

**NATIVE VEGETATION CLEARING PERMIT
MOUNT GOULD IRON PROJECT
M52/236**

PREPARED FOR:

NEWCAM MINERALS



AUGUST 2021

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MOUNT GOULD IRON ORE PROJECT NATIVE VEGETATION CLEARING PERMIT

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TABLE OF CONTENTS

1.	INTRODUCTION	1
2.	ACCESS AND TENURE	4
3.	BASELINE ENVIRONMENT	6
3.2	SOILS AND LAND SYSTEMS	7
3.3	FLORA AND VEGETATION	10
3.3.1	Pre-European Vegetation Associations	11
3.3.2	Vegetation Communities	11
3.3.3	Significant Flora Species	16
3.3.4	Introduced Flora Species	18
3.4	TERRESTRIAL FAUNA AND HABITAT	20
3.4.1	Significant Vertebrate Fauna Habitat	20
3.4.2	Significant Fauna Species	22
3.4.3	Short Range Endemics	3
3.4.4	Introduced Fauna Species	3
3.5	SURFACE WATER AND GROUNDWATER	5
4.	PROPOSED LAND CLEARING	7
5.	ASSESSMENT OF CLEARING PRINCIPLES	8
5.1	NATIVE VEGETATION CLEARING PRINCIPLES	8
5.2	BIODIVERSITY	8
5.3	SIGNIFICANT FAUNA HABITAT	11
5.4	THREATENED FLORA AND PRIORITY FLORA	13
5.5	THREATENED ECOLOGICAL COMMUNITIES	14
5.6	REMNANT VEGETATION	15
5.7	WATERCOURSE OR WETLAND ENVIRONMENTS	15
5.8	LAND DEGRADATION	15
5.9	CONSERVATION ESTATE	17
5.10	SURFACE AND GROUNDWATER QUALITY	17
5.11	FLOODING POTENTIAL	18
6.	REPORTING AND AUDITING	20
7.	CONCLUSION	21
8.	REFERENCES	22

TABLES

Table 1:	Mount Gould Project Tenements	4
Table 2:	Land Systems of the Purpose Permit Area	8
Table 3:	Pre-European Vegetation Systems and Extent	11
Table 4:	Floristic Community Types of the Survey Area	12
Table 5:	Summary of Significant Flora Assessment Results	16
Table 6:	Fauna Habitats of the Survey Area	21
Table 7:	Summary of Significant Fauna Assessment Results	1
Table 8:	Summary of Clearing Assessment Against Clearing Principles	8

Table 9:	Mapped Extent and Potential Impact on FCTs	10
Table 10:	Mapped Extent and Potential Impact on Fauna Habitat Types.....	12
Table 11:	Significant Flora Potentially Impacted by the Purpose Permit Area.....	13
Table 12:	Pre-European Vegetation Association Representation	15

FIGURES

Figure 1:	Project Location.....	2
Figure 2:	Purpose Permit Area and Indicative Clearing Footprint.....	3
Figure 3:	Access and Tenure.....	5
Figure 4:	Land Systems of the Project Area	9
Figure 5:	Floristic Community Types in the Survey Area.....	14
Figure 6:	Mount Gould PEC Extent	15
Figure 7:	Significant Flora Recorded in the Survey Area.....	19
Figure 8:	Fauna Habitat and Significant Fauna Recorded in the Survey Area	2
Figure 9:	Invertebrate Fauna of the Survey Area.....	4
Figure 10:	Topography and Surface Water of the Project Area	6

APPENDICES

Appendix 1:	Letter of Authority
Appendix 2:	Record of Tenement Ownership
Appendix 3:	Mount Gould Tenement Flora and Vegetation Assessment Desktop Review (Woodman 2008)
Appendix 4:	Mount Gould DSO Project Flora and Vegetation Assessment (Woodman 2009)
Appendix 5:	Mount Gould DSO Project Proposed Exploration Drilling Programme - Conservation Significant Flora and Vegetation Assessment (Woodman 2010)
Appendix 6:	Local and Regional Significant Flora Assessment and Regional Vegetation Review (Woodman 2012)
Appendix 7:	NatureMap and PMST Database Search Results (DBCA 2021b, DAWE 2021)
Appendix 8:	Mount Gould Vertebrate Fauna Study (Biologic 2012a)
Appendix 9:	Mount Gould Short-range Endemic Invertebrate Survey Report (Biologic 2012b)

1. INTRODUCTION

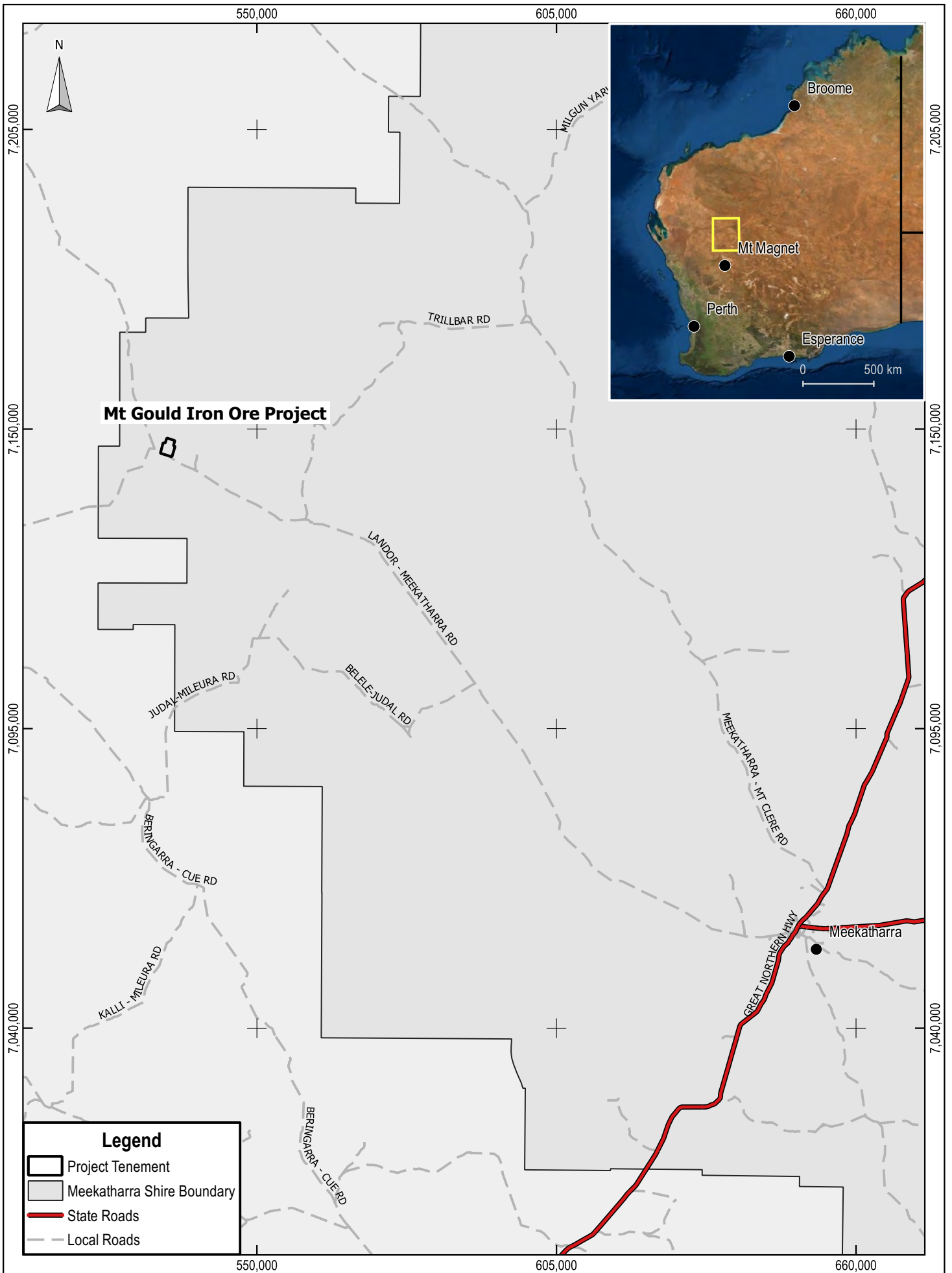
Newcam Minerals Pty Ltd (Newcam) proposes to develop and operate the Mount Gould Iron Project (the Project), located approximately 900 km north of Perth and 140 km west northwest of Meekatharra in the Mid-west region of Western Australia (WA) (Figure 1). The Project is on tenement M 52/236 which overlies the Mount Gould Pastoral Station.

Mount Gould has previously been mined for Micaceous Iron Ore (MIO), and a small pit is present on the saddle ridge between the two main peaks forming the landform. The summit of Mount Gould lies on the northeastern peak which attenuates to the west. The deposit was originally mined in two separate campaigns between 1995 and 2004 and produced approximately 8,000 tonnes of ore during the period. Ore from early operations was crushed on site and transported to facilities in either Perth, Northam, or Jandakot for further crushing and processing. Historically the Project consists of exploration drilling, an open pit, waste landforms and associated support infrastructure including roads and access tracks, a maintenance shed and hardstand area, ore storage bays, ore load out and magazine hardstand area. In 2008, geological mapping and biological surveys were undertaken on the tenement however no physical works, including exploration were completed.





Newcam acquired the tenement and the Mount Gould Iron Project in 2019. In 2019, a Reverse Circulation and Diamond Drilling campaign was undertaken on the western portion of Mount Gould to further delineate the potential resource which resulted in a mineral estimate of approximately 4 Mt at 64.5% Iron. Newcam now intends to develop the deposit as a small-scale open pit mining, crushing, and trucking operation, where ore will be transported to Geraldton Port for direct shipping export.

Clearing of native vegetation is required for project development. Newcam proposes to clear 136.5 ha of native vegetation within a Purpose Permit Area of 309.5 ha (Figure 2) which allows adequate space within the Purpose Permit Area for proposed and future mining, siting of infrastructure, and associated activities. Approximately 20 ha of the area encompassed within the Indicated Clearing Footprint (136.5 ha) is historic clearing.

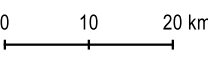
The purpose of this document is to support application for a Native Vegetation Clearing Permit (NVCP) under Part IV of the *Environmental Protection Act 1986* (EP Act) to allow clearing of native vegetation for the Mount Gould Iron Project. This application is being submitted to the Department of Mines, Industry Regulation and Safety (DMIRS) in conjunction with development of a Mining Proposal (MP) and Mine Closure Plan (MCP) for evaluation of the environmental and social impacts of the Project and outline of how activities will be managed. The MP and MCP are anticipated to be submitted to DMIRS in Q4 2021 after the finalisation of baseline studies and reports.



Legend

-  Project Tenement
-  Meekatharra Shire Boundary
-  State Roads
-  Local Roads

Scale: 1:900000
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 Grid: GDA94 / MGA zone 50

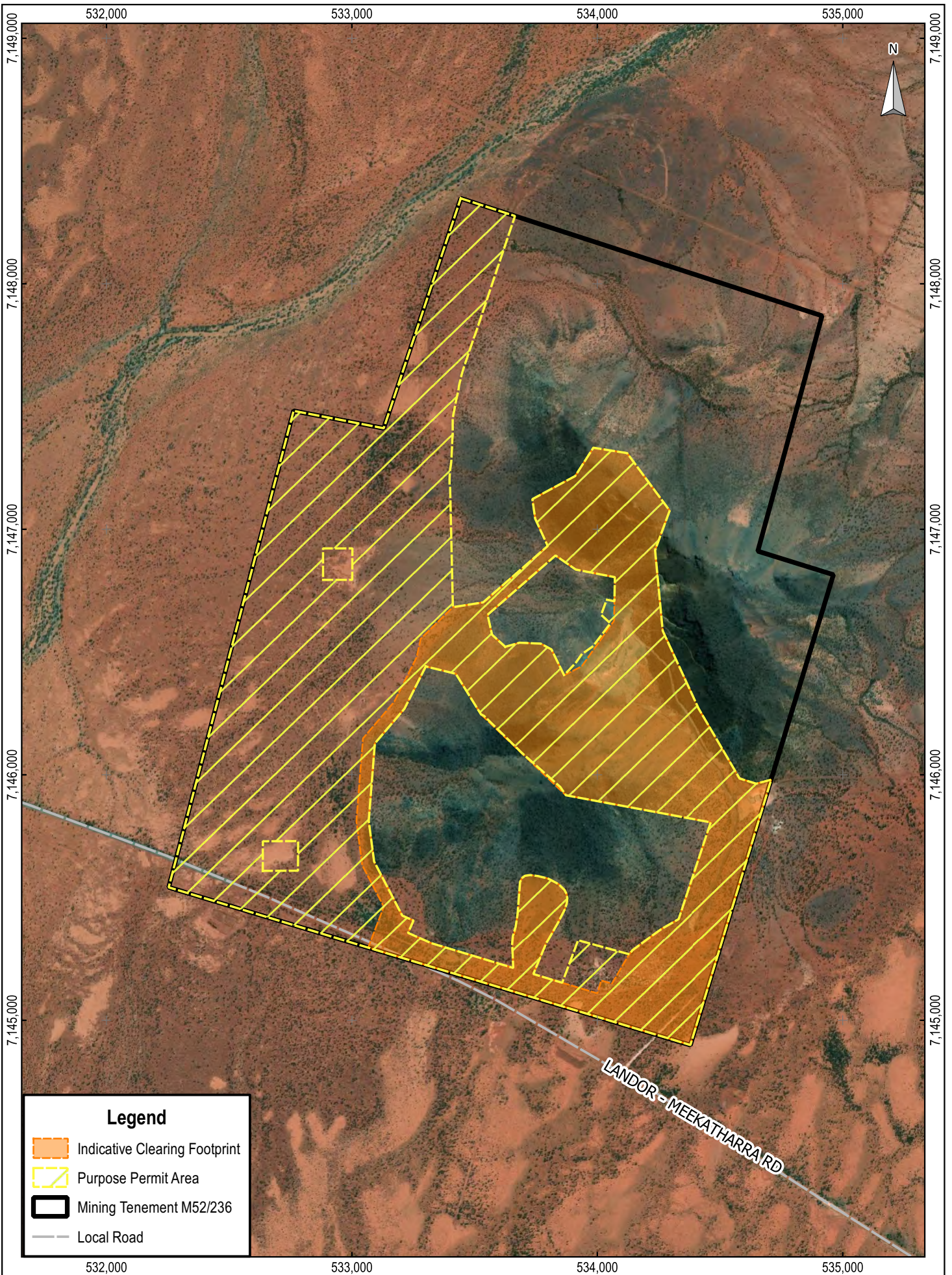


Newcam Minerals Pty Ltd
 Mt Gould Iron Project
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Figure 1
Mount Gould Project Location

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2. ACCESS AND TENURE

The Project is located in the Shire of Meekatharra within the Mid-west region of Western Australia. The Project lies approximately 700 km north of Perth, 140 km west northwest of Meekatharra and approximately 500 km northeast of Geraldton and is accessed via the Great Northern Highway and the partially sealed Landor- Meekatharra Road (Figure 1).

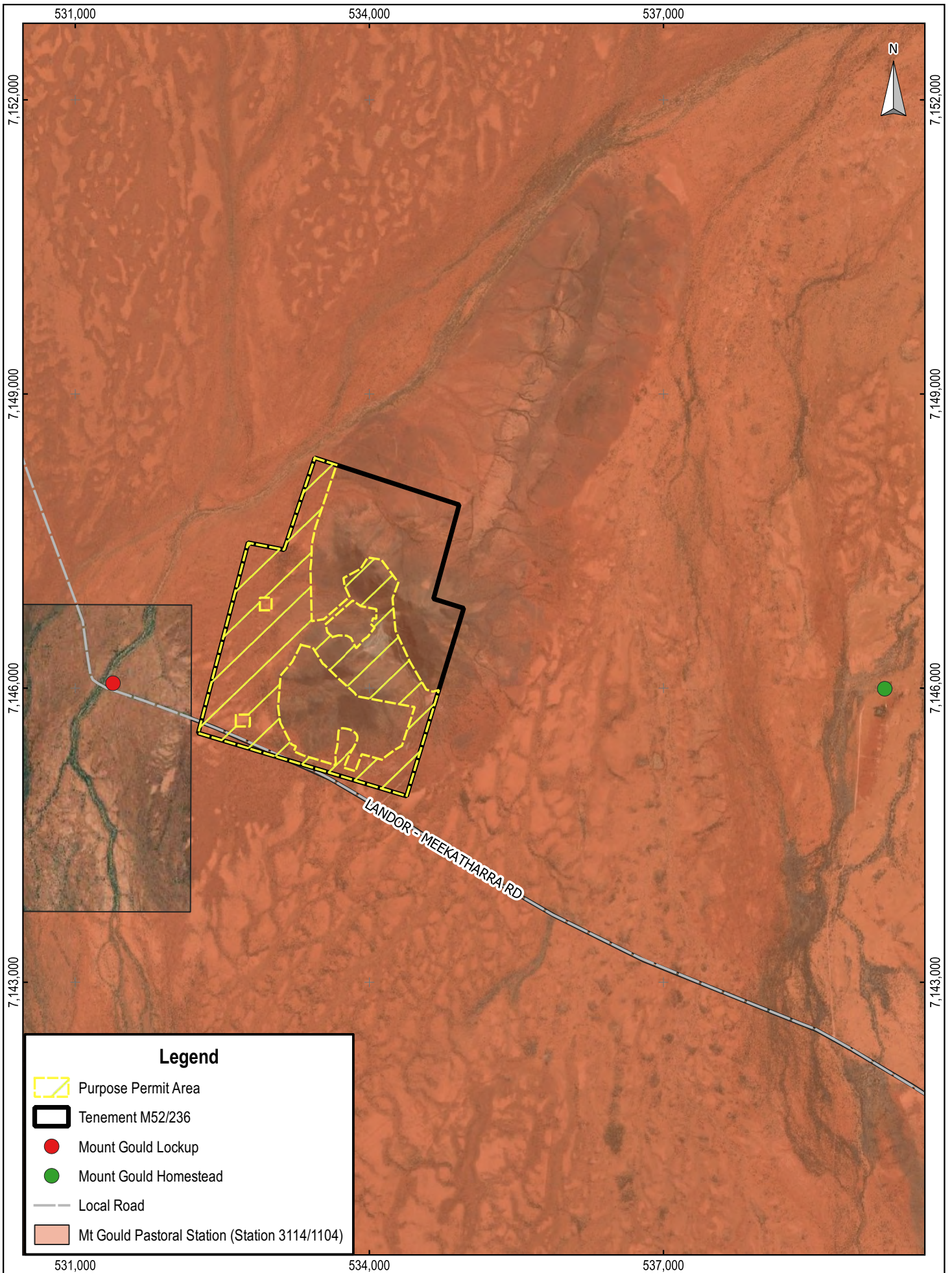
The privately leased Mount Gould Pastoral Station underlies the project tenement and Newcam has sought approval and authorisation to undertake associated mining activities on the lease (Appendix 1). The Mount Gould Homestead and the historic Mount Gould Lock Up are located approximately 5 km east and 3 km west of the Project, respectively (Figure 3).

ACME Mioxide Pty Ltd (ACME) acquired M52/236 and the associated Mount Gould Micaceous Iron Oxide Project from Mount Gould Minerals Pty Ltd (a subsidiary of Atlas Iron Limited) on 31st May 2016. Newcam Minerals entered into a binding agreement with ACME Mioxide in 2019 for the sale and transfer of the mining lease for an agreed sum and agreed future royalty amount upon stages of extraction of the ore body. The mining lease currently remains under ACME ownership due to ongoing valuations of transactional stamp duty owned to the WA state revenue office. Upon final determination and payment, the mining lease will transfer into Newcam Minerals ownership. All decisions regarding the operations and management of the lease are solely made and authorised by Newcam.

A summary of the applicable tenement to the Purpose Permit Area is provided in Table 1. A record of tenure ownership is provided in Appendix 2.

Table 1: Mount Gould Project Tenements

Tenement	Tenement Holder	Area (ha)	Grant Date	Expiry Date
M 52/236	ACME Mioxide Pty Ltd	613.5	24/01/1992	23/01/2034



Legend

- Purpose Permit Area
- Tenement M52/236
- Mount Gould Lockup
- Mount Gould Homestead
- Local Road
- Mt Gould Pastoral Station (Station 3114/1104)

Scale: 1: 50,000
 Original Size: A4
 Grid: GDA94 / MGA zone 50

0 0.75 1.5 km

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Figure 3

Access and Tenure

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3. BASELINE ENVIRONMENT

3.1 CLIMATE

The Purpose Permit Area is located within the Murchison Bioregion which experiences desert climate typified by hot dry summers and mild winters, commonly with 12 dry months a year. Rainfall is mostly unreliable and occurs predominantly in winter, however low erratic bimodal rainfall events are possible in both summer and winter (Tille 2006). A representative Bureau of Meteorology (BoM) weather station is located at Meekatharra Airport (Site 7045), approximately 140 km southeast of the Purpose Permit Area.

Climate data from the weather station shows monthly mean minimum temperatures range from 7.4°C to 24.4°C and monthly mean maximum temperatures range from 19.2°C to 38.3°C (Chart 1). The hottest month is January with a mean maximum temperature of 38.3°C and mean minimum temperature of 24.4°C, whilst July is the coldest month with average maximum and minimum temperatures of 19.2°C and 7.4°C, respectively (BoM 2021).

Mean annual rainfall is 234.9 mm (BoM 2021) with average rainfall peaking in February (Chart 1). Annual precipitation falls predominantly in late summer/ early autumn (January to March) with winter rains also apparent in June and July. Summer rains are influenced by tropical cyclones which form off the Pilbara coast between December and April and bring rain-bearing depressions into the region (Meissner *et al* 2009). Winter rains are influenced by strong cold fronts from the south weakening as they move upwards (Meissner *et al* 2009) bringing isolated showers and strong winds.

The single largest daily rainfall event was 114.4 mm, recorded in June 1989 (BoM 2021). The largest annual rainfall (since 1944) occurred in 2000 with the area receiving 573.2 mm (BoM 2021). Historically average annual rainfall has been received 45% of the time, however 2015 was the last time average annual rainfall has been received in recent years. The average annual rainfall is exceeded by the average annual evaporation rate of approximately 3,200 mm, by a factor of approximately 13.

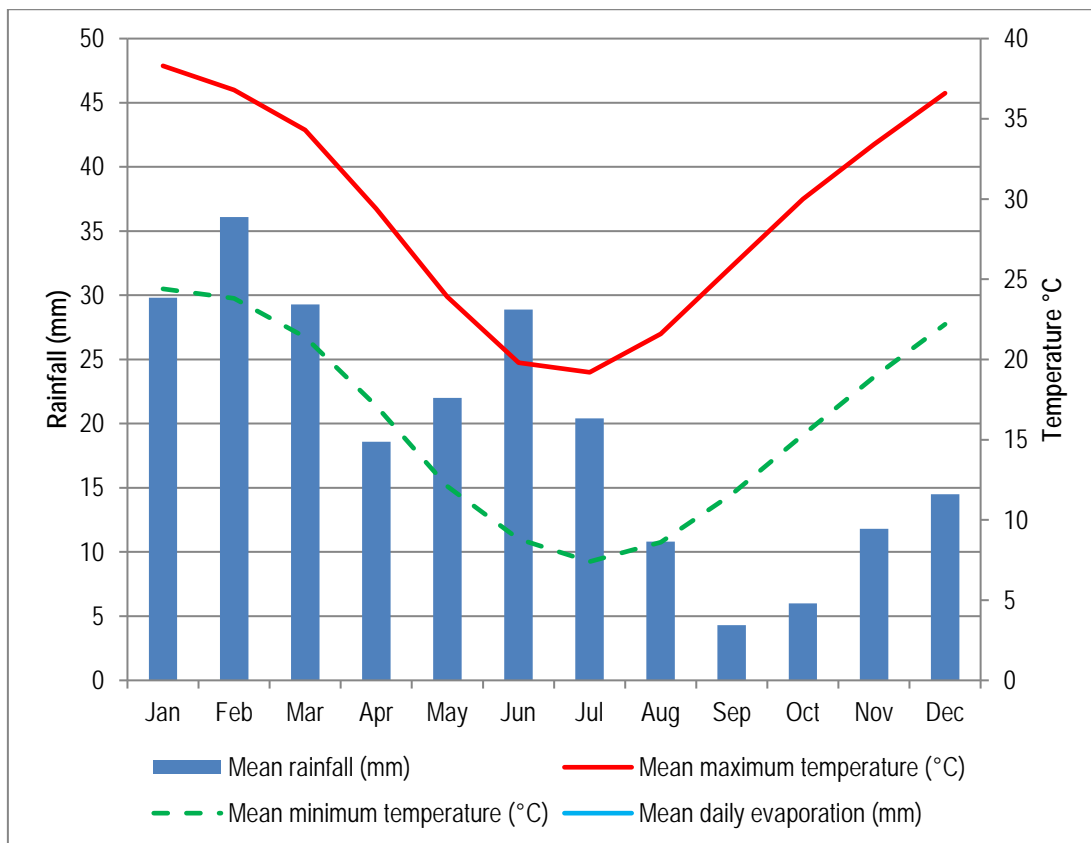


Chart 1: Meekatharra Airport Weather Station Climate Data 1944 - 2020 (BoM 2021)

3.2 SOILS AND LAND SYSTEMS

The Purpose Permit Area is located within the Murchison Bioregion classified by the Interim Biogeographic Regionalisation for Australia (IBRA) and described as an extensive plateau of generally low relief with occasional, protrusive Banded Iron Formations (BIF) ranges (Jack Hills Range, Robinson Range, Weld Range) and mesas (Mount Gould) prominent throughout the regional landscape (Thackway and Cresswell 1995). The ranges and mesas are dissected by flat colluvium and alluvial sandplains and undulating hills and low mulga woodlands dominate the vegetation (Thackway and Cresswell 1995).

The Murchison Bioregion is divided into two subregions the Eastern Murchison (MUR01) and Western Murchison (MUR02), of which the Purpose Permit Area is located within the Western Murchison subregion. The Western Murchison subregion forms the northern part of the Yilgarn Craton. This subregion is dominated by hardpan wash plains, with stony plains, sandplains, hills and mesas throughout, over granite and gneiss rock (Tille 2006).

Mount Gould is a prominent ironstone hill extrusion from the relatively flat landscape consisting of two main peaks. The granitic rocks and granitic gneisses at Mount Gould are interlayered with minor deformed and metamorphosed BIF, mafic and ultramafic intrusive rocks, and metasedimentary rocks (England and Neilson 2019).

Mount Gould forms the most northern extent of the Jack Hills Range and extends approximately 680 m from ground level at its highest peak. Landforms identified within the Purpose Permit Area include:

- Hills and ridges with peaks to 120 m supporting scattered Acacia and chenopod shrublands.
- Gently sloping footslopes or rounded interfluvies also supporting scattered Acacia and chenopod shrublands.
- Alluvial fans and shallow drainage floors supporting scattered mixed shrub communities.

- Slightly elevated sand plains supporting scattered tall mixed species shrublands.

The Department of Primary Industries and Regional Development (DPIRD) provides broad scale (1:250,000) landscape system mapping delineating the landscape patterns, landforms and associated major soil groups and vegetation types of WA. The Purpose Permit Area intersects both the Peak Hill Land system and the Cole Land Systems as described in Table 2 and shown in Figure 4 (DPIRD 2021a). The land systems are widespread beyond the Purpose Permit Area and are well represented within the regional area.

Table 2: Land Systems of the Purpose Permit Area

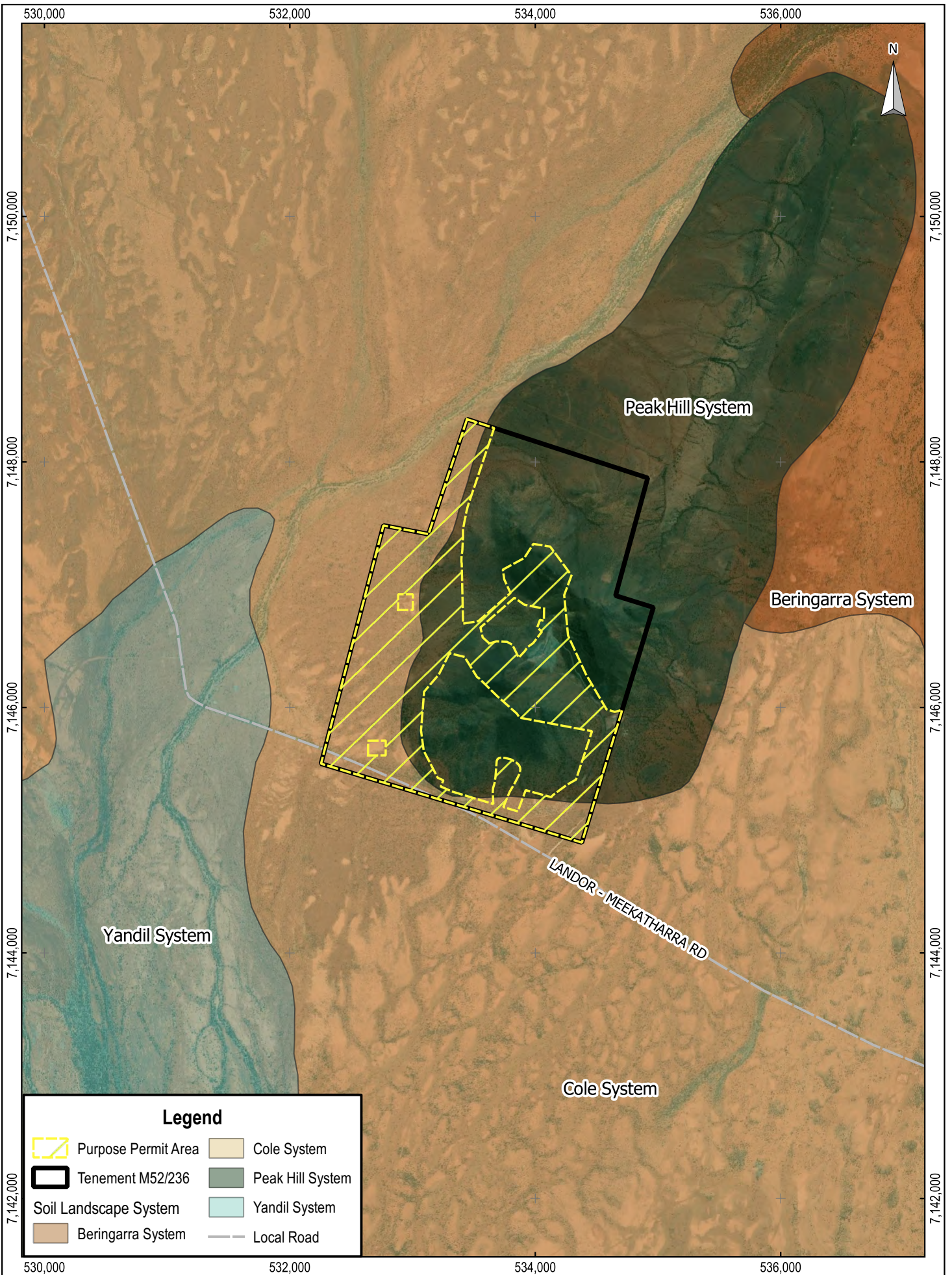
Land System	Description	Mapped Extent Within M52/236 (ha)
Cole System	Hardpan wash plains with reticulate patterns of wanderrie banks and mulga groves and more concentrated drainage tracts, supporting mixed mulga and wanderrie shrublands	152.4
Peak Hill System	Rugged sinuous ranges and rounded hills of Proterozoic banded ironstone and haematitic shale, supporting stunted mulga and cottonbush shrublands	460.6

Soils of the Purpose Permit Area include Red-brown Hardpan Shallow Loams, Red Sandy-earths, and Stony Soils (MBS 2021).

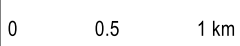
Red-brown Hardpan Shallow Loams are generally found on the gentle eastern hillslopes of Mount Gould, in the east to southeastern edge of the Purpose Permit Area, characterised by a shallow red-brown silty layer that extended for between 30 - 60 cm below the surface, followed by heavily weathered fragile chemical sedimentary rock extended for approximately 1 m (MBS 2021). This soil type supports moderate cover of 1-2 m shrubs and an associated understory of perennial grasses, herbs, and forbs. This soil type is subject to sheet erosion and can have a moderate to high risk of erosion after major depletion of perennial plants (Hennig 2009). However, as elevation in the landscape increases, soils become increasingly skeletal in nature, and the volume of soil present decreases as a dense surface gravel and outcropping layer becomes prominent (MBS 2021), reducing the risk of erosion.

Red Sandy-earth Soils are typically found in flat environments on the southern edge of the Purpose Permit Area, characterised by dark red/brown loamy soil with increasing clay content with depth. Profiles typically extend between 1.2-1.5 m until reaching hardpan (MBS 2021). These soils typically have little to no surface gravel or gravel in the topsoil layers and support a moderate cover of mixed 1-2 m shrubs and perennial grasses, although large areas of bare soil are also present (MBS 2021). This soil type is considered to be well vegetated and therefore of low erosion risk (Hennig 2009).

Stony Soils are common throughout the centre of the Purpose Permit Area, typically aligning with the peaks of Mount Gould and are characterised by containing >20% cobbles (>16 mm) by mass (MBS 2021). These profiles are located on the gentle eastern hillslopes of Mount Gould and support a moderate cover of 1-2 m shrubs and associated understory of perennial grasses, herbs, and forbs (MBS 2021). The soil surface is outcropping rock or a dense stony mantle and are not prone to any erosion risk (Hennig 2009).



Scale: 1: 40,000
 Original Size: A4
 Grid: GDA94 / MGA zone 50



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Figure 4
Landscape Systems of the Project Area

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3.3 FLORA AND VEGETATION

A number of flora and vegetation assessments have been undertaken across the tenement, encompassing the Purpose Permit Area, these include:

- Mount Gould Flora and Vegetation Assessment Desktop Review (Woodman 2008).
- Mount Gould DSO Project Flora and Vegetation Assessment (Woodman 2009).
- Mount Gould Proposed Exploration Drilling Program Conservation Significant Flora and Vegetation Assessment - Draft (Woodman 2010).
- Mount Gould DSO Project Local and Regional Significant Flora Assessment and Regional Vegetation Review (Woodman 2012).

Except for the Woodman 2010 survey, which focussed on a specified drilling footprint within the Purpose Permit Area, the survey extent of the baseline flora studies corresponds with the tenement boundary (survey area) and covers an area of 613 ha. The Woodman 2010 report remains in draft form and does not provide any further information to what was provided in the other baseline flora reports. For this reason, the report has not been heavily referred to for analysis and assessment of the baseline environment. Baseline flora survey reports are attached in Appendix 3, Appendix 4, Appendix 5 and

Appendix 6.

3.3.1 Pre-European Vegetation Associations

Pre-European vegetation associations (VAs) of Western Australia were first mapped by Beard (1976) and later reinterpreted and redefined by Shepherd (*et al* 2002) to reflect national standards and the extensive clearing undertaken since the Beard mapping (1976). Two pre-European vegetation associations, 29 and 202, are within the Purpose Permit Area, with 202 dominating its spatial extent and 29 associated with the southern corner. Vegetation association 29 has been described as "*Low woodland, open low woodland or sparse woodland of Mulga Acacia aneura and associated species.*" Vegetation associating 202 has been described as "*Scrub, open scrub or sparse scrub with Wattle, teatree & other Acacia spp. And Melaleuca spp.*" (DPIRD 2021b). The current and pre-European extents of these vegetation associations are shown in Table 3.

Table 3: Pre-European Vegetation Systems and Extent

Pre-European VA	Pre-European Extent (ha)	Current Extent (ha)
29	7,903,991.45	7,898,973.24
202	448,529.31	448,343.80

3.3.2 Vegetation Communities

Baseline flora surveys (Woodman 2009) mapped and described seven Floristic Community Types (FCTs) within the survey area which all intersect the Purpose Permit Area. These FCTs were represented by 94 native vascular flora species, from 28 families and 53 genera. The FCTs are described in Table 4 and shown in Figure 5.

Table 4: Floristic Community Types of the Survey Area

Floristic Community Type	Vegetation Description	Mapped Extent (ha)
1	Open tall shrubland of <i>Acacia aneura</i> over sparse low shrubland of <i>Ptilotus obovatus</i> over open low forbland of <i>Goodenia tenuiloba</i> .	194.6
2	Sparse tall shrubland of mixed <i>Acacia</i> species over sparse low shrubland of <i>Ptilotus obovatus</i> and <i>Eremophila</i> species over open low forbland of <i>Goodenia tenuiloba</i> .	26.6
3	Sparse tall shrubland isolated shrubs of <i>Acacia aneura</i> over isolated mid shrubs of <i>Eremophila fraseri</i> subsp. <i>parva</i> over isolated low shrubs of <i>Ptilotus obovatus</i> over open low forbland of mixed species including <i>Ptilotus aevoides</i> and <i>Goodenia tenuiloba</i> .	82.2
4	Open tall shrubland of isolated shrubs of <i>Acacia aneura</i> over open to sparse mid shrubland of <i>Eremophila latrobei</i> subsp. and <i>Philotheca brucei</i> subsp. <i>cinerea</i> over open to sparse low shrubland and low tussock grassland of <i>Ptilotus obovatus</i> and <i>Cymbopogon ambiguus</i> .	104.7
5	Isolated tall shrubland of <i>Acacia aneura</i> and or <i>Grevillea berryana</i> over sparse low shrubland of <i>Eremophila latrobei</i> subsp. <i>latrobei</i> , <i>Philotheca brucei</i> subsp. <i>cinerea</i> and <i>Ptilotus obovatus</i> over low hummock grassland of <i>Triodia melvillei</i> .	25.3
6a	Open tall shrubland of <i>Acacia ramulosa</i> var. <i>linophylla</i> and <i>Acacia kempeana</i> over sparse mid shrubland of <i>Eremophila forrestii</i> subsp. <i>forrestii</i> over isolated low shrubland of <i>Corchorus crozophorifolius</i> over sparse low grassland and forbland of mixed species including <i>Eriachne mucronata</i> and <i>Ptilotus aevoides</i> .	146.4
6b	Tall sparse shrubland of <i>Acacia ramulosa</i> var. <i>linophylla</i> and <i>Acacia citrinoviridis</i> over open mid shrubland of <i>Halgania gustafsenii</i> var. <i>Murchison</i> over sparse low forbland of <i>Goodenia tenuiloba</i> .	10.6
C	Cleared / Historic disturbance	22.5
Total		613.0

In general, the vegetation in the survey area was in 'Excellent' to 'Good' condition (Woodman 2009). Grazing by stock was more evident on the flats surrounding Mount Gould, with reduced evidence on the slopes and summit, due to feral goats (Woodman 2012). A total of 22.5 ha of previous clearing and/or historic disturbance exists within the survey area as a result of previous mining and pastoral activities.

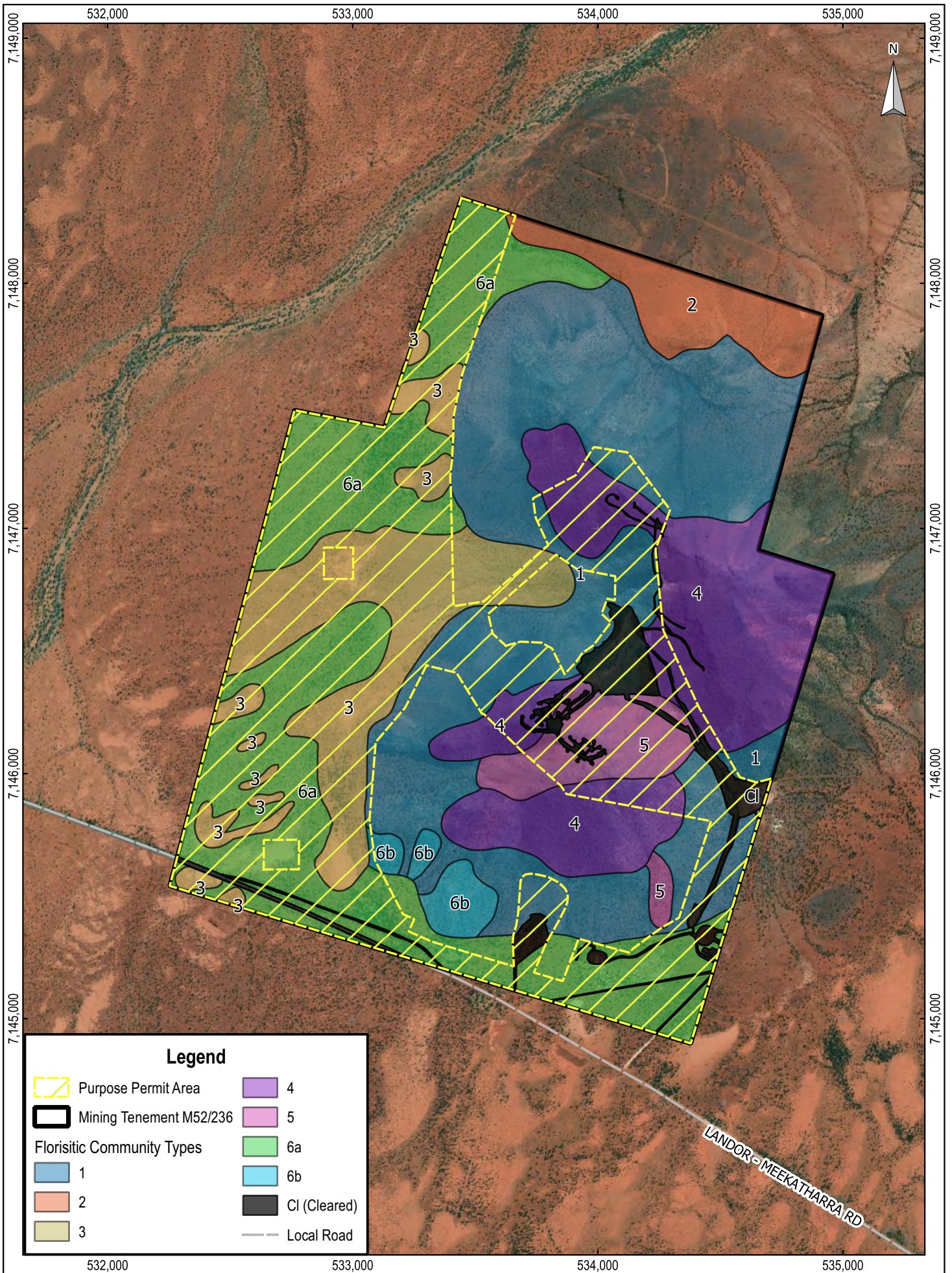
Three of the FCTs (2, 3 and 6a) were considered likely to be common and widespread throughout both Mount Gould and the region, in terms of soil types, substrates, and topological position. The distribution of the remaining FCTs were considered restricted to the Mount Gould landform (FCT 4, 5, 6b), or the greater region (FCT 1) (Woodman 2009). FCT 1 is also known regionally from Jack Hills. FCT 4, 5 and 6b are considered to be of high local significance as they are not known to occur elsewhere as their soil types, substrates, and topological positions differentiate from vegetation units of other BIF ridges in the region (Woodman 2009). Conservation significant flora taxa were recorded in all FCTs during the baseline studies, except for FCT 6a.

Previous baseline flora surveys indicated No Threatened Ecological Communities (TEC) pursuant to Commonwealth and State legislation are located within the survey area and therefore the Purpose Permit Area (Woodman 2009, Woodman 2012). However, the surveys have indicated the presence of one Priority 1 Ecological Community (PEC), the Mount Gould Vegetation Complex BIF (the Mount Gould PEC), listed at state level by the Department of Biodiversity, Conservation and Attractions (DBCA) (Woodman 2009, Woodman 2012).

Recent search results from the DBCA Threatened and Priority Ecological Community Database confirmed findings from the baseline surveys to be valid, indicating no presence of TECs within the Purpose Permit Area (DBCA 2021a), and the presence of the Mount Gould PEC. The mapped extent of the Mount Gould PEC (inclusive

of a 500 m buffer) is 1,683.7 ha, which overlaps approximately 222 ha (13%) of the Purpose Permit Area and 136.5 ha (8.1%) of the Indicative Clearing Footprint (Figure 6).

FCTs representative of the Mount Gould PEC (FCT 1, 4, 5, 6b), are statistically dissimilar in species composition from FCTs (vegetation units) on the nearby Jack Hills and Robinson Range BIF ridges and therefore, the Mount Gould PEC, defined as the current complex, is unlikely to occur elsewhere (Woodman 2012). However, the FCTs forming part of the complex which is the Mount Gould PEC are likely to occur elsewhere (Woodman 2012), except for FCT 5. The distribution of FCT 5 is restricted to the summit and slopes of Mount Gould and comprises hummock grassland (spinifex) dominated by *Triodia melvillei* (Woodman 2012) and is unlikely to occur elsewhere, therefore this FCT is considered to have a high level of regional significance (Woodman 2012).



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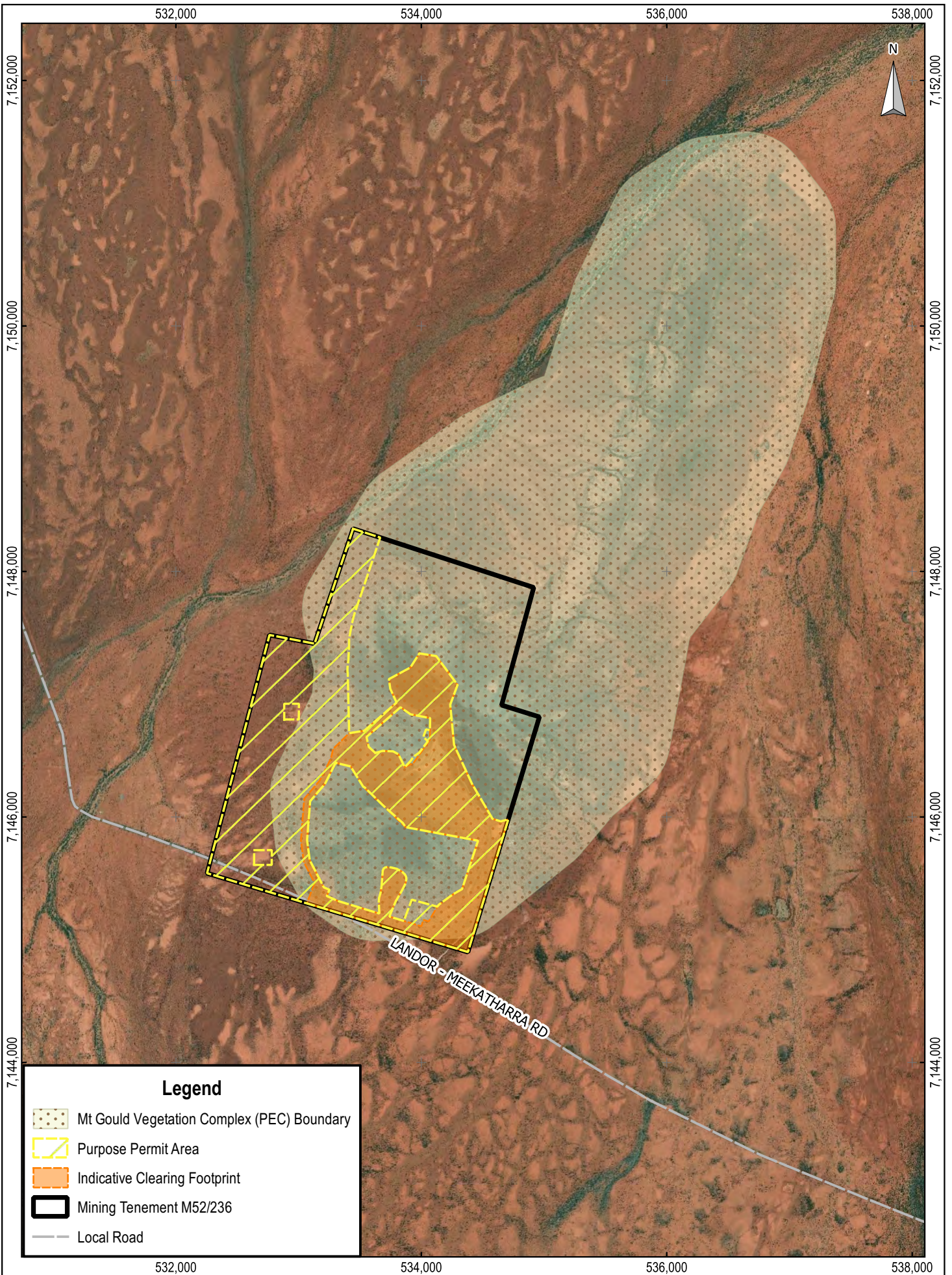
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Figure 5
Floristic Community Types
in the Survey Area

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Legend

-  Mt Gould Vegetation Complex (PEC) Boundary
-  Purpose Permit Area
-  Indicative Clearing Footprint
-  Mining Tenement M52/236
-  Local Road

Scale: 1: 40,000
 Original Size: A4
 Grid: GDA94 / MGA zone 50

0 0.5 1 km

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Figure 6

Mount Gould PEC Extent

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3.3.3 Significant Flora Species

Results from the baseline desktop assessment (Woodman 2008) recognised ten species of significance to likely to occur within a 20 km radius of the Project, indicating one Threatened species and nine DBCA listed species have the potential to occur within the Purpose Permit Area (Table 5). Following the desktop assessment, field surveys carried out between 2009 and 2012 (Woodman 2009, 2010, 2012) recorded and confirmed the presence of four significant species within the survey area (Table 5 and Figure 7), *Eremophila warnesii* (P1), *Halgania gustafsenii* (P1), *Rhodanthe sphaerocephala* (P1) and *Tribulus adelacanthus* (P3). Of these, only *Eremophila warnesii*, was previously recognised from the desktop assessment.

To verify the validity of the baseline assessments, MBS Environmental (MBS) conducted database searches of NatureMap and the Protected Matters Search Tool (PMST), within 20 km of the Purpose Permit Area (Appendix 7). A summary of the recent database and baseline assessment results are given in Table 5.

Table 5: Summary of Significant Flora Assessment Results

Significant Flora Species	Current Conservation Status		Recognised from Desktop Assessment (Woodman 2008)	Recorded During Field Survey (Woodman 2009, 2010, 2012)	Recognised from Recent Database Searches (DAWE 2021, DBCA 2021b)
	EPBC Act (BC Act)	DBCA Listing			
<i>Angianthus microcephalus</i>		P2			✓
<i>Calytrix verruculosa</i>		P1	✓		
<i>Eremophila warnesii</i> ms		P1	✓	✓	✓
<i>Frankenia confusa</i>		P4			✓
<i>Gunniopsis propinqua</i>		P3	✓		
<i>Halgania gustafsenii</i>		P1		✓	✓
<i>Hemigenia tysonii</i>		P3	✓		
<i>Lepidium xylodes</i>		P1	✓		
<i>Thysanotus fragrans</i> (formerly <i>Murchisonia</i>)		P2	✓		
<i>Ptilotus lazaridis</i>		P3	✓		✓
<i>Pityrodia augustensis</i>	VU (VU)	-	✓		✓
<i>Rhodanthe sphaerocephala</i>		P1		✓	✓
<i>Stenanthemum mediale</i>		P1	✓		
<i>Tribulus adelacanthus</i>		P3		✓	✓
<i>Verticordia jamiesonii</i>		P3	✓		✓

Comparison of assessment results shown in Table 5, indicates:

- Of the ten significant flora species initially recognised from desktop assessment only four are still considered likely to occur within the Purpose Permit Area. This includes *Eremophila warnesii*, *Ptilotus lazaridis*, *Pityrodia augustensis*, and *Verticordia jamiesonii*.
- An additional five significant flora species are now recognised as potentially occurring within the Purpose Permit Area, which were not previously recognised from the desktop assessment. This includes *Angianthus microcephalus*, *Frankenia confusa*, *Halgania gustafsenii*, *Rhodanthe sphaerocephala* and *Tribulus adelacanthus*. Three of these species have been recorded during field surveys.
- *Pityrodia augustensis* (Mt Augustus Foxglove) remains listed as Vulnerable under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the WA *Biodiversity Conservation Act 2016* (BC Act) and is still considered to potentially occur within the survey area due to the

presence of suitable habitat (DAWE 2021). However, this species has not been recorded during any of the field surveys and the closest records occur over 200 km east southeast of the survey area (DBCA 2021b). Therefore, it is considered unlikely this species occurs within the Purpose Permit Area.

- The conservation status of *Eremophila warnesii* (P1), *Lepidium xyloides* (P1), *Stenanthemum mediale* (P1), *Hemigenia tysonii* (P3) and *Verticordia jamiesonii* (P3) remains unchanged from desktop assessment results. Of these, only *Eremophila warnesii* and *Verticordia jamiesonii* are still recognised as potentially occurring in the Purpose Permit Area, with *Eremophila warnesii* recorded during field surveys.
- Three species recognised in the desktop assessment have since changed conservation status with *Calytrix verruculosa* downgrading from P1 to P3, *Gunniopsis propinqua* downgrading from P3 to 'not threatened' and *Ptilotus lazaridis* downgraded from P1 to P3. Of these only *Ptilotus lazaridis* is still has the potential to occur in the Purpose permit Area but has not been recorded during field surveys.
- *Murchisonia fragrans* underwent a name change and is now known as *Thysanotus fragrans*. The species remains a P2 species but no longer has potential to occur within the Purpose Permit Area and has not been recorded during field surveys.
- *Frankenia confusa* is now considered as potentially occurring within the Purpose Permit Area but has not been previously recorded during field surveys. This species occurs on wet pale brown sand, brown clay and grey soils on banks of rivers, waterholes and river floodplains and is known from locations associated with major drainage channels (DBCA 2021c). The closest known records are along the banks of the Murchison River over 12 km south of the Purpose Permit Area (DBCA 2021c). Soil types within the Purpose Permit Area (shallow loams, sandy-earths and stony soils) do not typically represent preferred habitat for this species. The closest watercourse is ephemeral and occurs 75 m outside of the Purpose Permit Area, therefore suitable habitat to support this species is considered unlikely to occur within the Purpose Permit Area.
- *Angianthus microcephalus* is also now considered as potentially occurring within the Purpose Permit Area but has not been previously recorded during field surveys. This species occurs on sandy or clayey soil, salt swamps and pans (DBCA 2021d) and suitable habitat is unlikely to occur within the Purpose Permit Area. The closest known record of the species is along the Murchison River (DBCA 2021d), over 12 km south of the Purpose Permit Area. Soil types within the Purpose Permit Area (shallow loams, sandy-earths and stony soils) do not typically represent preferred habitat for this species therefore, this species is considered unlikely to occur within the Purpose Permit Area.

The following species discussed are of current conservation significance and have been recorded during field surveys.

Eremophila warnesii and *H. gustafsenii* were found to be well represented throughout the survey area, (Woodman 2012). *E. warnesii* was generally restricted to the northern upper slopes of Mount Gould within FCTs 1, 4 and 5 with small patches found on mid to lower slopes. A total of 13,339 individuals from 327 locations were recorded within the survey area (Figure 7) and 780 records from 15 locations were recorded regionally (Woodman 2012). *H. gustafsenii* was found mostly on the steep lower slopes of Mount Gould within FCTs 4,5 and 6b extending to the mid-slopes and unexpectedly also on the gently sloping stony areas at the base of Mount Gould on the western side. This species is known from 12,883 individuals recorded from 1,028 locations within the survey area (Figure 7) and 689 individuals recorded from 75 locations regionally (Woodman 2012). It is considered likely that further populations of *E. warnesii* and *H. gustafsenii* are present within the surrounding region, as suitable habitat exists in the surrounding areas of recorded populations (Woodman 2012).

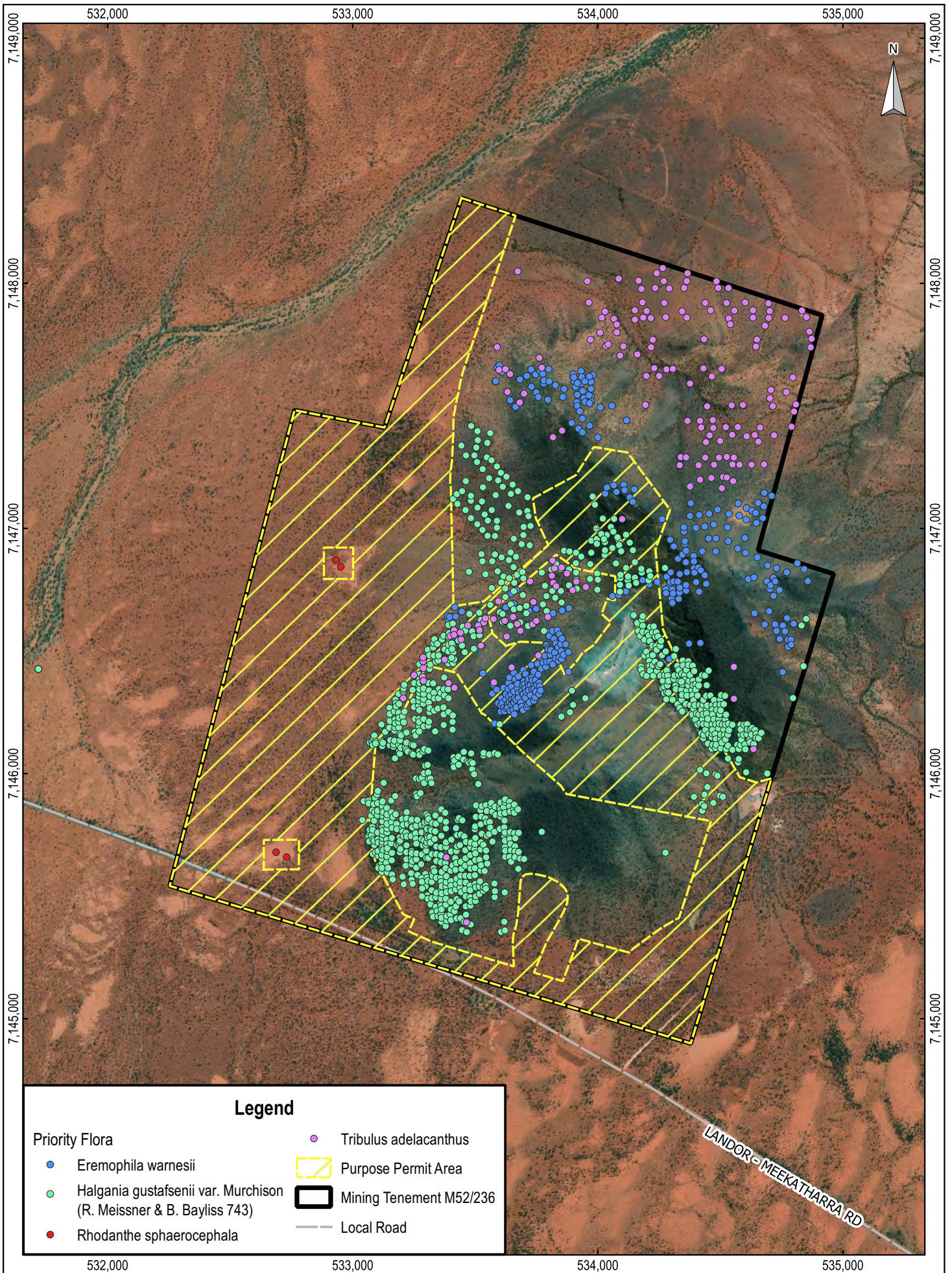
Rhodanthe sphaerocephala occurred only within FCT 3 which comprises clay pans on the western boundary of the survey area. The species is known from 20 individuals recorded from four locations within the survey area and three other locations east and southeast of the survey area (Woodman 2012). *R. sphaerocephala* was noted as moderately restricted at a regional level due to all known populations occurring within a 200 km range and the species' potential requirement for significant rainfall to trigger germination (Woodman 2012).

Tribulus adelacanthus (P3) was first noted in the Woodman 2009 field survey but at the time was not listed as a Priority flora taxon and therefore was not reported as such. By 2012 the taxon had been recently elevated to P3 status, and further locations were recorded during the regional survey (Woodman 2012). *T. adelacanthus* is known from 2,126 individuals recorded from 183 locations (Woodman 2008, 2012). It occurs only in stony undulating areas (FCT 2) in the northwest corner of the survey area. It is considered likely that significantly more individuals would occur at locations outside the Purpose Permit Area as suitable habitat is present throughout the region (Woodman 2012).

3.3.4 Introduced Flora Species

Baseline assessments previously recognised two introduced weed species as potentially occurring within 20 km of the Project, *Cenchrus ciliaris* (Buffel grass) and *Prosopis* spp (Woodman 2008, Woodman 2009), of which only *C. ciliaris* (Buffel-grass) is recognised to likely to occur within a 20 km radius of the Purpose Permit Area from recent database searches (DAWE 2021). None of these weed species were recorded during baseline field surveys.

One introduced species was previously recorded in the survey area, *Portulaca oleracea* (Duckweed) (Woodman, 2009). This species is not recognised as a Weed of National Significance (WoNS) or Declared Pest under the *Biosecurity and Agriculture Management Act 2007* (WA). The record consists of only one individual occurring within the sparse shrublands of FCT 3, within the Purpose Permit Area but outside the Indicative Clearing Footprint.



Legend

● Priority Flora	● Tribulus adelacanthus
● Eremophila warnesii	▨ Purpose Permit Area
● Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	▭ Mining Tenement M52/236
● Rhodanthe sphaerocephala	— Local Road

Scale: 1: 20,000
 Original Size: A4
 Grid: GDA94 / MGA zone 50

0 250 500 m

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Figure 7
**Significant Flora Recorded
 in the Survey Area**

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3.4 TERRESTRIAL FAUNA AND HABITAT

Fauna and habitat baseline studies undertaken across the tenement, and therefore the Purpose Permit Area, include:

- Mount Gould Vertebrate Fauna Study (Biologic 2012a)
- Mount Gould SRE Invertebrate Study (Biologic 2012b).

The survey extent of the baseline fauna studies corresponds with the tenement boundary (survey area) which covers an area of 613 ha. Survey reports are attached in Appendix 8 and Appendix 9.

3.4.1 Significant Vertebrate Fauna Habitat

Seven fauna habitats were delineated and characterised within the survey area (Biologic 2012a) as described in Table 6 and shown in Figure 8.

Habitats 2 and 3 are predominant across the survey area and are considered widespread but restricted to the BIF ridges in the region, whilst Habitats 4, 5 and 6 are considered commonly represented throughout the region (Biologic 2012a). Two habitats, the *Spinifex Hummock Grasslands*, which was encompassed within Habitat 1 and a small component of Habitat 4 and *Breakaway System* (Habitat 7) support the following significant fauna species:

- Painted Finch (*Emblema pictum*) (Habitat 1) - Locally Significant.
- Peregrine Falcon (*Falco peregrinus*) (Habitat 7) - Other Specially Protected Fauna (BC Act).
- Woolley's Pseudantechinus (*Pseudantechinus woolleyae*) (Habitat 7) - Locally Significant.
- Little Woodswallow (*Artamus minor*) (Habitat 7) - Locally Significant.

The Breakaway System was considered likely to support fauna with restricted ranges and specific habitat requirements, such as bats, and rocky habitat specialists, such as the Long-tailed Dunnart (DBCA listed Priority 4). However, the Long-tailed Dunnart (*Sminthopsis longicaudata*) was not recorded during the survey with the closest records at Jack Hills ridge, 12 km south of the Purpose Permit Area (Biologic 2012a). While several bat species were recorded in the Breakaway System habitat, utilising ANABAT acoustic detectors, records of the locally significant Little Broad-nosed Bat were absent and recorded only within Habitat 3 (Biologic 2012a).

The Spinifex Hummock Grasslands was considered a potentially suitable habitat for reptiles of restricted range, such as the locally significant Spinifex Slender Bluetongue (*Cyclodomorphus melanops*), which was not, however recorded in the surveys. The habitat consists of hill crests and slopes, containing Mount Gould's summit and extensive outcroppings and cliff faces, over *Triodia melvillei* hummock grasslands (Biologic 2012a). This habitat supported a breeding population of Painted Finch, and the summit of Mount Gould supported breeding sites of Peregrine Falcon. The Spinifex Hummock Grasslands recorded several invertebrate species and was considered a potentially supportive habitat for SRE species.

The Breakaway System and Spinifex Hummock Grasslands habitats are restricted to Mount Gould and are considered isolated in the region and are considered locally significant, as they provide core habitat for conservation significant fauna (Biologic 2012a). However, areas of similar habitat have been previously surveyed on the slopes and crests of Jack Hill and the Robison Ranges and may occur throughout the BIF ridges of the region (Biologic 2012a).

Table 6: Fauna Habitats of the Survey Area

Habitat ID	Description	Total Mapped Extent Within the Survey Area (ha)
1	Spinifex Hummock Grasslands on Ironstone Hills and Ridges Hill crests and slopes supporting <i>Acacia aneura</i> and/or <i>Grevillea berryana</i> over sparse low shrubland of <i>Eremophila latrobei</i> subsp. <i>latrobei</i> , <i>Philothea brucei</i> ; subsp. <i>cinerea</i> and <i>Ptilotus obovatus</i> over low hummock grassland of <i>Triodia melvillei</i> . The hill crests (such as Mount Gould summit) also contain extensive ironstone outcropping, boulder piles and cliff faces.	25.3
2	Open Mulga shrublands over Tussock Grassland on Ironstone Hills and Ridges Open tall shrubland or isolated shrubs of <i>Acacia aneura</i> over open to sparse mid shrubland of <i>Eremophila latrobei</i> subsp. <i>latrobei</i> and <i>Philothea brucei</i> subsp. <i>cinerea</i> over open to sparse low shrubland and low tussock grassland of <i>Ptilotus obovatus</i> and <i>Cymbopogon ambiguus</i> on steep mid and upper slopes and crests on banded ironstone.	103.7
3	Stony lower slopes and plains below hill systems Open tall shrubland of <i>Acacia aneura</i> occasionally with <i>Acacia ramulosa</i> var. <i>linophylla</i> and <i>Acacia citrinoviridis</i> over sparse low shrubland of <i>Ptilotus obovatus</i> over open low forbland of <i>Goodenia tenuiloba</i> on mid and lower slopes on banded ironstone and quartz shale.	205.3
4	Mixed Acacia shrublands on sandplain Open tall shrubland of <i>Acacia ramulosa</i> var. <i>linophylla</i> and <i>Acacia kempeana</i> over sparse mid shrubland of <i>Eremophila forrestii</i> subsp. <i>forrestii</i> over isolated low shrubland of <i>Corchorus crozophorifolius</i> over sparse low grassland and forbland of mixed species including <i>Eriachne mucronata</i> and <i>Ptilotus aervoides</i> on flat plains.	146.4
5	Sparse Mulga shrublands on hardpan Sparse tall shrubland or isolated shrubs of <i>Acacia aneura</i> over isolated mid shrubs of <i>Eremophila fraseri</i> subsp. <i>parva</i> over isolated low shrubs of <i>Ptilotus obovatus</i> over open low forbland of mixed species including <i>Ptilotus aervoides</i> and <i>Goodenia tenuiloba</i> in clay pans and on clay flats.	82.2
6	Sparse Acacia shrublands on stony undulating plains Sparse tall shrubland of mixed Acacia species over sparse low shrubland of <i>Ptilotus obovatus</i> and <i>Eremophila</i> species over open low forbland of <i>Goodenia tenuiloba</i> on stony undulating plains.	26.6
7	Breakaway systems containing deep crevices, caves, and rock ledges Minor breakaway areas containing small caves. A large cave containing seasonal moisture occurs near Mount Gould's summit. Occurs on the steep slopes, generally in small areas	1.1
C	Cleared/ Historic disturbance.	22.5
	Total	613.0

3.4.2 Significant Fauna Species

The baseline vertebrate fauna study (Biologic 2012a) recorded 125 vertebrate species, comprising 15 native and seven introduced mammal, 75 bird, 27 reptile and one amphibian faunal assemblage/s within the survey area.

Database searches (NatureMap, PMST, Birdata) and literature reviews pertaining to vertebrate fauna assessments from surrounding areas, including nearby ironstone ranges of similar elevation and morphology to Mount Gould (Jack Hills, Weld Range, Robinson Range) were undertaken as part of the baseline vertebrate study (Biologic 2012a). These results indicate 20 significant fauna species have the potential to occur within the Purpose Permit Area (Table 7). Field survey (Biological 2012a) recorded and confirmed the presence of eight significant species within the survey area (Table 7 and Figure 8), all which were previously recognised in the database and literature reviews. This included one Other Specially Protected species, one Listed Marine Species, two DBCA listed Priority species and four species recognised as locally significant, due to their dependence on the BIF ridges in the region (Biologic 2012a).

To verify the validity of the baseline assessments, MBS Environmental (MBS) conducted database searches of NatureMap and the Protected Matters Search Tool (PMST), within 20 km of the Purpose Permit Area (Appendix 7). A summary of the recent database and baseline assessment results is given in Table 7. Comparison of the assessment results, indicates:

- Of the 20 significant fauna species initially recognised from the baseline assessments, only four are still considered likely to occur within the Purpose Permit Area. This includes the Peregrine Falcon, Grey Falcon, Rainbow Bee-eater and Oriental Plover.
- The Grey Falcon has been upgraded from a P4 DBCA listed species to a Vulnerable listing under both the BC Act. There is a lack of suitable roosting habitat (tall trees within ephemeral or permanent drainage lines) within the survey area and the species has not been recorded during field surveys. The species is potentially an infrequent visitor but is unlikely to breed or permanently reside within the Purpose Permit Area (Biologic 2021a).
- An additional 11 significant fauna species are now recognised as potentially occurring within the Purpose Permit Area, which were not previously recognised from the baseline assessments and ten previously recognised from the baseline assessments are now considered to not occur. This results in a total of 15 significant fauna species now recognised as potentially occurring within the Purpose Permit Area comprising of four Threatened species, one Other Specially Protected species, one P2 species and nine Marine species of which six are also listed as Migratory under the EPBC Act (DAWE 2021, DBCA 2021b).
- There is a general lack of suitable habitat within the Purpose Permit Area for Marine (and Migratory) species within the Purpose Permit Area and these species are considered unlikely to occur. However, the Rainbow Bee-eater was recorded during baseline field surveys. The Rainbow Bee-Eater was once recognised as a Migratory species (EPBC Act) but is now listed as a Marine species (EPBC Act).
- The conservation status of the Australian Bustard and Bush Stone-curlew has been downgraded to 'not threatened' (DBCA 2021b).
- Recent database searches do not recognise BIF dependent species or species of local significance.
- Golden Gudgeon (*Hypseleotris aurea*) (P2) is a freshwater fish known from the Murchison and Gascoyne River systems and is considered extremely unlikely to occur, due to the lack of suitable habitat (watercourses) in the Purpose Permit Area.
- Shield-backed Trapdoor Spider (Vulnerable (EPBC Act) and Endangered (BC Act)) is considered unlikely to occur due to the lack of suitable burrowing habitat in the Purpose Permit Area which typically consists of heavy clay soils in areas of open *Eucalyptus* woodland, and sparse *Acacia* understorey (ACC 2007).
- Australian Painted Snipe (Endangered (EPBC Act, BC Act)) is a shallow freshwater (occasionally brackish) wetland bird species found in both ephemeral and permanent inland waters, generally with good cover of grasses, rushes and reeds or low scrub (DAWE 2013). The closest watercourse is located 75m outside the Purpose Permit Area.

Table 7: Summary of Significant Fauna Assessment Results

Common Name (<i>Species Name</i>)	Current Conservation Status			Recognised from Desktop Assessment (Biologic 2012a)	Recorded During Field Survey (Biologic 2012a, 2012b)	Recognised from Recent Database Searches (DAWE 2021, DBCA 2021b)
	EPBC Act (BC Act)	DBCA Listing	Local Significance			
Australian Bustard (<i>Ardeotis australis</i>)	-	-	-	✓	✓	
Australian Painted Snipe (<i>Rostratula australis</i>)	EN (EN) Marine	-	-			✓
Banded Whiteface (<i>Aphelocephala nigricincta</i>)	-	-	Local	✓		
Black-eared Cuckoo (<i>Chrysococcyx osculans</i>)	Marine	-	-			✓
Bush Stone-curlew (<i>Burhinus grallarius</i>)	-	-	-	✓		
Common Sandpiper (<i>Actitis hypoleucos</i>)	M (Mi) Marine	-	-			✓
Curlew Sandpiper (<i>Calidris ferruginea</i>)	CR (CR) Mi Marine	-	-			✓
Fork-tailed Swift (<i>Apus pacificus</i>)	Mi (Mi)	-	-	✓		
Golden gudgeon (<i>Hypseleotris aurea</i>)	-	P2	-			✓
Grey Falcon (<i>Falco hypoleucos</i>)	VU (VU)	-	-	✓		✓
Grey Honeyeater (<i>Conopophila whitei</i>)	-	-	Local	✓		
Grey Wagtail (<i>Motacilla cinerea</i>)	Mi (Mi) Marine	-	-			✓
Little Broad-nosed Bat (<i>Scotorepens greyii</i>)	-	-	Local	✓	✓	
Little Woodswallow (<i>Artamus minor</i>)	-	-	BIF Dependent	✓	✓	
Long-tailed Dunnart (<i>Sminthopsis longicaudata</i>)	-	P4	BIF Dependent	✓		
Major Mitchell's Cockatoo (<i>Lophochroa leadbeateri</i>)	-	-	-	✓		
Malleefowl (<i>Leipoa ocellata</i>)	VU (VU)	-	-	✓		

Common Name (<i>Species Name</i>)	Current Conservation Status			Recognised from Desktop Assessment (Biologic 2012a)	Recorded During Field Survey (Biologic 2012a, 2012b)	Recognised from Recent Database Searches (DAWE 2021, DBCA 2021b)
	EPBC Act (BC Act)	DBCA Listing	Local Significance			
Oriental Plover (<i>Charadrius veredus</i>)	Mi (Mi) Marine	-	-	✓		✓
Painted Finch (<i>Emblema pictum</i>)	-	-	Local	✓	✓	
Pectoral Sandpiper (<i>Calidris melanotos</i>)	Mi (Mi) Marine	-	-			✓
Peregrine Falcon (<i>Falco peregrinus</i>)	(OS)	-	BIF Dependent	✓	✓	✓
Rainbow Bee-eater (<i>Merops ornatus</i>)	Marine	-	-	✓	✓	✓
Sharp tailed Sandpiper (<i>Calidris acuminata</i>)	Mi (Mi) Marine	-	-			✓
Shield-back Trapdoor Spider (<i>Idiosoma nigrum</i>)	VU (EN)	-	-			✓
Slender-billed Thornbill (<i>Acanthiza iredalei</i>)	VU	-	-	✓		
Spinifex Slender Blue-tongue (<i>Cyclodomorphus melanops</i>)	-	-	BIF Dependent	✓		
Unbanded Delma (<i>Delma butleri</i>)	-	-	BIF Dependent	✓		
Western Spiny-tailed Skink (<i>Egernia stokesii badia</i>)	EN (VU)	-	-	✓		
Woolley's Pseudantechinus (<i>Pseudantechinus woolleyae</i>)	-	-	BIF Dependent	✓	✓	
Yellow Wagtail (<i>Motacilla flava</i>)	Mi (Mi) Marine	-	-			✓

*Mi - Migratory, OS - Other Specially Protected Fauna, VU - Vulnerable, EN - Endangered, CR - Critically Endangered

The following fauna species discussed are of current significance and reside within the survey area that encompasses the Purpose Permit Area (Biologic 2012a).

The Peregrine Falcon is listed as Specially Protected under the BC Act and is considered uncommon and rare throughout Western Australia except for in the Stirling Range (Biologic 2012b). This species habitat most often comprises cliffs above rivers ranges and wooded watercourses and lakes and nests recesses of cliff faces, tree hollows and abandoned nests of other birds (Biologic 2012b). Its utilisation range is roughly 20 – 30 km². The Peregrine Falcon was recorded on the summit of Mount Gould which comprises a series of cliff faces with numerous ledges and recesses, outside the Purpose Permit Area (Figure 8). Two adults and one fledgling were observed near the cliff face, in which two nest sites were detected. The presence of faecal smears was observed below the roosting site, indicating extensive and repeated use of the site. It is likely a breeding pair permanently reside on the summit.

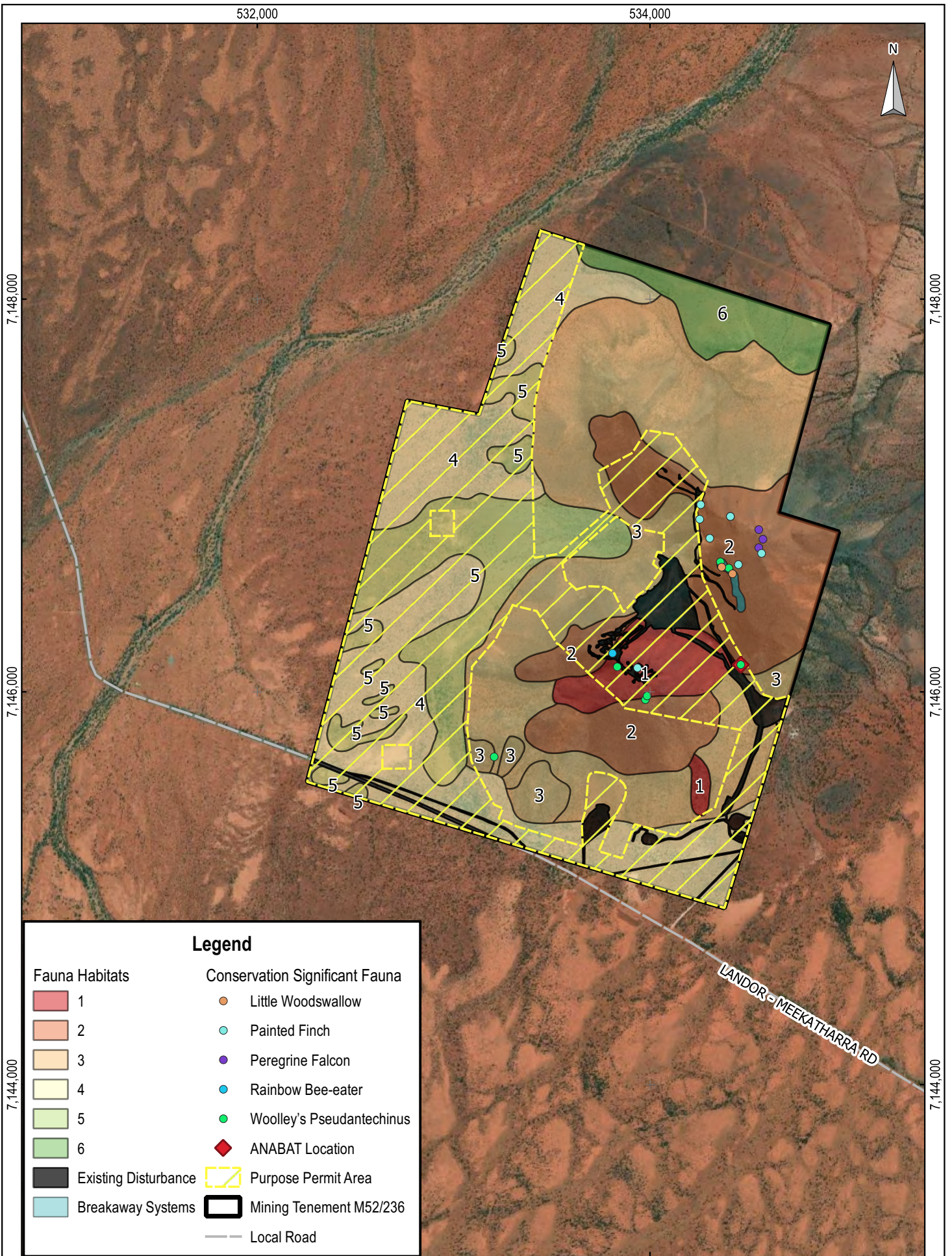
The Rainbow Bee-eater (*Merops ornatus*), listed as Marine under the EBPC Act, was recorded within the Purpose Permit Area in association with the Spinifex Hummock Grassland Habitat (Habitat 1 and 4). It was considered a seasonal visitor to the region, due to its southward migration pattern from Northern Australia (Biologic 2012a). This species typically inhabits sandy, light wooded habitats nesting in slightly angled ground burrows within flat ground to gently elevated slopes. It is noted as common and prominent, where present, in both natural and altered environments with versatility in nest selection (Biologic 2012a). It is not considered dependent on the survey area due to its migratory status and versatility in nesting habitat (Figure 8) (Biologic 2012a).

The Little Woodswallow (*Artamus minor*), considered locally significant, was recorded outside the Purpose Permit Area, within the Breakaway Systems (Habitat 7). This species utilises vertical rock faces for roosting sites, breeding and refuge, and several roosting sites were discovered within the breakaway system (Figure 8).

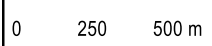
The Woolley Pseudantechinus (*Pseudantechinus woolleyae*), considered locally significant, was recorded from several locations within the survey area, both outside (Habitat 7) and within (Spinifex Hummock Grassland) the Purpose Permit Area (Figure 8). This species inhabits deep rock crevices and caves in rocky outcroppings and is found between the Pilbara and Murchison regions in association with rocky hills and cave habitats (Biologic 2012a).

The Painted Finch (*Emblema pictum*) is considered locally significant due to its occurrence within the survey area representing a southerly extent of its range and its dependence on the Spinifex Hummock Grassland habitat. This species typically inhabits and nests in spinifex grassland habitat within rocky regions, in the vicinity of gorges and other features that supply pools of water (Biologic 2012a). The Painted Finch was recorded by direct observation and the presence of nests within the Spinifex Hummock Grasslands (Habitat 1 and 4), as well as observations of a larger group drinking from pools of water within the Breakaway system (Habitat 7) (Figure 8).

The Little Broad-nosed Bat (*Scotorepens greyii*) is considered locally significant due to its occurrence within the study area representing a southern extreme of its range, which extends throughout Northern Australia, including the Gascoyne, Pilbara, and Kimberley regions (Biologic 2012a). This species is noted as common throughout these areas, roosting in tree hollows within open woodlands and plains (Biologic 2012a). This species was recorded in several locations within the survey area, however, due to its mobile nature and as records were identified with an ANABAT acoustic detector, precise locations of individuals cannot be determined (Biologic 2012a). The location of the ANABAT detection of this taxa is shown in Figure 8.



Scale: 1: 25,000
 Original Size: A4
 Grid: GDA94 / MGA zone 50



Newcam Minerals
 Mount Gould Iron Ore Project
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Figure 8
Fauna Habitat and Significant Fauna Recorded in the Survey Area

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3.4.3 Short Range Endemics

A total of 31 invertebrate specimens were collected during the baseline studies (Biologic 2012a, Biologic 2012b) which comprised 26 pseudoscorpions, three isopods, one spider and one land snail. Of these, one pseudoscorpion (*Synsphyronus* 'PSE010') species and one trapdoor spider species (*Idiommatia* 'MYG254') were considered Potential SRE. The pseudoscorpion species was represented within the survey area by 15 specimens across eight sites typically within microhabitats of leaf litter, under rocks, within spinifex, outcroppings, boulders, and exposed slopes, all ground-dwelling in nature (Biologic 2012b). This species is also known from outside the survey area but is still restricted to the local region. The trapdoor spider (species unknown) was a mature male recorded within a pitfall trap and was considered to be dispersing to find a mate (Biologic 2012b). Due to the large distances that trapdoor spiders can traverse and that only a singular specimen was recorded, it was considered likely this species occurs in the surrounding plains of the region and had wandered from outside the survey area (Biologic 2012b). No evidence of burrows was observed during the survey.

The singular land snail individual recorded was found to occur across a wide, national geographic distribution in Australia, and was classified as Non SRE (Biologic 2012b). Multiple records of isopods were recorded within the survey area, of which taxonomic resolution was limited to genus. This genus contains species widespread throughout arid regions of the southwest of Western Australia. These taxa were considered Unknown SRE, although it was considered likely they are not restricted to the survey area, as they were found within multiple habitat types, including spinifex and exposed outcroppings (Biologic 2012b).

No Known SRE taxa were recorded during the survey. The invertebrate fauna recorded in the survey area are shown in Figure 9.

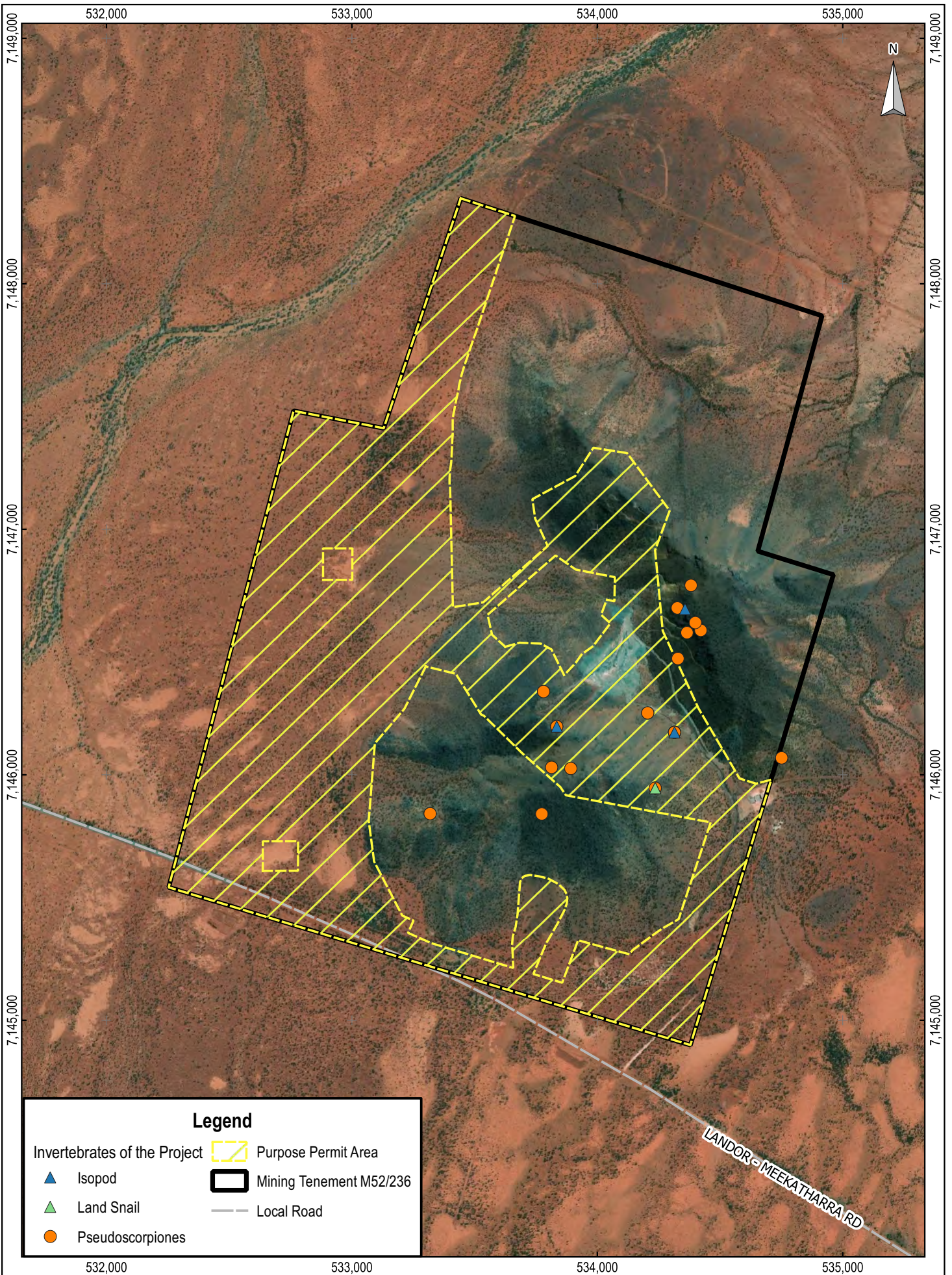
Three) potential SRE habitats were identified during the desktop habitat assessment (Biologic 2012b). The outcropping and minor breakaway areas provided a high level of exposure protection and lack of habitat diversity due to low soil quantities and is considered likely to support SRE taxa (Biologic 2012b). The Spinifex Hummock Grasslands (Figure 8) was identified as likely SRE habitat, due to its locally isolated occurrence and increased cover, which resulted in cooler localised soil conditions, recording an increased abundance of invertebrate activity. The exposed ironstone at the peaks of Mount Gould, and the Breakaway Systems (Figure 8) was also considered potential SRE habitat to a lesser degree, due to its exposure protection (Biologic 2012b).

3.4.4 Introduced Fauna Species.

From database searches and literature reviews (Biologic 2012b, DAWE 2021), ten introduced fauna species potentially occur within the Purpose Permit Area. Seven of these were recorded during baseline field surveys:

- Domestic dog, dingo (*Canis lupus*).
- Goat (*Capra hircus*).
- Cat (*Felis catus*).
- Rabbit (*Oryctolagus cuniculus*).
- House mouse (*Mus musculus*).
- European cattle (*Bos taurus*).
- Camel (*Camelus dromedarius*).

Donkey (*Equus asinus*), Horse (*Equus caballus*) and Red Fox (*Vulpes vulpes*) were considered likely to occur but have not been recorded to date, whilst Sheep (*Ovis aries*) were not considered likely to occur but were recorded during baseline field surveys. The presence of Dingo, Camel, Rabbit, Cattle and Sheep were recorded from scats and tracks as opposed to actual observations of fauna (Biologic 2021b).



Scale: 1: 20,000
 Original Size: A4
 Grid: GDA94 / MGA zone 50

0 250 500 m

Newcam Minerals
 Mount Gould Iron Ore Project
 NVCP

Figure 9
Invertebrate Fauna
Recorded in the Survey
Area

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MBS
 ENVIRONMENTAL

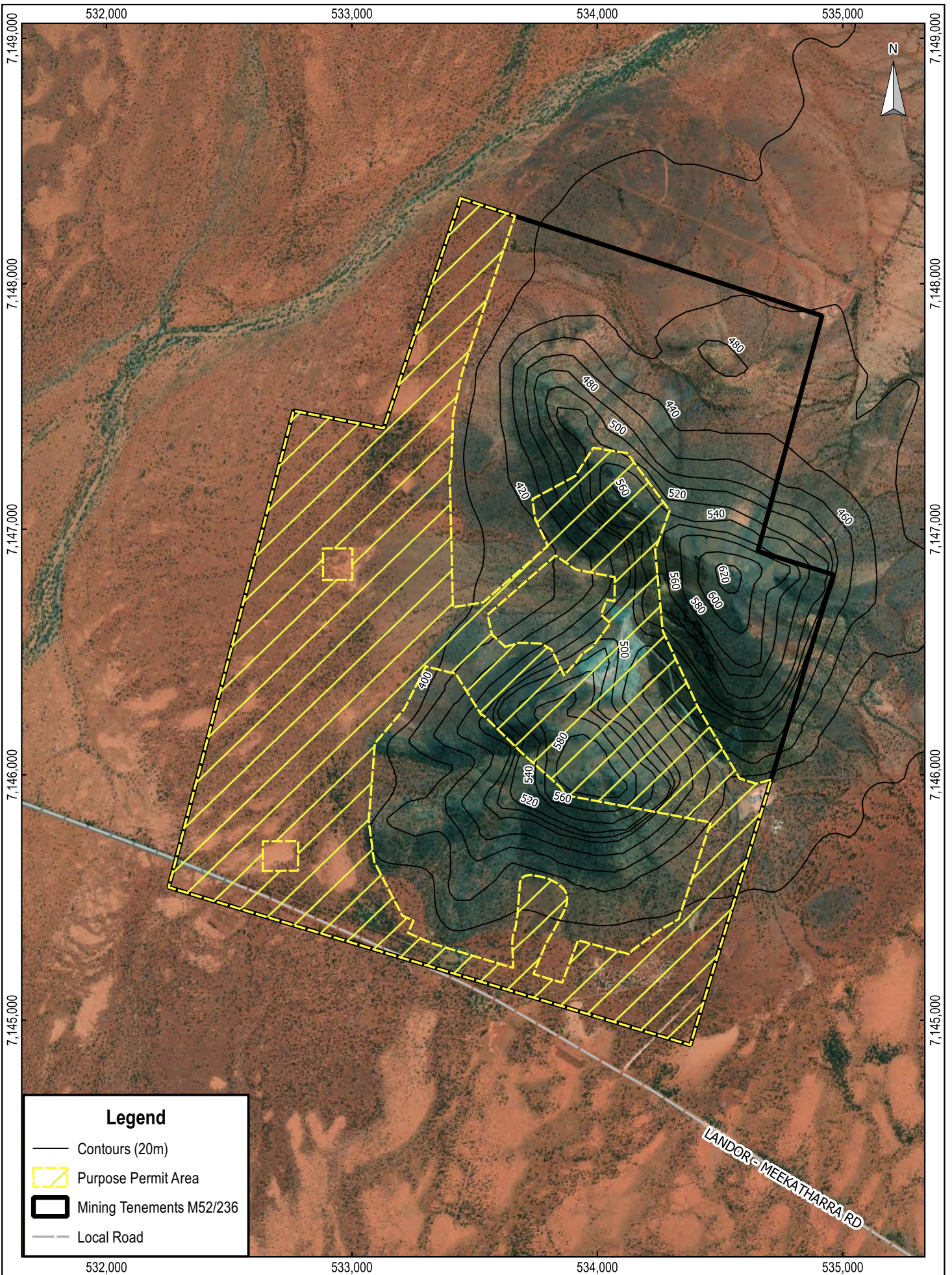
3.5 SURFACE WATER AND GROUNDWATER

The Purpose Permit Area lies within the Murchison River Basin which covers an area of 82, 000 square km. The majority of surface water flows in the Basin generally drain to the west into major watercourses, namely the Murchison, Wooramel, and Greenough Rivers eventually discharging into the Indian Ocean at Kalbarri, whilst the remaining surface water discharges inland to Salt Lake systems (Curry *et al* 1994). There are no perennial rivers in the Western Murchison bioregion, watercourses are ephemeral, and therefore dry up for at least part of the year, leaving dry sandy riverbeds and intermittent permanent pools (Curry *et al* 1994). The bioregion has a surface water deficiency due to its low annual rainfall (190 - 240 mm), erratic seasonal distribution, and high evaporation potential (Curry *et al* 1994).

The Purpose Permit Area sits on an escarpment encompassing the headwater of the Murchison and Wooramel Rivers and is flanked by three minor ephemeral watercourses, Bedaburra Creek 5 km to the east and Gould Creek and Mukalo Creek, approximately 5 km to the west. Similar to the Murchison River, the creeks flow intermittently after long periods of heavy rainfall, typically arising from cyclonic events. During these events, the high topographic relief (400 m - 620 m) (Figure 10) of the Purpose Permit Area promotes rainfall and surface water runoff to flow downslope to the washplain below and into the nearby creeks, eventually converging with the Murchison River approximately 12 km south. There are no major or minor watercourses within the Purpose Permit Area, with Gould Creek the closest watercourse approximately 75 m north of the Purpose Permit Area.

Limited groundwater data is available for the Purpose Permit Area. Groundwater is likely to occur in low yielding, fractured rock aquifers and calcrete aquifers in paleochannels surrounding the Mount Gould landform. Water for mining activities (dust suppression) will likely be sourced from historical production bores off-tenement or from Mount Gould Pastoral Station bores. Groundwater levels across the Purpose Permit Area vary between 368 mAHD to 390 mAHD, with a groundwater flow direction from the north of the tenement to the south, following topographic gradients (AQ2 2021). The groundwater quality ranges from brackish to saline (AQ2 2021), with the Total Dissolved Solids (TDS) concentrations ranging from 2,100 to 28,000 mg/L. The relative concentrations of the major ions in collected samples suggest groundwater receives low volumes of direct recharge and groundwater salinity is derived from cyclic salts from precipitation and salts leached from bedrock and the lateritic and weathered soil profile during recharge (Curry *et al* 2004, AQ2 2021).

The Purpose Permit Area does not occur within a proclaimed surface water area under the *Rights in Water and Irrigation Act 1914* (RIWI Act) (DWER 2021a). The Project is situated in the East Murchison Groundwater Proclamation Area under Section 26B (1) of the RIWI Act and will therefore require licencing for any groundwater abstraction. The Purpose Permit Area does not intercept any public drinking water source areas (DWER 2021b).



Legend

- Contours (20m)
- ▨ Purpose Permit Area
- ▭ Mining Tenements M52/236
- Local Road

Scale: 1: 20,000
 Original Size: A4
 Grid: GDA94 / MGA zone 50

0 250 500 m

Newcam Minerals
 Mount Gould Iron Ore Project
 NVCP

Figure 10
Topography of the Project Area

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4. PROPOSED LAND CLEARING

The Mount Gould Iron Project requires clearing up of 136.5 ha within the Purpose Permit Area of 309.5 ha shown in Figure 2. The Purpose Permit area has been designed to minimise impacts to the environmental values of the region by excluding populations of Priority flora species and significant fauna habitats where possible and minimising the indicative clearing footprint within FCTs of high conservation values as much as possible.

The location of the Waste Rock Dump (WRD) has been sited within the restricted FCT 5 and accounts for a large proportion of the proposed disturbance to this FCT (Table 9). Newcam has investigated alternative options for the location of the WRD but has concluded the proposed location is most suitable due to:

- Local topography. The Project is geotechnically constrained because of the steep slopes of Mt Gould. Local topography restricts machinery access and safe material tipping heights at some locations, therefore reducing the number of locations suitable for construction of the WRD.
- Visual amenity. The proposed WRD location lies within a valley which allows safe materials tipping and assists blending the WRD landform with the surrounding environment. The proposed location also minimises views of the WRD from public roads in the nearby area.
- Backfilling of pits. Newcam anticipate to stage mining of the pits and backfill Pit 1 with waste materials. The WRD footprint has been minimised as much as possible and takes into account backfilling activities to reduce the total volume of material disposed to the WRD.

Clearing will facilitate mining and associated activities occurring wholly within mining tenement M52/236. This NVCP application is developed in conjunction with a Mining Proposal for the evaluation of the significant environmental and social impacts of the Mount Gould Iron Project and how relevant activities will be managed. Clearing may be undertaken in a staged manner as necessary approvals are obtained for the Project over time.

Shapefiles are provided for the Purpose Permit Area and Indicative Clearing Footprint with this NVCP application. There may be minor variations made to the precise location of relevant infrastructure and access tracks within this nominated footprint, however the area covered by the footprint, in which all disturbance will occur, will not change.

5. ASSESSMENT OF CLEARING PRINCIPLES

5.1 NATIVE VEGETATION CLEARING PRINCIPLES

Clearing applications are assessed against the 10 principles outlined in Schedule 5 of the EP Act. These principles aim to ensure that potential impacts resulting from removal of native vegetation are assessed in an integrated method and consistently apply to all lands throughout Western Australia. The principles address the four environmental areas of biodiversity significance, land degradation, conservation estate and ground and surface water quality.

The following sections discuss the potential impacts associated with clearing for the Project. A summary of the outcomes of the assessment against the 10 Clearing Principles are provided in Table 8.

Table 8: Summary of Clearing Assessment Against Clearing Principles

Principle Number	Clearing Principle	Outcome
a	Native vegetation should not be cleared if it comprises a high level of biological diversity.	Unlikely to be at variance
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.	Unlikely to be at variance
c	Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora.	Unlikely to be at variance
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 (TEC).	Not at variance
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.	Not at variance
f	Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.	Not at variance
g	Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.	Unlikely to be at variance
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 areas.	Not at variance
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.	Unlikely to be at variance
j	Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence of flooding.	Unlikely to be at variance

5.2 BIODIVERSITY

Clearing Principle A: Native vegetation should not be cleared if it comprises a high level of biological diversity.

Impacts to the biological diversity of native vegetation associated with clearing in the Purpose Permit Area are limited to localised flora and/or habitat loss, damage, or death as a result of mechanised clearing for project development and the introduction and/or spread of weed species via earthwork and ancillary machinery movements.

One Other Specially Protected fauna species, one Migratory species and four locally significant fauna species were identified within the survey area which have all been recorded outside the Purpose Permit Area in the surrounding region (Biologic 2012a).

No TECs were identified within or adjacent to the Purpose Permit Area. The Purpose Permit Area intersects a portion of the Mount Gould Vegetation Complex PEC.

Potential impacts of clearing on FCTs mapped within the Purpose Permit Area and Indicative Clearing Footprint are shown in Table 9. Findings from baseline studies determined:

- The Purpose Permit Area will intersect all seven FCTs mapped within the Project area. The indicative clearing footprint does not intersect FCT 2 and only marginally FCT 6b.
- FCTs 2, 3 and 6a are considered common and widespread within both the project area and the surrounding region, comprising 41.6% (or 255.2 ha) of the total mapped vegetation, 64.6% (or 199.9 ha) of the Purpose Permit area and 21.9% (or 29.8 ha) of the Indicative Clearing Footprint.
- Potential impact of the Indicative Clearing Footprint to any mapped FCT does not exceed 43 ha or 73%.
- The highest potential impact of any FCT within the Purpose Permit Area is 88.5% (FCT 6a) of its mapped extent (129.6 ha) but only 17.4 % (25.5 ha) is located within the Indicative Clearing Footprint. This vegetation unit is considered to be common and widespread throughout the region.
- The greatest potential impact of clearing to any FCT of local significance, FCT 5, is 72.9% or 18.4 ha of its mapped extent (25.3 ha). The Purpose Permit Area has been specifically designed to exclude portions of FCT 5 where possible. Due to resource location and topography, major site infrastructure is situated within this FCT.
- Potential impact to all other locally significant FCTs (FCT 1, 4, and 6b) does not exceed 26% of its mapped extent.
- The Indicative Clearing Footprint represents only 44.1% of the Purpose Permit Area, and thus the maximum combined extent of potential impacts to FCTs will not exceed 136.5 ha.
- Overall, the Indicative Clearing Footprint restricts clearing of fauna habitats to <25% of the survey area mapped extent (613 ha).

The potential clearing of vegetation communities mapped in the Purpose Permit Area are detailed in Table 9.

Table 9: Mapped Extent and Potential Impact on FCTs

Floristic Community Type	Mapped Extent (ha)	Mapped Extent and Potential Impact Within Purpose Permit Area (ha)	Mapped Extent and Potential Impact Within Indicative Clearing Footprint (ha)
1	194.6	43.3 (22.2%)	42.7 (22.0 %)
2	26.6	0.2 (0.6%)	0.0 (0)
3	82.2	70.1 (85.3%)	4.3 (5.3%)
4	104.7	25.4 (24.3%)	25.5 (24.4%)
5	25.3	18.3 (72.5%)	18.4 (72.9%)
6a	146.4	129.6 (88.5%)	25.5 (17.5%)
6b	10.6	0.4 (3.5%)	0.4 (3.5%)
Cleared/Historic Disturbance	22.5	22.2 (98.8%)	19.9 (87.2%)
Total	613.0	309.5 (50.5%)	136.5 (22.3%)

It is unlikely that the proposed disturbance will spread or introduce weed species, due to the low occurrence of weed taxa within the survey area. The occurrence of one introduced species was recorded within the Purpose Permit Area, however, this was outside the indicative clearing footprint and is unlikely to be disturbed.

Management measures to reduce impacts on biodiversity include:

- All clearing activities will be carried out in accordance with best industry practice.
- Clearing of native vegetation within the Purpose Permit Area will not exceed 136.5ha.
- The Purpose Permit Area has been designed to avoid and/or minimise FCTs of high conservation value.
- Utilising existing disturbed areas to reduce impacts to significant flora and vegetation.
- All clearing activities will be supervised by Traditional Owners.
- Clearly delineating all clearing areas with survey pegs and/or flagging tape.
- Stockpiling stripped topsoil and vegetation for use in future rehabilitation activities.
- Implement an internal clearing register to record the amount of clearing undertaken and report the cumulative total in the Annual Environmental Report (AER) and NVCP Annual Clearing Report, submitted to DMIRS.
- Vehicle and equipment hygiene procedures will be implemented to minimise introduction and or spread of weeds in the Purpose Permit Area.
- As disturbed areas become available for rehabilitation, stockpiled topsoil and vegetation will be spread to act as a seed source and mulch to protect the soil from erosion and provide habitat for fauna.
- Implementing dust control measures.
- Implementing speed limits to minimise dust emissions and to minimise the risk of fauna injury or death due to vehicle traffic.
- All personnel will undertake a site induction which will include detail on the importance of flora and fauna management.

The Purpose Permit Area has been designed to minimise impact to the biodiversity values of the region by minimising the clearing footprint within PEC and FCTs of high conservation values as much as possible. Complete avoidance of conservation significant FCTs is not achievable given topographical environment, and the geographical extents of vegetation along the resource boundary.

It is not expected proposed clearing will significantly impact the biodiversity of the area and subsequently is unlikely to be at variance with Clearing Principle A.

5.3 SIGNIFICANT FAUNA HABITAT

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

The baseline fauna survey (Biologic 2012b) mapped seven (7) fauna habitats within the survey area Figure 8, which all occur within the Purpose Permit Area. Three (3) of these habitats (1, 2 and 7) are known to support conservation or locally significant fauna (Biologic 2012a).

Spinifex Hummock Grasslands (Habitat 1) and the Open Mulga shrublands (Habitat 2), are considered to be locally significant as they support and provide core habitat for Peregrine Falcon, Rainbow Bee-eater, Woolley's Pseudantechinus and Painted Finch (Biologic 2012b). The ANABAT detection of the Little Broad-nosed Bat was recorded within Habitat 2, but due to the indirect nature of the observation the habitat occupation of this species is difficult to ascertain. It is considered unlikely that this habitat supports this species, due to its typical roosting habitat consisting of tree hollows within open woodlands and plains (Biologic 2012a).

Habitats 1 and 2 are considered to be isolated within the ironstone hills and ridges of the survey area, however similar vegetation structure found on Jack Hills and Robinson Ranges BIF. The surrounding region are also known to support the conservation significant fauna of the survey area (Biologic 2012, Woodman 2012). Habitats 1 and 2 comprise 21% of the total mapped fauna habitats and 14.1% of the Purpose Permit Area.

Habitat 7, which consists of breakaway systems containing deep crevices, caves and rock ledges occurs only at the summit of Mount Gould. This habitat was considered of high conservation significance as it supports and provides core habitat to locally significant Woolley Pseudantechinus and Little Woodswallow (Figure 8) both of which are known from records in surrounding BIF ranges (Biologic 2012a). The summit of Mount Gould is excluded from the Purpose Permit Area.

The remaining fauna habitats are considered widespread and commonly represented throughout the region (Biologic 2012a).

Table 10 describes the spatial extent and potential impact to the mapped fauna habitats. The key findings are as follows:

- Habitats 4, 5 and 6 are considered common and widespread within both the survey area and the surrounding region, comprising 41.6% (or 255.2 ha) of the total mapped fauna habitats and 64.6% (or 199.9 ha) of the Purpose Permit Area.
- Habitats 2 and 3 are considered widespread within the region but restricted to BIF ranges of the region, comprising 50.4% (309 ha) of the habitats mapped and 22.3% (69.1 ha) of the Purpose Permit Area.
- The largest portion of proposed clearing of any habitat (Habitat 1) is approximately 73% (18.4 ha) of its mapped extent (25.3 ha). However, this is more a reflection of the limited mapped extent rather than the significance of proposed clearing. All other fauna habitat types will be potentially impacted by <25%.

The majority of conservation significant species were recorded outside the Purpose Permit Area (66.6% of all records). These records occurred within the summit of Mount Gould and will be excluded from the Purpose Permit Area. One species found only within the Purpose Permit Area, the Rainbow bee-eater, which was recorded within the Spinifex Hummock Grasslands habitat. Due to the presence of additional suitable habitat outside the Purpose Permit Area, and the nesting versatility and mobility of this species, this is not considered a significant threat to the conservation status of this species

- The indicative clearing footprint represents only 44.1% of the Purpose Permit Area, and thus the spatial extent of potential impact to all FCTs will be reduced due to this representing the maximum proposed impact within the survey area.
- Overall, the indicative clearing footprint restricts clearing of fauna habitats to < 25% of the mapped survey area.

Table 10: Mapped Extent and Potential Impact on Fauna Habitat Types

Fauna Habitat ID	Mapped Extent (ha)	Mapped Extent and Potential Impact within Purpose Permit Area (ha)	Mapped Extent and Potential Impact Within Indicative Clearing Footprint (ha)
1	25.3	18.4 (72.9%)	18.4 (72.9%)
2	103.7	25.5 (24.5%)	25.5 (24.5%)
3	205.3	43.6 (21.3%)	43.1 (21.0%)
4	146.4	129.6 (88.5%)	25.5 (17.5%)
5	82.2	70.1 (85.3%)	4.3 (5.2%)
6	26.6	0.2 (0.6%)	0 (0)
7	1.1	0 (0)	0 (0)
Cleared/ Historic Disturbance	22.5	22.2 (98.8%)	19.6 (87.2%)
Total	613.0	309.5 (50.5%)	136.5 (22.7%)

The main risk to fauna habitat is loss or fragmentation through clearing activities. To minimise impacts to significant fauna habitat, management measures include:

- All clearing activities will be carried out in accordance with best industry practice.
- The Purpose Permit Area has been designed to avoid fauna habitats of conservation significance where possible.
- Overall clearing to all fauna habitat types is restricted to <25%
- Utilising existing disturbed areas to avoid significant fauna habitat where possible.
- All clearing activities will be supervised by Traditional Owners.
- Implement an internal clearing register to record the amount of clearing undertaken and report the cumulative total in the Annual Environmental Report (AER) and Annual Clearing Report, submitted to DMIRS.
- Vehicle and equipment hygiene procedures will be implemented to minimise entry and or spread of weeds in the Purpose Permit Area.
- Implementing speed limits to minimise dust emissions and to minimise the risk of fauna injury or death due to vehicle traffic.
- All personnel will undertake a site induction which will include detail on the importance of flora and fauna management.

The conservation and locally significant fauna, whilst primarily occurring within the restricted Habitats 1, 2 and 7, have been recorded throughout the surrounding region or are considered mobile and highly versatile in habitat utilisation (Biologic 2012b). Therefore, the proposed clearing is unlikely to be at variance with Clearing Principle B.

5.4 THREATENED FLORA AND PRIORITY FLORA

Clearing Principle C: Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare (Threatened) flora.

Baseline flora surveys identified no Threatened species but three Priority 1 species, and one Priority 3 species as being present within the Purpose Permit Area as shown in Table 11 and (Figure 7).

A total of 3,920 individuals of *E. warnesii* reside within the Purpose Permit Area potentially impacting 29.4% of the surveyed population within the survey area (Table 11). This species was found to be widespread within the survey area and was not strictly associated with any FCT, occurring in FCT 1, FCT 4 and FCT 5. The Purpose Permit Area has been designed to avoid populations of *E. warnesii*, with a total of 9,417 individuals excluded in the north, east and west of the survey area, representing 70.6% of the surveyed population (Figure 7).

A total of 2586 individuals of *H. gustafsenii* reside within the Purpose Permit area, impacting approximately 20.4% of the surveyed population within the survey area (Table 11). This species was also noted as widespread within the survey area, and was found within FCT 4, FCT 5 and FCT 6b (Woodman 2009). The Purpose Permit Area has been designed to avoid populations of *H. gustafsenii*, with a total of 10,077 individuals excluded in the north and south of the survey area, representing 79.6% of the surveyed population (Figure 7). Two populations were recorded outside the survey area.

A total of 284 individuals of *T. adelacanthus* reside within the Purpose Permit Area, potentially resulting in a 13.4% impact to the surveyed population within the survey area (Table 11). Most of this species was recorded in the north of the survey area which has been excluded from the Purpose Permit Area, equating to approximately 1,842 individuals, or 86.6% of the surveyed population (Figure 7) (Woodman 2012). It was considered likely further populations exist within the region, due to the presence of similar habitat ranges consisting of stony undulating areas (Woodman 2012).

A total of 20 individuals of *R. sphaerocephala* was recorded from four locations on the western edge of the survey area (Figure 7). Due to the limited population extent within the survey area, and a lack of known regional records, these locations have been excluded from the Purpose Permit Area and will not be significantly impacted by proposed clearing activities.

The indicative clearing footprint represents only 41.9% of the Purpose Permit Area, and thus the spatial extent of potential impact to all Priority listed flora will be reduced due to this representing the maximum proposed disturbance area.

Table 11: Significant Flora Potentially Impacted by the Purpose Permit Area

Significant Flora Taxa	<i>Eremophila warnesii</i> (P1)	<i>Halgania gustafsenii</i> (P1)	<i>Rhodanthe sphaerocephala</i> (P1)	<i>Tribulus adelacanthus</i> (P3)
Potential impacts within Purpose Permit Area	3,920	2,586	0	284
Number of individuals outside Purpose Permit Area	9,417	10,077	20	1,842
Total Surveyed Population	13,337	12,663	20	2,126
Estimated impact on surveyed population (%)	29.4	20.4	0	13.4

Management measures to reduce impacts on Priority flora include:

- All clearing activities will be carried out in accordance with best industry practice.

- The Purpose Permit Area has been designed to avoid and/or minimise clearing impacts to significant flora
- Utilising existing disturbed areas to reduce loss of significant flora individuals.
- All clearing activities will be supervised by Traditional Owners.
- Avoid Priority flora during clearing activities where practicable, with clear delineation of individuals near clearing boundaries to ensure disturbance is minimised.
- Implement an internal clearing register to record the amount of clearing undertaken and report the cumulative total in the AER and Annual Clearing Report, submitted to DMIRS.
- Conduct clearing in accordance with the Mining Proposal
- Clearly delineating all clearing areas with survey pegs and/or flagging tape.
- Vehicle and equipment hygiene procedures will be implemented to minimise entry and or spread of weeds in the Purpose Permit Area.
- All personnel will undertake a site induction which will include detail on the importance of flora and fauna management.

No impacts will be had on any Threatened species under either the BC Act or EPBC Act. The Purpose Permit Area was designed to avoid areas where conservation significant taxa are known to occur as much as possible. Priority 1 and Priority 3 species are likely to be impacted by proposed clearing activities, however the proportion impacted will be low, with a significant number of individuals from each taxa remaining both within the survey area and the surrounding region.

Given the absence of Threatened flora and the regional presence of additional suitable habitat for Priority listed species outside the Purpose Permit Area (Biologic 2012b), the proposed clearing activities are considered unlikely to be at variance with Clearing Principle C.

5.5 THREATENED ECOLOGICAL COMMUNITIES

Clearing Principle 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.

No TECs listed under the EPBC Act or BC Act were identified within a 50 km search radius.

The Mount Gould Vegetation Complex is listed as a P1 PEC and extends throughout the Purpose Permit Area. Approximately 222.2 ha (13.2%) of its spatial extent will be potentially impacted by the Purpose Permit Area. Of this, a maximum of 136.5 ha will be cleared, which represents 8.1% of its mapped extent. The Purpose Permit Area and Indicative Clearing Footprint were designed to minimise impacts to the PEC (in particular FCT 5) as much as practicable. Complete avoidance of the PEC is not achievable considering the topographical nature of the Purpose Permit Area and resource locale.

Management measures to reduce impacts on the Mount Gould PEC Complex include:

- Clearing of the PEC will not exceed 136.5 ha.
- The Purpose Permit Area has been designed to avoid and/or minimise FCTs representative of the PEC.
- Clearly delineating all clearing areas with survey pegs and/or flagging tape.
- Collection of seed from local species for use in future rehabilitation activities and implementation of rehabilitation trials where considered necessary.

As the proposed clearing will have no impacts on a TEC it is not at variance to Clearing Principle D.

5.6 REMNANT VEGETATION

Clearing Principle 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 Purpose Permit Area intersects two pre-European vegetation associations, as detailed in Table 12 .

The Environmental Protection Authority (EPA) uses a standard level of native vegetation retention of at least 30% of the pre-clearing extent of an ecological community as a benchmark. The levels of native vegetation retention have most recently been recognised in the *National Objectives and Targets for Biodiversity Conservation 2001-2005*, which suggests the retention of 30% or more, of the pre-clearing extent of an ecological community is necessary if Australia's biological diversity is to be protected (DoEH 2001). The pre-European vegetation associations occupying within the Purpose Permit Area will have at least 99% remaining at a State level after the proposed clearing (Table 12).

Table 12: Pre-European Vegetation Association Representation

Vegetation Association	Original Extent (ha)	Current Extent (ha)	Area within Purpose Permit Area (ha)	% Remaining
29	7,903,991.45	7,898,973.24	110.0	99.94
202	448,529.31	448,343.80	222.7	99.96

As the remaining extent of the vegetation associations at the State-wide, scales exceed 99%, the Purpose Permit Area will not have a significant impact on pre-European vegetation and therefore will not be at variance with Clearing Principle E.

5.7 WATERCOURSE OR WETLAND ENVIRONMENTS

Clearing Principle F: Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.

There are no permanent water bodies or wetland systems within or intersecting the Purpose Permit Area (Figure 10). The Gould Creek is located 75 metres north of the tenement boundary and is the closest watercourse feature within the local vicinity.

As clearing will not impact watercourses or wetlands, it will not be at variance with Clearing Principle F.

5.8 LAND DEGRADATION

Clearing Principle G: Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.

Generally, vegetation was assessed as being in Excellent to Good condition (Woodman 2009). There is approximately 22.3 ha of existing disturbance throughout the Purpose Permit Area from previous mining and pastoral activities. These areas have been encapsulated within the Purpose Permit Area to reduce the area of clearing required by proposed mining and associated activities and to ensure the application of rehabilitation and closure provisions. The existing disturbance equates to 16.3% of the total proposed clearing footprint extent.

Existing land degradation is mostly attributed to previous mining and exploration activity within the Purpose Permit Area, as well as grazing by livestock on the flats surrounding Mount Gould, and minor feral goat grazing on the slopes and summits of Mount Gould (Woodman 2009). Due to the absence of water bodies within the Purpose

Permit Area, land degradation from erosion and reshaping of the landscape from localised flooding would not be expected during typical weather conditions. Due to the low presence of weeds within the survey area, land degradation from weed infestation would not be expected.

The Red Brown Hardpan Shallow Loam soil type was described as having a moderate to high erosion risk after clearing of perennial vegetation, which may occur due to the proposed clearing (Hennig 2009). However, as elevation increases it was noted that soils of the Purpose Permit Area becoming skeletal in nature, with soil volume decreasing as a surface gravel layer becomes prominent, accompanied by the emergence of outcropping and significant rocky features (MBS 2021). Therefore, the risk of soil erosion will decrease along slopes of increasing elevations.

Red Brown Hardpan Shallow Loams were generally found in the gentle eastern hillslopes of Mount Gould, in the east to southeastern edge of the Purpose Permit Area, characterised by a shallow red-brown silty layer that extended for between 30 - 60 cm below the surface, followed by heavily weathered fragile chemical sedimentary rock extended for approximately 1 m (MBS 2021). This soil type supports moderate cover of 1-2m shrubs and an associated understory of perennial grasses, herbs, and forbs. This soil type has been described as being subject to sheet erosion and can have a moderate to high risk of erosion after major depletion of perennial plants (Hennig 2009). However, as elevation increases, soils become increasing skeletal in nature, and the volume of soil present decreases as a dense surface gravel and outcropping layer becomes prominent (MBS 2021). Where clearing occurs within this soil type, surface water management infrastructure will be implemented to mitigate potential erosion impacts.

Potential sources of land degradation from clearing activities include:

- Wind erosion during vegetation stripping activities.
- Wind and water erosion of cleared areas.
- Water erosion due to changes in surface water flow.
- Soil compaction.
- Soil contamination.
- Introduction and/or spread of weeds.

Management measures to reduce impacts on land degradation include:

- All clearing activities will be carried out in accordance with best industry practice.
- The indicative clearing footprint has been designed to minimise the amount of clearing as much as possible whilst allowing for safe operations, given the topographic constraints.
- Confining vehicle movements to defined roads and tracks.
- Stockpiling topsoil and stripped vegetation for reuse in rehabilitation.
- As disturbed areas become available for rehabilitation, stockpiled topsoil and vegetation will be spread over disturbed areas to act as a seed source and mulch to protect the soil from erosion.
- Establishment of surface water management infrastructure to direct surface water flow to natural drainage channels.
- Monitoring of high-risk erosion events, such as extreme weather, to mitigate impacts as far as reasonably practicable.
- Minimising area for vegetation clearance.
- Managing all clearing via the approved Mining Proposal.
- Dust suppression via water cart and soil binding where practicable.

- Conducting topsoil-stripping activities during periods of low winds.
- Confining vehicle movements to defined roads and tracks.
- Storing all hydrocarbons and chemicals as per Dangerous Goods and Australian Standards codes.
- Vehicle and equipment hygiene procedures will be implemented to minimise entry and or spread of weeds in the Purpose Permit Area.
- Scarifying compacted soil prior to rehabilitation.

In the context of the low erodibility of the land system and intact vegetation on a local and regional scale, the extent of disturbance from the proposed clearing is not anticipated to increase land degradation. As such, the clearing is unlikely to be at variance with Clearing Principle G.

5.9 CONSERVATION ESTATE

Clearing Principle 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 proposed clearing area is not associated with any conservation lands and the nearest conservation estate, Collier Range National Park, is located approximately 177 km northeast of the Purpose Permit Area, therefore proposed clearing is not considered to be at variance with Clearing Principle H.

5.10 SURFACE AND GROUNDWATER QUALITY

Clearing Principle 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.

There are no major watercourses, permanent water bodies, wetlands, riparian vegetation, or groundwater dependent ecosystems within the Purpose Permit Area. There are no surface water management areas in the Purpose Permit Area, however it does intersect the proclaimed East Murchison Groundwater Area, and therefore an application to take water will be required for project development.

Surface water quality has the potential to be affected by increased sedimentation caused through clearing of surfaces and soil disturbance during sporadic but intense rainfall events over the Purpose Permit Area. Initially, surface water quality is expected to be similar to that of rainwater and salinity likely increases as groundwater resources in the catchment area recharge (Curry *et al* 1994). Intense rainfall events, environmentally important to the region, are likely to increase surface run-off from cleared areas and may mobilise sediment into the surrounding floodplains and Gould Creek. However, due to the low rainfall experienced in the region (Chart 1) such weather events are considered infrequent and impacts to surface water quality minimal. Typical season conditions (dry) are expected to prevail during clearing activities and are therefore unlikely to transport sediment from the cleared areas and impact the water quality of Gould Creek outside the Purpose Permit Area.

Groundwater quality ranges from brackish to saline (TDS 2,100 - 2,800 mg/L) suggesting groundwater sources receive low volumes of direct recharge and/or absorbs chloride from the soil profile during recharge (AQ2 2021). Clearing activities are not expected to decrease water quality levels.

Hydrocarbon and chemical spills may occur from vehicles and machinery used for land clearing activities. Uncontained spills and wastewater from vehicles wash downs have the potential to affect surface water and groundwater quality.

Management measures to prevent deterioration of surface and groundwater quality include:

- All clearing activities will be carried out in accordance with best industry practice.

- The Purpose Permit Area does not intercept any major or minor watercourse.
- The clearing footprint is restricted to 136.5 ha.
- Diversion drains will be constructed to direct surface water flow downslope of Mount Gould to the surrounding plains to capture any potentially contaminated water.
- Sumps will be established in strategic locations to capture the flow of potentially contaminated surface water from Mount Gould.
- Existing disturbance areas have been incorporated in the Purpose Permit design to minimise the amount of clearing required.
- Refuelling and maintenance activities to be conducted using drip trays, liners, bunds, or spill mats to minimise hydrocarbon spillage and contamination of surface and groundwater.
- Vehicles and machinery will be subject to pre-start checks and scheduled maintenance to ensure adequate function and condition and to reduce occurrence of hydrocarbon and chemical spills.
- All waste will be removed from site and appropriately disposed.
- Progressive rehabilitation of completed surfaces to minimise active areas exposed where possible.
- All natural surface water drainage channels/patterns will be reinstated during rehabilitation.

All personnel will undertake a site induction which will include detail on the importance surface water management. Proposed disturbance is unlikely to mobilise sediment into the nearby creeks and volumes of sediment are unlikely to adversely impact surface water quality and subsequent groundwater quality due to the normal environmental conditions expected to prevail during clearing activities. Heavy rainfall events may cause greater impacts although this is generally a natural process and generally sporadic. Surface water diversions, drains, and bunds will be established to manage such events.

Proposed disturbance is unlikely to cause deterioration in the quality of surface or groundwater within the Purpose Permit Area. No significant impacts to soils are anticipated and subsequently the clearing is considered unlikely to be at variance with Clearing Principle I.

5.11 FLOODING POTENTIAL

Clearing Principle J: Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence of flooding.

The Purpose Permit Area is within the Murchison IBRA region which experiences arid climate where annual rainfall is generally less than 365 mm and the region loses more water via evapotranspiration than it receives as rain by a factor of 13, typically a result of hot, sunny weather and limited rainfall volumes. The mean annual rainfall is 234.9 mm, of which approximately 60% falls in winter (Chart 1) when thunderstorms and the occasional influence of cyclone activity are more likely to occur. While minor localised flooding is not uncommon in the Murchison region major floods are few, with historical records indicating nine major floods in the region since 1848 (Curry *et al* 1994).

Mount Gould acts as a local watershed, dissecting and dispersing rainfall on areas of high topographic relief to the surrounding flat wash plains below which generally sheets surface water flow. Removal of vegetation generally increases flooding whereby uptake, infiltration, moisture retention and physical barriers to reduce flow velocities provided by vegetation are removed. Clearing of the perennial vegetation in the Purpose Permit Area has the potential to impact water flow velocities and water shedding capacity during rainfall events. Minor watercourses nearby are ephemeral and will only flow during significant rainfall events, when shallow pooling is also evident in some areas throughout the broader landscape (Geoscience Australia 2021). The hills and ridges of the Purpose Permit Area are covered with dense ironstone mantles, hematite shales and frequent outcropping. Soils are typically stony or shallow gravel. Removal of vegetation would likely increase water flow, although the mechanical process of clearing and disruption of flat, hard surfaces of a watershed are likely to increase infiltration of water into the soil.

profile, encouraging pooling in shallow excavations and reducing downgradient volumes. Localised surface water runoff may increase where vegetation is cleared, however, the impact is unlikely to be detectable in the context of the range of the natural variability of runoff.

Geoscience Australia's "*Water Observation from Space*" dataset gives national coverage of the probability of an area being covered in water, based on satellite imagery. Applying this dataset to the Purpose Permit Area indicates no detection of water, except for small areas of occasional ponding 3 km east and suggests the Purpose Permit Area is dry the majority of the time which is expected in the arid zone of WA. From this it can be determined the Purpose Permit Area is not in an area that regularly floods for prolonged periods.

Management measures to prevent flooding include:

- All clearing activities will be carried out in accordance with best industry practice.
- The Purpose Permit Area has been designed with consideration to drainage lines and flood levels with the aim of minimising disturbance of these areas.
- The Purpose Permit Area does not intercept any major or minor watercourse.
- The clearing footprint is restricted to 136.5 ha.
- Existing flow paths will be maintained where possible.
- Diversion drains will be constructed to direct surface water flow away from clearing areas, towards the surrounding wash plains to reduce localised pooling/flooding.
- Diversion will be constructed such that surface water will flow into local drainage lines at rates similar to natural flows.
- Existing disturbance areas have been incorporated in the Purpose Permit Area design to minimise the amount of clearing required.
- Progressive rehabilitation of completed surfaces to minimise active areas exposed where possible.
- All natural surface water drainage channels/patterns will be reinstated during rehabilitation.

All personnel will undertake a site induction which will include detail on the importance of surface water management. Overall, the proposed clearing is unlikely to increase the flooding potential within the Purpose Permit Area and its immediate surrounds. Therefore, the proposed clearing is unlikely to be at variance with Clearing Principle J.

6. REPORTING AND AUDITING

Disturbance as a result of the proposed vegetation clearing will be reported yearly under the Mount Gould AER and Mine Rehabilitation Fund (MRF) reporting.

Upon approval of this NVCP, subsequent environmental approvals will be sought to construct and develop the Mount Gould Iron Project. These approvals will include additional conditions and commitments relating to environmental monitoring and reporting.

7. CONCLUSION

The vegetation and habitats present within the Purpose Permit Area are generally well represented on a local and regional scale. The Purpose Permit area has been designed to minimise impacts to the environmental values of the region by excluding populations of priority flora species and significant fauna habitats where possible, and to minimise the clearing footprint area within FCTs of high conservation values as much as possible. It is considered unlikely there will be any impact on the conservation status of relevant flora and fauna species or vegetation communities. There are likely to be only minor localised impacts from loss of vegetation and fauna habitat.

The proposed clearing will not impact significantly upon the ten clearing principles and a range of environmental management measure will be implemented to ensure clearing is managed to minimise any potential adverse impacts. Rehabilitation will minimise exposed areas and the long-term loss of vegetation cover.

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APPENDICES

APPENDIX 3: MOUNT GOULD TENEMENT FLORA AND VEGETATION ASSESSMENT DESKTOP REVIEW (WOODMAN 2008)

ATLAS IRON LIMITED

MOUNT GOULD TENEMENT

FLORA AND VEGETATION ASSESSMENT

DESKTOP REVIEW

April 2008



woodmanenvironmentalconsulting

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TABLE OF CONTENTS

1. DESCRIPTION OF PROJECT AND PROJECT AREA	1
2. EXISTING ENVIRONMENT	1
2.1 CLIMATE.....	1
2.2 SOILS AND LANDFORMS	2
3. FLORA AND VEGETATION	3
3.1 DECLARED RARE AND PRIORITY FLORA, AND INTRODUCED SPECIES.....	3
3.2 PREVIOUS FLORA SURVEYS	5
3.3 VEGETATION.....	7
3.4 PREVIOUS VEGETATION SURVEYS.....	9
4. CLEARING REGULATIONS	10
5. SUMMARY OF ENVIRONMENTAL FACTORS	12
6. RECOMMENDATIONS.....	12
6. REFERENCES.....	13

APPENDICIES

- Appendix A: Declared Rare and Priority Flora Species Conservation Codes (Atkins 2006)
- Appendix B: Definitions of Categories of Threatened Ecological Communities (Department of Environment and Conservation 2007d)

TABLES

- Table 1: Information regarding DRF and Priority Flora taxa listed on DEC Threatened Flora Databases, and the WAHerb Specimen Database, for Mount Gould tenement (Department of Environment and Conservation 2007a)
- Table 2: Conservation-significant taxa recorded during flora and vegetation assessment of the Weld Range (Markey & Dillon 2006)
- Table 3: Description, Pre-European Extent, Current Extent and Reservation Status of Vegetation Community Association Related to Physiognomy in the Mount Gould Survey Area (Shepard *et al.* 2002)
- Table 4: Non-Permitted areas as described under the Environmental *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*
- Table 5: Description of Environmentally Sensitive Areas, and their application to the project area (Western Australia 2004)

FIGURES

Figure 1: Average maximum and minimum temperatures (°Celsius) and average rainfall (mm) for Meekatharra Airport (Bureau of Meteorology 2007)

1. DESCRIPTION OF PROJECT AND PROJECT AREA

Atlas Iron Limited (Atlas) is proposing to conduct preliminary exploration drilling for iron ore within tenement M52/236 located at Mount Gould ('Mount Gould tenement'). The Mount Gould tenement is located within the Mid-West Region, approximately 150 km north-east of Meekatharra, just north of the Murchison River. Exploration and mining for minerals including iron ore has historically been undertaken in the Mount Gould area, with more recent exploration at the nearby Jack Hills, located approximately 20 km to the south-east (Murchison Metals Ltd 2007). It is estimated that the preliminary drilling program will clear less than 2 hectares (ha) of native vegetation, as a number of pre-existing cleared tracks will be used for exploration activities.

The Mid-West Region is attracting considerable interest in recent times with regard to proposed mining projects on Banded Ironstone Formation (BIF) ranges. This includes existing and proposed mines at Koolanooka, Mt Gibson, Minjar, Golden Grove (including Gossan Hill), Karara-Mungada and Jack Hills. The Department of Environment and Conservation (DEC) has recently conducted a series of vegetation assessments concentrating on BIF within the Mid-West Region, to further knowledge regarding the flora and vegetation on these formations in response to these proposals.

The level of Flora and Vegetation survey for this project has been defined as a Level 2 Survey, which consists of background research/desktop study and reconnaissance survey, followed by either a detailed or comprehensive survey. The level of survey required has been determined from Table 2 of the Environmental Protection Authority's (EPA) Guidance Statement No. 51 (Environmental Protection Authority 2004), where the Bioregion Group is defined as Group 2, and the nature of the impact is considered to be moderate. The purpose of the background research/desktop study is to review known information on the target area through all sources of literature available (Environmental Protection Authority 2004).

Atlas commissioned Woodman Environmental in 2007 to conduct a desktop review of the flora and vegetation values of the Mount Gould tenement. This has been undertaken in conjunction with a desktop survey of Atlas's Wilgie-Mia tenement (tenement M20/118), located approximately 130 km south of the project area, which has been conducted as a separate report.

2. EXISTING ENVIRONMENT

2.1 CLIMATE

The Mount Gould tenement is located close to the south-western boundary of the desert bioclimatic regions, which is characterised by low and erratic rainfall that can occur in both summer and winter (Beard 1976). Figure 1 displays average monthly maximum and minimum temperatures, and average monthly rainfall, recorded for Meekatharra Airport,

the nearest meteorological station to the Mount Gould tenement (Bureau of Meteorology 2007).

The average daily maximum temperatures at Meekatharra Airport peak in January, and lowest average minimum temperatures are experienced in July. The average annual rainfall for this station is 236.6 mm. Average monthly rainfall peaks in both summer and winter. The summer rainfall is influenced by tropical cyclones, which generally form between December to April, while during winter, strong cold fronts from the south produce some rainfall.

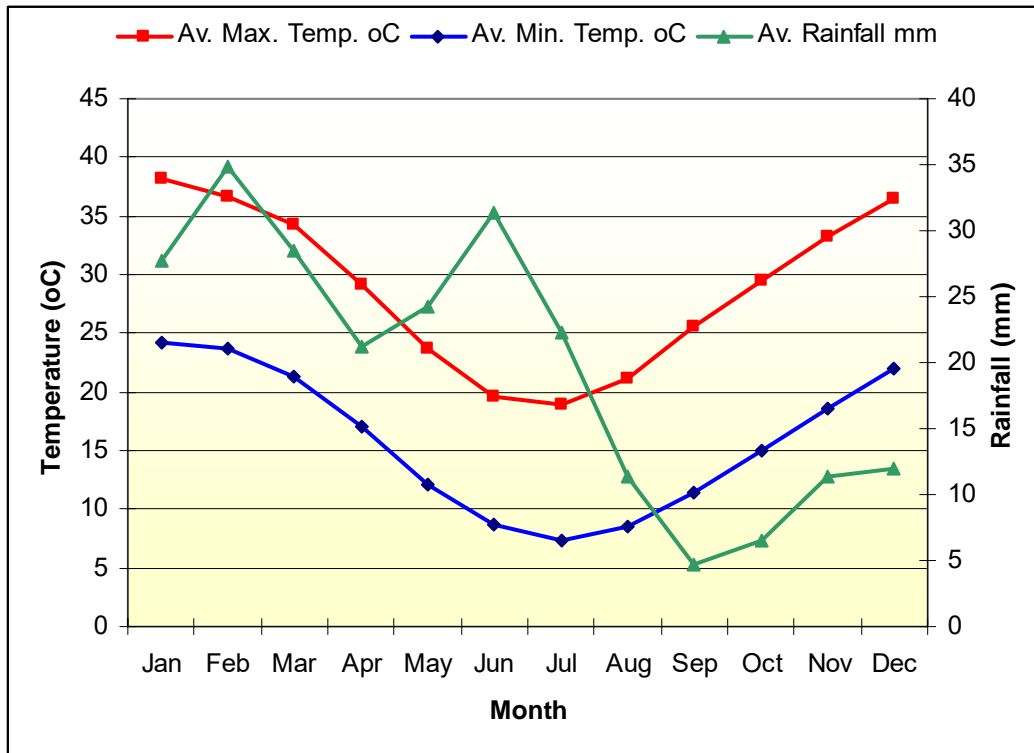


Figure 1: Average maximum and minimum temperatures (°Celsius) and average rainfall (mm) for Meekatharra Airport (Bureau of Meteorology 2007)

2.2 SOILS AND LANDFORMS

The Mount Gould tenement is located in the Murchison Bioregion (Austin Botanical District), which is formed of Archaean granite with infolded volcanics and meta-sediments of like age, composing the Yilgarn Block (Beard 1990). This region is generally undulating, with occasional ranges of low hills, and extensive sandplains in the eastern half.

Beard (1976) termed the central northern part of this region (where the Mount Gould tenement is situated) the Upper Murchison sub-region, which contains the Murchison River basin. This area has been strongly dissected, resulting in most of the Tertiary

plateau surface being removed, and sandplains existing as small remnants. Most of the country is hilly and undulating, with shallow soils and exposures of granite in the hills, but also extensive plains at the lower levels (Beard 1976). The principle ranges are the Weld Range and Jack Hills, the latter located 20 km from the Mount Gould Tenement.

Beard (1976) divided the Upper Murchison into eastern and western portions when describing dominant soil types; only the western portion is relevant to the Mount Gould Tenement. Beard (1976) described 5 principal soil units in the western portion of the Upper Murchison; as described below:

1. Shallow, stony, earthy loams on hills and ranges, with extensive portions without soil cover;
2. Earthy loams overlying red-brown hardpan at shallow depth, on undulating pediments;
3. Shallow acid red earths and shallow earthy loams, often occurring in intimate micro-association and overlying red-brown hardpan within 75 cm of the surface, on extensive flat and gently-sloping plains with a scatter of surface gravels;
4. Hard alkaline and neutral red soils on alluvial flats that are frequently saline and flank river courses; and
5. Deep earthy loams in recent alluvia of river floodplains.

It is likely that the soils of the Mount Gould Tenement consist primarily of soil unit 1, however units 2 and 3 could also potentially occur.

3. FLORA AND VEGETATION

3.1 DECLARED RARE AND PRIORITY FLORA, AND INTRODUCED SPECIES

The DEC Declared Rare Flora (DRF) and Priority Flora taxa databases, including the Western Australian Herbarium (WAHerb) specimen database, were interrogated for information regarding significant taxa within the tenement area and its immediate surrounds (DEC 2007a). The following search co-ordinates, encompassing the entire Mount Gould tenement with a buffer of approximately 20 km, were used:

North-west corner:	-25° 33'	116° 59'
South-east corner:	-26° 04'	117° 37'

Nine taxa of conservation significance were returned from the above database searches (Table 1). Appendix A presents a description of conservation status codes (DEC 2006).

Table 1: Information regarding DRF and Priority Flora taxa listed on DEC Threatened Flora Databases, and the WAHerb Specimen Database, for Mount Gould tenement (DEC 2007a)

Taxon	Status	Number of Specimens in WAHerb	WAHerb Specimen Database	DEC Threatened Flora Database (DEFL Database)	DEC DRF / Priority Flora List	Distribution (Declared Rare and Priority Flora List)
<i>Calytrix verruculosa</i>	P1	13	x	-	x	Tuchanana Ck, Yoothapina Stn, Mt Hale, Meekatharra, (Leinster, Mt Keith)
<i>Eremophila warnesii</i> ms	P1	3	-	-	x	Yarlarweelor, Mt Gould, Mt Clere
<i>Lepidium xylodes</i>	P1	5	x	-	x	Belele Stn, Moorarie Stn
<i>Ptilotus lazaridis</i>	P1	8	x	-	-	-
<i>Stenanthemum mediale</i>	P1	7	x	-	-	-
<i>Murchisonia fragrans</i>	P2	9	-	-	x	Kalbarri, Mileura, Moorarie.
<i>Gunniopsis propinqua</i>	P3	14	x	-	-	-
<i>Hemigenia tysonii</i>	P3	17	x	-	x	Byro Stn, Mt Narryer, Cue, Mt Hale
<i>Verticordia jamiesonii</i>	P3	22	x	x	x	Mt Hale, Yalgoo, Cue, Sth Warburton, Waterfall Gorge, Rowe Hills

A search of the Department of Environment and Water Resources (DEWR) database, with regard to taxa of significance as listed under the *Environmental Protection and Biodiversity Conservation Act 1999*, was performed for the Mount Gould tenement (DEWR 2007a). One Threatened Species, *Pityrodia augustensis* (DRF) (Mt Augustus Foxglove), was listed as potentially occurring in the tenement area (Department of Environment and Water Resources 2007a). This species is listed as Vulnerable under the *Environmental Protection and Biodiversity Conservation Act 1999*. This species is currently known from the Mt Augustus area, and Mt Fraser within the Robinson Range (Brown *et. al.* 1998; DEC 2007c). As this species was not recorded within the search of the DEC's DRF and Priority Flora taxa databases, it is highly unlikely that it will be present within the Mount Gould tenement.

Two invasive taxa, *Cenchrus ciliaris* and *Prosopis* spp., were also listed as potentially occurring in the Mount Gould tenement (DEWR 2007a). *Prosopis* spp. are classified as P1 Declared Plants for the whole of Western Australia under the *Agriculture and Related Resources Protection Act 1976* (Department of Agriculture and Food 2007), meaning movement of plants or their seeds within the state, including on contaminated machinery and produce, is prohibited. *Prosopis* spp. are also listed as Weeds of National Significance (Thorp & Lynch 2000), and are under national management for the purpose of restricting their spread, and eradicating them from parts of Australia. *C. ciliaris* is not listed as a Declared Plant in Western Australia (Department of Agriculture and Food 2007) but is considered by the States and Territories to pose a particularly significant threat to biodiversity (Department of Environment and Water Resources 2007a).

3.2 PREVIOUS FLORA SURVEYS

Mattiske Consulting Pty Ltd (2005) undertook a detailed flora and vegetation survey of the proposed iron ore mining area and associated infrastructure facilities at Murchison Metals Ltd's Jack Hills project area, located approximately 20 km south of the Mount Gould Tenement, between 2004 and 2005. Some searching of Mt Gould was undertaken as part of this project. A total of 215 plant taxa from 185 genera and 36 families were recorded within the project area. The most well-represented families included Mimosaceae, Myoporaceae, Poaceae, Chenopodiaceae and Asteraceae. No DRF taxa were located during this survey, however 3 Priority taxa were located; *Calytrix verruculosa* (P1), *Gunniopsis divisa* (P1) and *Verticordia jamiesonii* (P3). None of these species were recorded at Mt Gould (Mattiske Consulting 2005).

Meissner and Caruso (2006) undertook a regional flora survey of the Jack Hills, located approximately 20 km south of the Mount Gould tenement, during August 2005, as part of a wider series of flora surveys throughout the Mid-West for the DEC. A total of 50 permanent 20 m x 20 m quadrats were established, covering the major geographical, geomorphologic and floristic variation found in the study area. A total of 209 plant taxa from 98 genera and 43 families were recorded from the quadrats and adjacent areas. The most-well represented families included Asteraceae, Poaceae, Mimosaceae, Malvaceae and Myoporaceae. No DRF taxa were located during this survey, however 1 Priority taxon, *Gunniopsis propinqua* (P3), was recorded. They also identified 2 new taxa at the time of survey: *Prostanthera* sp. Murchison (G. Byrne 239) and *Lobelia heterophylla*

subsp. *Pilbara* (R. Meissner & Y. Caruso 1). Currently, neither of these taxa are listed Priority taxa however *Prostanthera* sp. Murchison (G. Byrne 239) is under consideration for Priority 1 status (Markey & Dillon 2006). Additionally, Meissner & Caruso (2006) identified 6 taxa that currently require further taxonomic review to determine whether they are conservation significant and represent distinct entities, as listed below:

- *Abutilon* sp. (R. Meissner & Y. Caruso 136)
- *Calandrinia* sp. (R. Meissner & Y. Caruso 111)
- *Glycine* sp. (R. Meissner & Y. Caruso 110)
- *Gunniopsis* aff. *divisa* (R Meissner & Y. Caruso 125)
- *Hibiscus* sp. (R. Meissner & Y. Caruso 123)
- *Indigofera* aff. *australis*

Markey & Dillon (2006) undertook a regional flora survey of the Weld Range, located approximately 130 km south of the Mount Gould tenement, during August 2005, also as part of a wider series of flora surveys throughout the Mid-West for the DEC. A total of 52 permanent 20 m x 20 m quadrats were established, covering the major geographical, geomorphologic and floristic variation found in the study area, however quadrat locations were restricted to areas where road access was adequate, as much of the range was inaccessible due to heavy rains and poor track conditions. A total of 243 plant taxa from 52 families were recorded from the quadrats and adjacent areas. The most well-represented families included Asteraceae, Poaceae, Mimosaceae, Chenopodiaceae, Myoporaceae, Amaranthaceae and Goodeniaceae. No DRF taxa were located during this survey, however 7 Priority taxa were recorded (Table 2). They also identified *Prostanthera* sp. Murchison (G. Byrne 239), which is under consideration for P1 status. Additionally, Markey & Dillon (2006) identified 7 taxa that require further study, to determine whether they represent distinct entities, as listed below:

- *Sida* aff. *atrovirens* (A. Markey & S. Dillon 3076)
- *Sida* aff. *fibulifera* (A. Markey & S. Dillon 3084)
- *Sida* sp. (A. Markey & S. Dillon 3071)
- *Calandrinia* sp. (R. Meissner & Y. Caruso 111)
- *Eremophila* aff. *georgei* (A. Markey & S. Dillon 2928)
- *Plantago* aff. *hispida* (A. Markey & S. Dillon 3440)
- *Crassula* aff. *tetramera* (pentamerous variant)

Table 2: Conservation-significant taxa recorded during flora and vegetation assessment of the Weld Range (Markey & Dillon 2006)

Taxon	Status
<i>Dodonaea</i> sp. Ninghan (H. Demarz 5121)	P1
<i>Micromyrtus placoids</i>	P1
<i>Phyllanthus baeckeoides</i>	P1
<i>Prostanthera petrophila</i>	P1

Taxon	Status
<i>Sauropus</i> sp. Woolgorong (M. Officer s.n. 10/8/94)	P1
<i>Stenanthemum patens</i>	P1
<i>Acacia speckii</i>	P3

3.3 VEGETATION

The study area is located within the northern section of the Murchison IBRA Region (Interim Biogeographic Regionalisation for Australia) (DEWR 2007b), and specifically within the MUR2 – Western Murchison Subregion (Desmond, Cowan and Chant 2001). The subregion forms the northern part of the Murchison Terrains of the Yilgarn Craton and contains the headwaters of the Murchison and Wooramel Rivers which drain west towards the coast. Pastoralism occupies approximately 96% of the region and there are numerous mining interests.

The study area is located within the Austin Botanical District within the Murchison Region, as defined by Beard (1990). The vegetation of district is predominantly mulga low woodland (*Acacia aneura*) on plains with scrub on hills. There is also tree steppe of *Eucalyptus* spp. and *Triodia basedowii* on the sand plains. Vegetation within the Murchison Region was broadly mapped and described by Beard at a scale of 1:1,000,000 (Beard 1976). Shepard *et. al.* (2002) mapped and described vegetation community associations related to physiognomy, based on the original Beard mapping. The project area encompasses 2 vegetation types which are summarised in Table 3.

The DEC Threatened Ecological Communities (TEC) database was interrogated upon request (DEC 2007b). There are no occurrences of TECs within the search area. Definitions of TEC criteria are given in Appendix B. Although no TECs are known from the search area, there is currently considerable interest in the flora and vegetation of BIF in the Mid-West region by the DEC.

Table 3: Description, Pre-European Extent, Current Extent and Reservation Status of Vegetation Community Association Related to Physiognomy in the Mount Gould Survey Area (Shepard *et al.* 2002)
(Areas in hectares unless indicated)

Vegetation Association	Description	Current Extent	Remaining Since Pre – European Extent (%)	IUCN Class 1-4 Reserves (%)	Other Reserves (%)	CALM pastoral leases
29	Sparse low woodland; mulga, discontinuous in scattered groups	7,782,264	100	0.3	0	2.4
202	Shrublands; mulga & <i>Acacia quadrimarginea</i> scrub	405,532	98.1	0	1.1	1.5

3.4 PREVIOUS VEGETATION SURVEYS

A total of 18 plant communities were defined for the Jack Hills project area by Mattiske Consulting (2005) during surveys in 2005. Communities were described based on dominance of species within a vegetation unit. The majority of the project area was dominated by Low Open Woodlands of *Acacia aneura*, *Acacia kempeana*, *Acacia rhodophloia* and *Grevillea berryana* on broad plains and flats interspersed with minor flow lines dominated by Low Woodlands of *Acacia aneura*, *Acacia citrinoviridis*, *Acacia tetragonophylla*, *Acacia rhodophloia*, *Acacia pruinocarpa* and *Psyrdrax latifolia*. The project area encompassed a number of major and minor flowlines, rocky ridges, breakaways, gravel slopes and plains. Two communities described within the Jack Hills project area were observed at Mt Gould:

- T1: Hummock Grassland of *Triodia melvillei* with emergent *Acacia aneura* var. *major*, *Acacia rhodophloia*, *Acacia xiphophylla* over *Eremophila margarethae*, *Philotheca brucei* subsp. *cinerea*, *Hibiscus sturtii* var. *forrestii*, *Ptilotus obovatus* var. *obovatus*, *Eriachne pulchella* subsp. *pulchella* and *Goodenia tenuiloba* on upper slopes and rocky ridges of main ranges.
- T2: Hummock Grassland of *Triodia melvillei* with denser pockets emergent species including *Acacia aneura* var. *major*, *Acacia ramulosa* subsp. *linophylla*, *Acacia xiphophylla*, *Grevillea berryana*, *Eremophila margarethae* and *Philotheca brucei* subsp. *cinerea* over *Hibiscus sturtii* var. *forrestii*, *Ptilotus obovatus* var. *obovatus*, *Eriachne pulchella* subsp. *pulchella* and *Goodenia tenuiloba* on upper slopes and rocky ridges of main ranges.

None of the plant communities described were considered to be Threatened Ecological Communities (Mattiske 2005).

Additional studies conducted by the DEC identified 6 floristic community types (FCTs) within the Jack Hills area (Meissner and Caruso 2006). None of the FCTs defined are found within conservation reserves. FCT 6 (Shrublands of *Acacia cockertoniana* ms, *Philotheca brucei* subsp. *cinerea*, *Eremophila* spp. over hummock grasslands of *Triodia melvillei*) is believed to be a relictual community with high perennial species richness. This community is known from high altitudes between Mt Matthew and Mt Hale. Further surveys are required to determine the relationships between FCT 6 and the *Triodia*-dominated vegetation communities of Mt Gould and Robinson Ranges (Meissner and Caruso 2006).

Markey and Dillon (2006) identified 8 FCTs within the Weld Range survey area. The area encompassed a number of rocky hillslopes, banded iron outcrops, footslopes and colluvial fans. None of these communities are reported to be found within conservation reserves. These communities are not restricted to the Weld Range area, however they are believed to be distinctly different to that observed in the Jack Hills area.

4. CLEARING REGULATIONS

Under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*, clearing resulting from low impact or other mineral or petroleum activities, are controlled under Regulation 5 Item 20 (Clearing: low impact or other mineral or petroleum activities), in accordance with Schedule 1 of the regulations. This provides an exemption for mineral or petroleum activities as defined in clause 2(2) of Schedule 1, allowing clearing of up to 10 hectares per financial year for clearing authorised under the Mining Act 1978 and the various Petroleum Acts in an authority area, including mining tenements as defined in the *Mining Act 1978*. Clearing must also be undertaken outside non-permitted areas (as defined in Schedule 1 of the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*). Non-permitted areas are described in Table 4:

Table 4: Non-Permitted areas as described under the Environmental Protection (Clearing of Native Vegetation) Regulations 2004

Item	Non-permitted Area	Further Description
a.)	The following bioregions, or part-bioregions:	Avon Wheatbelt
		Esperance
		Geraldton Sandplains
		Jarrah Forest
		Mallee
		Swan Coastal Plain
		Warren
		Intensive-Land Use Zone of the Yalgoo Bioregion;
b.)	Alienated Land as defined in Section 3(1) of the Land Administration Act 1997	
c.)	A townsite as defined in Section 3(1) of the Land Administration Act 1997 that is occupied	
d.)	A conservation area as defined in Schedule 5 Clause 2 to the Act;	Conservation park, national park, nature reserve, marine nature reserve, marine park or marine management area within the meaning of the Conservation and Land Management Act 1984, or any other lands or waters reserved, protected or managed for the purposes of, or purposes including, nature conservation
e.)	Crown Land reserved under the Land Administration Act 1997 the care and control of which is placed with the Water and Rivers Commission under that Act or Section 32 of the Waterways Conservation Act 1976	

Item	Non-permitted Area	Further Description
f.)	A water supply area;	
g.)	An area covered by the riparian vegetation of a wetland or watercourse;	
h.)	The area extending 2km inland from the high water mark of the coastline of Western Australia;	
i.)	An environmentally sensitive area (ESA);	See Table 5
j.)	An area known as a 'priority one area' as described in 'Wild Rivers of Western Australia' (1999) published by the Water and Rivers Commission, Perth;	
k.)	An area known as a 'Red Book Area'.	

Table 5 defines criteria for ESAs, and the position of the project area in relation to these criteria.

Table 5: Description of Environmentally Sensitive Areas, and their application to the project area

Letter	Description	Application
A	A declared World Heritage property	-
B	Area registered under the Register of the National Estate, because of its natural heritage values under the <i>Australian Heritage Commission Act 1975</i>	-
C	A defined wetland and the area within 50m of the wetland	-
D	Area covered by vegetation within 50m of rare flora, to the extent where the vegetation is continuous with the vegetation in which the rare flora is located	-
E	Area covered by a threatened ecological community	-
F	A Bush Forever Site, except to the extent to which the site may be cleared under a decision of the Western Australia Planning Commission	-
G	Areas covered under the <i>Environmental Protection (Gnangara Mound Crown Land) Policy 1992</i> and the <i>Environmental Protection (Western Swamp Tortoise) Policy 2002</i>	-
H	Areas covered by the lakes to which the <i>Environmental Protection (Swan Coastal Plain Lakes) Policy 1992</i> applies	-
I	Protected wetlands as defined in the <i>Environmental Protection (South West Agricultural Zone Wetlands) Policy 1998</i>	-
J	Areas of fringing native vegetation in the policy area as defined in the <i>Environmental Protection (Swan and Canning Rivers) Policy 1998</i>	-

5. SUMMARY OF ENVIRONMENTAL FACTORS

This desktop review of flora and vegetation within the Mt Gould project area has identified the following key issues that may require management prior to commencement of exploration activities:

6. Potentially 9 Priority Flora taxa (Table 3) present in the project area;
7. Potentially 1 Declared and 1 Invasive weed species present in the project area;
8. No TECs known from the project area.

Currently, the Mt Gould tenement is not located within a non-permitted area (Section 4), although significant riparian vegetation may occur within the area. Although no TECs are currently located within the project area, the DEC is showing considerable interest in the vegetation of BIF areas within the Mid-West region.

From the results of the desktop flora and vegetation study, the conservation significance of the project area is moderate to high due to:

- The likelihood of Priority Flora species occurring in the project area;
- The limited number of previous flora surveys conducted in the Mt Gould area, and the potential impacts to banded ironstone formation (BIF) vegetation communities.

6. RECOMMENDATIONS

The level of Flora and Vegetation survey for this project has been defined as a Level 2 Survey, which consists of background research or a desktop study followed by a detailed or comprehensive survey. This has been determined from Table 2 of the EPA's Guidance Statement No. 51 (Environmental Protection Authority 2004), where the Bioregion Group is defined as Group 2, and the nature of the impact is considered to be moderate. It is recommended that a Level 2 Survey be conducted to:

- Describe and map plant communities (FCTs) present in the project area;
- Identify significant species and plant communities;
- Recommend management actions to mitigate impacts of exploratory drilling.

The level of investigation required for the proposal should be discussed with the Department of Environment and Conservation prior to the commencement of fieldwork.

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Appendix A: Declared Rare and Priority Flora Species Conservation Codes (DEC 2006)**R: Declared Rare Flora – Extant Taxa**

Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such.

X: Declared Rare Flora – Presumed Extinct Taxa

Taxa which have not been collected, or otherwise verified, over the past 50 years despite thorough searching, or of which all known wild populations have been destroyed more recently, and have been gazetted as such.

1: Priority One – Poorly Known Taxa

Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat, e.g. road verges, urban areas, farmland, active mineral leases, etc., or the plants are under threat, e.g. from disease, grazing by feral animals, etc. May include taxa with threatened populations on protected lands. Such taxa are under consideration for declaration as ‘rare flora’, but are in urgent need of further survey.

2: Priority Two – Poorly Known Taxa

Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as ‘rare flora’, but are in urgent need of further survey.

3: Priority Three – Poorly Known Taxa

Taxa which are known from several populations, and the taxa are not believed to be under immediate threat (i.e. not currently endangered), either due to the number of known populations (generally >5), or known populations being large, and either widespread or protected. Such taxa are under consideration for declaration as ‘rare flora’ but are in need of further survey.

4: Priority Four – Rare Taxa

Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5-10 years.

Appendix B: Definitions of Categories of Threatened Ecological Communities (Department of Environment and Conservation 2007d)

Presumed Totally Destroyed (PD)

An ecological community which has been adequately searched for but for which no representative occurrences have been located. The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future.

An ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant **and either** of the following applies (A or B):

- A) Records within the last 50 years have not been confirmed despite thorough searches of known or likely habitats **or**
- B) All occurrences recorded within the last 50 years have since been destroyed

Critically Endangered (CR)

An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated.

An ecological community will be listed as **Critically Endangered** when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting **any one or more of** the following criteria (A, B or C):

- A) The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% **and either or both** of the following apply (i or ii):
 - i) geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 10 years);
 - ii) modification throughout its range is continuing such that in the immediate future (within approximately 10 years) the community is unlikely to be capable of being substantially rehabilitated.

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

- i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 10 years);
 - ii) there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes;
 - iii) there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes.
- C) The ecological community exists only as highly modified occurrences that may be capable of being rehabilitated if such work begins in the immediate future (within approximately 10 years).

Endangered (EN)

An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future.

An ecological community will be listed as **Endangered** when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information by it meeting **any one or more of** the following criteria (A, B, or C):

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

- i) the estimated geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term future (within approximately 20 years);
- ii) modification throughout its range is continuing such that in the short term future (within approximately 20 years) the community is unlikely to be capable of being substantially restored or rehabilitated.

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

- i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction

throughout its range in the short term future (within approximately 20 years);

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

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

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

Vulnerable (VU)

An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range.

An ecological community will be listed as **Vulnerable** when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction or significant modification in the medium to long term future. This will be determined on the basis of the best available information by it meeting **any one or more of** the following criteria (A, B or C):

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

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

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

APPENDIX 4: MOUNT GOULD DSO PROJECT FLORA AND VEGETATION ASSESSMENT (WOODMAN 2009)

ATLAS IRON LIMITED
MOUNT GOULD DSO PROJECT

FLORA AND VEGETATION ASSESSMENT



May 2009



woodmanenvironmentalconsulting

A. C. N. 088 055 903

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TABLE OF CONTENTS

EXECUTIVE SUMMARY.....	i
1. INTRODUCTION.....	1
1.1 PROJECT DESCRIPTION.....	1
1.2 AIMS.....	2
2. BACKGROUND.....	3
2.1 CLIMATE.....	3
2.2 SOILS AND LANDFORMS.....	4
2.3 FLORA AND VEGETATION SURVEYS.....	4
2.3.1 Sources of Information.....	4
2.3.2 Flora.....	5
2.3.3 Vegetation.....	8
3. METHODS.....	11
3.1 LICENCES AND TIMING OF SURVEY.....	11
3.2 AERIAL PHOTOGRAPHY INTERPRETATION.....	11
3.3 FIELD SURVEY.....	11
3.4 PLANT COLLECTION AND IDENTIFICATION.....	12
3.5 STATISTICAL ANALYSIS.....	12
3.6 DESCRIPTION OF FLORISTIC COMMUNITY TYPES.....	13
3.7 SIGNIFICANT OF FLORA AND VEGETATION.....	13
3.7.1 Significance of Flora Taxa.....	13
3.7.2 Significance of Vegetation.....	14
4. RESULTS.....	16
4.1 FLORA.....	16
4.1.1 Conservation Significant Flora Taxa.....	16
4.1.2 Other Flora of Interest.....	17
4.1.3 Significance of Flora.....	18
4.2 FLORISTIC COMMUNITY TYPES.....	19
4.2.1 Floristic Community Types at Mount Gould.....	20
4.2.2 Significance of Vegetation.....	28
5. DISCUSSION.....	33
6. RECOMMENDATIONS.....	33
7. REFERENCES.....	34

TABLES

Table 1:	DRF and Priority Flora Potentially Found Within or in the Vicinity of the Project area
Table 2:	Description, Pre-European Extent, Current Extent and Reservation Status of Vegetation Associations Related to Physiognomy in the Project area
Table 3:	Floristic Community Types (FCTs) Described on Mount Gould by Meissner <i>et al.</i> (2007)

Table 4:	Significance of Local Populations to the Overall/Regional Conservation of Species
Table 5:	Descriptions of Conservation Significance Rankings of Floristic Community Types
Table 6:	Conservation Significance of Flora Taxa Populations within the Project area
Table 7:	Conservation Significance of Floristic Community Types (FCTs) Described within the Project area

FIGURES

Figure 1:	Average Maximum and Minimum Temperatures (°Celsius) and Average Rainfall (mm) for Meekatharra Airport
Figure 2a:	Project area Floristic Community Types and Significant Flora Taxa
Figure 2b:	Project area Floristic Community Types and Significant Flora Taxa Showing Aerial Photography

PLATES

Plate 1:	Population of <i>Eremophila warnesii</i> (P1) on the eastern peak of Mount Gould
Plate 2:	FCT 1 - Quadrat MG15 (Woodman Environmental)
Plate 3:	FCT 2 - Quadrat MG22 (Woodman Environmental)
Plate 4:	FCT 3 - Quadrat MG05 (left), MG06 (Woodman Environmental)
Plate 5:	FCT 4 - Quadrat MG25 (left), Quadrat MG23 (Woodman Environmental)
Plate 6:	FCT 5 - Quadrat MG09 (Woodman Environmental)
Plate 7:	FCT 6a - Quadrat MG02 (Woodman Environmental)
Plate 8:	FCT 6b - Quadrat MG03 (Woodman Environmental)

APPENDICIES

Appendix A:	Definitions of Conservation Status Codes
Appendix B:	Definitions, Categories and Criteria for Threatened and Priority Ecological Communities
Appendix C:	Vascular Plant Taxa Recorded Within the Project area, 2008
Appendix D:	Vascular Plant Species Recorded in Each Floristic Community Type in the Project area, 2008

- Appendix E: Raw Quadrat Data from the Project area
- Appendix F: Taxa amalgamated for the Project area Quadrat Analysis
- Appendix G: Summary Dendrogram of Floristic Community Types of the Project area
- Appendix H: Summary Matrix of Species Presence within Quadrats in the Project area
- Appendix I: Significant Indicator Species of the 7-Group Classification of the Project area
- Appendix J: Summary Dendrogram of Analysis of Mount Gould and Robinson Range Quadrats
- Appendix K: Summary Matrix of Species Presence within Mount Gould and Robinson Range Quadrats
- Appendix L: Summary Dendrogram of Analysis of Mount Gould and Jack Hills Quadrats
- Appendix M: Summary Matrix of Species Presence within Mount Gould and Jack Hills Quadrats

EXECUTIVE SUMMARY

Atlas Iron Limited (Atlas) is proposing to conduct preliminary exploration drilling for iron ore, with the view of mining the ore depending on the results of drilling, within tenement M52/236 ('Project area'), as part of its Mount Gould Direct Shipping Ore (DSO) Project. The Mount Gould DSO Project area ('Project area') is located at Mount Gould within the Mid-West Region, approximately 150 km north-east of Meekatharra, north of the Murchison River. Atlas initially commissioned Woodman Environmental Consulting (Woodman Environmental) in 2007 to conduct a desktop flora and vegetation study of the Project area. Following the completion of this study, Atlas commissioned Woodman Environmental in 2008 to undertake a detailed flora and vegetation survey of the Project area. The level of Flora and Vegetation survey for the Project area has been defined as a Level 2 Survey, which consists of background research/desktop study and reconnaissance survey, followed by either a detailed or comprehensive survey. The level of survey required has been determined from Table 2 of the Environmental Protection Authority's Guidance Statement No. 51, where the Bioregion Group is defined as Group 2, and the nature of the potential impact is considered to be moderate.

A total of 25 permanent 20 m by 20 m vegetation assessment quadrats were established over the Project area. All types of vegetation units discernable from aerial photographs (scale 1:10,000) were surveyed with at least one quadrat. Opportunistic recordings of other species were also noted in areas adjacent to quadrats, and when traversing between quadrats. Statistical analysis using PATN was undertaken to describe Floristic Community Types (FCTs) present in the Project area, utilising data from both Woodman Environmental and Department of Environment and Conservation quadrats, which were established in 2006. Indicator species analysis was also undertaken. Mapping of populations of *Eremophila warnesii* (P1), which is known from the summit of Mount Gould, was also undertaken.

A total of 94 discrete vascular flora taxa, from 28 families and 53 genera, were recorded from the Project area. Of these taxa, one introduced (weed) taxon was recorded. The families with the highest number of taxa were Poaceae (10 taxa), Myoporaceae (10), Mimosaceae (9) and Asteraceae (8). No Declared Rare Flora taxa were recorded within the Project area; however three Priority Flora taxa were recorded: *Eremophila warnesii*, *Halgania gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743) and *Rhodanthe sphaerocephala* (all P1). The populations of these taxa within the Project area are all ranked as highly significant in terms of the overall conservation of each taxon, as all three are known from less than five populations, and have restricted geographical distributions in the general region of Mount Gould. There is also very little data available regarding the size and condition of these populations. In particular, *H. gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743) is only known from Mount Gould, where it is by no means abundant.

The floristic classification of the quadrats within the Project area defined 7 FCTs and subtypes. Most FCTs consisted of tall shrublands dominated by *Acacia aneura*, however one FCT on the summit and slopes of Mount Gould consisted of a hummock grassland

dominated by *Triodia melvillei*. Comparison of quadrat data from the Project area with datasets from the nearby Robinson Range and Jack Hills indicated that the FCTs described on the summit and upper slopes of Mount Gould, including the hummock grassland of *Triodia melvillei*, do not occur elsewhere, and are therefore of high regional conservation significance. Mount Gould itself is included as part of the Robinson Range vegetation complexes (banded ironstone formation) Priority Ecological Community, which is listed as Priority 1.

As no mining footprint has been developed for the Mount Gould DSO Project, no assessment of the impacts of any such proposal to significant flora and FCTs has been undertaken. It is of high importance that this be undertaken if mining is proposed, particularly given the high conservation significance of the Priority flora and FCTs present within the Project area.

The following recommendations are given:

- Utilize areas of existing disturbance for any future proposed drilling operations where possible;
- Survey of any proposed drilling in remnant vegetation on Mount Gould by an experienced botanist if drilling occurs within the vicinity of known Priority flora locations, or within likely habitat of Priority flora; and
- Additional regional survey for Priority flora taxa if impacts to populations of such taxa within the Project area as a result of clearing for drilling or mining operations are likely to be significant.

1. INTRODUCTION

1.1 Project Description

Atlas Iron Limited (Atlas) is proposing to conduct preliminary exploration drilling for iron ore, with the view of mining the ore depending on the results of drilling, within tenement M52/236 ('Project area'), located at Mount Gould. Mount Gould is located within the Mid-West Region, approximately 150 km north-east of Meekatharra, north of the Murchison River. The Mount Gould iron ore deposit was discovered in 1897 and regarded as a significant deposit due to its proximity to the enriched hematite deposit at Mount Hale, located in the Jack Hills to the south. In the late 1960's and early 1970's various geological surveys and mapping was carried out over the prospect and the presence of micaceous hematite was also noted. In 1986 Imdex Limited entered into an agreement with Endeavour Resources (who held the mining lease) to develop, mine and market the micaceous iron ore and during the period 1986-1995, Imdex conducted an extended program of geological mapping, drilling, costeaning and bulk sampling of the ore body. In 1995 Imdex lodged a Notice of Intent to mine 5000 tonnes and constructed roads, stockpiles and a crushing plant onsite, with ore transported to the Company's plant in Jandakot for final milling. In May 1998 the tenement was authorised for iron ore by Mount Gould Minerals Pty Ltd. In August 2007 Atlas Iron Limited acquired the tenement from Mount Gould Minerals Pty Ltd along with mining lease M20/118 located at Weld Range.

The Mid-West Region is currently attracting considerable interest with regard to proposed mining projects on Banded Ironstone Formation (BIF) ranges. This includes existing and proposed mines at Koolanooka, Mt Gibson, Minjar, Golden Grove (including Gossan Hill), Karara-Mungada, Weld Range and Jack Hills. The Department of Environment and Conservation (DEC) has recently conducted a series of vegetation assessments concentrating on BIFs throughout the Mid-West Region in response to these proposals, to enhance knowledge regarding the flora and vegetation on these formations, and develop management objectives for these formations.

Atlas initially commissioned Woodman Environmental Consulting (Woodman Environmental) in 2007 to conduct a desktop flora and vegetation study of the Project area (Woodman Environmental 2008). Following the completion of this study, Atlas commissioned Woodman Environmental in 2008 to undertake a detailed flora and vegetation survey of the Project area. This was undertaken in conjunction with a detailed survey of Atlas' Weld Range DSO Project area, located approximately 130 km south of the Project area, which has been presented as a separate report.

The level of Flora and Vegetation survey for the Project area has been defined as a Level 2 Survey, which consists of background research/desktop study and reconnaissance survey, followed by either a detailed or comprehensive survey. The level of survey required has been determined from Table 2 of the Environmental Protection Authority's (EPA) Guidance Statement No. 51 (EPA 2004), where the Bioregion Group is defined as Group 2, and the nature of the potential impact is considered to be moderate.

1.2 Aims

The aim of this study was to ascertain flora and vegetation values that may be impacted by the proposed drilling and future mining operations (if any) within the Project area. This included survey for Declared Rare Flora (DRF) and Priority Flora species that may be present within the Project area, and establishment of survey quadrats in all vegetation units. The information collected during the survey will assist Atlas in their decision-making with regard to minimising the potential impacts of drilling and mining-related activities to the flora and vegetation values of the Project area.

The tasks required to meet this aim were:

- Establish a series of 20 m x 20 m permanent quadrats within all vegetation units in the Project area;
- Undertake statistical analysis to define Floristic Community Types (FCTs) within the Project area;
- Produce a FCT map of the Project area;
- Search for flora species, particularly DRF and Priority Flora species that may be present within the Project area;
- Provide a report detailing FCTs and flora species present within the Project area; and
- Identify management measures to minimise the impact of any proposed disturbance on the flora and vegetation of the Project area.

2. BACKGROUND

2.1 Climate

The Project area is located close to the south-western boundary of the desert bioclimatic region, which is characterised by low and erratic rainfall that can occur in both summer and winter (Beard 1976). Figure 1 displays average monthly maximum and minimum temperatures, and average monthly rainfall, recorded for Meekatharra Airport, the nearest meteorological station to the Project area (Bureau of Meteorology 2009).

The average daily maximum temperatures at Meekatharra Airport peak in January, and lowest average minimum temperatures are experienced in July. The average annual rainfall for this station is 236.5 mm. Average monthly rainfall peaks in both summer and winter. The summer rainfall is influenced by tropical cyclones, which generally form between December and April, while during winter strong cold fronts from the south produce some rainfall.

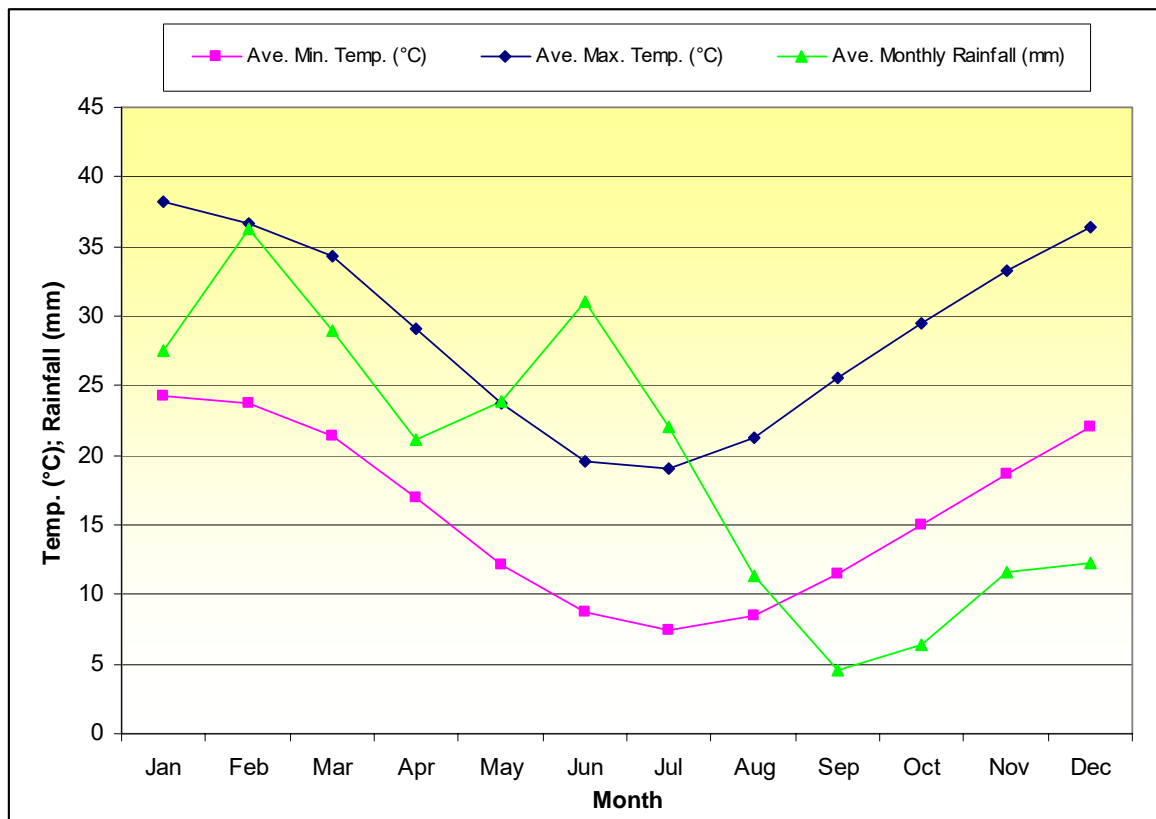


Figure 1: Average Maximum and Minimum Temperatures (°Celsius) and Average Rainfall (mm) for Meekatharra Airport (Bureau of Meteorology 2009)

2.2 Soils and Landforms

The Project area is located in the Murchison Bioregion (Austin Botanical District), which is formed of Archaean granite with infolded volcanics and meta-sediments of like age, composing the Yilgarn Block (Beard 1990). This region is generally undulating, with occasional ranges of low hills, and extensive sandplains in the eastern half.

Beard (1976) termed the central northern part of this region (where the Project area is situated) the Upper Murchison sub-region, which contains the Murchison River basin. This area has been strongly dissected, resulting in most of the Tertiary plateau surface being removed, and sandplains existing as small remnants. Most of the country is hilly and undulating, with shallow soils and exposures of granite in the hills, but also extensive plains at the lower levels (Beard 1976). The principle ranges are the Weld Range and Jack Hills, the latter located 20 km from the Project area.

Beard (1976) divided the Upper Murchison into eastern and western portions when describing dominant soil types; only the western portion is relevant to the Project area. Beard (1976) described five principal soil units in the western portion of the Upper Murchison; as described below:

1. Shallow, stony, earthy loams on hills and ranges, with extensive portions without soil cover;
2. Earthy loams overlying red-brown hardpan at shallow depth, on undulating pediments;
3. Shallow acid red earths and shallow earthy loams, often occurring in intimate micro-association and overlying red-brown hardpan within 75 cm of the surface, on extensive flat and gently-sloping plains with a scatter of surface gravels;
4. Hard alkaline and neutral red soils on alluvial flats that are frequently saline and flank river courses; and
5. Deep earthy loams in recent alluvia of river floodplains.

It is likely that the soils of the Project area consist primarily of soil unit 1, however units 2 and 3 could also potentially occur.

2.3 Flora and Vegetation Surveys

2.3.1 Sources of Information

Very few flora and vegetation surveys carried out to date have encompassed the Project area, and those have been conducted mainly at State and Regional levels. These have mainly been conducted by J. S. Beard, in his mapping and description of vegetation systems on a State wide level (Beard 1976; 1990), which was further expanded by Shepherd *et al.* (2002). An inventory and rangeland condition survey of the Murchison River catchment and surrounds, which includes Mount Gould, has also been undertaken (Curry *et al.* 1994). The Department of Environment and Conservation (DEC) undertook a survey of Mount Gould as part of a series of vegetation assessments concentrating on BIFs throughout the Mid-West Region, however this did not sample the entire Project area area.

Applicable DEC databases were interrogated as part of the initial desktop survey of the Project area in 2007 for the presence of known DRF and Priority Flora species, Threatened Ecological Communities (TECs) and Priority Ecological Communities (PECs). The GIS tool *NatureMap* (DEC 2009a) was then used to determine any additional records of DRF and Priority Flora taxa that may have been added to DEC databases since the initial interrogation. Commonwealth Department of Environment and Water Resources (DEWR) databases were also interrogated for factors of environmental significance. Appendix A presents the definition of DRF and Priority Flora codes (Atkins 2008), and Appendix B presents definitions and criteria for TECs and PECs (DEC 2007a).

2.3.2 Flora

Meissner *et al.* (2007) undertook a regional flora survey of Mount Gould, in conjunction with a survey of the Robinson Range (located approximately 80 km east of Mount Gould), during August 2006, as part of a wider series of flora surveys throughout the Mid-West for the DEC. A total of 50 permanent 20 m x 20 m quadrats were established during the survey, including 5 on Mount Gould, covering the major geographical, geomorphologic and floristic variation found in the study area. A total of 172 plant taxa from 81 genera and 40 families were recorded from the quadrats and adjacent areas. The most-well represented families included Asteraceae, Poaceae, Mimosaceae, Malvaceae and Amaranthaceae.

No DRF taxa were located during this survey, however the Priority taxa *Euphorbia sarcostemmoides*, *Halgania gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743) (initially referred to as *Halgania ?gustafsenii* var. *gustafsenii* (R. Meissner & B. Bayliss 743), *Pityrodia ipthima* (initially referred to as *Pityrodia* sp. Robinson Range (R. Meissner & B. Bayliss 725) (all P1) and *Baeckea* sp. Melita Station (H. Pringle 2738) (P3) were recorded. Of these, only *Halgania gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743) (P1) was recorded on Mount Gould. They also identified a single new taxon at the time of survey: *Indigofera fractiflexa* subsp. Mount Augustus (S. Patrick & A. Crawford SP4734), however this taxon is not currently considered to be of conservation significance. Additionally, six taxa were identified that currently require further collections and/or taxonomic review to determine whether they are conservation significant and represent distinct entities, as listed below:

- *Hibiscus* cf. *solanifolius* (R. Meissner & B. Bayliss 923)
- *Sida* aff. *atrovirens* (R. Meissner & B. Bayliss 1031)
- *Sida* aff. *intricata* (R. Meissner & B. Bayliss 1037)
- *Portulaca* aff. *oleracea* (R. Meissner & B. Bayliss 963)
- *Paspalidium* sp. (R. Meissner & B. Bayliss 956)
- *Solanum* aff. *ashbyae* (R. Meissner & B. Bayliss 1040)

Meissner & Caruso (2006) undertook a regional flora survey of the Jack Hills, located approximately 20 km south of the Project area, during August 2005, as part of a wider series of flora surveys throughout the Mid-West for the DEC. A total of 50 permanent 20 m x 20 m quadrats were established, covering the major geographical, geomorphologic and

floristic variation found in the study area. A total of 209 plant taxa from 98 genera and 43 families were recorded from the quadrats and adjacent areas. The most-well represented families included Asteraceae, Poaceae, Mimosaceae, Malvaceae and Myoporaceae. No DRF taxa were located during this survey, however the Priority taxa *Acacia* sp. Jack Hills (R. Meissner & R. Meissner & Y. Caruso 4) (initially referred to as *Acacia cockertoniana* ms) (P1), *Gunniopsis propinqua* and *Prostanthera ferricola* (initially referred to as *Prostanthera* sp. Murchison (G. Byrne 239)) (both P3), were recorded. They also identified the new taxon (at the time of survey) *Lobelia heterophylla* subsp. Pilbara (R. Meissner & Y. Caruso 1), however this taxon is not considered to be of conservation significance. Additionally, five taxa were identified that currently require further collections and/or taxonomic review to determine whether they are conservation significant and represent distinct entities, as listed below:

- *Abutilon* sp. (R. Meissner & Y. Caruso 136)
- *Glycine* sp. (R. Meissner & Y. Caruso 110)
- *Gunniopsis* aff. *divisa* (R Meissner & Y. Caruso 125)
- *Hibiscus* sp. (R. Meissner & Y. Caruso 123)
- *Indigofera* aff. *australis*

Mattiske Consulting Pty Ltd (2005) undertook a detailed flora and vegetation survey of the proposed iron ore mining area and associated infrastructure facilities at Murchison Metals Ltd's Jack Hills project area, located approximately 20 km south of the Project area, between 2004 and 2005. Some searching of Mount Gould was undertaken as part of this survey. A total of 215 plant taxa from 185 genera and 36 families were recorded during the survey. The most well-represented families included Mimosaceae, Myoporaceae, Poaceae, Chenopodiaceae and Asteraceae. No DRF taxa were located during this survey, however three Priority taxa were located: *Calytrix verruculosa* (P1), *Gunniopsis divisa* (P1) and *Verticordia jamiesonii* (P3). None of these species were recorded at Mount Gould (Mattiske Consulting Pty Ltd 2005).

A search of the DEC Threatened Flora Databases (Threatened Flora Database; Western Australian Herbarium (WAHerb) Specimen Database; Declared Rare and Priority Flora List) for the Project area was previously undertaken in 2007 (DEC 2007b). The search co-ordinates used were:

North-west corner:	-25° 33'	116° 59'
South-east corner:	-26° 04'	117° 37'

The WAHerb Specimen Database and the Declared Rare and Priority Flora Database provided information on DRF and Priority Flora species over the area covered by the search co-ordinates. The GIS tool *NatureMap* (DEC 2009a), which utilises the Threatened Flora Database and WAHerb Specimen Database, was then used to determine any additional records of DRF and Priority Flora taxa that may have been added to DEC databases since the initial interrogation. Information resulting from the database searches is presented in Table 1. These species may potentially occur within the Project area.

Table 1: DRF and Priority Flora Potentially Found Within or in the Vicinity of the Project area (DEC 2007b; DEC 2009a)	
Taxon	Conservation Status
<i>Acacia</i> sp. Jack Hills (R. Meissner & Y. Caruso 4)	P1
<i>Calytrix verruculosa</i>	P1
<i>Eremophila petrophila</i> subsp. <i>densa</i>	P1
<i>Eremophila warnesii</i>	P1
<i>Halgania gustafsenii</i> var. Murchison (R. Meissner & B. Bayliss 743)	P1
<i>Lepidium xylodes</i>	P1
<i>Ptilotus lazaridis</i>	P1
<i>Stenanthemum mediale</i>	P1
<i>Murchisonia fragrans</i>	P2
<i>Gunniopsis propinqua</i>	P3
<i>Hemigenia tysonii</i>	P3
<i>Homalocalyx echinulatus</i>	P3
<i>Prostanthera ferricola</i>	P3
<i>Verticordia jamiesonii</i>	P3

A search of the Department of the Environment, Water, Heritage and the Arts (DEWHA) database, with regard to taxa of significance as listed under the *Environmental Protection and Biodiversity Conservation Act 1999*, was performed for the Project area (DEWHA 2009). One Threatened Species, *Pityrodia augustensis* (DRF) (Mt Augustus Foxglove), was listed as potentially occurring in the Project area area (DEWHA 2009). This species is listed as Vulnerable under the *Environmental Protection and Biodiversity Conservation Act 1999*. This species is currently only known from the Mt Augustus area. As this species was not recorded within the search of the DEC's DRF and Priority Flora taxa databases, it is highly unlikely that it will be present within the Project area.

Two invasive taxa, *Cenchrus ciliaris* and *Prosopis* spp., were also listed as potentially occurring in the Project area (DEWHA 2009). *Prosopis* spp. are classified as P1 Declared Plants for the whole of Western Australia under the *Agriculture and Related Resources Protection Act 1976* (Department of Agriculture and Food 2009), meaning movement of plants or their seeds within the state, including on contaminated machinery and produce, is prohibited. *Prosopis* spp. are also listed as Weeds of National Significance (Thorp & Lynch 2000), and are under national management for the purpose of restricting their spread, and eradicating them from parts of Australia. *C. ciliaris* is not listed as a Declared Plant in Western Australia (Department of Agriculture and Food 2009) but is considered by the States and Territories to pose a particularly significant threat to biodiversity (DEWHA 2009).

2.3.3 Vegetation

The Project area is located within the northern section of the Murchison IBRA Region (Interim Biogeographic Regionalisation for Australia) (Environment Australia 2000), and specifically within the MUR2 – Western Murchison Subregion (Desmond, Cowan and Chant 2001). The subregion forms the northern part of the Murchison Terrains of the Yilgarn Craton and contains the headwaters of the Murchison and Wooramel Rivers which drain west towards the coast. Pastoralism occupies approximately 96% of the region and there are numerous mining interests.

The Project area is located within the Austin Botanical District within the Murchison Region, as defined by Beard (1990). The vegetation of district is predominantly mulga low woodland (*Acacia aneura*) on plains with scrub on hills. There is also tree steppe of *Eucalyptus* spp. and *Triodia basedowii* on the sand plains. Vegetation within the Murchison Region was broadly mapped and described by Beard at a scale of 1:1,000,000 (Beard 1976). Shepard *et al.* (2002) mapped and described vegetation associations related to physiognomy, based on the original Beard mapping. The Project area encompasses two vegetation types which are summarised in Table 2.

Curry *et al.* (1994) described Mount Gould as belonging to the Peak Hill Land System, which consists of rugged sinuous ranges and hills of banded ironstone and hematitic shale, with vegetation dominated by *Acacia aneura* and *A. tetragonophylla*, with scattered *Eremophila*, *Cassia* and *Solanum*. The Robinson Range (located approximately 60 km to the east of Mount Gould) was mapped as the same Land System, however the nearby Jack Hills (approximately 20 km south of Mount Gould), were mapped as a different (Weld) Land System.

The DEC TEC and PEC database was interrogated upon request (DEC 2007c). There are no occurrences of TECs within the search area. However, Mount Gould is included as part of the Robinson Range vegetation complexes (banded ironstone formation) PEC, which is listed as P1 (DEC 2008). There is the potential that this PEC may be listed as a TEC in the future.

Meissner *et al.* (2007) identified seven FCTs within the Robinson Range and Mount Gould areas, two of which were recorded on Mount Gould. These are summarised in Table 3. FCT 1 is found on Mount Gould and in the Robinson Range, while FCT 2 is restricted to Mount Gould. It appears that FCT 2, a spinifex (*Triodia*) community found at the summit of Mount Gould, differs to spinifex communities found on the Robinson Range (FCT 7) and Jack Hills (FCT 6 as described in Meissner & Caruso (2006)), primarily in the perennial shrub species found within the community. Neither of the FCTs described on Mount Gould appear to occur at the Jack Hills, located only 20 km south of Mount Gould (Meissner *et al.* 2007).

Table 2: Description, Pre-European Extent, Current Extent and Reservation Status of Vegetation Associations Related to Physiognomy in the Mount Gould Survey Area (Shepard <i>et al.</i> 2002) (Areas in hectares unless indicated)						
Vegetation Association	Description	Current Extent	% Remaining Since Pre – European Extent	IUCN Class 1-4 Reserves (%)	Other Reserves (%)	DEC pastoral leases
29	Sparse low woodland; mulga, discontinuous in scattered groups	7,782,264	100	0.3	0	2.4
202	Shrublands; mulga & <i>Acacia quadrimarginea</i> scrub	405,532	98.1	0	1.1	1.5

FCT	Description	Location
1	Open to sparse shrublands of <i>Acacia aneura</i> over open to isolated shrublands of <i>Eremophila</i> spp. (<i>E. latrobei</i> subsp. <i>latrobei</i> , <i>E. jucunda</i> subsp. <i>jucunda</i> , <i>E. forrestii</i> subsp. <i>forrestii</i>), <i>Ptilotus obovatus</i> var. <i>obovatus</i> and <i>P. polystachyus</i> over forbland and grassland of <i>Dysphania rhadinostachya</i> , <i>Aristida contorta</i> , <i>Eriachne pulchella</i> and <i>Goodenia tenuiloba</i> .	Lower slopes of Mount Gould and Robinson Range
2	Isolated shrubland of <i>Acacia aneura</i> or <i>Grevillea berryana</i> over sparse to open shrubland of <i>Philothea brucei</i> subsp. <i>cinerea</i> , <i>Eremophila latrobei</i> subsp. <i>latrobei</i> over hummock grassland of <i>Triodia melvillei</i>	Upper slopes and crests of Mount Gould

Meissner & Caruso (2006) identified six FCTs within the Jack Hills area. None of the FCTs defined are found within conservation reserves. FCT 6 (Shrublands of *Acacia* sp. Jack Hills (R. Meissner and Y. Caruso 4), *Philothea brucei* subsp. *cinerea*, *Eremophila* spp. over hummock grasslands of *Triodia melvillei*) is believed to be a relictual FCT with high perennial species richness. This FCT is known from high altitudes between Mt Matthew and Mt Hale, and is now believed to be different to superficially similar FCTs found on Mount Gould and in the Robinson Range (Meissner *et al.* 2007).

A total of 18 plant communities were defined for the Jack Hills project area by Mattiske Consulting (2005) during surveys in 2005. Communities were described based on dominance of species within a vegetation unit. The majority of the project area was dominated by Low Open Woodlands of *Acacia aneura*, *Acacia kempeana*, *Acacia rhodophloia* and *Grevillea berryana* on broad plains and flats interspersed with minor flow lines dominated by Low Woodlands of *Acacia aneura*, *Acacia citrinoviridis*, *Acacia tetragonophylla*, *Acacia rhodophloia*, *Acacia pruinocarpa* and *Psydrax latifolia*. The project area encompassed a number of major and minor flowlines, rocky ridges, breakaways, gravel slopes and plains. Two spinifex communities described within the Jack Hills project area were observed on Mt Gould, however, this contradicts Meissner *et al.* (2007), who determined that communities located in the Jack Hills and Mount Gould are significantly different in terms of species composition, despite their geographical proximity (20 km apart). None of the plant communities described were considered to be Threatened Ecological Communities (Mattiske Consulting Pty Ltd 2005).

3. METHODS

3.1 Licences and Timing of Survey

Field surveys were undertaken from the 4th to 8th August, and from the 29th September to 3rd October 2008. The timing of surveys was designed to sample the Project area area over two seasons, as stipulated by the EPA Guidance Statement No. 51 (EPA 2004). Plant collections were taken under the following license numbers:

- Greg Woodman: SL008043
- David Coultas: SL008065
- Kim Kershaw SL008034

3.2 Aerial Photography Interpretation

Aerial photography of the Project area area was supplied to Woodman Environmental by Atlas at a scale of 1:10 000. Preliminary vegetation boundaries in the Project area were transcribed onto the aerial photography based on patterning and landforms. All vegetation patterns were targeted for establishment of flora quadrats to ensure that each identifiable vegetation unit and landform feature received survey effort.

3.3 Field Survey

A total of 25 permanent 20 m by 20 m vegetation assessment quadrats were established over the Project area. Each quadrat was established and assessed in accordance with the methods contained in procedures as presented by the Department of Conservation and Land Management (CALM) (2006a, b). All types of vegetation units discernable from aerial photographs (scale 1:10,000) were surveyed with at least one quadrat. The quadrats were established in the least disturbed vegetation available.

All quadrats were oriented to the four cardinal points, with a star picket used to mark the north-west corner, and fence droppers used to mark the remaining corners. Aluminium tags were used to mark the north-west corner with the quadrat number. GPS locations for each quadrat were taken using a Garmin GPS 72 (accurate to approximately 5 m) at the north-west corner. All co-ordinates were taken in GDA94, Zone 50. A photograph of each quadrat was also taken facing south-east from the north-west corner. No soil samples were collected for analysis during this survey.

The following data was recorded at each quadrat:

- Personnel
- Date
- GPS Location (GDA 94; Zone 51)
- Topography
- Soil Type and Colour

- Slope
- Condition of Vegetation (Government of Western Australia 2000)
- Vascular Plant Species Height and Cover
- Photograph facing south-east from star picket

Opportunistic recordings of other species were also noted in areas adjacent to quadrats, and when traversing between quadrats.

The Priority 1 species *Eremophila warnesii* is known from the summit of Mount Gould. When populations of this species were identified, the spatial distributions of the populations were defined by recording GPS co-ordinates around the edge of the populations. Estimates of the number of individuals within each population were also recorded. This was undertaken to attempt to discern the complete spatial distribution of this species within the Project area.

3.4 Plant Collection and Identification

All vascular plant species present within each quadrat were recorded during the field work in 2008. Specimens of unknown taxa were collected and pressed for identification at the W.A. Herbarium. All plant identification work was conducted by Frank Obbens and David Coultas. Species nomenclature follows Packowska & Chapman (2000), with all names checked against the MAX database to ensure their currency. The MAX database is a database maintained by the Department of Environment and Conservation (DEC) containing the current names of all plant taxa in Western Australia. The conservation status of each species was checked against conservation status codes presented on *Florabase* (DEC 2009b).

Specimens of significant flora species collected and Rare Flora Report Forms (RFRF) (as required by the DEC) will be submitted to the W.A. Herbarium and the DEC respectively upon the conclusion of this project.

3.5 Statistical Analysis

Statistical analysis and determination of FCTs was conducted using quadrat data only. Statistical analysis of the quadrat-derived data was conducted using methods similar to those used by Meissner *et al.* (2007). In the DEC studies (including Meissner *et al.* 2007) quadrat data was analysed statistically using three separate statistical packages and following a method utilised in previous regional floristic surveys (Gibson 2004 and references therein).

Classification and ordination analyses were conducted on a data matrix compiled from both Woodman Environmental and Meissner *et al.* (2007) quadrat data, with introduced, annual and singleton (occurring once in the dataset) taxa omitted prior to analysis. Only collections identifiable to at least species level were used in the analysis. Various taxa were grouped together within the data matrix for the analyses where taxonomy was unclear or where different infra-taxa were identified within the dataset and not correlated to

community type. Taxa where nomenclature had been updated between Woodman Environmental data and Meissner *et al.* (2007) datasets were aligned for the analysis.

Pattern analysis was conducted using PATN (V3.03) (Belbin 1989). The Bray-Curtis coefficient was used to generate an association matrix for classification and ordination analyses. Within PATN the agglomerative hierarchical clustering method using flexible UPGMA ($\beta=-0.1$) was used to generate a species by site classification (Sneath & Sokal 1973) and two-way tables. Indicator species analysis (INDVAL) was conducted using PC-Ord (McCune & Mefford 1999) using the method of Dufrene & Legendre (1997). The INDVAL measures were used to determine the indicator species for each FCT and a Monte Carlo permutation test was used to test for the significance of the indicator species.

This analysis sought to expand upon the Meissner *et al.* (2007) Mount Gould dataset and identify FCTs across the entire Project area, utilising both Woodman Environmental data and Meissner *et al.* (2007) Mount Gould data. Therefore, only quadrats established within the Project area were initially analysed, to allow for the description of FCTs within the Project area. The analysis performed by Meissner *et al.* (2007), which utilised both Mount Gould and Robinson Range quadrat data, was then repeated with the addition of Woodman Environmental quadrat data, to assess distribution of FCTs identified within the Project area within a regional context. Additionally, Mount Gould quadrat data was analysed with Jack Hills quadrat data (Meissner & Caruso 2006) to attempt to provide further regional context.

3.6 Description of Floristic Community Types

The description of FCTs in the Project area generally follows the National Vegetation Information System (NVIS) model. This model follows nationally-agreed guidelines to describe and represent vegetation types, so that comparable and consistent data is produced nation-wide. With reference to the NVIS Hierarchy in Table 1 of the NVIS Australian Vegetation Attribute Manual (ESCAVI 2003), a FCT is the equivalent of a Sub-Association. Similar methods of describing FCTs have previously been used in the description of the vegetation of the Ravensthorpe Range (Craig *et al.* 2008).

3.7 Significant of Flora and Vegetation

3.7.1 Significance of Flora Taxa

The local distribution of flora taxa is defined as their known distribution within the Project area. The regional distribution refers to the known regional distribution of each taxon throughout Western Australia, in particular in the Murchison-Gascoyne Regions.

The regional significance of the local populations of conservation-significant flora taxa is determined by the location of the Project area with regards to the regional distribution of the taxa, and previously known records of these taxa either within or in close proximity to the Project area (Table 4).

Table 4: Significance of Local Populations to the Overall/Regional Conservation of Species	
Ranking	Description
High	<ul style="list-style-type: none"> • Known range of taxa either entirely located within the Project area area, or within the Project area area and to a radius of <5km of the Project area area; and/or • Taxa known from <10 discrete populations, including within the Project area area; and/or • Project area area on boundary of known regional distribution
Moderate	<ul style="list-style-type: none"> • Known range of taxa extends <50km; and/or • Taxa known from >10 discrete populations; and/or • Project area area may be on boundary of known regional distribution
Low	<ul style="list-style-type: none"> • Known range of taxa extends >50km; and/or • Taxa known from >20 discrete populations; and/or • Project area area not on boundary of known regional distribution

3.7.2 Significance of Vegetation

Woodman Environmental have developed conservation significance descriptions for FCTs in the Project area. The criteria used to determine conservation significance for each FCT is described in Table 5. Note that potential impacts to FCTs are not used in the determination of conservation significance of FCTs. Also, limited regional studies have been conducted in the Mid-West Region, being the surveys undertaken by Meissner & Caruso (2006) and Meissner *et al.* (2007). These surveys did not incorporate vegetation units that occur on flats and other non-BIF or rock-based substrate areas, and did not include spatial mapping of units, and therefore cannot be used for comparison with FCTs that were mapped on such areas in the Project area.

Factors used to determine conservation significance included the numbers and types of Priority Flora and other significant flora species known from within the FCT, and the inferred extent of the preferred soil type, substrate and topographical position within the region, where known. The mapped area of each FCT within the Project area was also considered in addition to the criteria presented in Table 5, with FCTs comprising a mapped area less than 10 % of the total area mapped (<61 ha) considered to be locally restricted.

Table 5: Descriptions of Conservation Significance Rankings of Floristic Community Types	
Conservation Significance Ranking	Description
1	<ul style="list-style-type: none"> • The FCT is likely to be widespread through the region as identified in the regional quadrat dataset (Meissner & Caruso 2006; Meissner <i>et al.</i> 2007), and/or the FCT occurs on landforms that are widespread and not restricted within the region; • Priority flora species/significant flora species are: <ul style="list-style-type: none"> • unlikely to occur; • are known to occur in limited amounts in the FCT; or • are relatively widespread through the Project area area
2	<ul style="list-style-type: none"> • The FCT is likely to be widespread through the region as identified in the regional quadrat dataset, and/or the FCT occurs on landforms that are widespread and not restricted within the region; • Priority flora species/significant flora known to occur in the FCT
3	<ul style="list-style-type: none"> • The FCT is possibly restricted in the region (regional quadrat data may not be available); • The FCT occurs on landforms that are restricted in the region; • Priority flora species/significant flora species may occur in the FCT.
4	<ul style="list-style-type: none"> • The FCT is represented within the regional quadrat dataset outside of the Project area; • The FCT occurs on landforms that are not widespread and are restricted within the region; • Priority flora species (including P1)/significant flora species are known to occur in the FCT.
5	<ul style="list-style-type: none"> • The FCT is not represented or represented poorly within the regional quadrat dataset; • The FCT occurs on landforms that are restricted in the region; • Priority flora species (including P1 species)/significant flora species are known to occur in the FCT.

4. RESULTS

4.1 Flora

A total of 94 discrete vascular flora taxa, from 28 families and 53 genera, were recorded from the Project area. Of these taxa, one introduced (weed) taxon was recorded. The families with the highest number of taxa were Poaceae (10 taxa), Myoporaceae (10), Mimosaceae (9) and Asteraceae (8). Mean taxa richness per quadrat was 16.0 ± 5.1 , with a range of 7 – 27 taxa per quadrat. Appendix C presents a full list of taxa recorded within the Project area by Woodman Environmental, while Appendix D presents a list of taxa (recorded in Woodman Environmental quadrats only) recorded within each FCT. Appendix E presents the raw data from each quadrat. The number of taxa recorded during this survey is more than double that recorded from Mount Gould by Meissner *et al.* (2007), who recorded 45 taxa from 5 quadrats, with a mean taxa richness of 17.8 ± 4.1 , and a range of 12 – 23 taxa per quadrat. However, their survey only assessed Mount Gould itself and not the surrounding flats that were assessed during this survey.

4.1.1 Conservation Significant Flora Taxa

No DRF taxa were recorded within the Project area; however three Priority Flora taxa were recorded: *Eremophila warnesii*, *Halgania gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743) and *Rhodanthe sphaerocephala* (all P1). All recorded locations of these taxa are presented on Figure 2, including records from the survey of Mount Gould by Meissner *et al.* (2007), and historical records from the DEC's threatened flora database and the W.A. Herbarium specimen database.

Eremophila warnesii (P1) is a low, dense shrub to 0.5 m high, and is known from three W.A. Herbarium records: two from Yarlalweelor Station approximately 40 km east of the Project area, and one from Mount Clere Station, approximately 80 km north of the Project area (DEC 2009a). It was noted as being abundant at one of these locations, however no information is available for the two remaining locations. Chinnock (2007) notes that the type population of this species is located on the summit of Mount Gould, where it was found to occur in a narrow band. He also notes that this species is likely to be found on other hills in the area.

Two sub-populations of this species were recorded during this survey: one on the eastern peak of Mount Gould, and one on the western peak (Figure 2). *E. warnesii* was found growing on very steep, rocky, open slopes with no overstorey near the summits of each peak. The boundaries of the population on the eastern peak were traversed, and counts of individuals were undertaken. It is estimated that there are approximately 10,800 individuals in this population. The boundaries of the population on the western peak were not traversed due to time constraints, however this population appears much smaller than that on the eastern peak. It is estimated that less than 1,000 individuals occur in this population.



Plate 1: Population of *Eremophila warnesii* on the eastern peak of Mount Gould

Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743) (P1) is an erect shrub to 1 m, and is known only from six herbarium records, all from Mount Gould itself (DEC 2009a). This taxon was identified by Meissner *et al.* (2007) as potentially differing from other known variants of *H. gustafsenii*, with the phrase name *H. gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743) erected in late 2008. It was also listed as Priority 1 at this time. This taxon was recorded in three quadrats during this survey (Figure 2), and appears to be distributed on the slopes of Mount Gould, where it is relatively common. No detailed mapping of this taxon was undertaken, as at the time of survey it was not a listed taxon of conservation significance.

Rhodanthe sphaerocephala (P1) is an erect annual herb to 0.25 m high, and was previously known from two areas: Belele Station, approximately 60 km south-east of the Project area, and Doolgunna and Three Rivers Stations, approximately 200 km east of the Project area. The collections from this survey are therefore significant, as it is the first record for the Mount Gould area. Six plants were recorded from Doolgunna Station, however no information is available for the other records. This species was recorded in two quadrats in 2008, both in open claypans with little to no overstorey (Figure 2). It was uncommon at both locations, however the area appeared to have received little rain prior to surveys being conducted; it is likely to be more abundant in more favourable conditions.

4.1.2 Other Flora of Interest

A collection of *Amaranthus interruptus* represents a significant extension of the known range, with the nearest records near Karijini National Park, approximately 400 km to the north (DEC 2009a). The collections of *Olearia stuartii*, *Tribulus adelacanthus* and *Abutilon otocarpum* fill significant locality holes in the known ranges of these species.

Collections of the above species will be submitted to the W.A. Herbarium upon conclusion of the project.

4.1.3 Significance of Flora

The three Priority flora taxa recorded within the Project area are all listed as Priority 1, and are therefore all of high conservation concern, given that Priority 1 flora are taxa that are known generally from less than 5 populations which are under threat, either due to small population size, or being on lands under immediate threat such as mineral leases, or are under threat from disease or grazing (Atkins 2008). Such taxa are under consideration for gazettal as DRF, but are in urgent need of further survey. Table 6 presents a summary of conservation significance rankings of flora within the Project area.

Taxon	Conservation Status	Conservation Significance Ranking (From Table 4)
<i>Eremophila warnesii</i>	P1	High
<i>Halgania gustafsenii</i> var. Murchison (R. Meissner & B. Bayliss 743)	P1	High
<i>Rhodanthe sphaerocephala</i>	P1	High

Eremophila warnesii (P1) is known from one large and one small population on the summit of Mount Gould within the Project area. The regional distribution of this species is restricted, with all known populations all occurring within 100 km of Mount Gould. The significance of the Project area populations of *E. warnesii* in terms of the overall conservation of the species is ranked High (Table 4); as less than 10 populations of this species are currently known, and the local population is on the boundary of its known range.

Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743) (P1) is known from a number of locations that probably represent a single population on the slopes of Mount Gould within the Project area. This population is the only known population of this taxon. The significance of the Project area population of this taxon in terms of the overall conservation of the taxon is therefore ranked High (Table 4), as a single population is currently known, and it is restricted to the Project area.

Rhodanthe sphaerocephala (P1) is known from two locations, which at the time of survey consisted of a few plants at each, within the Project area. The regional distribution of this species is moderately restricted, with known populations occurring over a 200 km range, with populations within the Project area representing the western-most population. The significance of the Project area populations of *R. sphaerocephala* in terms of the overall conservation of the species is ranked High (Table 4); as less than 10 populations of this species are currently known, and the local populations are on the boundary of its known range.

4.2 Floristic Community Types

A total of 40 perennial taxa were used during statistical analysis to determine FCTs within the Project area, including taxa recording during this survey and during the survey by Meissner *et al.* (2007). A number of taxa were amalgamated in the analysis due to taxonomic issues. In particular, *Solanum lasiophyllum*, *Solanum ashbyae* and *Solanum ashbyae/lasiophyllum* complex were amalgamated, because poor specimens meant that these taxa could not be distinguished confidently between quadrats. These taxa are collectively referred to as *Solanum lasiophyllum/ashbyae* in the description of FCTs below. *Acacia aneura* var. *?aneura* and *Acacia aneura* var. *microcarpa* were also combined, and are referred to as *Acacia aneura* var. *?aneura*.

A list of all taxa amalgamated in the analysis is presented in Appendix F. A summary dendrogram of relationships between each quadrat is presented in Appendix G, with a summary matrix of species presence within quadrats presented in Appendix H. The summary dendrogram shows that the first major division separates FCT 6, which consists of all quadrats located on sandplains, and a single quadrat located on a low ridge, from the remaining FCTs. These quadrats are distinguished by a greater representation from species group 5, and also no representation from a sub-set of species group 1, as shown in the summary matrix in Appendix H. Appendix I presents significant indicator species for each FCT.

The floristic classification of the 30 quadrats (five from Meissner *et al.* (2007); 25 from Woodman Environmental) defined seven FCTs and sub-types (Appendix G). The groupings of Meissner *et al.* (2007) quadrats have changed significantly compared to their analysis. The two Mount Gould quadrats that grouped together in Meissner *et al.* FCT 1 have been split, with one quadrat grouping in Woodman Environmental FCT 4, and one in Woodman Environmental FCT 5. Two of the three quadrats that grouped together in Meissner *et al.* FCT 2 have grouped together in Woodman Environmental FCT 5, while the third has migrated to group in Woodman Environmental FCT 4. This is a direct result of quadrats established by Woodman Environmental having greater similarity to the quadrat that migrated. Figure 2 presents the spatial distribution of each FCT within the Project area.

Generally the vegetation in the Project area was in Excellent to Good condition. Grazing by stock was more evident on the flats surrounding Mount Gould, with minor grazing from feral goats evident on the slopes and summit of Mount Gould. A number of disturbed areas exist within the Project area as a result of previous mining and pastoral activities (Figure 2), including an old pit and waste dump area, and a stockpiling area.

4.2.1 Floristic Community Types at Mount Gould

FCT 1: Open tall shrubland of *Acacia aneura* over sparse low shrubland of *Ptilotus obovatus* over open low forbland of *Goodenia tenuiloba*

The following common species were recorded:

Tall Shrubs: *Acacia aneura*, *Acacia ramulosa* var. *linophylla*
Low Shrubs: *Sida* sp. dark green fruits (S. van Leeuwen 2260), *Ptilotus obovatus*,
Solanum lasiophyllum/ashbyae
Forbs: *Goodenia tenuiloba*, *Phyllanthus erwinii*

Landforms: Steep mid and lower slopes

Soils: Red-brown silty clay-loam soils with banded ironstone and quartz shale and boulders

FCT 1 was represented by a total of four quadrats, all established by Woodman Environmental. This FCT was mapped on the steep, shaley mid and lower slopes of Mount Gould (Figure 2). A defining characteristic of this FCT was the overall low perennial species richness, particularly in the mid stratum. Mean species richness per quadrat was 13.5. This FCT is closely related to FCT 2, which also has very low perennial species richness, however FCT 2 occurs on low rocky rises away from Mount Gould itself. The Priority flora taxon *Eremophila warnesii* (P1) was recorded in this FCT. Indicator species for this FCT are *Sida* sp. dark green fruits (S. van Leeuwen 2260) and *Solanum ashbyae/lasiophyllum* complex (Appendix I).



Plate 2: FCT 1 - Quadrat MG15 (Woodman Environmental)

FCT 2: Sparse tall shrubland of mixed *Acacia* species over sparse low shrubland of *Ptilotus obovatus* and *Eremophila* species over open low forbland of *Goodenia tenuiloba*

The following common species were recorded:

Tall Shrubs: *Acacia rhodophloia*, *Acacia aneura*, *Acacia ramulosa* var. *linophylla*

Low Shrubs: *Ptilotus obovatus*, *Eremophila latrobei* subsp. *latrobei*, *Eremophila fraseri* subsp. *parva*, *Eremophila ?jucunda*

Forbs: *Goodenia tenuiloba*

Landforms: Stony undulating plains

Soils: Red-brown silty clay-loam soils with banded ironstone and quartz stones

FCT 2 was represented by a total of two quadrats, both established by Woodman Environmental. This FCT was mapped on a stony, undulating plain to the north of Mount Gould (Figure 2). Very little of this habitat occurred in the Project area, hence the small sample size. Mean species richness per quadrat was 9.5. This FCT is closely related to FCT 1. The sole indicator species for this FCT is *Acacia rhodophloia* (Appendix I).



Plate 3: FCT 2 - Quadrat MG22 (Woodman Environmental)

FCT 3: Sparse tall shrubland or isolated shrubs of *Acacia aneura* over isolated mid shrubs of *Eremophila fraseri* subsp. *parva* over isolated low shrubs of *Ptilotus obovatus* over open low forbland of mixed species including *Ptilotus aervooides* and *Goodenia tenuiloba*

The following common species were recorded:

Tall Shrubs: *Acacia aneura*
Mid shrubs: *Eremophila fraseri* subsp. *parva*
Low Shrubs: *Ptilotus obovatus*
Forbs: *Goodenia tenuiloba*, *Ptilotus aervooides*, *Ptilotus helipteroides*,
Euphorbia boophthona, *Euphorbia drummondii*, *Phyllanthus erwinii*, *Velleia glabrata*, *Helipterum craspedioides*
Grasses: *Aristida contorta*

Landforms: Clay pans, clay flats

Soils: Red-brown clay-loam

FCT 3 was represented by a total of three quadrats, all established by Woodman Environmental. This FCT was mapped in claypans and on clay flats to the east of Mount Gould (Figure 2). This FCT varied greatly structurally, with two quadrats in claypans consisting of only isolated shrubs, while one quadrat possessed a sparse tall shrubland. Mean species richness per quadrat was 21.3, with the majority of taxa being ephemerals. This FCT is not closely related to any other FCT (Appendix G). The Priority flora species *Rhodanthe sphaerocephala* (P1) was only recorded in FCT 3. The sole indicator species for this FCT is *Phyllanthus erwinii* (Appendix I).



Plate 4: FCT 3 - Quadrat MG05 (left), MG06 (right) (Woodman Environmental)

FCT 4: Open tall shrubland or isolated shrubs of *Acacia aneura* over open to sparse mid shrubland of *Eremophila latrobei* subsp. *latrobei* and *Philotheca brucei* subsp. *cinerea* over open to sparse low shrubland and low tussock grassland of *Ptilotus obovatus* and *Cymbopogon ambiguus*

The following common species were recorded:

Tall Shrubs: *Acacia aneura*, *Acacia rhodophloia*, *Acacia citrinoviridis*
Mid shrubs: *Eremophila latrobei* subsp. *latrobei*, *Philotheca brucei* subsp. *cinerea*
Low Shrubs: *Ptilotus obovatus*, *Solanum lasiophyllum/ashbyae* complex, *Corchorus crozophorifolius*, *Abutilon lepidum*
Forbs: *Cheilanthes sieberi*, *Cheilanthes brownii*, *Phyllanthus erwinii*
Grasses: *Cymbopogon ambiguus*, *Enneapogon caerulescens*, *Eriachne mucronata*

Landforms: Steep mid and upper slopes (occasionally lower slopes) and crests

Soils: Skeletal red-brown silty clay-loams over massive banded ironstone outcropping

FCT 4 was represented by the largest number of quadrats, with a total of 12 quadrats, (two Meissner *et al.*; 10 Woodman Environmental). This FCT was mapped on the steep upper slopes and crests of Mount Gould (Figure 2). Occasionally it extended down to the lower slopes (e.g. quadrat MG25). This FCT also varied greatly structurally. Typically, quadrats consisted of a tall open shrubland of *Acacia aneura*, or occasionally *A. citrinoviridis*, with a distinct open mid shrubland stratum of *Eremophila latrobei* subsp. *latrobei* and *Philotheca brucei* subsp. *cinerea*, and a sparse low shrubland stratum (e.g. MG25). However, a number of quadrats, particularly near the summit of the western peak of Mount Gould consisted of only isolated tall and mid shrubs, and possessed an open low shrubland and tussock or hummock grassland stratum of *Ptilotus obovatus*, *Eremophila warnesii* and *Cymbopogon obtectus* (e.g. MG23). Mean species richness per quadrat was 16.3. This FCT is related to FCT 5, which differs in having a greater representation of species group 4 (Appendix H). The Priority flora taxa *Eremophila warnesii* and *Halgania gustafsenii* var. *Murchison* (R. Meissner & B. Bayliss 743) (both P1) were recorded in this FCT. Indicator species for this FCT are *Abutilon lepidum*, *Cheilanthes sieberi* and *Cymbopogon ambiguus* (Appendix I).



Plate 5: FCT 4 - Quadrat MG25 (left), Quadrat MG23 (right) (Woodman Environmental)

FCT 5: Isolated tall shrubland of *Acacia aneura* and/or *Grevillea berryana* over sparse low shrubland of *Eremophila latrobei* subsp. *latrobei*, *Philotheca brucei* subsp. *cinerea* and *Ptilotus obovatus* over low hummock grassland of *Triodia melvillei*

The following common species were recorded:

Tall Shrubs: *Acacia aneura*, *Grevillea berryana*
Low Shrubs: *Ptilotus obovatus*, *Eremophila latrobei* subsp. *latrobei*, *Philotheca brucei* subsp. *cinerea*
Forbs: *Goodenia tenuiloba*
Grasses: *Triodia melvillei*, *Monacather paradoxus*, *Eriachne mucronata*

Landforms: Steep upper slopes and crests

Soils: Skeletal red-brown silty clay-loams over massive banded ironstone outcropping

FCT 5 was represented by a total of four quadrats, (three Meissner *et al.*; one Woodman Environmental). This FCT was mapped on the steep upper slopes and crests of Mount Gould (Figure 2). The presence of taxa from species group 4 generally characterised this FCT (Appendix H). The presence of *Triodia melvillei* in a low hummock grassland stratum was also characteristic, however this species was not recorded in one quadrat that grouped in this FCT, and was also recorded in several quadrats in the related FCT 4. Mean species richness was 16.5. Indicator species for this FCT are *Eremophila latrobei* subsp. *latrobei*, *Eriachne mucronata*, *Grevillea berryana*, *Monacather paradoxus* and *Triodia melvillei* (Appendix I)



Plate 6: FCT 5 - Quadrat MG09 (Woodman Environmental)

- FCT 6:** FCT 6 was split into two distinct sub-types based on soil and topography type, and representation of particular species groups (Appendix H).
- FCT 6a:** Open tall shrubland of *Acacia ramulosa* var. *linophylla* and *Acacia kempeana* over sparse mid shrubland of *Eremophila forrestii* subsp. *forrestii* over isolated low shrubland of *Corchorus crozophorifolius* over sparse low grassland and forbland of mixed species including *Eriachne mucronata* and *Ptilotus aervoides*

The following common species were recorded:

- Tall Shrubs:** *Acacia ramulosa* var. *linophylla*, *Acacia kempeana*
- Mid Shrubs:** *Eremophila forrestii* subsp. *forrestii*, *Eremophila compacta* subsp. *?fecunda*, *Senna artemesioides* subsp. *helmsii*
- Low Shrubs:** *Corchorus crozophorifolius*, *Solanum ashbyae* complex, *Sida ?intricata*, *Abutilon otocarpum*
- Forbs:** *Goodenia tenuiloba*, *Ptilotus aervoides*, *Phyllanthus erwinii*, *Euphorbia drummondii*, *Dysphania melanocarpa* forma *melanocarpa*
- Grasses:** *Aristida contorta*, *Eriachne aristidea*, *Eriachne mucronata*
- Landforms:** Flat plains
- Soils:** Red-brown sandy and silty clay-loams

FCT 6a was represented by a total of four quadrats, all established by Woodman Environmental. This FCT was mapped on flat, sandy plains to the south and west of Mount Gould (Figure 2). The presence of taxa from species group 5, as well as a particular subset of species group 1, characterised this community (Appendix H). Mean species richness per quadrat was 19. FCT 6a is very closely related to FCT 6b, however FCT 6b is not represented by species group 5, and occurs on low ridges rather than flat plains. The best indicator species for this FCT are *Acacia kempeana*, *Eremophila forrestii* subsp. *forrestii* and *Sida ?intricata* (Appendix I).



Plate 7: FCT 6a - Quadrat MG02 (Woodman Environmental)

FCT 6b: Tall sparse shrubland of *Acacia ramulosa* var. *linophylla* and *Acacia citrinoviridis* over open mid shrubland of *Eremophila latrobei* subsp. *latrobei* over open low shrubland of *Halgania gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743) over sparse low shrubland of *Goodenia tenuiloba*

Landforms: Steep low ridge

Soils: Red-brown silty clay-loam over massive banded ironstone and quartz outcropping

FCT 6b was only represented by a single quadrat established by Woodman Environmental. This FCT was mapped on a steep low ridge shaded by the western peak of Mount Gould, near the south-western lower slope of Mount Gould (Figure 2). The single quadrat in FCT 6b grouped with the quadrats in FCT 6a to comprise FCT 6, however FCT 6b is not represented by species group 5, whose representation characterises FCT 6a (Appendix H). FCTs 6a and 6b also occur on different landforms and soil types, and it is likely that if more quadrats were established on the low ridge system where FCT 6b has been mapped, these quadrats would group as a distinct FCT. There are no indicator species for this FCT as it is represented by a single quadrat. Fourteen taxa were recorded in the quadrat within FCT 3. The Priority flora taxon *Halgania gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743) (P1) was recorded in this FCT.



Plate 8: FCT 6b - Quadrat MG03 (Woodman Environmental)

4.2.2 Significance of Vegetation

There are no occurrences of TECs within the Project area. However, Mount Gould itself is included as part of the Robinson Range vegetation complexes (banded ironstone formation) PEC, which is listed as Priority 1 (DEC 2008).

A repeat of the analysis conducted by Meissner *et al.* (2007) with the addition of Woodman Environmental data confirms their findings that the FCTs on and around Mount Gould are significantly different to those on Robinson Range. With the exception of a single quadrat (Meissner *et al.* (2007) quadrat (MTGD02), all quadrats at Mount Gould were separated from those on Robinson Range at the first division of the summary dendrogram. Quadrat MTGD02 originally grouped with a number of Robinson Range quadrats along with another Mount Gould quadrat (MTGD01) in the Meissner *et al.* (2007) analysis, and remained grouped with Robinson Range quadrats following the addition of Woodman Environmental data, while MTGD01 migrated to group with other Mount Gould quadrats. Despite the grouping of MTGD02 with Robinson Range quadrats, this is not considered to be sufficient evidence to suggest that the FCTs present at Mount Gould occur on Robinson Range. Further establishment of quadrats on Robinson Range would be required to confirm whether any FCTs from Mount Gould occur there. Appendices J and K present the summary dendrogram of relationships between each quadrat, and the summary matrix of species presence within quadrats, from this combined dataset.

Following an analysis of the Mount Gould quadrat data with quadrat data from the nearby Jack Hills (Meissner & Caruso 2006), it is apparent that certain FCTs present within the Project area show greater similarity to those occurring on the Jack Hills than to those on the Robinson Range. While most Jack Hills quadrats did not group with Mount Gould quadrats, quadrats that grouped into Woodman Environmental FCTs 1 and 2 (found on mid and lower slopes and stony plains) have grouped with a number of Jack Hills quadrats that grouped into Meissner & Caruso (2006) FCTs 1 and 2 (found on crests and mid and lower slopes). It is therefore apparent that a single FCT may occur on lower and mid slopes and stony plains at both Mount Gould and Jack Hills. However, the FCTs found on the upper slopes and crests of Mount Gould do not appear to occur in the Jack Hills. Although two quadrats from the Jack Hills did group with those established on the upper slopes and crests of Mount Gould, this is not considered sufficient evidence to suggest that the FCTs on the upper slopes and crests of Mount Gould also occur on the Jack Hills. Appendices L and M present the summary dendrogram of relationships between each quadrat, and the summary matrix of species presence within quadrats.

It is also worthy of note that both above analyses supports Meissner *et al.* (2007) in finding that the Jack Hills, Mount Gould and Robinson Range all possess distinct *Triodia*-dominated FCTs on upper slopes and crests. It is thought that these communities are relictual.

Table 7 presents the conservation significance rankings (as defined in Section 3.6.2) given to each of the FCTs mapped over the Project area. In general, FCTs mapped on the plains surrounding Mount Gould were given lower rankings of conservation significance in comparison to those on Mount Gould itself, primarily due to the inferred wider distribution of their soil types and habitats in the region, but also because of the fewer numbers of Priority Flora species known within these FCTs.

FCT	Mapped Area (ha)	Comments	Significant Flora Species	Conservation Significance Ranking
1	196.7	FCT 1 mapped on steep mid and lower slopes which are restricted to Mount Gould in the Project area area, and are restricted in the region; Appear to be present elsewhere other than Mount Gould in the region based on previous regional studies (Meissner & Caruso 2006; Meissner <i>et al.</i> 2007); Part of a Priority 1 PEC.	<i>Eremophila warnesii</i> (P1)	<u>3</u> : Distribution of FCT 1 restricted to Mount Gould and Jack Hills regionally, and Mount Gould within the Project area area; Soil, substrate and topographical positions all restricted in region. Presence of significant flora species with P1 ranking; Significant flora species of very restricted distribution; Significant flora species not restricted to FCT 4.
2	26.6 (<10 % of Project area area mapped)	FCT 2 mapped on undulating stony plains which are restricted to north of Mount Gould within the Project area area, however are likely to be common and widespread throughout the region; Not analysed during previous regional studies; Not a listed TEC or PEC.	NA	<u>1</u> : FCT 2 likely to be widespread within the region according to known soil types, substrate and topographical positions.
3	82.4	FCT 3 mapped on clay flats and in clay pans which are restricted to the western section of the Project area, however are likely to be common and widespread throughout the region; Not analysed during previous regional studies; Not a listed TEC or PEC.	<i>Rhodanthe sphaerocephala</i> (P1).	<u>2</u> : FCT 3 likely to be widespread within the region according to known soil types, substrate and topographical positions; Presence of significant flora species with P1 ranking; Significant flora species of moderately restricted distribution; Significant flora species restricted to FCT 3.

FCT	Mapped Area (ha)	Comments	Significant Flora Species	Conservation Significance Ranking
4	106.5	FCT 4 mapped on steep mid and upper slopes and crests which are restricted to Mount Gould in the Project area area, and are restricted in the region; Not present elsewhere other than Mount Gould in the region based on previous regional studies; Part of a Priority 1 PEC.	<i>Eremophila warnesii</i> (P1); <i>Halgania gustafsenii</i> var. Murchison (R. Meissner & B. Bayliss 743) (P1).	<u>5</u> : Distribution of FCT 4 restricted to Mount Gould both regionally and within the Project area area; Soil, substrate and topographical positions all restricted in region; Presence of significant flora species with P1 ranking; Significant flora species of very restricted distribution; Significant flora species not restricted to FCT 4.
5	27.7 (<10 % of Project area area mapped)	FCT 5 mapped on steep upper slopes and crests which are restricted to Mount Gould in the Project area area, and are restricted in the region; Not present elsewhere other than Mount Gould in the region based on previous regional studies; Part of a Priority 1 PEC.	<i>Eremophila warnesii</i> (P1); <i>Halgania gustafsenii</i> var. Murchison (R. Meissner & B. Bayliss 743) (P1).	<u>5</u> : Distribution of FCT 5 restricted to Mount Gould both regionally and within the Project area area; Soil, substrate and topographical positions all restricted in region; Presence of significant flora species with P1 ranking; Significant flora species of very restricted distribution; Significant flora species not restricted to FCT 5.
6a	151.7	FCT 6a mapped on flat plains which are distributed south and west of Mount Gould within the Project area area, however are likely to be common and widespread throughout the region; Not analysed during previous regional studies; Not a listed TEC or PEC.	NA	<u>1</u> : FCT 6a likely to be widespread within the region according to known soil types, substrate and topographical positions.

FCT	Mapped Area (ha)	Comments	Significant Flora Species	Conservation Significance Ranking
6b	10.6 (<10 % of Project area mapped)	FCT 6b mapped on a steep low ridge at the foot of Mount Gould which is restricted to the south-western foot Mount Gould in the Project area area, and is restricted in the region; Not present elsewhere other than Mount Gould in the region based on previous regional studies; Part of a Priority 1 PEC.	<i>Halgania gustafsenii</i> var. Murchison (R. Meissner & B. Bayliss 743) (P1)	5: Distribution of FCT 6b restricted to Mount Gould both regionally and within the Project area area; Soil, substrate and topographical positions all restricted in region; Presence of significant flora species with P1 ranking; Significant flora species of very restricted distribution; Significant flora species not restricted to FCT 6b.

5. DISCUSSION

Three Priority Flora taxa were recorded within the Project area by Woodman Environmental: *Eremophila warnesii*, *Halgania gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743) and *Rhodanthe sphaerocephala* (all P1). The populations of these taxa within the Project area are all ranked as highly significant in terms of the overall conservation of each taxon (Table 6). All three are known from less than five populations, and have restricted geographical distributions in the general region of Mount Gould. There is also very little data available regarding the size and condition of these populations. In particular, *H. gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743) is only known from the Project area, where it is by no means abundant. If significant numbers of individuals of these taxa are proposed to be impacted as a result of clearing for drilling or mining operations, additional survey may be required both within and outside of the Project area, to assess the size and condition of any known populations, and to search for additional populations in likely habitat areas.

A total of seven FCTs and sub-types were described in the Project area. Comparison with quadrat datasets from the nearby Robinson Range and Jack Hills has revealed that a number of the FCTs on Mount Gould (FCTs 4, 5 and 6b) do not occur elsewhere, and therefore have high conservation significance (ranking 5; Table 7). FCT 1 appears to occur on lower and mid slopes on Mount Gould and the Jack Hills, however is still likely to be regionally restricted, and hence has moderate conservation significance (ranking 3; Table 7). Mount Gould itself is included as part of the Robinson Range vegetation complexes Priority 1 PEC, and therefore may be listed as a TEC in the near future. It is therefore important in the meantime that any clearing in the FCTs on Mount Gould is minimised as much as is feasible.

As no mining has been proposed for the Project area, no assessment of the impacts of any such proposal to significant flora and FCTs has been undertaken. It is of high importance that this be undertaken if mining is proposed, particularly given the high conservation significance of the Priority flora and FCTs present within the Project area.

6. RECOMMENDATIONS

The following recommendations are given:

- Utilise areas of existing disturbance for any future proposed drilling operations where possible;
- Survey of any proposed drilling in remnant vegetation on Mount Gould by an experienced botanist if drilling occurs within the vicinity of known Priority flora locations, or within likely habitat of Priority flora; and
- Additional regional survey for Priority flora taxa if impacts to populations of such taxa within the Project area as a result of clearing for drilling or mining operations are likely to be significant.

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Appendix A: Definitions of Conservation Status Codes (Atkins 2008)**R: Declared Rare Flora – Extant Taxa**

Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such.

X: Declared Rare Flora – Presumed Extinct Taxa

Taxa which have not been collected, or otherwise verified, over the past 50 years despite thorough searching, or of which all known wild populations have been destroyed more recently, and have been gazetted as such.

1: Priority One – Poorly Known Taxa

Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat, e.g. road verges, urban areas, farmland, active mineral leases, etc., or the plants are under threat, e.g. from disease, grazing by feral animals, etc. May include taxa with threatened populations on protected lands. Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.

2: Priority Two – Poorly Known Taxa

Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.

3: Priority Three – Poorly Known Taxa

Taxa which are known from several populations, and the taxa are not believed to be under immediate threat (i.e. not currently endangered), either due to the number of known populations (generally >5), or known populations being large, and either widespread or protected. Such taxa are under consideration for declaration as 'rare flora' but are in need of further survey.

4: Priority Four – Rare Taxa

Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5-10 years.

Appendix B: Definitions, Categories and Criteria for Threatened Ecological Communities and Priority Ecological Communities (Department of Environment and Conservation 2007a)

DEFINITIONS, CATEGORIES AND CRITERIA FOR THREATENED AND PRIORITY ECOLOGICAL COMMUNITIES

1. GENERAL DEFINITIONS

Ecological Community

A naturally occurring biological assemblage that occurs in a particular type of habitat.

Note: The scale at which ecological communities are defined will often depend on the level of detail in the information source, therefore no particular scale is specified.

A **threatened ecological community** (TEC) is one which is found to fit into one of the following categories; “presumed totally destroyed”, “critically endangered”, “endangered” or “vulnerable”.

Possible threatened ecological communities that do not meet survey criteria are added to DEC’s Priority Ecological Community Lists under Priorities 1, 2 and 3. Ecological Communities that are adequately known, 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.

An **assemblage** is a defined group of biological entities.

Habitat is defined as the areas in which an organism and/or assemblage of organisms lives. It includes the abiotic factors (eg. substrate and topography), and the biotic factors.

Occurrence: a discrete example of an ecological community, separated from other examples of the same community by more than 20 metres of a different ecological community, an artificial surface or a totally destroyed community.

By ensuring that every discrete occurrence is recognised and recorded future changes in status can be readily monitored.

Adequately Surveyed is defined as follows:

“An ecological community that has been searched for thoroughly in most likely habitats, by relevant experts.”

Community structure is defined as follows:

“The spatial organisation, construction and arrangement of the biological elements comprising a biological assemblage” (eg. *Eucalyptus salmonophloia* woodland over

scattered small shrubs over dense herbs; structure in a faunal assemblage could refer to trophic structure, eg. dominance by feeders on detritus as distinct from feeders on live plants).

Definitions of Modification and Destruction of an ecological community:

Modification: “changes to some or all of ecological processes (including abiotic processes such as hydrology), species composition and community structure as a direct or indirect result of human activities. The level of damage involved could be ameliorated naturally or by human intervention.”

Destruction: “modification such that reestablishment of ecological processes, species composition and community structure within the range of variability exhibited by the original community is unlikely within the foreseeable future even with positive human intervention.”

Note: Modification and destruction are difficult concepts to quantify, and their application will be determined by scientific judgement. Examples of modification and total destruction are cited below:

Modification of ecological processes: The hydrology of Toolibin Lake has been altered by clearing of the catchment such that death of some of the original flora has occurred due to dependence on fresh water. The system may be brought back to a semblance of the original state by redirecting saline runoff and pumping waters of the rising underground watertable away to restore the hydrological balance. Total destruction of downstream lakes has occurred due to hydrology being altered to the point that few of the original flora or fauna species are able to tolerate the level of salinity and/or water logging.

Modification of structure: The understorey of a plant community may be altered by weed invasion due to nutrient enrichment by addition of fertiliser. Should the additional nutrients be removed from the system the balance may be restored, and the original plant species better able to compete. Total destruction may occur if additional nutrients continue to be added to the system causing the understorey to be completely replaced by weed species, and death of overstorey species due to inability to tolerate high nutrient levels.

Modification of species composition: Pollution may cause alteration of the invertebrate species present in a freshwater lake. Removal of pollutants may allow the return of the original inhabitant species. Addition of residual highly toxic substances may cause permanent changes to water quality, and total destruction of the community.

Threatening processes are defined as follows:

“Any process or activity that threatens to destroy or significantly modify the ecological community and/or affect the continuing evolutionary processes within any ecological community.”

Examples of some of the continuing threatening processes in Western Australia include: general pollution; competition, predation and change induced in ecological communities as a result of introduced animals; competition and displacement of native plants by introduced species; hydrological changes; inappropriate fire regimes; diseases resulting from introduced microorganisms; direct human exploitation and disturbance of ecological communities.

Restoration is defined as returning an ecological community to its pre-disturbance or natural state in terms of abiotic conditions, community structure and species composition.

Rehabilitation is defined as the re-establishment of ecological attributes in a damaged ecological community although the community will remain modified.

2. DEFINITIONS AND CRITERIA FOR PRESUMED TOTALLY DESTROYED, CRITICALLY ENDANGERED, ENDANGERED AND VULNERABLE ECOLOGICAL COMMUNITIES

Presumed Totally Destroyed (PD)

An ecological community that has been adequately searched for but for which no representative occurrences have been located. The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future.

An ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant and either of the following applies (A or B):

- A) Records within the last 50 years have not been confirmed despite thorough searches of known or likely habitats or
- B) All occurrences recorded within the last 50 years have since been destroyed

Critically Endangered (CR)

An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated.

An ecological community will be listed as **Critically Endangered** when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting **any one or more** of the following criteria (A, B or C):

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

- i) geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 10 years);
 - ii) modification throughout its range is continuing such that in the immediate future (within approximately 10 years) the community is unlikely to be capable of being substantially rehabilitated.
- B) Current distribution is limited, **and one or more** of the following apply (i, ii or iii):
- i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 10 years);
 - ii) there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes;
 - iii) there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes.
- C) The ecological community exists only as highly modified occurrences that may be capable of being rehabilitated if such work begins in the immediate future (within approximately 10 years).

Endangered (EN)

An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future.

An ecological community will be listed as **Endangered** when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information by it meeting **any one or more** of the following criteria (A, B, or C):

- A) The geographic range, and/or total area occupied, and/or number of discrete occurrences have been reduced by at least 70% since European settlement **and either or both** of the following apply (i or ii):
 - i) the estimated geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term future (within approximately 20 years);

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

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

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

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

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

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

Vulnerable (VU)

An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range.

An ecological community will be listed as **Vulnerable** when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction or significant modification in the medium to long-term future. This will be determined on the basis of the best available information by it meeting **any one or more** of the following criteria (A, B or C):

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

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

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

3. DEFINITIONS AND CRITERIA FOR PRIORITY ECOLOGICAL COMMUNITIES

PRIORITY ECOLOGICAL COMMUNITY LIST

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

Priority One: Poorly-known ecological communities

Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and 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.

Priority Two: Poorly-known ecological communities

Communities that are known from few small occurrences, all or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, State forest, unallocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.

Priority Three: Poorly known ecological communities

- (i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or:
- (ii) communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or;
- (iii) communities made up of large, and/or widespread occurrences, that may or not be represented in the reserve system, but are under threat of modification across much

of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes.

Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.

Priority Four: Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring.

- (a) Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands.
- (b) Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.
- (c) Ecological communities that have been removed from the list of threatened communities during the past five years.

Priority Five: Conservation Dependent ecological communities

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

Appendix C: Vascular Plant Taxa Recorded From the Mount Gould DSO Project Area, 2008

note *denotes introduced species

Family	Species	Conservation Code
Adiantaceae (007)	<i>Cheilanthes brownii</i>	
	<i>Cheilanthes sieberi</i>	
Poaceae (031)	<i>Aristida holathera</i> var. <i>holathera</i>	
	<i>Cymbopogon ambiguus</i>	
	<i>Digitaria brownii</i>	
	<i>Enneapogon caerulescens</i>	
	<i>Eragrostis ?eriopoda</i>	
	<i>Eriachne aristidea</i>	
	<i>Eriachne mucronata</i>	
	<i>Eriachne pulchella</i> subsp. <i>dominii</i>	
	<i>Eriachne pulchella</i> subsp. <i>pulchella</i>	
	<i>Triodia melvillei</i>	
Cyperaceae (032)	<i>Bulbostylis</i> sp.	
Proteaceae (090)	<i>Grevillea berryana</i>	
	<i>Hakea lorea</i> subsp. <i>lorea</i>	
Chenopodiaceae (105)	<i>Dysphania melanocarpa</i> forma <i>melanocarpa</i>	
	<i>Dysphania rhadinostachya</i> subsp. <i>inflata</i>	
	<i>Maireana carnosa</i>	
	<i>Maireana georgei</i>	
	<i>Salsola australis</i>	
	<i>Sclerolaena diacantha</i>	
Amaranthaceae (106)	<i>Amaranthus interruptus</i>	
	<i>Ptilotus aervoides</i>	
	<i>Ptilotus helipteroides</i> var. <i>helipteroides</i>	
	<i>Ptilotus obovatus</i>	
	<i>Ptilotus polystachyus</i> var. <i>?polystachyus</i>	
	<i>Ptilotus rotundifolius</i>	
	<i>Ptilotus schwartzii</i>	
Aizoaceae (110)	<i>Tetragonia cristata</i>	
Portulacaceae (111)	<i>Calandrinia polyandra</i>	
	<i>Calandrinia</i> sp.	
	* <i>Portulaca ?oleracea</i>	

Appendix C: Vascular Plant Taxa Recorded From the Mount Gould DSO Project Area, 2008

note *denotes introduced species

Family	Species	Conservation Code
Brassicaceae (138)	<i>Lepidium oxytrichum</i>	
Mimosaceae (163)	<i>Acacia aneura</i> var. ? <i>aneura</i> <i>Acacia aneura</i> var. ? <i>conifera</i> <i>Acacia</i> ? <i>ayersiana</i> <i>Acacia citrinoviridis</i> <i>Acacia cuthbertsonii</i> subsp. <i>cuthbertsonii</i> <i>Acacia demissa</i> <i>Acacia kempeana</i> <i>Acacia ramulosa</i> var. <i>linophylla</i> <i>Acacia rhodophloia</i>	
Caesalpiniaceae (164)	<i>Senna artemisioides</i> subsp. <i>helmsii</i> <i>Senna</i> sp. Meekatharra (E. Bailey 1-26)	
Papilionaceae (165)	<i>Swainsona affinis</i>	
Geraniaceae (167)	<i>Erodium cygnorum</i>	
Zygophyllaceae (173)	<i>Tribulus adelacanthus</i> <i>Tribulus suberosus</i> <i>Zygophyllum</i> ? <i>iodocarpum</i>	
Rutaceae (175)	<i>Philotheca brucei</i> subsp. <i>cinerea</i>	
Polygalaceae (183)	<i>Polygala isingii</i>	
Euphorbiaceae (185)	<i>Euphorbia australis</i> <i>Euphorbia boophthona</i> <i>Euphorbia drummondii</i> <i>Phyllanthus erwinii</i>	
Sapindaceae (207)	<i>Dodonaea petiolaris</i>	
Tiliaceae (220)	<i>Corchorus crozophorifolius</i>	
Malvaceae (221)	<i>Abutilon lepidum</i> <i>Abutilon otocarpum</i> <i>Sida ectogama</i> <i>Sida</i> ? <i>intricata</i> <i>Sida</i> sp. dark green fruits (S. van Leeuwen 2260)	

Appendix C: Vascular Plant Taxa Recorded From the Mount Gould DSO Project Area, 2008

note *denotes introduced species

Family	Species	Conservation Code
Malvaceae (221) cont.	<i>Sida</i> sp. Golden calyces glabrous (H.N. Foote 32)	
	<i>Sida</i> sp. spiciform panicles (E. Leyland s.n. 14/8/90)	
Haloragaceae (276)	<i>Haloragis</i> ? <i>gossei</i>	
Apiaceae (281)	<i>Trachymene pilbarensis</i>	
Convolvulaceae (307)	<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>	
Boraginaceae (310)	<i>Halgania gustafsenii</i> var. Murchison (R. Meissner & B. Bayliss 743)	P1
	<i>Heliotropium heteranthum</i>	
	<i>Heliotropium inexplicitum</i>	
	<i>Trichodesma zeylanicum</i> var. ? <i>grandiflorum</i>	
Solanaceae (315)	<i>Nicotiana</i> ? <i>occidentalis</i> subsp. <i>obliqua</i>	
	<i>Solanum lasiophyllum</i>	
Myoporaceae (326)	<i>Eremophila compacta</i> subsp. ? <i>fecunda</i>	
	<i>Eremophila fraseri</i> subsp. ? <i>parva</i>	
	<i>Eremophila forrestii</i> subsp. <i>forrestii</i>	
	<i>Eremophila</i> ? <i>jucunda</i>	
	<i>Eremophila lachnocalyx</i>	
	<i>Eremophila latrobei</i> subsp. <i>latrobei</i>	
	<i>Eremophila</i> ? <i>pendulina</i>	
	<i>Eremophila phyllopoda</i> subsp. <i>phyllopoda</i>	
	<i>Eremophila spathulata</i>	
<i>Eremophila warnesii</i>	P1	
Goodeniaceae (341)	<i>Goodenia</i> sp.	
	<i>Goodenia tenuiloba</i>	
	<i>Velleia glabrata</i>	
Asteraceae (345)	<i>Brachyscome ciliaris</i>	
	<i>Calotis hispidula</i>	
	<i>Cephalopterum drummondii</i>	
	<i>Helipterum craspedioides</i>	
	<i>Olearia stuartii</i>	
	<i>Rhodanthe maryonii</i>	
	<i>Rhodanthe sphaerocephala</i>	P1
<i>Streptoglossa liatroides</i>		

Appendix D: Vascular Plant Taxa Recorded in Each Floristic Community Type Within the Mount Gould DSO Project Area, 2008

note *denotes introduced species

Taxon	Floristic Community Type						
	1	2	3	4	5	6a	6b
<i>Abutilon lepidum</i>	X			X			
<i>Abutilon otocarpum</i>			X			X	
<i>Acacia aneura</i> var. ? <i>aneura</i>	X	X	X	X		X	
<i>Acacia aneura</i> var. ? <i>conifera</i>	X		X				
<i>Acacia ?ayersiana</i>			X				
<i>Acacia citrinoviridis</i>				X			X
<i>Acacia cuthbertsonii</i> subsp. <i>cuthbertsonii</i>			X				
<i>Acacia kempeana</i>						X	
<i>Acacia ramulosa</i> var. <i>linophylla</i>	X	X				X	X
<i>Acacia rhodophloia</i>	X	X		X			
<i>Amaranthus interruptus</i>				X	X		
<i>Aristida contorta</i>	X	X	X	X		X	X
<i>Bulbostylis</i> sp.					X		
<i>Calandrinia polyandra</i>						X	
<i>Calandrinia</i> sp.			X	X		X	
<i>Calotis hispidula</i>			X				
<i>Cephalopterum drummondii</i>			X				
<i>Cheilanthes brownii</i>				X	X		
<i>Cheilanthes sieberi</i>				X			
<i>Corchorus crozophorifolius</i>	X	X	X	X		X	X
<i>Cymbopogon ambiguus</i>				X			
<i>Digitaria brownii</i>				X			
<i>Dodonaea petiolaris</i>				X			
<i>Dysphania melanocarpa</i> forma <i>melanocarpa</i>			X			X	
<i>Dysphania rhadinostachya</i> subsp. <i>inflata</i>	X	X	X	X	X	X	
<i>Enneapogon caerulescens</i>	X			X	X		
<i>Eragrostis ?eriopoda</i>				X		X	
<i>Eremophila compacta</i> subsp. ? <i>fecunda</i>						X	
<i>Eremophila forrestii</i> subsp. <i>forrestii</i>						X	
<i>Eremophila fraseri</i> subsp. ? <i>parva</i>		X	X				
<i>Eremophila ?jucunda</i>		X					

Appendix D: Vascular Plant Taxa Recorded in Each Floristic Community Type Within the Mount Gould DSO Project Area, 2008

note *denotes introduced species

Taxon	Floristic Community Type						
	1	2	3	4	5	6a	6b
<i>Eremophila lachnocalyx</i>	X						
<i>Eremophila latrobei</i> subsp. <i>latrobei</i>	X	X		X	X		X
<i>Eremophila</i> ? <i>pendulina</i>	X						
<i>Eremophila phyllopoda</i> subsp. <i>phyllopoda</i>	X						
<i>Eremophila warnesii</i>				X			
<i>Eriachne aristidea</i>			X	X		X	
<i>Eriachne mucronata</i>	X			X	X	X	X
<i>Eriachne pulchella</i> subsp. <i>dominii</i>	X		X	X			X
<i>Eriachne pulchella</i> subsp. <i>pulchella</i>	X		X				
<i>Erodium cygnorum</i>			X	X			
<i>Euphorbia australis</i>	X			X			
<i>Euphorbia boophthona</i>		X	X	X	X	X	
<i>Euphorbia drummondii</i>			X			X	
<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>				X			
<i>Goodenia</i> sp.						X	
<i>Goodenia tenuiloba</i>	X	X	X	X		X	X
<i>Grevillea berryana</i>				X	X		
<i>Hakea lorea</i> subsp. <i>lorea</i>						X	
<i>Halgania gustafsenii</i> var. Murchison (R. Meissner & B. Bayliss 743)				X			X
<i>Haloragis</i> ? <i>gossei</i>	X						
<i>Heliotropium heteranthum</i>	X						
<i>Heliotropium inexplicitum</i>				X			
<i>Helipterum craspedioides</i>			X			X	
<i>Lepidium oxytrichum</i>				X			
<i>Maireana carnosia</i>			X				
<i>Maireana georgei</i>	X						
<i>Nicotiana</i> ? <i>occidentalis</i> subsp. <i>obliqua</i>			X	X			
<i>Philothea brucei</i> subsp. <i>cinerea</i>				X	X		
<i>Phyllanthus erwinii</i>	X		X	X	X	X	X
<i>Polygala isingii</i>			X				
* <i>Portulaca</i> ? <i>oleracea</i>	X		X	X			X

Appendix D: Vascular Plant Taxa Recorded in Each Floristic Community Type Within the Mount Gould DSO Project Area, 2008

note *denotes introduced species

Taxon	Floristic Community Type						
	1	2	3	4	5	6a	6b
<i>Ptilotus aervoides</i>	X		X			X	
<i>Ptilotus helipteroides</i> var. <i>helipteroides</i>			X			X	
<i>Ptilotus obovatus</i>	X	X	X	X	X		
<i>Ptilotus polystachyus</i> var. <i>?polystachyus</i>	X		X	X		X	
<i>Ptilotus rotundifolius</i>		X					
<i>Ptilotus schwartzii</i>			X				
<i>Rhodanthe maryonii</i>	X		X				
<i>Rhodanthe sphaerocephala</i>			X				
<i>Salsola australis</i>			X			X	
<i>Sclerolaena diacantha</i>	X		X				
<i>Senna artemisioides</i> subsp. <i>helmsii</i>			X	X		X	
<i>Senna</i> sp. Meekatharra (E. Bailey 1-26)			X				
<i>Sida ectogama</i>				X			
<i>Sida ?intricata</i>						X	
<i>Sida</i> sp. dark green fruits (S. van Leeuwen 2260)	X			X			
<i>Sida</i> sp. Golden calyces glabrous (H.N. Foote 32)				X			X
<i>Sida</i> sp. spiciform panicles (E. Leyland s.n. 14/8/90)	X			X			
<i>Solanum lasiophyllum</i>	X		X	X	X	X	X
<i>Streptoglossa liatroides</i>	X						
<i>Tetragonia cristata</i>			X			X	
<i>Trachymene pilbarensis</i>				X	X		
<i>Tribulus adelacanthus</i>		X					
<i>Tribulus suberosus</i>							X
<i>Trichodesma zeylanicum</i> var. <i>?grandiflorum</i>						X	
<i>Triodia melvillei</i>				X	X		
<i>Velleia glabrata</i>			X				
<i>Zygophyllum ?iodocarpum</i>			X				

Appendix E: Raw Quadrat Data from the Mount Gould DSO Project Area

Note:

Cover Classes:

D: > 70 % cover

M: 30-70 % cover

S: 10-30 % cover

V: < 10 % cover

I: Isolated plants

L: Isolated clumps

Site Name	Site Type	Dimensions	Establishment Date	Datum	Zone	Easting	Northing	FCT Code	Soil type	Soil Colour	Topography	Slope
MG01	Quadrat	20m x 20m	5/08/2008	GDA94	50	534010	7145412	1	silty clay loam	red brown	lowerslope	moderate

Species Name	Av. Height	Cover Class
<i>Acacia aneura</i> var. <i>?aneura</i>	3.5	S
<i>Acacia ramulosa</i> var. <i>linophylla</i>	2	V
<i>Corchorus crozophorifolius</i>	0.3	I
<i>Eriachne mucronata</i>	0.3	V
<i>Goodenia tenuiloba</i>	0.1	S
<i>Sida</i> sp. dark green fruits (S. van Leeuwen 2260)	0.1	I
<i>Solanum lasiophyllum</i>	0.5	I

Site Name	Site Type	Dimensions	Establishment Date	Datum	Zone	Easting	Northing	FCT Code	Soil type	Soil Colour	Topography	Slope
MG02	Quadrat	20m x 20m	5/08/2008	GDA94	50	534089	7145157	6a	silty clay loam	red	flat	flat

Species Name	Av. Height	Cover Class
<i>Abutilon otocarpum</i>	0.2	I
<i>Acacia kempeana</i>	3	I
<i>Acacia ramulosa</i> var. <i>linophylla</i>	5	S
<i>Aristida contorta</i>	0.3	L
<i>Calandrinia</i> sp.	0.1	I
<i>Corchorus crozophorifolius</i>	0.5	I
<i>Dysphania melanocarpa</i> forma <i>melanocarpa</i>	0.1	I
<i>Eremophila compacta</i> subsp. <i>?fecunda</i>	0.8	I
<i>Eremophila forrestii</i> subsp. <i>forrestii</i>	2	V
<i>Eriachne aristidea</i>	0.3	L
<i>Eriachne mucronata</i>	0.3	L
<i>Euphorbia boophthona</i>	0.1	I
<i>Euphorbia drummondii</i>	0.1	I
<i>Goodenia tenuiloba</i>	0.1	I
<i>Hakea lorea</i> subsp. <i>lorea</i>	0.2	I
<i>Helipterum craspedioides</i>	0.1	I
<i>Phyllanthus erwinii</i>	0.1	I
<i>Ptilotus aervooides</i>	0.1	V
<i>Ptilotus polystachyus</i> var. <i>?polystachyus</i>	0.1	I
<i>Salsola australis</i>	0.1	I
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	1.5	I
<i>Sida</i> ? <i>intricata</i>	0.1	I
<i>Solanum lasiophyllum</i>	0.5	I
<i>Trichodesma zeylanicum</i> var. <i>?grandiflorum</i>	0.3	I

Site Name	Site Type	Dimensions	Establishment Date	Datum	Zone	Easting	Northing	FCT Code	Soil type	Soil Colour	Topography	Slope
MG03	Quadrat	20m x 20m	5/08/2008	GDA94	50	533383	7145423	6b	silty clay loam	red brown	lowerslope	steep

Species Name	Av. Height	Cover Class
<i>Acacia citrinoviridis</i>	3	I
<i>Acacia ramulosa</i> var. <i>linophylla</i>	2	I
<i>Aristida contorta</i>	0.3	L
<i>Brachyscome ciliaris</i>		
<i>Corchorus crozophorifolius</i>	0.3	I
<i>Dodonaea petiolaris</i>		
<i>Eremophila latrobei</i> subsp. <i>latrobei</i>	2	S
<i>Eriachne mucronata</i>	0.2	L
<i>Eriachne pulchella</i> subsp. <i>dominii</i>	0.1	L
<i>Goodenia tenuiloba</i>	0.1	V
<i>Halgania gustafsenii</i> var. Murchison (R. Meissner & B. Bayliss 743) (P1)	0.5	S
<i>Phyllanthus erwinii</i>	0.1	I
* <i>Portulaca ?oleracea</i>	0.1	I
<i>Sida</i> sp. Golden calyces glabrous (H.N. Foote 32)	0.1	I
<i>Solanum lasiophyllum</i>	0.5	I
<i>Tribulus suberosus</i>	0.3	I

Site Name	Site Type	Dimensions	Establishment Date	Datum	Zone	Easting	Northing	FCT Code	Soil type	Soil Colour	Topography	Slope
MG04	Quadrat	20m x 20m	5/08/2008	GDA94	50	532767	7145567	6a	silty clay loam	red brown	flat	flat

Species Name	Av. Height	Cover Class
<i>Acacia aneura</i> var. <i>?aneura</i>	0.8	I
<i>Acacia kempeana</i>	3	S
<i>Acacia ramulosa</i> var. <i>linophylla</i>	2	I
<i>Aristida contorta</i>	0.1	L
<i>Calandrinia</i> sp.	0.1	I
<i>Corchorus crozophorifolius</i>	0.3	I
<i>Eragrostis ?eriopoda</i>	0.3	L
<i>Eremophila forrestii</i> subsp. <i>forrestii</i>	0.8	I
<i>Eriachne aristidea</i>	0.1	I
<i>Eriachne mucronata</i>	0.3	I
<i>Euphorbia boophthona</i>	0.1	I
<i>Euphorbia drummondii</i>	0.1	I
<i>Goodenia</i> sp.	0.1	I
<i>Goodenia tenuiloba</i>	0.1	I
<i>Helipterum craspedioides</i>	0.1	I
<i>Phyllanthus erwinii</i>	0.1	I
<i>Ptilotus aervoides</i>	0.1	I
<i>Ptilotus polystachyus</i> var. <i>?polystachyus</i>	0.1	I
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	1	I
<i>Sida ?intricata</i>	0.1	I
<i>Solanum lasiophyllum</i>	0.1	I
<i>Tetragonia cristata</i>	0.1	I

Site Name	Site Type	Dimensions	Establishment Date	Datum	Zone	Easting	Northing	FCT Code	Soil type	Soil Colour	Topography	Slope
MG05	Quadrat	20m x 20m	5/08/2008	GDA94	50	532873	7145628	3	clay loam	brown	closed depression	flat

Species Name	Av. Height	Cover Class
<i>Aristida contorta</i>	0.1	L
<i>Calandrinia</i> sp.	0.1	I
<i>Calotis hispidula</i>	0.1	I
<i>Cephalopterum drummondii</i>	0.1	I
<i>Dysphania rhadinostachya</i> subsp. <i>inflata</i>	0.1	I
<i>Eremophila fraseri</i> subsp. <i>?parva</i>	2	I
<i>Eriachne pulchella</i> subsp. <i>dominii</i>	0.1	L
<i>Erodium cygnorum</i>	0.1	I
<i>Euphorbia boophthona</i>	0.1	I
<i>Euphorbia drummondii</i>	0.1	I
<i>Goodenia tenuiloba</i>	0.1	I
<i>Helipterum craspedioides</i>	0.1	I
<i>Nicotiana ?occidentalis</i> subsp. <i>obliqua</i>	0.1	I
<i>Phyllanthus erwinii</i>	0.1	I
<i>Polygala isingii</i>	0.1	I
* <i>Portulaca ?oleracea</i>	0.1	I
<i>Ptilotus aervoides</i>	0.1	I
<i>Ptilotus helipteroides</i> var. <i>helipteroides</i>	0.1	I
<i>Ptilotus obovatus</i>	0.3	I
<i>Rhodanthe maryonii</i>	0.1	I
<i>Rhodanthe sphaerocephala</i> (P1)	0.1	I
<i>Sclerolaena diacantha</i>	0.1	I
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	0.2	I
<i>Senna</i> sp. Meekatharra (E. Bailey 1-26)	0.5	I
<i>Tetragonia cristata</i>	1.4	I
<i>Velleia glabrata</i>	0.1	I
<i>Zygophyllum ?iodocarpum</i>	0.1	I

Site Name	Site Type	Dimensions	Establishment Date	Datum	Zone	Easting	Northing	FCT Code	Soil type	Soil Colour	Topography	Slope
MG06	Quadrat	20m x 20m	6/08/2008	GDA94	50	532900	7145880	3	clay loam	red brown	flat	flat

Species Name	Av. Height	Cover Class
<i>Abutilon otocarpum</i>	0.1	I
<i>Acacia aneura</i> var. <i>?aneura</i>	4	V
<i>Acacia aneura</i> var. <i>?conifera</i>	3	V
<i>Acacia ?ayersiana</i>	4	V
<i>Acacia cuthbertsonii</i> subsp. <i>cuthbertsonii</i>	2.5	V
<i>Aristida contorta</i>	0.1	L
<i>Corchorus crozophorifolius</i>	0.3	I
<i>Dysphania melanocarpa</i> forma <i>melanocarpa</i>	0.1	I
<i>Dysphania rhadinostachya</i> subsp. <i>inflata</i>	0.1	I
<i>Eremophila fraseri</i> subsp. <i>?parva</i>	3	V
<i>Eriachne aristidea</i>	0.1	L
<i>Euphorbia boophthona</i>	0.1	I
<i>Euphorbia drummondii</i>	0.1	I
<i>Phyllanthus erwinii</i>	0.1	I
* <i>Portulaca ?oleracea</i>	0.1	I
<i>Ptilotus aervoides</i>	0.1	I
<i>Ptilotus polystachyus</i> var. <i>?polystachyus</i>	0.1	I
<i>Salsola australis</i>	0.1	I
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	0.2	I
<i>Solanum lasiophyllum</i>	0.3	I

Site Name	Site Type	Dimensions	Establishment Date	Datum	Zone	Easting	Northing	FCT Code	Soil type	Soil Colour	Topography	Slope
MG07	Quadrat	20m x 20m	6/08/2008	GDA94	50	533788	7146335	4	silty clay loam	red brown	upperslope	very steep

Species Name	Av. Height	Cover Class
<i>Abutilon lepidum</i>	0.2	I
<i>Acacia aneura</i> var. <i>?aneura</i>	4	S
<i>Cheilanthes brownii</i>	0.1	I
<i>Cymbopogon ambiguus</i>	0.5	L
<i>Enneapogon caerulescens</i>	0.1	L
<i>Eremophila warnesii</i> (P1)		
<i>Phyllanthus erwinii</i>	0.1	I
* <i>Portulaca ?oleracea</i>	0.1	I
<i>Ptilotus obovatus</i>	0.3	I
<i>Sida</i> sp. Golden calyces glabrous (H.N. Foote 32)	0.1	I
<i>Solanum lasiophyllum</i>	0.5	I

Site Name	Site Type	Dimensions	Establishment Date	Datum	Zone	Easting	Northing	FCT Code	Soil type	Soil Colour	Topography	Slope
MG08	Quadrat	20m x 20m	6/08/2008	GDA94	50	533711	7146175	4	silty clay loam	red brown	upperslope	very steep

Species Name	Av. Height	Cover Class
<i>Abutilon lepidum</i>	0.2	I
<i>Acacia citrinoviridis</i>	3	S
<i>Acacia rhodophloia</i>	3	V
<i>Aristida contorta</i>	0.3	L
<i>Calandrinia</i> sp.	0.1	I
<i>Cheilanthes brownii</i>	0.1	I
<i>Cheilanthes sieberi</i>	0.1	I
<i>Enneapogon caerulescens</i>	0.1	L
<i>Eremophila latrobei</i> subsp. <i>latrobei</i>	1.8	S
<i>Eriachne pulchella</i> subsp. <i>dominii</i>	0.1	L
<i>Erodium cygnorum</i>	0.1	I
<i>Euphorbia boophthona</i>	0.1	I
<i>Philothea brucei</i> subsp. <i>cinerea</i>	1	S
<i>Phyllanthus erwinii</i>	0.1	I
<i>Ptilotus obovatus</i>	0.5	V
<i>Sida</i> sp. Golden calyces glabrous (H.N. Foote 32)	0.3	I
<i>Trachymene pilbarensis</i>	0.1	I

Site Name	Site Type	Dimensions	Establishment Date	Datum	Zone	Easting	Northing	FCT Code	Soil type	Soil Colour	Topography	Slope
MG09	Quadrat	20m x 20m	6/08/2008	GDA94	50	533917	7146017	5	silty clay loam	red brown	upperslope	steep

Species Name	Av. Height	Cover Class
<i>Amaranthus interruptus</i>	0.2	I
<i>Bulbostylis</i> sp.	0.1	I
<i>Cheilanthes brownii</i>	0.1	I
<i>Dysphania rhadinostachya</i> subsp. <i>inflata</i>	0.1	I
<i>Enneapogon caerulescens</i>	0.1	L
<i>Eremophila latrobei</i> subsp. <i>latrobei</i>	1.5	I
<i>Eriachne mucronata</i>	0.2	L
<i>Euphorbia boophthona</i>	0.1	I
<i>Grevillea berryana</i>	5	V
<i>Philothea brucei</i> subsp. <i>cinerea</i>	0.5	V
<i>Phyllanthus erwinii</i>	0.1	I
<i>Ptilotus obovatus</i>	0.2	I
<i>Solanum lasiophyllum</i>	0.3	I
<i>Trachymene pilbarensis</i>	0.1	I
<i>Triodia melvillei</i>	0.5	M

Site Name	Site Type	Dimensions	Establishment Date	Datum	Zone	Easting	Northing	FCT Code	Soil type	Soil Colour	Topography	Slope
MG10	Quadrat	20m x 20m	6/08/2008	GDA94	50	533944	7145930	4	silty clay loam	red brown	crest-upperslope	very steep

Species Name	Av. Height	Cover Class
<i>Acacia aneura</i> var. <i>?aneura</i>	4	V
<i>Acacia citrinoviridis</i>	5	S
<i>Acacia rhodophloia</i>	3	V
<i>Aristida contorta</i>	0.2	L
<i>Calandrinia</i> sp.	0.1	I
<i>Cheilanthes brownii</i>	0.1	I
<i>Cheilanthes sieberi</i>	0.1	I
<i>Corchorus crozophorifolius</i>	0.1	L
<i>Enneapogon caerulescens</i>	0.2	L
<i>Eragrostis ?eriopoda</i>	0.2	L
<i>Eremophila latrobei</i> subsp. <i>latrobei</i>	2	S
<i>Eriachne aristidea</i>	0.1	L
<i>Eriachne pulchella</i> subsp. <i>dominii</i>	0.1	L
<i>Erodium cygnorum</i>	0.1	I
<i>Goodenia tenuiloba</i>	0.1	I
<i>Philothea brucei</i> subsp. <i>cinerea</i>	1	S
<i>Phyllanthus erwinii</i>	0.1	I
<i>Ptilotus obovatus</i>	0.5	V
<i>Sida</i> sp. Golden calyces glabrous (H.N. Foote 32)	0.2	I

Site Name	Site Type	Dimensions	Establishment Date	Datum	Zone	Easting	Northing	FCT Code	Soil type	Soil Colour	Topography	Slope
MG11	Quadrat	20m x 20m	6/08/2008	GDA94	50	534364	7146535	4	silty clay loam	red brown	upperslope	very steep

Species Name	Av. Height	Cover Class
<i>Abutilon lepidum</i>	0.1	I
<i>Acacia citrinoviridis</i>	6	S
<i>Amaranthus interruptus</i>	0.1	I
<i>Calandrinia</i> sp.	0.1	I
<i>Cheilanthes sieberi</i>	0.1	I
<i>Cymbopogon ambiguus</i>	0.5	V
<i>Enneapogon caerulescens</i>	0.1	I
<i>Eremophila latrobei</i> subsp. <i>latrobei</i>	0.5	I
<i>Lepidium oxytrichum</i>	0.1	I
<i>Nicotiana ?occidentalis</i> subsp. <i>obliqua</i>	0.1	I
<i>Phyllanthus erwinii</i>	0.1	I
<i>Ptilotus obovatus</i>	0.5	M

Site Name	Site Type	Dimensions	Establishment Date	Datum	Zone	Easting	Northing	FCT Code	Soil type	Soil Colour	Topography	Slope
MG12	Quadrat	20m x 20m	7/08/2008	GDA94	50	534305	7146995	4	silty clay loam	red	upperslope	very steep

Species Name	Av. Height	Cover Class
<i>Abutilon lepidum</i>	0.1	I
<i>Acacia aneura</i> var. <i>?aneura</i>	0.1	I
<i>Amaranthus interruptus</i>	0.1	I
<i>Cheilanthes brownii</i>	0.1	I
<i>Cheilanthes sieberi</i>	0.1	I
<i>Corchorus crozophorifolius</i>	0.1	I
<i>Cymbopogon ambiguus</i>	0.5	V
<i>Enneapogon caerulescens</i>	0.1	L
<i>Eremophila warnesii</i> (P1)	0.4	V
<i>Eriachne mucronata</i>	0.2	L
<i>Euphorbia australis</i>	0.1	I
<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>	0.1	I
<i>Philothea brucei</i> subsp. <i>cinerea</i>	0.1	I
<i>Phyllanthus erwinii</i>	0.1	I
* <i>Portulaca ?oleracea</i>	0.1	I
<i>Ptilotus obovatus</i>	0.4	V
<i>Ptilotus polystachyus</i> var. <i>?polystachyus</i>	0.1	I
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	0.1	I
<i>Sida</i> sp. spiciform panicles (E. Leyland s.n. 14/8/90)	0.3	I
<i>Solanum lasiophyllum</i>	0.1	I

Site Name	Site Type	Dimensions	Establishment Date	Datum	Zone	Easting	Northing	FCT Code	Soil type	Soil Colour	Topography	Slope
MG13	Quadrat	20m x 20m	7/08/2008	GDA94	50	534473	7146985	4	silty clay loam	red brown	upperslope	very steep

Species Name	Av. Height	Cover Class
<i>Cheilanthes brownii</i>	0.1	I
<i>Corchorus crozophorifolius</i>	0.2	I
<i>Cymbopogon ambiguus</i>	0.5	V
<i>Enneapogon caerulescens</i>	0.1	L
<i>Eremophila warnesii</i> (P1)	0.3	V
<i>Eriachne mucronata</i>	0.2	L
<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>	0.1	I
<i>Olearia stuartii</i>		
<i>Phyllanthus erwinii</i>	0.1	I
<i>Ptilotus obovatus</i>	0.3	I
<i>Solanum lasiophyllum</i>	0.1	I
<i>Tridodia melvillei</i>	0.5	S

Site Name	Site Type	Dimensions	Establishment Date	Datum	Zone	Easting	Northing	FCT Code	Soil type	Soil Colour	Topography	Slope
MG14	Quadrat	20m x 20m	7/08/2008	GDA94	50	534161	7147057	4	silty clay loam	red brown	upperslope	very steep

Species Name	Av. Height	Cover Class
<i>Abutilon lepidum</i>	0.1	I
<i>Acacia aneura</i> var. <i>?aneura</i>	3	S
<i>Acacia rhodophloia</i>	3	V
<i>Aristida contorta</i>	0.1	L
<i>Cheilanthes sieberi</i>	0.1	I
<i>Corchorus crozophorifolius</i>	0.1	I
<i>Eremophila latrobei</i> subsp. <i>latrobei</i>	1.8	S
<i>Eriachne aristidea</i>	0.1	L
<i>Goodenia tenuiloba</i>	0.1	I
<i>Philotheca brucei</i> subsp. <i>cinerea</i>	0.8	S
<i>Phyllanthus erwinii</i>	0.1	I
<i>Ptilotus obovatus</i>	0.5	V
<i>Solanum lasiophyllum</i>	0.1	I
<i>Streptoglossa liatroides</i>		

Site Name	Site Type	Dimensions	Establishment Date	Datum	Zone	Easting	Northing	FCT Code	Soil type	Soil Colour	Topography	Slope
MG15	Quadrat	20m x 20m	7/08/2008	GDA94	50	534142	7147212	1	silty clay loam	red brown	midslope	very steep

Species Name	Av. Height	Cover Class
<i>Abutilon lepidum</i>	0.1	I
<i>Acacia aneura</i> var. <i>?aneura</i>	3	V
<i>Acacia aneura</i> var. <i>?conifera</i>	3	I
<i>Aristida contorta</i>	0.1	I
<i>Eremophila lachnocalyx</i>	1.8	I
<i>Eriachne pulchella</i> subsp. <i>dominii</i>	0.1	I
<i>Euphorbia australis</i>	0.1	I
<i>Maireana georgei</i>	0.1	I
<i>Phyllanthus erwinii</i>	0.1	I
<i>Ptilotus obovatus</i>	0.5	V
<i>Sclerolaena ?diacantha</i>	0.1	I
<i>Sida</i> sp. dark green fruits (S. van Leeuwen 2260)	0.1	I
<i>Solanum lasiophyllum</i>	0.1	I
<i>Streptoglossa liatroides</i>	0.1	I

Site Name	Site Type	Dimensions	Establishment Date	Datum	Zone	Easting	Northing	FCT Code	Soil type	Soil Colour	Topography	Slope
MG16	Quadrat	20m x 20m	7/08/2008	GDA94	50	534580	7147683	1	silty clay loam	red brown	lowerslope	gentle

Species Name	Av. Height	Cover Class
<i>Acacia aneura</i> var. <i>?aneura</i>	0.5	I
<i>Acacia ramulosa</i> var. <i>linophylla</i>	1.5	I
<i>Acacia rhodophloia</i>	3	S
<i>Aristida contorta</i>	0.1	L
<i>Enneapogon caerulescens</i>	0.1	L
<i>Eremophila latrobei</i> subsp. <i>latrobei</i>	2	V
<i>Eremophila ?pendulina</i>	1.2	V
<i>Eremophila phyllopoda</i> subsp. <i>phyllopoda</i>	1	V
<i>Goodenia tenuiloba</i>	0.1	S
<i>Haloragis ?gossei</i>	0.1	I
<i>Heliotropium heteranthum</i>	0.1	I
<i>Phyllanthus erwinii</i>	0.1	I
<i>Ptilotus obovatus</i>	0.5	V
<i>Sida</i> sp. dark green fruits (S. van Leeuwen 2260)	0.2	I
<i>Solanum lasiophyllum</i>	0.1	I

Site Name	Site Type	Dimensions	Establishment Date	Datum	Zone	Easting	Northing	FCT Code	Soil type	Soil Colour	Topography	Slope
MG17	Quadrat	20m x 20m	1/10/2008	GDA94	50	533448	7147992	6a	Sandy clay loam	Red	Plain	Flat

Species Name	Av. Height	Cover Class
<i>Acacia kempeana</i>	0.4	I
<i>Acacia ramulosa</i> var. <i>linophylla</i>	3	S
<i>Aristida contorta</i>	0.2	L
<i>Calandrinia polyandra</i>	0.1	I
<i>Corchorus crozophorifolius</i>	0.5	I
<i>Dysphania melanocarpa</i> forma <i>melanocarpa</i>	0.1	I
<i>Eremophila forrestii</i> subsp. <i>forrestii</i>	1.5	V
<i>Eriachne aristidea</i>	0.2	L
<i>Euphorbia drummondii</i>	0.1	I
<i>Goodenia tenuiloba</i>	0.1	I
<i>Phyllanthus erwinii</i>	0.1	I
<i>Ptilotus aervoides</i>	0.1	I
<i>Ptilotus helipteroides</i> var. <i>helipteroides</i>	0.1	I
<i>Ptilotus polystachyus</i> var. <i>?polystachyus</i>	0.2	I
<i>Sida ?intricata</i>	0.1	I
<i>Solanum lasiophyllum</i>	1	I

Site Name	Site Type	Dimensions	Establishment Date	Datum	Zone	Easting	Northing	FCT Code	Soil type	Soil Colour	Topography	Slope
MG18	Quadrat	20m x 20m	1/10/2008	GDA94	50	533277	7147321	6a	Sandy clay loam	Red	Plain	Flat

Species Name	Av. Height	Cover Class
<i>Abutilon otocarpum</i>	0.2	I
<i>Acacia kempeana</i>	4	I
<i>Acacia ramulosa</i> var. <i>linophylla</i>	4	S
<i>Aristida contorta</i>	0.1	I
<i>Corchorus crozophorifolius</i>	0.2	I
<i>Dysphania melanocarpa</i> forma <i>melanocarpa</i>	0.1	I
<i>Dysphania rhadinostachya</i> subsp. <i>inflata</i>	0.1	I
<i>Eremophila compacta</i> subsp. <i>?fecunda</i>	0.3	I
<i>Eremophila forrestii</i> subsp. <i>forrestii</i>	2	V
<i>Eriachne aristidea</i>	0.1	L
<i>Eriachne mucronata</i>	0.3	I
<i>Phyllanthus erwinii</i>	0.1	I
<i>Ptilotus aervoides</i>	0.1	I
<i>Sida ?intricata</i>	0.1	I

Site Name	Site Type	Dimensions	Establishment Date	Datum	Zone	Easting	Northing	FCT Code	Soil type	Soil Colour	Topography	Slope
MG19	Quadrat	20m x 20m	1/10/2008	GDA94	50	533616	7147468	1	Skeletal silty clay loam over quartz and ironstone stones	Red-Brown	Lower slope	Steep

Species Name	Av. Height	Cover Class
<i>Acacia aneura</i> var. ? <i>aneura</i>	3	I
<i>Acacia ramulosa</i> var. <i>linophylla</i>	2.5	V
<i>Acacia rhodophloia</i>	3	V
<i>Aristida contorta</i>	0.1	I
<i>Corchorus crozophorifolius</i>	0.3	I
<i>Dysphania rhadinostachya</i> subsp. <i>inflata</i>	0.1	I
<i>Eriachne pulchella</i> subsp. <i>pulchella</i>	0.1	I
<i>Goodenia tenuiloba</i>	0.1	V
<i>Phyllanthus erwinii</i>	0.1	I
* <i>Portulaca ?oleracea</i>	0.1	I
<i>Ptilotus aervoides</i>	0.1	I
<i>Ptilotus obovatus</i>	0.3	I
<i>Ptilotus polystachyus</i> var. ? <i>polystachyus</i>	0.1	I
<i>Rhodanthe maryonii</i>	0.1	I
<i>Sida</i> sp. dark green fruits (S. van Leeuwen 2260)	0.1	I
<i>Sida</i> sp. spiciform panicles (E. Leyland s.n. 14/8/90)	0.1	I
<i>Solanum lasiophyllum</i>	0.1	I
<i>Streptoglossa liatroides</i>	0.1	I

Site Name	Site Type	Dimensions	Establishment Date	Datum	Zone	Easting	Northing	FCT Code	Soil type	Soil Colour	Topography	Slope
MG20	Quadrat	20m x 20m	1/10/2008	GDA94	50	533247	7147554	3	Clay-loam	Brown-red	Clay pan	Flat

Species Name	Av. Height	Cover Class
<i>Acacia aneura</i> var. <i>?aneura</i>	0.1	I
<i>Aristida contorta</i>	0.1	L
<i>Eriachne aristidea</i>	0.1	I
<i>Eriachne pulchella</i> subsp. <i>pulchella</i>	0.1	I
<i>Euphorbia boophthona</i>	0.1	I
<i>Euphorbia drummondii</i>	0.1	I
<i>Goodenia tenuiloba</i>	0.1	I
<i>Helipterum craspedioides</i>	0.1	I
<i>Maireana carnosa</i>	0.1	I
<i>Phyllanthus erwinii</i>	0.1	I
<i>Ptilotus aervooides</i>	0.1	I
<i>Ptilotus helipteroides</i> var. <i>helipteroides</i>	0.1	I
<i>Ptilotus obovatus</i>	0.5	I
<i>Ptilotus polystachyus</i> var. <i>?polystachyus</i>	0.1	I
<i>Ptilotus schwartzii</i>	0.1	I
<i>Rhodanthe sphaerocephala</i> (P1)	0.1	I
<i>Velleia glabrata</i>	0.1	I

Site Name	Site Type	Dimensions	Establishment Date	Datum	Zone	Easting	Northing	FCT Code	Soil type	Soil Colour	Topography	Slope
MG21	Quadrat	20m x 20m	1/10/2008	GDA94	50	534289	7148024	2	Silty clay loam over ironstone and quartz pebbles	Red-brown	Lower slope/undulating plain	Gentle

Species Name	Av. Height	Cover Class
<i>Acacia aneura</i> var. ? <i>aneura</i>	4	V
<i>Acacia ramulosa</i> var. <i>linophylla</i>	2.5	I
<i>Acacia rhodophloia</i>	0.5	I
<i>Aristida contorta</i>	0.1	I
<i>Eremophila ?jucunda</i>	0.3	I
<i>Eremophila latrobei</i> subsp. <i>latrobei</i>	0.3	I
<i>Goodenia tenuiloba</i>	0.1	V
<i>Ptilotus obovatus</i>	0.3	I
<i>Tribulus adelacanthus</i>	0.1	I

Site Name	Site Type	Dimensions	Establishment Date	Datum	Zone	Easting	Northing	FCT Code	Soil type	Soil Colour	Topography	Slope
MG22	Quadrat	20m x 20m	1/10/2008	GDA94	50	534812	7147869	2	Silty clay loam over ironstone and quartz rocks	Red-brown	Stony undulating plain	Gentle

Species Name	Av. Height	Cover Class
<i>Acacia ramulosa</i> var. <i>linophylla</i>	3	I
<i>Acacia rhodophloia</i>	3	V
<i>Aristida contorta</i>	0.1	I
<i>Corchorus crozophorifolius</i>	0.1	I
<i>Dysphania rhadinostachya</i> subsp. <i>inflata</i>	0.3	I
<i>Eremophila fraseri</i> subsp. <i>?parva</i>	3	V
<i>Euphorbia boophthona</i>	0.1	I
<i>Goodenia tenuiloba</i>	0.1	V
<i>Ptilotus obovatus</i>	0.3	I
<i>Ptilotus rotundifolius</i>	1	I

Site Name	Site Type	Dimensions	Establishment Date	Datum	Zone	Easting	Northing	FCT Code	Soil type	Soil Colour	Topography	Slope
MG23	Quadrat	20m x 20m	2/10/2008	GDA94	50	534742	7146539	4	Skeletal silty clay loam over massive ironstone	Red-brown	Midslope	Very Steep

Species Name	Av. Height	Cover Class
<i>Abutilon lepidum</i>	0.1	I
<i>Acacia aneura</i> var. ? <i>aneura</i>	3	I
<i>Amaranthus interruptus</i>	0.1	I
<i>Cymbopogon ambiguus</i>	0.5	V
<i>Digitaria brownii</i>	0.1	I
<i>Enneapogon caerulescens</i>	0.1	L
<i>Eremophila warnesii</i> (P1)	0.3	V
<i>Philothea brucei</i> subsp. <i>cinerea</i>	0.5	I
<i>Phyllanthus erwinii</i>	0.1	I
<i>Ptilotus obovatus</i>	0.3	V
<i>Sida</i> sp. spiciform panicles (E. Leyland s.n. 14/8/90)	0.1	I
<i>Solanum lasiophyllum</i>	0.3	I

Site Name	Site Type	Dimensions	Establishment Date	Datum	Zone	Easting	Northing	FCT Code	Soil type	Soil Colour	Topography	Slope
MG24	Quadrat	20m x 20m	2/10/2008	GDA94	50	534847	7146546	4	Skeletal silty clay loam over massive ironstone and conglomerate boulders	Red	Lower slope	Very steep

Species Name	Av. Height	Cover Class
<i>Abutilon lepidum</i>	0.1	I
<i>Acacia aneura</i> var. <i>?aneura</i>	3	V
<i>Acacia rhodophloia</i>	3	V
<i>Cheilanthes brownii</i>	0.1	L
<i>Cheilanthes sieberi</i>	0.1	I
<i>Corchorus crozophorifolius</i>	0.4	I
<i>Cymbopogon ambiguus</i>	0.5	I
<i>Dodonaea petiolaris</i>	0.5	I
<i>Dysphania rhadinostachya</i> subsp. <i>inflata</i>	0.1	I
<i>Eremophila latrobei</i> subsp. <i>latrobei</i>	2	V
<i>Eriachne mucronata</i>	0.5	I
<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>	0.1	I
<i>Goodenia tenuiloba</i>	0.1	I
<i>Halgania gustafsenii</i> var. Murchison (R. Meissner & B. Bayliss 743) (P1)	0.3	I
<i>Heliotropium inexplicitum</i>	0.1	I
<i>Philothea brucei</i> subsp. <i>cinerea</i>	0.5	I
<i>Phyllanthus erwinii</i>	0.1	I
<i>Ptilotus obovatus</i>	0.5	V
<i>Sida ectogama</i>	0.2	I
<i>Sida</i> sp. Golden calyces glabrous (H.N. Foote 32)	0.2	I
<i>Solanum lasiophyllum</i>	0.1	I

Site Name	Site Type	Dimensions	Establishment Date	Datum	Zone	Easting	Northing	FCT Code	Soil type	Soil Colour	Topography	Slope
MG25	Quadrat	20m x 20m	1/10/2008	GDA94	50	534506	7146116	4	Skeletal silty clay loam over massive ironstone and ironstone boulders	Red	Lower slope	Steep

Species Name	Av. Height	Cover Class
<i>Abutilon lepidum</i>	0.1	I
<i>Acacia aneura</i> var. <i>?aneura</i>	4	S
<i>Amaranthus interruptus</i>	0.1	I
<i>Aristida contorta</i>	0.2	I
<i>Cheilanthes sieberi</i>	0.1	I
<i>Corchorus crozophorifolius</i>	0.3	I
<i>Cymbopogon ambiguus</i>	0.5	L
<i>Digitaria brownii</i>	0.2	I
<i>Dodonaea petiolaris</i>	0.5	I
<i>Dysphania rhadinostachya</i> subsp. <i>inflata</i>	0.1	I
<i>Enneapogon caerulescens</i>	0.1	I
<i>Eremophila latrobei</i> subsp. <i>latrobei</i>	1	I
<i>Eriachne ?mucronata</i>	0.5	L
<i>Euphorbia australis</i>	0.1	I
<i>Goodenia tenuiloba</i>	0.1	I
<i>Grevillea berryana</i>	4	V
<i>Halgania gustafsenii</i> var. Murchison (R. Meissner & B. Bayliss 743) (P1)	0.5	I
<i>Philothea brucei</i> subsp. <i>cinerea</i>	1	I
<i>Ptilotus obovatus</i>	0.5	V
<i>Sida ectogama</i>	0.5	I
<i>Sida</i> sp. dark green fruits (S. van Leeuwen 2260)	0.1	I
<i>Sida</i> sp. spiciform panicles (E. Leyland s.n. 14/8/90)	0.3	I
<i>Solanum lasiophyllum</i>	0.8	I

**Appendix F: Taxa amalgamated for the Mount Gould DSO Project
Area Quadrat Analysis**

Acacia aneura var. ?*aneura*

Acacia aneura var. *microcarpa*

Cheilanthes sieberi

Cheilanthes sieberi subsp. *sieberi*

Enneapogon caeruleus

Enneapogon caeruleus var. *caeruleus*

Eragrostis eriopoda

Eragrostis ?*eriopoda*

Eriachne ?mucronata

Eriachne mucronata

Hakea lorea

Hakea lorea subsp. *lorea*

Ptilotus obovatus

Ptilotus obovatus var. *obovatus*

Ptilotus polystachyus forma *polystachyus*

Ptilotus polystachyus var. ?*polystachyus*

Sida aff. *atrovirens*

Sida atrovirens ms

Sida sp. dark green fruits (S. van Leeuwen 2260)

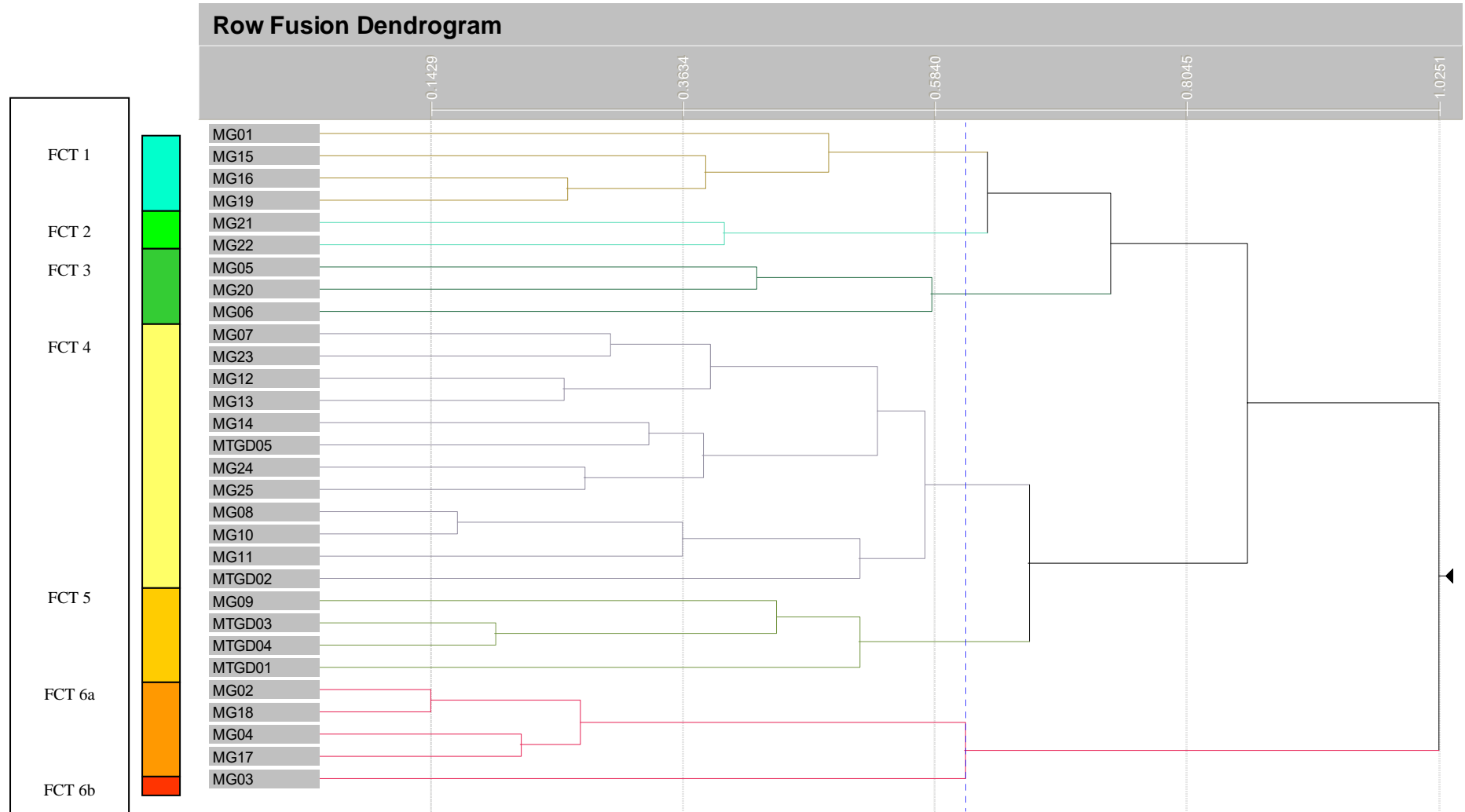
Solanum ashbyae

Solanum ashbyii/lasiopetalum complex

Solanum lasiophyllum

Appendix G: Summary Dendrogram of Floristic Community Types of the Mount Gould DSO Project Area

Note: Quadrats labeled MG are Woodman Environmental, MTGD are Meissner *et al.* (2007)



Appendix I: Significant Indicator Species of the 7-group classification of the Mount Gould DSO Project Area, 2008

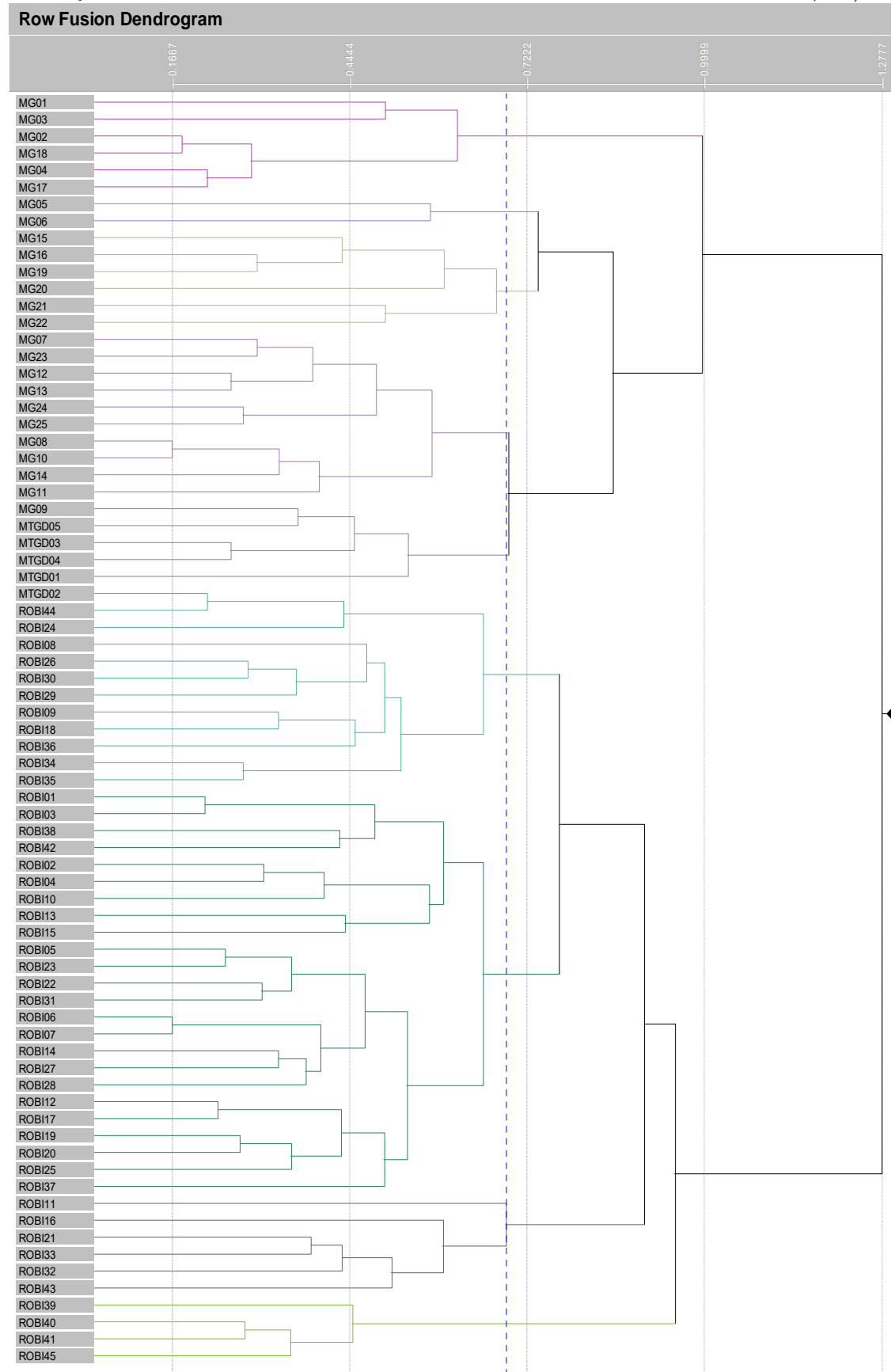
Note: Shading denotes highest indicator values per taxon. Indicator values (%) are shown only for taxa shown only for taxa which were significant at $p < 0.05$ (Monte Carlo permutation tests: * = $p < 0.05$; ** = $p < 0.01$; * = $p < 0.001$)**

Note: FCT 6b not included as it was represented by a single quadrat

Taxon	Floristic Community Type					
	1	2	3	4	5	6a
<i>Sida</i> sp. dark green fruits (S. van Leeuwen 2260)**	60	0	0	2	15	0
<i>Solanum ashbyae/lasiophyllum</i> complex*	30	0	3	17	8	17
<i>Acacia rhodophloia</i> *	14	55	0	6	0	0
<i>Phyllanthus erwinii</i> *	15	0	26	18	2	26
<i>Abutilon lepidum</i> *	7	0	0	48	0	0
<i>Cheilanthes sieberi</i> **	0	0	0	67	0	0
<i>Cymbopogon ambiguus</i> *	0	0	0	48	7	0
<i>Eremophila latrobei</i> subsp. <i>latrobei</i> **	3	10	0	18	41	0
<i>Eriachne mucronata</i> *	3	0	0	7	41	23
<i>Grevillea berryana</i> *	0	0	0	1	68	0
<i>Monacather paradoxus</i> *	0	0	0	0	75	0
<i>Triodia melvillei</i> *	0	0	0	3	61	0
<i>Acacia kempeana</i> ***	0	0	0	0	0	100
<i>Eremophila forrestii</i> subsp. <i>forrestii</i> ***	0	0	0	0	0	100
<i>Sida ?intricata</i> ***	0	0	0	0	0	100

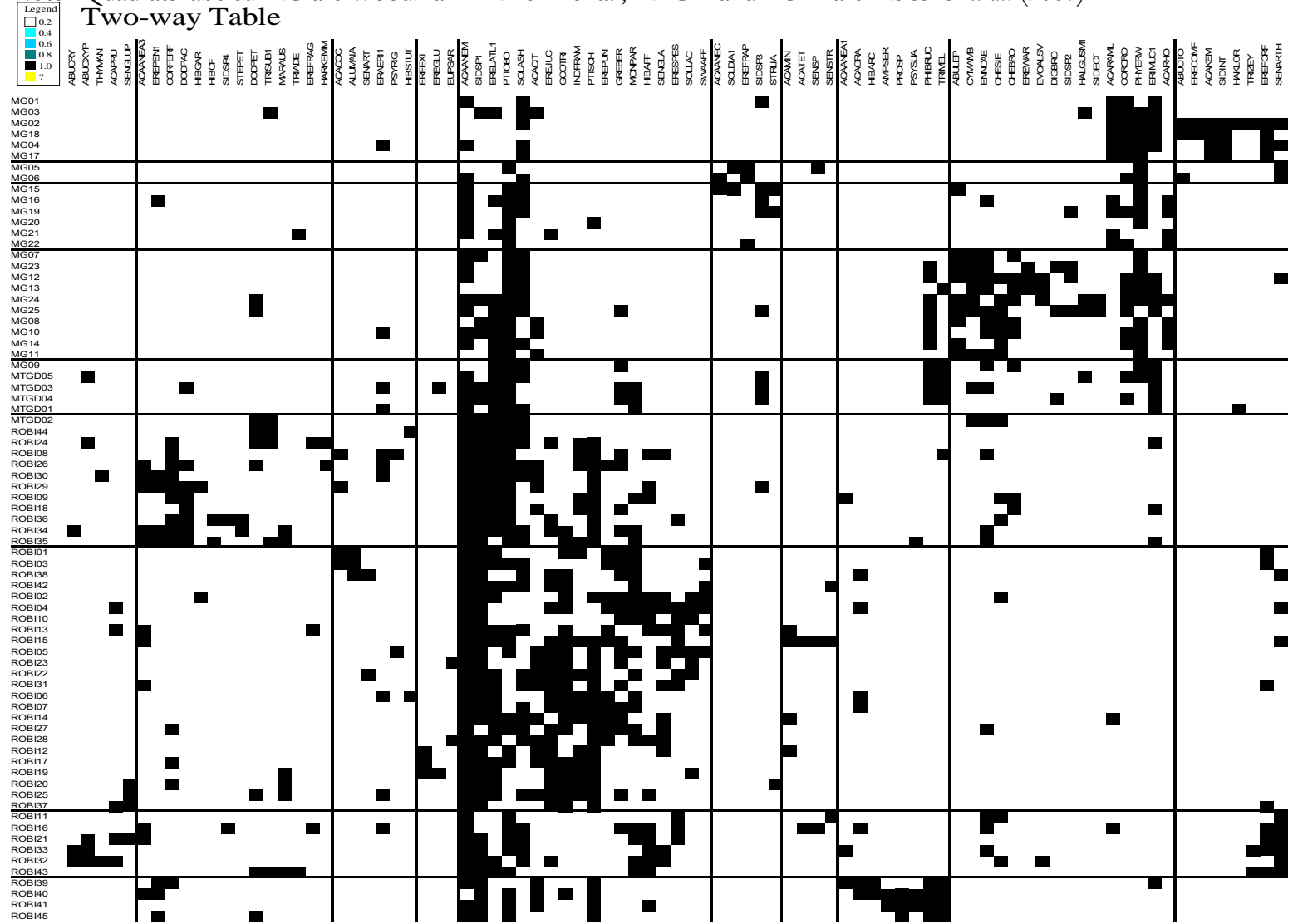
Appendix J: Summary Dendrogram of Analysis of Mount Gould and Robinson Range Quadrats

Note: Quadrats labeled MG are Woodman Environmental, MTGD and ROBI are Meissner *et al.* (2007)



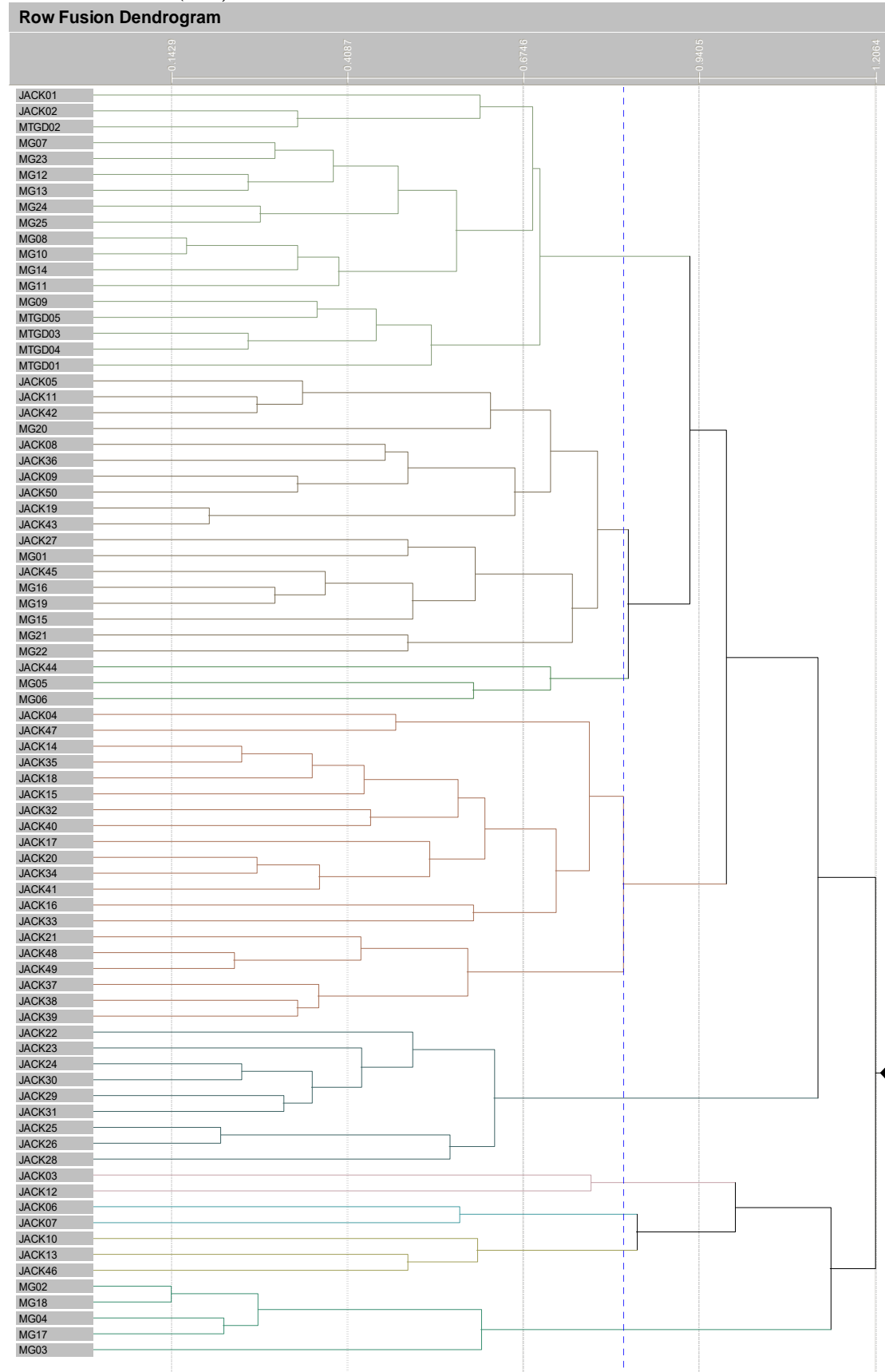
Appendix K: Summary Matrix of Species Presence within Mount Gould and Robinson Range Quadrats

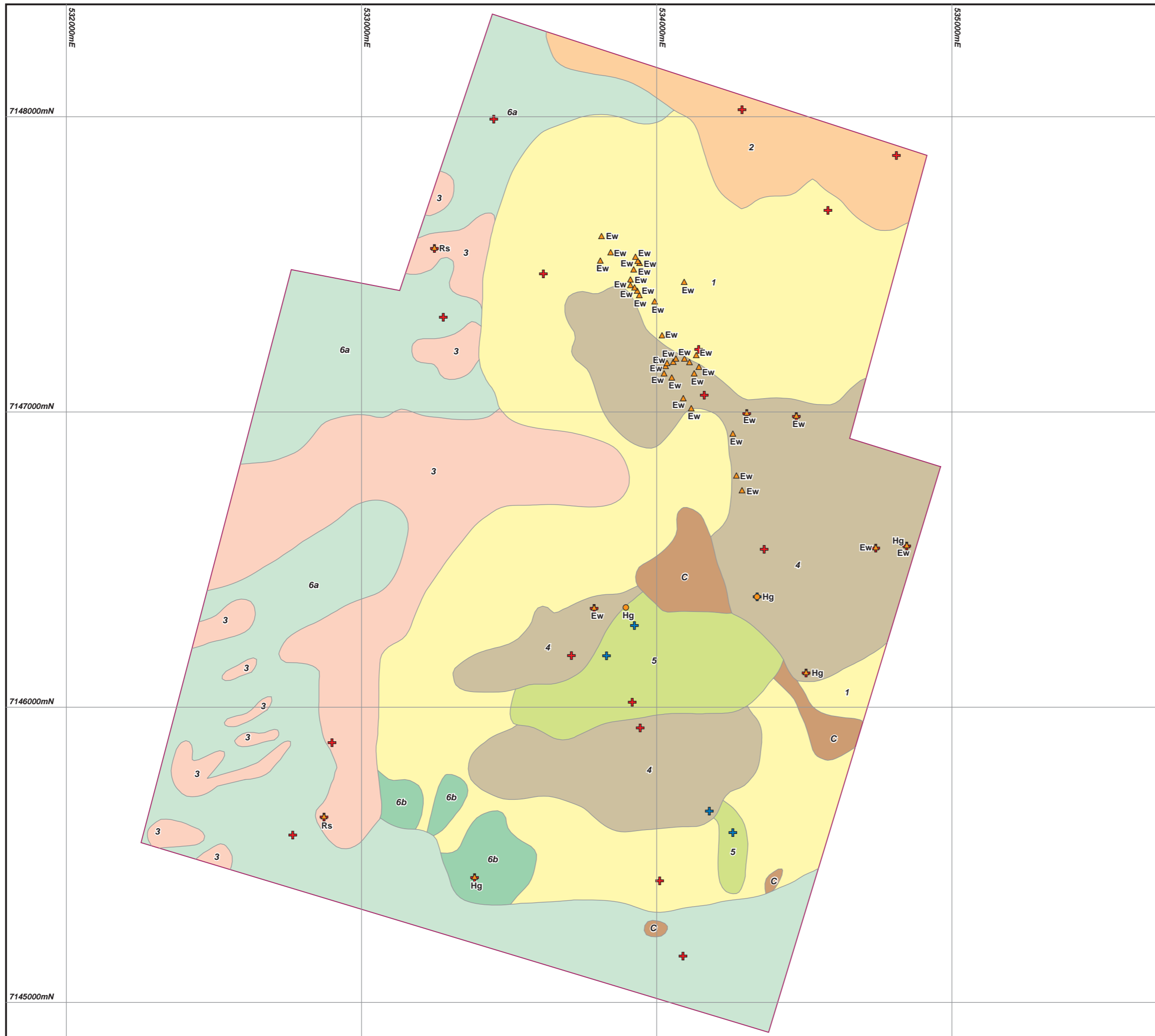
Note: Quadrats labeled MG are Woodman Environmental, MTGD and ROBI are Meissner *et al.* (2007)



Appendix L: Summary Dendrogram of Analysis of Mount Gould and Jack Hills Quadrats

Note: Quadrats labeled MG are Woodman Environmental, MTGD are Meissner *et al.* (2007). JACK are Meissner & Caruso. (2006)





LEGEND

Floristic Community Types

- 1: Open tall shrubland of *Acacia aneura* over sparse low shrubland of *Ptilotus obovatus* over open low forbland of *Goodenia tenuiloba* on steep mid and lower slopes on banded ironstone and quartz shale
- 2: Sparse tall shrubland of mixed *Acacia* species over sparse low shrubland of *Ptilotus obovatus* and *Eremophila* species over open low forbland of *Goodenia tenuiloba* on stony undulating plains
- 3: Sparse tall shrubland or isolated shrubs of *Acacia aneura* over isolated mid shrubs of *Eremophila fraseri* subsp. *parva* over isolated low shrubs of *Ptilotus obovatus* over open low forbland of mixed species including *Ptilotus aevoides* and *Goodenia tenuiloba* in clay pans and on clay flats
- 4: Open tall shrubland or isolated shrubs of *Acacia aneura* over open to sparse mid shrubland of *Eremophila latrobei* subsp. *latrobei* and *Philotheca brucei* subsp. *cinerea* over open to sparse low shrubland and low tussock grassland of *Ptilotus obovatus* and *Cymbopogon ambiguus* on steep mid and upper slopes and crests on banded ironstone
- 5: Isolated tall shrubland of *Acacia aneura* and/or *Grevillea beryana* over sparse low shrubland of *Eremophila latrobei* subsp. *latrobei*, *Philotheca brucei* subsp. *cinerea* and *Ptilotus obovatus* over low hummock grassland of *Triodia melvillei* on steep upperslopes and crests on banded ironstone
- 6a: Open tall shrubland of *Acacia ramulosa* var. *linophylla* and *Acacia kempeana* over sparse mid shrubland of *Eremophila forrestii* subsp. *forrestii* over isolated low shrubland of *Corchorus crozophorifolius* over sparse low grassland and forbland of mixed species including *Eriachne mucronata* and *Ptilotus aevoides* on flat plains
- 6b: Tall sparse shrubland of *Acacia ramulosa* var. *linophylla* and *Acacia citrinoviridis* over open mid shrubland of *Eremophila latrobei* subsp. *latrobei* over open low shrubland of *Halgania gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743) over sparse low forbland of *Goodenia tenuiloba* on a steep low ridge on banded ironstone

Recording Sites

- Red cross: Woodman Environmental quadrat
- Blue cross: DEC quadrat

Declared Rare and Priority Flora Species

- Ew: *Eremophila wamesii* P1
- Hg: *Halgania gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743) P1
- Rs: *Rhodanthe sphaerocephala* P1

Scale

0 100 200m
Scale
MGA94 Zone 50

Priority Rare	DEC	WEC
1	●	▲
2	●	▲
3	●	▲
4	●	▲

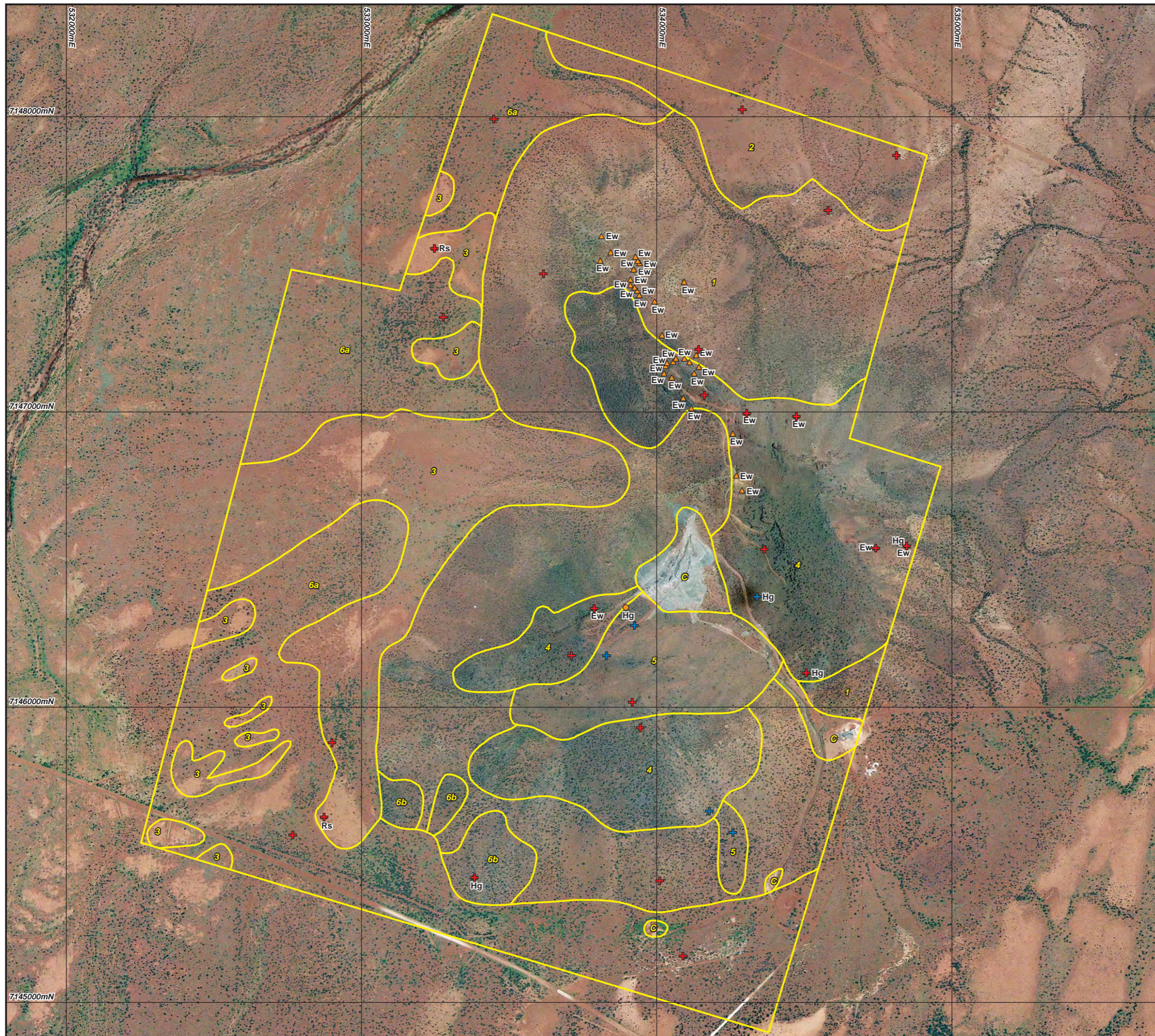
ATLAS

**Mt Gould DSO Project Area
Floristic Community Types and
Significant Flora Taxa**

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 Drawn: CAD Resources - www.cadresources.com.au | Figure:
 Tel: (08) 9246 3242 - Fax: (08) 9246 3202
 CAD Ref: g1627_MG_f01.dgn | Date: Apr 2009 | Rev: A | A3

2a



LEGEND

Floristic Community Types

- 1: Open tall shrubland of *Acacia aneura* over sparse low shrubland of *Ptilotus obovatus* over open low forbland of *Goodenia tenuiloba* on steep mid and lower slopes on banded ironstone and quartz shale
- 2: Sparse tall shrubland of mixed *Acacia* species over sparse low shrubland of *Ptilotus obovatus* and *Eremophila* species over open low forbland of *Goodenia tenuiloba* on stony undulating plains
- 3: Sparse tall shrubland or isolated shrubs of *Acacia aneura* over isolated mid shrubs of *Eremophila fraseri* subsp. *parva* over isolated low shrubs of *Ptilotus obovatus* over open low forbland of mixed species including *Ptilotus aervooides* and *Goodenia tenuiloba* in clay pans and on clay flats
- 4: Open tall shrubland or isolated shrubs of *Acacia aneura* over open to sparse mid shrubland of *Eremophila latrobei* subsp. *latrobei* and *Philotheca brucei* subsp. *cinerea* over open to sparse low shrubland and low tussock grassland of *Ptilotus obovatus* and *Cymbopogon ambiguus* on steep mid and upper slopes and crests on banded ironstone
- 5: Isolated tall shrubland of *Acacia aneura* and/or *Grevillea beryana* over sparse low shrubland of *Eremophila latrobei* subsp. *latrobei*, *Philotheca brucei* subsp. *cinerea* and *Ptilotus obovatus* over low hummock grassland of *Triodia melvillei* on steep upper slopes and crests on banded ironstone
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- 6b: Tall sparse shrubland of *Acacia ramulosa* var. *linophylla* and *Acacia citrinoviridis* over open mid shrubland of *Eremophila latrobei* subsp. *latrobei* over open low shrubland of *Halgania gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743) over sparse low forbland of *Goodenia tenuiloba* on a steep low ridge on banded ironstone

Recording Sites

- Red cross: Woodman Environmental quadrat
- Blue cross: DEC quadrat

Declared Rare and Priority Flora Species

Ew: *Eremophila warnesii* P1
 Hg: *Halgania gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743) P1
 Rs: *Rhodanthe sphaerocephala* P1

Priority Rare DEC WEC

1	●	▲
2	●	▲
3	●	▲
4	●	▲

Scale: 0 100 200m
MGA94 Zone 50

Atlas

**Mt Gould DSO Project Area
Floristic Community Types and
Significant Flora Taxa
Showing Aerial Photography**

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Author: D Coultas | WEC Ref: ATLAS08-10-01 | Scale: 1:12,500
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 Tel: (08) 9246 3242 - Fax: (08) 9246 3202
 CAD Ref: g1627_MG_f02.dgn | Date: Apr 2009 | Rev: A | A3

2b

**APPENDIX 5: MOUNT GOULD DSO PROJECT PROPOSED
EXPLORATION DRILLING PROGRAMME - CONSERVATION
SIGNIFICANT FLORA AND VEGETATION ASSESSMENT (WOODMAN
2010)**

ATLAS IRON LIMITED

Mount Gould DSO Project

Proposed Exploration Drilling Programme

**Conservation Significant Flora and Vegetation
Assessment**



November 2010



woodmanenvironmentalconsulting

A.C.N. 088 055 903

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Report Number: Atlas10-25-01

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TABLE OF CONTENTS

1. INTRODUCTION	1
1.1 BACKGROUND	1
2. METHODS.....	2
3. RESULTS.....	2
3.1 CONSERVATION SIGNIFICANT FLORA	2
3.2 FLORISTIC COMMUNITY TYPES	5
4. DISCUSSION AND CONCLUSIONS	7
5. RECOMMENDATIONS	9
6. REFERENCES	10

Tables

Table 1:	Conservation Significance of Flora Taxa Populations within the Project area
Table 2:	Summary of Conservation Significant Flora Taxa to be Impacted and Flagged for Avoidance at Mount Gould, August 2010
Table 3:	Floristic Community Types to be Impacted by the Proposed Mount Gould Exploration Drilling Programme

Appendices

Appendix A:	Mount Gould Drill Line Survey Data and Recommendations
Appendix B:	Definitions of Conservation Status Codes (Smith 2010)
Appendix C:	Definitions of Priority Ecological Communities (DEC 2010a)

Figures

Figure 1:	Location of Conservation Significant Flora on Proposed Drill Lines and Access Tracks – Mount Gould
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1. INTRODUCTION

Atlas Iron Limited (Atlas) is proposing to conduct preliminary exploration drilling for iron ore as part of its Mount Gould Direct Shipping Ore (DSO) Project, within tenement M52/236, located at Mount Gould. Mount Gould is located within the Mid-West Region, approximately 150 km north-east of Meekatharra, north of the Murchison River.

Woodman Environmental Consulting (Woodman Environmental) previously conducted a desktop flora and vegetation study of the Mount Gould DSO Project area ('Project area'), and a detailed flora and vegetation survey of the Project area. The level of flora and vegetation survey for the Project area was a Level 2 Survey as defined by the Environmental Protection Authority Guidance Statement 51 (EPA 2004).

Atlas have identified exploration drill lines and access tracks that they propose to clear during late 2010 for an exploration drilling programme. The area to be cleared consists of approximately 7 km of proposed drill lines and 2.4 km of proposed access tracks. Atlas commissioned Woodman Environmental to undertake searching for conservation significant flora taxa within the areas of proposed disturbance to support a Programme Of Works ('POW') application for the drill programme. This report presents the results of this survey, with information in this report intended for use as supporting documentation for Atlas' POW application for the proposed exploration drilling, to be submitted to the Department of Minerals and Petroleum (DMP).

1.1 Background

A flora and vegetation survey of the Project area was undertaken by Woodman Environmental (2009) in Spring 2008. A total of 25 permanent quadrats were established over the Project area. A total of 94 discrete vascular flora taxa, from 28 families and 53 genera, were recorded from the Project area. Of these taxa, one introduced (weed) taxon was recorded. No Declared Rare Flora (DRF) taxa were recorded within the Project area. However, three taxa of conservation significance were recorded within the Project area (Table 1). The significance of the local population of each of these taxa at Mount Gould in terms of the taxon's regional conservation was also ranked and is also listed in Table 1.

Taxon	Conservation Status	Conservation Significance Ranking (Woodman Environmental 2009)
<i>Eremophila warnesii</i>	P1	High
<i>Halgania gustafsenii</i> var. Murchison (R. Meissner & B. Bayliss 743)	P1	High
<i>Rhodanthe sphaerocephala</i>	P1	High

Woodman Environmental (2009) identified seven Floristic Community Types (FCTs) and sub-types within the Mount Gould Project area. Most FCTs consisted of tall shrublands

dominated by *Acacia aneura*, however one FCT on the summit and slopes of Mount Gould consisted of a hummock grassland dominated by *Triodia melvillei*. The study did not identify any listed Threatened Ecological Communities (TECs) within the Project area. However, comparison of quadrat data from the Project area with datasets from the nearby Robinson Range and Jack Hills indicated that the FCTs described on the summit and upper slopes of Mount Gould, including the hummock grassland of *Triodia melvillei*, do not occur elsewhere, and are therefore of high regional conservation significance.

Mount Gould itself is included as part of the Robinson Range vegetation complexes (banded ironstone formation) Priority Ecological Community (PEC), which is listed as Priority 1. There is the potential that this PEC may be listed as a TEC in the future.

2. METHODS

All proposed drill lines and tracks provided to Woodman Environmental by Atlas Iron in GIS format (excluding Lines 28 – 33) were inspected by experienced botanists in the field from the 11th- 12th of August 2010. The areas inspected included 7 km of proposed drill lines and 2.4 km of proposed tracks surveyed to a width of 20 m. Lines 28 – 33 were not inspected as these lines were located in a cleared pit area and no vegetation was present.

During inspection of drill lines and proposed access track areas, any conservation significant flora taxa located at each pad or track location that could be practically left *in situ* were flagged with red and white flagging tape for avoidance, with GPS co-ordinates and number of individuals recorded. Individuals of these flora taxa that could not practically be avoided were also recorded and not flagged.

Calculations using GIS software were undertaken to determine the area of each FCT to be impacted. These calculations were based on the entire surveyed width of 20 m for both proposed drill lines and tracks being cleared.

3. RESULTS

3.1 Conservation Significant Flora

A total of two conservation significant flora taxa were recorded as occurring on drill lines and access tracks during the survey: *Eremophila warnesii* (P1) and *Halgania gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743) (P1). The results of the survey are summarised in Table 2. Appendix A presents the raw survey data, including information regarding location of conservation significant flora and recommended avoidance procedures for these flora taxa. Figure 1 displays locations of conservation significant flora in relation to the proposed drill lines and access tracks, including areas where avoidance of significant flora has been recommended in Appendix A. Counts of individuals presented in the 'Number Potentially to be Cleared' column in Table 2 and Appendix A are based on all drill lines and tracks provided by Atlas being cleared to the surveyed width of 20 m; these totals are therefore considered to be worst-case scenario, as it is unlikely that the entire surveyed area will require clearing. Final accurate totals of number of individuals to be cleared cannot be provided at this stage, as further information on the proposed clearing

footprint is required; the final totals of number of individuals to be cleared is also dependent on whether recommendations in Appendix A are accepted. Appendix B presents descriptions of conservation significance rankings (Smith 2010).

Taxon	Drill Line Lines/Track	Number Potentially to be Cleared	Number Flagged for Avoidance
<i>Eremophila warnesii</i>	5	0	1
<i>Eremophila warnesii</i>	19	100	0
<i>Eremophila warnesii</i>	20	4	0
<i>Eremophila warnesii</i>	22	0	12
<i>Eremophila warnesii</i>	36	0	3
<i>Eremophila warnesii</i>	37	50	9
<i>Eremophila warnesii</i>	38	30	22
<i>Eremophila warnesii</i>	40	0	6
<i>Eremophila warnesii</i>	47	0	1
<i>Eremophila warnesii</i>	48	100	2
<i>Eremophila warnesii</i>	49	0	3
<i>Eremophila warnesii</i>	51	100	4
<i>Eremophila warnesii</i>	52	3	0
<i>Eremophila warnesii</i>	53	50	1
<i>Eremophila warnesii</i>	54	50	1
<i>Eremophila warnesii</i>	Track between 38-39	1	4
<i>Eremophila warnesii</i>	Track between 42-45	1	1
<i>Eremophila warnesii</i>	Track between 43-55	0	4
<i>Eremophila warnesii</i>	Track between 42-45 & Line 50	200	0
Total <i>Eremophila warnesii</i>		689	74
<i>Halgania gustafsenii</i> var. Murchison (R. Meissner & B. Bayliss 743)	12	20	0
<i>Halgania gustafsenii</i> var. Murchison (R. Meissner & B. Bayliss 743)	13	0	10
<i>Halgania gustafsenii</i> var. Murchison (R. Meissner & B. Bayliss 743)	17	0	2
<i>Halgania gustafsenii</i> var. Murchison (R. Meissner & B. Bayliss 743)	27	0	14
<i>Halgania gustafsenii</i> var. Murchison (R. Meissner & B. Bayliss 743)	Track 1 (around summit of hill)	0	3
<i>Halgania gustafsenii</i> var. Murchison (R. Meissner & B. Bayliss 743)	Track between 15-18	61	5
<i>Halgania gustafsenii</i> var. Murchison (R. Meissner & B. Bayliss 743)	Track between 6-26	0	14
Total <i>Halgania gustafsenii</i> var. Murchison (R. Meissner & B. Bayliss 743) (P1)		81	48

Eremophila warnesii (P1) is a low dense shrub to 0.5 m high, and is known from four WA Herbarium records: two from Yarlalweelor Station, one from Mount Clere Station and one from the western slopes of Mount Gould (DEC 2010b). It was noted as being abundant at one of these locations, however no information is available for the two remaining locations. Chinnock (2007) noted that the type population of this species is located on the summit of

Mount Gould, where it was found to occur in a narrow band. He also noted that this taxon is likely to be found on other hills in the area.

There are also locations of *E. warnesii* along the Meekathara - Mount Clere Road north of Meekathara, where it is common in places but relatively restricted. There are no other known locations of the taxon however it is poorly known and may be more widespread (Dr. Andrew Brown *pers. comm.*¹).

E. warnesii was recorded within one large and one smaller population at Mount Gould by Woodman Environmental (2009), with a total of 36 locations recorded. The conservation significance of the local populations in terms of its regional conservation was given a ranking of 'High' due to: less than 10 populations of this taxon being currently known, and the local population being on the boundary of its known range (Woodman Environmental 2009).

During the current survey *E. warnesii* was recorded at a number of drill lines and tracks, with a total of 689 plants potentially to be cleared and 74 plants flagged for avoidance (Table 1).

Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743) (P1) is an erect shrub to 1 m. It is restricted to the Mount Gould area, with six WA Herbarium records, all from Mount Gould itself (DEC 2010b). The single population of this taxon at Mount Gould is the only known population, with a total of five locations recorded (Woodman Environmental 2009). The conservation significance of the local population in terms of its regional conservation was ranked 'High' due to it being the only known population.

This taxon was identified by Meissner *et al.* (2007) as potentially differing from other known variants of *H. gustafsenii*, with the phrase name *H. gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743) erected in late 2008. It was also listed as Priority 1 at this time.

Numerous locations of *H. gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743) were recorded during this survey. A total of 81 plants are located on areas proposed to be cleared and 48 plants have been flagged for avoidance (Table 1).

Rhodanthe sphaerocephala (P1) was previously recorded at Mount Gould by Woodman Environmental (2009), at two locations within FCT 3 (mapped on clay pans and clay flats). This taxon was not recorded on the drill lines or access tracks inspected; although the timing of the survey was not ideal for this taxon (flowering occurring in October), the habitat requirements for this taxon differs from the areas being targeted for drilling and therefore it is very unlikely that this taxon occurs on the drill lines and access tracks.

1-Andrew Brown: Coordinator of Threatened
Flora, Species and Communities Branch, DEC

3.2 Floristic Community Types

Review of the proposed drill lines against the FCT mapping of the Mount Gould Project Area (Woodman Environmental 2009) has determined that three of the seven FCTs mapped within the Project area will potentially be impacted by the proposed drilling (Figure 1; Table 3). All of these FCTs were mapped on the lower slopes to crest of Mount Gould. These FCTs form part of the Priority 1 Mount Gould vegetation complexes (banded ironstone formation) PEC (DEC 2010a). Table 3 also presents the potential level of impact to each FCT in terms of area to be cleared (in hectares). Area totals are based on all drill lines and tracks provided by Atlas being cleared to the surveyed width of 20 m; these totals are therefore considered to be worst-case scenario, as it is unlikely that the entire surveyed area will require clearing. Final accurate areas of each FCT to be cleared cannot be provided at this stage, as further information on the proposed clearing footprint is required; the final areas of each FCT to be cleared are also dependent on whether recommendations in Appendix A are accepted. Appendix C presents descriptions of PEC conservation status rankings (DEC 2010a).

DRAFT

Floristic Community Type	Conservation Significance Ranking (Woodman Environmental 2009)	Floristic Community Type Description	Total Area Mapped (ha)	Area Potentially to be Impacted (ha)	Percentage of Mapped FCT Potentially to be Impacted
1	3	Open tall shrubland of <i>Acacia aneura</i> over sparse low shrubland of <i>Ptilotus obovatus</i> over open low forbland of <i>Goodenia tenuiloba</i>	196.73	0.87	0.44
4	5	Open tall shrubland or isolated shrubs of <i>Acacia aneura</i> over open to sparse mid shrubland of <i>Eremophila latrobei</i> and <i>Philotheca brucei</i> subsp. <i>cinerea</i> over open to sparse low shrubland and low tussock grassland of <i>Ptilotus obovatus</i> and <i>Cymbopogon ambiguus</i>	106.52	12.57	11.80
5	5	Open tall shrubland or isolated shrubs of <i>Acacia aneura</i> over open to sparse mid shrubland of <i>Eremophila latrobei</i> and <i>Philotheca brucei</i> subsp. <i>cinerea</i> over open to sparse low shrubland and low tussock grassland of <i>Ptilotus obovatus</i> and <i>Cymbopogon ambiguus</i>	27.65	5.26	19.02

4. DISCUSSION AND CONCLUSIONS

The conservation significant flora taxa *Eremophila warnesii* (P1) and *Halgania gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743) (P1) have the potential to be impacted by the proposed drilling programme at Mount Gould. Both of these taxa are restricted in distribution, with the population of *Halgania gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743) at Mount Gould being the only known population. There is no current complete population census of either taxon at Mount Gould.

Of the five original locations of *Halgania gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743) (P1) recorded by Woodman Environmental (2009) at Mount Gould, four are in areas which will not be impacted by the proposed drilling programme. However, this is the only population of this taxon known, and therefore the conservation status of this taxon has the potential to be upgraded to DRF. The impact to 81 individuals of this highly restricted taxon has the potential to be a significant impact to the population at Mount Gould. The drill lines that will be affected include lines 12, 13, 27 and the track between lines 15 and 18. Appendix A presents comments noted at each drill line with regard to where clearing should be stopped and which drill lines are not to be cleared to avoid individuals of this taxon; Figure 1 presents the drill lines where clearing should be avoided.

There is a high level of potential impact to the number of *Eremophila warnesii* individuals, with 689 individuals potentially to be impacted (Table 1). The drill lines that will be affected are lines 19, 20, 21, 37, 39, 47, 48, 51, 52, 53, 54, the track between lines 38 and 39 and the proposed track to lines 48, 49 and 50 (Figure 1). Appendix A presents comments where clearing of drill lines should be stopped, and which drill lines should not be cleared; Figure 1 presents the drill lines where clearing should be avoided. The 2008 survey of Mount Gould recorded the majority of the population of this taxon on the northern slopes of Mount Gould (Woodman Environmental 2009), and these will not be impacted by the proposed drilling programme.

The FCTs which will be impacted by the proposed drilling are considered to have high conservation significance as they are not represented elsewhere or are restricted in the region, occur on landforms that are restricted in the region and are known to contain priority flora taxa (Woodman Environmental 2009). The FCTs also form part of a Priority 1 PEC and it is therefore important that any clearing of vegetation is kept to a minimum. A footprint of the size of the area to be cleared has not been accurately defined. In order to establish if clearing will significantly impact the conservation significance of this PEC, more detailed information on the areas to be cleared will need to be provided.

During this survey it was also noted that the vegetation on Mount Gould, in particular *Halgania gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743) (P1) individuals, were in poor condition, with many apparently dead individuals. When the FCT mapping was undertaken in spring 2008, the vegetation was in much better condition (Woodman Environmental 2009). Such changes are likely due to drought conditions over the past two

years, and possibly grazing by kangaroos and feral goats. This reinforces the need to minimize, or avoid if practicable, any impacts to this taxon as a result of the proposed drilling, as the persistence of the population may also be threatened by these factors.

DRAFT

5. RECOMMENDATIONS

The following recommendations are given for the proposed exploration drilling programme at Mount Gould:

- All machinery being used in the exploration drilling programme at Mount Gould should be clean and free of weeds and plant pathogens prior to arriving at site;
- All individuals of conservation significant flora flagged with red and white tape should be avoided during the clearing process where practicable;
- Clearing of vegetation should be limited to the surveyed drill lines and tracks and should only be undertaken when necessary, to ensure minimal impact to conservation significant flora and vegetation;
- Recommendations as per stopping of clearing on drill lines and tracks, altering tracks and not clearing some drill lines altogether should be undertaken as per Appendix A;
- Individuals of both *Eremophila warnesii* (P1), and in particular *Halgania gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743) (P1), should be avoided by the proposed drilling where practical to do so.
- If there is a requirement for any further clearing that was not surveyed by Woodman Environmental, the areas should be surveyed for conservation significant flora prior to clearing;
- Survey should be conducted using DGPS to undertake an accurate tally of the position and extent of clearing following completion of drilling operations;
- Rehabilitation of exploration areas should be conducted as soon as practical, following completion of drilling activities.

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Appendix A: Mount Gould Drill Line Survey Data and Recommendations

Drill Line/Track	Priority species	E	N	Number Potentially to be cleared	Number flagged for avoidance	Comments
Line 01	-	-	-	-	-	Not surveyed, in existing disturbance (pit)
Line 02	-	-	-	-	-	-
Line 03	-	-	-	-	-	-
Line 04	-	-	-	-	-	-
Line 05	<i>Eremophila warnesii</i>	533807	7146232	-	1	At northern end of line there is a population of <i>Eremophila warnesii</i> below the cliff face, this should not be impacted.
Line 06	-	-	-	-	-	-
Line 07	-	-	-	-	-	-
Line 08	-	-	-	-	-	-
Line 09	-	-	-	-	-	-
Line 10	-	-	-	-	-	-
Line 11	-	-	-	-	-	-
Line 12	<i>Halgania gustafsenii</i> var. Murchison (R. Meissner & B. Bayliss 743)	533622	7145867	10	-	Recommended that drilling not occur south of the second GPS point as there is a large population of <i>Halgania gustafsenii</i> var. Murchison (R. Meissner & B. Bayliss 743)
		533633	7145843	10	-	
Line 13	<i>Halgania gustafsenii</i> var. Murchison (R. Meissner & B. Bayliss 743)	533551	7145864	-	10	Recommended that drilling not be undertaken at southern end of this line as there is a large population of <i>Halgania gustafsenii</i> var. Murchison (R. Meissner & B. Bayliss 743)
Line 14	-	-	-	-	-	-
Line 15	-	-	-	-	-	-
Line 16	-	-	-	-	-	-
Line 17	<i>Halgania gustafsenii</i> var. Murchison (R. Meissner & B. Bayliss 743)	533901	7146228	-	2	Plants are near a peg.
Line 18	-	-	-	-	-	-

Drill Line/Track	Priority species	E	N	Number Potentially to be cleared	Number flagged for avoidance	Comments
Line 19	<i>Eremophila warnesii</i>	533690	7146255	100	-	North of this GPS point are plants that will be impacted, recommended that drilling not be undertaken north of this GPS point
Line 20	<i>Eremophila warnesii</i>	533663	7146232	4	-	North of this GPS point are plants that will be impacted, recommended that drilling not be undertaken north of this GPS point
Line 21	-	-	-	-	-	-
Line 22	<i>Eremophila warnesii</i>	533584	7146207	-	12	Plants at northern end of line, recommended that clearing be stopped before this GPS point
Line 23	-	-	-	-	-	-
Line 24	-	-	-	-	-	-
Line 25	-	-	-	-	-	-
Line 26	-	-	-	-	-	Recommended that this line not be drilled, as track should not be cleared from line 27 to line 26 because of impacts to conservation significant flora
Line 27	<i>Halgania gustafsenii</i> var. Murchison (R. Meissner & B. Bayliss 743)	533178	7146111	-	8	Recommended that this line not be drilled as there is a large population of <i>Halgania gustafsenii</i> var. Murchison (R. Meissner & B. Bayliss 743)
		533170	7146133	-	6	
Line 28	-	-	-	-	-	Not surveyed, in existing disturbance (pit)
Line 29	-	-	-	-	-	Not surveyed, in existing disturbance (pit)
Line 30	-	-	-	-	-	Not surveyed, in existing disturbance (pit)
Line 31	-	-	-	-	-	Not surveyed, in existing disturbance (pit)
Line 32	-	-	-	-	-	Not surveyed, in existing disturbance (pit)
Line 33	-	-	-	-	-	Not surveyed, in existing disturbance (pit)
Line 34	-	-	-	-	-	-
Line 35	-	-	-	-	-	-
Line 36	<i>Eremophila warnesii</i>	534077	7147039	-	2	-
		534101	7147048	-	1	
Line 37	<i>Eremophila warnesii</i>	534106	7147129	50	-	Recommended that no clearing occur east of the first GPS Point downslope, as large population of <i>Eremophila warnesii</i> here
		534078	7147119	-	3	
		534064	7147111	-	2	
		534061	7147101	-	4	

Drill Line/Track	Priority species	E	N	Number Potentially to be cleared	Number flagged for avoidance	Comments																																																																																																																																							
Line 38	<i>Eremophila warnesii</i>	533990	7147110	-	2	Recommended that drilling not be undertaken east of second GPS Point. If drilling required, east of where this line intersects track between Line 38 and 39, use existing track as drill line. 30 <i>Eremophila warnesii</i> individuals will be impacted if existing track used; if not used, then 250+ <i>Eremophila warnesii</i> individuals will be impacted.																																																																																																																																							
		534034	7147131	30	20		Line 39	-	-	-	-	-	-	Line 40	<i>Eremophila warnesii</i>	534117	7147016	-	5	-	Line 40	<i>Eremophila warnesii</i>	534028	7146973	-	1	-	Line 41	-	-	-	-	-	-	Line 42	-	-	-	-	-	-	Line 43	-	-	-	-	-	-	Line 44	-	-	-	-	-	-	Line 45	-	-	-	-	-	-	Line 46	-	-	-	-	-	-	Line 47	<i>Eremophila warnesii</i>	534764	7146403	-	1	Recommended that drilling not occur at this GPS point	Line 48	<i>Eremophila warnesii</i>	534716	7146628	-	2	Recommended that no clearing occurs south of second GPS point to avoid impact to individuals	534735	7146621	100	-	Line 49	<i>Eremophila warnesii</i>	534762	7146628	-	1	-	534782	7146638	-	1	534790	7146639	-	1	Line 50	-	-	-	-	-	-	Line 51	<i>Eremophila warnesii</i>	534726	7146779	100	4	Recommended that no drilling occur north of this GPS point as more plants are located here	Line 52	<i>Eremophila warnesii</i>	534759	7146811	3		Cannot avoid plants, recommended that no drilling occur at the very northern end of the line	Line 53	<i>Eremophila warnesii</i>	534808	7146800	50	1	Recommended that no drilling occur north of this GPS point, as plants will be impacted	Line 54	<i>Eremophila warnesii</i>	534857	7146827	50	1	Recommended that no drilling occur north of this GPS point, as plants will be impacted	Line 55	-	-	-
Line 39	-	-	-	-	-	-																																																																																																																																							
Line 40	<i>Eremophila warnesii</i>	534117	7147016	-	5	-																																																																																																																																							
Line 40	<i>Eremophila warnesii</i>	534028	7146973	-	1	-																																																																																																																																							
Line 41	-	-	-	-	-	-																																																																																																																																							
Line 42	-	-	-	-	-	-																																																																																																																																							
Line 43	-	-	-	-	-	-																																																																																																																																							
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Line 46	-	-	-	-	-	-																																																																																																																																							
Line 47	<i>Eremophila warnesii</i>	534764	7146403	-	1	Recommended that drilling not occur at this GPS point																																																																																																																																							
Line 48	<i>Eremophila warnesii</i>	534716	7146628	-	2	Recommended that no clearing occurs south of second GPS point to avoid impact to individuals																																																																																																																																							
		534735	7146621	100	-																																																																																																																																								
Line 49	<i>Eremophila warnesii</i>	534762	7146628	-	1	-																																																																																																																																							
		534782	7146638	-	1																																																																																																																																								
		534790	7146639	-	1																																																																																																																																								
Line 50	-	-	-	-	-	-																																																																																																																																							
Line 51	<i>Eremophila warnesii</i>	534726	7146779	100	4	Recommended that no drilling occur north of this GPS point as more plants are located here																																																																																																																																							
Line 52	<i>Eremophila warnesii</i>	534759	7146811	3		Cannot avoid plants, recommended that no drilling occur at the very northern end of the line																																																																																																																																							
Line 53	<i>Eremophila warnesii</i>	534808	7146800	50	1	Recommended that no drilling occur north of this GPS point, as plants will be impacted																																																																																																																																							
Line 54	<i>Eremophila warnesii</i>	534857	7146827	50	1	Recommended that no drilling occur north of this GPS point, as plants will be impacted																																																																																																																																							
Line 55	-	-	-	-	-	-																																																																																																																																							

Drill Line/Track	Priority species	E	N	Number Potentially to be cleared	Number flagged for avoidance	Comments
Track 1 (around summit of hill)	<i>Halgania gustafsenii</i> var. Murchison (R. Meissner & B. Bayliss 743)	534475	7146305	-	1	-
		534483	7146296	-	1	
		534498	7146280	-	1	
Track between 15-18 (Track 5)	<i>Halgania gustafsenii</i> var. Murchison (R. Meissner & B. Bayliss 743)	533566	7145857	1	3	Access between Lines 11 and 13 intersects a large population of <i>Halgania gustafsenii</i> var. Murchison (R. Meissner & B. Bayliss 743). Access must divert north around GPS co-ordinate
		533577	7145854	-	2	
		533599	7145862	20	-	
		533646	7145865	40	-	
Track between 38-39	<i>Eremophila warnesii</i>	534030	7147120	-	2	Recommended that access stay to the west of flagged individuals at this point as more individuals upslope
Track between 38-39	<i>Eremophila warnesii</i>	534021	7147123	1	-	-
		534020	7147133	-	2	
Track between 42-45 (Track 2)	<i>Eremophila warnesii</i>	534600	7146694	-	1	-
		534624	7146642	1	-	
Track between 43-55 (Track 4)	<i>Eremophila warnesii</i>	534624	7146684	-	1	-
		534679	7146693	-	1	
		534709	7146694	-	2	
Track between 6-26	<i>Halgania gustafsenii</i> var. Murchison (R. Meissner & B. Bayliss 743)	533290	7146096	-	1	Recommended that the section of track between lines 25 and 27 not be cleared because numerous individuals will be impacted
		533220	7146117	-	1	
		533194	7146119	-	8	
		533153	7146122	-	4	
Track between track between 42-45 and Line 50	<i>Eremophila warnesii</i>	534743	7146599	200		Recommended that this track not be cleared; to avoid impacts to individuals, use a track from the northern end of each line, as no individuals were recorded there
Totals	<i>Eremophila warnesii</i>			689	74	
	<i>Halgania gustafsenii</i> var. Murchison (R. Meissner & B. Bayliss 743)			81	48	

Appendix B: Definitions of Conservation Status Codes (Smith 2010)

R: Declared Rare Flora – Extant Taxa

Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such.

X: Declared Rare Flora – Presumed Extinct Taxa

Taxa which have not been collected, or otherwise verified, over the past 50 years despite thorough searching, or of which all known wild populations have been destroyed more recently, and have been gazetted as such.

1: Priority One – Poorly Known Taxa

Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat, e.g. road verges, urban areas, farmland, active mineral leases, etc., or the plants are under threat, e.g. from disease, grazing by feral animals, etc. May include taxa with threatened populations on protected lands. Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.

2: Priority Two – Poorly Known Taxa

Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.

3: Priority Three – Poorly Known Taxa

Taxa which are known from several populations, and the taxa are not believed to be under immediate threat (i.e. not currently endangered), either due to the number of known populations (generally >5), or known populations being large, and either widespread or protected. Such taxa are under consideration for declaration as 'rare flora' but are in need of further survey.

4: Priority Four – Rare Taxa

Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5-10 years.

Appendix C: Definitions of Priority Ecological Communities (DEC 2010a)

3. DEFINITIONS AND CRITERIA FOR PRIORITY ECOLOGICAL COMMUNITIES

PRIORITY ECOLOGICAL COMMUNITY LIST

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

Priority One: Poorly-known ecological communities

Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and 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.

Priority Two: Poorly-known ecological communities

Communities that are known from few small occurrences, all or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, State forest, unallocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.

Priority Three: Poorly known ecological communities

- (i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or;
- (ii) communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or;
- (iii) communities made up of large, and/or widespread occurrences, that may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes.

Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.

Priority Four: Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring.

- (a) Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands.
- (b) Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.
- (c) Ecological communities that have been removed from the list of threatened communities during the past five years.

Priority Five: Conservation Dependent ecological communities

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

**APPENDIX 6: LOCAL AND REGIONAL SIGNIFICANT FLORA
ASSESSMENT AND REGIONAL VEGETATION REVIEW (WOODMAN
2012)**

ATLAS IRON LIMITED

MOUNT GOULD DSO PROJECT

**LOCAL AND REGIONAL SIGNIFICANT FLORA
ASSESSMENT AND REGIONAL VEGETATION
REVIEW**



April 2012



woodmanenvironmentalconsulting

A.C.N. 088 055 903

DOCUMENT REVISION HISTORY

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0	Final Report	DC	GW	12/04/2012		

Report Reference: Atlas11-23-01

Cover Photo: *Halgania gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743) (P1) with Mount Gould in the background (Woodman Environmental)

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TABLE OF CONTENTS

EXECUTIVE SUMMARY	i
1. INTRODUCTION.....	1
1.1 PROJECT AND SURVEY BACKGROUND	1
1.2 OBJECTIVES.....	2
2. METHODS.....	3
2.1 PROJECT AREA SURVEY FOR CONSERVATION SIGNIFICANT TAXA	3
2.2 REGIONAL SURVEY FOR CONSERVATION SIGNIFICANT TAXA.....	4
2.3 LIMITATIONS OF SURVEY	5
2.4 REVIEW OF MOUNT GOULD VEGETATION COMPLEXES PEC INFORMATION.....	5
3. RESULTS.....	6
3.1 PROJECT AREA SURVEY FOR CONSERVATION SIGNIFICANT TAXA	6
3.2 REGIONAL SURVEY FOR CONSERVATION SIGNIFICANT TAXA.....	8
3.3 REVIEW OF MOUNT GOULD VEGETATION COMPLEXES PEC INFORMATION.....	10
4. DISCUSSION AND CONCLUSIONS	12
4.1 PROJECT AREA AND REGIONAL SURVEY FOR CONSERVATION SIGNIFICANT TAXA.....	12
4.2 REVIEW OF MOUNT GOULD VEGETATION COMPLEXES PEC INFORMATION.....	15
5. RECOMMENDATIONS.....	17
6. REFERENCES	18

APPENDICES

Appendix A:	Conservation Codes for Western Australian Flora (DEC 2012a)
Appendix B:	Results of Search of the Department of Environment and Conservation's W.A. Herbarium Specimen database and Declared Endangered Flora List database (DEFL)
Appendix C:	Point Locations of Significant Flora Taxa Recorded During 2011 Survey

FIGURES

Figure 1:	Method of Survey of Project Area for Conservation Significant Flora, 2011
Figure 2:	Regional Areas Searched for Conservation Significant Flora, 2011
Figure 3a:	Distribution of <i>Eremophila warnesii</i> (P1) in the Project Area, 2011
Figure 3b:	Distribution of <i>Halgania gustafsenii</i> var. Murchison (R. Meissner & B. Bayliss 743) (P1) in the Project Area, 2011
Figure 3c:	Distribution of <i>Rhodanthe sphaerocephala</i> (P1) in the Project Area, 2011
Figure 3d:	Distribution of <i>Tribulus adelacanthus</i> (P3) in the Project Area, 2011
Figure 4a:	Regional Distribution of <i>Eremophila warnesii</i> (P1), 2011

Figure 4b: Regional Distribution of *Halgania gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743) (P1), 2011

TABLES

Table 1: Summary of Results of Survey of Project Area, 2011

Table 2: Summary of Results of Regional Survey for *Eremophila warnesii* and *Halgania gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743), 2011

PLATES

Plate 1: *Eremophila warnesii* (P1), Yarlalweelor Station

Plate 2: *Halgania gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743) (P1)

EXECUTIVE SUMMARY

Atlas Iron Limited (Atlas) is proposing to conduct preliminary exploration drilling for iron ore as part of its Mount Gould Direct Shipping Ore (DSO) Project, within tenement M52/236, located at Mount Gould. Mount Gould is a large ironstone hill located on the privately leased Mount Gould Pastoral Station within the Mid-West Region, approximately 150 km north-west of Meekatharra, just north of the Murchison River.

Previous surveys of the Mount Gould Project area (Project area) identified populations of 4 conservation significant flora taxa within the Project area, as listed below:

- * *Eremophila warnesii* (P1)
- * *Halgania gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743) (P1)
- * *Rhodanthe sphaerocephala* (P1)
- * *Tribulus adelacanthus* (P3)

The populations of *E. warnesii* and *H. gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743) are located on and near proposed exploration drill lines on Mount Gould, and could potentially be significantly impacted.

The vegetation on Mount Gould was listed as a Priority Ecological Community (PEC) in 2009, as Mount Gould Vegetation complexes (Priority 1). This ranking remains current. Based on current knowledge, the vegetation on Mount Gould, particularly near the summit, is not known from elsewhere, and hence could significantly constrain future development in the Project area.

As exploration drilling is proposed, with the potential for mining of the iron ore resource to also occur, Atlas commissioned Woodman Environmental Consulting Pty Ltd ('Woodman Environmental') to accurately map the distribution and record abundance of all conservation significant flora taxa within the Project area, to allow for impacts to these taxa as a result of proposed drilling or mining to be accurately assessed. Woodman Environmental were also commissioned to conduct a regional search for further populations of *E. warnesii* and *H. gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743), to provide additional contextual data when assessing any future proposed impacts to these taxa, and to conduct a review of relevant literature and available data to determine targets for survey for additional areas of the vegetation occurring on Mount Gould.

Both *E. warnesii* and *H. gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743) were found to be relatively common in the Project area, particularly on Mount Gould. *E. warnesii* was generally restricted to the northern upper slopes of Mount Gould, while *H. gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743) was most common on the steep lower slopes of Mount Gould, occasionally extending to the mid slopes, however numerous individuals were also somewhat unexpectedly recorded on gently sloping stony areas at the base of the western side of Mount Gould. *Tribulus adelacanthus* was also found to be relatively common in the Project area, being recorded at numerous locations, however was generally restricted to the gently sloping stony areas at the base of Mount Gould. *R. sphaerocephala* was recorded at only 4 locations in 2011; all were new locations, with the species not recorded 2 historical known locations.

Both *E. warnesii* and *H. gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743) (both P1) were recorded during regional survey for these taxa. *E. warnesii* was recorded from 4 discreet areas during the regional survey, which are considered to represent 4 populations. These populations were distributed over a distance of approximately 60 km east-west, and 6 km north-south. One population is an extension of the population recorded within the Project area, with the remaining 3 populations recorded on Yarlalweelor Station. A total of 780 individuals were recorded across the 4 populations (excluding individuals within the Project area). *H. gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743) was recorded only from the Mount Gould area during the regional survey, where 2 populations were identified (Figure 4b). One population is an extension of the population recorded within the Project area, with the second population located approximately 2 km north of Mount Gould. A total of 689 individuals were recorded across the 2 populations (excluding individuals within the Project area).

The regional populations of *E. warnesii* and *H. gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743) taxa are very small compared to the population in the Project area. Therefore, if a large proportion of the population in the Project area were to be impacted in the future, the regional impacts to the taxon would still be considered high based on the results of this survey, and further regional survey may be required to prove the existence of other large populations. However, it is considered that there is a strong likelihood that there are significant numbers of individuals that were not recorded during this survey because of time constraints; a preliminary review of aerial photography in the vicinity of the recorded populations indicates that large areas of appropriate habitat occur. These habitat areas would be considered a primary target for further regional survey if required.

The review of information relating to the Mount Gould vegetation complexes PEC demonstrates that there is evidence that the vegetation present on Mount Gould as a whole differs from those on nearby ranges. A strong trend towards dissimilarity of specific vegetation units between Mount Gould and other nearby ranges has also been demonstrated. This indicates that the Mount Gould vegetation complexes PEC as currently defined is unlikely to occur anywhere else, as the vegetation complexes referred to in the PEC description are statistically different in terms of species composition from other nearby ranges. However, it is likely that specific vegetation units that form part of the vegetation complexes occur elsewhere, although this is unlikely to extend to the vegetation units that occur at the summit of Mount Gould, including vegetation units dominated by *Triodia melvillei*. These have been demonstrated to be dissimilar to superficially similar vegetation units on nearby ranges.

It is therefore important that the validity of further regional survey for the Mount Gould vegetation complexes PEC be discussed with the Department of Environment and Conservation prior to any survey being conducted. Further survey would only be worthwhile if the demonstration of occurrences of specific vegetation units elsewhere in the region is considered by the DEC to be appropriate when considering impacts within the Project area in a regional context. If this is not considered appropriate, then minimising disturbance to Mount Gould remains the only option to minimise impacts to the Mount Gould vegetation complexes PEC.

The following recommendations are given:

1. Conservation significant flora taxa located within the Project area should be avoided where possible during future proposed exploration and mining activities, particularly the highly restricted *Halgania gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743) and *Eremophila warnesii* (both P1)
2. A desktop impact assessment should be undertaken prior to any proposed future exploration and mining activities using data collected during this survey, to quantify local and regional impacts to conservation significant flora taxa, and determine whether further regional survey for conservation significant flora taxa is required.
3. The DEC should be engaged in discussions regarding further survey for the Mount Gould vegetation complexes PEC, to determine the validity of further survey, and if deemed valid, to agree on appropriate methods for further survey.

1. INTRODUCTION

1.1 Project and Survey Background

Atlas Iron Limited (Atlas) is proposing to conduct preliminary exploration drilling for iron ore as part of its Mount Gould Direct Shipping Ore (DSO) Project, within tenement M52/236, located at Mount Gould. Mount Gould is a large ironstone hill located on the privately leased Mount Gould Pastoral Station within the Mid-West Region, approximately 150 km north-west of Meekatharra, just north of the Murchison River. Woodman Environmental Consulting Pty Ltd ('Woodman Environmental') conducted a detailed flora and vegetation survey of the Project area in 2008 (Woodman Environmental 2009), as well as a targeted conservation significant flora survey of a number of proposed exploration drill lines in 2010 (Woodman Environmental 2010). A portion of the Project area was also sampled by the Department of Environment and Conservation (DEC) as part of a survey of Mount Gould and the Robinson Range (located 80 km east of Mount Gould) in 2006 (Meissner *et al.* 2009).

The above surveys identified populations of 4 conservation significant flora taxa within the Project area, as listed below:

- * *Eremophila warnesii* (P1)
- * *Halgania gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743) (P1)
- * *Rhodanthe sphaerocephala* (P1)
- * *Tribulus adelacanthus* (P3)

It is worthy of note that *Tribulus adelacanthus* (P3) was not listed as a Priority flora taxon at the time of survey by Woodman Environmental in 2008, and therefore was not reported as such (Woodman Environmental 2009). This taxon has been recently elevated to Priority 3 status, likely because there are only a handful of collections lodged at the W.A. Herbarium (DEC 2012a). Appendix A presents conservation codes for Western Australian flora (DEC 2012a).

Of the taxa listed above, the populations of *E. warnesii*, *H. gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743) and *R. sphaerocephala* in the Project area were considered to be of High significance to the overall conservation significance of each taxon (Woodman Environmental 2009). This is still considered an accurate assessment; all taxa are known from few records with little information on abundance (DEC 2012a), with *H. gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743) only known from the Project area. The population of *T. adelacanthus* in the Project area was not assessed for significance by Woodman Environmental (2009), however it is considered that this population is significant with regard to the overall conservation significance of the taxon, as currently only 4 confirmed collections are lodged at the W.A. Herbarium (DEC 2012a).

In terms of potential impacts from future drilling or mining, *R. sphaerocephala* is only known from clay pans on the western boundary of the Project area, while *T. adelacanthus* is only known from stony undulating areas in the north-east corner of the Project area. It is therefore considered that neither of these taxa is likely to be significantly impacted by future mining or drilling. However, the populations of *E.*

warnesii and *H. gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743) are located on and near proposed exploration drill lines on Mount Gould, and could potentially be significantly impacted.

Woodman Environmental (2009) identified seven Floristic Community Types (FCTs) (equivalent to a vegetation unit) and sub-types within the Project area. Most FCTs consisted of tall shrublands dominated by *Acacia aneura*, however one FCT on the summit and slopes of Mount Gould consisted of a hummock grassland dominated by *Triodia melvillei*. The study did not identify any listed Threatened Ecological Community (TEC) within the Project area. However, comparison of quadrat data from the Project area with datasets from the nearby Robinson Range and Jack Hills indicated that the FCTs described on the summit and upper slopes of Mount Gould, including the spinifex vegetation unit of *T. melvillei*, do not occur elsewhere, and are therefore of high regional conservation significance. This was supported by Meissner *et al.* (2009), who also described several FCTs at Mount Gould, and also noted that the spinifex vegetation unit near the summit of Mount Gould differed from superficially similar vegetation units from the Robinson Range and Jack Hills.

The vegetation on Mount Gould was listed as a Priority Ecological Community (PEC) in 2009, as Mount Gould Vegetation complexes (Priority 1) (DEC 2009). This ranking remains current (DEC 2011a). Based on current knowledge, the vegetation on Mount Gould, particularly near the summit, is not known from elsewhere, and hence could significantly constrain future development in the Project area.

As exploration drilling is proposed, with the potential for mining of the iron ore resource to also occur, Atlas commissioned Woodman Environmental Consulting Pty Ltd ('Woodman Environmental') to accurately map the distribution and record the abundance of all conservation significant flora taxa within the Project area, to allow for impacts to these taxa as a result of proposed drilling or mining to be accurately assessed. A regional search for further populations of the conservation significant flora taxa that could potentially be significantly impacted by future exploration drilling and mining (*E. warnesii* and *H. gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743)) was commissioned, to provide additional contextual data when assessing any future proposed impacts to these taxa. Woodman Environmental were also commissioned to conduct a review of relevant literature and available data to determine targets for survey for additional areas of the vegetation occurring on Mount Gould, and prepare a plan to undertake such a survey. This survey would provide additional contextual data when assessing any future proposed impacts to the PEC.

1.2 Objectives

The objectives of this survey and report are:

- Map and census all conservation significant flora taxa previously recorded in the Project area, and any other known or potential conservation significant flora taxa not previously recorded in the Project area;
- Review DEC databases, publicly available flora survey documents and any other relevant datasets to identify likely targets for survey for additional populations of the Priority flora taxa *Eremophila warnesii* and *Halgania gustafsenii* var.

Murchison (R. Meissner & B. Bayliss 743) (both P1) in the region surrounding the Project area;

- Survey identified likely areas in the region for the above conservation significant flora taxa;
- Prepare a report and maps presenting the results of the surveys in a format suitable for use in preparing impact assessments for future exploration and mining activities;
- Review Government databases, publicly available vegetation survey documents and other relevant datasets to identify likely targets for survey for additional areas of the vegetation units making up the Mount Gould Vegetation complexes PEC; and
- Prepare a proposed survey plan (as part of the aforementioned report) to undertake additional regional mapping of potential areas of vegetation equivalent to the Mount Gould Vegetation complexes PEC, based on information gained from the review above.

2. METHODS

2.1 Project Area Survey for Conservation Significant Taxa

Survey of the Project area for conservation significant flora was undertaken by experienced botanists from Woodman Environmental over 2 visits in 2011, from the 8th – 12th of August, and from the 12th – 16th September. Flora collecting permits for the botanists are listed below:

David Coultas: SL009406 (flora collecting permit); 149-1011 (DRF collecting permit)
Alison Saligari: SL009407 (flora collecting permit); 153 1011 (DRF collecting permit)
John Grantham: SL009434 (flora collecting permit)
Neal Henshaw: SL009410 (flora collecting permit)
Bethea Loudon: SL009414 (flora collecting permit); 64-1112 (DRF collecting permit)
Lisa McFarlane: SL009435 (flora collecting permit)

Prior to survey, a review of potential appropriate habitat areas for *Eremophila warnesii*, *Halgania gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743) and *Tribulus adelacanthus* was undertaken, with potential appropriate habitat determined using known locations of these taxa, as well as topographical and soil characteristics. Potential appropriate habitat areas were then traversed on foot in a grid pattern, with grid lines 30 m apart and varying in direction depending on the topography of the habitat. This distance was deemed desirable in terms of both time efficiency and data quality; *E. warnesii* and *H. gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743) are shrubs that can usually be seen for some distance, however the terrain in the Project area is steep and undulating, meaning that in some instances visibility was restricted either side of the walked line, and hence lines were required to be relatively close together. *T. adelacanthus* is also a small herb that can only be seen from relatively short (approximately 15 m) distances away. As *R. sphaerocephala* is only known from claypans on the eastern boundary of the Project area, only clay pan areas were targeted for searching for this taxon. All clay pan areas were inspected on foot, however because of the very bare and open nature and generally small size of the clay pans, a grid pattern was not followed; rather, all patches of ephemeral taxa seen were inspected.

Areas traversed during the survey are displayed on Figure 1. Approximately 370 ha of the Project area was inspected.

GPS co-ordinates of each Priority flora taxon individual, or clump of individuals when numerous individuals occurred within a few metres of each other, were recorded, along with the number of individuals occurring at the GPS co-ordinate. Any further taxa encountered that were considered to possibly represent a conservation significant flora taxon were also recorded in this fashion, with specimens collected for identification at the W.A. Herbarium. All conservation codes were checked for currency using the DEC's *Florabase* online database (DEC 2012a), as this contains the most up-to-date information on the conservation status of all taxa in Western Australia.

2.2 Regional Survey for Conservation Significant Taxa

Initially, all available existing data on the biology, habitat preference and known locations of *Eremophila warnesii* and *Halgania gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743) was sourced. This included obtaining specimen information and locality details from the W.A. Herbarium's specimen database and the DEC's Declared Endangered Flora (DEFL) database (DEC 2011b) (Appendix B). All locations of these taxa obtained were then overlaid on aerial photography of the region surrounding the Project area. The locations were then reviewed together with habitat preference information, to determine prospective locations for targeted searches. Other factors considered when selecting prospective locations for searches included proximity of access tracks, land tenure (e.g. pastoral station, nature reserve, Aboriginal reserve) and the presence of active mining or mineral exploration, as this could restrict access.

Targeted searches were undertaken by experienced botanists from Woodman Environmental from the 30th August to the 1st September 2011. Flora collecting permits for the botanists are listed below:

Bethea Loudon: SL009414 (flora collecting permit); 64-1112 (DRF collecting permit)
Kim Kershaw: SL009404 (flora collecting permit); 150-1011 (DRF collecting permit)

Attempts were made to visit as many of the areas identified as prospective prior to the field survey as possible, with further refinement of search areas undertaken in the field, based on factors such as topography and substrate. Most areas accessed were traversed on foot, with spacing of personnel dependent on factors such as density of vegetation and topography. Searching was also undertaken from the vehicle where appropriate. Figure 2 displays areas searched during the survey. Any populations discovered were recorded using similar methods to those outlined in Section 2.1, with voucher specimens collected at each population for lodgement at the W.A. Herbarium. The limit of any populations discovered was defined where possible, however, due to time constraints, this was not possible at all locations. If no individuals were found at known historical locations, attempts were made to survey any habitat in the vicinity (i.e. within approximately 500 m) of the locations, however this was also dependent on time constraints.

2.3 Limitations of Survey

The timing of the survey coincided with the peak flowering period for most taxa within the region (including both taxa targeted as part of regional searches), and is therefore considered to have been an appropriate survey time. The Mount Gould region is also likely to have received reasonable rainfall in the lead-up to the survey; Meekatharra, the nearest meteorological station to the Project area, received approximately 35 mm of rain in July, with a further 27 mm falling in August prior to the survey (Bureau of Meteorology 2011a). This is above the long-term average for both months (22 mm and 11.5 mm respectively) (Bureau of Meteorology 2011b). This resulted in the vegetation being in excellent condition, with all conservation significant taxa either in flower or at least in good condition for identification.

Because of time constraints, regional survey was generally concentrated on known locations of *Eremophila warnesii* and *Halgania gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743), and on hills in the immediate vicinity of the Project area, which were considered the most prospective area for populations of the targeted conservation significant taxa to be located. Access was sought and granted to pastoral stations on which known locations of the above taxa and nearby prospective hills and ranges, with a number of tracks and roads identified and utilised. However, there were still significant prospective areas of ranges that could not be accessed in the time allocated for the survey. The large distances between known locations, and the difficulty in accessing several locations, also meant that limited time could be spent searching at each location.

Botanists from Woodman Environmental have had previous experience at Mount Gould, and were familiar with all conservation significant taxa known from the Project area prior to this survey. However, known locations of each taxon were visited prior to conducting the survey, to re-familiarise with the field appearance of each taxon. The botanists were therefore adequately experienced and skilled to undertake the survey.

2.4 Review of Mount Gould Vegetation Complexes PEC Information

As the description of the Mount Gould PEC specifically refers to vegetation complexes on Mount Gould, all publicly available relevant reports relating to vegetation units at and in the vicinity of Mount Gould were sourced and reviewed, to gain an understanding of the composition and distribution of these vegetation units, and hence identify areas potentially containing equivalent vegetation units to those of Mount Gould. The following reports were reviewed:

- Flora and Vegetation of Banded Iron Formations of the Yilgarn Craton: Jack Hills (Meissner & Caruso 2008);
- Flora and Vegetation of the Banded Iron Formation of the Yilgarn Craton: Robinson Ranges and Mount Gould (Meissner *et al.* (2009);
- Review of Differences in Communities on the Jack Hills Project Area (Mattiske Consulting Pty Ltd 2010);
- Report for Jack Hills – *Triodia melvillei* Community Assessment (GHD 2009);

- Patterns of Plant Diversity in Ironstone Ranges in Arid South Western Australia (Gibson *et al.* 2012);
- Vegetation units of the Ironstone Ranges of South Western Australia: Hotspots for Plant Diversity and Mineral Deposits (Gibson *et al.* 2010);
- Flora and Vegetation of the Jack Hills (Mattiske Consulting Pty Ltd 2005).

Section 3.3 provides a summary of current information regarding the vegetation complexes on Mount Gould, and details potential future survey based on this information.

3. RESULTS

3.1 Project Area Survey for Conservation Significant Taxa

All conservation significant flora taxa listed in Section 1.1 were recorded in the Project area during this survey. A summary of the results of this survey, with respect to each taxon, is presented in Table 1 below. Figures 3a-d displays point locations of each taxon, with these locations also presented in Appendix C. There were no additional conservation significant taxa recorded in the Project area during this survey.

Both *Eremophila warnesii* and *Halgania gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743) were found to be relatively common in the Project area, particularly on Mount Gould. *E. warnesii* was generally restricted to the northern upper slopes of Mount Gould, however several small patches of individuals were found on mid to lower slopes (Figure 3a). It often occurred at high densities over relatively large areas. *H. gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743) was most common on the steep lower slopes of Mount Gould, occasionally extending to the mid slopes, however numerous individuals were also somewhat unexpectedly recorded on gently sloping stony areas at the base of the western side of Mount Gould (Figure 3b). This taxon also grew in relatively high densities on the lower slopes of Mount Gould, however occurred as scattered individuals on the gently sloping stony areas at the base of Mount Gould.

As for *E. warnesii* and *H. gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743), *Tribulus adelacanthus* was found to be relatively common in the Project area, being recorded at numerous locations, however was generally restricted to the gently sloping stony areas at the base of Mount Gould (Figure 3d). *R. sphaerocephala* was recorded at only 4 locations in 2011; all were new locations, with the species not recorded at the 2 known locations (previously recorded in 2008 (Woodman Environmental 2009)). As per the locations recorded in 2008, all 4 new locations were in clay pans (Figure 3c).

The populations of all taxa were generally considered to be healthy, however numerous dead *E. warnesii* individuals were noted, potentially related to previous drought stress as identified by Woodman Environmental (2010). No impacts as a result of grazing by stock or other herbivores (native or introduced) were noted.

Table 1: Summary of Results of Survey of Project Area, 2011

Taxon	Conservation Code	Total Number of Locations	Total Number of Individuals	Relative Abundance and Distribution in Project Area
<i>Eremophila warnesii</i>	P1	327	13,339	Common, mostly restricted to northern slopes (predominantly upper slopes) of Mount Gould
<i>Halgania gustafsenii</i> var. Murchison (R. Meissner & B. Bayliss 743)	P1	1,028	12,833	Common; restricted to the north-eastern corner of Project area
<i>Rhodanthe sphaerocephala</i>	P1	4	20	Rare, restricted to clay pans on the western edge of the Project area
<i>Tribulus adelacanthus</i>	P3	183	2,126	Common, restricted to lower slopes of Mount Gould, and undulating stony areas in the north-eastern part of the Project area

3.2 Regional Survey for Conservation Significant Taxa

Both *Eremophila warnesii* and *Halgania gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743) (both P1) were recorded during regional survey for these taxa. Table 2 below summarises the results of the regional survey, while each taxon is discussed in detail below. Point locations of each taxon are presented in Appendix C, and are displayed on Figures 4a-b.

Table 2: Summary of Results of Regional Survey for *Eremophila warnesii* and *Halgania gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743), 2011

Taxon	Conservation Code	Approximate Number of Populations Recorded	Total Number of Locations	Total Number of Individuals
<i>Eremophila warnesii</i>	P1	4	15	780
<i>Halgania gustafsenii</i> var. Murchison (R. Meissner & B. Bayliss 743)	P1	2	75	689

E. warnesii was recorded from 4 discreet areas during the regional survey, which are considered to represent 4 populations (Figure 4a). These populations were distributed over a distance of approximately 60 km east-west, and 6 km north-south. One population is an extension of the population recorded within the Project area, which was originally identified in 1993 (DEC 2012a). The remaining 3 populations were recorded on Yarlarweelor Station; 1 was located at a known record of this taxon, a second was located in the vicinity of the same known record, with the final population located in the vicinity of another known record of this taxon, however not at the given coordinates of the record (Figure 4a). A further 3 of the 4 remaining known records of this taxon were visited, however no individuals were identified at these locations; this is discussed in Section 4.1. The remaining known location was determined to be potentially erroneous; this is also discussed further in Section 4.1.

A total of 780 individuals were recorded across the 4 populations (excluding individuals within the Project area). The 3 populations on Yarlarweelor Station are relatively small, with less than 120 individuals in each; however this may not represent the total extent of the populations, as only individuals in the vicinity of access tracks were counted. The population on Mount Gould is by far the largest (in excess of 13,000 individuals), however the majority of the population is in the Project area, with the proportion outside of the Project consisting of approximately 550 individuals.

E. warnesii was recorded on 2 widely different habitat types during the survey. The population in and just outside the Project area mostly occurs on skeletal soils on the steep rocky ironstone slopes of Mount Gould, where dense patches of individuals frequently occur. However, the remaining 3 populations on Yarlarweelor Station occur in minor drainage lines or on low floodplains, generally on deeper sandy clay loam soils, with individuals also generally more scattered. All populations were noted as having numerous dead individuals, potentially related to previous drought stress,

however were considered to be in healthy condition overall, with no signs of impact from grazing by stock or other herbivores observed.



Plate 1: *Eremophila warnesii* (P1), Yarlarweelor Station (Photos: Woodman Environmental)

H. gustafsenii var. Murchison (R. Meissner & B. Bayliss 743) was recorded only from the Mount Gould area during the regional survey, where 2 populations were identified (Figure 4b). One population is an extension of the population recorded within the Project area, with the second population located approximately 2 km north of Mount Gould. A total of 689 individuals were recorded across the 2 populations (excluding individuals within the Project area). The population north of Mount Gould is relatively small, with 191 individuals recorded; this may not represent the total extent of the population, as it occurs on a linear ridge that was not completely surveyed because of time constraints, however it is not expected that a large number of individuals would occur on the unsurveyed part of the ridge. The population on Mount Gould is by far the largest (in excess of 12,800 individuals), however the majority of the population is in the Project area, with the proportion outside of the Project consisting of approximately 498 individuals. All individuals were recorded on stony areas; the majority of individuals occur on the steep foot and mid slopes of Mount Gould, however a significant number occur on undulating stony areas, including low ridges. All populations were noted as being in healthy condition overall, with no signs of impact from grazing by stock or other herbivores observed.

Searching for this taxon was undertaken at the very northern end of the Jack Hills, namely on Mount Taylor, approximately 13 km south of Mount Gould. A collection of

a taxon thought to be *H. gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743) was made on Mount Taylor, however this was subsequently identified as *H. gustafsenii* var. *gustafsenii* ms by W.A. Herbarium botanist Steve Dillon. No other populations were identified, including while conducting searches for *E. warnesii*. According to W.A. Herbarium and DEFL records, this taxon has previously only been collected from Mount Gould; the co-ordinates for 1 record plot just to the west of Mount Gould near the Mount Gould lock-up (Figure 4b), however the locality details stipulate 'Mount Gould', and therefore the co-ordinates are likely to be erroneous. A review of aerial photography also indicates that the co-ordinates for this record plot on a low floodplain (Figure 4b), which is unlikely to be suitable habitat, given all other individuals were recorded on stony areas. The location of this record was therefore not visited.



Plate 2: *Halgania gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743) (P1)
(Photos: Woodman Environmental)

Additionally, further locations of *Tribulus adelacanthus* were also recorded during the regional survey, within the vicinity of Mount Gould. Point locations are presented in Appendix C.

3.3 Review of Mount Gould Vegetation Complexes PEC Information

The review of the reports listed in Section 2.4 has demonstrated that a relatively large amount of survey of the vegetation present on Mount Gould has already occurred, and also on nearby ironstone ranges of similar elevation and morphology to Mount Gould. This includes Woodman Environmental's survey of the Project area (Woodman

Environmental 2009) and the DEC's survey of Mount Gould and the Robinson Range (Meissner *et al.* 2009). Additionally, Matiske Consulting Pty Ltd (2005) established quadrats on Mount Gould as part of regional surveys to provide regional context for vegetation units on the Jack Hills, for the Jack Hills Iron Ore Project. GHD (2009) also conducted survey on Mount Gould, as well as several other nearby ranges, as part of regional surveys for *Triodia melvillei*-dominated vegetation units for the Jack Hills Expansion Project.

Several studies have assessed the similarity of vegetation units across Mount Gould, the Jack Hills and the Robinson Range by comparing the similarity of individual quadrats to each other. According to the studies of both Meissner *et al.* (2009) and Woodman Environmental (2009), the vegetation units present on Mount Gould, particularly vegetation units at the summit, were dissimilar from those recorded on the Robinson Range. Both studies statistically analysed quadrat data from both Mount Gould and the Robinson Range, using the same method (classification of quadrats based on similarity in perennial species composition only). And while both studies found a trend towards similarity of lower slope vegetation units between Mount Gould and the Robinson Range, both studies found that several summit vegetation units were restricted to either Mount Gould or the Robinson Range based on quadrat groupings, including *Triodia melvillei*-dominated vegetation units. Further to this, Meissner *et al.* (2009) also found that the soil chemistry, surface rockiness and slope that the *Triodia melvillei*-dominated vegetation units on Mount Gould and the Robinson Range occurred on was very different, despite the similar topographical positions of the vegetation units.

Woodman Environmental (2009) also statistically analysed quadrat data from both Mount Gould and the Jack Hills, and demonstrated a similar trend, with 3 vegetation units described from the summit and slopes of Mount Gould, including a *Triodia melvillei*-dominated vegetation unit, appearing dissimilar from vegetation units present on the summits of the Jack Hills, with lower slope vegetation units again appearing similar. This trend was also noted by Meissner *et al.* (2009), however it was also noted that the analysis comparing Mount Gould and Jack Hills data was preliminary.

The trend towards dissimilarity between vegetation on ironstone ranges has also been documented by Gibson *et al.* (2012), who analysed species composition data from 24 ironstone ranges in arid south western Australia, including Mount Gould, the Robinson Range and the Jack Hills. They found that while ranges located closer together tended to be more similar to each other in terms of species composition, all 24 ranges were significantly different in terms of species composition (analysis was conducted using Permanova). This dissimilarity appears to be largely driven by the rapid turnover of regional perennial species pools (Gibson *et al.* 2012). A similar result was documented by Gibson *et al.* (2010), albeit on a smaller scale, with the study demonstrating high species composition change between 4 ironstone ranges located within 60 km of each other in the Goldfields area of Western Australia. The study found that much of this compositional change was not explained by climate and geology, which often drive compositional change, as all the ranges were similar in these respects. The compositional change is likely to be a result of historical biogeography and stochastic processes, in combination with other ecological factors.

The above results are contradicted to an extent by that of both Matiske Consulting Pty Ltd (2005) and Matiske Consulting Pty Ltd (2010). Matiske Consulting Pty Ltd

(2005) mapped the same *Triodia melvillei*-dominated vegetation units on both Mount Gould and the Jack Hills. However, it is apparent that the sampling on Mount Gould was limited (several quadrats), and that the vegetation units were mapped based on structure rather than species composition, as no mention is made of any statistical analysis. This is therefore not considered to constitute sufficient evidence that the vegetation units on Mount Gould are present on the Jack Hills.

Mattiske Consulting Pty Ltd (2010) also determined that there were some similarities between *Triodia melvillei*-dominated vegetation units on the Jack Hills to that on Mount Gould, and on several other ranges in the region surrounding the Jack Hills. This incorporated data collected by GHD (2009) from the Robinson Ranges, the Kennedy Ranges, Mount Gould, and several other ranges in the region. The sampling of the regional ranges during this survey, including Mount Gould, was relatively limited (several quadrats on each range). One analysis undertaken (using similar methods described above for Meissner *et al.* 2009), although showing some alignment of quadrats from Jack Hills with those on other ranges (including Mount Gould), did not demonstrate any firm trends in similarity of quadrats from the other ranges, particularly Mount Gould quadrats. This probably reflects the limited sampling on the other ranges. A separate analysis used combined species lists from sites containing *Triodia melvillei* from each of the ranges, and compared these lists against each other. This analysis is insufficient in determining differences in vegetation units, as it essentially compared a 'total' species list from each range to each other, rather than multiple sub-samples of the vegetation (as provided by individual quadrat data). The similarity of vegetation across the ranges therefore cannot be inferred using this type of analysis. It is therefore considered that the assumptions of this study are unfounded based on the evidence provided.

4. DISCUSSION AND CONCLUSIONS

4.1 Project area and Regional Survey for Conservation Significant Taxa

Both *Eremophila warnesii* and *Halgania gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743), whose populations within the Project area were considered of High conservation significance (Woodman Environmental 2009), were found to be common in the Project area. *E. warnesii* was recorded widely over Mount Gould itself, and was abundant in several areas, with over 13,000 individuals recorded. This species was also found to extend just outside the Project area on the slopes of Mount Gould, with 3 additional populations recorded on Yarlalweelor Station to the east of the Project area. However, based on current data, these populations are very small compared to the population in the Project area. Therefore, if a large proportion of the population in the Project area were to be impacted in the future, the regional impacts to the taxon would still be considered high based on the results of this survey, and further regional survey may be required to prove the existence of other large populations.

It is considered however that there is a strong likelihood that there are significant numbers of individuals that were not recorded during this survey because of time constraints, both within the existing recorded populations on Yarlalweelor Station, and in the vicinity of these populations. While *E. warnesii* was only expected to occur on

rocky areas based on the location of the population in the Project area, the 3 populations recorded on Yarlarweelor Station were located on low floodplains and in minor drainage lines. A preliminary review of aerial photography in the vicinity of the recorded populations indicates that this habitat is abundant in the area, and it is therefore considered likely that more individuals would occur in these habitat areas. These habitat areas would be considered a primary target for further regional survey if required.

The 3 populations of *E. warnesii* recorded on Yarlarweelor Station in 2011 were either at or in close proximity to historical records of the species (Figure 4a). However, no individuals could be found at 2 historical locations on Mount Clere Station (Figure 4a), despite relatively detailed searching. It is possible that the species could have become extinct at these locations, however it is more likely that the coordinates of the locations are erroneous. It is likely that if more time were dedicated to searching in the general vicinity of these locations, individuals would be discovered; these 2 records are therefore considered primary targets for further regional survey if required.

It is apparent following a review of the historical records of *E. warnesii* that the coordinates of 2 records from the DEFL and W.A. Herbarium databases are likely to be erroneous (Figure 4a). Based on the dates of records, DEFL records 32849 and 32850 (Appendix B) should be equivalent to W.A. Herbarium records PERTH 03792439 and PERTH 04031830 respectively. However, the coordinates of the DEFL records are different to those of the W.A. Herbarium records. In the case of DEFL record 32849, the coordinates match the locality details ('near Bogie Man Mill, Yarlarweelor') attached to W.A. Herbarium record PERTH 03792439, however these locality details do not match the coordinates of PERTH 03792439. Both locations were visited, with *E. warnesii* recorded at DEFL record 32849 only (PERTH 03792439 plots at Yarlarweelor Station homestead). The coordinates of PERTH 03792439 are therefore considered erroneous. In the case of DEFL record 32850, the coordinates do not match the locality details ('4 km E of Windarra Well, Yarlarweelor Station') attached to W.A. Herbarium record PERTH 04031830, whose coordinates closely match the locality details. DEFL record 32850 was therefore not visited, as it plots on nearby Moorarie Station, and is considered erroneous. However, W.A. Herbarium record PERTH 04031830 was visited, with *E. warnesii* recorded in the vicinity of this record.

H. gustafsenii var. Murchison (R. Meissner & B. Bayliss 743) was also recorded widely over Mount Gould, and also on stony undulating areas around the base of the mountain. This taxon was also abundant in several areas, with more than 12,500 individuals recorded. This species was also found to extend just outside the Project area on the lower slopes of Mount Gould, with 1 additional population recorded on low hills just north of Mount Gould. This population, plus the portion of the population outside the Project area, represents a very small percentage of the total number of known individuals based on current data. As for *E. warnesii*, if a large proportion of the population in the Project area were to be impacted in the future, the regional impacts to the taxon would still be considered high based on the results of this survey, and further regional survey may be required to prove the existence of other large populations.

It is considered likely however that there are further individuals that were not recorded during this survey because of time constraints, particularly given the discovery of a small population on low hills north of Mount Gould. A preliminary review of aerial

photography indicates that there are several other low linear ridges in the vicinity of Mount Gould, and it is therefore considered likely that more individuals would occur in these habitat areas. These habitat areas would be considered a primary target for further regional survey if required.

The collection of *H. gustafsenii* var. *gustafsenii* ms on Mount Taylor at the northern end of the nearby Jack Hills correlates with the results of DEC's survey of the Jack Hills (Meissner & Caruso 2008), where *H. gustafsenii* var. *gustafsenii* ms was recorded in quadrats established across the Jack Hills. *H. gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743) is distinguished from *H. gustafsenii* var. *gustafsenii* ms by having sparsely silky hairs with sessile glands on the leaves and peduncles, as opposed to long silky hairs on the leaves and dense silky hairs on the peduncles for *H. gustafsenii* var. *gustafsenii* ms. The leaves of *H. gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743) also appear bright green in the field, compared to grey-green for *H. gustafsenii* var. *gustafsenii* ms (Meissner & Caruso 2008). It is currently unclear as to whether *H. gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743) warrants separation as a distinct taxon based on these characters, as they appear similar in many other morphological characters, with populations of the 2 taxa separated by less than 15 km. However, as a matter of precaution, the 2 taxa must be considered distinct based on current information. It is possible that *H. gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743) may be an unusual morphotype of *H. gustafsenii* var. *gustafsenii*, rather than a distinct taxon; however, a comprehensive taxonomic study of all entities currently treated as *Halgania gustafsenii* is required to determine this. If this is determined to be the case, then further regional searching would not be required.

It is worthy of note that both *E. warnesii* and *H. gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743) would both qualify for listing as Threatened (Declared Rare Flora – Extant) under the *Wildlife Conservation Act* 1950 in Western Australia based on current information, as they both meet International Union for Conservation of Nature (IUCN) Red List Criteria for at least the 'Vulnerable' category (IUCN 2001), and are therefore considered to be facing a high risk of extinction in the wild. However, to be listed as Threatened in Western Australia, it must be demonstrated that an appropriate amount of survey has been conducted to determine the distribution and abundance of a taxon. Appropriate survey effort is determined by the DEC's guidelines for nomination of a species as Threatened (DEC 2012b); under these guidelines, *E. warnesii* and *H. gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743) would both require a minimum of 1 month of searching time to justify their listing as Threatened. It is considered that both taxa have not been sufficiently surveyed for to establish their complete distribution and abundance, as significant areas of potential habitat remain to be surveyed. Both taxa would therefore not qualify for listing as Threatened until further survey has been conducted.

Rhodanthe sphaerocephala was recorded at 4 point locations in 2011, however none of these represented locations where it was recorded in 2008. It is possible that this species naturally occurs in very low numbers in the Mount Gould area, and may require a significant rainfall event to facilitate widespread seed germination. There was some rainfall prior to survey, however the amount may have been low enough to facilitate only scattered germination.

Tribulus adelacanthus was found to be common in the Project area in undulating stony areas; this is despite it being recorded at only a single location in 2008 (Woodman Environmental 2009). In excess of 2,000 individuals were recorded at over 180 point locations; however, it is expected that significantly more individuals occurred at more locations. Unfortunately this species was senescing at the time of survey, and accurate identification of senescent individuals was often difficult, particularly as several other superficially similar *Tribulus* species were observed during the survey (e.g. *T. forrestii*, *T. astrocarpus*).

It is considered that the Project area has been surveyed adequately enough during this survey to negate the need for further field survey in the Project area for conservation significant flora taxa prior to any future exploration or mining activities. However, it is recommended that a desktop impact assessment be undertaken prior to any proposed future exploration and mining activities (when an exact impact area is known) using the data collected during this survey, to quantify local and regional impacts to conservation significant flora taxa, and potentially mitigate these impacts prior to disturbance.

4.2 Review of Mount Gould Vegetation Complexes PEC Information

The review of information relating to the Mount Gould vegetation complexes PEC presented in Section 3.3 provides strong evidence that the vegetation present on Mount Gould as a whole differs from those on nearby ranges. This is documented by Gibson *et al.* (2012), who demonstrated significant differences in species composition between each of 24 ironstone ranges, including Mount Gould and the nearby Jack Hills and Robinson Ranges. A strong trend towards dissimilarity of specific vegetation units between Mount Gould and other nearby ranges has also been demonstrated, with Meissner *et al.* (2009) and Woodman Environmental (2009) showing dissimilarity between floristic data from the Mount Gould summit and floristic data from the summits of the Jack Hills and the Robinson Range.

The main implication of these studies is that the Mount Gould vegetation complexes PEC as currently defined is unlikely to occur anywhere else, as the vegetation complexes referred to in the PEC description are statistically different in terms of species composition from other nearby ranges (Gibson *et al.* 2012). However, it is likely that the specific vegetation units that form part of the vegetation complexes occur elsewhere. For example, both Meissner *et al.* (2009) and Woodman Environmental (2009) show that vegetation units on the lower slopes of Mount Gould are likely to be synonymous with those on the lower slopes of the Robinson Range, and also possibly the Jack Hills (Woodman Environmental 2009). This does not appear to be the case for the vegetation units that occur at the summit of Mount Gould, including vegetation units dominated by *Triodia melvillei*, as these have been demonstrated to be dissimilar to superficially similar vegetation units on nearby ranges (Meissner *et al.* 2009; Woodman Environmental 2009).

With regard to potential impacts of the Project on the Mount Gould vegetation complexes PEC, it is important that the validity of further regional survey for the Mount Gould vegetation complexes PEC be discussed with the DEC prior to any survey being conducted. Further survey would only be worthwhile if the demonstration of occurrences of specific vegetation units elsewhere in the region is considered by the

DEC to be appropriate when considering impacts within the Project area in a regional context. If this is not considered appropriate, then minimising disturbance to Mount Gould remains the only option to minimise impacts to the Mount Gould vegetation complexes PEC. A detailed survey plan has therefore not been developed at this time, pending further discussions with the DEC.

If further survey for the vegetation units on Mount Gould is deemed valid by the DEC, it is considered that the vegetation units on the summit of Mount Gould, particularly the *Triodia melvillei*-dominated vegetation unit, would require the most significant survey effort, as these vegetation units are most likely to be significantly impacted. Both Meissner *et al.* (2009) and Woodman Environmental (2009) have demonstrated dissimilarity in the *Triodia melvillei*-dominated vegetation units on Mount Gould, the Robinson Range and Jack Hills; it is therefore proposed that other significant hills in the vicinity of Mount Gould be assessed for the presence of vegetation units similar to those on the summit of Mount Gould, particularly those that support *Triodia melvillei*. The likelihood of discovering further occurrences is considered low, as the Jack Hills and the Robinson Range are the largest ironstone ranges in the vicinity of Mount Gould, however a preliminary review of aerial photography indicates that there are several other large hills that could potentially support a *Triodia melvillei*-dominated vegetation unit. Several previous regional surveys (see Section 3.3) have analysed data from a relatively limited number of quadrats, thus limiting the statistical rigor of the analysis, and reducing the potential for identification of similar vegetation units on different ranges. It therefore is proposed that several quadrats be established within any occurrences found, to sample any variation within the vegetation unit. The most efficient method of accessing these hills may be to utilise a helicopter.

It is also considered prudent that the lower slope vegetation units on Mount Gould are surveyed for regionally. Although some similarity between these vegetation units and vegetation units on the Robinson Range and the Jack Hills has been demonstrated (Meissner *et al.* 2009; Woodman Environmental 2009), it is unclear as to the geographical extent of these vegetation units. These would also be sampled while sampling for the summit vegetation units on hills in the vicinity of Mount Gould. The Jack Hills in particular, and to a lesser extent the Robinson Range, could also be included as potential survey targets for these vegetation units.

5. RECOMMENDATIONS

The following recommendations are given:

1. Locations of all conservation significant flora taxa should be avoided where possible during future proposed exploration and mining activities, particularly the highly restricted *Halgania gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743) and *Eremophila warnesii* (both P1)
2. A desktop impact assessment should be undertaken prior to any proposed future exploration and mining activities (when an exact impact area is known) using data collected during this survey, to quantify local and regional impacts to conservation significant flora taxa, and determine whether further regional survey for conservation significant flora taxa is required.
3. The DEC should be engaged in discussions regarding further survey for the Mount Gould vegetation complexes PEC, to determine the validity of further survey, and if deemed valid, to agree on appropriate methods for further survey.

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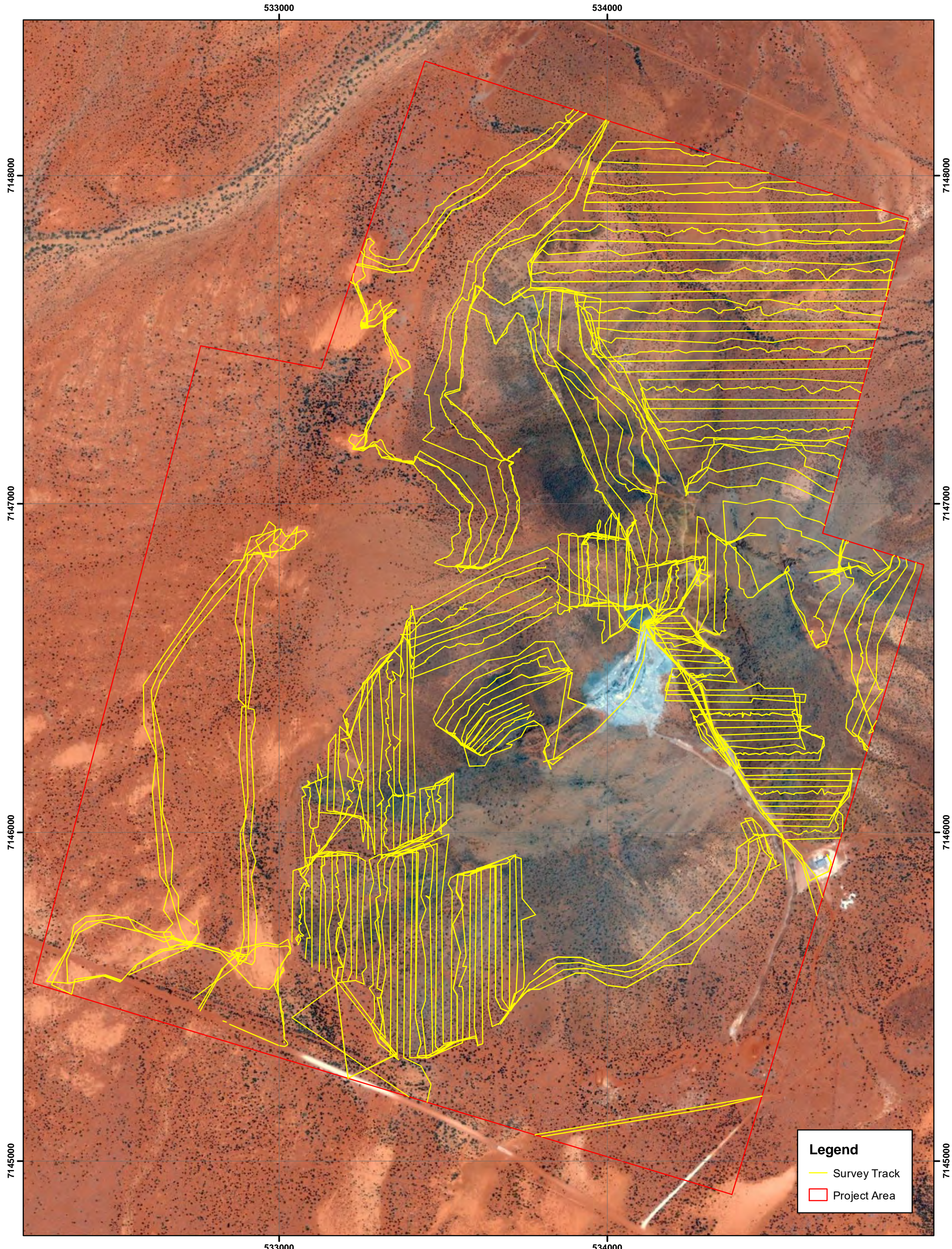
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Legend

- Survey Track
- Project Area



This map should only be used in conjunction with WEC report Atlas11-23-01



Mount Gould DSO Project
Method of Survey of Project Area for
Conservation Significant Flora, 2011

Revision: A - January 2012

Author: David Coultas
 WEC Ref: Atlas11-23-01
 Filename: Atlas11-23-01-f01.mxd

Scale 1:10,000 (A3) Grid: MGA Zone 50

Figure
1



This map should only be used in conjunction with WEC report Atlas11-23-01



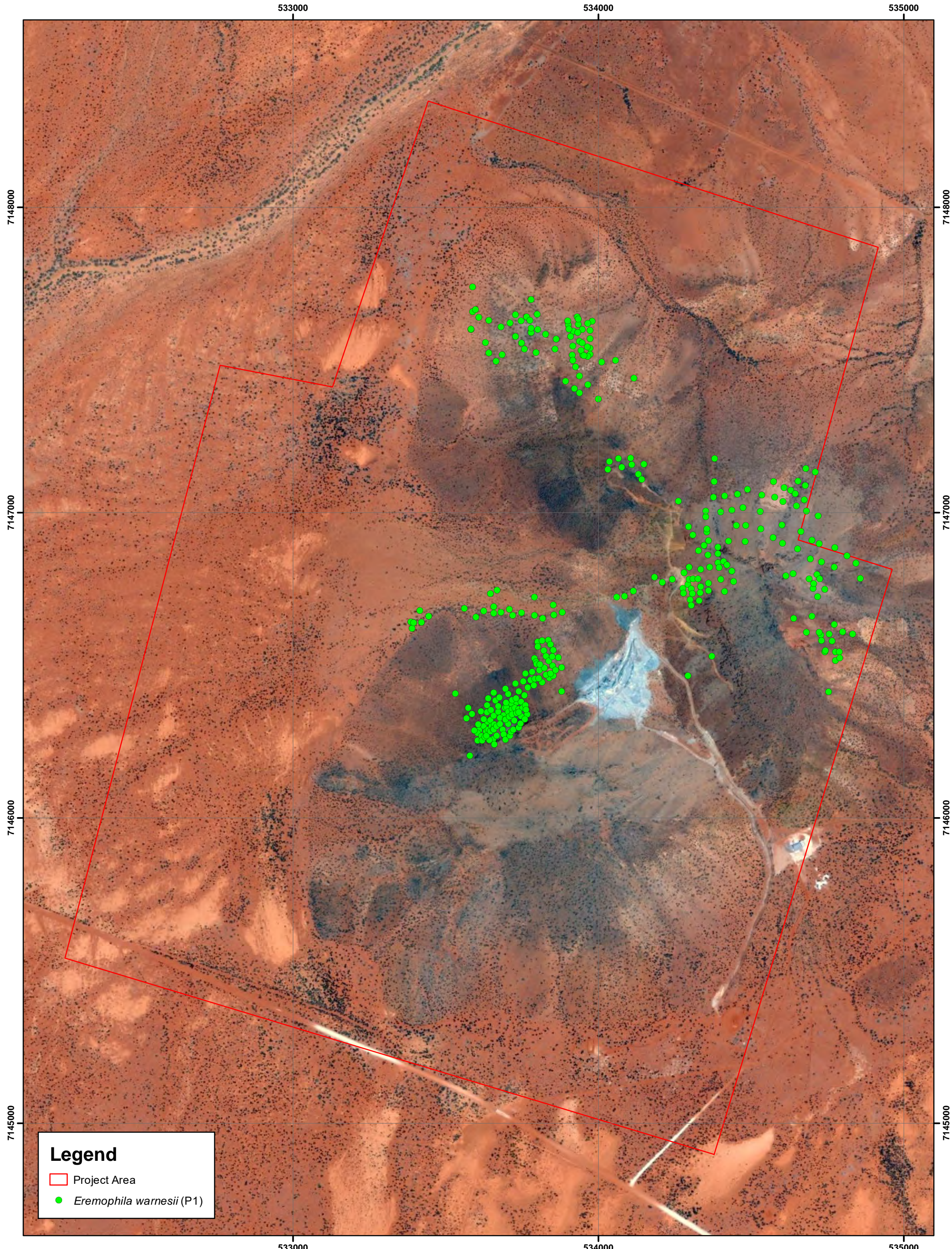
**Mount Gould DSO Project
Regional Areas Searched for
Conservation Significant Flora, 2011**

Revision: A - January 2012

Author: David Coultas
WEC Ref: Atlas11-23-01
Filename: Atlas11-23-01-f02.mxd

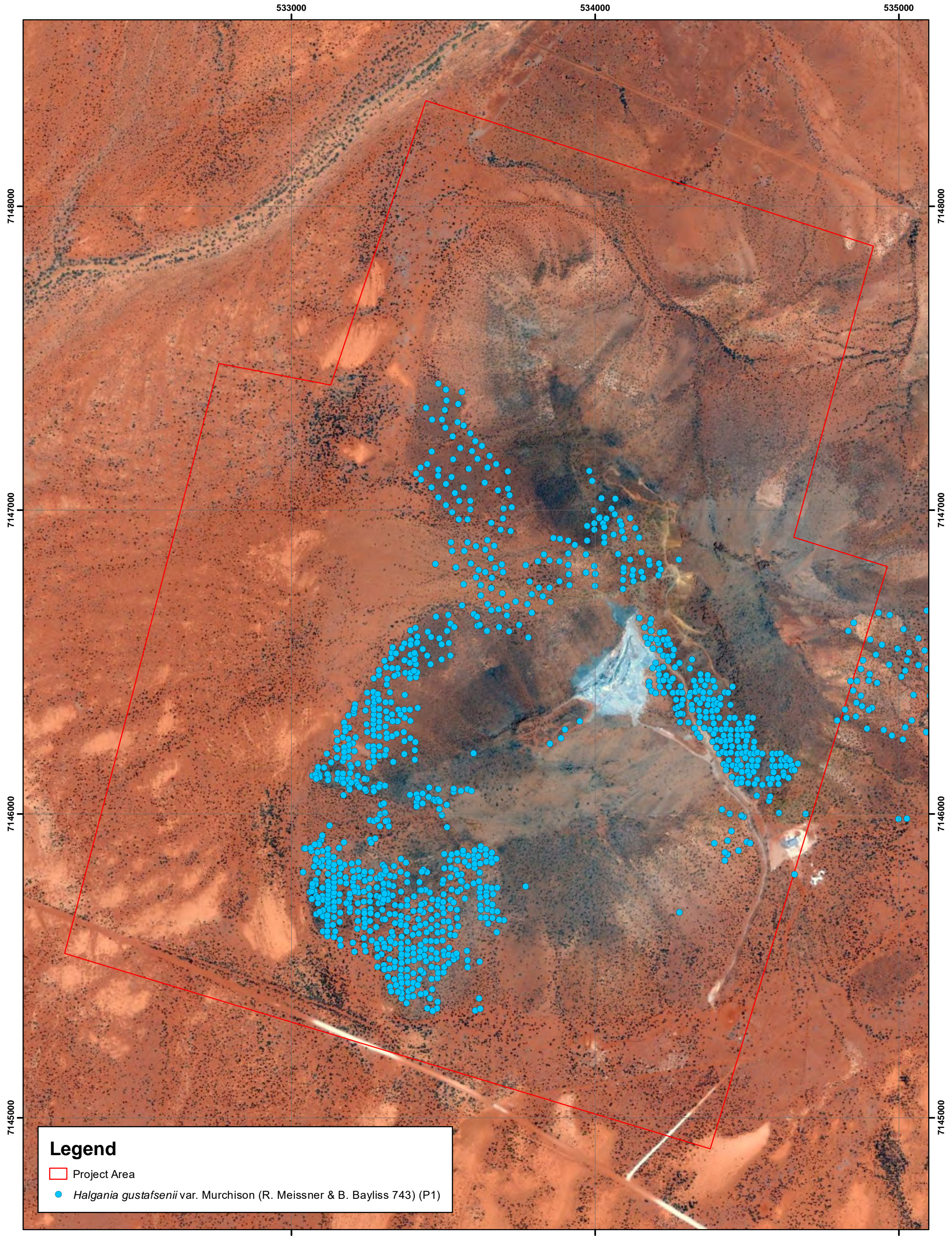
Scale 1:275,000 (A3) Grid: MGA Zone 50

**Figure
2**



Legend

- Project Area
- *Eremophila warnesii* (P1)



Legend

- Project Area
- *Halgania gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743) (P1)



This map should only be used in conjunction with WEC report Atlas11-23-01

Mount Gould DSO Project
Distribution of *Halgania gustafsenii* var.
Murchison (R. Meissner & B. Bayliss 743)
(P1) in the Project Area, 2011

Revision: A - January 2012

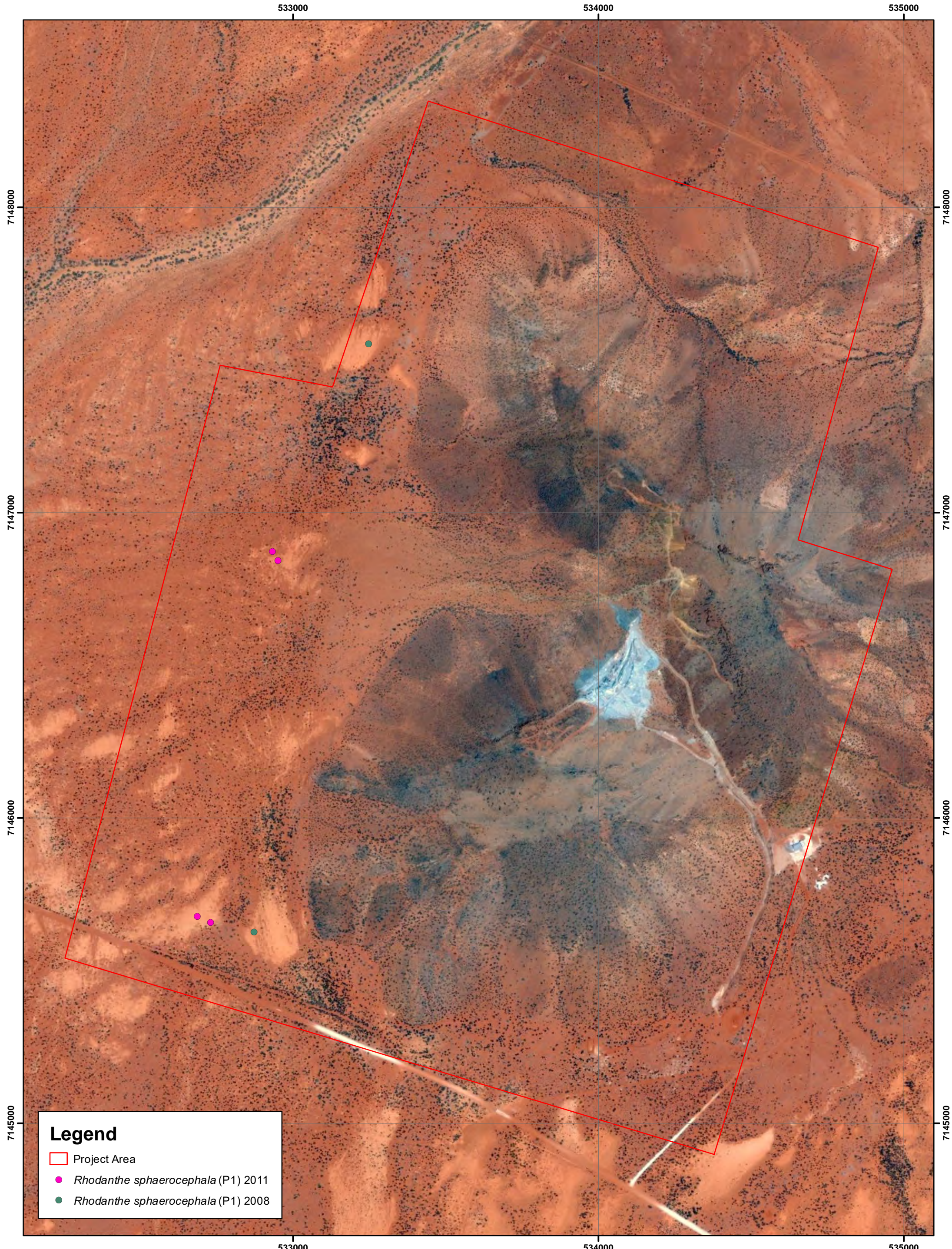
Author: David Coultas

WEC Ref: Atlas11-23-01

Filename: Atlas11-23-01-f03b.mxd

Scale 1:10,000 (A3) Grid: MGA Zone 50

Figure
3b



Legend

- Project Area
- *Rhodanthe sphaerocephala* (P1) 2011
- *Rhodanthe sphaerocephala* (P1) 2008



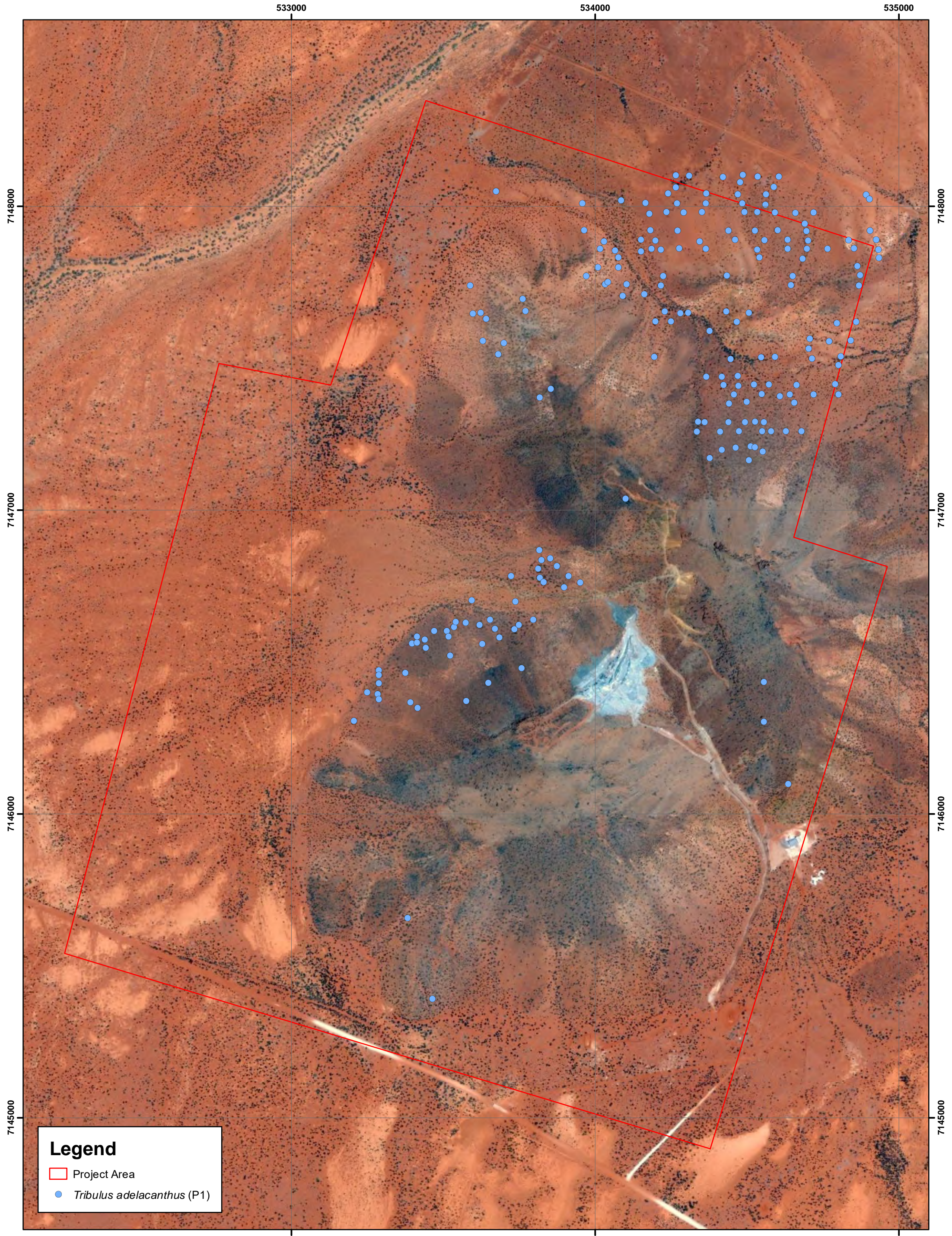
This map should only be used in conjunction with WEC report Atlas11-23-01

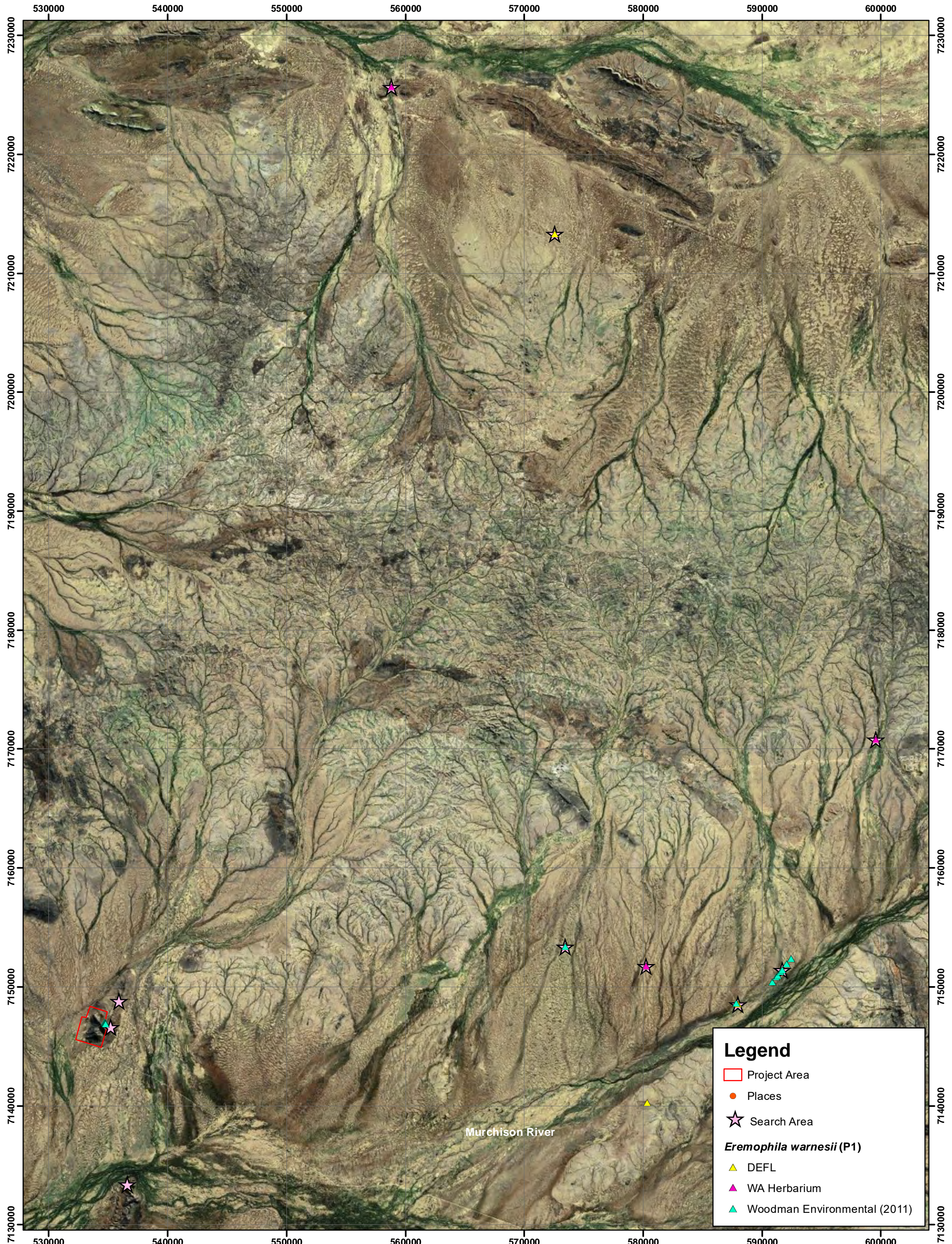
Mount Gould DSO Project
Distribution of
Rhodanthe sphaerocephala (P1)
in the Project Area, 2011

Revision: A - January 2012

Author: David Coultas
 WEC Ref: Atlas11-23-01
 Filename: Atlas11-23-01-f03c.mxd
 Scale 1:10,000 (A3) Grid: MGA Zone 50

Figure
3c





Legend

- Project Area
- Places
- ★ Search Area

***Eremophila warnesii* (P1)**

- ▲ DEFL
- ▲ WA Herbarium
- ▲ Woodman Environmental (2011)



This map should only be used in conjunction with WEC report Atlas11-23-01

**Mount Gould DSO Project
Region Distribution of
Eremophila warnesii (P1), 2011**

Revision: A - January 2012

Author: David Coultas
 WEC Ref: Atlas11-23-01
 Filename: Atlas11-23-01-f04a.mxd
 Scale 1:275,000 (A3) Grid: MGA Zone 50

**Figure
4a**



Legend

- Project Area
- Places
- ☆ Search Area

***Halgania gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743) (P1)**

- ▲ WA Herbarium
- ▲ Woodman Environmental (2011)



This map should only be used in conjunction with WEC report Atlas11-23-01

**Mount Gould DSO Project
Region Distribution of
Halgania gustafsenii var. Murchison
(R. Meissner & B. Bayliss 743) (P1), 2011**

Revision: A - January 2012

Author: David Coultas
 WEC Ref: Atlas11-23-01
 Filename: Atlas11-23-01-f04b.mxd
 Scale 1:50,000 (A3) Grid: MGA Zone 50

**Figure
4b**

Appendix A: Conservation Codes for Western Australian Flora (DEC 2012)

Under the Wildlife Conservation Act, the Minister for the Environment may declare species of flora to be protected if they are considered to be in danger of extinction, rare or otherwise in need of special protection. Schedules 1 and 2 deal with those that are threatened and those that are presumed extinct, respectively.

T: Threatened Flora (Declared Rare Flora – Extant)

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

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

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

X: Presumed Extinct Flora (Declared Rare Flora – Extinct)

Taxa that have been adequately searched for and there is no reasonable doubt that the last individual has died, and have been gazetted as such (Schedule 2 under the Wildlife Conservation Act 1950).

Taxa that have not yet been adequately surveyed to be listed under Schedule 1 or 2 are added to the Priority Flora List 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 flora or fauna. Taxa that are adequately known, are rare but not threatened, or meet criteria for Near Threatened, or that have been recently removed from the threatened list for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring. Conservation Dependent species are placed in Priority 5.

1: Priority One – Poorly-known Taxa

Taxa that are known from one or a few collections or sight records (generally less than 5), all on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, Shire, Westrail and Main Roads WA road, gravel and soil reserves, and active mineral leases and under threat of habitat destruction or degradation. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes.

2: Priority Two – Poorly-known Taxa

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

3: Priority Three – Poorly-known Taxa

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

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

1. **Rare.** Taxa that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These taxa are usually represented on conservation lands

2. **Near Threatened.** Taxa that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.

3. Taxa that have been removed from the list of threatened species during the past 5 years for reasons other than taxonomy.

5: Priority 5 – Conservation Dependent Taxa

Taxa that are not threatened but are subject to a specific conservation program, the cessation of which would result in the taxon becoming threatened within 5 years.

Appendix B: Results of Search of the Department of Environment and Conservation's W.A. Herbarium Specimen database and Declared Endangered Flora List database (DEFL)

Part 1 – W.A. Herbarium Specimen Database

SHEET_NO	SPECIES	CONSCOD E	SITE	VEGETATION	LOCALITY	LAT	LONG_	DATE_
PERTH 03792439	Eremophila warnesii	1			Near Bogie Man Mill, Yarlarweelor	-25.57666	117.99139	06 1972
PERTH 04031830	Eremophila warnesii	1	Red-brown clayey sand.	In open scrub.	4 km E of Windarra Well, Yarlarweelor Station	-25.75000	117.80000	10 08 1986
PERTH 07324863	Eremophila warnesii	1	Slopes of quartz ridge.		Mount Clere Station	-25.08333	117.58333	06 1970
PERTH 08204063	Eremophila warnesii	1	On upper western slopes. On stony and rocky brown loam.	With Eriostemon sp., Eremophila latrobei, Triodia sp. and Ptilotus obovatus.	W slopes of Mount Gould	-25.79898	117.34333	24 10 1993
PERTH 2629720	Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	1			Mount Gould, c. 150 km NW of Meekatharra	-25.80000	117.31639	01 08 1969
PERTH 2631741	Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	1	In saxosis.		Mount Gould, prope flume Murchison [near Murchison River]	-25.80000	117.31639	27 08 1960
PERTH 2629747	Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	1			Mount Gould, NW of Meekatharra	-25.80000	117.31639	01 07 1969

SHEET_NO	SPECIES	CONSCODE	SITE	VEGETATION	LOCALITY	LAT	LONG_	DATE_
PERTH 2631784	Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	1	Ironstone.		Mount Gould (foot)	-25.80000	117.31639	17 08 1972
PERTH 07528272	Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	1	NW aspect. Steep 1:5 upper slope, with a discontinuous fabric of ironstone ranging to 1 m. overlying strongly laminated phyllite/schist and below strongly dipping outcropping ironstone. Rock cover 70%.	Ptilotus obovatus var. obovatus Dwarf Scrub D over Eriachne mucronata and Iseilema dolichotrichum Open Low Grass.	Mount Gould on Mount Gould Station. On Carnarvon-Meekatharra Road, 154 km NW of Meekatharra	-25.80075	117.33811	04 07 2006
PERTH 07736320	Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	1	SW facing steep mid slope of haematite and banded ironstone. Very slightly rocky banded ironstone outcrop with red brown skeletal very sandy loam soils.	Isolated shrubs of Acacia aneura over open shrubland of Philotheca brucei subsp. cinerea and grassland of Triodia melvillei and Eriachne mucronata and Corchorus crozophorifolius.	Mount Gould, survey site MTGD 05, located halfway up main track on Mount Gould. Also ca 4.7 km W of Mount Gould Station and 1.5 km NW of Meekatharra - Landor Road	-25.80041	117.34256	19 08 2006

Part 2 – Declared Endangered Flora Database (DEFL)

SHEET	SPNAME	CONSVCODE	POPID1	POPID2	GDA94LAT	GDA94LONG	VESTING	PURPOSE1	PURPOSE2	STATUS	OWNERDATE
32849	Eremophila warnesii	1	1		-25.77842	117.87722	PLB	PAS	EXL		15/06/1972
32850	Eremophila warnesii	1	2		-25.85386	117.80156	PLB	PAS	EXL		10/08/1986
32852	Eremophila warnesii	1	3		-25.19431	117.71986	PLB	PAS			11/09/2000
35170	Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	1	1		-25.80075	117.33811	PLB	PAS	MIN		19/08/2006

Appendix C: Point Locations of Significant Flora Taxa Recorded During 2011 Survey

Taxon	GPS E	GPS N	No. of Individuals	Date Collected	Record Location
Eremophila warnesii	533387	7146643	3	09/08/2011	Project Area
Eremophila warnesii	533390	7146622	1	09/08/2011	Project Area
Eremophila warnesii	533416	7146679	6	09/08/2011	Project Area
Eremophila warnesii	533531	7146409	1	10/08/2011	Project Area
Eremophila warnesii	533569	7146326	1	10/08/2011	Project Area
Eremophila warnesii	533574	7146362	1	10/08/2011	Project Area
Eremophila warnesii	533579	7146204	26	10/08/2011	Project Area
Eremophila warnesii	533587	7146342	1	10/08/2011	Project Area
Eremophila warnesii	533593	7146287	3	10/08/2011	Project Area
Eremophila warnesii	533604	7146279	9	10/08/2011	Project Area
Eremophila warnesii	533604	7146253	2	10/08/2011	Project Area
Eremophila warnesii	533606	7146307	8	10/08/2011	Project Area
Eremophila warnesii	533611	7146288	5	10/08/2011	Project Area
Eremophila warnesii	533615	7146350	2	10/08/2011	Project Area
Eremophila warnesii	533617	7146268	10	10/08/2011	Project Area
Eremophila warnesii	533619	7146254	3	10/08/2011	Project Area
Eremophila warnesii	533625	7146302	13	10/08/2011	Project Area
Eremophila warnesii	533625	7146324	4	10/08/2011	Project Area
Eremophila warnesii	533628	7146266	35	10/08/2011	Project Area
Eremophila warnesii	533632	7146284	20	10/08/2011	Project Area
Eremophila warnesii	533633	7146270	50	10/08/2011	Project Area
Eremophila warnesii	533635	7146346	8	10/08/2011	Project Area
Eremophila warnesii	533635	7146370	14	10/08/2011	Project Area
Eremophila warnesii	533637	7146315	10	10/08/2011	Project Area
Eremophila warnesii	533639	7146291	15	10/08/2011	Project Area
Eremophila warnesii	533639	7146392	6	10/08/2011	Project Area
Eremophila warnesii	533643	7146255	44	10/08/2011	Project Area
Eremophila warnesii	533647	7146322	33	10/08/2011	Project Area
Eremophila warnesii	533647	7146284	65	10/08/2011	Project Area

Taxon	GPS E	GPS N	No. of Individuals	Date Collected	Record Location
Eremophila warnesii	533648	7146354	10	10/08/2011	Project Area
Eremophila warnesii	533650	7146301	20	10/08/2011	Project Area
Eremophila warnesii	533655	7146259	116	10/08/2011	Project Area
Eremophila warnesii	533656	7146292	60	10/08/2011	Project Area
Eremophila warnesii	533657	7146411	1	10/08/2011	Project Area
Eremophila warnesii	533658	7146335	34	10/08/2011	Project Area
Eremophila warnesii	533658	7146291	76	10/08/2011	Project Area
Eremophila warnesii	533659	7146242	2	10/08/2011	Project Area
Eremophila warnesii	533660	7146307	25	10/08/2011	Project Area
Eremophila warnesii	533663	7146385	15	10/08/2011	Project Area
Eremophila warnesii	533667	7146270	226	10/08/2011	Project Area
Eremophila warnesii	533667	7146301	60	10/08/2011	Project Area
Eremophila warnesii	533672	7146348	29	10/08/2011	Project Area
Eremophila warnesii	533672	7146366	60	10/08/2011	Project Area
Eremophila warnesii	533676	7146396	29	10/08/2011	Project Area
Eremophila warnesii	533677	7146328	10	10/08/2011	Project Area
Eremophila warnesii	533677	7146308	36	10/08/2011	Project Area
Eremophila warnesii	533686	7146290	114	10/08/2011	Project Area
Eremophila warnesii	533690	7146273	85	10/08/2011	Project Area
Eremophila warnesii	533691	7146337	30	10/08/2011	Project Area
Eremophila warnesii	533693	7146361	44	10/08/2011	Project Area
Eremophila warnesii	533695	7146324	75	10/08/2011	Project Area
Eremophila warnesii	533695	7146258	2	10/08/2011	Project Area
Eremophila warnesii	533696	7146323	62	10/08/2011	Project Area
Eremophila warnesii	533696	7146423	2	10/08/2011	Project Area
Eremophila warnesii	533698	7146377	76	10/08/2011	Project Area
Eremophila warnesii	533700	7146363	35	10/08/2011	Project Area
Eremophila warnesii	533704	7146309	205	10/08/2011	Project Area
Eremophila warnesii	533704	7146348	20	10/08/2011	Project Area
Eremophila warnesii	533705	7146406	38	10/08/2011	Project Area
Eremophila warnesii	533708	7146333	60	10/08/2011	Project Area

Taxon	GPS E	GPS N	No. of Individuals	Date Collected	Record Location
Eremophila warnesii	533711	7146271	19	10/08/2011	Project Area
Eremophila warnesii	533714	7146283	76	10/08/2011	Project Area
Eremophila warnesii	533715	7146375	41	10/08/2011	Project Area
Eremophila warnesii	533718	7146386	55	10/08/2011	Project Area
Eremophila warnesii	533718	7146357	40	10/08/2011	Project Area
Eremophila warnesii	533718	7146339	50	10/08/2011	Project Area
Eremophila warnesii	533721	7146290	62	10/08/2011	Project Area
Eremophila warnesii	533725	7146320	97	10/08/2011	Project Area
Eremophila warnesii	533726	7146361	20	10/08/2011	Project Area
Eremophila warnesii	533728	7146442	1	10/08/2011	Project Area
Eremophila warnesii	533731	7146392	15	10/08/2011	Project Area
Eremophila warnesii	533732	7146344	40	10/08/2011	Project Area
Eremophila warnesii	533733	7146380	43	10/08/2011	Project Area
Eremophila warnesii	533739	7146416	6	10/08/2011	Project Area
Eremophila warnesii	533739	7146297	9	10/08/2011	Project Area
Eremophila warnesii	533740	7146357	25	10/08/2011	Project Area
Eremophila warnesii	533740	7146346	35	10/08/2011	Project Area
Eremophila warnesii	533744	7146311	10	10/08/2011	Project Area
Eremophila warnesii	533746	7146381	36	10/08/2011	Project Area
Eremophila warnesii	533747	7146334	76	10/08/2011	Project Area
Eremophila warnesii	533752	7146362	20	10/08/2011	Project Area
Eremophila warnesii	533754	7146448	4	10/08/2011	Project Area
Eremophila warnesii	533757	7146404	2	10/08/2011	Project Area
Eremophila warnesii	533760	7146324	8	10/08/2011	Project Area
Eremophila warnesii	533761	7146371	1	10/08/2011	Project Area
Eremophila warnesii	533762	7146474	19	10/08/2011	Project Area
Eremophila warnesii	533763	7146356	30	10/08/2011	Project Area
Eremophila warnesii	533766	7146339	80	10/08/2011	Project Area
Eremophila warnesii	533769	7146428	6	10/08/2011	Project Area
Eremophila warnesii	533777	7146453	55	10/08/2011	Project Area
Eremophila warnesii	533784	7146480	130	10/08/2011	Project Area

Taxon	GPS E	GPS N	No. of Individuals	Date Collected	Record Location
Eremophila warnesii	533788	7146435	20	10/08/2011	Project Area
Eremophila warnesii	533790	7146524	31	10/08/2011	Project Area
Eremophila warnesii	533792	7146456	32	10/08/2011	Project Area
Eremophila warnesii	533795	7146512	39	10/08/2011	Project Area
Eremophila warnesii	533798	7146505	60	10/08/2011	Project Area
Eremophila warnesii	533801	7146578	4	10/08/2011	Project Area
Eremophila warnesii	533802	7146561	25	10/08/2011	Project Area
Eremophila warnesii	533805	7146457	25	10/08/2011	Project Area
Eremophila warnesii	533806	7146485	35	10/08/2011	Project Area
Eremophila warnesii	533808	7146504	40	10/08/2011	Project Area
Eremophila warnesii	533815	7146582	2	10/08/2011	Project Area
Eremophila warnesii	533816	7146445	3	10/08/2011	Project Area
Eremophila warnesii	533821	7146549	15	10/08/2011	Project Area
Eremophila warnesii	533824	7146493	50	10/08/2011	Project Area
Eremophila warnesii	533828	7146531	50	10/08/2011	Project Area
Eremophila warnesii	533828	7146469	8	10/08/2011	Project Area
Eremophila warnesii	533835	7146584	150	10/08/2011	Project Area
Eremophila warnesii	533838	7146515	60	10/08/2011	Project Area
Eremophila warnesii	533839	7146460	6	10/08/2011	Project Area
Eremophila warnesii	533843	7146568	65	10/08/2011	Project Area
Eremophila warnesii	533843	7146475	1	10/08/2011	Project Area
Eremophila warnesii	533849	7146528	20	10/08/2011	Project Area
Eremophila warnesii	533851	7146499	22	10/08/2011	Project Area
Eremophila warnesii	533853	7146550	82	10/08/2011	Project Area
Eremophila warnesii	533853	7146467	4	10/08/2011	Project Area
Eremophila warnesii	533860	7146485	8	10/08/2011	Project Area
Eremophila warnesii	533869	7146527	28	10/08/2011	Project Area
Eremophila warnesii	533880	7146415	1	10/08/2011	Project Area
Eremophila warnesii	533880	7146495	2	10/08/2011	Project Area
Eremophila warnesii	533582	7147600	24	11/08/2011	Project Area
Eremophila warnesii	533589	7147657	15	11/08/2011	Project Area

Taxon	GPS E	GPS N	No. of Individuals	Date Collected	Record Location
Eremophila warnesii	533589	7147740	1	11/08/2011	Project Area
Eremophila warnesii	533608	7147639	5	11/08/2011	Project Area
Eremophila warnesii	534292	7146467	35	11/08/2011	Project Area
Eremophila warnesii	534372	7146530	1	11/08/2011	Project Area
Eremophila warnesii	533852	7146698	1	13/09/2011	Project Area
Eremophila warnesii	533854	7146665	20	13/09/2011	Project Area
Eremophila warnesii	533882	7146675	3	13/09/2011	Project Area
Eremophila warnesii	534059	7146724	1	13/09/2011	Project Area
Eremophila warnesii	534086	7146728	2	13/09/2011	Project Area
Eremophila warnesii	534114	7146743	1	13/09/2011	Project Area
Eremophila warnesii	534728	7146600	100	13/09/2011	Project Area
Eremophila warnesii	534183	7146789	20	13/09/2011	Project Area
Eremophila warnesii	534210	7146772	6	13/09/2011	Project Area
Eremophila warnesii	534242	7146782	6	13/09/2011	Project Area
Eremophila warnesii	534281	7146803	3	13/09/2011	Project Area
Eremophila warnesii	534293	7146765	1	13/09/2011	Project Area
Eremophila warnesii	534296	7146781	4	13/09/2011	Project Area
Eremophila warnesii	534309	7146784	8	13/09/2011	Project Area
Eremophila warnesii	534723	7146609	20	13/09/2011	Project Area
Eremophila warnesii	534729	7146582	100	13/09/2011	Project Area
Eremophila warnesii	534740	7146546	30	13/09/2011	Project Area
Eremophila warnesii	534742	7146549	5	13/09/2011	Project Area
Eremophila warnesii	534754	7146414	2	13/09/2011	Project Area
Eremophila warnesii	534755	7146604	120	13/09/2011	Project Area
Eremophila warnesii	534764	7146580	30	13/09/2011	Project Area
Eremophila warnesii	534772	7146634	2	13/09/2011	Project Area
Eremophila warnesii	534776	7146546	77	13/09/2011	Project Area
Eremophila warnesii	534776	7146516	25	13/09/2011	Project Area
Eremophila warnesii	534788	7146546	50	13/09/2011	Project Area
Eremophila warnesii	534789	7146526	30	13/09/2011	Project Area
Eremophila warnesii	534799	7146611	3	13/09/2011	Project Area

Taxon	GPS E	GPS N	No. of Individuals	Date Collected	Record Location
Eremophila warnesii	534831	7146604	5	13/09/2011	Project Area
Eremophila warnesii	534857	7146785	1	13/09/2011	Project Area
Eremophila warnesii	533583	7147601	25	14/09/2011	Project Area
Eremophila warnesii	533598	7147665	25	14/09/2011	Project Area
Eremophila warnesii	533631	7147557	10	14/09/2011	Project Area
Eremophila warnesii	533642	7147630	15	14/09/2011	Project Area
Eremophila warnesii	533642	7147523	10	14/09/2011	Project Area
Eremophila warnesii	533664	7147496	2	14/09/2011	Project Area
Eremophila warnesii	533682	7147608	40	14/09/2011	Project Area
Eremophila warnesii	533684	7147518	100	14/09/2011	Project Area
Eremophila warnesii	533710	7147622	13	14/09/2011	Project Area
Eremophila warnesii	533728	7147649	16	14/09/2011	Project Area
Eremophila warnesii	533729	7147578	250	14/09/2011	Project Area
Eremophila warnesii	533746	7147628	40	14/09/2011	Project Area
Eremophila warnesii	533749	7147555	100	14/09/2011	Project Area
Eremophila warnesii	533757	7147536	22	14/09/2011	Project Area
Eremophila warnesii	533765	7147641	15	14/09/2011	Project Area
Eremophila warnesii	533775	7147631	24	14/09/2011	Project Area
Eremophila warnesii	533779	7147591	10	14/09/2011	Project Area
Eremophila warnesii	533780	7147604	35	14/09/2011	Project Area
Eremophila warnesii	533796	7147525	2	14/09/2011	Project Area
Eremophila warnesii	533799	7147650	4	14/09/2011	Project Area
Eremophila warnesii	533801	7147600	100	14/09/2011	Project Area
Eremophila warnesii	533827	7147584	8	14/09/2011	Project Area
Eremophila warnesii	533857	7147536	6	14/09/2011	Project Area
Eremophila warnesii	533862	7147569	6	14/09/2011	Project Area
Eremophila warnesii	533893	7147430	16	14/09/2011	Project Area
Eremophila warnesii	533899	7147629	31	14/09/2011	Project Area
Eremophila warnesii	533903	7147601	50	14/09/2011	Project Area
Eremophila warnesii	533909	7147578	100	14/09/2011	Project Area
Eremophila warnesii	533914	7147515	50	14/09/2011	Project Area

Taxon	GPS E	GPS N	No. of Individuals	Date Collected	Record Location
Eremophila warnesii	533916	7147546	80	14/09/2011	Project Area
Eremophila warnesii	533916	7147500	15	14/09/2011	Project Area
Eremophila warnesii	533921	7147407	27	14/09/2011	Project Area
Eremophila warnesii	533926	7147478	20	14/09/2011	Project Area
Eremophila warnesii	533932	7147591	20	14/09/2011	Project Area
Eremophila warnesii	533935	7147633	7	14/09/2011	Project Area
Eremophila warnesii	533937	7147448	10	14/09/2011	Project Area
Eremophila warnesii	533937	7147392	38	14/09/2011	Project Area
Eremophila warnesii	533947	7147555	20	14/09/2011	Project Area
Eremophila warnesii	533953	7147514	30	14/09/2011	Project Area
Eremophila warnesii	533966	7147419	1	14/09/2011	Project Area
Eremophila warnesii	533972	7147598	45	14/09/2011	Project Area
Eremophila warnesii	533972	7147570	10	14/09/2011	Project Area
Eremophila warnesii	533972	7147540	1	14/09/2011	Project Area
Eremophila warnesii	533972	7147519	13	14/09/2011	Project Area
Eremophila warnesii	533979	7147626	18	14/09/2011	Project Area
Eremophila warnesii	534000	7147371	20	14/09/2011	Project Area
Eremophila warnesii	534030	7147142	65	14/09/2011	Project Area
Eremophila warnesii	534037	7147167	20	14/09/2011	Project Area
Eremophila warnesii	534065	7147176	25	14/09/2011	Project Area
Eremophila warnesii	534076	7147149	35	14/09/2011	Project Area
Eremophila warnesii	534106	7147178	50	14/09/2011	Project Area
Eremophila warnesii	534109	7147156	40	14/09/2011	Project Area
Eremophila warnesii	534130	7147126	100	14/09/2011	Project Area
Eremophila warnesii	534142	7147109	10	14/09/2011	Project Area
Eremophila warnesii	534149	7147159	50	14/09/2011	Project Area
Eremophila warnesii	534262	7147038	30	14/09/2011	Project Area
Eremophila warnesii	534277	7146752	15	14/09/2011	Project Area
Eremophila warnesii	534278	7146736	31	14/09/2011	Project Area
Eremophila warnesii	534295	7146954	45	14/09/2011	Project Area
Eremophila warnesii	534297	7146821	2	14/09/2011	Project Area

Taxon	GPS E	GPS N	No. of Individuals	Date Collected	Record Location
Eremophila warnesii	534301	7146714	110	14/09/2011	Project Area
Eremophila warnesii	534304	7146696	15	14/09/2011	Project Area
Eremophila warnesii	534304	7146751	30	14/09/2011	Project Area
Eremophila warnesii	534307	7146735	100	14/09/2011	Project Area
Eremophila warnesii	534310	7146927	14	14/09/2011	Project Area
Eremophila warnesii	534326	7146783	10	14/09/2011	Project Area
Eremophila warnesii	534327	7146876	11	14/09/2011	Project Area
Eremophila warnesii	534330	7146713	43	14/09/2011	Project Area
Eremophila warnesii	534333	7146738	55	14/09/2011	Project Area
Eremophila warnesii	534334	7146758	40	14/09/2011	Project Area
Eremophila warnesii	534334	7146814	11	14/09/2011	Project Area
Eremophila warnesii	534345	7146893	2	14/09/2011	Project Area
Eremophila warnesii	534351	7146987	100	14/09/2011	Project Area
Eremophila warnesii	534351	7147005	100	14/09/2011	Project Area
Eremophila warnesii	534355	7146937	250	14/09/2011	Project Area
Eremophila warnesii	534355	7146948	150	14/09/2011	Project Area
Eremophila warnesii	534359	7146862	90	14/09/2011	Project Area
Eremophila warnesii	534360	7146746	55	14/09/2011	Project Area
Eremophila warnesii	534360	7146769	200	14/09/2011	Project Area
Eremophila warnesii	534360	7146909	75	14/09/2011	Project Area
Eremophila warnesii	534363	7146821	65	14/09/2011	Project Area
Eremophila warnesii	534376	7147051	60	14/09/2011	Project Area
Eremophila warnesii	534379	7147103	35	14/09/2011	Project Area
Eremophila warnesii	534391	7146887	15	14/09/2011	Project Area
Eremophila warnesii	534392	7146865	65	14/09/2011	Project Area
Eremophila warnesii	534392	7146837	28	14/09/2011	Project Area
Eremophila warnesii	534394	7146820	15	14/09/2011	Project Area
Eremophila warnesii	534400	7147002	250	14/09/2011	Project Area
Eremophila warnesii	534401	7146781	14	14/09/2011	Project Area
Eremophila warnesii	534410	7146840	37	14/09/2011	Project Area
Eremophila warnesii	534413	7146742	6	14/09/2011	Project Area

Taxon	GPS E	GPS N	No. of Individuals	Date Collected	Record Location
Eremophila warnesii	534413	7147055	12	14/09/2011	Project Area
Eremophila warnesii	534420	7146829	26	14/09/2011	Project Area
Eremophila warnesii	534426	7146907	100	14/09/2011	Project Area
Eremophila warnesii	534436	7146809	12	14/09/2011	Project Area
Eremophila warnesii	534436	7147008	100	14/09/2011	Project Area
Eremophila warnesii	534442	7146774	16	14/09/2011	Project Area
Eremophila warnesii	534452	7146959	120	14/09/2011	Project Area
Eremophila warnesii	534454	7147060	15	14/09/2011	Project Area
Eremophila warnesii	534473	7147016	100	14/09/2011	Project Area
Eremophila warnesii	534481	7146906	100	14/09/2011	Project Area
Eremophila warnesii	534482	7146959	60	14/09/2011	Project Area
Eremophila warnesii	534488	7147077	7	14/09/2011	Project Area
Eremophila warnesii	534529	7147004	200	14/09/2011	Project Area
Eremophila warnesii	534532	7146948	250	14/09/2011	Project Area
Eremophila warnesii	534535	7147059	100	14/09/2011	Project Area
Eremophila warnesii	534571	7146918	200	14/09/2011	Project Area
Eremophila warnesii	534573	7147102	30	14/09/2011	Project Area
Eremophila warnesii	534577	7147052	150	14/09/2011	Project Area
Eremophila warnesii	534600	7146961	250	14/09/2011	Project Area
Eremophila warnesii	534603	7146900	200	14/09/2011	Project Area
Eremophila warnesii	534605	7147036	200	14/09/2011	Project Area
Eremophila warnesii	534607	7147083	30	14/09/2011	Project Area
Eremophila warnesii	534614	7146793	200	14/09/2011	Project Area
Eremophila warnesii	534629	7147073	20	14/09/2011	Project Area
Eremophila warnesii	534637	7146800	200	14/09/2011	Project Area
Eremophila warnesii	534639	7146654	1 (dead)	14/09/2011	Project Area
Eremophila warnesii	534644	7147063	20	14/09/2011	Project Area
Eremophila warnesii	534647	7147022	100	14/09/2011	Project Area
Eremophila warnesii	534651	7146882	100	14/09/2011	Project Area
Eremophila warnesii	534654	7147104	9	14/09/2011	Project Area
Eremophila warnesii	534673	7147042	40	14/09/2011	Project Area

Taxon	GPS E	GPS N	No. of Individuals	Date Collected	Record Location
Eremophila warnesii	534677	7147090	12	14/09/2011	Project Area
Eremophila warnesii	534679	7147145	13	14/09/2011	Project Area
Eremophila warnesii	534681	7146608	3	14/09/2011	Project Area
Eremophila warnesii	534690	7146784	80	14/09/2011	Project Area
Eremophila warnesii	534693	7146849	100	14/09/2011	Project Area
Eremophila warnesii	534699	7146662	1	14/09/2011	Project Area
Eremophila warnesii	534702	7146753	1	14/09/2011	Project Area
Eremophila warnesii	534705	7146768	2	14/09/2011	Project Area
Eremophila warnesii	534709	7147133	6	14/09/2011	Project Area
Eremophila warnesii	534716	7146799	65	14/09/2011	Project Area
Eremophila warnesii	534717	7146725	2	14/09/2011	Project Area
Eremophila warnesii	534724	7146784	14	14/09/2011	Project Area
Eremophila warnesii	534729	7146838	100	14/09/2011	Project Area
Eremophila warnesii	534741	7146749	1	14/09/2011	Project Area
Eremophila warnesii	534771	7146821	50	14/09/2011	Project Area
Eremophila warnesii	534814	7146858	250	14/09/2011	Project Area
Eremophila warnesii	534842	7146834	150	14/09/2011	Project Area
Eremophila warnesii	533396	7146639	3	15/09/2011	Project Area
Eremophila warnesii	533420	7146641	1	15/09/2011	Project Area
Eremophila warnesii	533445	7146661	7	15/09/2011	Project Area
Eremophila warnesii	533561	7146688	11	15/09/2011	Project Area
Eremophila warnesii	533600	7146658	3	15/09/2011	Project Area
Eremophila warnesii	533624	7146678	25	15/09/2011	Project Area
Eremophila warnesii	533647	7146734	1	15/09/2011	Project Area
Eremophila warnesii	533657	7146693	25	15/09/2011	Project Area
Eremophila warnesii	533657	7146670	30	15/09/2011	Project Area
Eremophila warnesii	533668	7146748	1	15/09/2011	Project Area
Eremophila warnesii	533681	7146675	29	15/09/2011	Project Area
Eremophila warnesii	533708	7146684	15	15/09/2011	Project Area
Eremophila warnesii	533719	7146663	19	15/09/2011	Project Area
Eremophila warnesii	533748	7146672	13	15/09/2011	Project Area

Taxon	GPS E	GPS N	No. of Individuals	Date Collected	Record Location
Eremophila warnesii	533779	7147698	2	15/09/2011	Project Area
Eremophila warnesii	533790	7146724	1	15/09/2011	Project Area
Eremophila warnesii	533791	7146663	49	15/09/2011	Project Area
Eremophila warnesii	533817	7146654	45	15/09/2011	Project Area
Eremophila warnesii	533902	7147616	80	15/09/2011	Project Area
Eremophila warnesii	533917	7147593	45	15/09/2011	Project Area
Eremophila warnesii	533931	7147642	18	15/09/2011	Project Area
Eremophila warnesii	533934	7147618	35	15/09/2011	Project Area
Eremophila warnesii	533938	7147561	26	15/09/2011	Project Area
Eremophila warnesii	533943	7147532	31	15/09/2011	Project Area
Eremophila warnesii	533947	7147600	39	15/09/2011	Project Area
Eremophila warnesii	533948	7147516	21	15/09/2011	Project Area
Eremophila warnesii	533964	7147543	2	15/09/2011	Project Area
Eremophila warnesii	533965	7147620	17	15/09/2011	Project Area
Eremophila warnesii	533966	7147511	25	15/09/2011	Project Area
Eremophila warnesii	534010	7147494	1	15/09/2011	Project Area
Eremophila warnesii	534057	7147500	3	15/09/2011	Project Area
Eremophila warnesii	534117	7147441	16	15/09/2011	Project Area
Eremophila warnesii	534380	7147177	2	15/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533039	7145810	7	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533042	7145888	10	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533045	7145887	3	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533061	7145744	5	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533064	7145889	27	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533065	7145878	5	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533066	7145748	4	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533067	7145723	1	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533069	7145762	4	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533069	7145771	10	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533070	7146127	6	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533075	7145828	1	09/08/2011	Project Area

Taxon	GPS E	GPS N	No. of Individuals	Date Collected	Record Location
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533077	7145748	5	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533077	7145901	6	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533079	7146130	3	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533080	7145782	2	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533081	7145770	8	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533081	7145853	6	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533081	7145850	4	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533082	7145672	10	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533082	7146117	8	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533083	7145731	7	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533085	7146141	6	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533086	7145875	6	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533087	7145807	1	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533088	7145708	5	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533088	7145725	6	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533088	7146155	1	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533090	7145842	15	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533091	7145906	3	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533091	7145901	3	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533093	7145679	6	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533093	7146130	1	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533093	7146123	2	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533099	7145915	2	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533101	7145830	20	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533102	7145759	12	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533102	7145849	56	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533102	7145879	10	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533102	7145929	1	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533103	7145731	45	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533104	7145614	6	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533104	7145664	31	09/08/2011	Project Area

Taxon	GPS E	GPS N	No. of Individuals	Date Collected	Record Location
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533104	7145684	50	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533104	7145718	20	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533107	7146154	5	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533117	7146200	4	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533118	7145635	20	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533119	7145598	10	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533119	7145615	4	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533119	7145652	7	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533119	7145668	6	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533119	7145698	9	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533119	7146131	5	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533120	7146112	7	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533121	7145710	22	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533121	7145722	25	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533121	7145778	12	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533121	7145805	2	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533121	7145856	4	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533121	7145867	11	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533121	7145886	1	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533122	7145828	8	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533122	7145737	20	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533122	7145752	15	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533122	7145766	11	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533123	7146125	19	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533124	7145843	3	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533125	7145688	8	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533126	7145962	1	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533132	7146170	2	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533137	7145637	7	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533139	7145731	35	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533139	7145817	34	09/08/2011	Project Area

Taxon	GPS E	GPS N	No. of Individuals	Date Collected	Record Location
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533139	7145859	3	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533140	7145662	11	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533140	7145712	40	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533140	7145743	53	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533140	7145760	37	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533140	7145776	47	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533140	7145794	21	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533140	7145833	33	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533141	7145596	1	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533141	7145684	23	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533141	7145695	14	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533144	7145615	10	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533148	7146219	2	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533149	7146187	1	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533150	7146268	4	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533151	7146243	1	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533151	7146115	10	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533152	7146214	5	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533153	7146136	14	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533156	7145715	28	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533157	7145890	1	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533158	7145842	4	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533159	7145802	33	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533159	7145737	14	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533159	7145646	6	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533160	7145676	25	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533160	7145588	17	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533161	7145778	6	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533163	7145568	2	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533164	7145823	18	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533166	7146109	20	09/08/2011	Project Area

Taxon	GPS E	GPS N	No. of Individuals	Date Collected	Record Location
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533167	7146119	18	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533170	7146253	5	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533170	7146175	10	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533170	7146134	9	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533171	7146103	10	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533172	7146062	1	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533173	7146221	10	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533173	7146188	32	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533173	7145908	1	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533174	7146301	6	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533174	7146205	20	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533175	7145834	1	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533176	7146287	8	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533177	7146274	8	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533179	7145794	3	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533180	7145773	8	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533180	7145708	10	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533187	7146248	8	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533187	7146325	5	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533188	7146116	18	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533188	7146188	37	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533188	7146211	20	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533189	7145710	5	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533189	7146284	10	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533189	7146091	17	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533189	7146228	3	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533190	7145721	10	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533191	7145739	25+	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533192	7145679	2	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533192	7146081	1	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533193	7145726	13	09/08/2011	Project Area

Taxon	GPS E	GPS N	No. of Individuals	Date Collected	Record Location
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533193	7146136	14	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533193	7146162	26	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533194	7145692	4	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533197	7146105	15	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533197	7146156	8	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533198	7145838	3	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533202	7145814	1	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533202	7145779	5	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533203	7145579	4	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533203	7146233	1	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533204	7145763	10	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533206	7145791	2	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533206	7146333	3	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533206	7146341	8	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533207	7145745	10	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533207	7146348	5	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533208	7145548	1	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533208	7146209	30	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533210	7146362	6	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533211	7146253	1	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533214	7146107	20+	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533216	7145624	2	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533217	7145758	30	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533218	7146098	11	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533219	7145707	4	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533219	7145679	3	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533219	7145650	7	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533219	7146126	6	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533219	7146167	30+	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533220	7145842	19	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533220	7145816	10	09/08/2011	Project Area

Taxon	GPS E	GPS N	No. of Individuals	Date Collected	Record Location
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533221	7145743	54	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533224	7145793	23	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533224	7146090	2	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533238	7145593	2	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533239	7145803	2	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533239	7145745	42	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533239	7145713	3	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533240	7145812	4	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533240	7145780	38	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533240	7145683	4	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533240	7145656	3	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533240	7145630	1	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533240	7145567	7	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533241	7145675	3	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533241	7146118	3	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533242	7146082	3	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533243	7145780	2	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533243	7145643	1	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533244	7146341	27	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533244	7145550	1	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533246	7146077	9	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533247	7146295	32	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533248	7146115	2	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533250	7146271	17	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533250	7146400	12	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533251	7146369	26	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533253	7146170	2	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533254	7146223	4	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533256	7146154	4	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533256	7145756	20	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533256	7146155	2	09/08/2011	Project Area

Taxon	GPS E	GPS N	No. of Individuals	Date Collected	Record Location
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533258	7145980	2	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533258	7145733	52	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533259	7145917	3	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533259	7145787	7	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533259	7145714	11	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533259	7145650	8	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533259	7145616	5	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533260	7145690	15	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533260	7145674	23	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533262	7145907	4	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533263	7145811	5	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533264	7145586	5	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533269	7146277	8	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533269	7146404	6	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533270	7146192	3	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533270	7146222	6	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533270	7146297	10	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533270	7146313	9	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533270	7146355	12	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533271	7146089	7	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533271	7146172	2	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533271	7146210	2	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533271	7146259	3	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533272	7145978	3	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533272	7146076	3	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533272	7146329	7	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533272	7146344	7	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533272	7146384	18	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533272	7146446	3	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533273	7146370	20	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533282	7145983	1	09/08/2011	Project Area

Taxon	GPS E	GPS N	No. of Individuals	Date Collected	Record Location
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533285	7146395	4	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533287	7146090	3	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533287	7146458	5	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533287	7146474	2	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533288	7146285	10	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533288	7146374	37	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533288	7146378	15	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533289	7146222	4	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533289	7146255	2	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533289	7146304	18	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533289	7146325	14	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533289	7146347	30	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533290	7146192	4	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533291	7145961	2	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533291	7146001	2	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533292	7146100	4	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533295	7146032	2	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533296	7145590	8	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533297	7145540	1	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533304	7145503	1	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533305	7145490	4	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533305	7146035	2	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533306	7145489	1	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533306	7146505	14	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533308	7146195	6	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533308	7146094	3	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533308	7146004	2	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533309	7146369	18	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533309	7145978	2	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533310	7146289	12	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533311	7146339	29	09/08/2011	Project Area

Taxon	GPS E	GPS N	No. of Individuals	Date Collected	Record Location
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533311	7146212	11	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533312	7146483	6	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533313	7146427	4	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533313	7146250	3	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533314	7146267	3	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533315	7146316	27	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533316	7146445	2	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533317	7145979	1	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533321	7145961	1	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533324	7146402	1	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533328	7146514	3	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533328	7146368	9	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533330	7146532	5	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533331	7146481	9	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533331	7146329	30+	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533332	7146256	5	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533333	7146548	20+	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533333	7146306	20+	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533336	7146172	1	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533339	7146456	4	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533345	7146529	6	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533347	7146265	2	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533349	7146461	6	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533350	7146482	5	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533350	7146307	5	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533352	7146345	3	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533359	7146329	4	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533364	7146547	4	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533370	7146270	9	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533371	7146562	1	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533371	7146241	3	09/08/2011	Project Area

Taxon	GPS E	GPS N	No. of Individuals	Date Collected	Record Location
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533371	7146198	1	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533372	7146344	7	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533372	7146507	3	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533373	7146392	4	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533374	7146318	10	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533375	7146507	4	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533375	7146465	10	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533389	7146344	1	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533390	7146498	13	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533390	7146449	1	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533390	7146064	1	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533391	7146606	3	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533391	7146558	3	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533391	7146525	5	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533391	7146465	7	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533391	7146307	1	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533391	7146251	9	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533393	7146573	2	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533407	7146211	1	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533407	7146179	1	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533408	7146526	2	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533408	7146237	4	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533409	7146450	9	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533410	7146494	10	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533411	7146561	1	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533411	7146066	1	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533412	7146041	6	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533412	7146026	4	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533413	7146583	6	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533414	7146466	7	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533415	7146350	6	09/08/2011	Project Area

Taxon	GPS E	GPS N	No. of Individuals	Date Collected	Record Location
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533415	7146053	5	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533431	7146069	1	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533432	7146036	14	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533452	7146057	1	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533453	7146088	15+	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533468	7146048	5	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533474	7146044	14	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533483	7146048	3	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533487	7146018	2	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533489	7146043	2	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533495	7145997	1	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533511	7146031	1	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533533	7146074	2	09/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533276	7145920	1	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533279	7145630	9	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533281	7145573	2	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533281	7145732	35	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533281	7145760	3	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533281	7145790	16	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533282	7145499	7	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533282	7145558	6	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533282	7145670	10	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533283	7145531	9	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533286	7145707	4	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533291	7145727	3	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533294	7145789	1	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533294	7145801	1	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533299	7145685	1	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533299	7145709	11	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533300	7145655	1	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533300	7145834	1	10/08/2011	Project Area

Taxon	GPS E	GPS N	No. of Individuals	Date Collected	Record Location
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533302	7145751	7	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533303	7145719	15	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533303	7145769	3	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533303	7145774	5	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533304	7145575	3	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533304	7145743	4	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533305	7145805	1	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533306	7145738	3	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533306	7145826	5	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533307	7145562	11	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533308	7145655	2	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533309	7145814	3	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533315	7145727	6	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533315	7145741	12	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533317	7145466	2	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533317	7145718	25	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533318	7145774	8	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533321	7145768	16	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533322	7145524	6	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533322	7145558	12	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533323	7145492	7	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533323	7145590	4	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533323	7145671	15	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533324	7145433	2	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533325	7145798	17	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533326	7145582	14	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533328	7145416	8	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533330	7145613	4	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533333	7145601	15	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533334	7145733	10	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533336	7145764	5	10/08/2011	Project Area

Taxon	GPS E	GPS N	No. of Individuals	Date Collected	Record Location
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533337	7145829	4	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533339	7145456	37	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533339	7145496	65	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533339	7145795	9	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533340	7145671	4	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533341	7145514	45	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533341	7145575	66	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533341	7145643	4	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533341	7145702	10	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533345	7145439	33	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533349	7145417	14	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533358	7145470	12	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533358	7145812	1	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533359	7145647	1	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533360	7145460	18	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533360	7145575	7	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533360	7145637	1	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533360	7145666	2	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533360	7145699	2	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533361	7145425	24	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533361	7145489	16	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533361	7145529	18	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533361	7145558	10	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533361	7145746	1	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533361	7145854	3	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533362	7145395	5	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533362	7145411	11	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533362	7145446	32	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533363	7145511	20	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533363	7145540	24	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533363	7145599	14	10/08/2011	Project Area

Taxon	GPS E	GPS N	No. of Individuals	Date Collected	Record Location
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533377	7145840	3	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533378	7145635	11	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533379	7145378	11	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533379	7145614	20	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533380	7145465	22	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533380	7145489	35	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533380	7145700	19	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533380	7145719	4	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533380	7145776	2	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533380	7145803	2	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533381	7145539	50	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533382	7145557	32	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533382	7145581	16	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533382	7145658	2	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533383	7145445	57	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533383	7145516	63	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533384	7145400	7	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533384	7145419	41	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533398	7145426	23	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533399	7145604	12	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533400	7145477	63	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533400	7145446	41	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533401	7145682	2	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533401	7145561	38	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533401	7145542	40	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533401	7145402	20	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533402	7145730	3	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533402	7145520	71	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533407	7145625	16	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533415	7145438	20	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533418	7145655	10	10/08/2011	Project Area

Taxon	GPS E	GPS N	No. of Individuals	Date Collected	Record Location
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533419	7145607	25	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533420	7145527	20	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533421	7145777	3	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533421	7145458	10	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533422	7145749	4	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533423	7145684	10	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533423	7145635	25	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533423	7145549	20	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533424	7145571	25	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533424	7145488	25	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533424	7145409	10	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533426	7145749	15	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533426	7145703	16	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533428	7145811	1	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533433	7145818	3	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533434	7145677	5	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533434	7145478	15	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533437	7145708	3	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533438	7145534	30	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533439	7145556	30	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533440	7145583	20	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533440	7145410	10	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533441	7145751	20	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533441	7145640	21	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533442	7145516	16	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533444	7145611	20	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533446	7145361	5	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533447	7145809	2	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533455	7145743	13	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533455	7145394	15	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533459	7145687	9	10/08/2011	Project Area

Taxon	GPS E	GPS N	No. of Individuals	Date Collected	Record Location
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533459	7145624	40	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533459	7145583	53	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533459	7145527	60	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533460	7145654	15	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533461	7145555	24	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533461	7145499	90	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533461	7145458	7	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533462	7145721	13	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533462	7145424	1	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533465	7145353	3	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533478	7145582	57	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533478	7145543	48	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533479	7145667	37	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533479	7145634	43	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533479	7145524	27	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533479	7145495	47	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533479	7145362	1	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533480	7145700	21	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533480	7145461	3	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533481	7145612	54	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533481	7145384	5	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533482	7145718	4	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533482	7145479	10	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533497	7145691	87	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533498	7145773	3	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533498	7145614	48	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533498	7145585	48	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533499	7145784	4	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533499	7145712	37	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533500	7145737	12	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533500	7145674	50	10/08/2011	Project Area

Taxon	GPS E	GPS N	No. of Individuals	Date Collected	Record Location
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533500	7145647	31	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533500	7145550	77	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533501	7145480	19	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533502	7145823	3	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533502	7145536	20	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533502	7145499	33	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533503	7145870	2	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533512	7145957	3	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533517	7145509	10	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533517	7145539	23	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533517	7145648	23	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533519	7145560	17	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533521	7145850	18	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533522	7145604	8	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533522	7145690	52	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533522	7145793	19	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533523	7145626	22	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533523	7145719	28	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533525	7145824	14	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533526	7145754	8	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533527	7145867	2	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533533	7145522	1	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533533	7145709	10	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533534	7145536	10	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533538	7145602	15	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533541	7145817	9	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533542	7145542	10	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533543	7145530	10	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533544	7145658	10	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533544	7145686	5	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533544	7145871	2	10/08/2011	Project Area

Taxon	GPS E	GPS N	No. of Individuals	Date Collected	Record Location
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533546	7145801	25	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533547	7145746	20	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533547	7145847	5	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533549	7145632	10	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533556	7145753	6	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533558	7145780	5	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533559	7145802	10	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533561	7145779	5	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533564	7145869	15	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533565	7145880	10	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533570	7145722	5	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533570	7145844	10	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533578	7145551	4	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533578	7145762	33	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533579	7145496	5	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533580	7145520	16	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533581	7145865	57	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533583	7145831	29	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533599	7146201	3	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533600	7145774	5	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533600	7145864	31	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533602	7145852	21	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533603	7145824	5	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533603	7145837	18	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533603	7145882	2	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533605	7145354	3	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533616	7145863	61	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533618	7145395	3	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533618	7145780	8	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533619	7145744	26	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533619	7145808	7	10/08/2011	Project Area

Taxon	GPS E	GPS N	No. of Individuals	Date Collected	Record Location
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533620	7145515	2	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533621	7145360	16	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533621	7145700	27	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533621	7145726	18	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533621	7145759	7	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533621	7145839	46	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533622	7145660	18	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533622	7145685	27	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533622	7145884	23	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533622	7145895	3	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533640	7145884	23	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533640	7145866	36	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533640	7145660	14	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533641	7145743	33	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533641	7145732	27	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533642	7145845	51	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533643	7145761	7	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533644	7145712	7	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533645	7145687	35	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533646	7145640	7	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533658	7145856	8	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533659	7145873	4	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533659	7145840	20	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533659	7145757	6	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533662	7145703	3	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533662	7145682	20	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533662	7145659	7	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533663	7145736	2	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533674	7145854	2	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533675	7145611	1	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533677	7145758	2	10/08/2011	Project Area

Taxon	GPS E	GPS N	No. of Individuals	Date Collected	Record Location
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533677	7145680	6	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533683	7145653	10	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533699	7145651	3	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533771	7145762	1	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533780	7146582	2	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533851	7146232	10	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533886	7146250	4	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533899	7146280	1	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533949	7146307	3	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534276	7145677	1	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534392	7145905	7	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534417	7146015	2	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534425	7145876	2	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534426	7145848	5	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534434	7145867	1	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534435	7145914	6	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534443	7146001	1	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534447	7145945	4	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534471	7145880	3	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534480	7145996	1	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534488	7145991	2	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534498	7145909	10	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534510	7145905	11	10/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533409	7147120	5	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533424	7147140	2	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533427	7147100	4	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533443	7147338	4	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533446	7147152	1	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533460	7147075	5	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533461	7147193	8	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533462	7147298	5	11/08/2011	Project Area

Taxon	GPS E	GPS N	No. of Individuals	Date Collected	Record Location
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533474	7146823	4	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533482	7147113	3	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533482	7147042	11	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533482	7147133	6	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533483	7146082	6	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533483	7147418	2	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533496	7147298	2	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533504	7147330	1	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533507	7147271	7	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533508	7147017	10	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533509	7147085	5	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533509	7147397	17	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533510	7147360	7	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533525	7146895	10	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533527	7147110	10	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533529	7146994	2	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533529	7146866	5	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533530	7147242	13	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533531	7147168	15	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533534	7146084	8	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533538	7147057	14	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533541	7146813	1	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533547	7147290	2	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533549	7147349	16	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533550	7146970	13	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533551	7147032	5	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533556	7147205	22	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533557	7146078	18	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533561	7147389	1	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533566	7147278	10	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533567	7147075	10	11/08/2011	Project Area

Taxon	GPS E	GPS N	No. of Individuals	Date Collected	Record Location
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533569	7146866	10	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533579	7146083	11	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533580	7146969	5	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533580	7146894	4	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533583	7147136	8	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533588	7147003	1	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533588	7147253	37	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533588	7147031	6	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533591	7146825	2	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533592	7146078	1	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533593	7147196	25	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533604	7147227	8	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533607	7146882	15	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533612	7147170	40	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533615	7146804	5	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533627	7147211	17	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533635	7147092	3	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533637	7146871	2	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533644	7146902	5	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533645	7147141	17	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533652	7147179	12	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533656	7146842	10	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533657	7146958	6	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533666	7146884	12	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533674	7147152	4	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533679	7147065	20	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533689	7146936	5	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533696	7146973	8	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533697	7147006	8	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533712	7147071	11	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533713	7147127	3	11/08/2011	Project Area

Taxon	GPS E	GPS N	No. of Individuals	Date Collected	Record Location
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533717	7147050	9	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533722	7146931	1	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533725	7147010	2	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534146	7146646	2	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534161	7146614	15	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534165	7146581	18	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534173	7146562	4	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534176	7146436	11	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534177	7146424	10	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534180	7146627	5	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534183	7146642	2	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534183	7146603	2	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534184	7146578	6	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534185	7146405	6	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534190	7146481	3	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534190	7146546	10	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534198	7146497	4	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534199	7146398	4	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534202	7146575	1	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534208	7146563	3	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534210	7146477	7	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534210	7146459	9	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534211	7146439	1	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534212	7146540	31	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534213	7146420	3	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534213	7146598	14	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534223	7146522	10	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534224	7146483	1	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534224	7146442	7	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534224	7146575	6	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534226	7146399	4	11/08/2011	Project Area

Taxon	GPS E	GPS N	No. of Individuals	Date Collected	Record Location
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534228	7146600	2	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534233	7146456	2	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534235	7146558	16	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534238	7146520	5	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534239	7146576	4	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534240	7146505	6	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534241	7146419	3	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534244	7146439	2	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534246	7146559	2	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534248	7146438	3	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534254	7146446	2	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534255	7146399	1	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534255	7146521	8	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534258	7146541	12	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534262	7146483	10	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534263	7146348	5	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534265	7146378	3	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534271	7146353	3	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534271	7146328	5	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534273	7146401	7	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534277	7146498	15	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534279	7146303	1	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534281	7146421	13	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534281	7146332	18	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534284	7146360	5	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534285	7146399	1	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534288	7146378	10	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534288	7146330	3	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534305	7146301	3	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534310	7146386	10	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534311	7146479	4	11/08/2011	Project Area

Taxon	GPS E	GPS N	No. of Individuals	Date Collected	Record Location
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534313	7146400	24	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534317	7146359	9	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534318	7146508	1	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534318	7146344	12	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534324	7146439	7	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534325	7146283	30	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534330	7146404	23	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534330	7146422	62	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534333	7146377	20	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534334	7146267	3	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534341	7146342	4	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534342	7146301	27	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534343	7146406	4	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534344	7146321	5	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534344	7146365	25	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534344	7146253	3	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534346	7146461	3	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534348	7146441	7	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534354	7146401	14	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534354	7146382	10	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534359	7146284	2	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534361	7146423	20	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534363	7146337	8	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534364	7146318	4	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534369	7146360	20	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534369	7146458	1	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534370	7146443	5	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534373	7146378	5	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534376	7146402	7	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534377	7146279	1	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534384	7146340	13	11/08/2011	Project Area

Taxon	GPS E	GPS N	No. of Individuals	Date Collected	Record Location
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534386	7146319	5	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534386	7146240	24	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534387	7146440	11	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534389	7146378	10	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534389	7146360	35	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534390	7146299	22	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534390	7146265	3	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534393	7146418	26	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534396	7146279	5	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534398	7146220	14	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534400	7146364	26	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534400	7146343	14	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534403	7146245	19	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534407	7146200	11	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534407	7146318	11	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534412	7146384	5	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534412	7146359	5	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534413	7146241	30	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534415	7146279	6	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534418	7146205	25	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534422	7146164	1	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534422	7146260	30	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534425	7146401	2	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534427	7146222	25	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534429	7146281	20	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534430	7146300	31	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534430	7146144	3	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534430	7146242	26	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534431	7146201	11	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534432	7146158	14	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534437	7146400	2	11/08/2011	Project Area

Taxon	GPS E	GPS N	No. of Individuals	Date Collected	Record Location
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534439	7146178	44	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534442	7146317	7	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534444	7146259	5	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534444	7146244	40	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534444	7146360	2	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534446	7146278	10	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534446	7146202	32	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534449	7146122	5	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534449	7146223	38	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534452	7146161	19	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534452	7146420	5	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534459	7146318	5	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534464	7146148	10	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534465	7146101	13	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534467	7146163	10	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534467	7146279	8	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534467	7146200	12	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534468	7146178	48	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534468	7146260	15	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534468	7146241	29	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534469	7146117	10	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534474	7146300	39	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534474	7146221	49	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534479	7146161	18	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534480	7146104	44	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534482	7146201	19	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534482	7146140	15	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534483	7146279	10	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534483	7146117	19	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534486	7146259	12	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534493	7146185	14	11/08/2011	Project Area

Taxon	GPS E	GPS N	No. of Individuals	Date Collected	Record Location
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534494	7146222	35	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534496	7146204	9	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534497	7146242	23	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534499	7146302	8	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534500	7146281	14	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534501	7146141	30	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534501	7146258	20	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534502	7146159	2	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534502	7146103	16	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534503	7146320	21	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534506	7146126	27	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534509	7146200	26	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534514	7146283	2	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534515	7146178	34	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534517	7146157	11	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534519	7146317	10	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534520	7146220	6	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534521	7146139	15	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534522	7146200	17	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534523	7146240	2	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534524	7146100	3	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534531	7146159	3	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534531	7146061	3	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534531	7146114	16	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534534	7146203	8	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534535	7146177	7	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534549	7146199	4	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534549	7146097	33	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534569	7146117	23	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534572	7146045	1	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534575	7146059	1	11/08/2011	Project Area

Taxon	GPS E	GPS N	No. of Individuals	Date Collected	Record Location
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534575	7146100	45	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534582	7146199	10	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534583	7146158	56	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534583	7146180	105	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534583	7146117	45	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534586	7146138	20	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534594	7146158	64	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534597	7146199	3	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534601	7146119	100	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534602	7146099	27	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534605	7146005	9	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534609	7146160	52	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534609	7146201	7	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534611	7146180	34	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534619	7146138	50	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534621	7146127	70	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534623	7146180	6	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534627	7146159	47	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534630	7146186	1	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534636	7146120	29	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534641	7146178	3	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534646	7146161	22	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534646	7146145	35	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534656	7146144	7	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534667	7146166	4	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534691	7146000	1	11/08/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533849	7146745	7	13/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533849	7146835	19	13/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533852	7146698	5	13/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533862	7146909	1	13/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533882	7146768	3	13/09/2011	Project Area

Taxon	GPS E	GPS N	No. of Individuals	Date Collected	Record Location
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533882	7146832	17	13/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533884	7146906	1	13/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533910	7146858	7	13/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533911	7146820	4	13/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533911	7146901	2	13/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533912	7146790	2	13/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533914	7146754	6	13/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533932	7146885	3	13/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533968	7146794	2	13/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533969	7146854	1	13/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533973	7146901	1	13/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533973	7146950	15	13/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533996	7146957	7	13/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533996	7146937	7	13/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533997	7146816	3	13/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533998	7146750	3	13/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534000	7146791	8	13/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534013	7146974	5	13/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534028	7146892	7	13/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534029	7146944	27	13/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534029	7146911	23	13/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534036	7146973	15	13/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534059	7146920	30	13/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534085	7146952	50	13/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534090	7146742	4	13/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534090	7146770	42	13/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534092	7146798	55	13/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534092	7146811	1	13/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534122	7146788	25	13/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534123	7146804	10	13/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534126	7146767	40	13/09/2011	Project Area

Taxon	GPS E	GPS N	No. of Individuals	Date Collected	Record Location
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534151	7146799	16	13/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534156	7146778	30	13/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534179	7146820	11	13/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534207	7146788	38	13/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534210	7146825	1	13/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534214	7146806	15	13/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534274	7146839	1	13/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534796	7146308	2	13/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534831	7146604	1	13/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534839	7146438	3	13/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534850	7146631	2	13/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533670	7146811	10	14/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533692	7146822	9	14/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533830	7146855	1	14/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533979	7147130	1	14/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533988	7147097	1	14/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533994	7147000	9	14/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534014	7146977	7	14/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534020	7147040	3	14/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534025	7146956	14	14/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534053	7147006	4	14/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534063	7146987	6	14/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534066	7147039	7	14/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534074	7146857	2	14/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534080	7146964	30	14/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534087	7146932	15	14/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534095	7146907	30	14/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534115	7146974	20	14/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534115	7146839	3	14/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534130	7146942	80	14/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534143	7146911	61	14/09/2011	Project Area

Taxon	GPS E	GPS N	No. of Individuals	Date Collected	Record Location
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534151	7146862	8	14/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534177	7146835	5	14/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533403	7146472	32	15/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533404	7146531	1	15/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533405	7146508	26	15/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533408	7146612	3	15/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533413	7146585	15	15/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533413	7146566	5	15/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533431	7146543	2	15/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533446	7146522	30	15/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533449	7146599	10	15/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533457	7146495	50	15/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533459	7146583	3	15/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533476	7146651	2	15/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533487	7146580	2	15/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533493	7146560	17	15/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533494	7146509	35	15/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533512	7146604	4	15/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533516	7146656	10	15/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533517	7146564	4	15/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533523	7146627	14	15/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533523	7146522	16	15/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533535	7146616	2	15/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533561	7146688	6	15/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533567	7146757	4	15/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533600	7146658	4	15/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533606	7146780	1	15/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533611	7146651	5	15/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533612	7146619	2	15/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533620	7146623	2	15/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533622	7146755	1	15/09/2011	Project Area

Taxon	GPS E	GPS N	No. of Individuals	Date Collected	Record Location
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533623	7146720	3	15/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533638	7146797	2	15/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533643	7146603	4	15/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533645	7146690	9	15/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533657	7146744	1	15/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533657	7146670	4	15/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533659	7146778	5	15/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533681	7146675	2	15/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533683	7146617	24	15/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533694	7146728	16	15/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533696	7146796	9	15/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533708	7146654	27	15/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533708	7146684	2	15/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533715	7146602	11	15/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533737	7146700	3	15/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533749	7146623	19	15/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533771	7146820	17	15/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533776	7146690	7	15/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533784	7146766	34	15/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533790	7146724	2	15/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533791	7146663	2	15/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533810	7146833	3	15/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533814	7146745	2	15/09/2011	Project Area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	533826	7146717	3	15/09/2011	Project Area
Rhodanthe sphaerocephala	532687	7145679	7	11/08/2011	Project Area
Rhodanthe sphaerocephala	532730	7145659	5	11/08/2011	Project Area
Rhodanthe sphaerocephala	532932	7146872	1	11/08/2011	Project Area
Rhodanthe sphaerocephala	532951	7146844	7	11/08/2011	Project Area
Tribulus adelacanthus	533206	7146307	20	09/08/2011	Project Area
Tribulus adelacanthus	533250	7146401	3	09/08/2011	Project Area
Tribulus adelacanthus	533285	7146395	50	09/08/2011	Project Area

Taxon	GPS E	GPS N	No. of Individuals	Date Collected	Record Location
Tribulus adelacanthus	533287	7146458	50	09/08/2011	Project Area
Tribulus adelacanthus	533287	7146474	30	09/08/2011	Project Area
Tribulus adelacanthus	533288	7146378	5	09/08/2011	Project Area
Tribulus adelacanthus	533288	7146430	10	09/08/2011	Project Area
Tribulus adelacanthus	533375	7146465	2	09/08/2011	Project Area
Tribulus adelacanthus	533391	7146369	5	09/08/2011	Project Area
Tribulus adelacanthus	533415	7146350	10	09/08/2011	Project Area
Tribulus adelacanthus	533382	7145658	10	10/08/2011	Project Area
Tribulus adelacanthus	533464	7145393	5	10/08/2011	Project Area
Tribulus adelacanthus	533576	7146372	1	10/08/2011	Project Area
Tribulus adelacanthus	533648	7146433	3	10/08/2011	Project Area
Tribulus adelacanthus	533757	7146482	10	10/08/2011	Project Area
Tribulus adelacanthus	533589	7147740	50+	11/08/2011	Project Area
Tribulus adelacanthus	533673	7148049	20	11/08/2011	Project Area
Tribulus adelacanthus	534555	7146305	1	11/08/2011	Project Area
Tribulus adelacanthus	534555	7146435	10	11/08/2011	Project Area
Tribulus adelacanthus	534635	7146100	6	11/08/2011	Project Area
Tribulus adelacanthus	533597	7147647	5	14/09/2011	Project Area
Tribulus adelacanthus	533623	7147650	10	14/09/2011	Project Area
Tribulus adelacanthus	533631	7147557	3	14/09/2011	Project Area
Tribulus adelacanthus	533642	7147630	5	14/09/2011	Project Area
Tribulus adelacanthus	533681	7147514	1	14/09/2011	Project Area
Tribulus adelacanthus	533699	7147550	3	14/09/2011	Project Area
Tribulus adelacanthus	533815	7146869	1	14/09/2011	Project Area
Tribulus adelacanthus	533817	7147372	1	14/09/2011	Project Area
Tribulus adelacanthus	533852	7146841	20	14/09/2011	Project Area
Tribulus adelacanthus	533854	7147399	3	14/09/2011	Project Area
Tribulus adelacanthus	533874	7146816	15	14/09/2011	Project Area
Tribulus adelacanthus	533912	7146783	20	14/09/2011	Project Area
Tribulus adelacanthus	533951	7146761	5	14/09/2011	Project Area
Tribulus adelacanthus	534417	7147199	2	14/09/2011	Project Area

Taxon	GPS E	GPS N	No. of Individuals	Date Collected	Record Location
Tribulus adelacanthus	534463	7147206	1	14/09/2011	Project Area
Tribulus adelacanthus	534511	7147210	2	14/09/2011	Project Area
Tribulus adelacanthus	534526	7147208	3	14/09/2011	Project Area
Tribulus adelacanthus	534552	7147193	1	14/09/2011	Project Area
Tribulus adelacanthus	533398	7146561	9	15/09/2011	Project Area
Tribulus adelacanthus	533413	7146585	2	15/09/2011	Project Area
Tribulus adelacanthus	533413	7146566	15	15/09/2011	Project Area
Tribulus adelacanthus	533439	7146575	16	15/09/2011	Project Area
Tribulus adelacanthus	533442	7146547	2	15/09/2011	Project Area
Tribulus adelacanthus	533470	7146604	6	15/09/2011	Project Area
Tribulus adelacanthus	533512	7146604	30	15/09/2011	Project Area
Tribulus adelacanthus	533517	7146585	4	15/09/2011	Project Area
Tribulus adelacanthus	533523	7146522	5	15/09/2011	Project Area
Tribulus adelacanthus	533535	7146616	50	15/09/2011	Project Area
Tribulus adelacanthus	533541	7146633	12	15/09/2011	Project Area
Tribulus adelacanthus	533574	7146630	25	15/09/2011	Project Area
Tribulus adelacanthus	533594	7146703	1	15/09/2011	Project Area
Tribulus adelacanthus	533620	7146623	7	15/09/2011	Project Area
Tribulus adelacanthus	533628	7146559	12	15/09/2011	Project Area
Tribulus adelacanthus	533654	7146639	2	15/09/2011	Project Area
Tribulus adelacanthus	533671	7146610	6	15/09/2011	Project Area
Tribulus adelacanthus	533684	7146582	25	15/09/2011	Project Area
Tribulus adelacanthus	533723	7146784	2	15/09/2011	Project Area
Tribulus adelacanthus	533734	7146609	20	15/09/2011	Project Area
Tribulus adelacanthus	533737	7146700	2	15/09/2011	Project Area
Tribulus adelacanthus	533749	7146623	10	15/09/2011	Project Area
Tribulus adelacanthus	533761	7147696	4	15/09/2011	Project Area
Tribulus adelacanthus	533771	7147656	2	15/09/2011	Project Area
Tribulus adelacanthus	533796	7146639	12	15/09/2011	Project Area
Tribulus adelacanthus	533812	7146807	5	15/09/2011	Project Area
Tribulus adelacanthus	533818	7146778	6	15/09/2011	Project Area

Taxon	GPS E	GPS N	No. of Individuals	Date Collected	Record Location
Tribulus adelacanthus	533823	7146837	1	15/09/2011	Project Area
Tribulus adelacanthus	533830	7146764	5	15/09/2011	Project Area
Tribulus adelacanthus	533897	7146748	10	15/09/2011	Project Area
Tribulus adelacanthus	533957	7148009	17	15/09/2011	Project Area
Tribulus adelacanthus	533963	7147922	4	15/09/2011	Project Area
Tribulus adelacanthus	533970	7147770	22	15/09/2011	Project Area
Tribulus adelacanthus	534009	7147799	4	15/09/2011	Project Area
Tribulus adelacanthus	534016	7147860	20	15/09/2011	Project Area
Tribulus adelacanthus	534029	7147885	5	15/09/2011	Project Area
Tribulus adelacanthus	534033	7147744	35	15/09/2011	Project Area
Tribulus adelacanthus	534042	7147751	20	15/09/2011	Project Area
Tribulus adelacanthus	534066	7147855	40	15/09/2011	Project Area
Tribulus adelacanthus	534077	7147800	2	15/09/2011	Project Area
Tribulus adelacanthus	534077	7147832	5	15/09/2011	Project Area
Tribulus adelacanthus	534085	7148019	3	15/09/2011	Project Area
Tribulus adelacanthus	534091	7147705	10	15/09/2011	Project Area
Tribulus adelacanthus	534099	7147038	3	15/09/2011	Project Area
Tribulus adelacanthus	534104	7147743	10	15/09/2011	Project Area
Tribulus adelacanthus	534151	7147890	3	15/09/2011	Project Area
Tribulus adelacanthus	534151	7147852	30	15/09/2011	Project Area
Tribulus adelacanthus	534161	7147710	4	15/09/2011	Project Area
Tribulus adelacanthus	534166	7148011	10	15/09/2011	Project Area
Tribulus adelacanthus	534178	7147977	15	15/09/2011	Project Area
Tribulus adelacanthus	534182	7147922	4	15/09/2011	Project Area
Tribulus adelacanthus	534185	7147860	10	15/09/2011	Project Area
Tribulus adelacanthus	534194	7147504	1	15/09/2011	Project Area
Tribulus adelacanthus	534198	7147622	30	15/09/2011	Project Area
Tribulus adelacanthus	534199	7147887	7	15/09/2011	Project Area
Tribulus adelacanthus	534216	7147858	10	15/09/2011	Project Area
Tribulus adelacanthus	534217	7147739	5	15/09/2011	Project Area
Tribulus adelacanthus	534224	7147770	2	15/09/2011	Project Area

Taxon	GPS E	GPS N	No. of Individuals	Date Collected	Record Location
Tribulus adelacanthus	534230	7147654	11	15/09/2011	Project Area
Tribulus adelacanthus	534234	7147981	10	15/09/2011	Project Area
Tribulus adelacanthus	534240	7148041	7	15/09/2011	Project Area
Tribulus adelacanthus	534250	7147622	15	15/09/2011	Project Area
Tribulus adelacanthus	534265	7148062	5	15/09/2011	Project Area
Tribulus adelacanthus	534269	7148009	10	15/09/2011	Project Area
Tribulus adelacanthus	534271	7147920	3	15/09/2011	Project Area
Tribulus adelacanthus	534277	7147862	5	15/09/2011	Project Area
Tribulus adelacanthus	534280	7147649	5	15/09/2011	Project Area
Tribulus adelacanthus	534291	7147979	10	15/09/2011	Project Area
Tribulus adelacanthus	534306	7147651	1	15/09/2011	Project Area
Tribulus adelacanthus	534334	7147258	5	15/09/2011	Project Area
Tribulus adelacanthus	534338	7147291	1	15/09/2011	Project Area
Tribulus adelacanthus	534344	7147886	4	15/09/2011	Project Area
Tribulus adelacanthus	534352	7147981	15	15/09/2011	Project Area
Tribulus adelacanthus	534360	7147290	3	15/09/2011	Project Area
Tribulus adelacanthus	534363	7148009	15	15/09/2011	Project Area
Tribulus adelacanthus	534363	7147860	15	15/09/2011	Project Area
Tribulus adelacanthus	534366	7147439	5	15/09/2011	Project Area
Tribulus adelacanthus	534366	7148041	5	15/09/2011	Project Area
Tribulus adelacanthus	534376	7147171	3	15/09/2011	Project Area
Tribulus adelacanthus	534376	7147591	5	15/09/2011	Project Area
Tribulus adelacanthus	534411	7147258	10	15/09/2011	Project Area
Tribulus adelacanthus	534417	7147439	13	15/09/2011	Project Area
Tribulus adelacanthus	534422	7147412	25	15/09/2011	Project Area
Tribulus adelacanthus	534431	7147653	15	15/09/2011	Project Area
Tribulus adelacanthus	534433	7147772	1	15/09/2011	Project Area
Tribulus adelacanthus	534438	7147289	16	15/09/2011	Project Area
Tribulus adelacanthus	534438	7147920	5	15/09/2011	Project Area
Tribulus adelacanthus	534441	7147352	10	15/09/2011	Project Area
Tribulus adelacanthus	534446	7147498	30	15/09/2011	Project Area

Taxon	GPS E	GPS N	No. of Individuals	Date Collected	Record Location
Tribulus adelacanthus	534456	7147380	15	15/09/2011	Project Area
Tribulus adelacanthus	534460	7147890	5	15/09/2011	Project Area
Tribulus adelacanthus	534465	7147620	20	15/09/2011	Project Area
Tribulus adelacanthus	534469	7147442	6	15/09/2011	Project Area
Tribulus adelacanthus	534471	7147410	25	15/09/2011	Project Area
Tribulus adelacanthus	534474	7147260	17	15/09/2011	Project Area
Tribulus adelacanthus	534484	7148008	10	15/09/2011	Project Area
Tribulus adelacanthus	534491	7147981	30	15/09/2011	Project Area
Tribulus adelacanthus	534494	7147289	10	15/09/2011	Project Area
Tribulus adelacanthus	534499	7147357	10	15/09/2011	Project Area
Tribulus adelacanthus	534505	7147651	2	15/09/2011	Project Area
Tribulus adelacanthus	534506	7147164	2	15/09/2011	Project Area
Tribulus adelacanthus	534522	7147413	18	15/09/2011	Project Area
Tribulus adelacanthus	534525	7147920	9	15/09/2011	Project Area
Tribulus adelacanthus	534526	7147292	10	15/09/2011	Project Area
Tribulus adelacanthus	534533	7147981	5	15/09/2011	Project Area
Tribulus adelacanthus	534534	7147857	1	15/09/2011	Project Area
Tribulus adelacanthus	534540	7147833	5	15/09/2011	Project Area
Tribulus adelacanthus	534546	7147502	28	15/09/2011	Project Area
Tribulus adelacanthus	534548	7147382	25	15/09/2011	Project Area
Tribulus adelacanthus	534549	7147261	15	15/09/2011	Project Area
Tribulus adelacanthus	534555	7147289	10	15/09/2011	Project Area
Tribulus adelacanthus	534557	7147889	30	15/09/2011	Project Area
Tribulus adelacanthus	534571	7147414	3	15/09/2011	Project Area
Tribulus adelacanthus	534578	7147260	10	15/09/2011	Project Area
Tribulus adelacanthus	534592	7147504	10	15/09/2011	Project Area
Tribulus adelacanthus	534601	7147922	6	15/09/2011	Project Area
Tribulus adelacanthus	534607	7147376	10	15/09/2011	Project Area
Tribulus adelacanthus	534627	7147260	5	15/09/2011	Project Area
Tribulus adelacanthus	534633	7147890	10	15/09/2011	Project Area
Tribulus adelacanthus	534633	7147860	150	15/09/2011	Project Area

Taxon	GPS E	GPS N	No. of Individuals	Date Collected	Record Location
Tribulus adelacanthus	534640	7147381	35	15/09/2011	Project Area
Tribulus adelacanthus	534645	7147742	10	15/09/2011	Project Area
Tribulus adelacanthus	534649	7147771	1	15/09/2011	Project Area
Tribulus adelacanthus	534655	7147354	7	15/09/2011	Project Area
Tribulus adelacanthus	534662	7147412	12	15/09/2011	Project Area
Tribulus adelacanthus	534678	7147261	6	15/09/2011	Project Area
Tribulus adelacanthus	534682	7147827	10	15/09/2011	Project Area
Tribulus adelacanthus	534696	7147918	8	15/09/2011	Project Area
Tribulus adelacanthus	534697	7147859	50	15/09/2011	Project Area
Tribulus adelacanthus	534701	7147887	9	15/09/2011	Project Area
Tribulus adelacanthus	534702	7147531	16	15/09/2011	Project Area
Tribulus adelacanthus	534706	7147565	5	15/09/2011	Project Area
Tribulus adelacanthus	534714	7147499	5	15/09/2011	Project Area
Tribulus adelacanthus	534719	7147380	15	15/09/2011	Project Area
Tribulus adelacanthus	534764	7147859	30	15/09/2011	Project Area
Tribulus adelacanthus	534769	7147556	3	15/09/2011	Project Area
Tribulus adelacanthus	534790	7147415	2	15/09/2011	Project Area
Tribulus adelacanthus	534796	7147616	30	15/09/2011	Project Area
Tribulus adelacanthus	534800	7147477	10	15/09/2011	Project Area
Tribulus adelacanthus	534808	7147506	30	15/09/2011	Project Area
Tribulus adelacanthus	534833	7147889	5	15/09/2011	Project Area
Tribulus adelacanthus	534851	7147862	10	15/09/2011	Project Area
Tribulus adelacanthus	534863	7147803	10	15/09/2011	Project Area
Tribulus adelacanthus	534868	7147739	15	15/09/2011	Project Area
Tribulus adelacanthus	534872	7147774	6	15/09/2011	Project Area
Eremophila warnesii	587805	7148641	70+	01/09/2011	Approx. 200m N along old track from Bogie Man Mill on Yarlalweelor Station
Eremophila warnesii	590877	7150425	7	01/09/2011	4 km NE of cattle yards at Bogieman Mill, Yarlalweelor Station
Eremophila warnesii	591196	7150819	10	01/09/2011	4.5km NE of cattle yards at Bogieman Mill, Yarlalweelor Station

Taxon	GPS E	GPS N	No. of Individuals	Date Collected	Record Location
Eremophila warnesii	591318	7150974	14	01/09/2011	4.7km NE of cattle yards at Bogieman Mill, Yarlalweelor Station
Eremophila warnesii	591565	7151290	6	01/09/2011	5.1km NE of cattle yards at Bogieman Mill, Yarlalweelor Station
Eremophila warnesii	591685	7151449	8	01/09/2011	5.3km NE of cattle yards at Bogieman Mill, Yarlalweelor Station
Eremophila warnesii	592055	7151922	1	01/09/2011	5.9km NE of cattle yards at Bogieman Mill, Yarlalweelor Station
Eremophila warnesii	592430	7152375	1	01/09/2011	6.5km NE of cattle yards at Bogieman Mill, Yarlalweelor Station
Eremophila warnesii	573439	7153384	111	01/09/2011	4 km W of Windarn Well, Yarlalweelor Station
Eremophila warnesii	534662	7146938	100	14/09/2011	Mount Gould, adjacent to Project area
Eremophila warnesii	534681	7147005	50	14/09/2011	Mount Gould, adjacent to Project area
Eremophila warnesii	534699	7146910	150	14/09/2011	Mount Gould, adjacent to Project area
Eremophila warnesii	534718	7146989	2	14/09/2011	Mount Gould, adjacent to Project area
Eremophila warnesii	534723	7146898	50	14/09/2011	Mount Gould, adjacent to Project area
Eremophila warnesii	534774	7146885	200	14/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	535773	7148701	116	30/08/2011	Low hills to north of Mount Gould
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	535824	7148815	30	30/08/2011	Low hills to north of Mount Gould
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	535874	7148860	39	30/08/2011	Low hills to north of Mount Gould
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	535923	7148947	6	30/08/2011	Low hills to north of Mount Gould
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534655	7145803	6	11/08/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534820	7146345	1	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534827	7146317	4	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534849	7146406	8	13/09/2011	Mount Gould, adjacent to Project area

Taxon	GPS E	GPS N	No. of Individuals	Date Collected	Record Location
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534857	7146322	17	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534859	7146366	5	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534860	7146437	9	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534873	7146390	9	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534874	7146477	4	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534878	7146355	12	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534881	7146507	3	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534893	7146281	8	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534900	7146440	3	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534900	7146343	1	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534902	7146461	3	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534905	7146575	3	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534910	7146350	3	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534922	7146525	3	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534926	7146432	9	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534932	7146664	4	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534943	7146558	6	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534948	7146277	4	13/09/2011	Mount Gould, adjacent to Project area

Taxon	GPS E	GPS N	No. of Individuals	Date Collected	Record Location
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534966	7146492	3	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534968	7146657	4	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534975	7146260	3	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534994	7146546	1	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	534998	7145985	2	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	535007	7146453	1	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	535012	7146246	6	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	535013	7146609	6	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	535019	7146473	6	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	535019	7146286	5	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	535024	7145986	1	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	535025	7146506	10	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	535032	7146533	4	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	535042	7146309	1	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	535047	7146392	4	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	535063	7146580	2	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	535063	7146491	5	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	535083	7146539	5	13/09/2011	Mount Gould, adjacent to Project area

Taxon	GPS E	GPS N	No. of Individuals	Date Collected	Record Location
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	535089	7146270	3	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	535091	7146670	20	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	535093	7146477	4	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	535101	7146391	5	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	535124	7146544	5	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	535140	7146642	10	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	535151	7146602	21	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	535156	7146517	2	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	535157	7146647	24	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	535169	7146731	6	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	535174	7146579	15	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	535177	7146691	10	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	535185	7146499	2	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	535188	7146721	23	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	535190	7146621	8	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	535202	7146759	15	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	535203	7146670	2	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	535207	7146568	9	13/09/2011	Mount Gould, adjacent to Project area

Taxon	GPS E	GPS N	No. of Individuals	Date Collected	Record Location
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	535208	7146693	15	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	535211	7146586	13	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	535227	7146743	7	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	535228	7146628	7	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	535234	7146662	4	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	535243	7146773	11	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	535253	7146709	13	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	535257	7146754	15	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	535259	7146800	6	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	535288	7146731	7	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	535295	7146786	14	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	535315	7146822	4	13/09/2011	Mount Gould, adjacent to Project area
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)	535328	7146780	4	13/09/2011	Mount Gould, adjacent to Project area
Tribulus adelacanthus	534266	7148102	5	15/09/2011	Mount Gould, adjacent to Project area
Tribulus adelacanthus	534309	7148100	10	15/09/2011	Mount Gould, adjacent to Project area
Tribulus adelacanthus	534421	7148097	3	15/09/2011	Mount Gould, adjacent to Project area
Tribulus adelacanthus	534469	7148040	3	15/09/2011	Mount Gould, adjacent to Project area
Tribulus adelacanthus	534476	7148079	10	15/09/2011	Mount Gould, adjacent to Project area

Taxon	GPS E	GPS N	No. of Individuals	Date Collected	Record Location
Tribulus adelacanthus	534485	7148103	15	15/09/2011	Mount Gould, adjacent to Project area
Tribulus adelacanthus	534535	7148098	30	15/09/2011	Mount Gould, adjacent to Project area
Tribulus adelacanthus	534561	7148006	10	15/09/2011	Mount Gould, adjacent to Project area
Tribulus adelacanthus	534562	7148040	6	15/09/2011	Mount Gould, adjacent to Project area
Tribulus adelacanthus	534588	7148063	10	15/09/2011	Mount Gould, adjacent to Project area
Tribulus adelacanthus	534591	7147980	20	15/09/2011	Mount Gould, adjacent to Project area
Tribulus adelacanthus	534605	7148099	5	15/09/2011	Mount Gould, adjacent to Project area
Tribulus adelacanthus	534658	7147978	15	15/09/2011	Mount Gould, adjacent to Project area
Tribulus adelacanthus	534690	7147944	30	15/09/2011	Mount Gould, adjacent to Project area
Tribulus adelacanthus	534718	7147980	10	15/09/2011	Mount Gould, adjacent to Project area
Tribulus adelacanthus	534801	7147380	7	15/09/2011	Mount Gould, adjacent to Project area
Tribulus adelacanthus	534840	7147559	10	15/09/2011	Mount Gould, adjacent to Project area
Tribulus adelacanthus	534859	7147620	25	15/09/2011	Mount Gould, adjacent to Project area
Tribulus adelacanthus	534891	7148038	2	15/09/2011	Mount Gould, adjacent to Project area
Tribulus adelacanthus	534902	7148023	1	15/09/2011	Mount Gould, adjacent to Project area
Tribulus adelacanthus	534904	7147920	9	15/09/2011	Mount Gould, adjacent to Project area
Tribulus adelacanthus	534925	7147890	7	15/09/2011	Mount Gould, adjacent to Project area
Tribulus adelacanthus	534931	7147858	5	15/09/2011	Mount Gould, adjacent to Project area

Taxon	GPS E	GPS N	No. of Individuals	Date Collected	Record Location
Tribulus adelacanthus	534934	7147830	5	15/09/2011	Mount Gould, adjacent to Project area

APPENDIX 7: NATUREMAP AND PMST DATABASE SEARCH RESULTS (DBCA 2021B, DAWE 2021)

NatureMap Species Report

Created By Guest user on 13/07/2021

Current Names Only Yes
Core Datasets Only Yes
Method 'By Circle'
Centre 117° 20' 07" E, 25° 47' 53" S
Buffer 20km
Group By Conservation Status

Conservation Status	Species	Records
Non-conservation taxon	277	670
Other specially protected fauna	1	6
Priority 1	3	20
Priority 2	2	2
Priority 3	3	10
Priority 4	1	1
Rare or likely to become extinct	1	1
TOTAL	288	710

Name ID	Species Name	Naturalised	Conservation Code	Endemic To Query Area
Rare or likely to become extinct				
1.	24473 <i>Falco hypoleucos</i> (Grey Falcon)		T	
Other specially protected fauna				
2.	25624 <i>Falco peregrinus</i> (Peregrine Falcon)		S	
Priority 1				
3.	18055 <i>Eremophila warnesii</i>		P1	
4.	33457 <i>Halgania gustafsenii</i> var. Murchison (R. Meissner & B. Bayliss 743)		P1	Y
5.	13302 <i>Rhodanthe sphaerocephala</i>		P1	
Priority 2				
6.	7830 <i>Angianthus microcephalus</i> (Small-headed Angianthus)		P2	
7.	34022 <i>Hypseleotris aurea</i> (Golden Gudgeon)		P2	
Priority 3				
8.	2739 <i>Ptilotus lazaridis</i>		P3	
9.	18065 <i>Tribulus adelacanthus</i>		P3	
10.	6092 <i>Verticordia jamiesonii</i>		P3	
Priority 4				
11.	5193 <i>Frankenia confusa</i>		P4	
Non-conservation taxon				
12.	4895 <i>Abutilon lepidum</i>			
13.	4902 <i>Abutilon oxycarpum</i> (Flannel Weed)			
14.	43020 <i>Abutilon oxycarpum</i> subsp. Prostrate (A.A. Mitchell PRP 1266)			
15.	37260 <i>Acacia aptaneura</i>			
16.	3260 <i>Acacia citrinoviridis</i>			
17.	14088 <i>Acacia cyperophylla</i> var. <i>cyperophylla</i>			
18.	17743 <i>Acacia demissa</i>			
19.	3305 <i>Acacia distans</i>			
20.	36418 <i>Acacia incurvaneura</i>			
21.	29015 <i>Acacia pyriformis</i> var. <i>pyriformis</i>			
22.	19483 <i>Acacia ramulosa</i> var. <i>linophylla</i>			
23.	3519 <i>Acacia rhodophloia</i>			
24.	13078 <i>Acacia sclerosperma</i> subsp. <i>sclerosperma</i>			
25.	3577 <i>Acacia tetragonophylla</i> (Kurara, Wakalpuka)			
26.	29531 <i>Acacia thoma</i>			
27.	3586 <i>Acacia tysonii</i>			
28.	3606 <i>Acacia xiphophylla</i>			
29.	24559 <i>Acanthagenys rufogularis</i> (Spiny-cheeked Honeyeater)			
30.	24261 <i>Acanthiza chrysorrhoa</i> (Yellow-rumped Thornbill)			
31.	24264 <i>Acanthiza robustirostris</i> (Slaty-backed Thornbill)			
32.	24265 <i>Acanthiza uropygialis</i> (Chestnut-rumped Thornbill)			



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: 05/07/21 12:50:24

[Summary](#)

[Details](#)

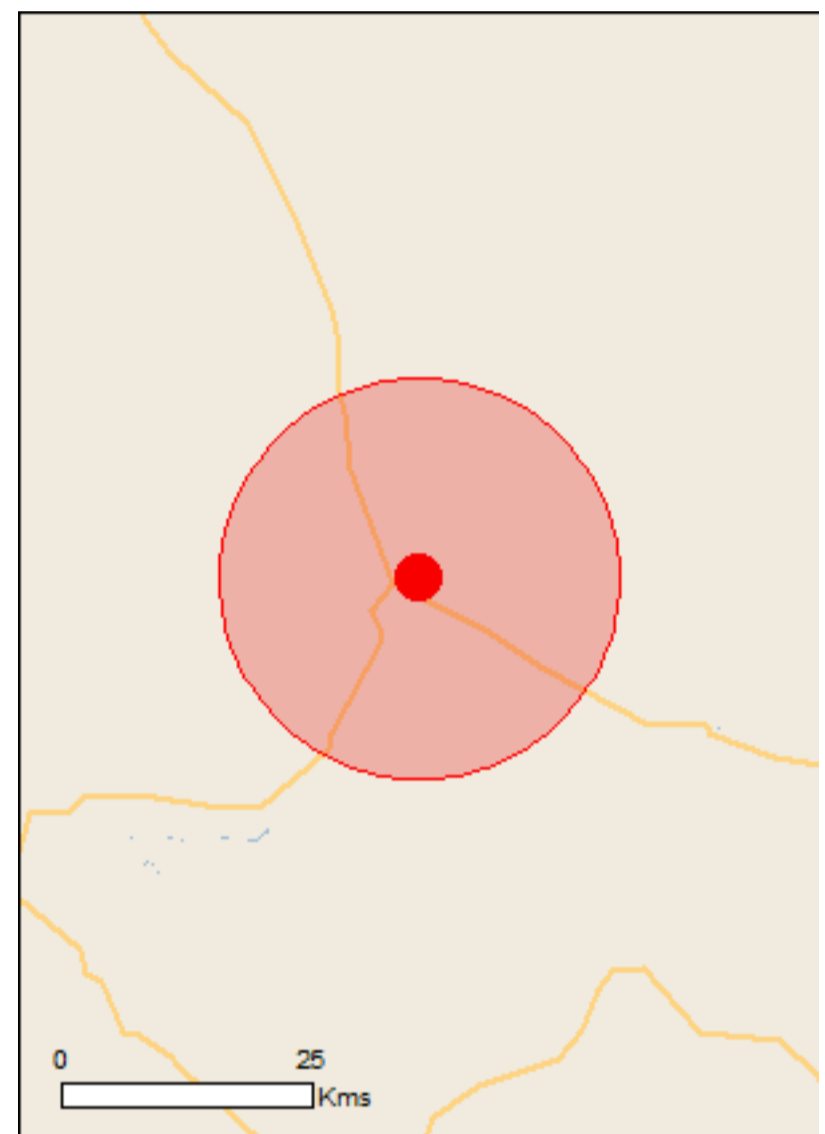
[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

[Acknowledgements](#)



This map may contain data which are
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[Coordinates](#)

Buffer: 20.0Km



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:	5
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:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	10
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:	None
Regional Forest Agreements:	None
Invasive Species:	7
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Species [\[Resource Information \]](#)

Name	Status	Type of Presence
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Birds

Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
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Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat known to occur within area
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Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
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Other

Idiosoma nigrum Shield-backed Trapdoor Spider, Black Rugose Trapdoor Spider [66798]	Vulnerable	Species or species habitat likely to occur within area
--	------------	--

Plants

Pityrodia augustensis Mt Augustus Foxglove [4962]	Vulnerable	Species or species habitat likely to 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 Terrestrial Species

Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
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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 may occur within area
--	--	--

Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
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Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
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Name	Threatened	Type of Presence
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		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		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat likely 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
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	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 Resources Audit, 2001.

Name	Status	Type of Presence
Mammals		
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
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		
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat likely to occur within area

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

-25.79806 117.33528

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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Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
33.	<i>Acariformes</i> sp.			
34.	27577 <i>Acarospora novae-hollandiae</i>			
35.	25535 <i>Accipiter cirrocephalus</i> (Collared Sparrowhawk)			
36.	25536 <i>Accipiter fasciatus</i> (Brown Goshawk)			
37.	25544 <i>Aegotheles cristatus</i> (Australian Owlet-nightjar)			
38.	<i>Aeshnidae</i> sp.			
39.	2660 <i>Amaranthus cuspidifolius</i>			
40.	30833 <i>Amphibolurus longirostris</i> (Long-nosed Dragon)			
41.	25318 <i>Antaresia perthensis</i> (Pygmy Python)			
42.	25670 <i>Anthus australis</i> (Australian Pipit)			
43.	25528 <i>Aphelocephala leucopsis</i> (Southern Whiteface)			
44.	24285 <i>Aquila audax</i> (Wedge-tailed Eagle)			
45.	24341 <i>Ardea pacifica</i> (White-necked Heron)			
46.	24610 <i>Ardeotis australis</i> (Australian Bustard)			
47.	207 <i>Aristida contorta</i> (Bunched Kerosene Grass)			
48.	25566 <i>Artamus cinereus</i> (Black-faced Woodswallow)			
49.	24355 <i>Artamus minor</i> (Little Woodswallow)			
50.	24356 <i>Artamus personatus</i> (Masked Woodswallow)			
51.	24251 <i>Bos taurus</i> (European Cattle)	Y		
52.	7871 <i>Brachyscome ciliaris</i>			
53.	750 <i>Bulbostylis barbata</i>			
54.	24359 <i>Burhinus grallarius</i> (Bush Stone-curlew)			
55.	25715 <i>Cacatua roseicapilla</i> (Galah)			
56.	25716 <i>Cacatua sanguinea</i> (Little Corella)			
57.	42307 <i>Cacomantis pallidus</i> (Pallid Cuckoo)			
58.	2860 <i>Calandrinia polyandra</i> (Parakeelya)			
59.	2867 <i>Calandrinia remota</i>			
60.	7891 <i>Calocephalus francisii</i> (Fine-leaf Beauty-heads)			
61.	7905 <i>Calotis multicaulis</i> (Many-stemmed Burr-daisy)			
62.	5451 <i>Calytrix desolata</i>			
63.	24253 <i>Capra hircus</i> (Goat)	Y		
64.	258 <i>Cenchrus ciliaris</i> (Buffel Grass)	Y		
65.	<i>Ceratopogonidae</i> sp.			
66.	32 <i>Cheilanthes brownii</i>			
67.	12818 <i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>			
68.	24321 <i>Chenonetta jubata</i> (Australian Wood Duck, Wood Duck)			
69.	<i>Chironominae</i> sp.			
70.	24431 <i>Chrysococcyx basalis</i> (Horsfield's Bronze Cuckoo)			
71.	25580 <i>Cinclosoma castaneothorax</i> (Chestnut-breasted Quail-thrush)			
72.	24289 <i>Circus assimilis</i> (Spotted Harrier)			
73.	27703 <i>Collema coccophorum</i>			
74.	25675 <i>Colluricincla harmonica</i> (Grey Shrike-thrush)			
75.	6612 <i>Convolvulus clementii</i>			
76.	25568 <i>Coracina novaehollandiae</i> (Black-faced Cuckoo-shrike)			
77.	13560 <i>Corchorus crozophorifolius</i>			
78.	<i>Corduliidae</i> sp.			
79.	<i>Corixidae</i> sp.			
80.	<i>Cormocephalus turneri</i>			
81.	24416 <i>Corvus bennetti</i> (Little Crow)			
82.	25593 <i>Corvus orru</i> (Torresian Crow)			
83.	24420 <i>Cracticus nigrogularis</i> (Pied Butcherbird)			
84.	25595 <i>Cracticus tibicen</i> (Australian Magpie)			
85.	25596 <i>Cracticus torquatus</i> (Grey Butcherbird)			
86.	<i>Craterocephalus cuneiceps</i>			
87.	25458 <i>Ctenophorus caudicinctus</i> (Ring-tailed Dragon)			
88.	24882 <i>Ctenophorus nuchalis</i> (Central Netted Dragon)			
89.	24886 <i>Ctenophorus reticulatus</i> (Western Netted Dragon)			
90.	24889 <i>Ctenophorus scutulatus</i> (Lozenge-marked Dragon)			
91.	25052 <i>Ctenotus leonhardii</i>			
92.	25074 <i>Ctenotus schomburgkii</i>			
93.	25075 <i>Ctenotus severus</i>			
94.	<i>Culicidae</i> sp.			
95.	6663 <i>Cuscuta epithymum</i> (Lesser Dodder, Greater Dodder)	Y		
96.	11021 <i>Cuscuta planiflora</i>	Y		
97.	279 <i>Cymbopogon ambiguus</i> (Scentgrass)			
98.	12799 <i>Cyperus betchei</i> subsp. <i>commiscens</i>			
99.	25004 <i>Delma tincta</i>			
100.	25607 <i>Dicaeum hirundinaceum</i> (Mistletoebird)			
101.	12721 <i>Dielitzia tysonii</i>			
102.	310 <i>Digitaria brownii</i> (Cotton Panic Grass)			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
103.	4772 <i>Dodonaea pachyneura</i>			
104.	4773 <i>Dodonaea petiolaris</i>			
105.	24470 <i>Dromaius novaehollandiae</i> (Emu)			
106.	33479 <i>Dysphania melanocarpa</i> (Black Crumbweed)			
107.	11653 <i>Dysphania rhadinostachya</i> subsp. <i>inflata</i>			
108.	11890 <i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>			
109.	<i>Dytiscidae</i> sp.			
110.	25092 <i>Egernia depressa</i> (Southern Pygmy Spiny-tailed Skink)			
111.	<i>Egretta novaehollandiae</i>			
112.	<i>Elanus axillaris</i>			
113.	24631 <i>Emblema pictum</i> (Painted Finch)			
114.	357 <i>Enneapogon caeruleus</i> (Limestone Grass)			
115.	24570 <i>Epthianura tricolor</i> (Crimson Chat)			
116.	380 <i>Eragrostis eriopoda</i> (Woollybutt Grass, Wangurnu)			
117.	17155 <i>Eremophila compacta</i> subsp. <i>fecunda</i>			
118.	15052 <i>Eremophila forrestii</i> subsp. <i>forrestii</i>			
119.	16696 <i>Eremophila fraseri</i> subsp. <i>fraseri</i>			
120.	7216 <i>Eremophila glutinosa</i>			
121.	17171 <i>Eremophila jucunda</i> subsp. <i>jucunda</i>			
122.	7228 <i>Eremophila lachnocalyx</i> (Woolly-calyxed Eremophila)			
123.	17576 <i>Eremophila latrobei</i> subsp. <i>latrobei</i>			
124.	15157 <i>Eremophila malacoides</i>			
125.	17167 <i>Eremophila phyllopoda</i> subsp. <i>phyllopoda</i>			
126.	7270 <i>Eremophila spathulata</i> (Spoon-leaved Eremophila)			
127.	15168 <i>Eremophila spuria</i>			
128.	7273 <i>Eremophila stronglylophylla</i>			
129.	400 <i>Eriachne aristidea</i>			
130.	411 <i>Eriachne helmsii</i> (Buck Wanderrie Grass)			
131.	413 <i>Eriachne mucronata</i> (Mountain Wanderrie Grass)			
132.	417 <i>Eriachne pulchella</i> (Pretty Wanderrie)			
133.	16486 <i>Eriachne pulchella</i> subsp. <i>pulchella</i>			
134.	4335 <i>Erodium cygnorum</i> (Blue Heronsbill)			
135.	35303 <i>Euphorbia australis</i> var. <i>subtomentosa</i>			
136.	4620 <i>Euphorbia boophthona</i> (Gascoyne Spurge)			
137.	24368 <i>Eurostopodus argus</i> (Spotted Nightjar)			
138.	11200 <i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>			
139.	25621 <i>Falco berigora</i> (Brown Falcon)			
140.	25622 <i>Falco cenchroides</i> (Australian Kestrel, Nankeen Kestrel)			
141.	25623 <i>Falco longipennis</i> (Australian Hobby)			
142.	24041 <i>Felis catus</i> (Cat)	Y		
143.	<i>Fissarena castanea</i>			
144.	5206 <i>Frankenia laxiflora</i> (Loose Flowered Frankenia)			
145.	24958 <i>Gehyra punctata</i>			
146.	24959 <i>Gehyra variegata</i>			
147.	24401 <i>Geopelia cuneata</i> (Diamond Dove)			
148.	25530 <i>Gerygone fusca</i> (Western Gerygone)			
149.	15306 <i>Gomphrena</i> sp. <i>Belele</i> (D.W. Goodall 3215)			
150.	7495 <i>Goodenia berardiana</i>			
151.	7521 <i>Goodenia lamprosperma</i>			
152.	7556 <i>Goodenia tenuiloba</i>			
153.	24443 <i>Grallina cyanoleuca</i> (Magpie-lark)			
154.	1963 <i>Grevillea berryana</i>			
155.	1986 <i>Grevillea deflexa</i>			
156.	2177 <i>Hakea lorea</i> (Witinti)			
157.	19137 <i>Hakea lorea</i> subsp. <i>lorea</i>			
158.	17485 <i>Halgania anagaloides</i>			
159.	24295 <i>Haliastur sphenurus</i> (Whistling Kite)			
160.	6180 <i>Haloragis trigonocarpa</i>			
161.	17307 <i>Heliotropium inexplicitum</i>			
162.	8045 <i>Helipterum craspedioides</i> (Yellow Billy Buttons)			
163.	24961 <i>Heteronotia binoei</i> (Bynoe's Gecko)			
164.	24491 <i>Hirundo neoxena</i> (Welcome Swallow)			
165.	<i>Hydrophilidae</i> sp.			
166.	<i>Hydroptilidae</i> sp.			
167.	458 <i>Iseilema dolichotrichum</i>			
168.	1178 <i>Juncus bufonius</i> (Toad Rush)	Y		
169.	24367 <i>Lalage tricolor</i> (White-winged Triller)			
170.	<i>Leiopotherapon unicolor</i>			
171.	3025 <i>Lepidium echinatum</i>			
172.	3033 <i>Lepidium oxytrichum</i>			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
173.	25155 <i>Lerista muelleri</i>			
174.	25157 <i>Lerista nicholli</i>			
175.	<i>Lestidae</i> sp.			
176.	<i>Libellulidae</i> sp.			
177.	36375 <i>Lysimachia arvensis</i> (Pimpernel)	Y		
178.	25489 <i>Macropus robustus</i> (Euro, Biggada)			
179.	24135 <i>Macropus robustus</i> subsp. <i>erubescens</i> (Euro, Biggada)			
180.	24136 <i>Macropus rufus</i> (Red Kangaroo, Marlu)			
181.	2533 <i>Maireana amoena</i>			
182.	2538 <i>Maireana carnos</i> a (Cottony Bluebush)			
183.	2551 <i>Maireana melanocoma</i> (Pussy Bluebush)			
184.	25651 <i>Malurus lamberti</i> (Variegated Fairy-wren)			
185.	25654 <i>Malurus splendens</i> (Splendid Fairy-wren)			
186.	24583 <i>Manorina flavigula</i> (Yellow-throated Miner)			
187.	24736 <i>Melopsittacus undulatus</i> (Budgerigar)			
188.	25184 <i>Menetia greyii</i>			
189.	24598 <i>Merops ornatus</i> (Rainbow Bee-eater)			
190.	490 <i>Monachather paradoxus</i>			
191.	4111 <i>Muelleranthus trifoliolatus</i>			
192.	24223 <i>Mus musculus</i> (House Mouse)	Y		
193.	14186 <i>Myriocephalus pygmaeus</i>			
194.	24737 <i>Neophema bourkii</i> (Bourke's Parrot)			
195.	24971 <i>Nephhrurus vertebralis</i>			
196.	494 <i>Neurachne minor</i>			
197.	11331 <i>Nicotiana occidentalis</i> subsp. <i>obliqua</i>			
198.	11734 <i>Nicotiana rosulata</i> subsp. <i>rosulata</i>			
199.	24224 <i>Notomys alexis</i> (Spinifex Hopping-mouse)			
200.	<i>Notonectidae</i> sp.			
201.	24742 <i>Nymphicus hollandicus</i> (Cockatiel)			
202.	24407 <i>Ocyphaps lophotes</i> (Crested Pigeon)			
203.	6723 <i>Omphalolappula concava</i> (Burr Stickseed)			
204.	24618 <i>Oreoica gutturalis</i> (Crested Bellbird)			
205.	25680 <i>Pachycephala rufiventris</i> (Rufous Whistler)			
206.	503 <i>Panicum decompositum</i> (Native Millet, Kaltu-kaltu)			
207.	24627 <i>Pardalotus rubricatus</i> (Red-browed Pardalote)			
208.	25682 <i>Pardalotus striatus</i> (Striated Pardalote)			
209.	10975 <i>Paspalidium basicladum</i>			
210.	518 <i>Paspalidium clementii</i> (Clements Paspalidium)			
211.	48061 <i>Petrochelidon nigricans</i> (Tree Martin)			
212.	24659 <i>Petroica goodenovii</i> (Red-capped Robin)			
213.	24409 <i>Phaps chalcoptera</i> (Common Bronzewing)			
214.	18540 <i>Philothea brucei</i> subsp. <i>cinerea</i>			
215.	17626 <i>Phyllanthus erwinii</i>			
216.	27984 <i>Placidium squamulosum</i>			
217.	24748 <i>Platycercus varius</i> (Mulga Parrot)			
218.	25721 <i>Platycercus zonarius</i> (Australian Ringneck, Ring-necked Parrot)			
219.	8167 <i>Pluhea dentex</i>			
220.	25510 <i>Pogona minor</i> (Dwarf Bearded Dragon)			
221.	24683 <i>Pomatostomus superciliosus</i> (White-browed Babbler)			
222.	25706 <i>Pomatostomus temporalis</i> (Grey-crowned Babbler)			
223.	2884 <i>Portulaca oleracea</i> (Purslane, Wakati)			
224.	6926 <i>Prostanthera wilkieana</i>			
225.	24106 <i>Pseudantechinus woolleyae</i> (Woolley's Pseudantechinus)			
226.	24237 <i>Pseudomys hermannsburgensis</i> (Sandy Inland Mouse)			
227.	18210 <i>Psydax rigidula</i>			
228.	8192 <i>Pterocaulon sphacelatum</i> (Apple Bush, Fruit Salad Plant)			
229.	24757 <i>Ptilonorhynchus maculatus</i> subsp. <i>guttatus</i> (Western Bowerbird)			
230.	2690 <i>Ptilotus aervoides</i>			
231.	2708 <i>Ptilotus chamaecladus</i>			
232.	2721 <i>Ptilotus exaltatus</i> (Tall Mulla Mulla)			
233.	2727 <i>Ptilotus gaudichaudii</i>			
234.	2731 <i>Ptilotus helipteroides</i> (Hairy Mulla Mulla)			
235.	2747 <i>Ptilotus obovatus</i> (Cotton Bush)			
236.	2757 <i>Ptilotus schwartzii</i>			
237.	42344 <i>Purnella albifrons</i> (White-fronted Honeyeater)			
238.	24278 <i>Pyrrholaemus brunneus</i> (Redthroat)			
239.	25614 <i>Rhipidura leucophrys</i> (Willie Wagtail)			
240.	13308 <i>Rhodanthe charsleyae</i>			
241.	13242 <i>Rhodanthe chlorocephala</i> subsp. <i>splendida</i>			
242.	13300 <i>Rhodanthe citrina</i>			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
243.	13238 <i>Rhodanthe maryonii</i>			
244.	13251 <i>Rhodanthe propinqua</i>			
245.	24982 <i>Rhynchoedura ornata</i> (Western Beaked Gecko)			
246.	45136 <i>Roebuckiella cuneata</i>			
247.	7608 <i>Scaevola cunninghamii</i>			
248.	7644 <i>Scaevola spinescens</i> (Currant Bush, Maroon)			
249.	13285 <i>Schoenia ayersii</i>			
250.	8200 <i>Schoenia cassiniana</i> (<i>Schoenia</i>)			
251.	48355 <i>Schoenoplectiella dissachantha</i>			
252.	<i>Scolopendra laeta</i>			
253.	<i>Scolopendra morsitans</i>			
254.	8207 <i>Senecio glossanthus</i> (Slender Groundsel)			
255.	31857 <i>Sida</i> sp. <i>Golden calyces glabrous</i> (H.N. Foote 32)			
256.	19712 <i>Sida</i> sp. <i>dark green fruits</i> (S. van Leeuwen 2260)			
257.	16617 <i>Sida</i> sp. <i>spiciform panicles</i> (E. Leyland s.n. 14/8/90)			
258.	25266 <i>Simoselaps bertholdi</i> (Jan's Banded Snake)			
259.	30948 <i>Smicromis brevirostris</i> (Weebill)			
260.	24116 <i>Sminthopsis macroura</i> (Stripe-faced Dunnart)			
261.	6989 <i>Solanum ashbyae</i>			
262.	7018 <i>Solanum lasiophyllum</i> (Flannel Bush, Mindjulu)			
263.	3076 <i>Stenopetalum filifolium</i>			
264.	8238 <i>Streptoglossa liatroides</i>			
265.	<i>Supunna picta</i>			
266.	12355 <i>Swainsona affinis</i>			
267.	4217 <i>Swainsona beasleyana</i>			
268.	4238 <i>Swainsona oroboides</i> (Variable Swainsona)			
269.	4242 <i>Swainsona pterostylis</i>			
270.	13585 <i>Swainsona tenuis</i>			
271.	13339 <i>Synaptantha tillaeacea</i> var. <i>tillaeacea</i>			
272.	24207 <i>Tachyglossus aculeatus</i> (Short-beaked Echidna)			
273.	30870 <i>Taeniopygia guttata</i> (Zebra Finch)			
274.	<i>Tanypodinae</i> sp.			
275.	19053 <i>Trachymene pilbarensis</i>			
276.	4374 <i>Tribulus astrocarpus</i>			
277.	4376 <i>Tribulus forrestii</i>			
278.	18072 <i>Tribulus suberosus</i>			
279.	6727 <i>Trichodesma zeylanicum</i> (Camel Bush, Kumbalin)			
280.	17877 <i>Triodia melvillei</i>			
281.	24851 <i>Turnix velox</i> (Little Button-quail)			
282.	<i>Tyrannochthonius aridus</i>			
283.	24386 <i>Vanellus tricolor</i> (Banded Lapwing)			
284.	25211 <i>Varanus caudolineatus</i>			
285.	25524 <i>Varanus panoptes</i> (Yellow-spotted Monitor)			
286.	25222 <i>Varanus panoptes</i> subsp. <i>panoptes</i>			
287.	25526 <i>Varanus tristis</i> (Racehorse Monitor)			
288.	12725 <i>Wahlenbergia caryophylloides</i>			

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 wholly 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.

APPENDIX 8: MOUNT GOULD VERTEBRATE FAUNA STUDY (BIOLOGIC 2012A)



biologic

Mount Gould

Vertebrate Fauna Study

Atlas Iron Pty Ltd

January 2012





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Table of Contents

EXECUTIVE SUMMARY	5
1 INTRODUCTION	7
1.1 Background	7
1.2 Approach to Survey	7
1.3 Legislative Framework	8
2 ENVIRONMENT	12
2.1 Biogeography	12
2.2 Climate	12
2.3 Existing Land Use	12
2.4 Landforms	12
2.5 Land Systems	13
2.6 Vegetation	16
2.7 Previous Surveys	19
3 METHODOLOGY	20
3.1 Survey Design	20
3.2 Literature and Database Review	20
3.3 Field Assessment	21
3.4 Taxonomy and Nomenclature	27
3.5 Survey team	27
3.6 Potential Limitations and Constraints	28
4 RESULTS	29
4.1 Desktop Review	29
4.2 Fauna Recorded from the Study Area	31
4.2.1 Native mammals	31
4.2.2 Birds	32
4.2.3 Reptiles	33



4.2.4	Amphibians	33
4.3	Fauna Habitats	34
4.4	CONSERVATION SIGNIFICANT FAUNA.....	43
4.4.1	Conservation Significant Fauna Recorded in the Study Area	43
4.4.2	Conservation Significant Fauna Potentially occurring in the Study Area	49
4.4.3	Locally Extinct Fauna.....	51
5	CONCLUSIONS	61
6	MANAGEMENT RECOMMENDATIONS	64
7	REFERENCES	65



EXECUTIVE SUMMARY

Biologic Environmental Survey (Biologic) was commissioned by Atlas Iron Pty Ltd (Atlas) to undertake a Level 2 fauna study of the Mount Gould Study Area; hereafter referred to as the Study Area. The study comprised:

- 1) A desktop survey and comprehensive review of previous fauna surveys within the Study Area;
- 2) A two season, baseline vertebrate fauna survey of the Study Area; and
- 3) A habitat assessment of the Study Area, with a particular emphasis on habitats considered likely to support conservation significant fauna.

Field surveys were conducted by Biologic in the Study Area in May 2011 and October 2011. Trapping, opportunistic surveys and targeted fauna survey techniques were used in combination with ANABAT detectors and infra-red motion cameras traps to survey the full suite of fauna that may occur in the Study Area.

Analysis of the databases and reports showed that a total of 268 vertebrate fauna taxa have the potential to occur within the Study Area. In total, 125 fauna species were recorded during the surveys comprising 15 native and seven introduced mammal, 75 bird, 27 reptile and one amphibian species.

Overall, a total of 14 conservation significant species (including species of local significance) either occur, or are considered likely to occur within the Study Area, either as a resident or as a visitor on seasonal basis.

Eight conservation significant species were recorded within the Study Area:

- Peregrine Falcon (*Falco peregrinus*) – listed under Schedule 4 of the *Wildlife Conservation Act 1950* (WC Act);
- Bush Stone-curlew (*Burhinus grallarius*) – listed as Priority 4 by the Department of Environment and Conservation (DEC);
- Australian Bustard (*Ardeotis australis*) – listed as Priority 4 by the DEC;
- Rainbow Bee-eater (*Merops ornatus*) – listed as Migratory under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act);
- Woolley's Pseudantechinus (*Pseudantechinus woolleyae*) – listed as Banded Iron Formation (BIF) Dependent by DEC;
- Little Woodswallow (*Artamus minor*) – listed as BIF Dependent by DEC;
- Painted Finch (*Emblema pictum*) – locally significant (restricted range); and



- Little Broad-nosed Bat (*Scotorepens greyii*) – locally significant (limit of range).

An additional two conservation significant species have been recorded nearby at Jack Hills (located approximately 12 km south of the Study Area), and its immediate surrounds, during previous fauna surveys:

- Long-tailed Dunnart (*Sminthopsis longicaudata*) – listed as Priority 4 by the DEC;
- Major Mitchell's Cockatoo (*Lophochroa leadbeateri*) - listed under Schedule 4 of the WC Act 1950.

Seven major fauna habitats are present within the Study Area. Of these, three habitats (Spinifex Hummock Grasslands on Ironstone Hills and Ridges, Open Mulga shrublands over Tussock Grassland on Ironstone Hills and Ridges, and Breakaway systems containing deep crevices, caves and rock ledges) are considered to have high conservation value for fauna. This assessment is based on those habitats likely to support conservation significant fauna, or habitats that are an uncommon feature across the landscape. Disturbances to such habitats are recommended to be avoided or minimised where possible.



1 INTRODUCTION

1.1 Background

Atlas Iron Pty Ltd (Atlas) proposes to develop the Mount Gould mine, a previously granted mining lease (M52/236). The project is located at Mount Gould, approximately 150 km north-west of Meekatharra, in the Murchison region of Western Australia (Figure 1.1).

Biologic was commissioned by Atlas to undertake a Level 2 Vertebrate Fauna Survey of the Mount Gould area (referred to as the Study Area) to assist in gaining environmental approvals for the proposed project.

1.2 Approach to Survey

The objectives of this fauna study were to:

- Undertake a review of previous fauna assessments and surveys, comprising a review of publicly available literature, data and map-based information, including a summary of previous fauna survey results (in the vicinity of the Study Area), and data compiled from relevant databases (e.g. Western Australian Museum, Australian Museum, Naturebase and Department of Environment and Conservation [DEC]);
- Conduct a two season Level 2 vertebrate survey within the Mount Gould Study Area (see Figure 1.2), specifically targeting species or habitat likely to support species listed as:
 - Threatened or Migratory Fauna listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act);
 - Scheduled fauna listed under the latest WA Wildlife Conservation (Specially Protected Fauna) Notice of the *Wildlife Conservation Act 1950* (WC Act);
 - Priority Fauna recognised by the DEC; and
 - Fauna listed on the International Union for the Conservation of Nature (IUCN) Red List;
- Conduct a habitat assessment of the Study Area, with a particular emphasis on habitats considered likely to support conservation significant fauna and mapping of any significant fauna habitats;
- Compile an inventory of vertebrate fauna recorded or expected to occur, with respect to the fauna habitats present; and



- Document the characteristics of the fauna assemblage of the Study Area including significance at the international, national, state, regional and local level.

1.3 Legislative Framework

Within Western Australia, all native fauna is protected under the *Wildlife Conservation Act 1950* and any action that has the potential to impact on native fauna needs to be approved by relevant State and/or Federal departments as dictated by the *State Environmental Protection Act 1986* and the *Federal Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Some species of fauna that are determined to be at risk of extinction or decline are afforded extra protection under these Acts. For the purposes of this report, these species are called *conservation significant species*. A summary of applicable legislation and status codes is provided in Table 1.1. Additional information on Status Codes is provided in Appendix A.

A number of migratory bird and marine species are prioritised for conservation under the EPBC Act or international agreements (Table 1.1). In addition the International Union for Conservation of Nature (IUCN) compiles a 'Red List' upon which species at risk of extinction are listed.

Some species, for which there is insufficient information to determine their status, are listed as Priority species by the DEC. Until information is available to determine that they are not at risk of extinction or decline, these species cannot be specifically listed under the EPBC Act or WC Act, but are generally considered by the Environmental Protection Authority (EPA)/DEC as of conservation significance for all development related approvals.

For the purposes of this report, some species may be identified as having 'local' significance. Locally significant fauna may include short-range endemic species, species that have declining populations or declining distributions, species at the extremes of their range, isolated outlying populations, species which may be undescribed (EPA, 2004), or species that are generally uncommon in the Murchison region but are not considered rare or threatened at a State or National level.

In addition to the above species, DEC has listed several vertebrate fauna species it considers to be significantly dependent on banded ironstone formation (BIF) ranges in the region (DEC, 2007). Vertebrate species were determined to be significantly dependent on the ironstone ridges if they were found to occur on the ridges and slopes but were absent from the surrounding plains.



Figure 1.1: Location of the Study Area - Mount Gould.

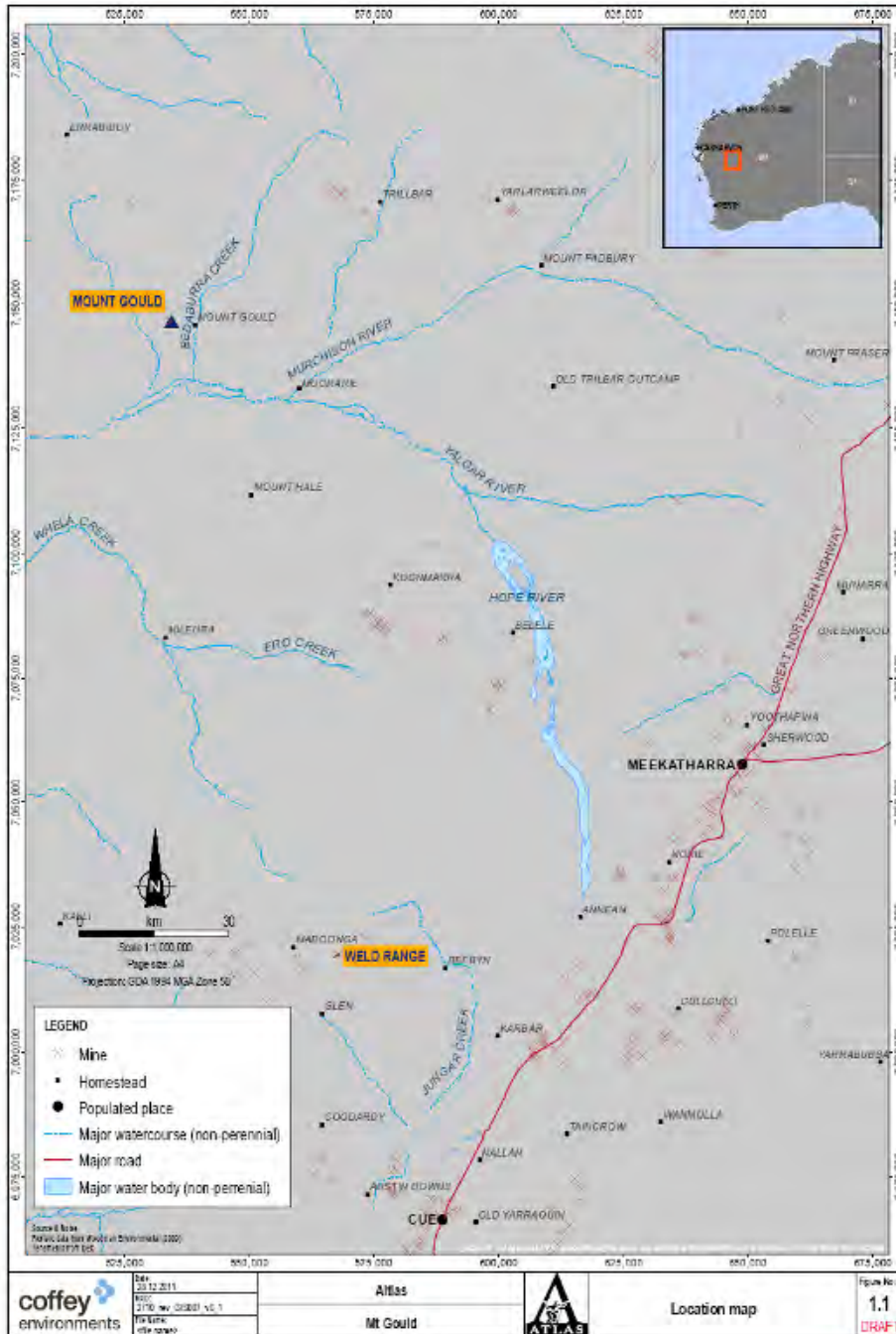




Figure 1.2: The Mount Gould Study Area – Mining Lease M52/236.





Table 1.1: Conservation Significance Assessment Guidelines.

Level	Act	Status Codes
International	<p>Taxa listed under the following International Conventions:</p> <ul style="list-style-type: none"> o Japan – Australia Migratory Bird Agreement (JAMBA) o China – Australia Migratory Bird Agreement (CAMBA) o Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention) <p>Additional may be listed as Migratory under the federal <i>Environment Protection and Biodiversity Conservation Act 1999</i>.</p> <p>The IUCN lists species at risk of extinction under nine categories.</p>	<p>EPBC Migratory</p> <p>IUCN Extinct</p> <p>IUCN Extinct in the Wild</p> <p>IUCN Critically Endangered</p> <p>IUCN Endangered</p> <p>IUCN Vulnerable</p> <p>IUCN Near Threatened</p> <p>IUCN Least Concern</p> <p>IUCN Data Deficient</p> <p>IUCN Not Evaluated</p>
Federal	<p>Environment Protection and Biodiversity Conservation Act 1999. The Department of Environment, Water, Heritage and the Arts lists Threatened fauna, which are determined by the Threatened Species Scientific Committee according to criteria set out in the Act. The Act lists fauna that are considered to be of conservation significance under one of six categories.</p>	<p>Extinct</p> <p>Extinct in the Wild</p> <p>Critically Endangered</p> <p>Endangered</p> <p>Vulnerable</p> <p>Conservation Dependent</p> <p>Migratory</p>
State	<p>Wildlife Conservation Act 1950. At a state level, native fauna species are protected under the <i>Wildlife Conservation Act 1950</i>. Species in need of conservation are given a ranking ranging from Critically Endangered to Vulnerable.</p>	<p>Schedule 1</p> <p>Schedule 2</p> <p>Schedule 3</p> <p>Schedule 4</p>
State	<p>DEC Priority list. The DEC produces a list of Priority species and ecological communities (PECs) that have not been assigned statutory protection under the <i>Wildlife Conservation Act 1950</i>. This system gives a ranking from Priority 1 to Priority 5.</p>	<p>Priority 1</p> <p>Priority 2</p> <p>Priority 3</p> <p>Priority 4</p> <p>Priority 5</p>
Local	<p>DEC BIF Dependent Fauna Species. DEC has listed several vertebrate fauna species it considers to be significantly dependent on banded ironstone formation ranges in the region.</p>	<p>Listed as significantly dependent</p>



2 ENVIRONMENT

2.1 Biogeography

Broadly, the Study Area falls on the northern fringe of the Murchison biogeographical region as defined by the Interim Biogeographic Regionalisation of Australia (Thackway and Cresswell, 1995). The Murchison Bioregion falls within the Bioregion Group 2 classification (EPA, 2004). Bioregions within Group 2 have “native vegetation that is largely contiguous but is used for commercial grazing.” The Murchison is subdivided into two subregions, and the Study Area lies in the Western Murchison subregion (MUR-2).

The general features of the Western Murchison subregion are summarised by Desmond *et al.* (2001). The subregion is characterised by low Mulga woodlands rich in ephemerals and bunch grasses on granitic outcrops and extensive hardpan washplains. It contains the headwaters of the Murchison and Wooramel Rivers. The landscape comprises low hills, mesas of duricrust, separated by flat colluvium and alluvial plains. The dominant land use is grazing (of native pastures) and there are several mining interests.

2.2 Climate

The Murchison region has an arid climate with winter rainfall. The mean average annual rainfall is 210 mm, ranging from 190 mm in the northeast to 240 mm in the southwest (BOM, 2011). Summers are hot and dry, with average daytime temperatures reaching 38°C in January and winters are mild with cool nights.

2.3 Existing Land Use

Pastoralism and mining are major industries in the Murchison region (reference ?). The Mount Gould Study Area lies on Mount Gould Station, with active mining occurring nearby at Jack Hills. Mount Gould contains the interpreted strike extension to iron ore currently being mined and exported from Jack Hills by Crosslands Resources. A small mining operation has been previously conducted at Mount Gould, with a small open pit and waste dump present on its lower slopes.

2.4 Landforms

The local topography is dominated by Jack Hills, an 80km long range consisting of folded and metamorphosed supracrustal rocks, including banded ironstone (reference ?). Jack Hills are the most northern occurrence of the banded ironstone formation (BIF) ranges, occurring across the Murchison, Midwest and Goldfields. Mount Gould is an outlier of the Jack Hills range, occurring approximately 12 km north of the main range. The area surrounding Mount Gould consists of relatively flat, undulating plains.



2.5 Land Systems

Curry *et al.* (1994) classified and mapped the Land Systems of the Murchison region, including the area containing Mount Gould. Land Types and Land Systems are classified according to similarities in landform, soil, vegetation, geology and geomorphology. Land Systems provide an indication of the fauna habitats present at a site. The Study Area is dominated by the Peak Hill Land System (Pea) and flanked by the Cole (Col) and Beringarra (Ber) Land Systems (see Figure 2.1). These are detailed in Table 2.1:

- Peak Hill System (Pea): rugged sinuous ranges and rounded hills of Proterozoic banded ironstone and hematitic shale, supporting stunted mulga and cottonbush shrublands;
- Beringarra Land System (Ber): Major riverine plains with active lower floodplains flanking channelled watercourses, supports mostly halophytic shrublands and mixed *Acacia* shrublands and low woodlands with minor perennial grasses; and
- Cole Land System (Col): Hardpan wash plains with reticulate patterns of wanderrie banks and mulga groves and more concentrated drainage tracts, supporting mixed mulga and wanderrie shrublands.

Table 2.1. Land Systems present within the Study Area.

Landform	Landform and Soil	Vegetation
Peak Hill Land System		
Hills and ridges (50%)	Rough hills and ridges, generally covered with dense ironstone mantles and frequent outcropping. Skeletal soils, confined to pockets of shallow loamy sands.	Very scattered mixed shrublands with <i>Acacia</i> spp. co-dominant. Shrubs include <i>Acacia aneura</i> , <i>A. tetragonophylla</i> , <i>Eremophila latrobei</i> , <i>E. exilifolia</i> , <i>Senna desolata</i> , <i>Solanum</i> spp. Perennial grasses: <i>Eriachne</i> spp., <i>Eragrostis</i> spp.
Lower slopes and interfluves (40%)	Gently sloping footslopes or rounded interfluves flanking hills and ridges, covered in moderately dense ironstone mantles. Soils are dark red loamy sands.	Very scattered mixed shrublands dominated by <i>Acacia grasbyi</i> . Trees (to 6m): <i>A. pruinocarpa</i> , <i>A. aneura</i> , <i>A. aff. citrinoviridis</i> . Mid shrubs (1-2m): <i>A. grasbyi</i> , <i>Senna desolata</i> , <i>Eremophila latrobei</i> . Low shrubs (<1m): <i>Senna helmsii</i> , <i>Ptilotus obovatus</i> , <i>P. rotundifolius</i> , <i>Euphorbia boophthona</i> .
Drainage floors and minor channels (10%)	Narrow dendritic channels to 10m wide grading into broad saline alluvial fans and minor valley floors. Soils are dark red loamy sands with ironstone fragments.	Scattered mixed shrublands dominated by <i>Acacia aneura</i> , <i>A. tetragonophylla</i> or <i>A. victoriae</i> . Mixed shrubs (1-2m): <i>Eremophila</i> spp. Low shrubs (<1m): <i>Ptilotus obovatus</i> , <i>Senna</i> spp., <i>Solanum lasiophyllum</i> .

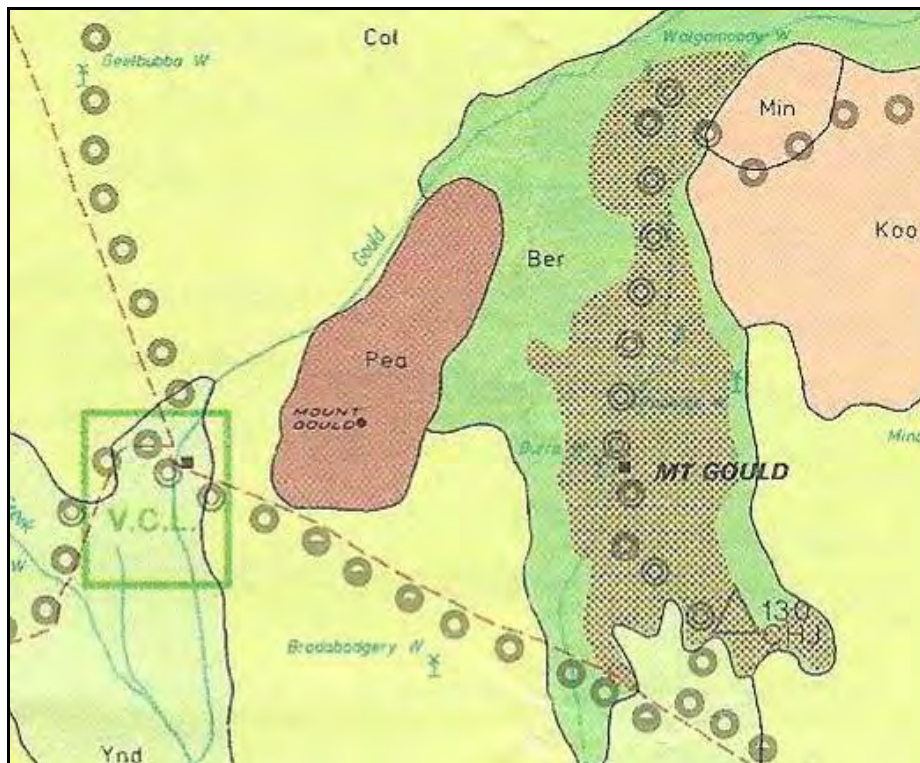


Landform	Landform and Soil	Vegetation
Berringara Land System		
Hardpan plains (30%)	Almost flat alluvial plains. Soils are hardpan loams and red earths.	Scattered to moderately close mixed shrublands dominated by <i>Acacia aneura</i> .
Alluvial plains (40%)	Very gently sloping saline alluvial plains. Soils are generally deep crusted or hard setting duplexes with occasional red earths.	Patchy mixed shrublands, often dominated by <i>Acacia victoriae</i> , <i>Senna desolata</i> , <i>Eremophila pterocarpa</i> or <i>Hakea preissii</i> .
Floodplains and inter-channel zones (20%)	Almost flat, active floodplains with locally cracking or gilgai surfaces. Soils are variable crusted duplexes and yellowish-red to brown clays.	Moderately closed to closed woodlands with upper storey of <i>Acacia distans</i> or low shrublands dominated by <i>Atriplex amnicola</i> and <i>Maeriana pyramida</i> .
Wide drainage floors (5%)	Flat drainage zones, with occasional anastomosing channels. Soils are yellowish red to brown clays and duplex types.	Moderately close woodlands and tall shrublands. Trees (6-8m): <i>Acacia distans</i> , <i>A. aneura</i> , <i>Eucalyptus coolibah</i> . Tall shrubs (>2m): <i>A. tetragonophylla</i> , <i>A. victoriae</i> , <i>Eremophila fraseri</i> , <i>E. lanata</i> . Mid shrubs (1-2m): <i>E. fraseri</i> , <i>Scaevola spinescens</i> .
Channels (5%)	Riverbeds and seasonal watercourses up to 100m wide and incised to 3m. Channels carry bedloads of coarse sand. Soils on banks are reddish brown alluvial silty clays and fine sandy loams.	Major channel beds unvegetated, otherwise moderately close to closed mixed woodlands with dense under shrubs on banks of major channels and floors of minor channels. Trees include <i>Casuarina obesa</i> , <i>Eucalyptus camaldulensis</i> , <i>E. coolibah</i> .
Cole Land System		
Sand sheets (5%)	Isolated tracts of slightly elevated sand plain. Soils are earthy sands.	Scattered tall shrublands dominated by <i>Acacia aneura</i> , <i>A. ramulosa</i> or <i>Eremophila forrestii</i> with a grassy layer prominent in places. Trees include <i>Acacia kempeana</i> , <i>A. aneura</i> , <i>A. ramulosa</i> , <i>Grevillea</i> sp.
Wanderrie banks (25%)	Complex networks of interconnecting wanderrie banks. Soils are earthy sands.	Scattered tall shrublands dominated by <i>Acacia aneura</i> , <i>A. ramulosa</i> , <i>Eremophila forrestii</i> with a grassy layer prominent. Trees include <i>Acacia kempeana</i> , <i>A. aneura</i> , <i>A. ramulosa</i> , <i>Grevillea</i> sp.



Landform	Landform and Soil	Vegetation
Hardpan plains (45%)	Level plains carrying sheet flow between sandy banks and groves.	Very scattered to scattered tall shrublands dominated by <i>Acacia aneura</i> . Trees and shrubs include <i>Acacia aneura</i> , <i>A. pruinocarpa</i> , <i>A. quadrimarginea</i> , <i>Grevillea striata</i> , <i>Hakea subera</i> , <i>A kempeana</i> , <i>Eremophila fraseri</i> .
Mulga groves (<5%)	Numerous accurate groves up to 100m wide some with sandy accumulations and grading into wanderrie banks. Soils are dark red hardpan sandy clay loams or sandy clays.	Moderately close to closed low Mulga woodland dominated by <i>Acacia aneura</i> , <i>A. tetragonophylla</i> or <i>Eremophila fraseri</i> . Trees include <i>A. aneura</i> , <i>A. pruinocarpa</i> , <i>A. tetragonophylla</i> , <i>A. distans</i> , <i>Psyrax latifolia</i> , <i>Grevillea striata</i> .
Broad drainage zones (20%)	Very gently incised plains mostly occurring as broad, unchannelled tracts. Soils are mostly yellowish red or red earths or loams.	Scattered to moderately close tall shrublands dominated by <i>Acacia aneura</i> or <i>A. tetragonophylla</i> . Trees and shrubs include <i>A. aneura</i> , <i>A. kempeana</i> , <i>A. tetragonophylla</i> , <i>A. grasbyi</i> , <i>Eremophila fraseri</i> , <i>E. forrestii</i> .

Figure 2.1: Land Systems in the Mount Gould area.





2.6 Vegetation

The vegetation of the Mount Gould Study Area has been classified and mapped by Woodman Environmental Consulting (Woodman Environmental Consulting, 2011) (Figure 2.2). Six Floristic Community Types (FCTs) are recognised from the area:

- FCT1: Open tall shrubland of *Acacia aneura* over sparse low shrubland of *Ptilotus obovatus* over open low forbland of *Goodenia tenuiloba* on steep mid and lower slopes on banded ironstone and quartz shale;
- FCT2: Sparse tall shrubland of mixed *Acacia* species over sparse low shrubland of *Ptilotus obovatus* and *Eremophila* species over open low forbland of *Goodenia tenuiloba* on stony undulating plains;
- FCT3: Sparse tall shrubland or isolated shrubs of *Acacia aneura* over isolated mid shrubs of *Eremophila fraseri* subsp. *parva* over isolated low shrubs of *Ptilotus obovatus* over open low forbland of mixed species including *Ptilotus aervoides* and *Goodenia tenuiloba* in clay pans and on clay flats;
- FCT4: Open tall shrubland or isolated shrubs of *Acacia aneura* over open to sparse mid shrubland of *Eremophila latrobei* subsp. *latrobei* and *Philotheca brucei* subsp. *cinerea* over open to sparse low shrubland and low tussock grassland of *Ptilotus obovatus* and *Cymbopogon ambiguus* on steep mid and upper slopes and crests on banded ironstone;
- FCT5: Isolated tall shrubland of *Acacia aneura* and/or *Grevillea berryana* over sparse low shrubland of *Eremophila latrobei* subsp. *latrobei*, *Philotheca brucei* subsp. *cinerea* and *Ptilotus obovatus* over low hummock grassland of *Triodia melvillei* on steep upperslopes and crests on banded ironstone;
- FCT6a: Open tall shrubland of *Acacia ramulosa* var. *linophylla* and *A. kempeana* over sparse mid shubland of *Eremophila forrestii* subsp. *forrestii* over isolated low shrubland of *Corchorus crozophorifolius* over sparse low grassland and forbland of mixed species including *Eriachne mucronata* and *Ptilotus aervoides* on flat plains; and
- FCT6b: Tall sparse shrubland of *Acacia ramulosa* var. *linophylla* and *A. citrinoviridis* over open mid shubland of *Eremophila latrobei* subsp. *latrobei* over open low shrubland of *Halgania gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743) over sparse low forbland of *Goodenia tenuiloba* on a steep low ridge on banded ironstone.

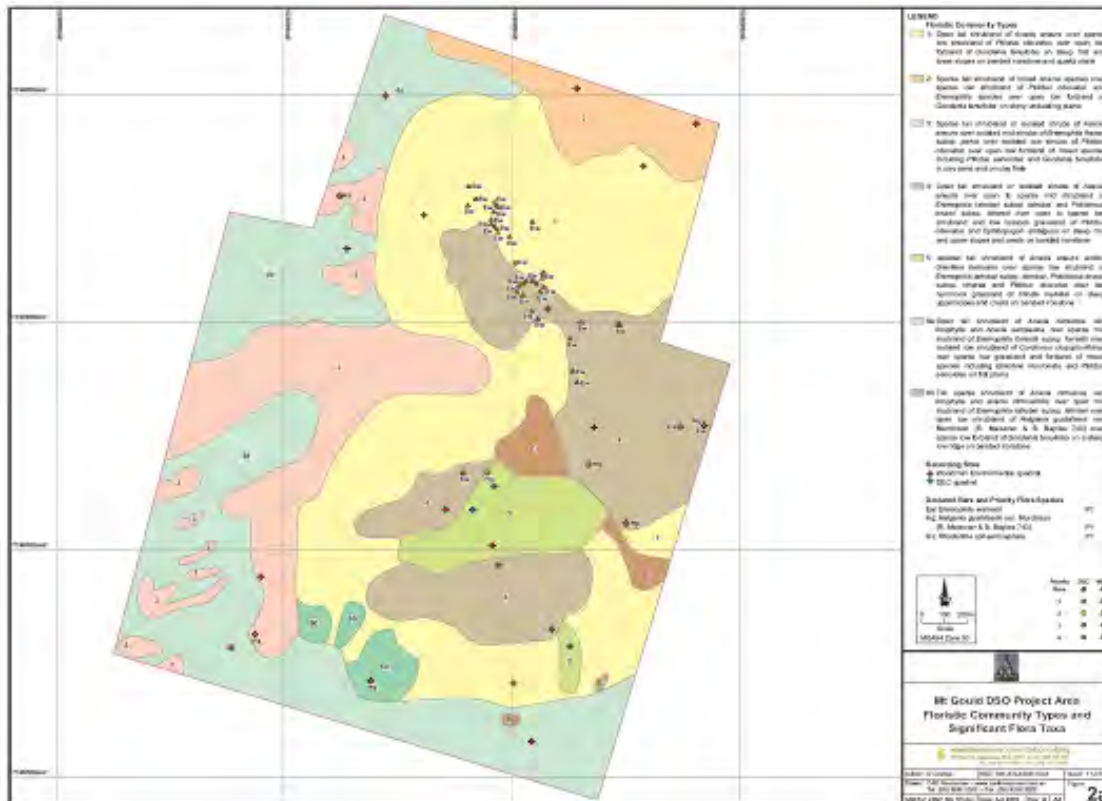


The vegetation at Mount Gould includes a significant ecological community, the Mount Gould Vegetation Complexes (banded ironstone formation), listed as a Priority 1 Ecology Community (PEC) by the DEC. Priority 1 PECs are described as:

“Ecological communities that are known from very few occurrences with a very restricted distribution (generally < 5 occurrences or a total area of < 100 ha). Occurrences are believed to be under threat either due to limited extent, or being on lands under immediate threat or for which current threats exist” (DEC, 2010).



Figure 2.2: Vegetation in the Mount Gould area.





2.7 Previous Surveys

A large number of mining projects are currently proposed and/or are in the process of development within the Midwest region, particularly on BIF Ranges. This includes existing and proposed mines at Koolanooka, Mt Gibson, Minjar, Golden Grove, Karara-Mungada, Weld Range and Jack Hills. In response to elevated mining interest in the region, the DEC has recently conducted a series of flora and vegetation assessments concentrating on BIFs throughout the Midwest, aiming to enhance knowledge and develop management objectives for the BIF Ranges.

As a result of proposed mining activity within the Jack Hills and Mount Gould area, a number of fauna surveys have been conducted, including both vertebrate and invertebrate species. These are discussed in further detail in Section 3.2 below.



3 METHODOLOGY

3.1 Survey Design

The fauna survey was designed to meet the requirements of applicable State and Federal legislation and carried out in a manner compliant with EPA requirements for the environmental surveying and reporting of fauna in Western Australia. These are:

- *Environmental Protection Act 1986 (WA) (EP Act);*
- *Wildlife Conservation Act 1950 (WA) (WC Act);*
- *Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth EPBC Act, 1999);*
- *Terrestrial Biological Surveys as an Element of Biodiversity Protection. Position Statement No. 3 (EPA, 2002); Guidance for the Assessment of Environmental Factors: Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia. No. 56. (EPA, 2004); and*
- *Technical Guide - Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment. (EPA and DEC, 2010).*

The field survey was conducted under DEC Regulation 17 (Licence to take Fauna for Scientific Purposes), issued to JM Turpin, licence number SF007941, valid from 18/04/2011 to 17/04/2012.

3.2 Literature and Database Review

A review of all reports containing information on the vertebrate fauna of the local area and relevant fauna reports from the surrounding region was conducted (Table 3.1).

Table 3.1: Literature reviewed

Survey Title	Consultant	Year	Type
Surveys adjacent to the Mount Gould Study Area			
Jack Hills Mine Expansion Vertebrate Fauna Assessment	ecologia	2006 - 2007	Level 2
Jack Hills Iron Ore Project: Vegetation and Fauna Assessment	MBS	2005	Level 2
Jack Hills Project Area 2006 Fauna Survey	Western Wildlife	2006	Level 2
Regional surveys			
Weld Range Vertebrate Fauna Assessment	ecologia	2006 - 2007	Level 2
Weld Range Fauna Survey	BCE	2008	Level 1
Oakajee Port and Rail OPR Rail Proposal Terrestrial Fauna Assessment	ecologia	2007-2009	Level 2



Three fauna databases (Table 3.2) were searched to determine records of species previously recorded in the Study Area (NatureMap and Birddata), or likely to occur based on bioclimatic modelling (Protected Matters Database).

Table 3.2: Databases used for the review

Provider	Database	Parameters
Department of Sustainability, Environment, Water, Population and the Communities (SEWPaC, 2011)	Protected Matters Database Search Tool. Accessed 20 March 2011.	Point -25.79624, 117.34354, 119.62420 with a 10km buffer
Department of Environment	NatureMap. Accessed 20 March 2011.	117° 20'32"E, 25° 47'36"S with a 40km buffer.
Birds Australia	Birdata. Accessed 20 March 2011.	One degree square containing the point -25.79624, 117.34354.

3.3 Field Assessment

3.3.1 Timing

The Phase 1 survey was undertaken between the 6th and 17th May 2011. The Phase 2 survey was undertaken between the 4th and 14th October 2011.

3.3.2 Climatic Conditions

The closest climate recording site to Mount Gould is located at Meekatharra, approximately 150 km to the southeast. Data from the Meekatharra Meteorological Office was used to describe weather conditions experienced during both survey phases. Additionally some recordings were also made at Mount Gould Station, which generally experiences daily temperatures of approximately 3 degrees higher than those experienced at Meekatharra (T. Penns, pers. com.; J. Turpin, pers. obs.).

The weather during the initial survey period (May 2011) ranged from warm to cool, with rainfall recorded on the 14th and 15th May. Daily maxima at Meekatharra ranged from 15.7°C to 26.8°C (mean of 22.8°C) and daily minima ranged from 9.7°C to 15.6°C (mean of 12.8°C) (Table 3.3) (BOM, 2011). During the second survey phase (October 2011) conditions were warm and generally dry. Daily maxima at Meekatharra ranged from 21.9°C to 32.0°C (mean of 28.3°C) and daily minima ranged from 11.1°C to 20.3°C (mean of 15.0°C) (BOM, 2011).

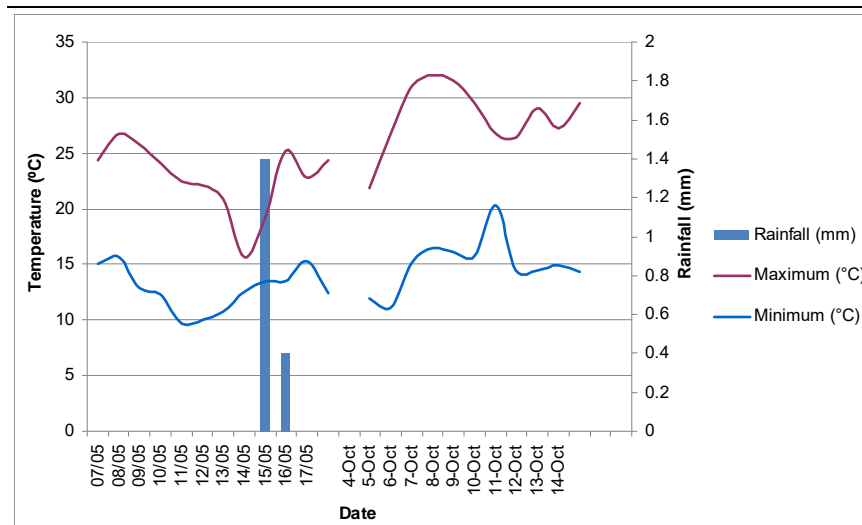
In the five months preceding the first phase of survey, Meekatharra received 345.6 mm of rainfall, significantly more than the long-term average of 126.7 mm for the same time period. This was due to several periods of cyclonic activity across north-western Western Australia during the 2010/2011 cyclone season. Between survey phases, Meekatharra received 75.2 mm of rainfall, less than the 109.3mm average for the same time period.



Table 3.3: Weather Recorded at Meekatharra (Source BOM, 2011)

Date	Temperature		Rain	Date	Temperature		Rain
Phase 1	Min (°C)	Max (°C)	(mm)	Phase 2	Min (°C)	Max (°C)	(mm)
6/05/2011	15.1	24.4	0	4/10/11	11.9	21.9	3.2
7/05/2011	15.6	26.8	0	5/10/11	11.1	26.8	0
8/05/2011	12.9	25.8	0	6/10/11	15.2	31.0	0
9/05/2011	12.3	24.1	0	7/10/11	16.5	32.0	0
10/05/2011	9.7	22.5	0	8/10/11	16.1	31.5	0
11/05/2011	10	22.1	0	9/10/11	15.8	29.5	0
12/05/2011	10.7	20.9	0	10/10/11	20.3	26.7	0
13/05/2011	12.6	15.7	0	11/10/11	14.4	26.4	0
14/05/2011	13.5	19.3	1.4	12/10/11	14.4	29.0	0
15/05/2011	13.5	25.2	0.4	13/10/11	14.9	27.2	0
16/05/2011	15.3	22.8	0	14/10/11	14.3	29.5	0
17/05/2011	12.4	24.4	0				

Figure 3.1: Daily temperatures at Meekatharra during the surveys (from BOM 2011)



3.3.3 Trapping

A combination of pitfall traps, funnel traps, Elliott traps and motion sensitive cameras were used to survey for ground-dwelling mammals, reptiles and amphibians. Six fauna survey sites (containing a combination of the above traps) were established in each of the major fauna habitats present during the first phase of survey. These six sites were re-sampled during the second phase of surveying, with a seventh site also established.



Each fauna survey site contained:

- Pitfall traps: a 20 L bucket, dug in to the ground, and bisected by a 5 m long, 30 cm high fence impermeable to ground fauna. In rocky habitats, where the substrate limited digging, a 50 cm length of stormwater PVC pipe was installed instead of a 20 L bucket. Each site contained 10 pitfall traps;
- Funnel traps; one trap placed at each end of the pit trap fence. Most sites contained 20 funnel traps;
- Elliott traps: placed in a line extending throughout the trapping site, spaced approximately 25 m apart. Most sites contained 20 funnel traps; and
- Motion cameras: at least one motion sensitive camera was established at each fauna site.

The locations of fauna survey sites (Sites 1 to 7) are shown on Figure 3.2. Table 3.4 lists the location, trap effort and habitat description for each fauna survey site. Location details of each trap are listed in Appendix B, and photos of each trapping site are provided in Appendix C.

During the first survey phase each survey site (and therefore each fauna trap) was open for six nights. During the second survey phase, sites were open for a minimum of seven nights. The survey effort at each site is shown in Table 3.4.

3.3.4 Bird surveys

Twenty minute set-time surveys of birds were undertaken at all sites. Species presence and abundance data were collected from a 2 ha area within habitat representative of the trapping site. Surveys were completed prior to 10 am, before increasing temperatures resulted in reduced activity.

Incidental records of all birds were taken while working within the Study Area. This was particularly important to record raptors that are generally active during the hotter part of the day.



3.3.5 Bat surveys

Bats were sampled using both an ANABAT detector (SD1, Titley Electronics, Phase 1) and Song Meter Detector (SM2, Wildlife Acoustics, Phase 2). Detectors were placed within a variety of habitats suitable to support bat fauna, including habitat potentially supporting significant species. Acoustic bat recordings were identified by Mr Bob Bullen (Bat Call WA). The locations of bat survey sites are listed in Table 3.4 and shown on Figure 3.2.

3.3.6 Motion sensitive cameras

Motion sensitive cameras were used to survey for mammals, particularly targeting macropods and small mammals such as dasyurids and rodents (including introduced species). Cameras were placed mostly within rocky habitats (such as caves, rock ledges and overhangs) and baited with universal bait (peanut butter, sardines and oats). Motion Sensitive Cameras were placed at a total of 25 sites (Appendix B).

3.3.7 Opportunistic fauna surveys

Surveys conducted by hand in a given habitat are termed opportunistic surveys. The aim of these surveys is to discover more cryptic or trap-shy species that would otherwise not be recorded by the trapping survey. This technique is an important component of comprehensive fauna surveys. Experienced herpetologists targeted such species by investigating microhabitats during surveying. Fifteen opportunistic surveys were conducted in all fauna habitats, both at trapping sites and at numerous opportunistic survey sites (Table 3.4 and Figure 3.2).

3.3.8 Nocturnal surveys

Nocturnal surveys were conducted in the hours just after sunset on the nights of the 8th, 9th and 10th October 2011. Nocturnal surveys were conducted throughout the Study Area, by vehicle and on foot. One vehicle, with two personnel, traversed the Study Area searching the roads for fauna. Nocturnal searches targeted fauna that may be largely absent during the day (such as night birds), as well as mammals, amphibians and reptiles. A total of 15 survey hours of nocturnal searching was completed over the three nights.

3.3.9 Supplementary Data

At all times while surveying, any observations of species not previously recorded during the survey, rare or conservation significant fauna or other fauna of interest were documented. These records included tracks, scats and any other traces of fauna, as well as incidental sightings of live animals.



3.3.10 Habitat assessment

Fauna habitats were described and assessed for their conservation significance, i.e. representation within the Study Area or the region and the likelihood that they support conservation significant fauna. All major fauna habitats present within the Study Area were sampled and scored (High, Medium or Low) according to the criteria shown in Table 3.5.

Table 3.5: Fauna habitat significance assessment criteria

Score	Criteria
High	1) Habitat supports EPBC or WC Act listed threatened fauna, OR 2) Habitat for EPBC or WC Act species is present in the Study Area, and there are records of that species within 50 km of the Study Area. If limited surveys have been undertaken in the vicinity of the Study Area then a precautionary approach will be used and the species will be considered likely to be present, OR 3) Uncommon habitat is critical habitat for a population of DEC listed Priority fauna. For example, if habitat is limited in the region and the habitat in the Study Area forms a significant portion of the known habitat for a Priority species, it would be scored as High significance.
Medium	1) Habitat supports DEC listed Priority fauna that are largely restricted to that habitat type within the Study Area. OR 2) Habitat supports EPBC listed Migratory fauna. OR 3) Habitat supports a particularly diverse and uncommon faunal assemblage. Habitat that occurs throughout region, and does not occur in small or isolated areas, is excluded.
Low	Habitat is widespread, common, and does not solely support any conservation significant fauna.

3.4 Taxonomy and Nomenclature

The latest checklist of Western Australian mammals, reptiles and amphibians was used to determine current taxonomy and nomenclature of these groups (Western Australian Museum, 2009). For birds, the current checklist of Australian birds, maintained by Birds Australia, was used. The bird list is based on the most recent review of the systematics and taxonomy of Australian birds by Christidis and Boles (2008).

3.5 Survey team

The project was undertaken by:

- Mr Jeff Turpin Project Manager / Senior Ecologist
- Mr Mike Griffiths Senior Zoologist
- Mr Simon Cherriman Senior Zoologist
- Mr Tim Gamblin Senior Zoologist
- Ms Gillian Basnett Zoologist



Biologic wishes to acknowledge the assistance of Mr Bob Bullen of Bat Call WA, who analysed bat recordings from both survey phases.

3.6 Potential Limitations and Constraints

EPA Guidance Statement No. 56 (EPA, 2004) outlines several potential limitations to fauna surveys. These are presented and discussed in Table 3.6.

Table 3.6: Survey limitations and constraints

Potential limitation or constraint	Applicability to this survey
Experience of personnel.	The senior field personnel involved in the survey each had five or more years of fauna survey experience.
Scope (what faunal groups were sampled and whether any constraints affect this).	All fauna groups were sampled. Wet and cool conditions during May reduced capture rates, but additional targeted and opportunistic surveys supplemented the fauna data. The lack of significant rainfall meant amphibians were under sampled. Birds, mammals and reptiles were sufficiently sampled.
Proportion of fauna identified.	All fauna were identified at the point of capture.
Sources of information (recent or historic) and availability of contextual information.	A number of surveys have been undertaken in the vicinity of the Study Area and the surrounding region. Results of these and other local fauna surveys are available on NatureMap. Numerous fauna consultant reports were available at the time of writing.
Proportion of the task achieved.	A comprehensive survey of the Study Area was completed.
Disturbances (e.g. fire or flood).	No major disturbances affected the survey however a small number of traps were disturbed by groups of cattle.
Intensity of survey.	Survey intensity was adequate to record information on conservation significant fauna of the Study Area.
Completeness of survey.	The Level 2 fauna survey is complete.
Resources (e.g. degree of expertise available).	All resources required to complete the survey to a high standard were available.
Remoteness or access issues.	None. More remote areas of the Study Area were accessed on foot.



4 RESULTS

4.1 Desktop Review

Analysis of the databases and reports outlined in Section 3 showed that a total of 268 vertebrate fauna taxa have the potential to occur within the Study Area. The greatest potential diversity is in the birds (166 species), followed by reptiles (68 species), mammals (28 species, including introduced species) and amphibians (6 species).

Prior to this survey, several vertebrate fauna surveys have been undertaken in the vicinity of the Study Area. Vertebrate fauna surveys have been conducted nearby at Jack Hills, approximately 15km south of Mount Gould (ecologia, 2009a; MBS, 2005a; MBS, 2005b; Western Wildlife, 2006). Fauna surveys have also been conducted at Weld Range (ecologia, 2009b; BCE, 2008), approximately 100km south of Jack Hills, and also in the area in between these two ranges (ecologia, 2010).

A summary of results from previous studies undertaken in the local area are presented in **Error! Reference source not found.** Results from the current survey are included for comparison. Appendix D contains species lists from all surveys conducted to date.



Table 4.1: Summary of previous surveys in the local, and adjacent, area.

Survey	Jack Hills	Jack Hills	Jack Hills	Jack Hills	Weld Range	Weld Range	Mount Gould Fauna Survey (this survey)
Consultant	ecologia	MBS	MBS	Western Wildlife	ecologia	Bamford Consulting	Biologic
Year	2006/2007	2005	2005	2006	2006/2007	2008	2011
Type	Two-phase Level 2	Level 1	Single phase Level 2	Single phase Level 2	Two-phase Level 2	Level 1	Two phase Level 2
Mammals -native	13	NA	9	11	16	4	15
Mammals -introduced	4	4	5	2	6	1	7
Birds	67	45	46	56	79	52	90
Reptiles	23	8	24	30	44	9	27
Amphibians	0	0	4	0	1	1	1
Total	107	57	88	99	146	67	140
Number Significant Fauna recorded	7	1	5	5	7	2	8
Significant Fauna recorded	Long-tailed Dunnart, Rainbow Bee-eater, <i>Scotorepens greyi</i> , Painted Finch, Slender Blue-tongue, Woolley's Pseudantechinus, Little Woodswallow	Rainbow Bee-eater	Long-tailed Dunnart, <i>Scotorepens greyi</i> , Bush Stone-curlew, Slender Blue-tongue, Little Woodswallow	Bush Stone-curlew, Peregrine Falcon, Woolley's Pseudantechinus, Slender Blue-tongue, Little Woodswallow	Bush Stone-curlew, Long-tailed Dunnart, <i>Lerista eupdoia</i> , Peregrine Falcon, Slender-billed Thornbill, Woolley's Pseudantechinus, Little Woodswallow	Woolley's Pseudantechinus, Little Woodswallow	Bush Stone-curlew, Peregrine Falcon, Australian Bustard, Rainbow Bee-eater, Painted Finch, Woolley's Pseudantechinus, <i>Scotorepens greyii</i> , Little Woodswallow
Distance from Mount Gould	15 km (south)	15 km (south)	15 km (south)	15 km (south)	100 km (south)	100 km (south)	NA



4.2 Fauna Recorded from the Study Area.

In total, 125 fauna species were recorded from the Study Area comprising 15 native and seven introduced mammal, 75 bird, 27 reptile and one amphibian species (see Appendix D and Appendix E). An additional 15 bird species were recorded from habitats adjacent to the Study Area bringing the total number of species recorded during the surveys to 140.

Eight conservation significant fauna species were recorded during the 2011 surveys (discussed in detail in Section 4.3). These were:

- Peregrine Falcon (*Falco peregrinus*, Schedule 4 WC Act);
- Australian Bustard (*Ardeotis australis*, DEC Priority 4)
- Bush Stone-curlew (*Burhinus grallarius*, DEC Priority 4);
- Rainbow Bee-eater (*Merops ornatus*, EPBC Migratory);
- Woolley's Pseudantechinus (*Pseudantechinus woolleyae*, DEC BIF Dependent);
- Little Woodswallow (*Artamus minor*, DEC BIF Dependent);
- Painted Finch (*Emblema pictum*, locally restricted); and
- Little Broad-nosed Bat (*Scotorepens greyii*, locally restricted).

The species inventory for the site also includes three species not previously recorded in the area: *Delma tinctoria*, the Inland Freetail-bat (*Mormopterus* sp. 3) and the Australian Bustard (Priority 4).

4.2.1 Native mammals

Of the 18 species of native mammals expected to occur in the Study Area, 15 species were recorded. The Euro (*Macropus robustus*) was observed singly or in pairs on the ridges and slopes of Mount Gould. The Red Kangaroo (*Macropus rufus*) was observed in low numbers on the surrounding plains. Woolley's Pseudantechinus (*Pseudantechinus woolleyae*) was recorded from several areas - by motion cameras, pitfall and Elliot Traps - from caves, rock crevices and rocky outcrops on the ridges and slopes of Mount Gould. Two native rodents, the Sandy Inland Mouse (*Pseudomys hermannsburgensis*) and Spinifex Hopping-mouse (*Notomys alexis*) were recorded from sandplain habitats, while the Stripe-faced Dunnart (*Sminthopsis macroura*) was recorded from stony and sandy plains. An Echidna (*Tachyglossus aculeatus*) was observed from a rocky outcrop and scats attributable to this species were recorded throughout the Study Area. Two bat species were observed from a cave (*Taphozous hilli* and *Vespadelus findlaysoni*). In total eight bat species were recorded in the Study Area, identified by the ANABAT detector or via observation (see Appendix D).



Seven introduced mammal species were recorded. A small herd of Feral Goats (*Capra hircus*) was recorded from the upper slopes of Mount Gould. The Feral Cat (*Felis catus*) was observed and recorded on motion cameras, while scats and tracks attributable the Dingo (*Canis lupus dingo*), Camel (*Camelus dromedarius*), Rabbit (*Oryctolagus cuniculus*), Cattle (*Bos taurus*) and Sheep (*Ovis aries*) were also recorded.

Historic evidence of the past occupation of four locally extinct native mammal species was also recorded. Very old scats from the Black-footed Rock-Wallaby (*Petrogale lateralis*) were recorded from a ledge within a cave on the slopes of Mount Gould. Additionally old abandoned shelters constructed by the Stick-nest Rat (*Leporillus* sp.) were recorded from the same cave. Abandoned burrow systems of the Boodie (*Bettongia lesueur*) were recorded from the plains surrounding Mount Gould. Numerous old pebble-mounds constructed by the Western Pebble-mound Mouse (*Pseudomys chapmani*) were recorded on the lower slopes and stony plains surrounding Mount Gould. These four mammal species are considered to be locally extinct in the region and are discussed in further detail in Section 4.4.3. The Western Pebble-mound Mouse appears to be relatively common in the adjacent Pilbara region; however, there have been no recent records of this species from the Murchison.

4.2.2 Birds

One-hundred and sixty-six bird species may occur in the Study Area, of which 75?? species were recorded during this survey. During systematic surveys, the most frequently recorded species were Budgerigar (*Melopsittacus undulatus*), Diamond Dove (*Geopelia cuneata*), Zebra Finch (*Taeniopygia guttata*), Masked Woodswallow (*Artamus personatus*), Yellow-throated Miner (*Manorina flavigula*) and Grey-crowned Babbler (*Pomatostomus temporalis*). Singletons (birds recorded as a single individual during this survey) were Collared Sparrowhawk (*Accipiter cirrocephalus*), Australian Bustard (*Ardeotis australis*), Southern Boobook (*Ninox novaeseelandiae*), Red-browed Pardalote (*Pardalotus rubricatus*), Striated Pardalote (*Pardalotus striatus*), Brown Songlark (*Cincloramphus cruralis*) and Mistletoebird (*Dicaeum hirundinaceum*, see Appendix E).

Several species observed are considered uncommon in the region including the Peregrine Falcon, Bush Stone-curlew, Bourke's Parrot (*Neopsephotus bourkii*) and Painted Finch. A large number of waterbirds were recorded from the Murchison River, which lies to the south of the Study Area. Details of all bird species recorded from the region are provided in Appendix D.

Several bird species were recorded nesting in the Study Area. These were the Peregrine Falcon (two nests located on cliff faces), Nankeen Kestrel (*Falco cenchroides*, six nests located on small cliffs and breakaways), Yellow-throated Miner (nesting within Mulga



shrubland), Black-faced Woodswallow (nesting within Mulga shrubland), Masked Woodswallow (nesting within Mulga Shrubland), Painted Finch (two nest located within Spinifex Hummock Grassland), Little Button-quail (*Turnix velox*, nesting within Spinifex Hummock Grassland), Zebra Finch (many nests recorded across Study Area) and Diamond Dove (many nests recorded across Study Area, particularly within Mulga shrubland).

4.2.3 Reptiles

Sixty eight reptile species potentially occur in the Study Area, of which 27 species were recorded during the survey. The most commonly trapped reptile species (using systematic trapping data only) were *Ctenophorus caudicinctus* (101 individuals), *Ctenotus severus* (122 individuals), *Gehyra variegata* (46 individuals) and *Lerista timida* (44 individuals). Two species recorded during the current survey had not been previously recorded in the local area; *Delma tinctoria* and *Ramphotyphlops grypoides* (see Appendix E).

4.2.4 Amphibians

One of the six potentially occurring amphibians was recorded during the survey; Desert Tree Frog (*Litoria rubella*). Additional species are expected; however, they would only be recorded during periods of rainfall.



4.3 Fauna Habitats

Seven major fauna habitats were identified within the Study Area. For the purposes of this report fauna habitats are aligned approximately with vegetation communities as defined by Woodman Environmental Consulting (2011). The major fauna habitats are listed below with the corresponding Floristic Community Type. Habitat descriptions are presented in Table 4.2.

1. **Spinifex Hummock Grasslands on Ironstone Hills and Ridges:** includes hill crests and slopes supporting *Acacia aneura* and/or *Grevillea berryana* over sparse low shrubland of *Eremophila latrobei* subsp. *latrobei*, *Philotheca brucei*; subsp. *cinerea* and *Ptilotus obovatus* over low hummock grassland of *Triodia melvillei* (FCT5). The hill crests (such as Mount Gould summit) also contain extensive ironstone outcropping, boulder piles and cliff faces;
2. **Open Mulga shrublands over Tussock Grassland on Ironstone Hills and Ridges:** Open tall shrubland or isolated shrubs of *Acacia aneura* over open to sparse mid shrubland of *Eremophila latrobei* subsp. *latrobei* and *Philotheca brucei* subsp. *cinerea* over open to sparse low shrubland and low tussock grassland of *Ptilotus obovatus* and *Cymbopogon ambiguus* on steep mid and upper slopes and crests on banded ironstone (FCT4);
3. **Stony lower slopes and plains below hill systems:** Open tall shrubland of *Acacia aneura* occasionally with *A. ramulosa* var. *linophylla* and *A. citrinoviridis* over sparse low shrubland of *Ptilotus obovatus* over open low forbland of *Goodenia tenuiloba* on mid and lower slopes on banded ironstone and quartz shale (FCT1 and FCT6B);
4. **Mixed Acacia shrublands on sandplain:** Open tall shrubland of *Acacia ramulosa* var. *linophylla* and *A. kempeana* over sparse mid shrubland of *Eremophila forrestii* subsp. *forrestii* over isolated low shrubland of *Corchorus crozophorifolius* over sparse low grassland and forbland of mixed species including *Eriachne mucronata* and *Ptilotus aevoides* on flat plains (FCT6a);
5. **Sparse Mulga shrublands on hardpan:** Sparse tall shrubland or isolated shrubs of *Acacia aneura* over isolated mid shrubs of *Eremophila fraseri* subsp. *parva* over isolated low shrubs of *Ptilotus obovatus* over open low forbland of mixed species including *Ptilotus aevoides* and *Goodenia tenuiloba* in clay pans and on clay flats (FCT3);
6. **Sparse Acacia shrublands on stony undulating plains:** Sparse tall shrubland of mixed *Acacia* species over sparse low shrubland of *Ptilotus obovatus* and



Eremophila species over open low forbland of *Goodenia tenuiloba* on stony undulating plains (FCT2); and


7. **Breakaway systems containing deep crevices, caves and rock ledges.**
Occurs on the steep slopes of Mount Gould, generally in small areas.




Table 4.2: Fauna habitat descriptions

Habitat type	Distinguishing characteristics	Photo
Spinifex Hummock Grasslands on Ironstone Ridge Crests and Upper Slopes	<p>Restricted to the upper slopes and crests of Mount Gould. An isolated fauna habitat that is absent on the surrounding plains. Small areas of similar habitat occur on the slopes and crests of Jack Hills. Ironstone outcropping occurs in some areas. Vegetation is dominated by <i>Triodia melvillei</i> hummock grasslands with or without a shrubland containing mostly <i>Acacia aneura</i>. The substrate varies but is mostly comprised of rocks, boulders and cobbles with minor areas of loam.</p>	




Habitat type	Distinguishing characteristics	Photo
Open Mulga shrublands over Tussock Grassland on Ironstone Hills and Ridges	<p>Occurs on the slopes of Mount Gould generally below FCT 5 (<i>Triodia melvillei</i> hummock grasslands). The substrate varies but is mostly comprised of rocks, boulders and cobbles with minor areas of loam. Vegetation is dominated by <i>Acacia aneura</i> occurring as a sparse shrubland or sparse woodland over tussock grasslands. Habitat is widespread but restricted to the BIF ridges in the region.</p>	




Habitat type	Distinguishing characteristics	Photo
Stony lower slopes and plains below hill systems	<p>Occurs on the lower slopes of Mount Gould and the adjacent stony plains. Vegetation is dominated by <i>Acacia aneura</i> shrublands occurring over tussock grasslands. The substrate is mostly comprised of cobbles with minor areas of sandy loam becoming more predominant on the plains. Habitat is widespread but restricted to the BIF ridges in the region.</p>	 A photograph showing a landscape of stony lower slopes and plains. The terrain is covered with sparse vegetation, including several large, dark, leafless trees and smaller shrubs. The ground is rocky and covered with dry, yellowish-brown grasses and tussocks. The background shows a hilly area under a cloudy sky.




Habitat type	Distinguishing characteristics	Photo
<p>Mixed <i>Acacia</i> shrublands on sandplain</p>	<p>Occurs in small areas adjacent to the slopes of Mount Gould. Characterised by deep sands supporting mixed <i>Acacia</i> shrublands (<i>Acacia ramulosa</i> var. <i>linophylla</i> and <i>A. kempeana</i>) over tussock grasslands. A widespread habitat.</p>	




Habitat type	Distinguishing characteristics	Photo
Sparse Mulga shrublands on hardpan	<p>Occurs on the plains surrounding Mount Gould and is widespread through the region. Vegetation is dominated by <i>Acacia aneura</i> shrublands sometimes forming dense groves with high leaf, twig and wood litter, and occasional <i>A. pruinocarpa</i> containing numerous hollows. Substrate has minor rocky areas and is predominately a sandy clay. A widespread habitat.</p>	 A photograph showing a landscape of sparse mulga shrublands on hardpan. The foreground is dominated by reddish-brown soil with patches of dry, yellowish grass. In the middle ground, there are several small, green shrubs and trees. The background shows a clear blue sky and more distant vegetation.



Habitat type	Distinguishing characteristics	Photo
<p>Sparse <i>Acacia</i> shrublands on stony undulating plains</p>	<p>Occurs on the plains surrounding Mount Gould and is widespread through the region. In the Study Area a small area occurs to the north of Mount Gould. Vegetation is generally sparse; however dense groves of mixed <i>Acacia</i> (<i>Acacia aneura</i>, <i>A. grasbyi</i>) occur in minor drainage lines. Substrate is mostly a gravely stony plain. A widespread habitat.</p>	



Habitat type	Distinguishing characteristics	Photo
<p>Breakaway systems containing deep crevices, caves and rock ledges</p>	<p>Minor breakaway areas containing small caves occur on the slopes of Mount Gould. A large cave containing seasonal moisture (dripping roof) occurs near the summit. Areas of similar habitat occur on Jack Hills however habitat is very isolated and restricted in the region.</p>	 A photograph showing a rocky breakaway system with a cave entrance. The rocks are reddish-brown and jagged. The cave entrance is dark and recessed into the rock face. The background shows a clear blue sky and some sparse vegetation.



4.4 CONSERVATION SIGNIFICANT FAUNA

4.4.1 Conservation Significant Fauna Recorded in the Study Area and surrounds

Eight conservation significant species were been recorded within the Study Area (Figure 4.1):

- Peregrine Falcon (*Falco peregrinus*) – listed under Schedule 4 of the *Wildlife Conservation Act 1950*;
- Bush Stone-curlew (*Burhinus grallarius*) – listed as Priority 4 by the DEC;
- Australian Bustard (*Ardeotis australis*) – listed as Priority 4 by the DEC;
- Rainbow Bee-eater (*Merops ornatus*) – listed as Migratory under the EPBC Act;
- Woolley's Pseudantechinus (*Pseudantechinus woolleyae*) – listed as BIF Dependent by DEC;
- Little Woodswallow (*Artamus minor*) – listed as BIF Dependent by DEC;
- Painted Finch (*Emblema pictum*) – locally significant; and
- Little Broad-nosed Bat (*Scotorepens greyii*) – locally significant.

An additional two conservation significant species have been recorded nearby at Jack Hills and surrounds during previous fauna surveys:

- Long-tailed Dunnart (*Sminthopsis longicaudata*) – listed as Priority 4 by the DEC;
- Major Mitchell's Cockatoo (*Lophochroa leadbeateri*) - listed under Schedule 4 of the *Wildlife Conservation Act 1950*;

Information on each of these species is provided in the following sections. Conservation codes are explained in Appendix A, while locations of conservation significant fauna from the Study Area are presented in Appendix F.

In all, nineteen species of conservation significance were identified during the database and literature searches that may occur in the Study Area (Table 4.3). Each of these species, and the factors affecting their likelihood of occurrence, are considered in Table 4.3. Additionally, evidence of historical occupation (within the Study Area) of four locally extinct fauna species were recorded.



Peregrine Falcon (*Falco peregrinus*)

The Peregrine Falcon is listed under Schedule 4 of the WC Act 1950. In Western Australia, the species is considered to be moderately common in the Stirling Range, uncommon in the Kimberley, Hamersley and Darling Ranges, and rare or scarce elsewhere (Johnstone and Storr, 1998). Inland it is most often encountered along cliffs above rivers, ranges and wooded watercourses and lakes, where it seeks out its main prey, aerial birds (Johnstone and Storr, 1998). The Peregrine Falcon nests in recesses of cliff faces, tree hollows or in large abandoned nests of other birds (Birds Australia, 2011) Peregrine Falcons pair and mate for life, with pairs maintaining a home range of about 20 - 30 km² throughout the year. Blakers *et al.*, (1984) consider Australia as one of the strongholds of the species, since it has declined in many other parts of the world.

The Peregrine Falcon was recorded from Mount Gould during the second survey phase. Three individuals (two adults and one fledgling) were observed from the Mount Gould summit, and two nest sites were located. This confirmed observations made during a previous visit to Mount Gould, where an adult falcon displayed aggressive territorial behaviour to an observer on the summit, indicating that this species may be breeding in the area (see Appendix F). The Mount Gould summit comprises a series of cliff faces with numerous ledges and recesses. Several well-used roost sites and two nest sites belonging to Peregrine Falcons were located among these faces, evident from the extensive faecal smears ("whitewash") down on the rocks below the roost/nest (see Plates 1, 2, 3). The whitewash below one of the nest sites was over 5m high and visible several kilometres away, which indicates extensive use by falcons over many years. A breeding pair is therefore likely to permanently reside on the summit of Mount Gould.

Disturbances to Peregrine Falcon nesting and roosting habitat should be avoided.



Plate 1: View of Mount Gould summit showing faecal smears of two well used roosts.



Plate 2: Front view of Peregrine Falcon nesting ledge showing extensive faecal stains (whitewash).



Plate 3: Top view of Peregrine Falcon nesting ledge, showing prey remains, indicating recent use.



Australian Bustard (*Ardeotis australis*)

The Australian Bustard is listed as Priority 4 by the DEC. This species occurs in a variety of grassland, grassy woodland and shrubland habitats. It is nomadic, and may range over very large areas (Johnstone and Storr, 1998). The species has declined from its range further to the south, with the main threats to its survival being a combination of habitat loss/degradation and predation by feral cats and foxes (Johnstone and Storr, 1998).

The Australian Bustard was recorded on the plains adjacent to Mount Gould during the 2011 survey. This species is occasionally seen on Mount Gould Station (T. Pens, pers. com.) and is likely to be an occasional visitor to the plains surrounding Mount Gould.

Bush Stone-curlew (*Burhinus grallarius*)

The Bush Stone-curlew is classified as Priority 4 by DEC and Near Threatened by Garnett and Crowley (2000). This species is often associated with woodlands and dense shrublands such as Mulga (J. Turpin, pers. obs.).

This species has a widespread distribution, however, has significantly declined in southern parts of its range. Historically this species was widely distributed throughout much of Western Australia but it is now considered rare, with an estimated Australian population of 15,000 individuals (Garnett and Crowley 2000). Since Bush Stone-curlews are a ground dwelling and non-migratory species, they may be susceptible to local disturbances by humans and to predation by cats and foxes (Johnstone and Storr, 1998). Home range studies have not been conducted in the Murchison, however, in arid Eastern Australia Bush Stone-curlews occupy a large, permanent, home range (of about 250–600 ha) which contracts to a much smaller area (10–25 ha) during breeding (DEWHA, 2010a).

This species was recorded at Mount Gould from Fauna Site 4 and also from Mount Gould homestead. The Bush Stone-curlew has been recorded from the nearby Jack Hills and also at Weld Range and is likely to be a resident within the Study Area.

Rainbow Bee-eater (*Merops ornatus*)

The Rainbow Bee-eater is listed as Migratory under the EPBC Act. The species occurs all year round in the tropics of northern Australia, with a southward migration to both south-eastern and south-western Australia in early spring. Southern birds return north in autumn (Johnstone and Storr, 1998). It has a wide range and occurs in the better watered parts of Western Australia, between the Kimberley and south-west of Western Australia, preferring lightly wooded, preferably sandy country near water (Johnstone and Storr, 1998). It nests in burrows dug usually at a slight angle in flat ground, gently elevated slopes, sandy banks or cuttings, and often at the margins of roads or tracks.



When present, the Rainbow Bee-eater is common and prominent in both natural and altered environments. Although a species of high conservation significance, it is abundant and versatile in its selection of nest sites. This species was recorded in a number of locations at Mount Gould and may be a seasonal visitor to the Study Area.

Long-tailed Dunnart (*Sminthopsis longicaudata*)

The Long-tailed Dunnart is listed as Priority 4 by the DEC. This species has only been recorded from widely separated populations in the Pilbara, Murchison, Gibson Desert, southern Carnarvon Basin and in the Western MacDonnell Ranges (Northern Territory) (Burbidge *et al.* 2008). The Long-tailed Dunnart appears to be a specialist of rocky habitats (rocky ridges, hills and breakaways). It has been previously recorded at Weld Range and Jack Hills (ecologia, 2009a and 2009b); however, apart from records from BIF ridges, there are no records from the surrounding plains (DEC, 2011). DEC considers the Long-tailed Dunnart to be significantly dependent on banded ironstone formation ranges in the region (DEC, 2007).

The Long-tailed Dunnart has been previously recorded from several sites at Jack Hills. These include from banded ironstone ridge crests, slopes and minor drainage lines approximately 19km south of Mount Gould (ecologia, 2010). Due to the presence of suitable habitat, and nearby records, the Long-tailed Dunnart is likely to occur within the Study Area.

Major Mitchell's Cockatoo (*Lophochroa leadbeateri*)

Major Mitchell's Cockatoo is listed under Schedule 4 of the Wildlife Conservation Act. It is sporadically distributed through arid and semi-arid Australia and may occur in sparsely timbered grasslands and shrublands and rocky outcrops (DEC, 2011). In the region this species is mostly restricted to the margins of the Murchison River (Birds Australia, 2011) where it has been recorded within *Eucalyptus camaldulensis* woodland particularly near water (J Turpin, pers. obs.). The Major Mitchell's Cockatoo has been recorded from Mount Gould Station, from permanent waterholes in the Murchison River near Mount Taylor and also from Mount Taylor Well, approximately 8km south of the Study Area (T Penns, pers. com.). As this species nests within Eucalypt Woodland it is unlikely to be dependent on habitat within the Study Area.

Locally Significant Fauna Recorded at Mount Gould

In addition to the above species, DEC has listed several vertebrate fauna species it considers to be significantly dependent on banded ironstone formation ranges in the region (DEC, 2007). These include (in addition to Peregrine Falcon and Long-tailed Dunnart):



- Little Woodswallow – this species utilises vertical rock faces for refuges, breeding and roosting sites and is generally restricted to the BIF within the region (DEC, 2007). The Little Woodswallow was recorded from the Study Area (several roosting sites recorded).
- Woolley's Pseudantechinus – this species has a disjunct distribution between the Pilbara and Murchison regions with a strong habitat preference for rocky hills. As a result, it occurs in several fragmented populations. It inhabits deep rock crevices and caves in rocky outcrops. Woolley's Pseudantechinus was recorded from several locations within the Study Area, often containing extensive outcropping with deep rock crevices (see Figure 4.1).

The Painted Finch (*Emblema pictum*) occurs in the Pilbara, Kimberley and central deserts in Western Australia (Birds Australia, 2011). It typically inhabits spinifex grasslands in rocky country, in the vicinity of gorges where there are pools of water and occasionally in sandplain spinifex if water is available (Morcombe, 2000). The Painted Finch occurs in the Mount Gould area at the southern extent of its range. Storr (1985) mentions Mount Hale (in the nearby Jack Hills) as a southerly location for this species. Due to its distribution and dependence on the limited *Triodia* grasslands of the BIF ridges in the region, this species is considered locally significant.

The Painted Finch was recorded during both survey phases, with the species recorded nesting in large spinifex clumps on top of Mount Gould and drinking from small water pools collected in a large cave. The Painted Finch is expected to be dependent of the *Triodia melvillei* hummock grasslands occurring in the Jack Hills Range and at Mount Gould and was not recorded on the surrounding plains away from the ridge during either survey.

The Little Broad-nosed Bat (*Scotorepens greyii*) is locally common throughout northern Australia, roosting in tree hollows in open woodlands and plains. Within Western Australia it is known from the Gascoyne, Pilbara and Kimberley regions occurring in the Mount Gould area at the southern extreme of its range (ecologia, 2009). As a result the Little Broad-nosed Bat is considered locally significant.



4.4.2 Conservation Significant Fauna Potentially occurring in the Study Area

There are several additional conservation significant fauna species with the potential to occur in the Mount Gould Study Area. These species are discussed below:

Slender-billed Thornbill (*Acanthiza iredalei*)

The Western Slender-billed Thornbill is listed as Vulnerable under the EPBC Act. It occurs in shrubland, typically in areas of saltmarsh dominated by samphire, bluebush (*Maireana*) or saltbush (*Atriplex*) around salt lakes or low heath on sandplain (Pavey, 2006). The species occurs in a number of disjunct populations in Western Australia, from Shark Bay to the Nullarbor (Johnstone and Storr, 2004). The Western Slender-billed Thornbill is considered uncommon, rare and in some areas locally extinct in inland Western Australia. The species is declining in much of its range owing to the degradation of chenopod vegetation by livestock and rabbits (Johnstone and Storr, 2004). In the Northern Territory, the western subspecies of the Slender-billed Thornbill is classified as Regionally Extinct (Pavey, 2006). This species has been recorded at scattered locations throughout the Murchison, including at Weld Range (ecologia, 2009) and Nallan Station (Birds Australia, 2011). As the species inhabits samphire amongst the margins of salt lakes it is unlikely to occur in the Study Area.

Malleefowl (*Leipoa ocellata*)

The Malleefowl is listed as Vulnerable under the EPBC and WC Acts. In Western Australia Malleefowl occur mainly in scrubs and thickets of Mallee (*Eucalyptus* spp.), Boree (*Melaleuca lanceolata*) and Bowgada (*Acacia linophylla*), and also other dense litter-forming shrublands including Mulga Shrublands (Johnstone and Storr, 2004). The species distribution was once larger and less fragmented, but the widespread clearing of suitable habitat, coupled with the degradation of habitat by fire and livestock, and fox predation, have reduced Malleefowl numbers considerably. Malleefowl previously inhabited most of the Murchison; however, the species has undergone a dramatic range reduction in the region.

Malleefowl have developed a highly sophisticated method of temperature control for egg incubation. The species constructs distinctive nests that comprise a large mound covering a central core of leaf litter, typically in areas of dense vegetation. Old abandoned Malleefowl mounds have been recorded on the slopes of Weld Range (ecologia, 2009) and the species has been sighted between Weld Range and Jack Hills (M Seivwright, pers. com.). No Malleefowl mounds were recorded within the Study Area, which lies at the northern limit of this species distribution. Due to the paucity of the *Acacia* shrublands at Mount Gould, Malleefowl are unlikely to breed in the area.



Western Spiny-tailed Skink (Black Form, *Egernia stokesii badia*)

Western Spiny-tailed Skink (*Egernia stokesii badia*) is listed as Endangered under the EPBC Act and under Schedule 1 of the WC Act. This species has been recently recorded at several locations in the Murchison region, including near Weld Range (DEC, 2011). In the Murchison, the Western Spiny-tail Skink inhabits deep rock crevices on granite outcrops and hills (J. Turpin, pers. obs.). There are no areas of granite outcropping within the Mount Gould tenement and, as a result, this species is considered unlikely to occur within the Study Area.

Grey Falcon (*Falco hypoleucos*)

The Grey Falcon is listed as Priority 4 by DEC. This species appears to have a distribution centred around ephemeral or permanent drainage lines, utilising old nests of other bird species situated in the tallest trees along the river systems (Garnett and Crowley, 2000). Although the main threats to this species are not known, regional threats may include habitat degradation through grazing, which may have reduced prey abundance (Garnett and Crowley, 2000). The Grey Falcon is potentially a rare visitor to the Study Area, and is unlikely to breed within the Study Area due to a lack of suitable habitat.

Fork-tailed Swift (*Apus pacificus*)

The Fork-tailed Swift is listed as Migratory under the EPBC Act. It is an aerial species largely independent of terrestrial habitats, and is likely to be an irregular visitor to the Study Area.

Oriental Plover (*Charadrius veredus*)

The Oriental Plover is listed as Migratory under the EPBC Act. It is a non-breeding visitor to Australia, where it occurs in both coastal and inland areas. Along the coast the Oriental Plover inhabits estuarine mudflats, beaches and near coastal grasslands. Inland it occurs in flat, open, semi arid or arid grasslands (DEWHA, 2010a). On migration to Northern Australia (September – November), Oriental Plovers gather in flocks on open, thinly vegetated, grassland plains (Morecombe, 2000). There are no records of this species near Mount Gould; however, it was returned during database searches as potentially occurring within the Study Area.

Spinifex Slender Blue-tongue (*Cyclodomorphus melanops*)

The Spinifex Slender Blue-tongue is listed by DEC as significantly dependent on the BIF ranges in the region. It is considered to be restricted to the Spinifex dominated habitats on



the upper slopes of BIF ridges in the region, and absent from the surrounding plains (DEC, 2007).

The Spinifex Slender Blue-tongue inhabits spinifex hummock grasslands and has several disjunct populations across Western Australia including in the Pilbara and Gascoyne. It has been recorded at Jack Hills, from spinifex hummock grasslands on the upper slopes of the range (ecologia, 2009; Western Wildlife, 2006) and is also likely to occur at Mount Gould. Due to the highly restricted and isolated occurrence of Spinifex grasslands in the region, the Spinifex Slender Blue-tongue is also expected to have a highly restricted range in the region, limited to populations at Jack Hills, Robinson Range and Mount Gould.

Unbanded Delma (*Delma butleri*)

The Unbanded Delma is listed by DEC as significantly dependent on the BIF ranges in the region. It is considered to be restricted to the Spinifex dominated habitats on the upper slopes of BIF ridges in the region, and absent from the surrounding plains (DEC, 2007). It has been recorded at Jack Hills and is likely to occur at Mount Gould.

Locally Significant Fauna

The Banded Whiteface (*Aphelocephala nigricincta*) occurs across central Australia with the Murchison lying at the edge of this species range. Habitat for this species includes sandhills, chenopod shrubland and gibber plains (Simpson and Day, 2004). It appears to be uncommon in the Murchison though has been recorded near Cue. The Banded Whiteface is likely to be a rare visitor to the Study Area.

An additional bird species, the Grey Honeyeater, is also considered to be locally significant. It was formally listed as a priority species by DEC and is uncommon throughout the Murchison, recorded from a few scattered localities. This species inhabits low *Acacia* woodlands and shrublands across arid central Australia, particularly those dominated by Mulga. The Grey Honeyeater has been previously recorded at Weld Range (ecologia, 2009) and is likely to occur within the Study Area.

4.4.3 Locally Extinct Fauna

The Western Pebble-mound Mouse is listed as Priority 4 by the DEC, due to a significant decline in range from the Gascoyne and Murchison (van Dyck and Strahan, 2008). Preferred habitat includes the gentler slopes of rocky ranges where the ground is covered with a stony mantle and vegetated by hard spinifex, often with a sparse overstorey of eucalypts and scattered shrubs (van Dyck and Strahan, 2008).

Numerous old pebble-mounds constructed by the Western Pebble-mound Mouse (*Pseudomys chapmani*) were recorded on the lower slopes and stony plains surrounding



Mount Gould (see Appendix G, Plate 4). The Western Pebble-mound Mouse appears to be relatively common in the adjacent Pilbara region; however, there have been no recent records of this species from the Murchison. No active Pebble mounds were recorded and this species is unlikely to persist at Mount Gould.



Plate 4: Old, inactive Pebble Mound on the lower slopes of Mount Gould.

The Black-flanked Rock-Wallaby (*Petrogale lateralis*) is listed as Vulnerable under the EPBC Act and has significantly declined in Western Australia, with several populations declining to extinction in recent years. Old scats attributable to *Petrogale lateralis* were recorded from a ledge within a cave on the slopes of Mount Gould (see Appendix G) and are likely to be many decades old. This species formerly occurred in the region with records from Mount Farmer and Weld Range; however, there have been no records for many years (DEC, 2011). The Black-footed Rock-Wallaby is now considered to be extinct across the Murchison (DEC, 2011; WWF, 2011) and no fresh evidence of the species was recorded from the Study Area. This species is highly unlikely to persist in the local area.

The Boodie (*Bettongia lesueur*) and Stick-nest Rat (*Leporillus* sp.) are considered extinct on mainland Australia, although there have been some recent re-introductions to managed reserves. Old abandoned shelters constructed by the Stick-nest Rat were recorded from a cave on Mount Gould (see Appendix G). Abandoned burrow systems of the Boodie were recorded from the plains surrounding Mount Gould. Abandoned and



decayed shelters of both species (nests or mounds) are commonly seen across the Murchison; however, neither species has been recorded from the region in over 50 years.



Figure 4.1: Conservation significant fauna recorded in the Study Area

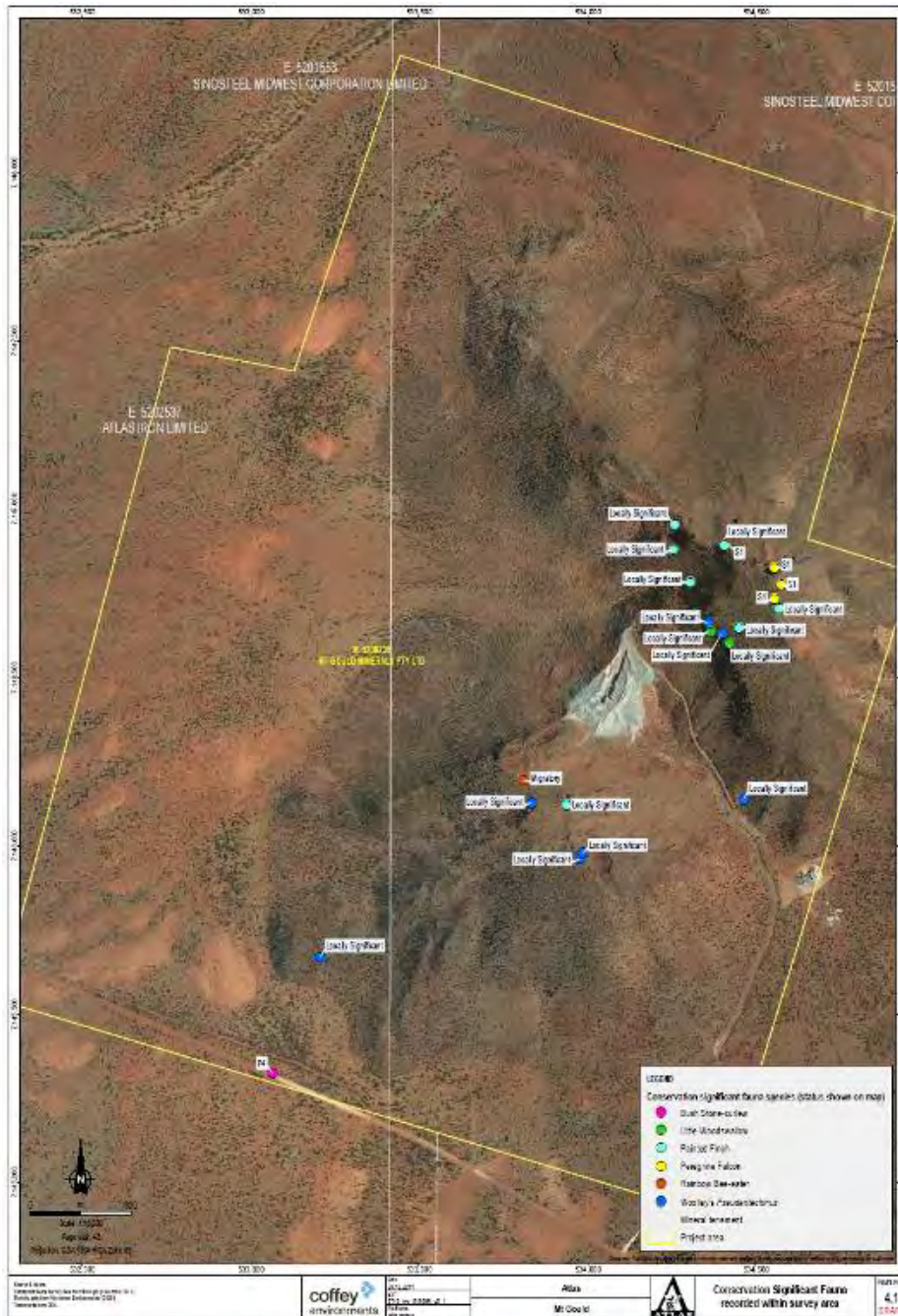




Table 4.3: Conservation significant fauna recorded or potentially occurring in the Study Area

CONSERVATION SIGNIFICANT FAUNA		Conservation Status				Records		Habitat		Status
COMMON NAME	SPECIES NAME	EPBC	WA Act	DEC	Local	Study Area	Local Area	Type	Present In Study Area	Study Area
REPTILES										
Western Spiny-tailed Skink	<i>Egernia stokesii badia</i>	END	S1				Meka	Granite Outcrops	No	Unlikely to occur
Spinifex Slender Blue-tongue	<i>Cyclodomorphus melanops</i>				BIF		Jack Hills	Spinifex Hummock Grasslands	Yes	Likely Resident
Unbanded Delma	<i>Delma butleri</i>				BIF		Jack Hills	Spinifex Hummock Grasslands	Yes	Likely Resident
BIRDS										
Peregrine Falcon	<i>Falco peregrinus</i>		S4		BIF	Recorded	Mount Gould	Rocky ridges, major drainage lines	Yes	Breeding Resident
Grey Falcon	<i>Falco hypoleucos</i>			P4			Lake Annean	Drainage lines, plains	No	Potential rare visitor
Australian Bustard	<i>Ardeotis australis</i>			P4		Recorded	Mount Gould	Plains	Yes	Seasonal Visitor
Bush Stone-curlew	<i>Burhinus grallarius</i>			P4		Recorded	Mount Gould	Mulga shrublands	Yes	Resident
Rainbow Bee-eater	<i>Merops ornatus</i>	MIG	S3			Recorded	Mount Gould	Watercourses, woodland	Yes	Seasonal Visitor
Fork-tailed Swift	<i>Apus pacificus</i>	MIG	S3				Lake Austin	Aerial	Yes	Seasonal Visitor
Oriental Plover	<i>Charadrius veredus</i>	MIG					None	Inland Plains	Yes	Potential Visitor



CONSERVATION SIGNIFICANT FAUNA		Conservation Status				Records		Habitat		Status
COMMON NAME	SPECIES NAME	EPBC	WA Act	DEC	Local	Study Area	Local Area	Type	Present In Study Area	Study Area
Slender-billed Thornbill	<i>Acanthiza iredalei</i>	VUL					Weld Range	Samphire, Chenopods	No	Unlikely to occur
Malleefowl	<i>Leipoa ocellata</i>	VUL	S1				Weld Range	Acacia shrublands, no recent records	Yes	Unlikely to occur
Major Mitchell's Cockatoo	<i>Lophochroa leadbeateri</i>		S4				Jack Hills	Major drainage line, woodland	No	Unlikely to occur
Little Woodswallow	<i>Artamus minor</i>				BIF	Recorded	Mount Gould	Rocky ridges	Yes	Resident
Painted Finch	<i>Emblema pictum</i>				L	Recorded	Mount Gould	Spinifex Ridges	Yes	Resident
Banded Whiteface	<i>Aphelocephala nigricincta</i>				L		Lake Austin	Open stony plains	Yes	Potential visitor
Grey Honeyeater	<i>Conopophila whitei</i>				L		Weld Range	Mulga Shrublands	Yes	Likely Resident
MAMMALS										
Long-tailed Dunnart	<i>Sminthopsis longicaudata</i>			P4	BIF		Jack Hills	Rocky Ridges, BIF	Yes	Possible Resident
Woolley's Pseudantechinus	<i>Pseudantechinus woolleyae</i>				BIF	Recorded	Mount Gould	Rocky Ridges, BIF	Yes	Resident
Little Broad-nosed Bat	<i>Scotorepens greyii</i>				L	Recorded	Mount Gould	Tree hollows in woodlands, shrublands	Yes	Resident

Conservation Status Codes:

1. EPBC Act 1999: Endangered (END), Vulnerable (VUL), Migratory (M).
2. Wildlife Conservation Act 1950 (WCA): Schedule 1 (S1), Schedule 4 (S4).
3. DEC Priority Fauna (DEC): Priority 4 (P4).
4. Local Significance (Local): Taxa considered significant at the local level (L) or species considered by DEC to be mostly restricted to BIF in the region (BIF).



4.5 Important Fauna Habitats

Each of the fauna habitats identified in Section 4.3 was given a significance score of High, Medium or Low based on criteria outlined in Table 3.5. Details of the assessment are provided in Table 4.1.

Two habitats, Spinifex Hummock Grasslands on Ironstone Hill Crests and Upper Slopes and Breakaway systems, were considered to be of High significance because they support or provide core habitat for a number of conservation significant species and are rare or restricted habitats in the region. A third habitat, Open Mulga shrublands over Tussock Grassland on Ironstone Hills and Ridges, is also considered significant due to its restricted occurrence in the region and the potential for conservation significant fauna. Disturbances to habitats types considered to be of “high significance” should be avoided or minimised where possible.

Table 4.1: Fauna habitat significance scores

Fauna habitat	Score	Rationale
Spinifex Hummock Grasslands on Ironstone Hill Crests and Upper Slopes	High	Highly restricted habitat, locally and in the region. Includes the Mount Gould Vegetation Complexes (BIF), a listed Priority Ecology Community (PEC) by the DEC. Restricted to the slopes of Mount Gould. Spinifex hummock grasslands on BIF occur only on the upper slopes of Jack Hills, Mount Gould and Robinson Range in the region. Likely to support reptiles with restricted ranges such as spinifex specialist species including <i>Cyclodomorphus melanops</i> . Also supports a breeding population of Painted Finch. The summit of Mount Gould contains a series of cliff faces containing breeding sites of the conservation significant Peregrine Falcon. At least two nesting sites occur and many roosting sites. Also contains nesting sites for the Australian Kestrel. The rock outcrops also support the BIF restricted Woolley's Pseudantechinus and are also likely to support the Priority 4 listed Long-tailed Dunnart.
Open Mulga shrublands over Tussock Grassland on Ironstone Hills and Ridges	Moderate - High	Occurs on the slopes of Mount Gould generally below <i>Triodia melvillei</i> hummock grasslands. A restricted and isolated habitat in the region. The rock outcrops also support the BIF restricted Woolley's Pseudantechinus and are also likely to support the Priority 4 listed Long-tailed Dunnart.
Stony lower slopes and plains below hill systems	Moderate	Occurs on the lower slopes of Mount Gould and the adjacent stony plains.
Mixed Acacia shrublands on sandplain	Moderate	Occurs in small areas adjacent to the slopes of Mount Gould.
Sparse Mulga shrublands on hardpan	Low	Occurs on the plains surrounding Mount Gould and is widespread through the region.



Sparse Acacia shrublands on stony undulating plains	Low	Occurs on the plains surrounding Mount Gould and is widespread through the region.
Breakaway systems containing deep crevices, caves and rock ledges	High	<p>Occurs in small areas on the slopes of Mount Gould. A highly restricted habitat, also occurs on the nearby BIF ranges (Jack Hills, Robinson Range). Likely to support DEC Priority listed species, such as the Long-tailed Dunnart and supports the locally significant <i>Pseudantechinus woolleyae</i> and Little Woodswallow. Likely to supports some fauna species with restricted ranges and specific habitat requirements (eg. Bats).</p> <p>A deep cave on the slopes of Mount Gould contains a water seep after rainfall, providing a significant resource to the local Painted Finch population. Contains the historic evidence of Stick-nest Rats and Black-flanked Rock-wallabies. Deep caves are extremely uncommon in the region.</p>



5 CONCLUSIONS

Without a disturbance footprint it is difficult to determine impacts on specific fauna or fauna habitats, however, some conclusions can be drawn.

The development of mining activities at Mount Gould may impact on fauna in a number of ways. These include:

- Death/ injury/ displacement/ disturbance of fauna during clearing;
- Increased mortality of fauna from vehicle strikes;
- Loss of habitat through:
 - clearance, removal or degradation of native vegetation;
 - weed invasion displacing native vegetation;
 - hydrological changes altering or removing fauna habitat;
 - disturbance or loss of breeding sites (eg. cliffs, caves, tree hollows);
- Fragmentation of habitat;
- Alteration of the local fire regime;
- Changes in the abundance of feral species;
- Direct and indirect impacts of dust; and
- Disturbance of fauna in nearby areas from light, vibration and noise.

Important Fauna Habitats

Clearing for a development can lead to habitat loss, which may lead to a consequent decline in population size for local fauna species. Loss of habitat can occur directly by vegetation clearing or can also occur through the degradation of vegetation (such as weed invasion). The loss or degradation of vegetation can be minimised through controls during clearing and management during operation.

Seven fauna habitats were recorded from the Study Area with three of particular significance. The Spinifex hummock grasslands on the crests and upper slopes of Mount Gould are highly restricted, support species of conservation significance (including breeding populations of the locally significant Painted Finch) and are likely to support a highly restricted and specialised fauna assemblage. This vegetation type is also a Priority Ecological Community. This vegetation type is highly restricted in the region and may be confined to Jack Hills, Mount Gould and the Robinson Ranges. Disturbances to Spinifex hummock grasslands should be avoided.



Some small areas of breakaways containing caves and rock crevices also occur on the slopes of Mount Gould. These are likely to form core habitat for the DEC Priority 4 listed Long-tailed Dunnart and provide habitat for the locally restricted Woolley's Pseudantechinus and Little Woodswallow. Disturbances to this habitat should be avoided.

The Mulga shrublands over Tussock Grasslands on the slopes of Mount Gould are also of importance due to its restricted occurrence in the region and the potential for conservation significant fauna. Disturbances to this habitat types should be avoided where possible or minimised.

Conservation Significant Fauna

Loss of habitat can reduce population size that for some species may be critical. This may include the loss of breeding or nesting sites.

The hill crests, particularly the summit of Mount Gould, contain some cliff faces that have been extensively used by Peregrine Falcons for roosting and breeding over a number of years. Such habitat is very uncommon in the region and is therefore considered critical habitat for this species. The Peregrine Falcon is listed under Schedule 4 of the WC Act and, as such, disturbances to nesting and roosting habitat should be avoided.

The Spinifex Hummock Grasslands are also likely to support some highly restricted species. Locally significant and breeding populations of Painted Finch occur and two locally significant reptiles are expected; Spinifex Slender Blue-tongue and Unbanded Delma.

The rock crevices, outcrops and caves support the BIF restricted Woolley's Pseudantechinus and Little Woodswallow, and are likely to support the DEC Priority 4 listed Long-tailed Dunnart.

Feral Species

Introduced species may have adverse impacts upon native species. In particular, some mammal species expected in the area are sensitive to predation by Feral Cats and Foxes, of which both can increase in abundance with human activities. Additionally, a small group of Feral Goats reside on Mount Gould. Feral Goats have caused extensive damage to vegetation throughout the Murchison and have caused significant degradation of fauna habitats at Mount Gould (particularly near the summit). The management of feral fauna at Mount Gould should be considered. The small group occurring at Mount Gould may be easily eradicated.

Additionally, weed invasion poses a threat to the fauna and flora values of the Study Area. Invasive weed species can replace native species and degrade fauna habitats. Weeds can be spread by vehicles, earthworks and road construction. Weed outbreaks tend to



occur on recently disturbed ground such as road sides and drainage channels. A weed prevention and control strategy should be implemented to prevent the spread of weeds in the area.

Fire

Increased human activity is often associated with an increased risk of fire or altered fire regimes. Increased incidence of fire may lead to the temporary destruction of vegetation or more lasting degradation of fauna habitats. Fire is a natural feature of the environment, but frequent, extensive fires may adversely impact some fauna. The restricted fauna assemblage within the *Triodia* hummock grasslands may be particularly susceptible to extensive wild fire and fire management practises may need to be considered in this area.

Increased Fauna Mortality

Direct mortality of fauna can occur during clearing of vegetation, and ongoing mortality may arise due to road collisions. Direct mortality of common species during clearing is unavoidable, but can be minimised; however, direct and ongoing mortality may have a significant impact on rare species, and the viability of species that occur at low population densities, within and adjacent to the Study Area.

Impacts of dust, light, vibration and noise

Dust pollution in the form of airborne particulate matter may damage vegetation, leading to reduced growth and altered species composition (Singh *et al.*, 2004). Vegetation structure and type is known to influence the structure of fauna communities (Jellenik *et al.*, 2004), and thus a decline in vegetation quality is likely to impact faunal assemblages.

Impacts of light, vibration and noise upon fauna are difficult to predict, as such, a precautionary approach is advised. Noise and light pollution may disrupt fauna species and may lead to the displacement of some fauna, particularly more mobile species. This may be significant for some bird species, such as the breeding populations of Peregrine Falcon and Painted Finch. Increased levels of noise, light, vibration and dust may inhibit the breeding success of these species and, as a result, may require management.



6 MANAGEMENT RECOMMENDATIONS

The following management strategies are recommended to mitigate impacts of the development on native fauna:

1. Limit loss of habitat by controlling the clearing footprint and, as such, retain as much habitat as possible, in the best condition possible. This will help retain the fauna values already present and facilitate rehabilitation;
2. Avoid disturbances to significant fauna habitats –
 - a. Avoid disturbance to the Spinifex Hummock grasslands on the crests and upper slopes of Mount Gould;
 - b. Avoid disturbance to Peregrine Falcon nesting habitat;
 - c. Avoid disturbance to caves, breakaways and rocky outcrops;
 - d. Minimise disturbance Mulga shrublands on the mid slopes of Mount Gould;
3. Following construction, appropriate revegetation of all disturbed areas should be carried out, using locally collected seed;
4. Develop a weed prevention and control management plan;
5. Develop a fire management plan;
6. Develop a feral fauna management plan and consider the removal of Feral Goats from Mount Gould;
7. Minimise the impacts of dust, light, noise and vibration on local fauna and monitor their impacts on breeding populations of conservation significant birds; and
8. Develop dust, light, noise and vibration pollution management procedures if necessary.



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Appendix A: Conservation Status Codes

Environment Protection and Biodiversity Conservation (EPBC) Act 1999

Category	Definition
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.
Migratory	Taxa listed under the following International Conventions: <ul style="list-style-type: none"> o Japan – Australia Migratory Bird Agreement (JAMBA) o China – Australia Migratory Bird Agreement (CAMBA) o Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)

WA Wildlife Conservation Act 1950

Category	Definition
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 codes

Category	Definition
Priority 1	Taxa with few, poorly known populations on threatened lands.
Priority 2	Taxa with few, poorly known populations on conservation 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 Red List of Threatened Species

Category	Definition
Extinct	No individuals remaining.
Extinct in the Wild	Known only to survive in captivity, or as a naturalised population outside its historic range.
Critically Endangered	Extremely high risk of extinction in the wild.
Endangered	High risk of extinction in the wild.
Vulnerable	High risk of endangerment in the wild.
Near Threatened	Likely to become endangered in the near future.
Least Concern	Lowest risk. Does not qualify for a more risk category. Widespread and abundant taxa are included in this category.
Data Deficient	Not enough data to make an assessment of its risk of extinction.
Not Evaluated	Has not yet been evaluated against the IUCN criteria.



Appendix B: Survey site locations

Site	Number	Survey Type	Zone	Easting	Northing
1	1	Pitfall Trap	50J	534391.4	7146679
1	2	Pitfall Trap	50J	534411.9	7146665
1	3	Pitfall Trap	50J	534439.1	7146635
1	4	Pitfall Trap	50J	534462.3	7146622
1	5	Pitfall Trap	50J	534478.4	7146605
1	6	Pitfall Trap	50J	534524.3	7146561
1	7	Pitfall Trap	50J	534508.1	7146578
1	8	Pitfall Trap	50J	534540	7146532
1	9	Pitfall Trap	50J	534554.5	7146524
1	10	Pitfall Trap	50J	534571.5	7146504
2	1	Pitfall Trap	50J	534361.4	7146666
2	2	Pitfall Trap	50J	534358.7	7146662
2	3	Pitfall Trap	50J	534361.8	7146662
2	4	Pitfall Trap	50J	534357.1	7146636
2	5	Pitfall Trap	50J	534388.4	7146631
2	6	Pitfall Trap	50J	534401.2	7146630
2	7	Pitfall Trap	50J	534413.9	7146610
2	8	Pitfall Trap	50J	534419.6	7146594
2	9	Pitfall Trap	50J	534424.3	7146576
2	10	Pitfall Trap	50J	534430.9	7146556
3	1	Pitfall Trap	50J	533907.5	7146127
3	2	Pitfall Trap	50J	533921.5	7146120
3	3	Pitfall Trap	50J	533936.8	7146122
3	4	Pitfall Trap	50J	533961.8	7146092
3	5	Pitfall Trap	50J	533964.6	7146063
3	6	Pitfall Trap	50J	533984.7	7146020
3	7	Pitfall Trap	50J	533999.5	7146024
3	8	Pitfall Trap	50J	533985.8	7145979
3	9	Pitfall Trap	50J	533982.2	7145925
3	10	Pitfall Trap	50J	533976.2	7145960



Site	Number	Survey Type	Zone	Easting	Northing
4	1	Pitfall Trap	50J	533087.8	7145387
4	2	Pitfall Trap	50J	533107	7145406
4	3	Pitfall Trap	50J	533123.6	7145427
4	4	Pitfall Trap	50J	533146.3	7145439
4	5	Pitfall Trap	50J	533150.8	7145465
4	6	Pitfall Trap	50J	533168.7	7145483
4	7	Pitfall Trap	50J	533181.6	7145499
4	8	Pitfall Trap	50J	533182.9	7145531
4	9	Pitfall Trap	50J	533199.7	7145554
4	10	Pitfall Trap	50J	533202.1	7145567
5	1	Pitfall Trap	50J	533422	7145573
5	2	Pitfall Trap	50J	533400.4	7145582
5	3	Pitfall Trap	50J	533375.4	7145593
5	4	Pitfall Trap	50J	533352.6	7145612
5	5	Pitfall Trap	50J	533328.7	7145618
5	6	Pitfall Trap	50J	533305.3	7145630
5	7	Pitfall Trap	50J	533286	7145650
5	8	Pitfall Trap	50J	533257	7145659
5	9	Pitfall Trap	50J	533232	7145660
5	10	Pitfall Trap	50J	533206	7145669
6	1	Pitfall Trap	50J	534240	7147819
6	2	Pitfall Trap	50J	534238	7147798
6	3	Pitfall Trap	50J	534233	7147763
6	4	Pitfall Trap	50J	534230	7147726
6	5	Pitfall Trap	50J	534234	7147699
6	6	Pitfall Trap	50J	534246	7147682
6	7	Pitfall Trap	50J	534269	7147662
6	8	Pitfall Trap	50J	534291	7147641
6	9	Pitfall Trap	50J	534316	7147628
6	10	Pitfall Trap	50J	534344	7147614
7	1	Pitfall Trap	50J	533907.2	7145131
7	2	Pitfall Trap	50J	533883.9	7145111



Site	Number	Survey Type	Zone	Easting	Northing
7	3	Pitfall Trap	50J	533860.7	7145095
7	4	Pitfall Trap	50J	533842.4	7145089
7	5	Pitfall Trap	50J	533818.2	7145089
Motion Camera Sites		Habitat	Zone	Easting	Northing
1	3	Rock crevice	50J	533985	7145979
2	3	Rock crevice	50J	533833	7146127
3	Valley	Rock Outcrop	50J	534462	7146138
4	5	Rock Outcrop	50J	533206	7145669
5	2	Cave	50J	534401.2	7146630
6	6	Drainage Line	50J	534344	7147614
7	6	Rock Outcrop	50J	534350	7147746
8	6	Hill crest	50J	534417	7147768
9	6	Stony plain	50J	534337	7147992
10	7	Sandplain	50J	533860	7145095
11	opp	Incised drainage line	50J	535041	7147892
12	2	Cave	50J	534428	7146567
13	2	Rock crevice	50J	534357	7146636
14	2	Cave	50J	534357	7146656
15	3	Rock outcrop	50J	533772	7146189
16	3	Rock outcrop	50J	533985	7145979
17	4	Sandplain	50J	533194	7145568
18	5	Rocky slope	50J	533206	7145669
19	6	Dry creek gully	50J	534366	7147623
20	6	Dry creek gully	50J	535048	7147916
21	6	Dry creek gully	50J	534159.7113	7147730
22	6	Stony flats N Mt Gould -Extended camera trap	50J	535352.1189	7147807
23	Opp	Mount Gould Creek	50J	533430	7148379
24	Opp	Homestead	50J	539283	7146030
25	Opp	Dam	50J	535700	7146027



Appendix C: Fauna Survey Sites (Photos).

Trapping Sites:

Site 1: Mid Slope, Acacia over Spinifex



Site 2: Breakaway / Cave





Site 3: Ironstone Ridge Top, Spinifex hummock grassland



Site 4: Plain – mixed Acacia shrubland





Site 5: Lower Slope / Foothills



Site 6: Drainage Line / Stony Plain





Site 7: Mixed Acacia Sandplain



Site 2: Cave





Appendix D: Fauna Species Recorded and Expected in the Study Area

Information from nearby fauna assessments was used to generate species lists as well as DEC and Birds Australia Databases and Field Guides:

- Fauna Surveys– Jack Hills (Ecologia, 2009, Western Wildlife 2006, MBS, 2005a and MBS 2005b)
- Fauna Surveys– Weld Range (Ecologia, 2009, BCE, 2009)
- Fauna Survey – OPR Rail (Ecologia, 2010).

KEY

Database search codes:

- I) EPBC Protected Matters Search Tool;
- II) DEC NatureMap (Mount Gould with 40km buffer);
- III) Biologic & Other Data.

Conservation Status Codes:

1. EPBC Act 1999: Endangered (EN), Vulnerable (VU), Migratory (M).
2. Wildlife Conservation Act 1950 (WCA): Schedule 1 (S1), Schedule 4 (S4).
3. DEC Priority Fauna (DEC): Priority 1 (P1), Priority 4 (P4).
4. Local Significance (L): Taxa considered significant at the local level.



Appendix D: Fauna recorded in the Study Area and region.

Table D1: Mammals

Family and Species	Common name	Conservation Status				Database Searches [†]			Surveys from the vicinity of the Study Area						This Survey
		EPBC	WCA	DEC	Other	I	II	III	Jack Hills ecologia 2009	Jack Hills MBS 2005	Jack Hills Western Wildlife 2006	Weld Range ecologia 2009	Weld Range BCE 2008	OPR Rail* ecologia 2010	Biologic 2011
TACHYGLOSSIDAE															
<i>Tachyglossus aculeatus</i>	Echidna								X	X		X	X		X
DASYURIDAE															
<i>Antechinomys laniger</i>	Kultarr											X			
<i>Pseudantechinus woolleyae</i>	Woolley's Pseudantechinus				L		X		X		X	X	X		X
<i>Sminthopsis longicaudata</i>	Long-tailed Dunnart			P4			X		X	X		X			
<i>Sminthopsis macroura</i>	Stripe-faced Dunnart						X		X		X	X			X
<i>Sminthopsis dolichura</i>	Little long-tailed Dunnart										X				
MACROPODIDAE															
<i>Macropus robustus erubescens</i>	Euro, Biggada						X		X	X	X	X	X		X
<i>Macropus rufus</i>	Red Kangaroo, Marlu						X		X	X	X	X			X
EMBALLONURIDAE															
<i>Taphozous hilli</i>	Hill's Sheathtail-bat								X		X	X	X	X	X
MOLOSSIDAE															
<i>Mormopterus sp 3</i>	Inland Freetail-bat														X
<i>Tadarida australis</i>	White-striped Freetail-bat									X	X	X	X		X
VESPERTILIONIDAE															
<i>Chalinolobus gouldii</i>	Gould's Wattled Bat								X		X	X		X	X
<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat								X		X	X		X	X
<i>Scotorepens balstoni</i>	Inland Broad-nosed Bat						X		X		X	X			X
<i>Scotorepens greyii</i>	Little Broad-nosed Bat				L				X	X					X
<i>Vespadelus finlaysoni</i>	Finlayson's Cave Bat								X	X	X	X	X	X	X
MURIDAE															
<i>Notomys alexis</i>	Spinifex Hopping-mouse						X		X	X	X	X			X
<i>Pseudomys hermannsburgensis</i>	Sandy Inland Mouse						X		X	X		X			X
TOTAL							8		13	9	11	16	7	4	15
INTRODUCED MAMMALS															
<i>Bos taurus</i>	European Cattle						X					X			X
<i>Canis lupus dingo</i>	Dingo								X					X	X
<i>Camelus dromedarius</i>	Dromedary, Camel														X
<i>Capra hircus</i>	Goat						X		X	X	X	X	X		X
<i>Equus asinus</i>	Donkey														
<i>Equus caballus</i>	Horse														
<i>Felis catus</i>	Cat						X		X	X		X		X	X
<i>Mus musculus</i>	House Mouse						X		X	X		X			X
<i>Oryctolagus cuniculus</i>	Rabbit									X	X	X			X
<i>Vulpes vulpes</i>	Red Fox									X		X			
TOTAL							4		4	5	2	6	1	2	7



Table D2: Birds

Family and Species	Common name	Conservation Status			Database Searches [†]				Surveys from the vicinity of the Study Area					This Survey	
		EPBC	WCA	DEC	I	II	III	IV	Jack Hills ecologia 2009	Jack Hills MBS 2005a	Jack Hills MBS 2005b	Jack Hills Western Wildlife 2006	Weld Range ecologia 2009	Weld Range BCE 2008	Biologic 2011
CASUARIIDAE															
<i>Dromaius novaehollandiae</i>	Emu					X		X	X	X	X	X	X	X	X
PHASIANIDAE															
<i>Coturnix pectoralis</i>	Stubble Quail														X
<i>Coturnix ypsilophora</i>	Brown Quail														
ANATIDAE															
<i>Dendrocygna eytoni</i>	Plumed Whistling-duck														X
<i>Cygnus atratus</i>	Black Swan					X									X
<i>Tadorna tadornoides</i>	Australian Shelduck					X		X							
<i>Chenonetta jubata</i>	Australian Wood Duck					X		X							X
<i>Anas gracilis</i>	Grey Teal					X									X
<i>Anas superciliosa</i>	Pacific Black Duck					X									X
<i>Aythya australis</i>	Hardhead					X									
<i>Malacorhynchus membranaceus</i>	Pink-eared Duck					X									
<i>Biziura lobata</i>	Musk Duck					X		X							
PODICIPEDIDAE															
<i>Tachybaptus novaehollandiae</i>	Australasian Grebe					X									
<i>Podiceps poliocephalus</i>	Hoary-headed Grebe					X									
<i>Podiceps cristatus</i>	Great Crested Grebe														
COLUMBIDAE															
<i>Phaps chalcoptera</i>	Common Bronzewing					X		X	X		X	X	X	X	X
<i>Ocyphaps lophotes</i>	Crested Pigeon					X		X	X	X	X	X	X	X	X
<i>Geophaps plumifera</i>	Spinifex Pigeon					X									
<i>Geopelia cuneata</i>	Diamond Dove					X		X	X	X	X	X	X	X	X
<i>Geopelia striata</i>	Peaceful Dove					X		X							X
PODARGIDAE															
<i>Podargus strigoides</i>	Tawny Frogmouth					X			X	X		X			
EUROSTOPODIDAE															
<i>Eurostopodus argus</i>	Spotted Nightjar					X			X		X	X	X	X	X
AEGOTHELIDAE															
<i>Aegotheles cristatus</i>	Australian Owlet-nightjar					X		X	X	X	X	X	X	X	X
APODIDAE															
<i>Apus pacificus</i>	Fork-tailed Swift	M													
ANHINGIDAE															
<i>Anhinga novaehollandiae</i>	Australasian Darter					X		X							X
PHALACROCORACIDAE															
<i>Microcarbo melanoleucos</i>	Little Pied Cormorant					X		X							
<i>Phalacrocorax carbo</i>	Great Cormorant					X									
<i>Phalacrocorax varius</i>	Pied Cormorant					X									



Family and Species	Common name	Conservation Status			Database Searches [†]				Surveys from the vicinity of the Study Area						This Survey	
		EPBC	WCA	DEC	I	II	III	IV	Jack Hills ecologia 2009	Jack Hills MBS 2005a	Jack Hills MBS 2005b	Jack Hills Western Wildlife 2006	Weld Range ecologia 2009	Weld Range BCE 2008	Biologic 2011	
<i>Phalacrocorax sulcirostris</i>	Little Black Cormorant					X		X								X
PELECANIDAE																
<i>Pelecanus conspicillatus</i>	Australian Pelican					X										X
ARDEIDAE																
<i>Ardea pacifica</i>	White-necked Heron					X		X								
<i>Ardea modesta</i>	Eastern Great Egret	M				X		X								
<i>Egretta novaehollandiae</i>	White-faced Heron					X		X								X
<i>Ardea ibis</i>	Cattle Egret	M														
<i>Egretta garzetta</i>	Little Egret															
<i>Nycticorax caledonicus</i>	Rufous Night Heron					X										
THRESKIORNITHIDAE																
<i>Threskiornis spinicollis</i>	Straw-necked Ibis					X		X								X
<i>Threskiornis molucca</i>	Australian White Ibis					X		X								
<i>Plegadis falcinellus</i>	Glossy Ibis	M														
<i>Platalea regia</i>	Royal Spoonbill															
<i>Platalea flavipes</i>	Yellow-billed Spoonbill					X							X			
ACCIPITRIDAE																
<i>Elanus axillaris</i>	Black-shouldered Kite					X		X	X							
<i>Lophoictinia isura</i>	Square-tailed Kite					X										
<i>Hamirostra melanosternon</i>	Black-breasted Buzzard							X	X		X		X	X		
<i>Haliastur sphenurus</i>	Whistling Kite					X		X	X			X	X	X		X
<i>Milvus migrans</i>	Black Kite					X										
<i>Accipiter fasciatus</i>	Brown Goshawk								X	X	X	X	X			X
<i>Accipiter cirrocephalus</i>	Collared Sparrowhawk					X		X	X				X			X
<i>Circus assimilis</i>	Spotted Harrier					X		X		X						X
<i>Aquila audax</i>	Wedge-tailed Eagle					X		X	X		X	X	X	X		X
<i>Hieraaetus morphnoides</i>	Little Eagle					X										
FALCONIDAE																
<i>Falco cenchroides</i>	Nankeen Kestrel					X		X	X	X	X	X	X	X		X
<i>Falco berigora</i>	Brown Falcon					X		X	X	X		X	X	X		X
<i>Falco longipennis</i>	Australian Hobby					X		X				X	X			X
<i>Falco hypoleucos</i>	Grey Falcon			P4		X										
<i>Falco peregrinus</i>	Peregrine Falcon		S4			X		X				X	X			X
RALLIDAE																
<i>Gallirallus philippensis</i>	Buff-banded Rail															
<i>Porzana pusilla</i>	Bailon's Crane															
<i>Porzana tabuensis</i>	Spotless Crane															
<i>Tribonyx ventralis</i>	Black-tailed Native-hen					X		X								
<i>Fulica atra</i>	Eurasian Coot					X		X								
OTIDIDAE																
<i>Ardeotis australis</i>	Australian Bustard			P4		X		X								X



Family and Species	Common name	Conservation Status			Database Searches [†]				Surveys from the vicinity of the Study Area						This Survey
		EPBC	WCA	DEC	I	II	III	IV	Jack Hills ecologia 2009	Jack Hills MBS 2005a	Jack Hills MBS 2005b	Jack Hills Western Wildlife 2006	Weld Range ecologia 2009	Weld Range BCE 2008	Biologic 2011
BURHINIDAE															
<i>Burhinus grallarius</i>	Bush Stone-curlew			P4		X					X	X	X		X
RECURVIROSTRIDAE															
<i>Himantopus himantopus</i>	Black-winged Stilt					X									
<i>Recurvirostra novaehollandiae</i>	Red-necked Avocet														
<i>Cladorhynchus leucocephalus</i>	Banded Stilt														
CHARADRIIDAE															
<i>Charadrius ruficapillus</i>	Red-capped Plover					X									
<i>Euseyornis melanops</i>	Black-fronted Dotterel					X		X							X
<i>Erythrogonys cinctus</i>	Red-kneed Dotterel					X									
<i>Charadrius australis</i>	Inland Dotterel														
<i>Vanellus tricolor</i>	Banded Lapwing					X		X							X
<i>Charadrius veredus</i>	Oriental Plover	M													
SCOLOPACIDAE															
<i>Actitis hypoleucos</i>	Common Sandpiper	M													
<i>Tringa stagnatilis</i>	Marsh Sandpiper	M													
<i>Tringa glareola</i>	Wood Sandpiper	M													
<i>Tringa nebularia</i>	Common Greenshank	M													
<i>Calidris ruficollis</i>	Red-necked Stint	M													
<i>Calidris subminuta</i>	Long-toed Stint	M													
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	M													
<i>Calidris ferruginea</i>	Curlew Sandpiper	M													
TURNICIDAE															
<i>Turnix velox</i>	Little Button-quail					X		X	X				X		X
LARIDAE															
<i>Chlidonias hybridus</i>	Whiskered Tern					X									
CACATUIDAE															
<i>Eolophus roseicapillus</i>	Galah					X		X	X	X	X	X	X	X	X
<i>Cacatua sanguinea</i>	Little Corella					X		X	X						X
<i>Nymphicus hollandicus</i>	Cockatiel					X		X		X		X			X
<i>Lophochroa leadbeateri</i>	Major Mitchell's Cockatoo		S4			X									
PSITTACIDAE															
<i>Barnardius zonarius</i>	Australian Ringneck					X		X	X			X	X		X
<i>Psephotus varius</i>	Mulga Parrot					X		X	X	X	X	X	X	X	X
<i>Melopsittacus undulatus</i>	Budgerigar					X		X	X	X	X	X	X		X
<i>Neopsephotus bourkii</i>	Bourke's Parrot					X			X	X	X	X	X		X
<i>Neophema elegans</i>	Elegant Parrot											X			
<i>Pezoporus occidentalis</i>	Night Parrot	EN, M	S1												
CUCULIDAE															
<i>Chalcites basalus</i>	Horsfield's Bronze-Cuckoo					X		X	X	X	X	X	X	X	X
<i>Chalcites osculans</i>	Black-eared Cuckoo					X		X				X	X		



Family and Species	Common name	Conservation Status			Database Searches [†]				Surveys from the vicinity of the Study Area						This Survey
		EPBC	WCA	DEC	I	II	III	IV	Jack Hills ecologia 2009	Jack Hills MBS 2005a	Jack Hills MBS 2005b	Jack Hills Western Wildlife 2006	Weld Range ecologia 2009	Weld Range BCE 2008	Biologic 2011
<i>Cacomantis pallidus</i>	Pallid Cuckoo					X		X			X		X	X	X
STRIGIDAE															
<i>Ninox novaeseelandiae</i>	Southern Boobook					X							X		X
TYTONIDAE															
<i>Tyto javanica</i>	Eastern Barn Owl								X						
HALCYONIDAE															
<i>Todiramphus pyrrhopygius</i>	Red-backed Kingfisher					X			X	X	X	X			X
<i>Todiramphus sanctus</i>	Sacred Kingfisher					X									X
MEROPIDAE															
<i>Merops ornatus</i>	Rainbow Bee-eater	M				X			X	X					X
CLIMACTERIDAE															
<i>Climacteris affinis</i>	White-browed Tree-creeper														
PTILINORHYNCHIDAE															
<i>Ptilonorhynchus guttatus</i>	Western Bowerbird					X		X	X		X	X	X	X	X
MALURIDAE															
<i>Malurus splendens</i>	Splendid Fairy-wren					X		X	X		X	X	X	X	X
<i>Malurus leucopterus</i>	White-winged Fairy-wren					X		X				X			X
<i>Malurus lamberti</i>	Variegated Fairy-wren					X		X	X			X	X		X
ACANTHIZIDAE															
<i>Pyrrholaemus brunneus</i>	Redthroat					X		X	X		X	X	X	X	X
<i>Smicromis brevirostris</i>	Weebill					X		X		X		X			X
<i>Gerygone fusca</i>	Western Gerygone					X		X	X	X	X	X			X
<i>Acanthiza robustirostris</i>	Slaty-backed Thornbill					X		X	X	X		X			X
<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill					X		X	X	X	X	X	X	X	X
<i>Acanthiza uropygialis</i>	Chestnut-rumped Thornbill					X		X	X		X	X	X	X	X
<i>Acanthiza apicalis</i>	Inland Thornbill					X			X			X	X	X	
<i>Aphelocephala leucopsis</i>	Southern Whiteface					X		X	X	X		X	X	X	X
<i>Aphelocephala nigrcincta</i>	Banded Whiteface					X									
PARDALOTIDAE															
<i>Pardalotus rubricatus</i>	Red-browed Pardalote					X									X
<i>Pardalotus striatus</i>	Striated Pardalote					X					X	X			X
MELIPHAGIDAE															
<i>Certhionyx variegatus</i>	Pied Honeyeater					X		X						X	
<i>Lichenostomus virescens</i>	Singing Honeyeater					X		X	X	X	X	X			X
<i>Lichenostomus keartlandi</i>	Grey-headed Honeyeater														
<i>Lichenostomus penicillatus</i>	White-plumed Honeyeater					X		X	X		X	X	X	X	X
<i>Purnella albifrons</i>	White-fronted Honeyeater					X			X					X	
<i>Manorina flavigula</i>	Yellow-throated Miner					X		X	X	X	X	X	X	X	X
<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater					X		X	X	X	X	X	X	X	X
<i>Conopophila whitei</i>	Grey Honeyeater											X			
<i>Epthianura tricolor</i>	Crimson Chat					X		X	X		X	X			X



Family and Species	Common name	Conservation Status			Database Searches [†]				Surveys from the vicinity of the Study Area						This Survey
		EPBC	WCA	DEC	I	II	III	IV	Jack Hills ecologia 2009	Jack Hills MBS 2005a	Jack Hills MBS 2005b	Jack Hills Western Wildlife 2006	Weld Range ecologia 2009	Weld Range BCE 2008	Biologic 2011
<i>Epthianura aurifrons</i>	Orange Chat												X		
<i>Epthianura albifrons</i>	White-fronted Chat							X							
<i>Sugomel niger</i>	Black Honeyeater													X	
<i>Lichmera indistincta</i>	Brown Honeyeater					X		X	X	X				X	
POMATOSTOMIDAE															
<i>Pomatostomus temporalis</i>	Grey-crowned Babbler					X		X	X	X	X	X	X	X	X
<i>Pomatostomus superciliosus</i>	White-browed Babbler					X		X	X			X	X	X	X
PSOPHODIDAE															
<i>Cinclosoma castaneothorax</i>	Chestnut-breasted Quail-thrush					X			X	X	X	X	X	X	X
<i>Psophodes occidentalis</i>	Chiming Wedgebill								X		X			X	
NEOSITTIDAE															
<i>Daphoenositta chrysoptera</i>	Varied Sittella					X		X	X	X	X				
CAMPEPHAGIDAE															
<i>Coracina maxima</i>	Ground Cuckoo-shrike					X		X	X				X		
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike					X		X	X	X	X	X	X	X	X
<i>Lalage sueurii</i>	White-winged Triller					X		X	X	X		X	X	X	X
PACHYCEPHALIDAE															
<i>Pachycephala rufiventris</i>	Rufous Whistler					X		X	X	X	X	X	X	X	X
<i>Colluricincla harmonica</i>	Grey Shrike-thrush					X		X	X	X	X	X	X	X	X
<i>Oreoica gutturalis</i>	Crested Bellbird					X		X	X	X	X	X	X	X	X
ARTAMIDAE															
<i>Artamus personatus</i>	Masked Woodswallow					X		X					X		X
<i>Artamus cinereus</i>	Black-faced Woodswallow					X		X	X	X	X	X	X	X	X
<i>Artamus minor</i>	Little Woodswallow					X			X	X	X	X	X	X	X
<i>Cracticus torquatus</i>	Grey Butcherbird					X		X	X	X	X	X	X	X	X
<i>Cracticus nigrogularis</i>	Pied Butcherbird					X		X	X	X	X	X	X	X	X
<i>Cracticus tibicen</i>	Australian Magpie					X		X	X		X		X	X	X
RHIPIDURIDAE															
<i>Rhipidura albiscapa</i>	Grey Fantail												X		
<i>Rhipidura leucophrys</i>	Willie Wagtail					X		X	X	X	X	X	X	X	X
CORVIDAE															
<i>Corvus bennetti</i>	Little Crow					X		X	X	X		X	X	X	X
<i>Corvus orru</i>	Torresian Crow					X		X	X		X	X			X
MONARCHIDAE															
<i>Grallina cyanoleuca</i>	Magpie-lark					X		X	X				X	X	X
PETROICIDAE															
<i>Petroica goodenovii</i>	Red-capped Robin					X		X	X	X	X	X	X	X	X
<i>Melanodryas cucullata</i>	Hooded Robin					X		X	X				X		
<i>Microeca fascinans</i>	Jacky Winter											X			
ACROCEPHALIDAE															



Family and Species	Common name	Conservation Status			Database Searches [†]				Surveys from the vicinity of the Study Area						This Survey
		EPBC	WCA	DEC	I	II	III	IV	Jack Hills ecologia 2009	Jack Hills MBS 2005a	Jack Hills MBS 2005b	Jack Hills Western Wildlife 2006	Weld Range ecologia 2009	Weld Range BCE 2008	Biologic 2011
<i>Acrocephalus australis</i>	Australian Reed-Warbler														
MEGALURIDAE															
<i>Megalurus gramineus</i>	Little Grassbird														
<i>Cincloramphus mathewsi</i>	Rufous Songlark					X		X	X	X			X	X	X
<i>Cincloramphus cruralis</i>	Brown Songlark					X		X				x			X
HIRUNDINIDAE															
<i>Cheramoeca leucosterna</i>	White-backed Swallow					X					X		X		
<i>Hirundo neoxena</i>	Welcome Swallow					X		X				X	X		X
<i>Petrochelidon ariel</i>	Fairy Martin							X					X		
<i>Petrochelidon nigricans</i>	Tree Martin					X		X			X	X			X
NECTARINIIDAE															
<i>Dicaeum hirundinaceum</i>	Mistletoebird							X		X			X	X	X
ESTRILDIDAE															
<i>Taeniopygia guttata</i>	Zebra Finch					X		X	X	X	X	X	X	X	X
<i>Emblema pictum</i>	Painted Finch								X						X
MOTACILLIDAE															
<i>Anthus novaeseelandiae</i>	Australasian Pipit					X		X	X	X	X	X	X	X	X
TOTAL		14	3	3		123		91	67	45	46	56	79	52	90

[†]Database search codes: I) EPBC Protected Matters Search Tool; II) DEC NatureMap; Iii) Biologic & Other Data; iv) Birds Australia Birddata Database.

Conservation Status Codes:

1. EPBC Act 1999: Endangered (EN), Vulnerable (VU), Migratory (M).
2. Wildlife Conservation Act 1950 (WCA): Schedule 1 (S1), Schedule 4 (S4).
3. DEC Priority Fauna (DEC): Priority 1 (P1), Priority 4 (P4).
4. Local Significance (Local): Taxa considered significant at the local level.



Table D3: Reptiles

Family and Species	Common name	Conservation Status			Database Searches [†]			Surveys from the vicinity of the Study Area							This Survey
		EPBC	WCA	DEC	I	II	III	Jack Hills ecologia 2009	Jack Hills MBS 2005a	Jack Hills MBS 2005b	Jack Hills Western Wildlife 2006	Weld Range ecologia 2009	Weld Range BCE 2008	OPR Rail* ecologia 2010	Biologic 2011
CHELUIDAE															
<i>Chelodina steindachneri</i>	Flat-shelled Turtle												X		
AGAMIDAE															
<i>Amphibolurus longirostris</i>	Long-nosed Dragon					X		X	X	X	X				X
<i>Caimanops amphiboluroides</i>	Mulga Dragon												X		
<i>Ctenophorus caudicinctus</i>	Ring-tailed Dragon					X		X	X	X	X	X	X		X
<i>Ctenophorus nuchalis</i>	Central Netted Dragon					X		X	X	X	X				X
<i>Ctenophorus reticulatus</i>	Western Netted Dragon					X			X	X	X	X			X
<i>Ctenophorus scutulatus</i>	Lozenge-marked Dragon					X				X	X	X			X
<i>Moloch horridus</i>	Thorny Devil											X			
<i>Pogona minor</i>	Bearded Dragon					X		X	X	X	X		X		X
<i>Tympanocryptis cephalus</i>	Pebble Dragon					X				X	X				
DIPODACTYLIDAE															
<i>Diplodactylus conspicillatus</i>	Fat-tailed Gecko					X					X				
<i>Diplodactylus granariensis</i>	Wheatbelt Stone Gecko														
<i>Diplodactylus pulcher</i>	Fine-faced Gecko									X	X	X			
<i>Lucasium squarrosum</i>	Mottled Ground Gecko											X			
<i>Lucasium stenodactylum</i>	Pale-snouted Ground Gecko					X		X	X	X	X				X
<i>Oedura marmorata</i>	Marbled Velvet Gecko							X		X	X				
<i>Rhynchoedura ornata</i>	Beaked Gecko					X				X	X	X			X
<i>Strophurus elderi</i>	Jewelled Gecko														
<i>Strophurus strophurus</i>	Western Spiny-tailed Gecko					X				X	X				
<i>Strophurus wilsoni</i>	Mount Augustus Spiny-tailed Gecko														
<i>Strophurus wellingtonae</i>	Western-shield Spiny-tailed Gecko											X		X	
CARPHODACTYLIDAE															
<i>Nephrurus vertebralis</i>	Midline Knob-tail					X						X			X
<i>Nephrurus wheeleri</i>	Banded Knob-tail														
GEKKONIDAE															
<i>Gehyra punctata</i>	Spotted Dtella					X		X		X	X	X			X
<i>Gehyra purpurascens</i>	Purplish Dtella					X									
<i>Gehyra variegata</i>	Tree Dtella					X		X	X	X	X	X	X		X
<i>Heteronotia binoei</i>	Bynoe's Gecko							X	X	X	X	X	X		X
PYGOPODIDAE															
<i>Delma australis</i>	Marble-faced Delma											X			
<i>Delma butleri</i>	Unbanded Delma					X				X	X				
<i>Delma tincta</i>	Excitable Delma					X									X
<i>Lialis burtonis</i>	Burton's Legless Lizard														
<i>Pygopus nigriceps</i>	Hooded Scaly-foot							X				X			
SCINCIDAE															
<i>Cryptoblepharus buchananii</i>	A skink								X			X	X		
<i>Ctenotus leonhardii</i>	A skink					X				X	X	X			X
<i>Ctenotus schomburgkii</i>	A skink					X				X	X	X	X		X
<i>Ctenotus severus</i>	A skink					X		X		X	X	X	X		X
<i>Ctenotus uber</i>	A skink											X			
<i>Cyclodomorphus melanops</i>	Slender Blue-tongue					X		X		X	X				



Family and Species	Common name	Conservation Status			Database Searches [†]			Surveys from the vicinity of the Study Area						This Survey	
		EPBC	WCA	DEC	I	II	III	Jack Hills ecologia 2009	Jack Hills MBS 2005a	Jack Hills MBS 2005b	Jack Hills Western Wildlife 2006	Weld Range ecologia 2009	Weld Range BCE 2008	OPR Rail* ecologia 2010	Biologic 2011
<i>Egernia depressa</i>	Pygmy Spiny-tailed Skink					X		X				X		X	X
<i>Eremiascincus richardsonii</i>	Broad-banded Sand Swimmer					X					X	X			X
<i>Lerista eupdoa</i>	A skink			P1								X		X	
<i>Lerista macropisthopus</i>	A skink							X						X	
<i>Lerista nichollsi</i>	A skink					X					X			X	
<i>Lerista timida</i>	A skink							X		X	X	X	X	X	X
<i>Menetia greyii</i>	Dwarf Skink					X		X		X	X	X			X
<i>Menetia surda</i>	A skink														
<i>Tiliqua occipitalis</i>	Western Blue-tongue														
VARANIDAE															
<i>Varanus caudolineatus</i>	Pilbara Mulga Monitor									X		X			X
<i>Varanus giganteus</i>	Perentie							X			X	X			
<i>Varanus gouldii</i>	Bungarra or Sand Monitor							X			X				
<i>Varanus panoptes</i>	Yellow-spotted Monitor					X		X	X	X		X		X	X
<i>Varanus tristis tristis</i>	Racehorse Monitor							X		X	X	X			X
TYPHLOPIDAE															
<i>Ramphotyphlops grypus</i>	Long-beaked Blind Snake														X
<i>Ramphotyphlops hamatus</i>	Pale-headed Blind Snake							X			X	X			
BOIDAE															
<i>Antaresia perthensis</i>	Pygmy Python							X		X	X	X			X
<i>Antaresia stimsoni</i>	Stimson's Python														
<i>Aspidites melanocephalus</i>	Black-headed Python														
ELAPIDAE															
<i>Acanthopis pyrrhus</i>	Desert Death Adder														
<i>Brachyuropsis approximans</i>	North-west Shovel-nosed Snake										X	X			
<i>Demansia psammophis</i>	Yellow-faced Whipsnake							X							X
<i>Furina ornata</i>	Moon Snake											X			
<i>Parasuta monachus</i>	Monk Snake											X			
<i>Pseudechis australis</i>	Mulga Snake														
<i>Pseudechis butleri</i>	Spotted Mulga Snake											X			
<i>Pseudonaja modesta</i>	Ringed Brown Snake											X			
<i>Pseudonaja mengdeni</i>	Western Brown Snake														
<i>Simoselaps bertholdi</i>	Jan's Banded Snake											X			X
<i>Suta fasciata</i>	Rosen's Snake											X			
TOTAL						26		23	8	24	30	44	9	10	27

[†]Database search codes: I) EPBC Protected Matters Search Tool; II) DEC NatureMap; III) Local Biologic Records & Other Data.

Conservation Status Codes:

5. EPBC Act 1999: Endangered (EN), Vulnerable (VU), Migratory (M).
6. Wildlife Conservation Act 1950 (WCA): Schedule 1 (S1), Schedule 4 (S4).
7. DEC Priority Fauna (DEC): Priority 1 (P1), Priority 3 (P3), Priority 4 (P4).
8. Local Significance (Local): Taxa considered significant at the local level.



Table D4: Amphibians

Family and Species	Common name	Database	Surveys from the vicinity of the Study Area						This Survey
		DEC NatureMap	Jack Hills ecologia 2009	Jack Hills MBS 2005	Jack Hills Western Wildlife 2006	Weld Range ecologia 2009	Weld Range BCE 2008	OPR Rail* ecologia 2010	Biologic 2011
HYLIDAE									
<i>Cyclorana maini</i>	Main's Frog			X					
<i>Cyclorana platycephala</i>	Water-Holding Frog			X					
<i>Litoria rubella</i>	Desert Tree Frog			X		X	X		X (Recorded adjacent)
MYOBATRACHIDAE									
<i>Neobatrachus sutor</i>	Shoemaker Frog								
<i>Neobatrachus wilsmorei</i>	Goldfields Bull Frog								
<i>Opisthodon spenceri</i>	Centralian Burrowing Frog			X					
TOTAL	6	0	0	4	0	1	1	0	1



Appendix E: Site by species records from the survey.

Table E1: Mammals

Family and Species	Common Name	Site 1		Site 2		Site 3		Site 4		Site 5		Site 6		Site 7		Anabat Records		Opportunistic Records		Motion Camera		TOTAL
		P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	
TACHYGLOSSIDAE																						
<i>Tachyglossus aculeatus</i>	Echidna	S		S		S				1								S	S			1
DASYURIDAE																						
<i>Pseudantechinus woolleyae</i>	Woolley's False Antechinus			2	S	2	3			1								S	S	1		9
<i>Sminthopsis macroura</i>	Striped Faced Dunnart							1				1										2
MACROPODIDAE																						
<i>Macropus robustus</i>	Euro		1		1		2											2	2	4		12
<i>Macropus rufus</i>	Red Kangaroo																	3	2			5
EMBALLONURIDAE																						
<i>Taphozous hilli</i>	Hill's Sheath-tail-bat			B	B		B					B		B	B	B						
MOLOSSIDAE																						
<i>Mormopterus sp 3</i>	Inland Freetail-bat			B										B	B	B						
<i>Tadarida australis</i>	White-striped Freetail-bat			B											B							
VESPERTILIONIDAE																						
<i>Chalinolobus gouldii</i>	Gould's Wattleed Bat			B	B		B		B			B			B	B						
<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat															B						
<i>Scotorepens balstoni</i>	Western Broad-nosed Bat			B					B			B		B	B	B						
<i>Scotorepens greyii</i>	Little Broad-nosed Bat						B								B	B						
<i>Vespadelus finlaysoni</i>	Finlayson's Cave Bat			B	2		B								B	B						
MURIDAE																						
<i>Notomys alexis</i>	Spinifex Hopping mouse													1							1	2
<i>Pseudomys hermannsbergensis</i>	Sandy Inland Mouse						1	3				4										8
INTRODUCED MAMMALS																						
<i>*Mus musculus</i>	House Mouse		1		1				4		1											7



Family and Species	Common Name	Site 1		Site 2		Site 3		Site 4		Site 5		Site 6		Site 7		Anabat Records		Opportunistic Records		Motion Camera		TOTAL
		P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	
<i>*Canis lupus dingo</i>	Dingo																	1	S			1
<i>*Capra hircus</i>	Goat						3											5	2			10
<i>*Felis catus</i>	Feral Cat					1												S	1			2
<i>*Oryctolagus cuniculus</i>	Rabbit																		1			1
<i>*Bos taurus</i>	Cattle							S	S						S				5			5
EXTINCT MAMMALS																						
<i>Petrogale lateralis</i>	Black-footed Rock-wallaby						S															
<i>Lepporillus sp.</i>	Stick-nest Rat					S	S											S	S			
<i>Pseudomys chapmani</i>	Western Pebble-mound Mouse												S					S	S			

Note: species recorded using ANABAT and SM2 bat detectors are denoted by a B as individual numbers cannot be determined. Historic evidence of three extinct mammals was also recorded in the form of old scats in caves or old, disused and abandoned shelters.



Table E2: Birds

Family and Species	Common Name	Site 1		Site 2		Site 3		Site 4		Site 5		Site 6		Site 7		Opportunistic Records		Motion Camera		TOTAL
		P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	
CASUARIIDAE																				
<i>Dromaius novaehollandiae</i>	Emu																1			1
PHASIANIDAE																				
<i>Coturnix pectoralis</i>	Stubble Quail																	2		2
COLUMBIDAE																				
<i>Phaps chalcoptera</i>	Common Bronzewing																1			1
<i>Ocyphaps lophotes</i>	Crested Pigeon								1		2	4			1	2	1			11
<i>Geopelia cuneata</i>	Diamond Dove	51		32		10		3	4	118		475			12	17	13			735
EUROSTOPODIDAE																				
<i>Eurostopodus argus</i>	Spotted Nightjar					1											1	1		3
AEGOTHELIDAE																				
<i>Aegotheles cristatus</i>	Australian Owlet-nightjar				1		1											1		3
ACCIPITRIDAE																				
<i>Haliastur sphenurus</i>	Whistling Kite								1						1	1	2			5
<i>Accipiter fasciatus</i>	Brown Goshawk			1									1				2			4
<i>Accipiter cirrocephalus</i>	Collared Sparrowhawk																	1		1
<i>Circus assimilis</i>	Spotted Harrier	2															6	2		10
<i>Aquila audax</i>	Wedge-tailed Eagle	2															3	1		6
FALCONIDAE																				
<i>Falco cenchroides</i>	Nankeen Kestrel	7	6	8	4	8		3		2								9		45
<i>Falco berigora</i>	Brown Falcon			1						2										3
<i>Falco longipennis</i>	Australian Hobby	1								1								1		3
<i>Falco peregrinus</i>	Peregrine Falcon	1	2				2										1	3		9



Family and Species	Common Name	Site 1		Site 2		Site 3		Site 4		Site 5		Site 6		Site 7		Opportunistic Records		Motion Camera		TOTAL
		P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	
OTIDIDAE																				
<i>Ardeotis australis</i>	Australian Bustard																1			1
BURHINIDAE																				
<i>Burhinus grallarius</i>	Bush Stone-curlew							1									1			2
CHARADRIIDAE																				
<i>Vanellus tricolor</i>	Banded Lapwing															5				5
TURNICIDAE																				
<i>Turnix velox</i>	Little Button-quail	8				10	1	16	7			11				15	3			71
CACATUIDAE																				
<i>Eolophus roseicapillus</i>	Galah							4								10	2			16
<i>Cacatua sanguinea</i>	Little Corella															2				2
<i>Nymphicus hollandicus</i>	Cockatiel											2				21	4			27
PSITTACIDAE																				
<i>Barnardius zonarius</i>	Australian Ringneck								6							2	6			14
<i>Psephotus varius</i>	Mulga Parrot									2						2				4
<i>Melopsittacus undulatus</i>	Budgerigar								8							69	34			111
<i>Neopsephotus bourkii</i>	Bourke's Parrot													2						2
CUCULIDAE																				
<i>Chalcites basalis</i>	Horsfield's Bronze-Cuckoo														4					4
<i>Cacomantis pallidus</i>	Pallid Cuckoo																3			3
STRIGIDAE																				
<i>Ninox novaeseelandiae</i>	Southern Boobook															1				1
HALCYONIDAE																				
<i>Todiramphus pyrrhopygius</i>	Red-backed Kingfisher															2	3			5
MEROPIIDAE																				
<i>Merops ornatus</i>	Rainbow Bee-eater						2									6	3			11



Family and Species	Common Name	Site 1		Site 2		Site 3		Site 4		Site 5		Site 6		Site 7		Opportunistic Records		Motion Camera		TOTAL
		P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	
PTILINORHYNCHIDAE																				
<i>Ptilonorhynchus guttatus</i>	Western Bowerbird							1	3	6	3					1	3			17
MALURIDAE																				
<i>Malurus splendens</i>	Splendid Fairy-wren														15	5	2			22
ACANTHIZIDAE																				
<i>Pyrrholaemus brunneus</i>	Redthroat														6	1	2			8
<i>Smicromis brevirostris</i>	Weebill																6			6
<i>Gerygone fusca</i>	Western Gerygone															4				4
<i>Acanthiza robustirostris</i>	Slaty-backed Thornbill														7	11				18
<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill														5	4				9
<i>Acanthiza uropygialis</i>	Chestnut-rumped Thornbill						5					5		4			4			18
<i>Aphelocephala leucopsis</i>	Southern Whiteface											3				3	4			10
PARDALOTIDAE																				
<i>Pardalotus rubricatus</i>	Red-browed Pardalote																	1		1
<i>Pardalotus striatus</i>	Striated Pardalote						1													1
MELIPHAGIDAE																				
<i>Lichenostomus virescens</i>	Singing Honeyeater									1		3			2	1	2			9
<i>Lichenostomus penicillatus</i>	White-plumed Honeyeater															9	5			14
<i>Manorina flavigula</i>	Yellow-throated Miner	2		4		21		11	9	7	13	13	8			4	12			104
<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater		1					4							4	2	1			12
<i>Epthianura tricolor</i>	Crimson Chat									4		2			2	12	8			28
POMATOSTOMIDAE																				
<i>Pomatostomus temporalis</i>	Grey-crowned Babbler							16	14	19	12	8	15			14	3			101
<i>Pomatostomus superciliosus</i>	White-browed Babbler							3	6								5			14
CINCLOSOMATIDAE																				
<i>Cinclosoma castaneothorax</i>	Chestnut-breasted Quail-thrush												2			5	11	3		18



Family and Species	Common Name	Site 1		Site 2		Site 3		Site 4		Site 5		Site 6		Site 7		Opportunistic Records		Motion Camera		TOTAL
		P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	
CAMPEPHAGIDAE																				
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike														1	6	3			10
<i>Lalage sueurii</i>	White-winged Triller							1					1		7	5	6			20
PACHYCEPHALIDAE																				
<i>Pachycephala rufiventris</i>	Rufous Whistler									3	2					7	2			14
<i>Colluricincla harmonica</i>	Grey Shrike-thrush	1		1	1	2				1		1		1	1	6			15	
<i>Oreoica gutturalis</i>	Crested Bellbird						2	1	1			2		4	2	7			19	
ARTAMIDAE																				
<i>Artamus personatus</i>	Masked Woodswallow	5			5	4	4					8		140	60	28			254	
<i>Artamus cinereus</i>	Black-faced Woodswallow					2						2		6	6	3			19	
<i>Artamus minor</i>	Little Woodswallow	6	7	15	8		7								11	11			65	
<i>Cracticus torquatus</i>	Grey Butcherbird						6	2	6	5	2	2		2	1	1			27	
<i>Cracticus nigrogularis</i>	Pied Butcherbird	2		1		2		2		1			1		1				10	
<i>Cracticus tibicen</i>	Australian Magpie															2			2	
RHIPIDURIDAE																				
<i>Rhipidura leucophrys</i>	Willie Wagtail	1		1			1	2		5			1		2	5		4	22	
CORVIDAE																				
<i>Corvus bennetti</i>	Little Crow		1												7	8	3		19	
<i>Corvus orru</i>	Torresian Crow											1	2		1		2		6	
MONARCHIDAE																				
<i>Grallina cyanoleuca</i>	Magpie-lark										2				4	6	4		16	
PETROICIDAE																				
<i>Petroica goodenovii</i>	Red-capped Robin														4	4	2		10	
MEGALURIDAE																				
<i>Cincloramphus mathewsi</i>	Rufous Songlark							1							1		3		5	
<i>Cincloramphus cruralis</i>	Brown Songlark															1			1	



Family and Species	Common Name	Site 1		Site 2		Site 3		Site 4		Site 5		Site 6		Site 7		Opportunistic Records		Motion Camera		TOTAL
		P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	
HIRUNDINIDAE																				
<i>Hirundo neoxena</i>	Welcome Swallow																5	2		7
<i>Petrochelidon nigricans</i>	Tree Martin																21	5		26
NECTARINIIDAE																				
<i>Dicaeum hirundinaceum</i>	Mistletoebird								1											1
ESTRILDIDAE																				
<i>Taeniopygia guttata</i>	Zebra Finch	4	6	20	12		14	2		3		2	8		10	34	43		158	
<i>Emblema pictum</i>	Painted Finch	18	18	11	5	14	3									20	5		94	
MOTACILLIDAE																				
<i>Anthus novaeseelandiae</i>	Australasian Pipit											2	5			3	6		16	
SPECIES RECORDED IN ADJACENT AREAS																				
COLUMBIDAE																				
<i>Geopelia striata</i>	Peaceful Dove																4			4
ANATIDAE																				
<i>Cygnus atratus</i>	Black Swan																	6		6
<i>Anas superciliosa</i>	Pacific Black Duck															1	2		3	
<i>Anas gracilis</i>	Grey Teal															10			10	
<i>Chenonetta jubata</i>	Wood Duck															14			14	
<i>Dendrocygna eytoni</i>	Plumed Whistling Duck																80		80	
PELECANIDAE																				
<i>Pelecanus conspicillatus</i>	Australian Pelican																1			1
ARDEIDAE																				
<i>Egretta novaehollandiae</i>	White-faced Heron															4	2		6	
THRESKIORNITHIDAE																				
<i>Threskiornis spinicollis</i>	Straw-necked Ibis															20	10		30	
ANHINGIDAE																				
<i>Anhinga novaehollandiae</i>	Australasian Darter															7	2		9	



Family and Species	Common Name	Site 1		Site 2		Site 3		Site 4		Site 5		Site 6		Site 7		Opportunistic Records		Motion Camera		TOTAL
		P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	
PHALACROCORACIDAE																				
<i>Phalacrocorax sulcirostris</i>	Little Black Cormorant																	6		6
CHARADRIIDAE																				
<i>Eusemyornis melanops</i>	Black-fronted Dotterel																	2		2
HALCYONIDAE																				
<i>Todiramphus sanctus</i>	Sacred Kingfisher																2			2
MALURIDAE																				
<i>Malurus leucopterus</i>	White-winged Fairy-wren																3			3
<i>Malurus lamberti</i>	Variegated Fairy-wren																5			5



Table E3: Reptiles

Family and Species	Common Name	Site 1		Site 2		Site 3		Site 4		Site 5		Site 6		Site 7		Opportunistic Records		Motion Camera		TOTAL
		P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	
GEKKONIDAE																				
<i>Gehyra punctata</i>	Spotted Rock Dtella	1	2		1	2	6				4		1			1	6			24
<i>Gehyra variegata</i>	Tree Dtella	1	2					2	7	1	3	2	5		4	4	15			46
<i>Heteronotia binoei</i>	Bynoe's Gecko				1			1	2				1			8	7			20
<i>Lucasium stenodactylum</i>	Pale-snouted Ground Gecko												1		1		5			7
<i>Nephrurus vertebralis</i>	Midline Knob-tailed Gecko														1		1			2
<i>Rhynchoedura ornata</i>	Beaked Gecko								1						1		5			7
PYGOPODIDAE																				
<i>Delma tincta</i>			1				2													3
AGAMIDAE																				
<i>Ctenophorus caudicinctus</i>	Ring-tailed Dragon		1		2		6	1		5	26	1	29			8	21		1	101
<i>Ctenophorus nuchalis</i>	Central Netted Dragon												1		1		3			5
<i>Ctenophorus reticulatus</i>	Western Netted Dragon				1												1			2
<i>Ctenophorus scutulatus</i>	Lozenge-marked Dragon							1	9						8		2			20
<i>Lophognathus longirostris</i>	Long-nosed Dragon												1				1			2
<i>Pogona minor</i>	Bearded Dragon		1		1	1	1	1	4		2					1	1		1	14
SCINCIDAE																				
<i>Ctenotus leonhardii</i>	Leonhardi's Ctenotus							2	17		1				2					22
<i>Ctenotus schomburgkii</i>	Barred Wedge-snout Ctenotus							4	1											5
<i>Ctenotus severus</i>	Rock Skink	16	18	2	1	20	28	1	10			5	7		2	2	9		1	122
<i>Egernia depressa</i>	Pygmy Spiny-tailed Skink														1	2	1			4
<i>Eremiascincus richardsoni</i>	Broad-banded Sandswimmer																1			1
<i>Lerista timida</i>	A Skink	4	5			3	4	1	10	1	6	2	3		1		4			44
<i>Menetia greyii</i>	Dwarf Skink	4	1	3	1	3	9		2	2	1	1	1				4			32
VARANIDAE																				
<i>Varanus caudolineatus</i>	Line-tailed Pygmy Monitor																1			1
<i>Varanus panoptes panoptes</i>	Yellow-spotted Monitor										1	1			1	1	2		2	8



Family and Species	Common Name	Site 1		Site 2		Site 3		Site 4		Site 5		Site 6		Site 7		Opportunistic Records		Motion Camera		TOTAL
		P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	P1	P2	
<i>Varanus tristis</i>	Black-headed Monitor	1															1			2
TYPHLOPIDAE																				
<i>Ramphotyphlops grypus</i>	Blind Snake							1				1								2
BOIDAE																				
<i>Antaresia perthensis</i>	Pygmy Python				1			1												2
ELAPIDAE																				
<i>Demansia psammophis</i>	Yellow-faced Whipsnake																1			1
<i>Simoselaps bertholdi</i>	Jan's banded Snake		2				1													3
TOTAL		27	33	5	8	30	57	14	65	9	44	12	51	0	23	27	92	0	5	502
SPECIES RICHNESS		6	9	2	7	6	8	9	12	4	8	6	11	0	11	7	21	0	4	27



Table E4: Amphibians

Family and Species	Common Name	Notes
HYLIDAE		
<i>Litoria rubella</i>	Desert Tree Frog	Several recorded outside the Study Area at Mount Gould homestead during both survey phases



Appendix F: Conservation significant fauna recorded within the Study Area

Species	Conservation Status	Location Easting	Location Northing	Comments
Peregrine Falcon	S1	534409	7146893	Old nest site
Peregrine Falcon	S1	534554	7146826	Old nest site
Peregrine Falcon	S1	534554	7146734	3 Individuals (2 adults, 1 fledgling)
Peregrine Falcon	S1	534575	7146777	1 individual
Bush Stone-curlew	P4	533065	7145324	tracks
Bush Stone-curlew	P4	539292	7146042	Heard calling
Australian Bustard	P4	-	-	Recorded adjacent to Study Area
Rainbow Bee-eater	Migratory	533809	7146196	2 individuals
Rainbow Bee-tear	Migratory	537047	7134591	2 observed outside Study Area
Painted Finch	Locally Significant	534304	7146782	Nest
Painted Finch	Locally Significant	534568	7146705	Nest
Painted Finch	Locally Significant	534258	7146953	10 individuals
Painted Finch	Locally Significant	534253	7146879	5 individuals
Painted Finch	Locally Significant	534409	7146893	5 individuals, cave entrance where moisture seeping onto floor
Painted Finch	Locally Significant	534450	7146648	Site 1
Painted Finch	Locally Significant	533936	7146122	Site 3
Woolley's Pseudantechinus	Locally Significant	534358	7146662	1 individual trapped
Woolley's Pseudantechinus	Locally Significant	533976	7145960	1 individual trapped
Woolley's Pseudantechinus	Locally Significant	534401	7146630	Recorded on Motion Camera
Woolley's Pseudantechinus	Locally Significant	534462	7146138	Recorded on Motion Camera
Woolley's Pseudantechinus	Locally Significant	533833	7146127	Recorded on Motion Camera
Woolley's Pseudantechinus	Locally Significant	533985	7145979	Recorded on Motion Camera
Woolley's Pseudantechinus	Locally Significant	533206	7145669	Recorded on Motion Camera
Little Woodswallow	Locally Significant	534420	7146601	Roosting site
Little Woodswallow	Locally Significant	534365	7146635	10 individuals



Appendix G: Evidence of extinct Mammals recorded within the Study Area

Species	Conservation Status	Location Easting	Location Northing	Comments
<i>Petrogale lateralis</i>	S1	534357.1	7146636	Old scats
<i>Lepporillus</i> sp.	EX	534357.1	7146636	Decayed nest
<i>Lepporillus</i> sp.	EX	534357.1	7146636	Decayed nest
<i>Pseudomys chapmani</i>	P4	534970	7147466	extinct mound
<i>Pseudomys chapmani</i>	P4	535159	7147414	extinct mound
<i>Pseudomys chapmani</i>	P4	535192	7147369	extinct mound
<i>Pseudomys chapmani</i>	P4	535161	7147413	extinct mound
<i>Pseudomys chapmani</i>	P4	534188	7147911	extinct mound
<i>Pseudomys chapmani</i>	P4	534219	7147921	extinct mound
<i>Pseudomys chapmani</i>	P4	534207	7147830	extinct mound
<i>Pseudomys chapmani</i>	P4	534145	7147706	extinct mound
<i>Pseudomys chapmani</i>	P4	534529	7147471	extinct mound
<i>Pseudomys chapmani</i>	P4	534443	7147658	extinct mound
<i>Pseudomys chapmani</i>	P4	535303	7148110	extinct mound
<i>Pseudomys chapmani</i>	P4	535295	7148108	extinct mound
<i>Pseudomys chapmani</i>	P4	535143	7147439	extinct mound
<i>Pseudomys chapmani</i>	P4	534994	7147579	extinct mound
<i>Pseudomys chapmani</i>	P4	534979	7147591	extinct mound
<i>Pseudomys chapmani</i>	P4	535143	7147489	extinct mound

APPENDIX 9: MOUNT GOULD SHORT-RANGE ENDEMIC INVERTEBRATE SURVEY REPORT (BIOLOGIC 2012B)



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**Mount Gould Short-range Endemic
Invertebrate Survey Report**

Atlas Iron Ltd

July 2012





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TABLE OF CONTENTS

1. Introduction 6

2. Environment..... 9

 2.1 Biogeography 9

 2.2 Climate 9

 2.3 Landforms 10

 2.4 Vegetation 10

 2.5 Land Systems 13

3. Assessment methodology..... 16

 3.1 Database review 16

 3.2 Review of previous studies 16

 3.3 Field survey methods 17

 3.3.1 Site selection 17

 3.3.2 Sampling techniques 23

 3.3.3 Identification of Specimens..... 23

 3.3.4 Habitat Assessment..... 23

 3.3.5 Limitations 23

4. Results..... 26

 4.1 Previous Studies at Mt Gould..... 26

 4.2 Database Searches..... 26

 4.3 Field Survey 26

 4.3.1 Pseudoscorpions 27

 4.3.2 Land Snails..... 29

 4.3.3 Isopods..... 29

 4.4 Habitat Assessment 30

 4.4.1 Mixed *Acacia* shrubland 30

 4.4.2 Outcropping and minor breakaway areas:..... 30



4.4.3 Spinifex hummock grasslands 30

4.4.4 Bouldering 31

5. Conclusion 32

6. References 33

Appendix A Biologic’s SRE Prospectivity Assessment Guidelines 34

Appendix B Database Results 36

Appendix C Survey Sites and Habitats 38

Appendix D Species List and Locations at Mount Gould 40

Appendix E Isopod Identification Report 41

Appendix F Arachnid and Mollusc Identification Report 43

LIST OF FIGURES

Figure 1.1: Regional location 7

Figure 1.2: Study Area 8

Figure 2.1: Average climate data for Meekatharra (BOM 2012) 9

Figure 2.2: Vegetation mapping of the Study Area (Woodman 2011). 12

Figure 3.1: Survey sites 18

Figure 4.1: Species locations 28

LIST OF PLATES

Plate 3.1: Mixed *Acacia* shrubland 19

Plate 3.2: Outcropping; south-facing 19

Plate 3.3: Ironstone bouldering 20

Plate 3.4: Spinifex communities 20

Plate 3.5: Exposed slopes 21

Plate 3.6: Mulga plains 21

Plate 3.7: Exposed outcropping 22

Plate 3.8: Minor drainage line 22



EXECUTIVE SUMMARY

Biologic Environmental Survey (Biologic) was commissioned by Atlas Iron Ltd (Atlas) to undertake a short-range endemic (SRE) survey to support the environmental approval for the Mount Gould tenement (52/236), hereafter referred to as the Study Area. The Study Area is approximately 610 hectares (ha) and is located approximately 150 kilometres (km) north-west of the township of Meekatharra, in the Murchison region in Western Australia. Mount Gould is an isolated feature in the landscape, with a number of habitats (outcropping, ironstone bouldering and spinifex communities) that are regarded as prospective for SRE fauna, largely as they are not found in the surrounding area.

The objective of this survey was to conduct a Level 2 SRE invertebrate fauna survey within the *Study Area*.

The database searches recorded no previous records of SRE taxa in the Study Area, and only one species in the surrounding area (the land snail *Pupoides cf. adalaidae*) that was also recorded in this survey.

Forty sites were chosen in the Study Area, 20 SRE sites and 20 reference sites, covering all habitats prospective for SRE fauna (SRE sites) and habitats not prospective (reference sites).

Of the eight taxa recorded in the Study Area (seven from this survey and one from previous work), only two can be considered Potential SREs, the pseudoscorpion *Synsphyronus* 'PSE010', and the trapdoor spider *Idiommatia* 'MYG254'. *Synsphyronus* 'PSE010' is known to occur outside of the Study Area but still regarded as limited to the local area. *Idiommatia* 'MYG254', which was collected in a dry pit trap during vertebrate survey work, was a mature male, likely in search of a mate. This species is regarded as a Potential SRE, however, whether the population of this species (burrows) is present in the Study Area, or this individual has wandered in from outside the Study Area in search of a mate, is unknown. It is likely that this species occurs in the surrounding plains, and outside of the Study Area.

All other taxa recorded are either known to be widespread or are unlikely to be restricted. As well, all taxa recorded (other than singletons) were found in a variety of habitats (including exposed habitats), and not restricted to a particular habitat type (including *Synsphyronus* 'PSE010').

The isolated nature of Mt Gould is what is largely driving the SRE prospectivity of the habitats in the Study Area, however, the species recorded within these habitats were also found in other, non-prospective, habitats, including areas more exposed, and many beyond the Study Area in the adjacent Jack Hills. The only Potential SRE known from Mount Gould, that has not been recorded elsewhere, is the trapdoor spider *Idiommatia* 'MYG254', which may require further survey work to establish where the species occurs with respect to the Study Area.

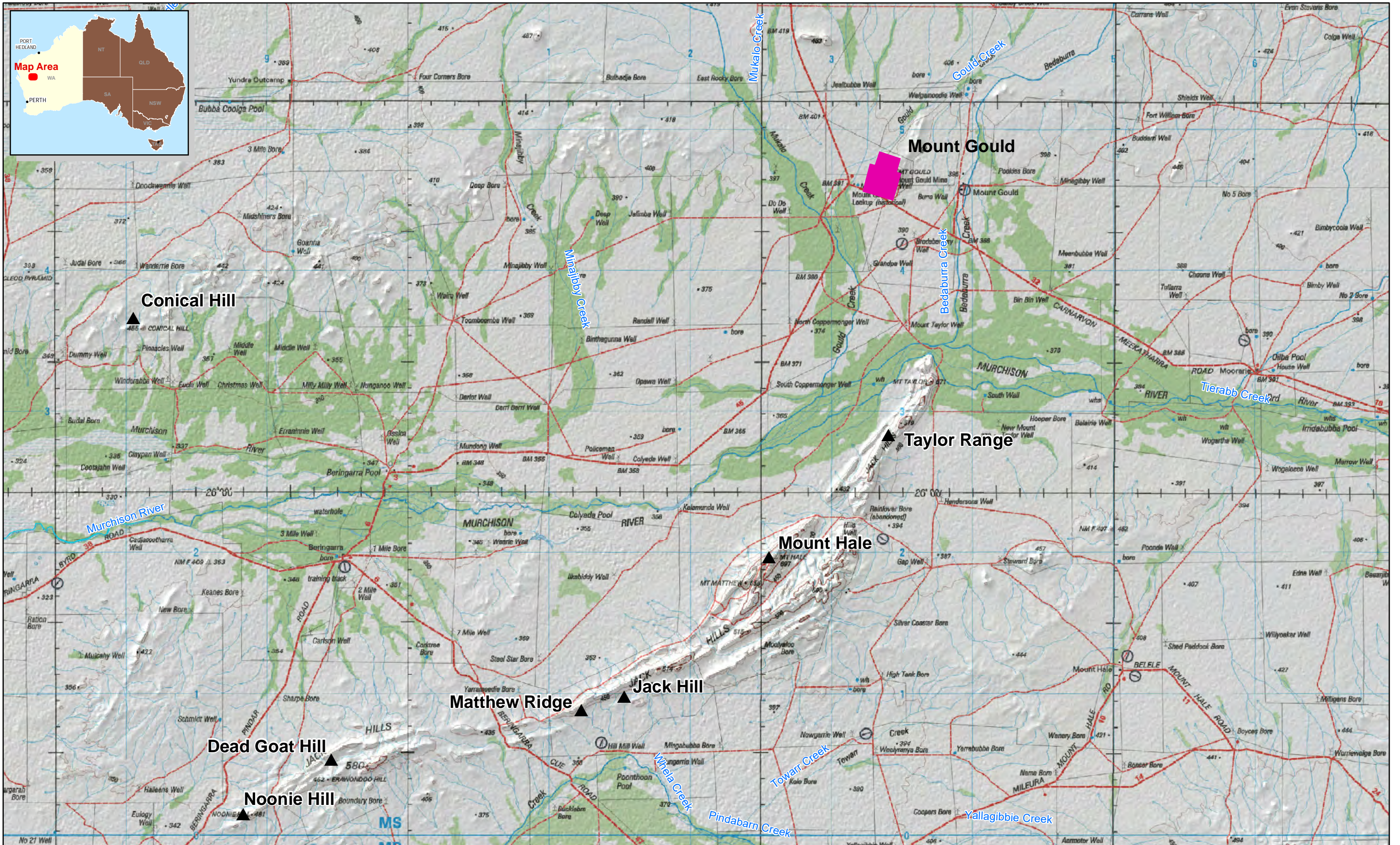


1. INTRODUCTION

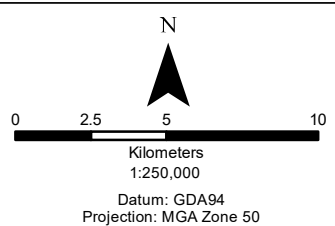
Biologic Environmental Survey (Biologic) was commissioned by Atlas Iron Ltd (Atlas) to undertake a short-range endemic (SRE) survey to support the environmental approval for the Mount Gould tenement (52/236), hereafter referred to as the Study Area. The Study Area is approximately 610 hectares (ha) and is located approximately 150 kilometres (km) north-west of the township of Meekatharra, in the Murchison region in Western Australia. (Figure 1.1). Mount Gould is an isolated feature in the landscape, with a number of habitats (outcropping, ironstone bouldering and spinifex communities) that are regarded as prospective for SRE fauna, largely as they are not found in the surrounding area.

The objective of this survey was to conduct a Level 2 SRE invertebrate fauna survey within the Study Area (Figure 1.2) with the following aims:

- Undertake a SRE literature review for the Study Area and the surrounding area. The literature review should include a summary of previous fauna survey results, literature review and search of relevant specimen databases;
- Undertake a SRE survey of the Study Area. Surveys are to be undertaken in accordance with EPA (2009), Sampling of Short Range Endemic Fauna for Environmental Impact Assessment in Western Australia. Methodology should target all SRE species within the Study Area and include any reference sites as required in adjacent areas (taking into consideration previous survey work completed).
- Prepare a SRE report detailing the results of the survey.



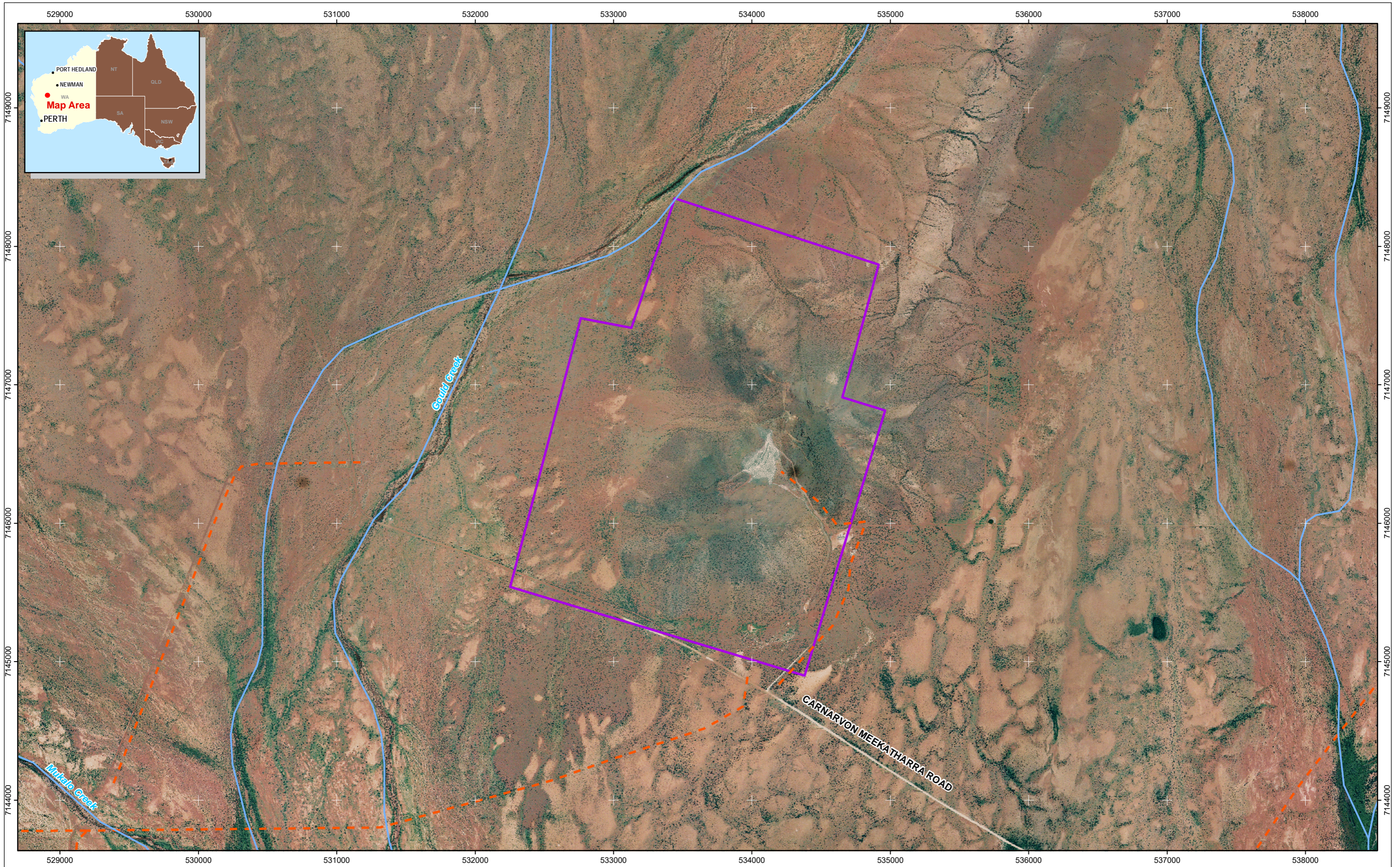
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**ATLAS IRON
MT GOULD
Regional Location
Figure 1.1**

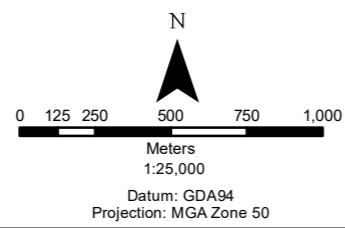
Legend
 Study Area

Griffin Spatial
& Mapping
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**ATLAS IRON
MT GOULD
Study Area**

Figure 1.2

Legend

- Study Area
- Track
- Watercourse

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2. ENVIRONMENT

2.1 Biogeography

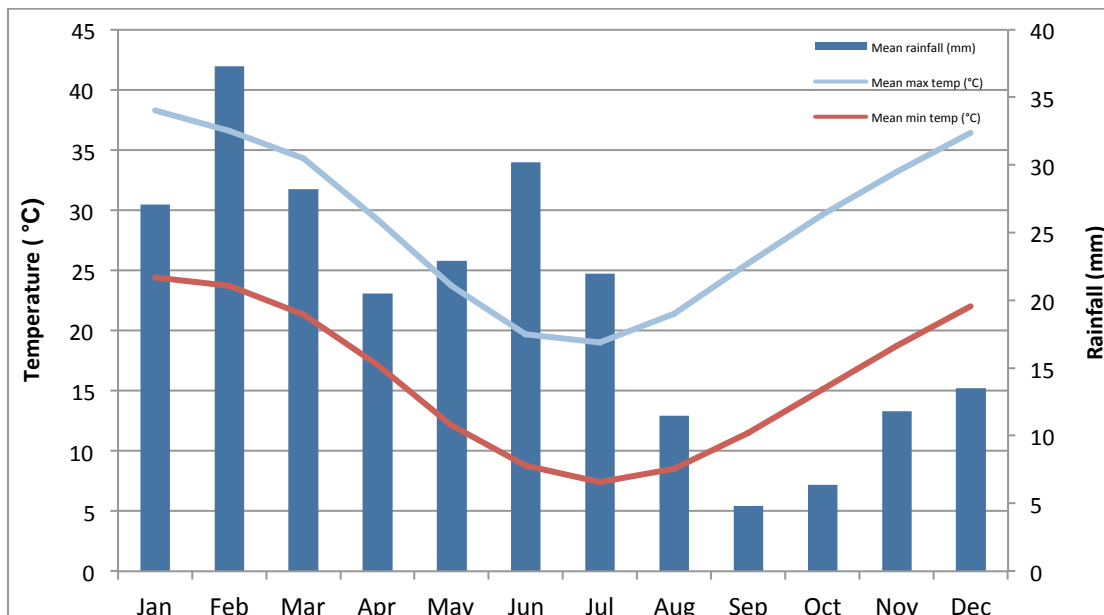
Broadly, the Study Area falls on the northern fringe of the Murchison biogeographical region as defined by the Interim Biogeographic Regionalisation of Australia (Thackway and Cresswell 1995). The Murchison Bioregion falls within the Bioregion Group 2 classification (EPA 2004). Bioregions within Group 2 have “native vegetation that is largely contiguous but is used for commercial grazing.” The Murchison is subdivided into two subregions, and the Study Area lies in the Western Murchison subregion (MUR-2).

The general features of the Western Murchison subregion are summarised by Desmond *et al.* (2001). The subregion is characterised by low Mulga woodlands rich in ephemerals and bunch grasses on granitic outcrops and extensive hardpan washplains. It contains the headwaters of the Murchison and Wooramel Rivers. The landscape comprises low hills, mesas of duricrust, separated by flat colluvium and alluvial plains. The dominant land use is grazing and exploration.

2.2 Climate

The Murchison region has an arid climate with winter rainfall (Figure 2.1). The mean average annual rainfall is 210 mm, ranging from 190 mm in the northeast to 240 mm in the southwest (BOM, 2012). Summers are hot and dry, with average daytime temperatures reaching 38°C in January and winters are mild with cool nights.

Figure 2.1: Average climate data for Meekatharra (BOM 2012)





2.3 Landforms

The local topography is dominated by Jack Hills, an 80km long range consisting of folded and metamorphosed supracrustal rocks, including banded ironstone. Jack Hills are the most northern occurrence of the banded ironstone formation (BIF) ranges, occurring across the Murchison, Midwest and Goldfields. Mount Gould is an outlier of the Jack Hills range, occurring approximately 12 km north of the main range. The area surrounding Mount Gould consists of relatively flat, undulating plains.

2.4 Vegetation

The vegetation of the Mount Gould Study Area has been classified and mapped by Woodman Environmental Consulting (Woodman 2011) (Figure 2.2). Six Floristic Community Types (FCTs) are recognised from the area:

- FCT1: Open tall shrubland of *Acacia aneura* over sparse low shrubland of *Ptilotus obovatus* over open low forbland of *Goodenia tenuiloba* on steep mid and lower slopes on banded ironstone and quartz shale;
- FCT2: Sparse tall shrubland of mixed *Acacia* species over sparse low shrubland of *Ptilotus obovatus* and *Eremophila* species over open low forbland of *Goodenia tenuiloba* on stony undulating plains;
- FCT3: Sparse tall shrubland or isolated shrubs of *Acacia aneura* over isolated mid shrubs of *Eremophila fraseri* subsp. *parva* over isolated low shrubs of *Ptilotus obovatus* over open low forbland of mixed species including *Ptilotus aervoides* and *Goodenia tenuiloba* in clay pans and on clay flats;
- FCT4: Open tall shrubland or isolated shrubs of *Acacia aneura* over open to sparse mid shrubland of *Eremophila latrobei* subsp. *latrobei* and *Philotheca brucei* subsp. *cinerea* over open to sparse low shrubland and low tussock grassland of *Ptilotus obovatus* and *Cymbopogon ambiguus* on steep mid and upper slopes and crests on banded ironstone;
- FCT5: Isolated tall shrubland of *Acacia aneura* and/or *Grevillea berryana* over sparse low shrubland of *Eremophila latrobei* subsp. *latrobei*, *Philotheca brucei*; subsp. *cinerea* and *Ptilotus obovatus*, over low hummock grassland of *Triodia melvillei* on steep upperslopes and crests on banded ironstone;
- FCT6a: Open tall shrubland of *Acacia ramulosa* var. *linophylla* and *A. kempeana* over sparse mid shubland of *Eremophila forrestii* subsp. *forrestii* over isolated low shrubland of

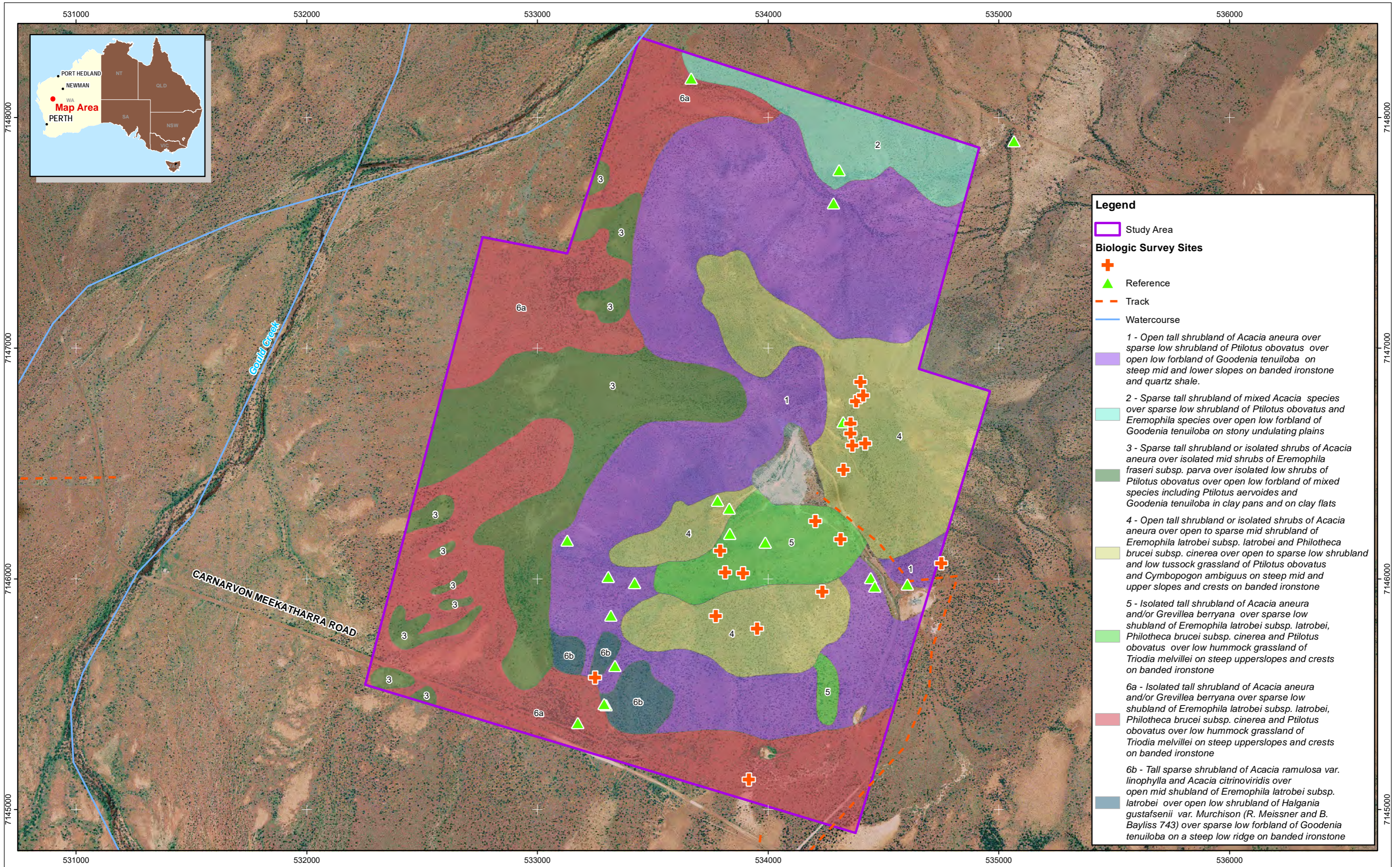


Corchorus crozophorifolius over sparse low grassland and forbland of mixed species including *Eriachne mucronata* and *Ptilotus aervoides* on flat plains; and

- FCT6b: Tall sparse shrubland of *Acacia ramulosa* var. *linophylla* and *A. citrinoviridis* over open mid shubland of *Eremophila latrobei* subsp. *latrobei* over open low shrubland of *Halgania gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743) over sparse low forbland of *Goodenia tenuiloba* on a steep low ridge on banded ironstone.

The vegetation at Mount Gould includes a significant ecological community, the Mount Gould Vegetation Complexes (banded ironstone formation), listed as a Priority 1 Ecology Community (PEC) by the DEC. Priority 1 PECs are described as:

“Ecological communities that are known from very few occurrences with a very restricted distribution (generally < 5 occurrences or a total area of < 100 ha). Occurrences are believed to be under threat either due to limited extent, or being on lands under immediate threat or for which current threats exist” (DEC, 2010).



Legend

Study Area

Biologic Survey Sites

- Reference
- Track
- Watercourse

1 - Open tall shrubland of *Acacia aneura* over sparse low shrubland of *Ptilotus obovatus* over open low forbland of *Goodenia tenuiloba* on steep mid and lower slopes on banded ironstone and quartz shale.

2 - Sparse tall shrubland of mixed *Acacia* species over sparse low shrubland of *Ptilotus obovatus* and *Eremophila* species over open low forbland of *Goodenia tenuiloba* on stony undulating plains

3 - Sparse tall shrubland or isolated shrubs of *Acacia aneura* over isolated mid shrubs of *Eremophila fraseri* subsp. *parva* over isolated low shrubs of *Ptilotus obovatus* over open low forbland of mixed species including *Ptilotus aevoides* and *Goodenia tenuiloba* in clay pans and on clay flats

4 - Open tall shrubland or isolated shrubs of *Acacia aneura* over open to sparse mid shrubland of *Eremophila latrobei* subsp. *latrobei* and *Philotheca brucei* subsp. *cinerea* over open to sparse low shrubland and low tussock grassland of *Ptilotus obovatus* and *Cymbopogon ambiguus* on steep mid and upper slopes and crests on banded ironstone

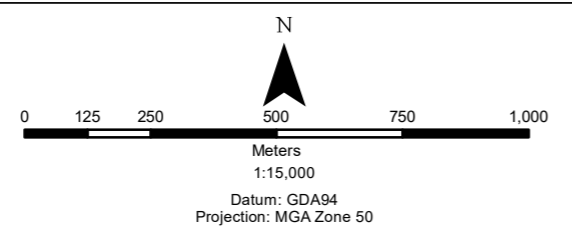
5 - Isolated tall shrubland of *Acacia aneura* and/or *Grevillea berryana* over sparse low shrubland of *Eremophila latrobei* subsp. *latrobei*, *Philotheca brucei* subsp. *cinerea* and *Ptilotus obovatus* over low hummock grassland of *Triodia melvillei* on steep upperslopes and crests on banded ironstone

6a - Isolated tall shrubland of *Acacia aneura* and/or *Grevillea berryana* over sparse low shrubland of *Eremophila latrobei* subsp. *latrobei*, *Philotheca brucei* subsp. *cinerea* and *Ptilotus obovatus* over low hummock grassland of *Triodia melvillei* on steep upperslopes and crests on banded ironstone

6b - Tall sparse shrubland of *Acacia ramulosa* var. *linophylla* and *Acacia citrinoviridis* over open mid shubland of *Eremophila latrobei* subsp. *latrobei* over open low shrubland of *Halgania gustafsenii* var. *Murchison* (R. Meissner and B. Bayliss 743) over sparse low forbland of *Goodenia tenuiloba* on a steep low ridge on banded ironstone



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**ATLAS IRON
MT GOULD**

Vegetation Communities (Woodman 2012)

Figure 2.2





2.5 Land Systems

Curry *et al.* (1994) classified and mapped the Land Systems of the Murchison region, including the area containing Mount Gould. Land Types and Land Systems are classified according to similarities in landform, soil, vegetation, geology and geomorphology and the combination of these factors can provide an indication of the fauna habitats present at a site. The Study Area is dominated by the Peak Hill Land System (Pea) and flanked by the Cole (Col) and Beringarra (Ber) Land Systems. These are detailed in Table 2.1, and summarised below. The percentage provided in Table 2.1 indicates the percentage of that particular habitat type within each of the different Land Systems, and is not specific to the Study Area.

- Peak Hill System (Pea): rugged sinuous ranges and rounded hills of Proterozoic banded ironstone and hematitic shale, supporting stunted mulga and cottonbush shrublands;
- Beringarra Land System (Ber): Major riverine plains with active lower floodplains flanking channelled watercourses, supports mostly halophytic shrublands and mixed *Acacia* shrublands and low woodlands with minor perennial grasses; and
- Cole Land System (Col): Hardpan wash plains with reticulate patterns of wanderrie banks and mulga groves and more concentrated drainage tracts, supporting mixed mulga and wanderrie shrublands.

Table 2.1: Land Systems present within the Study Area.

Landform	Landform and Soil	Vegetation
Peak Hill Land System		
Hills and ridges (50%)	Rough hills and ridges, generally covered with dense ironstone mantles and frequent outcropping. Skeletal soils, confined to pockets of shallow loamy sands.	Very scattered mixed shrublands with <i>Acacia</i> spp. co-dominant. Shrubs include <i>Acacia aneura</i> , <i>A. tetragonopyhlla</i> , <i>Eremophila latrobei</i> , <i>E. exilifolia</i> , <i>Senna desolata</i> , <i>Solanum</i> spp. Perennial grasses: <i>Eriachne</i> spp., <i>Eragrostis</i> spp.
Lower slopes and interfluves (40%)	Gently sloping footslopes or rounded interfluves flanking hills and ridges, covered in moderately dense ironstone mantles. Soils are dark red loamy sands.	Very scattered mixed shrublands dominated by <i>Acacia grasbyi</i> . Trees (to 6m): <i>A. pruinocarpa</i> , <i>A. aneura</i> , <i>A. aff. citrinoviridis</i> . Mid shrubs (1-2m): <i>A. grasbyi</i> , <i>Senna desolata</i> , <i>Eremophila latrobei</i> . Low shrubs (<1m): <i>Senna helmsii</i> , <i>Ptilotus obovatus</i> , <i>P. rotundifolius</i> , <i>Euphorbia boophthona</i> .



Landform	Landform and Soil	Vegetation
Drainage floors and minor channels (10%)	Narrow dendritic channels to 10m wide grading into broad saline alluvial fans and minor valley floors. Soils are dark red loamy sands with ironstone fragments.	Scattered mixed shrublands dominated by <i>Acacia aneura</i> , <i>A. tetragonophylla</i> or <i>A. victoriae</i> . Mixed shrubs (1-2m): <i>Eremophila</i> spp. Low shrubs (<1m): <i>Ptilius obovatus</i> , <i>Senna</i> spp., <i>Solanum lasiophyllum</i> .
Berringara Land System		
Hardpan plains (30%)	Almost flat alluvial plains. Soils are hardpan loams and red earths.	Scattered to moderately close mixed shrublands dominated by <i>Acacia aneura</i> .
Alluvial plains (40%)	Very gently sloping saline alluvial plains. Soils are generally deep crusted or hard setting duplexes with occasional red earths.	Patchy mixed shrublands, often dominated by <i>Acacia victoriae</i> , <i>Senna desolata</i> , <i>Eremophila pterocarpa</i> or <i>Hakea preissii</i> .
Floodplains and inter-channel zones (20%)	Almost flat, active floodplains with locally cracking or gilgai surfaces. Soils are variable crusted duplexes and yellowish-red to brown clays.	Moderately closed to closed woodlands with upper storey of <i>Acacia distans</i> or low shrublands dominated by <i>Atriplex amnicola</i> and <i>Maeriana pyramida</i> .
Wide drainage floors (5%)	Flat drainage zones, with occasional anastomosing channels. Soils are yellowish red to brown clays and duplex types.	Moderately close woodlands and tall shrublands. Trees (6-8m): <i>Acacia distans</i> , <i>A. aneura</i> , <i>Eucalyptus coolibah</i> . Tall shrubs (>2m): <i>A. tetragonophylla</i> , <i>A. victoriae</i> , <i>Eremophila fraseri</i> , <i>E. lanata</i> . Mid shrubs (1-2m): <i>E. fraseri</i> , <i>Scaevola spinescens</i> .
Channels (5%)	Riverbeds and seasonal watercourses up to 100m wide and incised to 3m. Channels carry bedloads of coarse sand. Soils on banks are reddish brown alluvial silty clays and fine sandy loams.	Major channel beds unvegetated, otherwise moderately close to closed mixed woodlands with dense under shrubs on banks of major channels and floors of minor channels. Trees include <i>Casuarina obesa</i> , <i>Eucalyptus camaldulensis</i> , <i>E. coolibah</i> .
Cole Land System		
Sand sheets (5%)	Isolated tracts of slightly elevated sand plain. Soils are earthy sands.	Scattered tall shrublands dominated by <i>Acacia aneura</i> , <i>A. ramulosa</i> or <i>Eremophila forrestii</i> with a grassy layer prominent in places. Trees include <i>Acacia kempeana</i> , <i>A. aneura</i> , <i>A. ramulosa</i> , <i>Grevillea</i> sp.



Landform	Landform and Soil	Vegetation
Wanderrie banks (25%)	Complex networks of interconnecting wanderrie banks. Soils are earthy sands.	Scattered tall shrublands dominated by <i>Acacia aneura</i> , <i>A. ramulosa</i> , <i>Eremophila forrestii</i> with a grassy layer prominent. Trees include <i>Acacia kempeana</i> , <i>A aneura</i> , <i>A. ramulosa</i> , <i>Grevillea</i> sp.
Hardpan plains (45%)	Level plains carrying sheet flow between sandy banks and groves.	Very scattered to scattered tall shrublands dominated by <i>Acacia aneura</i> . Trees and shrubs include <i>Acacia aneura</i> , <i>A. pruinocarpa</i> , <i>A. quadrimarginea</i> , <i>Grevillea striata</i> , <i>Hakea subera</i> , <i>A kempeana</i> , <i>Eremophila fraseri</i> .
Mulga groves (<5%)	Numerous <i>Acacia</i> groves up to 100m wide some with sandy accumulations and grading into wanderrie banks. Soils are dark red hardpan sandy clay loams or sandy clays.	Moderately close to closed low Mulga woodland dominated by <i>Acacia aneura</i> , <i>A. tetragonophylla</i> or <i>Eremophila fraseri</i> . Trees include <i>A. aneura</i> , <i>A. pruinocarpa</i> , <i>A. tetragonophylla</i> , <i>A. distans</i> , <i>Psydrax latifolia</i> , <i>Grevillea striata</i> .
Broad drainage zones (20%)	Very gently incised plains mostly occurring as broad, unchannelled tracts. Soils are mostly yellowish red or red earths or loams.	Scattered to moderately close tall shrublands dominated by <i>Acacia aneura</i> or <i>A. tetragonophylla</i> . Trees and shrubs include <i>A. aneura</i> , <i>A. kempeana</i> , <i>A. tetragonophylla</i> , <i>A. grasbyi</i> , <i>Eremophila fraseri</i> , <i>E. forrestii</i> .



3. ASSESSMENT METHODOLOGY

3.1 Database review

Two online databases and two WA Museum databases were searched for terrestrial SRE records:

- Department of Environment and Conservation's (DEC) NatureMap (accessed 14/03/2012);
- Atlas of Living Australia (ALA) (accessed 14/03/2012);
- WA Museum Arachnid database (accessed 15/03/2012); and the
- WA Museum Mollusc database (accessed 15/03/2012).

DEC's NatureMap allows a maximum of a 40 km radius around a precise centroid, defined as above. For the ALA a 50 km radius around a centroid (Mt Gould: 25.803159°S 117.339858°E) was used. ALA allows access to the biodiversity records of the Online Zoological Collections of the Australian Museum (OZCAM), which accesses collection data from the following institutions:

- Museum of Victoria;
- Museum and Art Gallery of the Northern Territory;
- South Australian Museum;
- Commonwealth Scientific and Industrial Research Organisation (CSIRO);
- Australian National Wildlife Collection;
- Western Australian Museum;
- Queen Victoria Museum and Art Gallery;
- Tasmanian Museum and Art Gallery; and
- Queensland Museum.

The WA Museum arachnid and mollusc databases was searched using a bounding box 100km x 100km. This search differs from the ALA search in that OZCAM does not have access to the entire WA Museum database.

3.2 Review of previous studies

No previous SRE studies have taken place at Mt Gould, but vertebrate fauna survey work has taken place (Biologic 2012). As part of this survey work, any SRE specimens captured in dry pit traps were collected for inclusion in this report.



3.3 Field survey methods

A single season survey was carried out in the Study Area, comprising a variety of active foraging techniques (hand foraging, litter sifting, soil sifting and vegetation beating) and targeting the primary SRE taxonomic groups (trapdoor spiders (mygalomorphae), scorpions, millipedes, pseudoscorpions and land snails). Isopods were also collected, as they are easy to collect and are usually the second most prevalent group in SRE surveys, behind pseudoscorpions, and, as such, usually provide robust data to help illustrate continuity of habitats.

3.3.1 Site selection

Sites were chosen according to Guidance Statement 20 (EPA 2009) and Biologic's SRE Prospectivity Assessment Guidelines (Appendix A), and in conjunction with the vegetation mapping by Woodman (2011). Habitats considered prospective for SRE terrestrial invertebrates at Mt Gould are listed below, along with the level of Prospectivity. A more detailed assessment of these habitats is provided in Appendix B. Forty sites were chosen in the Study Area (Figure 3.1) 20 SRE sites and 20 reference sites.

Table 3.1: SRE habitat types surveyed

Habitat Type	Description	SRE Prospectivity
Mixed <i>Acacia</i>	Tall, mixed <i>Acacia</i> shrubland.	3: possible (Figure 3.2)
Rocky Outcrops	South-west facing outcrops	4: likely (Figure 3.3)
Bouldering	Boulders at peak	3: possible (Figure 3.4)
Spinifex	<i>Triodia melvillei</i> community	4: likely (Figure 3.5)

Table 3.2: Reference (non-SRE) habitat types surveyed

Habitat Type	Description	SRE Prospectivity
Exposed slopes	Slight and/or not facing South	1: highly unlikely (Figure 3.6)
Mulga plains	Stoney and sandy plains	1: highly unlikely (Figure 3.7)
Exposed outcrops	Not facing South	1: highly unlikely (Figure 3.8)
Minor drainage line	Exposed, with minor vegetation change	2: unlikely (Figure 3.9)

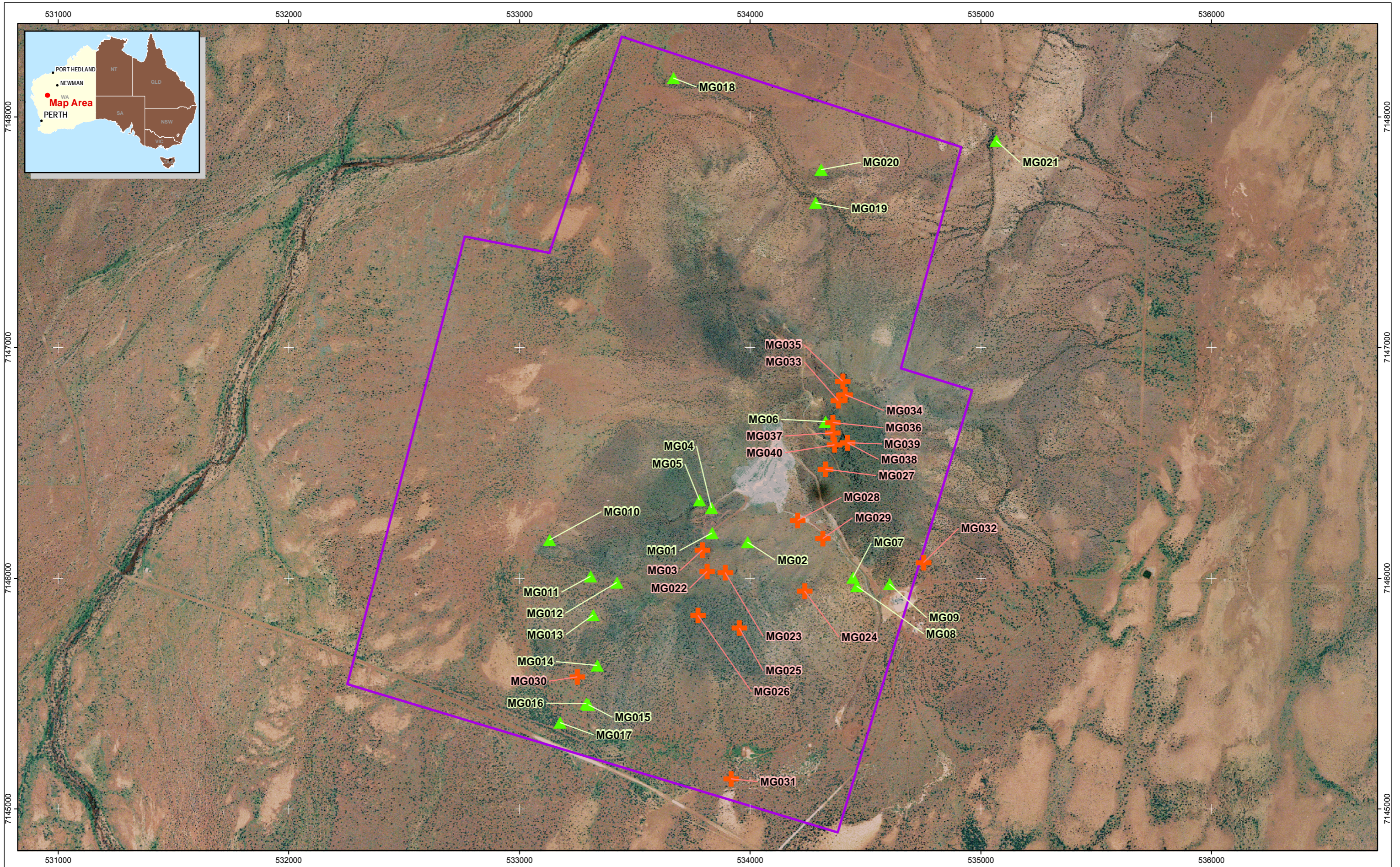




Plate 3.1: Mixed *Acacia* shrubland



Plate 3.2: Outcropping; south-facing





Plate 3.3: Ironstone bouldering



Plate 3.4: Spinifex communities





Plate 3.5: Exposed slopes



Plate 3.6: Mulga plains





Plate 3.7: Exposed outcropping



Plate 3.8: Minor drainage line





3.3.2 Sampling techniques

The sampling methodology adopted was carried out in accordance with the following documents:

- 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); and
- Guidance Statement No. 20 'Sampling of Short Range Endemic Fauna for Environmental Impact Assessment in Western Australia' No. 20. (EPA 2009).

Active foraging was undertaken at each site for 1.5 person hours and involved the following techniques:

- Active searching/rock turning: Rocky habitats were actively searched for rock dwelling species of pseudoscorpions, scorpions and isopods.
- Leaf litter searching: Leaf litter was placed in a leaf litter reducer (leaf litter sieve) at the site and agitated so that any small species fall through onto a sheet, or a tray, for collection. This targets most SRE species but particularly pseudoscorpions, millipedes, snails and scorpions.
- Soil searching: Soil is collected from the base of large, and or, significant trees and vegetation. Soil up to 30 centimetres (cm) deep is put through a soil sieve and specimens collected. This technique primarily targets aestivating snails and millipedes.

3.3.3 Identification of Specimens

All specimens were lodged with the WA Museum. The pseudoscorpions were identified by Dr Mieke Burger and Dr Mark Harvey, the land snail by Corey Whisson and the isopods by Dr Simon Judd.

3.3.4 Habitat Assessment

Biologic carried out a habitat assessment at each of the 40 survey sites. These assessments were based on various aspects of the habitat, related largely to its protective qualities, e.g. topography and aspect, and vegetation, leaf litter, soil and rock type and availability.

3.3.5 Limitations

3.3.5.1 General limitations

The EPA (2009) identified several key limitations with respect to the assessment of SRE invertebrates, including:



- Lack of a complete taxonomic framework for many groups, which directly affects the determination of whether a taxa can be regarded as an SRE or not. Within this report five types of SRE taxa are recognised, so as to clearly identify those that have these taxonomic limitations. Of these five, only the first three (Known SRE, Potential SRE and Indet. SRE) are regarded as significant, with Unknown SREs and Non-SREs not considered further:
 - **Known SRE:** a taxon that is known to be a short-range endemic (SRE);
 - **Possible SRE:** a taxon or specimen that is not a Known SRE but belongs to a higher taxonomic group (e.g. genus or family) that indicates it may have a restricted distribution;
 - **Potential SRE:** a taxon that can be identified to species level and belongs to a higher taxonomic group that indicates it may have a restricted distribution, but lacks distributional data to state clearly whether it is or not;
 - **Indetermined SRE (Indet. SRE):** a specimen that cannot be placed to species level, usually due to the specimen not having the required morphological state for species determination (i.e. a female or a juvenile), but belongs to a higher taxonomic group that indicates it may have a restricted distribution;
 - **Unknown SRE:** a taxon or specimen that belongs to a SRE group, is not known to occur outside of the Study Area, but it is not possible to determine its SRE status based on species, genus or family level identification; and
 - **Non-SRE:** a taxon that is either known to occur widely or is determined as unlikely to have a restricted distribution.
- Lack of sufficient taxonomic expertise to provide identifications for many groups within the timeframe required by project proposals;
- Difficulty sampling many taxa, which can be exacerbated by the lack of experience and knowledge of survey personnel. These difficulties usually result in sampling data that has severe limitations in its use, particularly with respect to quantitative analysis, but also with respect to assessing the likelihood of a taxon occurring in sites where it wasn't recorded. Any weight placed on the absence of a species at a site needs to be placed in this context; and
- Ecological and habitat knowledge of most taxa is incomplete, or based on broad assumptions.

3.3.5.2 *Limitations specific to this survey*

- Site selection was conducted in conjunction with vegetation mapping by Woodman (2011). However, there were some discrepancies between the boundaries and extent of some vegetation communities on the map and that on the ground, particularly the



spinifex and the mixed *Acacia* habitats. This needs to be taken into account when extrapolating SRE species distributions based on vegetation.

- The general area around Mount Gould received substantial rainfall one month prior to the survey being conducted. However, the Study Area appeared dry and the vegetation had not responded to the rainfall, in comparison with the surrounding area. Therefore, no microhabitats containing moisture were recorded during the habitat assessments. This is likely to have affected the level of activity of SRE taxa and hence the sampling efficiency.



4. RESULTS

4.1 Previous Studies at Mt Gould

Vertebrate fauna survey work conducted by Biologic (2012) recorded one mature male trapdoor spider in a dry pit trap at the peak of the southern hill, within the spinifex community. This occurrence is close to site MG03 of this survey. This species was identified as *Idiommatia* 'MYG254' (Family Barychelidae), which has not been previously recorded elsewhere. The WA Museum, and this report, regards this species as a **Potential SRE**.

While recording a mature male trapdoor spider is significant, the fact that only one specimen was captured during the dry pit trapping needs to be considered. Mature male trapdoor spiders generally only disperse when in search of a mate, and this is normally done en masse, often associated with a rain event, and can occur over large distances. The fact that no other specimens were recorded may mean that this specimen has wandered a considerable distance, and may not be a resident of Mount Gould. Conversely, it may be that the individual has ventured from the surrounding plains, which do form part of the Study Area.

4.2 Database Searches

The database search reported 31 target taxa, 27 from the WA Museum Arachnology database, two from the WA Museum Mollusc database, one from DEC's Naturemap and one from ALA, although the records of this particular species was also picked up within the WA Museum database search (Appendix B). No SRE taxa were previously known from the Study Area.

Of these taxa, only one was recorded in this survey, the land snail *Pupoides* cf. *adelaidae*. As well, some of the pseudoscorpion taxa in the database may well be conspecific with those recorded in the Study Area, but the taxonomic resolution is poor.

The other record of note is the presence of the mygalomorph *Idiosoma nigrum* at Jack Hills, which is regarded as likely the most northern occurrence of the species. *Idiosoma nigrum* is a Schedule 1 (Wildlife Conservation Act 1950) threatened trapdoor spider, which occurs through the northern Wheatbelt and Midwest regions. This species was not recorded at Mount Gould.

4.3 Field Survey

Twenty nine specimens of the target SRE taxa were collected from the 40 survey sites, 26 pseudoscorpions, three isopods and one land snail. These specimens comprised seven species (as discussed below) of which only one is considered a Potential SRE.



4.3.1 Pseudoscorpions

Twenty six specimens of pseudoscorpion were recorded in the *Study Area* comprising five possible species from four genera, and from two separate families (Garypidae and Olpiidae).

4.3.1.1 *Synsphyronus*

The first species, *Synsphyronus* 'PSE010' (Family Garypidae), was recorded at eight sites throughout the *Study Area* (Figure 4.1), with 15 specimens collected (five males, two females and eight juveniles). The WA Museum has commented that many species of *Synsphyronus* may represent a short-range endemic species (Harvey 1987), particularly species found in ground habitats such as under rocks and in soil, with the tree-dwelling species tending to be much more widely distributed, and less likely to be short-range endemics. The specimens recorded in this survey were all ground-dwelling but were found in a variety of microhabitats, including leaf litter, under rocks, and in the soil under spinifex. It was also found at a number of different habitat types; within spinifex, outcropping and boulders and on exposed slopes.

This species has also been recorded at Jack Hills, more than 100km to the south, but the current known range is still less than 8000km², which is still within the most recent definition of what constitutes a SRE species (Harvey 2002). Within the context of this survey we can regard this species as a **Potential SRE** which occurs outside of the *Study Area*.

4.3.1.2 *Austrohorus*

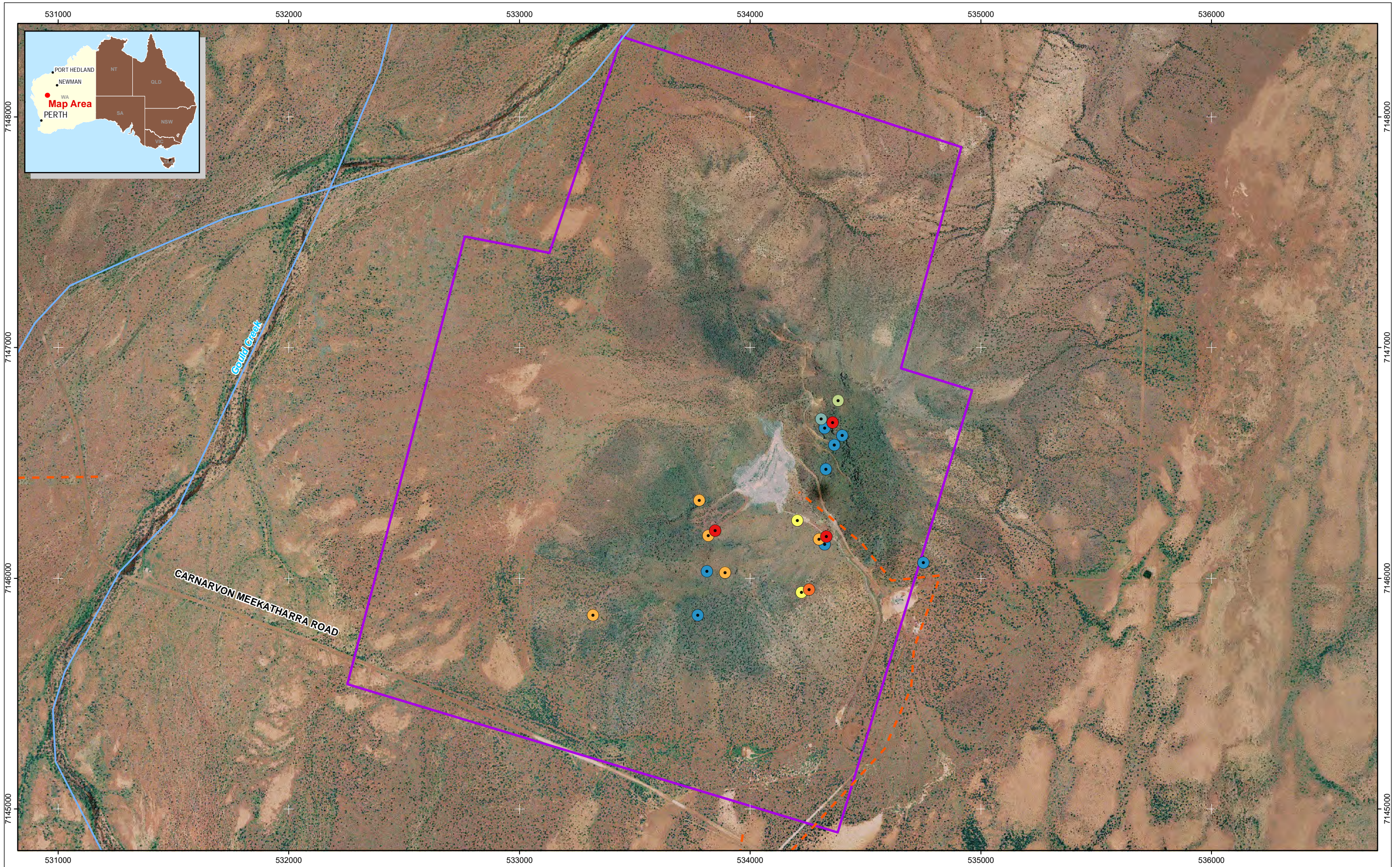
The second species was recorded as *Austrohorus* sp. (Family Olpiidae), which was recorded at two sites, with two specimens collected (one male and one juvenile). This species was found at two different habitats, the boulders and a spinifex site, indicating a lack of habitat preference, and therefore can be regarded as less likely to be a restricted species.

The WA Museum has stated that based on their current levels of knowledge, it is not possible to state whether this species is a short-range endemic. As such, this species can be regarded as an **Unknown SRE**.

4.3.1.3 *Beierolpium*

The third species was *Beierolpium* 'sp. 8/4' (Family Olpiidae), recorded at one site, with two specimens collected (one male and one female).

An additional *Beierolpium* juvenile specimen was collected from one site, though it appears that this individual may be of a separate species from *Beierolpium* 'sp. 8/4' due to the presence of different morphological features than expected. Specimens recorded at a single site (also known as singletons) are difficult to assess as they do not allow statements to be made about distribution or habitat preference.



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ENVIRONMENTAL SCIENCE

BIOLOGIC ENVIRONMENTAL SCIENCE	Date:	28/05/2012
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Drawn by GSM	Requested by BD	GSM Reference FIG3_1 Species Locations

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ATLAS IRON MT GOULD Species Locations

Figure 3.1

Legend

Study Area

Species Locations

- Isopod *Buddelundia* sp.
- Land Snail *Pupoides* 'cf. *adelaidae*'
- Pseudoscorpion *Indolpium* sp.
- Pseudoscorpion *Austrohorus*
- Pseudoscorpion *Beierolpium* 'sp. 8/4'
- Pseudoscorpion *Beierolpium* 'sp. juv.'
- Pseudoscorpion *Synsphyronus* 'PSE010'

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The WA Museum has stated that further taxonomic work is required on this genus before firm species identifications can be conducted and, as such, it is difficult to determine whether either of these two taxa are SREs. As such, both these specimens are regarded as **Unknown SREs**.

4.3.1.4 *Indolpium*

The fifth species, *Indolpium* sp. (Family Olpiidae), was recorded at five sites with six specimens collected (three males, one female and two juveniles). This species was recorded within a number of different habitats, including three sites that were exposed (reference sites) and two spinifex sites.

The WA Museum has commented that similar specimens have been collected from this region of WA and based on their current levels of knowledge it is unlikely that these specimens represent SRE species, and as such are regarded as **Non-SRE**.

4.3.2 Land Snails

One dead juvenile specimen closely resembling *Pupoides adelaidae* (Adams & Angas, 1864), and therefore referred to as *Pupoides* cf. *adelaidae* (Family Pupillidae), was collected. This species has a wide geographic distribution that appears to extend from New South Wales and north-western Victoria, across southern South Australia into the wheatbelt areas of Western Australia and as far to the north-west as Morawa (Solem, 1986; Solem, 1991). It may possibly also extend from Shark Bay north to North West Cape on the west coast of Western Australia (Solem, 1986).

This species was only recorded once and, as such, little can be said with respect to habitat preference or distribution within the Study Area. Along with the WA Museum comments, this species can be regarded as a **Non-SRE**.

4.3.3 Isopods

Three females of the genus *Buddelundia* (Family Armadillidae) were recorded from three sites, all comprising the one taxon. Due to only females being collected they are difficult to identify to species level and, as such, difficult to determine the SRE status of the taxon. However, the taxon does belong to a species-group within *Buddelundia*, which consists of species widespread throughout the arid regions of the south-west of Western Australia.

This species was recorded in three different habitats, outcropping, exposed outcropping and spinifex. Given this, and alongside the difficulty to determine its SRE status, this species can be regarded as an **Unknown SRE**.



4.4 Habitat Assessment

The habitats considered most prospective for SRE fauna at Mount Gould were chosen based on three factors; isolation, protection and habitat diversity.

4.4.1 Mixed *Acacia* shrubland

Woodman (2011) indicated the presence of three isolated pockets of tall, mixed *Acacia* shrubland (Figure 2.2) within the Study Area, surrounded by Mulga shrubland. This habitat was chosen largely due to its apparent isolation, but also its potential for greater habitat diversity, compared to the surrounding Mulga habitat, and possible protective qualities (shade and leaf litter). However, the structural and protective differences between the areas of mixed *Acacia* and the Mulga shrubland were minor, and are unlikely to represent a significant habitat change. As well the mixed *Acacia* shrubland areas were very small, and not well defined.

The survey work illustrated this overall lack of prospectivity, with no SRE specimens collected in eight sites (six reference and two SRE) within the mixed *Acacia* and Mulga shrublands. As such the mixed *Acacia* shrubland can be regarded as unlikely to have any SRE fauna restricted to it.

4.4.2 Outcropping and minor breakaway areas:

This habitat is isolated in the region (with some similar habitat occurring at Jack Hills) and provides a high level of protection from exposure (particularly when south or east facing), however habitat diversity is usually limited, likely due to the limited availability of soil. The isolation and protective qualities means there are likely to be SRE taxa associated with these habitats.

The survey work recorded similar results between reference and SRE outcropping sites, the difference being SRE sites were south-facing and the reference sites were more exposed. The six SRE sites recorded three pseudoscorpions and one isopod, and the four reference sites recorded two pseudoscorpions and one isopod. None of these species were restricted to this particular habitat.

4.4.3 *Spinifex* hummock grasslands

Restricted to the upper slopes and crests of Mount Gould, and are absent on the surrounding plains, however small areas of similar habitat occur on the slopes and crests of Jack Hills. This habitat is dominated by *Triodia melvillei* hummock grasslands with, or without, a shrubland containing mostly Mulga. Although not regarded as a “typical” SRE habitat, its isolation locally (at Mount Gould), as well as regionally, indicates it may be prospective for fauna with restricted distributions. The spinifex hummocks provided protection from exposure, and the soil underneath was markedly cooler than the areas that were exposed. There also



appeared to be a noticeable increase in invertebrate activity in the cooler areas of the hummocks.

A comparison can be made between this habitat and the exposed slope habitat, which was also surveyed at six sites as a reference habitat. The only difference between the two being the presence of spinifex hummocks, rather than grass hummocks, and the exposed slopes tended to have more Mulga present. The survey work recorded five pseudoscorpions and one isopod from the six spinifex sites, and only two pseudoscorpions from the six exposed slope sites. This appears to indicate the spinifex is an important part of the Mount Gould Study Area, providing protected spots in otherwise exposed habitats. However, no species recorded was limited to the spinifex, but most species were recorded within it.

4.4.4 Bouldering

The exposed ironstone at the peak of the south hill provides similar protection to the outcropping, although the lack of aspect makes it more exposed.

Four sites were surveyed within this habitat, with two pseudoscorpions and one land snail recorded. While this was the only habitat to record *Pupoides cf. adelaidae*, this taxon is regarded as very likely to be widespread and, as such, the lack of specimens is most likely a sampling artefact, and not an indication of its habitat preference or rarity. Neither of the two species of pseudoscorpion are restricted to this habitat, with both occurring at different habitat types.



5. CONCLUSION

Of the eight taxa recorded in the Study Area (seven from this survey and one from previous work), only two can be considered Potential SREs, the pseudoscorpion *Synsphyronus* 'PSE010', and the trapdoor spider *Idiommatia* 'MYG254'. *Synsphyronus* 'PSE010' is known to occur outside of the Study Area but still regarded as limited to the local area. *Idiommatia* 'MYG254', which was collected in a dry pit trap during vertebrate survey work, was a mature male, likely in search of a mate. This species is regarded as a Potential SRE, however, whether the population of this species (burrows) is present in the Study Area, or this individual has wandered in from outside the Study Area in search of a mate, is unknown. It is likely that this species occurs in the surrounding plains, and outside of the Study Area.

Four of the remaining taxa are regarded as Unknown SREs, largely due to a lack of taxonomic certainty, and the final two taxa recorded are known to be widespread. As well all taxa recorded (other than singletons) were found in a variety of habitats (including exposed habitats), and not restricted to a particular habitat type (including *Synsphyronus* 'PSE010').

The habitat assessment found that there is little difference in SRE prospectivity between the mixed *Acacia* shrubland and the Mulga shrubland, as the degree of isolation is limited on the ground. Similarly the survey work showed that both habitats were highly depauperate for SRE fauna.

The outcropping and boulder habitats were more prospective, and more isolated regionally, but there appeared to be little difference in fauna collected in exposed outcropping (reference) compared to south-facing outcropping (SRE).

The spinifex appeared to be the most prospective habitat, with the hummocks providing cooler microhabitats underneath where invertebrate, and SRE, activity was increased. However no species recorded were restricted to this habitat, although it does appear to play an important role in the Study Area as the most widespread prospective habitat.

Mount Gould is an isolated feature in the landscape, with a number of habitats which are not found in the surrounding area, however the species recorded within these habitats were also found in other habitats, and many beyond the Study Area in the adjacent Jack Hills. The only Potential SRE known from Mount Gould, that has not been recorded elsewhere, is the trapdoor spider *Idiommatia* 'MYG254', which may require further survey work to establish where the species occurs with respect to the Study Area.



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Appendix A Biologic's SRE Prospectivity Assessment Guidelines

Biologic's habitat assessments are aimed at determining the significance of each site (from a SRE perspective), and the likelihood that a site, or habitat, contains SRE taxa that will not be found at any other site or habitat. The assessment is based on three factors; isolation, protection and habitat complexity, and is briefly outlined below.

Isolation: based on the level of connectivity between sites that share similar habitat characteristics. Isolation is the most important factor when it comes to the level of risk, as any fauna with limited dispersal characteristics, regardless of the habitat preference, will likely be, at least, an isolated population. Examples include islands and mountain tops (e.g. Mt Meharry in the Pilbara), which have been shown to harbour significant species.

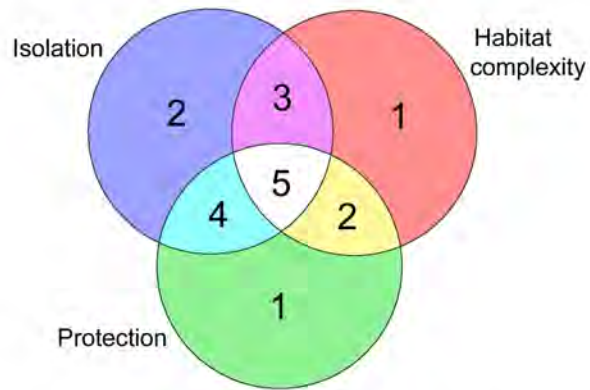
Habitat complexity: this factor drives species richness at a site, i.e. the more complex a site is, the more species it will contain. Complexity, with respect to SREs, is based around a number of microhabitat types:

- Leaf litter: both depth and structural variation
- Rocky substrates: loose rocks and crevices
- Vegetation variation: flora richness and structural variation
- Soil: depth and structural variation.

Examples include deep gullies and gorges, where many of these areas contain most of the above microhabitat types, and therefore tend to be the richest areas.

Protection: this primarily covers protection from exposure, particularly with respect to arid regions; however, protection from disturbances are also very important for the long term viability of SRE habitats and communities, i.e. protection from fire, flood and invasive species.

Protection is provided at two levels; the site level, where the structural composition of the site (aspect, slope etc) can provide protection from exposure and disturbance by providing physical barriers (e.g. gorges and gullies); and the habitat level, where certain microhabitat characteristics, associated with habitat complexity, provide more direct protection, particularly from exposure (i.e. leaf litter, rocky substrates, canopy cover and soil depth).



Likelihood of SRE taxa occurrence
1: Highly Unlikely
2: Unlikely
3: Possible
4: Likely
5: Highly Likely

Habitat assessment diagram



Appendix B Database Results

SRE GROUP	SPECIES	LOCATION
Mygalomorphae	<i>Aureocrypta</i> `chichester`	Jack Hills
Mygalomorphae	<i>Aureocrypta</i> `chichester`	Matthew Ridge
Mygalomorphae	Nemesiidae `sp.`	Matthew Ridge
Mygalomorphae	Nemesiidae `indet. juv.`	Taylor Range
Millipede	<i>Antichiropus</i> `Dead Goat Hill`	Dead Goat Hill
Millipede	<i>Antichiropus</i> `sp. check (male)`	Dead Goat Hill
Millipede	Polyzoniida `sp.`	Taylor Range
Pseudoscorpion	<i>Oratemnus</i> `sp.`	Dead Goat Hill
Pseudoscorpion	<i>Tyrannochthonius aridus</i>	Taylor Range
Pseudoscorpion	<i>Tyrannochthonius aridus</i>	Matthew Ridge
Pseudoscorpion	<i>Tyrannochthonius aridus</i>	Jack Hills
Pseudoscorpion	<i>Synsphyronus</i> `sp.`	Jack Hills
Pseudoscorpion	<i>Synsphyronus</i> `sp. (nymph)`	Jack Hills
Pseudoscorpion	<i>Synsphyronus</i> `8/3 long pedipalps`	Jack Hills
Pseudoscorpion	Olpidae `sp. (nymph)`	Taylor Range
Pseudoscorpion	<i>Austrohorus</i> `sp. A`	Jack Hills
Pseudoscorpion	<i>Austrohorus</i> `sp.`	Dead Goat Hill
Pseudoscorpion	<i>Austrohorus</i> `sp. B`	Jack Hills
Pseudoscorpion	<i>Beierolpium</i> `sp. 8/4`	Jack Hills
Pseudoscorpion	<i>Beierolpium</i> `sp. 8/2`	Taylor Range
Pseudoscorpion	<i>Beierolpium</i> `sp.`	Dead Goat Hill
Pseudoscorpion	<i>Beierolpium</i> `sp. nov. 8/4 small`	Jack Hills
Pseudoscorpion	<i>Beierolpium</i> `sp. 8/3`	Jack Hills
Pseudoscorpion	<i>Indolpium</i> `sp.`	Jack Hills
Pseudoscorpion	<i>Indolpium</i> `sp. (female)`	Jack Hills



SRE GROUP	SPECIES	LOCATION
Pseudoscorpion	<i>Indolpium`sp. (nymph)`</i>	Jack Hills
Pseudoscorpion	<i>Indolpium`sp. (tritonymph)`</i>	Jack Hills
Scorpion	<i>Lychas`MML1`</i>	Jack Hills
Scorpion	<i>Lychas splendens</i>	Jack Hills
Scorpion	<i>Urodacus`jack hills`</i>	Jack Hills
Land Snail	<i>Gastrocopta bannertonensis</i>	Jack Hills
Land Snail	<i>Pupoides cf. adelaidae</i>	Jack Hills

**Appendix C Survey Sites and Habitats**

SITE	SRE/REFERENCE	LATITUDE	LONGITUDE	HABITAT
MG001	Reference	25°48' 7.31"S	117°20' 15.06"E	Exposed outcrop
MG002	Reference	25°48' 8.56"S	117°20' 20.58"E	Exposed outcrop
MG003	Impact	25°48' 9.68"S	117°20' 13.55"E	Outcrop: Sth face
MG004	Reference	25°48' 3.78"S	117°20' 14.94"E	Exposed outcrop
MG005	Reference	25°48' 2.68"S	117°20' 13.11"E	Exposed outcrop
MG006	Reference	25°47' 51.56"S	117°20' 32.67"E	Exposed slope
MG007	Reference	25°48' 13.51"S	117°20' 37.00"E	Exposed slope
MG008	Reference	25°48' 14.71"S	117°20' 37.63"E	Exposed slope
MG009	Reference	25°48' 14.4"S	117°20' 42.7"E	Exposed slope
MG010	Reference	25°48' 8.34"S	117°19' 49.75"E	Exposed slope
MG011	Reference	25°48' 13.43"S	117°19' 56.14"E	Mulga plains
MG012	Reference	25°48' 14.3"S	117°20' 0.27"E	Mulga plains
MG013	Reference	25°48' 18.89"S	117°19' 56.56"E	Exposed slope
MG014	Reference	25°48' 26.0"S	117°19' 57.23"E	Mulga plains
MG015	Reference	25°48' 31.53"S	117°19' 55.87"E	Mulga plains
MG016	Reference	25°48' 31.37"S	117°19' 55.55"E	Mulga plains
MG017	Reference	25°48' 34.04"S	117°19' 51.45"E	Mulga plains
MG018	Reference	25°47' 03.18"S	117°20' 8.85"E	Drainage line
MG019	Reference	25°47' 20.74"S	117°20' 31.04"E	Drainage line
MG020	Reference	25°47' 16.06"S	117°20' 31.90"E	Exposed slope



SITE	SRE/REFERENCE	LATITUDE	LONGITUDE	HABITAT
MG021	Reference	25°47' 11.91"S	117°20' 59.12"E	Drainage line
MG022	Impact	25°48' 12.72"S	117°20' 14.32"E	Spinifex: peak
MG023	Impact	25°48' 12.86"S	117°20' 17.13"E	Spinifex: peak
MG024	Impact	25°48' 15.43"S	117°20' 29.49"E	Boulders: peak
MG025	Impact	25°48' 20.67"S	117°20' 19.32"E	Boulders: peak
MG026	Impact	25°48' 18.89"S	117°20' 12.90"E	Boulders: peak
MG027	Impact	25°47' 58.26"S	117°20' 32.70"E	Spinifex: Sth face
MG028	Impact	25°48' 5.48"S	117°20' 28.36"E	Spinifex: NE face
MG029	Impact	25°48' 8.04"S	117°20' 32.29"E	Spinifex: NE face
MG030	Impact	25°48' 27.62"S	117°19' 54.12"E	Mixed <i>Acacia</i>
MG031	Impact	25°48' 41.91"S	117°20' 18.13"E	Mixed <i>Acacia</i>
MG032	Impact	25°48' 11.38"S	117°20' 47.98"E	Outcrop: Sth face
MG033	Impact	25°47' 48.57"S	117°20' 34.65"E	Spinifex: Sth face
MG034	Impact	25°47' 47.75"S	117°20' 35.73"E	Spinifex: Sth face
MG035	Impact	25°47' 45.85"S	117°20' 35.35"E	Boulders: peak
MG036	Impact	25°47' 51.7"S	117°20' 33.79"E	Outcrop: Sth face
MG037	Impact	25°47' 53.11"S	117°20' 33.8"E	Outcrop: Sth face
MG038	Impact	25°47' 54.52"S	117°20' 36.1"E	Outcrop: Sth face
MG039	Impact	25°47' 54.52"S	117°20' 36.1"E	Outcrop: Sth face
MG040	Impact	25°47' 54.83"S	117°20' 34.08"E	Outcrop: Sth face

**Appendix D Species List and Locations at Mount Gould**

SITE NUMBER	SRE GROUP	SPECIES
MG001	Isopod	<i>Buddelundia</i> sp.
MG001	Pseudoscorpion	<i>Indolpium</i> sp.
MG005	Pseudoscorpion	<i>Indolpium</i> sp.
MG006	Pseudoscorpion	Olpidae `sp. juv.`
MG006	Pseudoscorpion	<i>Synsphyronus</i> `PSE010`
MG013	Pseudoscorpion	<i>Indolpium</i> sp.
MG022	Pseudoscorpion	<i>Synsphyronus</i> `PSE010`
MG023	Pseudoscorpion	<i>Indolpium</i> sp.
MG024	Pseudoscorpion	<i>Austrohorus</i> sp.
MG024	Land Snail	<i>Pupoides</i> `cf. <i>adelaidae</i> `
MG026	Pseudoscorpion	<i>Synsphyronus</i> `PSE010`
MG027	Pseudoscorpion	<i>Synsphyronus</i> `PSE010`
MG028	Pseudoscorpion	<i>Austrohorus</i> sp.
MG029	Isopod	<i>Buddelundia</i> sp.
MG029	Pseudoscorpion	<i>Indolpium</i> sp.
MG029	Pseudoscorpion	<i>Synsphyronus</i> `PSE010`
MG032	Pseudoscorpion	<i>Synsphyronus</i> `PSE010`
MG033	Pseudoscorpion	Olpidae `sp. 8/4`
MG036	Isopod	<i>Buddelundia</i> sp.
MG038	Pseudoscorpion	<i>Synsphyronus</i> `PSE010`
MG040	Pseudoscorpion	<i>Synsphyronus</i> `PSE010`



Appendix E Isopod Identification Report

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28th March 2012

Biologic
50B Angove Street
North Perth.
WA. 6006.

Attn: Brad Durrant

RE: MOUNT GOULD ISOPOD IDENTIFICATION.

I have completed my examination of the three specimens from Mount Gould. There was a single species of *Buddelundia* (Armadillidae) present. Only females were collected. I have compared this material to the limited amount of material I have from the Murchison Region. I have previously examined specimens from Jack Hills which would have made a useful comparison but unfortunately these specimens were unavailable. I have retained the specimens for further taxonomic work and for eventual lodgement at the WAM. My reference numbers are as follows: MG001-2183; MG029-2184, & MG036-2185.

This species is part of a group of *Buddelundia* that includes *Buddelundia sulcata*, *Buddelundia binotata* and possibly the type species *Buddelundia labiata*. These species are all very similar and are widespread in the drier regions outside of the south-west of Western Australia. I have two *Buddelundia* species from Weld Range and Meka Station (south of Mount Gould) which are both morphologically different to the species collected here.

I have a single female specimen from Robinson Range (108 kms to the ENE) which is tentatively the same species. I cannot make a more positive determination because no males specimen were present. Very similar species are found further east at Lake Way and at Yeelirrie. I have not allocated this species a number because I have very little material from the Murchison and its terrestrial isopods are largely unknown. I need more to more material from the area to work up a reference collection. Molecular analysis is probably necessary to resolve many of the species in this group of *Buddelundia*. These specimens will be very useful in this regard.

There is no evidence to suggest that this species does not occur more widely in the Mount Gould area.

End of report. Please contact me if you require further information.

Yours sincerely,

Simon Judd



Appendix F Arachnid and Mollusc Identification Report

Terrestrial Invertebrates from Mt Gould, Western Australia

Report to *Biologic*

16 March 2012

Mieke A. Burger, Corey Whisson & Mark S. Harvey

Department of Terrestrial Zoology, Western Australian Museum,
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Although identifications in this report were consistent with the best available information and current scientific thinking at the time of identification the use of this report is at the risk of the user. Any liability to users of this report for loss of any kind arising out of the use of this report or the information and identifications it contains is expressly disclaimed.

Summary

The samples submitted to the Western Australian Museum on the 28th February 2012 included pseudoscorpions from the families Garypidae (*Synsphyronus*) and Olpiidae (*Austrohorus*, *Beierolpium*, *Indolpium*); and a land snail from the family Pupillidae (*Pupoides*).

The land snail is most likely from a widespread species that occurs in four states of Australia. For the pseudoscorpions, the current level of taxonomy means that most of specimens were not able to be assigned to a particular species and therefore their distributions are not known. But based on our current knowledge, *Synsphyronus* `PSE010` has potential to be a short-range endemic species.

Short-Range Endemism

The terrestrial invertebrate fauna of inland Australia contains a plethora of species, and just the arthropods were recently estimated to consist of more than 250,000 species (Yeates, Harvey et al. 2004; Chapman 2009). The vast majority of these are found within the Insecta and Arachnida, although significant numbers of millipedes are to be expected. For many years, the prospect of including invertebrates in assessments of biological systems subject to alteration proved daunting and were largely ignored as being too diverse and too difficult to comprehend to satisfy the rapid turn-around needed for environmental surveys.

In a recent publication, the issue of Short-Range Endemism in the Australian invertebrate fauna was examined (Harvey 2002), and series of major groups were nominated as having a very high proportion of individual species that satisfied a certain set of criteria. The main criterion nominated for inclusion as a Short-Range Endemic (SRE) was that the species had a naturally small range of less than 10,000 km². Harvey (2002) found that those species possessed a series of ecological and life-history traits, including:

- poor powers of dispersal;
- confinement to discontinuous habitats;
- usually highly seasonal, only active during cooler, wetter periods; and
- low levels of fecundity.

The Western Australian (WA) fauna contains a number of SRE taxa, including millipedes, land snails, trap-door spiders, some pseudoscorpions, slaters, and onychophorans and these represent focal groups in Environmental Impact Assessment studies in the state (EPA 2009). The south coast region is relatively well known compared with other regions of the state (Framenau, Moir et al. 2008), but there are many poorly known species and gaps in our understanding of the distributions of many species.

Methods

Terrestrial invertebrates collected by *Biologic* from the Mt Gould area were submitted to the WA Museum on 28th February 2012. The specimens were examined at the WA museum using Leica dissecting microscopes (MZ6, MZ16).

CLASS ARACHNIDA

ORDER PSEUDOSCORPIONES

The WA pseudoscorpion fauna is fairly diverse with representatives of 17 different families. They are found in a variety of biotopes, but can be most commonly collected from either the bark of trees, from the underside of rocks, or from leaf litter habitats. The material from this survey included 26 individuals from two families: Garypidae and Olpiidae (Appendix 1).

Family Garypidae

***Synsphyronus* `PSE010` (family Garypidae)**

Five males, 2 females, and 8 juveniles of an undescribed species of *Synsphyronus* were collected from Mt Gould. Many species of *Synsphyronus* may represent short-range endemic species (Harvey 1987), but these species are generally found in ground habitats such as under rocks, the tree-dwelling species tend to be much more widely distributed, and are not short-range endemics. This species has been previously recorded from just over 100 km south of this area (records dating from between 2006 to 2011), but the extent of the range does not go wider than 8 000 km² (see Figure 1) which indicates the possibility of this species being a short-range endemic. Specimens from the two populations (may only be separated by sampling bias) are not distinct from each other morphologically, but perhaps more sampling and/or molecular analysis would be able to add evidence for them being the same species and whether this species is more widely distributed.

Family Olpiidae

***Austrohorus* sp. (family Olpiidae)**

One male and one juvenile specimen of *Austrohorus* sp. were collected during this survey (Appendix 1). Based on our current levels of knowledge, it is not possible to state whether this species is a short-range endemic.

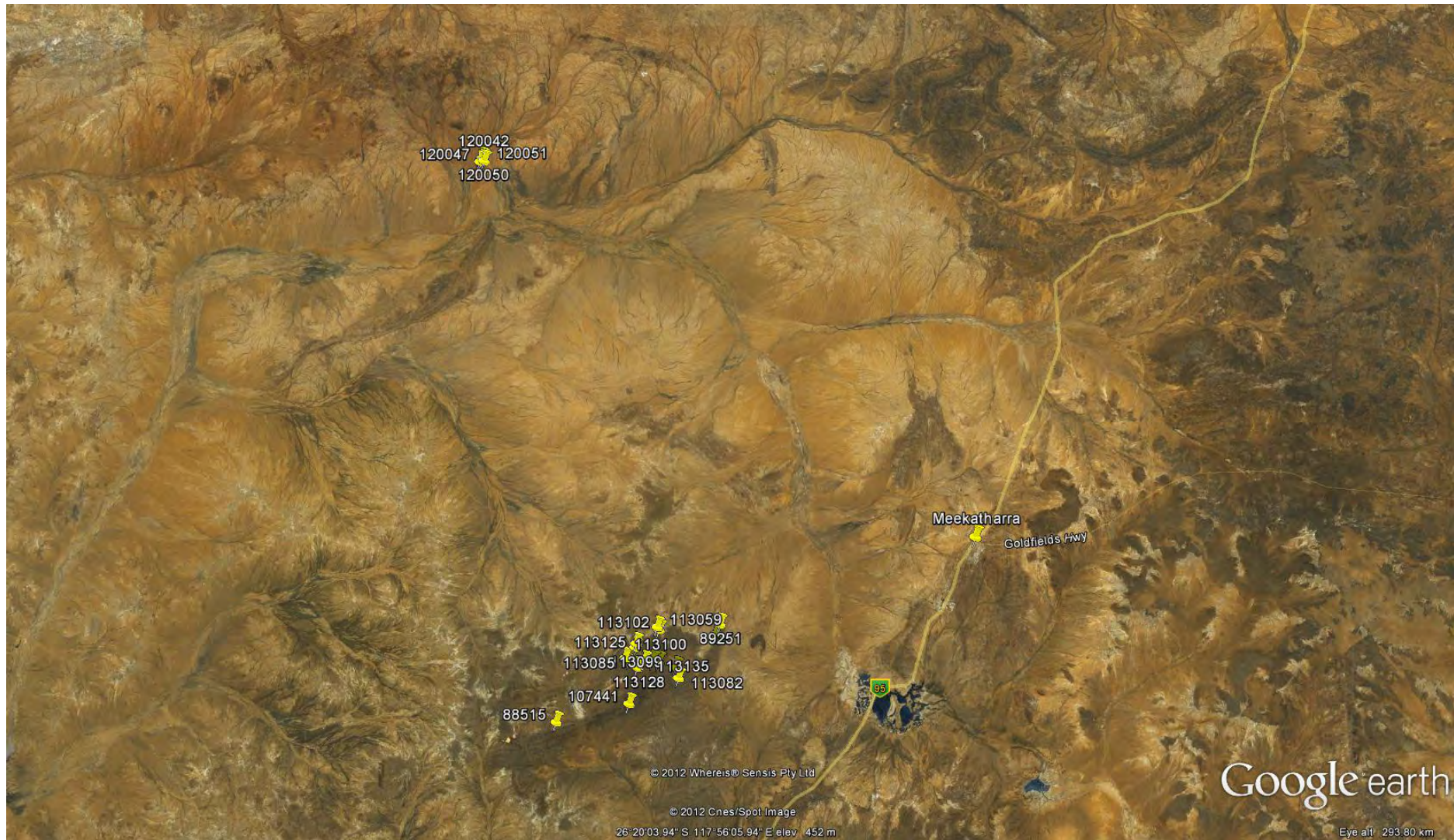


Figure 1. Current distribution of *Synsphyronus* `PSE010`. Numbered pins represent WAM registration numbers. The northern cluster includes specimens from this report (WAMTS021) and the southern cluster includes previous records. The average distance between these two clusters is ~ 120 km.

Beierolpium` sp. 8/4` (family Olpiidae)

The 8/4 representation associated with this genus refers to the number of trichobothria (sensory hairs) on the fixed and movable fingers, which is one of the characters that would coincide with species distinction in this genus. A single male and a single female specimen were collected during this survey (Appendix 1). An additional juvenile specimen of *Beierolpium* was collected from this area. This individual appeared like it might be from a separate species due to the difference in trichobothria count (7/2) compared to what would normally be expected from a tritonymph juvenile from *Beierolpium* sp. 8/4 (which would be 7/3). The systematic status of members of this genus has not been fully assessed. At present it is not possible to firmly establish the identity of these species until a complete systematic revision of the WA members of *Beierolpium* is undertaken.

***Indolpium* sp. (family Olpiidae)**

Three males, one female, and one juvenile specimen of *Indolpium* were collected during the survey (Appendix 1). Similar specimens have been collected from this region of WA and based on our current levels of knowledge it is unlikely that these specimens represent SRE species.

CLASS GASTROPODA

ORDER STYLOMMATOPHORA

Family Pupillidae

Pupoides cf. *adelaidae* (Adams & Angas, 1864)

The dead-taken juvenile specimen (WAM S83239, MG024) most closely resembles *Pupoides adelaidae*. That species has a wide geographic distribution that appears to extend from New South Wales and north-western Victoria, across southern South Australia into the wheatbelt areas of Western Australia and as far to the north-west as Morawa (Solem, 1986; Solem, 1991). It may possibly also extend from Shark Bay north to North West Cape on the west coast of Western Australia (Solem, 1986).

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Appendix 1. Specimen data for pseudoscorpions and snail collected from Mt Gould

REGNO	FLDNO	CLASS	ORDER	FAMILY	GENUS	SPECIES	LATITUDE	LONGITUDE	M	F	Juv.	TOTAL
T120042	MG006	Arachnida	Pseudoscorpiones	Garypidae	<i>Synsphyronus</i>	`PSE010`	25°47`51.56"S	117°20`32.67"E			1	1
T120044	MG022	Arachnida	Pseudoscorpiones	Garypidae	<i>Synsphyronus</i>	`PSE010`	25°48`12.72"S	117°20`14.32"E		1	1	2
T120047	MG026	Arachnida	Pseudoscorpiones	Garypidae	<i>Synsphyronus</i>	`PSE010`	25°48`18.89"S	117°20`12.9"E			3	3
T120048	MG027	Arachnida	Pseudoscorpiones	Garypidae	<i>Synsphyronus</i>	`PSE010`	25°47`58.26"S	117°20`32.76"E			1	1
T120050	MG029	Arachnida	Pseudoscorpiones	Garypidae	<i>Synsphyronus</i>	`PSE010`	25°48`8.04"S	117°20`32.29"E	3		1	4
T120051	MG032	Arachnida	Pseudoscorpiones	Garypidae	<i>Synsphyronus</i>	`PSE010`	25°48`11.38"S	117°20`47.98"E	1		1	2
T120053	MG038	Arachnida	Pseudoscorpiones	Garypidae	<i>Synsphyronus</i>	`PSE010`	25°47`53.5"S	117°20`35.3"E	1			1
T120054	MG040	Arachnida	Pseudoscorpiones	Garypidae	<i>Synsphyronus</i>	`PSE010`	25°47`54.83"S	117°20`34.08"E		1		1
T120046	MG024	Arachnida	Pseudoscorpiones	Olpidae	<i>Austrohorus</i>		25°48`15.43"S	117°20`29.49"E			1	1
T120049	MG028	Arachnida	Pseudoscorpiones	Olpidae	<i>Austrohorus</i>		25°48`5.48"S	117°20`28.36"E	1			1
T120052	MG033	Arachnida	Pseudoscorpiones	Olpidae	<i>Beierolpium</i>	`sp. 8/4`	25°47`48.57"S	117°20`34.65"E	1	1		2
T121681	MG006	Arachnida	Pseudoscorpiones	Olpidae	<i>Beierolpium</i>	`sp. juv.`	25°47`51.56"S	117°20`32.67"E			1	1
T120040	MG001	Arachnida	Pseudoscorpiones	Olpidae	<i>Indolpium</i>		25°48`7.31"S	117°20`15.06"E	1	1		2
T120041	MG005	Arachnida	Pseudoscorpiones	Olpidae	<i>Indolpium</i>		25°48`2.68"S	117°20`13.11"E				1
T120043	MG013	Arachnida	Pseudoscorpiones	Olpidae	<i>Indolpium</i>		25°48`18.89"S	117°19`56.56"E	1			1
T120045	MG023	Arachnida	Pseudoscorpiones	Olpidae	<i>Indolpium</i>		25°48`12.86"S	117°20`17.13"E	1			1
T121682	MG029	Arachnida	Pseudoscorpiones	Olpidae	<i>Indolpium</i>		25°48`8.04"S	117°20`32.29"E			1	1
S83239	MG024	Gastropoda	Stylommatophora	Pupillidae	<i>Pupoides</i>	`cf. adalaidae`	25°48`15.43"S	117°20`29.49"E			1	1