	Flake
5	Jasper	Flake
5	Quartz	Broken Flake
5	Chalcedony	Core
5	Silcrete	Flake Fragment
5	Chalcedony	Retouched Flake
6	Basalt	Broken Flake
6	Silcrete	Scraper
6	Quartz	Core
6	Chalcedony	2 Retouched Flakes
6	Quartz	Flake Fragment
7	BIF	Basal Grindstone
7	Clear Quartz	Flake
7	Chert	Flake
8	Basalt	Point
8	Basalt	Broken Flake
8	Silcrete	Core
9	Chalcedony	10 Broken Flakes
9	Chalcedony	8 Flakes
9	Chalcedony	4 Retouched Flakes
9	Chalcedony	3 Flake Fragments
9	Chalcedony	8 Retouched Fragments
9	Chacedony	2 Cores
9	Quartz	3 Flake Fragments
9	Quartz	Backed Blade
9	BIF	Core
10	BIF	Basal Grindstone (44cm x 17cm x 8cm)
10	Quartz	Core
10	Chalcedony	Core
10	Chalcedony	Flake
11	BIF	Basal Grindstone (28cm x 25cm x 11cm)
11	Quartz	2 Flake Fragments
11	Quartz	2 Flakes
11	BIF	Core
12	Quartz	3 Cores
12	Quartz	2 Flakes
12	Chalcedony	Retouched Flakes
13	BIF	Basal Grindstone (27cm x 17cm x 14cm)
13	BIF	Basal Grindstone (31cm x 20cm x 7cm)
14	BIF	Basal Grindstone (29cm x 18cm x 7 cm)
14	Chalcedony	Flake
14	BIF	Core
15	Quartz	3 Cores
15	Quartz	Flake
15	Silcrete	Flake

15	Jasper	Core
15	Tuff	Point
16	Quartz	Core
16	Quartz	5 Broken Flakes
16	Quartz	3 Flakes
16	Quartz	Retouched Flake
16	Basalt	Broken Flake
16	Quartzite	Flake Fragment
17	BIF	Retouched Flake
17	Quartz	Core
17	Quartz	Flake
17	Quartz	Broken Flake
17	Chert	Flake
17	Quartz	Flake Fragment
17	Chalcedony	Broken Flake
17	Jasper	Retouched Flake
18	BIF	Core
18	BIF	2 Flake Fragmenta
18	Chalcedony	Retouched Flake
19	Chert	Core
19	BIF	2 Cores
19	BIF	2 Flake Fragments
19	Chalcedony	Flake Fragment
20	Olive Coloured Glass	Retouched Fragment
20	Clear Quartz	Retouched Flake
20	Quartz	Core
20	Quartz	2 Flake Fragments
20	Silcrete	Flake
20	Silcrete	Flake Fragment
20	Chalcedony	Flake Fragment

Table 20. AIC Site 2006. One metres sample squares results.

Boundary Point Number	mE	mN
1	247872	6764102
2	247879	6764099
3	247881	6764091
4	247873	6764083
5	247849	6764074
6	247817	6764052
7	247827	6764043
8	247846	6763976
9	247820	6763904
10	247776	6763841
11	247721	6763795
12	247631	6763746
13	247536	6763733

14	247466	6763697
15	247402	6763709
16	247386	6763771
17	247451	6763861
18	247395	6763966
19	247412	6764072
20	247427	6764159
21	247476	6764210
22	247545	6764154
23	247601	6764165
24	247682	6764133
25	247736	6764086
26	247786	6764081
27	247809	6764079

Table 21. GPS Boundary Points for AIC Site 2006.

Figure 24. Quarried Boulder. Site AIC 2006.

Figure 25. Chalcedony Blades. Site AIC 2006.

Figure 26. View East of Site.

Figure 27. Cemented Water Pool. Site AIC 2006.

Figure 28. View West of Site AIC 2006.

This site has been disturbed by the installation of the mustering yard, water trough and mining activity. Nonetheless, over half of the site's archaeological record was assessed as in-situ and unaffected by previous activities. This site provides suitable data to

conduct an empirical and qualitative study of artefacts to investigate, stone procurement and stone tool reduction, grindstone procurement, usage, curation and transportation and Aboriginal settlement patterns. The potential to answer long-term sequences of occupation/technological change is diminished by the lack of potential for stratified deposits and previous disturbance to the site. This site type is not unique in the region, although the number and range of artefacts present is not extremely common. In consideration to the above statements, this site is assessed as of Moderate archaeological significance.

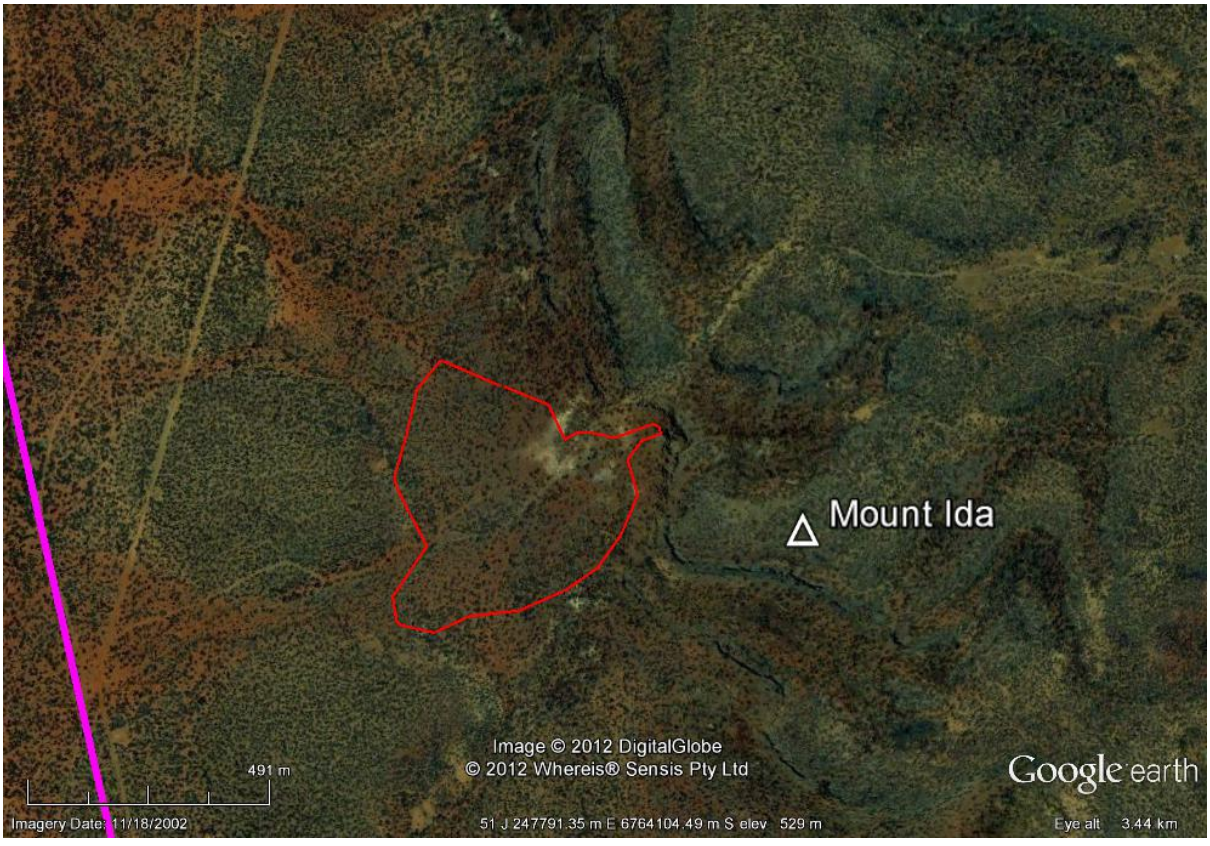

Figure 29. Aerial View of Site AIC 2006 (Google Earth 2012).

13.0 DISCUSSION

Jupiter Mines commissioned R. & E. O'Connor Pty Ltd to undertake an Aboriginal heritage survey of the proposed Mount Ida, Mount Mason and haulage road project. John Cecchi undertook the archaeological field survey between June and July 2012. As a result of the survey a total of eleven sites of Aboriginal heritage were identified and recorded. The archaeological significance of each site was assessed in order to provide suitable heritage management recommendations.

The eleven sites recorded included the following site components: Artefact Scatter (9), Grinding Material (5), Water source (4) and Rockholes (3). Most of the artefact scatter sites were identified near water sources. The assemblages near more reliable water sources exhibited significant percentages of curated items, and formal tools, including grinding basal stones, scrapers, mullers, backed blades and notched tools. Although a variety of stone resources was used to manufacture artefacts, material such as chalcedony and chert featured predominantly in the formal tool categories, whilst BIF and ironstone (both locally available) was the sole stone used for basal grindstones.

Isolated artefacts within the survey area were mainly located adjacent drainage lines that drain the elevated areas. Most of the isolated artefacts were manufactured from BIF and quartz with a notable percentage of isolated retouched flakes and cores.

Most of the basal grindstones recorded within the survey area exhibiting flat grinding surfaces. with limited polish and were not highly grooved. Veth & O'Connor (1996) have argued theories regarding the presumed functional differences between amorphous types of basal grindstones and formal grindstone that were used for the main purpose of grinding seed in the wet milling process (for example as defined by Smith 1996). The difference has been mainly associated with the grinding surface; the

latter consisting of deep groove/s whilst the other with flat surfaces. From data collected at Serpent Glen Site, northeast of Wiluna, Veth & O'Connor argue that the morphological difference between heavily grooved and flat surface grindstone is related to the availability of raw resources and not function. This assumption is based on the fact that seed grinding was an activity undertaken at Serpent Glen and most of the basal grindstones there exhibited flat grinding surfaces. Furthermore, the stone from which the grindstones were manufactured from, was locally available and grindstones were assessed to be more efficient at their earlier stages, with the grooves diminishing their grinding effectiveness. The researchers concluded that functionality of basal grindstones is not necessarily defined by their grinding surface, but on the availability of raw materials and subsequent reduction of the implement. In the context of the survey area, BIF was the preferred stone type used to manufacture grindstones, which is locally available, and with a preference for naturally uneven and rough surfaces. Further research such as residue/use wear analysis may identify starch grains, resin, cellulosic plant cells, phytoliths or other material to assess their function and/or antiquity (Veth et al 1997).

RECOMMENDATIONS

- Eleven sites of Aboriginal heritage have been identified and recorded as a result of the archaeological survey of Jupiter's Mount Ida, Mount Mason and Haul Road development.

- The Aboriginal sites recorded should not be impacted without prior Ministerial consent. Further research is recommended for sites assessed as of Moderate or High archaeological significance should Jupiter require their use.

- All sites of Aboriginal heritage are protected under the Act, whether previously registered or not. Further archaeological and ethnographic consultation may be required should any archaeological material be uncovered during the project.

- Should skeletal remain be uncovered during earth works, all works in the area should cease and the WA Police should be contacted.

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APPENDIX A DEFINITION OF ARCHAEOLOGICAL TERMS

Scarred Trees

Aboriginal scarred trees reflect several traditional activities involving the removal of bark and wood. A significant amount of Aboriginal cultural material was sourced from the bark and wood of trees to make implements such as shields, sacred boards, shelters and containers. Other scars have been recorded as toe holds made in order to climb trees, or holes within trunks used to smoke out and hunt mammals (Long 2005). Aboriginal scars occur on a variety of tree types and given the variety of purposes for which they were used, appear in a diverse range of sizes and shapes.

Scars on trees formed after the piece of bark or wood is extracted and damage to the cambium results in a drying out of the sapwood, where bark will not be able to grow back again. Overgrowth of bark surrounding the scar may occur and to such an extent to eventually close or apparently seal the wound, although this new growth will never join with the dry face underneath.

A scar on a tree can also derive from other injuries the bark receives, for example via lighting strike, fire damage, collapse of branches or other trees onto trunk, vehicle collision, surveyors marks, ring barking and faunal damage. Given these considerations, it is sometimes difficult to accurately identify a scarred tree as of Aboriginal, European or natural origin.

Long (2005) provides the following guidelines to assess the whether a scar on a tree is from natural or incidental types of scarring:

- What impacts have occurred in the vicinity of the scar?

- How old is the tree on which the scar occurs, and how long has the scar been there?

- What impacts have occurred to the tree, and can you work out the order in which they have occurred?

-Can you identify the form and size of the original scar on the tree?

An epicormic shoot or stem will be located immediately below a section of damaged trunk which interrupts the connection between the roots and the canopy and is a common feature associated with cultural scars (Long 2005).

If the scar occurs on a dead tree, an arborist could perhaps indicate when the tree died, how old the tree was at the time of death and provide an estimate of the time between scarification and death of the tree. This information would provide a possible time span for the production of the scar on the tree. C-14 dating and growth ring counting can provide accurate dates for the age of the tree.

A **Quarry** may occur wherever outcrops of suitable stone are found. These exhibit a concentration of primary flakes in the artefact assemblage with a relative dense concentration, and may contain the original quarried stone exhibiting hundreds of flake scars.

Because rocks and minerals can fracture as a result of geomorphic or other natural processes flaked stones are classified as **stone artefacts** if they exhibit one or more of the following features (Holdaway & Stern 2004: 108-9):

A positive or negative ring crack

A negative or positive bulb of percussion

An érraillure scar below the point of percussion

Negative flake scars or ridges

Flakes, Cores and Retouched flakes (Tools), are the three main categories of artefacts and their features are detailed below (Hiscock 1984: 129):

Flakes must exhibit at least one of the following traits:

A ring crack

A positive bulb of percussion

An érraillure scar below the point of percussion

Cores exhibit negative flake scars marking the place where previous flakes were struck. A core may be described as Unidirectional, Bidirectional, Bifacial or Multidirectional depending on the orientation of the flake scars and location of the striking platform (Holdaway & Stern 2004:180-2).

Retouched Flakes, also classified as Tools, are stones that show signs of flake scars across their ventral surface and display a ring crack.

Grindstone Attribute Legend

Grindstone Surface refers to the natural or manmade appearance of a grinding surface. These may be described as flat, pitted or irregular. Flat surfaces are obtained from pieces of stones that naturally exhibit flat surfaces or that have been heavily reduced. The latter can usually be recognised by polish and glazing. Further reduction through grinding will cause discrete worn surfaces described as grooves. Some stone surfaces may be irregular as they are naturally rough or uneven. Pitted surfaces are those that underwent rejuvenation via pecking. Polish level refers to the amount of visible polish on the grindstone surface. Highly polished surfaces are the result of heavily worked grinding stones where a silica residue has formed on the top surface of the grinding surface. The grinding patch refers to the area of stone that become extremely smooth as a result of grinding, that may also exhibit polish.

APPENDIX B DIA SITE REGISTER RESULTS

Appendix K: Historic Native Vegetation Clearing Permit (CPS 5764/2)

Government of **Western Australia**
Department of **Mines and Petroleum**

Our Ref: A2172/201301 / CPS 5764/2
Enquiries: Lesley Polomka Tel: (08) 9222 3313 Fax: (08) 9222 3860
Email: lesley.polomka@dmp.wa.gov.au

Ms Melissa North
Chief Financial Officer
Jupiter Mines Limited
PO Box Z5117
PERTH WA 6000

Dear Ms North

Permit to Clear Native Vegetation under the *Environmental Protection Act 1986*
Jupiter Mines Limited – Mt Mason DSO Hematite Project (CPS 5764/2)
(Amendment to CPS 5764/1)

Please find enclosed your amended permit to clear native vegetation granted under s.51M of the *Environmental Protection Act 1986*. This authorisation gives you approval to clear, subject to certain terms, conditions or restrictions. A copy of your permit is now available for the public to view, as required by the regulations.

Read your permit carefully. If you do not understand your permit, contact this Department immediately. There are penalties for failing to comply with the requirements of your permit.

Please note the changes from the previous version of the permit (CPS 5764/1). The changes relate to the duration of the permit.

Compliance with the terms, conditions or restrictions of this permit does not absolve the Permit Holder from responsibility for compliance with the requirements of all Commonwealth and State legislation.

If you have any queries regarding this decision, please do not hesitate to contact Lesley Polomka, Senior Environmental Officer, on (08) 9222 3313 or email lesley.polomka@dmp.wa.gov.au.

Yours sincerely

M. Leyk

Marnie Leybourne
DIRECTOR OPERATIONS
ENVIRONMENT

Officer with delegated authority under Section 20
of the Environmental Protection Act 1986

24 September 2015

Encs

GOVERNMENT OF
WESTERN AUSTRALIA

CLEARING PERMIT

Granted under section 51E of the Environmental Protection Act 1986

Purpose Permit Number: 5764/2

Duration of Permit: From 9 November 2013 to 30 November 2018

Permit Holder: Jupiter Mines Limited

The Permit Holder is authorised to clear native vegetation subject to the following conditions of this Permit.

PART I - CLEARING AUTHORISED

1. **Land on which clearing is to be done**
   General Purpose Lease 29/22
   General Purpose Lease 29/23
   Miscellaneous Licence 29/79
   Miscellaneous Licence 29/100
   Miscellaneous Licence 29/121
   Mining Lease 29/408
   Mining Lease 29/414

2. **Purpose for which clearing may be done**
   Clearing for the purpose of mineral production and associated activities.

3. **Area of Clearing**
   The Permit Holder must not clear more than 115 hectares of native vegetation. All clearing must be within the areas shaded yellow on attached Plans 5764/2A and 5764/2B.

4. **Application**
   This Permit allows the Permit Holder to authorise persons, including employees, contractors and agents of the Permit Holder, to clear native vegetation for the purposes of this Permit subject to compliance with the conditions of this Permit and approval from the Permit Holder.

PART II - MANAGEMENT CONDITIONS

5. **Weed control**
   When undertaking any clearing or other activity authorised under this Permit, the Permit Holder must take the following steps to minimise the risk of the introduction and spread of *weeds*:

   (i) clean earth-moving machinery of soil and vegetation prior to entering and leaving the area to be cleared;
   (ii) ensure that no *weed*-affected soil, *mulch, fill* or other material is brought into the area to be cleared; and
   (iii) restrict the movement of machines and other vehicles to the limits of the areas to be cleared.

PART III - RECORD KEEPING AND REPORTING

6. Records to be kept

The Permit Holder must maintain the following records for activities done pursuant to this Permit:

In relation to the clearing of native vegetation authorised under this Permit,

(i) the location where the clearing occurred, recorded using a Global Positioning System (GPS) unit set to Geocentric Datum Australia 1994 (GDA94), expressing the geographical coordinates in Eastings and Northings or decimal degrees;
(ii) the date that the area was cleared;
(iii) the size of the area cleared (in hectares); and
(iv) purpose for which clearing was undertaken.

7. Reporting

(a) The Permit Holder shall provide a report to the Director Operations, Environment, Department of Mines and Petroleum by 31 October each year for the life of this permit, demonstrating adherence to all conditions of this permit, and setting out the records required under Condition 6 of this permit in relation to clearing carried out between 1 July and 30 June of the previous financial year.

(b) Prior to 30 November 2018, the Permit Holder must provide to the Director Operations, Environment, Department of Mines and Petroleum a written report of records required under Condition 6 of this Permit where these records have not already been provided under Condition 7(a) of this Permit.

DEFINITIONS

The following meanings are given to terms used in this Permit:

fill means material used to increase the ground level, or fill a hollow;

mulch means the use of organic matter, wood chips or rocks to slow the movement of water across the soil surface and to reduce evaporation;

weed/s means any plant –
(a) that is a declared pest under section 22 of the *Biosecurity and Agriculture Management Act 2007*; or
(b) published in a Department of Parks and Wildlife Regional Weed Rankings Summary, regardless of ranking; or
(c) not indigenous to the area concerned.

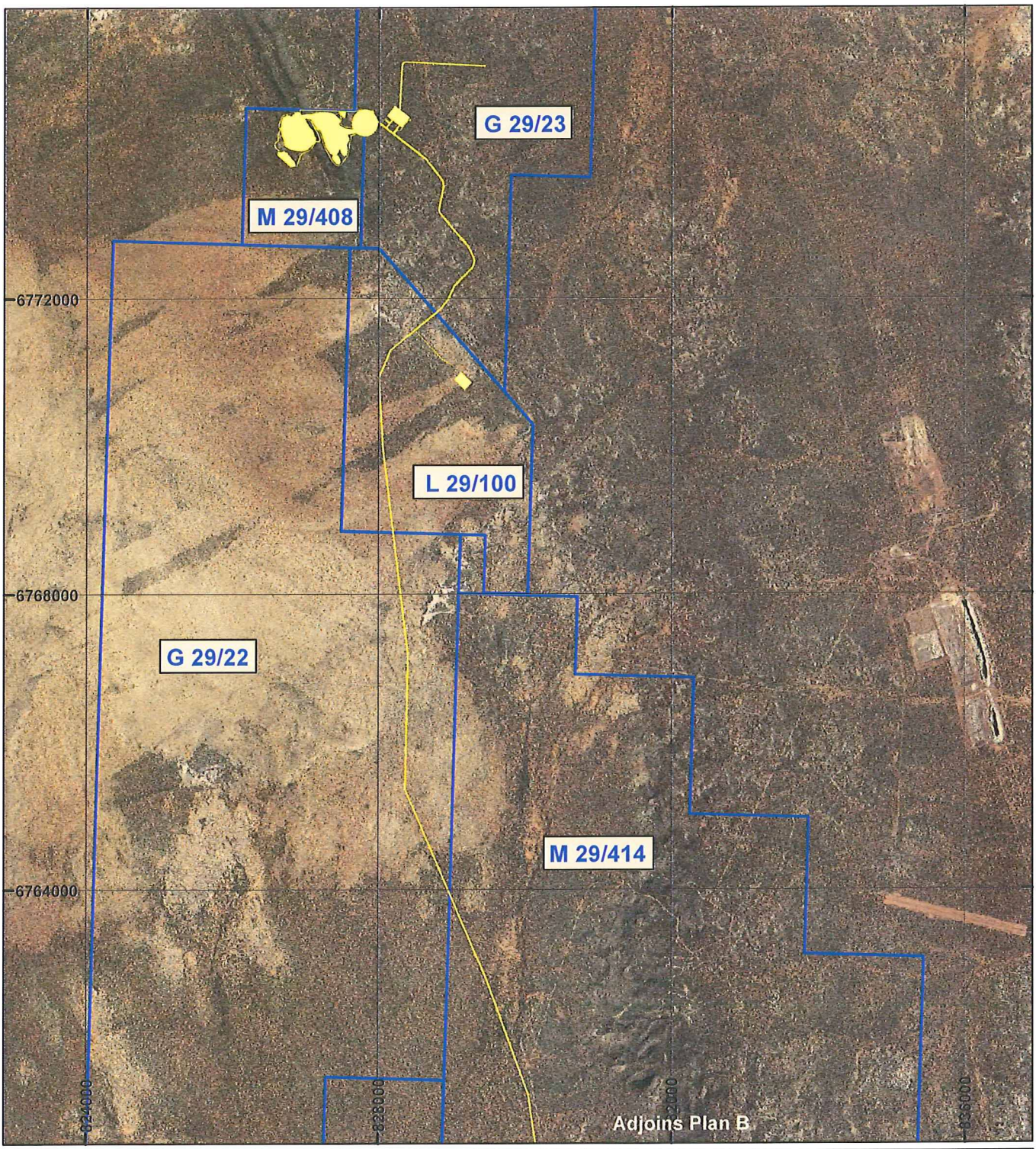
M. Leybourne

Marnie Leybourne
DIRECTOR OPERATIONS
ENVIRONMENT
DEPARTMENT OF MINES AND PETROLEUM

Officer with delegated authority under Section 20
of the *Environmental Protection Act 1986*

24 September 2015

PLAN 5764/2A



LEGEND

- Mining Tenements

Clearing Instruments

- Areas Approved to Clear

Mount Mason 2939 Aug 2010 Mosaic - Landgate

N

0 3,000 M

Scale 1:75,000
(Appoximate when reproduced at A4)

Geocentric Datum Australia 1994

Note: the data in this map have not been projected. This may result in geometric distortion or measurement inaccuracies.

M. Leyb Date 24/9/15

MARNIE LEYBOURNE

Officer with delegated authority under Section 20 of the Environmental Protection Act 1986

Information derived from this map should be confirmed with the data custodian acknowleged by the agency acronym in the legend.

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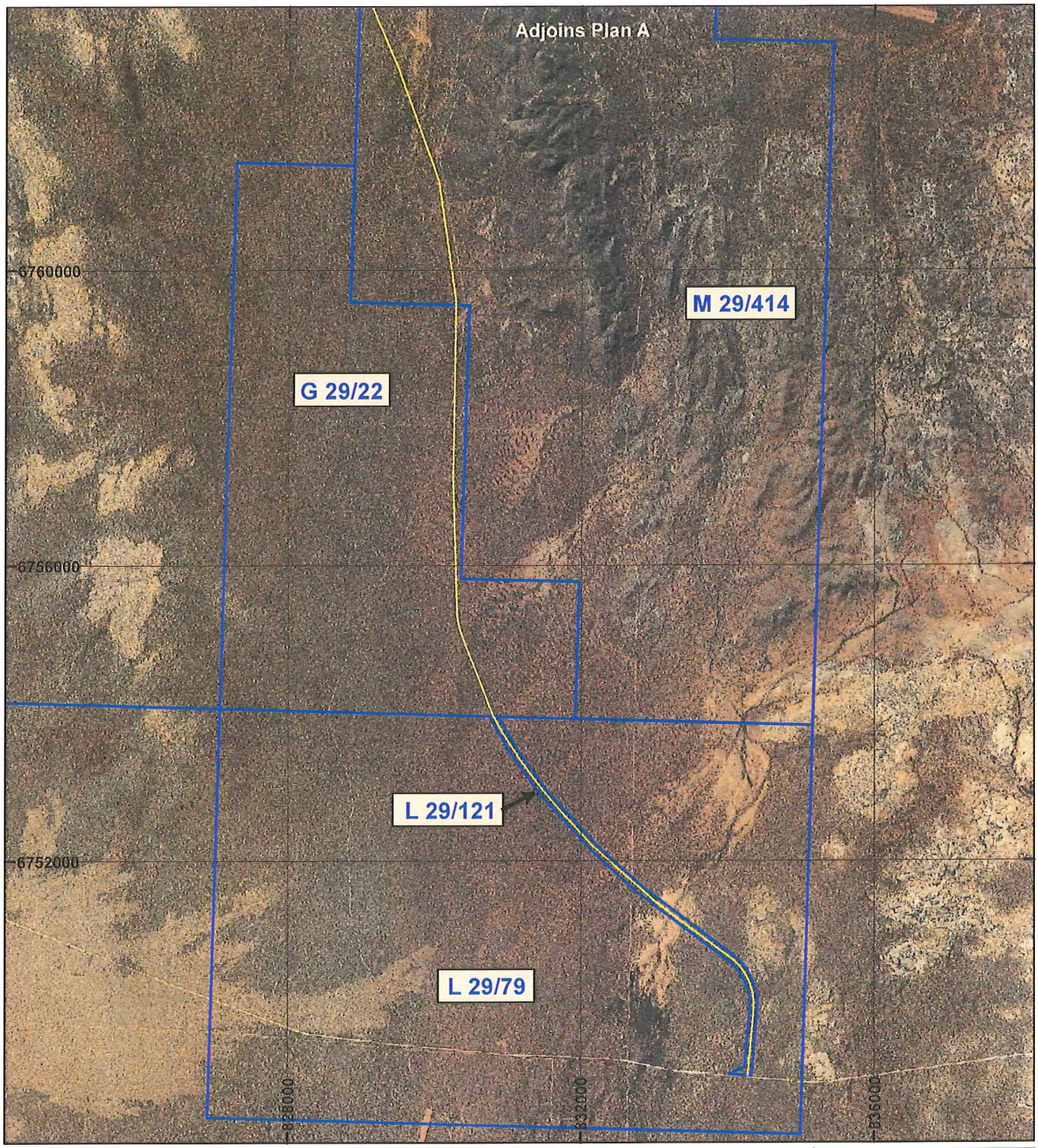
PLAN 5764/2B



LEGEND

- Mining Tenements

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Mount Mason 2939 Aug 2010 Mosaic - Landgate

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Scale 1:75,000
(Appoximate when reproduced at A4)

Geocentric Datum Australia 1994

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M. Leybourne Date 24/9/15

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