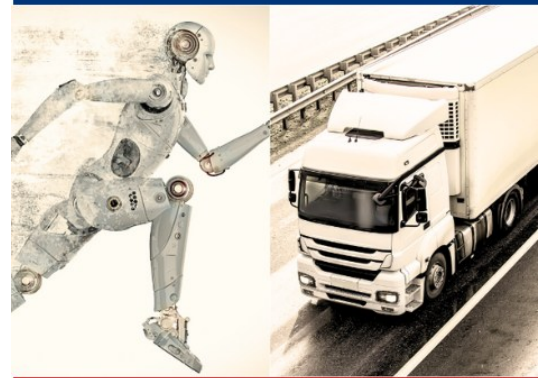


Trench Operation:
Native Vegetation Clearing Permit
Supporting Document



ASX : TGN



4th May 2026

Revision Schedule:

Date	Revision	Reason for Change	Reviewed
9/02/2026	R0	First Version	BBastow
27/02/2026	R0	Client Review	DJordan, SNagra
23/03/2026	R0	Client Review – addressing previous feedback	DJordan, AGreville
3/04/2026	R1	Final For Submission	DJordan, AGreville
4/05/2026	R2	Revised numbers and figures	DJordan, AGreville

EXECUTIVE SUMMARY

Tungsten Mining NL, through its wholly owned subsidiary, Mid-West Tungsten Pty Ltd (Mid-West Tungsten), proposes to develop the Trench Operation (the Trench; the operation). The operation is located approximately 330km northeast of Perth and 15km northeast of Rothsay, in the Shire of Perenjori. Access to the operation is via the Warriedar Copper Mine Road and historic Minjar Haul Road.

Mid-West Tungsten proposes to clear up to 402.80ha within an application area of 2,704.6ha to develop the Trench open pit and establish a tailings storage facility, processing plant, waste rock landforms, internal roads, pipelines and other supporting infrastructure. The proposed clearing has taken into consideration the significant environmental values known to occur on site. As a result, all known threatened flora taxa have been avoided, and impacts to conservation-significant fauna, priority flora, and priority invertebrates (including SREs) have been minimised where practicable through the conceptual site layout.

Ownership for the tenements associated with the operation has changed multiple times, with one of the first mines established in the early 1900s. As a result, historic disturbance is present across the tenure and accounts for approximately 243.86ha or 9.0% of the application area. This historic disturbance was considered while planning the conceptual site layout and will be used, where possible, in preference to clearing new areas. Where this is not possible, Mid-West Tungsten will minimise the clearing where practicable, taking into account safety requirements.

The operation is located within the Tallering sub-region of the Yalgoo Interim Biogeographic Regionalisation of Australia, which is characterised by low to open woodlands of Eucalyptus, Acacia and Callitris on red sandy plains. The operation is within the Mongers Lake catchment system, which comprises a long chain of salt lakes and low-lying areas extending along the east and south of the operation. There are no surface water bodies within the application area. Drainage is typically from small rocky creeks in steeper areas where there is sufficient water contributing to the catchment; where no creek has formed, flow is effectively overland in topographic valleys (Hydrologia, 2024).

Flora and vegetation surveys undertaken since 2011 within and surrounding the application area have identified no State or Nationally listed threatened or priority ecological communities, no groundwater dependent ecosystems, one threatened flora species listed under the WA *Biodiversity Conservation Act 2016* (BC Act) and 19 priority flora species listed by the Department of Biodiversity, Conservation and Attractions (DBCA) within the application area. The threatened species *Acacia sulcatacaulis* (EN) has a limited distribution, with most of the known occurrences within the application area. All priority species are also known to occur within a 50km radius of the application area, based on the DBCA's flora database. No *Acacia sulcatacaulis* (EN) are proposed to be cleared as a 50m exclusion zone has been applied to all known individuals during the conceptual site layout design. The proposed clearing envelope has been designed to limit clearing for 11 priority flora species and avoid clearing for the remaining 8 priority flora species. The proposed clearing will result in the removal of two Priority 1 (P1) and nine Priority 3 (P3) flora species, with impacts limited to less than 5% of all priority species within the conceptual site layout, except for *Allocasuarina tessellata* (P3), which is estimated at 9.5% of the known plants. Based on the work completed to date, additional occurrences of *Allocasuarina tessellata* (P3) are likely, as the entire application area has not been surveyed. It is believed the actual impact on *Allocasuarina tessellata* (P3) will be less than 9.5% if additional surveys were completed.

Vegetation in the application area ranges from cleared/degraded to excellent, with nine vegetation units identified, including a mosaic and a degraded unit. Spectrum Ecology (2021) determined that the vegetation units AdAa, AdAt and AsCp are locally significant, with approximately 5.4% AdAa and 12.2% AdAt of the mapped extent proposed to be cleared. No clearing is proposed within the vegetation unit AsCp, which was found to be restricted to within the application area. Vegetation units AdAa and AdAt, are known from additional locations within a 20km radius of the application area (JBBC & ISPL, 2026a).

None of the identified vegetation units aligns with a known Threatened Ecological Community (TEC) or Priority Ecological Community (PEC). Seven PECs have been recorded within 5km of the application area, which are geologically restricted to Banded Ironstone Formations of the Blue Hills, Warriedar, Pinyalling and Walagnumming ranges, and are unlikely to occur in the application area. No TECs are recorded within 15km of the application area.

Vertebrate fauna and Short-range Endemic (SRE) habitat have been mapped across and around the application area by Spectrum Ecology (2022), Western Ecological (2026) and Bennelongia (2026a). Four terrestrial fauna habitats, along with eight SRE habitats, have been identified, including a cleared/degraded unit, with none of the identified habitats restricted to the application area. Western Ecological (2026) noted the Rocky Hill habitat is restricted to higher elevations, with less than 1% of the total mapped extent proposed for clearing. Most of the

proposed clearing is within the Open Eucalyptus Woodland (22.1%), followed by Mixed Shrubland (11.1%). Similarly, for the SRE fauna, habitat clearing is largely proposed in the Open Eucalyptus Woodland (10.8%), with less than 5% of the other habitats cleared. No clearing is proposed within the Sandplains with Mixed Shrublands habitat. Bennelongia (2026a) noted that the SRE habitats Granite Outcrops and Low Hills with Mixed Shrublands have a moderate-high prospectivity for SRE species.

Four conservation-significant fauna species have been recorded in the application area, with three also listed under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act). A total of 37 Malleefowl (*Leipoa ocellata*) (VU under the EPBC Act and BC Act) mounds were recorded in the application area with a mound, which was inactive during Western Ecological's (2026) assessment, identified within the conceptual site layout. The application area contains 181 mygalomorph burrows belonging to *Idiosoma gutharuka* (P1) (50 burrows), *I. clypeatum* (P3) (109 burrows), and *I. intermedium* (P3) (22 burrows); the conceptual site layout includes 37 *I. clypeatum* (P3) and eight *I. intermedium* (P3) burrows. No *I. gutharuka* (P1) burrows are proposed to be impacted, with the nearest record being 500m from the proposed disturbance area. All these species have also been recorded within 50km of the operation area.

Mid-West Tungsten has identified potential impacts on flora, fauna and surface water resulting from clearing and will implement management measures. These measures include, but are not limited to:

- Avoiding Threatened Flora locations;
- Designing around all conservation-significant values;
- Undertaking pre-clearance inspections for conservation-significant flora and fauna species and making adjustments to stay within impact limits;
- Marking out areas for retention and verifying them before clearing;
- Installing appropriate infrastructure for disturbed drainage channels and undertaking clearing progressively;
- Restrict vehicle movements to approved tracks and roads;
- Ensure staff and contractors are aware of the location of conservation significant flora and their responsibility to ensure they are protected;
- Implementing weed hygiene procedures and vehicle/equipment inspections; and
- Implementing dust control on roads and stockpiles.

An assessment against the 10 Principles outlined in Schedule 5 of the *Environmental Protection Act 1986* (WA) has identified that the proposed clearing may be at variance with three Principles. These three principles are:

- (a) clearing native vegetation with a high level of biological diversity;
- (b) vegetation comprising a significant fauna habitat; and
- (h) impacts to environmental values of nearby conservation areas.

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1. INTRODUCTION

Location, Ownership & Tenure

Tungsten Mining NL, through its wholly owned subsidiary Mid-West Tungsten Pty Ltd (Mid-West Tungsten), proposes to develop the Trench Operation (Trench; the operation). The operation is situated approximately 330km northeast of Perth and 15km northeast of Rothsay in the Shire of Perenjori (Figure 1). Site access to the operation is via the Warriedar Copper Mine Road and historic Minjar Haul Road.

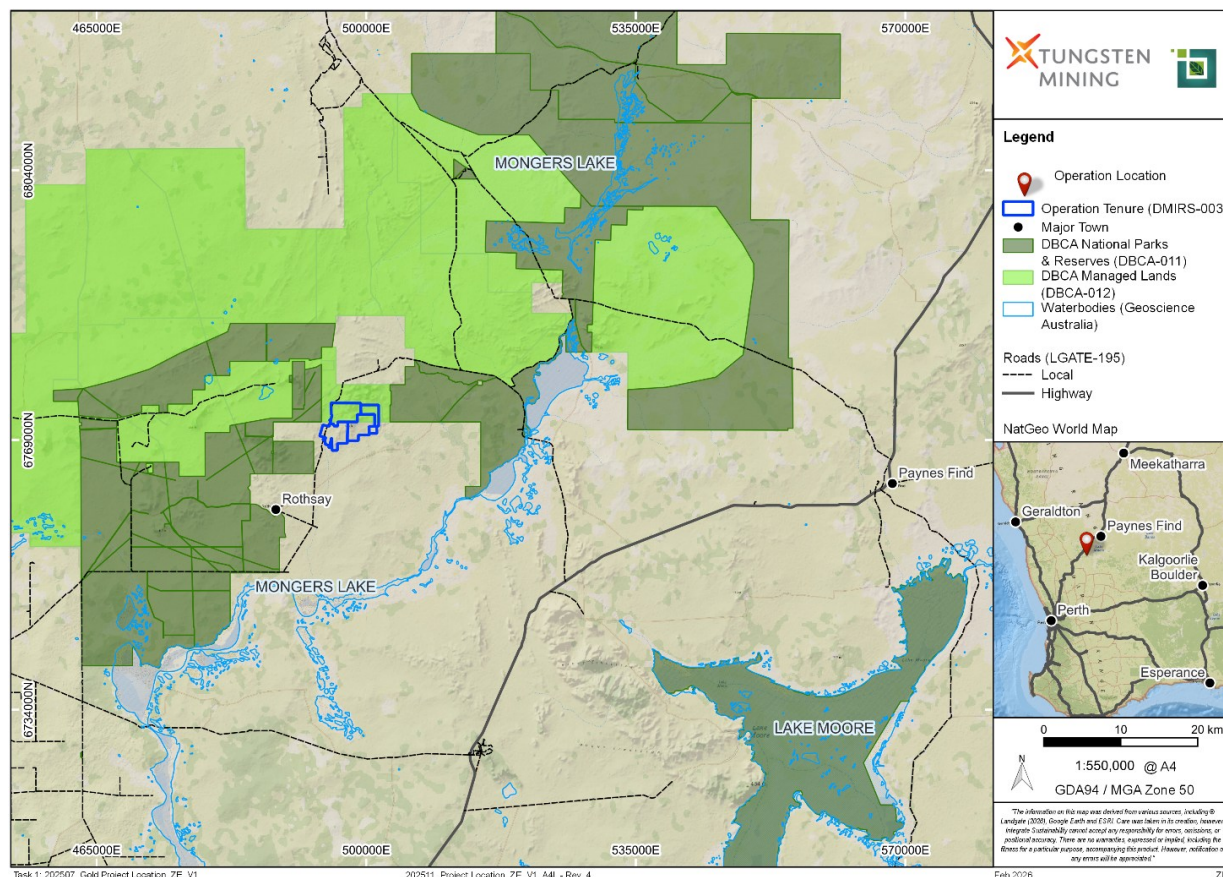


Figure 1 Operation Location

The operation is located within tenements M59/386, M59/387, M59/425, L59/161, L59/162, E59/1324 and P59/2244 (Figure 2). Tungsten Mining NL completed an agreement with Minjar Gold Pty Ltd in December 2024 to transfer ownership of the Mining Leases and Exploration Licence to Mid-West Tungsten (Tungsten Mining NL, 2024) (Table 1). The Miscellaneous Licences are held by Mid-West Tungsten along with the Prospecting Licence, which will be replaced by either a General Purpose or Miscellaneous Licence.

Tenements M59/386, M59/425, L59/161 and E59/1324 are partially located within the Department of Biodiversity, Conservation and Attractions (DBCA) lands of interest, the former Karara Pastoral station (Figure 2). Tenement M59/387, L59/162 and P59/2244 along with a portion of M59/386, M59/425 and E59/1324 are partly within the Wanarra Pastoral lease.

Table 1 Operation Tenure

Tenement	Area (ha)	Holder	Granted	Expiry
M59/386	843.35	Minjar Gold Pty Ltd*	25/07/1995	19/12/2037
M59/387	886.75	Minjar Gold Pty Ltd*	25/07/1995	19/12/2037
M59/425	940.00	Minjar Gold Pty Ltd*	19/09/1996	16/10/2045
E59/1324	453.77	Minjar Gold Pty Ltd*	23/03/2007	21/09/2026
L59/161	2.76	Mid-West Tungsten Pty Ltd	23/11/2018	22/11/2039
L59/162	3.95	Mid-West Tungsten Pty Ltd	28/09/2018	27/09/2039
P59/2244	28.15	Mid-West Tungsten Pty Ltd	9/06/2020	8/06/2028

* In the process of being transferred to Mid-West Tungsten Pty Ltd

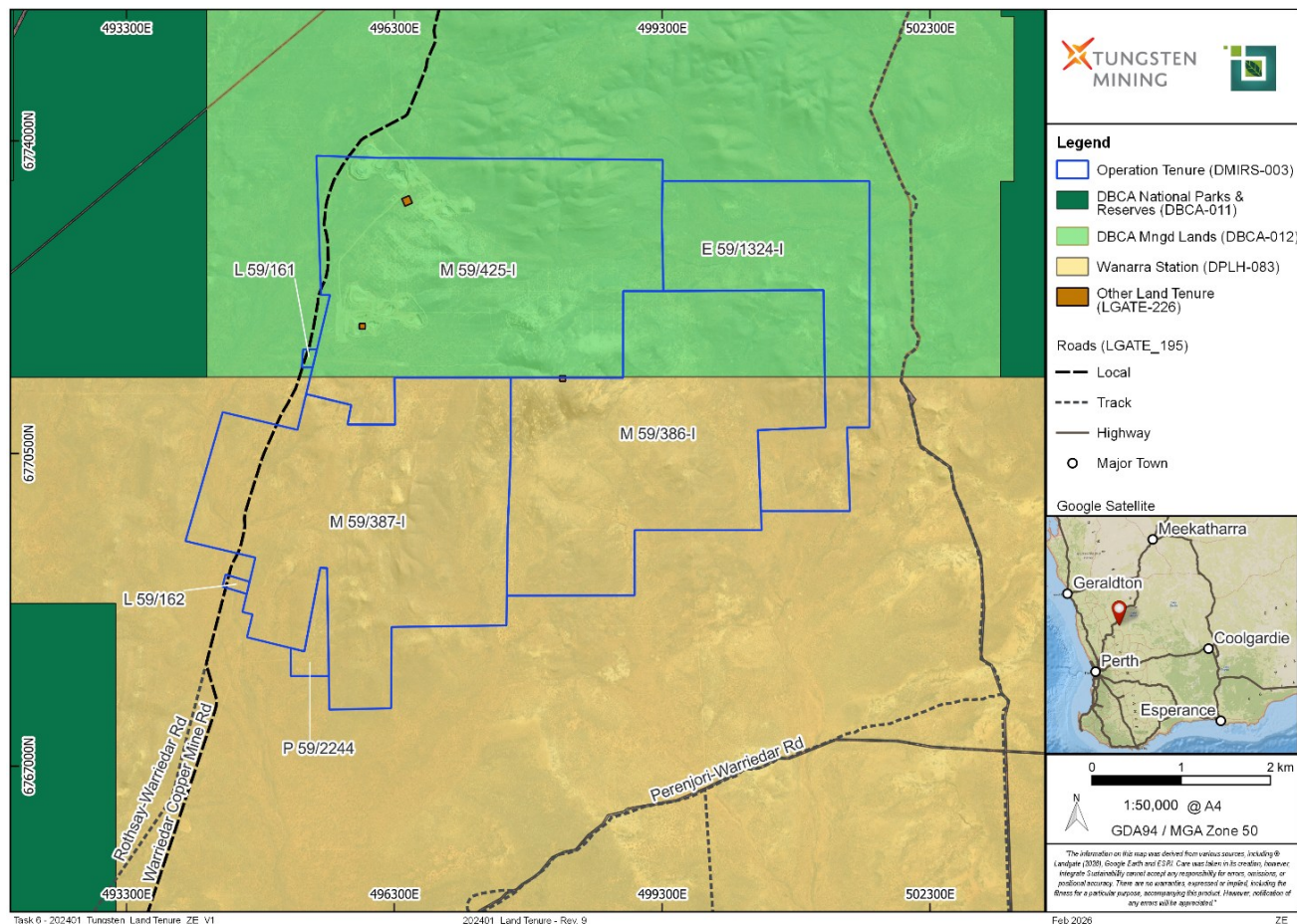


Figure 2 Operation Tenure and Underlying Land

History

Mining first commenced at Rothsay, approximately 26km east of the operation, in the late 1890s and operated irregularly until 1939. Mining at Paynes Find, located approximately 70km west, first commenced in the early 1900s, with exploration works ongoing. Prolific mining for iron ore, gold and base metals is present in the local area of the operation.

Ownership of the operational tenure has changed multiple times, with exploration initiated by Minefields Exploration NL, and Australian and New Zealand Exploration Company. The Highland Chief mine, located in tenement M59/425, was established in the early 1900s as one of the first mines within the operational tenure. Mines such as Black Dog, Bobby McGee and Camp have occurred more recently.

In December 1999, the operational tenements were purchased by Gindalbie Gold NL (name changed to Gindalbie Metals Ltd) who began gold mining operations. Gindalbie Metals Ltd then entered into the Mt Mulgine Joint Venture and Farm-in Agreement in 2005 with Vital Metals Limited for the tungsten and molybdenum mineral rights. In 2010, Vital Metals Limited assigned their 70% interest in the tungsten and molybdenum rights to Hazelwood Resources Limited (currently ATC Alloys Ltd), who then acquired the remaining 30% interest from Gindalbie Metals Ltd in 2013.

Through a sale agreement with Hazelwood Resources Limited in December 2015, Mid-West Tungsten acquired the entire tungsten and molybdenum rights across the tenements package.

In 2017, an initial site layout for the operation was referred to the Environmental Protection Authority (EPA) for assessment under Part IV of the *Environmental Protection Act 1986* (WA) (EP Act). The EPA decided not to formally assess the 2017 proposed operation as it was unlikely to have a significant impact. In 2020, the site layout was then changed when Mid-West Tungsten applied for a Native Vegetation Clearing Permit and Mining Proposal. The Mining Proposal was approved while the Native Vegetation Clearing Permit was not approved, as a result, no mining has occurred for the operation.

In November 2024, Mid-West Tungsten initiated an agreement with Minjar Gold Pty Ltd, who held mineral rights over the tenements other than for tungsten and molybdenum, to acquire all interests, rights and title related to the operation. The acquisition was completed in December 2024.

Proposal Description

Mid-West Tungsten proposes to initiate mining at the Trench deposit for tungsten, molybdenum and gold ore. The operation will comprise an open pit, waste rock landforms, internal roads, Run of Mine (ROM) pad, low-grade ore stockpile, topsoil stockpiles, pipeline, processing plant and other infrastructure to support the operation (Figure 3). A summary of the operation and proposed clearing are provided in Table 2.

Table 2 Proposal Summary

Site Details	
Project Name	Trench Operation
Description of Operation	Open pit mining at the Trench deposit for tungsten, molybdenum and gold ore.
Project Commencement	Q4, 2026
Clearing Details	
Total Clearing Proposed	402.80ha
Clearing Method	Clearing will be undertaken through mechanical means.
Purpose of Clearing	Develop the Trench open-pit, tailings storage facility, processing plant, waste rock landforms, internal roads, solar farm and other supporting infrastructure.
Proponent Details	
Company Name	Mid-West Tungsten Pty Ltd
ABN	68 609 574 503
Postal Address	Level 4/46 Colin St West Perth WA 6005
Key Contact	Daniel Jordan ESG Manager Email: daniel@tungstenmining.com Phone Number: 0428 397 935

Proposed Clearing

Mid-West Tungsten is applying to clear a maximum of 402.80ha of native vegetation over five tenements (Table 3) within an overall area of 2,704.6ha (application area) (Figure 3). The proposed clearing will allow the following activities:

- Development of the Trench open pit;
- Establishment of a processing plant, ROM pad and tailings storage facility; and
- Establishment of supporting infrastructure, including, but not limited to, internal roads, mine service area, low-grade ore stockpile and topsoil stockpile areas.

Where possible, previously disturbed areas were considered during planning and will be used in preference to clearing new areas for the operation. Where this is not possible, Mid-West Tungsten will minimise the cleared area as much as practicable considering safety requirements.

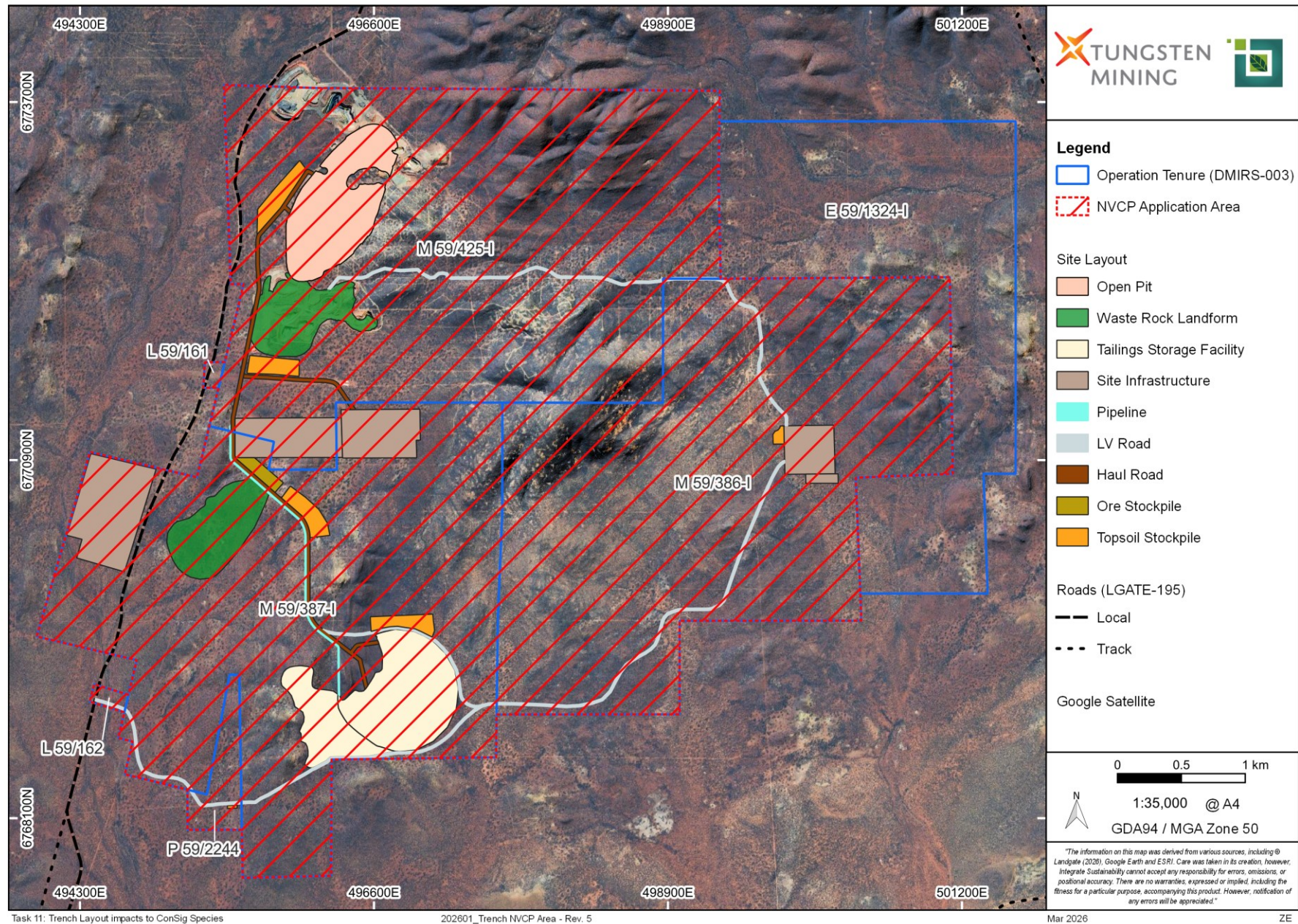


Figure 3 Conceptual Site Layout within Application Area

Table 3 Proposed Disturbance per Tenement

Tenement	Proposed Disturbance (ha)
M59/386	27.79
M59/387	228.40
M59/425	145.04
L59/162	0.49
P59/2244	1.08
Total	402.80

Past approvals and historic disturbance

In February 2014, Minjar obtained approvals for the Mining Proposal (Reg ID: 43533) and the Native Vegetation Clearing Permit (NVCP) (CPS 5809/1) for activities at Black Dog, Mugs Luck, Bobby McGee, Trench and Camp to recover gold-bearing ore. Amendments were made to these approvals in 2014 and 2015 to reflect changes to the layout of the original project. Mining Proposal (Reg. ID: 47711) was approved in May 2014 and a variation to the NVCP (CPS 5809/2) was approved in June 2014. A further amendment for the Camp pits and associated activities was approved via Mining Proposal (Reg. ID: 52906) in January 2015, and the NVCP (CPS 5809/3) was amended and approved in December 2014. In July 2015, further changes were made to the Camp layout via the Mining Proposal (Reg ID: 55029) and an amendment to NVCP (CPS 5809/4)).

Historic disturbance is present in the application area (Figure 4) as a result of previous exploration and mining activities undertaken in the operation area. In total, this previous disturbance accounts for approximately 243.86ha and 9.0% of the application area.

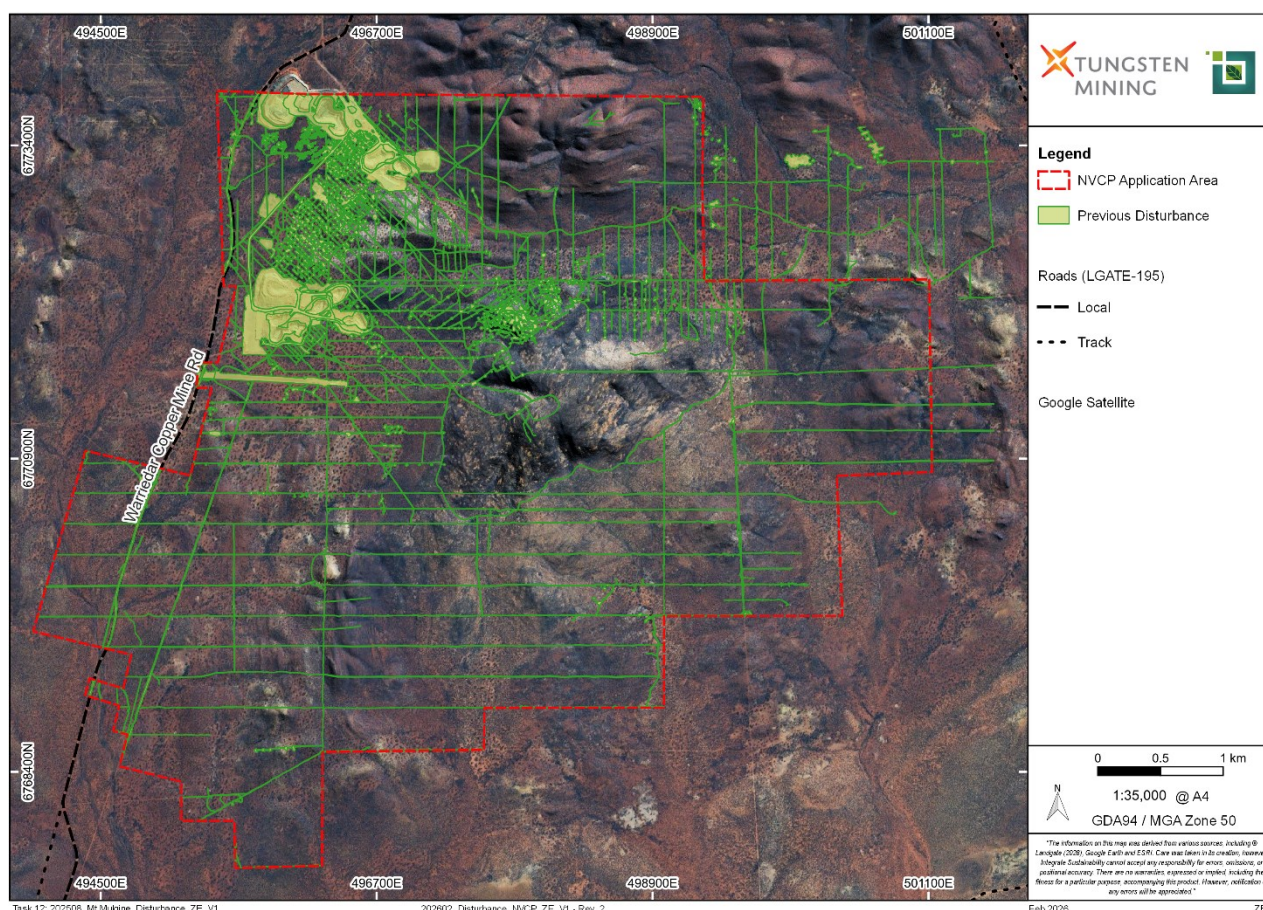


Figure 4 Previous Disturbance in the Application Area

In 2017, TGN referred the Mulgine Tungsten Project to the EPA for assessment (at the time, the project proposed clearing 146.21ha). The EPA decided not to formally assess as it was unlikely to have a significant impact on the environment. As the proposed operation is similar to the 2017 proposal, the Department of Water and Environmental Regulation Green Energy Team has advised that the current project does not require reconsideration by the EPA and can be managed under the *Environmental Protection Act 1986*, Part V, Native Vegetation Clearing Permit process.

2. STAKEHOLDER ENGAGEMENT

Mid-West Tungsten understands the importance of developing and maintaining relationships with stakeholders for the operation to run smoothly. A combination of stakeholder engagement mechanisms has been and will continue to be utilised to ensure all stakeholders are aware of the operation. These mechanisms include face-to-face meetings, virtual/online meetings, phone calls, emails and report distribution.

Mid-West Tungsten has determined the following stakeholders are affected, likely to affect, or have an interest in the operation:

- Department of Mines, Petroleum and Exploration;
- Department of Water and Environmental Regulation;
- Department of Biodiversity, Conservation and Attractions;
- Pastoral Lease holders – Wanarra; and
- Aboriginal People – Badamia People, Southern Yamatji.

Stakeholder engagement has occurred throughout the development of Trench, with current engagement focused on understanding the best approach for submitting this NVCP application (Table 4).

Table 4 Stakeholder Engagement

Date	Stakeholder	Communication
15/12/2025	Department of Mines, Petroleum and Exploration (DMPE) – Native Vegetation Branch	Discussion about the proposed activities associated with Trench and the approach for submitting the NVCP. DMPE suggested it was more appropriate to submit the application to DWER for assessment, as Trench relates to tungsten, a critical mineral.
17/12/2025	DBCA Environmental Management Branch and Threatened Species and Communities	Discussion about proposed activities and future plans for Trench.
22/01/2026	Department of Water and Environmental Regulation (DWER) Green Energy Branch	Introductory discussion about the approach for the NVCP application and provided a summary of the changes to the operation over time. A detailed overview with maps of the operation changes was requested.
5/02/2026	DWER Water Licensing	Discussion about likely water sources outside of the operation area to assist with future proposed activities for Trench. Further information about areas of interest, likely water requirements and timing, and an overview of the operation was requested.
17/02/2026	DWER Water Licensing	TGN provided the requested information about the operation, its water requirements and timing, and areas of interest for water.
25/02/2026	DWER Green Energy Branch	TGN provided the requested overview and maps detailing changes to the operation through the different approval processes
18/03/2026	DWER Green Energy Branch	Discussion about the provided information with a request for further information and spatial data for the site layout related to the different approval processes for the operation
30/03/2026	DWER Green Energy Branch	Received feedback about the approach. It was found that the current operation was overall the same as the one proposed in 2017, and as such, the potential impacts can be managed under Part V Division 2 of the EP Act. It was also recommended that the application is submitted to DMPE for assessment.
31/03/2026	DWER Water Licensing	Discussion about water sources available outside of the operation to assist with future proposed activities for Trench.

3. ENVIRONMENTAL SETTING

Climate

The climate for the operation is characterised by hot, dry summers and cool, moist winters. The closest weather monitoring station with long-term data is located at Paynes Find (~60-80km east; Bureau of Meteorology (BoM) Station 7139, 1919-). Data recorded at Paynes Find shows the maximum rainfall is from May to August, with a slight increase in March (Figure 5). Higher March falls are often a result of tropical lows (including ex-tropical cyclones) trending southeast over WA or summer thunderstorms.

Average maximum temperatures at Paynes Find vary from 18.6°C to 37.4°C across the year, with temperatures above 30.0°C recorded from November to March (Figure 5). Average minimum temperatures range from 5.4°C to 21.1°C, with temperatures below 10.0°C recorded from May to September.

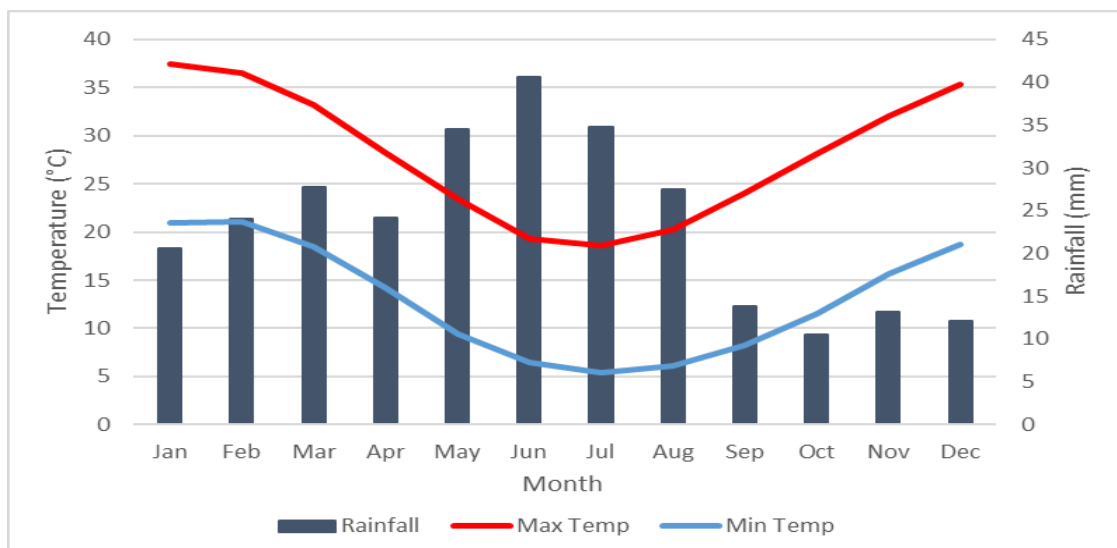


Figure 5 Long-term Rainfall and Temperature Recorded at Paynes Find

Bioregion

The Interim Biogeographic Regionalisation for Australia (IBRA) was developed by the Australian Government's Department of Sustainability, Environment, Water, Population and Communities (currently Department of Climate Change, Energy, the Environment and Water) (Thackway & Cresswell, 2017). It is a landscape-based approach that classifies Australia into regions based on dominant landscape, climate, lithology, geology, landforms, and vegetation.

The operation is located within the Yalgoo IBRA region and Talling IBRA sub-region (Figure 6). The Yalgoo IBRA region is the interzone between the cooler, moister Avon Wheatbelt region and the semi-arid to arid Murchison and Coolgardie regions. It is characterised by Callitris/Gimlet, Mulga, and Bowgada open woodlands and scrubs on earth-to-sandy-earth plains in the Western Yilgarn Craton and the Southern Carnarvon Basin.

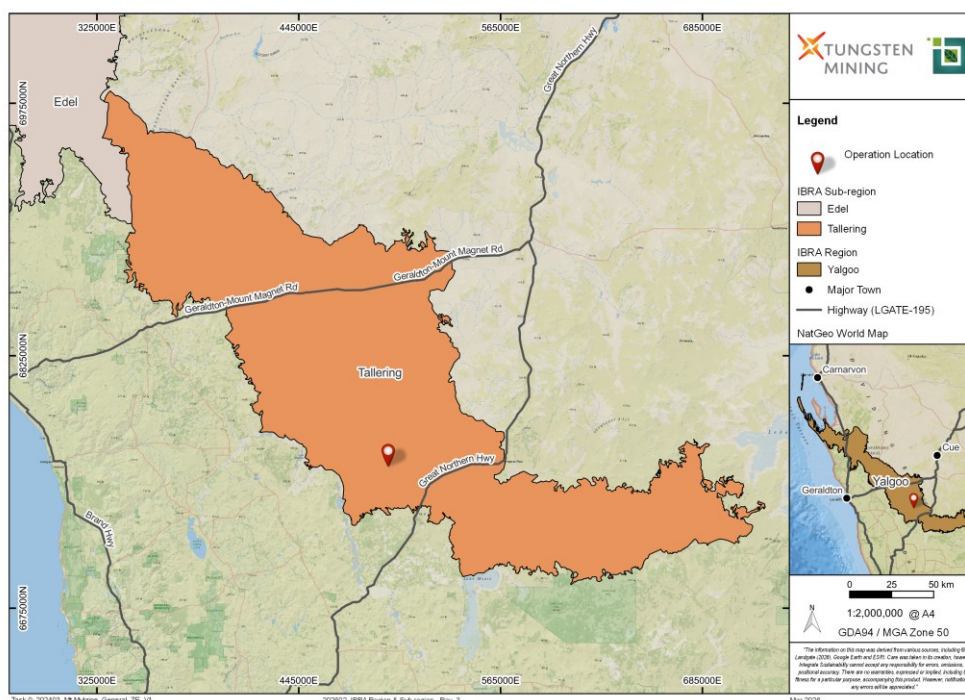


Figure 6 IBRA Region and IBRA Sub-region for the operation

The Tallering IBRA sub-region is underlain by the north end of the Phanerozoic Perth Basin, along with parts of the Western Terraines and the southern end of the Narryer Terraine of the Yilgarn Craton (McKenzie, Keighery, & Gibson, 2001). The sub-region is characterised by low- to open-woodlands of Eucalyptus, Acacia and Callitris on red sandy plains.

Land Systems

Payne *et al.* (1998) completed a survey from 1992 to 1993 that characterised the Sandstone-Yalgoo-Paynes Find area. Geology, landforms, vegetation and soils were described to characterise different land systems.

The application area includes six land systems (Figure 7; Table 5), which are well represented in the wider region. It is noted that the Singleton land system covers the smallest area in Western Australia at 23,834ha and is associated with rugged greenstone hills present within and around the application area. The Yowie land system is associated with loamy plains and covers over 1,500,000ha across Western Australia, but it is the smallest area within the application area.

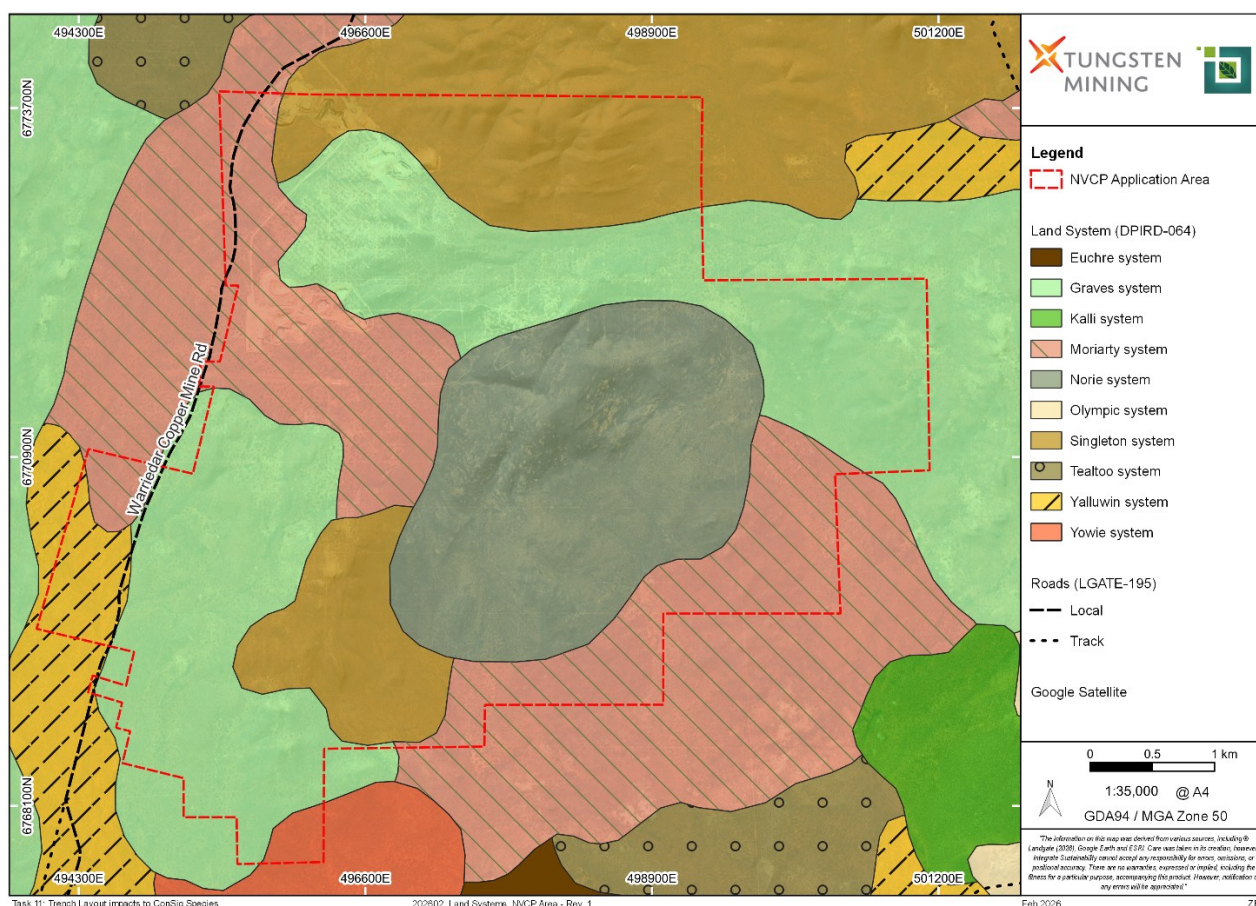


Figure 7 Land Systems within the Application Area

Table 5 Land System Descriptions

Land System	Extent (ha)	Land Type	Description
Graves	129,528	Low hills with Eucalypt-halophyte woodlands and Acacia shrublands	Basalt and greenstone rises and low hills, supporting Eucalypt woodlands with prominent saltbush and bluebush understorey
Moriarty	219,719	Stony plains and lower alluvial plains with predominantly saline soils and halophytic shrublands	Low greenstone rises and stony plains supporting halophytic and Acacia shrublands with patchy Eucalypt overstorey
Norie	218,337	Hills with Acacia shrublands	Granite hills with exfoliating domes and extensive tor fields supporting Acacia shrublands
Singleton	23,834	Hills with mixed shrublands	Rugged greenstone ranges with dense Casuarina and Acacia shrublands
Yalluwin	26,278	Wash plains on hardpan with Mulga shrublands	Hardpan plains and drainage tracts carrying concentrated flow supporting Mulga, Curare and other Acacia
Yowie	1,605,576	Plains with deep sandy soils supporting Acacia shrublands and occasionally with wanderrie grasses	Loamy plains supporting shrublands of Mulga and Bowgada with patchy wanderrie grasses

Soils

Soil landscape surveys and mapping completed over Western Australia (Tille, 2006) show that the application area is within the Murchison Province, which is characterised by hardpan wash plains and sandplains (with some stony

plains, hills, mesas and salt lakes) on granitic rocks and greenstone of the central north-western portion of the Yilgarn Craton. The Murchison Province is divided into seven soil-landscape units, with the application area located within the Karara Hills, Plains and Lakes Zone (270). The Karara Hills, Plains and Lakes Zone is characterised by hills and ranges, sandy plains, hardpan wash plains, stony plains and salt lakes (with some mesas and plains) on greenstone and granitic rocks of the Yilgarn Craton (Tille, 2006). Soils include red shallow loams, red loamy earths, red deep sands, salt-lake soils, some red shallow sands, stony soils, and red shallow sandy duplexes.

In 2018, Grame Campbell & Associates Pty Ltd (GCA) (2018) was commissioned by Mid-West Tungsten to conduct a Soils Assessment Study over an initial site layout for the operation. In total, 66 samples were collected, including 60 topsoil and six subsoil samples. The study found that the topsoil samples were predominantly classified as shallow, duplex soils with light-to-moderate texture of colluvial origin, whereas the subsoil samples were classified as red-brown hardpans.

Across the topsoil samples, pH (1:5 with water) ranged from 4.3-8.0, with a pH<5.0 found above the Greisen regolith. The subsoils, on the other hand, ranged from pH 6.1-8.3, with only two samples having a pH>8.0. Electrical Conductivity (EC) (1:5 with water) was 0.019-1.550dS/m in the topsoil and 0.085-1.050dS/m in the subsoil; only three samples recorded EC above 1.0dS/m, including a subsoil sample, with most samples below 0.5dS/m.

Concentrations of macro nutrients, including total nitrogen, Colwell-phosphorus and potassium, and KCl extractable sulfur, were modest for all the samples, and reflected the highly efficient and 'tight' cycling of nutrients within natural rangeland ecosystems. Plant available water capacity ranged from 10-15% (v/v) for the topsoil and 11-13% for the subsoil, indicating a non-limiting ability for water to infiltrate to the plant roots of rangeland species.

Surface Water

The application area is within the Mongers Lake catchment system, which comprises a long chain of salt lakes and low-lying areas extending along the east and south of the operation. Drainage typically originates from small rocky creeks in steeper areas where sufficient runoff contributes to the catchment (Figure 8). Where no creek has formed, flow is effectively overland in topographic valleys (Hydrologia, 2024). These creeks and flow paths typically dissipate quickly onto wash plains below the steeper hillslopes, although some larger streamlines to the west and south persist over a longer distance but dissipate before reaching Mongers Lake, approximately 22km to the south.

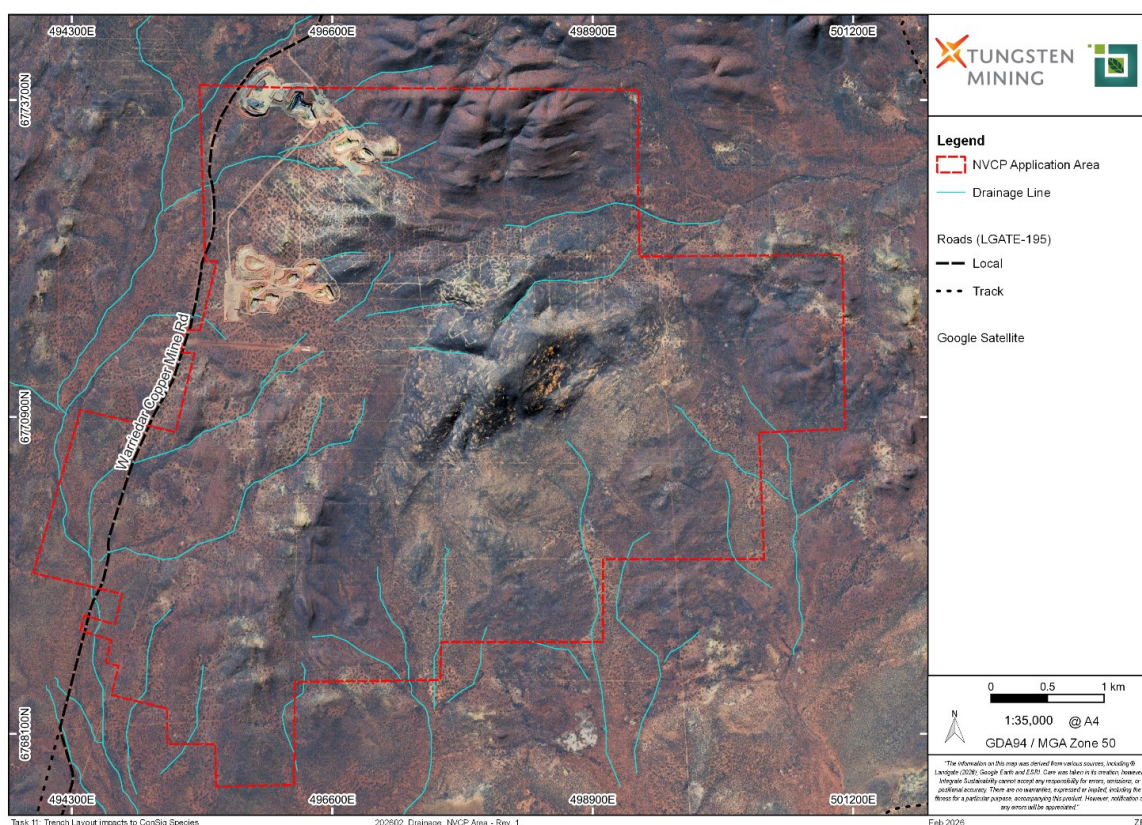


Figure 8 Drainage Lines through the Application Area

Groundwater

The application area is within the Mullewa/Byro groundwater resource subarea of the Gascoyne groundwater province. Regionally, groundwater flows from catchment divides and bedrock ridges towards valley floors, primarily discharging into salt lakes south of the operation. The groundwater system is recharged by rainfall, with most recharge occurring during heavy rainfall as a result of additional surface runoff and local flooding (Water Resource Management Division, 2006).

Groundwater in the local area primarily occurs within fractured rock aquifers and palaeochannel aquifers (Rockwater, 2025). Three production bores are present in the application area (Figure 9), which were installed by Minjar Gold Pty

Ltd in the fractured rock aquifer. These bores have been cumulatively pumped at a rate of 6-8L/s since 2014, with groundwater level measured in 2024 at 63.81m and 72.65m below ground level for BDW005 and BDW007, respectively (Rockwater, 2025). No groundwater level data was recorded for BDW003. Salinity from these bores has been measured at 1,010mg/L, which is considered brackish.

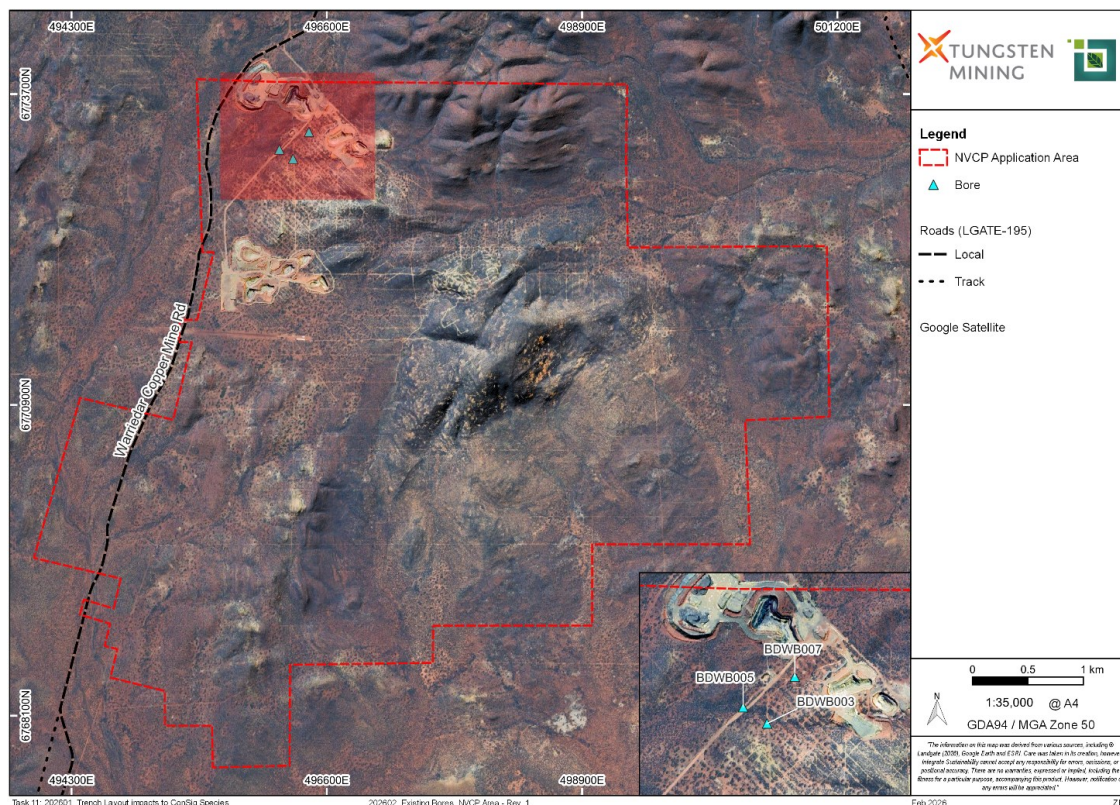


Figure 9 Bores within Application Area

Groundwater Dependent Ecosystems

A search of the Groundwater Dependent Ecosystem (GDE) Atlas was completed on 30 March 2026, which found no GDEs present within the operational area (Figure 10). The search did, however, identify a Low potential GDE within 5km which is associated with shrublands and described as Bowgada and *Acacia quadrimarginea* on stony ridges. Three High potential GDEs were also identified within 20km, which are associated with two salt lakes and a wetland.

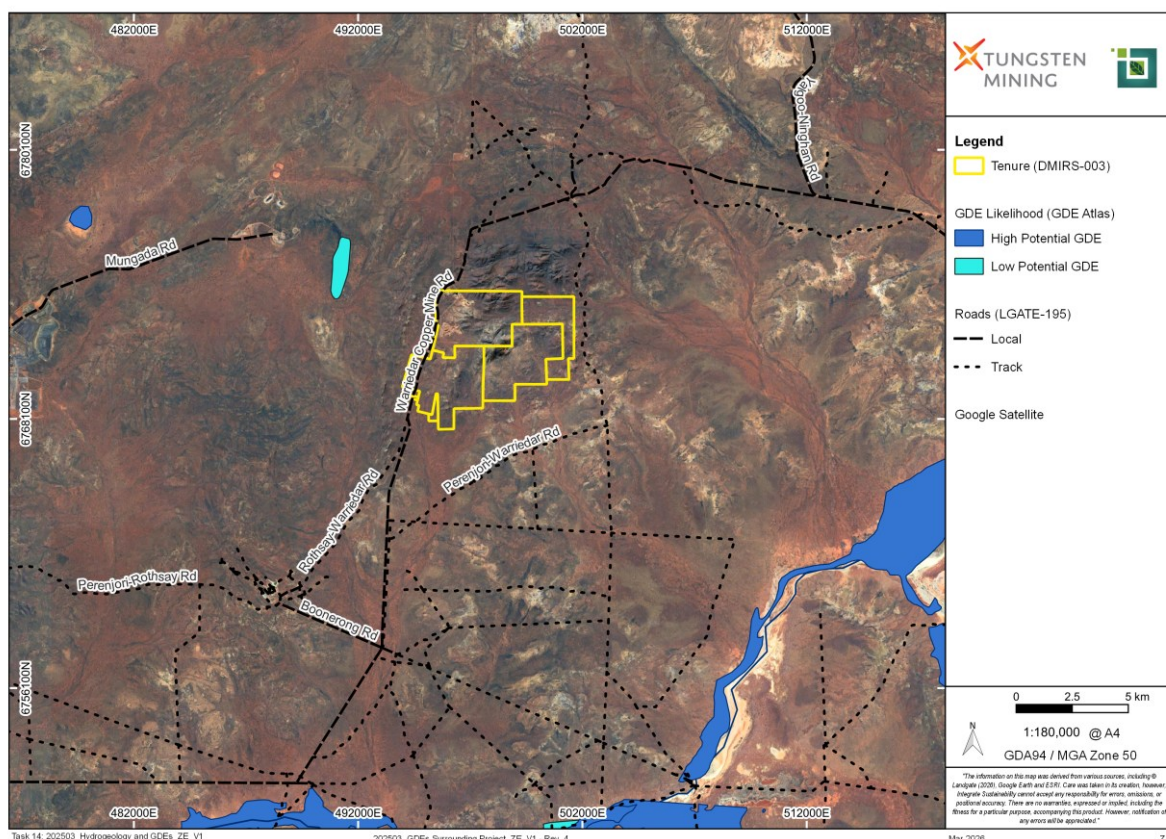


Figure 10 Groundwater Dependent Ecosystems Surrounding Trench

Flora and Vegetation

Flora and vegetation surveys have been conducted across the application area and the region since 2011 by APM, Ecoscape, Jenny Borger Botanical Consulting (JBBC), Spectrum Ecology, and Terratree.

Between 2019 and 2021, Spectrum Ecology (2021) was engaged by Tungsten Mining NL to undertake a Flora and Vegetation Assessment over the operation area ([Appendix A](#)). During the assessment, Spectrum Ecology consolidated results from the previous surveys and conducted four field surveys to characterise flora and vegetation.

Tungsten Mining NL engaged JBBC, with support from Integrate Sustainability Pty Ltd (ISPL), to undertake a Targeted Search of Locally Significant Vegetation Communities within 20km of the operation in 2023 (JBBC & ISPL, 2026a) ([Appendix B](#)) and a Conservation Significant Flora Survey over the proposed activity area in 2025 (Figure 11) (JBBC & ISPL, 2026b) ([Appendix C](#)). During the targeted search, JBBC & ISPL undertook a survey to determine the presence of three locally significant vegetation units outside the operation area. The flora survey involved two survey trips targeting known conservation-significant flora species.

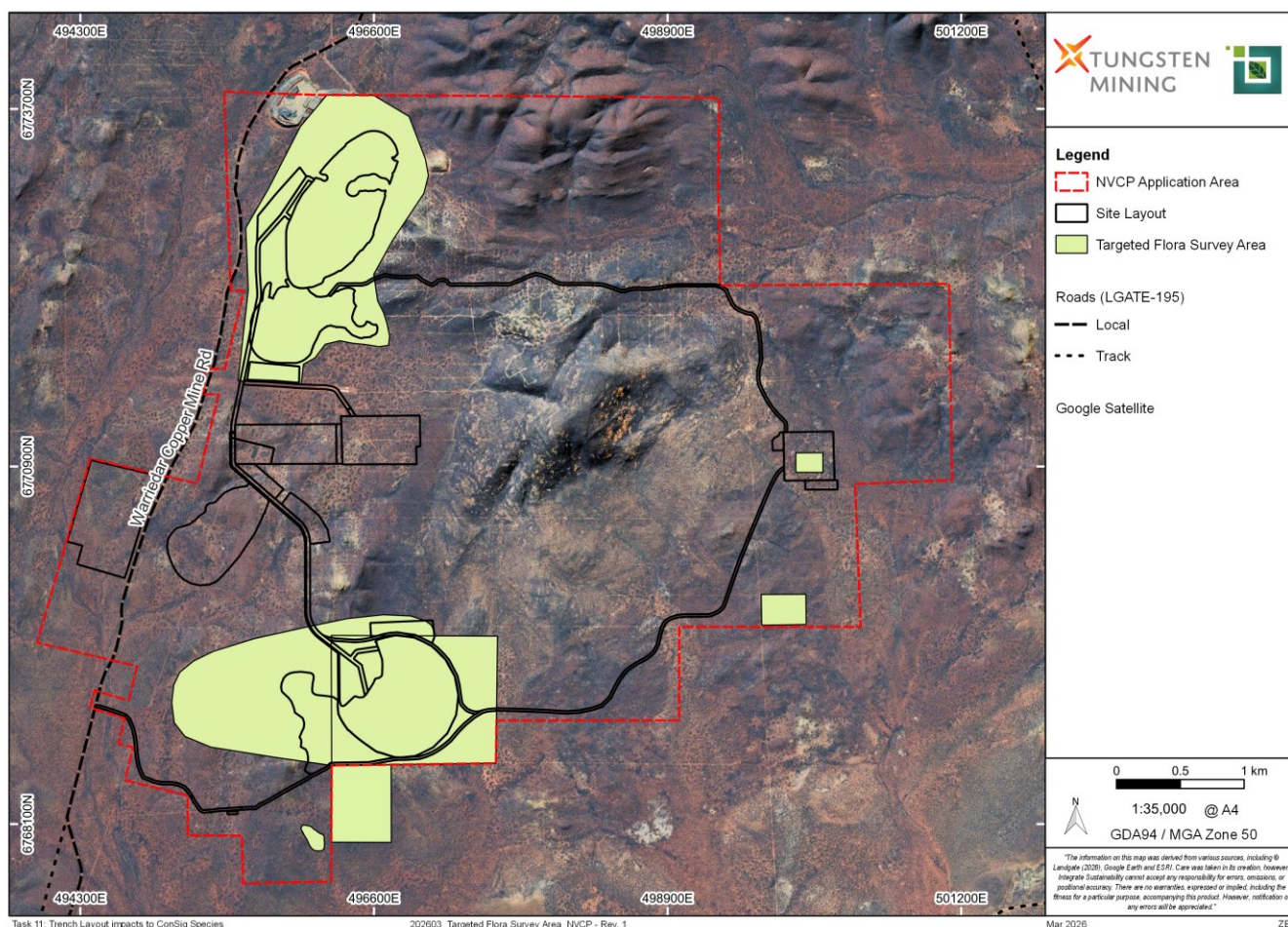


Figure 11 2025 Targeted Flora Survey Area over the Conceptual Site Layout

Conservation-Significant Flora

Flora surveys have identified 20 conservation-significant species listed under either the *Biodiversity Conservation Act 2016* (WA) (BC Act) or by the Department of Biodiversity, Conservation and Attractions (DBCA) across the application area, with one Priority 1 species recorded in the direct surroundings (Figure 12; Figure 13). None of these flora species are currently listed under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act), with only one species known to be restricted to the application area and the adjacent area. The conservation-significant species recorded within the application area are:

- *Acacia sulcataulis* (EN);
- *Acacia diallaga* (P1);
- *Chamelaucium* sp. Warriedar (P1);
- *Chamelaucium* sp. Yalgoo (P1);
- *Hemigenia tichbonii* (P1);
- *Hydrocotyle dimorphocarpa* (P1);
- *Lepidosperma* sp. Blue Hills (P1);
- *Acacia karinae* (P3);
- *Acacia subsessilis* (P3);
- *Allocasuarina tessellata* (P3);
- *Drummondita fulva* (P3);
- *Grevillea globosa* (P3);
- *Grevillea scabrada* (P3);
- *Grevillea subtiliflora* (P3);
- *Micromyrtus acuta* (P3);
- *Micromyrtus trudgenii* (P3);
- *Persoonia pentasticha* (P3);
- *Rhodanthe collina* (P3);
- *Stenanthemum poicilum* (P3); and
- *Dodonaea amplisemina* (P4).

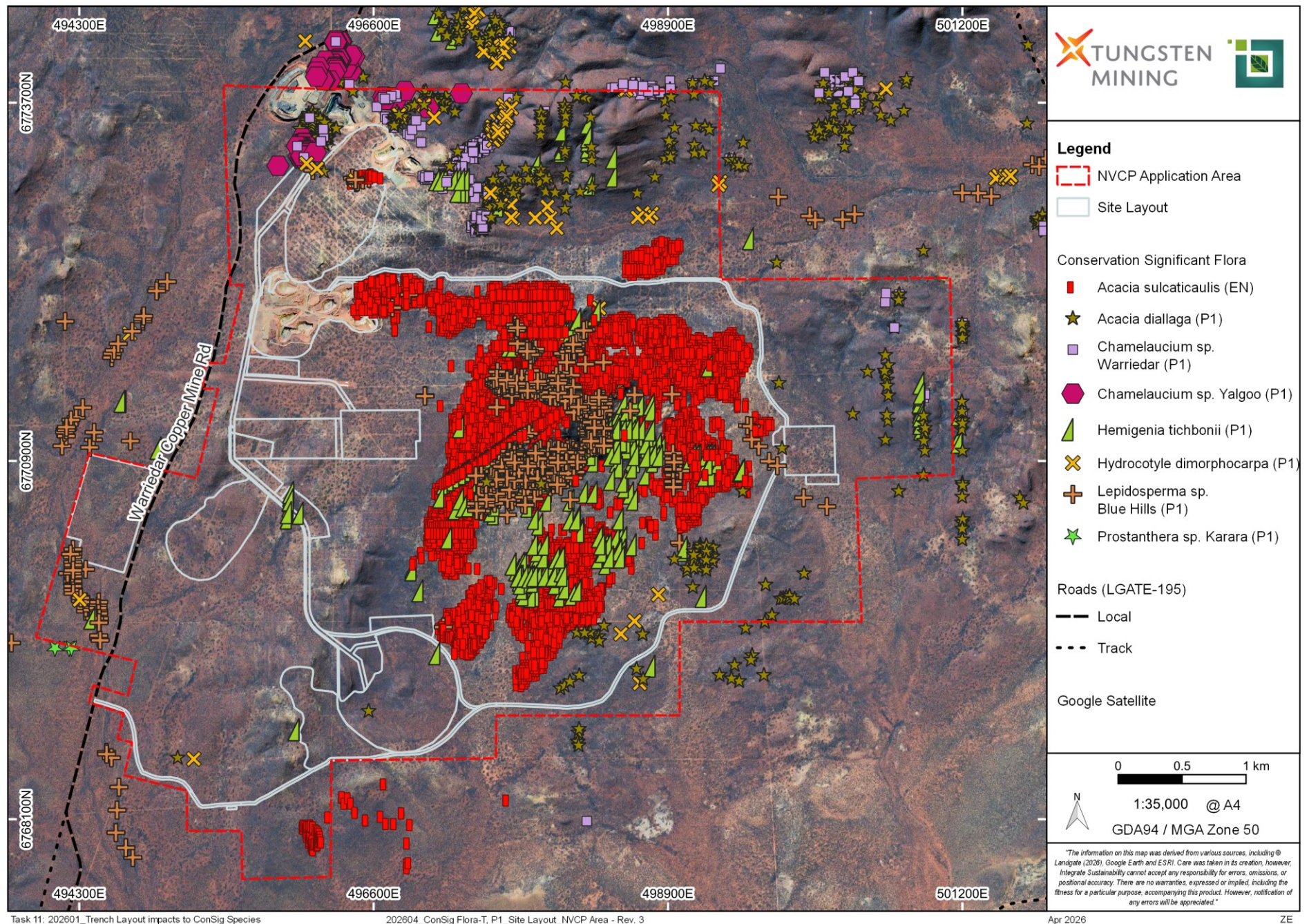


Figure 12 Threatened and Priority Flora within the Application Area

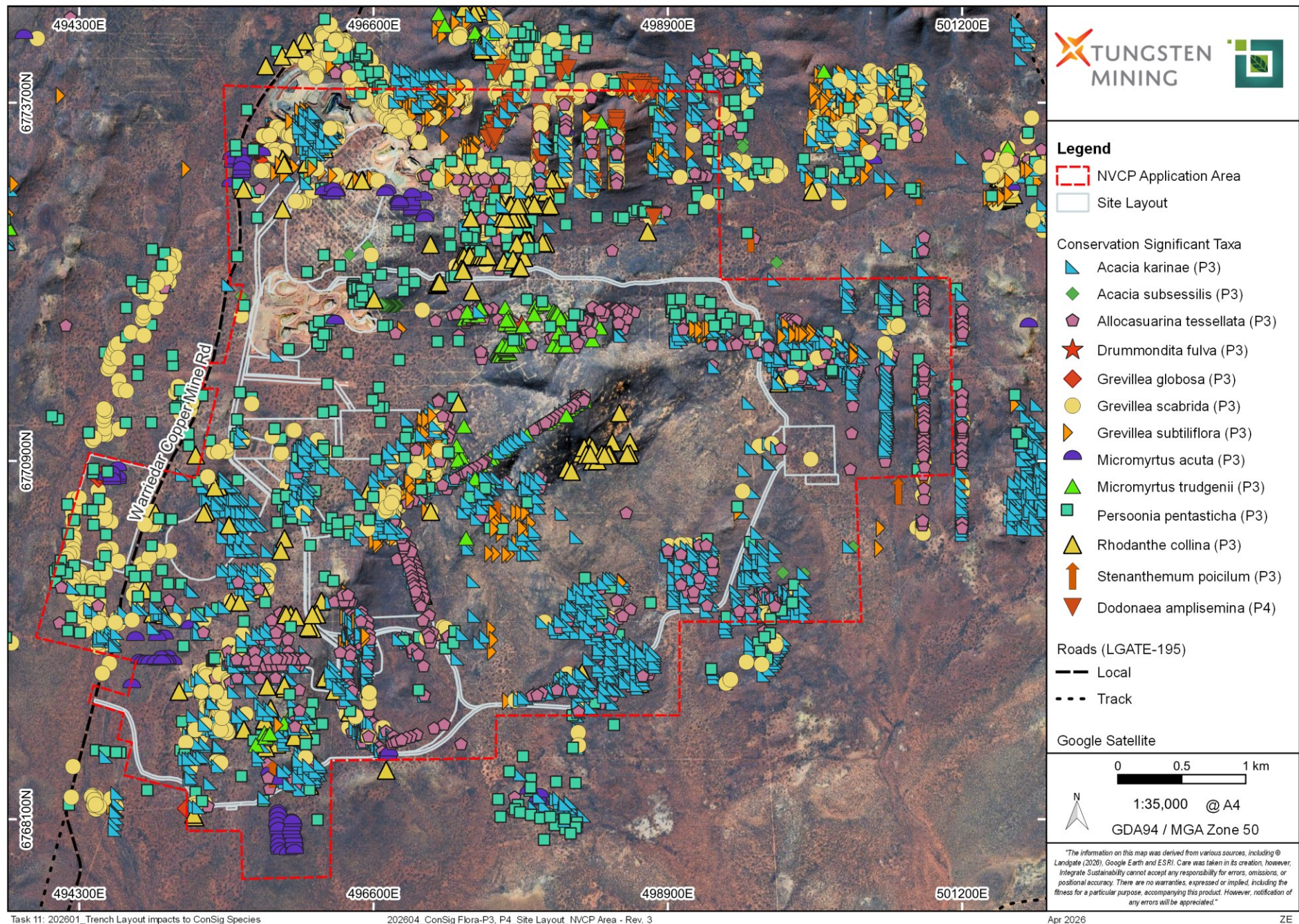


Figure 13 Priority 3 and Priority 4 Flora within the Application Area

Weeds

Spectrum Ecology (2021) identified 15 introduced flora species across the application area. None of these species are a Declared Plant under the *Biodiversity and Agriculture Management Act 2007* (WA) or listed as a Weed of National Significance. The recorded weed species are:

- *Arctotheca calendula*;
- *Bromus diandrus*;
- *Cuscuta planiflora*;
- *Ehrharta longiflora*;
- *Hypochaeris glabra*;
- *Lysimachia arvensis*;
- *Mesembryanthemum nodiflorum*;
- *Monoculus monstrosus*;
- *Pentameris airoides*;
- *Petrorhagia dubia*;
- *Rostraria pumila*;
- *Silene gallica*;
- *Sisymbrium erysimoides*;
- *Sonchus oleraceus*; and
- *Spergula pentandra*.

The most prevalent introduced species is *Cuscuta planiflora*, with 17 small- to medium-sized clumps recorded in the application area. Most of the other recorded weeds included a single individual or clump (Spectrum Ecology, 2021).

Regional Vegetation Units

Pre-European vegetation mapping was originally undertaken by Beard at various scales across Western Australia (Beard, Beeston, Harvey, Hopkins, & Shepherd, 2013). The produced maps have since been updated to align with the Native Vegetation Information System (NVIS) descriptions at a scale of 1:250,000. State-wide vegetation statistics on the pre-European extent, current extent and area in DBCA managed lands are available for these vegetation associations, which is useful to determine if a vegetation association is rare or otherwise significant (DBCA, 2019).

Based on the pre-European vegetation mapping, the application area intersects four vegetation sub-associations, including the mosaic unit 326.3 (Table 6; Figure 14). All these sub-associations are restricted to the Yalgoo IBRA region, with sub-association 434.0 covering the smallest area at 1,387ha. Clearing has mostly occurred in sub-association 355.2, which covers historic mining activities, with minimal clearing in the other sub-associations. Despite this, the pre-European extent for all sub-associations exceeds 97%, indicating that excessive clearing has not occurred in these vegetation sub-associations.

Table 6 Pre-European Vegetation Sub-associations

Sub-association	NVIS Vegetation Description	Pre-European Extent (ha)	Current Extent (ha)	Remaining (%)
326.3	<i>Acacia ramulosa</i> , <i>Acacia acuminata</i> , <i>Acacia grasbyi</i> , <i>Acacia tetragonophylla</i> , <i>Acacia aneura</i> tall open shrubland, over <i>Senna artemisioides</i> subsp. x <i>artemisioides</i> , <i>Chorizema genistoides</i> , <i>Dodonaea inaequifolia</i> , <i>Eremophila forrestii</i> , <i>Eremophila viscida</i> mid sparse shrubland, over <i>Chamaexeros fimbriata</i> , <i>Dichopogon capillipes</i> , <i>Wurmbea densiflora</i> , <i>Cephalopterum drummondii</i> , <i>Helipterum craspedioides</i> low open forbland. <i>Acacia sclerosperma</i> , <i>Acacia eremaea</i> , <i>Grevillea obliquistigma</i> , <i>Hakea preissii</i> , <i>Acacia aneura</i> tall open shrubland.	542,040	542,013	100
355.2	<i>Eucalyptus loxophleba</i> , <i>Eucalyptus oleosa</i> low isolated trees, over <i>Acacia aneura</i> , <i>Acacia ramulosa</i> tall open shrubland.	56,303	54,965	97.6
420.5	<i>Acacia ramulosa</i> , <i>Acacia acuminata</i> , <i>Acacia quadrimarginea</i> , <i>Acacia stereophylla</i> tall open shrubland, over <i>Allocasuarina campestris</i> , <i>Melaleuca uncinata</i> , <i>Thryptomene australis</i> mid sparse shrubland.	457,736	456,619	99.8
434.0	<i>Eucalyptus loxophleba</i> , <i>Allocasuarina huegeliana</i> isolated low trees, over <i>Acacia quadrimarginea</i> , <i>Acacia acuminata</i> tall open shrubland.	1,387	1,387	100

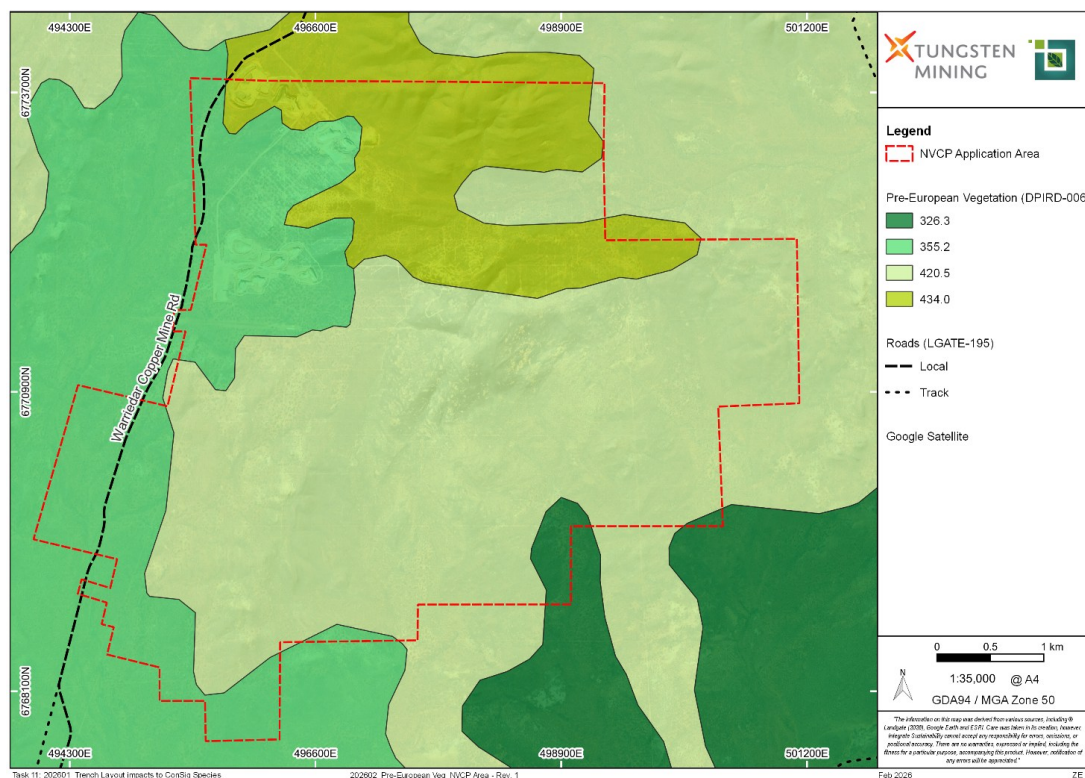


Figure 14 Pre-European Vegetation Sub-associations within the Application Area

Local Vegetation Units

Spectrum Ecology (2021) identified nine vegetation units in the application area, including a mosaic and degraded unit (Figure 15). The AdAa/AdAt mosaic resulted from difficulty in determining vegetation boundaries in aerial imagery due to similar topographic, substrate, structural, and colour characteristics, as well as fine-scale vegetation transitions.

After comparing the vegetation unit descriptions to Beard's pre-European vegetation map and considering the local distribution of these units, three vegetation units were determined to be locally and regionally significant: AdAa, AdAt and AsCp. The vegetation unit AdAa resembles pre-European vegetation unit 434.0, while AdAt and AsCp did not resemble any pre-European vegetation unit. Priority species are dominant in the units AdAa and AdAt, while *Acacia sulcaticaulis* (EN) is dominant in unit AsCp. Spectrum Ecology (2021) noted that vegetation unit AsCp appears to be restricted to the Mt Mulgine hills and slopes. A description of seven of the identified vegetation units is provided in Table 7; no description is provided for the AdAa/AdAt mosaic or the degraded vegetation unit.

Table 7 Summary of Local Vegetation Units

Veg Unit	Description	Total Mapped Area (ha)	Area (%)
AaAr	<i>Allocasuarina acutivalvis</i> subsp. <i>prinsepiana</i> tall sparse shrubland over <i>Acacia ramulosa</i> var. <i>ramulosa</i> (+/- <i>Micromyrtus acuta</i>) mid open shrubland over <i>Austrostipa elegantissima</i> isolated tussock grasses	273.7	8.7
AdAa	<i>Allocasuarina dielsiana</i> (+/- <i>Acacia umbraculiformis</i>) low open woodland over <i>Acacia acuminata</i> , <i>Allocasuarina tessellata</i> , <i>Acacia karinae</i> tall open shrubland over <i>Borya sphaerocephala</i> low sparse shrubland	786.0	24.9
AdAt	<i>Acacia duriuscula</i> or <i>Allocasuarina tessellata</i> tall open shrubland	274.6	8.7
AsCp	<i>Acacia sulcaticaulis</i> and/or <i>Allocasuarina acutivalvis</i> subsp. <i>prinsepiana</i> tall open to closed shrubland over <i>Calycopeplus paucifolius</i> mid sparse shrubland over <i>Philothea deserti</i> subsp. <i>deserti</i> low sparse shrubland	303.6	9.6
EIAr	<i>Eucalyptus loxophleba</i> subsp. <i>supralaevis</i> or <i>E. loxophleba</i> subsp. <i>lissophloia</i> low open woodland over <i>Acacia ramulosa</i> var. <i>ramulosa</i> tall open shrubland over <i>Ptilotus obovatus</i> , <i>Scaevola spinescens</i> low isolated shrubs	942.2	29.8
EIAr	<i>Eucalyptus loxophleba</i> subsp. <i>supralaevis</i> low woodland over <i>Acacia tetragonophylla</i> , <i>Allocasuarina dielsiana</i> , <i>Acacia ramulosa</i> var. <i>ramulosa</i> tall open shrubland over <i>Dodonaea inaequifolia</i> , <i>Acacia acanthoclada</i> subsp. <i>glaucescens</i> mid-low sparse shrubland	91.0	2.9
EsTh	<i>Eucalyptus salubris</i> low open woodland over <i>Tecticornia halcnemoides</i> low sparse shrubland	35.3	1.1

While undertaking a targeted survey for the three locally significant vegetation units, JBBC & ISPL (2026a) determined there was variation in the description for vegetation units AdAa and AdAt (Table 8). The identified variation was utilised to categorise 55 and 13 sites as vegetation units AdAa and AdAt, respectively (Figure 16). Three of the AdAa sites and one AdAt site were located within the operational area, while the other sites were identified within a 20km area. Vegetation unit AsCp, on the other hand, was only identified within the operation area.

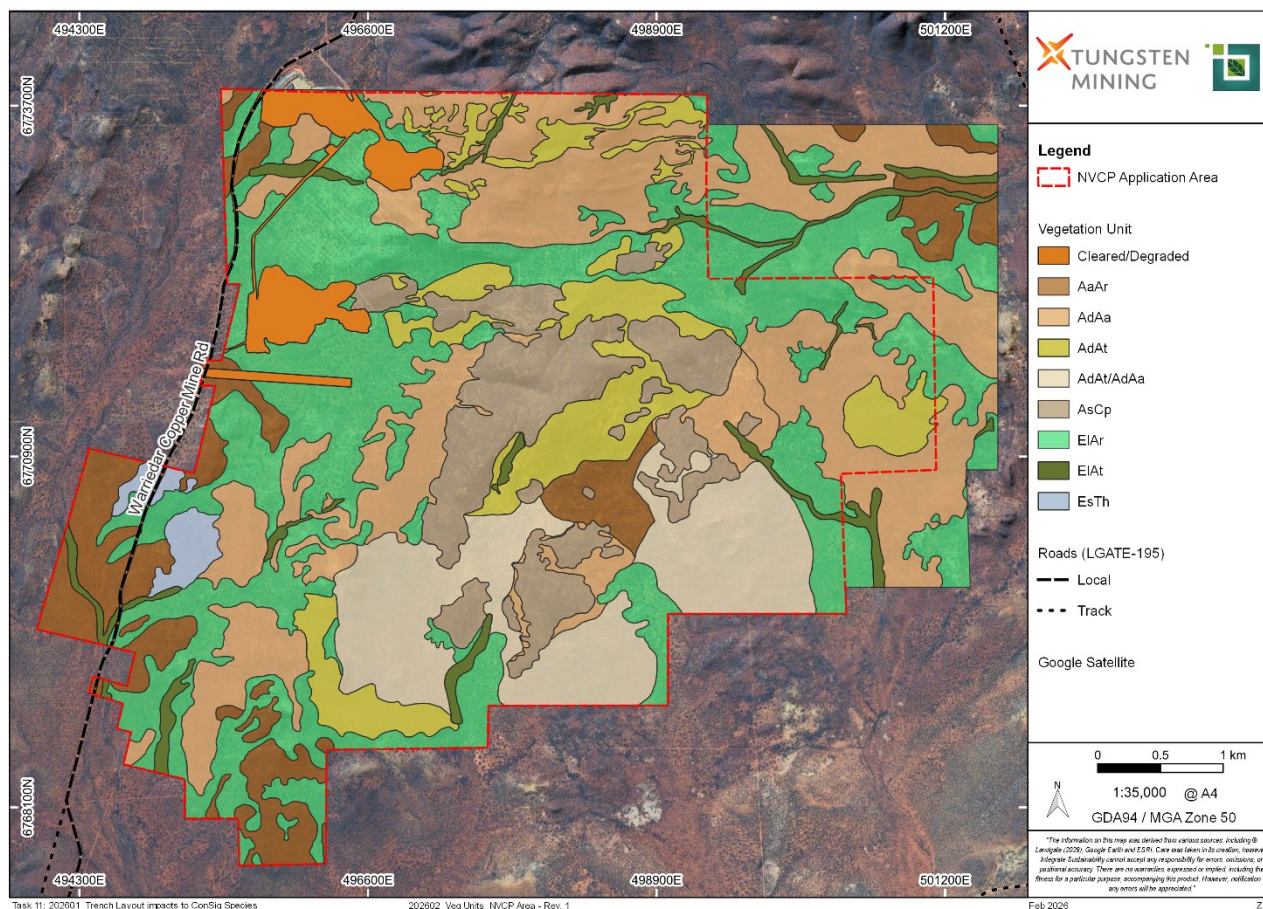


Figure 15 Local Vegetation Units within the Application Area

Table 8 Variation in Description for Vegetation Units AdAa and AdAt

Veg Unit	Description
AdAa	<i>Allocasuarina dielsiana</i>, <i>Melaleuca hamata</i> low open woodland over <i>Acacia acuminata</i>, <i>Allocasuarina tessellata</i> (P3), <i>Acacia karinae</i> (P3) tall open shrubland over <i>Borya sphaerocephala</i> low sparse shrubland <i>Allocasuarina dielsiana</i> and/or <i>Melaleuca hamata</i> isolated trees over <i>Acacia umbraculiformis</i> low open woodland to open woodland over <i>Acacia</i> spp. (<i>A. ramulosa</i> var. <i>ramulosa</i>, <i>Allocasuarina dielsiana</i>, <i>Acacia acuminata</i>, <i>Acacia tetragonophylla</i>, <i>A. diallaga</i> (P1), <i>A. karinae</i> (P3)) tall open shrubland to open shrubland over <i>Grevillea scabrida</i> (P3), <i>Ptilotus obovatus</i>, <i>Solanum lasiophyllum</i> low sparse shrubland <i>Allocasuarina dielsiana</i>, <i>Acacia acuminata</i>, <i>Acacia umbraculiformis</i> or <i>Melaleuca hamata</i>, <i>Brachychiton gregorii</i> low open woodland over <i>Acacia acuminata</i>, <i>Allocasuarina tessellata</i> (P3), <i>Acacia tetragonophylla</i>, <i>Acacia karinae</i> (P3) tall sparse shrubland over <i>Acacia diallaga</i> (P1), <i>A. karinae</i> (P3), <i>A. tetragonophylla</i>, <i>Allocasuarina tessellata</i> (P3), <i>Melaleuca radula</i> shrubland to open shrubland over <i>Grevillea scabrida</i> (P3), <i>Ptilotus obovatus</i>, <i>Acacia diallaga</i> (P1) low sparse shrubland over <i>Borya sphaerocephala</i>, <i>Ptilotus drummondii</i> low open forbland
AdAt	<i>Allocasuarina dielsiana</i> and/or <i>Melaleuca hamata</i> isolated trees to low open woodland (2 – 10%) over <i>Allocasuarina tessellata</i> (P3) tall shrubland or shrubland over <i>Borya sphaerocephala</i> low open to sparse forbland Hill, summit; granite, laterite; aspect east/west <i>Acacia umbraculiformis</i>, <i>A. ramulosa</i> var. <i>ramulosa</i>, <i>Calycophyllum paucifolius</i>, <i>Allocasuarina acutivalvis</i> subsp. <i>prinsepiana</i>, <i>Brachychiton gregorii</i>, <i>Melaleuca nematophylla</i> tall open shrubland over <i>Acacia ramulosa</i> var. <i>ramulosa</i>, <i>Allocasuarina acutivalvis</i> subsp. <i>prinsepiana</i>, <i>Philotheca sericea</i>, <i>Acacia tetragonophylla</i>, <i>Micromyrtus trudgenii</i> (P3) open shrubland over <i>Aluta aspera</i> subsp. <i>hesperia</i>, <i>Eremophila latrobei</i> subsp. <i>warty leaves</i>, <i>Acacia ramulosa</i> var. <i>ramulosa</i> low open shrubland

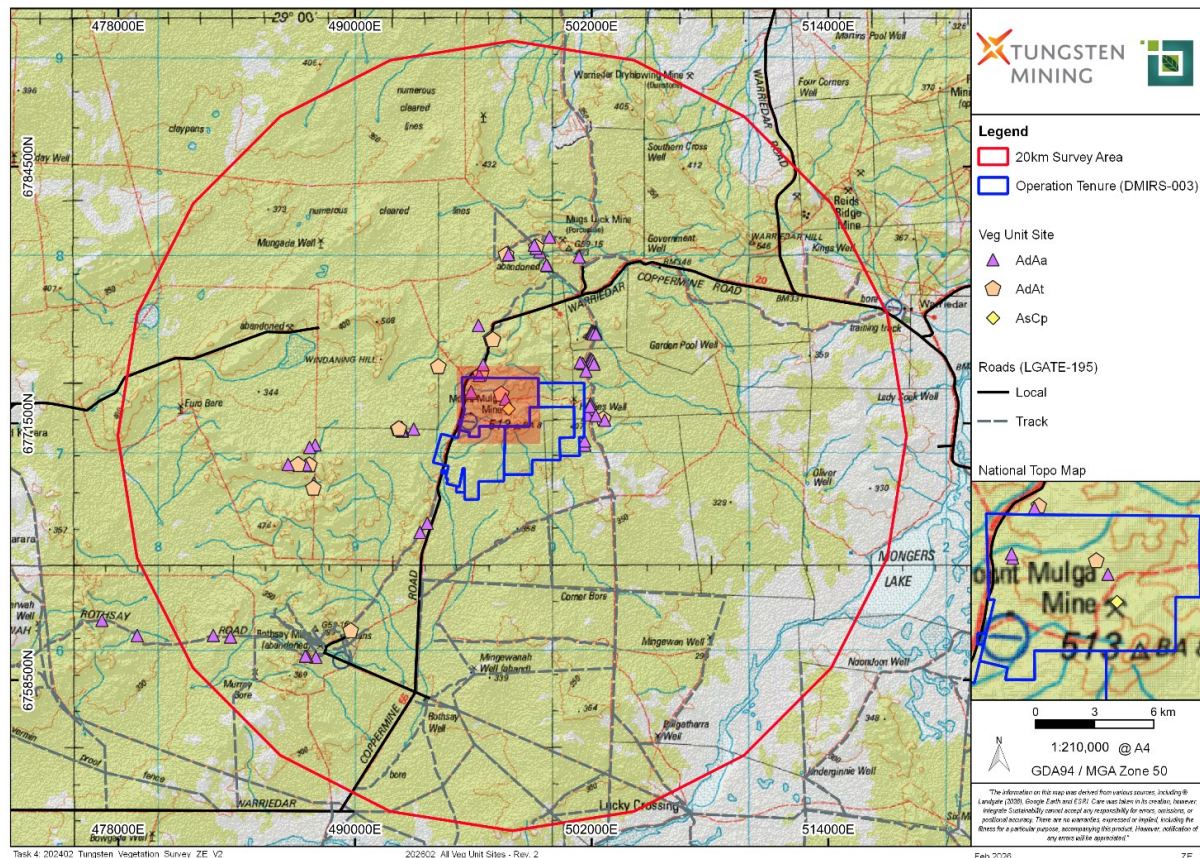


Figure 16 Locally Significant Vegetation Units Located Outside the Operation Area

Vegetation Condition

Spectrum Ecology (2021) used the vegetation condition rating system developed by Keighery (1994) as recommended by the EPA (2016) for the Interzone Botanical Province. Vegetation in the application area ranged from Cleared/Degraded to Excellent; no vegetation matching the Pristine or Degraded condition descriptions was identified (Table 9; Figure 17).

The majority of the operation area was mapped as Excellent (77%) with only minor disturbance present such as isolated vehicle tracks and small areas of historical clearing. Very Good (19%) and Good (1%) vegetation conditions were associated with defined tracks, exploration activities including drilling programs and evidence of grazing. Areas mapped as Cleared/Degraded (3%) have been incorporated into the conceptual site layout where practicable.

Table 9 Vegetation Condition Descriptions

Vegetation Condition	Description	Total Mapped Area (ha)	Area (%)
Pristine	Pristine or nearly so, no obvious signs of disturbance or damage caused by human activities since European settlement.	-	-
Excellent	Vegetation structure intact, disturbance affecting individual species. Damage to trees caused by fire, the presence of non-aggressive weeds, and occasional vehicle tracks.	2,434	77
Very Good	Vegetation structure is altered with obvious signs of disturbance. Disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback logging and/or grazing.	602	19
Good	Vegetation structure was significantly altered by obvious signs of multiple disturbances. Retains basic vegetation structure or the ability to regenerate it. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.	25	1
Degraded	Basic vegetation structure is severely impacted by disturbance. Scope for regeneration is not to a state approaching good condition without intensive management. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds at high density, partial clearing, dieback and grazing.	-	-
Cleared / Degraded	The structure of the vegetation is no longer intact, and the area is completely or almost completely without native species. These areas are often described as "parkland cleared" with the flora comprising weed or crop species with isolated native trees and shrubs.	100	3

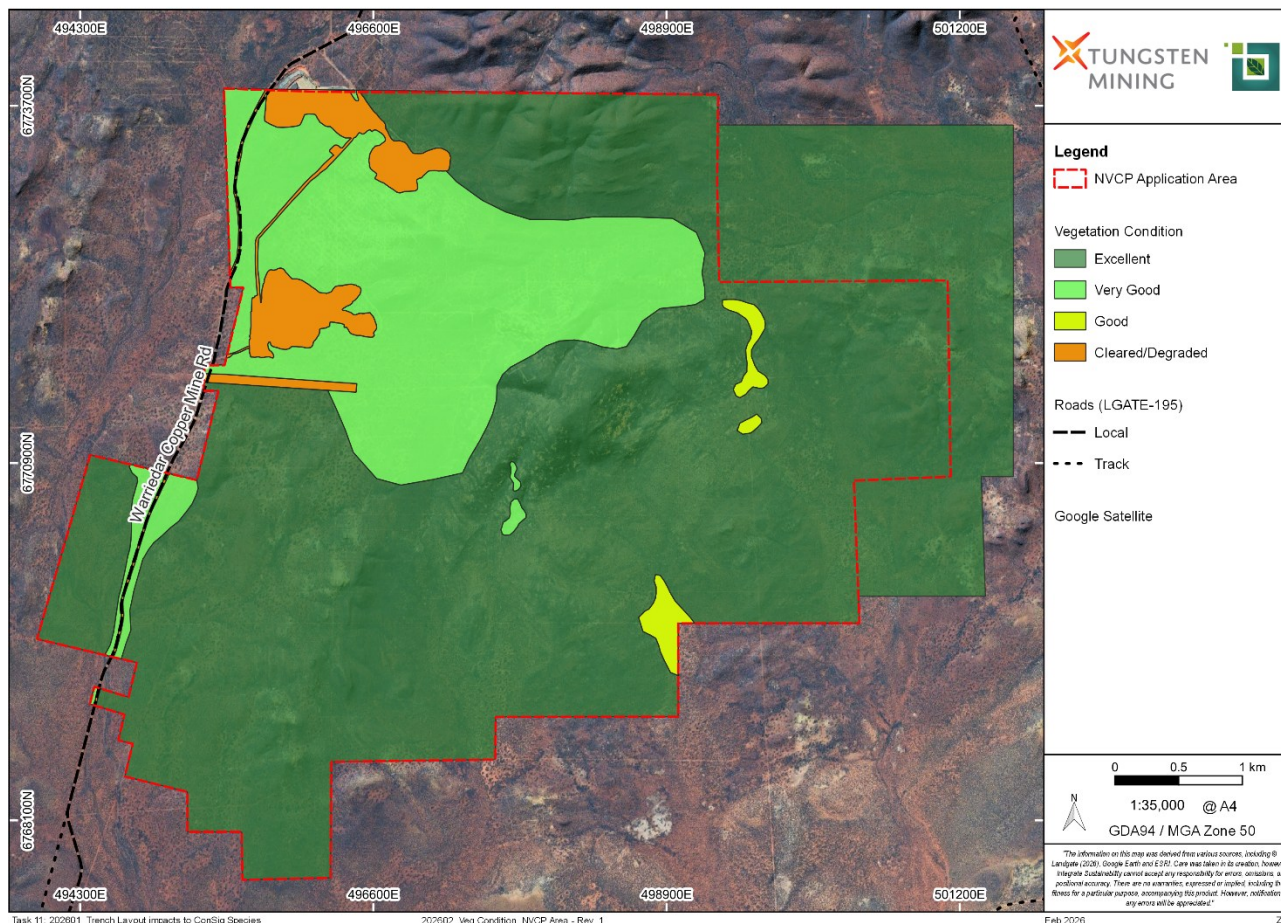


Figure 17 Vegetation Condition within the Application Area

Conservation-Significant Vegetation Communities

None of the identified local vegetation units aligns with known Threatened Ecological Community (TEC) or Priority Ecological Community (PEC) designations. A search of the publicly available DBCA spatial layer (DBCA-038) found no TECs within 15km and seven PECs within 5km. Spectrum Ecology (2021) noted PECs surrounding the application area are geologically restricted to the Banded Ironstone Formations of the Blue Hills, Warriedar, Pinyalling and Walagnumming ranges, and are therefore unlikely to occur in the application area.

Fauna

Vertebrate fauna and Short-range Endemic (SRE) surveys have been undertaken across the operation area from 2011 to 2025 by APM, Bamford, Bennelongia, Spectrum Ecology, Terrestrial Ecosystems and Western Ecological.

Tungsten Mining engaged Spectrum Ecology (2022) to undertake a Terrestrial Fauna Assessment over the operation area ([Appendix D](#)). During the assessment, Spectrum Ecology conducted basic surveys for terrestrial fauna and SRE species between 2019 and 2021, and consolidated results from previous surveys.

In 2023, Western Ecological (2026) was engaged by Tungsten Mining NL to undertake a Detailed Terrestrial Fauna Survey over the operation area ([Appendix E](#)). During the assessment, Western Ecological conducted a two-season survey and targeted search for threatened fauna.

In 2025, Tungsten Mining NL engaged Terrestrial Ecosystems (2026) to undertake a Targeted Vertebrate Fauna Survey over the proposed mining area (Figure 18) ([Appendix F](#)). The fauna survey targeted the conservation-significant fauna species Gilled Slender Blue-tongue (*Cyclodomorphus branchialis*), Malleefowl (*Leipoa ocellata*) and Western Spiny-tailed Skink (*Egernia stokesii badia*), which are all listed as Vulnerable under the BC Act.

Tungsten Mining NL engaged Bennelongia (2026a) in 2024, to undertake a Targeted SRE Invertebrate Fauna Survey within and around the operation area ([Appendix G](#)). During the assessment, Bennelongia targeted invertebrates within SRE groups and consolidated results from previous SRE surveys. In 2025, Bennelongia (2026b) were engaged to undertake a Targeted Conservation Significant Mygalomorph Spider Survey and Assessment over the proposed mining area (Figure 18) ([Appendix H](#)).

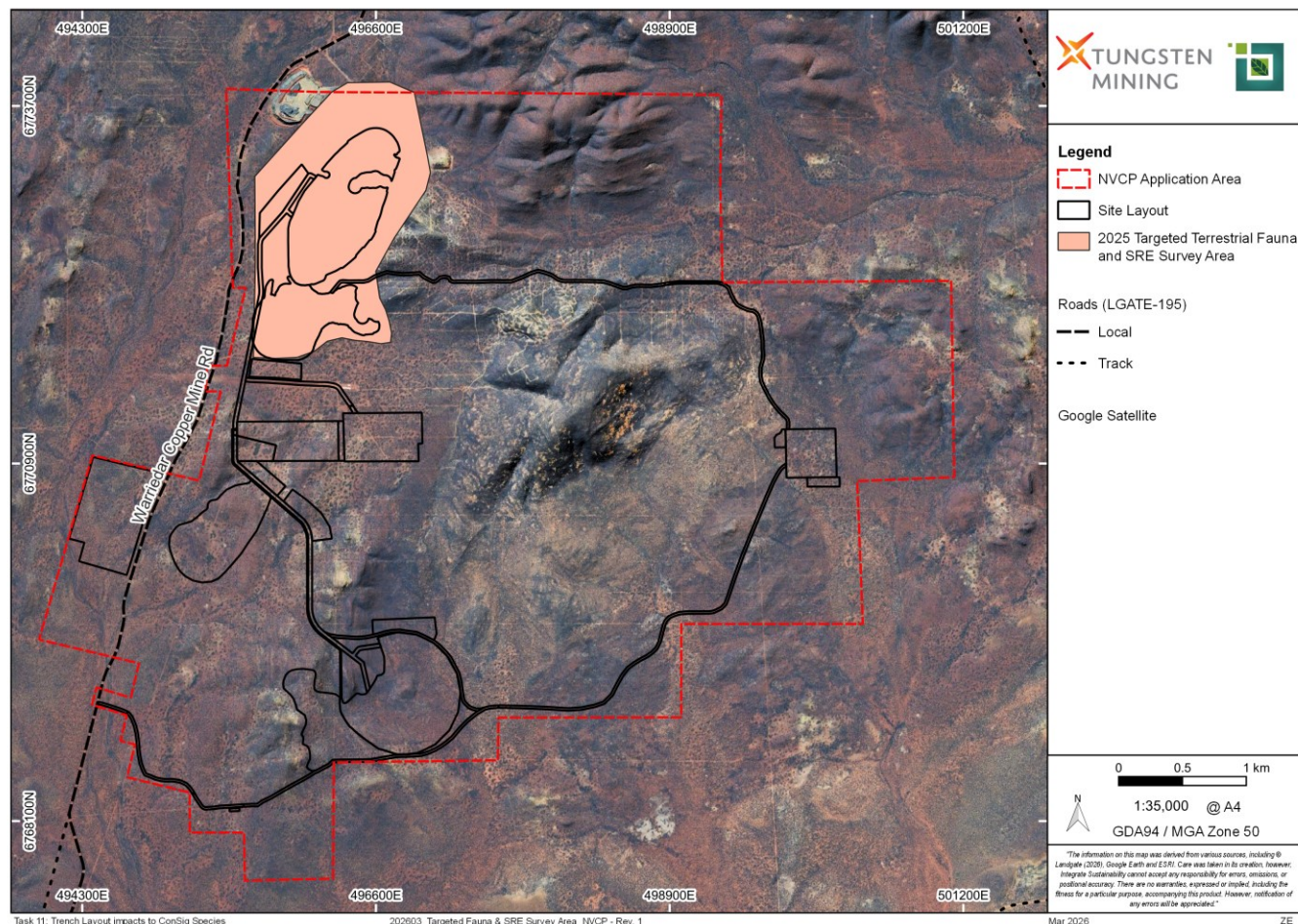


Figure 18 2025 Targeted Terrestrial Vertebrate Fauna and SRE Survey Area over the Conceptual Site Layout

Vertebrate Fauna Habitat

A total of four fauna habitats have been mapped within and outside the application area by Western Ecological (Table 10; Figure 19). The operation area was found to contain foraging habitat (515.0ha) and potential nesting habitat (1,777.0ha) for the Malleefowl (VU) (Figure 20). Western Ecological (2026) noted the potential nesting habitat lacks a dense canopy, which is an important feature for Malleefowl (VU) nesting locations.

Table 10 Vertebrate Fauna Habitat Descriptions

Habitat Type	Description	Total Mapped Area (ha)
Mixed Shrubland	Dominated by a canopy of mixed Acacia (including <i>Acacia ramulosa</i> and <i>A. acuminata</i>) and Allocasuarina shrubs over a mid-story of Eremophila and Hakea. Primarily located on hill slopes.	2,171.2
Open Eucalyptus Woodland	Dominated by a canopy of <i>Eucalyptus salubris</i> over a mid-story of Eremophila and Senna. Primarily located in the lower, flatter parts of the operation area.	515.0
Rocky Hill	Canopy of mixed shrubs, however, they are very sparse and ground cover is virtually absent. It is restricted to higher elevations.	350.3
Cleared/Degraded	Disturbed and previously cleared areas	92.7

Most of the application area is mapped as Mixed Shrubland, followed by Open Eucalyptus Woodland (Figure 19). The Mixed Shrubland habitat is considered suitable for numerous bird species, while the Open Eucalyptus Woodland is suitable for larger bird species and burrowing reptile species (Western Ecological, 2026). Large log piles and fallen trees are also present in the Open Eucalyptus Woodland, which may provide refuge habitat for a range of fauna species. The Rocky Hill habitat is considered suitable for saxicoline reptiles due to sparse mixed shrubs and almost-absent ground cover. This habitat is generally restricted to higher elevations.

Overall, all three habitats are considered widespread across the Yalgoo IBRA region and are not restricted to the application area.

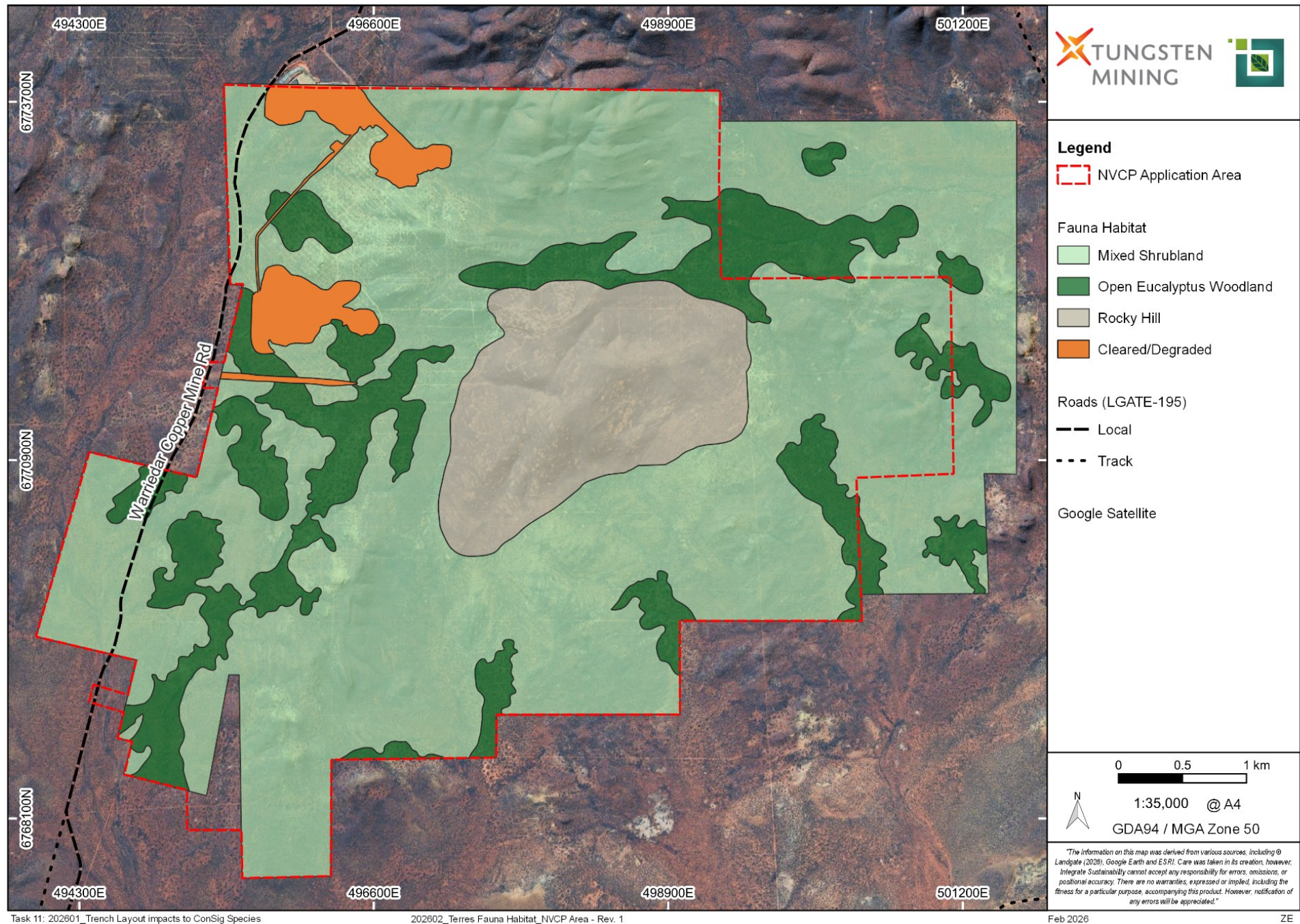


Figure 19 Terrestrial Fauna Habitat within the Application Area

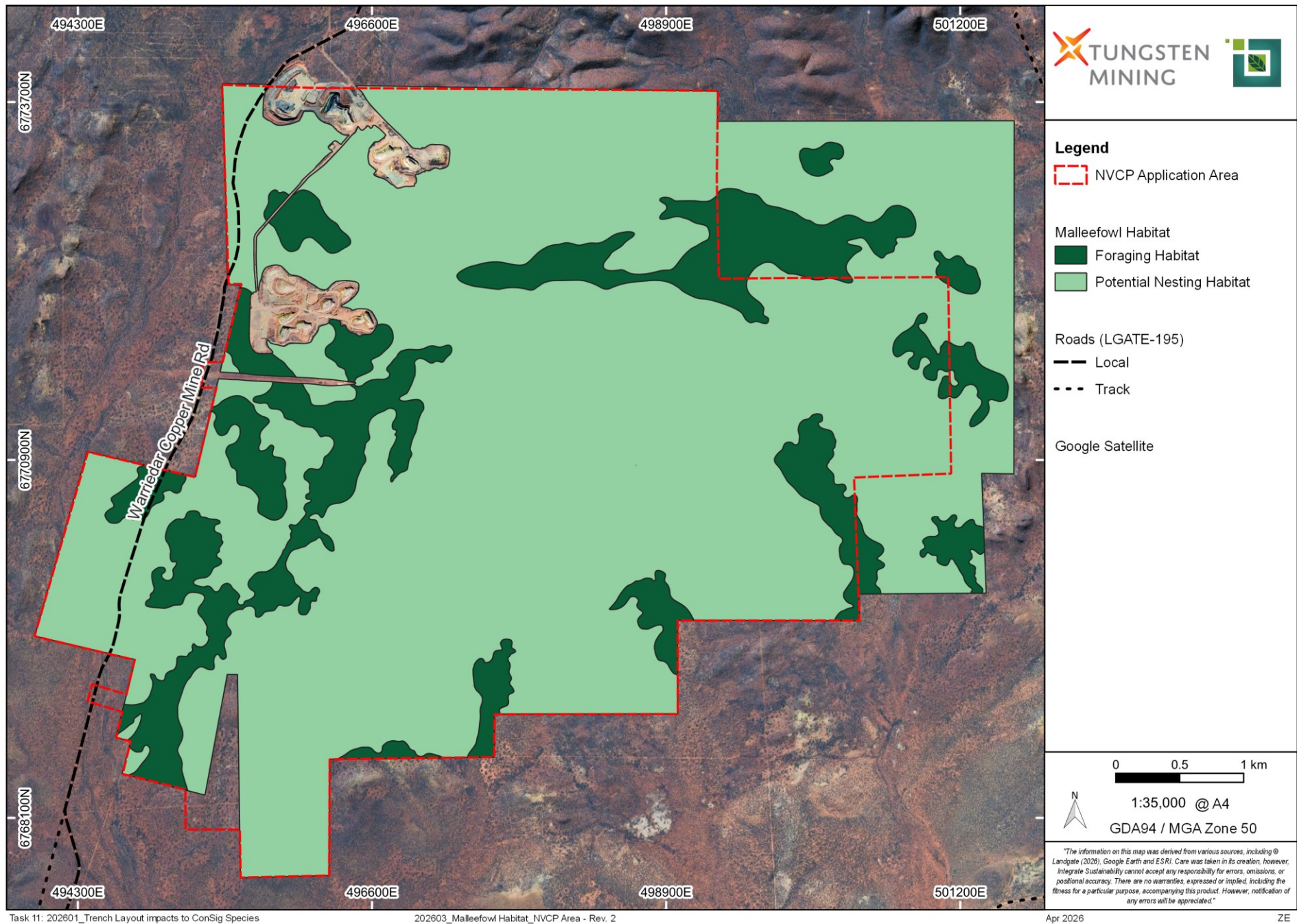


Figure 20 Malleefowl (VU) Foraging and Potential Nesting Habitat within Application Area

SRE Fauna Habitat

Bennelongia mapped eight SRE habitats across and around the operation area (Figure 21). The most prevalent habitats in the application area are Low Hills with Mixed Shrublands and Stony Plains.

Potential refuge habitats for specialist invertebrates are present in the Granite Outcrops, Low Hills with Mixed Shrublands and Mixed Shrublands, which indicates they have a moderate-high prospectivity for SRE species (Table 11). Similarly, the Open Eucalyptus Woodland habitat can provide shelter for multiple mygalomorph spiders, including from the *Idiosoma* genus, some of which are considered SRE or listed by DBCA. The Stony Plains with Mixed Shrubland, Sandplains with Mixed Shrubland, and Floodplains and Drainage Areas, on the other hand, are ideal for generalist species as the present microhabitats are rarely isolated. No SRE or invertebrate species are expected in the Cleared/Degraded areas.

Table 11 SRE Habitat Descriptions

Habitat Type	Description	SRE Prospectivity	Total Mapped Area (ha)
Low hills with Mixed Shrublands	Low basalt and rugged greenstone ranges with dense Casuarina and Acacia shrublands.	Moderate prospectivity for SRE species as the multiple vegetation types can provide refuge for different groups such as pseudoscorpions, centipedes, scorpions and mygalomorph spiders. However, these are rarely isolated habitats and are often exploited by generalist species.	4,523
Stony Plains with Mixed Shrubland	Low rises and stony plains supporting Chenopod shrublands with patchy Eucalypt overstoreys.	Ideal for generalist species within the different SRE Groups, such as mygalomorph spiders, slaters and centipedes.	2,359
Mixed Shrublands	Mixed shrublands of Acacia, Casuarina, Chenopod or Bowgada over low hills and plains.	Moderate prospectivity for SRE species as the multiple vegetation types can provide refuge for different groups such as pseudoscorpions, centipedes, scorpions and mygalomorph spiders. However, these are rarely isolated habitats and are often exploited by generalist species.	1,470
Sandplains with Mixed Shrubland	Low plains supporting tall shrublands of Mulga and Bowgada with patchy wanderrie grasses and minor halophytic shrublands.	Ideal for generalist species within the different SRE Groups, such as mygalomorph spiders, slaters and centipedes.	1,382
Floodplains and Drainage Areas	Carrying concentrated flow, supporting Mulga, Curara and other Acacia shrublands.	Ideal for generalist species within the different SRE Groups, such as mygalomorph spiders, slaters and centipedes.	588
Open Eucalyptus Woodlands	Open Eucalyptus woodlands over low hills with occasional saltbush and bluebush understoreys.	Open Eucalyptus woodland often provides shelter for multiple mygalomorph spider species, including those from the genus <i>Idiosoma</i> .	591
Granite Outcrops	Granite hills with exfoliating domes and tor fields, supporting Acacia shrublands.	Granite outcrops have high prospectivity for SRE species as they often represent isolated habitats within the broader landscape, and specialist species (such as pseudoscorpions and millipedes) tend to be restricted to this habitat type.	373
Cleared/Degraded	Disturbed and previously cleared areas.	None	100

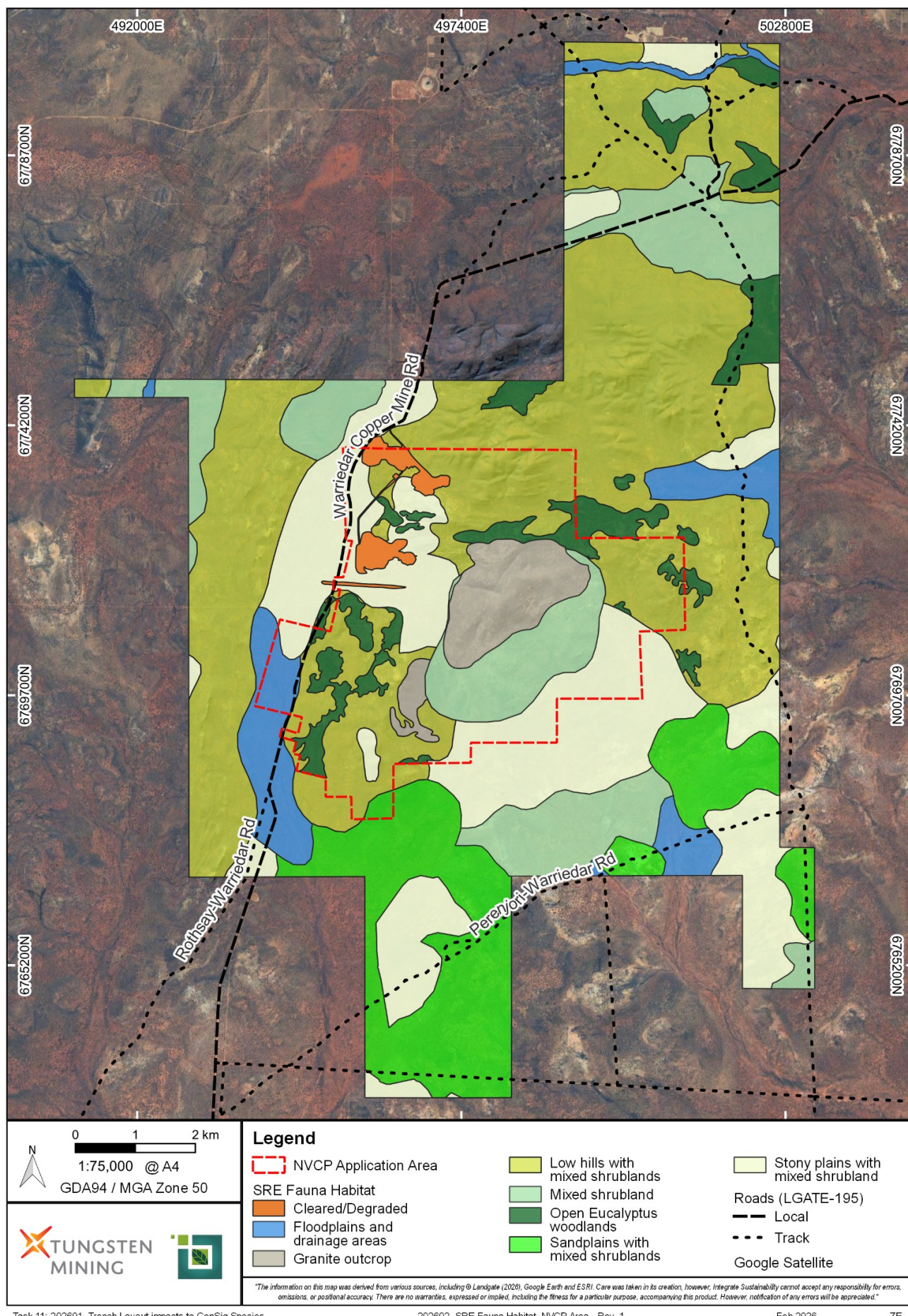


Figure 21 SRE Habitats within the Application and adjacent areas

Vertebrate Fauna

Across all vertebrate fauna surveys, a total of 160 species have been recorded, comprising 103 birds, 38 reptiles, 18 mammals, and 1 amphibian. Spectrum Ecology (2022) recorded 15 additional species during their Terrestrial Fauna Assessment, including an amphibian species, compared to previous surveys. Similarly, an additional 24 species

were recorded by Western Ecological (2026). The species were recorded using a variety of techniques including traps (pitfall, cage, Elliot, funnel and camera), acoustic recording units, nocturnal spotlighting and targeted searches over potential Threatened fauna habitat.

Conservation-Significant Vertebrate Fauna

Fauna surveys have identified five conservation-significant species listed under the BC Act across and directly surrounding the operation, three of which are also listed under the EPBC Act (Table 12). Four of the identified conservation-significant species have been recorded within the application area; the Western Spiny-tailed Skink has been recorded approximately 350m south (Figure 22).

It is acknowledged that Western Ecological (2026) completed a database search on a 50km area around the operation, which suggested the Central Long-eared Bat (*Nyctophilus major tor*), listed as P3 by DBCA, is possibly present within the operation area. Western Ecological noted that while little to no suitable habitat is present in the operation area, three records from approximately 40km south were identified, and the species has good dispersal abilities.

During Terrestrial Ecosystems' (2026) targeted survey, no conservation-significant fauna were identified.

Table 12 Conservation-Significant Fauna

Common Name	Scientific Name	EPBC Act Status	BC Act Status
Western Spiny-tailed Skink	<i>Egernia stokesii badia</i>	EN	VU
Malleefowl	<i>Leipoa ocellata</i>	VU	VU
Grey Wagtail	<i>Motacilla cinerea</i>	MI	MI
Gilled Slender Blue-tongue	<i>Cyclodomorphus branchialis</i>	-	VU
Peregrine Falcon	<i>Falco peregrinus</i>	-	OS

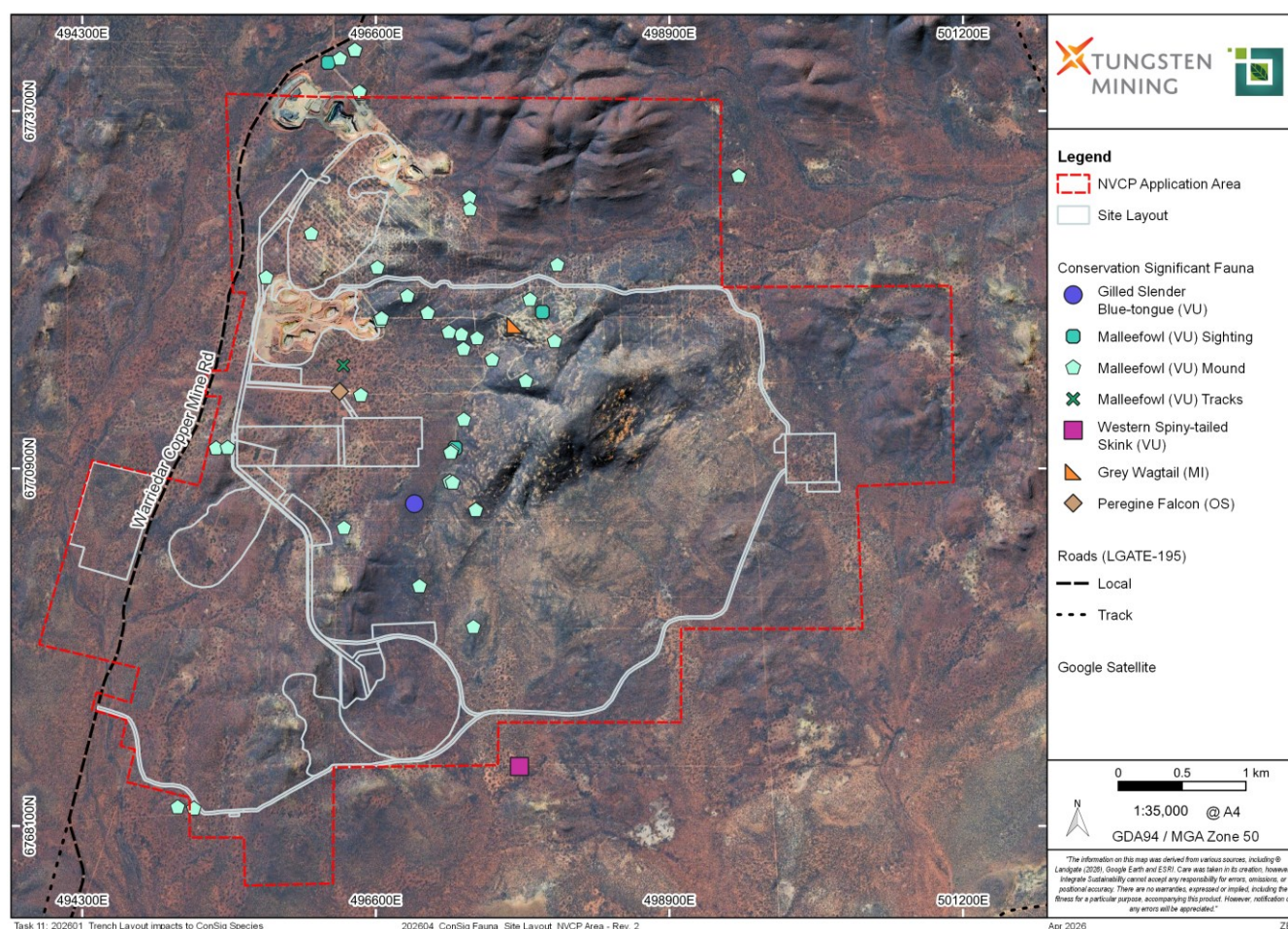


Figure 22 Conservation-Significant Fauna within Application Area

Short Range Endemics

Bennelongia (2026a) collected a total of 216 specimens, with 46 specimens classified to a higher level as they were either immature or the non-diagnostic sex. In total, 37 species were identified, with none classified as Confirmed SRE species; however, two mygalomorph spiders listed by DBCA and managed under the BC Act were found in the operation area and application area (Table 13; Figure 23). During a previous survey, the Confirmed SRE species *Idiosoma gutharuka*, listed as P1 by DBCA, was identified in the application area. No species listed under the EPBC Act have been recorded.

In 2025, during a targeted survey for mygalomorph spiders, Bennelongia (2026b) identified 23 mygalomorph spider burrows in the application area. These burrows included 13 for *Idiosoma clypeatum* (P3), eight for *I. intermedium* (P3) and one each for the genus *Gaius* and *Lycosidae*. No burrows belonging to *Idiosoma gutharuka* (P1) were identified, and no impacts to known occurrences are envisaged.

Table 13 Conservation-Significant Invertebrates

Common Name	Scientific Name	WA Status	SRE Status
Gutha Pintharuka Shield-backed Trapdoor Spider	<i>Idiosoma gutharuka</i>	P1	Confirmed
Northern Shield-backed Trapdoor Spider	<i>Idiosoma clypeatum</i>	P3	Widespread
Coolgardie Shield-backed Trapdoor Spider	<i>Idiosoma intermedium</i>	P3	Widespread

Bennelongia (2026a) consolidated taxonomic information on invertebrates collected during previous surveys and reassessed their SRE status. Based on geographic or taxonomic information and whether a species belongs to a taxonomic group likely to contain SREs, 31 Potential SREs were identified within the application area, with *Acanthodillo* 'BIS412' found within the operation area (Figure 23).

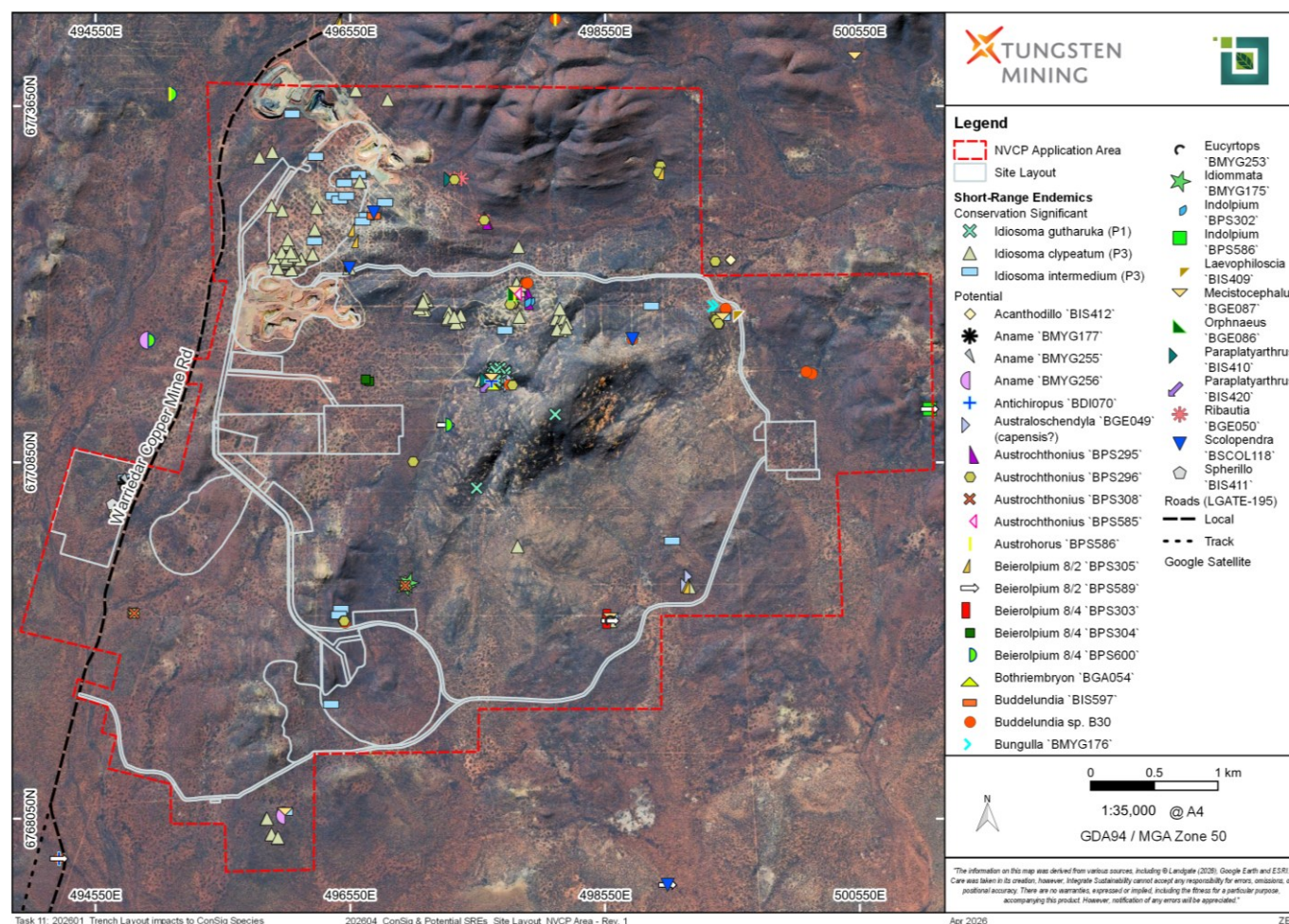


Figure 23 Conservation-Significant and Potential SREs within the Application Area

Introduced Fauna

Three introduced fauna species have been recorded in the application area: Feral Cat (*Felis catus*), European Rabbit (*Oryctolagus cuniculus*) and Goat (*Capra hircus*). The Feral Cat and European Rabbit were recorded by Western Ecological (2026) with the Goat recorded during a previous fauna survey.

4. ENVIRONMENTAL IMPACTS

Potential Impacts to Flora and Vegetation

Direct Loss of Vegetation

Tungsten Mining NL is proposing to clear up to 402.80ha of native vegetation within an application area of 2,704.6ha. Where possible, previously disturbed areas have been considered for the conceptual site layout and will be utilised during clearing activities to preserve uncleared vegetation.

Three locally significant vegetation units have been identified within the application area, along with a mosaic. Clearing is proposed within vegetation units AdAa (42.5ha), AdAt (33.6ha) and AdAt/AdAa mosaic (50.3ha); no clearing is proposed within vegetation unit AsCp. When compared to the total mapped extent, proposed clearing will remove approximately 5.4%, 12.2%, and 14.3% of vegetation units AdAa, AdAt, and AdAt/AdAa mosaic respectively. A targeted survey for the locally significant vegetation units identified the presence of vegetation units AdAa and AdAt within a 20km area around the operation, while vegetation unit AsCp was only found within the operation area. The proposed clearing will not result in the complete removal of any vegetation units.

Direct Loss of Conservation-Significant Flora

One BC Act listed threatened species and 19 DBCA listed priority flora species have been identified within the application area during flora surveys (Table 14). None of these species are currently listed under the EPBC Act, with only one species restricted to the application area and the adjacent area. All remaining species have been recorded outside the operation area.

Table 14 Conservation-Significant Flora Abundance within Application Area and Conceptual Site Layout

Taxon Name	Total No. of Known Plants in WA*	Total No. within Application Area	Total No. within Conceptual Site Layout	% of Known Records within Application Area	% of Known Records within Conceptual Site Layout
<i>Acacia sulcatacaulis</i> (EN)	249,593	249,566	0	99.99%	0%
<i>Acacia diallaga</i> (P1)	9,553	2,499	1	26.2%	0.01%
<i>Chamelaucium</i> sp. Warriedar (P1)	7,305	1,957	0	26.8%	0%
<i>Chamelaucium</i> sp. Yalgoo (P1)	472	101	0	21.4%	0%
<i>Hemigenia tichbonii</i> (P1)	8,282	3,110	200	37.6%	2.4%
<i>Hydrocotyle dimorphocarpa</i> (P1)	28,137	4,265	0	15.2%	0%
<i>Lepidosperma</i> sp. Blue Hills (P1)	95,353	11,881	0	12.5%	0%
<i>Acacia karina</i> (P3)	270,336	18,287	1,799	6.8%	0.7%
<i>Acacia subsessilis</i> (P3)	1,462	211	7	14.4%	0.5%
<i>Allocasuarina tessellata</i> (P3)	129,988	57,707	12,335	44.4%	9.5%
<i>Drummondita fulva</i> (P3)	41,952	150	0	0.4%	0%
<i>Grevillea globosa</i> (P3)	2,025	15	15	0.7%	0.7%
<i>Grevillea scabrifolia</i> (P3)	31,122	9,778	295	31.4%	0.95%
<i>Grevillea subtiliflora</i> (P3)	15,211	10,430	13	68.6%	0.1%
<i>Micromyrtus acuta</i> (P3)	69,701	10,121	3,275	14.5%	4.7%
<i>Micromyrtus trudgenii</i> (P3)	57,231	2,080	0	3.6%	0%
<i>Persoonia pentasticha</i> (P3)	6,191	1,519	111	24.5%	1.8%
<i>Rhodanthe collina</i> (P3)	640,102	27,603	383	4.3%	0.1%
<i>Stenanthemum poicilum</i> (P3)	1,477	121	0	8.2%	0%
<i>Dodonaea amplisemina</i> (P4)	6,841	6,349	0	92.8%	0%

* Total is based on abundance recorded during flora and vegetation surveys, and from a DBCA database search

Acacia sulcatacaulis (EN) is predominantly known from the application area, with an additional population recorded approximately 200m south of the application area. To date, 249,593 individuals have been identified, of whom 249,566 are found in the application area. It is noted that surveys for this species have focused on the operational area, with the species only recently recorded outside this area. As a result, further surveys are required to quantify the size of the outside population. Although the application area contains most of the known occurrences, no individuals are proposed to be cleared under this application (Table 14). A 50m exclusion zone has been applied to each known plant to ensure that no *Acacia sulcatacaulis* (EN) are cleared.

The conceptual site layout also avoids eight priority flora species which are present within the application area (Table 14). *Lepidosperma* sp. Blue Hills (P1) is the closest recorded species at 5m to a light vehicle road, while the other species are at least 25m from the conceptual site layout. The application area also contains less than 25% of the known population for six of these species, while approximately 27% and 93% of *Chamelaucium* sp. Warriedar (P1) and *Dodonaea amplisemina* (P4) populations, respectively, are within the application area. It is noted that all these

species are known from other populations within a 50km radius of the application area; *Dodonaea amplisemina* (P4), in particular, was identified up to 43km away.

The total proposed clearing area (402.80ha) does contain records for 11 priority flora species (Table 14). Based on the conceptual site layout, it has been estimated that less than 1% of the known population of *Acacia diallaga* (P1), *Acacia karinae* (P3), *Acacia subsessilis* (P3), *Grevillea globosa* (P3), *Grevillea scabrida* (P3), *Grevillea subtiliflora* (P3) and *Rhodanthe collina* (P3) will be cleared. Approximately 1.8% of the known *Persoonia pentasticha* (P3), 2.4% of *Hemigenia tichbonii* (P1), 4.7% of *Micromyrtus acuta* (P3) and 9.5% of *Allocasuarina tessellata* (P3) will be cleared. TGN notes that not all of the application area has been surveyed, and there is a high probability that additional occurrences of *Allocasuarina tessellata* (P3) and other priority species will be located (particularly on the eastern side, where the known records follow historic drill lines). As such, the likely impact on *Allocasuarina tessellata* (P3) is predicted to be less than 9.5% currently estimated.

A search of DBCA's flora database has found that the 11 priority flora species within the conceptual site layout are present within 60km of the application area. *Acacia subsessilis* (P3), *Micromyrtus acuta* (P3), *Persoonia pentasticha* (P3) and *Rhodanthe collina* (P3) also contained records over 100km from the application area.

Degradation of Vegetation

Degradation of vegetation can result from direct and indirect impacts of clearing up to 402.80ha. These impacts can include:

- Uncontrolled vehicle access leading to physical damage of vegetation;
- Land clearing and construction activities depositing dust on vegetation;
- Vehicles and/or equipment spreading or introducing weeds;
- Leaks from containment structures, pipes, vehicles or equipment leading to contaminated soils, surface water or groundwater;
- Hydrocarbon or chemical spills contaminating soils, surface water or groundwater;
- Inappropriate disposal of domestic waste or waste hydrocarbons and chemicals leading to contamination of soils, surface water or groundwater; or
- Clearing and associated activities accidentally causing a fire.

Potential Impacts to Fauna

Fauna Deaths Due to Displacement

Clearing vegetation is likely to include the removal of reptile, mammal or invertebrate burrows that are either currently in use or could be used again, or foraging habitat for species. Removal of these areas could force individuals into adjacent areas that may offer fewer resources or fall within another individual's territory. Forced relocations can also place individuals under survival pressure and increase the possibility of predation.

Surveys to date have identified 37 Malleefowl (VU) mounds along with 181 mygalomorph burrows, comprising of *Idiosoma gutharuka* (P1) (50 burrows), *I. clypeatum* (P3) (109 burrows) and *I. intermedium* (P3) (22 burrows), within the application area. A Malleefowl (VU) mound, that was inactive during Western Ecological's (2026) assessment, along with 37 *I. clypeatum* (P3) and eight *I. intermedium* (P3) burrows were recorded in the conceptual site layout and will likely be cleared. *I. gutharuka* (P1) burrows are at least 500m from the conceptual site layout (Figure 24). All these species are also recorded within a 50km radius of the application area, with Malleefowl (VU) mounds widely recorded adjacent to the application area.

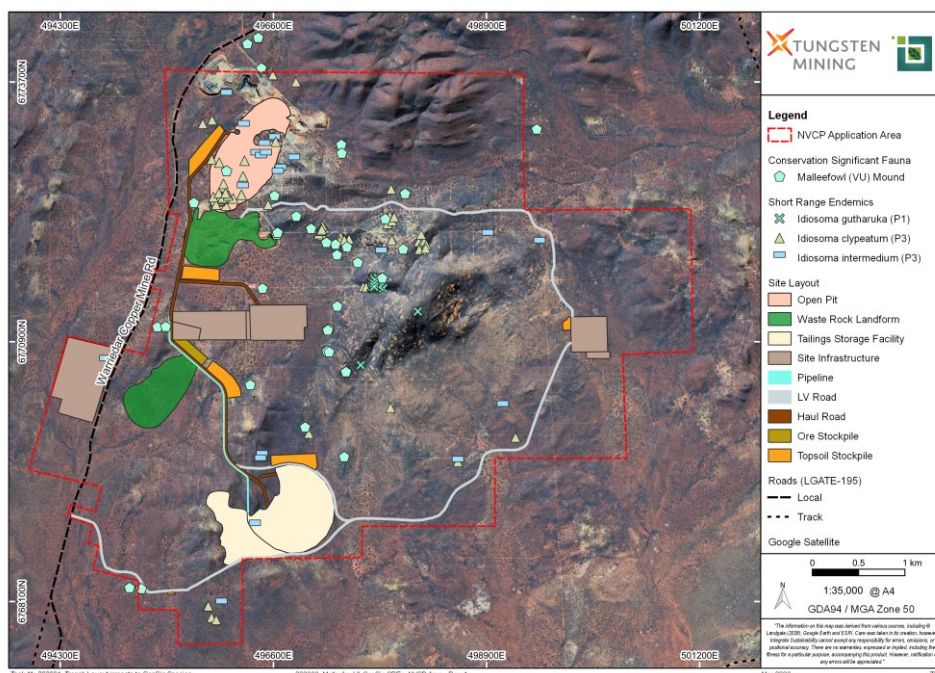


Figure 24 Malleefowl (VU) Mounds and Conservation-Significant SRE Burrows in the Application Area

Fragmentation of Habitat

Previous exploration and mining activities have resulted in some habitat fragmentation across the application area, with most clearing occurring in tenement M59/425, which has been considered during planning of the conceptual site layout. Despite this, habitat types mapped by Western Ecological (2026) and Bennelongia (2026a) are not restricted to the application area and are found in the wider region. It is considered unlikely that habitat fragmentation caused by the proposed clearing will significantly impact fauna species.

Loss of Foraging Habitat

Vegetation clearing will reduce foraging areas and habitat; however, no habitat type is expected to be entirely removed within the application area, as per the conceptual site layout. In particular, less than 1% of the vertebrate fauna habitat Rocky Hill will be cleared predominantly proposed within the Open Eucalyptus Woodland (22.1%) and Mixed Shrubland (11.1%) habitats (Table 15; Figure 25).

Table 15 Proposed Clearing in Fauna Habitats

Habitat Type	Total Mapped Area (ha)	Proposed Cleared Area (ha)	Proposed Cleared Area (%)
Mixed shrubland	2,171.2	241.9	11.1
Open Eucalyptus woodland	515.0	113.9	22.1
Rocky hill	350.3	0.5	0.1
Cleared/Degraded	92.7	45.1	49.3

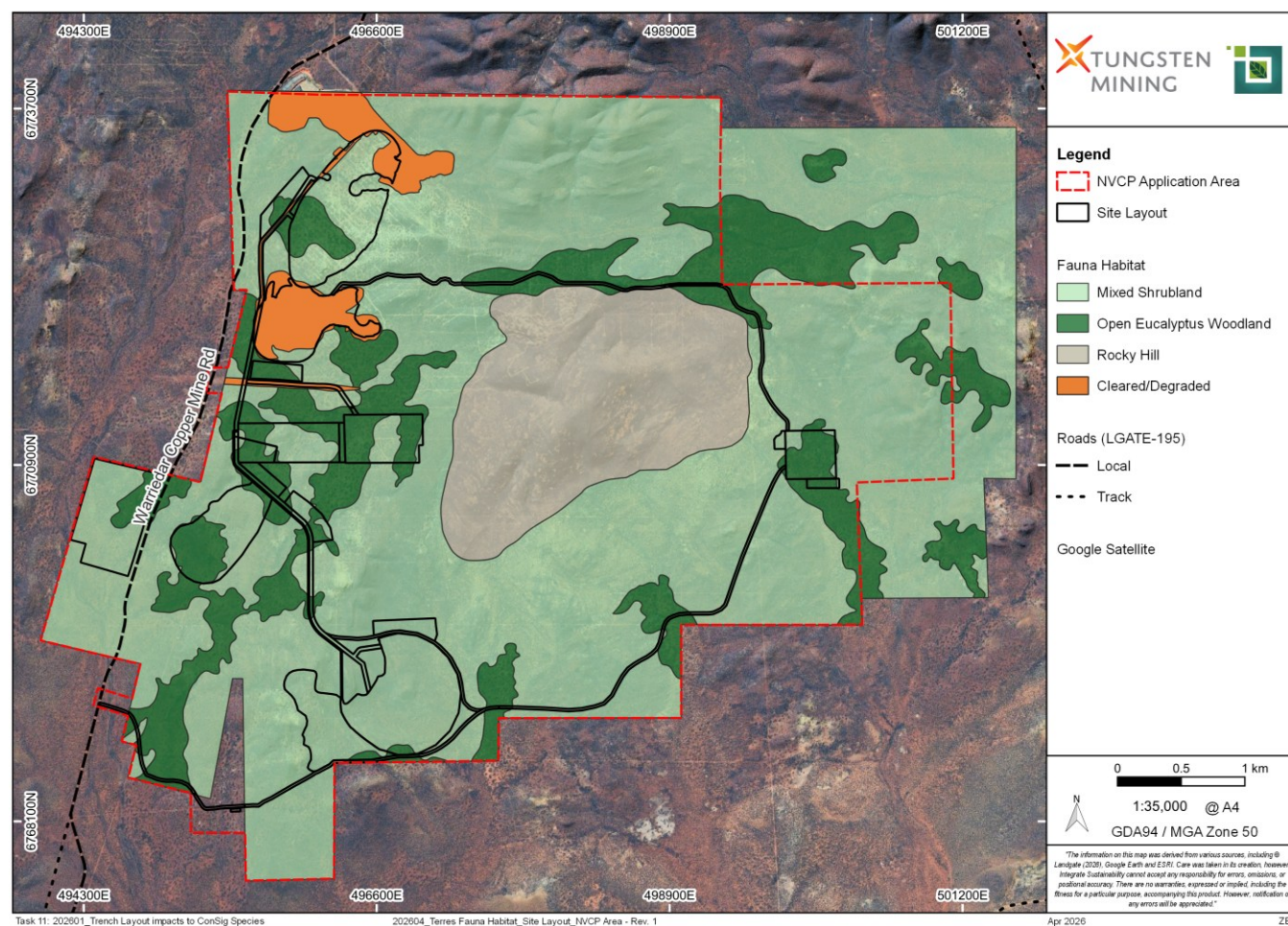


Figure 25 Terrestrial Fauna Habitat with Conceptual Site Layout

Western Ecological (2026) noted the operation area contains suitable foraging habitat and potential nesting habitat for the Malleefowl (VU). Clearing within the foraging habitat proposes to clear 22.1% of the total mapped area compared to 13.6% of the potential nesting habitat (Table 16; Figure 26).

Table 16 Proposed Clearing in Malleefowl (VU) Foraging and Potential Nesting Habitat

Malleefowl (VU) Habitat	Total Mapped Area (ha)	Proposed Cleared Area (ha)	Proposed Cleared Area (%)
Foraging habitat	515.0	113.9	22.1
Potential Nesting habitat	1,777.0	242.3	13.6

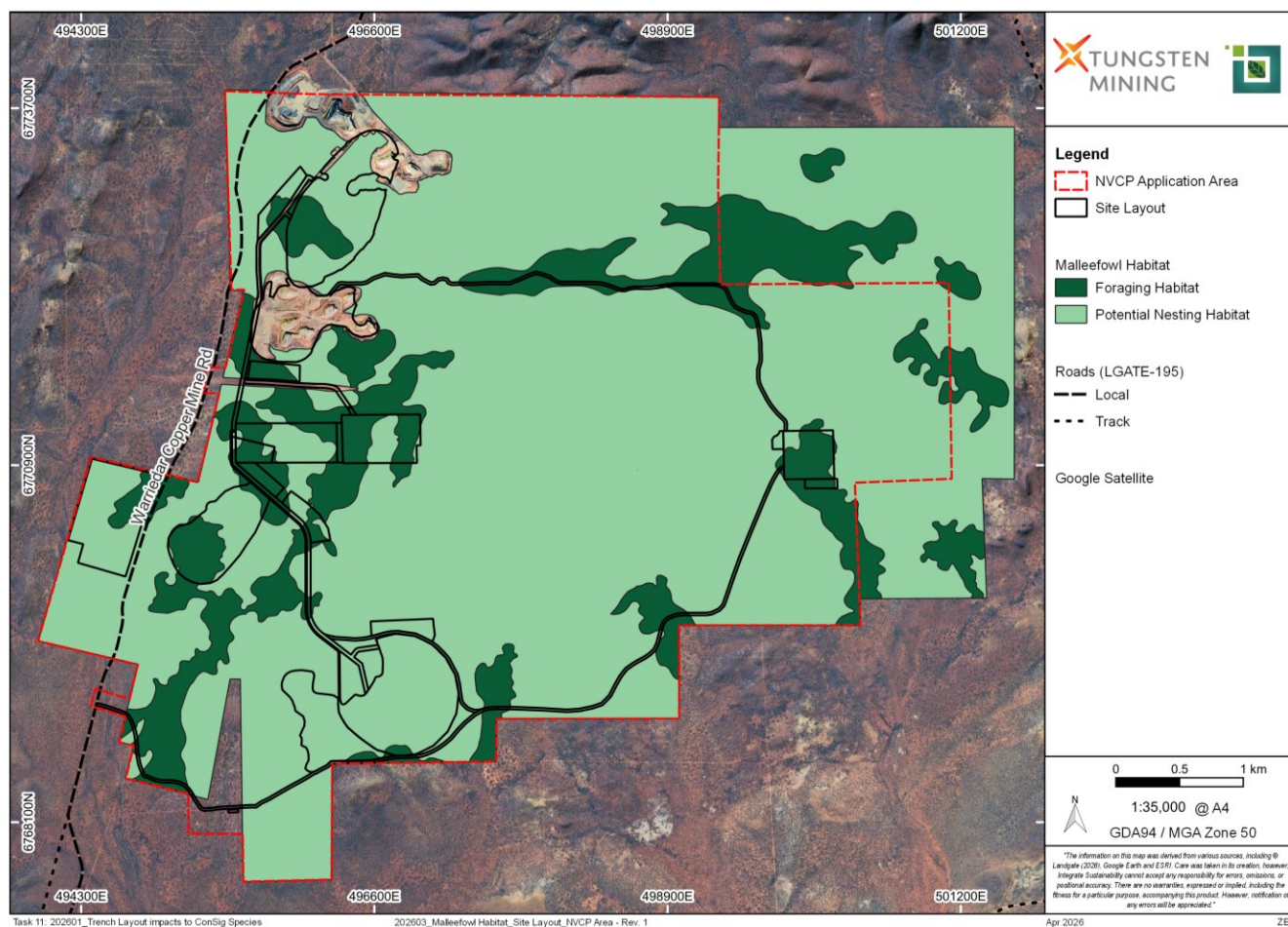


Figure 26 Malleefowl (VU) Foraging and Potential Nesting Habitat with Conceptual Site Layout

Table 17 Proposed Clearing in SRE Habitats

Habitat Type	Total Mapped Area (ha)	Proposed Cleared Area (ha)	Proposed Cleared Area (%)
Low hills with mixed shrublands	4,523	133.9	3.0
Stony plains with mixed shrubland	2,359	119.1	5.1
Mixed shrublands	1,470	8.7	0.6
Sandplains with mixed shrubland	1,382	0	0
Floodplains and drainage areas	588	16.1	2.7
Open Eucalyptus woodlands	591	63.7	10.8
Granite outcrops	373	16.3	4.4
Cleared/degraded	100	45.1	45.1

Most of the SRE habitats will have around 5% of the mapped area cleared (Table 17), with clearing predominantly occurring in the Open Eucalyptus Woodland at 10.8%. Bennelongia (2026a) did note the Open Eucalyptus Woodland habitat can provide shelter for mygalomorph spider species, including those from the *Idiosoma* genus. The Granite Outcrops, Low Hills with Mixed Shrublands and the Mixed Shrublands habitats are also considered to provide moderate to high prospectivity for SRE species, while the remaining habitats are suitable for generalists. No clearing is proposed within the Sandplains with Mixed Shrublands habitat.

All vertebrate fauna and SRE habitats mapped in the application area are well represented across the wider region. No unique habitats have been identified within the application area, although Western Ecological (2026) did note the Rocky Hill habitat is restricted to higher elevations.

Increased Vehicle Strikes

An increase in fauna deaths from vehicle strikes is likely to occur where roads/tracks are constructed or upgraded, particularly affecting slow-moving or easily startled species or those that feed on dead carcasses on the road. Vehicles are more likely to strike fauna at night, as visibility is reduced and more animals are on the move.

Fire

Clearing and associated activities can inadvertently cause fires, which are a key threat to conservation-significant species, as many small mammals and birds rely on long-unburnt vegetation. It is possible that fire could spread from the application area into adjacent areas, as the operation includes areas of dense vegetation.

Potential Impacts to Surface Water

Increased Turbidity

Erosion from disturbed areas and steep slopes, along with surface water flowing over these areas, may lead to higher sediment levels, increasing surface water turbidity. Despite this, the operation is located in the upper catchment, approximately 22km north of Lake Monger, which is the main downstream riverine environment (Hydrologia, 2024). Local erosion is therefore unlikely to affect the wider environment.

Altered Surface Water Flows

Construction of infrastructure for the operation may alter surface water flows. Small overland and concentrated flow paths are present in the application area, which will likely be intersected by the clearing required for the operation.

5. MANAGEMENT MEASURES

The proposed clearing area within the application area is the maximum area deemed necessary for developing the operation. Mitigation measures to manage potential impacts have been developed and will be implemented (Table 18). Tungsten Mining NL will explore opportunities to further reduce clearing.

Considering the existing environment, proposed activities and management strategies, Tungsten Mining NL believes that impacts to flora/vegetation, fauna and surface water within the application area have been reduced to an acceptable level.

Table 18 Potential Impacts and Mitigation Measures

Impact	Pathways	Management Measures
Potential Impacts to Flora		
Direct loss of vegetation	• Clearing • Fire • Vehicle movement • Weeds	• Review the proposed operation design against vegetation survey data to avoid/minimise clearing significant flora and vegetation. • Utilise historically disturbed areas for infrastructure, where possible and practical. • Verify the clearing boundary, including any areas of native vegetation to be retained, and ensure it is marked out with either barrier tape or star pickets prior to clearing activities. • Ensure clearing occurs progressively and in accordance with permit conditions. • Survey the cleared areas and track disturbance against approved limits. • Restrict vehicle movements to approved tracks and roads.
Direct loss of conservation-significant flora		• Prior to clearing activities, inspect the area for conservation-significant flora species; where new threatened species area records these will also be avoided and priority species clearing will be limited to the estimated impacts. • Ensure staff and contractors are aware of the location of conservation-significant flora and their responsibility to ensure they are protected. • Restrict vehicle movements to approved tracks and roads.
Degradation of vegetation	• Chemical spills or leaks • Dust deposition • Fire • Vehicle movement • Weeds	• Restrict vehicle movements to approved tracks and roads, and enforce speed limits. • Progressively rehabilitate cleared areas when they are no longer required. • Implement dust control measure on road track and stockpiles. • All vehicles and workshops will contain fire extinguishing equipment and spill kit. • Conduct a pre-start on heavy machinery and equipment prior to clearing activities. • Weed hygiene procedures and inspections will be implemented on vehicles and equipment. • Chemicals and hydrocarbons will be kept banded and in designated storage areas. • Refuelling will occur in designated areas. • Staff and contractors will be trained in emergency procedures, spill response and clean up.

Impact	Pathways	Management Measures
Potential Impacts to Fauna		
Fauna Deaths Due to Displacement	Clearing	- Utilise existing disturbed areas where possible. - Prior to clearing activities, inspect the area for Malleefowl (VU) mounds, which will be recorded and avoided where possible. - Educate staff/contractors about fauna interactions. - Report any incidents of fauna interactions. - Progressively rehabilitate cleared areas when they are no longer required and reinstate habitat characteristics to encourage fauna recolonisation.
Fragmentation of habitat	- Clearing - Vehicle movement	- Review the proposed operation design against habitat survey data. - Progressively rehabilitate cleared areas when they are no longer required. - Restrict vehicle movements to approved tracks and roads.
Loss of foraging area or habitat	Clearing	- Prior to clearing activities, inspect the area for Malleefowl (VU) mounds, which will be recorded and avoided where possible. - Progressively rehabilitate cleared areas when they are no longer required and reinstate habitat characteristics to encourage fauna recolonisation.
Increased vehicle strikes	Vehicle movement	- Restrict vehicle movements to approved tracks and roads. - Enforce speed limits. - Educate staff/contractors about fauna interactions. - Report any incidents of fauna interactions.
Fire	- Machinery/equipment use - Human behaviour	- All vehicles and workshops to contain fire extinguishing equipment. - Train staff and contractors in emergency procedures. - Conduct pre-start inspections on heavy machinery and equipment before clearing activities. - A hot work permit will be required before conducting hot work.
Potential Impacts to Surface Water		
Increased turbidity	- Clearing - Alteration of natural flows - Large rainfall events	- A site-wide surface water management plan will be developed, and clean and dirty water will be separated. - Appropriately engineered infrastructure will be installed for any disturbed drainage channels.
Altered surface water flows	- Clearing - Construction of infrastructure	

6. ASSESSMENT AGAINST CLEARING PRINCIPLES

Schedule 5 of the EP Act outlines 10 Principles that guide decision-makers on whether native vegetation should be cleared. The Department of Water and Environmental Regulation and the Department of Mines, Petroleum and Exploration utilise the Principles as a comparative tool to determine whether clearing activities are environmentally acceptable and can be appropriately managed. An assessment of the proposed 402.80ha of clearing against the 10 Principles has been undertaken, which is summarised in Table 19.

Table 19 Summary of Assessment Against the 10 Clearing Principles

Clearing Principle	Not at Variance	Potentially at Variance
a) Native vegetation should not be cleared if it comprises a high level of biological diversity		X
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 WA		X
c) Native vegetation should not be cleared if it includes, or is necessary for the continued existence of rare flora	X	
d) Native vegetation should not be cleared if it comprises the whole or part of, or is necessary for the maintenance of, a Threatened Ecological Community	X	
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	X	
f) Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland	X	
g) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation	X	
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		X
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	X	
j) Native vegetation should not be cleared if clearing of the vegetation is likely to cause, or exacerbate, the incidence of flooding	X	

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

Spectrum Ecology (2021) identified three vegetation units with local and regional significance in the operation area, which occur within the application area: AdAa, AdAt and AsCp. The mosaic AdAt/AdAa is also present. Vegetation condition in the application area varies from cleared/degraded to excellent.

The conceptual site layout will result in clearing approximately 42.5ha, 33.6ha, and 50.3ha for vegetation units AdAa, AdAt, and the mosaic AdAt/AdAa, respectively. When compared to the total mapped area within the operation area, this equates to approximately 5.4%, 12.2% and 14.3% for vegetation units AdAa, AdAt and mosaic AdAt/AdAa, respectively. No clearing is proposed within the vegetation unit AsCp.

A targeted survey for the three locally significant vegetation units identified that the vegetation units AdAa and AdAt are present outside the application area within 20km. Vegetation unit AsCp has only been identified within the application area; however, no direct impacts are proposed.

We note that while vegetation units AdAa and AdAt were located outside the application area and no clearing is proposed in AsCp, all three vegetation units contain a high level of biological diversity. Clearing of AdAa and AdAt may be at variance with the Clearing Principle 'a'; noting that the extent of clearing is limited, and both vegetation units are present beyond the application area.

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 WA

Fauna habitats mapped by Western Ecological (2026) and Bennelongia (2026a) are considered widespread, with none restricted to the application area. It was noted that approximately 22.1% and 13.6% of the foraging and potential nesting habitat for Malleefowl (VU), respectively, will be cleared. Similarly, approximately 10.8% of the SRE habitat Open Eucalyptus Woodland will be cleared, which includes Bennelongia (2026a) noted as providing shelter for mygalomorph spider species, including those from the *Idiosoma* genus.

The application area also contains 37 Malleefowl (VU) mounds, and 50 *Idiosoma gutharuka* (P1), 109 *I. clypeatum* (P3) and 22 *I. intermedium* (P3) burrows (Figure 24). A Malleefowl (VU) mound along with 37 *I. clypeatum* (P3) and eight *I. intermedium* (P3) burrows were identified in the conceptual site layout. *I. gutharuka* (P1) burrows are at least 500m from the conceptual site layout. All these species have records within 50 km of the operation area.

While the fauna habitats are widespread, clearing is proposed within suitable foraging habitat for Malleefowl (VU) and suitable shelter habitat for mygalomorph spiders. Recent records of conservation-significant fauna and SREs in the conceptual site layout also indicate that clearing may therefore be at variance with Principle 'b', as some suitable habitat for conservation-significant fauna will be removed.

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

Previous flora and vegetation surveys undertaken within and around the operation area have found *Acacia sulcatcaulis* (EN) predominantly within the application area, with a population identified south of 1km. Based on current knowledge, 249,566 individuals are believed to occur within the application area compared to the total known population of 249,593; no individuals are proposed to be cleared, and a 50m exclusion zone has been applied. It is acknowledged the total population abundance is a low estimate as only the most recent flora survey (JBBC & ISPL, 2026b) identified the species outside the application area. Despite the exclusion zone utilised, some plants may be exposed to dust from nearby activities. Dust will be managed in accordance with the site dust management plan.

The application area also includes six Priority 1, 12 Priority 3 and one Priority 4 flora species managed by DBCA. The conceptual site layout will result in the clearing of only two Priority 1 and nine Priority 3 species. A single individual for *Acacia diallaga* (P1), and less than 1% of the known *Acacia karinae* (P3), *Acacia subsessilis* (P3), *Grevillea globosa* (P3), *Grevillea scabrida* (P3), *Grevillea subtiliflora* (P3) and *Rhodanthe collina* (P3) populations will be cleared. Based on previous flora and vegetation surveys, and a search of DBCA's flora database, approximately 1.8% of *Persoonia pentasticha* (P3), 2.4% of *Hemigenia tichbonii* (P1), 4.7% of *Micromyrtus acuta* (P3) are within the conceptual site layout compared to 9.5% *Allocasuarina tessellata* (P3). It is noted that the known population of *Allocasuarina tessellata* (P3) is likely to be larger than currently recorded in the application area; further surveys have been scheduled to verify this statement. No priority flora species known within the area are restricted to the application area; a search of the DBCA's flora database found that all species occur within a 50km radius around the application area. *Acacia subsessilis* (P3), *Micromyrtus acuta* (P3), *Persoonia pentasticha* (P3) and *Rhodanthe collina* (P3) were recorded within 100km.

Based on the exclusion zone utilised for *Acacia sulcatcaulis* (EN) and the observed extent for the priority flora species, the proposed clearing is not considered at variance with Principle 'c'.

d) Native vegetation should not be cleared if it comprises the whole or part of, or is necessary for the maintenance of, a Threatened Ecological Community

No TECs or PECs listed under the EPBC Act or EP Act occur within the application area. The closest TEC is over 15km away, while PECs are known to occur within 5km, but are unlikely to occur in the application area, as they are geologically restricted. Clearing is, therefore, not at variance with Principle 'd'.

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 publicly available layer Pre-European Vegetation (DPIRD-006) indicates the application area intersects four vegetation sub-associations: 326.3, 355.2, 420.5 and 434.0. All of these sub-associations have retained over 97% of their original pre-European vegetation extent. Based on the conceptual site layout, 1.5ha, 180.6ha, 207.9ha and 13.1ha in sub-associations 326.3, 355.2, 420.5 and 434.0, respectively, will be cleared, which equates to less than 1% of the total extent. Clearing is, therefore, not at variance with Principle 'e'.

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

The application area does not contain any water bodies or permanent rivers or creeks; only small overland flow paths and drainage lines. The proposed clearing is not considered at variance with Principle 'f'.

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

The conceptual site layout covers the land systems Graves, Moriarty, Norie, Singleton and Yalluwin. Payne et al. (1998) described the Graves and Moriarty systems as susceptible to water erosion, especially where the soil surface is disturbed, or shrub cover is reduced, while the drainage tracts in the Norie and Yalluwin systems are susceptible to increased water erosion. The Singleton system, on the other hand, is largely protected from erosion by stone mantles.

Historic disturbance has occurred across these land systems in the application area due to previous mining and exploration activities. Where possible, this historic disturbance has been taken into account in the planning of the conceptual site layout. In particular, approximately 44.1ha of the total proposed clearing in the Moriarty system (131.0ha) and approximately 37.2ha of 165.6ha proposed within the Graves system have previously been cleared. Further disturbance from the proposed clearing is not expected to have a significant ecological impact, especially when managed in accordance with the mitigation measures outlined in the Management Measures. Clearing is, therefore, not at variance with Principle 'g'.

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

Two water reserves (R16485 and R16489) are located within the operation and application area (Figure 27), with tenement conditions for M59/425 consenting to exploration activities. A trigonometrical station (R11873), managed by the Department of Lands, Planning and Heritage, is also present in the application area. The two water reserves are present within the conceptual site layout, while the trigonometrical station is approximately 1km from any features in the conceptual site layout.

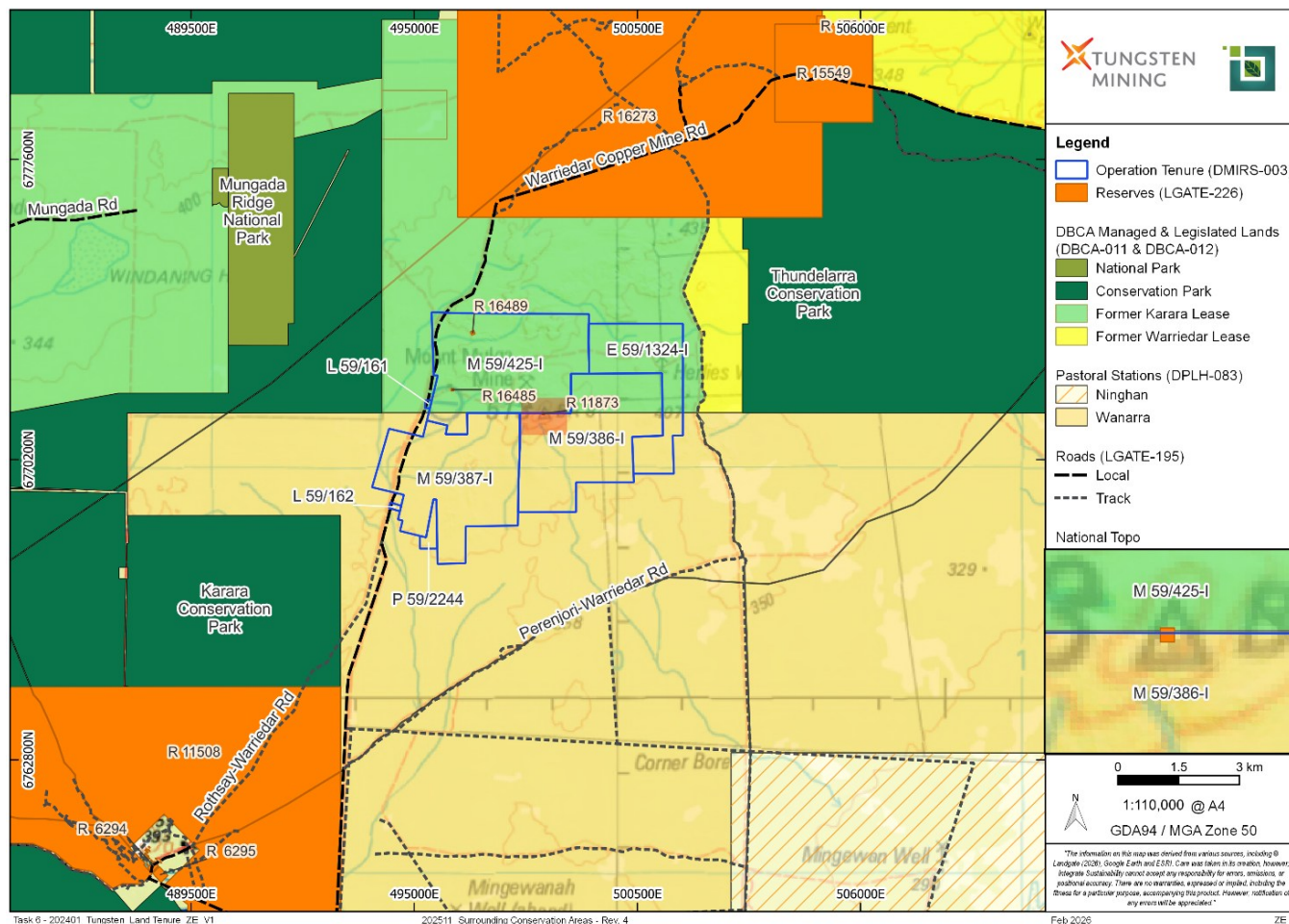


Figure 27 Conservation Areas within and Surrounding the Operation Area

Three other conservation areas surround the operation (Figure 27). The closest is Karara Conservation Park and Thundelarra Conservation Park, approximately 500m west and 2.3km east, respectively, while Mungada Ridge National Park is approximately 3.4km west. Mungada Ridge National Park is the smallest of these conservation areas, at approximately 1,030ha, and was established to protect banded iron formations and their associated vegetation communities (Whitby, 2022). Karara Conservation Park and Thundelarra Conservation Park, on the other hand, cover 82,000ha and 100,100ha, respectively. The ex-Karara pastoral station, held by the DBCA, was acquired to serve as an ecological corridor between Thundelarra Conservation Park and Mungada Ridge National Park. The proposed clearing will result in the removal of some land within the ecological corridor and thus may be at variance with Principle 'h'; it is acknowledged that a significant proportion of the ecological corridor will remain intact.

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 water bodies, permanent rivers or creeks in the application area. Hydrologia (2024) noted that surface water flow only occurs intermittently, and water quality data is not available on the catchment or these drainage lines, but is likely to be largely fresh, although it may be turbid.

Three bores are present in the application area and the conceptual site layout. Groundwater testing suggests the groundwater in the area is brackish (1,010mg/L).

The potential for surface or groundwater contamination is low as hazardous substances and contaminated water will be contained and banded to prevent release to the environment. Clearing is not considered at variance with Principle 'i'.

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

The average annual rainfall is 295mm, significantly lower than the average annual evaporation of 2,530mm. Flood risk for the operation is considered minimal, and therefore, clearing is not at variance with Principle 'j'.

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APPENDICES

Appendix A 2019-2021 Flora and Vegetation Assessment

MT MULGINE

2019-2021 FLORA & VEGETATION ASSESSMENT

PREPARED FOR: TUNGSTEN MINING NL





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V4	Melissa Hay and Carmel Winton (flora)	Carmel Winton	19-June-2020
V5	Carmel Winton (flora)	Melissa Hay & Claire McGuire	16-Dec-2020
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V7	Melissa Hay	Melissa Hay	01-Jul-2021
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EXECUTIVE SUMMARY

The Mt Mulgine Project (the Project) is situated approximately 330 kilometres (km) north east of Perth and 15 km north east of Rothsay. The Project is located within contiguous Mining Leases M59/386, M59/387, M59/425 and E59/1324 which are held by Minjar Gold Pty Ltd (Minjar). Minor activities (construction and operation of roads) will be undertaken within the Miscellaneous Leases L59/161 and L59/162. Prospecting Lease P59/2244 was approved in June 2020, which is also owned by Mid West Tungsten and forms part of the Project Area.

Tungsten Mining NL (Tungsten Mining) commissioned Spectrum Ecology (Spectrum) to undertake a detailed and targeted flora and vegetation assessment for the Mt Mulgine Project (Mt Mulgine). Three flora survey phases have been undertaken at the Study Area in August/September 2019, March 2020, and August/September 2020. A targeted survey for *Acacia sulcatacaulis* was completed in August/September 2021, data associated with vegetation units and *Acacia sulcatacaulis* has been updated to reflect this survey.

A total of 296 confirmed vascular plant taxa were recorded from the Project of which 15 were introduced. There are no Threatened flora taxa recorded within the Project. Seventeen significant flora taxa were recorded within the Project during the assessment:

Priority 1:

- *Acacia diallaga*
- *Acacia karina*
- *Acacia sulcatacaulis*
- *Chamelaucium* sp. Warriedar (A.P. Brown & S. Patrick APB 1100)
- *Hemigenia tichbonii*
- *Hydrocotyle dimorphocarpa*
- *Lepidosperma* sp. Blue Hills (A. Markey & S. Dillon 3468)

Priority 3:

- *Allocasuarina tessellata*
- *Grevillea globosa*
- *Grevillea scabrida*
- *Grevillea subtiliflora*
- *Micromyrtus acuta*
- *Micromyrtus trudgenii*
- *Persoonia pentasticha*
- *Rhodanthe collina*
- *Stenanthemum poecilum*

Priority 4:

- *Dodonaea amplisemina*

One Priority 1 taxa, *Acacia sulcatacaulis* has high local and high regional significance. *Acacia sulcatacaulis* (P1) has 100% of its known records occurring within the Project. Species distribution modelling (SDM) was undertaken in 2020 and estimates that there is no occurrence of this taxon outside of the hills and slopes of Mt Mulgine (Spectrum Ecology, 2020c).

No Threatened or Priority Ecological Communities were recorded in the Project and none of the vegetation units recorded resemble any known communities.

Seven vegetation units were identified as occurring within the Project:

- ElAr: *Eucalyptus loxophleba* subsp. *supralaevis* or *E. loxophleba* subsp. *lissophloia* low open woodland over *Acacia ramulosa* var. *ramulosa* tall open shrubland over *Ptilotus obovatus*, *Scaevola spinescens* low isolated shrubs on flats;
- ElAt: *Eucalyptus loxophleba* subsp. *supralaevis* low woodland over *Acacia tetragonophylla*, *Allocasuarina dielsiana*, *Acacia ramulosa* var. *ramulosa* tall open shrubland over *Dodonaea inaequifolia*, *Acacia acanthoclada* subsp. *glaucescens* mid-low sparse shrubland on drainage lines on flats;

- AaAr: *Allocasuarina acutivalvis* subsp. *prinsepiana* tall sparse shrubland over *Acacia ramulosa* var. *ramulosa* (+/-*Micromyrtus acuta*) mid open shrubland over *Austrostipa elegantissima* isolated tussock grasses on flats;
- EsTh: *Eucalyptus salubris* low open woodland over *Tecticornia ?halocnemoides* low sparse shrubland on flats;
- AdAa: *Allocasuarina dielsiana* (+/-*Acacia umbraculiformis*) low open woodland over *Acacia acuminata*, *Allocasuarina tessellata*, *Acacia karina* tall open shrubland over *Borya sphaerocephala* low sparse shrubland on foot and mid slopes;
- AsCp: *Acacia sulcaticaulis* and/or *Allocasuarina acutivalvis* subsp. *prinsepiana* open shrubland over *Calycopeplus paucifolius* mid sparse shrubland over *Philotheca deserti* subsp. *deserti* low sparse shrubland on slopes and crests; and
- AdAt: *Acacia duriuscula* or *Allocasuarina tessellata* tall open shrubland on slopes and crests.

Three (AdAa, AsCp, AdAt) were considered to have high local and regional significance due to their restricted distribution in the bioregion and forming habitat for restricted significant flora. AsCp appears to be restricted to the Mt Mulgine hills and slopes.

1. INTRODUCTION

1.1. Project Background

The Mt Mulgine Project (the Project) is situated approximately 330 kilometres (km) northeast of Perth and 15 km northeast of Rothsay. The Project is located within contiguous Mining Leases M59/386, M59/387, M59/425, and E59/1324 which are held by Minjar Gold Pty Ltd (Minjar). Minor activities (construction and operation of roads) will be undertaken within the Miscellaneous Leases L59/161 and L59/162. Prospecting Lease P59/2244 was approved in June 2020, which is also owned by Mid West Tungsten and forms part of the Project area referred to throughout this document.

The Project is within the Shire of Perenjori and can be accessed from the Warriedar Copper Mine Road and the Minjar Haul Road. The Project tenements M59/425 and M59/386 are partially located within the former Warriedar pastoral lease, which is now managed by the Department of Biodiversity Conservation and Attractions (DBCA). Tenements M59/387 and a portion of M59/425 are partly within the Wanarra pastoral lease.

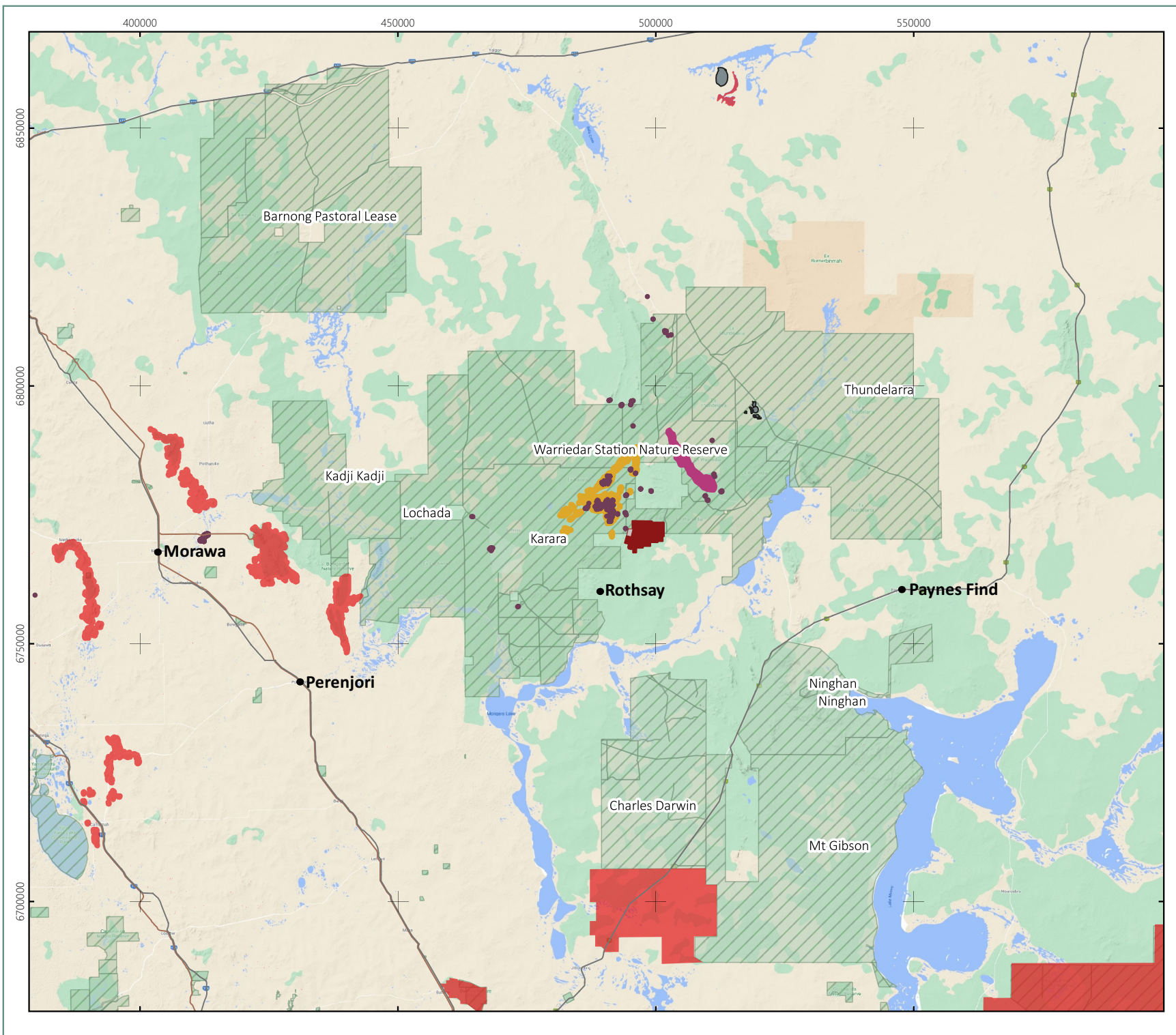
Tungsten Mining NL (Tungsten Mining) is developing the Mt Mulgine Tungsten Project. Tungsten Mining holds the tungsten and molybdenum rights to the Mt Mulgine Project and also has the rights to all by-products from the mining of tungsten and molybdenum. Minjar Gold (Minjar) is the registered tenement holder and has certain rights to other minerals having conducted gold exploration and mining activities within the Project tenements in the past.

The Mt Mulgine Project consists of two main areas, the Mulgine Hill and the Mulgine Trench Deposits. Both are within tenement M59/425. Additional site infrastructure including the Processing Plant and ROM Pad, Waste Rock Landforms (WRL), Stockpiles, Tailings Storage Facilities (TSF) and Camp Facilities will be located within the M59/387 and M59/386 tenements.

A Pre-Feasibility Study (PFS) for a proposed large-scale project for the Mt Mulgine Trench deposit commenced in April 2019 with the aim of detailing a single option to move forward into a Definitive Feasibility Study.

1.2. Objectives

Tungsten Mining commissioned Spectrum Ecology (Spectrum) to undertake a detailed flora and vegetation assessment for the Mt Mulgine Project, including three phases of field surveys. A detailed assessment is required as the Project supports a high diversity of biological significance. The objective of a detailed flora and vegetation assessment is to provide adequate information on the significant flora and vegetation values of the Project in order to undertake a thorough Environmental Impact Assessment.



Legend

Mt Mulgine Project

Tenement M59/460

Significant Lands

Conservation Estate

Environmentally Sensitive Areas - DWER 2019

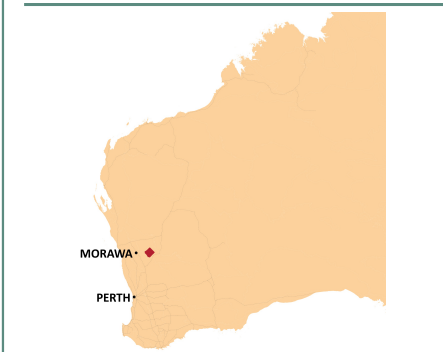
Environmentally Sensitive Areas - Threatened Flora

Directory of Important Wetlands

PECs

Blue Hills BIF

Warriedar/Pinyalling/Walagnumming Hills BIF



0 10 20 30 40 km

Scale: 1:1,000,000

Coordinate System: GDA 1994 MGA Zone 50

Projection: Transverse Mercator

Units: Meter



Author: CS

Date: 09-12-2020

Location of the Mt Mulgine Project & Significant Lands

Mt Mulgine Project

Prepared for
Tungsten Mining NL

Figure
1.1

1.3. Bioregion & Climate

The Interim Biogeographic Regionalisation for Australia (IBRA) classifies Australia into regions based on dominant landscape, climate, lithology, geology, landform and vegetation (Thackway and Cresswell, 1995).

The Project is located within the Yalgoo IBRA region (Figure 1.2) a large region which forms an interzone between the Southwest and the Eremaean botanical provinces. The Yalgoo bioregion is characterised by Callitris/Gimlet, Mulga and Bowgada open woodlands and scrubs on earth to sandy-earth plains in the Western Yilgarn Craton and the Southern Carnarvon Basin. The Yalgoo region is divided into two sub-regions: Edel and Tallering and the Project is located within the Tallering sub-region (Figure 1.2).

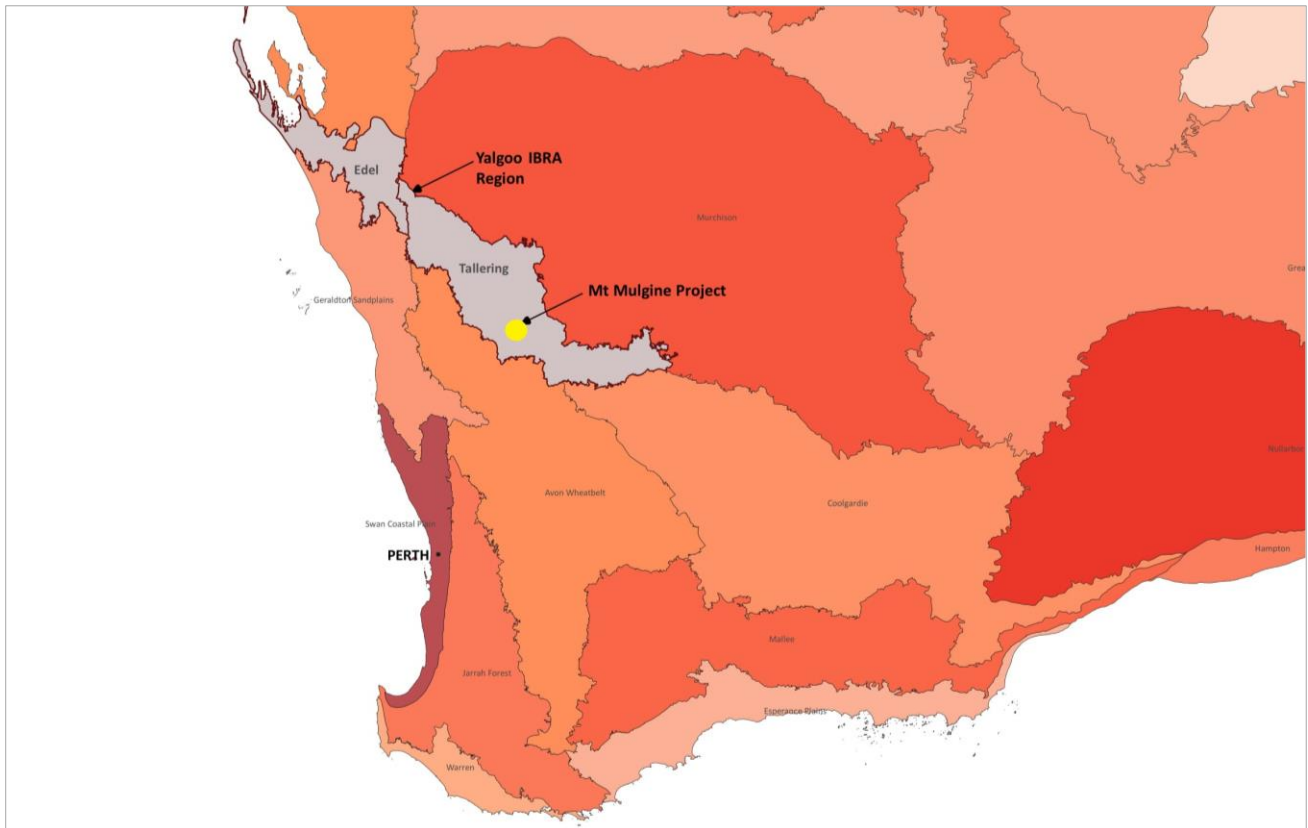


Figure 1.2: IBRA Classification

The climate of the Yalgoo bioregion is classified as Mediterranean, arid to semi-arid and warm, with 200 to 300 mm of rainfall annually (Desmond and Chant, 2001; McKenzie, May and McKenna, 2003). Rainfall for the region is highest in the winter months (June-August).

1.4. Disturbance History

The dominant current and historical land use across the Yalgoo region is grazing of native pastures (77%) (Desmond and Chant, 2001) however since 2015 nine pastoral stations or sections of (Barnong, Burnerbinmah, Kadji, Karara, Lochada, Thundelarra, Woolgorong, Warriedar, and Yuin) have been returned as conservation estates. Mining interest in the region is considerable however most mining leases are still required to be stocked (Desmond and Chant, 2001).

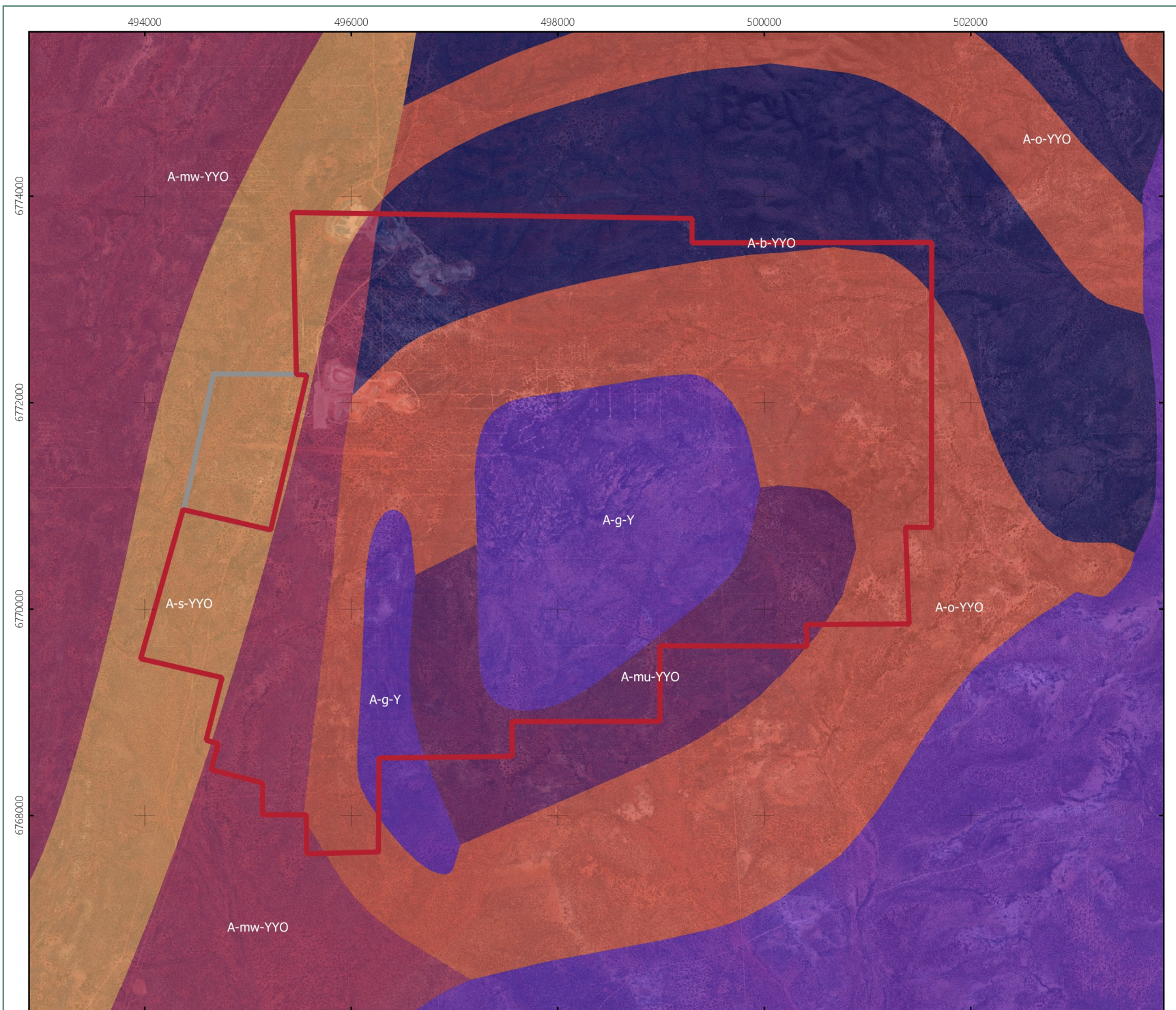
1.5. Geology

The geology of Western Australia has been mapped at a scale of 1:500,000 (Geological Survey of Western Australia, 2016). No finer mapping is available digitally for the area. Two units and six sub-units have been mapped within the Project and these are listed in Table 1.1 and mapped on Figure 1.3.

None of the sub-units are restricted to the Yalgoo bioregion and all extend into other areas within Western Australia. All units have less than 1.0% of their total occurrence within the Project.

Table 1.1: Geological Units (1:500,000)

Unit	Sub-unit Code	Description	Area in Project (ha)	% of State Total in Project	Total Extent (ha)	Location & Description of Occurrence
Yilgarn Craton Granites	A-g-Y	Granitic rock, undivided; metamorphosed.	804	<0.0%	23,777,563	Mapped as a very large area covering much of the Yilgarn Craton over many IBRA regions.
Youanmi Terrane Greenstones	A-b-YYO	Mafic volcanic rock with minor mafic and ultramafic intrusive rocks; subordinate felsic rocks; metamorphosed.	298	<0.0%	977,038	Widespread across large areas of the Yilgarn Craton.
	A-mu-YYO	Metamorphosed ultramafic rock, undivided; typically deeply weathered.	364	0.3%	105,936	Widespread across the Yilgarn Craton but with small occurrences and a low total area.
	A-mw-YYO	Metamorphosed mafic igneous rock, undivided.	331	0.2%	164,979	Widespread across the Yilgarn Craton but with small occurrences.
	A-o-YYO	Mafic intrusive rock dominant; metamorphosed.	1,147	0.7%	156,564	Widespread across the Yilgarn Craton but with small occurrences.
	A-s-YYO	Clastic sedimentary rock dominant; metamorphosed.	218	0.7%	294,673	Widespread across the Yilgarn Craton but with small occurrences.



Legend

- Mt Mulgine Project
- Extension Tenement M59/460

Geology Units (1:500,000)

- A-b-YYO
- A-g-Y
- A-mu-YYO
- A-mw-YYO
- A-o-YYO
- A-s-YYO



0 0.5 1 1.5 2 km

Scale: 1:50000

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter



Author: Evan Hamilton

Date: 14-12-2020

Geological Units (1:500,000)

Mt Mulgine Project

Prepared for
Tungsten Mining NL

Figure
1.3

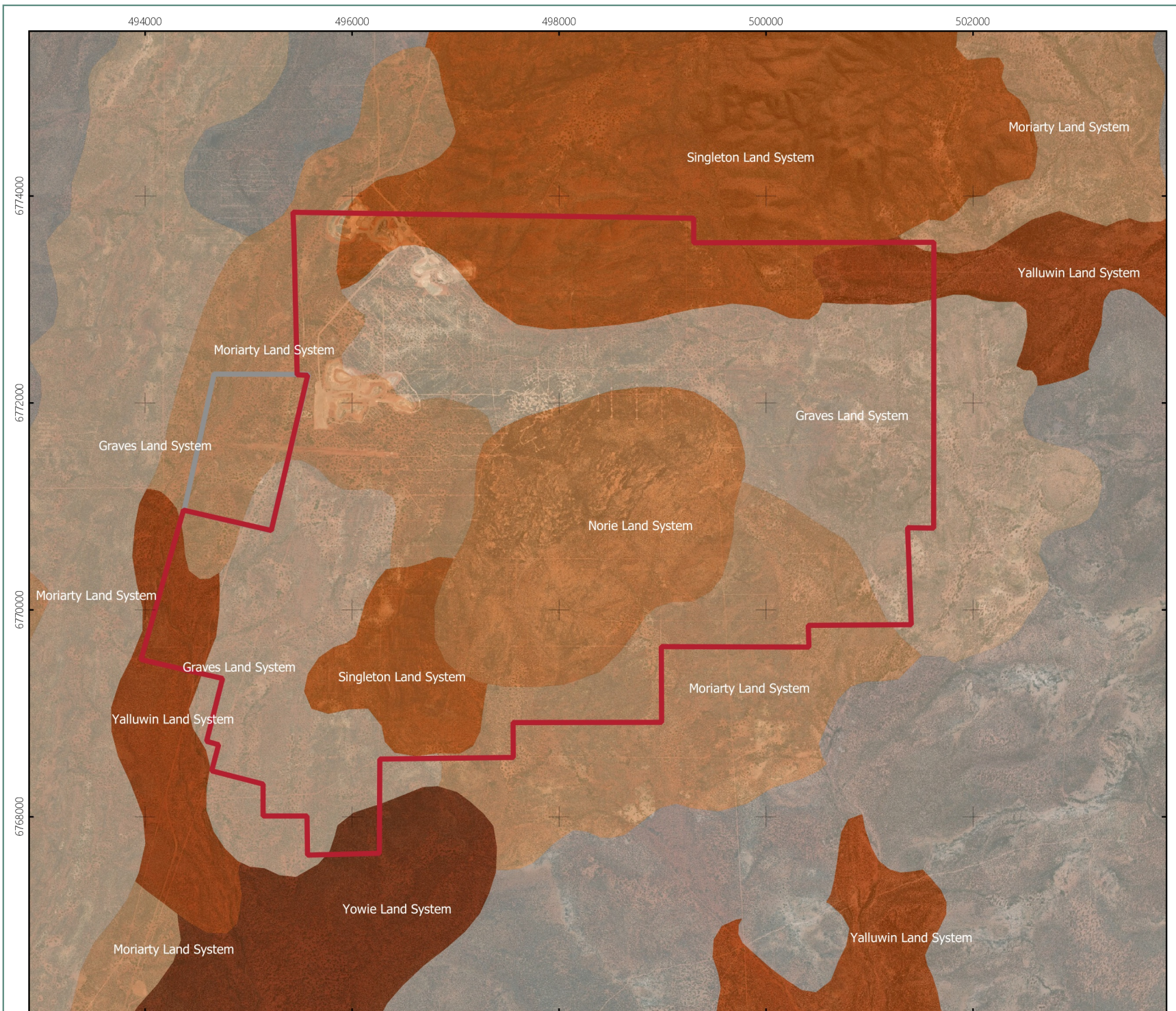
1.6. Land Systems

Payne *et al* (1998) completed an inventory of the Sandstone-Yalgoo-Paynes Find area to document the land systems including the condition of each. Land systems were described using the biophysical characteristics of geology, landforms, vegetation, and soils.

The Project includes six land systems as described in Table 1.2 and mapped in Figure 1.4. Most of the land systems that occur are well represented in the wider region. The Singleton land system covers the smallest area and has the most restricted distribution. This land system is associated with rugged Greenstone Hills in areas within and close to the Project.

Table 1.2: Land Systems

Land System	Description	Area in Project (ha)	% of Total Extent in Project	Total Extent (ha)	Location & Description of Occurrence
Graves	Basalt and Greenstone rises and low hills supporting Eucalypt woodlands with prominent Saltbush and Bluebush understoreys.	1,220	1.1%	111,245	Widespread over the Yalgoo, Southern Murchison and Coolgardie IBRA regions.
Moriarty	Low Greenstone rises and stony plains supporting Chenopod shrublands with patchy Eucalypt overstoreys.	626	0.2%	264,921	Widespread over the Yalgoo, Southern Murchison and Coolgardie IBRA regions, and small occurrences in the Avon Wheatbelt.
Norie	Granite hills with exfoliating domes and extensive tor fields, supporting Acacia shrublands.	632	0.3%	211,312	Widespread across the Murchison, Yalgoo and some small occurrences in the Coolgardie region.
Singleton	Rugged Greenstone ranges with dense Casuarina and Acacia shrublands.	543	2.3%	23,834	Restricted land system to the Yalgoo region and local area surrounding the Project.
Yalluwin	Hardpan plains and drainage tracts carrying concentrated flow, supporting Mulga, Curara and other Acacia shrublands.	122	0.5%	26,278	Small occurrences but recorded in the Yalgoo and Murchison regions.
Yowie	Sandy plains supporting tall shrublands of Mulga and Bowgada with patchy Wanderrie grasses.	17	<0.0%	1,614,487	Very widespread across the Yalgoo and Southern Murchison, extending into the Avon Wheatbelt and Coolgardie regions.

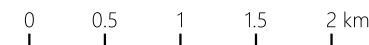


Legend

- Mt Mulgine Project
- Extension Tenement M59/460

Land Systems

- Graves Land System
- Moriarty Land System
- Norie Land System
- Singleton Land System
- Yalluwin Land System
- Yowie Land System



Scale: 1:50000

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter



Author: Evan Hamilton

Date: 14-12-2020

Land Systems

Mt Mulgine Project

Prepared for
Tungsten Mining NL

Figure
1.4

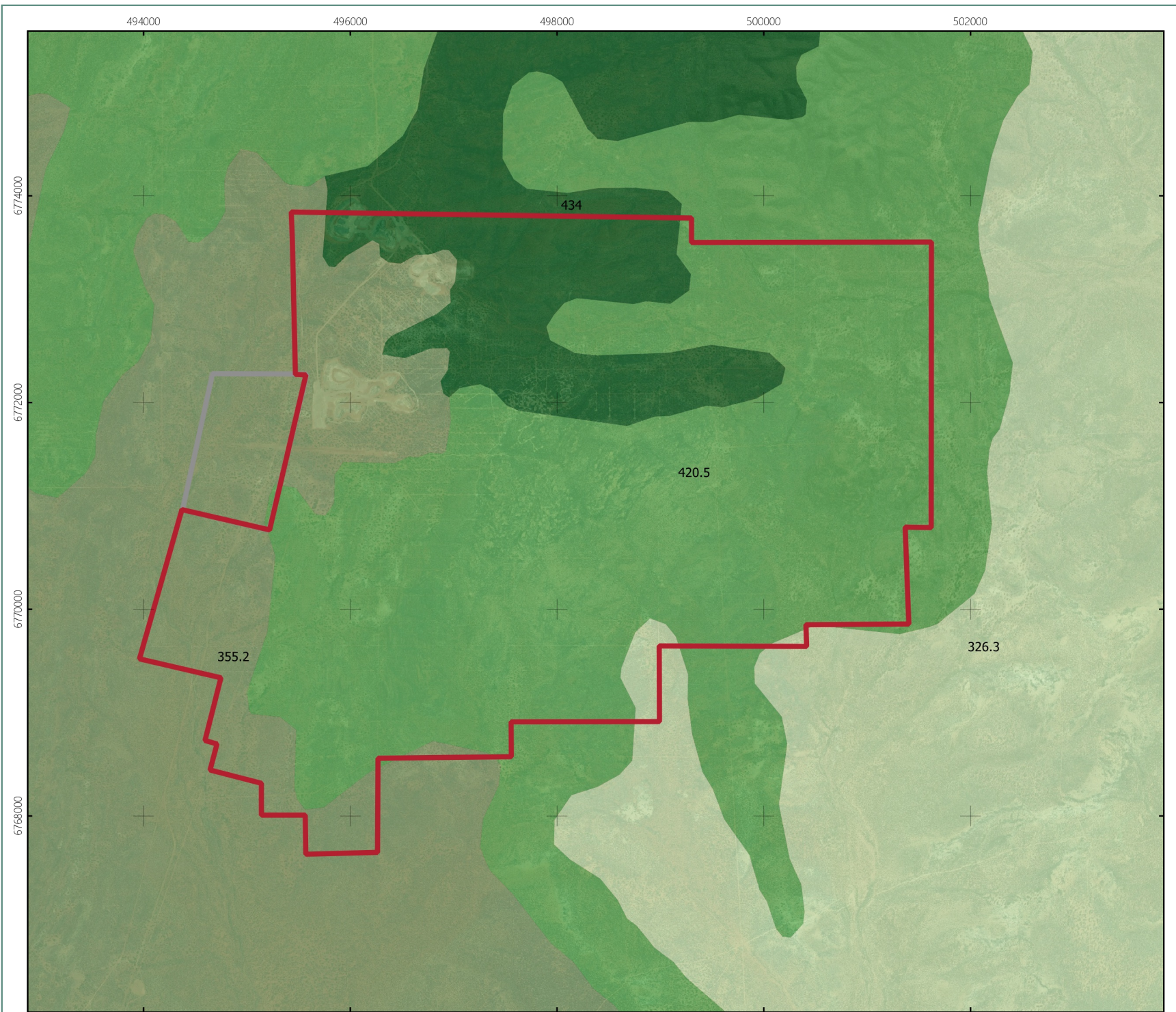
1.7. Beard Vegetation

Pre-European vegetation mapping was originally undertaken by Beard at various scales across the State and has since been updated to be consistent with Native Vegetation Information System (NVIS) descriptions at a scale of 1:250,000 (DPIRD, 2019). State-wide vegetation statistics are available for these associations which lists pre-European extent, current extent, area in DBCA managed lands and is a useful tool to determine if a vegetation association is rare or otherwise significant (WA Gov, 2019).

Four vegetation sub-associations, including one mosaic, have been mapped within the Project and these are listed in Table 1.3 and mapped in Figure 1.5. All of the sub-associations are restricted to the Yalgoo IBRA region with associations 326.3, 355.2, and 420.5 very widespread across it. Association 434.0 is very restricted with a total extent of 1,387 ha mapped in the state, of which 34.5% is within the Project. All four vegetation associations have more than 97% of their pre-European extent remaining, have not been extensively cleared and all have good representation within DBCA-managed lands (Table 1.3).

Table 1.3: Beard Vegetation

Sub-Association	NVIS Vegetation Description	Area in Project (ha)	% of Current Extent in Project	Pre-European Extent State (ha)	Current Extent State (ha)	% Remaining	% of Current Extent in DBCA Managed Land
326.3	<i>Acacia ramulosa</i> , <i>Acacia acuminata</i> , <i>Acacia grasbyi</i> , <i>Acacia tetragonophylla</i> , <i>Acacia aneura</i> tall open shrubland, over <i>Senna artemisioides</i> subsp. x <i>artemisioides</i> , <i>Chorizema genistoides</i> , <i>Dodonaea inaequifolia</i> , <i>Eremophila forrestii</i> , <i>Eremophila viscida</i> mid sparse shrubland, over <i>Chamaexeros fimbriata</i> , <i>Dichopogon capillipes</i> , <i>Wurmbea densiflora</i> , <i>Cephalopterum drummondii</i> , <i>Helipterum craspedioides</i> low open forbland.	34	<0.0%	542,040	542,013	100	44
	<i>Acacia sclerosperma</i> , <i>Acacia eremaea</i> , <i>Grevillea obliquistigma</i> , <i>Hakea preissii</i> , <i>Acacia aneura</i> tall open shrubland.						
355.2	<i>Eucalyptus loxophleba</i> , <i>Eucalyptus oleosa</i> low isolated trees, over <i>Acacia aneura</i> , <i>Acacia ramulosa</i> tall open shrubland.	597	1.1%	56,303	54,965	97.6	43
420.5	<i>Acacia ramulosa</i> , <i>Acacia acuminata</i> , <i>Acacia quadrimarginea</i> , <i>Acacia stereophylla</i> tall open shrubland, over <i>Allocasuarina campestris</i> , <i>Melaleuca uncinata</i> , <i>Thryptomene australis</i> mid sparse shrubland.	2,053	0.5%	457,736	456,619	99.8	21
434.0	<i>Eucalyptus loxophleba</i> , <i>Allocasuarina huegeliana</i> isolated low trees, over <i>Acacia quadrimarginea</i> , <i>Acacia acuminata</i> tall open shrubland.	478	34.5%	1,387	1,387	100	85



Legend

-  Mt Mulgine Project
-  Extension Tenement M59/460

Beard Vegetation Units

-  326.3
-  355.2
-  420.5
-  434



0 0.5 1 1.5 2 km

Scale: 1:50000

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter



Author: Evan Hamilton

Date: 14-12-2020

Beard Vegetation

Mt Mulgine Project

Prepared for
Tungsten Mining NL

Figure
1.5

1.8. Significant Lands

1.8.1. Environmentally Sensitive Areas

Environmentally Sensitive Areas (ESA) that are associated with flora and vegetation are areas that are defined by the Department of Water and Environmental Regulation (DWER) (2019) as:

- A defined wetland and the area within 50 m of a wetland;
- The area covered by vegetation within 50 m of Threatened flora, to the extent to which the vegetation is continuous with the vegetation in which the Threatened flora is located;
- The area covered by a TEC;
- A Bush Forever site;
- Areas covered by the Gngangara Mound Crown Land Policy and Western Swamp Tortoise Policy; and
- Areas covered by lakes, wetlands and fringing vegetation of the Swan Coastal Plain Lakes Policy, including South West Agricultural Zone Wetlands Policy and Swan and Canning Rivers Policy.

No ESAs are located within the Project. The closest known ESA to the Project area are the known locations of the Threatened Flora species 1.5 km to the West of the Project (Figure 1.1).

1.8.2. Australian Wetlands Database

The Australian Wetlands Database includes nationally significant wetlands (as listed in the directory of important wetlands), wetlands listed under the Ramsar convention, wetlands that are representative, rare or unique, or wetlands that are considered of international importance (DoEE, 2019).

No nationally significant wetlands, including Ramsar wetlands, are located within the Project. The closest is the Thundelarra Lignum Swamp, located 27 km to the North-East (Figure 1.1).

1.8.3. Conservation Estate

The Western Australian Conservation Estate includes land and waters vested in the Conservation and Parks Commission under the *Conservation and Land Management Act (1984)*. The Conservation Estate is generally managed by the Parks and Wildlife Service of DBCA to protect Western Australia's biodiversity, and includes National Parks, Nature Reserves, Conservation Reserves and other areas managed primarily for biodiversity conservation (DoEE, 2016).

The Northern half of the Project is included in the Warriedar Station Nature Reserve, an ex-pastoral station that has been incorporated into the National Reserve System (Figure 1.1).

2. METHODS

2.1. Field Survey Timing

Four field surveys were undertaken for the assessment which included three phases for the detailed level survey and a targeted *Acacia sulcatacaulis* survey. The first phase was in spring 2019, the second phase in autumn 2020 and the third phase in spring 2020. The *Acacia sulcatacaulis* survey was undertaken in August-September 2021. Table 2.1 outlines the field survey timing specifics.

Table 2.1: Field Survey Timing

Field Survey	Date	Person Days	BOM Station	Rainfall (mm)					
				3 Months Prior	3 Month Median	+/-	12 Months Prior	Annual Median	+/-
Phase 1 – Spring primary survey & targeted <i>Stylidium scintillans</i>	31 Aug – 10 Sept 2019	19	Karara:	106	104	2	249	227	22
			Paynes Find:	79	86	-7	244	189	55
Phase 2 – Autumn supplementary survey & targeted flora	4 Mar – 14 Mar 2020	22	Karara:	61	27	34	229	227	2
			Paynes Find:	83	27	56	233	189	44
Phase 3 – Spring supplementary survey, targeted annual & <i>Stylidium scintillans</i>	27 Aug – 5 Sept 2020	40	Karara:	85	110	-25	200	227	-27
			Paynes Find:	69	86	-17	180	189	-9
Targeted <i>Acacia sulcatacaulis</i> survey	13-23 Aug 2021, 11-12 Sept 2021	48	Paynes Find:	179	86	+93	425	189	+236

Figure 2.1 and Figure 2.2 illustrate the climatic conditions leading up to the 2019 and 2020 field surveys. This data was derived from the two closest Bureau of Meteorology (BOM) weather stations at Karara (#10195) and Paynes Find (#7139), located 30 km west and 70 km east of the Project, respectively (BOM 2020).

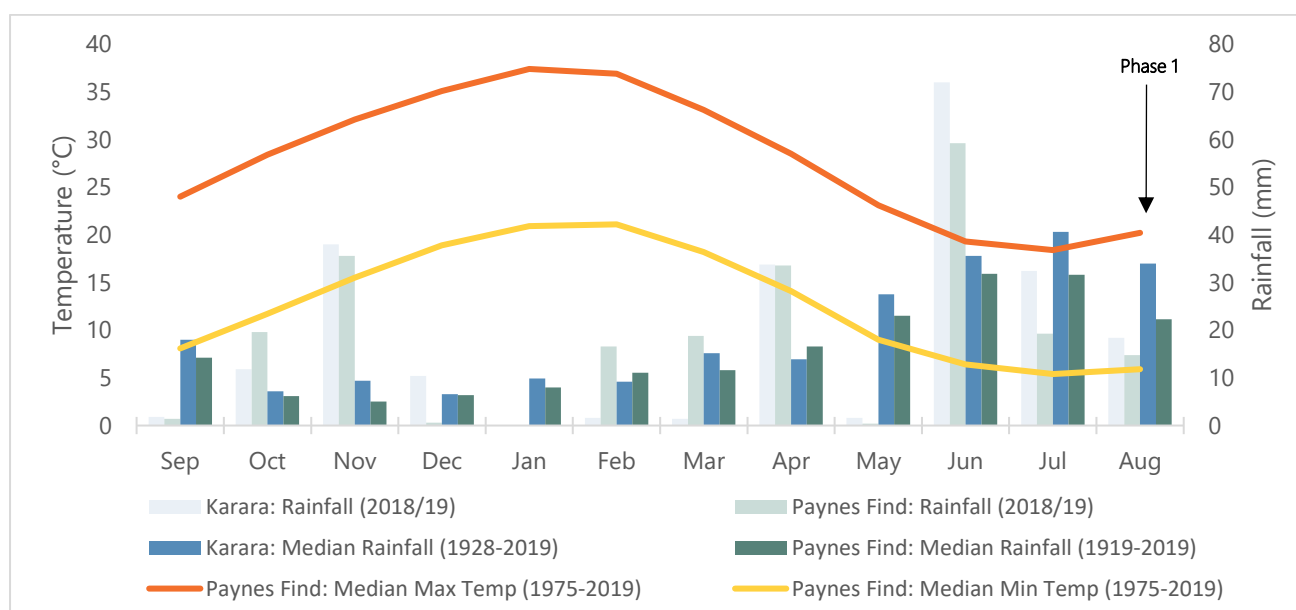


Figure 2.1: Climate Data for Karara (#10195) & Paynes Find (#7139) Preceding 2019 Survey

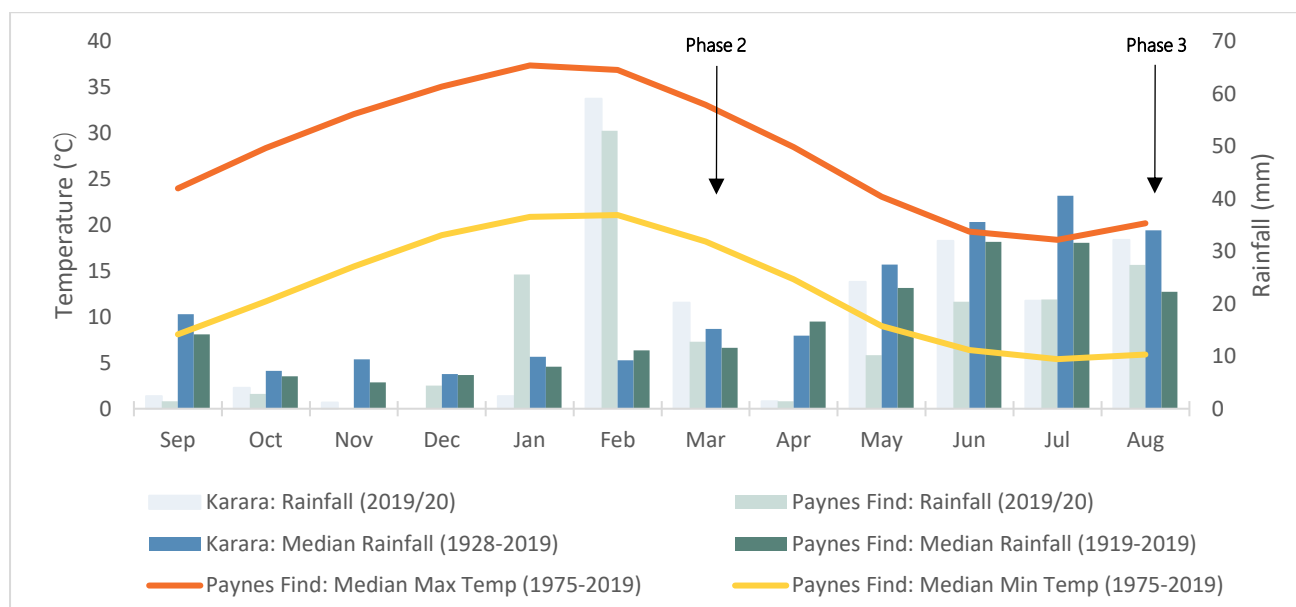


Figure 2.2: Climate Data for Karara (#10195) & Paynes Find (#7139) Preceding 2020 Surveys

Seasonal conditions were excellent for the primary field survey and adequate for the supplementary field surveys as recommended by the technical guidance (EPA, 2016b). The phase 1 flora survey was undertaken following a period of typical rainfall, with Karara receiving 2 mm above, and Paynes Finds receiving 7 mm under, the sum of median rainfall for the three months prior to the survey. The annual rainfall was above median for both Karara and Paynes Find receiving 22 and 55 mm higher, respectively than the sum of the annual median rainfall.

The phase 2 flora survey was undertaken following a period of above median rainfall, with Karara receiving 34 mm and Paynes Finds receiving 56 mm higher than the sum of median rainfall for the three months prior to the survey. The annual rainfall was also generally above median for both Karara and Paynes Find receiving 2 and 44 mm higher, respectively than the sum of the annual median rainfall.

The phase 3 targeted flora survey was undertaken following a period of less, but typical rainfall, with Karara receiving 25 mm under, and Paynes Finds receiving 17 mm under the sum of median rainfall for the three months prior to the survey. The annual rainfall was below the median for both Karara and Paynes Find receiving 27 and 9 mm less, respectively than the sum of the annual median rainfall.

The targeted flora surveys for *Stylidium scintillans* occurred in spring of 2019 and 2020, when the majority of the known records of this taxon has been recorded flowering; late August to early September (Wege, 2012). Seasonal conditions during both surveys were therefore optimal for the flowering times of this species. In addition, known locations were visited prior to undertaking both surveys and were recorded to be in flower.

The targeted *Acacia sulcatacaulis* survey was undertaken following excellent seasonal conditions and the majority of the individuals were flowering at the time of the survey. The targeted survey, however, was not timing dependent as the species is a large perennial shrub that is present irrespective of season.

2.2. Project Team

Spectrum Ecology's botanists involved in the assessment are listed in Table 2.2, along with their role and years of experience.

Table 2.2: Project Team

Staff	Role & Project Tasks	Licence	Experience
Melissa Hay	Principal Botanist – phase 2 & 3 field survey, targeted <i>Acacia sulcatiaulis</i> survey, project management, reporting	FB6200000-2	14 yrs
Carmel Winton	Senior Botanist – phase 1, 2, 3 field survey, reporting, phase 3 plant IDs	FB62000134 TFL 59-1920	7 yrs
Raimond Orifici	Senior Botanist – phase 1 field survey	FB62000158	22 yrs
Dr Timothy Hammer	Senior Taxonomist / Botanist – phase 1, 2 & 3 plant IDs	-	6 yrs
Susan Murrey	Botanist – phase 3 field survey	FB62000101-1b	2 yrs
Chris Shaw	Botanist – phase 3 field survey, reporting	FB62000241	2 yrs
Jordan Whitmore	Senior Botanist – targeted <i>Acacia sulcatiaulis</i> survey	FB62000352	5 yrs
Emily Crowther	Botanist – targeted <i>Acacia sulcatiaulis</i> survey	FB62000330	1 yr
Tamara Green	Botanist – targeted <i>Acacia sulcatiaulis</i> survey	FB62000343	2 yrs

2.3. Legislation & Guidelines

Flora and vegetation in Western Australia are protected by various legislation, including:

- The State *Biodiversity Conservation Act 2016* (BC Act);
- The State *Environmental Protection Act 1986* (EP Act); and
- The Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act).

This detailed assessment is compliant with the appropriate flora and vegetation guidelines as outlined in the EPA Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment (EPA, 2016b).

2.4. Significant Flora & Vegetation Definitions

As defined by the EPA's (2016a) technical guide for conducting flora and vegetation surveys for environmental impact assessment, flora and vegetation can be considered significant for a range of reasons (Table 2.3). Significant flora and vegetation recorded during the assessment are then further considered at a local and regional scale to conduct an adequate assessment of impacts. Considerations used to determine the local and regional significance of flora and vegetation recorded at the Study Area are listed in Table 2.3.

Table 2.3: Flora & Vegetation Significance Definitions

Significant Definitions (EPA 2016a)		Local & Regional Significance	
Flora	• Being identified as Threatened, (state listed WC Act and/or nationally listed EPBC Act). • Being identified as Priority species: Priority 1 to 4, (DBCA, 2019). • Locally endemic or association with a restricted habitat type (e.g. surface water or groundwater dependant ecosystems). • New species or anomalous features that indicate a potential new species. • Representative of the range of a species (particularly, at the extremes of range recently	Local	Rating
		• Flora taxon well known from the local area. • Landforms/habitat the flora taxon occurs on are widespread through the local area. • Flora taxon occurs across multiple landforms and habitats.	Low
		• Flora taxon not well known from the local area. • Landforms/habitat the flora taxon occurs are restricted through the local area. • Flora taxon only occurs on one habitat type that is restricted.	High

Significant Definitions (EPA 2016a)		Local & Regional Significance	
	- discovered range extensions, or isolated outliers of the main range). - Unusual species, including restricted subspecies, varieties or naturally occurring hybrids; - Relictual status, being representative of taxonomic groups that no longer occur widely in the broader landscape.	Regional	Rating
		- Flora taxon's known distribution extends over the IBRA region or sub-region. - Flora taxon's known distribution may span over multiple IBRA regions.	Low
		- Flora taxon's known distribution is only known from few locations across the IBRA region. - May be common in the local area, but only known from this area within the region or sub-region.	High
Vegetation	- Identified as TEC (state listed WC Act and/or nationally listed EPBC Act). - Identified as PEC (DBCA 2017). - Restricted distribution. - Degree of historical impact from threatening processes. - A role as a refuge. - Providing an important function required to maintain ecological integrity of a significant ecosystem. - Vegetation that is highly disturbed can reduce the significance.	Local	Rating
		- Vegetation type's mapped extent is widespread across the Study Area or local area. - Landforms/habitat the vegetation type occurs on are widespread in the local area.	Low
		- Vegetation type's mapped extent is restricted in the Study Area. - Landforms/habitat the vegetation type occurs on are restricted in the local area. - Vegetation type provides habitat for locally significant flora taxa.	High
		Regional	Rating
		- Determined by comparing vegetation types to the best available data source. This can include state-wide vegetation mapping (Beard), region specific (if available), land system and/or geology mapping. - Vegetation types are matched with regional mapping units that are widespread throughout the region.	Low
		- Vegetation types are matched with mapping that is restricted throughout the region. - Vegetation type provides habitat for regionally significant flora taxa.	High

2.5. Introduced Flora & Declared Plant Categories

Introduced flora can pose a threat to native vegetation and biodiversity. The Department of Primary Industries and Regional Development (DPIRD) keeps a database of organisms that are declared pests in Western Australia. This database is regulated under the *Biosecurity and Agricultural Management Act 2007* (BAM Act) (WA Gov, 2007). The legal status and control requirements for these environmentally significant weeds are provided in Appendix A.

2.6. Nomenclature

2.6.1. Flora

Flora nomenclature used in this report is consistent with the Western Australian Herbarium's plant census, provided on Florabase (WAH, 2020). All species are current at the time of the original report preparation (2020).

2.7. Desktop Assessment

2.7.1. Database Searches

The following databases were searched and reviewed for significant flora and vegetation and incorporated into the desktop assessment (Table 2.4).

Table 2.4: Database Searches

Data Source	Custodian	Details
Commonwealth Protected Matter Search Tool (PMST)	Department of the Environment and Energy (DoEE)	Date: 21/8/2019 Buffer: 40 km
NatureMap	Department of Parks and Wildlife (DPaW)	Date: 24/7/2019 Buffer: 40 km, Centre Point: 116°58'54"E 29°11'09"S
DBCA Threatened Database Search	Department of Biodiversity Conservation and Attraction (DBCA)	Date: 17/12/2019 Details: Polygon plus 40 km
Threatened & Priority Flora database (WAH/TPFL)	DBCA	Date: 22/08/2019, Buffer: 40 km, Reference: 40- 0819FL
TEC & PEC database	DBCA	Date: 03/09/2019, Buffer: 15 km, Reference: 02- 0919EC
Index of Biodiversity Surveys of Assessments (IBSA) database.	Department of Water and Environmental Regulation (DWER)	Date: 30/11/2019, Buffer: 100 km

2.7.2. Previously Conducted Biological Assessments

Thirty-seven previously conducted biological assessments, within the vicinity of the Project, were reviewed for significant flora and vegetation communities. Reports were incorporated if they were provided by Tungsten Mining, or if they were publicly available. The reports incorporated into the desktop assessment are listed in Table 2.5 and the approximate location of the survey, where available, is shown in Figure 2.3.

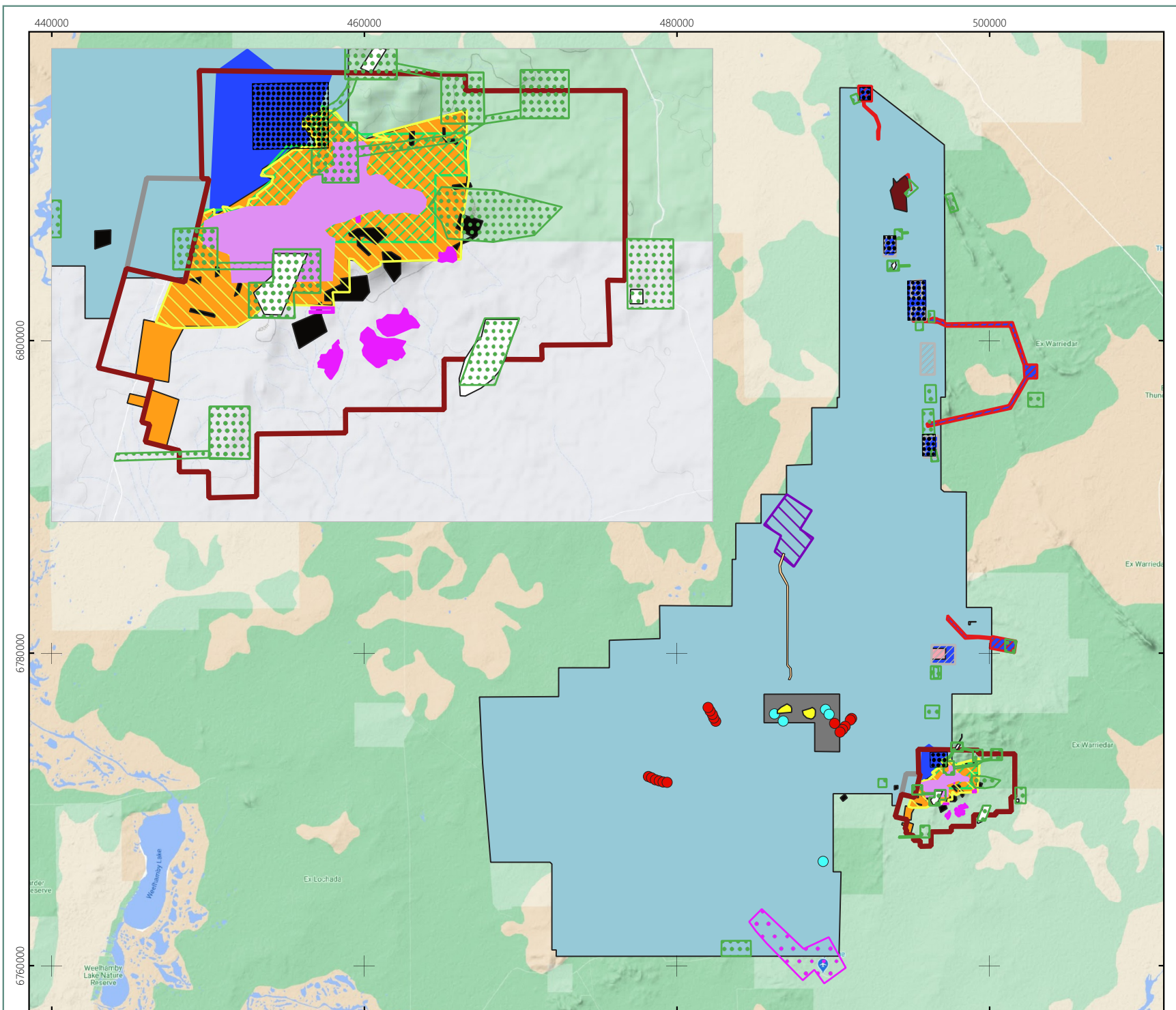
Table 2.5: Previously Conducted Biological Assessments

Reference	Survey Type	Title	Prepared For	Location of Study from Project
(APM, 2011)	Detailed flora & vegetation	Minjar Gold biological survey. Minjar Gold Mine expansion. Flora & vegetation assessment	Minjar Gold Pty Ltd	Within
(APM, 2012a)	Level 1 terrestrial fauna. Targeted Malleefowl & <i>Egernia stokesii badia</i> surveys	Fauna Assessment. Austin, Blackdog, Bobby McGee, Bugeye, Camp, Highland Chief, Keronima, M1, Monaco, Mugs Luck, Riley, Silverstone, Trench and Windinne Well Projects. South Murchison, WA	Minjar Gold Pty Ltd	Area between Project and 45 km North
(APM, 2012b)	Flora - level 1 & targeted	Minjar Gold Mine expansion. Level 1 flora & vegetation assessment & targeted search for flora of conservation significance. Austin, Blackdog Camp, Highland Chief, Keronima, Mugs Luck, Riley & Trench. Mid-West, WA	Minjar Gold Pty Ltd	6.5 km North
(APM, 2012c)	Flora - targeted	<i>Stylidium scintillans</i> (WEGE) assessment. Keronima & surrounding tenements. Mid-West, WA	Minjar Gold Pty Ltd	6 km North
(APM, 2017a)	Flora & fauna - targeted	Mt Mulgine Project - Mulgine Hill M59/425 - M59/387. Targeted survey for Threatened and Priority Flora, and conservation significant fauna habitat. Murchison, WA. October 2017	Mid-West Tungsten Pty Ltd, Tungsten Mining NL	Within
(APM, 2017b)	Flora - detailed, Fauna - level 1	Mt Mulgine Project biological survey. Rothsay, WA. February 2017	Tungsten Mining NL	Within
(APM, 2018a)	Flora & fauna - targeted	Mt Mulgine Project - Mulgine Hill M59/425 - M59/387. Targeted survey for Threatened and Priority Flora, and conservation significant fauna habitat. Murchison, WA. July 2018	Mid-West Tungsten Pty Ltd, Tungsten Mining NL	Within
(APM, 2018b)	Flora - detailed, Fauna - level 1	Mt Mulgine Project biological survey. Rothsay, WA. July 2018	Tungsten Mining NL	Within
(APM 2018c)	Flora - targeted	Tungsten Mining NL. <i>Acacia sulcataculis</i> (P1) targeted search population extension & management. Mount Mulgine, WA	Tungsten Mining NL	Within & 1 km East
(Bamford & Wilcox, 2004)	Level 2 (single phase), opportunistic SRE	Blue Hills fauna assessment	ATA Environmental	6 km West
(BCE, 2006)	Level 2 (two phase), opportunistic SRE	Fauna values of Gindalbie Metals Karara & Mungada Haematite/Magnetite Project	Gindalbie Metals Ltd	5 km West
(BCE, 2013a)	Level 1 & targeted vertebrate and SRE invertebrate survey	Hinge Project Area fauna assessment	Karara Mining Limited	14 km North-West

Reference	Survey Type	Title	Prepared For	Location of Study from Project
(BCE, 2013b)^	Targeted vertebrate and SRE invertebrate survey	Significant fauna survey of the Hinge Haul Road: November 2012	Karara Mining Limited	14 km North-West
(BCE, 2017)	Level 1 fauna assessment	Rothsay Project Area fauna assessment	Egan Street Resources	7 km West
(ecologia, 2007)	Level 2 SRE assessment	Koolanooka/Blue Hills DSO mining Project Short Range Endemic biological assessment	Midwest Corporation Limited	7 km West
(ecologia, 2010)	Level 2 SRE assessment	Blue Hills Short Range Endemic invertebrate survey	Sinosteel Midwest Corporation	7 km West
(ecologia, 2011a)^	Level 2 SRE assessment	Blue Hills Additional Short-range Endemic invertebrate survey	Sinosteel Midwest Corporation	7 km West
(ecologia, 2011b)	Level 1 vertebrate fauna	Blue Hills Project level 1 fauna assessment	Sinosteel Midwest Corporation	7 km West
(ecologia, 2012)^	Targeted invertebrate fauna survey	Blue Hills <i>Idiosoma nigrum</i> targeted survey	Sinosteel Midwest Corporation	7 km West
(Ecoscape, 2016)	Consolidation of terrestrial fauna data, targeted terrestrial fauna survey	Blue Hills - Mungada East terrestrial fauna assessment	Sinosteel Midwest Corporation	5 km West
(Jenny Borger Botanical, 2018)	Flora - targeted	Targeted flora survey for new populations of <i>Acacia sulcata</i> to support the application for a clearing permit for the Mount Mulgine Project CPS 8141/1 for Mid-West Tungsten Pty Ltd Tenements M59/386, M59/387, M59/425	Tungsten Mining NL	Within
(Mattiske, 2009a)	Detailed flora & vegetation	Flora and vegetation survey of the Austin Project Area within tenement M59/420, Minjar Project Area	Golden Stallion Resources	North 5 – 30 km
(Mattiske, 2009b)	Detailed flora & vegetation	Flora and vegetation survey of the Bugeye Project Area within tenement M59/420, Minjar Project Area	Golden Stallion Resources	North 5 – 30 km
(Mattiske, 2009c)	Detailed flora & vegetation	Flora and vegetation survey of the Eastern Creek Project Area within tenements M59/421 and M59/458, Minjar Project Area	Golden Stallion Resources	North 5 – 30 km
(Mattiske, 2009d)	Detailed flora & vegetation	Flora and vegetation survey of the Keronima Project Area within tenement M59/420, Minjar Project Area	Golden Stallion Resources	North 5 – 30 km

Reference	Survey Type	Title	Prepared For	Location of Study from Project
(Mattiske, 2009e)	Detailed flora & vegetation	Flora and vegetation survey of the Monaco Project Area within tenements M59/420 and M59/458, Minjar Project Area	Golden Stallion Resources	North 5 – 30 km
(Mattiske, 2009f)	Detailed flora & vegetation	Flora and vegetation survey of the Silverstone Project Area within tenement M59/420, Minjar Project Area	Golden Stallion Resources	North 5 – 30 km
(Mattiske, 2009g)	Detailed flora & vegetation	Flora and vegetation survey of the Windinnie Well Project Area within tenement M59/420, Minjar Project Area	Golden Stallion Resources	North 5 – 30 km
(Outback Ecology, 2013)	Detailed flora & vegetation	Karara Mining Limited. Targeted flora & vegetation assessment - Hinge Haul Road	Karara Mining Limited	9.6 km North-West
(Terratree, 2013)	Detailed flora & vegetation, & targeted flora	Level 1 and 2 Flora and Vegetation Survey and Mapping Potential Habitat for the Threatened (Declared Rare) species <i>Stylidium scintillans</i>	Minjar Gold	Within & North
(Terratree 2014)	Detailed flora & vegetation, & targeted flora	Level 1 and 2 Flora and Vegetation Survey and Mapping Potential Habitat for the Threatened (Declared Rare) species <i>Stylidium scintillans</i>	Minjar Gold	Within & North
(Terratree 2015)	Level 1 flora & vegetation, & targeted flora & fauna	Level 1 Flora and Vegetation and Targeted Threatened Flora and Fauna Assessment	Minjar Gold	North 35 km
(Terrestrial Ecosystems, 2019) [^]	Targeted fauna - preclearance	Pre-clearance fauna assessment - Mt Mulgine trench area	Tungsten Mining NL	Within
(Woodman, 2012)	Detailed flora & vegetation	Karara Mining Limited. Regional flora & vegetation survey of the Karara to Minjar Block	Karara Mining Limited	Within, 40 km North & 30 km West
(Woodman, 2017)	Detailed flora & vegetation	Rothsay Gold Project - Flora and vegetation assessment	Egan Street Resources	8 km South-West
(Woodman 2018)	Flora - targeted	Rothsay Gold Project - Targeted survey for <i>Stylidium scintillans</i> (Threatened)	Egan Street Resources	8 km South-West
Woodman (2019)	Flora - targeted	Rothsay Gold Project - <i>Hemigenia tichbonii</i> survey, May 2019	Egan Street Resources	8 km South-West

[^] = exact survey location unknown/not mapped



Legend

- Mt Mulgine Project
- Extension Tenement M59/460

Previous Flora Assessments

- APM (2011)
- APM (2012a)
- APM (2012b)
- APM (2012c)
- APM (2017a)
- APM (2017b)
- APM (2018a)
- APM (2018b)
- APM (2018c)
- Bamford & Wilcox (2004)
- BCE (2006)
- BCE (2013a)

BCE (2017)

- Ecologia (2007;2010;2011a)
- Ecoscape (2016)
- Jenny Borger (2018)
- Mattiske (2009a-g)
- Outback Ecology (2013)
- Terratree (2013)
- Terratree (2014)
- Terratree (2015)
- Woodman (2012)
- Woodman (2017;2018;2019)



Scale: 1:330000

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter



Author: Melissa Hay

Date: 03-12-2020

Previously Conducted Flora Assessments

Mt Mulgine Project

Prepared for
Tungsten Mining NL

Figure
2.3

2.7.3. Number of Plants

The significant flora records from the database searches and literature review vary considerably in the amount of detail, regarding abundance, that is available. Ranging from accurate counts, foliage cover, and general descriptions to no detail at all. Where no value was provided for abundance, the numbers were inferred according to Table 2.6. The assumption of value is likely to be an underestimate and hence final estimates are likely to be conservative. Where a range of potential abundance is provided, the lower middle value of the range was used. Exact duplicates were removed and where abundance values differ, the larger number was used.

Table 2.6: Number of Plants Assumed

Description or Cover Provided	Cover (%)	# Plants Assumed
No value	-	1
Rare, few, scattered, some, isolated plants, isolated clumps, very sparse, uncommon	<2%	3
Several, small group, scarce, sparse, scattered, small population, dozens	2-10%	10
Infrequent, uncommon, many, medium sized patch	10-30%	20
Occasional, moderately common, localised, large patch	30-70%	30
Common, Locally common, locally frequent, locally scattered, locally abundant, mid-dense, healthy population	70-90%	50
Frequent, very common, plentiful, abundant, dominant, extensive, dense	>90%	100

2.7.4. Likelihood of Occurrence Assessment

The following information was collated for each significant flora taxon or TEC/PEC identified during the desktop assessment:

- Conservation status (EPBC Act, WC Act, DBCA listing);
- Description of species and flowering period;
- Description of habitat requirements and presence within the Project;
- Source of record (DBCA, previous report etc.); and
- Distance of record to the Project.

A likelihood of occurrence assessment was conducted using the criteria listed in Table 2.7. This included assessing the distance of the record from the Project (historical database records considered not accurate were excluded if required), presence of appropriate habitats within the Project (using land systems, geology, vegetation mapping, and/or aerial imagery).

Table 2.7: Likelihood of Occurrence Assessment Criteria

Likelihood	Flora & Vegetation
Recorded	Species or vegetation community accurately recorded within the Project during the literature review (includes TEC/PEC buffers that intersect).
High	Species or vegetation community recorded in close proximity of the Project, and suitable habitat does, or is likely to occur.
Medium	Species or vegetation community recorded outside the Project but within 20 km and suitable habitat may occur.
Low	Species or vegetation community rarely or not recorded within 20 km of the Project and suitable habitat does not likely occur within the Project.

2.7.5. Data for the Index of Biodiversity Surveys for Assessment (IBSA)

The Environmental Protection Authority (EPA) has given instruction that all biological surveys collecting data on biodiversity submit the report and associated raw data to IBSA as an IBSA data package.

All survey data collected at the Project will be provided electronically following the final iteration of this biological survey to comply with IBSA data standards.

2.8. Detailed Flora & Vegetation Assessment

2.8.1. Sampling Effort & Survey Methods

A combination of quadrats, relevés, traverses, and opportunistic sampling is appropriate for a detailed level survey as stipulated in the guidance statement (EPA, 2016c). These survey techniques are described in Table 2.8.

A total of 58 quadrats (27 phase 1, 31 phase 2), 17 relevés (nine phase 1, six phase 2, two phase 3), and 435.7 km of targeted traverses were sampled across the Project during the detailed level assessment (Figure 2.4). Quadrat site data presented in Appendix B and Site by Species Matrix included as Appendix C. An additional 428 km of traverses were walked during the *Acacia sulcata* targeted survey (Figure 2.5).

Table 2.8: Detailed Survey Technique

Survey Technique	Description
Quadrats	Quadrats are a comprehensive survey technique for gathering information for detailed flora and vegetation surveys. Each vegetation unit must be represented by a minimum of three quadrat sites and have at least one corner (NW) permanently marked. Information collected at each quadrat includes: • Site code, date, location, botanist; • Four photographs, one from each corner of the site; • Vegetation condition and disturbances (including fire); • Landform including; slope, soil, rock type, aspect; • Flora and vegetation information; dominant cover, structure and species count where necessary; and • Comprehensive recording of every species within the quadrat boundary (20 x 20 m for a Yalgoo botanical survey);
Relevés	Relevés used in a detailed survey are employed to support the vegetation mapping and survey effort. They are a lower intensity survey technique or sampled where quadrats are too dangerous to set up. Information collected at each relevé is the same as that of a quadrat site, excluding the comprehensive collection of every species within the quadrat boundary, and the requirement to permanently mark the site's corners.
Traverses	A traverse is an unmarked route along which data is collected. Traverses are useful for identifying the boundaries and characteristics of vegetation units, selecting sites for detailed survey, and targeting significant flora or vegetation. Information recorded along a traverse is as for the relevé, with the addition of noting vegetation changes and relationships between vegetation and substrate.
Opportunistic Sampling	Flora and vegetation not recorded through other sampling methods is opportunistically sampled as encountered in the survey. Opportunistic sampling also included recording locations of significant, introduced (weed) and unknown species.
Targeted Sampling	Areas likely to support significant flora or vegetation are targeted during the survey. Including areas with existing records of significant flora (see Section 3.1.3). Areas are selected based on existing records from database searches, geology, vegetation mapping and known ESAs. Where possible, unusual and restricted geological features are sampled. When potentially significant flora taxa are encountered during a survey, sufficient information is recorded in compliance with a Threatened and Priority Flora Report Form (TPRF).

2.8.1.1. Extension of Project P59/2244

TGN acquired tenement P59/2244 adjoining the south-west of the Mulgine Project in June 2020. This section added 33 ha to the Project and was surveyed during the Phase 3 assessment in order to combine with the Mt Mulgine flora and vegetation assessment. The area has been assessed at a detailed level including targeted transects conducted for all significant flora. Two additional relevés (R301 & R302) were sampled to extend the vegetation and vegetation condition mapping into this area.

2.8.1.2. Extension of Project M59/460

M59/460 is a tenement owned by Minjar Gold Pty Ltd adjoining the west of the Mulgine Project (the Extension Area) (Figure 1.1). The Extension Area comprises 127 ha and was surveyed during the phase 3 assessment. The tenement M59/460 (the Extension Area) has been presented as a separate memo report (Spectrum Ecology, 2020b).

The Extension Area has been assessed at a detailed level including separate flora species list and targeted transects conducted for all significant flora at 100 m spacing throughout the entire area. Significant flora counts recorded within the Extension Area are included within the “regional” counts for the purposes of this assessment. Four relevés (R460-1, R460-2, R460-3 & R460-4) were sampled to extend the vegetation and vegetation condition mapping congruent with the current assessment.

2.8.2. Significant Flora Targeted Searches & Counts

2.8.2.1. *Stylidium scintillans* Targeted Survey

Stylidium scintillans (Threatened) habitat was previously recorded from the Project and surrounding areas (Terratree, 2013). This species is the only Microgeophytic Triggerplant recorded from the Yalgoo Bioregion. This taxon is confined to the “upper slopes and summits of low rises and breakaways composed of highly weathered granitic basement rock with weathered or colluvial ironstone rock and kaolinitic residue” (Wege, 2012). Individuals sometimes grow out of rock fissures and often occurs in large numbers over a small area. It occurs in open shrubland with an overstorey of the following species combination: *Micromyrtus acuta*, *Acacia assimilis* subsp. *assimilis* and *Melaleuca nematophylla*; *Acacia aulacophylla*, *Micromyrtus trudgenii* and *Melaleuca nematophylla*; and *Acacia ramulosa* and *A. aulacophylla* (Wege, 2012).

Two surveys targeting *Stylidium scintillans* (Threatened) were conducted, including in early September 2019 and late August 2020, targeting areas of suitable habitat throughout the Project. The location of the known population of *S. scintillans*, 1.5 km to the West of the Project confirmed the flowering time, growth habit and habitat for each of the field surveys. Both surveys located and recorded the known population indicating appropriate survey timing. See Appendix D for details of the targeted surveys.

No *Stylidium scintillans* were present within the Project. No habitat presenting as optimal potential habitat was identified within the Project.

2.8.2.2. Significant Flora Targeted Survey

The following targeted flora survey effort was undertaken during the three phases conducted for the assessment (Figure 2.4).

Phase 1: Survey of entire Project area was undertaken, however was not comprehensive. Potential habitat and previous records were targeted, and opportunistic collections were recorded of any known significant flora taxa as encountered. A targeted survey for Threatened Flora *Stylidium scintillans* at areas of potential habitat was also undertaken.

Phase 2: Comprehensive targeted flora survey of potential areas for infrastructure in areas not previously surveyed (see section 2.7.2). Traverses were spaced 50 to 100 m apart and the width surveyed was approximately 25 m. Additional traverses were undertaken in areas outside the potential areas for infrastructure where time allowed. All perennial significant flora taxa were recorded, however did not include the annual taxa; *Hydrocotyle dimorphocarpa* (P1) and *Rhodanthe collina* (P3) as they were not present at the time of the survey.

Phase 3: Comprehensive targeted flora survey of potential areas for infrastructure. Traverses were spaced 50 to 100 m apart and the width surveyed was approximately 25 m. Targeted survey for all significant flora, including the annual taxa; *Hydrocotyle dimorphocarpa* (P1) and *Rhodanthe collina* (P3). Areas previously surveyed were checked for accuracy of significant flora records and any additional locations were recorded. Regional targeted surveys for the 17 significant flora recorded from the Project were also conducted at this time (see Section 2.9).

When significant flora taxa were recorded, sufficient information was recorded to complete Threatened and Priority Flora Report Form and detailed counts were undertaken except where populations were large or widespread, in which case the population was estimated using methods consistent with the Threatened and Priority Flora Report Form – Field Manual (DBCA, 2017b).

2.8.2.3. *Acacia sulcaticaulis* Targeted Survey

A comprehensive targeted flora survey to map the entire population of *Acacia sulcaticaulis* was undertaken. Vegetation mapping for a previous version of this report (version 7) was used to develop a target Survey Area and included all vegetation units that contained known records of *Acacia sulcaticaulis* and three mosaics: AsCp/AaAr, AsCp/AdAt, and AdAa/AsCp (Figure 2.5). Mosaics were mapped previously where vegetation boundaries were difficult to determine from aerial imagery due to similar topographical, substrate, structural and colour characteristics, or due to fine vegetation intersections. Vegetation mapping was updated following the *Acacia sulcaticaulis* targeted survey. Areas that were considered unsuitable habitat (i.e. *Eucalyptus* woodlands) within the target Survey Area were not walked.

Traverses were spaced at 20 m apart and were undertaken east-west over the target Survey Area. Approximately 428 km of traverses were surveyed (Figure 2.5).

Counts were calculated for each 20 x 20 m quadrat along the traverse, where individual stems in a representative 5x5 m quadrat were counted, and then multiplied by 16 to arrive at a 20 x 20 m count. The 5 x 5 m quadrat was selected at a location within the 20 x 20 m to ensure that it was representative for plant counts. i.e. if there is an area within the 20 x 20 m quadrat that was denser and an area that had no plants, the 5 x 5 m quadrat was selected in an area that was average for the 20 x 20 m quadrat. The sampling design is shown in Plate 2.1. Where there were no visual obstructions across the 20 x 20 m area, the total number of plants were recorded. This was repeated at 20 m intervals along the traverse wherever *Acacia sulcaticaulis* was present. This method ensured that the density of the taxon was accounted for across the vegetation types and comprehensive counts and boundaries of the taxon were recorded.

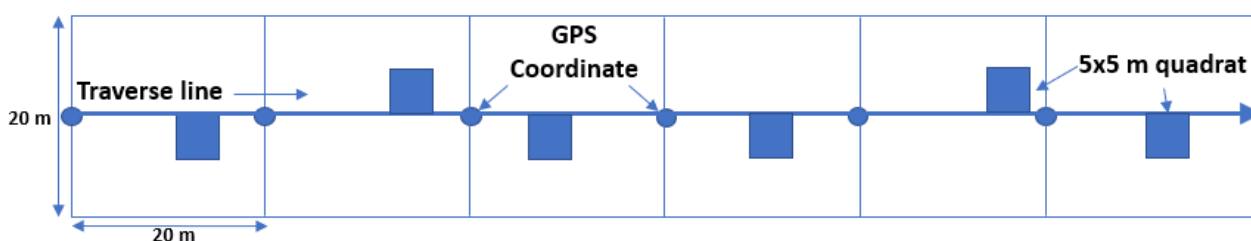
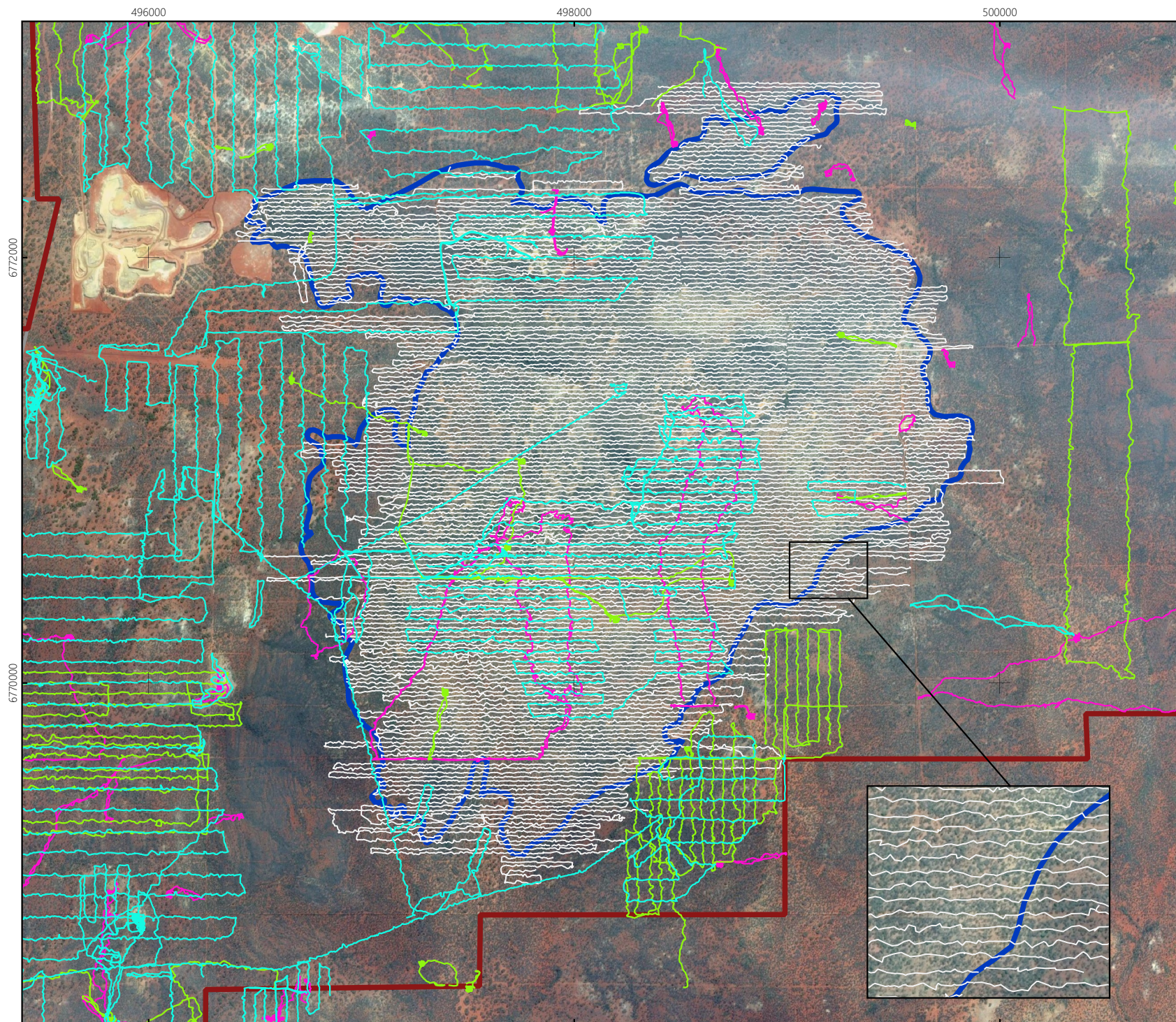
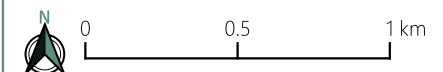


Plate 2.1: *Acacia sulcaticaulis* Targeted Survey Sampling Design



Legend

- ▬ Mt Mulgine Project
- ▬ *Acacia sulcatacaulis* Targeted Survey Area
- Flora & Vegetation Sampling Effort**
 - ▬ *Acacia sulcatacaulis* Traverse
 - ▬ Traverse Phase 1
 - ▬ Traverse Phase 2
 - ▬ Traverse Phase 3



Scale: 1:24815
 Coordinate System: GDA 1994 MGA Zone 50
 Projection: Transverse Mercator
 Units: Meter



Author: Jesse Harper

Date: 30-10-2021

Acacia sulcatacaulis Targeted Survey Sampling Effort

Mt Mulgine Project

Prepared for
Tungsten Mining NL

Figure
2.5

2.8.2.4. Previously Recorded Significant Flora Confirmation

Selected locations of previously recorded significant flora were visited for confirmation of occurrence within the Project (see list in Appendix E). All but four of the significant flora taxa recorded during the desktop assessment were confirmed to occur within the Project. The four species not confirmed were searched for and not recorded during the flora and vegetation assessment, or determined to be identification errors and are therefore not considered to occur, these include:

- P1 – *Chamelaucium* sp. Yalgoo (Y. Chadwick 1816) recorded by APM 2012b and the WA Herbarium (WAH). Two previous locations were visited during phase 2 and one WAH location was visited during phase 3. Flowering *Chamelaucium* specimens were collected from each area. All specimens were identified as *Chamelaucium* sp. Warriedar (A.P. Brown & S. Patrick APB 1100). It is possible that the desktop records of *Chamelaucium* sp. Yalgoo (Y. Chadwick 1816) have been incorrectly identified due to the similarities between the two taxa and have therefore been included in the final counts as *Chamelaucium* sp. Warriedar (A.P. Brown & S. Patrick APB 1100).
- P3 – *Acacia subsessilis* recorded by APM 2012b. Three locations of these species were visited in the phase 2 field survey and have been excluded from the final data as they were not found in the Project despite exhaustive searching and are thought to be data errors.
- P3 – *Austrostipa blackii* recorded by the WAH. One location was ground-truthed during the phase 3 field survey and the species was not found, the plaque for the WAH survey was located. This record is thought to no longer occur in the Project.
- P3 – *Drummondita fulva* recorded by APM 2012b & 2017b. Locations of confirmed *Drummondita fulva* individuals were ground-truthed during the regional targeted survey in areas outside of the Project whilst in flower. These were compared with specimens collected inside the Project during the current assessment at the previous known locations and were determined to be different. These previous records have been excluded from the desktop assessment and do not occur in the Project.

2.8.3. Specimen Identification & Lodgement

At least one specimen of every flora species encountered was collected. Specimens were identified by plant Taxonomist Timothy Hammer (phase 1, 2, 3), Frank Obbens (phase 1) and Carmel Winton (phase 3) using the appropriate taxonomic keys and, where required, relevant taxonomic experts at the Western Australian Herbarium were consulted.

Specimens were vouchered with the Western Australian Herbarium as per guidance: when they represent new populations of Threatened or Priority Flora, new occurrences of TECs or PECs, individuals that have atypical characteristics, or bioregional range extensions (Table 2.9).

Table 2.9: Specimens Lodged with the Western Australian Herbarium

Taxa	Lodgement Number
<i>Acacia diallaga</i>	1929.OC10-1
<i>Acacia karina</i>	1929.M24-3
<i>Acacia sulcaticaulis</i>	1929.R05-01
<i>Acacia sulcaticaulis</i>	2007_MH1046
<i>Acacia sulcaticaulis</i>	2007_MH664
<i>Acacia sulcaticaulis</i>	2007_MH1729
<i>Acacia sulcaticaulis</i>	2007_MH1982
<i>Allocasuarina tessellata</i>	1929.R01-02
<i>Chamelaucium</i> sp. Warriedar (A.P. Brown & S. Patrick APB 1100)	2007.CF164

Taxa	Lodgement Number
<i>Dodonaea amplisemina</i>	2007.CF374
<i>Grevillea globosa</i>	2007.MH106
<i>Grevillea scabrida</i>	1929.OC10-2
<i>Grevillea subtiliflora</i>	2007.MH228
<i>Hemigenia tichbonii</i>	1929.OC09-3
<i>Hydrocotyle dimorphocarpa</i>	1929.OC10-3
<i>Lepidosperma</i> sp. Blue Hills (A. Markey & S. Dillon 3468)	2007.MH187
<i>Micromyrtus acuta</i>	2007.M08-04, 2007.Q226-2
<i>Micromyrtus trudgenii</i>	2007.MH900
<i>Persoonia pentasticha</i>	2007.MH192
<i>Prostanthera</i> sp. Karara (D. Coultas & K. Greenacre Opp 8)	2007.MH134
<i>Rhodanthe collina</i>	1929.M18-58
<i>Stenanthemum poecilum</i>	2007.Q204-13
<i>Stylidium scintillans</i>	1929.SS1

2.8.4. Vegetation Mapping

Vegetation units for the Project are classified to enable analysis of impact and identify local or regional significance of vegetation communities. Floristic composition vegetation classification was used in this assessment as the preferred system outlined for this level of survey in the Technical Guidance (EPA, 2016b). Vegetation unit boundaries were updated following the 2021 *Acacia sulcaticaulis* targeted survey.

The floristic classification is determined using multivariate cluster analysis software, PATN. Presence/absence on a site-by-species matrix produced an association dendrogram generated with the Bray-Curtis coefficient and classified using the flexible UPGMA method in PATN (Belbin and Collins, 2009). Opportunistic collections, releve data, annual species and perennial herbs were excluded from the statistical analysis.

Broad floristic groups indicated by the dendrogram were described at NVIS Level III (NVIS TWG, 2017). Within the broad floristic groups, structurally distinct vegetation units were grouped at a finer scale. Final vegetation units were described to NVIS Level V and the vegetation boundaries were drawn using the quadrat data, aerial imagery, mapping notes and relevés. Level V NVIS description provides information on dominant growth form, height and cover for up to three species at each of the upper, mid and ground strata (NVIS Technical Working Group, 2017).

2.8.5. Vegetation Condition

Vegetation condition was recorded at quadrats and where other areas of different vegetation condition were observed. The vegetation condition was mapped across the Project using the scale recommended for the Interzone Botanical Province as shown in Table 2.10 (EPA, 2016b).

Table 2.10: Vegetation Condition Scale & Criteria

Vegetation Condition	Disturbance Criteria
Pristine	Pristine or nearly so, no obvious signs of disturbance or damage caused by human activities since European settlement.
Excellent	Vegetation structure intact, disturbance affecting individual species. Damage to trees caused by fire, the presence of non-aggressive weeds and occasional vehicle tracks.
Very Good	Vegetation structure altered with obvious signs of disturbance. Disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback logging and/or grazing.

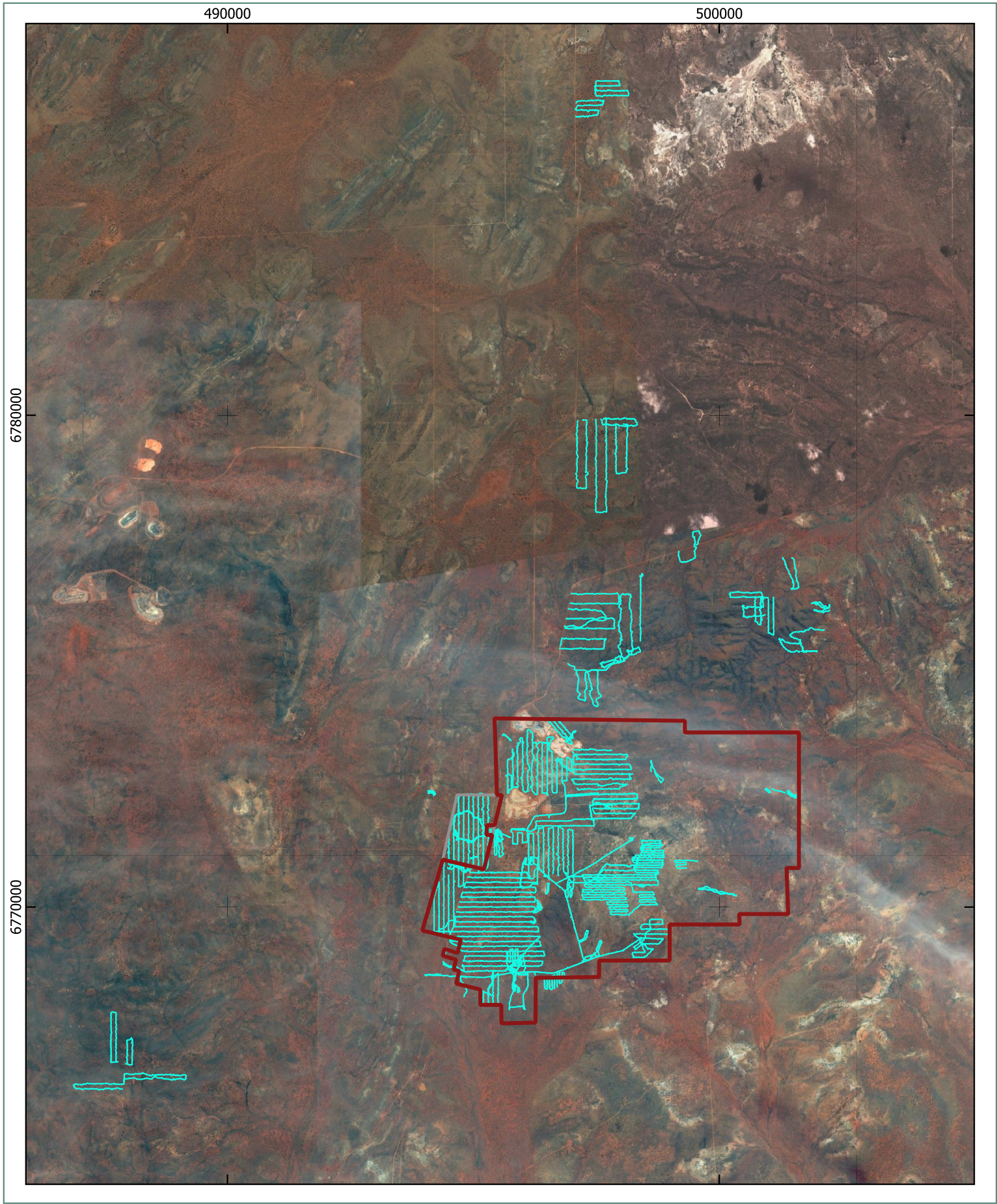
Vegetation Condition	Disturbance Criteria
Good	Vegetation structure significantly altered by obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration bit not to a state approaching good condition without intensive management. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds at high density, partial clearing, dieback and grazing.
Completely Degraded	The structure of the vegetation is no longer intact, that the area is completely or almost completely without native species. These areas are often described as “parkland cleared” with the flora comprising weed or crop species with isolated native trees and shrubs.

2.9. Regional Targeted Flora Assessment

A regional targeted survey north and southwest of the Project was conducted concurrently with the phase 3 targeted field survey up to a distance of 16 km from the Project. This survey focussed on potential habitats of the taxa assigned a high local or regional significance as determined following phase 2 findings, or with a high percentage of their total number located within the Project.

Species distribution modelling (SDM) for significant flora taxa was used to identify areas of potential habitat in the vicinity of the Project (within 20 km) and this guided regional survey location and effort (Spectrum Ecology, 2020c). While these species were the primary focus, any significant taxa encountered were recorded opportunistically.

Five focus areas were identified for the regional survey, four spanning 0.3 km – 13.0 km north and one 5.8 km southwest of the Project. Traverses of 50 – 200 m spacing were walked in each focus area. A total of 102.2 km of traverses were walked by four botanists over ten person days. The regional survey effort map is presented as Figure 2.6.



- Legend**
- Mt Mulgine Project
 - Extension Tenement M59/460
 - Traverse Spring 2020



0 1 2 km
Scale 1:100,000 @ A4

Coordinate System:
GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter



Author: Evan Hamilton Date: 26-10-2021

Regional Targeted Survey Sampling Effort

Mt Mulgine Project
Prepared for Tungsten
Mining NL

Figure
2.6

2.10. Limitations & Constraints

Survey specific limitations and constraints for the detailed flora and vegetation assessment conducted at the Project are discussed in Table 2.11. There were no constraints to completing the flora and vegetation assessments.

Table 2.11: Limitations & Constraints – Flora

Limitation	Constraint	Comment
Availability of the contextual information at a regional and local scale.	No	Historically this area is known for several mines making previous botanical surveys available both regionally and locally. Vegetation mapping conducted within the Project did not accurately match the vegetation previously recorded at the Project and therefore it was re-surveyed and mapped. Some differences between the flora data listed in the reports and what was provided electronically were noted and for these situations, the electronic data was utilised. Thirty-seven reports were referenced during the literature review. These were pursued to give local and regional context to significant flora populations found at the Project. Over 35,000 significant flora records have been included in the desktop assessment.
Competency/experience of the consultant carrying out the survey including experience in bioregion surveyed.	No	Botanists who conducted the field survey have more than 50 years combined experience in flora and vegetation surveys throughout Western Australia, with previous experience in the Yalgoo bioregion and the vicinity of the Project.
Restrictions to, or functionality of survey equipment and tools to complete the flora and vegetation assessment.	No	There were no restrictions to or compromised functionality of survey equipment or tools in any of the phases of field work.
Proportion of flora recorded and/or collected, any identification issues.	No	Sampling techniques were appropriate for this level of survey and seasonal timing was good for collecting specimens with optimal floristic material. Species accumulation curve analysis estimated that that 77% of potential species at the Project were recorded. An average of 30.3 species recorded per quadrat was recorded during the primary survey of which 40% of species recorded were annual. Overall specimen quality was exceptional. A total of 29 collected specimens (7%) were unable to be conclusively identified, indicated by the presence of a query. This is normal and can be attributed to insufficient material (19), complex (1), sterile (8) or juvenile specimens (1). Four of the query specimens were unable to be identified beyond family and nine beyond genus.
Survey effort and extent.	No	Three phases of flora survey and a targeted <i>Acacia sulcata</i> survey were conducted at the Project, including two during the primary survey timing for a flora survey in the interzone botanical region. A total of 58 quadrats and 17 relevés were sampled at the Project. Traverses were conducted across proposed areas for infrastructure at 50-100 m spacing. An initial phase of comprehensive targeted surveying was conducted in Autumn 2020 focussing on potential areas for infrastructure and perennial significant flora. A further comprehensive targeted survey was conducted in spring 2020 for annual significant flora, <i>Hydrocotyle dimorphocarpa</i> (P1) and <i>Rhodanthe collina</i> (P3) and any of the other significant flora taxa that were under sampled during the previous flora surveys, including the recently described <i>Hemigenia tichbonii</i> (P1). A total 435.7 km of targeted flora traverses

Limitation	Constraint	Comment
		were conducted across the Project during phase 1 to 3, and 428 km were undertaken during the <i>Acacia sulcatiaulis</i> targeted survey in 2021. Targeted Survey – Significant Flora Sampling technique and quantity for the targeted survey was appropriate. This survey was conducted over three surveys. Seasonal timing for Phase 3 was specific to capture the annual significant herbs, <i>Hydrocotyle dimorphocarpa</i> (P1) and <i>Rhodanthe collina</i> (P3). Adequate specimens for all Priority Flora were obtained over the two field surveys with reproductive material for every species sampled during at least one of the field surveys. Sixty-three previously recorded locations were ground-truthed to confirm specimens and minimise identification issues. Targeted Survey – <i>Stylidium scintillans</i> Sampling techniques for the <i>Stylidium scintillans</i> (Threatened Flora) targeted searches were designed in consultation with relevant literature (Wege, 2012) and criteria for surveying and collecting Threatened flora (DBCA, 2017b). This ensured appropriate data collection and correct identification of the species and habitat. Seasonal timing was acceptable for this species for both targeted surveys. Targeted Survey – <i>Acacia sulcatiaulis</i> The <i>Acacia sulcatiaulis</i> targeted flora survey was comprehensive and thorough with 428 km of traverses walked over 48 person days at 20 m spacings across the entire known range of the species. There were no inaccessible areas. The entire population within the Project has been surveyed.
Timing/weather/season/cycle.	No	The phase 1 flora survey was undertaken following a period of typical rainfall, with Karara receiving 2 mm more than and Paynes Finds receiving 7 mm under the sum of median rainfall for the three months prior to the survey. The annual rainfall was above median for both Karara and Paynes Find receiving 22 and 55 mm higher, respectively than the sum of the annual median rainfall. The phase 2 flora survey was undertaken following a period of above median rainfall, with Karara receiving 34 mm and Paynes Finds receiving 56 mm higher than the sum of median rainfall for the three months prior to the survey. The annual rainfall was also generally above median for both Karara and Paynes Find receiving 2 and 44 mm higher, respectively than the sum of the annual median rainfall. A phase 3 spring survey was conducted in August 2020 with optimal survey conditions for the target annual significant flora species. The three months prior to the survey were drier but typical for the season, with Karara receiving 25 mm under, and Paynes Finds receiving 17mm under the sum of median rainfall. The targeted flora surveys for <i>Stylidium scintillans</i> occurred when the majority of this species has been recorded flowering; late August to early September (Wege, 2012) and confirmation of appropriate survey timing was achieved by visiting previously known records 1.5 km west of the Project.
Disturbances (e.g. fire, flood, accidental human intervention) which affected results of survey.	No	No disturbances that would affect the results of the assessment were recorded during the survey.
Remoteness and/or access problems.	No	There were no access issues at the Project.

3. RESULTS

3.1. Flora

3.1.1. Desktop Assessment Results

One hundred significant flora taxa were recorded during the desktop assessment from the vicinity of the Project area (Table 3.1; full list at Appendix F). Of these 100, nineteen were identified as previously recorded within the Project area, including seven Priority 1, eleven Priority 3 taxa and one Priority 4 taxa (Figure 3.1). Fifteen of these were recorded during the current surveys, as indicated by a "~" in Table 3.1). Twenty-one significant flora taxa were assigned a high likelihood of occurrence (Figure 3.2), two of these were recorded during the current survey (indicated with a "~" in Table 3.1). Six taxa were assigned a medium likelihood of occurrence within the Project (Table 3.1 and Figure 3.3). None of these were recorded during the current surveys.

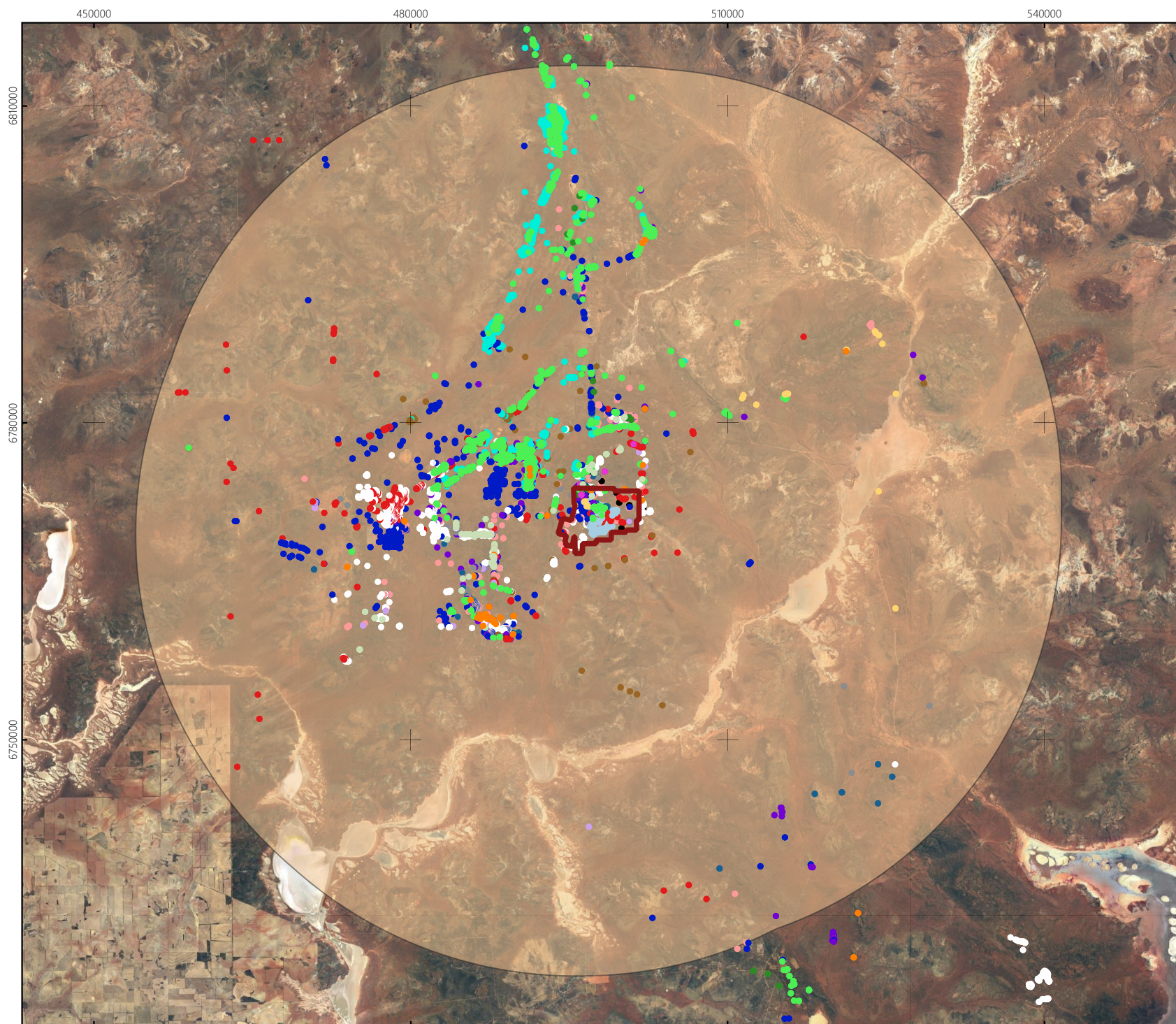
Sixty-four previous locations of the 19 taxa found to be recorded in the Project from the desktop results, were revisited and confirmed during all three phases of the surveys (Appendix E). From this ground-truthing, four species have been determined as likely identification/data errors and one is no longer considered to occur (discussed further in Section 2.8.2.4). Additionally, errors in one dataset were identified for one taxon, *Acacia sulcatacaulis*. These taxa have been amended or excluded from the final data (Section 3.1.2) but remain in the desktop assessment results because they form part of the original results. They are indicated with a "^" in Table 3.1. Both the set of original data and the amended data are presented in Table 3.1.

Table 3.1: Significant Flora – Desktop Assessment

Desktop Likelihood	Taxa	Original Desktop Numbers			Amended Desktop Numbers		
		# Inside Project*	# Outside Project	Total	# Inside Project*	# Outside Project	Total
Recorded	Priority 1						
	~ <i>Acacia diallaga</i>	2,246	1,245	3,491	(n/a)		
	~ <i>Acacia karina</i>	8,341	241,523	249,864	(n/a)		
	~ <i>Acacia sulcatacaulis</i>	103,283*	0	103,283	103,471	0	103,471
	~ <i>Chamelaucium</i> sp. Warriear (A.P. Brown & S. Patrick APB 1100)	1,829	1,439	3,268	2,556	1,916	4,472
	^ <i>Chamelaucium</i> sp. Yalgoo (Y. Chadwick 1816)	727	477	1,247	0	477	0
	~ <i>Hydrocotyle dimorphocarpa</i>	2,589	1,290	3,879	(n/a)		
	~ <i>Lepidosperma</i> sp. Blue Hills (A. Markey & S. Dillon 3468)	10,644	81,277	91,921	(n/a)		
	Priority 3						
	^ <i>Acacia subsessilis</i>	206	562	768	0	562	562
High	~ <i>Allocasuarina tessellata</i>	6,457	31,608	38,065	(n/a)		
	^ <i>Austrostipa blackii</i>	3	1,608	1,611	0	1,608	1,608
	^ <i>Drummondita fulva</i>	358	36,725	37,083	0	36,725	0
	~ <i>Grevillea scabrida</i>	8,275	13,227	21,502	(n/a)		
	~ <i>Grevillea subtiliflora</i>	1,842	1,839	3,681	(n/a)		
	~ <i>Micromyrtus acuta</i>	2,001	50,212	52,213	(n/a)		
	~ <i>Micromyrtus trudgenii</i>	1,153	47,939	49,092	(n/a)		
	~ <i>Persoonia pentasticha</i>	566	2,039	2,605	(n/a)		
	~ <i>Rhodanthe collina</i>	3,644	560,287	563,931	(n/a)		
	~ <i>Stenanthemum poicilum</i>	98	1,094	1,192	(n/a)		
High	Priority 4						
	~ <i>Dodonaea amplisemina</i>	798	834	1,632	(n/a)		
	Threatened						
	<i>Stylidium scintillans</i>	-	192,808	192,808	(n/a)		
	Priority 1						
	<i>Eremophila oldfieldii</i> subsp. <i>papula</i>	-	270	270	(n/a)		
	<i>Eremophila sericea</i>	-	276	276	(n/a)		
	~ <i>Hemigenia tichbonii</i>	-	1,836	1,836	(n/a)		
	<i>Millotia dimorpha</i>	-	85,086	85,086	(n/a)		

Desktop Likelihood	Taxa	Original Desktop Numbers			Amended Desktop Numbers		
		# Inside Project*	# Outside Project	Total	# Inside Project*	# Outside Project	Total
High ~	<i>Prostanthera</i> sp. Karara (D. Coultas & K. Greenacre Opp 8)	-	1,608	1,608	(n/a)		
	Priority 2						
	<i>Calandrinia kalanniensis</i>	-	165	165	(n/a)		
	<i>Calandrinia</i> sp. Warriedar (F. Obbens 04/09)	-	541	541	(n/a)		
	Priority 3						
	<i>Angianthus prostratus</i>	-	18	18	(n/a)		
	<i>Bossiaea</i> sp. Jackson Range (G. Cockerton & S. McNee LCS 13614)	-	1,722	1,722	(n/a)		
	<i>Calotis</i> sp. Perrinvale Station (R.J. Cranfield 7096)	-	59	59	(n/a)		
	<i>Cyanicula fragrans</i>	-	156	156	(n/a)		
	<i>Dicrastylis linearifolia</i>	-	918	918	(n/a)		
	<i>Eremophila grandiflora</i>	-	886	886	(n/a)		
	<i>Grevillea globosa</i>	-	1,663	1,663	(n/a)		
	<i>Grevillea granulosa</i>	-	2	2	(n/a)		
	<i>Gunniopsis divisa</i>	-	3,958	3,958	(n/a)		
	<i>Melaleuca barlowii</i>	-	121	121	(n/a)		
	<i>Petrophile pauciflora</i>	-	203	203	(n/a)		
	<i>Polianthion collinum</i>	-	11,519	11,519	(n/a)		
	<i>Psammomoya implexa</i>	-	7,106	7,106	(n/a)		
Medium	Threatened						
	<i>Eucalyptus synandra</i>	-	200	200	(n/a)		
	Priority 1						
	<i>Eremophila</i> sp. Thundelarra (B. Buirchell BB 324)	-	35	35	(n/a)		
	<i>Gnephosis setifera</i>	-	1	1	(n/a)		
	Priority 3						
	<i>Grevillea leptopoda</i>	-	3	3	(n/a)		
	<i>Menkea draboides</i>	-	122	122	(n/a)		
	Priority 4						
	<i>Wurmbea murchisoniana</i>	-	6	6	(n/a)		

^ = likely identification errors or no longer occurring; ~ = recorded during current surveys, * = number is from the original desktop assessment and may have been updated following data accuracy checks.



Legend

- ▬ Mt Mulgine Project
- ▬ 40 km Buffer from Project

Literature Review Significant Flora - Recorded

- P1: *Acacia diallaga*
- P1: *Acacia karina*
- P1: *Acacia sulcatacaulis*
- P1: *Allocasuarina tessellata*
- P1: *Chamelaucium* sp. Warriedar
- P1: *Chamelaucium* sp. Yalgoo
- P1: *Grevillea scabrida*
- P1: *Hydrocotyle dimorphocarpa*
- P1: *Lepidosperma* sp. Blue Hills
- P3: *Acacia subsessilis*
- P3: *Austrostipa blackii*
- P3: *Drummondita fulva*
- P3: *Grevillea subtiliflora*
- P3: *Micromyrtus acuta*
- P3: *Micromyrtus trudgenii*
- P3: *Persoonia pentasticha*
- P3: *Rhodanthe collina*
- P3: *Stenanthemum poicilum*



0 10 20 km

Scale: 1:500000

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter



Author: Melissa Hay

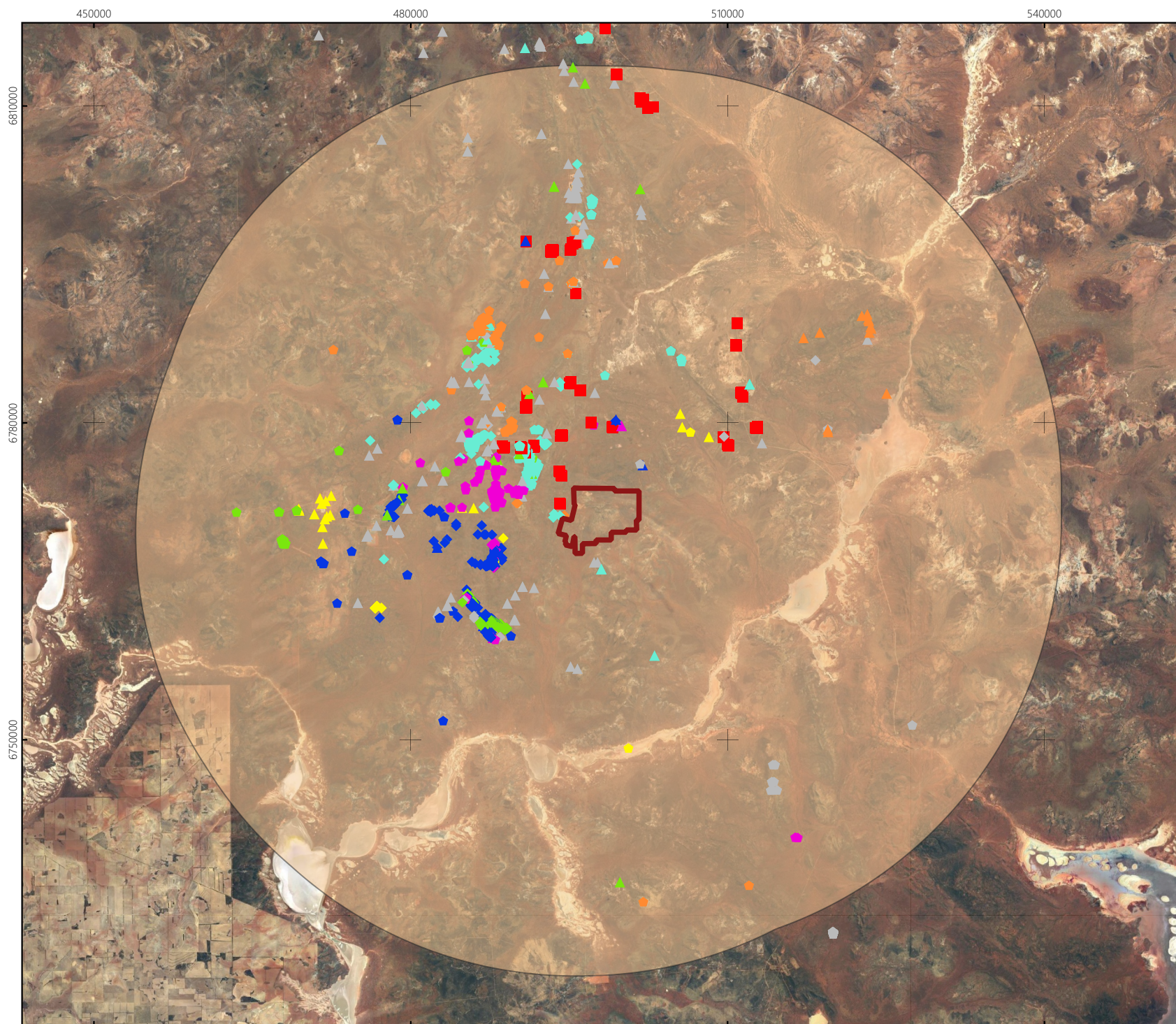
Date: 19-01-2020

Significant Flora Records from the Desktop Assessment - Recorded

Mt Mulgine Project

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Figure
3.1



Legend

- ▬ Mt Mulgine Project
- ▬ 40 km Buffer from Project

Literature Review Significant Flora - High

- T (-/VU): *Stylidium scintillans*
- ◆ P1: *Eremophila oldfieldii* subsp. papula
- ◆ P1: *Eremophila sericea*
- ◆ P1: *Hemigenia tichbonii*
- ◆ P1: *Millotia dimorpha*
- ◆ P1: *Prostanthera* sp. Karara
- ◆ P2: *Calandrinia kalanniensis*
- ◆ P2: *Calandrinia* sp. Warriedar
- ▲ P3: *Angianthus prostratus*
- ▲ P3: *Bossiaea* sp. Jackson Range
- ▲ P3: *Calotis* sp. Perrinvale Station
- ▲ P3: *Cyanicula fragrans*
- ▲ P3: *Dicrastylis linearifolia*
- ▲ P3: *Eremophila grandiflora*
- ▲ P3: *Grevillea globosa*
- ▲ P3: *Grevillea granulosa*
- ▲ P3: *Gunniopsis divisa*
- ▲ P3: *Melaleuca barlowii*
- ▲ P3: *Petrophile pauciflora*
- ▲ P3: *Polianthion collinum*
- ▲ P3: *Psammomoya implexa*
- ▲ P4: *Dodonaea ampleximena*



0 10 20 km

Scale: 1:500000

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter



Author: Melissa Hay

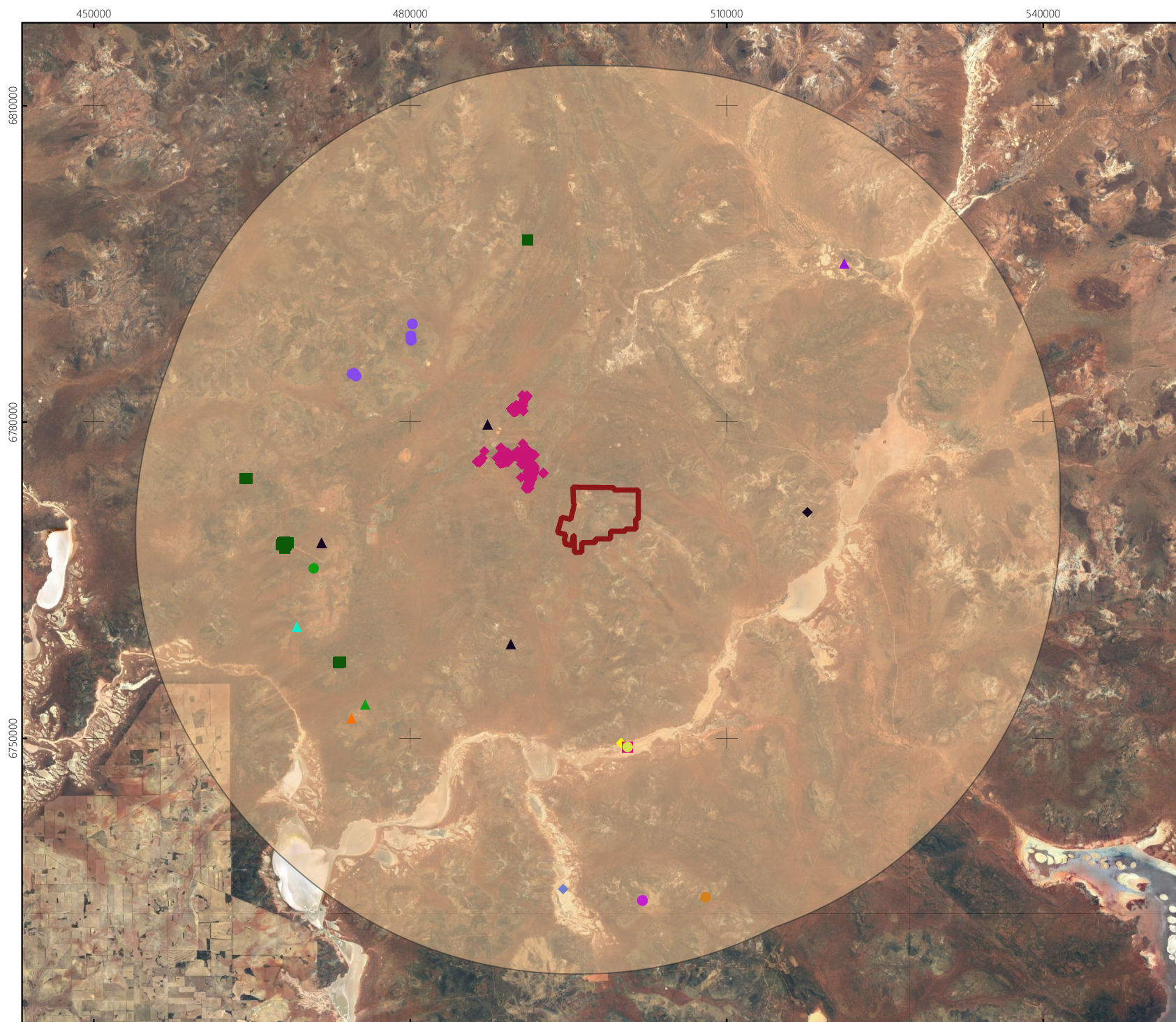
Date: 19-01-2020

Significant Flora Records from the Desktop Assessment - High Likelihood

Mt Mulgine Project

Prepared for
Tungsten Mining NL

Figure
3.2



Legend

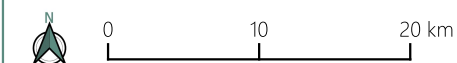
- Mt Mulgine Project
- 40 km Buffer from Project

Literature Review Significant Flora - Medium

- T (VU/VU): Eucalyptus synandra
- P1: Eremophila sp. Thundelarra
- P1: Gnephosis setifera
- P3: Grevillea leptopoda
- P3: Menkea draboides
- P4: Wurmbea murchisoniana

Literature Review Significant Flora - Low

- T (-/EN): Acacia woodmaniorum
- P1: Eucalyptus jutsonii subsp. kobela
- P1: Korthalsella leucothrix
- P1: Philotheca nutans
- P2: Persoonia kararae
- P3: Acacia formidabilis
- P3: Angianthus micropodioides
- P3: Euryomyrtus recurva
- P3: Gnephosis cassiniana
- P3: Podotheca uniseta



Scale: 1:500000

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter



Author: Melissa Hay

Date: 19-01-2020

Significant Flora Records from
the Desktop Assessment -
Medium & Low Likelihood
Within 40 km

Mt Mulgine Project

Prepared for
Tungsten Mining NL

Figure
3.3

3.1.2. Flora Assessment Results

In total, 296 confirmed vascular plant taxa were recorded from the Project, of which 15 were introduced. These taxa represent 59 families and 156 genera. Families with the greatest number of taxa were Asteraceae (47 taxa), Fabaceae (33 taxa), and Myrtaceae (20 taxa). Genera with the most taxa were *Acacia* (23 taxa), *Rhodanthe* (10 taxa), and *Eremophila* (10 taxa). The total species list is presented in Appendix G.

3.1.2.1. Species Accumulation Curve

The species accumulation curve (SAC) is presented in Figure 3.4. The Chao 2 non-parametric species richness estimator indicated that 77% of flora species were recorded during the flora assessment. The SAC was plotted using the *specaccum* function in the *vegan* package in R v.4.

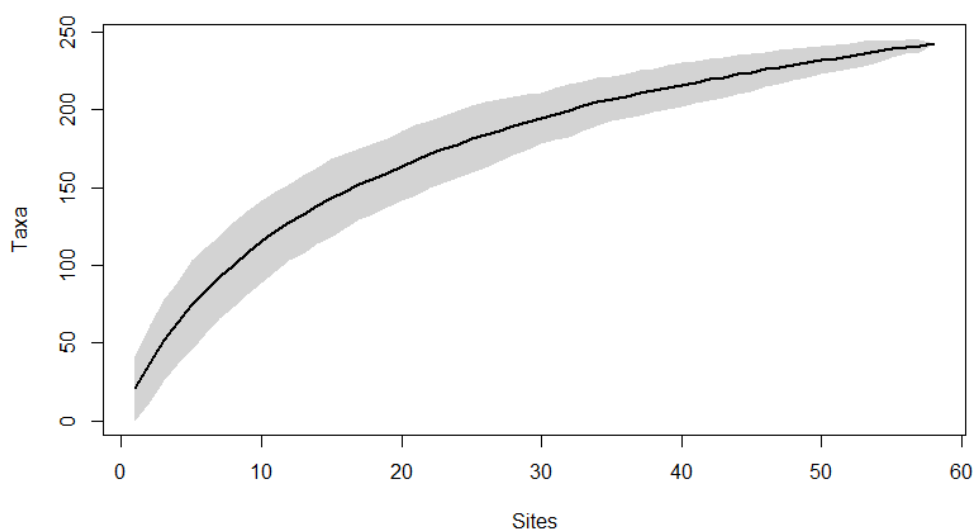


Figure 3.4: Species Accumulation Curve

3.1.3. Significant Flora

No Threatened flora were recorded within the Project during the current or desktop assessment. Seventeen Priority Flora taxa were recorded within the Project (Table 3.2; Figure 3.5; Figure 3.6):

Priority 1:

- *Acacia diallaga*
- *Acacia karina*
- *Acacia sulcatacaulis*
- *Chamelaucium* sp. Warriedar (A.P. Brown & S. Patrick APB 1100)
- *Hemigenia tichbonii*
- *Hydrocotyle dimorphocarpa*
- *Lepidosperma* sp. Blue Hills (A. Markey & S. Dillon 3468)

Priority 4:

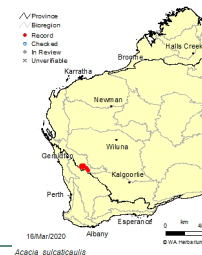
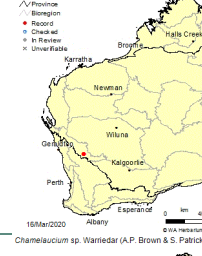
- *Dodonaea amplisemina*

Priority 3:

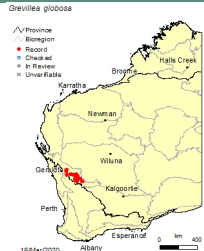
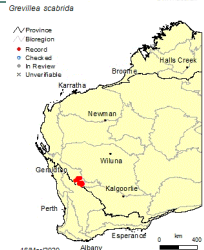
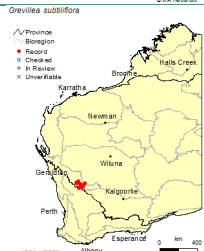
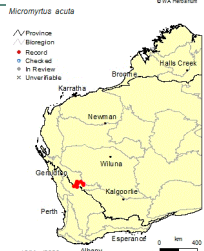
- *Allocasuarina tessellata*
- *Grevillea globosa*
- *Grevillea scabrifolia*
- *Grevillea subtiliflora*
- *Micromyrtus acuta*
- *Micromyrtus trudgenii*
- *Persoonia pentasticha*
- *Rhodanthe collina*
- *Stenanthemum poecilum*

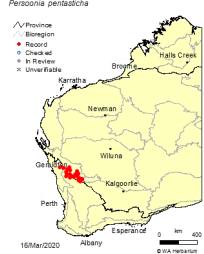
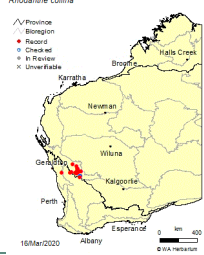
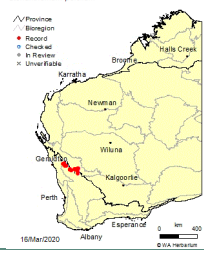
Maps for each species are provided in Appendix H. Coordinates are provided electronically with the report.

Table 3.2: Significant Flora

Taxa	Description	Landform & Primary Vegetation Unit from Project	Number of Individuals in Project Area	Regional Distribution	Photograph
P1 <i>Acacia diallaga</i>	Dense, spreading, much-branched shrubs 0.5–1.5 m tall.	Landform: Slopes Primary Vegetation: AdAa	Current: 843 Desktop: 2,246 Total: 3,089		
P1 <i>Acacia karina</i>	Straggling, woody shrub, to 1.5 m high, phyllodes terete with appressed hairs between nerves.	Landform: Slopes and flats Primary Vegetation: AdAa	Current: 8,520 Desktop: 8,341 Total: 16,861		
P1 <i>Acacia sulcataculis</i>	Multi-stemmed shrubs or trees 2–5 m tall, stems with few to many, shallow to deep longitudinal flutings.	Landform: Hill slopes and crests Primary Vegetation: AsCp	Current: Phase 1-3: 11,277 Total: 211,985* (targeted only)		
P1 <i>Chamelaucium</i> sp. Warriedar (A.P. Brown & S. Patrick APB 1100)^	Low branching shrub to 0.5 m.	Landform: Slopes Primary Vegetation: AdAa	Current: 550 Desktop: 2,556 Total: 3,106		

Taxa	Description	Landform & Primary Vegetation Unit from Project	Number of Individuals in Project Area	Regional Distribution	Photograph	
P1	<i>Hemigenia tichbonii</i>	Shrubs. Stems, cross section more or less circular. Peltate scales absent. Leaves 10-25 mm long, 0.6-0.7 mm wide, whorled, entire.	Landform: Slopes Primary Vegetation: AdAt and AdAa	Current: 3,158 Desktop: 0 Total: 3,158		
P1	<i>Hydrocotyle dimorphocarpa</i>	Herb to 0.1 m.	Landform: Slopes Primary Vegetation: AdAa	Current: 3,284 Desktop: 2,589 Total: 5,873		
P1	<i>Lepidosperma</i> sp. Blue Hills (A. Markey & S. Dillon 3468)	Sedge to 1.0 m in height.	Landform: Hills, crests and drainage Primary Vegetation: AsCp and AdAt	Current: 1,724 Desktop: 10,644 Total: 12,368		
P3	<i>Allocasuarina tessellata</i>	Dioecious shrub or tree, 3-5 m high.	Landform: Slopes Primary Vegetation: AdAa and AdAt	Current: 19,765 Desktop: 6,457 Total: 26,222		

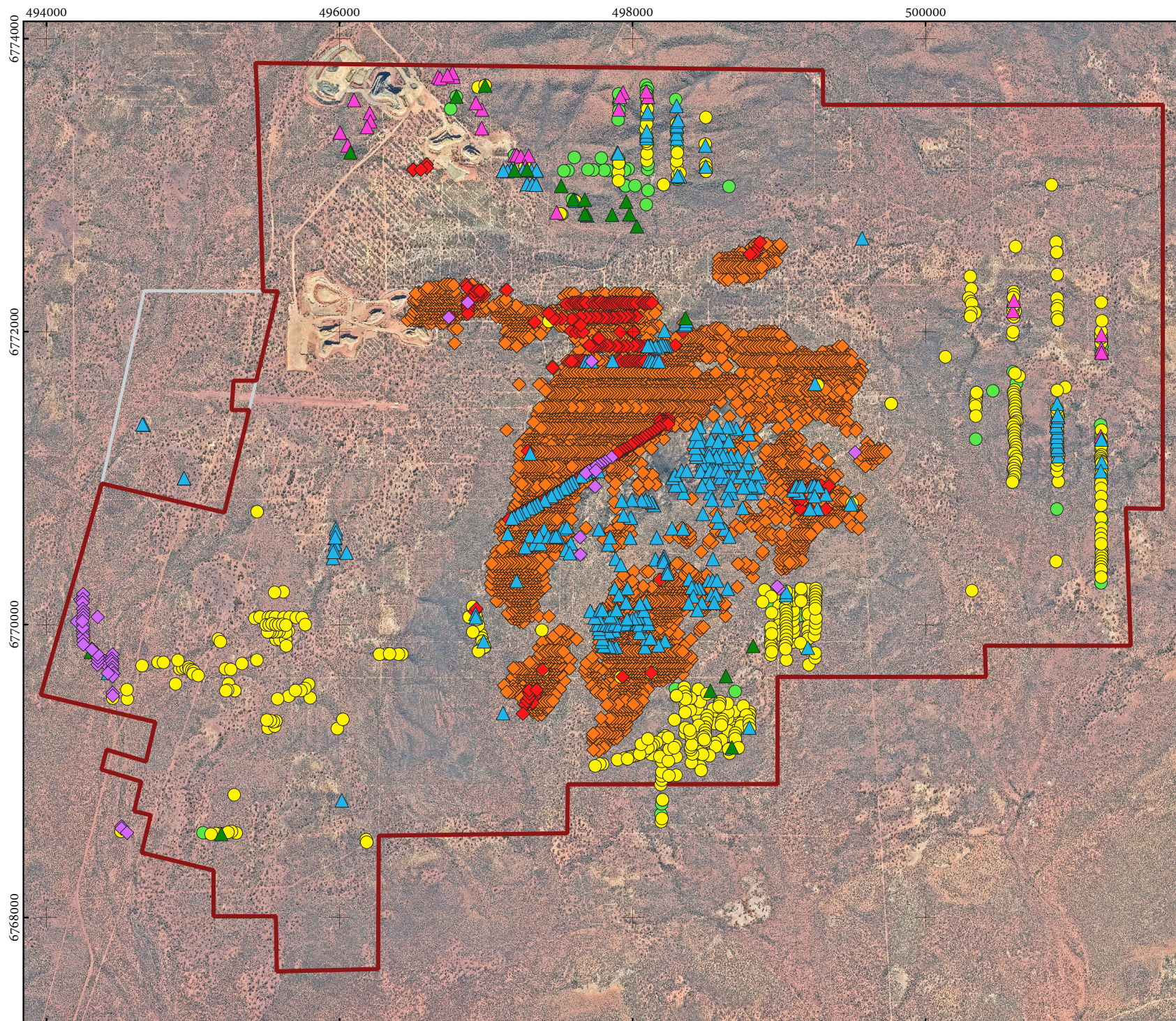
Taxa		Description	Landform & Primary Vegetation Unit from Project	Number of Individuals in Project Area	Regional Distribution	Photograph
P3	<i>Grevillea globosa</i>	Spreading, non-lignotuberosus shrub, 1-3 m high. Fl. cream & white & green/red-brown, Jan or Jun or Nov.	Landform: Flats Primary Vegetation: AdAr	Current: 15 Desktop: 0 Total: 15		
P3	<i>Grevillea scabrata</i>	Densely & irregularly branched shrub, 0.6-1.5 m high. Fl. green-white/green-yellow/white, Jul.	Landform: Slopes and flats Primary Vegetation: AdAa	Current: 4,484 Desktop: 8,275 Total: 12,759		
P3	<i>Grevillea subtiliflora</i>	Erect to spreading shrub, 1-2.5 m high. Fl. white, Apr or Jul to Sep.	Landform: Slopes Primary Vegetation: AdAa	Current: 107 Desktop: 1,842 Total: 1,949		
P3	<i>Micromyrtus acuta</i>	Erect shrub, 0.8-2 m high.	Landform: Flats Primary Vegetation: AaAr and ElAr	Current: 6,367 Desktop: 2,001 Total: 8,368		

Taxa	Description	Landform & Primary Vegetation Unit from Project	Number of Individuals in Project Area	Regional Distribution	Photograph
P3	<i>Micromyrtus trudgenii</i>	Erect, open shrub, 1-2 m high.	Landform: Hills and crests Primary Vegetation: AsCp	Current: 1,023 Desktop: 1,153 Total: 2,176	 
P3	<i>Persoonia pentasticha</i>	Erect, spreading shrub, 0.4-1.8 m high. Fl. yellow, Aug to Nov.	Landform: Slopes and flats Primary Vegetation: AdAa	Current: 246 Desktop: 566 Total: 812	 
P3	<i>Rhodanthe collina</i>	Erect, bushy annual, herb, 0.1-0.25 m high. Fl. white & yellow, Aug to Oct.	Landform: Flats Primary Vegetation: ElAr	Current: 22,708 Desktop: 3,644 Total: 26,352	 
P3	<i>Stenanthemum poecilum</i>	Erect or decumbent shrub, 0.15-0.5 m high. Fl. white, May to Jun or Sep to Nov.	Landform: Slopes Primary Vegetation: AdAa	Current: 200 Desktop: 98 Total: 298	 

Taxa	Description	Landform & Primary Vegetation Unit from Project	Number of Individuals in Project Area	Regional Distribution	Photograph
P4	<i>Dodonaea amplisemina</i>	Dioecious, multi-stemmed shrub, 0.3-1 m high.	Landform: Slopes Primary Vegetation: AdAa	Current: 6,266 Desktop: 798 Total: 7,064	 

Map images used with permission (WAH, DBCA (<https://florabase.dpaw.wa.gov.au/help/copyright>). Accessed 11/05/2020.

*The total number of *Acacia sulcata* is from the 2021 targeted survey only. The targeted survey **has replaced all** other counts undertaken at the Project (Phase 1-3 & desktop).



Legend

Mt Mulgine Project

Extension Tenement M59/460

Significant Flora - Phase 1, 2 & 3

● P1: *Acacia diallaga*

● P1: *Acacia karina*

◆ P1: *Acacia sulcatcaulis*

▲ P1: *Chamelaucium* sp. Warriedar

▲ P1: *Hemigenia tichbonii*

▲ P1: *Hydrocotyle dimorphocarpa*

◆ P1: *Lepidosperma* sp. Blue Hills

Significant Flora - Targeted Acacia Survey

◆ P1: *Acacia sulcatcaulis*



0 0.5 1 1.5 km

Scale: 1:36000

Coordinate System: GDA 1994 MGA Zone 50

Projection: Transverse Mercator

Units: Meter



Author: Jesse Harper

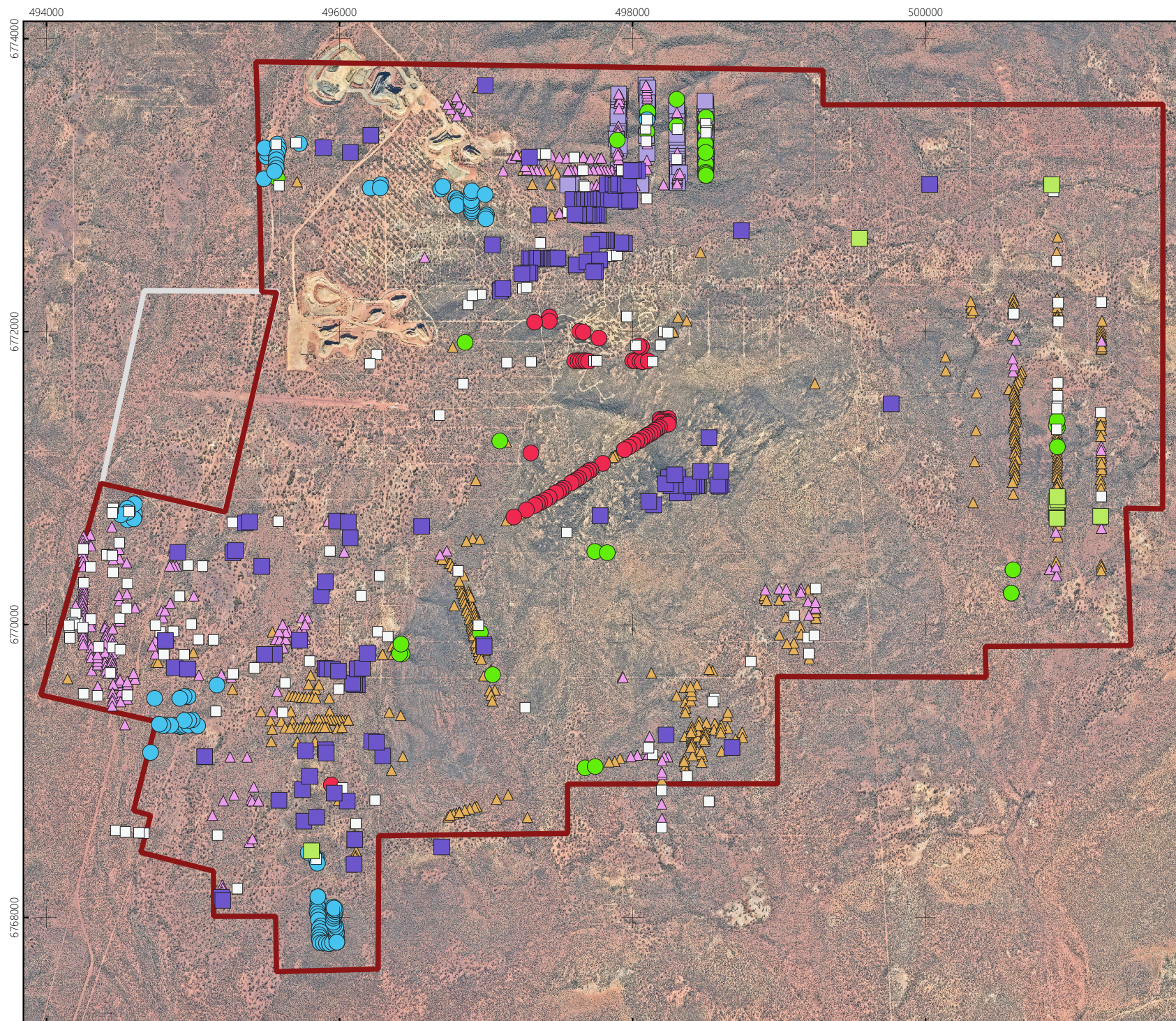
Date: 30/10/2021

Significant Flora – Priority 1

Mt Mulgine Project

Prepared for
Tungsten Mining NL

Figure
3.5



Legend

- Mt Mulgine Project
- Extension Tenement M59/460

Significant Flora

- ▲ P3: Allocasuarina tessellata
- △ P3: Grevillea globosa
- ▲ P3: Grevillea scabrada
- P3: Grevillea subtiliflora
- P3: Micromyrtus acuta
- P3: Micromyrtus trudgenii
- P3: Persoonia pentasticha
- P3: Rhodanthe collina
- P3: Stenanthemum poicilum
- P4: Dodonaea amplisemina



0 0.5 1 1.5 km

Scale: 1:36000

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter



Author: Carmel Winton

Date: 16/12/2020

Significant Flora – Priority 3 & 4

Mt Mulgine Project

Prepared for
Tungsten Mining NL

Figure
3.6

3.1.3.1. Regional Targeted Assessment Results

Fourteen significant flora taxa were recorded during the regional targeted flora survey, this included six Priority 1, seven Priority 3 and one Priority 4 taxa. Individual counts for these taxa and the number of locations recorded are listed in Table 3.3. Counts are discussed further in Section 4.1 and Table 4.1. Regional distribution maps of each significant flora found during the regional targeted assessment are presented in Appendix I.

Table 3.3: Regional Significant Flora Counts

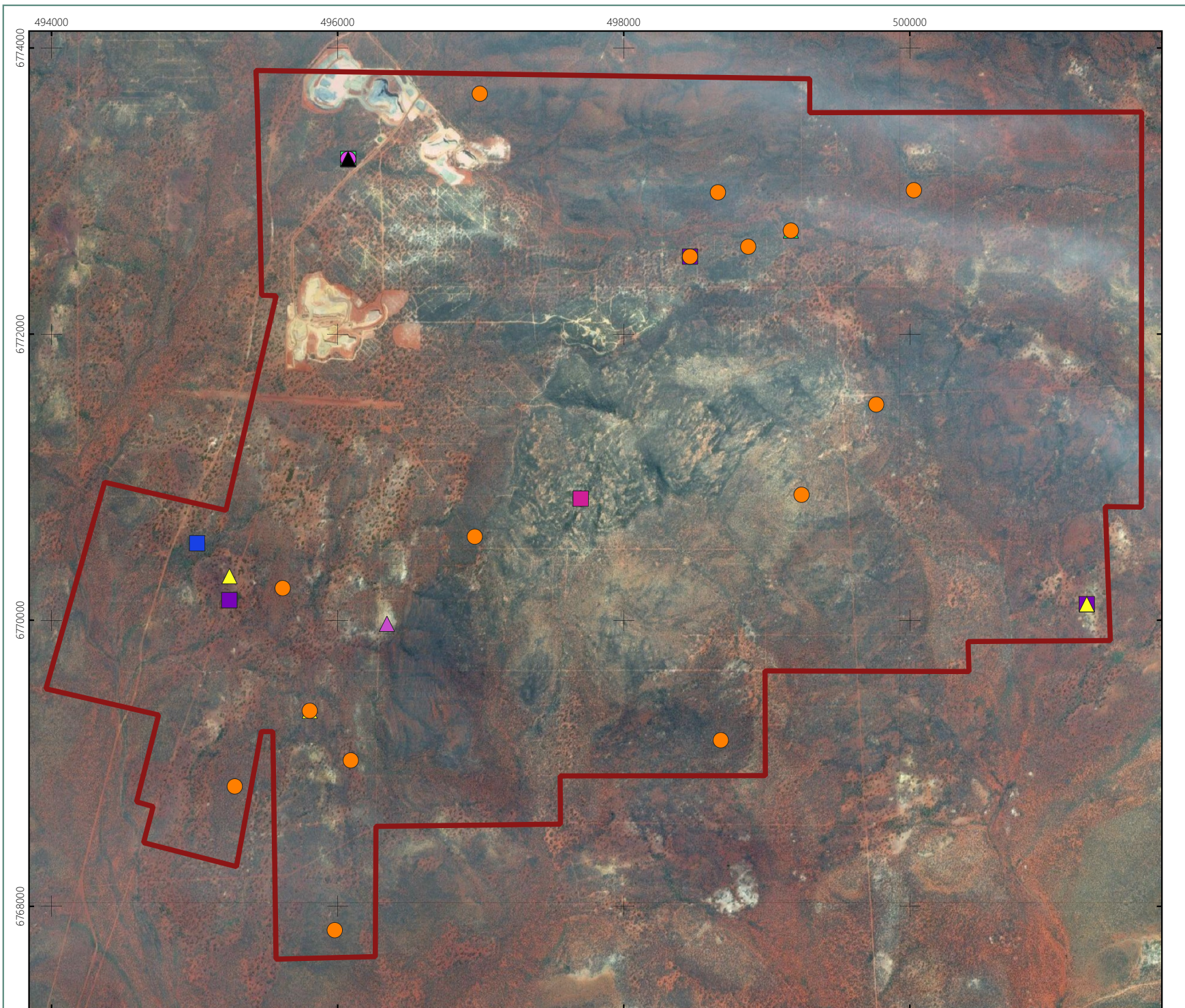
Taxa Recorded in the Project	#Regional Survey		Total Regional Individual Plants (Desktop + Regional)
	Individuals	Locations	
Priority 1			
<i>Acacia diallaga</i>	4,877	336	6,172
<i>Acacia karina</i>	3,546	329	245,069
<i>Acacia sulcatacaulis</i>	0	0	0
<i>Chamelaucium</i> sp. Warriedar (A.P. Brown & S. Patrick APB 1100)	3,791	317	5,707
<i>Hemigenia tichbonii</i>	3,288	291	5,124
<i>Hydrocotyle dimorphocarpa</i>	21,238	105	22,528
<i>Lepidosperma</i> sp. Blue Hills (A. Markey & S. Dillon 3468)	384	17	81,661
Priority 3			
<i>Allocasuarina tessellata</i>	34,511	371	66,119
<i>Grevillea globosa</i>	0	0	1,662
<i>Grevillea scabrida</i>	3,755	219	16,998
<i>Grevillea subtiliflora</i>	1,694	313	3,533
<i>Micromyrtus acuta</i>	5,125	11	55,337
<i>Micromyrtus trudgenii</i>	4,299	250	52,238
<i>Persoonia pentasticha</i>	93	55	2,129
<i>Rhodanthe collina</i>	23,963	44	584,250
<i>Stenanthemum poicilum</i>	0	0	1,094
Priority 4			
<i>Dodonaea amplesimina</i>	107	8	941

3.1.3.2. Introduced Flora

Fifteen introduced flora taxa from 22 locations within the Project were recorded (Table 3.4) mostly as individual records or small clumps of individuals with no substantial populations identified. None of these species are Declared Pests in Western Australia under the BAM Act (2007), and none of the species are listed on the Weeds of National Significance list (Figure 3.7; Appendix J).

Table 3.4: Introduced Flora

Species	Quadrats	Count / Description
<i>*Arctotheca calendula</i>	R06	Single record. Decumbent or ascending annual, herb, 0.03-0.3 m high. Fl. yellow, Aug to Nov. Weed of roadsides, waste places & cultivated land.
<i>*Bromus diandrus</i>	M018	Single small clump. Tufted annual, grass-like or herb, 0.2-0.7 m high. Fl. purple/yellow-green/cream, Aug to Nov. Yellow/grey/black sand, loam, red/brown clay.
<i>*Cuscuta planiflora</i>	M002, M003, M004, M006, M008, M010, M012, M013, M014, M015, M017, M018, M022, M024, M025, M027	Many small to medium size clumps across sites. Parasitic, twining annual, herb or climber. Fl. white, Sep to Oct. Parasitic on ephemerals. Clay flats, hills.
<i>*Ehrharta longiflora</i>	R06	Single small clump. Caespitose annual, grass-like or herb, 0.2-0.6 m high. Fl. purple-green, Jul to Nov. White or grey sand, loam. Sand dunes.
<i>*Hypochaeris glabra</i>	M018	Single record. Rosetted annual or perennial, herb, 0.08-0.5 m high, leaves smooth; flower heads up to 1.5 cm across. Fl. yellow, Jan to Dec (mainly in spring). Common weed of lawns, horticultural areas, roadsides & bushland.
<i>*Lysimachia arvensis</i>	M018, 2x Opportunistic Collections	Three records with multiple individuals. Small, low-growing and short-lived herbaceous plant with stems up to 50 cm long
<i>*Mesembryanthemum nodiflorum</i>	M001, M021, R04	Multiple small to large clumps. Prostrate or erect, succulent annual, herb, 0.02-0.2 m high. Fl. white, Sep to Nov. Sandy clay, loam, clay loam. Claypans, saline areas.
<i>*Monoculus monstrosus</i>	R04	Single small clump. Erect annual, herb, to 0.7 m high. Red-brown loams or sandy clays, yellow-white or grey-brown sandy loam, brown clay loam, limestone, granite. Undulating sandplains, hills and slopes, valley slopes, creekbeds, saline watercourses.
<i>*Pentameris airoides</i>	M018, M025	Two individuals. Widespread annual weed in the temperate southern half of Australia, introduced from South Africa, widespread annual. Flowers Aug. to Dec.
<i>*Petrorhagia dubia</i>	R06	Single clump. Erect annual, herb, 0.1-0.7 m high. Fl. pink/pink-purple/white, Mar or Jul to Dec. Sand, loam, clay.
<i>*Rostraria pumila</i>	M011, M014, M021	Multiple isolated individuals. Tufted annual, grass-like or herb, 0.05-0.2 m high. Fl. green, Jul to Oct. Grey, black or red sand, sandy clay, clay, limestone. Roadsides, sand dunes, cliff slopes.
<i>*Silene gallica</i>	M018	Single individual. Erect or ascending, rather viscid annual, herb, 0.1-0.5(-0.8) m high. Fl. white-pink, Jul to Dec. Sandy soils. Disturbed areas.
<i>*Sisymbrium erysimoides</i>	M002	Single individual. Erect annual, herb, 0.1-0.8 m high. Fl. yellow, Apr or Jun to Oct. Sandy & clayey soils.
<i>*Sonchus oleraceus</i>	M018	Single individual. Erect annual, herb, to 1.5 m high. Fl. yellow, Jan to Dec. Variety of soils. Weed of waste places & disturbed ground.
<i>*Spergula pentandra</i>	M009, M021	Multiple small clumps. Spreading annual, herb, to 0.3 m high. Fl. white, May to Oct.



Legend

 Mt Mulgine Project

Introduced Flora

- *Arctotheca calendula
- *Bromus diandrus
- *Cuscuta planiflora
- *Ehrharta longiflora
- *Hypochaeris glabra
- *Lysimachia arvensis
- *Mesembryanthemum nodiflorum
- *Monoculus monstrosus
- *Pentameris airoides
- *Petrohragia dubia
- ▲ *Rostraria pumila
- ▲ *Silene gallica
- ▲ *Sisymbrium erysimoides
- ▲ *Sonchus oleraceus
- ▲ *Spargula pentandra



0 0.5 1 1.5 km

Scale: 1:36000

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter



Author: Melissa Hay

Date: 20/05/2020

Introduced Flora

Mt Mulgine Project

Prepared for
Tungsten Mining NL

Figure
3.7

3.2. Vegetation

3.2.1. Desktop Assessment - TEC/PEC

No Threatened Ecological Communities (TECs) were recorded as occurring within 15 km of the Project. Two Priority 1 Priority Ecological Communities (PECs) were recorded within 15 km of the Project (Table 3.5; Figure 1.1). Both PECs are geologically restricted to the Banded Ironstone Formations (BIF) of the Blue Hills, Warriedar, Pinyalling, and Walagnumming ranges and therefore are given a low likelihood of occurrence within the Project. None of the vegetation at the Project resemble any TEC/PEC communities.

Table 3.5: PECs

Likelihood	Status	PEC	Description	Distance from Project
Low	PEC P1	Blue Hills BIF	Blue Hills (Mount Karara/Mungada Ridge/Blue Hills) vegetation complexes (banded ironstone formation)	2 km NW of the Project
		Warriedar/Pinyalling/Walagnumming Hills BIF	Warriedar Hill/Pinyalling vegetation complexes (banded ironstone formation)	10 km NE of the Project

3.2.2. Vegetation

Seven vegetation units from five broad floristic groups were recorded in the Project (Table 3.6; Figure 3.8).

Five broad floristic groups were derived from the statistical analysis (Appendix K). Two distinctive structural vegetation groups were noted during field observation and identified as clusters within the dendrogram. These groups have been described as structural sub-groups (Table 3.6).

When mapping vegetation boundaries, some units were difficult to determine from aerial imagery due to similar topographical, substrate, structural and colour characteristics or due to fine vegetation intersections. In these situations, the vegetation was mapped as a mosaic. Two vegetation units have been mapped as one mosaic (AdAt/AdAa).

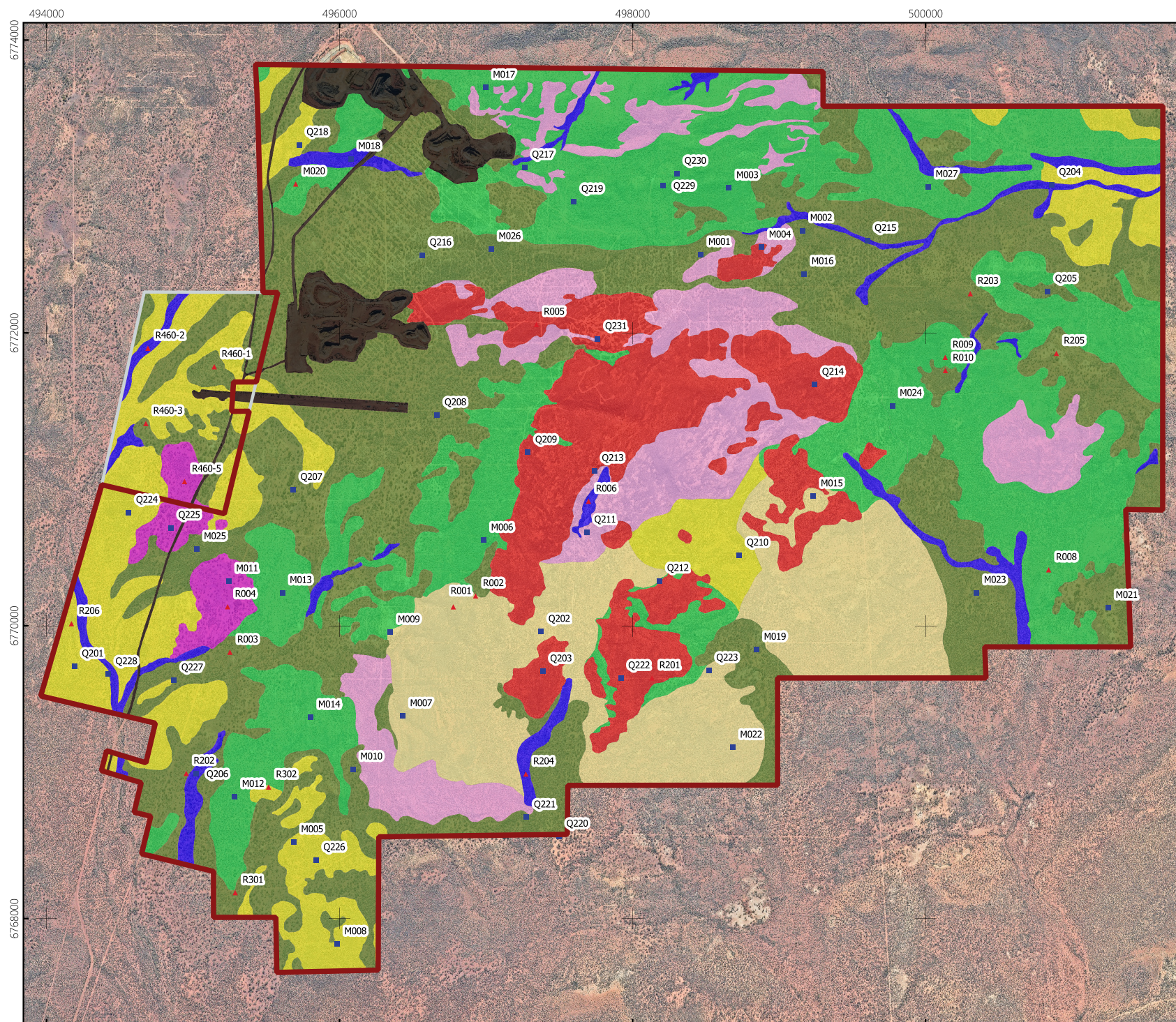
Vegetation mapping has been updated following the *Acacia sulcata* targeted survey using the results of the survey to map vegetation unit boundaries.

Table 3.6: Vegetation Units

Unit	Description	Associated Species	Quadrat Sites	Area in Project (ha) & %	Representative Photo
FLORISTIC GROUP 1: <i>Eucalyptus</i> low open woodland over <i>Acacia</i> tall open shrubland on flats & drainage lines					
Structural Sub-group A					
EIAr	<i>Eucalyptus loxophleba</i> subsp. <i>supralaevis</i> or <i>E. loxophleba</i> subsp. <i>lissophloia</i> low open woodland over <i>Acacia ramulosa</i> var. <i>ramulosa</i> tall open shrubland over <i>Ptilotus obovatus</i> , <i>Scaevola spinescens</i> low isolated shrubs	<i>Exocarpos aphyllus</i> , <i>Eremophila oldfieldii</i> subsp. <i>oldfieldii</i> , <i>Senna artemisioides</i> subsp. <i>filifolia</i> , <i>Acacia acuminata</i> , <i>Eucalyptus kochii</i> subsp. <i>plenissima</i> , <i>Melaleuca scalena</i> , <i>M. hamata</i> Dominant Significant Flora: Nil	M001, M002, M010, M016, M021, M023, M025, M026 Q205, Q207, Q208, Q216, Q220, Q227, Q221	942.2 ha 29.8%	
Structural Sub-group B					
EIAr	<i>Eucalyptus loxophleba</i> subsp. <i>supralaevis</i> low woodland over <i>Acacia tetragonophylla</i> , <i>Allocasuarina dielsiana</i> , <i>Acacia ramulosa</i> var. <i>ramulosa</i> tall open shrubland over <i>Dodonaea inaequifolia</i> , <i>Acacia acanthoclada</i> subsp. <i>glaucescens</i> mid-low sparse shrubland	<i>Austrostipa elegantissima</i> , <i>Ptilotus obovatus</i> , <i>Senna artemisioides</i> subsp. <i>filifolia</i> , <i>Sida</i> sp. Dark Green Fruits (S. van Leeuwen 2260), <i>Gastrolobium laytonii</i> Dominant Significant Flora: Nil	M018, Q204, Q206, Q215	91.0 ha 2.9%	
FLORISTIC GROUP 2: <i>Acacia</i> tall open shrubland over <i>Micromyrtus</i> mid open shrubland on flats					
AaAr	<i>Allocasuarina acutivalvis</i> subsp. <i>prinsepiana</i> tall sparse shrubland over <i>Acacia ramulosa</i> var. <i>ramulosa</i> (+/- <i>Micromyrtus acuta</i>) mid open shrubland over <i>Austrostipa elegantissima</i> isolated tussock grasses	<i>Acacia acuminata</i> , <i>A. burkittii</i> , <i>A. ramulosa</i> var. <i>linophylla</i> , <i>Eremophila latrobei</i> subsp. <i>latrobei</i> , <i>Melaleuca nematophylla</i> , Dominant Significant Flora: <i>Micromyrtus acuta</i>	M005, M008, Q201, Q210, Q218, Q224, Q226, Q228	273.7 ha 8.7%	

Unit	Description	Associated Species	Quadrat Sites	Area in Project (ha) & %	Representative Photo
FLORISTIC GROUP 3: <i>Eucalyptus</i> low open woodland over <i>Tecticornia</i> sparse low shrubland on flats					
EsTh	<i>Eucalyptus salubris</i> low open woodland over <i>Tecticornia ?halocnemoides</i> low sparse shrubland	<i>Acacia acanthoclada</i> subsp. <i>glaucescens</i> , <i>Frankenia setosa</i> , <i>Maireana tomentosa</i> , <i>M. trichoptera</i> , <i>Sclerolaena diacantha</i> , <i>Senna</i> sp. Austin (A. Strid 20210). Dominant Significant Flora: Nil	M011, Q225	35.3 ha 1.1 %	
FLORISTIC GROUP 4: <i>Allocasuarina</i> low open woodland over <i>Acacia</i> tall open shrubland over <i>Borya</i> low sparse shrubland on slopes					
AdAa	<i>Allocasuarina dielsiana</i> (+/- <i>Acacia umbraculiformis</i>) low open woodland over <i>Acacia acuminata</i> , <i>Allocasuarina tessellata</i> , <i>Acacia karina</i> tall open shrubland over <i>Borya sphaerocephala</i> low sparse shrubland	<i>Dodonaea inaequifolia</i> , <i>Melaleuca scalena</i> , <i>Mirbelia microphylla</i> , <i>Brachychiton gregorii</i> , <i>Eucalyptus kochii</i> subsp. <i>plenissima</i> Dominant Significant Flora: <i>Allocasuarina tessellata</i> , <i>Acacia karina</i>	M003, M006, M007, M012, M013, M014, M017, M020, M022, M024, M027, Q217, Q219, Q222, Q229, Q230	786.0 ha 24.9%	
FLORISTIC GROUP 5: <i>Acacia</i> tall open shrubland over <i>Calycopeplus</i> or <i>Allocasuarina</i> mid shrubland on slopes and crests					
Structural Sub-group 5A					
AsCp	<i>Acacia sulcaticaulis</i> and/or <i>Allocasuarina acutivalvis</i> subsp. <i>prinsepiana</i> tall open to closed shrubland over <i>Calycopeplus paucifolius</i> mid sparse shrubland over <i>Philotheca deserti</i> subsp. <i>deserti</i> low sparse shrubland	<i>Allocasuarina acutivalvis</i> subsp. <i>prinsepiana</i> , <i>A. campestris</i> , <i>Eremophila clarkei</i> , <i>Sida</i> sp. Dark Green Fruits (S. van Leeuwen 2260) Dominant Significant Flora: <i>Acacia sulcaticaulis</i>	Q203, Q209, Q212, Q213, Q214, Q231, M004	303.6 ha 9.6%	

Unit	Description	Associated Species	Quadrat Sites	Area in Project (ha) & %	Representative Photo
Structural Sub-group 5B					
AdAt	<i>Acacia duriuscula</i> or <i>Allocasuarina tessellata</i> tall open shrubland	<i>Acacia acuminata</i> , <i>Allocasuarina campestris</i> , <i>Eremophila clarkei</i> , <i>Malleostemon tuberculatus</i> , <i>Solanum lasiophyllum</i> Dominant Significant Flora: <i>Allocasuarina tessellata</i>	M009, M015, Q202, Q211, Q223	352.0 ha 11.1%	
AdAt/ AdAa	Mosaic	-	-	352.0 ha 11.1%	-



Legend

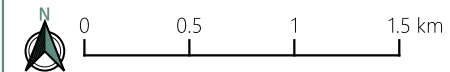
- ☒ Mt Mulgine Project
☐ Extension Tenement M59/460

Sites

- Quadrat
- ▲ Releve

Vegetation Unit Code

- | | |
|---|-----------|
|  | AaAr |
|  | AdAa |
|  | AdAt |
|  | AsCp |
|  | ElAr |
|  | ElAt |
|  | EsTh |
|  | AdAt/AdAa |
|  | Degraded |



Scale: 1:36,000

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter



Author: Melissa Hay

Date: 27/10/2021

Vegetation Units

Mt Mulgine Project

Prepared for
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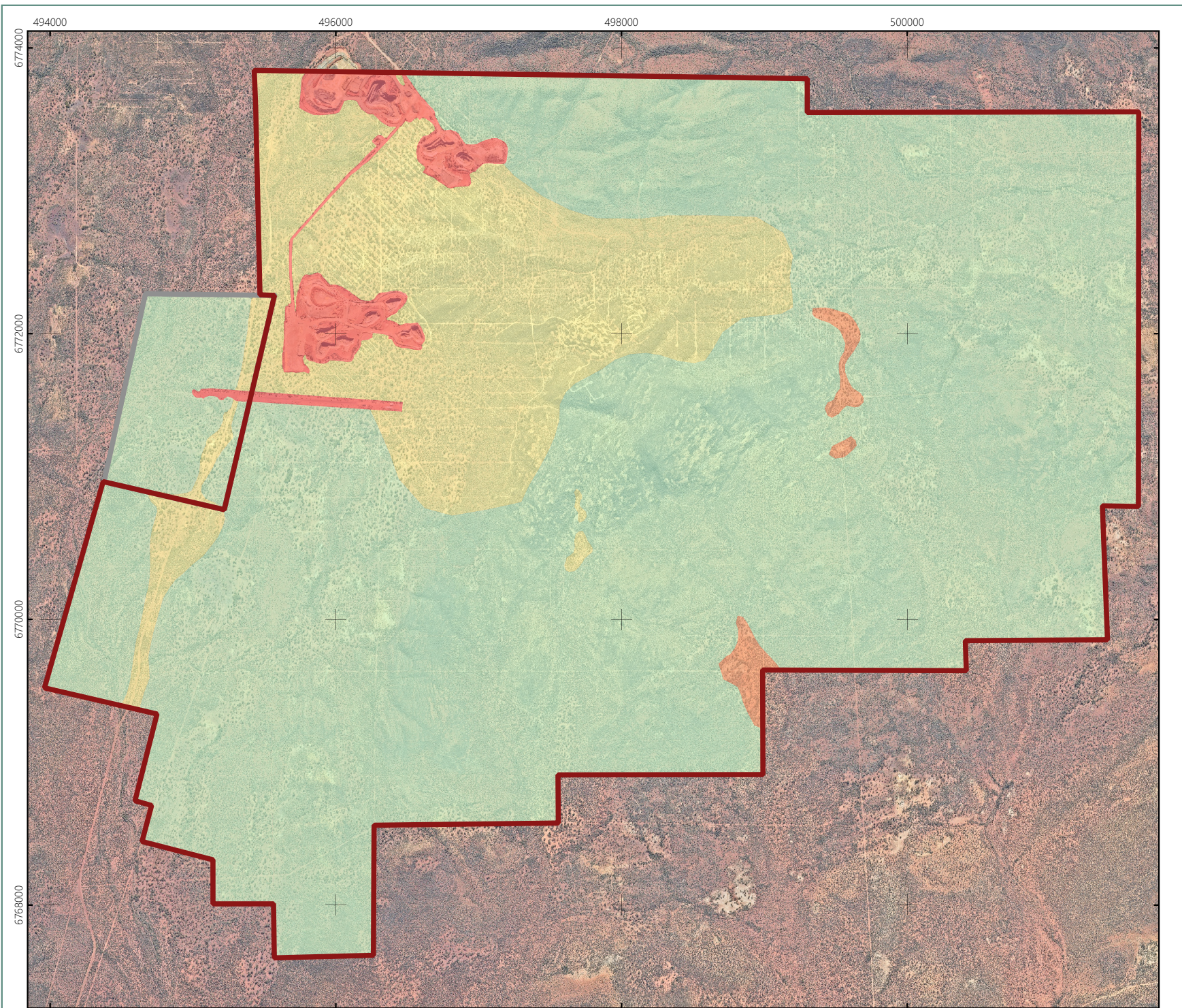
Figure
3.8

3.2.3. Vegetation Condition

Vegetation condition at the Project is presented in Table 3.7 and mapped in Figure 3.9. The majority of the Project is mapped as Excellent (77%) with minor clearing and tracks throughout the tenement. There were some areas of Very Good (19%) and Good (1%) due to roads, the drilling program, exploration and evidence of grazing. The existing airstrip and mine were mapped as Completely Degraded and comprised 3% of the Project.

Table 3.7: Vegetation Condition

Vegetation Condition	Area in Project (ha)	% of the Project	Disturbance Details
Pristine	-	-	-
Excellent	2,434	77	Some old tracks and minor clearing in areas of vegetation with no obvious signs of disturbance.
Very Good	602	19	Obvious signs of previous clearing for drill lines; tracks.
Good	25	1	Tracks; Windmill; Grazing; Structural changes to vegetation.
Degraded	-	-	-
Completely Degraded	100	3	Airstrip; Mining (Haul Road, Waste Rock Dumps, Pits); Drilling; Bund.



Legend

-  Mt Mulgine Project
-  Extension Tenement M59/460

Vegetation Condition

-  Excellent
-  Very Good
-  Good
-  Completely Degraded



0 0.5 1 1.5 km

Scale: 1:36000

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter



Author: Carmel Winton

Date: 14/12/2020

Vegetation Condition

Mt Mulgine Project

Prepared for
Tungsten Mining NL

Figure
3.9

4. DISCUSSION

4.1. Flora

4.1.1. Threatened Flora

One Threatened flora taxon was recorded from the database searches; *Stylidium scintillans*, located 1.5 km west of the Project. Targeted searches for *Stylidium scintillans* were conducted throughout the Project over two years totalling eight person days with optimal timing and seasonality (Spectrum Ecology, 2020d). No optimal habitat for *Stylidium scintillans* was found in the Project (Spectrum Ecology, 2020d) and the species was not recorded. No other Threatened flora were recorded or considered likely to occur at the Project.

4.1.2. Local & Regional Significance

There were 17 significant flora taxa recorded within the Project. Previous records were confirmed by undertaking targeted significant flora traverses throughout the Project (see Appendix E). All but four of the significant flora recorded during the desktop assessment as occurring within the Project, were confirmed to occur within. The four species not confirmed were searched for, however not recorded or the identification has been updated and they are not considered to occur in the Project (see Section 2.8.2.4).

Species distribution modelling (SDM) for Priority Flora at the Project was conducted in February 2020 prior to the second phase of field work in March 2020, in order to direct the sequential survey effort (Spectrum Ecology, 2020c). This modelling estimated the probability of potential habitat for significant flora within the Project and regionally up to 75 km outside of the Project area. These modelling results were included when determining local and regional significance of Priority Flora.

Local and regional significance is detailed in Table 4.1 and the mapped regional results of each Priority Flora are presented in Appendix I.

The Priority 1 taxon, *Acacia sulcatacaulis* has been assigned a high local and high regional significance. *Acacia sulcatacaulis* has 100% of its known records occurring within the Project. SDM and ground-truthing during regional surveys in spring 2020, indicate there are no populations of this taxa outside of the hills and slopes of Mt Mulgine.

Seven taxa were assigned a high regional, but low local significance:

Priority 1:

- *Acacia diallaga*
- *Acacia karina*
- *Chamelaucium* sp. Warriedar (A.P. Brown & S. Patrick APB 1100)
- *Hemigenia tichbonii*
- *Hydrocotyle dimorphocarpa*

Priority 3:

- *Grevillea subtiliflora*
- *Micromyrtus trudgenii*

These taxa have a large percentage of records occurring outside, but in the vicinity of, the Project and have been shown to have widespread potential habitat distribution from the SDM in the immediate local vicinity and during the regional targeted assessment (low local significance) (Spectrum Ecology, 2020c). These taxa, however, have a close distribution to the Project, with all records occurring within 150 km across the region (high regional significance).

Nine taxa were assigned a low regional and local significance:

Priority 1:

- *Lepidosperma* sp. Blue Hills (A. Markey & S. Dillon 3468)

Priority 4:

- *Dodonaea amplisemina*

Priority 3:

- *Allocasuarina tessellata*
- *Grevillea globosa*
- *Grevillea scabrida*
- *Micromyrtus acuta*
- *Persoonia pentasticha*
- *Rhodanthe collina*
- *Stenanthemum poicilum*

These taxa have widespread habitat distribution in the local area and are known from records throughout the Yalgoo bioregion 150 km or more away from the Project.

Table 4.1: Local & Regional Significance of Significant Flora in the Project

Taxa Recorded	# Inside Project			# Outside Project			Grand Total Individuals	% Inside	Local Significance	Regional Significance		
	Current	Desktop	Total	Current	Desktop	Total						
Priority 1												
<i>Acacia diallaga</i>	843	2,246	3,089	4,877	1,245	6,122	9,211	34	Many records surrounding the Project east and northwest with a 20 km range	Low	Known from one location close to the Project. SDM estimates main population located directly north	High
<i>Acacia karina</i>	8,520	8,341	16,861	3,546	241,523	245,069	261,930	6	Very common in local area, with records surrounding the Project and a 40 km range	Low	150 km distribution in Yalgoo. SDM estimates main population located directly north	High
<i>Acacia sulcatacaulis</i>	211,985	-	211,985	0	0	0	211,985	100	No records outside the Project	High	Known from one population location within the Project. SDM estimates species is endemic to the Mt Mulgine hills and slopes	High
<i>Chamelaucium</i> sp. Warriedar (A.P. Brown & S. Patrick APB 1100)	550	2,556	3,106	3,791	1,916	5,707	8,813	35	Many records surrounding the Project east and northwest with a 30 km range	Low	Known from one location close to the Project. SDM estimates one other population within 75 km	High
<i>Hemigenia tichbonii</i>	3,158	0	3,158	3,288	1,836	5,124	8,282	38	Common to the southwest of the Project with a 10 km range	Low	120 km distribution – Yalgoo & Avon Wheatbelt. SDM estimates low probable habitat within 75km SW of the Project	High
<i>Hydrocotyle dimorphocarpa</i>	3,284	2,589	5,873	21,238	1,290	22,528	28,401	21	Many records north of Project with an 8 km range.	Low	100 km distribution in Yalgoo. SDM estimates main population located directly north of the Project	High
<i>Lepidosperma</i> sp. Blue Hills (A. Markey & S. Dillon 3468)	1,724	10,644	12,368	384	81,277	81,661	94,029	13	Very common in the local area, with records surrounding the Project and a 110 km range	Low	150 km distribution in Yalgoo and Avon Wheatbelt. SDM estimates potential habitat with broad distribution to the NW	Low
Priority 3												
<i>Allocasuarina tessellata</i>	19,765	6,457	26,222	34,511	31,608	66,119	92,341	28	Very common in the local area, with records surrounding the Project and a 60 km range	Low	200 km distribution in Yalgoo & Avon Wheatbelt. SDM estimates species is widely distributed	Low
<i>Grevillea globosa</i>	15	0	15	0	1,663	1,663	1,678	<1	Very common in the local area, with records surrounding the Project and a 70 km range	Low	300 km distribution in Avon Wheatbelt & Yalgoo	Low

Taxa Recorded	# Inside Project			# Outside Project			Grand Total		Local Significance	Regional Significance		
	Current	Desktop	Total	Current	Desktop	Total	Individuals	% Inside				
<i>Grevillea scabrada</i>	4,484	8,275	12,759	3,755	13,227	16,982	29,741	43	Very common in the local area, with records surrounding the Project and a 70 km range	Low	180 km distribution in Yalgoo & Avon Wheatbelt. SDM estimates species is widely distributed	Low
<i>Grevillea subtiliflora</i>	107	1,842	1,949	1,694	1,839	3,533	5,482	36	Very common in the local area, with records surrounding the Project and a 60 km range	Low	120 km distribution in Yalgoo & Avon Wheatbelt. SDM estimates main population located directly north	High
<i>Micromyrtus acuta</i>	6,367	2,001	8,368	5,125	50,212	55,337	63,705	13	Very common in the local area, with records surrounding the Project and a 70 km range	Low	180 km distribution in Yalgoo & Avon Wheatbelt. SDM estimates high probability of widespread distribution of potential habitat	Low
<i>Micromyrtus trudgenii</i>	1,023	1,153	2,176	4,299	47,939	52,238	54,414	4	Very common in the local area, with records surrounding the Project and a 100 km range	Low	100 km distribution in Yalgoo. SDM estimates moderate probability of widespread potential habitat distribution	High
<i>Persoonia pentasticha</i>	246	566	812	93	2,039	2,132	2,944	28	Very common in the local area, with records surrounding the Project and a 130 km range	Low	300 km distribution in Avon Wheatbelt, Geraldton Sandplains & Yalgoo. SDM estimates very widespread distribution of potential habitat	Low
<i>Rhodanthe collina</i>	22,708	3,644	26,352	23,963	560,287	584,250	610,602	4	Very common in the local area, with records surrounding the Project and a 100 km range	Low	250 km distribution in Avon Wheatbelt & Yalgoo. SDM estimates widespread distribution of potential habitat	Low
<i>Stenanthemum poicilum</i>	200	98	298	0	1,094	1,094	1,392	21	Very common in the local area, with records surrounding the Project and a 70 km range	Low	220 km distribution in Avon Wheatbelt & Yalgoo. SDM estimates high probability of very widespread potential habitat throughout the immediate region	Low
Priority 4												
<i>Dodonaea amplisemina</i>	6,266	798	7,064	107	834	941	8,005	88	Several records to the southeast of the Project and a 50 km range	Low	500 km distribution in Avon Wheatbelt, Gascoyne, Murchison & Yalgoo. SDM estimates main population restricted to BIF ranges to the NW of the Project	Low

4.2. Vegetation

4.2.1. Vegetation Resembling TEC/PECs

No TECs were recorded as occurring within 15 km of the Project. Two Priority 1 PECs were recorded in the vicinity of the Project (Table 3.4; Figure 1.1). Both PECs are geologically restricted to the Banded Ironstone Formations (BIF) of the Blue Hills, Warriedar, Pinyalling, and Walagnumming ranges.

Both PECs were assigned a low likelihood of occurrence in the Project as there was no BIF substrate recorded within. None of the vegetation units recorded at the Project resemble any known TEC/PEC communities.

4.2.2. Local & Regional Significance

Local and regional significance for each vegetation unit is listed in Table 4.2. Regional significance was determined by comparing the vegetation units of the Project with the pre-European vegetation association mapping undertaken by Beard (DPIRD, 2019) (see Section 1.7) to determine potential regional extent. Local significance was determined using the other definitions for significant vegetation (section 2.4); whether it plays a role as refuge, has a degree of historical impact from threatening processes or maintains integrity of a significant ecosystem.

Three vegetation units were considered to have high local and regional significance at the Project:

- AdAa: *Allocasuarina dielsiana* (+/-*Acacia umbraculiformis*) low open woodland over *Acacia acuminata*, *Allocasuarina tessellata* (P3), *Acacia karina* (P1) tall open shrubland over *Borya sphaerocephala* low sparse shrubland;
- AsCp: *Acacia sulcataculis* (P1) and/or *Allocasuarina acutivalvis* subsp. *prinsepiana* tall open shrubland over *Calycopeplus paucifolius* mid sparse shrubland over *Philotheca deserti* subsp. *deserti* low sparse shrubland; and
- AdAt: *Acacia duriuscula* or *Allocasuarina tessellata* (P3) tall open shrubland.

Table 4.2: Local & Regional Significance of Vegetation Units

Vegetation Unit	Local Significance	Regional Significance		
Flats				
ElAr - <i>Eucalyptus loxophleba</i> subsp. <i>supralaevis</i> or <i>E. loxophleba</i> subsp. <i>lissophloia</i> low open woodland over <i>Acacia ramulosa</i> var. <i>ramulosa</i> tall open shrubland over <i>Ptilotus obovatus</i> , <i>Scaevola spinescens</i> low isolated shrubs.	Role as refuge: habitat for 14 significant flora. SDM indicates widespread habitat and distribution of these significant flora. One P1 taxa, <i>Acacia sulcaticaulis</i> is associated with this vegetation and has very restricted habitat regionally. Does not have a restricted distribution, historical impact from threatening processes, or maintains a significant ecosystem.	Low	Resembles widespread pre-European vegetation	Low
ElAt - <i>Eucalyptus loxophleba</i> subsp. <i>supralaevis</i> low woodland over <i>Acacia tetragonophylla</i> , <i>Allocasuarina dielsiana</i> , <i>Acacia ramulosa</i> var. <i>ramulosa</i> tall open shrubland over <i>Dodonaea inaequifolia</i> , <i>Acacia acanthoclada</i> subsp. <i>glaucescens</i> mid-low sparse shrubland.	Role as refuge: habitat for 13 significant flora. SDM indicates habitat is regionally widespread for 11 of these significant taxa. Does not have a restricted distribution, historical impact from threatening processes, or maintains a significant ecosystem.	Low	Resembles widespread pre-European vegetation	Low
AaAr - <i>Allocasuarina acutivalvis</i> subsp. <i>prinsepiana</i> tall sparse shrubland over <i>Acacia ramulosa</i> var. <i>ramulosa</i> (+/- <i>Micromyrtus acuta</i> (P3)) mid open shrubland over <i>Austrostipa elegantissima</i> isolated tussock grasses.	Role as refuge: habitat for 13 significant flora. SDM indicates habitat and distribution of these significant flora is regionally widespread. One P3 taxon, <i>Micromyrtus acuta</i> is the dominant species of the mid strata for this vegetation unit. Habitat for this species is regionally widespread. Does not have a restricted distribution, historical impact from threatening processes, or maintains a significant ecosystem.	Low	Resembles widespread pre-European vegetation	Low
EsTh - <i>Eucalyptus salubris</i> low open woodland over <i>Tecticornia ?halocnemoides</i> low sparse shrubland.	Role as refuge: habitat for two significant flora. SDM indicates widespread habitat and distribution of these significant flora taxa. Does not have a restricted distribution, historical impact from threatening processes, or maintains a significant ecosystem.	Low	Resembles widespread pre-European vegetation	Low
Slopes, Hills & Crests				
AdAa - <i>Allocasuarina dielsiana</i> (+/- <i>Acacia umbraculiformis</i>) low open woodland over <i>Acacia acuminata</i> , <i>Allocasuarina tessellata</i> , <i>Acacia karina</i> tall open shrubland over <i>Borya sphaerocephala</i> low sparse shrubland.	Role as refuge: habitat for 16 significant Flora, primary habitat for 13 significant flora. SDM indicates habitat is regionally widespread for 13 of these significant flora taxa. One P1 taxa, <i>Acacia sulcaticaulis</i> is associated with this vegetation and has very restricted habitat regionally.	High	Resembles restricted vegetation from pre-European vegetation associations indicating this vegetation unit is not widespread	High

Vegetation Unit	Local Significance	Regional Significance		
	Two taxa, <i>Acacia karina</i> (P1) and <i>Allocasuarina tessellata</i> (P3) and are the dominant species of the mid strata for this vegetation unit. Both of these species are regionally widespread. Has a restricted distribution. Does not have historical impact from threatening processes or maintains a significant ecosystem.			
AsCp - <i>Acacia sulcatacaulis</i> and/or <i>Allocasuarina acutivalvis</i> subsp. <i>prinsepiana</i> tall open shrubland over <i>Calycopeplus paucifolius</i> mid sparse shrubland over <i>Philotheca deserti</i> subsp. <i>deserti</i> low sparse shrubland.	Role as refuge: habitat for 10 Priority Flora. SDM indicates habitat is regionally widespread for eight of these significant flora taxa. One P1 taxa, <i>Acacia sulcatacaulis</i> is one of the dominant species of the upper strata for this vegetation unit. 99.7% of known records for this taxon are located in this vegetation unit. Has a very restricted distribution. Has historical impact from threatening processes and may maintain a significant ecosystem.	High	Did not resemble pre-European vegetation indicating the vegetation unit is not widespread.	High
AdAt - <i>Acacia duriuscula</i> or <i>Allocasuarina tessellata</i> tall open shrubland.	Role as refuge: habitat for 16 Priority Flora; SDM indicates habitat is widespread for 11 of these significant taxa. One P1 taxa, <i>Acacia sulcatacaulis</i> is associated with this vegetation and has very restricted habitat regionally. Has a very restricted distribution. Has historical impact from threatening processes and may maintain a significant ecosystem.	High	Did not resemble pre-European vegetation indicating the vegetation unit is not widespread.	High

4.2.2.1. Regional Significance

Table 4.3 lists the four Beard vegetation associations mapped against the vegetation units of the Project.

One Beard vegetation association identified within the Project (434; *Eucalyptus loxophleba*, *Allocasuarina huegeliana* isolated low trees, over *Acacia quadrimarginea*, *Acacia acuminata* tall open shrubland) is a very restricted unit. The total state extent of this association is 1,387 ha, of which, 34.5% is within the Project (see Table 1.3). This association appears to favour the greenstone and basalt rises prominent in the north of the Project. One vegetation unit from the Project, AdAa (*Allocasuarina dielsiana* (+/-*Acacia umbraculiformis*) tall sparse shrubland over *Acacia acuminata*, *Allocasuarina tessellata*, *Acacia karina* mid open shrubland over *Borya sphaerocephala* low sparse shrubland) resembles this restricted vegetation association and because of this alignment, is considered to have high regional significance.

The remaining three Beard vegetation associations have a wide distribution throughout the Yalgoo bioregion and a large portion of pre-European extent remaining (all more than 97.0%, see Table 1.3). The proportion of each association within the Project is negligible, at most there is 1% of the association's current extent present in the Project. Four vegetation units from the Project resemble these associations (see Table 4.3) and are considered to have low regional significance because they are likely to be widespread throughout the region.

Two vegetation units do not resemble the Beard vegetation associations. This indicates that these vegetation units are likely to not be widespread regionally and are considered locally and regionally significant:

- AsCp: *Acacia sulcatacaulis* (P1) and/or *Allocasuarina acutivalvis* subsp. *prinsepiana* tall open shrubland over *Calycopeplus paucifolius* mid sparse shrubland over *Philotheca deserti* subsp. *deserti* low sparse shrubland; and
- AdAt: *Acacia duriuscula* or *Allocasuarina tessellata* (P3) tall open shrubland.

Both of these vegetation units have significant flora in the dominant strata. When considering the SDM mapping for these significant taxa (Spectrum Ecology, 2020c) the estimated potential habitat for *Acacia sulcatacaulis* is restricted to the Project and the estimated potential habitat of *Allocasuarina tessellata* is regionally widespread.

Table 4.3: Vegetation Units of the Project Resembling Beard Vegetation Associations

Sub-Association	NVIS Vegetation Description	Area in Project (ha)	Current Extent State (ha)	Vegetation Units at the Project
326.3 (mosaic)	<i>Acacia ramulosa</i>, <i>Acacia acuminata</i>, <i>Acacia grasbyi</i>, <i>Acacia tetragonophylla</i>, <i>Acacia aneura</i> tall open shrubland, over <i>Senna artemisioides</i> subsp. x <i>artemisioides</i>, <i>Chorizema genistoides</i>, <i>Dodonaea inaequifolia</i>, <i>Eremophila forrestii</i>, <i>Eremophila viscida</i> mid sparse shrubland, over <i>Chamaexeros fimbriata</i>, <i>Dichopogon capillipes</i>, <i>Wurmbea densiflora</i>, <i>Cephalopterum drummondii</i>, <i>Helipterum craspedioides</i> low open forbland. <i>Acacia sclerosperma</i>, <i>Acacia eremaea</i>, <i>Grevillea obliquistigma</i>, <i>Hakea preissii</i>, <i>Acacia aneura</i> tall open shrubland.	34	542,013	No vegetation units resembling this association
355.2	<i>Eucalyptus loxophleba</i> , <i>Eucalyptus oleosa</i> low isolated trees, over <i>Acacia aneura</i> , <i>Acacia ramulosa</i> tall open shrubland.	597	54,965	ElAr - <i>Eucalyptus loxophleba</i> subsp. <i>supralaevis</i> or <i>E. loxophleba</i> subsp. <i>lissophloia</i> low open woodland over <i>Acacia ramulosa</i> var. <i>ramulosa</i> tall open shrubland over <i>Ptilotus obovatus</i>, <i>Scaevola spinescens</i> low isolated shrubs ElAt - <i>Eucalyptus loxophleba</i> subsp. <i>supralaevis</i> low woodland over <i>Acacia tetragonophylla</i>, <i>Allocasuarina dielsiana</i>, <i>Acacia ramulosa</i> var. <i>ramulosa</i> tall open shrubland over <i>Dodonaea inaequifolia</i>, <i>Acacia acanthoclada</i> subsp. <i>glaucescens</i> mid-low sparse shrubland EsTh - <i>Eucalyptus salubris</i> low open woodland over <i>Tecticornia ?halocnemoides</i> low sparse shrubland
420.5	<i>Acacia ramulosa</i> , <i>Acacia acuminata</i> , <i>Acacia quadrimarginea</i> , <i>Acacia stereophylla</i> tall open shrubland, over <i>Allocasuarina campestris</i> , <i>Melaleuca uncinata</i> , <i>Thryptomene australis</i> mid sparse shrubland.	2,053	456,619	AaAr - <i>Allocasuarina acutivalvis</i> subsp. <i>prinsepiana</i> tall sparse shrubland over <i>Acacia ramulosa</i> var. <i>ramulosa</i> (+/- <i>Micromyrtus acuta</i>) mid open shrubland over <i>Austrostipa elegantissima</i> isolated tussock grasses
434.0	<i>Eucalyptus loxophleba</i> , <i>Allocasuarina huegeliana</i> isolated low trees, over <i>Acacia quadrimarginea</i> , <i>Acacia acuminata</i> tall open shrubland.	478	1,387	AdAa - <i>Allocasuarina dielsiana</i> (+/- <i>Acacia umbraculiformis</i>) low open woodland over <i>Acacia acuminata</i> , <i>Allocasuarina tessellata</i> , <i>Acacia karina</i> tall open shrubland over <i>Borya sphaerocephala</i> low sparse shrubland

4.2.2.2. Local Significance

All of the vegetation units are associated with records of Priority Flora either from the desktop or during the current assessment. Some Priority Flora taxa are associated with multiple vegetation units in varying densities. Table 4.4 lists the percentage of priority flora "Project records" (records of priority flora occurring inside the Project, from the current and desktop assessments, except *Acacia sulcatacaulis* which uses the targeted results only) located within each vegetation unit to indicate density of occurrence within (records located on the mapped degraded area were not included in the calculations).

Four vegetation units identify Priority Flora as the dominant species in the vegetation description, and are indicated with bold type in Table 4.4:

- AaAr: *Allocasuarina acutivalvis* subsp. *prinsepiana* tall sparse shrubland over *Acacia ramulosa* var. *ramulosa* (+/-*Micromyrtus acuta* P3) mid open shrubland over *Austrostipa elegantissima* isolated tussock grasses;
- AdAa: *Allocasuarina dielsiana* (+/-*Acacia umbraculiformis*) low open woodland over *Acacia acuminata*, *Allocasuarina tessellata* (P3), *Acacia karina* (P1) tall open shrubland over *Borya sphaerocephala* low sparse shrubland;
- AsCp: *Acacia sulcatacaulis* (P1) and/or *Allocasuarina acutivalvis* subsp. *prinsepiana* tall open shrubland over *Calycopeplus paucifolius* mid sparse shrubland over *Philotheca deserti* subsp. *deserti* low sparse shrubland; and
- AdAt: *Acacia duriuscula* or *Allocasuarina tessellata* (P3) tall open shrubland.

Unit AaAr has the Priority 3 taxon *Micromyrtus acuta* in the dominant mid strata. This taxon is estimated to have widespread distribution in the SDM (Spectrum Ecology, 2020c) and this unit resembles the widespread Beard association 420.5. **This vegetation unit is not considered locally or regionally significant.**

Units AdAa and AdAt have Priority 1 and 3 taxa in the dominant stratum; *Acacia karina* (P1) and *Allocasuarina tessellata* (P3). These units contain 48.1% and 20.9% of total Project records for these taxa respectively, presenting a high density of these taxa within the unit. AdAa resembles restricted Beard vegetation association 434.0. The SDM indicated these taxa have widespread potential habitat distribution. AdAa is considered the primary habitat for eleven of the 16 Priority Flora taxa in the Project (see Table 3.2). **These units are considered to have high local significance.**

Unit AsCp has the Priority 1 taxon *Acacia sulcatacaulis* in the dominant upper strata. This unit appears to be restricted to the Mt Mulgine slopes and crests as indicated by the SDM (Spectrum Ecology, 2020c). There were no records of this taxon identified during the regional targeted survey. Records from the targeted survey show 99.7% of this taxon occurring within this vegetation unit (Table 4.4).

Five units are associated with locally restricted Priority 1 flora. One of these units is Priority 1 flora, *Acacia sulcatacaulis*, in vegetation unit AsCp, as discussed above. The five vegetation units associated with restricted flora are:

- ElAr: *Eucalyptus loxophleba* subsp. *supralaevis* or *E. loxophleba* subsp. *lissophloia* open woodland over *Acacia ramulosa* var. *ramulosa* tall open shrubland over *Ptilotus obovatus*, *Scaevola spinescens* low isolated shrubs:
 - <0.1% *Acacia sulcatacaulis* of Project records are found in this vegetation unit;
- AaAr: *Allocasuarina acutivalvis* subsp. *prinsepiana* tall sparse shrubland over *Acacia ramulosa* var. *ramulosa* (+/-*Micromyrtus acuta* (P3)) mid open shrubland over *Austrostipa elegantissima* isolated tussock grasses:
 - 0.1% *Acacia sulcatacaulis* of Project records are found in this vegetation unit;

- AdAa: *Allocasuarina dielsiana* (+/-*Acacia umbraculiformis*) low open woodland over *Acacia acuminata*, *Allocasuarina tessellata* (P3), *Acacia karina* (P1) tall open shrubland over *Borya sphaerocephala* low sparse shrubland:
 - 0.1% *Acacia sulcatacaulis* of Project records are found in this vegetation unit;
- AsCp: *Acacia sulcatacaulis* (P1) and/or *Allocasuarina acutivalvis* subsp. *prinsepiana* tall open to closed shrubland over *Calycopeplus paucifolius* mid sparse shrubland over *Philotheca deserti* subsp. *deserti* low sparse shrubland:
 - 99.7% *Acacia sulcatacaulis* of Project records are found in this vegetation unit; and
- AdAt: *Acacia duriuscula* or *Allocasuarina tessellata* (P3) tall open shrubland:
 - 0.1% *Acacia sulcatacaulis* of Project records are found in this vegetation unit;
- Mosaic AdAt/AdAa:
 - 0.1% *Acacia sulcatacaulis* of Project records are found in this vegetation unit.

The boundary of AsCp was updated following the targeted *Acacia sulcatacaulis* survey and records outside of this unit exist only as scattered individuals.

ElAr and ElAt resemble the widespread Beard association 355.2 and although they are associated with the restricted Priority 1 taxa listed above, they are not considered of high local significance due to the comparatively low percentage of records occurring within the vegetation unit.

AsCp, as discussed above, appears to be endemic to the Mt Mulgine hills and slopes, and is considered to have high local significance.

Table 4.4: Vegetation Units & Associated Priority Flora

Taxon		% of Individuals within Vegetation Unit^	Taxon		% of Individuals within Vegetation Unit^
Flats - EIAr					
P1	<i>Acacia diallaga</i>	2.9	P3	<i>Grevillea scabrida</i>	10.5
P1	<i>Acacia karina</i>	6.0	P3	<i>Grevillea subtiliflora</i>	2.6
P1	<i>Acacia sulcaticaulis</i>	<0.1	P3	<i>Micromyrtus acuta</i>	32.1
P1	<i>Chamelaucium</i> sp. Warriedar	4.2	P3	<i>Micromyrtus trudgenii</i>	1.4
P1	<i>Hydrocotyle dimorphocarpa</i>	0.5	P3	<i>Persoonia pentasticha</i>	25.3
P1	<i>Lepidosperma</i> sp. Blue Hills	4.5	P3	<i>Rhodanthe collina</i>	25.7
P3	<i>Allocasuarina tessellata</i>	3.0	P3	<i>Stenanthemum poicilum</i>	16.8
Flats - EIAt					
P1	<i>Acacia diallaga</i>	0.3	P3	<i>Grevillea scabrida</i>	12.1
P1	<i>Acacia karina</i>	1.2	P3	<i>Grevillea subtiliflora</i>	3.6
P1	<i>Chamelaucium</i> sp. Warriedar	2.6	P3	<i>Persoonia pentasticha</i>	6.2
P1	<i>Hemigenia tichbonii</i>	0.6	P3	<i>Rhodanthe collina</i>	4.8
P1	<i>Hydrocotyle dimorphocarpa</i>	9.4	P3	<i>Stenanthemum poicilum</i>	1.0
P1	<i>Lepidosperma</i> sp. Blue Hills	16.9	P4	<i>Dodonaea amplisemina</i>	2.4
P3	<i>Allocasuarina tessellata</i>	0.3			
Flats - AaAr					
P1	<i>Acacia karina</i>	4.9	P3	<i>Grevillea subtiliflora</i>	2.9
P1	<i>Acacia sulcaticaulis</i>	0.1	P3	<u><i>Micromyrtus acuta</i></u>	35.2
P1	<i>Hemigenia tichbonii</i>	4.1	P3	<i>Micromyrtus trudgenii</i>	4.4
P1	<i>Lepidosperma</i> sp. Blue Hills	0.7	P3	<i>Persoonia pentasticha</i>	9.8
P3	<i>Allocasuarina tessellata</i>	2.2	P3	<i>Rhodanthe collina</i>	0.4
P3	<i>Grevillea globosa</i>	100.0	P3	<i>Stenanthemum poicilum</i>	10.4
P3	<i>Grevillea scabrida</i>	8.3			
Flats - EsTh					
P1	<i>Acacia karina</i>	<0.1	P3	<i>Persoonia pentasticha</i>	0.4
Slopes - AdAa					
P1	<i>Acacia diallaga</i>	76.5	P3	<i>Grevillea scabrida</i>	60.3
P1	<u><i>Acacia karina</i></u>	48.1	P3	<i>Grevillea subtiliflora</i>	76.0
P1	<i>Acacia sulcaticaulis</i>	0.1	P3	<i>Micromyrtus acuta</i>	32.5
P1	<i>Chamelaucium</i> sp. Warriedar	74.5	P3	<i>Micromyrtus trudgenii</i>	10.4
P1	<i>Hemigenia tichbonii</i>	21.2	P3	<i>Persoonia pentasticha</i>	39.6
P1	<i>Hydrocotyle dimorphocarpa</i>	78.8	P3	<i>Rhodanthe collina</i>	24.8
P1	<i>Lepidosperma</i> sp. Blue Hills	1.3	P3	<i>Stenanthemum poicilum</i>	66.8
P3	<u><i>Allocasuarina tessellata</i></u>	36.5	P4	<i>Dodonaea amplisemina</i>	75.3
Hills & Crest - AsCp					
P1	<i>Acacia diallaga</i>	0.1	P3	<i>Allocasuarina tessellata</i>	15.3
P1	<i>Acacia karina</i>	6.0	P3	<i>Grevillea scabrida</i>	0.1
P1	<u><i>Acacia sulcaticaulis</i></u>	99.7	P3	<i>Micromyrtus trudgenii</i>	81.6
P1	<i>Hemigenia tichbonii</i>	27.5	P3	<i>Persoonia pentasticha</i>	5.8
P1	<i>Lepidosperma</i> sp. Blue Hills	33.3	P3	<i>Rhodanthe collina</i>	<0.1
Hills & Crest – AdAt					
P1	<i>Acacia diallaga</i>	4.6	P3	<i>Grevillea scabrida</i>	7.3
P1	<i>Acacia karina</i>	7.0	P3	<i>Grevillea subtiliflora</i>	10.3

Taxon		% of Individuals within Vegetation Unit [^]	Taxon		% of Individuals within Vegetation Unit [^]
P1	<i>Acacia sulcatacaulis</i>	0.1	P3	<i>Micromyrtus acuta</i>	0.2
P1	<i>Chamelaucium</i> sp. Warriear	18.7	P3	<i>Micromyrtus trudgenii</i>	2.2
P1	<i>Hemigenia tichbonii</i>	39.1	P3	<i>Persoonia pentasticha</i>	10.5
P1	<i>Hydrocotyle dimorphocarpa</i>	10.3	P3	<i>Rhodanthe collina</i>	43.7
P1	<i>Lepidosperma</i> sp. Blue Hills	42.6	P3	<i>Stenanthemum poicilum</i>	5.0
P3	<u>Allocasuarina tessellata</u>	20.9	P4	<i>Dodonaea amplisemina</i>	22.3
Mosaic – AdAt / AdAa					
P1	<i>Acacia diallaga</i>	15.5	P3	<i>Allocasuarina tessellata</i>	21.8
P1	<u>Acacia karina</u>	26.7	P3	<i>Grevillea scabrida</i>	1.5
P1	<i>Acacia sulcatacaulis</i>	0.1	P3	<i>Grevillea subtiliflora</i>	4.6
P1	<i>Hemigenia tichbonii</i>	7.3	P3	<i>Persoonia pentasticha</i>	2.3
P1	<i>Hydrocotyle dimorphocarpa</i>	0.9	P3	<i>Rhodanthe collina</i>	0.6
P1	<i>Lepidosperma</i> sp. Blue Hills	0.7			

Bold & underline = Priority Flora as dominant taxa for the vegetation unit.

[^] = percentages calculated using the total numbers from the current and desktop assessments, except *Acacia sulcatacaulis* which is only using the targeted assessment results.

5. CONCLUSIONS

5.1. Threatened Flora

No Threatened flora taxa have previously been recorded within the Project. One Threatened flora taxon was assigned a high likelihood of occurrence, *Stylidium scintillans*. This taxon was thoroughly searched for during the primary field assessment in spring 2019 and the targeted assessment in spring 2020 (see Appendix D). It was determined that the presence of this species within the Project is unlikely as identified areas of potential habitat were thoroughly searched and no areas of suitable habitat were noted, or plants recorded, during the optimal time of flowering.

5.2. Significant Flora

A total of 17 significant flora taxa have been recorded within the Project:

Priority 1:

- *Acacia diallaga*
- *Acacia karina*
- *Acacia sulcatacaulis*
- *Allocasuarina tessellata*
- *Chamelaucium* sp. Warriedar (A.P. Brown & S. Patrick APB 1100)
- *Grevillea scabrida*
- *Hemigenia tichbonii*
- *Hydrocotyle dimorphocarpa*
- *Lepidosperma* sp. Blue Hills (A. Markey & S. Dillon 3468)

Priority 3:

- *Grevillea globosa*
- *Grevillea subtiliflora*
- *Micromyrtus acuta*
- *Micromyrtus trudgenii*
- *Persoonia pentasticha*
- *Rhodanthe collina*
- *Stenanthemum poicilum*

Priority 4:

- *Dodonaea amplisemina*

No other significant flora taxa as listed in Section 2.4 were recorded at the Project.

One Priority 1 flora taxa, *Acacia sulcatacaulis*, was assigned a high local and regional significance as it appears to be endemic to the Mt Mulgine hills and slopes.

Seven Priority Flora taxa have a high regional significance, but a low local significance as they are common in the local area but not from the region:

Priority 1:

- *Acacia diallaga*
- *Acacia karina*
- *Chamelaucium* sp. Warriedar (A.P. Brown & S. Patrick APB 1100)
- *Hemigenia tichbonii*
- *Hydrocotyle dimorphocarpa*

Priority 3:

- *Grevillea subtiliflora*
- *Micromyrtus trudgenii*

5.3. Vegetation

No TECs or PECs occur within or are likely to occur within the Project. Of the seven vegetation units recorded, three vegetation units are considered to have high local and regional significance at the Project:

- AdAa: *Allocasuarina dielsiana* (+/- *Acacia umbraculiformis*) low open woodland over *Acacia acuminata*, *Allocasuarina tessellata* (P3), *Acacia karina* (P1) tall open shrubland over *Borya sphaerocephala* low sparse shrubland;
- AsCp: *Acacia sulcataculis* (P1) and/or *Allocasuarina acutivalvis* subsp. *prinsepiana* tall open shrubland over *Calycopeplus paucifolius* mid sparse shrubland over low sparse shrubland *Philotheca deserti* subsp. *deserti*; and
- AdAt: *Acacia duriuscula* or *Allocasuarina tessellata* (P3) tall open shrubland.

6. REFERENCES

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Appendix A: Conservation Codes



Appendix A1: Definitions of Conservation Categories under the EPBC Act

Category	Definition
Extinct	A native species is eligible to be included in the extinct category at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.
Extinct in the Wild	A native species is eligible to be included in the extinct in the wild category at a particular time if, at that time: (a) it is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or (b) it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
Critically Endangered	A native species is eligible to be included in the critically endangered category at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
Endangered	A native species is eligible to be included in the endangered category at a particular time if, at that time: (a) it is not critically endangered; and (b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
Vulnerable	A native species is eligible to be included in the vulnerable category at a particular time if, at that time: (a) it is not critically endangered or endangered; and (b) it is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
Conservation Dependent	A native species is eligible to be included in the conservation dependent category at a particular time if, at that time: (a) the species is the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered; or (b) the following subparagraphs are satisfied: (i) the species is a species of fish; (ii) the species is the focus of a plan of management that provides for management actions necessary to stop the decline of, and support the recovery of, the species so that its chances of long-term survival in nature are maximised; (iii) the plan of management is in force under a law of the Commonwealth or of a State or Territory; (iv) cessation of the plan of management would adversely affect the conservation status of the species.

Appendix A2: Definitions of Conservation Categories under the BC Act (DBCA 2019)

Threatened Species: Listed by order of the Minister as Threatened in the category of critically endangered, endangered or vulnerable under section 19(1), or is a rediscovered species to be regarded as Threatened species under section 26(2) of the Biodiversity Conservation Act 2016 (BC Act).

Threatened fauna is that subset of 'Specially Protected Fauna' listed under schedules 1 to 3 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for Threatened Fauna.

Threatened flora is that subset of 'Rare Flora' listed under schedules 1 to 3 of the Wildlife Conservation (Rare Flora) Notice 2018 for Threatened Flora.

The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria as detailed below.

Category	Definition
CR	Critically endangered species Threatened species considered to be "facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as critically endangered under section 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines. Published under schedule 1 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for critically endangered fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for critically endangered flora.
EN	Endangered species Threatened species considered to be "facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as endangered under section 19(1)(b) of the BC Act in accordance with the criteria set out in section 21 and the ministerial guidelines. Published under schedule 2 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for endangered fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for endangered flora.
VU	Vulnerable species Threatened species considered to be "facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as vulnerable under section 19(1)(c) of the BC Act in accordance with the criteria set out in section 22 and the ministerial guidelines. Published under schedule 3 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for vulnerable fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for vulnerable flora.

Extinct species: Listed by order of the Minister as extinct under section 23(1) of the BC Act as extinct or extinct in the wild.

Category	Definition
EX	Extinct species Species where "there is no reasonable doubt that the last member of the species has died", and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act). Published as presumed extinct under schedule 4 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for extinct fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for extinct flora.
EW	Extinct in the wild species Species that "is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form", and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act). Currently there are no Threatened fauna or Threatened flora species listed as extinct in the wild. If listing of a species as extinct in the wild occurs, then a schedule will be added to the applicable notice.

Specially protected species: Listed by order of the Minister as specially protected under section 13(1) of the BC Act. Meeting one or more of the following categories: species of special conservation interest; migratory species; cetaceans; species subject to international agreement; or species otherwise in need of special protection.

Species that are listed as Threatened species (critically endangered, endangered or vulnerable) or extinct species under the BC Act cannot also be listed as Specially Protected species.

MI	Migratory species Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines (section 15 of the BC Act). Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and fauna subject to the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention), an environmental treaty under the United Nations Environment Program. Migratory species listed under the BC Act are a subset of the migratory animals, that are known to visit Western Australia, protected under the international agreements or treaties, excluding species that are listed as Threatened species. Published as migratory birds protected under an international agreement under schedule 5 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.
CD	Species of special conservation interest (Conservation dependent fauna) Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as Threatened, and listing is otherwise in accordance with the ministerial guidelines (section 14 of the BC Act). Published as conservation dependent fauna under schedule 6 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.
OS	Other specially protected species Fauna otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines (section 18 of the BC Act). Published as other specially protected fauna under schedule 7 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.
¹ The definition of flora includes algae, fungi and lichens. ² Species includes all taxa (plural of taxon - a classificatory group of any taxonomic rank, e.g. a family, genus, species or any infraspecific category i.e. subspecies or variety, or a distinct population).	

Appendix A3: Definitions of Priority Species Classification (DBCA 2019)

Priority species: Possibly Threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as Threatened fauna or flora.

Species that are adequately known, are rare but not Threatened, or meet criteria for near Threatened, or that have been recently removed from the Threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring.

Assessment of Priority codes is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.

Category	Definition
P1	Priority 1: Poorly-known species Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.
P2	Priority 2: Poorly-known species Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.
P3	Priority 3: Poorly-known species Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.
P4	Priority 4: Rare, Near Threatened and other species in need of monitoring (a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently Threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands. (b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent. (c) Species that have been removed from the list of Threatened species during the past five years for reasons other than taxonomy

Appendix A4: Legal Status Definition of Listed Plants in Western Australia

Legal Status	Definition
Declared Pest, Prohibited – s12	Prohibited organisms are declared pests by virtue of section 22(1) and may only be imported and kept subject to permits.
Declared Pest – s22(2)	Declared pests must satisfy any applicable import requirements when imported and may be subject to control keeping requirements.
Permitted – s11	Permitted organisms must satisfy applicable import requirements and import permits (where required).
Permitted, Requires Permit – r73	Regulation 73 permitted organisms may be subject to restriction under legislation other than the BAM Act (2007).
Unlisted	Unlisted organisms are prohibited in WA.
Control Categories	Definition
C1 Exclusion	Organisms should be excluded from parts or all of WA.
C2 Eradication	Organisms should be eradicated from all or parts of WA.
C3 Management	Organisms should have some form of management applied that will alleviate the harmful impact of the organism, reduce the numbers or distribution of the organism or prevent or contain the spread of the organism.
Unassigned	Declared pest that are recognised as having a harmful impact under certain circumstances where their subsequent control requirements are determined by a plan or other legislative arrangements under the Act.
Keeping Categories	Definition
Prohibited keeping	Can only be kept under a permit for public display, education or scientific purposes.
Restricted keeping	Kept under a permit by private individuals due to a low risk of becoming a problem for the environment.
Exempt keeping	No permit or conditions are required for keeping. Organism may be subject to restrictions under the Wildlife Conservation Act (WCA, 1950).

Appendix B: Flora Quadrat Site Data



Site: Phase 1 M001		Type: Quadrat		Size: 20 x 20		Date: 9/1/2019		Botanist: CW RO	
Landform:	Hill Slope: Simple								
Slope, aspect:	Gentle 30° N								
Soil:	Sand; Clay; Red;								
Rocks:	Granite; Quartz								
Abundance:	Abundant 50-90%								
Size:	20-60 mm Coarse Gravel								
Fire:	>5 years								
Condition:	Excellent								
Notes:	-								
Veg Unit:									
Location (NW):	50J 498467 6772535								
Species				Height	Cover	Species		Height	Cover
Acacia erinacea				0.5	0.01	Lepidium oxytrichum		0.1	0.01
Acacia ramulosa var. ramulosa				4	15	Maireana trichoptera		0.1	0.5
Acacia tetragonophylla				2	1	Mesembryanthemum nodiflorum		0.1	0.01
Actinobole uliginosum				0.1	0.01	Podolepis gardneri		0.1	0.01
Allocasuarina tessellata				2	0.1	Podolepis lessonii		0.1	0.01
Austrostipa nitida				0.1	0.1	Ptilotus eremita		0.1	0.1
Blennospora drummondii				0.1	0.01	Ptilotus exaltatus		0.1	0.01
Calandrinia baccata				0.1	0.1	Ptilotus obovatus		0.5	10
Calotis hispidula				0.1	0.01	Rhagodia drummondii		0.5	1
Cephalopterum drummondii				0.1	0.5	Rhodanthe polycephala		0.1	0.01
Cuscuta planiflora				0.1	0.01	Roepera ovata		0.2	0.01
Dodonia inaequifolia				1.5	2	Scaevola spinescens		1.5	1
Eremophila oldfieldii subsp. oldfieldii				3	3	Sclerolaena gardneri		-	0.1
Erodium cygnorum				0.1	0.1	Senna artemisioides subsp. filifolia		1.5	1
Eucalyptus loxophleba subsp. supralaevis				15	15	Stenopetalum anfractum		0.2	0.01
Exocarpos aphyllus				2	0.1	Thysanotus manglesianus		-	0.01
Gnephosis brevifolia				0.1	0.01	Waitzia acuminata var. acuminata		0.1	0.2
Goodenia mimuloides				0.1	0.1				

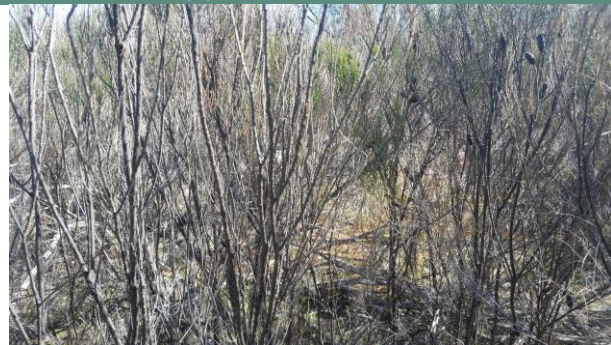
Site: Phase 1 M002		Type: Quadrat		Size: 20 x 20		Date: 9/10/2019	Botanist: CW RO
Landform:	Flat: Plain						
Slope, aspect:	Very Gentle 1o N						
Soil:	Loam; Red; Brown						
Rocks:	Granite; Quartz						
Abundance:	Very few <2%						
Size:	20-60 mm Coarse Gravel						
Fire:	>5 years						
Condition:	Very Good						
Notes:	Grazing (low); Weeds (low)						
Veg Unit:							
Location (NW):	50J 499162 6772699						
Species		Height	Cover	Species		Height	Cover
Acacia acuminata		2	0.1	Gnephosis brevifolia		0.1	0.01
Acacia ramulosa var. ramulosa		-	-	Hyalosperma glutinosum subsp. venustum		0.1	0.01
Acacia tetragonophylla		1.5	0.5	Pauridia glabella var. glabella		0.1	0.01
Actinobole uliginosum		0.1	0.01	Pittosporum angustifolium		5	0.1
Austrostipa eremophila		0.1	0.01	Podolepis gardneri		0.1	0.01
Brachychiton gregorii		5	0.5	Pogonolepis muelleriana		0.1	0.01
Brachyscome ciliaris		0.1	0.01	Ptilotus eremita		0.1	0.01
Caesia sp. Wongan (K.F. Kenneally 8820)		0.2	0.01	Ptilotus obovatus		0.5	1
Calandrinia baccata		0.1	0.01	Rhodanthe manglesii		0.1	0.01
Calotis hispidula		0.1	0.01	Rhodanthe oppositifolia subsp. oppositifolia		0.1	0.01
Calotis multicaulis		0.1	0.1	Rhodanthe polycephala		0.1	0.01
Cephalopterum drummondii		0.1	0.1	Roepera ovata		0.1	0.1
Cheilanthes adiantoides		0.1	0.01	Scaevola spinescens		1.2	0.5
Cuscuta planiflora		0.1	0.01	Sclerolaena gardneri		0.2	0.1
Dianella revoluta var. divaricata		0.4	0.01	Sisymbrium erysimoides		0.1	0.01
Dodonaea inaequifolia		1	0.5	Solanum lasiophyllum		0.4	0.01
Drosera sp. Branched styles (S.C. Coffey 193)		0.1	0.01	Stenopetalum anfractum		0.1	0.01
Erodium cygnorum		0.1	0.01	Velleia rosea		0.1	0.1
Eucalyptus loxophleba subsp. supralaevis		-	-	Waitzia acuminata var. acuminata		0.1	0.01
Euphorbia tannensis subsp. eremophila		0.1	0.01	Waitzia nitida		0.1	0.1
Exocarpos aphyllus		4	0.5				

Site: Phase 1 M003		Type: Quadrat		Size: 20 x 20		Date: 9/1/2019	Botanist: CW
Landform:	Hill Ridge: Hill						
Slope, aspect:	Moderate 10o S						
Soil:	Sand; Clay; Red						
Rocks:	Ironstone; Quartz; Granite						
Abundance:	Abundant 50-90%						
Size:	6-20 mm Medium Gravel						
Fire:	>5 years						
Condition:	Excellent						
Notes:	-						
Veg Unit:							
Location (NW):	50J 498659 6772991						
Species		Height	Cover	Species		Height	Cover
Acacia acuminata		2	15	Grevillea paniculata		1	0.1
Acacia diallaga		0.5	0.1	Hydrocotyle intertexta		0.1	0.5
Acacia tetragonophylla		2	2	Pimelea avonensis		0.5	0.1
Allocasuarina campestris		2	50	Podolepis gardneri		0.1	2
Allocasuarina dielsiana		3	15	Podolepis lessonii		0.1	0.5
Allocasuarina tessellata		-	-	Ptilotus eremita		0.1	0.1
Blennospora drummondii		0.1	1	Ptilotus obovatus		0.5	2
Caesia sp. Wongan (K.F. Kenneally 8820)		0.2	0.5	Rhodanthe stricta		0.1	0.1
Calotis multicaulis		0.1	0.1	Solanum lasiophyllum		0.1	0.1
Cheilanthes adiantoides		0.1	10	Styphelia serratifolia		0.5	0.1
Cuscuta planiflora		0.1	0.1	Thysanotus manglesianus		0.1	0.01
Drosera sp. Branched styles		0.1	0.01	Trachymene ornata		0.1	1
Eremophila clarkei		2	0.01	Velleia rosea		0.1	20
Erodium cygnorum		0.1	0.01	Waitzia acuminata var. acuminata		0.1	0.1
Euphorbia tannensis subsp. eremophila		0.1	0.01	Wurmbea densiflora		0.1	0.5
Goodenia berardiana		0.1	0.1				

Site: Phase 1 M004		Type: Quadrat		Size: 20 x 20		Date: 9/10/2019		Botanist: RO	
Landform:	Hill Slope: Lower								
Slope, aspect:	Very Gentle 1o N								
Soil:	Loam; Orange; Brown;								
Rocks:	Quartz								
Abundance:	Few 2-10%								
Size:	20-60 mm Coarse Gravel								
Fire:	>5 years								
Condition:	Excellent								
Notes:	None;								
Veg Unit:									
Location (NW):	50J 498881 6772585								
Species			Height	Cover	Species		Height	Cover	
Acacia duriuscula			4	1	Goodenia pusilliflora		0.1	0.01	
Acacia sulcataulis			4	3	Malleostemon tuberculatus		2	15	
Allocasuarina campestris			5	10	Myriocephalus guerinae		0.2	0.1	
Bellida graminea			0.1	0.01	Sida sp. Golden calyces glabrous (H.N. Foote 32)		0.3	3	
Brachyscome ciliaris			0.1	0.01	Solanum lasiophyllum		0.5	0.1	
Cheilanthes adiantoides			0.1	0.01	Thysanotus manglesianus		0.7	0.01	
Cuscuta planiflora			0.1	0.1	Trachymene ornata		0.1	0.01	
Drosera sp. Branched styles (S.C. Coffey 193)			0.1	0.01	Velleia rosea		0.1	0.1	
Eremophila latrobei subsp. latrobei			1.5	0.1	Vincetoxicum lineare		0.2	0.01	
Gastrolobium laytonii			1.5	0.1	Waitzia acuminata var. acuminata		0.1	0.01	
Gnephosis brevifolia			0.1	0.01					

Site: Phase 1 M005		Type: Quadrat		Size: 20 x 20	Date: 9/2/2019	Botanist: CW
Landform:	Hill Slope: Simple					
Slope, aspect:	Gentle 30 E					
Soil:	Clay; Red;					
Rocks:	Ironstone; Quartz					
Abundance:	Abundant 50-90%					
Size:	6-20 mm Medium Gravel					
Fire:	>5 years					
Condition:	Excellent					
Notes:	-					
Veg Unit:						
Location (NW):	50J 495687 6768523					
Species		Height	Cover	Species	Height	Cover
Acacia assimilis subsp. assimilis		2	0.1	Erodium cygnorum	0.1	0.01
Acacia ramulosa var. ramulosa		2.5	50	Goodenia mimuloides	0.1	0.1
Acacia sp.		2	0.1	Hyalosperma glutinosum subsp. glutinosum	0.1	0.1
Acacia tetragonophylla		2	0.1	Phebalium tuberculosum	1.5	2
Allocasuarina acutivalvis subsp. prinsepiana		2.5	0.1	Podolepis gardneri	0.1	0.5
Asteraceae sp.		0.1	0.1	Podolepis lessonii	0.1	0.5
Bellida graminea		0.1	0.1	Ptilotus eremita	0.1	0.01
Blennospora drummondii		0.1	0.1	Rhodanthe laevis	0.1	0.1
Caesia sp. Wongan (K.F. Kenneally 8820)		0.1	0.01	Rhodanthe stricta	0.1	0.5
Calocephalus multiflorus		0.1	0.01	Stenopetalum anfractum	0.2	0.01
Cephalipterum drummondii		0.1	0.1	Thysanotus manglesianus	0.1	0.01
Cheilanthes adiantoides		0.1	0.01	Thysanotus pyramidalis	0.1	0.01
Chthonocephalus pseudevax		0.1	0.01	Trachymene ornata	-	-
Acacia exocarpoides		1.5	0.1	Vincetoxicum lineare	0.1	0.01
Drosera sp. Branched styles (S.C. Coffey 193)		0.1	0.01	Waitzia acuminata var. acuminata	0.1	1
Eremophila clarkei		1	5	Wurmbea densiflora	0.1	0.01
Eremophila latrobei subsp. latrobei		1	1			

Site: Phase 1 M006		Type: Quadrat		Size: 20 x 20	Date: 9/10/2019	Botanist: RO
Landform:	Hill Slope: Lower					
Slope, aspect:	Gentle 30° W					
Soil:	Loam; Red; Brown					
Rocks:	Granite; Quartz					
Abundance:	Few 2-10%					
Size:	60-200 mm Cobbles					
Fire:	>5 years					
Condition:	Excellent					
Notes:	None					
Veg Unit:						
Location (NW):	50J 496984 6770584					
Species		Height	Cover	Species	Height	Cover
Acacia acuminata		5	35	Hemigenia macphersonii	1.5	1
Acacia tetragonophylla		1.8	0.2	Hybanthus floribundus subsp. floribundus	0.5	0.2
Allocasuarina dielsiana		4	1	Hydrocotyle intertexta	0.1	0.01
Allocasuarina tessellata		2.5	2	Melaleuca scalena	5	1.5
Blennospora drummondii		0.1	0.1	Pimelea avonensis	0.7	0.01
Borya sphaerocephala		0.1	0.01	Podolepis gardneri	0.1	0.1
Caesia sp. Wongan (K.F. Kenneally 8820)		0.2	0.01	Rhodanthe manglesii	0.1	0.01
Calandrinia baccata		0.1	0.01	Scaevola spinescens	1	0.1
Calothamnus gilesii		3	5	Schoenia cassiniana	0.1	0.1
Cephalopterum drummondii		0.1	0.1	Solanum lasiophyllum	0.4	0.01
Cheilanthes adiantoides		0.1	0.1	Stenopetalum anfractum	0.1	0.01
Cuscuta planiflora		0.1	0.01	Stenopetalum filifolium	0.1	0.01
Dianella revoluta var. divaricata		0.5	0.01	Thysanotus manglesianus	0.1	0.01
Drosera sp. Branched styles (S.C. Coffey 193)		0.1	0.01	Trachymene ornata	0.1	0.1
Erodium cygnorum		0.1	0.01	Velleia rosea	0.1	0.01
Goodenia pusilliflora		0.1	0.01	Waitzia acuminata var. acuminata	0.1	0.1

Site: Phase 1 M007		Type: Quadrat		Size: 20 x 20		Date: 9/2/2019		Botanist: CW	
Landform:	Hill Slope: Simple								
Slope, aspect:	Moderate 10o S								
Soil:	Clay; Red; Black								
Rocks:	Ironstone								
Abundance:	Many 20-50%								
Size:	6-20 mm Medium Gravel								
Fire:	> 5 years								
Condition:	Excellent								
Notes:	-								
Veg Unit:									
Location (NW):	50J 496431 6769384								
Species			Height	Cover	Species			Height	Cover
Acacia tetragonophylla			0.5	0.1	Lobelia winfridae			0.1	0.1
Acacia umbraculiformis			5	1	Phyllangium sulcatum			0.1	0.1
Allocasuarina dielsiana			5	0.5	Podolepis aristata subsp. affinis			0.1	2
Allocasuarina tessellata			2	90	Podolepis gardneri			0.1	0.1
Blennospora drummondii			0.1	1	Ptilotus eremita			0.1	0.1
Borya sphaerocephala			0.1	2	Ptilotus helipteroides			0.1	0.01
Brachyscome ciliaris			0.1	0.1	Rhodanthe manglesii			0.1	0.1
Caesia sp. Wongan (K.F. Kenneally 8820)			0.1	0.1	Rhodanthe stricta			0.1	0.1
Cephalopterum drummondii			0.1	0.1	Schoenia cassiniana			0.1	0.5
Cheilanthes adiantoides			0.1	0.1	Stenopetalum anfractum			0.2	0.01
Cyanicula amplexans			-	-	Trachymene ornata			0.1	0.1
Drosera sp. Branched styles (S.C. Coffey 193)			0.1	0.01	Velleia rosea			0.1	1
Erodium cygnorum			0.1	0.1	Waitzia acuminata var. acuminata			0.1	0.1
Euphorbia tannensis subsp. eremophila			0.1	0.01	Wurmbea densiflora			0.1	0.1
Goodenia pusilliflora			0.1	0.1					

Site: Phase 1 M008		Type: Quadrat		Size: 20 x 20		Date: 9/10/2019		Botanist: RO	
Landform:	Flat: Plain								
Slope, aspect:	Very Gentle 1o E								
Soil:	Loam; Orange; Brown;								
Rocks:	Ironstone; Quartz								
Abundance:	Common 10-20%								
Size:	<6 mm - Fine Gravel 6-20 mm Medium Gravel								
Fire:	>5 years								
Condition:	Excellent								
Notes:	None;								
Veg Unit:									
Location (NW):	50J 495983 6767826								
Species		Height	Cover	Species		Height	Cover		
Acacia acuminata		3	1.5	Melaleuca nematophylla		5	1.5		
Acacia latior		5	30	Micromyrtus acuta		2	5		
Acacia tetragonophylla		0.5	0.1	Monachather paradoxus		0.2	0.01		
Bellida graminea		0.1	0.01	Myriocephalus guerinae		0.1	0.01		
Brachyscome ciliaris		0.1	0.01	Phebalium tuberculosum		1.5	2		
Cheilanthes adiantoides		0.1	0.1	Podolepis gardneri		0.1	0.01		
Cuscuta planiflora		0.1	0.1	Podolepis lessonii		0.1	0.01		
Cyanicula amplexans		0.1	0.01	Thysanotus manglesianus		0.1	0.01		
Dianella revoluta var. divaricata		0.7	0.01	Trachymene ornata		0.1	0.01		
Drosera sp. Branched styles (S.C. Coffey 193)		0.1	0.01	Trichanthodium skirrophorum		0.7	0.01		
Erodium cygnorum		0.1	0.01	Velleia rosea		0.1	0.2		
Goodenia pusilliflora		0.1	0.1	Waitzia acuminata var. acuminata		0.1	0.1		
Hyalosperma glutinosum subsp. glutinosum		0.1	0.01						

Site: Phase 1 M009		Type: Quadrat		Size: 20 x 20	Date: 9/10/2019	Botanist: CW	
Landform:	Hill Crest: Hill						
Slope, aspect:	Moderate 10o None						
Soil:	Clay; Red; Orange;						
Rocks:	Calcrete; Ironstone						
Abundance:	-						
Size:	60-200 mm Cobbles; >600 mm Boulders;						
Fire:	>5 years						
Condition:	Excellent						
Notes:	Tracks;						
Veg Unit:							
Location (NW):	50J 496347 6769956						
Species		Height	Cover	Species		Height	Cover
Acacia duriuscula		2	15	Olearia pimeleoides		0.5	5
Alyxia buxifolia		0.5	0.1	Ptilotus obovatus		0.5	0.2
Calandrinia sp.		0.1	0.1	Scaevola spinescens		0.5	0.1
Eremophila clarkei		1.5	7	Schoenia cassiniana		0.1	0.1
Eremophila latrobei subsp. latrobei		0.5	7	Solanum lasiophyllum		0.5	0.1
Erodium cygnorum		-	-	Spergula pentandra		0.1	0.2
Goodenia mimuloides		0.1	0.1	Trachymene ornata		0.1	0.5
Lepidium sp.		0.1	0.1	Waitzia acuminata var. acuminata		0.1	0.01
Olearia humilis		0.5	0.1				

Site: Phase 1 M010		Type: Quadrat		Size: 20 x 20	Date: 9/10/2019	Botanist: RO
Landform:	Hill Slope: Mid					
Slope, aspect:	Gentle 3o E					
Soil:	Clay; Loam; Red; Brown;					
Rocks:	Ironstone; Quartz					
Abundance:	Few 2-10%					
Size:	20-60 mm Coarse Gravel 60-200 mm Cobbles;					
Fire:	>5 years					
Condition:	Excellent					
Notes:	None;					
Veg Unit:						
Location (NW):	50J 496092 6769020					
Species		Height	Cover	Species	Height	Cover
Acacia acuminata		1.5	0.1	Eucalyptus loxophleba subsp. supralaevis	10	15
Acacia duriuscula		3.5	0.2	Exocarpos aphyllus	2.5	0.2
Acacia erinacea		0.3	0.2	Goodenia berardiana	0.1	0.01
Acacia tetragonophylla		0.5	0.1	Maireana georgei	0.3	0.5
Atriplex sp.		0.4	0.1	Maireana trichoptera	0.2	0.2
Austrostipa eremophila		0.4	0.1	Poaceae sp.	0.1	0.01
Calandrinia baccata		0.1	0.01	Ptilotus eremita	0.1	0.01
Calotis hispidula		0.1	0.01	Ptilotus obovatus	0.4	1
Cephalipterum drummondii		0.1	0.01	Scaevola spinescens	0.5	0.2
Cuscuta planiflora		0.1	0.01	Sclerolaena diacantha	0.2	0.1
Dodonaea inaequifolia		0.7	0.5	Sclerolaena fusiformis	0.1	0.01
Eremophila oldfieldii subsp. oldfieldii		3	2	Senna sp. Austin (A. Strid 20210)	1	0.1
Eremophila oppositifolia subsp. angustifolia		3	0.2	Waitzia acuminata var. acuminata	0.1	0.01

Site: Phase 1 M011		Type: Quadrat		Size: 20 x 20		Date: 9/3/2019	Botanist: CW
Landform:	Hill Slope: Simple						
Slope, aspect:	Gentle 30 E						
Soil:	Sand; Clay; Red; Brown;						
Rocks:	Ironstone						
Abundance:	Abundant 50-90%						
Size:	<6 mm - Fine Gravel						
Fire:	>5 years						
Condition:	Excellent						
Notes:	Tracks;						
Veg Unit:							
Location (NW):	50J 495244 6770304						
Species		Height	Cover	Species		Height	Cover
?Eriochiton sclerolaenoides		0.5	0.1	Ptilotus exaltatus		0.1	0.1
Cephalipterum drummondii		0.1	2	Roepera ovata		0.1	0.1
Chenopodiaceae sp.		0.1	0.1	Rostraria pumila		0.1	0.1
Eucalyptus salubris		10	2	Sclerolaena diacantha		0.2	0.1
Frankenia ?setosa		0.5	0.1	Senna sp. Austin (A. Strid 20210)		2	0.1
Maireana trichoptera		0.1	0.1	Tecticornia sp.		0.5	5
Phyllangium sulcatum		0.1	0.1				

Site: Phase 1 M012		Type: Quadrat		Size: 20 x 20	Date: 9/3/2019	Botanist: RO
Landform:	Hill Slope: Simple					
Slope, aspect:	Very Gentle 1o W					
Soil:	Loam; Red; Brown;					
Rocks:	Granite; Quartz					
Abundance:	Many 20-50%					
Size:	60-200 mm Cobbles;					
Fire:	>5 years					
Condition:	Excellent					
Notes:	None;					
Veg Unit:						
Location (NW):	50J 495284 6768833					
Species		Height	Cover	Species	Height	Cover
Acacia acuminata		5	3	Grevillea scabrida	0.4	0.01
Acacia karina		1.5	0.5	Hemigenia macphersonii	1.2	0.1
Acacia ramulosa var. ramulosa		5	10	Podolepis gardneri	0.1	0.1
Allocasuarina dielsiana		8	12	Ptilotus eremita	0.1	0.01
Arthropodium dyeri		0.2	0.01	Rhodanthe chlorocephala subsp. splendida	0.1	0.01
Borya sphaerocephala		0.1	0.01	Rhodanthe laevis	0.1	0.01
Brachyscome ciliaris		0.1	0.01	Schoenia cassiniana	0.7	0.1
Caesia ?micrantha		0.2	0.01	Stenopetalum anfractum	0.1	0.1
Cephalipterum drummondii		0.1	0.2	Thysanotus manglesianus	0.1	0.1
Cheilanthes adiantoides		0.1	0.1	Thysanotus pyramidalis	0.2	0.01
Cuscuta planiflora		0.1	0.1	Trachymene ornata	0.7	0.01
Daucus glochidiatus		0.1	0.01	Velleia rosea	0.1	0.2
Eremophila clarkei		1	0.5	Vincetoxicum lineare	0.1	0.01
Erodium cygnorum		0.1	0.01	Waitzia acuminata var. acuminata	0.1	0.1
Gilruthia osbornii		0.1	0.01	Wurmbea sp. Paynes Find (C.J. French 1237)	0.1	0.01
Grevillea hakeoides subsp. stenophylla		3	0.5			

Site: Phase 1 M013		Type: Quadrat		Size: 20 x 20		Date: 9/3/2019		Botanist: CW	
Landform:	Flat: Plain								
Slope, aspect:	Gentle 3o E								
Soil:	Sand; Clay; Red; Brown;								
Rocks:	Creek stones; Ironstone; Quartz								
Abundance:	Abundant 50-90%								
Size:	20-60 mm Coarse Gravel								
Fire:	> 5 years								
Condition:	Excellent								
Notes:	-								
Veg Unit:									
Location (NW):	50J 495610 6770225								
Species			Height	Cover	Species			Height	Cover
Acacia acuminata			2	2	Erodium cygnorum			0.1	0.1
Acacia karina			2	15	Podolepis gardneri			0.1	2
Acacia tetragonophylla			2.5	1	Ptilotus helipteroides			0.1	0.01
Allocasuarina dielsiana			5	2	Ptilotus obovatus			0.5	0.1
Blennospora drummondii			0.1	0.1	Rhodanthe chlorocephala subsp. rosea			0.1	0.1
Borya sphaerocephala			0.1	1	Rhodanthe manglesii			0.1	0.1
Caesia sp. Wongan (K.F. Kenneally 8820)			0.5	0.1	Solanum lasiophyllum			0.5	0.1
Cephalipterum drummondii			0.1	12	Stenopetalum anfractum			0.1	0.1
Cheilanthes adiantoides			0.1	0.1	Trachymene ornata			0.1	0.1
Chthonocephalus pseudevax			0.1	0.1	Velleia rosea			0.1	2
Cuscuta planiflora			0.1	0.1	Wurmbea sp. Paynes Find (C.J. French 1237)			0.1	0.1

Site: Phase 1 M014		Type: Quadrat		Size: 20 x 20		Date: 9/3/2019	Botanist: RO	
Landform:	Flat: Plain							
Slope, aspect:	Very Gentle 1o N							
Soil:	Clay; Loam; Red; Brown;							
Rocks:	Granite; Ironstone; Quartz							
Abundance:	Common 10-20%							
Size:	20-60 mm Coarse Gravel 60-200 mm Cobbles;							
Fire:	>5 years							
Condition:	Excellent							
Notes:	None;							
Veg Unit:								
Location (NW):	50J 495804 6769375							
Species			Height	Cover	Species		Height	Cover
Acacia acuminata			2	1	Melaleuca scalena		10	0.5
Acacia ramulosa var. ramulosa			5	3	Millotia myosotidifolia		0.1	0.01
Acacia tetragonophylla			1.5	0.2	Myriocephalus pygmaeus		0.1	0.01
Acacia umbraculiformis			7	10	Parietaria cardiostegia		0.1	0.01
Allocasuarina dielsiana			7	2	Poaceae sp.		0.1	0.01
Arthropodium dyeri			0.2	0.01	Podolepis gardneri		0.1	0.1
Blennospora drummondii			0.7	0.01	Ptilotus obovatus		0.4	0.5
Borya sphaerocephala			0.1	0.1	Rhodanthe chlorocephala subsp. ?splendida		0.1	0.01
Cephalipterum drummondii			0.1	0.1	Rostraria pumila		0.1	0.01
Cheilanthes adiantoides			0.1	0.1	Schoenia cassiniana		0.1	0.01
Chthonocephalus pseudevax			0.1	0.01	Solanum lasiophyllum		0.3	0.01
Cuscuta planiflora			0.1	0.1	Stenopetalum anfractum		0.2	0.1
Eremophila serrulata			0.5	0.2	Thysanotus pyramidalis		0.1	0.01
Erodium cygnorum			0.1	0.01	Trachymene ornata		0.1	0.01
Goodenia berardiana			0.1	0.01	Velleia rosea		0.1	0.1
Hemigenia macphersonii			2.5	0.2	Vincetoxicum lineare		0.1	0.01
Lemooria burkittii			0.1	0.01				

Site: Phase 1 M015		Type: Quadrat		Size: 20 x 20	Date: 9/3/2019	Botanist: CW	
Landform:	Hill Crest: Hill						
Slope, aspect:	- None						
Soil:	Sand; Clay; Light; Red;						
Rocks:	Calcrete; Granite						
Abundance:	Many 20-50%						
Size:	200-600 mm Stones;						
Fire:	> 5 years						
Condition:	Excellent						
Notes:	-						
Veg Unit:							
Location (NW):	50J 499235 6770885						
Species		Height	Cover	Species		Height	Cover
Acacia acuminata		-	10	Gnephosis arachnoidea		0.1	0.1
Acacia duriuscula		-	30	Goodenia ?pinnatifida		0.1	1
Allocasuarina sp.		1.5	0.1	Hemigenia tichbonii		1	0.1
Arthropodium dyeri		0.3	0.1	Melaleuca hamata		5	2
Blennospora drummondii		0.1	0.1	Poaceae sp.		0.2	0.1
Borya sphaerocephala		0.1	25	Pogonolepis muelleriana		0.1	0.1
Brachychiton gregorii		0.5	0.1	Schoenia cassiniana		0.1	0.1
Cheilanthes adiantoides		0.1	0.1	Sida sp. Dark Green Fruits (S. van Leeuwen 2260)		0.5	0.1
Chthonocephalus pseudevax		0.1	0.1	Solanum lasiophyllum		0.2	0.1
Cuscuta planiflora		0.1	0.1	Trachymene ornata		0.1	0.1
Cyanicula amplexans		0.1	0.1	Velleia rosea		0.1	1
Erodium cygnorum		0.1	0.1	Waitzia acuminata var. acuminata		0.1	1

Site: Phase 1 M016		Type: Quadrat		Size: 20 x 20		Date: 9/3/2019	Botanist: RO
Landform:	Flat: Plain						
Slope, aspect:	Very Gentle 1o N						
Soil:	Sand; Loam; Orange;						
Rocks:	Quartz						
Abundance:	Few 2-10%						
Size:	20-60 mm Coarse Gravel 60-200 mm Cobbles;						
Fire:	>5 years						
Condition:	Excellent						
Notes:	None;						
Veg Unit:							
Location (NW):	50J 499172 6772403						
Species			Height	Cover	Species	Height	Cover
Acacia ramulosa var. ramulosa			10	10	Pogonolepis muelleriana	0.1	0.2
Acacia tetragonophylla			1.2	0.2	Ptilotus eremita	0.2	0.01
Acacia umbraculiformis			10	3	Ptilotus exaltatus	0.2	0.01
Austrostipa eremophila			0.3	0.01	Ptilotus obovatus	0.5	5
Calandrinia baccata			0.1	0.01	Rhagodia drummondii	0.5	0.5
Calotis hispidula			0.1	0.01	Roepera ovata	0.1	0.1
Cephalipterum drummondii			0.1	0.1	Sclerolaena densiflora	0.1	0.01
Dodonaea inaequifolia			1	0.1	Sclerolaena diacantha	0.2	0.2
Eremophila oldfieldii subsp. oldfieldii			1	0.1	Senna artemisioides subsp. x artemisioides	1.2	0.1
Eucalyptus loxophleba subsp. supralaevis			12	12	Solanum lasiophyllum	0.4	0.1
Exocarpos aphyllus			3	3	Stenopetalum anfractum	0.1	0.1
Hydrocotyle intertexta			0.1	0.01	Thysanotus manglesianus	0.1	0.1
Maireana georgei			0.3	0.2	Velleia rosea	0.1	0.01
Maireana trichoptera			0.2	0.1	Vincetoxicum lineare	0.1	0.01
Myriocephalus pygmaeus			0.1	0.01			
Poaceae sp.			0.1	0.01			

Site: Phase 1 M017		Type: Quadrat		Size: 20 x 20		Date: 9/4/2019		Botanist: CW	
Landform:	Hill Slope: Mid								
Slope, aspect:	Moderate 10o W								
Soil:	Clay; Red;								
Rocks:	Quartz; Ironstone								
Abundance:	Many 20-50%								
Size:	20-60 mm Coarse Gravel								
Fire:	>5 years								
Condition:	Very Good								
Notes:	Tracks;								
Veg Unit:									
Location (NW):	50J 496997 6773676								
Species			Height	Cover	Species		Height	Cover	
Acacia acuminata			3	25	Hydrocotyle dimorphocarpa		0.1	0.1	
Acacia diallaga			0.5	1	Phyllangium sulcatum		0.1	0.1	
Acacia karina			1.5	0.5	Podolepis gardneri		0.1	0.2	
Acacia ramulosa var. ramulosa			2	1	Ptilotus eremita		0.1	0.1	
Allocasuarina dielsiana			10	2	Ptilotus obovatus		0.5	0.1	
Allocasuarina tessellata			2	12	Rhodanthe collina		0.1	7	
Arthropodium dyeri			0.5	0.1	Schoenia cassiniana		0.1	0.2	
Austrostipa trichophylla			0.2	0.1	Sida calyxhymenia		0.1	0.1	
Brachyscome ciliaris			0.1	0.1	Solanum lasiophyllum		0.5	0.1	
Calotis multicaulis			0.1	0.1	Stenopetalum anfractum		0.2	0.1	
Cephalopterum drummondii			0.1	0.1	Trachymene cyanopetala		0.1	0.5	
Cheilanthes adiantoides			0.1	0.1	Trachymene ornata		0.1	0.1	
Cuscuta planiflora			0.1	0.1	Velleia rosea		0.1	5	
Erodium cygnorum			0.1	0.1	Waitzia acuminata var. acuminata		0.1	0.2	
Goodenia berardiana			0.1	0.1	Wurmbea sp. Paynes Find (C.J. French 1237)		0.1	0.1	
Grevillea scabrida			1.5	1					

Site: Phase 1 M018		Type: Quadrat		Size: 20 x 20		Date: 9/4/2019		Botanist: RO	
Landform:	Drainage: Drainage line on slope: lower								
Slope, aspect:	Gentle 30 W								
Soil:	Clay; Loam; Red; Brown;								
Rocks:	Granite; Quartz; Ironstone								
Abundance:	Common 10-20%								
Size:	20-60 mm Coarse Gravel 60-200 mm Cobbles;								
Fire:	>5 years								
Condition:	Very Good								
Notes:	Weeds (low); Erosion;								
Veg Unit:									
Location (NW):	50J 496077 6773189								
Species			Height	Cover	Species			Height	Cover
Acacia acanthoclada subsp. glaucescens			0.3	0.1	Millotia myosotidifolia			0.1	0.01
Acacia acuminata			8	30	Myriocephalus pygmaeus			0.1	0.01
Acacia ramulosa var. ramulosa			5	0.5	Nicotiana rotundifolia			0.1	0.01
Acacia tetragonophylla			2	1	Olearia pimeleoides			1	0.1
Allocasuarina dielsiana			10	12	Parietaria cardiostegia			0.1	0.01
Allocasuarina tessellata			4	0.5	Pentameris airoides			0.1	0.01
Arthropodium dyeri			0.2	0.2	Pimelea avonensis			0.6	0.2
Austrostipa eremophila			0.3	0.01	Pimelea microcephala subsp. microcephala			1.5	0.1
Blennospora drummondii			0.1	0.01	Podolepis gardneri			0.1	0.01
Bromus diandrus			0.2	0.1	Psyrax suaveolens			0.7	0.01
Caesia ?micrantha			0.2	0.01	Ptilotus eremita			0.1	0.01
Calotis multicaulis			0.1	0.5	Ptilotus obovatus			0.6	1.5
Cheilanthes adiantoides			0.1	0.5	Rhagodia drummondii			0.4	0.1
Comesperma integerrimum			0.1	0.01	Rhodanthe collina			0.1	0.01
Cuscuta planiflora			0.5	1.5	Schoenia cassiniana			0.1	0.01
Dianella revoluta var. divaricata			0.7	0.1	Senecio glossanthus			0.2	0.01
Dodonaea inaequifolia			3	12	Senna artemisioides subsp. x artemisioides			1.5	1
Erodium cygnorum			0.1	0.1	Silene gallica			0.1	0.01
Eucalyptus loxophleba subsp. supralaevis			10	1	Solanum lasiophyllum			0.7	0.5
Goodenia berardiana			0.1	0.01	Solanum nummularium			0.3	0.01
Goodenia mimuloides			0.2	1	Sonchus oleraceus			0.1	0.01
Halganias anagalloides			0.3	0.1	Stenopetalum anfractum			0.1	0.01
Haloragis trigonocarpa			0.1	0.01	Thysanotus manglesianus			0.1	0.1
Hemigenia macphersonii			2	1.5	Trachymene cyanopetala			0.1	0.1
Hydrocotyle dimorphocarpa			0.1	0.01	Trachymene ornata			0.1	0.2
Hypochaeris glabra			0.1	0.01	Triglochin sp. A Flora of Australia (G.J. Keighery 2477)			0.1	0.01
Leptosema aphyllum			0.7	0.1	Velleia rosea			0.1	1
Lysimachia arvensis			0.1	0.01	Vincetoxicum lineare			0.1	0.01
Melaleuca scalena			10	2	Waitzia acuminata var. acuminata			0.1	0.01

Site: Phase 1 M019		Type: Quadrat		Size: 20 x 20		Date: 9/4/2019		Botanist: CW	
Landform:	Flat: Plain								
Slope, aspect:	Level <10 None								
Soil:	Sand; Clay; Red;								
Rocks:	- -								
Abundance:	No rocks								
Size:	-								
Fire:	>5 years								
Condition:	Poor (not SW)								
Notes:	Grazing (low); Tracks;								
Veg Unit:									
Location (NW):	50J 498847 6769838								
Species		Height	Cover	Species		Height	Cover		
Acacia acanthoclada subsp. glaucescens		0.5	0.1	Olearia pimeleoides		1	0.1		
Acacia ramulosa var. ramulosa		2	15	Parietaria cardiostegia		0.1	0.1		
Acacia tetragonophylla		2	2	Phlegmatospermum drummondii		0.1	0.1		
Austrostipa elegantissima		0.5	0.1	Plantago debilis		0.1	0.1		
Austrostipa scabra		0.3	0.1	Podolepis gardneri		0.1	0.1		
Bursaria occidentalis		4	10	Ptilotus gaudichaudii		0.1	0.1		
Calandrinia sp. Truncate capsules (A. Markey & S. Dillon 3474)		0.1	0.1	Ptilotus obovatus		0.5	0.1		
Cephalipterum drummondii		0.1	0.1	Rhagodia drummondii		0.5	0.1		
Comesperma integerrimum		0.1	0.1	Santalum acuminatum		5	2		
Enchylaena lanata		0.2	0.1	Scaevola spinescens		1.5	0.1		
Erodium cygnorum		0.1	0.1	Senna artemisioides subsp. filifolia		2	10		
Eucalyptus kochii subsp. plenissima		10	20	Solanum lasiophyllum		0.5	0.1		
Euphorbia tannensis subsp. eremophila		0.1	0.1	Stenopetalum anfractum		0.1	0.1		
Exocarpos aphyllus		2.5	2	Trachymene cyanopetala		0.1	0.1		
Gnephosis arachnoidea		0.1	0.1	Velleia rosea		0.1	0.1		
Gnephosis brevifolia		0.1	0.1	Vincetoxicum lineare		0.1	0.1		
Goodenia berardiana		0.2	0.1	Waitzia acuminata var. acuminata		0.1	0.1		
Hydrocotyle dimorphocarpa		0.1	0.1						

Site: Phase 1 M020		Type: Quadrat		Size: 20 x 20	Date: 9/4/2019	Botanist: RO	
Landform:	Flat: Plain						
Slope, aspect:	Very Gentle 10 W						
Soil:	Clay; Loam; Red; Brown;						
Rocks:	Granite; Quartz; Ironstone						
Abundance:	Common 10-20%						
Size:	20-60 mm Coarse Gravel 60-200 mm Cobbles;						
Fire:	> 5 years						
Condition:	Excellent						
Notes:	Weeds (high); None;						
Veg Unit:							
Location (NW):	50J 495701 6773017						
Species		Height	Cover	Species		Height	Cover
Acacia acuminata		4	2	Dianella revoluta var. divaricata		0.7	0.1
Acacia ramulosa var. ramulosa		6	25	Eremophila ericalyx		1	0.1
Acacia tetragonophylla		2	1.5	Erodium cygnorum		0.1	0.01
Allocasuarina dielsiana		10	1.5	Eucalyptus kochii subsp. plenissima		8	1.5
Allocasuarina tessellata		4	2	Grevillea hakeoides subsp. stenophylla		2	0.1
Bellida graminea		0.1	0.01	Melaleuca scalena		10	2
Brachychiton gregorii		-	0.5	Persoonia manotricha		2.5	1.5
Cephalipterum drummondii		0.1	0.1	Ptilotus obovatus		0.5	0.1
Cheilanthes adiantoides		0.1	0.1	Velleia rosea		0.1	0.1
Cheiranthra simplicifolia		0.1	0.01	Waitzia acuminata var. acuminata		0.1	0.1

Site: Phase 1 M021		Type: Quadrat		Size: 20 x 20	Date: 9/8/2019	Botanist: CW
Landform:	Hill Slope: Lower					
Slope, aspect:	Very Gentle 1o S					
Soil:	Sand; Clay; Light; Red;					
Rocks:	Ironstone; Quartz					
Abundance:	Many 20-50%					
Size:	20-60 mm Coarse Gravel					
Fire:	>5 years					
Condition:	Excellent					
Notes:	Grazing (low); Tracks;					
Veg Unit:						
Location (NW):	50J 501248 6770123					
Species		Height	Cover	Species	Height	Cover
Acacia andrewsii		0.5	0.1	Maireana trichoptera	0.5	1
Acacia erinacea		0.5	2	Maireana triptera	0.5	0.1
Acacia ramulosa var. ramulosa		0.5	0.1	Mesembryanthemum nodiflorum	0.2	5
Acacia tetragonophylla		2	1	Plantago debilis	0.1	0.01
Atriplex semilunaris		0.1	0.01	Pogonolepis muelleriana	0.1	0.2
Austrostipa elegantissima		0.7	0.1	Ptilotus exaltatus	0.3	0.1
Calandrinia baccata		-	-	Ptilotus obovatus	0.5	0.5
Cephalipterum drummondii		0.2	0.2	Rhagodia drummondii	0.5	3
Enchylaena tomentosa		0.5	0.2	Rhodanthe ?oppositifolia subsp. oppositifolia	0.2	0.01
Eremophila oldfieldii subsp. oldfieldii		3	1	Roepera similis	0.1	0.1
Erymophyllum glossanthus		0.1	0.01	Rostraria pumila	0.2	0.2
Eucalyptus loxophleba subsp. lissophloia		10	5	Rytidosperma setaceum	0.1	0.1
Exocarpos aphyllus		2.5	1	Scaevola spinescens	0.5	0.1
Frankenia ?setosa		0.5	2	Sclerolaena drummondii	0.5	1
Gnephosis arachnoidea		0.1	0.2	Senecio glossanthus	0.2	0.1
Goodenia pusilliflora		0.1	0.01	Senna sp. Austin (A. Strid 20210)	2	1
Lepidium oxytrichum		0.5	0.1	Spergula pentandra	0.1	0.1
Maireana ?tomentosa		0.5	1			

Site: Phase 1 M022		Type: Quadrat		Size: 20 x 20	Date: 9/4/2019	Botanist: RO
Landform:	Hill Slope: Lower					
Slope, aspect:	Gentle 30 S					
Soil:	Clay; Loam; Red; Brown;					
Rocks:	Granite; Quartz					
Abundance:	Few 2-10%					
Size:	20-60 mm Coarse Gravel 60-200 mm Cobbles;					
Fire:	> 5 years					
Condition:	Excellent					
Notes:	None;					
Veg Unit:						
Location (NW):	50J 498684 6769169					
Species		Height	Cover	Species	Height	Cover
Acacia acuminata		4	12	Haloragis trigonocarpa	0.1	0.01
Acacia karina		4	5	Hemigenia macphersonii	1.5	0.2
Acacia tetragonophylla		1	0.2	Hydrocotyle dimorphocarpa	0.1	0.01
Acacia umbraculiformis		5	2	Lobelia winfridae	0.1	0.01
Allocasuarina dielsiana		10	12	Myriocephalus pygmaeus	0.1	0.01
Allocasuarina tessellata		4	1.5	Phyllangium sulcatum	0.1	0.01
Arthropodium dyeri		0.3	0.2	Podolepis gardneri	0.1	0.2
Blennospora drummondii		0.7	0.01	Ptilotus obovatus	0.5	0.1
Brachyscome ciliaris		0.1	0.01	Rhodanthe chlorocephala subsp. ?splendida	0.2	0.01
Caesia ?micrantha		0.3	0.1	Rhodanthe collina	0.1	0.2
Calotis hispida		0.1	0.01	Rhodanthe oppositifolia subsp. oppositifolia	0.1	0.1
Calotis multicaulis		0.1	0.01	Roepera ovata	0.1	0.01
Cephalipterum drummondii		0.1	0.1	Schoenia cassiniana	0.1	0.1
Cheilanthes adiantoides		0.1	0.1	Senna artemisioides subsp. x artemisioides	1.8	1.5
Chthonocephalus pseudevax		0.1	0.01	Solanum lasiophyllum	0.7	0.2
Comesperma integerrimum		0.1	0.1	Stenopetalum anfractum	0.2	0.2
Cuscuta planiflora		0.1	0.5	Thysanotus manglesianus	0.1	0.01
Drosera sp. Branched styles (S.C. Coffey 193)		0.1	0.01	Trachymene cyanopetala	0.1	0.01
Erodium cygnorum		0.1	0.01	Trachymene ornata	0.1	0.01
Gnephosis arachnoidea		0.1	0.01	Velleia rosea	0.1	0.2
Goodenia pusilliflora		0.1	0.01	Wurmbea sp. Paynes Find (C.J. French 1237)	0.1	0.01
Hakea sp.		0.5	0.1	Caladenia sp. 1	0.1	0.01
Halgania anagalloides		0.4	0.1			

Site: Phase 1 M023		Type: Quadrat	Size: 20 x 20	Date: 9/8/2019	Botanist: CW	
Landform:	Flat: Plain					
Slope, aspect:	Very Gentle 1o					
Soil:	Sand; Clay; Red;					
Rocks:	Quartz					
Abundance:	Few 2-10%					
Size:	20-60 mm Coarse Gravel					
Fire:	> 5 years					
Condition:	Excellent					
Notes:	Tracks;					
Veg Unit:						
Location (NW):	50J 500349.00540000002 6770226.0379999997					
Species		Height	Cover	Species	Height	Cover
Acacia ramulosa var. ramulosa		2.5	2	Ptilotus exaltatus	0.3	0.1
Austrostipa nitida		0.7	0.1	Ptilotus obovatus	0.5	7
Calandrinia baccata		0.1	0.01	Scaevola spinescens	0.5	7
Cephalopterum drummondii		0.1	0.1	Schoenia cassiniana	0.1	0.01
Erodium cygnorum		0.1	0.01	Senna artemisioides subsp. filifolia	2.5	10
Eucalyptus kochii subsp. plenissima		5	15	Sida ?sp. Dark Green Fruits (S. van Leeuwen 2260)	0.1	0.01
Grevillea paniculata		0.5	0.5	Solanum lasiophyllum	0.5	0.1
Maireana trichoptera		0.5	0.5	Stenopetalum anfractum	0.2	0.01
Maireana triptera		-	0.1	Thysanotus manglesianus	0.1	0.1
Monachather paradoxus		0.1	0.1	Trachymene cyanopetala	0.1	0.1
Podolepis gardneri		0.1	0.01	Velleia rosea	0.1	2
Pterostylis ?spathulata		0.1	0.1			

Site: Phase 1 M024		Type: Quadrat	Size: 20 x 20	Date: 9/8/2019	Botanist: CW	
Landform:	Hill Slope: Lower					
Slope, aspect:	Gentle 3o S					
Soil:	Sand; Clay; Light; Red;					
Rocks:	Quartz					
Abundance:	-					
Size:	60-200 mm Cobbles;					
Fire:	>5 years					
Condition:	Excellent					
Notes:	-					
Veg Unit:						
Location (NW):	50J 499774 6771502					
Species		Height	Cover	Species	Height	Cover
Acacia acuminata		2.5	15	Gnephosis brevifolia	0.1	0.01
Acacia diallaga		0.5	1	Goodenia ?pinnatifida	0.1	0.2
Acacia karina		2.5	5	Goodenia berardiana	0.2	0.1
Acacia ramulosa var. ramulosa		2.5	15	Hemigenia yalgensis	1	1.5
Acacia tetragonophylla		2.5	0.5	Lobelia winfridae	0.1	0.01
Allocasuarina dielsiana		7	2	Phyllangium sulcatum	0.1	0.1
Allocasuarina tessellata		2.5	1	Podolepis gardneri	0.1	0.5
Arthropodium dyeri		0.1	0.1	Rhodanthe collina	0.1	2
Austrostipa nitida		0.2	0.1	Schoenia cassiniana	0.1	0.5
Blennospora drummondii		0.1	0.1	Sida ?sp. Dark Green Fruits (S. van Leeuwen 2260)	0.2	0.1
Borya sphaerocephala		0.1	5	Solanum lasiophyllum	0.5	0.1
Calotis multicaulis		0.1	0.1	Stenopetalum anfractum	0.1	0.1
Cephalipterum drummondii		0.1	1	Styphelia serratifolia	0.5	0.1
Cheilanthes adiantoides		0.1	0.1	Trachymene cyanopetala	0.1	0.1
Chthonocephalus pseudevax		0.1	0.1	Trachymene ornata	0.1	0.1
Cuscuta planiflora		0.1	0.1	Velleia rosea	0.1	1
Erodium cygnorum		0.1	0.1	Waitzia acuminata var. acuminata	0.1	2
Euphorbia tannensis subsp. eremophila		0.1	0.01	Wurmbea sp. Paynes Find (C.J. French 1237)	0.1	0.01

Site: Phase 1 M025		Type: Quadrat		Size: 20 x 20	Date: 9/9/2019	Botanist: CW
Landform:	Flat: Plain					
Slope, aspect:	Very Gentle 1o None					
Soil:	Sand; Clay; Red;					
Rocks:	Quartz; Ironstone					
Abundance:	Few 2-10%					
Size:	6-20 mm Medium Gravel					
Fire:	>5 years					
Condition:	Very Good					
Notes:	Grazing (low);					
Veg Unit:						
Location (NW):	50J 495024 6770524					
Species		Height	Cover	Species	Height	Cover
Acacia ramulosa var. ramulosa		3	25	Maireana triptera	0.5	0.1
Acacia tetragonophylla		2	2	Pentameris airoides	0.1	0.01
Arthropodium dyeri		0.5	0.1	Phebalium tuberculosum	1	0.1
Austrostipa elegantissima		0.5	0.2	Plantago debilis	0.1	0.1
Austrostipa trichophylla		0.5	0.1	Podolepis gardneri	0.1	0.1
Bromus arenarius		0.3	0.2	Podolepis lessonii	0.1	0.1
Calotis multicaulis		0.5	0.1	Ptilotus eremita	0.1	0.1
Cephalipterum drummondii		0.1	1	Ptilotus obovatus	0.5	2
Cheilanthes adiantoides		0.1	0.1	Rhodanthe laevis	0.1	0.1
Chthonocephalus pseudevax		0.1	0.1	Rhodanthe manglesii	0.2	0.1
Cuscuta planiflora		0.1	0.1	Rhodanthe maryonii	0.1	0.1
Daucus glochidiatus		0.2	0.1	Rhodanthe oppositifolia subsp. oppositifolia	0.1	0.1
Erodium cygnorum		0.1	0.1	Schoenia cassiniana	-	0.1
Eucalyptus loxophleba subsp. lissophloia		7	2	Schoenus nanus	0.1	0.1
Euphorbia tannensis subsp. eremophila		0.1	0.1	Sida calyxhymenia	0.5	0.1
Gnephosis brevifolia		0.1	0.1	Solanum lasiophyllum	0.5	0.1
Goodenia ?pinnatifida		0.1	0.1	Stenopetalum anfractum	0.2	0.1
Hemigenia yalgensis		0.5	0.1	Thysanotus manglesianus	0.1	0.1
Hyalosperma glutinosum subsp. venustum		0.1	1	Trachymene ornata	0.1	0.1
Hydrocotyle intertexta		0.1	0.2	Velleia rosea	0.1	0.1
Lepidium oxytrichum		0.1	0.1	Caladenia sp. 2	0.1	0.01
Maireana triptera		0.5	0.1			

Site: Phase 1 M026		Type: Quadrat		Size: 20 x 20	Date: 9/9/2019	Botanist: CW	
Landform:	Hill Slope: Mid						
Slope, aspect:	Moderate 10o S						
Soil:	Clay; Red;						
Rocks:	Quartz						
Abundance:	Abundant 50-90%						
Size:	6-20 mm Medium Gravel						
Fire:	> 5 years						
Condition:	Very Good						
Notes:	Tracks; Partial clearing;						
Veg Unit:							
Location (NW):	50J 497036 6772573						
Species		Height	Cover	Species	Height	Cover	
Acacia ramulosa var. ramulosa		4	40	Hyalosperma glutinosum subsp. venustum	0.1	0.5	
Acacia tetragonophylla		1	0.1	Maireana triptera	0.5	0.2	
Actinobole uliginosum		0.1	0.1	Phlegmatospermum drummondii	0.1	0.1	
Arthropodium dyeri		0.5	0.1	Plantago debilis	0.1	0.1	
Austrostipa ?scabra		0.1	0.1	Podolepis lessonii	0.1	1	
Calandrinia ?polyandra		0.1	0.1	Ptilotus obovatus	0.5	1.5	
Calotis multicaulis		0.1	0.1	Rhodanthe collina	0.1	0.1	
Cheilanthes adiantoides		0.1	0.1	Schoenia cassiniana	0.1	0.1	
Dianella revoluta var. divaricata		1	0.1	Solanum lasiophyllum	0.5	0.1	
Erodium cygnorum		0.1	0.1	Trachymene cyanopetala	0.1	0.01	
Eucalyptus loxophleba subsp. lissophloia		10	2	Trachymene ornata	0.1	0.1	
Goodenia ?pinnatifida		0.1	0.1	Velleia rosea	0.1	0.1	
Hemigenia valensis		0.5	0.1	Waitzia acuminata var. acuminata	0.1	1	

Site: Phase 1 M027		Type: Quadrat	Size: 20 x 20	Date: 9/9/2019	Botanist: CW	
Landform:	Flat: Plain					
Slope, aspect:	Very Gentle 1o None					
Soil:	Sand; Clay; Red;					
Rocks:	Ironstone; Quartz					
Abundance:	Many 20-50%					
Size:	6-20 mm Medium Gravel					
Fire:	>5 years					
Condition:	Excellent					
Notes:	-					
Veg Unit:						
Location (NW):	50J 500019 6772998					
Species		Height	Cover	Species	Height	Cover
Acacia acuminata		2.5	20	Goodenia mimuloides	0.2	5
Acacia ramulosa var. ramulosa		4	15	Grevillea scabrida	0.5	0.1
Allocasuarina dielsiana		5	2	Hydrocotyle intertexta	0.1	0.2
Arthropodium dyeri		0.3	0.1	Nicotiana rotundifolia	0.4	0.01
Austrostipa ?scabra		0.1	0.1	Podolepis gardneri	0.1	2
Austrostipa nitida		0.1	0.1	Ptilotus eremita	0.1	0.1
Brunonia sp. Goldfields (K.R. Newbey 6044)		0.2	0.1	Ptilotus helipteroides	0.1	0.2
Calotis multicaulis		0.1	0.1	Rhodanthe collina	0.1	0.1
Cephalopterum drummondii		0.1	0.1	Schoenia cassiniana	0.1	0.1
Cheilanthes adiantoides		0.1	0.1	Sida sp. Dark Green Fruits (S. van Leeuwen 2260)	0.1	0.1
Cuscuta planiflora		0.1	0.1	Solanum cleistogamum	0.1	0.2
Eremophila ericalyx		0.5	0.1	Solanum lasiophyllum	0.5	0.1
Erodium cygnorum		0.1	0.1	Stenopetalum anfractum	0.4	0.1
Euphorbia tannensis subsp. eremophila		0.2	0.1	Thysanotus manglesianus	0.2	0.1
Gnephosis brevifolia		0.1	0.1	Velleia rosea	0.1	20
Gnephosis tenuissima		0.1	0.1	Waitzia acuminata var. acuminata	0.1	0.1

Site: Phase 1 R001		Type: Relevé	Size: -	Date: 9/2/2019	Botanist: CW	
Landform:	-					
Slope, aspect:	Gentle 30 None					
Soil:	Clay; Red; Brown;					
Rocks:	Calcrete; Ironstone; Quartz					
Abundance:	Abundant 50-90%					
Size:	20-60 mm Coarse Gravel 60-200 mm Cobbles;					
Fire:	>5 years					
Condition:	Excellent					
Notes:	Tracks;					
Veg Unit:						
Location (NW):	50J 496777 6770129					
Species		Height	Cover	Species	Height	Cover
Acacia acuminata		4	5	Calothamnus gilesii	2.5	0.1
Acacia tetragonophylla		2	2	Grevillea hakeoides subsp. stenophylla	1.5	0.1
Allocasuarina dielsiana		4	10	Hemigenia macphersonii	1	1
Allocasuarina tessellata		4	75			

Site: Phase 1 R002		Type: Releve		Size: -		Date: 9/2/2019		Botanist: CW	
Landform:	Hill Slope: Simple								
Slope, aspect:	Gentle 30 E								
Soil:	Clay; Brown;								
Rocks:	Quartz								
Abundance:	Abundant 50-90%								
Size:	20-60 mm Coarse Gravel								
Fire:	>5 years								
Condition:	Excellent								
Notes:	-								
Veg Unit:									
Location (NW):	50J 496929 6770204								
Species			Height	Cover	Species			Height	Cover
Dodonaea inaequifolia			1.5	2	Senna artemisioides subsp. filifolia			1.5	20
Eucalyptus kochii subsp. plenissima			12	20	Senna stowardii			2	1
Scaevola spinescens			1	5					

Site: Phase 1 R003		Type: Releve		Size: -		Date: 9/3/2019		Botanist: CW	
Landform:	Flat: Plain								
Slope, aspect:	Level <10 None								
Soil:	Sand; Clay; Red; Brown;								
Rocks:	Ironstone; Quartz;								
Abundance:	Many 20-50%								
Size:	6-20 mm Medium Gravel								
Fire:	>5 years								
Condition:	Excellent								
Notes:	-								
Veg Unit:									
Location (NW):	50J 495252 6769819								
Species		Height	Cover	Species		Height	Cover		
Acacia ramulosa var. ramulosa		2	5	Grevillea hakeoides subsp. stenophylla		2	0.1		
Acacia tetragonophylla		2	5	Senna artemisioides subsp. filifolia		2	15		
Eucalyptus loxophleba subsp. supralaevis		10	2						

Site: Phase 1 R004		Type: Relevé	Size: -	Date: 9/3/2019	Botanist: CW
Landform:	Hill Slope: Lower				
Slope, aspect:	Gentle 30 S				
Soil:	Sand; Clay; Red;				
Rocks:	Ironstone				
Abundance:	Abundant 50-90%				
Size:	<6 mm - Fine Gravel				
Fire:	>5 years				
Condition:	Excellent				
Notes:	-				
Veg Unit:					
Location (NW):	50J 495236 6770130				
Species	Height	Cover	Species	Height	Cover
<i>Austrostipa elegantissima</i>	0.4	0.1	<i>Ptilotus divaricatus</i>	0.3	0.1
<i>Eremophila oldfieldii</i> subsp. <i>oldfieldii</i>	1.5	0.1	<i>Rhodanthe mardonii</i>	0.1	0.1
<i>Eucalyptus loxophleba</i> subsp. <i>supralaevis</i>	20	2	<i>Senna</i> sp. Austin (A. Strid 20210)	1.5	1
<i>Mesembryanthemum nodiflorum</i>	0.1	0.1	<i>Tecticornia</i> sp.	0.5	5
<i>Monoculus monstrosus</i>	0.1	0.1			

Site: Phase 1 R005		Type: Relevé	Size: -	Date: 9/4/2019	Botanist: CW
Landform:	Hill Crest: Hill				
Slope, aspect:	- None				
Soil:	Clay; Red; White;				
Rocks:	Quartz; Quartz				
Abundance:	Continuous >90%				
Size:	200-600 mm Stones;				
Fire:	>5 years				
Condition:	Very Good				
Notes:	Tracks;				
Veg Unit:					
Location (NW):	50J 497344 6772058				
Species	Height	Cover	Species	Height	Cover
<i>Acacia aulacophylla</i>	2	2	<i>Gastrolobium laytonii</i>	1.5	0.1
<i>Acacia sulcatacaulis</i>	5	-	<i>Melaleuca nematophylla</i>	5	5
<i>Allocasuarina tessellata</i>	2	5	<i>Micromyrtus trudgenii</i>	2	0.1
<i>Amphipogon caricinus</i> var. <i>caricinus</i>	0.1	0.1	<i>Mirbelia ?microphylla</i>	0.5	0.1
<i>Calycopeplus paucifolius</i>	2	10	<i>Rhodanthe citrina</i>	0.1	0.1
<i>Cyanicula amplexans</i>	0.1	0.1	<i>Xanthosia kochii</i>	0.5	10

Site: Phase 1 R006		Type: Relevé	Size: -	Date: 9/5/2019	Botanist: RO
Landform:	Drainage: Drainage line on slope: mid				
Slope, aspect:	Moderate 10o S				
Soil:	Sand; Orange; Brown;				
Rocks:	Granite; Quartz				
Abundance:	Continuous >90%				
Size:	>600 mm Boulders;				
Fire:	>5 years				
Condition:	Very Good				
Notes:	Weeds (low);				
Veg Unit:					
Location (NW):	50J 497700 6770850				
Species	Height	Cover	Species	Height	Cover
<i>Acacia umbraculiformis</i>	5	10	<i>Petrorhagia dubia</i>	0.3	0.1
<i>Arctotheca calendula</i>	0.1	0.01	<i>Podolepis lessonii</i>	0.1	0.1
<i>Brachychiton gregorii</i>	5	1	<i>Ptilotus obovatus</i>	0.5	1
<i>Calycopeplus paucifolius</i>	5	15	<i>Solanum lasiophyllum</i>	0.7	3
<i>Cheilanthes adiantoides</i>	0.1	0.1	<i>Trachymene ornata</i>	0.1	0.1
<i>Ehrharta longiflora</i>	0.3	0.1			

Site: Phase 1 R008		Type: Releve		Size: -		Date: 9/8/2019		Botanist: CW	
Landform:	Flat: Plain								
Slope, aspect:	Very Gentle 1o None								
Soil:	Clay; Red;								
Rocks:	Quartz; Ironstone								
Abundance:	Many 20-50%								
Size:	6-20 mm Medium Gravel 60-200 mm Cobbles;								
Fire:	-								
Condition:	Excellent								
Notes:	-								
Veg Unit:									
Location (NW):	50J 500841 6770382								
Species		Height	Cover	Species		Height	Cover		
Acacia acuminata		4	5	Allocasuarina tessellata		2	2		
Allocasuarina dielsiana		5	2	Grevillea scabrada		0.5	5		

Site: Phase 1 R009		Type: Releve	Size: -	Date: 9/9/2019	Botanist: CW	
Landform:	Hill Slope: Mid					
Slope, aspect:	Moderate 10o W					
Soil:	Clay; Red;					
Rocks:	Ironstone					
Abundance:	Many 20-50%					
Size:	6-20 mm Medium Gravel					
Fire:	>5 years					
Condition:	Excellent					
Notes:	-					
Veg Unit:						
Location (NW):	50J 500135 6771833					
Species		Height	Cover	Species	Height	Cover
Acacia acuminata		2	1	Allocasuarina tessellata	2.5	-
Acacia karina		2	1	Grevillea paniculata	2	0.2
Allocasuarina dielsiana		5	10			

Site: Phase 1 R010		Type: Relevé		Size: -	Date: 9/9/2019	Botanist: CW	
Landform:	Hill Slope: Mid						
Slope, aspect:	Gentle 30 S						
Soil:	Sand; Clay; Red;						
Rocks:	Quartz; Ironstone						
Abundance:	Many 20-50%						
Size:	20-60 mm Coarse Gravel >600 mm Boulders;						
Fire:	>5 years						
Condition:	Excellent						
Notes:	-						
Veg Unit:							
Location (NW):	50J 500136 6771743						
Species		Height	Cover	Species	Height	Cover	
Acacia acuminata		2.5	7	Eremophila oldfieldii subsp. oldfieldii	2	1	
Acacia ramulosa var. ramulosa		4	2	Eucalyptus kochii subsp. plenissima	10	20	
Allocasuarina tessellata		2.5	1	Scaevola spinescens	1	2	
Dodoniae inaequifolia		1	2	Senna artemisioides subsp. filifolia	1.5	2	

Site: Phase 2 Q201		Type: Quadrat		Size: 20 x 20		Date: 3/5/2020	Botanist: CW, MH	
Landform:	Flat, Plain							
Slope, aspect:	<1° - Level None							
Soil:	Sand, Clay Orange, Brown							
Rocks:	Laterite -							
Abundance:	20-50% Many							
Size:	<6 mm - Fine gravel							
Fire:	> 5 yrs							
Condition:	Excellent							
Notes:	Grazing (Low)							
Veg Unit:								
Location (NW):	50J 494191 6769723							
Species		Height	Cover	Species		Height	Cover	
?Convolvulus remotus		0.1	0.1	Comesperma integerrimum		1	0.1	
?Hyalosperma glutinosum		0.1	0.1	Dianella revoluta var. divaricata		1	1	
Acacia acuminata		2.5	5	Eremophila latrobei subsp. latrobei		1	0.1	
Acacia ramulosa var. linophylla		2.5	5	Leucopogon sp. Clyde Hill (M.A. Burgman 1207)		1	1	
Acacia ramulosa var. ramulosa		2.5	15	Melaleuca hamata		5	3	
Acacia tetragonophylla		2	1	Philotheca deserti subsp. deserti		1	0.1	
Amphipogon caricinus var. caricinus		0.2	1	O.ttanthera althoferi subsp. althoferi		1.5	15	
Austrostipa elegantissima		0.4	0.1	Styphelia serratifolia		0.1	0.1	

Site: Phase 2 Q202		Type: Quadrat		Size: 20 x 20		Date: 3/5/2020	Botanist: MH
Landform:	Flat,Plain						
Slope, aspect:	1° - Very Gentle None						
Soil:	Sand,Clay Light,Orange						
Rocks:	Granite Quartz						
Abundance:	10 -20% Common						
Size:	6-20 mm - Medium gravel						
Fire:	> 5 yrs						
Condition:	Excellent						
Notes:	None						
Veg Unit:							
Location (NW):	50J 497376 6769960						
Species		Height	Cover	Species		Height	Cover
Acacia karina		1.5	1	Eremophila latrobei subsp. latrobei		0.5	0.1
Acacia umbraculiformis		3	3	Malleostemon tuberculatus		2.5	2
Borya sphaerocephala		0.2	3	Philotheca deserti subsp. deserti		0.5	0.2
Calycopeplus paucifolius		2.5	0.5	0.1tanthera althoferi subsp. althoferi		0.5	0.2
Dianella revoluta var. divaricata		0.5	0.01	Thryptomene costata		1.8	10

Site: Phase 2 Q203		Type: Quadrat		Size: 20 x 20		Date: 3/5/2020		Botanist: CW	
Landform:	Hill,Slope,Upper								
Slope, aspect:	10° - Moderate None								
Soil:	Sand Light,Orange,Brown								
Rocks:	Quartz Chert								
Abundance:	50-90% Abundant								
Size:	200-600 mm - Stones								
Fire:	> 5 yrs								
Condition:	Excellent								
Notes:	Grazing (Low)								
Veg Unit:									
Location (NW):	50J 497388 6769689								
Species				Height	Cover	Species		Height	Cover
Acacia karina				3	2	Eremophila clarkei		1	1
Acacia sulcaticaulis				3.5	60	Melaleuca nematophylla		4	5
Acacia tetragonophylla				1	1	Mirbelia depressa		0.1	1
Amphipogon caricinus var. caricinus				0.05	0.1	Philotheca deserti subsp. deserti		0.3	0.1
Borya sphaerocephala				0.1	1	Sida sp. Dark Green Fruits (S. van Leeuwen 2260)		0.05	0.1
Calycopeplus paucifolius				1.8	10	Styphelia serratifolia		0.1	0.1
Dianella revoluta var. divaricata				0.6	1				

Site: Phase 2 Q204		Type: Quadrat		Size: 20 x 20	Date: 3/5/2020	Botanist: MH	
Landform:	Drainage,Drainage line on flat						
Slope, aspect:	<1° - Level None						
Soil:	Clay,Loam Red,Orange						
Rocks:	Creek stones Granite						
Abundance:	20-50% Many						
Size:	60-200 mm - Cobbles						
Fire:	> 5 yrs						
Condition:	Excellent						
Notes:	None						
Veg Unit:							
Location (NW):	50J 500862 6773012						
Species		Height	Cover	Species		Height	Cover
Acacia acanthoclada subsp. glaucescens		0.3	0.2	Eucalyptus loxophleba subsp. supralaevis		6	8
Acacia karina		2	0.1	Gastrolobium laytonii		1	0.3
Acacia ramulosa var. ramulosa		2	0.5	Grevillea hakeoides subsp. stenophylla		2	0.2
Acacia tetragonophylla		2	1	Hemigenia yalgensis		0.5	0.1
Allocasuarina dielsiana		3	15	Hybanthus floribundus subsp. curvifolius		0.5	2
Austrostipa elegantissima		0.3	0.01	Ptilotus obovatus		0.3	0.01
Austrostipa trichophylla		0.1	0.01	Rhagodia drummondii		1	0.1
Callitris columellaris		2	0.2	Senna artemisioides subsp. filifolia		15	1
Comesperma integerrimum		0.2	0.1	Sida sp. Dark Green Fruits (S. van Leeuwen 2260)		0.1	0.01
Dianella revoluta var. divaricata		0.3	0.01	Solanum lasiophyllum		0.3	0.1
Dodonaea inaequifolia		2.5	5	Stenanthemum poicilum		0.5	0.1
Eremophila latrobei subsp. latrobei		1	0.1	Styphelia serratifolia		0.2	0.1

Site: Phase 2 Q205		Type: Quadrat		Size: 20 x 20		Date: 3/5/2020		Botanist: CW	
Landform:	Hill,Slope,Lower								
Slope, aspect:	3° - Gentle W								
Soil:	Sand,Clay Light,Orange,Brown								
Rocks:	Quartz Laterite								
Abundance:	50-90% Abundant								
Size:	60-200 mm - Cobbles								
Fire:	> 5 yrs								
Condition:	Excellent								
Notes:	Grazing (Low)								
Veg Unit:									
Location (NW):	50J 500835 6772284								
Species		Height	Cover	Species		Height	Cover		
Acacia andrewsii		1.8	3	Melaleuca hamata		4	1		
Acacia ramulosa var. ramulosa		3	25	Ptilotus obovatus		0.4	2		
Acacia tetragonophylla		2	2	Scaevola spinescens		0.5	1		
Austrostipa variabilis		0.3	0.1	Senna artemisioides subsp. filifolia		1.5	1		
Dodonaea inaequifolia		1.5	0.1	Senna sp. Austin (A. Strid 20210)		0.5	1		
Eremophila clarkei		0.5	1	Sida sp. Dark Green Fruits (S. van Leeuwen 2260)		0.5	0.5		
Eucalyptus loxophleba subsp. supralaevis		8	6	Solanum lasiophyllum		0.5	1		

Site: Phase 2 Q206		Type: Quadrat		Size: 20 x 20	Date: 3/6/2020	Botanist: MH
Landform:	Drainage,Drainage line on flat					
Slope, aspect:	<1° - Level None					
Soil:	Sand,Clay,Loam Red,Orange					
Rocks:	Creek stones -					
Abundance:	2-10% Few					
Size:	6-20 mm - Medium gravel					
Fire:	> 5 yrs					
Condition:	Excellent					
Notes:	Grazing (Low)					
Veg Unit:						
Location (NW):	50J 495021 6768988					
Species		Height	Cover	Species	Height	Cover
Acacia acanthoclada subsp. glaucescens		0.2	0.1	Eriochiton sclerolaenoides	0.1	0.01
Acacia acuminata		2.2	2	Eucalyptus loxophleba subsp. supralaevis	7	3
Acacia ramulosa var. ramulosa		2.2	10	Exocarpos aphyllus	2	0.3
Acacia tetragonophylla		1.5	1	Grevillea hakeoides subsp. stenophylla	2	0.5
Allocasuarina dielsiana		6	3	Maireana tomentosa	0.2	0.01
Austrostipa elegantissima		0.2	0.1	Olearia pimeleoides	0.3	0.01
Dianella revoluta var. divaricata		0.5	0.01	Ptilotus obovatus	0.4	0.5
Dodonia inaequifolia		1.5	0.5	Senna artemisioides subsp. filifolia	1.5	0.5
Enchylaena tomentosa var. tomentosa		0.3	0.01	Sida sp. Dark Green Fruits (S. van Leeuwen 2260)	0.1	0.01
Eremophila clarkei		1	0.1			

Site: Phase 2 Q207		Type: Quadrat		Size: 20 x 20	Date: 3/6/2020	Botanist: CW	
Landform:	Flat,Plain						
Slope, aspect:	3° - Gentle None						
Soil:	Sand,Clay Light,Red,Orange						
Rocks:	Quartz Laterite						
Abundance:	<2% Very few						
Size:	6-20 mm - Medium gravel						
Fire:	> 5 yrs						
Condition:	Excellent						
Notes:	Grazing (Low)						
Veg Unit:							
Location (NW):	50J 495684 6770929						
Species		Height	Cover	Species		Height	Cover
Acacia erinacea		1	2	Eucalyptus salubris		8	7
Acacia ramulosa var. ramulosa		0.5	1	Exocarpos aphyllus		2.5	1
Acacia tetragonophylla		0.5	1	Frankenia setosa		0.1	0.1
Atriplex bunburyana		0.5	3	Ptilotus exaltatus		0.05	1
Austrostipa elegantissima		0.5	0.01	Ptilotus obovatus		0.3	2
Enchylaena tomentosa var. tomentosa		1.5	1	Rhagodia drummondii		0.5	2
Eremophila latrobei subsp. latrobei		0.5	0.1	Rhagodia eremaea		0.6	4
Eremophila oldfieldii subsp. oldfieldii		3	1	Sclerolaena densiflora		0.2	1
Eremophila pantonii		3	4				

Site: Phase 2 Q208		Type: Quadrat		Size: 20 x 20		Date: 3/6/2020		Botanist: MH	
Landform:	Flat,Plain								
Slope, aspect:	<1° - Level None								
Soil:	Sand,Clay Red,Orange								
Rocks:	Ironstone Quartz								
Abundance:	2-10% Few								
Size:	6-20 mm - Medium gravel								
Fire:	> 5 yrs								
Condition:	Excellent								
Notes:	None								
Veg Unit:									
Location (NW):	50J 496667 6771439								
Species			Height	Cover	Species		Height	Cover	
Acacia acuminata			2	2	Eremophila clarkei		1.8	1.2	
Acacia ramulosa var. ramulosa			2.5	15	Eucalyptus loxophleba subsp. supralaevis		9	6	
Acacia tetragonophylla			1	1	Exocarpos aphyllus		2	0.5	
Allocasuarina acutivalvis subsp. prinsepiana			2	0.5	Marsdenia australis		1	0.01	
Austrostipa trichophylla			0.1	0.01	Persoonia pentasticha		0.3	0.1	
Cheilanthes sieberi subsp. sieberi			0.1	0.01	Ptilotus obovatus		0.3	1	
Dodonaea inaequifolia			1.8	0.3	Scaevola spinescens		1.2	0.1	
Acacia acuminata			2	2					

Site: Phase 2 Q209		Type: Quadrat		Size: 20 x 20	Date: 3/6/2020	Botanist: CW	
Landform:	Hill,Slope,Mid						
Slope, aspect:	10° - Moderate W						
Soil:	Sand Light,Orange,White						
Rocks:	Quartz Granite						
Abundance:	50-90% Abundant						
Size:	200-600 mm - Stones						
Fire:	> 5 yrs						
Condition:	Excellent						
Notes:	Grazing (Low)						
Veg Unit:							
Location (NW):	50J 497286 6771184						
Species		Height	Cover	Species		Height	Cover
?Convolvulus remotus		1	0.1	Hemigenia tichbonii		0.6	0.1
Acacia sulcaticaulis		4	65	Lamiaceae sp. 1		0.5	0.1
Allocasuarina acutivalvis subsp. prinsepiana		2.2	25	Micromyrtus trudgenii		0.5	6
Amphipogon caricinus var. caricinus		0.3	0.1	Mirbelia depressa		0.5	1
Calycopeplus paucifolius		2.5	25	Philotheca deserti subsp. deserti		0.5	9
Dianella revoluta var. divaricata		0.5	1	Styphelia serratifolia		0.3	1

Site: Phase 2 Q210		Type: Quadrat		Size: 20 x 20		Date: 3/6/2020		Botanist: MH	
Landform:	Flat,Plain								
Slope, aspect:	1° - Very Gentle S								
Soil:	Sand,Clay Red,Orange								
Rocks:	Granite Quartz								
Abundance:	2-10% Few								
Size:	6-20 mm - Medium gravel								
Fire:	> 5 yrs								
Condition:	Excellent								
Notes:	Grazing (Low)								
Veg Unit:									
Location (NW):	50J 498730 6770481								
Species		Height	Cover	Species		Height	Cover		
Acacia ramulosa var. ramulosa		3	35	Eremophila clarkei		1	0.2		
Acacia tetragonophylla		3	1	Melaleuca stereophloia		4	4		
Austrostipa elegantissima		0.4	0.01	Scaevola spinescens		1	0.5		
Borya sphaerocephala		0.1	0.01	Senna charlesiana		1	0.01		
Cheilanthes sieberi subsp. sieberi		0.1	0.01						

Site: Phase 2 Q211		Type: Quadrat		Size: 20 x 20		Date: 3/6/2020	Botanist: CW
Landform:	Hill,Ridge,Hill						
Slope, aspect:	23° - Steep S						
Soil:	Sand Light,Orange,White						
Rocks:	Quartz Granite						
Abundance:	50-90% Abundant						
Size:	200-600 mm - Stones						
Fire:	> 5 yrs						
Condition:	Excellent						
Notes:	None						
Veg Unit:							
Location (NW):	50J 497689 6770638						
Species		Height	Cover	Species		Height	Cover
?Convolvulus remotus		0.5	0.1	Eremophila latrobei subsp. latrobei		0.5	12
Acacia ramulosa var. ramulosa		3	8	Erodium cygnorum		0.05	0.1
Acacia tetragonophylla		0.5	1	Euphorbia tannensis subsp. eremophila		0.3	0.1
Acacia umbraculiformis		3	10	Philotheca deserti subsp. deserti		0.5	2
Brachychiton gregorii		3	2	Ptilotus obovatus		0.2	0.1
Calycopeplus paucifolius		2.5	22	Sida sp. Dark Green Fruits (S. van Leeuwen 2260)		0.2	0.01
Cheilanthes adiantoides		0.1	0.1	Solanum lasiophyllum		0.5	1
Eremophila clarkei		1	1				

Site: Phase 2 Q212		Type: Quadrat		Size: 20 x 20		Date: 3/6/2020	Botanist: MH
Landform:	Flat,Plain						
Slope, aspect:	<1° - Level None						
Soil:	Sand,Clay Light,Orange						
Rocks:	Granite -						
Abundance:	20-50% Many						
Size:	6-20 mm - Medium gravel						
Fire:	> 5 yrs						
Condition:	Excellent						
Notes:	None						
Veg Unit:							
Location (NW):	50J 498186 6770307						
Species		Height	Cover	Species		Height	Cover
Acacia karina		1	1	Euphorbia tannensis subsp. eremophila		0.2	0.01
Acacia umbraculiformis		4	2	Malleostemon tuberculatus		2	1
Acacia sulcaticaulis		2.5	1	Melaleuca stereophloia		4	3
Borya sphaerocephala		0.1	10	Mirbelia depressa		0.5	0.1
Calycopeplus paucifolius		1.5	1	Sida sp. Dark Green Fruits (S. van Leeuwen 2260)		0.1	0.01
Dodonaea adenophora		0.3	0.01	Solanum lasiophyllum		0.3	0.1
Eremophila clarkei		1	0.01	Thryptomene costata		1.8	8

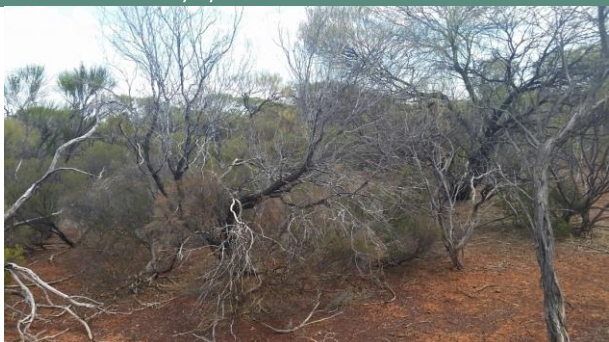
Site: Phase 2 Q213		Type: Quadrat		Size: 20 x 20	Date: 3/6/2020	Botanist: CW
Landform:	Hill,Slope,Upper					
Slope, aspect:	23° - Steep S					
Soil:	Sand Light,Orange,White					
Rocks:	Laterite Granite					
Abundance:	>90% Continuous					
Size:	>600 mm - Boulders					
Fire:	> 5 yrs					
Condition:	Excellent					
Notes:	None					
Veg Unit:						
Location (NW):	50J 497741 6771058					
Species		Height	Cover	Species	Height	Cover
?Convolvulus remotus		0.2	0.1	Dodonaea adenophora	1	1
Acacia assimilis subsp. assimilis		2.5	18	Eremophila clarkei	0.5	1
Acacia karina		1	2	Eremophila latrobei subsp. latrobei	1	4
Acacia ramulosa var. ramulosa		2.5	2	Hemigenia tichbonii	0.5	1
Acacia sulcatacaulis		3	4	Lepidosperma sp. Blue Hills (A. Markey & S. Dillon 3468)	0.5	8
Allocasuarina campestris		2.5	8	Philotheca deserti subsp. deserti	0.5	0.1
Borya sphaerocephala		0.5	3	Santalum spicatum	4	2
Calycopeplus paucifolius		3.5	12	Sida sp. Dark Green Fruits (S. van Leeuwen 2260)	0.05	0.1
Cheilanthes adiantoides		0.05	1	Solanum lasiophyllum	0.4	2

Site: Phase 2 Q214		Type: Quadrat		Size: 20 x 20	Date: 3/7/2020	Botanist: MH
Landform:	Hill,Crest,Hill					
Slope, aspect:	1° - Very Gentle S					
Soil:	Sand,Clay Light,Grey,Brown					
Rocks:	Granite -					
Abundance:	>90% Continuous					
Size:	200-600 mm - Stones					
Fire:	> 5 yrs					
Condition:	Excellent					
Notes:	None					
Veg Unit:						
Location (NW):	50J 499244 6771647					
Species		Height	Cover	Species	Height	Cover
Acacia burkittii		3	5	Calycopeplus paucifolius	2	0.5
Acacia karina		2.5	2	Cheilanthes sieberi subsp. sieberi	0.1	0.01
Allocasuarina tessellata		1.8	25	Gastrolobium laytonii	1	0.1
Borya sphaerocephala		0.1	0.5	Hemigenia tichbonii	1	0.01

Site: Phase 2 Q215		Type: Quadrat		Size: 10 x 40	Date: 3/7/2020	Botanist: CW	
Landform:	Drainage, Drainage line on flat						
Slope, aspect:	1° - Very Gentle None						
Soil:	Sand Red, Orange						
Rocks:	Laterite Quartz						
Abundance:	20-50% Many						
Size:	60-200 mm - Cobbles						
Fire:	> 5 yrs						
Condition:	Excellent						
Notes:	Grazing (Medium)						
Veg Unit:							
Location (NW):	50J 499603 6772630						
Species		Height	Cover	Species		Height	Cover
Acacia acanthoclada subsp. glaucescens		0.5	12	Exocarpos aphyllus		2	1
Acacia acuminata		2	1	Gastrolobium laytonii		2.5	5
Acacia exocarpoides		2	2	Hemigenia tichbonii		1	6
Acacia ramulosa var. ramulosa		2	1	Persoonia pentasticha		0.4	1
Acacia tetragonophylla		3	40	Ptilotus exaltatus		0.05	1
Allocasuarina dielsiana		10	5	Ptilotus obovatus		0.5	1
Allocasuarina tessellata		4	1	Rhagodia drummondii		0.5	1
Austrostipa elegantissima		0.5	1	Santalum acuminatum		7	1
Dodonia inaequifolia		2.2	35	Senna artemisioides subsp. filifolia		1	4
Eremophila oldfieldii subsp. oldfieldii		2	6	Sida sp. Dark Green Fruits (S. van Leeuwen 2260)		0.1	0.1
Eucalyptus loxophleba subsp. supralaevis		8	60	Stenanthemum poicilum		0.5	1

Site: Phase 2 Q216		Type: Quadrat		Size: 20 x 20		Date: 3/10/2020		Botanist: MH	
Landform:	Hill,Slope,Simple								
Slope, aspect:	3° - Gentle S								
Soil:	Clay Light,Grey,Brown								
Rocks:	Quartz -								
Abundance:	>90% Continuous								
Size:	200-600 mm - Stones								
Fire:	> 5 yrs								
Condition:	Excellent								
Notes:	Clearing								
Veg Unit:									
Location (NW):	50J 496566 6772531								
Species		Height	Cover	Species		Height	Cover		
Acacia acanthoclada subsp. glaucescens		0.5	2	Frankenia setosa		0.2	2		
Acacia andrewsii		0.7	3	Maireana tomentosa		0.1	1		
Acacia burkittii		2	0.1	Olearia muelleri		0.5	4		
Enchylaena tomentosa var. tomentosa		0.3	0.01	Ptilotus obovatus		0.3	0.01		
Eremophila oppositifolia		1.5	7	Rhagodia drummondii		0.5	0.1		
Eucalyptus loxophleba subsp. supralaevis		6	5	Sclerolaena diacantha		0.1	0.5		
Exocarpos aphyllus		2.5	1						

Site: Phase 2 Q217		Type: Quadrat		Size: 20 x 20	Date: 3/10/2020	Botanist: CW
Landform:	Hill,Slope,Mid					
Slope, aspect:	10° - Moderate S					
Soil:	Sand,Clay Light,Orange,White					
Rocks:	Quartz -					
Abundance:	20-50% Many					
Size:	60-200 mm - Cobbles					
Fire:	> 5 yrs					
Condition:	Excellent					
Notes:	Grazing (Low)					
Veg Unit:						
Location (NW):	50J 497264 6773131					
Species		Height	Cover	Species	Height	Cover
?Convolvulus remotus		0.2	0.1	Chamelaucium sp. Warriedar (A.P. Brown & S. Patrick APB 1100)	0.5	0.1
Acacia acuminata		2	8	Erodium cygnorum	0.05	0.1
Acacia karina		2	2	Grevillea scabrida	0.5	1
Acacia tetragonophylla		2	4	Melaleuca radula	2.5	1
Allocasuarina tessellata		4	40	Mirbelia microphylla	0.5	0.1
Borya sphaerocephala		0.05	18	Ptilotus obovatus	0.5	1
Calothamnus ailesii		2	8			

Site: Phase 2 Q218		Type: Quadrat		Size: 20 x 20		Date: 3/10/2020		Botanist: MH	
Landform:	Hill,Slope,Simple								
Slope, aspect:	1° - Very Gentle S,E								
Soil:	Sand,Clay Red,Orange								
Rocks:	Ironstone -								
Abundance:	>90% Continuous								
Size:	6-20 mm - Medium gravel								
Fire:	> 5 yrs								
Condition:	Excellent								
Notes:	None								
Veg Unit:									
Location (NW):	50J 495725 6773285								
Species			Height	Cover	Species		Height	Cover	
Acacia caesaneura			3	1	Philotheca sericea		1.5	2	
Acacia ramulosa var. ramulosa			3	5	Eremophila latrobei subsp. latrobei		1	0.1	
Acacia umbraculiformis			4	0.5	Hibbertia arcuata		1	0.5	
Allocasuarina acutivalvis subsp. prinsepiana			2.2	5	Micromyrtus acuta		1	15	
Calycopeplus paucifolius			2	0.5	Persoonia pentasticha		3	1	
Dianella revoluta var. divaricata			0.3	0.01	Philotheca brucei subsp. brucei		1	0.01	

Site: Phase 2 Q219		Type: Quadrat		Size: 20 x 20	Date: 3/10/2020	Botanist: CW
Landform:	Hill,Slope,Mid					
Slope, aspect:	10° - Moderate S,W					
Soil:	Sand,Clay,Loam Red,Brown					
Rocks:	Laterite Ironstone					
Abundance:	20-50% Many					
Size:	60-200 mm - Cobbles					
Fire:	> 5 yrs					
Condition:	Excellent					
Notes:	None,Grazing (Low)					
Veg Unit:						
Location (NW):	50J 497601 6772897					
Species		Height	Cover	Species	Height	Cover
?Convolvulus remotus		0.05	0.1	Erodium cygnorum	0.05	0.1
Acacia acuminata		3	7	Grevillea scabrida	0.5	7
Acacia diallaga		0.5	1	Haloragis odontocarpa	0.2	0.1
		3	1	Hemigenia tichbonii	1	1
Acacia karina		2	2	Mirbelia microphylla	0.5	0.1
Acacia tetragonophylla		2	2	Persoonia pentasticha	0.5	0.1
Acacia umbraculiformis		4	62	Ptilotus obovatus	0.5	8
Allocasuarina tessellata		0.5	1	Sida sp. Dark Green Fruits (S. van Leeuwen 2260)	0.05	0.1
Austrostipa scabra		0.7	0.1	Solanum lasiophyllum	0.5	1
Dodonaea inaequifolia		2	2	Styphelia serratifolia	0.5	1

Site: Phase 2 Q220		Type: Quadrat		Size: 20 x 20		Date: 3/11/2020	Botanist: MH
Landform:	Flat,Plain						
Slope, aspect:	<1° - Level None						
Soil:	Sand,Clay Red,Orange						
Rocks:	Quartz -						
Abundance:	<2% Very few						
Size:	6-20 mm - Medium gravel						
Fire:	> 5 yrs						
Condition:	Excellent						
Notes:	None						
Veg Unit:							
Location (NW):	50J 497499 6768561						
Species		Height	Cover	Species		Height	Cover
Acacia acuminata		2.2	2	Maireana tomentosa		0.3	0.1
Acacia ramulosa var. ramulosa		3	15	Ptilotus obovatus		0.3	1
Acacia tetragonophylla		3	2	Rhagodia eremaea		0.5	0.01
Austrostipa elegantissima		0.5	0.01	Scaevola spinescens		0.5	0.01
Comesperma integerrimum		0.1	0.81	Senna artemisioides subsp. filifolia		1.5	0.2
Dianella revoluta var. divaricata		0.3	0.01	Sida sp. Dark Green Fruits (S. van Leeuwen 2260)		0.1	0.01
Enchylaena tomentosa var. tomentosa		0.4	0.1	Solanum lasiophyllum		0.1	0.01
Eucalyptus loxophleba subsp. supralaevis		8	8				

Site: Phase 2 Q221		Type: Quadrat		Size: 20 x 20		Date: 3/11/2020		Botanist: CW	
Landform:	Flat,Plain								
Slope, aspect:	1° - Very Gentle None								
Soil:	Sand,Clay Light,Red,Orange								
Rocks:	Quartz -								
Abundance:	<2% Very few								
Size:	<6 mm - Fine gravel								
Fire:	> 5 yrs								
Condition:	Excellent								
Notes:	None								
Veg Unit:									
Location (NW):	50J 497277 6768692								
Species		Height	Cover	Species		Height	Cover		
?Convolvulus remotus		0.2	0.1	Erodium cygnorum		0.02	0.1		
Acacia acuminata		2.5	1	Eucalyptus ewartiana		4	12		
Acacia ramulosa var. ramulosa		3	23	Ptilotus obovatus		0.5	4		
Acacia tetragonophylla		1.5	2	Rhagodia eremaea		0.5	0.1		
Allocasuarina tessellata		3.5	1	Scaevola spinescens		0.5	1		
Austrostipa elegantissima		0.5	1	Senna artemisioides subsp. filifolia		1	0.1		
Eremophila oldfieldii subsp. oldfieldii		2.5	1	Sida sp. Dark Green Fruits (S. van Leeuwen 2260)		0.2	0.1		

Site: Phase 2 Q222		Type: Quadrat		Size: 20 x 20		Date: 3/11/2020		Botanist: MH	
Landform:	Hill,Slope,Lower								
Slope, aspect:	3° - Gentle S,W								
Soil:	Sand,Clay Orange,Brown								
Rocks:	Granite -								
Abundance:	50-90% Abundant								
Size:	200-600 mm - Stones								
Fire:	> 5 yrs								
Condition:	Excellent								
Notes:	None								
Veg Unit:									
Location (NW):	50J 497921 6769642								
Species				Height	Cover	Species		Height	Cover
Acacia acuminata				3	15	Eremophila clarkei		1	0.1
Acacia karina				2.2	1	Grevillea scabrida		0.3	0.1
Acacia sulcaticaulis				1.8	0.5	Hemigenia yalgensis		0.3	0.01
Acacia tetragonophylla				3	1	Melaleuca hamata		4	2
Allocasuarina tessellata				2	0.2	Melaleuca radula		1	0.1
Amphipogon caricinus var. caricinus				0.1	0.01	Mirbelia microphylla		0.3	0.01
Borya sphaerocephala				0.1	5	Styphelia serratifolia		0.2	0.1
Dodonaea adenophora				0.4	0.01				

Site: Phase 2 Q223		Type: Quadrat		Size: 20 x 20		Date: 3/11/2020	Botanist: CW
Landform:	Hill,Slope,Lower						
Slope, aspect:	1° - Very Gentle None						
Soil:	Sand,Hard clay Light,Red,Orange						
Rocks:	Granite Quartz						
Abundance:	2-10% Few						
Size:	60-200 mm - Cobbles						
Fire:	> 5 yrs						
Condition:	Excellent						
Notes:	Clearing						
Veg Unit:							
Location (NW):	50J 498522 6769695						
Species		Height	Cover	Species		Height	Cover
Acacia acuminata		2.5	2	Borya sphaerocephala		0.05	2
Allocasuarina campestris		6	2	Erodium cygnorum		0.02	0.1
Allocasuarina tessellata		2	78				

Site: Phase 2 Q224		Type: Quadrat	Size: 20 x 20	Date: 3/11/2020	Botanist: MH	
Landform:	Flat,Plain					
Slope, aspect:	1° - Very Gentle None					
Soil:	Sand,Clay Red,Orange					
Rocks:	Ironstone -					
Abundance:	>90% Continuous					
Size:	6-20 mm - Medium gravel					
Fire:	> 5 yrs					
Condition:	Excellent					
Notes:	None					
Veg Unit:						
Location (NW):	50J 494561 6770773					
Species		Height	Cover	Species	Height	Cover
Acacia burkittii		3	4	Eremophila latrobei subsp. latrobei	1	0.2
Acacia ramulosa var. ramulosa		3	5	Melaleuca nematophylla	3	0.3
Acacia sibina		3	3	Micromyrtus acuta	0.7	15
Acacia tetragonophylla		1.5	0.5	Persoonia pentasticha	3	2
Dianella revoluta var. divaricata		0.5	0.1	Philotheca deserti subsp. deserti	1.5	1

Site: Phase 2 Q225		Type: Quadrat		Size: 20 x 20		Date: 3/11/2020		Botanist: CW	
Landform:	Flat,Plain								
Slope, aspect:	1° - Very Gentle None								
Soil:	Sand,Clay Red,Orange								
Rocks:	Granite Ironstone								
Abundance:	50-90% Abundant								
Size:	6-20 mm - Medium gravel								
Fire:	> 5 yrs								
Condition:	Excellent								
Notes:	Clearing,Litter,Tracks								
Veg Unit:									
Location (NW):	50J 494850 6770669								
Species		Height	Cover	Species		Height	Cover		
Acacia acanthoclada subsp. glaucescens		0.5	0.1	Ptilotus exaltatus		0.05	0.1		
Eucalyptus salubris		9	18	Tecticornia ?halocnemoides		0.5	27		
Maireana tomentosa		0.02	0.1						

Site: Phase 2 Q226		Type: Quadrat		Size: 20 x 20	Date: 3/12/2020	Botanist: MH	
Landform:	Hill,Slope,Simple						
Slope, aspect:	3° - Gentle S						
Soil:	Sand,Clay Red,Orange						
Rocks:	Ironstone -						
Abundance:	>90% Continuous						
Size:	20-60 mm - Coarse gravel						
Fire:	> 5 yrs						
Condition:	Excellent						
Notes:	None						
Veg Unit:							
Location (NW):	50J 495840 6768400						
Species		Height	Cover	Species		Height	Cover
Acacia assimilis subsp. assimilis		3	1	Eremophila latrobei subsp. latrobei		1	0.5
Acacia ramulosa var. ramulosa		4	8	Melaleuca nematophylla		3	0.5
Allocasuarina acutivalvis subsp. prinsepiana		2	0.3	Micromyrtus acuta		1	15
Austrostipa elegantissima		0.3	0.01	Persoonia pentasticha		1.8	1
Eremophila clarkei		1	0.01	Philotheca brucei subsp. brucei		1	0.5

Site: Phase 2 Q227		Type: Quadrat		Size: 20 x 20	Date: 3/13/2020	Botanist: CW
Landform:	Flat,Plain					
Slope, aspect:	1° - Very Gentle None					
Soil:	Sand,Clay Orange,Brown					
Rocks:	Laterite Ironstone					
Abundance:	50-90% Abundant					
Size:	6-20 mm - Medium gravel					
Fire:	> 5 yrs					
Condition:	Excellent					
Notes:	Grazing (Low)					
Veg Unit:						
Location (NW):	50J 494870 6769628					
Species		Height	Cover	Species	Height	Cover
Acacia acanthoclada subsp. glaucescens		0.5	2	Eremophila oldfieldii subsp. oldfieldii	4.5	1
Acacia caesaneura		7	2	Eucalyptus loxophleba subsp. lissophloia	7	22
Acacia ramulosa var. linophylla		3.5	5	Maireana georgei	0.5	1.5
Acacia ramulosa var. ramulosa		2	1	Maireana tomentosa	0.5	1
Acacia tetragonophylla		1.5	2	Ptilotus obovatus	0.5	1
Austrostipa elegantissima		0.3	0.1	Ptilotus schwartzii	0.2	0.1
Enchylaena tomentosa var. tomentosa		0.5	0.1	Senna artemisioides subsp. filifolia	1.5	3
Eremophila clarkei		1	1			

Site: Phase 2 Q228		Type: Quadrat		Size: 20 x 20	Date: 3/13/2020	Botanist: MH
Landform:	Drainage,Drainage line on flat					
Slope, aspect:	<1° - Level None					
Soil:	Sand,Clay Red					
Rocks:	Ironstone -					
Abundance:	>90% Continuous					
Size:	6-20 mm - Medium gravel					
Fire:	> 5 yrs					
Condition:	Excellent					
Notes:	None					
Veg Unit:						
Location (NW):	50J 494421 6769670					
Species		Height	Cover	Species	Height	Cover
Acacia acuminata		3.5	8	Hemigenia sp. Yalgoo (A.M. Ashby 2624)	0.3	0.01
Acacia caesaneura		4	2	Hemigenia tichbonii	1	0.2
Acacia sibina		1	0.1	Lepidosperma sp. Blue Hills (A. Markey & S. Dillon 3468)	0.5	3
Acacia tetragonophylla		3	2	Leucopogon sp. Clyde Hill (M.A. Burgman 1207)	1	0.1
Amphipogon caricinus var. caricinus		0.2	0.01	Melaleuca stereophloia	4	15
Austrostipa elegantissima		0.5	0.01	Mirbelia depressa	0.3	0.01
Callitris columellaris		0.3	0.01	Persoonia manotricha	1.8	2
Dianella revoluta var. divaricata		0.3	0.01	Persoonia pentasticha	0.4	0.1
Eucalyptus ewartiana		4	1	Styphelia serratifolia	0.3	0.01
Exocarpos aphyllus		2	0.5	Thryptomene costata	1.8	4
Grevillea scabrada		0.4	3			

Site: Phase 2 Q229		Type: Quadrat		Size: 20 x 20		Date: 3/13/2020	Botanist: CW
Landform:	Hill,Slope,Mid						
Slope, aspect:	23° - Steep S						
Soil:	Sand,Clay Red,Orange						
Rocks:	Laterite Granite						
Abundance:	50-90% Abundant						
Size:	200-600 mm - Stones						
Fire:	> 5 yrs						
Condition:	Excellent						
Notes:	Grazing (Low)						
Veg Unit:							
Location (NW):	50J 498208 6773005						
Species		Height	Cover	Species		Height	Cover
?Convolvulus remotus		0.5	1	Dodonaea inaequifolia		2	7
Acacia acuminata		2.5	12	Eremophila clarkei		0.4	1
Acacia diallaga		0.5	6	Eremophila serrulata		1	5
Acacia karina		3	2	Erodium cygnorum		0.05	0.1
Acacia tetragonophylla		2	2	Grevillea scabrada		0.5	5
Acacia umbraculiformis		4	8	Haloragis odontocarpa		0.5	1
Allocasuarina dielsiana		5	2	Ptilotus obovatus		0.5	5

Site: Phase 2 Q230		Type: Quadrat		Size: 20 x 20		Date: 3/13/2020		Botanist: MH	
Landform:	Hill,Slope,Simple								
Slope, aspect:	10° - Moderate S								
Soil:	Sand,Clay Red,Orange								
Rocks:	Ironstone -								
Abundance:	>90% Continuous								
Size:	60-200 mm - Cobbles								
Fire:	> 5 yrs								
Condition:	Excellent								
Notes:	None								
Veg Unit:									
Location (NW):	50J 498305 6773088								
Species				Height	Cover	Species		Height	Cover
Acacia acuminata				3	15	Eremophila forrestii subsp. forrestii		1.5	0.2
Acacia karina				1	0.3	Erodium cygnorum		0.1	0.01
Acacia tetragonophylla				0.5	0.01	Grevillea scabrida		0.4	1
Acacia umbraculiformis				4	15	Hemigenia tichbonii		0.3	0.01
Borya sphaerocephala				0.1	0.01	Ptilotus obovatus		0.3	0.01
Dodonaea amplisemina				0.4	2	Sida sp. Dark Green Fruits (S. van Leeuwen 2260)		0.1	0.01
Dodonaea inaequifolia				0.2	0.01	Solanum lasiophyllum		0.5	0.01
Eremophila clarkei				1	0.01	Styphelia serratifolia		0.1	0.01

Site: Phase 2 Q231		Type: Quadrat		Size: 20 x 20		Date: 3/13/2020	Botanist: MH
Landform:	Hill,Slope,Upper						
Slope, aspect:	10° - Moderate S,E						
Soil:	Sand,Clay Light,Orange						
Rocks:	Granite -						
Abundance:	>90% Continuous						
Size:	60-200 mm - Cobbles						
Fire:	> 5 yrs						
Condition:	Excellent						
Notes:	None						
Veg Unit:							
Location (NW):	50J 497763 6771959						
Species		Height	Cover	Species		Height	Cover
Acacia burkittii		1.5	0.2	Gastrolobium laytonii		1	0.5
Acacia sulcatacaulis		4	3	Melaleuca nematophylla		3	2
Allocasuarina acutivalvis subsp. prinsepiana		4	30	Micromyrtus trudgenii		1	0.1
Allocasuarina campestris		3	3	Mirbelia microphylla		0.3	0.1
Amphipogon caricinus var. caricinus		0.1	0.01	Phebalium tuberculosum		1	5
Calycopeplus paucifolius		1.5	3	Styphelia serratifolia		0.5	1
Dianella revoluta var. divaricata		0.3	0.01	Xanthosia kochii		0.2	2
Philotheca sericea		1	1				

Site: Phase 2 R201		Type: Releve		Size: -		Date: 3/11/2020	Botanist: CW	
Landform:	Hill,Slope,Upper							
Slope, aspect:	1° - Very Gentle None							
Soil:	Sand Light,Orange,White							
Rocks:	Granite Quartz							
Abundance:	20-50% Many							
Size:	20-60 mm - Coarse gravel							
Fire:	> 5 yrs							
Condition:	Excellent							
Notes:	None							
Veg Unit:								
Location (NW):	50J 498133 6769643							
Species		Height	Cover	Species		Height	Cover	
Acacia karina		2	8	Calycopeplus paucifolius		2	10	
Acacia sulcaticaulis		2	81	Phebalium tuberculosum		0.5	2	
Allocasuarina tessellata		2	5					

Site: Phase 2 R202		Type: Releve		Size: -		Date: 3/6/2020		Botanist: MH	
Landform:	Flat,Plain								
Slope, aspect:	<1° - Level None								
Soil:	Sand,Clay Red,Orange								
Rocks:	Ironstone -								
Abundance:	<2% Very few								
Size:	<6 mm - Fine gravel								
Fire:	> 5 yrs								
Condition:	Excellent								
Notes:	None								
Veg Unit:									
Location (NW):	50J 494954 6768991								
Species		Height	Cover	Species		Height	Cover		
Acacia ramulosa var. ramulosa		2.5	3	Exocarpos aphyllus		2.5	5		
Eucalyptus clelandiorum		6	5	Ptilotus obovatus		0.4	0.5		
Eucalyptus loxophleba subsp. supralaevis		5	3	Senna artemisioides subsp. filifolia		1.5	3		

Site: Phase 2 R203		Type: Releve		Size: -		Date: 3/13/2020	Botanist: CW	
Landform:	Hill,Slope,Mid							
Slope, aspect:	10° - Moderate N							
Soil:	Sand,Clay Light,Orange,White							
Rocks:	Granite Quartz							
Abundance:	50-90% Abundant							
Size:	200-600 mm - Stones							
Fire:	> 5 yrs							
Condition:	Excellent							
Notes:	Clearing							
Veg Unit:								
Location (NW):	50J 500306 6772268							
Species		Height	Cover	Species		Height	Cover	
Acacia umbraculiformis		4	12	Thryptomene costata		2	27	

Site: Phase 2 R204		Type: Releve		Size: -		Date: 3/9/2020		Botanist: MH	
Landform:	Drainage, Drainage line on flat								
Slope, aspect:	<1° - Level None								
Soil:	Sand, Clay Red, Brown								
Rocks:	- -								
Abundance:	No rocks								
Size:	-								
Fire:	> 5 yrs								
Condition:	Excellent								
Notes:	None								
Veg Unit:									
Location (NW):	50J 497272 6768987								
Species		Height	Cover	Species		Height	Cover		
Acacia ramulosa var. ramulosa		3	25	Dodonaea inaequifolia		2.5	2		
Acacia tetragonophylla		3	5	Eucalyptus loxophleba subsp. supralaevis		8	5		

Site: Phase 2 R205		Type: Releve	Size: -	Date: 3/13/2020	Botanist: MH	
Landform:	Flat, Plain					
Slope, aspect:	<1° - Level None					
Soil:	Clay Red, Orange					
Rocks:	Ironstone Quartz					
Abundance:	50-90% Abundant					
Size:	60-200 mm - Cobbles					
Fire:	> 5 yrs					
Condition:	Excellent					
Notes:	None					
Veg Unit:						
Location (NW):	50J 500894 6771860					
Species		Height	Cover	Species	Height	Cover
Eucalyptus loxophleba subsp. lissophloia		8	15	Sclerolaena diacantha	0.1	1
Ptilotus obovatus		0.3	0.5			

Site: Phase 2 R206		Type: Releve		Size: -		Date: 3/11/2020	Botanist: MH
Landform:	Hill,Slope,Simple						
Slope, aspect:	3° - Gentle E						
Soil:	Sand,Clay Red,Orange						
Rocks:	Ironstone -						
Abundance:	>90% Continuous						
Size:	6-20 mm - Medium gravel						
Fire:	> 5 yrs						
Condition:	Excellent						
Notes:	None						
Veg Unit:							
Location (NW):	50J 494170 6770014						
Species		Height	Cover	Species		Height	Cover
Acacia ramulosa var. ramulosa		3	15	Hibbertia arcuata		1	0.5
Allocauarina acutivalvis subsp. prinsepiana		3	5	Persoonia pentasticha		3	1

Appendix C: Flora Site by Species Matrix



Taxa	ElAr	ElAr	AdAa	Ad/At	AaAr	AdAa	AdAa	AaAr	Ad/At	ElAr	EsTh	AdAa	AdAa	AdAa	Ad/At	ElAr	AdAa	ElAr	ElAr	AdAa	ElAr	AdAa	ElAr	AdAa	ElAr	AdAa	OC	AaAr	AsCp	AsCp	ElAt	ElAr	ElAt	ElAr	ElAr	AsCp		
	M001	M002	M003	M004	M005	M006	M007	M008	M009	M010	M011	M012	M013	M014	M015	M016	M017	M018	M019	M020	M021	M022	M023	M024	M025	M026	M027	OC	Q201	Q202	Q203	Q204	Q205	Q206	Q207	Q208	Q209	
<i>Abutilon cryptopetalum</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-		
<i>Acacia acanthoclada subsp. glaucescens</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	0.1	-	-	-	-	-	-	-	-	-	-	-	-	0.2	-	0.1	-	-		
<i>Acacia acuminata</i>	-	0.1	15	-	-	35	-	1.5	-	0.1	-	3	2	1	10	-	25	30	-	2	-	12	-	15	-	-	20	-	5	-	-	-	-	2	-	2	-	
<i>Acacia andrewsii</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	0	-	-	-	-	3	-	-	-	-	
<i>Acacia assimilis subsp. assimilis</i>	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	
<i>Acacia aulacophylla</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Acacia burkittii</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Acacia caesaneura</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	
<i>Acacia colletioides</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	
<i>Acacia diallaga</i>	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	1	-	-	-	0.1	-	-	-	-	-	-	-	-	-	
<i>Acacia duriuscula</i>	-	-	-	1	-	-	-	-	15	0.2	-	-	-	-	30	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	
<i>Acacia erinacea</i>	0.01	-	-	-	-	-	-	-	-	0.2	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	
<i>Acacia exocarpoides</i>	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	
<i>Acacia karina</i>	-	-	-	-	-	-	-	-	-	-	-	0.5	15	-	-	-	0.5	-	-	-	-	-	5	-	5	-	-	1.2	-	1	2	0.1	-	-	-	-	-	-
<i>Acacia latior</i>	-	-	-	-	-	-	-	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	
<i>Acacia puncticulata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	
<i>Acacia quadrimarginea</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	3	-	-	-	-	-	-	-	
<i>Acacia ramulosa var. linophylla</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-	-	
<i>Acacia ramulosa var. ramulosa</i>	15	0	-	-	50	-	-	-	-	-	-	10	-	3	-	10	1	0.5	15	25	0.1	-	2	15	25	40	15	0	15	-	-	0.8	27	10	1	15	-	
<i>Acacia sibina</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	
<i>Acacia sp. 1</i>	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Acacia sulcaticaulis</i>	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	70	-	-	60	-	-	-	-	-	65	
<i>Acacia tetragonophylla</i>	1	0.5	2	-	0.1	0.2	0.1	0.1	-	0.1	-	-	1	0.2	-	0.2	-	1	2	1.5	1	0.2	-	0.5	2	0.1	-	-	1	-	1	1	2	1	1	1	-	-
<i>Acacia umbraculiformis</i>	-	-	-	-	-	-	1	-	-	-	-	-	-	10	-	3	-	-	-	-	-	2	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-	
<i>Actinobole uliginosum</i>	0.01	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	
<i>Allocastrum acutivalvis subsp. prinsepiana</i>	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	25		
<i>Allocastrum campestre</i>	-	-	51	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	110	-	-	-	-	-	-	-	-	-	
<i>Allocastrum dielsiana</i>	-	-	20	-	-	1	0.5	-	-	-	-	12	2.1	2	-	-	2	12	-	1.5	-	12	-	2	-	-	2	-	-	-	-	15	-	3	-	-	-	
<i>Allocastrum sp.</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Allocastrum tessellata</i>	0.1	-	0	-	-	2	90	-	-	-	-	-	-	-	-	-	14	0.5	-	2	-	1.5	-	1	-	-	2	-	-	-	-	-	-	-	-	-	-	
<i>Alyogyne hakeifolia</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	
<i>Alyxia buxifolia</i>	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	
<i>Amphipogon caricinus var. caricinus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	1	-	0.1	-	-	-	-	-	0.1	
<i>Amyema preissii</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	
<i>Androcalva luteiflora</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	
<i>Arctotheca calendula</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Arthropodium dyeri</i>	-	-	-	-	-	-	-	-	-	-	-	0.01	-	0.01	0.1	-	0.2	0.2	-	-	-	0.2	-	0.1	0.2	0.1	0.1	-	-	-	-	-	-	-	-	-	-	
<i>Asteraceae sp.</i>	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Atriplex bunburyana</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	
<i>Atriplex sp.</i>	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Atriplex vesicaria</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	
<i>Atriplex semilunaris</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01	-	-															

Taxa	EIAr	EIAr	AdAa	Ad/At	AaAr	AdAa	AdAa	AaAr	Ad/At	EIAr	EsTh	AdAa	AdAa	AdAa	Ad/At	EIAr	AdAa	EIAr	EIAr	AdAa	EIAr	AdAa	EIAr	AdAa	EIAr	AdAa	OC	AaAr	AsCp	AsCp	EIAr	EIAr	EIAr	EIAr	AsCp	
	M001	M002	M003	M004	M005	M006	M007	M008	M009	M010	M011	M012	M013	M014	M015	M016	M017	M018	M019	M020	M021	M022	M023	M024	M025	M026	M027	OC	Q201	Q202	Q203	Q204	Q205	Q206	Q207	Q208
<i>Bellida graminea</i>	-	-	-	0.01	0.1	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Blennospora drummondii</i>	0.01	-	1	-	0.1	0.1	1	-	-	-	-	-	0.1	0.01	0.1	-	-	0.01	-	-	-	0.01	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-
<i>Borya sphaerocephala</i>	-	-	-	-	-	0.01	2	-	-	-	-	0.01	1	0.1	25	-	-	-	-	-	-	-	-	5	-	-	-	2	-	3	1	-	-	-	-	-
<i>Brachychiton gregorii</i>	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	0.5	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-
<i>Brachyscome ciliaris</i>	-	0.01	-	0.01	-	-	0.1	0.01	-	-	-	0.01	-	-	-	-	0.1	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Bromus arenarius</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2	-	-	-	-	-	-	-	-	-	-	-
<i>Bromus diandrus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Brunonia</i> sp. Goldfields (K.R. Newbey 6044)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	
<i>Bulbine semibarbata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	
<i>Bursaria occidentalis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Caesia</i> ? <i>micrantha</i>	-	-	-	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-	0.01	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Caesia</i> sp. Wongan (K.F. Kenneally 8820)	-	0.01	0.5	-	0.01	0.01	0.1	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	
<i>Caladenia</i> sp. 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Caladenia</i> sp. 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	
<i>Calandrinia</i> ? <i>polyandra</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	
<i>Calandrinia baccata</i>	0.1	0.01	-	-	-	0.01	-	-	-	0.01	-	-	-	-	-	0.01	-	-	-	-	0	-	0.01	-	-	-	-	0.01	-	-	-	-	-	-	-	-
<i>Calandrinia</i> sp.	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Calandrinia</i> sp. Truncate capsules (A. Markey & S. Dillon 3474)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Callistemon phoeniceus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	
<i>Callitris columellaris</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	0.2	-	-	-	-	
<i>Calocephalus multiflorus</i>	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Calothamnus gilesii</i>	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Calotis hispidula</i>	0.01	0.01	-	-	-	-	-	-	-	0.01	-	-	-	-	-	0.01	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Calotis multicaulis</i>	-	0.1	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	0.5	-	-	-	0.01	-	0.1	0.1	0.1	0.1	-	-	-	-	-	-	-	-	-
<i>Calycopeplus paucifolius</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15	-	0.5	10	-	-	-	-	25	
<i>Cephalopterum drummondii</i>	0.5	0.1	-	-	0.1	0.1	0.1	-	-	0.01	2	0.2	12.1	0.1	-	0.1	0.1	-	0.1	0.1	0.2	0.1	0.1	1	1	-	0.1	-	-	-	-	-	-	-	-	
<i>Chamaexeros macranthera</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	
<i>Chamaelaucium pauciflorum</i> subsp. <i>Perenjori</i> (B.J Conn 2181)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	
<i>Chamaelaucium</i> sp. Warriedar (A.P. Brown & S. Patrick APB 1100)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	
<i>Cheilanthes adiantoides</i>	-	0.01	10	0.01	0.01	0.1	0.1	0.1	-	-	-	0.1	0.1	0.1	0.1	-	0.1	0.5	-	0.1	-	0.1	-	0.1	0.1	0.1	0.1	-	-	-	-	-	-	-	-	
<i>Cheilanthes brownii</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	
<i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01	-	
<i>Cheiranthera simplicifolia</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Chenopodiaceae</i> sp.	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Chthonocephalus pseudevax</i>	-	-	-	-	0.01	-	-	-	-	-	-	-	0.1	0.01	0.1	-	-	-	-	-	-	0.01	-	0.1	0.1	-	-	-	-	-	-	-	-	-	-	
<i>Codonocarpus cotinifolius</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	
<i>Comesperma integerrimum</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01	0.1	-	-	0.1	-	-	-	-	0	0.1	-	-	0.1	-	-	-	-	
<i>Convolvulus remotus</i> ?	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	0.1	-
<i>Cratystylis subspinescens</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	
<i>Cuscuta planiflora</i>	0.01	0.01	0.1	0.1	-	0.01	-	0.1	-	0.01	-	0.1	0.1	0.1	0.1	-	0.1	1.5	-	-	-	0.5	-	0.1	0.1	-	0.1	-	-	-	-	-	-	-	-	
<i>Cyanicula amplexans</i>	-	-	-	-	-	-	0	0.01	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Daucus glochidiatus</i>	-	-	-	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	
<i>Dianella revoluta</i> var. <i>divaricata</i>	-	0.01	-	-	-	0.01	-	0.01	-	-	-	-	-	-	-	-	-	0.1	-	0.1	-	-	-	-	-	0.1	-	-	1	0.01	1	0.01	-	0.01	1	
<i>Dodonaea adenophora</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	
<i>Dodonaea amplisemina</i>	-	-	-</																																	

Taxa	ElAr	ElAr	AdAa	Ad/At	AaAr	AdAa	AdAa	AaAr	Ad/At	ElAr	EsTh	AdAa	AdAa	AdAa	Ad/At	ElAr	AdAa	ElAr	ElAr	AdAa	ElAr	AdAa	ElAr	AdAa	ElAr	ElAr	AdAa	OC	AaAr	AsCp	AsCp	ElAt	ElAr	ElAt	ElAr	ElAr	AsCp
	M001	M002	M003	M004	M005	M006	M007	M008	M009	M010	M011	M012	M013	M014	M015	M016	M017	M018	M019	M020	M021	M022	M023	M024	M025	M026	M027	OC	Q201	Q202	Q203	Q204	Q205	Q206	Q207	Q208	Q209
<i>Dodonaea rigida</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	
<i>Drosera</i> sp. <i>Branched styles</i> (S.C. Coffey 193)	-	0.01	0.01	0.01	0.01	0.01	0.01	0.01	-	-	-	-	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Ehrharta longiflora</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
<i>Enchylaena lanata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
<i>Enchylaena tomentosa</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01	1.1	-	-		
<i>Eremophila clarkei</i>	-	-	0.01	-	5	-	-	-	7.1	-	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	1	-	1	0.1	-	1.2	
<i>Eremophila eriocalyx</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-		
<i>Eremophila forrestii</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-		
<i>Eremophila forrestii</i> subsp. <i>forrestii</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-		
<i>Eremophila georgei</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-		
<i>Eremophila latrobei</i> subsp. <i>latrobei</i>	-	-	-	0.1	1	-	-	-	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	0.1	0.1	-	0.1	-	-	0.1	-		
<i>Eremophila oldfieldii</i> subsp. <i>oldfieldii</i>	3	-	-	-	-	-	-	-	-	2	-	-	-	-	-	0.1	-	-	-	-	1	-	-	-	-	-	-	0	-	-	-	-	-	1	-	-	
<i>Eremophila oppositifolia</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
<i>Eremophila oppositifolia</i> subsp. <i>angustifolia</i>	-	-	-	-	-	-	-	-	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
<i>Eremophila pantonii</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	4	-		
<i>Eremophila serrulata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-		
<i>Eriachne pulchella</i> subsp. <i>pulchella</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-		
<i>Eriochiton sclerolaenoides</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01	-	-		
<i>Eriochiton sclerolaenoides</i> ?	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
<i>Erodium cygnorum</i>	0.1	0.01	0.01	-	0.01	0.01	0.1	0.01	0	-	-	0.01	0.1	0.01	0.1	-	0.1	0.1	0.1	0.01	-	0.01	0.01	0.1	0.1	0.1	0.1	-	-	-	-	-	-	-	-		
<i>Erymophyllum glossanthus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
<i>Eucalyptus clelandiorum</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-		
<i>Eucalyptus ewartiana</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-		
<i>Eucalyptus kochii</i> subsp. <i>plenissima</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20	1.5	-	-	15	-	-	-	8	-	-	-	-	-	-	-	-		
<i>Eucalyptus loxophleba</i> subsp. <i>lissophloia</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	-	-	-	2	2	-	0	-	-	-	-	-	-	-		
<i>Eucalyptus loxophleba</i> subsp. <i>supralaevis</i>	15	0	-	-	-	-	-	-	-	15	-	-	-	-	-	12	-	1	-	-	-	-	-	-	-	-	-	0	-	-	-	8	6	3	-	6	
<i>Eucalyptus salubris</i>	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-												

Taxa																																					
	ElAr	ElAr	AdAa	Ad/At	AaAa	AdAa	AdAa	AaAr	Ad/At	ElAr	EsTh	AdAa	AdAa	AdAa	Ad/At	ElAr	AdAa	ElAr	ElAr	AdAa	ElAr	AdAa	ElAr	AdAa	ElAr	AdAa	OC	AaAr	AsCp	AsCp	ElAt	ElAr	ElAt	ElAr	ElAr	AsCp	
M001	M002	M003	M004	M005	M006	M007	M008	M009	M010	M011	M012	M013	M014	M015	M016	M017	M018	M019	M020	M021	M022	M023	M024	M025	M026	M027	OC	Q201	Q202	Q203	Q204	Q205	Q206	Q207	Q208	Q209	
<i>Grevillea subtiliflora</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	
<i>Hakea invaginata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	
<i>Hakea preissii</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	
<i>Hakea recurva</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	
<i>Hakea</i> sp. 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Halgania anagalloides</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Haloragis odontocarpa</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Haloragis trigonocarpa</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Hemigenia botryphylla</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	
<i>Hemigenia macphersonii</i>	-	-	-	-	-	1	-	-	-	-	0.1	-	0.2	-	-	-	1.5	-	-	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Hemigenia</i> sp. Yalgoo (A.M. Ashby 2624)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	
<i>Hemigenia tichbonii</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	0.1	
<i>Hemigenia yalgensis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.5	0.1	0.1	-	0	-	-	-	0.1	-	-	-	-	-	
<i>Hibbertia arcuata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
<i>Hyalosperma glutinosum</i> subsp. <i>glutinosum</i>	-	-	-	-	0.1	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Hyalosperma glutinosum</i> subsp. <i>venustum</i>	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.5	-	-	-	-	-	-	-	-	-	-	
<i>Hyalosperma glutinosum</i> ?	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	
<i>Hybanthus floribundus</i> subsp. <i>curvifolius</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	
<i>Hybanthus floribundus</i> subsp. <i>floribundus</i>	-	-	-	-	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Hydrocotyle dimorphocarpa</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	0.01	0.1	-	-	0.01	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	
<i>Hydrocotyle intertexta</i>	-	-	0.5	-	0.01	-	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-	0.2	-	0.2	-	-	-	-	-	-	-	-	-	-
<i>Hypochaeris glabra</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Lamiaceae</i> sp. 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1		
<i>Lemooria burkittii</i>	-	-	-	-	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Lepidium oxytrichum</i>	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Lepidium</i> sp.	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Lepidosperma costale</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	
<i>Lepidosperma</i> sp. Blue Hills (A. Markey & S. Dillon 3468)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-																					

Taxa	EiAr	EiAr	AdAa	Ac/At	AaAr	AdAa	AdAa	AaAr	Ac/At	EiAr	EsTh	AdAa	AdAa	AdAa	Ac/At	EiAr	AdAa	EiAr	EiAr	AdAa	EiAr	AdAa	EiAr	AdAa	EiAr	AdAa	OC	AaAr	AsCp	AsCp	EiAt	EiAr	EiAt	EiAr	EiAr	AsCp
	M001	M002	M003	M004	M005	M006	M007	M008	M009	M010	M011	M012	M013	M014	M015	M016	M017	M018	M019	M020	M021	M022	M023	M024	M025	M026	M027	OC	Q201	Q202	Q203	Q204	Q205	Q206	Q207	Q208
<i>Micromyrtus trudgenii</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	6
<i>Millotia myosotidifolia</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Mirbelia ?microphylla</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
<i>Mirbelia depressa</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1	
<i>Mirbelia microphylla</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	
<i>Monachather paradoxus</i>	-	-	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Monoculus monstrosus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
<i>Myriocephalus guerinae</i>	-	-	-	0.1	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Myriocephalus pygmaeus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01	-	0.01	-	0.01	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Nicotiana rotundifolia</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-	
<i>Olearia humilis</i>	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
<i>Olearia muelleri</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-		
<i>Olearia pimeleoides</i>	-	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-	-	0.1	0.1	-	-	-	-	-	-	-	0	-	-	-	-	-	0.01	-	-	
<i>Parietaria cardiostegia</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01	-	-	-	0.01	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
<i>Pauridia glabella</i> var. <i>glabella</i>	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
<i>Pentameris airoides</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	
<i>Persoonia manotricha</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.5	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	
<i>Persoonia pentasticha</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	0.1	-	
<i>Petrorhagia dubia</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
<i>Phebalium tuberculosum</i>	-	-	-	-	2	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	
<i>Philotheca brucei</i> subsp. <i>brucei</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	0.2	0.1	-	-	-	-	
<i>Philotheca deserti</i> subsp. <i>deserti</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	9	
<i>Philotheca sericea</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	
<i>Phlegmatospermum drummondii</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	
<i>Phyllangium sulcatum</i>	-	-	-	-	-	-	0.1	-	-	-	0.1	-	-	-	-	-	0.1	-	-	-	-	0.01	-	0.1	-	-	-	-	-	-	-	-	-	-	-	
<i>Pimelea avonensis</i>	-	-	0.1	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Pimelea microcephala</i> subsp. <i>microcephala</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	
<i>Pittosporum angustifolium</i>	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Plantago debilis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	0.01	-	-	-	-	0.1	0.1	-	-	-	-	-	-	-	-	-	
<i>Poaceae</i> sp.	-	-	-	-	-	-	-	-	-	0.01	-	-	-	0.01	0.1	0.01	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	
<i>Podolepis aristata</i> subsp. <i>affinis</i>	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
<i>Podolepis capillaris</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	
<i>Podolepis gardneri</i>	0.01	0.01	2	-	0.5	0.1	0.1	0.01	-	-	-	0.1	2	0.1	-	-	0.2	0.01	0.1	-	-	0.2	0.01	0.5	0.1	-	2	-	-	-	-	-	-	-	-	
<i>Podolepis lessonii</i>	0.01	-	0.5	-	0.6	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2	1	-	-	-	-	-	-	-	-	-	
<i>Pogonolepis muelleriana</i>	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	0.1	0.2	-	-	-	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Prostanthera althoferi</i> subsp. <i>althoferi</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	15	0.2	-	-	-	-	-	-	
<i>Prostanthera patens</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	
<i>Psydrax suaveolens</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Pterostylis ?spathulata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Ptilotus divaricatus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	
<i>Ptilotus eremita</i>	0.1	0.01	0.1	-	0.01	-	0.1	-	-	0.01	-	0.01	-	-	-	0.01	0.1	0.01	-	-	-	-	-	-	0.1	-	0.1	0.1	-	-	-	-	-	-	-	
<i>Ptilotus exaltatus</i>	0.01	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	0.01	-	-	-	-	0.1	-	0.1	-	-	-	-	-	-	-	-	-	-	1	-	
<i>Ptilotus gaudichaudii</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Ptilotus helipteroides</i>	-	-	-	-	-	-	0.01	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2	-	-	-	-	-	-	-	-	
<i>Ptilotus obovatus</i>	10	1	2	-	-	-	-	-	0.2	1	-	-	0.1	0.5	-	5	0.1	1.5	0.1	0.1	0.8															

Taxa	EIAr	EIAr	AdAa	Ad/At	AaAr	AdAa	AdAa	AaAr	Ad/At	EIAr	EsTh	AdAa	AdAa	AdAa	Ad/At	EIAr	AdAa	EIAr	EIAr	AdAa	EIAr	AdAa	EIAr	AdAa	EIAr	AdAa	OC	AaAr	AsCp	AsCp	EIAr	EIAr	EIAr	EIAr	EIAr	AsCp
	M001	M002	M003	M004	M005	M006	M007	M008	M009	M010	M011	M012	M013	M014	M015	M016	M017	M018	M019	M020	M021	M022	M023	M024	M025	M026	M027	OC	Q201	Q202	Q203	Q204	Q205	Q206	Q207	Q208
<i>Rhodanthe chlorocephala</i> subsp. ?splendida	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Rhodanthe chlorocephala</i> subsp. rosea	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Rhodanthe chlorocephala</i> subsp. splendida	-	-	-	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-
<i>Rhodanthe citrina</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Rhodanthe collina</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7	0.01	-	-	-	0.2	-	2	-	0.1	0.1	-	-	-	-	-	-	-	-	-
<i>Rhodanthe laevis</i>	-	-	-	-	0.1	-	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-
<i>Rhodanthe manglesii</i>	-	0.01	-	-	-	0.01	0.1	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-
<i>Rhodanthe maryonii</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-
<i>Rhodanthe oppositifolia</i> subsp. oppositifolia	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-
<i>Rhodanthe polycephala</i>	0.01	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Rhodanthe stricta</i>	-	-	0.1	-	0.5	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Roepera ovata</i>	0.01	0.1	-	-	-	-	-	-	-	-	0.1	-	-	-	-	0.1	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Roepera similis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Rostraria pumila</i>	-	-	-	-	-	-	-	-	-	-	0.1	-	-	0.01	-	-	-	-	-	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Rytidosperma setaceum</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Santalum acuminatum</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-
<i>Santalum spicatum</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-
<i>Scaevola spinescens</i>	1	0.5	-	-	-	0.1	-	-	0.1	0.2	-	-	-	-	-	-	-	0.1	-	0.1	-	7	-	-	-	-	-	-	-	-	-	1	-	-	0.1	-
<i>Schoenia cassiniana</i>	-	-	-	-	-	0.1	0.5	-	0.1	-	-	0.1	-	0.01	0.1	-	0.2	0.01	-	-	-	0.1	0.01	0.5	0.1	0.1	0.1	-	-	-	-	-	-	-	-	-
<i>Schoenus nanus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-
<i>Sclerolaena densiflora</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
<i>Sclerolaena diacantha</i>	-	-	-	-	-	-	-	-	-	0.1	0.1	-	-	-	-	0.2	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-
<i>Sclerolaena drummondii</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Sclerolaena fusiformis</i>	-	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Sclerolaena gardneri</i>	0.1	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Senecio glossanthus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01	-	-	0.11	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-
<i>Senna artemisioides</i> subsp. filifolia	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10	-	-	-	10	-	-	-	0	-	-	-	1	1	0.5	-	-	-
<i>Senna artemisioides</i> subsp. x artemisioides	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	1	-	-	-	1.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Senna charlesiana</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Senna</i> sp. Austin (A. Strid 20210)	-	-	-	-	-	-	-	-	-	0.1	0.1	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	0	-	-	-	-	1	-	-	-	-
<i>Senna stowardii</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-
<i>Seringia elliptica</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-
<i>Seringia velutina</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-
<i>Sida</i> ?sp. Dark Green Fruits (S. van Leeuwen 2260)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01	0.1	-	-	-	-	-	-	-	-	-	-	-	-
<i>Sida calyxhymentia</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	0.1	-	0.1	-	-	-	-	-	-	-	-	-
<i>Sida</i> sp. Dark Green Fruits (S. van Leeuwen 2260)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2	-	-	-	-	-	-	-	-	-	-	-	0.1	0	-	-	0.1	0.01	0.5	0.01	-	-
<i>Sida</i> sp. Golden calyces glabrous (H.N. Foote 32)	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Silene gallica</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Sisymbrium erysimoides</i>	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Solanum cleistogamum</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2	-	-	-	-	-	-	-	-	-	-
<i>Solanum lasiophyllum</i>	-	0.01	0.1	0.1	-	0.01	-	-	0.1	-	-	-	0.1	0.01	0.1	0.1	0.1	0.5	0.1	-	-	0.2	0.1	0.1	0.1	0.1	0.1	-	-	-	0.1	1	-	-	-	-
<i>Solanum nummularium</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Sonchus oleraceus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Spergula pentandra</i>	-	-	-	-	-	-	-	-	0.2	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Stenanthemum poicilum</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-														

Taxa	ElAr	ElAr	AdAa	Ad/At	AaAr	AdAa	AdAa	AaAr	Ad/At	ElAr	EsTh	AdAa	AdAa	AdAa	Ad/At	ElAr	AdAa	ElAr	ElAr	AdAa	ElAr	AdAa	ElAr	AdAa	ElAr	AdAa	OC	AaAr	AsCp	AsCp	ElAt	ElAr	ElAt	ElAr	ElAr	AsCp	
	M001	M002	M003	M004	M005	M006	M007	M008	M009	M010	M011	M012	M013	M014	M015	M016	M017	M018	M019	M020	M021	M022	M023	M024	M025	M026	M027	OC	Q201	Q202	Q203	Q204	Q205	Q206	Q207	Q208	Q209
<i>Stenopetalum filifolium</i>	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Styphelia serratifolia</i>	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	0.1	-	0.1	0.1	-	-	-	-	1
<i>Tecticornia ?halocnemoides</i>	-	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	
<i>Thryptomene costata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	10	-	-	-	-	-	-	-	
<i>Thysanotus manglesianus</i>	0.01	-	0.01	0.01	0.01	0.01	-	0.01	-	-	-	0.1	-	-	-	0.1	-	0.1	-	-	-	0.01	0.1	-	0.1	-	0.1	-	-	-	-	-	-	-	-	-	
<i>Thysanotus pyramidalis</i>	-	-	-	-	0.01	-	-	-	-	-	-	0.01	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Trachymene cyanopetala</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	0.1	0.1	-	-	0.01	0.1	0.1	0.1	-	0.01	0.1	-	-	-	-	-	-	-	-	-	
<i>Trachymene ornata</i>	-	-	1	0.01	0	0.1	0.1	0.01	0.5	-	-	0.01	0.1	0.01	0.1	-	0.1	0.2	-	-	-	0.01	-	0.1	0.1	0.1	-	-	-	-	-	-	-	-	-	-	
<i>Trichanthodium skirrophorum</i>	-	-	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Triglochin</i> sp. A <i>Flora of Australia</i> (G.J. Keighery 2477)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Velleia rosea</i>	-	0.1	20	0.1	-	0.01	1	0.2	-	-	-	0.2	2	0.1	1	0.01	5.2	1	0.1	0.1	-	0.2	2	1	0.1	0.1	20	-	-	-	-	-	-	-	-	-	
<i>Vincetoxicum lineare</i>	-	-	-	0.01	0.01	-	-	-	-	-	-	0.01	-	0.01	-	0.01	-	0.01	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Waitzia acuminata</i> var. <i>acuminata</i>	0.2	0.01	0.1	0.01	1	0.1	0.1	0.1	0.02	0.01	-	0.1	-	-	1	-	0.2	0.01	0.1	0.1	-	-	-	2	-	1	0.1	-	-	-	-	-	-	-	-	-	
<i>Waitzia nitida</i>	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Wurmbea densiflora</i>	-	-	0.5	-	0.01	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Wurmbea</i> sp. <i>Paynes Find</i> (C.J. French 1237)	-	-	-	-	-	-	-	-	-	-	-	0.01	0.1	-	-	-	0.1	-	-	-	-	0.01	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Xanthosia kochii</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

Taxa	AaAr	AsCp	AsCp	AsCp	Ad/At	ElAt	ElAr	AdAa	AaAr	AdAa	ElAr	ElAr	AdAa	Ad/At	AaAr	EsTh	AaAr	ElAr	AaAr	AdAa	AdAa	AsCp	Ad/At	ElAr	ElAr	EsTh	AsCp	ElAt	AdAa	AdAa	ElAr	AsCp	ElAr	ElAr	ElAt	ElAr	AaAr	
	Q210	Q211	Q212	Q213	Q214	Q215	Q216	Q217	Q218	Q219	Q220	Q221	Q222	Q223	Q224	Q225	Q226	Q227	Q228	Q229	Q230	Q231	AsCp	Ad/At	ElAr	ElAr	EsTh	AsCp	ElAt	AdAa	AdAa	ElAr	AsCp	ElAr	ElAr	ElAt	ElAr	AaAr
<i>Abutilon cryptopetalum</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Acacia acanthoclada</i> subsp. <i>glaucescens</i>	-	-	-	-	-	12	2	-	-	-	-	-	-	-	-	0.1	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Acacia acuminata</i>	-	-	-	-	-	1	-	9	-	7	2	1	15	2	-	-	-	-	8	12	15	-	5	-	-	-	-	-	5	1	7	-	-	-	-	-	-	
<i>Acacia andrewsii</i>	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Acacia assimilis</i> subsp. <i>assimilis</i>	-	-	-	18	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Acacia aulacophylla</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-		
<i>Acacia burkittii</i>	-	-	-	-	5	-	0.1	-	-	-	-	-	-	-	4	-	-	-	-	-	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Acacia caesaneura</i>	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Acacia colletioides</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Acacia diallaga</i>	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Acacia duriuscula</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Acacia erinacea</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Acacia exocarpoides</i>	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Acacia karina</i>	-	-	1	2	2	-	-	2	-	2	-	-	1	-	-	-	-	-	-	2	0.4	-	-	-	-	-	-	-	1	-	8	-	-	-	-	-	-	
<i>Acacia latior</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Acacia puncticulata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Acacia quadrimarginea</i>	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Acacia ramulosa</i> var. <i>linophylla</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Acacia ramulosa</i> var. <i>ramulosa</i>	35	8	-	2	-	1	-	-	5	-	15	23	-	-	5	-	8	1	-	-	-	-	-	-	5	-	-	-	2	-	3	-	25	-	15	-	-	
<i>Acacia sibina</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Acacia</i> sp. 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Acacia sulcatacaulis</i>	-	-	1	4	3	-	-	-	-	-	-	-	0.5	-	-	-	-	-	-	-	-	3	-	-	-	-	0	-	-	-	-	80	-	-	-	-	-	
<i>Acacia tetragonophylla</i>	1	1	-	-	-	40	-	4	-	2	2	2	1	-	0.5	-	-	2	2	2	0.01	-	2	-	5	-	-	-	-	-	-	-	-	-	5	-	-	
<i>Acacia umbraculiformis</i>	-	10	-	-	-	-	-	-	0.5	62	-	-	-	-	-	-	-	-	-	8	15	-	-	-	-	-	10	-	-	-	-	-	12	-	-	-	-	
<i>Actinobole uliginosum</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

Taxa	AaAr	AsCp	AsCp	AsCp	Ad/At	EiAt	EiAr	AdAa	AaAr	AdAa	EiAr	EiAr	AdAa	Ad/At	AaAr	EsTh	AaAr	EiAr	AaAr	AdAa	AdAa	AsCp	Ad/At	EiAr	EiAr	EsTh	AsCp	EiAt	AdAa	AdAa	EiAr	AsCp	EiAr	EiAr	EiAt	EiAr	AaAr	
	Q210	Q211	Q212	Q213	Q214	Q215	Q216	Q217	Q218	Q219	Q220	Q221	Q222	Q223	Q224	Q225	Q226	Q227	Q228	Q229	Q230	Q231	R001	R002	R003	R004	R005	R006	R008	R009	R010	R201	R202	R203	R204	R205	R206	
<i>Allocasuarina acutivalvis</i> subsp. <i>prinsepiana</i>	-	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-	0.3	-	-	-	-	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	
<i>Allocasuarina campestris</i>	-	-	-	12	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Allocasuarina dielsiana</i>	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	10	-	-	-	-	-	2	10	-	-	-	-	-	-	-	
<i>Allocasuarina</i> sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Allocasuarina tessellata</i>	-	-	-	-	25	1	-	40	-	1	-	1	0.2	78	-	-	-	-	-	-	-	-	75	-	-	-	5	-	2	0	1	5	-	-	-	-	-	-
<i>Alyogyne hakeifolia</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Alyxia buxifolia</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Amphipogon caricinus</i> var. <i>caricinus</i>	-	-	-	-	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-	0.01	-	-	0.01	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	
<i>Amyema preissii</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Androcalva luteiflora</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Arctotheca calendula</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	
<i>Arthropodium dyeri</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Asteraceae</i> sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Atriplex bunburyana</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Atriplex</i> sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Atriplex vesicaria</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Atriplex semilunaris</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Austrostipa</i> ? <i>scabra</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Austrostipa elegantissima</i>	0.01	-	-	-	-	1	-	-	-	-	0.01	1	-	-	-	-	0.01	0.1	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Austrostipa eremophila</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Austrostipa nitida</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Austrostipa scabra</i>	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Austrostipa trichophylla</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Austrostipa variabilis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Bellida graminea</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Blennospora drummondii</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Borya sphaerocephala</i>	0.01	-	10	3	0.5	-	-	18	-	-	-	-	5	2	-	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Brachychiton gregorii</i>	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-		
<i>Brachyscome ciliaris</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Bromus arenarius</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Bromus diandrus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Brunonia</i> sp. <i>Goldfields</i> (K.R. Newbey 6044)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Bulbine semibarbata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Bursaria occidentalis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Caesia</i> ? <i>micrantha</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Caesia</i> sp. <i>Wongan</i> (K.F. Kenneally 8820)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Caladenia</i> sp. 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Caladenia</i> sp. 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Calandrinia</i> ? <i>polyandra</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Calandrinia baccata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Calandrinia</i> sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Calandrinia</i> sp. <i>Truncate capsules</i> (A. Markey & S. Dillon 3474)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Callistemon phoeniceus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-																									

Taxa	AaAr	AsCp	AsCp	AsCp	Ad/At	ElAt	ElAr	AdAa	AaAr	AdAa	ElAr	ElAr	AdAa	Ad/At	AaAr	EsTh	AaAr	ElAr	AaAr	AdAa	AdAa	AsCp	Ad/At	ElAr	ElAr	EsTh	AsCp	ElAt	AdAa	AdAa	ElAr	AsCp	ElAr	ElAr	ElAt	ElAr	AaAr
	Q210	Q211	Q212	Q213	Q214	Q215	Q216	Q217	Q218	Q219	Q220	Q221	Q222	Q223	Q224	Q225	Q226	Q227	Q228	Q229	Q230	Q231	R001	R002	R003	R004	R005	R006	R008	R009	R010	R201	R202	R203	R204	R205	R206
<i>Cephalipterum drummondii</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Chamaexeros macranthera</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Chamelaucium pauciflorum</i> subsp. <i>Perenjori</i> (B.J Conn 2181)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Chamelaucium</i> sp. <i>Warriedar</i> (A.P. Brown & S. Patrick APB 1100)	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Cheilanthes adiantoides</i>	-	0.1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	
<i>Cheilanthes brownii</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>	0.01	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Cheiranthra simplicifolia</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Chenopodiaceae</i> sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Chthonocephalus pseudevax</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Codonocarpus cotinifolius</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Comesperma integerrimum</i>	-	-	-	-	-	-	-	-	-	-	0.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Convolvulus remotus?</i>	-	0.1	-	0.1	-	-	-	0.1	-	0.1	-	0.1	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Cratystylis subspinescens</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Cuscuta planiflora</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Cyanicula amplexans</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-
<i>Daucus glochidiatus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Dianella revoluta</i> var. <i>divaricata</i>	-	-	-	-	-	-	-	-	0.01	-	0.01	-	-	-	0.1	-	-	-	0.01	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Dodonaea adenophora</i>	-	-	0.01	1	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Dodonaea amplisemina</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Dodonaea inaequifolia</i>	-	-	-	-	-	35	-	-	-	2	-	-	-	-	-	-	-	-	-	7	0.01	-	-	2	-	-	-	-	-	2	-	-	-	2	-	-	
<i>Dodonaea rigida</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Drosera</i> sp. <i>Branched styles</i> (S.C. Coffey 193)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Ehrharta longiflora</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	
<i>Enchylaena lanata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Enchylaena tomentosa</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	-	-	-	-	-	-	0.01	-	-	-	0.1	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Eremophila clarkei</i>	0.2	1	0.01	1	-	-	-	-	-	-	-	-	0.1	-	-	-	0.01	1	-	1	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Eremophila eriocalyx</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Eremophila forrestii</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Eremophila forrestii</i> subsp. <i>forrestii</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Eremophila georgei</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Eremophila latrobei</i> subsp. <i>latrobei</i>	-	12	-	4	-	-	-	-	0.1	-	-	-	-	-	0.2	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Eremophila oldfieldii</i> subsp. <i>oldfieldii</i>	-	-	-	-	-	6	-	-	-	-	-	1	-	-	-	-	-	1.1	-	-	-	-	-	-	-	0.1	-	-	-	1	-	-	-	-	-	-	
<i>Eremophila oppositifolia</i>	-	-	-	-	-	-	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Eremophila oppositifolia</i> subsp. <i>angustifolia</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Eremophila pantonii</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Eremophila serrulata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Eriachne pulchella</i> subsp. <i>pulchella</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Eriochiton sclerolaenoides</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Eriochiton sclerolaenoides?</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Erodium cygnorum</i>	-	0.1	-	-	-	-	-	0.1	-	0.1	-	0.1	-	0.1	-	-	-	-	-	0.1	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Erymophyllum glossanthus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Eucalyptus clelandiorum</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-																

Taxa	AaAr	AsCp	AsCp	AsCp	Ad/At	ElAt	ElAr	AdAa	AaAr	AdAa	ElAr	ElAr	AdAa	Ad/At	AaAr	EsTh	AaAr	ElAr	AaAr	AdAa	AdAa	AsCp	Ad/At	ElAr	ElAr	EsTh	AsCp	ElAt	AdAa	AdAa	ElAr	AsCp	ElAr	ElAr	ElAt	ElAr	AaAr
	Q210	Q211	Q212	Q213	Q214	Q215	Q216	Q217	Q218	Q219	Q220	Q221	Q222	Q223	Q224	Q225	Q226	Q227	Q228	Q229	Q230	Q231	R001	R002	R003	R004	R005	R006	R008	R009	R010	R201	R202	R203	R204	R205	R206
<i>Eucalyptus salubris</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Euphorbia tannensis</i> subsp. <i>eremophila</i>	-	0.1	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Exocarpos aphyllus</i>	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	0.5	-	-	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-	
<i>Frankenia ?setosa</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Frankenia setosa</i>	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Gastrolobium laytonii</i>	-	-	-	-	0.1	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	
<i>Gilruthia osbornii</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Glischrocaryon aureum</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Gnephosis arachnoidea</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Gnephosis brevifolia</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Gnephosis tenuissima</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Goodenia ?pinnatifida</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Goodenia berardiana</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Goodenia mimuloides</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Goodenia pusilliflora</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Grevillea ?obliquistigma</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Grevillea extorris</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Grevillea globosa</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Grevillea hakeoides</i> subsp. <i>stenophylla</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Grevillea paniculata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2	-	-	-	-	-	-	-	
<i>Grevillea pterosperma</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Grevillea scabrida</i>	-	-	-	-	-	-	-	1	-	7	-	-	0.1	-	-	-	-	-	3	5	1	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-	-
<i>Grevillea subtiliflora</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Hakea invaginata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Hakea preissii</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Hakea recurva</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Hakea</i> sp. 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Halgania anagalloides</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Haloragis odontocarpa</i>	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Haloragis trigonocarpa</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Hemigenia botryphylla</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Hemigenia macphersonii</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Hemigenia</i> sp. Yalgoo (A.M. Ashby 2624)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Hemigenia tichbonii</i>	-	-	-	1	0.01	6	-	-	-	1	-	-	-	-	-	-	-	-	0.21	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Hemigenia yalgensis</i>	-	-	-	-	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Hibbertia arcuata</i>	-	-	-	-	-	-	-	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	
<i>Hyalosperma glutinosum</i> subsp. <i>glutinosum</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Hyalosperma glutinosum</i> subsp. <i>venustum</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Hyalosperma glutinosum?</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Hybanthus floribundus</i> subsp. <i>curvifolius</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Hybanthus floribundus</i> subsp. <i>floribundus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Hydrocotyle dimorphocarpa</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Hydrocotyle intertexta</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Hypochaeris glabra</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Lamiaceae</i> sp. 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-									

Taxa	AaAr	AsCp	AsCp	AsCp	Ad/At	ElAt	ElAr	AdAa	AaAr	AdAa	ElAr	ElAr	AdAa	Ad/At	AaAr	Esth	AaAr	ElAr	AaAr	AdAa	AdAa	AsCp	Ad/At	ElAr	ElAr	Esth	AsCp	ElAt	AdAa	AdAa	ElAr	AsCp	ElAr	ElAr	ElAt	ElAr	AaAr
	Q210	Q211	Q212	Q213	Q214	Q215	Q216	Q217	Q218	Q219	Q220	Q221	Q222	Q223	Q224	Q225	Q226	Q227	Q228	Q229	Q230	Q231	R001	R002	R003	R004	R005	R006	R008	R009	R010	R201	R202	R203	R204	R205	R206
<i>Lepidosperma</i> sp. Blue Hills (A. Markey & S. Dillon 3468)	-	-	-	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Leptosema aphyllum</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Leucopogon</i> sp. Clyde Hill (M.A. Burgman 1207)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Lobelia winfridae</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Lysimachia arvensis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Maireana</i> ? <i>tomentosa</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Maireana georgei</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Maireana tomentosa</i>	-	-	-	-	-	-	1	-	-	-	0.1	-	-	-	-	0.1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Maireana trichoptera</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Maireana triptera</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Malleostemon tuberculatus</i>	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Marsdenia australis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Melaleuca eleuterostachya</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Melaleuca hamata</i>	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Melaleuca nematophylla</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3	-	0.5	-	-	-	-	2	-	-	-	-	5	-	-	-	-	-	-	-	-	-	
<i>Melaleuca radula</i>	-	-	-	-	-	-	-	1	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Melaleuca scalena</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Melaleuca stereophloia</i>	4	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Mesembryanthemum nodiflorum</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	
<i>Micromyrtus acuta</i>	-	-	-	-	-	-	-	-	15	-	-	-	-	-	15	-	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Micromyrtus trudgenii</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	
<i>Millotia myosotidifolia</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Mirbelia</i> ? <i>microphylla</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	
<i>Mirbelia depressa</i>	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Mirbelia microphylla</i>	-	-	-	-	-	-	-	0.1	-	0.1	-	-	0.01	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Monachather paradoxus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Monoculus monstrosus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	
<i>Myriocephalus guerinae</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Myriocephalus pygmaeus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Nicotiana rotundifolia</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Olearia humilis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Olearia muelleri</i>	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Olearia pimeleoides</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											

Taxa	AaAr	AsCp	AsCp	AsCp	Ad/At	EiAt	EiAr	AdAa	AaAr	AdAa	EiAr	EiAr	AdAa	Ad/At	AaAr	EsTh	AaAr	EiAr	AaAr	AdAa	AdAa	AsCp	Ad/At	EiAr	EiAr	EsTh	AsCp	EiAt	AdAa	AdAa	EiAr	AsCp	EiAr	EiAr	EiAt	EiAr	EiAt	EiAr	AaAr
	Q210	Q211	Q212	Q213	Q214	Q215	Q216	Q217	Q218	Q219	Q220	Q221	Q222	Q223	Q224	Q225	Q226	Q227	Q228	Q229	Q230	Q231	R001	R002	R003	R004	R005	R006	R008	R009	R010	R201	R202	R203	R204	R205	R206		
Poaceae sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Podolepis aristata subsp. affinis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Podolepis capillaris	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Podolepis gardneri	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Podolepis lessonii	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	
Pogonolepis muelleriana	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Prostanthera althoferi subsp. althoferi	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Prostanthera patens	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Psydrax suaveolens	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Pterostylis ?spathulata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Ptilotus divaricatus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Ptilotus eremita	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Ptilotus exaltatus	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Ptilotus gaudichaudii	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Ptilotus helipteroides	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Ptilotus obovatus	-	0.1	-	-	-	1	0.01	1	-	8	1	4	-	-	-	-	-	1	-	5	0.01	-	-	-	-	-	-	1	-	-	-	0.5	-	-	-	0.5	-	-	
Ptilotus schwartzii	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Rhagodia drummondii	-	-	-	-	-	1	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Rhagodia eremaea	-	-	-	-	-	-	-	-	-	-	0.01	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Rhodanthe ?oppositifolia subsp. oppositifolia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Rhodanthe chlorocephala subsp. ?splendida	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Rhodanthe chlorocephala subsp. rosea	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Rhodanthe chlorocephala subsp. splendida	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Rhodanthe citrina	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Rhodanthe collina	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Rhodanthe laevis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Rhodanthe manglesii	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Rhodanthe maryonii	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Rhodanthe oppositifolia subsp. oppositifolia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Rhodanthe polycephala	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Rhodanthe stricta	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Roepera ovata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Roepera similis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Rostraria pumila	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Rytidosperma setaceum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Santalum acuminatum	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Santalum spicatum	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Scaevola spinescens	0.5	-	-	-	-	-	-	-	-	-	0.01	1	-	-	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Schoenia cassiniana	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Schoenus nanus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Sclerolaena densiflora	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Sclerolaena diacantha	-	-	-	-	-	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												

Taxa	AaAr	AsCp	AsCp	AsCp	Ad/At	ElAt	ElAr	AdAa	AaAr	AdAa	ElAr	ElAr	AdAa	Ad/At	AaAr	EsTh	AaAr	ElAr	AaAr	AdAa	AdAa	AsCp	Ad/At	ElAr	ElAr	EsTh	AsCp	ElAt	AdAa	AdAa	ElAr	AsCp	ElAr	ElAr	ElAt	ElAr	AaAr
	Q210	Q211	Q212	Q213	Q214	Q215	Q216	Q217	Q218	Q219	Q220	Q221	Q222	Q223	Q224	Q225	Q226	Q227	Q228	Q229	Q230	Q231	R001	R002	R003	R004	R005	R006	R008	R009	R010	R201	R202	R203	R204	R205	R206
<i>Senna stowardii</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Seringia elliptica</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
<i>Seringia velutina</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
<i>Sida ?sp. Dark Green Fruits (S. van Leeuwen 2260)</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
<i>Sida calyxhymenia</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
<i>Sida sp. Dark Green Fruits (S. van Leeuwen 2260)</i>	-	0.01	0.01	0.1	-	0.1	-	-	-	0.1	0.01	0.1	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Sida sp. Golden calyces glabrous (H.N. Foote 32)</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
<i>Silene gallica</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
<i>Sisymbrium erysimoides</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
<i>Solanum cleistogamum</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
<i>Solanum lasiophyllum</i>	-	1	0.11	2	-	-	-	-	-	1	0.01	-	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	
<i>Solanum nummularium</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
<i>Sonchus oleraceus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
<i>Spergula pentandra</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
<i>Stenanthemum poicilum</i>	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
<i>Stenopetalum anfractum</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
<i>Stenopetalum filifolium</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
<i>Styphelia serratifolia</i>	-	-	-	-	-	-	-	-	-	1	-	-	0.1	-	-	-	-	0.01	-	0.01	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>Tecticornia ?halocnemoides</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	27	-	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-		
<i>Thryptomene costata</i>	-	-	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-	27	-	-	-		
<i>Thysanotus manglesianus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
<i>Thysanotus pyramidalis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
<i>Trachymene cyanopetala</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
<i>Trachymene ornata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	
<i>Trichanthodium skirrophorum</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
<i>Triglochin sp. A Flora of Australia (G.J. Keighery 2477)</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
<i>Velleia rosea</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
<i>Vincetoxicum lineare</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
<i>Waitzia acuminata</i> var. <i>acuminata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
<i>Waitzia nitida</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
<i>Wurmbea densiflora</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
<i>Wurmbea sp. Paynes Find (C.J. French 1237)</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
<i>Xanthosia kochii</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	10	-	-	-	-	-	-	-	-	-	-	

Appendix D: *Stylidium scintillans* Targeted Flora Search, Memo



30 April 2020

RE: Mt Mulgine Targeted Threatened Flora Survey, *Stylidium scintillans*

Claire McGuire
Senior Environmental Advisor
Tungsten Mining NL

Dear Claire,

Spectrum Ecology completed a targeted Threatened flora survey for the Threatened flora species, *Stylidium scintillans* in 2019. This species is known to occur in the vicinity of Tungsten's Mt Mulgine Project area. Botanists, Carmel Forrester and Raimond Orifici, conducted the survey for the Mt Mulgine tenements M59/425, E59/1324, M59/386 and M59/387 from the 5 to 7 September 2019. There were no populations of the Threatened flora species *S. scintillans* found in the Study Area.

This site was revisited in March 2020 by Botanists Carmel Forrester and Melissa Hay for the second phase of a detailed flora survey. During this survey potential habitat for *S. scintillans* was opportunistically sighted. This potential habitat was classified as Unsuitable (see Table 2).

This memo updates the *S. scintillans* memo, previously submitted to Tungsten Mining in October 2019. Specifically, this memo provides:

- More detail of the September 2019 targeted survey methodology; and
- Commentary on previous *S. scintillans* habitat assessment from Terratree Pty Ltd (2013). This report was made available to Spectrum Ecology in March 2020, after the targeted survey and first submission of this memo and after the second phase detailed flora survey in (March 2020).

Please contact me if you require any further information in relation to the above.

Yours sincerely,
Carmel Forrester
Botanist

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INTRODUCTION

Scope of works

Tungsten Mining NL (Tungsten Mining) is developing the Mt Mulgine Project (Mt Mulgine or the Project) which is located in the Yalgoo bioregion of Western Australia (Thackway & Cresswell, 1995). The Project consists of two main areas; the Mulgine Hill and the Mulgine Trench deposits. Both are within the tenement M59/425. Additional proposed site infrastructure includes a Processing Plant and ROM Pad, Waste Rock Landforms, Stockpiles, Tailings Storage Facility, and Camp facilities which will be located within the M59/425, M59/387 and M59/386 tenements.

Tungsten Mining engaged Spectrum Ecology to undertake a flora and vegetation assessment and targeted Threatened flora survey for *Stylidium scintillans* in tenements M59/425, E59/1324, M59/386 and M59/387. The targeted flora survey of these combined four tenements will be referred to as the "Study Area" (see Figure 1). This Memo outlines the findings from the targeted Threatened flora survey for *S. scintillans* conducted in September 2019 and updates the previously submitted memo with:

- More detail of the September 2019 targeted survey methodology; and
- Commentary on previous *S. scintillans* habitat assessment conducted by Terratree Environmental (2013) (see section headed: Previous Habitat Assessment in the Study Area). This report was made available to Spectrum Ecology in March 2020, after the targeted survey and first submission of this memo and after the second phase detailed flora survey in (March 2020). Had the report been available prior to mobilisation, it would have been used as a reference to help inform the survey.

Targeted Threatened Flora Species *Stylidium scintillans*

Database searches and previous surveys for the Mt Mulgine Flora and Vegetation Study Area indicate that the Threatened flora (TF) species, *S. scintillans*, is known to occur in the vicinity of the Mt Mulgine Project Area (see Figure 1).

Three previously recorded locations of *S. scintillans* were documented in the vicinity of the Mt Mulgine Project Area. These populations are west (1.2 km) and north-west (1.6 and 2.0 km) of the Study Area and mapped in Figure 1. Co-ordinates for the existing populations are not available publicly and have been excluded from this memo. Co-ordinates can be supplied separately to TGN upon request.

Prior to the targeted survey, Spectrum's botanists familiarised themselves with *S. scintillans*, including the appearance, size, form, diagnostic features, distribution, habitat, phenology, associated species, and associated geology. The botanists also thoroughly read and discussed the journal article defining Microgeophytic Triggerplants (Wege, 2012). This journal article contains a taxonomic key to identify *S. scintillans* and was utilised throughout the field survey.

Authorisation to Take or Disturb Threatened Species was obtained for this targeted survey (Authorisation Number: TFL 59-1920). A copy of this can be supplied upon request. Requirements for this licence are understood and were adhered to during the Targeted Survey.

METHODOLOGY

Survey Timing

The targeted flora survey was conducted by two Botanists from 5 to 7 September 2019 (six person days). The Study Area was revisited in March 2020 by two Botanists for the second phase of a detailed flora survey. During this survey, potential habitat for *Stylidium scintillans* was opportunistically sighted.

Field survey timing for the targeted flora survey was selected to coincide with the optimal flowering season of *S. scintillans* as stipulated in Section 3.1.5 of the Threatened and Priority Flora Report Form – Field Manual (DBCA 2017). *Stylidium scintillans* flowers from early August to mid-September (Wege, 2012). Peak flowering time is subject to rainfall and seasonal variation.

Project Team

Details on the field team for the targeted Threatened flora survey are included in Table 1.

Table 1: Project Team

Botanist	Qualification	Experience	License
Carmel Forrester	BSc (Sust Dev)	5 years	FB62000134 TFL 59-1920
Raimond Orifici	BSc (Hort Hons)	15 years	FB62000158

Pre-field Potential Habitat Selection

Prior to field mobilisation, potential habitat sites were selected using aerial imagery, taking into account the known populations, habitat, and associated geology. Specifically, known populations of *S. scintillans* were mapped and areas within the tenement with similar geology, and aerial appearance were selected. This was the preliminary habitat selection and was revised once ground-truthing commenced.

Survey Effort

Known Habitat

Wege (2012) describes the potential habitat for *S. scintillans* as “confined to the upper slopes and summits of low rises and breakaways composed of highly weathered granitic basement rock with weathered or colluvial ironstone rock and kaolinitic residue. It grows in rocky, shallow, pale-brown clay loam soils, with individuals sometimes growing out of rock fissures. It occurs in open shrubland with the following overstory species combinations:

- *Micromyrtus acuta*, *Acacia assimilis* subsp. *assimilis* and *Melaleuca nematophylla*;
- *Acacia aulacophylla*, *Micromyrtus trudgenii* and *Melaleuca nematophylla*; and
- *Acacia ramulosa* and *A. aulacophylla*.

Stylidium scintillans tends to be associated with *Boyra sphaerocephala* and has been observed growing in sympatry with the perennial Triggerplant *S. longibracteatum*. Individuals of *S. scintillans* are generally found in bare, open areas between shrubs, often occurring in large numbers over a very small area.”

Habitat suitability of potential areas within the Study Area, were determined by afore quoted reference (Wege, 2012), in conjunction with a habitat assessment at the known *S. scintillans* population location.

Ground-truthing

Botanists, Carmel Forrester and Raimond Orifici, traversed potential habitats likely to contain the Threatened flora species, *S. scintillans*, occurring within the Study Area.

To refine the ground-truthing effort, the botanists located and assessed the closest known population of *Stylidium scintillans*, 1.2 km west of the Study Area. The location of this population was obtained from the DBCA database search prior to mobilisation.

Locating the known *S. scintillans* population strengthened the survey effort, ensuring:

- Appropriate habitat areas were traversed;
- Appropriate geology was targeted;
- Seasonal field survey timing was accurate; and
- Field effort direction was accurate.

Thirty-two individual plants of varying life stages were recorded from the known population. This population was searched and recorded in accordance with the DBCA's requirements for assessment of Threatened flora populations (DBCA 2017). The Threatened and Priority Flora Report Form has been submitted to the DBCA Threatened Species & Communities Branch.

To further refine the ground-truthing effort, botanists sought to better understand the geology present in the Study Area by consulting with TGN site Geologist, Henry Thomas. This consultation confirmed:

- Ironstone was present as Banded Ironstone Formation (BIF) at the known *S. scintillans* location;
- Some rock samples taken from potential habitat identified as weathered granitic basement rock;
- There were no known locations of BIF on the tenement; and
- The main areas of weathered granitic breakaways were covered in our preliminary habitat selection.

Refining the Habitat Selection

The pre-field potential habitat selection was refined based on the known habitat and ground truthing (outlined above). When ground-truthing, each potential habitat was classified as optimal to unsuitable, based upon:

- Presence of ironstone and or BIF;
- Presence of weathered granitic basement rock;
- Presence of clay-loam;
- Presence of associated species; and
- Presence of bare open areas.

This classification is outlined in Table 2 and mapped in Figure 2 and Figure 3.

For areas identified as optimal habitat, the botanists walked transects with 5 m spacing. For areas of sub-optimal habitat, 50 – 100 m spacing was used. Selected rocky outcrops or breakaways were traversed along the breakaway edges at 5 m spacing.

There were no areas of optimal habitat recorded in the Study Area during the targeted survey. All areas of interest were targeted and searched or discarded as unsuitable during the refining habitat selection process.

Table 2: Criteria for Classification of *Stylidium scintillans* Potential Habitat

Criteria for Classification	Optimal	Sub-optimal 1	Sub-optimal 2	Unsuitable
Lightly coloured aerial imagery	Present	Present	Present	Present
Presence of ironstone and or BIF	Present	Absent	Absent	Absent
Presence of weathered granitic basement rock	Present	Present	Present	Absent
Presence of breakaways	Present	Present	Absent	Absent
Presence of clay-loam between rocks	Present	Absent	Absent	Present
Presence of associated species (as outlined by Wege 2012)	Present	Present	Present	Absent
Presence of bare open areas	Present	Absent	Present	Absent
Presence of leaf litter	Absent	Present	Absent	Absent



Plate 1: Optimal Habitat



Plate 2: Sub-optimal 1



Plate 3: Sub-optimal 2



Plate 4: Unsuitable Habitat

Requirements for Assessment of Threatened Flora Populations

The Department of Biodiversity, Conservation and Attractions require location, sighting or collection information to be submitted on a Threatened and Priority Flora Report Form when a population of conservation significant flora is recorded. The technical guidance for recording Threatened flora is outlined in the Threatened and Priority Flora Report Form – Field Manual (DBCA 2017) and requires recording the following criteria:

- Comment on species presence/absence;
- Land access permission granted;
- Description of location including:
 - Photo;
 - Waypoint co-ordinates;
 - Map;
 - Vegetation description; and
 - Nearest town and directions to get to location without co-ordinates.
- A boundary polygon of the population, where population boundaries are defined by no more than 500 m between plants and not separated by tenure or abiotic feature;
- Number of minutes spent searching per 100 m²;
- Area of population in m²; and
- Records of life stages of plants including dead plants.

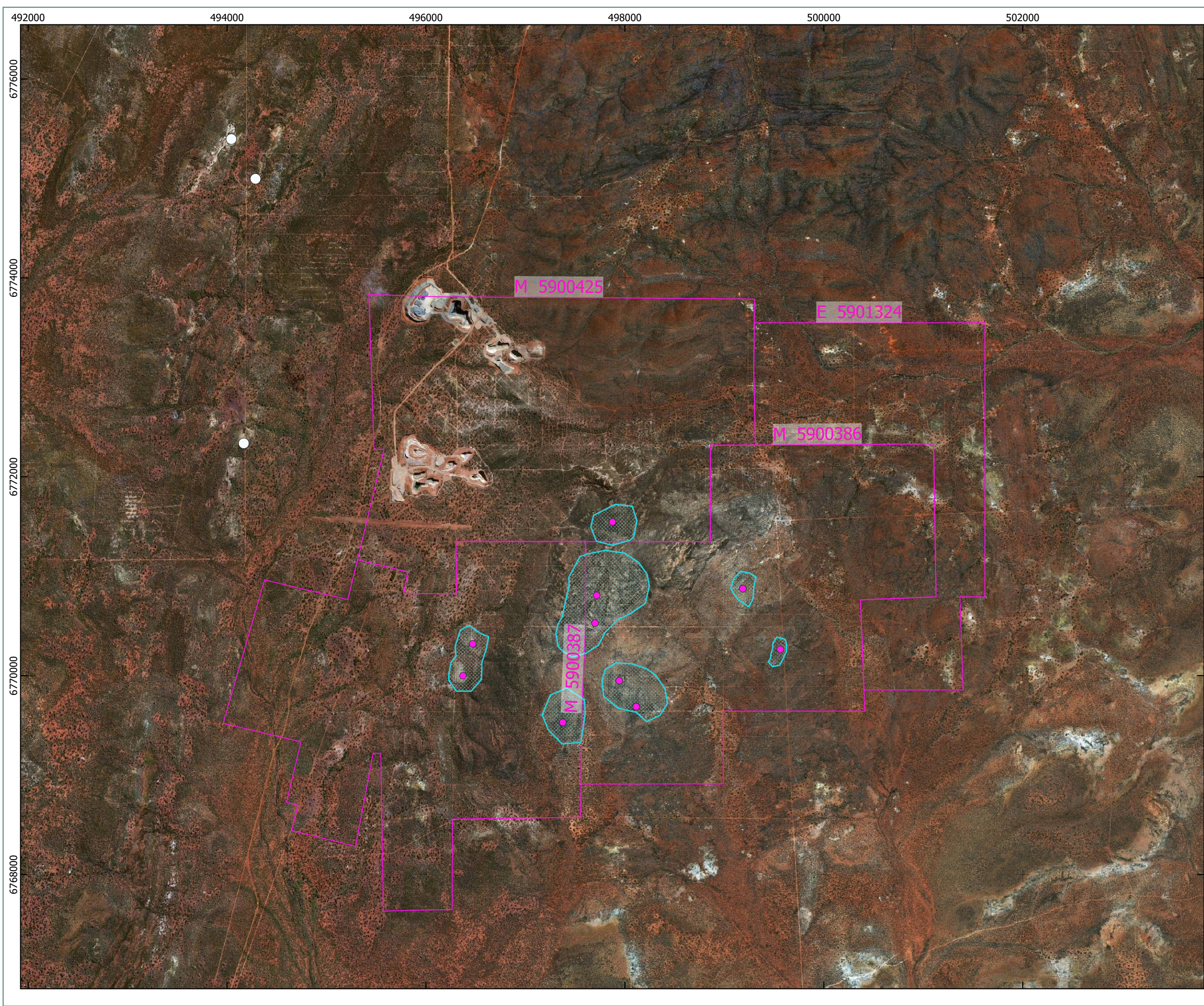
Previous Habitat Assessment at the Study Area

One previous assessment of potential habitat for *S. scintillans* was conducted in the vicinity of the Study Area by ecological consultants Terratree Pty Ltd (2013). Terratree assessed 26 small study areas in and up to 70 km north of the Study Area, as a detailed and targeted Threatened and priority flora survey effort. Approximately ten of these study areas occur within the TGN Study Area. Details of this report were not available prior to mobilisation of the Spectrum targeted or detailed flora surveys (September 2019 and March 2020 respectively).

Terratree consulted the same *Stylidium* journal article (Wege, 2012) as Spectrum for reference to potential habitat, and visited six known populations of *Stylidium scintillans* during their assessment. Section 3.4 and Appendix 1 of Terratree's assessment (2013) outlined their approach for assessing potential habitat for *S. scintillans* as: "rocky outcroppings, low rises, breakaways or ridges composed of granitic, lateritic or ironstone material. The presence of *Micromyrtus acuta* would also be considered to indicate suitable habitat, whether or not it occurred in a rocky outcrop location".

Based on this survey methodology, Terratree identified areas of potential *Stylidium scintillans* habitat in the Study Area. Some of these areas were also identified by Spectrum. From Terratree's description it appears their assessment of potential habitat is somewhat broader than the graded classification employed by Spectrum. This is demonstrated by including any area with presence of *Micromyrtus acuta* as potential habitat, with or without the presence of suitable geology and substrate.

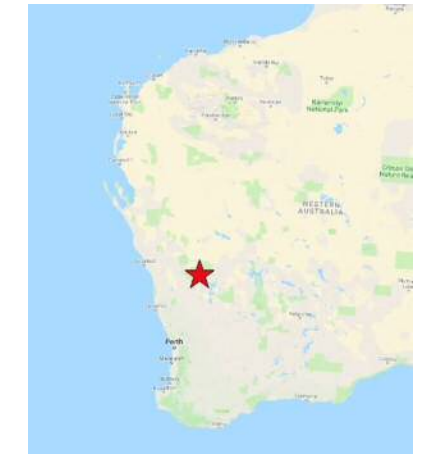
Overall, the methodology to classify potential habitat for *Stylidium scintillans* employed by each of the consultancies is comparable and has given overlapping results in each instance.



Legend

Location of *Stylidium scintillans*

- Known Populations
- Potential Occurrence
- ▨ Pre-field Potential Habitat Selection
- ▭ Tungsten Tenements



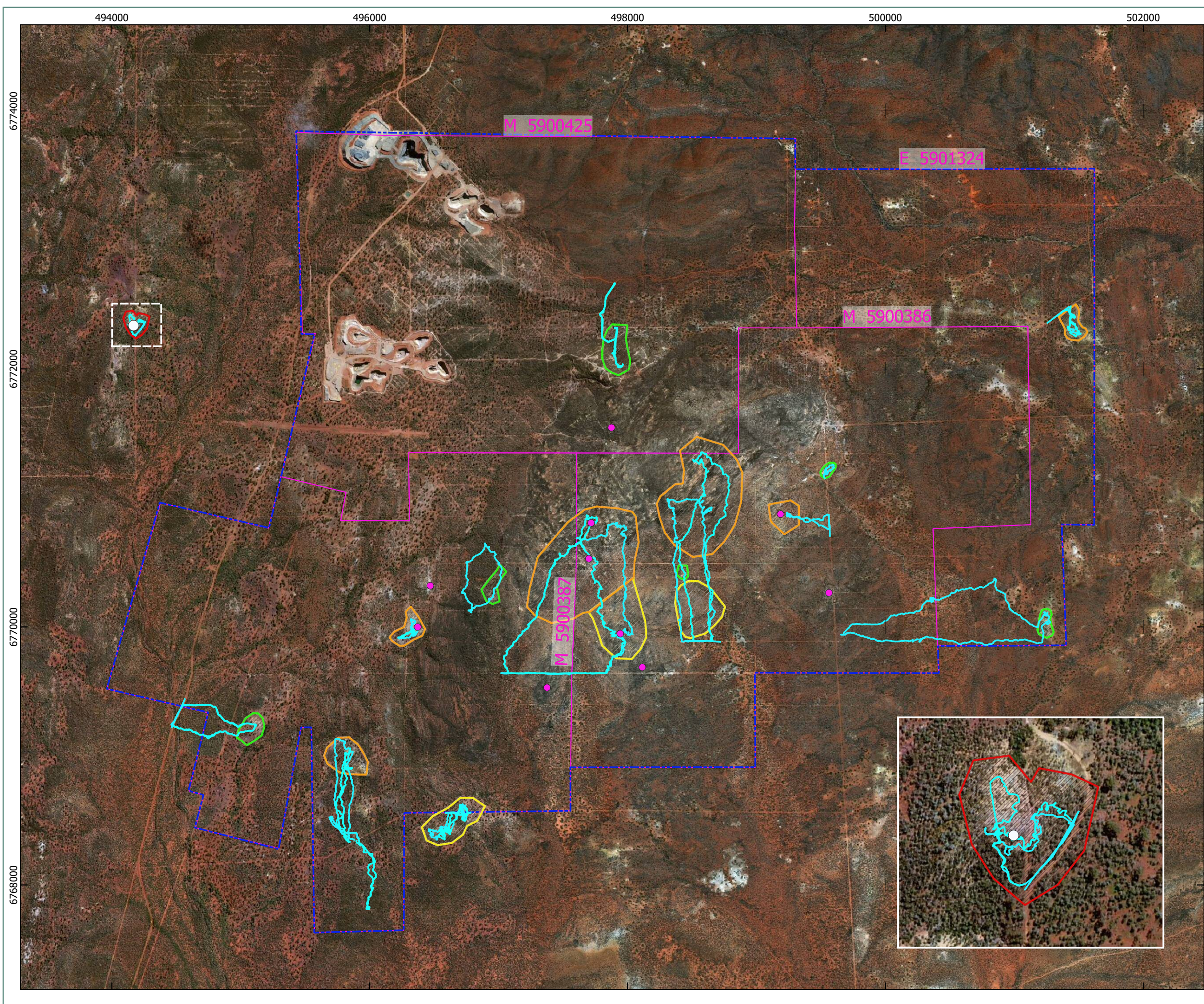
 0 0.3 0.6 0.9 km
Scale 1:35000 @ A3

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter

Author: CF Approved: AH Date: 09-10-2019

Known *Stylidium scintillans*
Locations and Pre-field Sites

Mt Mulgine Project



Legend

Location of *Styliidium scintilans*

○ Known Populations

● Potential Occurrence

— Field Traverse

▭ Targeted Fora Survey Study Area

▭ Tungsten Tenements

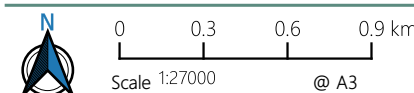
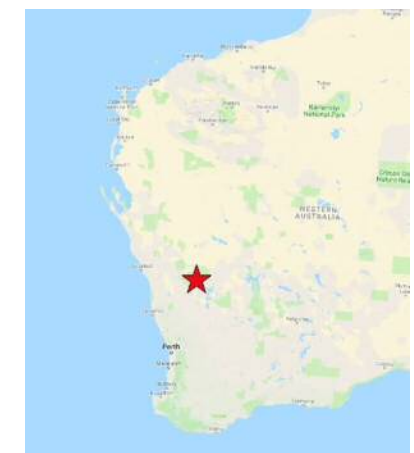
Field Habitat Classification

▨ Optimal

▨ Sub-Optimal 1

▨ Sub-Optimal 2

▨ Unsuitable



Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter

Author: CF Approved: AH Date: 09-10-2019

Field Survey Effort

Mt Mulgine Project

Prepared for
Tungsten Mining

Figure

02

RESULTS & DISCUSSION

No individuals of *Stylidium scintillans* (Threatened) were recorded in the Study Area.

Eight areas of potential habitat were identified from the previous habitat assessment at the Study area (Terratree, 2013). Sixteen areas of potential habitat were ground-truthed during the 2019 targeted flora survey. Only the existing population's habitat, Habitat SE_10, was an area of optimal habitat for *Stylidium scintillans*. The habitat assessment of each of these areas is indicated in Table 3 and Figure 3.

It is unlikely that any *S. scintillans* populations occur in the Study Area, given that:

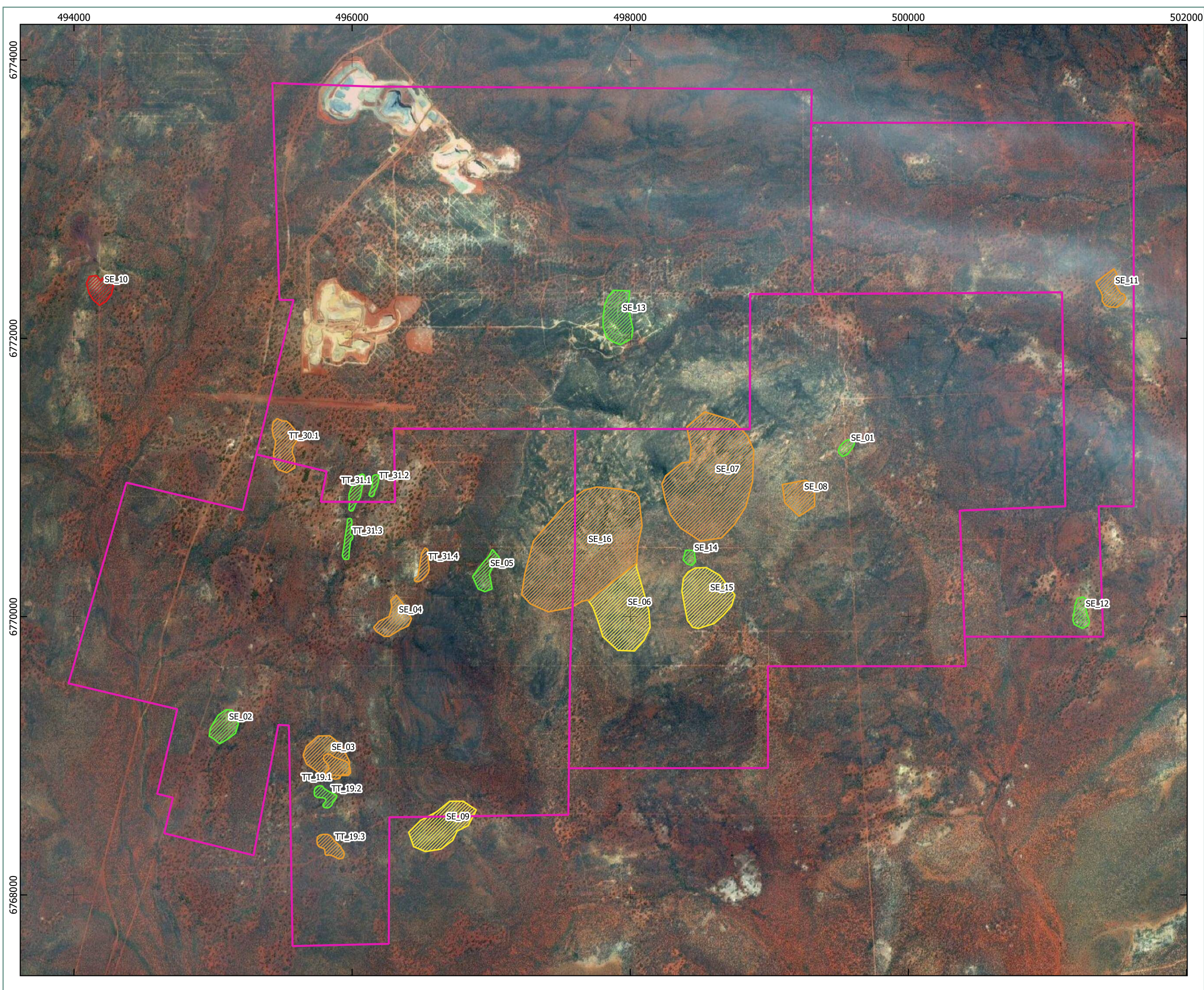
- Areas of potential habitat were identified in the Preliminary Habitat Selection prior to mobilisation and the targeted search areas were further refined and classified in the field;
- Botanists sought to understand the Study Area's geology and other key factors likely to indicate presence of the Threatened flora species, *S. scintillans*;
- Areas were searched in accordance with the guidance from the Threatened and Priority Flora Report Form;
- There was no habitat classified as "optimal" recorded in the Study Area;
- The field botanists had sufficient experience and information to conduct the targeted search and identify the species; and
- Field survey timing was optimal.

Table 3: Classification of Potential Habitat Areas of the Project

Potential Habitat Sites	Lightly coloured aerial imagery	Presence of ironstone / BIF	Presence of weathered granitic basement rock	Presence of breakaways	Presence of clay- loam between rocks	Presence of associated species	Presence of bare open areas	Presence of leaf litter	Habitat Classification
Terratree Previous Potential Habitats									
Habitat TT_19.1	Present	Absent	Present	Present	Unknown	Present	Unknown	Unknown	Sub-optimal 1
Habitat TT_19.2	Absent	Absent	Present	Absent	Unknown	Present	Unknown	Unknown	Unsuitable
Habitat TT_19.3	Present	Absent	Present	Present	Unknown	Present	Unknown	Unknown	Sub-optimal 1
Habitat TT_30.1	Present	Absent	Present	Present	Unknown	Present	Unknown	Unknown	Sub-optimal 1
Habitat TT_31.1	Absent	Absent	Absent	Present	Unknown	Present	Unknown	Unknown	Unsuitable
Habitat TT_31.2	Absent	Absent	Absent	Present	Unknown	Present	Unknown	Unknown	Unsuitable
Habitat TT_31.3	Absent	Absent	Absent	Absent	Unknown	Present	Unknown	Unknown	Unsuitable
Habitat TT_31.4	Present	Absent	Present	Present	Unknown	Present	Unknown	Unknown	Sub-optimal 1
Spectrum Ecology Potential Habitats									
Habitat SE_01	Present	Absent	Absent	Absent	Present	Absent	Absent	Absent	Unsuitable
Habitat SE_02	Present	Absent	Absent	Absent	Present	Absent	Absent	Absent	Unsuitable
Habitat SE_03	Present	Absent	Present	Present	Absent	Present	Absent	Present	Sub-optimal 1

Potential Habitat Sites	Lightly coloured aerial imagery	Presence of ironstone / BIF	Presence of weathered granitic basement rock	Presence of breakaways	Presence of clay- loam between rocks	Presence of associated species	Presence of bare open areas	Presence of leaf litter	Habitat Classification
Habitat SE_04	Present	Absent	Present	Present	Absent	Present	Absent	Present	Sub-optimal 1
Habitat SE_05	Present	Absent	Absent	Absent	Present	Absent	Absent	Absent	Unsuitable
Habitat SE_06	Present	Absent	Present	Absent	Absent	Present	Present	Absent	Sub-optimal 2
Habitat SE_07	Present	Absent	Present	Present	Absent	Present	Absent	Present	Sub-optimal 1
Habitat SE_08	Present	Absent	Present	Present	Absent	Present	Absent	Present	Sub-optimal 1
Habitat SE_09	Present	Absent	Present	Absent	Absent	Present	Present	Absent	Sub-optimal 2
Habitat SE_10	Present	Present	Present	Present	Present	Present	Present	Absent	Optimal^
Habitat SE_11	Present	Absent	Present	Present	Absent	Present	Absent	Present	Sub-optimal 1
Habitat SE_12	Present	Absent	Absent	Absent	Present	Absent	Absent	Absent	Unsuitable
Habitat SE_13	Present	Absent	Absent	Absent	Present	Absent	Absent	Absent	Unsuitable
Habitat SE_14	Present	Absent	Absent	Absent	Present	Absent	Absent	Absent	Unsuitable
Habitat SE_15	Present	Absent	Present	Absent	Absent	Present	Present	Absent	Sub-optimal 2
Habitat SE_16	Present	Absent	Present	Present	Absent	Present	Absent	Present	Sub-optimal 1

^ existing population



Legend

1929_Tungsten_Tenements

Habitat Classification

Optimal

Sub-optimal 1

Sub-optimal 2

Unsuitable

0

0.25

0.5

0.75 km

N

Scale 1:24681 @ A3

Spectrum

ECOLOGY

Coordinate System: GDA 1994 MGA Zone 50

Projection: Transverse Mercator

Units: Meter

Author: CF Approved: MH Date: 15-06-2020

Habitat Classification

Mt Mulgine

Prepared for
Tungsten Mining

Figure
03

LIMITATIONS AND CONSTRAINTS

Table 4: Limitations and Constrains of the Targeted Survey

Limitation	Constraint	Comment
Availability of contextual information at a regional and local scale.	No	Database searches were conducted prior to the survey.
Competency/experience of the team carrying out the survey, including experience in the bioregion surveyed.	No	The field botanists Carmel Forrester and Raimond Orifici have suitable experience conducting botanical surveys in Western Australia.
Proportion of flora recorded and/or collected, any identification issues.	No	The known <i>S. scintillans</i> population was found in suitable condition to conclusively identify. There were no <i>Stylidium</i> species found in the Study Area.
Was the appropriate area fully surveyed (effort and extent).	No	All areas of potential habitat identified were searched.
Access restrictions within the survey area.	No	Access to some rocky breakaways was difficult. There were no vehicle tracks to the central foothills. However, the south western foothills were adequately searched and found to be sub-optimal habitat for <i>S. scintillans</i> .
Survey timing, rainfall, season of survey.	No	The field survey was conducted in September during the optimal flowering time of the targeted species, <i>S. scintillans</i> . This is in accordance with the Threatened Priority Flora Report Form – Field Manual. Location of the known population of <i>S. scintillans</i> confirmed that the species was in flower at the time of the survey.
Disturbance that may have affected the results of survey such as fire, flood or clearing.	No	No disturbances were recorded at the Study Area that have affected the results of the survey.

REFERENCES

- Department of Biodiversity Conservation and Attractions. (2017). *Threatened and Priority Flora Report Form - Field Manual*. Department of Biodiversity, Conservation and Attractions.
- Terratree Ecological Assessment & Management. (2013). *Level 1 and 2 Flora and Vegetation Survey and Mapping Potential Habitat for the Threatened (Declared Rare) species Stylium scintillans*.
- Thackway, R., & Cresswell, I. D. (1995). *An Interim Biogeographic Regionalisation for Australia (IBRA)*.
- Wege, J. A. (2012). Navigating the floral Milky Way: the taxonomy of the microgeophytic triggerplants (*Stylium petiolare* and allies: Stylidiaceae). *Australian Systematic Botany*, 25(2), 138–169. Retrieved from <https://doi.org/10.1071/SB12001>

Appendix E: Confirmed Desktop Records



Taxa	Record ID*	Reference	Status	Easting	Northing	Comment
<i>Acacia diallaga</i>	R000241	APM (2012b)	P1	496080	6773325	Yes confirmed
<i>Acacia diallaga</i>	R042909	Terratree (2013/2014)	P1	497519	6772798	Yes confirmed
<i>Acacia diallaga</i>	R042920	Terratree (2013/2014)	P1	497557	6772901	Yes confirmed
<i>Acacia karina</i>	R043348	Terratree (2013/2014)	P1	497593	6772896	Yes confirmed
<i>Acacia karina</i>	R043628	Terratree (2013/2014)	P1	499766	6771511	Yes confirmed
<i>Acacia karina</i>	R043823	Terratree (2013/2014)	P1	500839	6773012	Yes confirmed
<i>Acacia karina</i>	R004994	Woodman (2012)	P1	496200	6773340	Yes confirmed
<i>Acacia karina</i>	R005095	Woodman (2012)	P1	495444	6770734	Yes confirmed
<i>Acacia subsessilis</i>	R000628	APM (2012b)	P3	496709	6772113	Data error, group of records changed to <i>Acacia sulcatacaulis</i>
<i>Acacia subsessilis</i>	R000608	APM (2012b)	P3	496554	6772572	No <i>Acacia subsessilis</i> found, removed
<i>Acacia subsessilis</i>	R000610	APM (2012b)	P3	496411	6772511	
<i>Acacia subsessilis</i>	R000612	APM (2012b)	P3	496554	6772574	
<i>Acacia subsessilis</i>	R000614	APM (2012b)	P3	496104	6773242	
<i>Acacia sulcatacaulis</i>	R000719	APM (2012b)	P1	496763	6772128	Yes confirmed
<i>Acacia sulcatacaulis</i>	R000764	APM (2012b)	P1	496732	6772079	Yes confirmed
<i>Acacia sulcatacaulis</i>	R042306	APM (2017a)	P1	497333	6772064	Yes confirmed
<i>Acacia sulcatacaulis</i>	R042341	APM (2017a)	P1	497633	6772026	Yes confirmed
<i>Acacia sulcatacaulis</i>	R042128	APM (2018a)	P1	499255	6771642	Yes confirmed
<i>Acacia sulcatacaulis</i>	R003664	Jenny Borger Botanical (2018)	P1	497281	6769715	Yes confirmed
<i>Acacia sulcatacaulis</i>	R003666	Jenny Borger Botanical (2018)	P1	497288	6769414	Yes confirmed
<i>Acacia sulcatacaulis</i>	R003749	Jenny Borger Botanical (2018)	P1	497908	6769670	Yes confirmed
<i>Acacia sulcatacaulis</i>	R003776	Jenny Borger Botanical (2018)	P1	498185	6770269	Yes confirmed
<i>Allocasuarina tessellata</i>	R043919	Terratree (2013/2014)	P1	497517	6772790	Yes confirmed
<i>Allocasuarina tessellata</i>	R043965	Terratree (2013/2014)	P1	498514	6769665	Yes confirmed
<i>Allocasuarina tessellata</i>	R044041	Terratree (2013/2014)	P1	500103	6773088	Yes confirmed
<i>Allocasuarina tessellata</i>	R042533	APM (2017a)	P1	497340	6772057	Yes confirmed
<i>Allocasuarina tessellata</i>	R042561	APM (2017a)	P1	497091	6771246	Yes confirmed
<i>Austrostipa blackii</i>	R004377	WAH/TPFL	P3	497072	6773583	No recorded
<i>Chamelaucium</i> sp. Warriedar (A.P. Brown & S. Patrick APB 1100)	R044151	Terratree (2013/2014)	P1	497480	6772812	Yes confirmed
<i>Chamelaucium</i> sp. Yalgoo (Y. Chadwick 1816)	R000829	APM (2012b)	P1	496416	6773736	Specimens collected from area and identified as <i>Chamelaucium</i> sp. Warriedar (A.P. Brown & S. Patrick APB 1100)
<i>Chamelaucium</i> sp. Yalgoo (Y. Chadwick 1816)	R000833	APM (2012b)	P1	496688	6773722	
<i>Chamelaucium</i> sp. Yalgoo (Y. Chadwick 1816)	R000851	APM (2012b)	P1	496677	6773747	
<i>Chamelaucium</i> sp. Yalgoo (Y. Chadwick 1816)	R000853	APM (2012b)	P1	496752	6773742	
<i>Chamelaucium</i> sp. Yalgoo (Y. Chadwick 1816)	R004146	WAH/TPFL	P1	496416	6773798	
<i>Dodonaea amplexifolia</i>	R044235	Terratree (2013/2014)	P4	497552	6773019	Yes confirmed
<i>Dodonaea amplexifolia</i>	R044241	Terratree (2013/2014)	P4	497597	6773004	Yes confirmed
<i>Drummondita fulva</i>	R000983	APM (2012b)	P3	495767	6773362	ID error
<i>Drummondita fulva</i>	R001009	APM (2012b)	P3	495727	6773244	ID error
<i>Drummondita fulva</i>	R002964	APM (2017b)	P3	497755	6771958	ID error
<i>Grevillea scabrifolia</i>	R001610	APM (2012b)	P1	496217	6773358	Yes confirmed
<i>Grevillea scabrifolia</i>	R001803	APM (2012b)	P1	497012	6773680	Yes confirmed
<i>Grevillea scabrifolia</i>	R044440	Terratree (2013/2014)	P1	497483	6772814	Yes confirmed
<i>Grevillea scabrifolia</i>	R024499	Woodman (2012)	P1	494453	6769635	Yes confirmed
<i>Grevillea subtiliflora</i>	R002235	APM (2012b)	P3	496151	6773291	Yes confirmed
<i>Grevillea subtiliflora</i>	R044799	Terratree (2013/2014)	P3	497103	6771238	Yes confirmed
<i>Grevillea subtiliflora</i>	R024689	Woodman (2012)	P3	497231	6773113	Yes confirmed

Taxa	Record ID*	Reference	Status	Easting	Northing	Comment
<i>Hydrocotyle dimorphocarpa</i>	R004189	WAH/TPFL	P1	496156	6773185	Yes confirmed
<i>Lepidosperma</i> sp. Blue Hills (A. Markey & S. Dillon 3468)	R025494	Woodman (2012)	P1	497744	6770959	Yes confirmed
<i>Lepidosperma</i> sp. Blue Hills (A. Markey & S. Dillon 3468)	R025742	Woodman (2012)	P1	494453	6769635	Yes confirmed
<i>Lepidosperma</i> sp. Blue Hills (A. Markey & S. Dillon 3468)	R025743	Woodman (2012)	P1	499549	6771171	Yes confirmed
<i>Micromyrtus acuta</i>	R030032	Woodman (2012)	P3	496301	6772970	Yes confirmed
<i>Micromyrtus trudgenii</i>	R042729	APM (2017a)	P3	497398	6772063	Yes confirmed
<i>Micromyrtus trudgenii</i>	R030651	Woodman (2012)	P3	497249	6771019	Yes confirmed
<i>Persoonia pentasticha</i>	R045073	Terratree (2013/2014)	P3	497392	6770572	Yes confirmed
<i>Persoonia pentasticha</i>	R045096	Terratree (2013/2014)	P3	497516	6770642	Yes confirmed
<i>Persoonia pentasticha</i>	R045106	Terratree (2013/2014)	P3	497559	6772819	Yes confirmed
<i>Persoonia pentasticha</i>	R045145	Terratree (2013/2014)	P3	498498	6769866	Yes confirmed
<i>Persoonia pentasticha</i>	R045226	Terratree (2013/2014)	P3	500874	6772958	Yes confirmed
<i>Persoonia pentasticha</i>	R035445	Woodman (2012)	P3	495565	6773324	Yes confirmed
<i>Persoonia pentasticha</i>	R035458	Woodman (2012)	P3	494280	6769635	Yes confirmed
<i>Persoonia pentasticha</i>	R035459	Woodman (2012)	P3	500734	6772029	Yes confirmed
<i>Rhodanthe collina</i>	R037521	Woodman (2012)	P3	496171	6773177	Yes confirmed
<i>Stenanthemum poicilum</i>	R004736	WAH/TPFL	P3	500702	6770662	Yes confirmed
<i>Stenanthemum poicilum</i>	R038509	Woodman (2012)	P3	500702	6770663	Yes confirmed

* = Provided in electronic data of desktop assessment records

Appendix F: Likelihood of Occurrence of Significant Flora



Desktop Likelihood	Taxon	Status	Family	Description	Habitat	Distance of Closest Record to Project (km)
Recorded	<i>Acacia diallaga</i>	P1	FABACEAE	Dense perennial spreading shrub.	Grows in skeletal soils on slopes or crests of low rocky hills in open Acacia and Allocasuarina shrubland. Basalt.	0
Low	<i>Acacia epacantha</i>	P3	FABACEAE	Dense, bushy, spiny shrub, 0.2-0.5(-0.7) m high. Fl. yellow, Jul to Aug.	Lateritic gravelly loam or clay.	168.9
Low	<i>Acacia formidabilis</i>	P3	FABACEAE	Diffuse, pungent shrub, 0.2-0.6 m high. Fl. yellow, Aug to Sep.	Yellow or red/brown sand. Undulating plains, hillsides.	33.5
Low	<i>Acacia imitans</i>	T (EN/CR)	FABACEAE	Low, dense, spreading, intricate & prickly shrub, 0.2-1 m high, to 2 m wide. Fl. yellow, Aug to Sep.	Rocky red loam. Rocky hills.	40.0
Recorded	<i>Acacia karina</i>	P1	FABACEAE	Straggling, woody shrub, to 1.5 m high, phyllodes terete with appressed hairs between nerves.	Red-brown silty clay loam with ironstone pebbles, banded ironstone, shalestone. Rocky slopes.	0
Recorded ^	<i>Acacia subsessilis</i>	P3	FABACEAE	Rounded, straggly, pungent shrub, 1-2 m high. Fl. yellow, Jul to Aug.	Red sand or stony gravel over ironstone. Rocky hills.	0
Recorded	<i>Acacia sulcicaulis</i>	P1	FABACEAE	Multi-stemmed onconic shrub.	Quartz substrates on steep slopes, ridges and along rock creek courses, in shrublands.	0
Low	<i>Acacia woodmaniorum</i>	T (-/EN)	FABACEAE	Intricately branched, prickly, hard shrub, to 2 m high.	Skeletal red silt, red-brown soil, banded ironstone, laterite. Slopes, sides of hills, crests of ridges, ranges, disturbed overburden of mine sites.	3.1
Low	<i>Allocasuarina ramosissima</i>	P3	CASUARINACEAE	Dioecious, somewhat divaricate shrub, 0.3-1.2 m high.	Lateritic soils, gravel.	168.8
Recorded	<i>Allocasuarina tessellata</i>	P1	CASUARINACEAE	Dioecious shrub or tree, 3-5 m high.	Loam, sand. Greenstone & dolerite boulders.	0
Low	<i>Angianthus micropodioides</i>	P3	ASTERACEAE	Erect or decumbent annual, herb, 0.03-0.15 m high. Fl. yellow-white, Nov to Dec or Jan to Feb.	Saline sandy soils. River edges, saline depressions, claypans.	19.0
High	<i>Angianthus prostratus</i>	P3	ASTERACEAE	Prostrate annual, herb. Fl. white-yellow, Jul to Sep.	Red clay or loamy soils. Saline depressions.	7.3
Low	<i>Anigozanthos humilis</i> subsp. Badgingarra (S.D. Hopper 7114)	P2	HAEMODORACEAE	Erect, hirsute rhizomatous, herb, to 0.9 m high.	Grey-white sand, rich brown sandy loam, sandy clay, alluvial soils. Low plains, river-banks, winter-wet swamps.	154.9
Recorded ^	<i>Austrostipa blackii</i>	P3	POACEAE	Tufted perennial, grass-like or herb, 1 m high. Fl. Sep to Nov.		0
Low	<i>Baeckea</i> sp. Perenjori (J.W. Green 1516)	P2	MYRTACEAE	Rounded shrub, ca 0.5 m high, 1 m wide. Fl. pink, Aug.	Loam, clay.	54.0
Low	<i>Banksia borealis</i> subsp. <i>elatior</i>	P3	PROTEACEAE	Compact, pungent, non-lignotuberous shrub, 1-2.5 m high. Fl. yellow-orange, Jul to Nov.	Lateritic gravelly soils, yellow sand. Hillslopes.	127.4
Low	<i>Banksia scabrella</i>	P4	PROTEACEAE	Much-branched, lignotuberous shrub, 0.6-2 m high. Fl. yellow & cream & purple, Sep to Dec or Jan.	White, grey or yellow sand, sometimes with lateritic gravel. Sandplains, lateritic ridges.	175.2

Desktop Likelihood	Taxon	Status	Family	Description	Habitat	Distance of Closest Record to Project (km)
Low	<i>Beaufortia bicolor</i>	P3	MYRTACEAE	Dense shrub, 0.3-1 m high. Fl. red & yellow & orange, Nov to Dec.	White sand over laterite. Sandplains.	146.7
Low	<i>Beyeria cinerea</i> subsp. <i>cinerea</i>	P3	EUPHORBIACEAE	Low dense shrub.	Sandy soils. Coastal areas.	227.3
High	<i>Bossiaea</i> sp. Jackson Range (G. Cockerton & S. McNee LCS 13614)	P3	FABACEAE	Spiny shrub.	Breakaway, laterised ironstone, red-brown clay loam soils.	6.0
High	<i>Calandrinia kalanniensis</i>	P2	MONTIACEAE	Semi-erect to erect tuberous, perennial, herb, to 0.09 m high. Fl. pink-white, Nov to Dec or Jan.	Shallow brown clay, often gritty, derived from eroded granite. Rock outcrops, herbfields.	0.1
High	<i>Calandrinia</i> sp. Warriear (F. Obbens 04/09)	P2	MONTIACEAE	Decumbent to semi erect annual herb.	Hill slopes and rocky outcrops. Lateritic/granite outcrops.	5.1
Low	<i>Calothamnus arcuatus</i>	P2	MYRTACEAE			142.8
High	<i>Calotis</i> sp. Perrinvale Station (R.J. Cranfield 7096)	P3	ASTERACEAE	Annual herb.	BIF rocky hillslopes.	1.3
Low	<i>Calytrix ecalycata</i> subsp. <i>ecalcata</i>	P3	MYRTACEAE	Erect, open shrub, 1-1.5 m high. Fl. yellow, Jul or Sep to Oct.	Yellow or white sand, sandy gravel, clay loam, granite, sandstone. Uplands, valley flats, ridges, hills, road verges.	138.1
Recorded	<i>Chamelaucium</i> sp. Warriear (A.P. Brown & S. Patrick APB 1100)	P1	MYRTACEAE	Low shrub.	Low slopes and flats. Basalt.	0
Recorded ^	<i>Chamelaucium</i> sp. Yalgoo (Y. Chadwick 1816)	P1	MYRTACEAE	Perennial shrub.	Upper slope. Red loamy clay on rocky ground.	0
High	<i>Cyanicula fragrans</i>	P3	ORCHIDACEAE	Tuberous, perennial, herb, 0.06-0.12 m high. Fl. blue, Aug to Sep.	Red loam. Flat granite outcrops.	2.5
Low	<i>Dasymalla axillaris</i>	T (CR/CR)	LAMIACEAE	Low shrub. Flowering time July, September, October, November or December.		40.0
Low	<i>Daviesia speciosa</i>	T (EN/EN)	FABACEAE	Many-stemmed shrub, 0.3-0.8 m high. Fl. red, Apr to May.	Gravelly lateritic soils. Undulating plains, rises.	144.8
Low	<i>Desmocladius elongatus</i>	P4	RESTIONACEAE	Rhizomatous, perennial, herb (sedge-like), 0.25-0.5 m high. Fl. Aug to Dec.	White or grey sand. Dry kwongan.	154.6
High	<i>Dicrastylis linearifolia</i>	P3	LAMIACEAE	Much-branched shrub, 1-3 m high, inflorescence with scale-like indumentum; upper surface of leaves hairy; stamens usually 5. Fl. white, Nov to Dec.	Red sand. Sandplain.	2.3
Recorded	<i>Dodonaea amplisemina</i>	P4	SAPINDACEAE	Dioecious, multi-stemmed shrub, 0.3-1 m high.	Red-brown sandy clay on basalt and gabbro and banded ironstone or on dolerite and quartzite. Rocky hills.	2.5

Desktop Likelihood	Taxon	Status	Family	Description	Habitat	Distance of Closest Record to Project (km)
Low	<i>Dodonaea scurra</i>	P1	SAPINDACEAE	Dioecious, multi-stemmed shrub, 0.4-1 m high.	Fine to coarse gravel, brown sandy loam, banded ironstone. Upper slopes of hills and crests of rock outcrops.	121.0
Recorded ^	<i>Drummondita fulva</i>	P3	RUTACEAE	Erect, branching shrub, 0.5-1.5 m high.	Skeletal, shallow, acidic soils of orange-red or red-brown sandy loams and clayey silts. Footslopes, lower to upper slopes and hillcrests.	<5 km
Low	<i>Enekbatus ?dualis</i>	P1	MYRTACEAE	Shrub, to 0.75 m high. Fl. pink, Sep.	Orange-brown silty sand, brown clayey sand, granite. Low hills, gentle mid to upper slopes, rock outcrops.	72.6
Low	<i>Eremaea acutifolia</i>	P3	MYRTACEAE	Spreading, dense shrub, 0.4-0.7(-1) m high. Fl. orange/pink, Aug to Nov.	Grey or yellow sand. Sandplains.	142.2
High	<i>Eremophila grandiflora</i>	P3	SCROPHULARIACEAE	Large, resinous shrub, to 3 m high.	Stony red-brown sandy-clay. On slopes and along drainage lines.	13.3
High	<i>Eremophila oldfieldii</i> subsp. <i>papula</i>	P1	SCROPHULARIACEAE	Shrub or tree, 1-6 m high. Fl. yellow-orange-red-pink, May to Oct.	Clay, loam, calcareous sand, rocky soils. Stony creek beds, rocky sites, granite outcrops, breakaways, undulating plains.	5.2
High	<i>Eremophila sericea</i>	P1	SCROPHULARIACEAE	Shrub to 1.5 m. Red-brown clay loam.	Low rocky rises.	6.1
Medium	<i>Eremophila</i> sp. Thundelarra (B. Buirchell BB 324)	P1	SCROPHULARIACEAE	Shrub 2-3 m.	Watercourse. Rangeland. Brown/red sand/loam.	29.1
Low	<i>Eremophila viscida</i>	T (EN/EN)	SCROPHULARIACEAE	Shrub, 1.2-4 m high. Fl. green-white-yellow, Sep to Nov.	Granitic soils, sandy loam. Stony gullies, sandplains.	40.0
Low	<i>Eucalyptus beardiana</i>	T (VU/EN)	MYRTACEAE	(Mallee), 3-5 m high, bark smooth. Fl. cream-white, Aug to Sep.	Red or yellow sand. Sand dunes & ridges.	40.0
Low	<i>Eucalyptus jutsonii</i> subsp. <i>kobela</i>	P1	MYRTACEAE	(Mallee), 4-8 m high, bark rough over most of stems, grey.	Deep yellow to orange sand. Broad and subdued rises high in the landscape.	20.7
Low	<i>Eucalyptus macrocarpa</i> subsp. <i>elachantha</i>	P4	MYRTACEAE	(Spreading or sprawling mallee), 0.8-4 m high, bark smooth, grey over salmon pink. Fl. red-pink, Aug to Sep or Nov to Dec.	White or grey sand over laterite. Hillslopes, ridges, sandplains.	142.0
Medium	<i>Eucalyptus synandra</i>	T (VU/VU)	MYRTACEAE	(Mallee), 3.5-10 m high, bark smooth. Fl. cream & pink, Aug or Dec or Jan to Mar.	Sandy & lateritic soils.	23.8
Low	<i>Euryomyrtus recurva</i>	P3	MYRTACEAE	Shrub, 0.3-1 m high. Fl. white-pink, Jul to Sep.	Yellow/red sand, brown/yellow sandy clay. Gravel pits, catchment slopes.	18.5
Low	<i>Frankenia conferta</i>	T (EN/VU)	FRANKENIACEAE	Small shrub.		40.0
Low	<i>Gnephosis cassiniana</i>	P3	ASTERACEAE	Erect annual, herb, 0.01-0.06 m high. Fl. yellow, Sep to Oct.	Sand, clay loam. Saline depressions, low wet areas.	16.1
Medium	<i>Gnephosis setifera</i>	P1	ASTERACEAE	Small annual, herb. Fl. yellow, Sep.	Sand. Saline flats.	24.3

Desktop Likelihood	Taxon	Status	Family	Description	Habitat	Distance of Closest Record to Project (km)
High	<i>Grevillea globosa</i>	P3	PROTEACEAE	Spreading, non-lignotuberous shrub, 1-3 m high. Fl. cream & white & green/red-brown, Jan or Jun or Nov.	Red loam, yellow sand.	1.4
High	<i>Grevillea granulosa</i>	P3	PROTEACEAE	Compact shrub, 0.4-1.5(-4) m high. Fl. red, Jul to Oct.	Gravelly sand, loam, clay. Sandplains.	7.4
Medium	<i>Grevillea leptopoda</i>	P3	PROTEACEAE	Spreading to erect shrub, 0.6-1.5 m high. Fl. white-cream, Aug to Sep.	Loam & lateritic gravel, sand, clay.	26.3
Low	<i>Grevillea phanerophlebia</i>	T (-/CR)	PROTEACEAE	Shrub, 0.9-1.5 m high. Fl. white, Sep.	Sand.	147.8
Recorded	<i>Grevillea scabrida</i>	P1	PROTEACEAE	Densely & irregularly branched shrub, 0.6-1.5 m high. Fl. green-white/green-yellow/white, Jul.	Red clay loam, stony loam.	0
Recorded	<i>Grevillea subtiliflora</i>	P3	PROTEACEAE	Erect to spreading shrub, 1-2.5 m high. Fl. white, Apr or Jul to Sep.	Red-brown loam.	0
High	<i>Gunniopsis divisa</i>	P3	AIZOACEAE	Annual, herb, 0.05-0.1 m high. Fl. white, Aug.	Loam, quartz. Roadsides.	1.9
Low	<i>Gyrostemon reticulatus</i>	T (CR/CR)	GYROSTEMONACEAE	Shrub, ca 1 m high, presumed extinct.		40.0
Low	<i>Hemiandra</i> sp. Eneabba (H. Demarz 3687)	P3	LAMIACEAE	Straggly, erect shrub, 0.5-0.9 m high, to 0.4 m wide. Fl. blue/violet, Feb.	Sand. Disturbed sites.	168.3
High	<i>Hemigenia tichbonii</i>	P1	LAMIACEAE	Shrubs. Flowering time August or October.		9.6
Low	<i>Hensmania chapmanii</i>	T (VU/VU)	HEMEROCALLIDACEAE	Rhizomatous, tufted perennial, herb, to 0.3 m high. Fl. yellow-brown, Dec or Jan.	Yellow-grey or lateritic sand.	130.3
Low	<i>Hensmania stoniella</i>	P3	HEMEROCALLIDACEAE	Tufted, stilt-rooted perennial, herb, 0.1-0.2 m high. Fl. yellow-cream-white, Sep to Nov.	White, grey or lateritic sand, often winter-wet.	154.0
Low	<i>Hybanthus cymulosus</i>	T (CR/CR)	VIOLACEAE	Perennial, herb, 0.15-0.9 m high. Fl. blue-purple, May to Jul.	Clay, rocky loam clay.	40.0
Recorded	<i>Hydrocotyle dimorphocarpa</i>	P1	ARALIACEAE	Annual herb.	Along creeklines and drainage lines. Red-brown soils. Rocky grounds.	0
Low	<i>Korthalsella leucothrix</i>	P1	SANTALACEAE	Aerial, parasitic shrub, leaf apex obtuse, c. 20 flowers per node. Fl. white, Aug. On <i>Acacia acuminata</i> and <i>A. craspedocarpa</i> .		19.0
Recorded	<i>Lepidosperma</i> sp. Blue Hills (A. Markey & S. Dillon 3468)	P1	CYPERACEAE	Perennial sedge.	Rocky BIF hills. Granite outcrops. Flats.	0
Low	<i>Lepidosperma</i> sp. Koolanooka (K.R. Newbey 9336)	P1	CYPERACEAE	Perennial sedge.	Rocky hills.	66.5
Low	<i>Malleostemon decipiens</i>	P1	MYRTACEAE			149.1
High	<i>Melaleuca barlowii</i>	P3	MYRTACEAE	Shrub, 1.5-1.8 m high. Fl. Apr.	Yellow-brown sand or red-brown clay loam. Roadside reserves, shrubland.	4.8

Desktop Likelihood	Taxon	Status	Family	Description	Habitat	Distance of Closest Record to Project (km)
Low	<i>Melaleuca sclerophylla</i>	P3	MYRTACEAE	Erect-spreading to prostrate shrub, 0.15-0.9 m high. Fl. purple-pink, Jun to Sep.	Gravelly sand, clayey sand. Granite outcrops, rises.	144.6
Medium	<i>Menkea draboides</i>	P3	BRASSICACEAE	Prostrate, spreading annual, herb, to 0.6 m wide. Fl. white/cream, Aug to Sep.	Red sand or clay, granite.	10.0
Recorded	<i>Micromyrtus acuta</i>	P3	MYRTACEAE	Erect shrub, 0.8-2 m high.	Grey-tan silty fine to coarse sand, laterite, granite. Rock outcrops.	0
Recorded	<i>Micromyrtus trudgenii</i>	P3	MYRTACEAE	Erect, open shrub, 1-2 m high.	Red-brown loamy clay, yellow-brown soils, gravel, siltstone, quartz, basalt, banded ironstone, dolerite. Tops and slopes of hills and ridges.	0
High	<i>Millotia dimorpha</i>	P1	ASTERACEAE	Erect or ascending annual, herb, ca 0.11 m high. Fl. yellow-white, Sep.	Red loamy soils.	5.6
Low	<i>Persoonia kararae</i>	P2	PROTEACEAE	Erect, spreading shrub, 1-5 m high. Fl. yellow, Sep to Nov.	Sandplains.	23.4
Recorded	<i>Persoonia pentasticha</i>	P3	PROTEACEAE	Erect, spreading shrub, 0.4-1.8 m high. Fl. yellow, Aug to Nov.	Sand, loam. Base of granite outcrops.	0
Low	<i>Petrophile globifera</i>	P3	PROTEACEAE			140.1
High	<i>Petrophile pauciflora</i>	P3	PROTEACEAE	Shrub, ca 1 m high. Fl. yellow, Sep.	Decaying & dissected granite breakaways.	9.9
Low	<i>Philothea nutans</i>	P1	RUTACEAE	Upright shrub, 0.3-0.9 m high. Fl. green-cream-yellow/red-pink, Apr or Jun to Jul or Sep.	Sandy soils. Low plains, undulating rises, edges of salt lakes.	34.8
Low	<i>Phlebocarya pilosissima</i> subsp. <i>pilosissima</i>	P3	HAEMODORACEAE	Shortly rhizomatous, compactly tufted perennial, grass-like or herb, 0.15-0.4 m high. Fl. cream-white, Aug to Oct.	White or grey sand, lateritic gravel.	168.2
Low	<i>Pityrodia viscida</i>	P4	LAMIACEAE	Viscid shrub, 0.3-0.6(-1) m high. Fl. white, Sep to Dec or Jan to Feb.	Lateritic sand.	80.7
Low	<i>Podotheca uniseta</i>	P3	ASTERACEAE	Ascending to erect, succulent annual, herb, 0.05-0.25 m high. Fl. yellow, Sep to Dec.	White/grey sand, sandy loam. Samphire flats.	32.0
High	<i>Polianthion collinum</i>	P3	RHAMNACEAE	Rounded shrub, to 1.25 m high. Fl. white-cream, May to Jul.	Red clay loam between blocks of banded ironstone. Low hills and slopes.	3.9
High	<i>Prostanthera</i> sp. Karara (D. Coultas & K. Greenacre Opp 8)	P1	LAMIACEAE	Lamiaceae shrub.	Unknown.	0.3
High	<i>Psammomoya implexa</i>	P3	CELASTRACEAE	Large, spreading, much-branched shrub, to 1 m high. Fl. white, Aug to Oct.	Stony rises.	8.1
Recorded	<i>Rhodanthe collina</i>	P3	ASTERACEAE	Erect, bushy annual, herb, 0.1-0.25 m high. Fl. white & yellow, Aug to Oct.	Loam. Rocky hills.	0
Low	<i>Roycea pycnophylloides</i>	T (EN/VU)	CHENOPODIACEAE	Perennial, herb, forming densely branched, silvery mats to 1 m wide. Fl. Sep.	Sandy soils, clay. Saline flats.	40.0

Desktop Likelihood	Taxon	Status	Family	Description	Habitat	Distance of Closest Record to Project (km)
Low	<i>Schoenus griffinianus</i>	P4	CYPERACEAE	Small, tufted perennial, grass-like or herb (sedge), to 0.1 m high. Fl. Sep to Oct.	White sand.	159.4
Low	<i>Stawellia dimorphantha</i>	P4	HEMEROCALLIDACEAE	Stilt-rooted perennial, herb, 0.05-0.2 m high. Fl. purple/cream, Jun to Nov.	White, grey, yellow sand.	195.8
Recorded	<i>Stenanthemum poicilum</i>	P3	RHAMNACEAE	Erect or decumbent shrub, 0.15-0.5 m high. Fl. white, May to Jun or Sep to Nov.	Red clay or sandy clay, loam.	0
Low	<i>Stylidium pseudocaespitosum</i>	P2	STYLIDIACEAE	Rosetted perennial, herb, 0.1-0.3 m high, leaves tufted, linear, 2-7 cm long, 0.5-2 mm wide, apex subacute, margin entire, scabrous. Scape glabrous. Inflorescence racemose. Fl. yellow, Sep to Nov.	White, grey or yellow sand over laterite. Breakaways and hillslopes.	134.2
High	<i>Stylidium scintillans</i>	T (-/VU)	STYLIDIACEAE	Ephemeral herb 3-10 cm.	Granite outcrops. Exposed shaly ironstone with skeletal red clay loam soils.	1.3
Low	<i>Tecticornia bulbosa</i>	T (VU/VU)	CHENOPODIACEAE	Sprawling shrub, ca 1 m high, 2-3 m wide.	Saline sandy clay or red/brown loam.	40.0
Low	<i>Thryptomene nitida</i>	P3	MYRTACEAE	n/a	n/a	137.0
Low	<i>Verticordia comosa</i>	P3	MYRTACEAE	Erect, spindly shrub, 1-2.4 m high. Fl. yellow, Oct to Dec.	Yellow or grey sand.	116.4
Low	<i>Verticordia rutilastra</i>	P3	MYRTACEAE	Shrub, 0.2-0.9 m high. Fl. yellow, Sep to Nov.	Sand & lateritic gravel. Hills.	148.7
Low	<i>Verticordia spicata</i> subsp. <i>squamosa</i>	T (EN/CR)	MYRTACEAE	Shrub, to 1 m high. Fl. white-pink, Nov to Dec.	Yellow sand, yellow-brown sand, yellow clayey sand. Sandplains, flats, road verges.	114.8
Low	<i>Vittadinia cervicalis</i> var. <i>occidentalis</i>	P1	ASTERACEAE	Annual, herb, more than 0.3 m high. Fl. white-purple-blue, Aug to Sep.		229.6
Medium	<i>Wurmbea murchisoniana</i>	P4	COLCHICACEAE	Cormous, perennial, herb, 0.1-0.26 m high, hermaphrodite. Fl. white, Jul to Sep. Clay, sandy clay, loam.	Seasonally inundated clay hollows, rock pools.	26.1
Low	<i>Wurmbea tubulosa</i>	T (EN/VU)	COLCHICACEAE	Cormous, perennial, herb, 0.01-0.03 m high, dioecious or sometimes andromonoecious. Fl. white-pink, Jun to Aug.	Clay, loam. Riverbanks, seasonally-wet places.	148.5

^ = likely identification errors or no longer occurring

Appendix G: Flora Species List



Family	Taxa	Status
Aizoaceae	<i>*Mesembryanthemum nodiflorum</i>	Weed
Amaranthaceae	<i>Ptilotus divaricatus</i>	-
Amaranthaceae	<i>Ptilotus eremita</i>	-
Amaranthaceae	<i>Ptilotus exaltatus</i>	-
Amaranthaceae	<i>Ptilotus gaudichaudii</i>	-
Amaranthaceae	<i>Ptilotus helipteroides</i>	-
Amaranthaceae	<i>Ptilotus obovatus</i>	-
Amaranthaceae	<i>Ptilotus schwartzii</i>	-
Apiaceae	<i>Daucus glochidiatus</i>	-
Apiaceae	<i>Xanthosia kochii</i>	-
Apocynaceae	<i>Alyxia buxifolia</i>	-
Apocynaceae	<i>Marsdenia australis</i>	-
Apocynaceae	<i>Vincetoxicum lineare</i>	-
Araliaceae	<i>Trachymene cyanopetala</i>	-
Araliaceae	<i>Trachymene ornata</i>	-
Araliaceae	<i>Hydrocotyle dimorphocarpa</i>	P1
Araliaceae	<i>Hydrocotyle intertexta</i>	-
Asparagaceae	<i>Arthropodium dyeri</i>	-
Asparagaceae	<i>Chamaexeros macranthera</i>	-
Asparagaceae	<i>Thysanotus manglesianus</i>	-
Asparagaceae	<i>Thysanotus pyramidalis</i>	-
Asphodelaceae	<i>Bulbine semibarbata</i>	-
Asteraceae	<i>Actinobole uliginosum</i>	-
Asteraceae	<i>*Arctotheca calendula</i>	Weed
Asteraceae	<i>Asteraceae</i> sp.	-
Asteraceae	<i>Bellida graminea</i>	-
Asteraceae	<i>Blennospora drummondii</i>	-
Asteraceae	<i>Calocephalus multiflorus</i>	-
Asteraceae	<i>Calotis hispidula</i>	-
Asteraceae	<i>Calotis multicaulis</i>	-
Asteraceae	<i>Cephalopterum drummondii</i>	-
Asteraceae	<i>Chthonocephalus pseudevax</i>	-
Asteraceae	<i>Cratystylis subspinescens</i>	-
Asteraceae	<i>Erymophyllum glossanthus</i>	-
Asteraceae	<i>Gilruthia osbornii</i>	-
Asteraceae	<i>Gnephosis arachnoidea</i>	-
Asteraceae	<i>Gnephosis brevifolia</i>	-
Asteraceae	<i>Gnephosis tenuissima</i>	-
Asteraceae	<i>Hyalosperma glutinosum</i> subsp. <i>glutinosum</i>	-
Asteraceae	<i>Hyalosperma glutinosum</i> subsp. <i>venustum</i>	-
Asteraceae	? <i>Hyalosperma glutinosum</i>	-
Asteraceae	<i>*Hypochaeris glabra</i>	Weed
Asteraceae	<i>Lemooria burkittii</i>	-
Asteraceae	<i>Millotia myosotidifolia</i>	-
Asteraceae	<i>*Monoculus monstrosus</i>	Weed
Asteraceae	<i>Myriocephalus guerinae</i>	-
Asteraceae	<i>Myriocephalus pygmaeus</i>	-
Asteraceae	<i>Olearia humilis</i>	-
Asteraceae	<i>Olearia muelleri</i>	-
Asteraceae	<i>Olearia pimeleoides</i>	-
Asteraceae	<i>Podolepis aristata</i> subsp. <i>affinis</i>	-
Asteraceae	<i>Podolepis capillaris</i>	-
Asteraceae	<i>Podolepis gardneri</i>	-
Asteraceae	<i>Podolepis lessonii</i>	-
Asteraceae	<i>Pogonolepis muelleriana</i>	-
Asteraceae	<i>Rhodanthe ?oppositifolia</i> subsp. <i>oppositifolia</i>	-

Family	Taxa	Status
Asteraceae	<i>Rhodanthe chlorocephala</i> subsp. ? <i>splendida</i>	-
Asteraceae	<i>Rhodanthe chlorocephala</i> subsp. <i>rosea</i>	-
Asteraceae	<i>Rhodanthe chlorocephala</i> subsp. <i>splendida</i>	-
Asteraceae	<i>Rhodanthe citrina</i>	-
Asteraceae	<i>Rhodanthe collina</i>	P3
Asteraceae	<i>Rhodanthe laevis</i>	-
Asteraceae	<i>Rhodanthe manglesii</i>	-
Asteraceae	<i>Rhodanthe maryonii</i>	-
Asteraceae	<i>Rhodanthe oppositifolia</i> subsp. <i>oppositifolia</i>	-
Asteraceae	<i>Rhodanthe polycephala</i>	-
Asteraceae	<i>Rhodanthe stricta</i>	-
Asteraceae	<i>Schoenia cassiniana</i>	-
Asteraceae	<i>Senecio glossanthus</i>	-
Asteraceae	* <i>Sonchus oleraceus</i>	Weed
Asteraceae	<i>Trichanthodium skirrophorum</i>	-
Asteraceae	<i>Waitzia acuminata</i> var. <i>acuminata</i>	-
Asteraceae	<i>Waitzia nitida</i>	-
Boraginaceae	<i>Halgania anagalloides</i>	-
Boryaceae	<i>Borya sphaerocephala</i>	-
Brassicaceae	<i>Lepidium oxytrichum</i>	-
Brassicaceae	<i>Lepidium</i> sp.	-
Brassicaceae	<i>Phlegmatospermum drummondii</i>	-
Brassicaceae	* <i>Sisymbrium erysimoides</i>	Weed
Brassicaceae	<i>Stenopetalum anfractum</i>	-
Brassicaceae	<i>Stenopetalum filifolium</i>	-
Campanulaceae	<i>Lobelia winfridae</i>	-
Caryophyllaceae	* <i>Petrorhagia dubia</i>	Weed
Caryophyllaceae	* <i>Silene gallica</i>	Weed
Caryophyllaceae	* <i>Spergula pentandra</i>	Weed
Casuarinaceae	<i>Allocasuarina acutivalvis</i> subsp. <i>prinsepiana</i>	-
Casuarinaceae	<i>Allocasuarina campestris</i>	-
Casuarinaceae	<i>Allocasuarina dielsiana</i>	-
Casuarinaceae	<i>Allocasuarina</i> sp.	-
Casuarinaceae	<i>Allocasuarina tessellata</i>	P1
Chenopodiaceae	<i>Atriplex bunburyana</i>	-
Chenopodiaceae	<i>Atriplex</i> sp.	-
Chenopodiaceae	<i>Atriplex vesicaria</i>	-
Chenopodiaceae	<i>Atriplex semilunaris</i>	-
Chenopodiaceae	<i>Chenopodiaceae</i> sp.	-
Chenopodiaceae	<i>Enchylaena lanata</i>	-
Chenopodiaceae	<i>Enchylaena tomentosa</i>	-
Chenopodiaceae	<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	-
Chenopodiaceae	<i>Eriochiton sclerolaenoides</i>	-
Chenopodiaceae	? <i>Eriochiton sclerolaenoides</i>	-
Chenopodiaceae	<i>Maireana ?tomentosa</i>	-
Chenopodiaceae	<i>Maireana georgei</i>	-
Chenopodiaceae	<i>Maireana tomentosa</i>	-
Chenopodiaceae	<i>Maireana trichoptera</i>	-
Chenopodiaceae	<i>Maireana triptera</i>	-
Chenopodiaceae	<i>Rhagodia drummondii</i>	-
Chenopodiaceae	<i>Rhagodia eremaea</i>	-
Chenopodiaceae	<i>Sclerolaena densiflora</i>	-
Chenopodiaceae	<i>Sclerolaena diacantha</i>	-
Chenopodiaceae	<i>Sclerolaena drummondii</i>	-
Chenopodiaceae	<i>Sclerolaena fusiformis</i>	-
Chenopodiaceae	<i>Sclerolaena gardneri</i>	-

Family	Taxa	Status
Chenopodiaceae	<i>Tecticornia ?halocnemoides</i>	-
Colchicaceae	<i>Wurmbea densiflora</i>	-
Colchicaceae	<i>Wurmbea</i> sp. Paynes Find (C.J. French 1237)	-
Convolvulaceae	? <i>Convolvulus remotus</i>	-
Convolvulaceae	* <i>Cuscuta planiflora</i>	Weed
Cupressaceae	<i>Callitris columellaris</i>	-
Cyperaceae	<i>Lepidosperma costale</i>	-
Cyperaceae	<i>Lepidosperma</i> sp. Blue Hills (A. Markey & S. Dillon 3468)	P1
Cyperaceae	<i>Schoenus nanus</i>	-
Dilleniaceae	<i>Hibbertia arcuata</i>	-
Droseraceae	<i>Drosera</i> sp. Branched styles (S.C. Coffey 193)	-
Ericaceae	<i>Leucopogon</i> sp. Clyde Hill (M.A. Burgman 1207)	-
Ericaceae	<i>Styphelia serratifolia</i>	-
Euphorbiaceae	<i>Calycopeplus paucifolius</i>	-
Euphorbiaceae	<i>Euphorbia tannensis</i> subsp. <i>eremophila</i>	-
Fabaceae	<i>Acacia acanthoclada</i> subsp. <i>glaucescens</i>	-
Fabaceae	<i>Acacia acuminata</i>	-
Fabaceae	<i>Acacia andrewsii</i>	-
Fabaceae	<i>Acacia assimilis</i> subsp. <i>assimilis</i>	-
Fabaceae	<i>Acacia aulacophylla</i>	-
Fabaceae	<i>Acacia burkittii</i>	-
Fabaceae	<i>Acacia caesaneura</i>	-
Fabaceae	<i>Acacia colletioides</i>	-
Fabaceae	<i>Acacia diallaga</i>	P1
Fabaceae	<i>Acacia duriuscula</i>	-
Fabaceae	<i>Acacia erinacea</i>	-
Fabaceae	<i>Acacia exocarpoides</i>	-
Fabaceae	<i>Acacia karina</i>	P1
Fabaceae	<i>Acacia latior</i>	-
Fabaceae	<i>Acacia puncticulata</i>	-
Fabaceae	<i>Acacia quadrimarginea</i>	-
Fabaceae	<i>Acacia ramulosa</i> var. <i>linophylla</i>	-
Fabaceae	<i>Acacia ramulosa</i> var. <i>ramulosa</i>	-
Fabaceae	<i>Acacia sibina</i>	-
Fabaceae	<i>Acacia</i> sp. 1	-
Fabaceae	<i>Acacia sulcaticaulis</i>	P1
Fabaceae	<i>Acacia tetragonophylla</i>	-
Fabaceae	<i>Acacia umbraculiformis</i>	-
Fabaceae	<i>Gastrolobium laytonii</i>	-
Fabaceae	<i>Leptosema aphyllum</i>	-
Fabaceae	<i>Mirbelia ?microphylla</i>	-
Fabaceae	<i>Mirbelia depressa</i>	-
Fabaceae	<i>Mirbelia microphylla</i>	-
Fabaceae	<i>Senna artemisioides</i> subsp. <i>filifolia</i>	-
Fabaceae	<i>Senna artemisioides</i> subsp. <i>x artemisioides</i>	-
Fabaceae	<i>Senna charlesiana</i>	-
Fabaceae	<i>Senna</i> sp. Austin (A. Strid 20210)	-
Fabaceae	<i>Senna stowardii</i>	-
Frankeniaceae	<i>Frankenia ?setosa</i>	-
Frankeniaceae	<i>Frankenia setosa</i>	-
Geraniaceae	<i>Erodium cygnorum</i>	-
Goodeniaceae	<i>Brunonia</i> sp. Goldfields (K.R. Newbey 6044)	-
Goodeniaceae	<i>Goodenia ?pinnatifida</i>	-
Goodeniaceae	<i>Goodenia berardiana</i>	-
Goodeniaceae	<i>Goodenia mimuloides</i>	-
Goodeniaceae	<i>Goodenia pusilliflora</i>	-

Family	Taxa	Status
Goodeniaceae	<i>Scaevola spinescens</i>	-
Goodeniaceae	<i>Velleia rosea</i>	-
Gyrostemonaceae	<i>Codonocarpus cotinifolius</i>	-
Haloragaceae	<i>Glischrocaryon aureum</i>	-
Haloragaceae	<i>Haloragis odontocarpa</i>	-
Haloragaceae	<i>Haloragis trigonocarpa</i>	-
Hemerocallidaceae	<i>Caesia ?micrantha</i>	-
Hemerocallidaceae	<i>Caesia</i> sp. Wongan (K.F. Kenneally 8820)	-
Hemerocallidaceae	<i>Dianella revoluta</i> var. <i>divaricata</i>	-
Hypoxidaceae	<i>Pauridia glabella</i> var. <i>glabella</i>	-
Juncaginaceae	<i>Triglochin</i> sp. A Flora of Australia (G.J. Keighery 2477)	-
Lamiaceae	<i>Hemigenia botryphylla</i>	-
Lamiaceae	<i>Hemigenia</i> sp. Yalgoo (A.M. Ashby 2624)	-
Lamiaceae	<i>Hemigenia tichbonii</i>	P1
Lamiaceae	<i>Hemigenia yalgensis</i>	-
Lamiaceae	<i>Lamiaceae</i> sp. 1	-
Lamiaceae	<i>Prostanthera althoferi</i> subsp. <i>althoferi</i>	-
Lamiaceae	<i>Prostanthera patens</i>	-
Lamiaceae	<i>Hemigenia macphersonii</i>	-
Loganiaceae	<i>Phyllangium sulcatum</i>	-
Loranthaceae	<i>Amyema preissii</i>	-
Malvaceae	<i>Abutilon cryptopetalum</i>	-
Malvaceae	<i>Alyogyne hakeifolia</i>	-
Malvaceae	<i>Androcalva luteiflora</i>	-
Malvaceae	<i>Brachychiton gregorii</i>	-
Malvaceae	<i>Brachyscome ciliaris</i>	-
Malvaceae	<i>Seringia elliptica</i>	-
Malvaceae	<i>Seringia velutina</i>	-
Malvaceae	<i>Sida</i> ?sp. Dark Green Fruits (S. van Leeuwen 2260)	-
Malvaceae	<i>Sida calyxhymenia</i>	-
Malvaceae	<i>Sida</i> sp. Dark Green Fruits (S. van Leeuwen 2260)	-
Malvaceae	<i>Sida</i> sp. Golden calyces glabrous (H.N. Foote 32)	-
Montiaceae	<i>Calandrinia ?polyandra</i>	-
Montiaceae	<i>Calandrinia baccata</i>	-
Montiaceae	<i>Calandrinia</i> sp.	-
Montiaceae	<i>Calandrinia</i> sp. Truncate capsules (A. Markey & S. Dillon 3474)	-
Myrtaceae	<i>Callistemon phoeniceus</i>	-
Myrtaceae	<i>Calothamnus gilesii</i>	-
Myrtaceae	<i>Chamelaucium pauciflorum</i> subsp. <i>Perenjori</i> (B.J. Conn 2181)	-
Myrtaceae	<i>Chamelaucium</i> sp. Warriardar (A.P. Brown & S. Patrick APB 1100)	P1
Myrtaceae	<i>Eucalyptus clelandiorum</i>	-
Myrtaceae	<i>Eucalyptus ewartiana</i>	-
Myrtaceae	<i>Eucalyptus kochii</i> subsp. <i>plenissima</i>	-
Myrtaceae	<i>Eucalyptus loxophleba</i> subsp. <i>lissophloia</i>	-
Myrtaceae	<i>Eucalyptus loxophleba</i> subsp. <i>supralaevis</i>	-
Myrtaceae	<i>Eucalyptus salubris</i>	-
Myrtaceae	<i>Malleostemon tuberculatus</i>	-
Myrtaceae	<i>Melaleuca eleuterostachya</i>	-
Myrtaceae	<i>Melaleuca hamata</i>	-
Myrtaceae	<i>Melaleuca nematophylla</i>	-
Myrtaceae	<i>Melaleuca radula</i>	-
Myrtaceae	<i>Melaleuca scalena</i>	-
Myrtaceae	<i>Melaleuca stereophloia</i>	-
Myrtaceae	<i>Micromyrtus acuta</i>	P3
Myrtaceae	<i>Micromyrtus trudgenii</i>	P3
Myrtaceae	<i>Thryptomene costata</i>	-

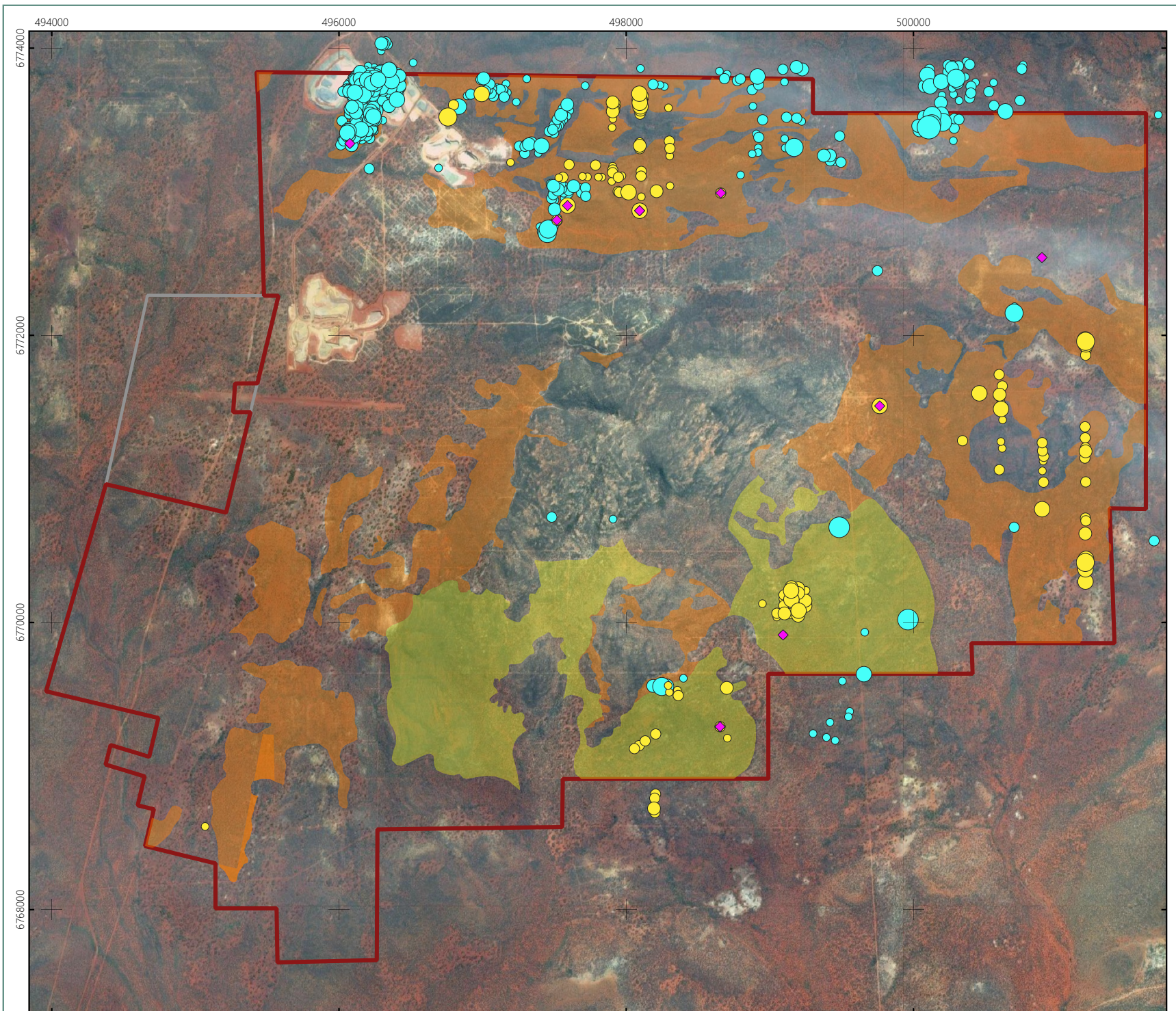
Family	Taxa	Status
Orchidaceae	<i>Caladenia</i> sp. 1	-
Orchidaceae	<i>Caladenia</i> sp. 2	-
Orchidaceae	<i>Cyanicula amplexans</i>	-
Orchidaceae	<i>Pterostylis</i> ? <i>spathulata</i>	-
Pittosporaceae	<i>Bursaria occidentalis</i>	-
Pittosporaceae	<i>Cheiranthra simplicifolia</i>	-
Pittosporaceae	<i>Pittosporum angustifolium</i>	-
Plantaginaceae	<i>Plantago debilis</i>	-
Poaceae	<i>Amphipogon caricinus</i> var. <i>caricinus</i>	-
Poaceae	<i>Austrostipa</i> ? <i>scabra</i>	-
Poaceae	<i>Austrostipa elegantissima</i>	-
Poaceae	<i>Austrostipa eremophila</i>	-
Poaceae	<i>Austrostipa nitida</i>	-
Poaceae	<i>Austrostipa scabra</i>	-
Poaceae	<i>Austrostipa trichophylla</i>	-
Poaceae	<i>Austrostipa variabilis</i>	-
Poaceae	<i>Bromus arenarius</i>	-
Poaceae	* <i>Bromus diandrus</i>	Weed
Poaceae	* <i>Ehrharta longiflora</i>	Weed
Poaceae	<i>Eriachne pulchella</i> subsp. <i>pulchella</i>	-
Poaceae	<i>Monachather paradoxus</i>	-
Poaceae	* <i>Pentameris airoides</i>	Weed
Poaceae	<i>Poaceae</i> sp.	-
Poaceae	* <i>Rostraria pumila</i>	Weed
Poaceae	<i>Rytidosperma setaceum</i>	-
Polygalaceae	<i>Comesperma integerrimum</i>	-
Primulaceae	* <i>Lysimachia arvensis</i>	Weed
Proteaceae	<i>Grevillea</i> ? <i>obliquistigma</i>	-
Proteaceae	<i>Grevillea extorris</i>	-
Proteaceae	<i>Grevillea globosa</i>	P3
Proteaceae	<i>Grevillea hakeoides</i> subsp. <i>stenophylla</i>	-
Proteaceae	<i>Grevillea paniculata</i>	-
Proteaceae	<i>Grevillea pterosperma</i>	-
Proteaceae	<i>Grevillea scabrida</i>	P1
Proteaceae	<i>Grevillea subtiliflora</i>	P3
Proteaceae	<i>Hakea invaginata</i>	-
Proteaceae	<i>Hakea preissii</i>	-
Proteaceae	<i>Hakea recurva</i>	-
Proteaceae	<i>Hakea</i> sp. 1	-
Proteaceae	<i>Persoonia manotricha</i>	-
Proteaceae	<i>Persoonia pentasticha</i>	P3
Pteridaceae	<i>Cheilanthes adiantoides</i>	-
Pteridaceae	<i>Cheilanthes brownii</i>	-
Pteridaceae	<i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>	-
Rhamnaceae	<i>Stenanthemum poicilum</i>	P3
Rubiaceae	<i>Psychodra suaveolens</i>	-
Rutaceae	<i>Phebalium tuberosum</i>	-
Rutaceae	<i>Philotheca brucei</i> subsp. <i>brucei</i>	-
Rutaceae	<i>Philotheca deserti</i> subsp. <i>deserti</i>	-
Rutaceae	<i>Philotheca sericea</i>	-
Santalaceae	<i>Exocarpos aphyllus</i>	-
Santalaceae	<i>Santalum acuminatum</i>	-
Santalaceae	<i>Santalum spicatum</i>	-
Sapindaceae	<i>Dodonaea adenophora</i>	-
Sapindaceae	<i>Dodonaea amplisemina</i>	P4
Sapindaceae	<i>Dodonaea inaequifolia</i>	-

Family	Taxa	Status
Sapindaceae	<i>Dodonaea rigida</i>	-
Scrophulariaceae	<i>Eremophila clarkei</i>	-
Scrophulariaceae	<i>Eremophila eriocalyx</i>	-
Scrophulariaceae	<i>Eremophila forrestii</i>	-
Scrophulariaceae	<i>Eremophila forrestii</i> subsp. <i>forrestii</i>	-
Scrophulariaceae	<i>Eremophila georgei</i>	-
Scrophulariaceae	<i>Eremophila latrobei</i> subsp. <i>latrobei</i>	-
Scrophulariaceae	<i>Eremophila oldfieldii</i> subsp. <i>oldfieldii</i>	-
Scrophulariaceae	<i>Eremophila oppositifolia</i>	-
Scrophulariaceae	<i>Eremophila oppositifolia</i> subsp. <i>angustifolia</i>	-
Scrophulariaceae	<i>Eremophila pantonii</i>	-
Scrophulariaceae	<i>Eremophila serrulata</i>	-
Solanaceae	<i>Nicotiana rotundifolia</i>	-
Solanaceae	<i>Solanum cleistogamum</i>	-
Solanaceae	<i>Solanum lasiophyllum</i>	-
Solanaceae	<i>Solanum nummularium</i>	-
Thymelaeaceae	<i>Pimelea avonensis</i>	-
Thymelaeaceae	<i>Pimelea microcephala</i> subsp. <i>microcephala</i>	-
Urticaceae	<i>Parietaria cardiostegia</i>	-
Violaceae	<i>Hybanthus floribundus</i> subsp. <i>curvifolius</i>	-
Violaceae	<i>Hybanthus floribundus</i> subsp. <i>floribundus</i>	-
Zygophyllaceae	<i>Roepera ovata</i>	-
Zygophyllaceae	<i>Roepera similis</i>	-

^ = recorded 15 m south of Project

Appendix H: Significant Flora Maps





Legend

- Mt Mulgine Project
- Extension Tenement M59/460
- Current Assessment - Collected Specimen

Current Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants

Desktop Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants

Vegetation Units

- Dominant taxon in vegetation unit
- High association with vegetation unit
- Medium association with vegetation unit



0 0.5 1 1.5 km

Scale: 1:36000

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter



Author: Evan Hamilton

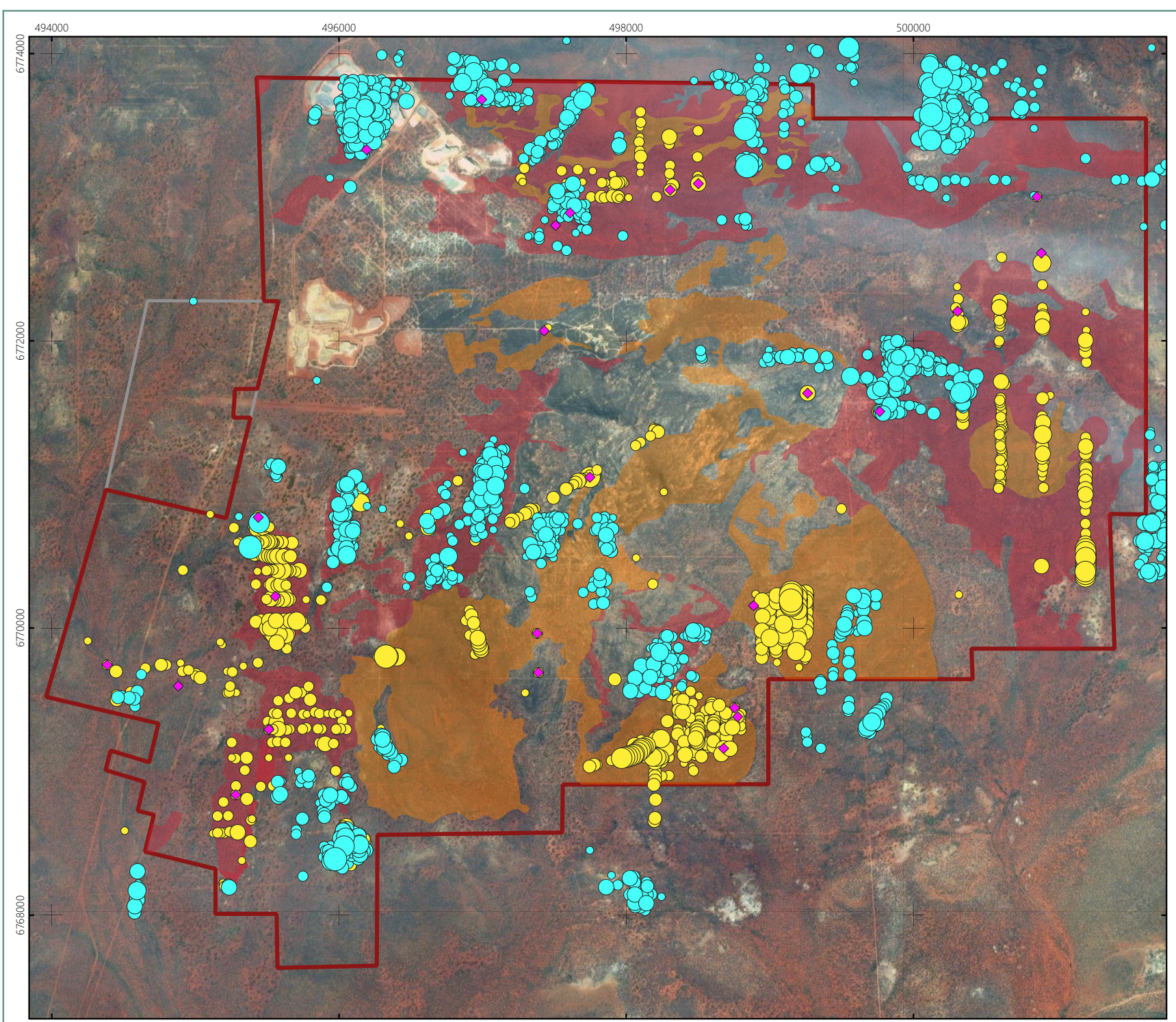
Date: 03/03/2021

Acacia diagella (P1)

Mt Mulgine Project

Prepared for
Tungsten Mining NL

Figure
H.1



Legend

- Mt Mulgine Project
- Extension Tenement M59/460
- ◆ Current Assessment - Collected Specimen

Current Assessment

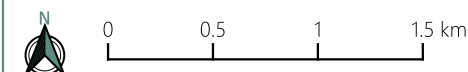
- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants

Desktop Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants

Vegetation Units

- Dominant taxon in vegetation unit
- High association with vegetation unit
- Medium association with vegetation unit



Scale: 1:36000

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter



Author: Evan Hamilton

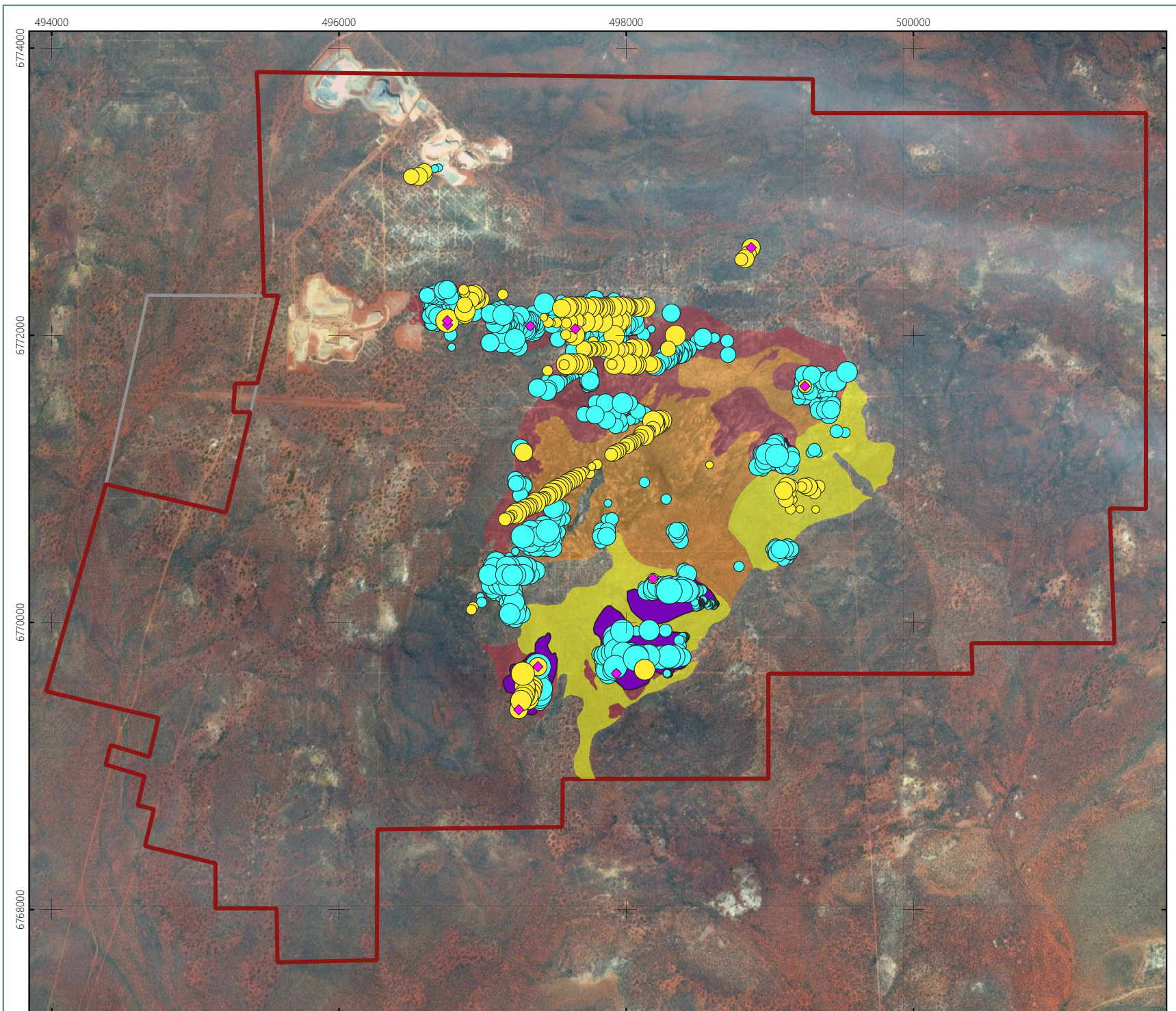
Date: 03/03/2021

Acacia karina (P1)

Mt Mulgine Project

Prepared for
Tungsten Mining NL

Figure
H.2



Legend

- Mt Mulgine Project
- Extension Tenement M59/460
- ◆ Current Assessment - Collected Specimen

Current Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants

Desktop Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants

Acacia sulcicaulis area (Jenny Borger 2018)

Vegetation Units - V7

- Dominant taxon in vegetation unit
- High association with vegetation unit
- Medium association with vegetation unit



Scale: 1:36000

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter



Author: Evan Hamilton

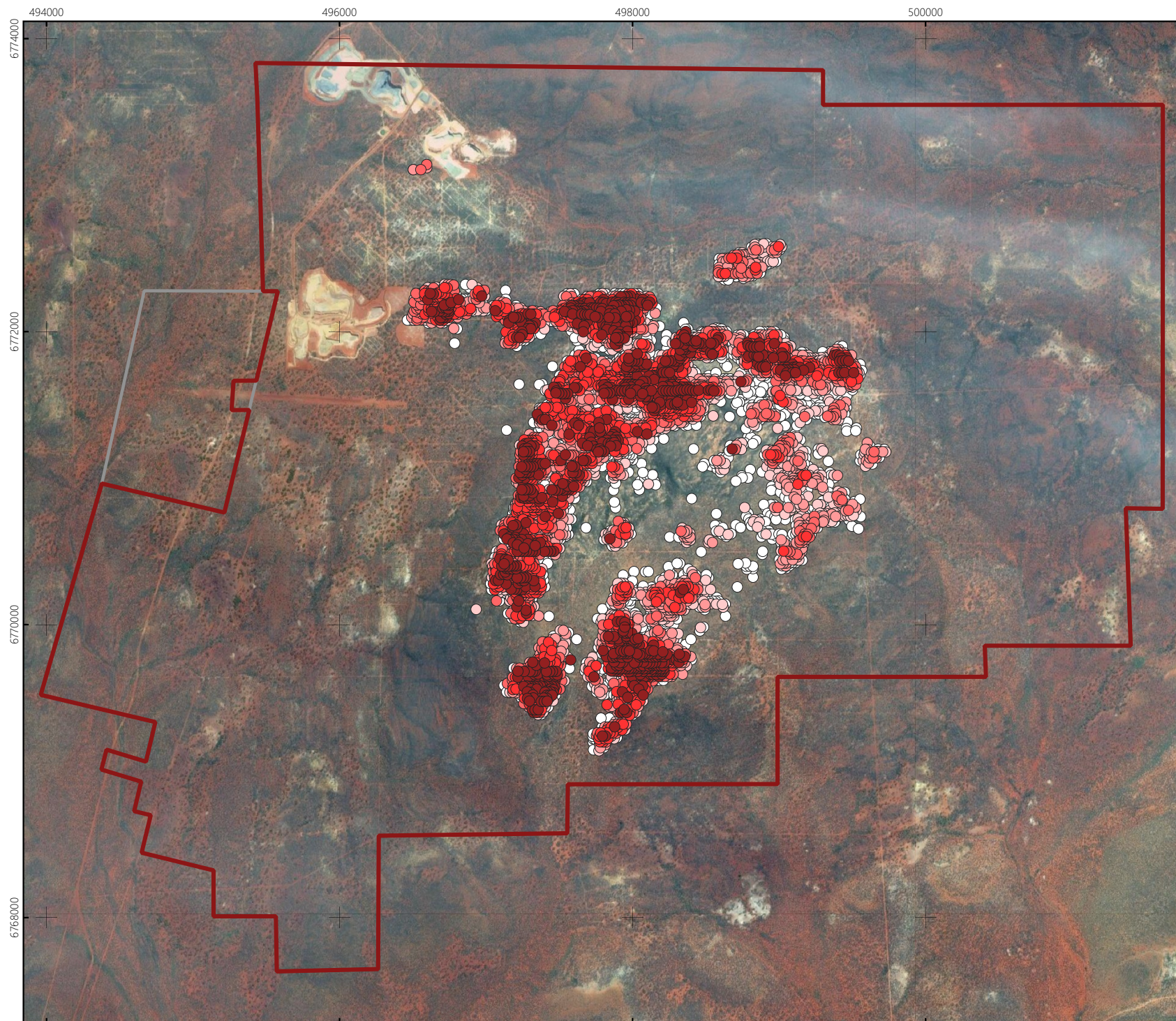
Date: 03/03/2021

Acacia sulcicaulis (P1) Desktop & Phase 1-3 Records

Mt Mulgine Project

Prepared for
Tungsten Mining NL

Figure
H.3A



Legend

- Mt Mulgine Project
- Extension Tenement M59/460

Acacia sulcicaulis (No of plants per 20x20 m)

- 1 - 4 plants
- 4 - 10 plants
- 10 - 22 plants
- 22 - 38 plants
- 38 - 64 plants
- 64 - 272 plants



0 0.5 1 1.5 km

Scale: 1:36000

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter



Author: Evan Hamilton

Date: 03/03/2021

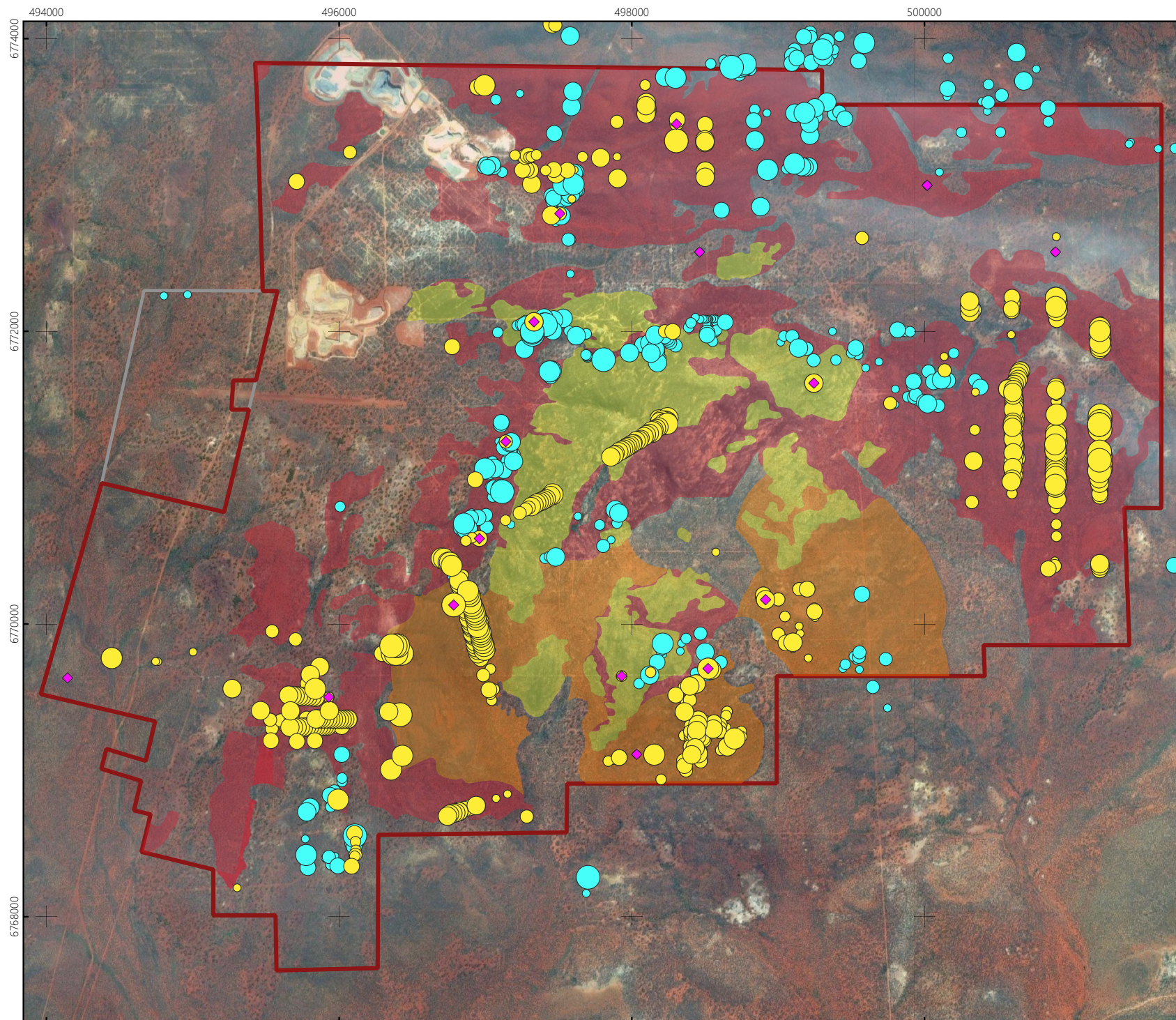
Acacia sulcicaulis (P1) Targeted Survey Records

Mt Mulgine Project

Prepared for
Tungsten Mining NL

Figure

H.3B



Legend

- Mt Mulgine Project
- Extension Tenement M59/460
- ◆ Current Assessment - Collected Specimen

Current Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants

Desktop Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants

Vegetation Units

- Dominant taxon in vegetation unit
- High association with vegetation unit
- Medium association with vegetation unit



0 0.5 1 1.5 km

Scale: 1:36000

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter



Author: Evan Hamilton

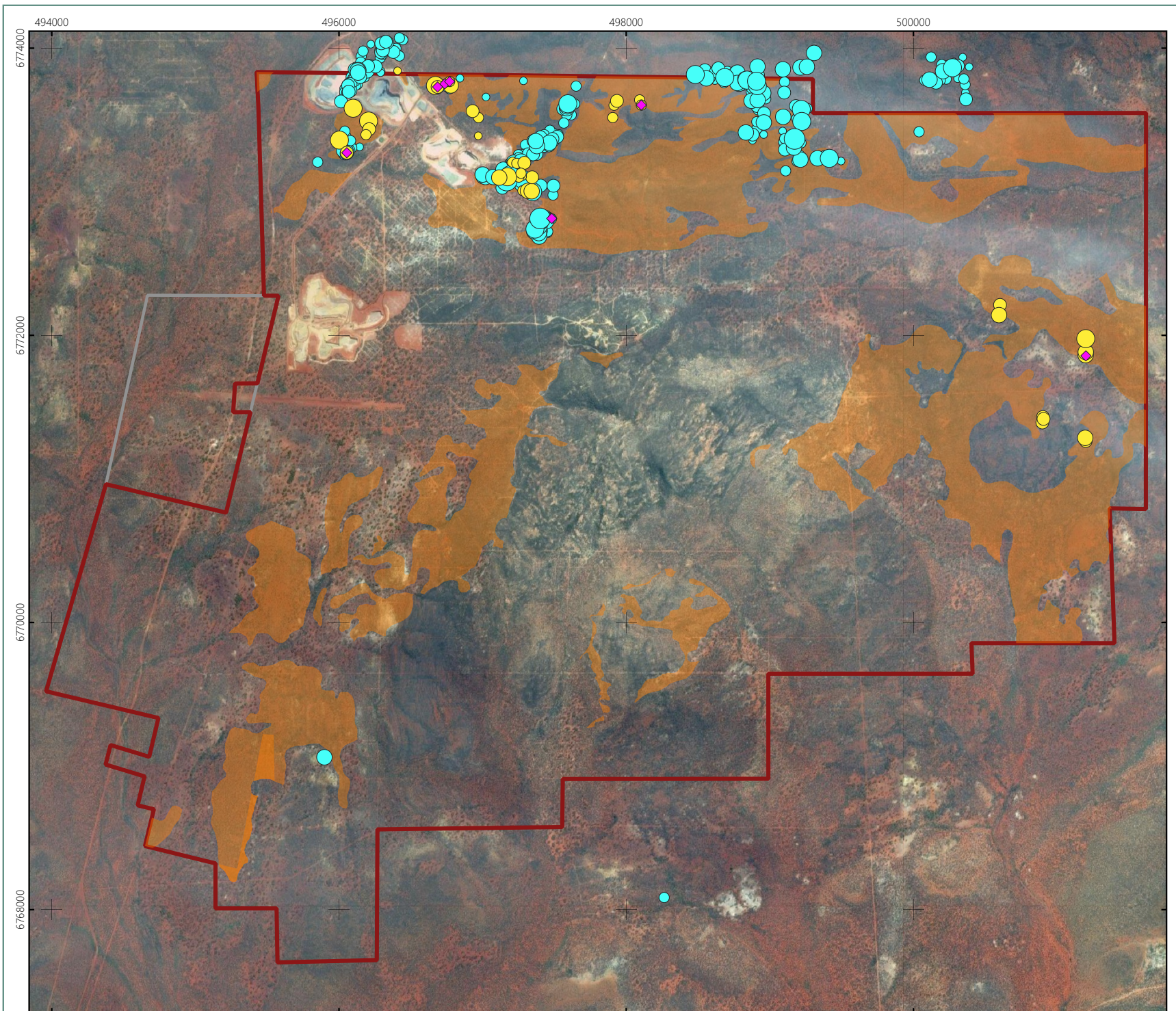
Date: 03/03/2021

Allocasuarina tessellata (P3)

Mt Mulgine Project

Prepared for
Tungsten Mining NL

Figure
H.4



Legend

- Mt Mulgine Project
- Extension Tenement M59/460
- Current Assessment - Collected Specimen

Current Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants

Desktop Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants

Vegetation Units

- Dominant taxon in vegetation unit
- High association with vegetation unit
- Medium association with vegetation unit



0 0.5 1 1.5 km

Scale: 1:36000

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter



Author: Evan Hamilton

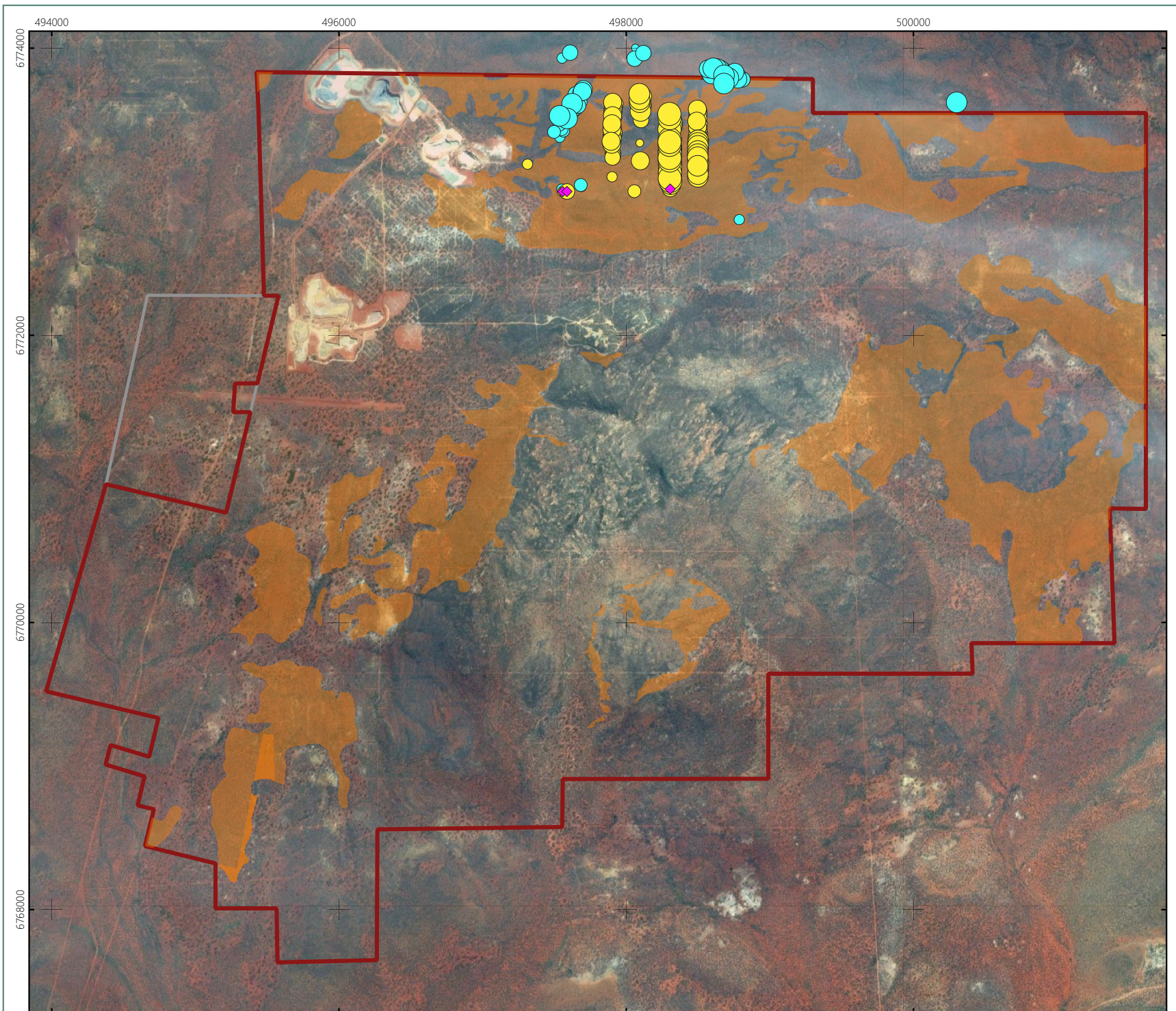
Date: 03/03/2021

Chamelaucium sp. Warriedar
(A.P. Brown & S. Patrick APB
1100) (P1)

Mt Mulgine Project

Prepared for
Tungsten Mining NL

Figure
H.5



Legend

- Mt Mulgine Project
- Extension Tenement M59/460
- Current Assessment - Collected Specimen

Current Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants

Desktop Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants

Vegetation Unit

- Dominant taxon in vegetation unit
- High association with vegetation unit
- Medium association with vegetation unit



0 0.5 1 1.5 km

Scale: 1:36000

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter



Author: Evan Hamilton

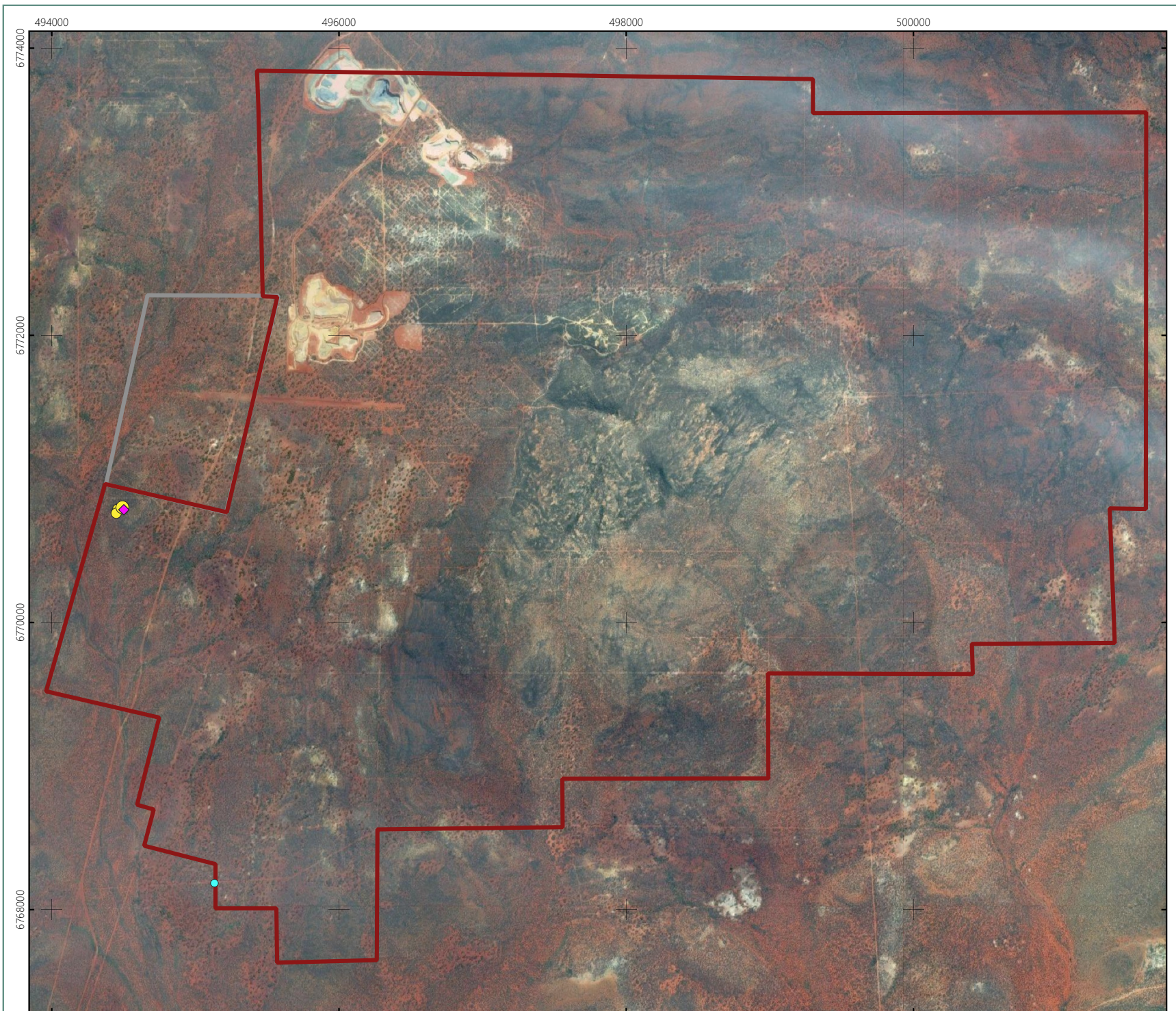
Date: 03/03/2021

Dodonaea amplisemina (P4)

Mt Mulgine Project

Prepared for
Tungsten Mining NL

Figure
H.6



Legend

- Mt Mulgine Project
- Extension Tenement M59/460
- Current Assessment - Collected Specimen

Current Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants

Desktop Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants



0 0.5 1 1.5 km

Scale: 1:36000

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter



Author: Evan Hamilton

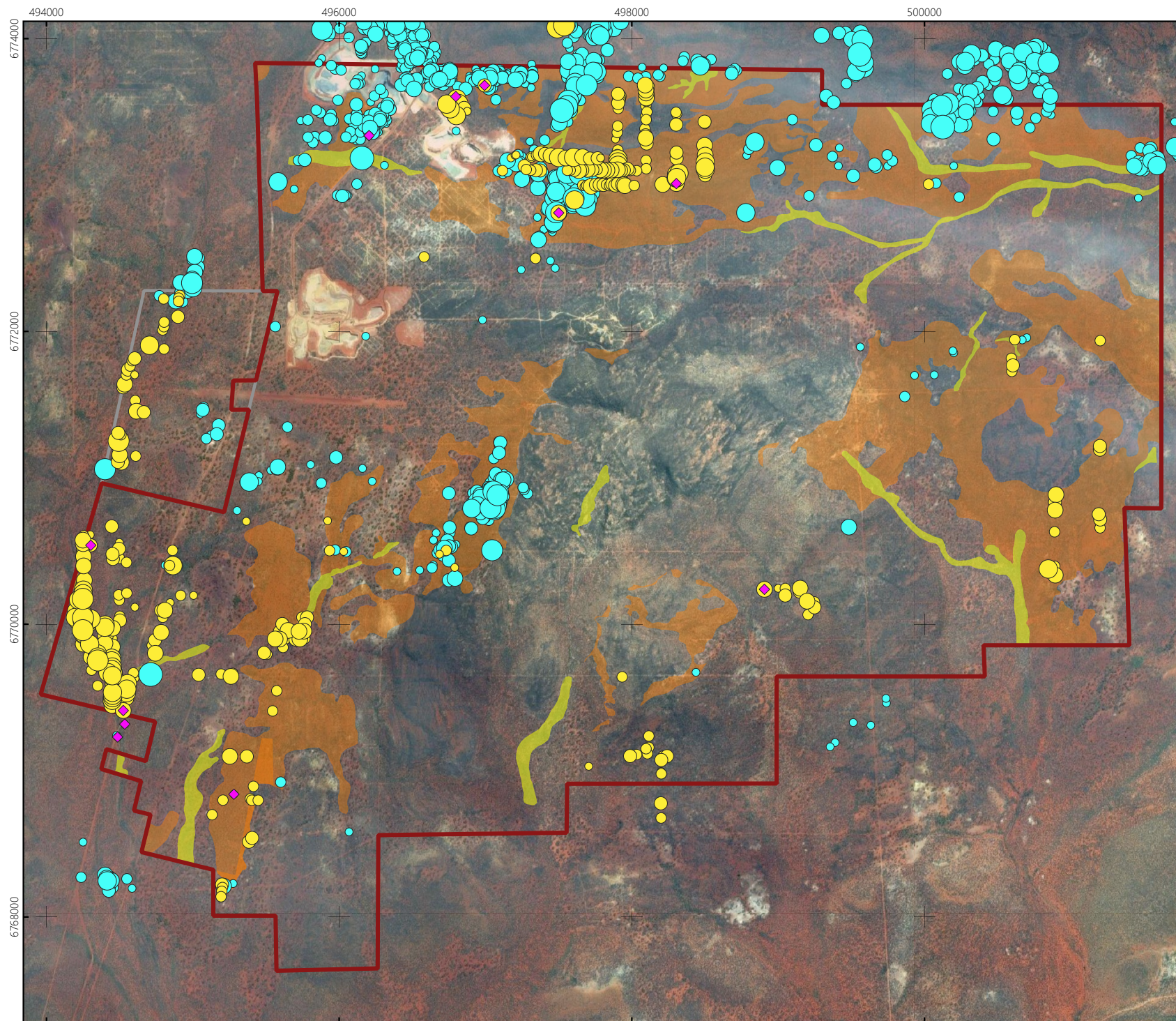
Date: 10/12/2020

Grevillea globosa (P3)

Mt Mulgine Project

Prepared for
Tungsten Mining NL

Figure
H.7



Legend

- Mt Mulgine Project
- Extension Tenement M59/460
- ◆ Current Assessment - Collected Specimen

Current Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants

Desktop Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants

Vegetation Unit

- Dominant taxon in vegetation unit
- High association with vegetation unit
- Medium association with vegetation unit



0 0.5 1 1.5 km

Scale: 1:36000

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter



Author: Evan Hamilton

Date: 03/03/2021

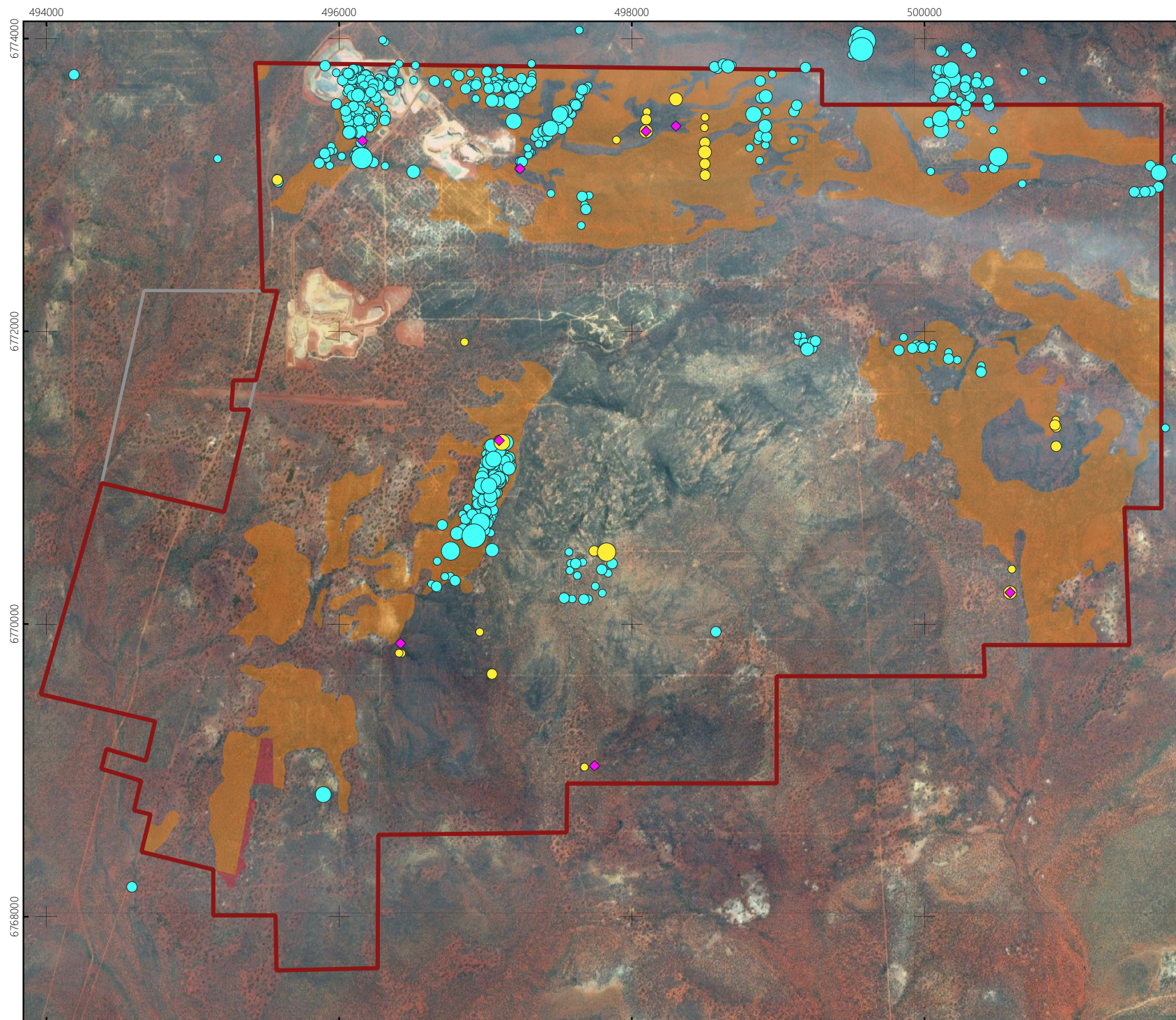
Grevillea scabrida (P3)

Mt Mulgine Project

Prepared for
Tungsten Mining NL

Figure

H.8



Legend

- Mt Mulgine Project
- Extension Tenement M59/460
- ◆ Current Assessment - Collected Specimen

Current Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants

Desktop Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants

Vegetation Unit

- Dominant taxon in vegetation unit
- High association with vegetation unit
- Medium association with vegetation unit



0 0.5 1 1.5 km

Scale: 1:36000

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter



Author: Evan Hamilton

Date: 03/03/2021

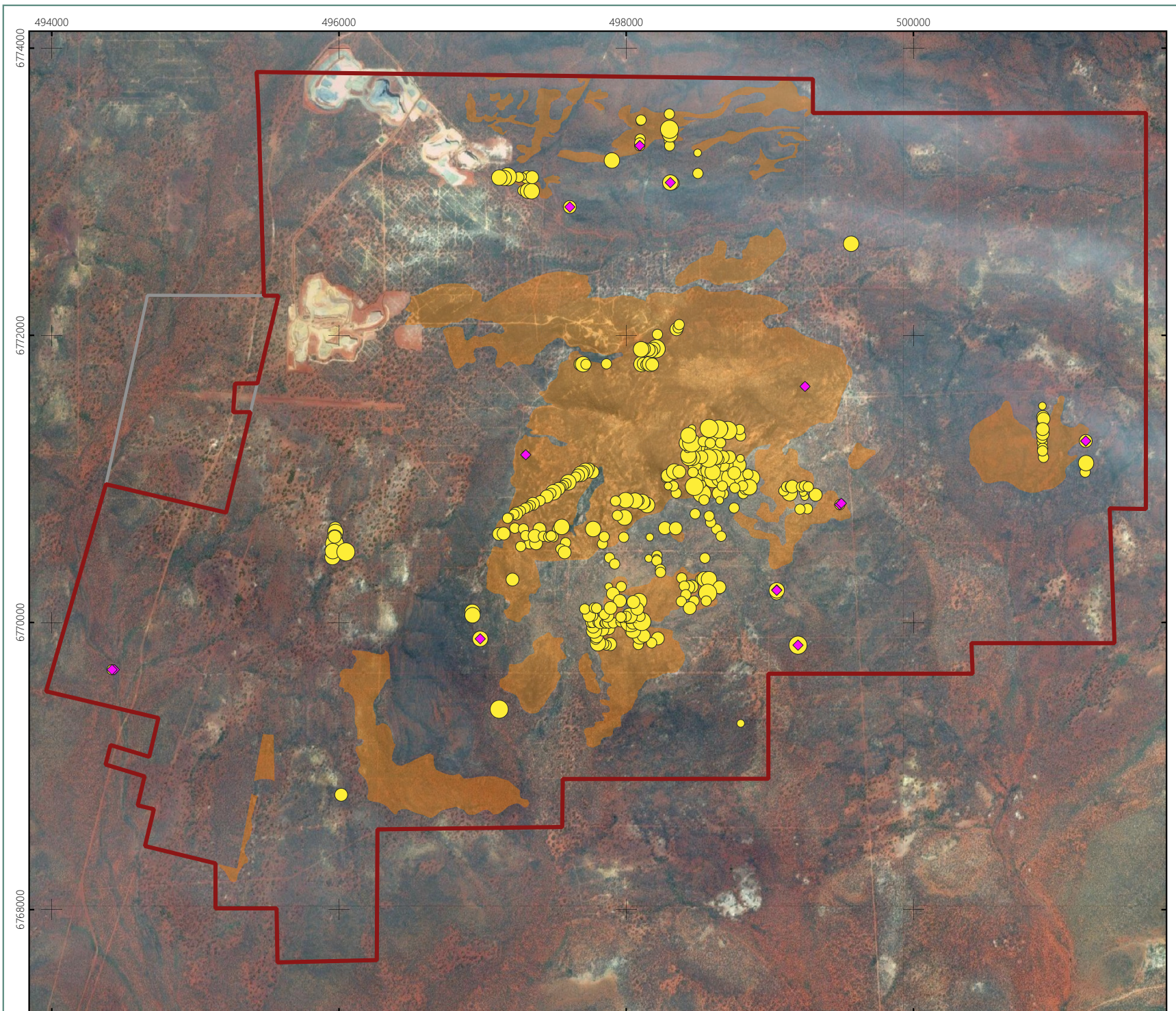
Grevillea subtiliflora (P3)

Mt Mulgine Project

Prepared for
Tungsten Mining NL

Figure

H.9



Legend

- Mt Mulgine Project
- Extension Tenement M59/460
- ◆ Current Assessment - Collected Specimen

Current Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants

Desktop Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants

Vegetation Unit

- Dominant taxon in vegetation unit
- High association with vegetation unit
- Medium association with vegetation unit



0 0.5 1 1.5 km

Scale: 1:36000

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter



Author: Evan Hamilton

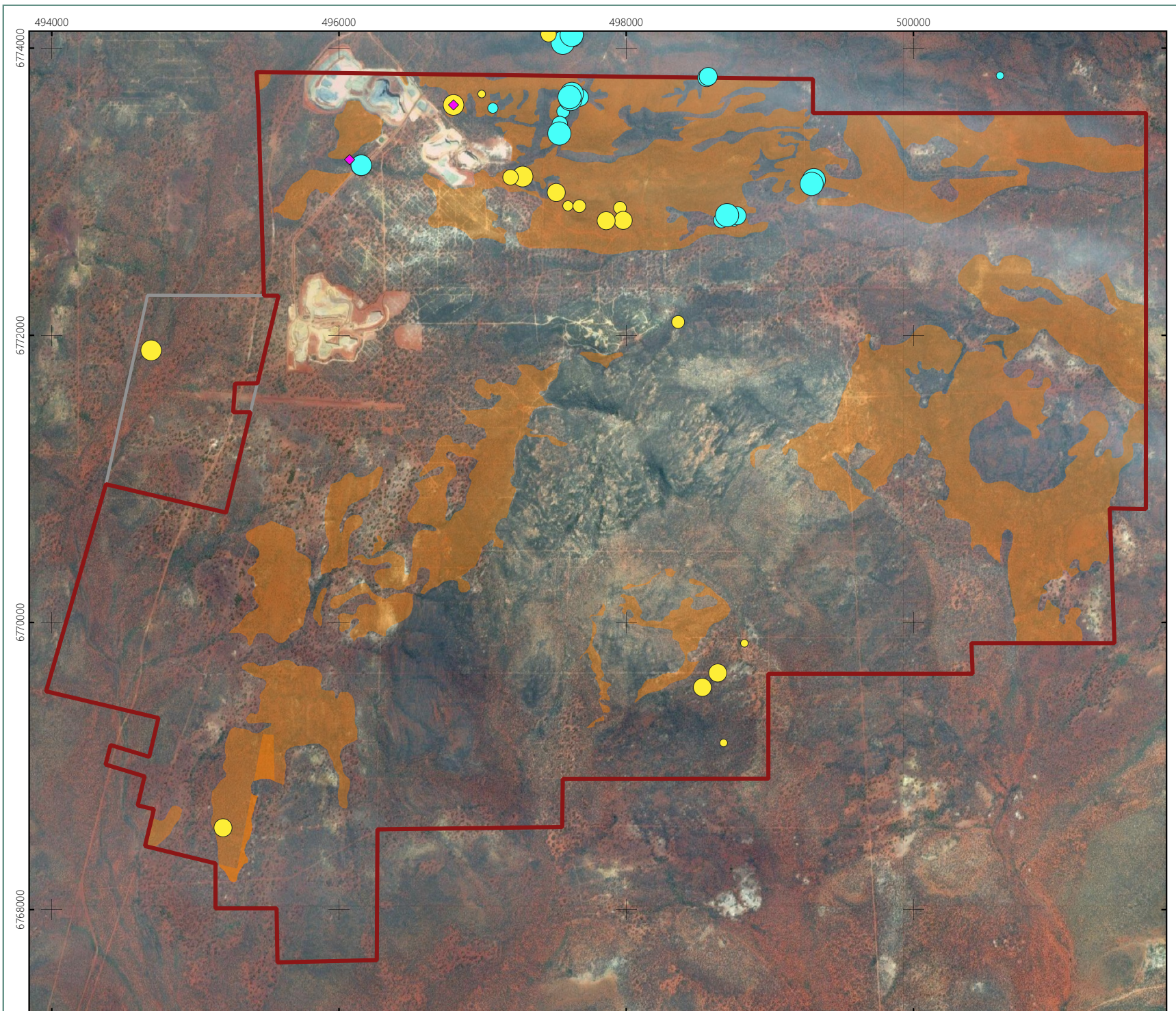
Date: 03/03/2021

Hemigenia tichbonii (P1)

Mt Mulgine Project

Prepared for
Tungsten Mining NL

Figure
H.10



Legend

- Mt Mulgine Project
- Extension Tenement M59/460
- Current Assessment - Collected Specimen

Current Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants

Desktop Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants

Vegetation Unit

- Dominant taxon in vegetation unit
- High association with vegetation unit
- Medium association with vegetation unit



0 0.5 1 1.5 km

Scale: 1:36000

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter



Author: Evan Hamilton

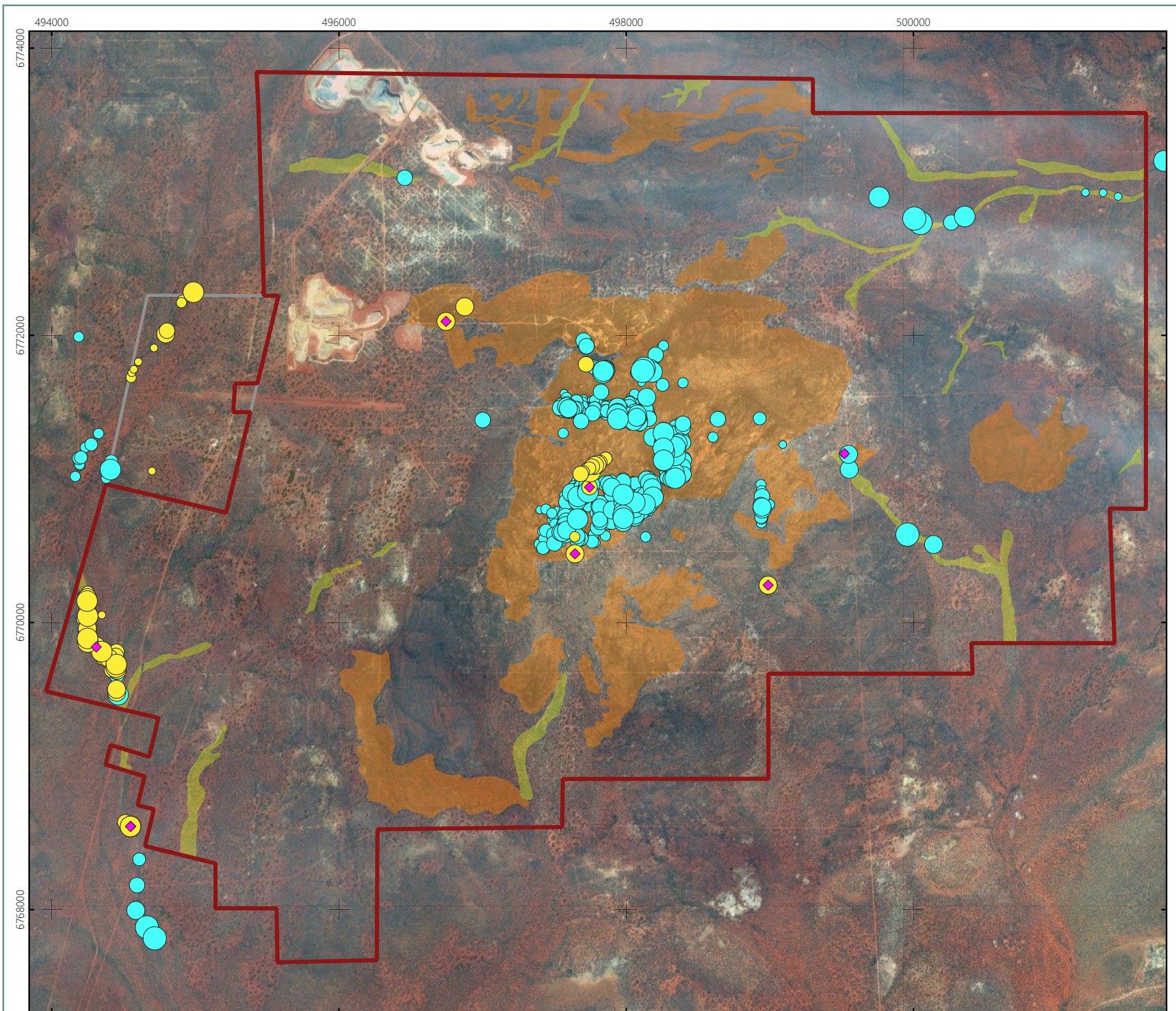
Date: 03/03/2021

Hydrocotyle dimorphocarpa
(P1)

Mt Mulgine Project

Prepared for
Tungsten Mining NL

Figure
H.11



Legend

- Mt Mulgine Project
- Extension Tenement M59/460
- ◆ Current Assessment - Collected Specimen

Current Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants

Desktop Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants

Vegetation Unit

- Dominant taxon in vegetation unit
- High association with vegetation unit
- Medium association with vegetation unit



0 0.5 1 1.5 km

Scale: 1:36000

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter



Author: Evan Hamilton

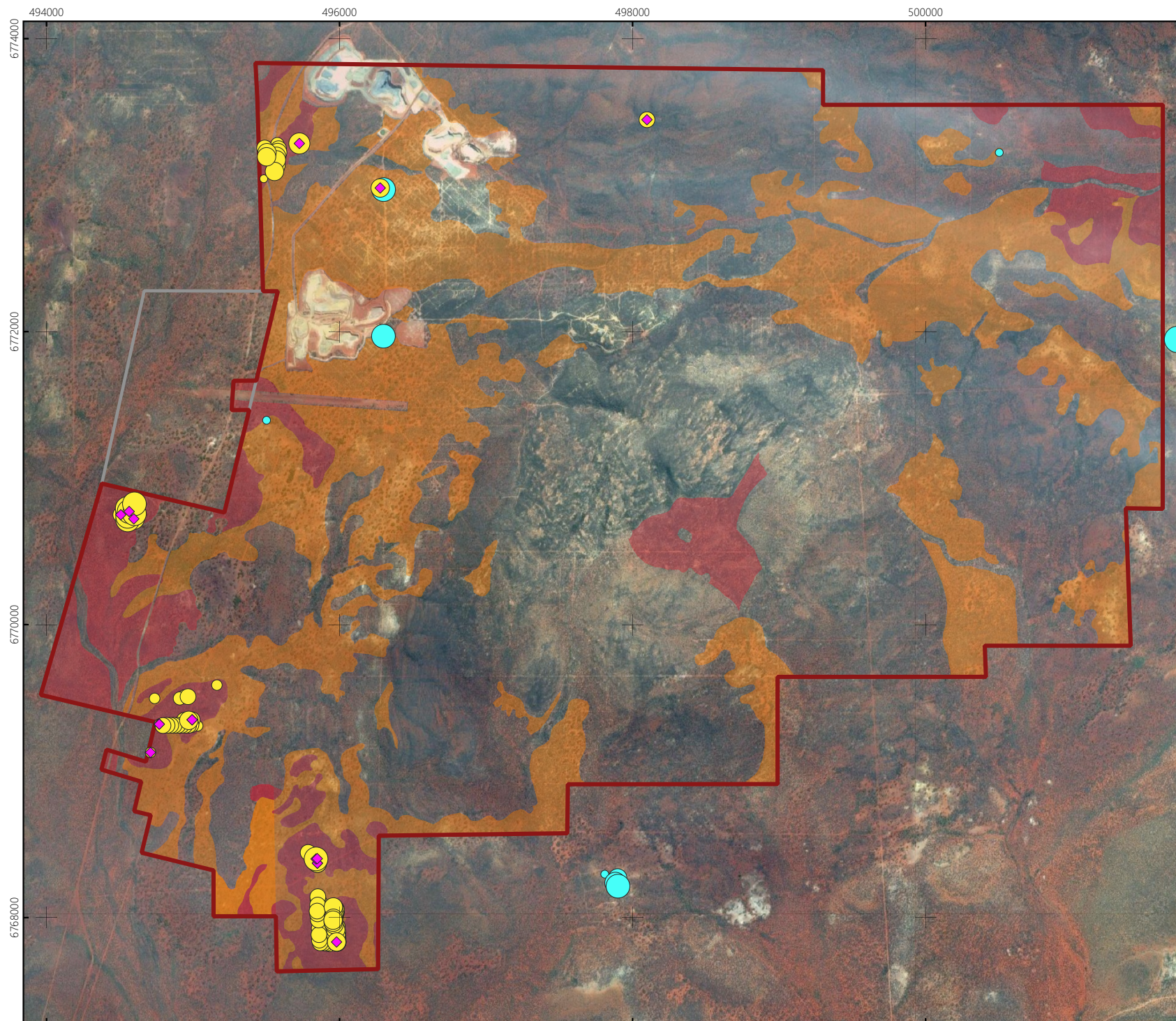
Date: 03/03/2021

Lepidosperma sp. Blue Hills
(A. Markey & S. Dillon 3468)
(P1)

Mt Mulgine Project

Prepared for
Tungsten Mining NL

Figure
H.12



Legend

- Mt Mulgine Project
- Extension Tenement M59/460
- ◆ Current Assessment - Collected Specimen

Current Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants

Desktop Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants

Vegetation Unit

- Dominant taxon in vegetation unit
- High association with vegetation unit
- Medium association with vegetation unit



0 0.5 1 1.5 km

Scale: 1:36000

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter



Author: Evan Hamilton

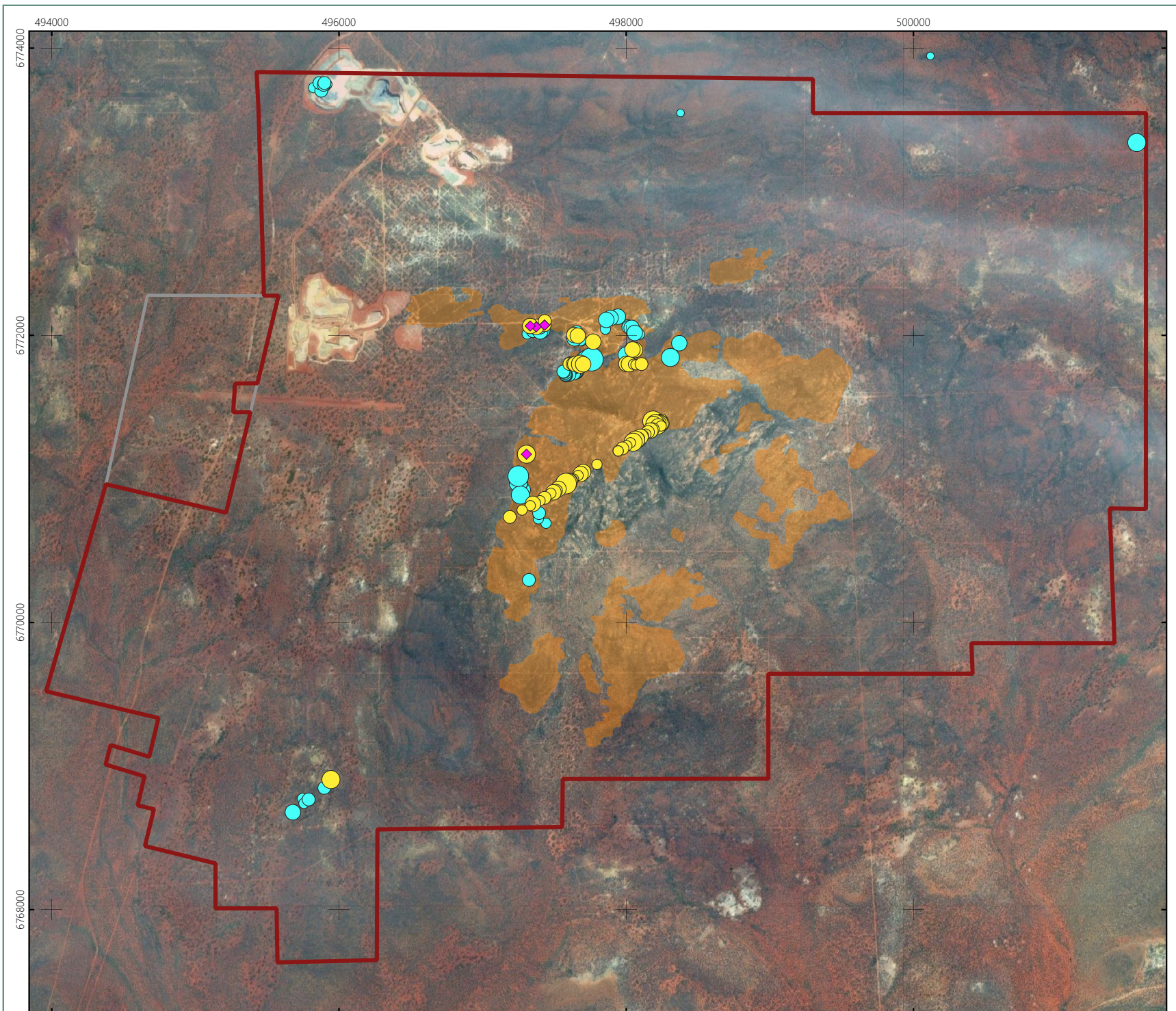
Date: 03/03/2021

Micromyrtus acuta (P3)

Mt Mulgine Project

Prepared for
Tungsten Mining NL

Figure
H.13



Legend

- Mt Mulgine Project
- Extension Tenement M59/460
- ◆ Current Assessment - Collected Specimen

Current Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants

Desktop Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants

Vegetation Unit

- Dominant taxon in vegetation unit
- High association with vegetation unit
- Medium association with vegetation unit



0 0.5 1 1.5 km

Scale: 1:36000

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter



Author: Evan Hamilton

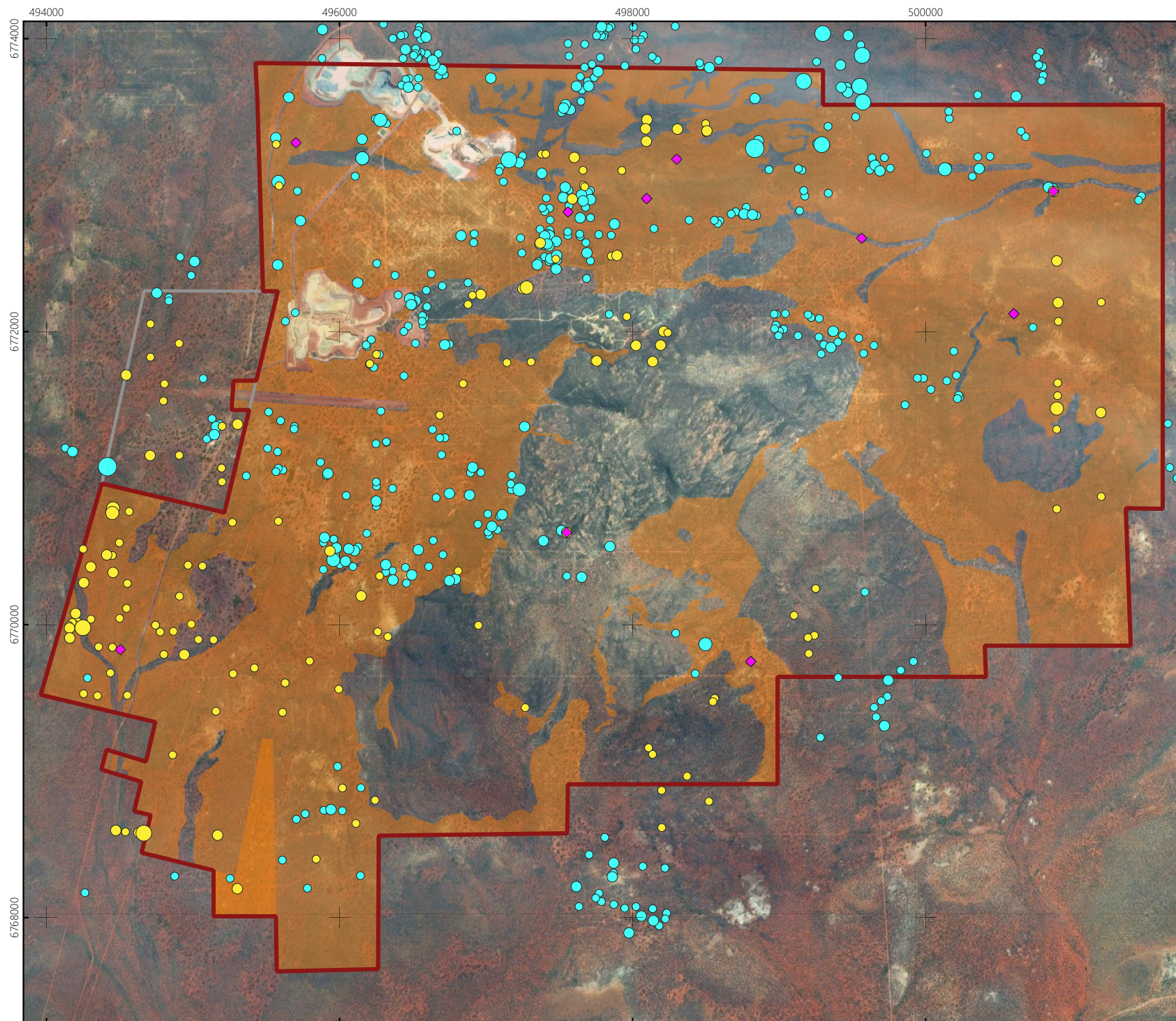
Date: 03/03/2021

Micromyrtus trudgenii (P3)

Mt Mulgine Project

Prepared for
Tungsten Mining NL

Figure
H.14



Legend

- Mt Mulgine Project
- Extension Tenement M59/460
- ◆ Current Assessment - Collected Specimen

Current Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants

Desktop Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants

Vegetation Unit

- Dominant taxon in vegetation unit
- High association with vegetation unit
- Medium association with vegetation unit



0 0.5 1 1.5 km

Scale: 1:36000

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter



Author: Evan Hamilton

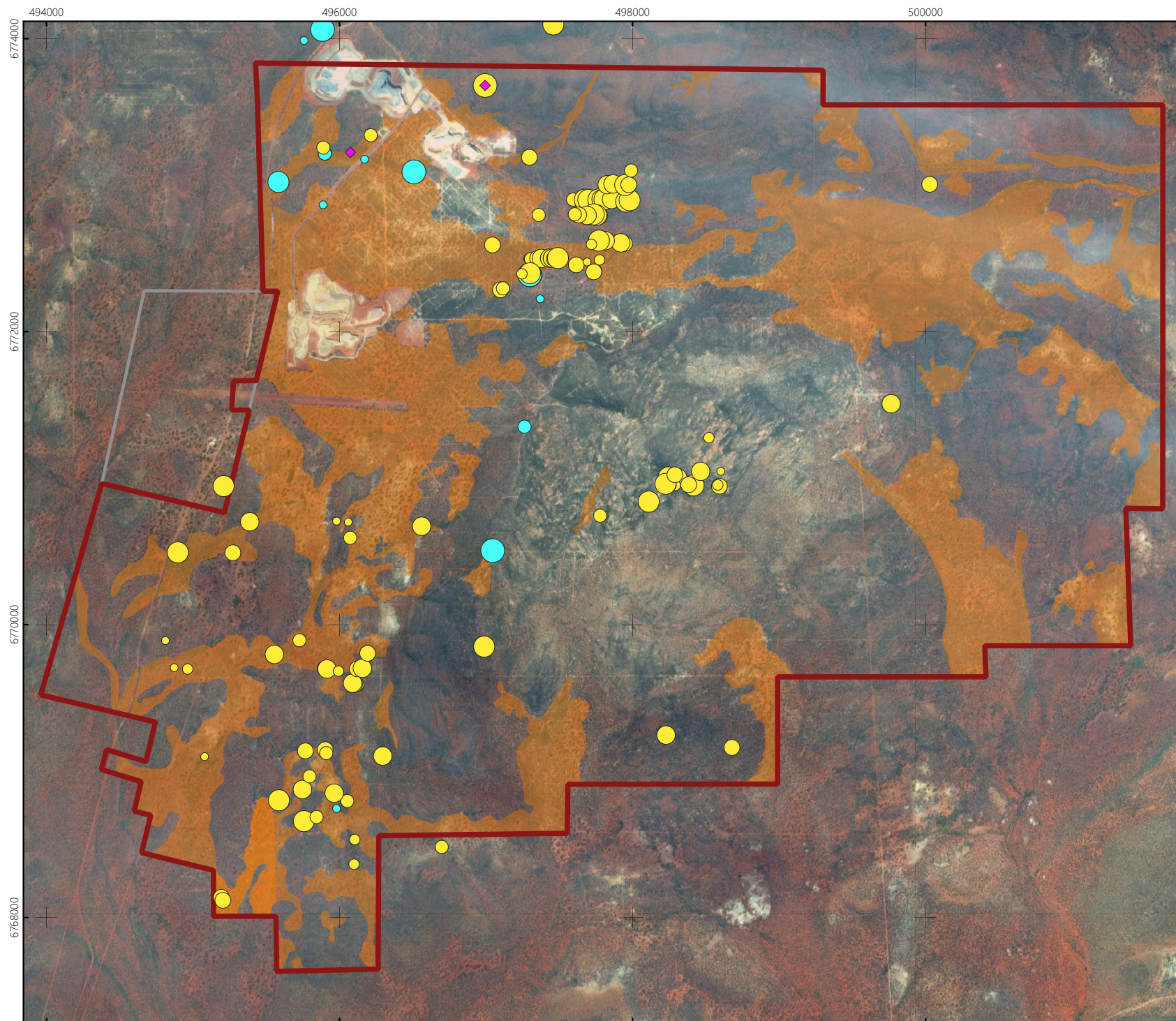
Date: 03/03/2021

Persoonia pentasticha (P3)

Mt Mulgine Project

Prepared for
Tungsten Mining NL

Figure
H.15



Legend

- Mt Mulgine Project
- Extension Tenement M59/460
- ◆ Current Assessment - Collected Specimen

Current Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants

Desktop Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants

Vegetation Unit

- Dominant taxon in vegetation unit
- High association with vegetation unit
- Medium association with vegetation unit



0 0.5 1 1.5 km

Scale: 1:36000

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter



Author: Evan Hamilton

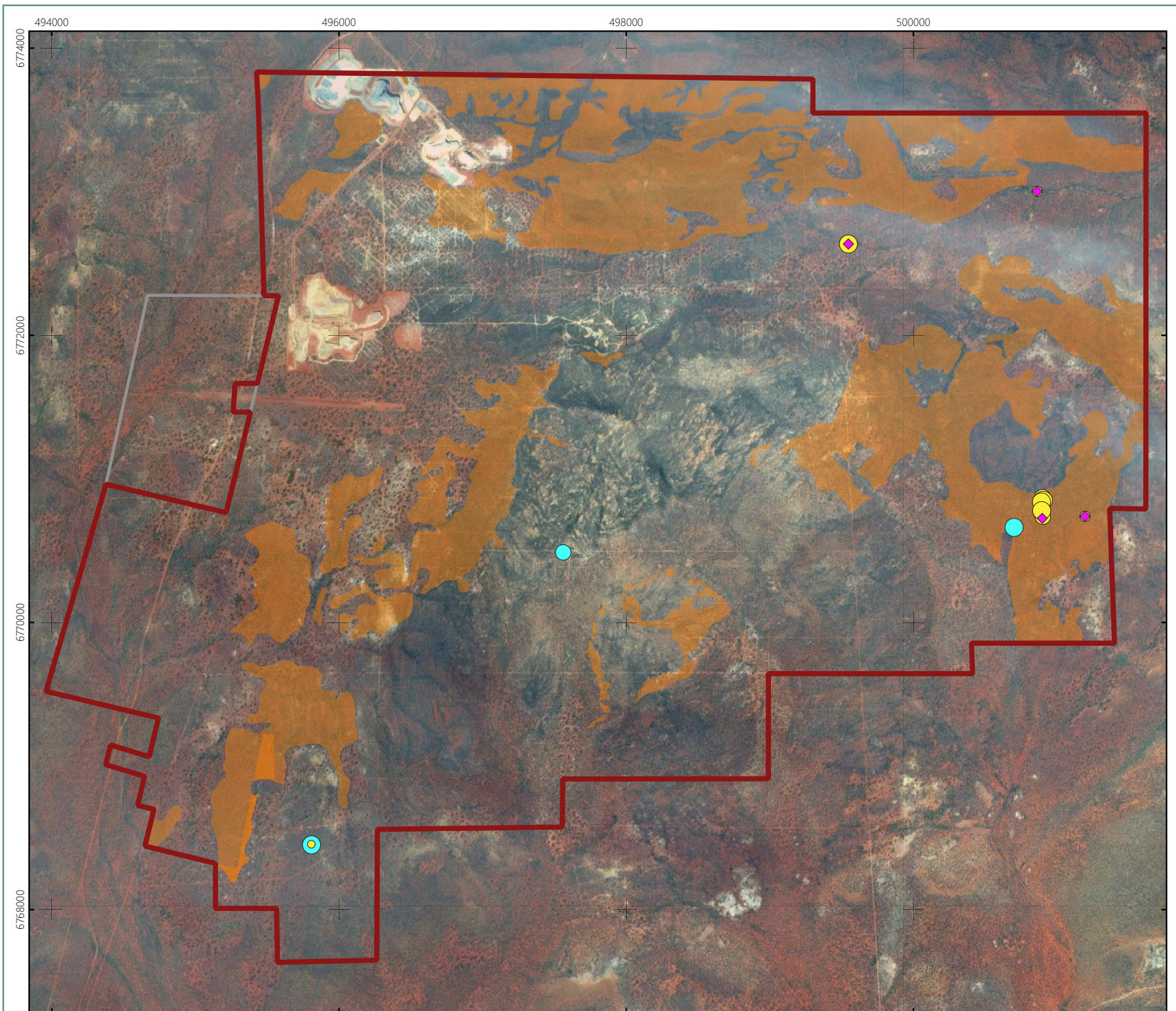
Date: 03/03/2021

Rhodanthe collina (P3)

Mt Mulgine Project

Prepared for
Tungsten Mining NL

Figure
H.16



Legend

- Mt Mulgine Project
- Extension Tenement Project
- Current Assessment - Collected Specimen

Current Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants

Desktop Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants

Vegetation Unit

- Dominant taxon in vegetation unit
- High association with vegetation unit
- Medium association with vegetation unit



0 0.5 1 1.5 km

Scale: 1:36000

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter



Author: Evan Hamilton

Date: 03/03/2021

Stenanthemum poicilum (P3)

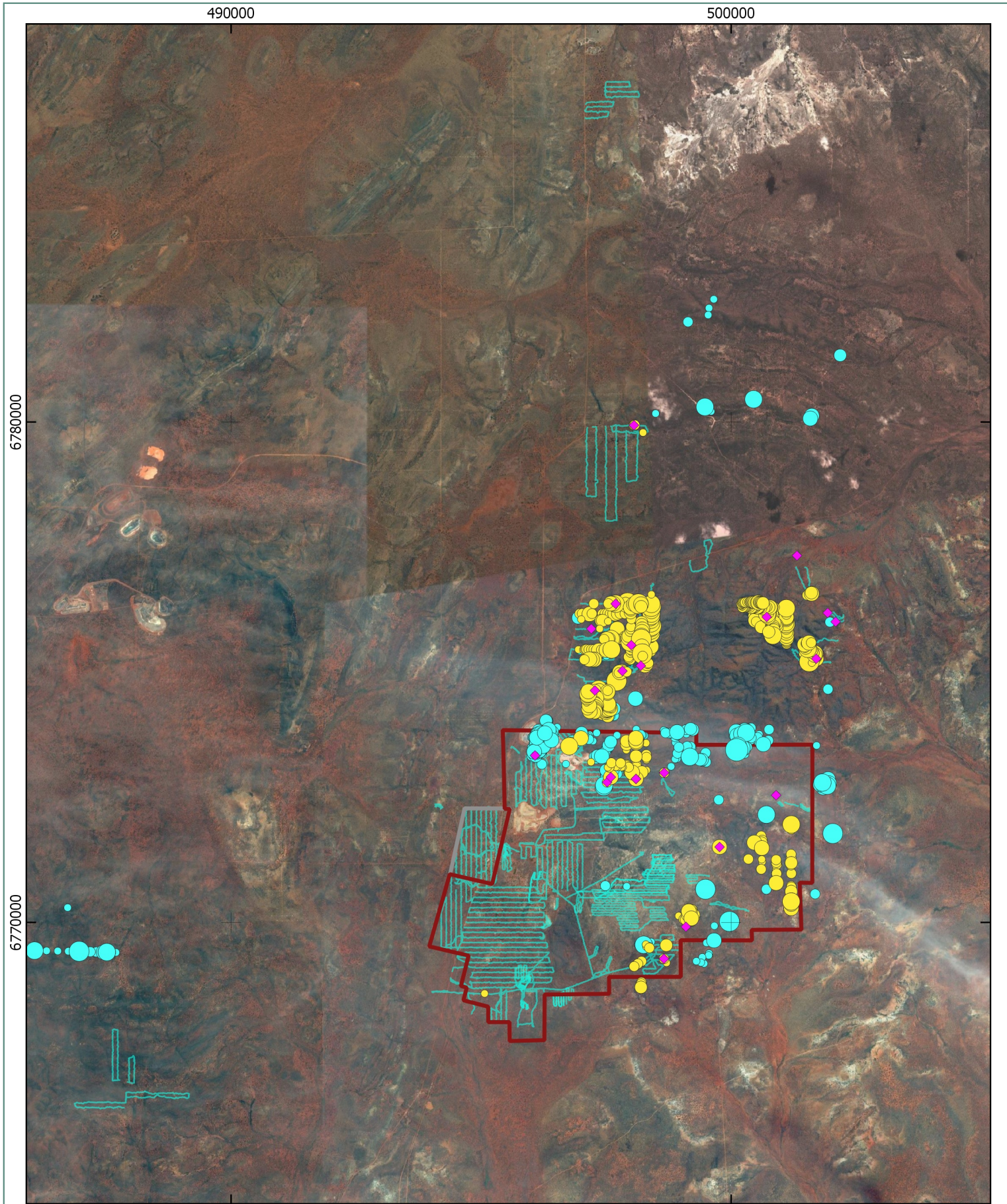
Mt Mulgine Project

Prepared for
Tungsten Mining NL

Figure
H.17

Appendix I: Regional Significant Flora Maps





Legend

- Mt Mulgine Project
- Extension Tenement M59/460
- Traverse Spring 2020
- ◆ Current Assessment - Collected Specimen

Current Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants

Desktop Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants



0 1 2 km

Scale 1:100000 @ A4

Coordinate System:
GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter

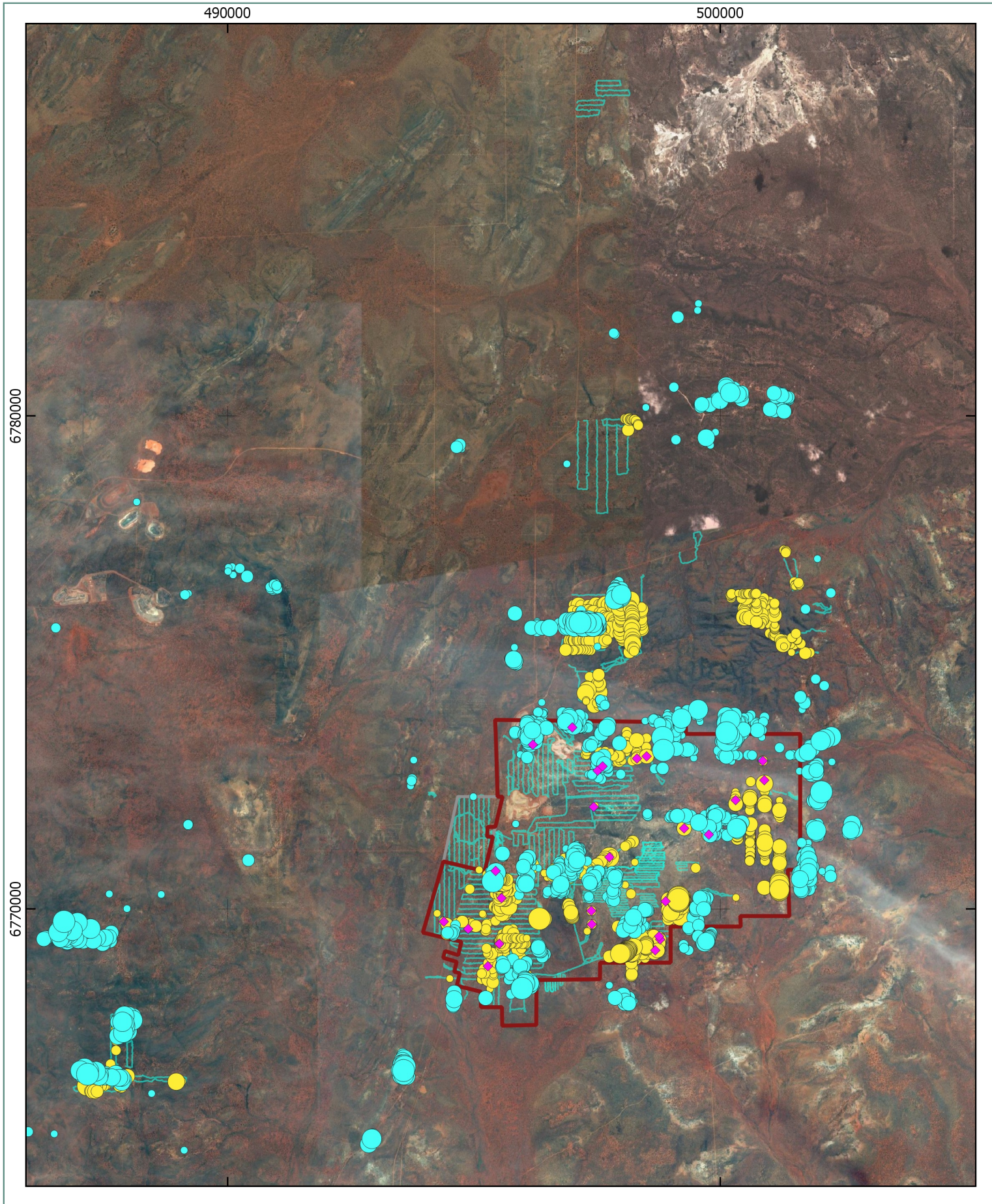


Author: Evan Hamilton Date: 10-12-2020

Acacia diagella (P1)

Mt Mulgine Project
Prepared for Tungsten
Mining NL

Figure
1.1



Legend

Mt Mulgine Project Extension Tenement M59/460

- Traverse Spring 2020
- ◆ Current Assessment - Collected Specimen

Desktop Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants

Current Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants



0 1 2 km

Scale 1:100000 @ A4

Coordinate System:
GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter

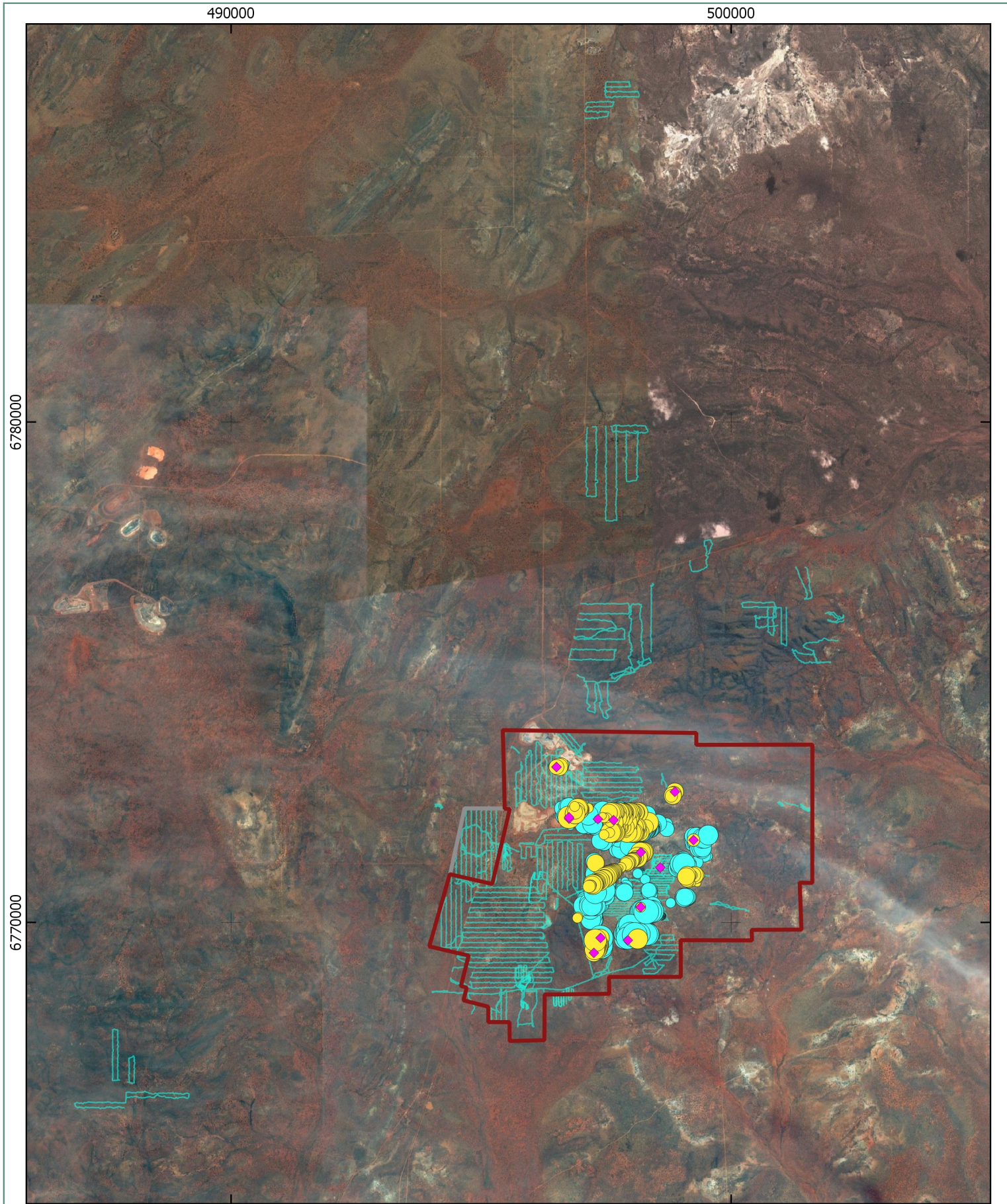


Author: Evan Hamilton Date: 16-11-2021

Acacia karina (P1)

Mt Mulgine Project
Prepared for Tungsten
Mining NL

Figure
1.2



Legend

- Mt Mulgine Project
- Extension Tenement M59/460
- Traverse Spring 2020
- ◆ Current Assessment - Collected Specimen
- Acacia sulcatacaulis area (Jenny Borg 2018)

Current Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants

Desktop Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants



0 1 2 km

Scale 1:100000 @ A4

Coordinate System:
GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter

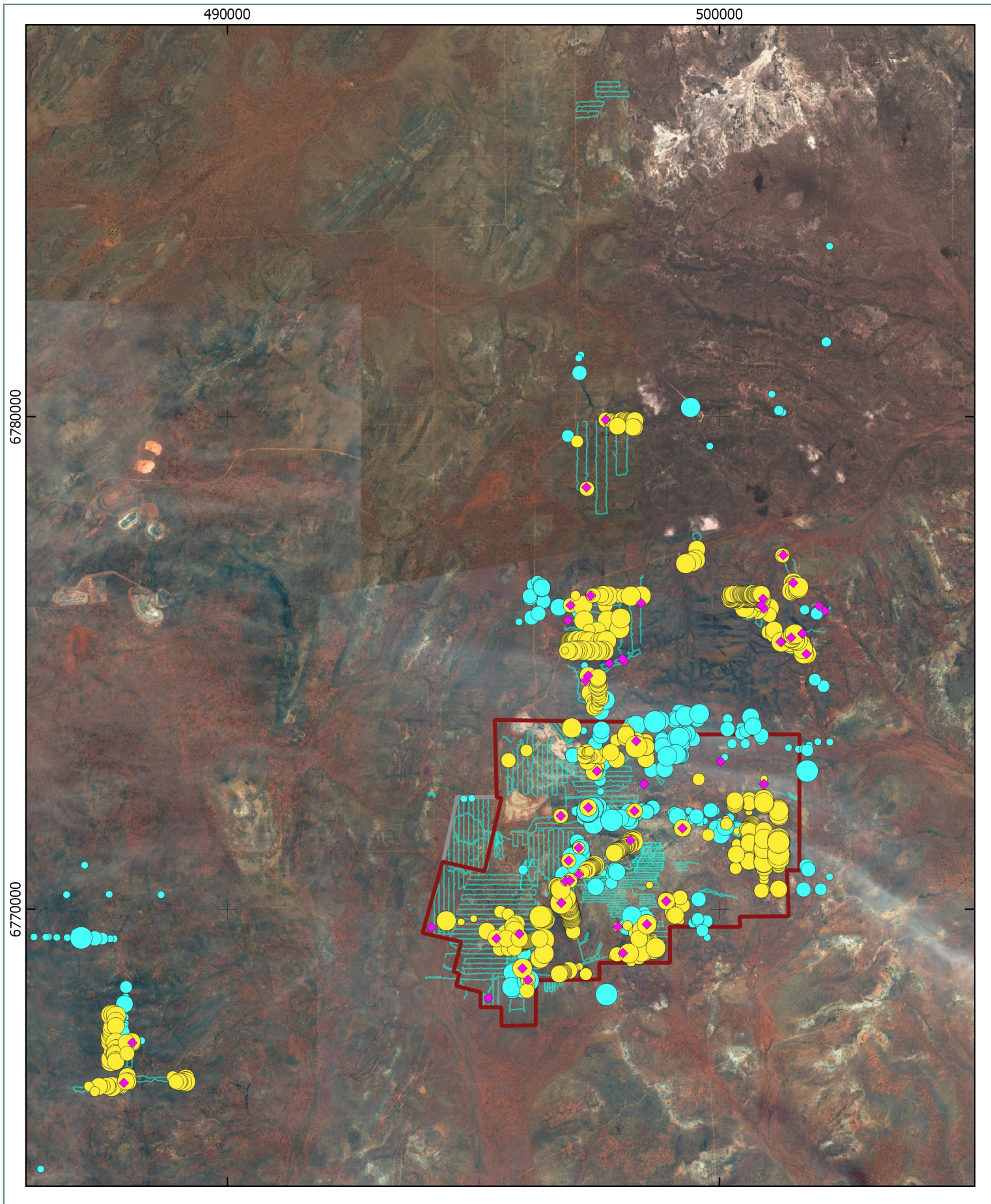


Author: Evan Hamilton Date: 10-12-2020

Acacia sulcatacaulis (P1)

Mt Mulgine Project
Prepared for Tungsten
Mining NL

Figure
1.3



Legend

- Mt Mulgine Project
- Extension Tenement M59/460
- Traverse Spring 2020
- ◆ Current Assessment - Collected Specimen

Current Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants

Desktop Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants



0 1 2 km

Scale 1:100000 @ A4

Coordinate System:
GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter

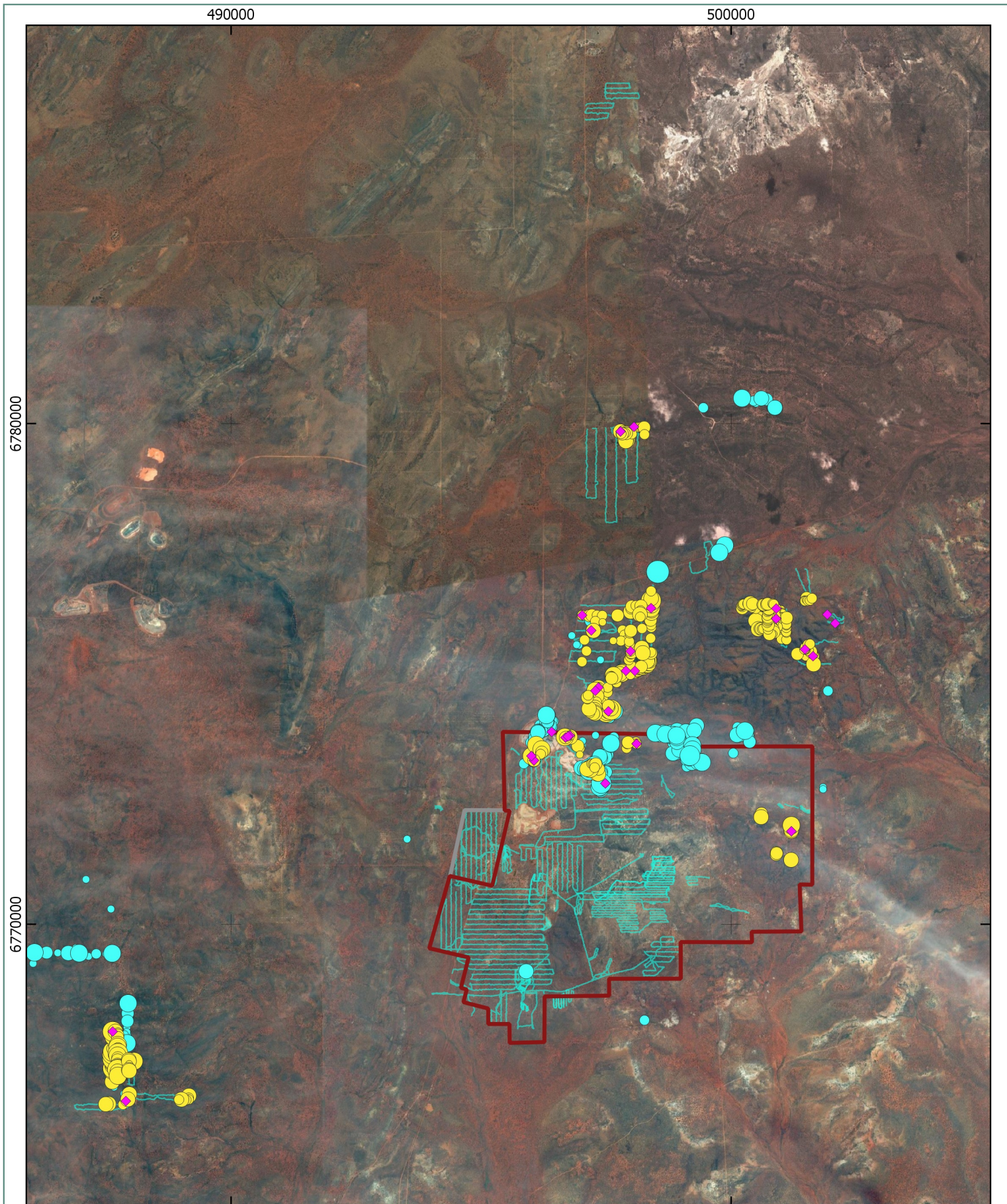


Author: Evan Hamilton Date: 10-12-2020

Allocasuarina tessellata (P3)

Mt Mulgine Project
Prepared for Tungsten
Mining NL

Figure
1.4



Legend

- Mt Mulgine Project
- Extension Tenement M59/460
- Traverse Spring 2020
- ◆ Current Assessment - Collected Specimen

Current Assessment

- 1 plant
- 2-5 plants
- 11-25 plants
- 6-10 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants

Desktop Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants



0 1 2 km

Scale 1:100000 @ A4

Coordinate System:
GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter

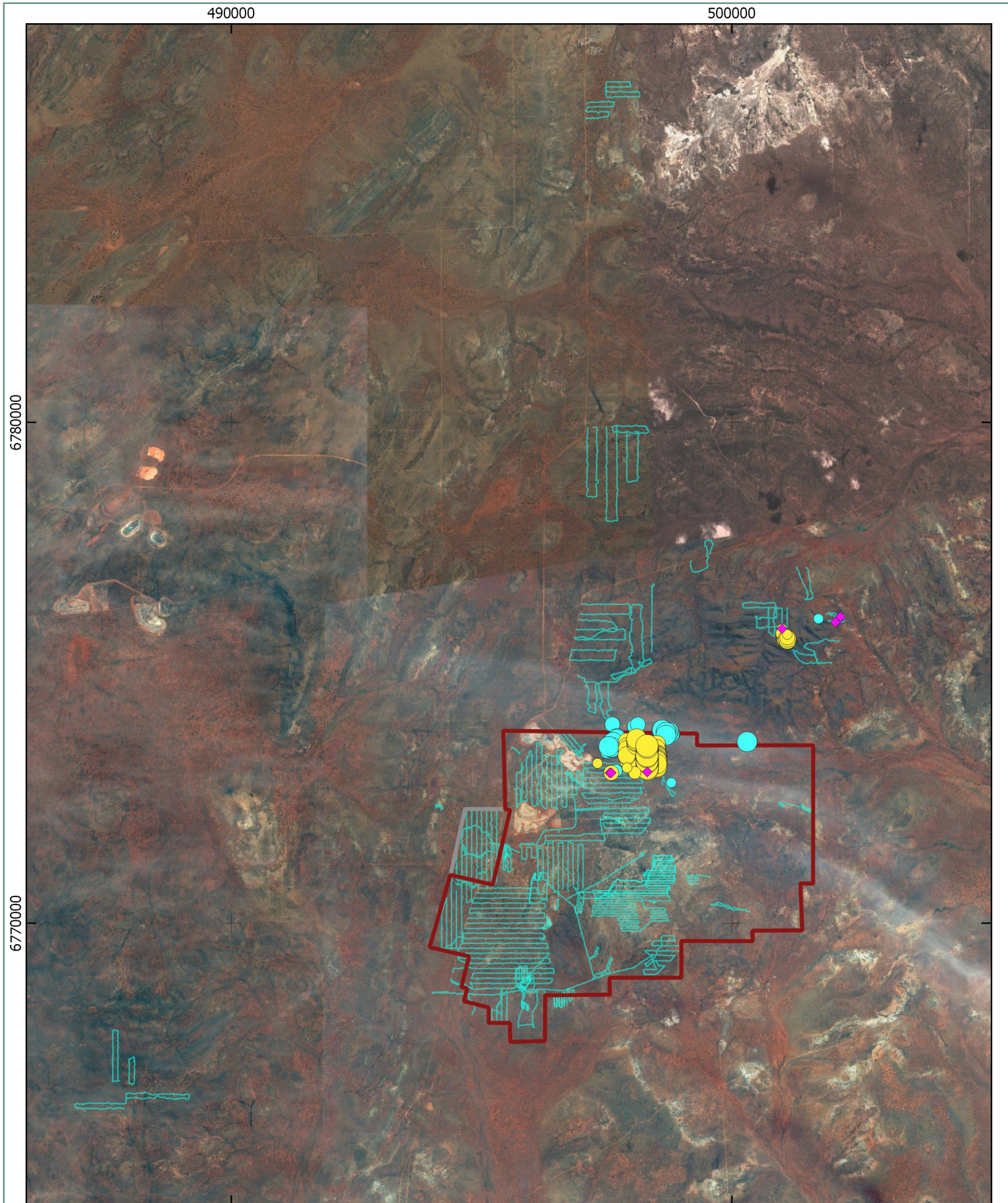


Author: Evan Hamilton Date: 10-12-2020

Chamelaucium sp.
Warriedar (A.P. Brown & S.
Patrick APB 1100) (P1)

Mt Mulgine Project
Prepared for Tungsten
Mining NL

Figure
1.5



Legend

- Mt Mulgine Project
- Extension Tenement M59/460
- Traverse Spring 2020
- ◆ Current Assessment - Collected Specimen

Current Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants

Desktop Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants



0 1 2 km

Scale 1:100000 @ A4

Coordinate System:
GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter

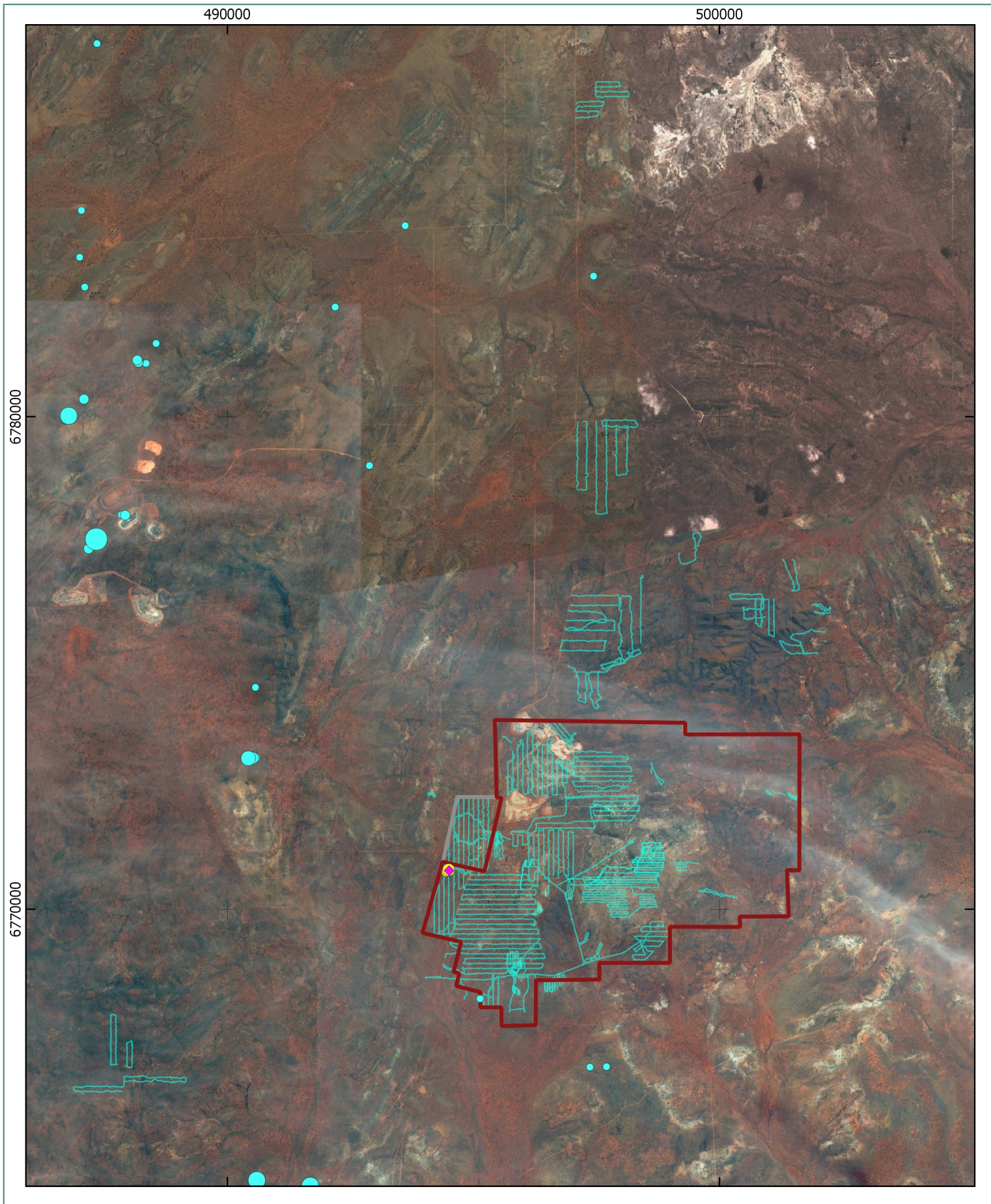


Author: Evan Hamilton Date: 10-12-2020

Dodonaea amplisemina
(P4)

Mt Mulgine Project
Prepared for Tungsten
Mining NL

Figure
1.6



Legend

- Mt Mulgine Project
- Extension Tenement M59/460
- Traverse Spring 2020
- ◆ Current Assessment - Collected Specimen

Current Assessment

- 1 plant
- 2-5 plants
- 11-25 plants
- 6-10 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants

Desktop Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants



0 1 2 km

Scale 1:100000 @ A4

Coordinate System:
GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter

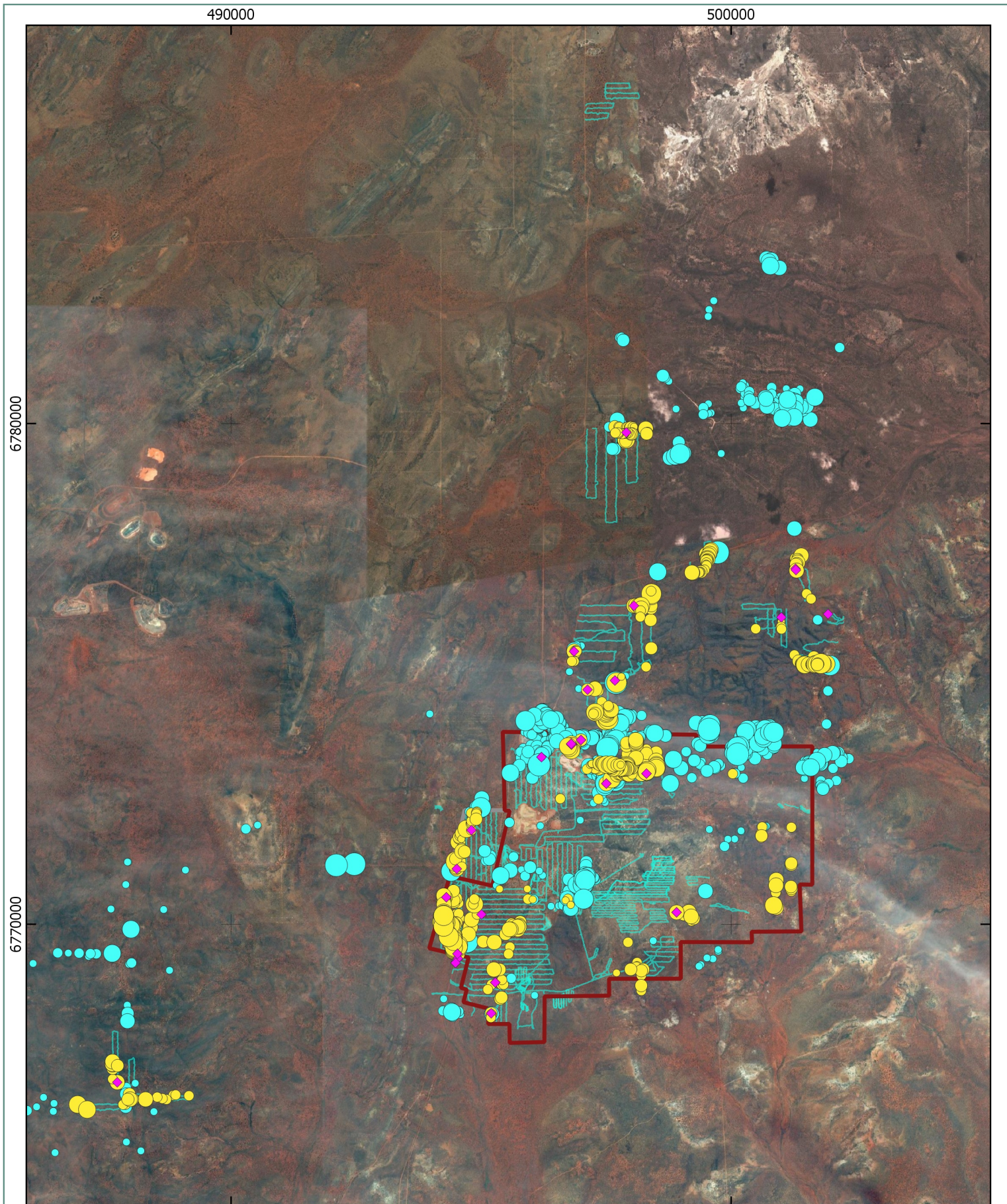


Author: Evan Hamilton Date: 10-12-2020

Grevillea globosa (P3)

Mt Mulgine Project
Prepared for Tungsten
Mining NL

Figure
1.7



Legend

- Mt Mulgine Project
- Extension Tenement M59/460
- Traverse Spring 2020
- ◆ Current Assessment - Collected Specimen

Current Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants

Desktop Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants



0 1 2 km

Scale 1:100000 @ A4

Coordinate System:
GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter

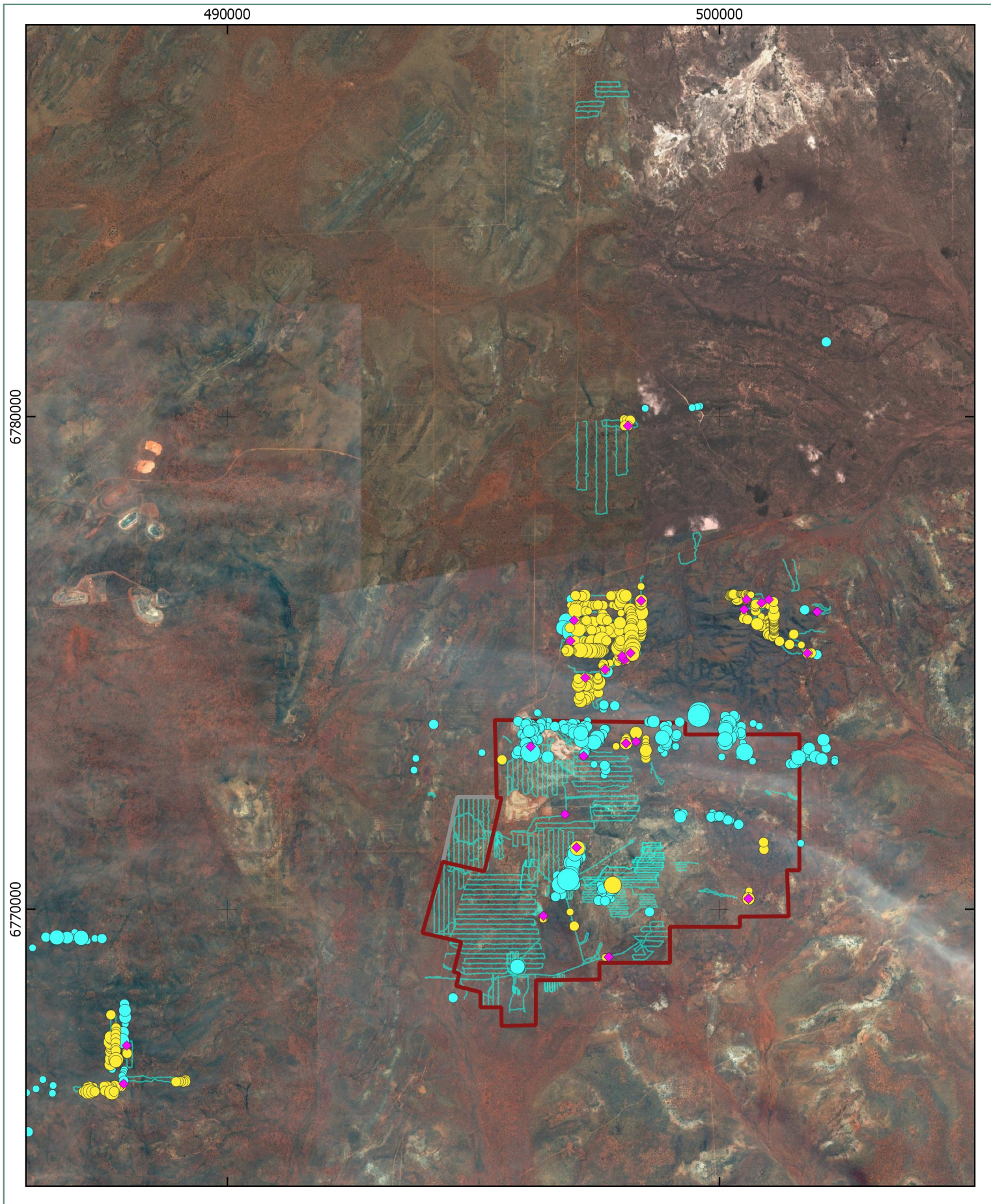


Author: Evan Hamilton Date: 10-12-2020

Grevillea scabrida (P3)

Mt Mulgine Project
Prepared for Tungsten
Mining NL

Figure
1.8



Legend

- Mt Mulgine Project
- Extension Tenement M59/460
- Traverse Spring 2020
- ◆ Current Assessment - Collected Specimen

Current Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants

Desktop Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants



0 1 2 km

Scale 1:100000 @ A4

Coordinate System:
GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter

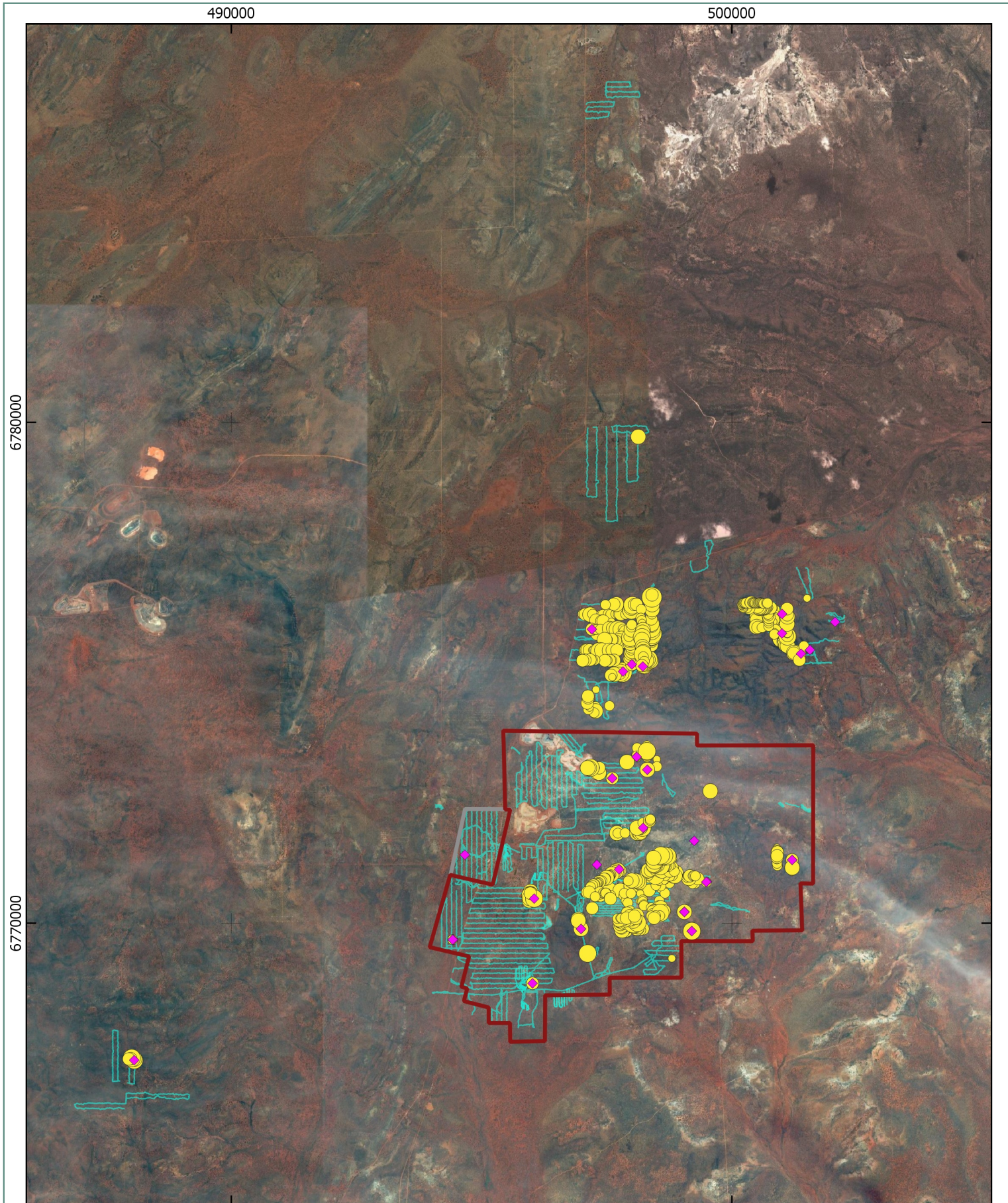


Author: Evan Hamilton Date: 10-12-2020

Grevillea subtiliflora (P3)

Mt Mulgine Project
Prepared for Tungsten
Mining NL

Figure
1.9



Legend

- Mt Mulgine Project
- Extension Tenement M59/460
- Traverse Spring 2020
- ◆ Current Assessment - Collected Specimen

Current Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants

Desktop Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants



0 1 2 km

Scale 1:100000 @ A4

Coordinate System:
GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter



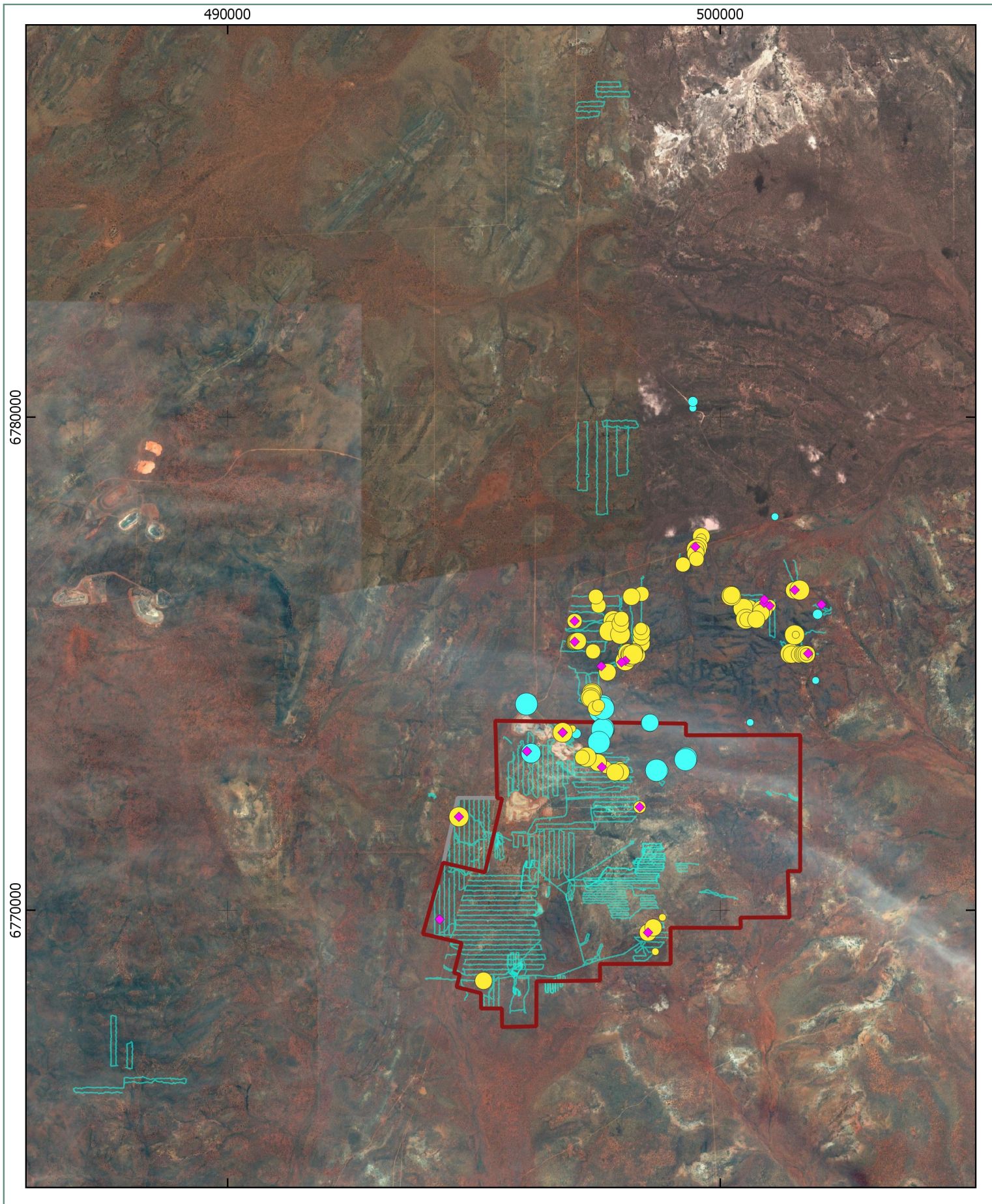
Author: Evan Hamilton Date: 10-12-2020

Hemigenia tichbonii (P1)

Mt Mulgine Project
Prepared for Tungsten
Mining NL

Figure

1.10



Legend

- Mt Mulgine Project
- Extension Tenement M59/460
- Traverse Spring 2020
- ◆ Current Assessment - Collected Specimen

Current Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants

Desktop Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants



0 1 2 km

Scale 1:100000 @ A4

Coordinate System:
GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter



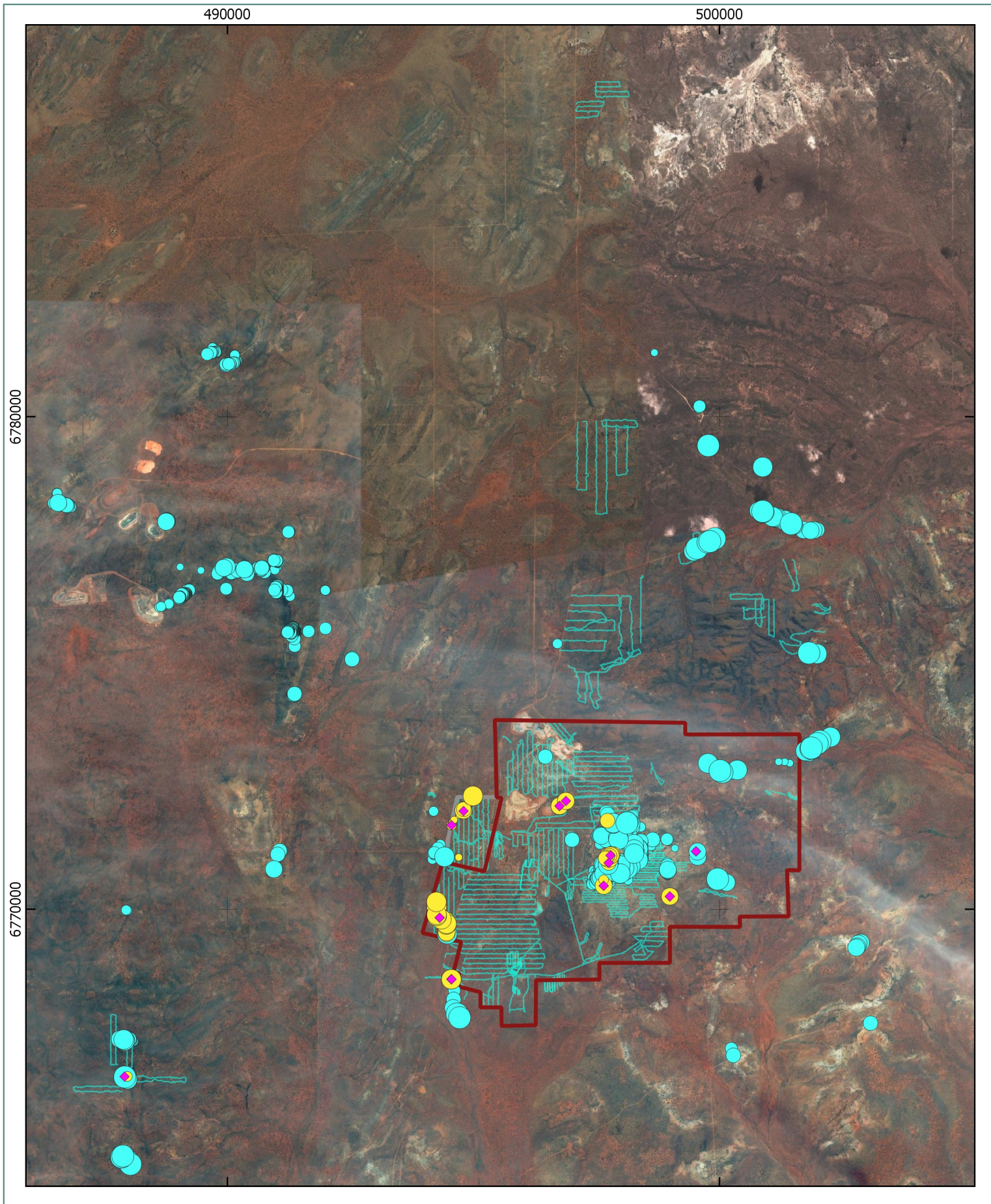
Author: Evan Hamilton Date: 10-12-2020

Hydrocotyle
dimorphocarpa (P1)

Mt Mulgine Project
Prepared for Tungsten
Mining NL

Figure

1.11



Legend

- Mt Mulgine Project
- Extension Tenement M59/460
- Traverse Spring 2020
- ◆ Current Assessment - Collected Specimen

Current Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants

Desktop Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
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0 1 2 km

Scale 1:100000 @ A4

Coordinate System:
GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter

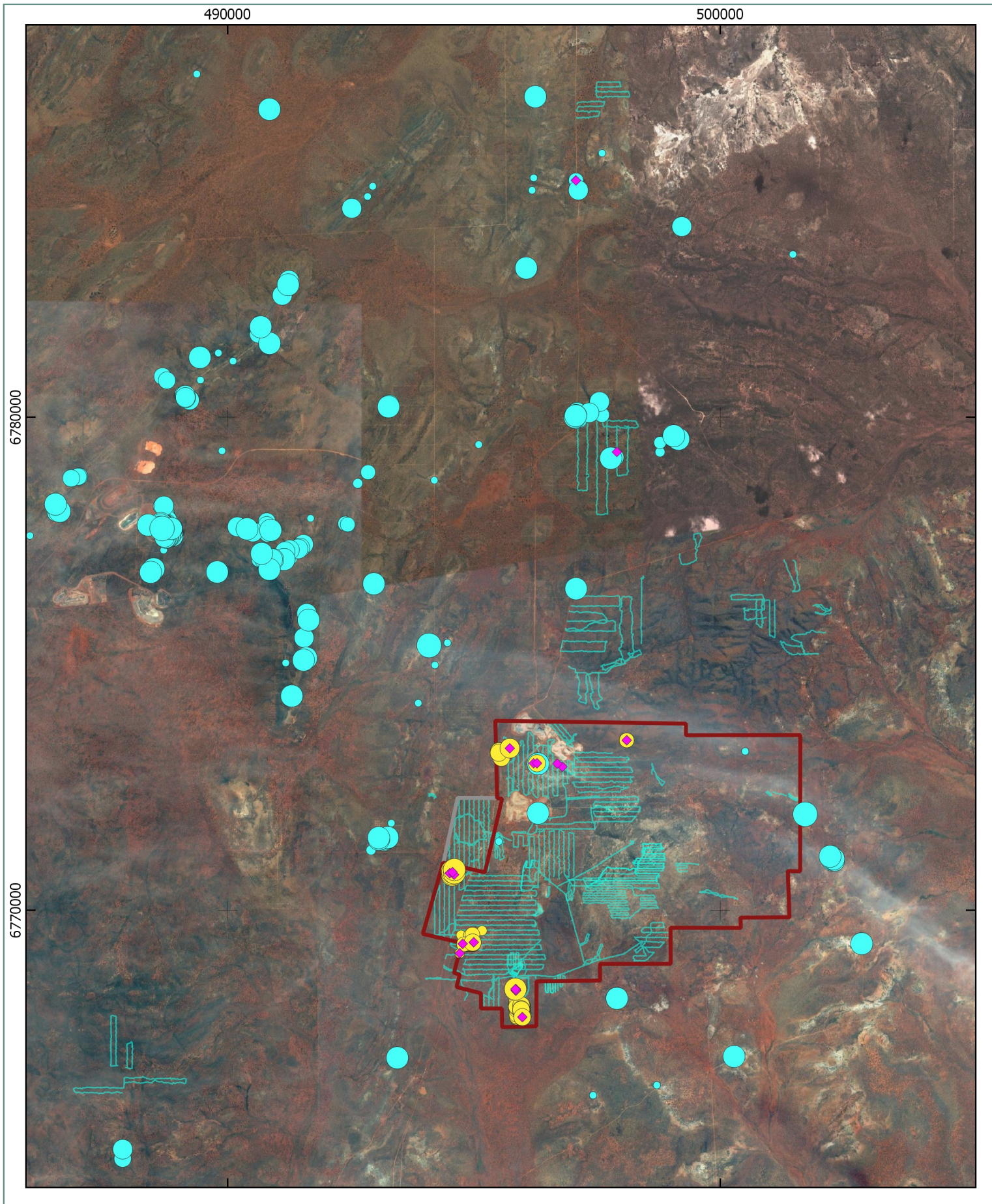


Author: Evan Hamilton Date: 10-12-2020

Lepidosperma sp. Blue Hills
(A. Markey & S. Dillon
3468) (P1)

Mt Mulgine Project
Prepared for Tungsten
Mining NL

Figure
1.12



Legend

- Mt Mulgine Project
- Extension Tenement M59/460
- Traverse Spring 2020
- ◆ Current Assessment - Collected Specimen

Current Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants

Desktop Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants



0 1 2 km

Scale 1:100000 @ A4

Coordinate System:
GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter

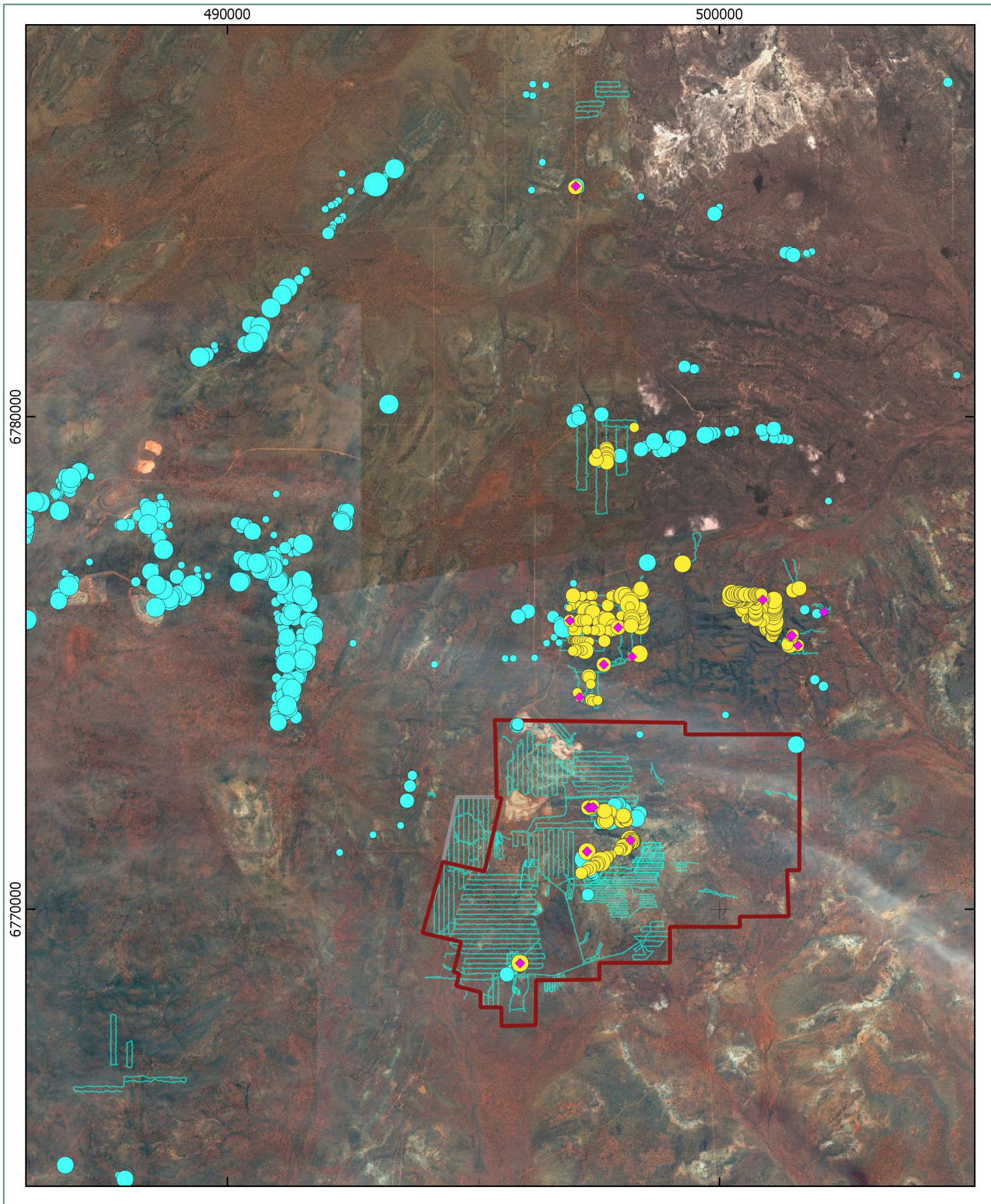


Author: Evan Hamilton Date: 10-12-2020

Micromyrtus acuta (P3)

Mt Mulgine Project
Prepared for Tungsten
Mining NL

Figure
1.13



Legend

- Mt Mulgine Project
- Extension Tenement M59/460
- Traverse Spring 2020
- ◆ Current Assessment - Collected Specimen

Current Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants

Desktop Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants



0 1 2 km

Scale 1:100000 @ A4

Coordinate System:
GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter

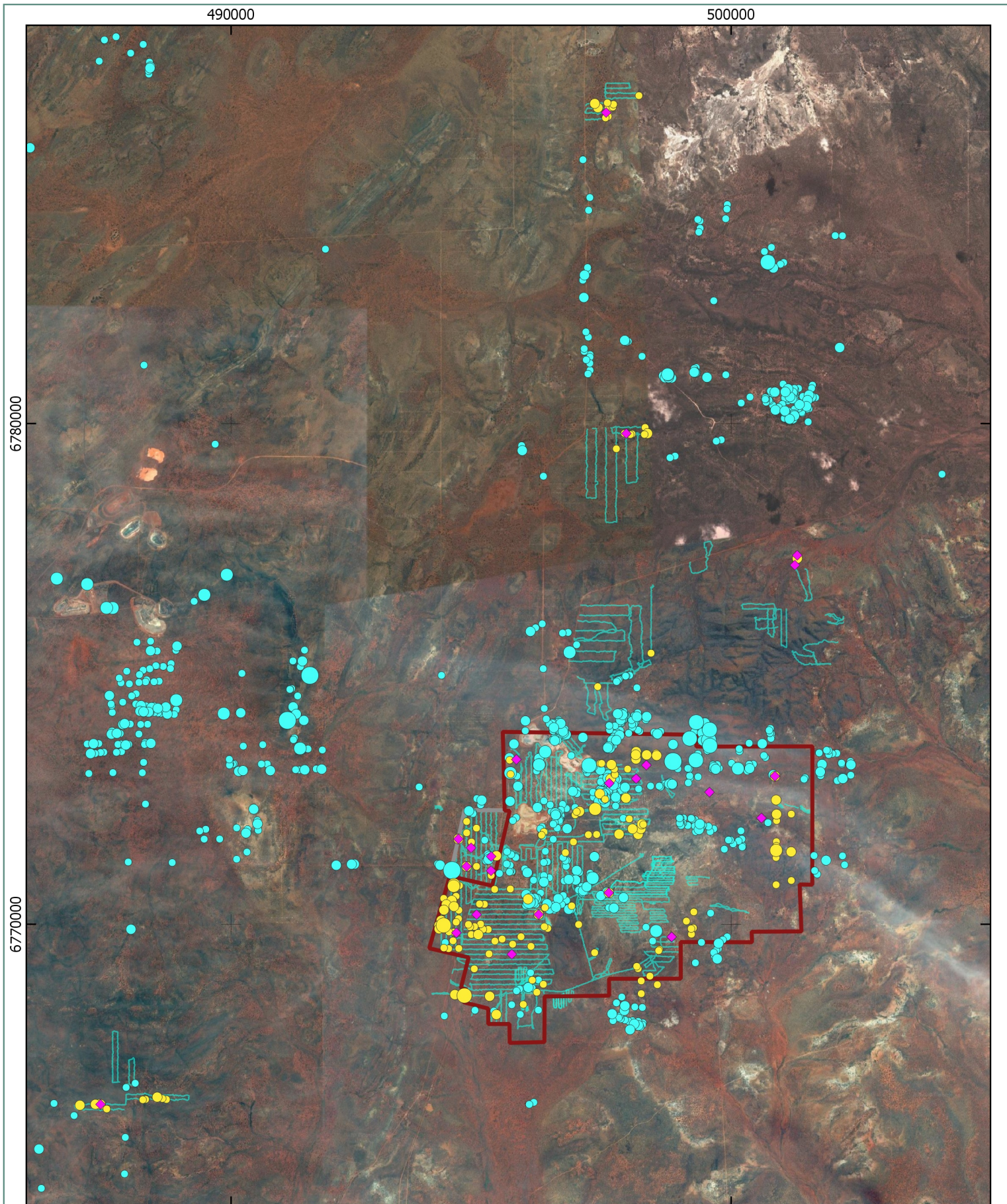


Author: Evan Hamilton Date: 10-12-2020

Micromyrtus trudgenii (P3)

Mt Mulgine Project
Prepared for Tungsten
Mining NL

Figure
1.14



Legend

- Mt Mulgine Project
- Extension Tenement M59/460
- Traverse Spring 2020
- ◆ Current Assessment - Collected Specimen

Current Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants

Desktop Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants



0 1 2 km

Scale 1:100000 @ A4

Coordinate System:
GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter

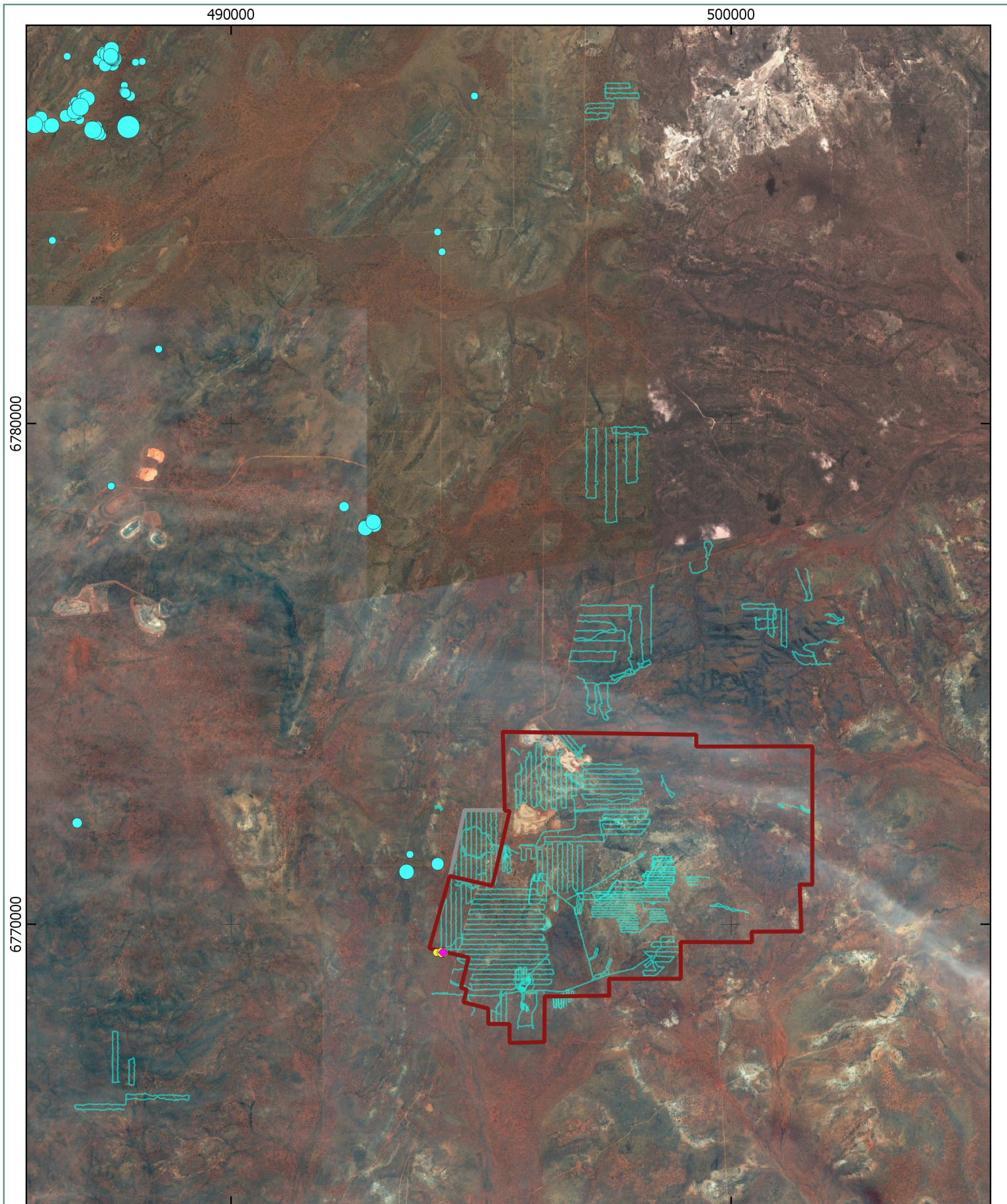


Author: Evan Hamilton Date: 10-12-2020

Persoonia pentasticha (P3)

Mt Mulgine Project
Prepared for Tungsten
Mining NL

Figure
1.15



Legend

- Mt Mulgine Project
- Extension Tenement M59/460
- Traverse Spring 2020
- ◆ Current Assessment - Collection Specimen

Current Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants

Desktop Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
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- 100-1000 plants
- >1000 plants



0 1 2 km

Scale 1:100000 @ A4

Coordinate System:
GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter

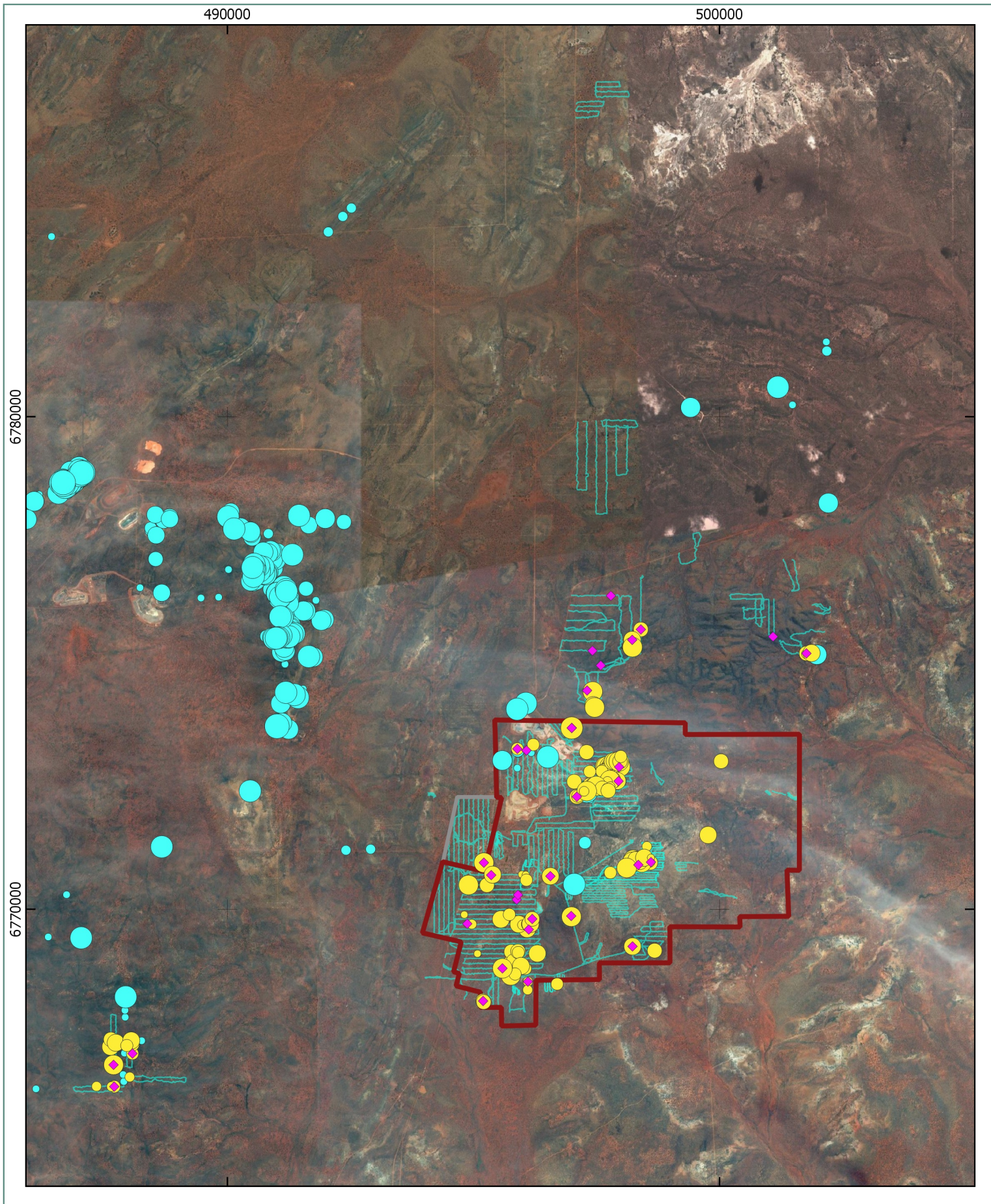


Author: Evan Hamilton Date: 10-12-2020

Prostanthera sp. Karara (D. Coultas & K. Greenacre Opp 8) (P1)

Mt Mulgine Project
Prepared for Tungsten
Mining NL

Figure
1.16



Legend

- Mt Mulgine Project
- Extension Tenement M59/460
- Traverse Spring 2020
- ◆ Current Assessment - Collected Specimen

Current Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants

Desktop Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants



0 1 2 km

Scale 1:100000 @ A4

Coordinate System:
GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter

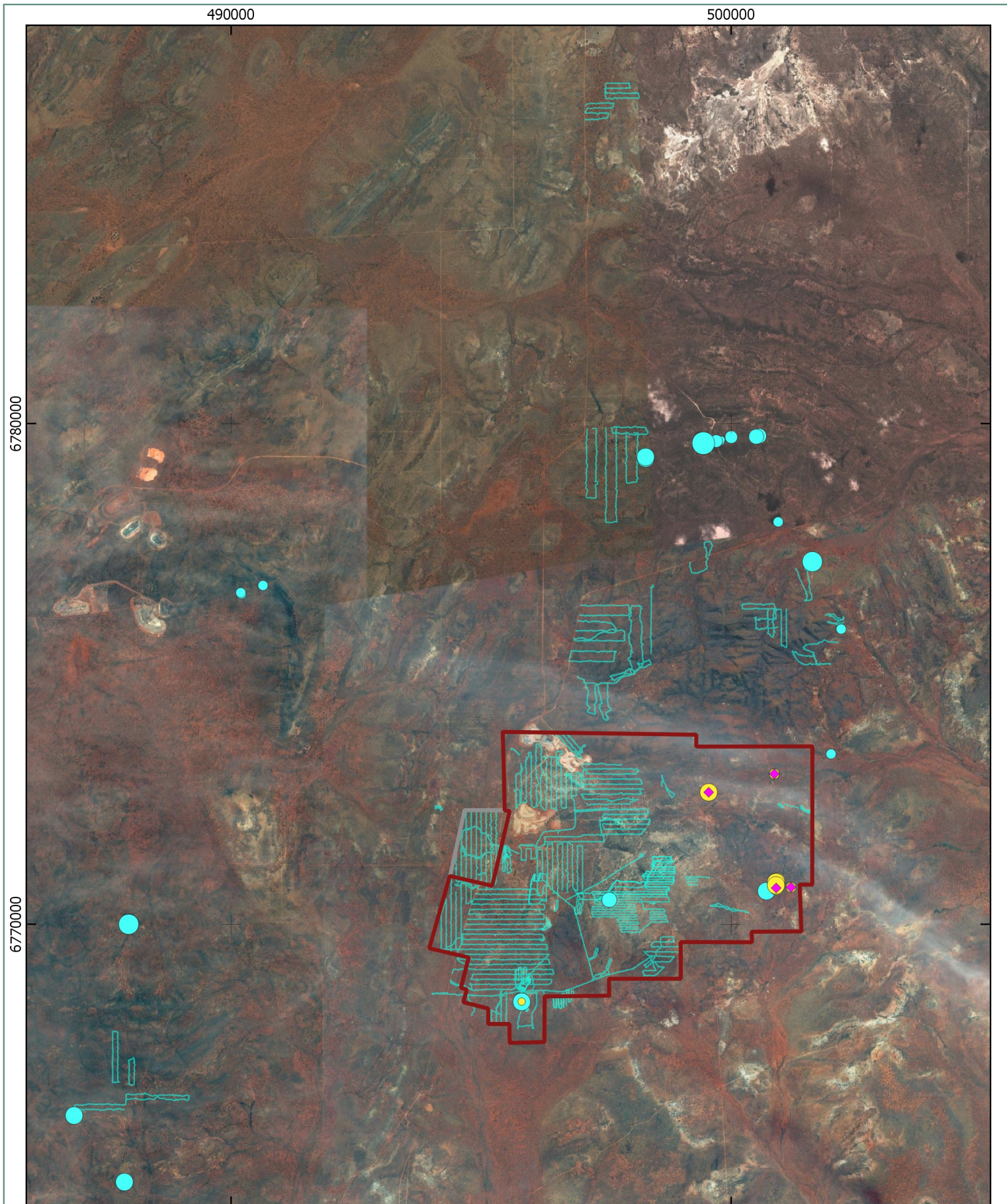


Author: Evan Hamilton Date: 10-12-2020

Rhodanthe collina (P3)

Mt Mulgine Project
Prepared for Tungsten
Mining NL

Figure
1.17



Legend

- Mt Mulgine Project
- Extension Tenement M59/460
- Traverse Spring 2020
- ◆ Current Assessment - Collected Specimen

Current Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants

Desktop Assessment

- 1 plant
- 2-5 plants
- 6-10 plants
- 11-25 plants
- 26-50 plants
- 51-100 plants
- 100-1000 plants
- >1000 plants



0 1 2 km

Scale 1:100000 @ A4

Coordinate System:
GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter



Author: Evan Hamilton Date: 10-12-2020

Stenanthemum poicilum
(P3)

Mt Mulgine Project
Prepared for Tungsten
Mining NL

Figure
1.18

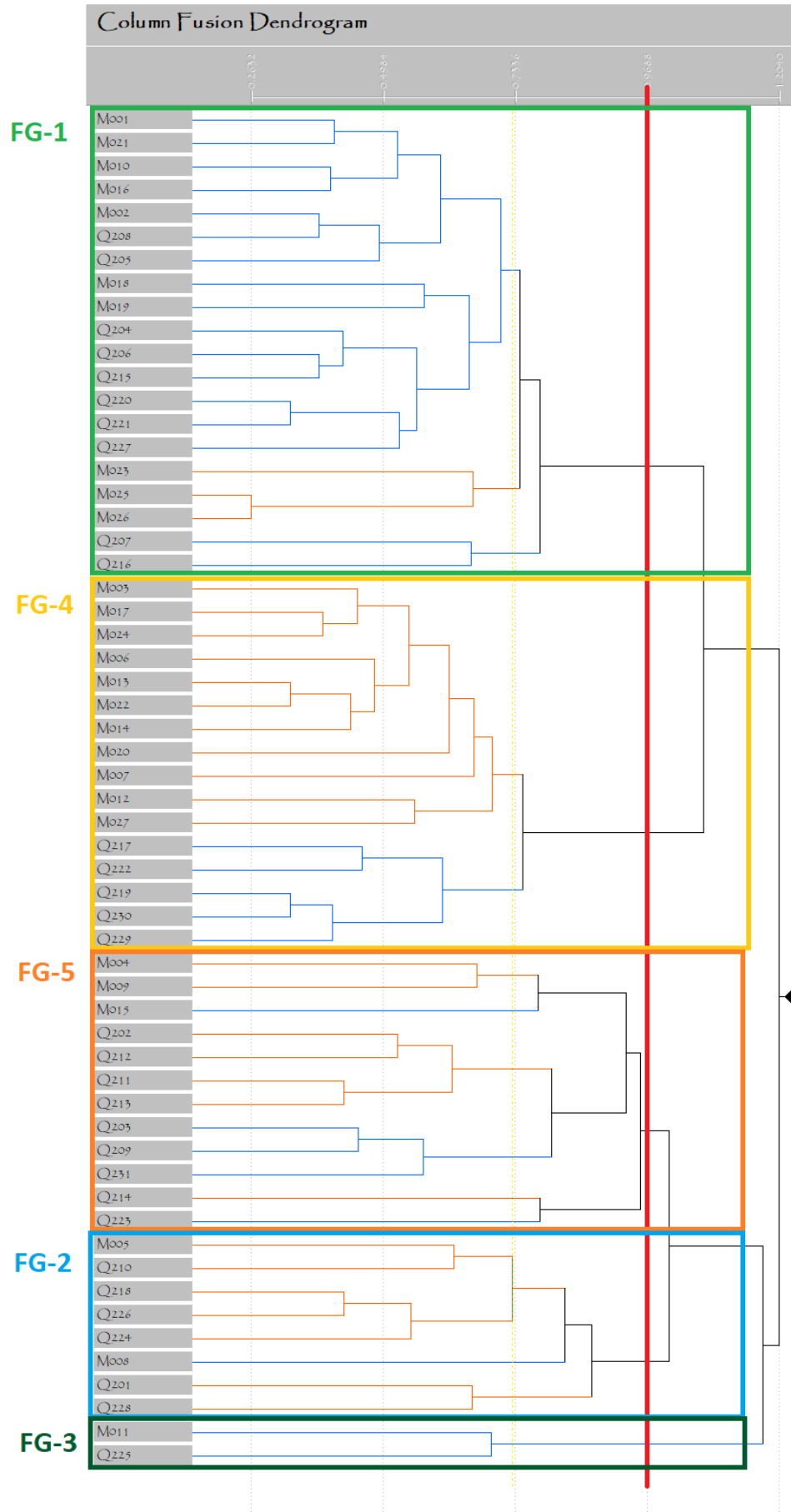
Appendix J: Introduced Flora Locations



Specimen	GPS Location		Cover (%)
	Easting	Northing	
<i>Arctotheca calendula</i>	497700	6770850	0.01
<i>Bromus diandrus</i>	496074	6773224	0.10
<i>Cuscuta planiflora</i>	498464	6772542	0.01
<i>Cuscuta planiflora</i>	499169	6772724	0.01
<i>Cuscuta planiflora</i>	498659	6772991	0.10
<i>Cuscuta planiflora</i>	498871	6772611	0.10
<i>Cuscuta planiflora</i>	496959	6770584	0.01
<i>Cuscuta planiflora</i>	495980	6767833	0.10
<i>Cuscuta planiflora</i>	496092	6769020	0.01
<i>Cuscuta planiflora</i>	495281	6768838	0.10
<i>Cuscuta planiflora</i>	495616	6770224	0.10
<i>Cuscuta planiflora</i>	495805	6769367	0.10
<i>Cuscuta planiflora</i>	499244	6770877	0.10
<i>Cuscuta planiflora</i>	496994	6773681	0.10
<i>Cuscuta planiflora</i>	496074	6773224	1.50
<i>Cuscuta planiflora</i>	498679	6769161	0.50
<i>Cuscuta planiflora</i>	499766	6771508	0.10
<i>Cuscuta planiflora</i>	495018	6770538	0.10
<i>Cuscuta planiflora</i>	500029	6773006	0.10
<i>Ehrharta longiflora</i>	497700	6770850	0.10
<i>Hypochaeris glabra</i>	496074	6773224	0.01
<i>Lysimachia arvensis</i>	496074	6773224	0.01
<i>Mesembryanthemum nodiflorum</i>	498464	6772542	0.01
<i>Mesembryanthemum nodiflorum</i>	501238	6770112	5.00
<i>Mesembryanthemum nodiflorum</i>	495243	6770140	0.10
<i>Monoculus monstrosus</i>	495243	6770140	0.10
<i>Pentameris airoides</i>	496074	6773224	0.01
<i>Pentameris airoides</i>	495018	6770538	0.01
<i>Petrorhagia dubia</i>	497700	6770850	0.10
<i>Rostraria pumila</i>	495244	6770308	0.10
<i>Rostraria pumila</i>	495805	6769367	0.01
<i>Rostraria pumila</i>	501238	6770112	0.20
<i>Silene gallica</i>	496074	6773224	0.01
<i>Sisymbrium erysimoides</i>	499169	6772724	0.01
<i>Sonchus oleraceus</i>	496074	6773224	0.01
<i>Spergula pentandra</i>	496345	6769975	0.20
<i>Spergula pentandra</i>	501238	6770112	0.10

Appendix K: Floristic Analysis - Dendrogram





Appendix B 2023 Targeted Search of Locally Significant Vegetation Communities



Mulgine

Targeted Search of Locally Significant Vegetation Communities

31 March 2026

Prepared for



Prepared by

Jenny Borger Botanical Consulting

and



Mulgine – Targeted Search of Locally Significant Vegetation Communities

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This document has been prepared based on assumptions as reported throughout and upon information and data supplied by others or generated by JBBC and ISPL. This document has been subject to review and changes from the Client and the Client’s representative.



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Executive Summary

Tungsten Mining NL (TGN), through its wholly owned subsidiary, Mid-West Tungsten Pty Ltd (Mid-West Tungsten), proposes to develop the Trench Operation (Trench; the operation). The operation is located at Mulgine approximately 330km northeast of Perth and 15km northeast of Rothsay, in the Shire of Perenjori in Western Australia. TGN plans to mine and produce a tungsten-molybdenum concentrate.

Jenny Borger Botanical Consulting (JBBC), with the support of Integrate Sustainability Pty Ltd (ISPL), was commissioned to identify locally and regionally significant vegetation units outside of TGN tenure within 20km of the proposed operation to assist with approvals. The locally and regionally significant vegetation units of focus for this survey are:

- AdAa: *Allocasuarina dielsiana* (+/-*Acacia umbraculiformis*) low open woodland over *Acacia acuminata*, *Allocasuarina tessellata* (P3), *Acacia karinae* (P3) tall open shrubland over *Borya sphaerocephala* low sparse shrubland;
- AdAt: *Acacia duriuscula* or *Allocasuarina tessellata* (P3) tall open shrubland; and
- AsCp: *Acacia sulcaticaulis* (EN) and/or *Allocasuarina acutivalvis* subsp. *prinsepiana* tall open to closed shrubland over *Calycophyllum paucifolium* mid sparse shrubland over *Philotheca deserti* subsp. *deserti* low sparse shrubland.

Between 2019 and 2021, Spectrum Ecology undertook four field assessments over the operational and recorded seven vegetation units. A significance assessment was undertaken and found that AdAa, AdAt and AsCp were locally and regionally significant. However, they did not classify any indicator species for the vegetation unit's presence, as a result, it was assumed that all species used to define the vegetation unit were indicators of its presence.

During the desktop assessment, locations of the assumed indicator species were collated from publicly available sources such as Atlas of Living Australia, Index of Biodiversity Surveys for Assessment, Dandjoo database searches, Spectrum Ecology's report and regional reports. The collated data was then spatially presented and mapped in QGIS to determine priority search areas for the targeted survey.

The field survey occurred between 27 November to 1 December 2023 by Jenny Borger (Botanist) and Zerianna Edwards (Environmental Scientist Graduate) to align with EPA's technical guidance. During the field survey, the Survey Area was separated into three zones, north, east and west, with each zone sampled on a different day. A total of 80 sites were surveyed, including six within Spectrum Ecology's mapped vegetation units to familiarise field personnel with the indicator species.

While visiting the Spectrum Ecology's targeted vegetation unit quadrats, variation was noted at some quadrats. This variation was utilised when categorising the surveyed sites as either one of the locally significant vegetation units or not representative. Based on the vegetation unit descriptions and noted variation, 55 and 13 sites were categorised as vegetation units AdAa and AdAt, respectively, with a single site identified as vegetation unit AsCp and another 10 not representative. One site (site 26) was identified as a mosaic of AdAa/AdAt.

During the 2024 field survey no *Acacia sulcaticaulis* (EN) were located outside its current known distribution, thus vegetation unit AsCp was only found in the areas previously mapped by Spectrum Ecology's. The 2024 survey did locate vegetation units with similar characteristics to AdAa and AdAt, and a mosaic of the two units within the 20km search area. The indicator species *Acacia karinae* (P3) and *Allocasuarina tessellata* (P3) were recorded along the Warriendar Coppermine Rd verge, although vegetation was not described. Based on *Acacia sulcaticaulis* (EN) only being found within the TGN tenure, vegetation unit AsCp is likely restricted to areas previously mapped by Spectrum Ecology.

No occurrences of *Acacia duriuscula*, an indicator for vegetation unit AdAt, were located, it is possible that the species was misidentified during the Spectrum Ecology's survey and should be *Acacia ramulosa* var. *ramulosa*. It is recommended that some or all of the quadrats associated with vegetation unit AdAt be revisited to verify *Acacia duriuscula* identification. Other is also the potential that *Grevillea paniculata* was misidentified for *G. subtiliflora* (P3) in the previous surveys, although, this has low impact on the vegetation units as it isn't a dominant nor indicator species.

1 Introduction

1.1 Project Overview

The Trench Operation (Trench; the operation) is located at Mulgine approximately 330km northeast of Perth and 15km northeast of Rothsay, in the Shire of Perenjori in Western Australia (Figure 1.1). Tungsten Mining NL (TGN), through its wholly owned subsidiary, Mid-West Tungsten Pty Ltd (Mid-West Tungsten), plans to mine and produce a tungsten-molybdenum concentrate. The Trench Operation is partially on the Wanarra pastoral station and ex Karara pastoral station held by the Department of Biodiversity, Conservation and Attractions (DBCA). Access to the operation is via the Warriedar Copper Mine Road and the Minjar Haul Road.

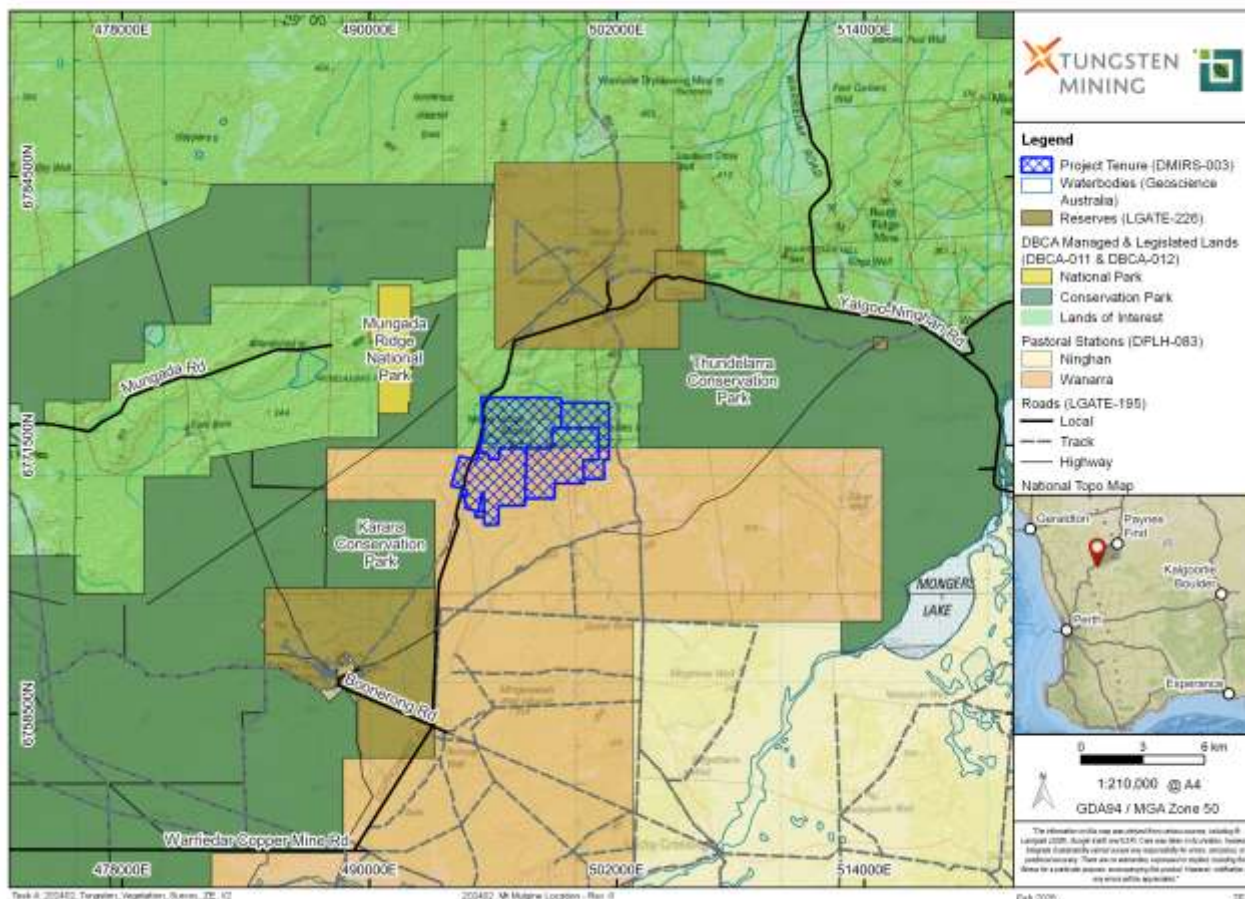


Figure 1.1 TGN Tenure location

Jenny Borger Botanical Consulting (JBBC), supported by Integrate Sustainability Pty Ltd (ISPL), was commissioned by TGN to conduct a targeted search for locally and regionally significant vegetation units within its tenure. The survey covered a 20km radius of the operation to support TGN's approvals process. The three vegetation units considered local and regional significance are:

- **AdAa:** *Allocasuarina dielsiana* (+/- *Acacia umbraculiformis*) low open woodland over *Acacia acuminata*, *Allocasuarina tessellata* (P3), *Acacia karinae* (P3) tall open shrubland over *Borya sphaerocephala* low sparse shrubland;
- **AdAt:** *Acacia duriuscula* or *Allocasuarina tessellata* (P3) tall open shrubland; and
- **AsCp:** *Acacia sulcatcaulis* (EN) and/or *Allocasuarina acutivalvis* subsp. *prinsepiana* tall open shrubland over *Calycopeplus paucifolius* mid sparse shrubland over low sparse shrubland *Philothea deserti* subsp. *deserti*.

1.2 Scope of Work

The objectives of the targeted search were to:

- Undertake a review of known locations of indicator species associated with the locally significant vegetation units, including *Acacia sulcatcaulis* (EN), *Acacia karinae* (P3) and *Allocasuarina tessellata* (P3), to determine priority survey locations in the Survey Area;
- Look for opportunistic records of the locally significant vegetation units' indicator species while in the field to determine additional survey locations; and



- Investigate and report on the regional occurrences of the locally significant vegetation units AdAa, AdAt and AsCp within the Survey Area.

1.3 Previous Studies

1.3.1 Tungsten Mining Area

Between 2019 and 2021, Spectrum Ecology (2021) conducted four field surveys to characterise flora and vegetation present in the TGN tenure. During the surveys, Spectrum Ecology recorded seven vegetation units from five broad floristic groups (Table 1.1), and determined the vegetation units AdAa, AdAt and AsCp are locally and regionally significant. Regional significance was determined by comparing the vegetation unit descriptions to Beard's pre-European vegetation association map. Locally significance, was determined by presences of conservation-significant flora taxa, the mapped extent of the vegetation unit and if landforms/habitat for the vegetation unit was restricted to the local area.

Boundaries for the vegetation units were determined with the aid of quadrat information collected during the surveys and aerial imagery. However, due to similarities in topography, substrate, structure and colour characteristics, and vegetation intersections, a mosaic of AdAt/AdAa was mapped in the TGN Tenure. A map of the locally significant vegetation units, including the mosaic, and the associated quadrats is provided in Figure 1.2.

Table 1.1 Non-mosaic Vegetation Unit Descriptions in Spectrum Ecology (2021) Report

Unit	Quadrats	Description
FLORISTIC GROUP 1: <i>Eucalyptus</i> low open woodland over <i>Acacia</i> tall open shrubland on flats & drainage lines		
EIAr	M001, M002, M010, M016, M021, M023, M025, M026, Q205, Q207, Q208, Q216, Q220, Q221, Q227	<i>Eucalyptus loxophleba</i> subsp. <i>supralaevis</i> or <i>E. loxophleba</i> subsp. <i>lissophloia</i> low open woodland over <i>Acacia ramulosa</i> var. <i>ramulosa</i> tall open shrubland over <i>Ptilotus obovatus</i> , <i>Scaevola spinescens</i> low isolated shrubs
EIAt	M018, Q204, Q206, Q215	<i>Eucalyptus loxophleba</i> subsp. <i>supralaevis</i> low woodland over <i>Acacia tetragonophylla</i> , <i>Allocasuarina dielsiana</i> , <i>Acacia ramulosa</i> var. <i>ramulosa</i> tall open shrubland over <i>Dodonaea inaequifolia</i> , <i>Acacia acanthoclada</i> subsp. <i>glaucescens</i> mid-low sparse shrubland
FLORISTIC GROUP 2: <i>Acacia</i> tall open shrubland over <i>Micromyrtus</i> mid open shrubland on flats		
AaAr	M005, M008, Q201, Q210, Q218, Q224, Q226, Q228	<i>Allocasuarina acutivalvis</i> subsp. <i>prinsepiana</i> tall sparse shrubland over <i>Acacia ramulosa</i> var. <i>ramulosa</i> (+/- <i>Micromyrtus acuta</i> (P3)) mid open shrubland over <i>Austrostipa elegantissima</i> isolated tussock grasses
FLORISTIC GROUP 3: <i>Eucalyptus</i> low open woodland over <i>Tecticornia</i> sparse low shrubland on flats		
EsTh	M011, Q225	<i>Eucalyptus salubris</i> low open woodland over <i>Tecticornia halocnemoides</i> low sparse shrubland Note: The <i>Tecticornia</i> is likely to be <i>T. disarticulata</i>
FLORISTIC GROUP 4: <i>Allocasuarina</i> low open woodland over <i>Acacia</i> tall open shrubland over <i>Borya</i> low sparse shrubland on slopes		
AdAa	M003, M006, M007, M012, M013, M014, M017, M020, M022, M024, M027, Q217, Q219, Q222, Q229, Q230	<i>Allocasuarina dielsiana</i> (+/- <i>Acacia umbraculiformis</i>) low open woodland over <i>Acacia acuminata</i> , <i>Allocasuarina tessellata</i> (P3), <i>Acacia karinae</i> (P3) tall open shrubland over <i>Borya sphaerocephala</i> low sparse shrubland
FLORISTIC GROUP 5: <i>Acacia</i> tall open shrubland over <i>Calycopeplus</i> or <i>Allocasuarina</i> mid shrubland on slopes and crests		
AsCp	M004, Q203, Q209, Q212, Q213, Q214, Q231	<i>Acacia sulcataculis</i> (EN) and/or <i>Allocasuarina acutivalvis</i> subsp. <i>prinsepiana</i> tall open to closed shrubland over <i>Calycopeplus paucifolius</i> mid sparse shrubland over <i>Philotheca deserti</i> subsp. <i>deserti</i> low sparse shrubland
AdAt	M009, M015, Q202, Q211, Q223	<i>Acacia duriuscula</i> or <i>Allocasuarina tessellata</i> (P3) tall open shrubland

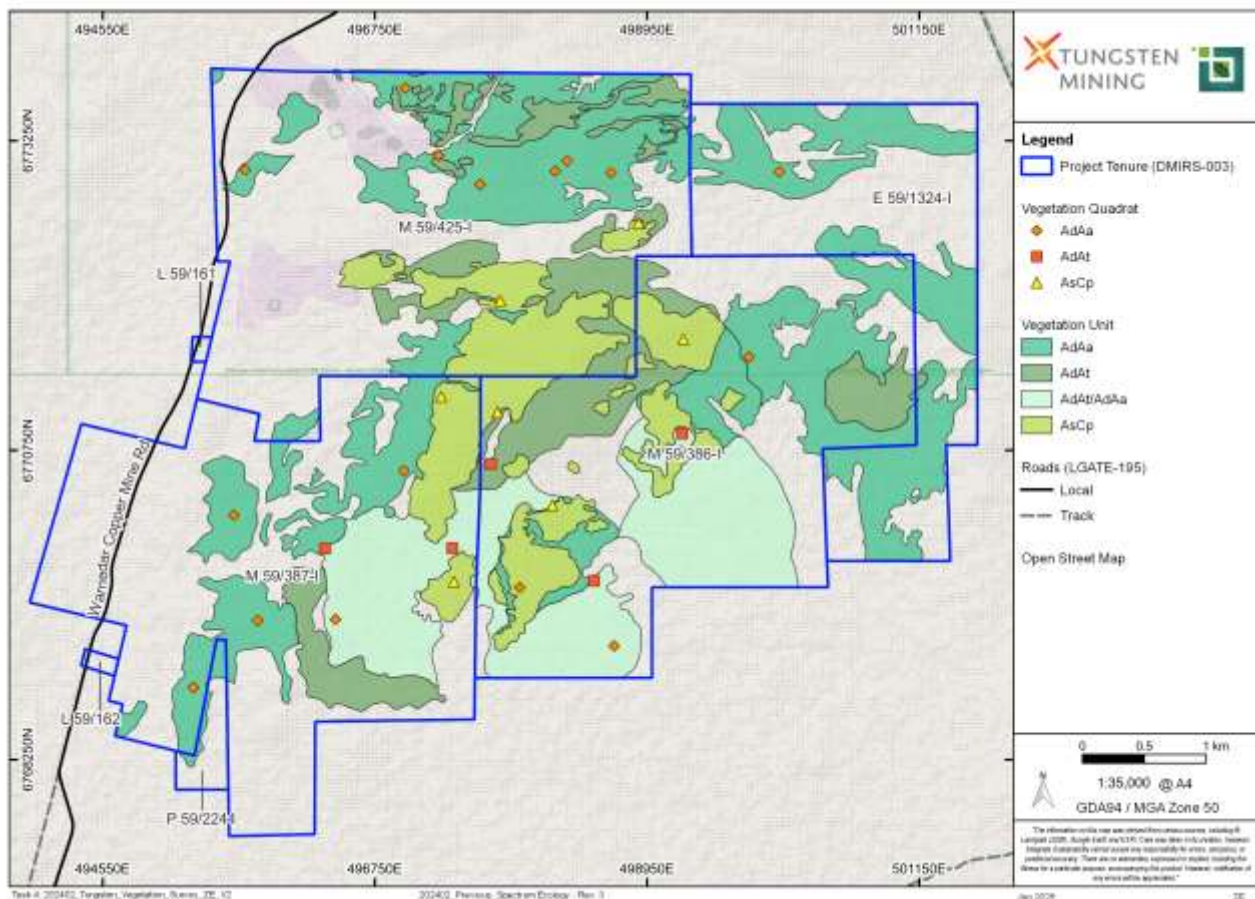


Figure 1.2 Spectrum Ecology's (2021) Floristic Group 4 and 5

1.3.2 Surrounding Areas

Previous flora and vegetation surveys undertaken for surrounding mine sites identified units with moderate to high similarity to AdAa and AdAt; no counterparts to unit AsCp were recorded (Table 1.2).

Between 2008 and 2011, Woodman Environmental (2012) conducted a regional survey covering Banded Ironstone Formations between the Karara and Shine Iron Ore Projects, including a portion of the current Survey Area. This study described 32 Floristic Community Types (FCTs). Of these, FCT 30 and FCT 32 align with vegetation unit AdAa, while FCT 31 shares similarities with both AdAa and AdAt (Table 1.2). Notably, Woodman Environmental identified FCT 30 as potentially conservation-significant, as it occupied less than 1% of the regional survey area.

Subsequent assessments have further characterized the local vegetation:

- **Rothsay Gold Project (2017):** Woodman Environmental described nine Vegetation Types (VTs) approximately 11km south-southwest of the current survey area. VT 4 showed similarities to AdAa and AdAt, while VT 5 aligned with AdAa. These VTs were not considered locally or regionally significant.
- **Communication Tower Survey (2021):** JBBC conducted a targeted survey 6km west-southwest of the current survey area, describing three Vegetation Associations (VAs). VA1 showed similarities to AdAt, while VA2 and VA3 were similar to AdAa (Table 1.2).

In 2013, JBBC (2013) conducted a flora and vegetation survey on road verges and two gravel pits along Warriedar Coppermine Road for the Shire of Perenjori. The road verges and a gravel pit are located within the Survey Area, while a gravel pit is located approximately 22km to the south-west. The survey identified *Acacia karinae* (P3) and *Allocasuarina tessellata* (P3) along the road verges which are indicator species for vegetation units AdAa and AdAt. No Threatened or Priority species were identified around the gravel pits. Vegetation was described for the gravel pits but not the road verges, and does not contain any similarities to the vegetation units AdAa, AdAt or AsCp.



Table 1.2 Description of Vegetation Units recorded at Karara * and Rothsay ** with similarities to the Mulgine Locally and Regionally Significant Vegetation Unit.

Site (Area)	Vegetation Unit	Area (ha)	Description
FCT 30 (Karara)	AdAa	161	Description: Tall open shrubland of mixed species including <i>Acacia acuminata</i>, <i>A. tetragonophylla</i>, <i>A. kochii</i> and <i>Allocasuarina dielsiana</i> over low sparse shrubland of species including <i>Senna artemisioides</i> subsp. <i>filifolia</i>, <i>Grevillea scabrida</i>, <i>Ptilotus obovatus</i>, <i>Hemigenia macphersonii</i> and <i>Sida calyxhymenia</i> on red-brown clay loam on drainage lines, flats to midslopes Significant Taxa: <i>Millotia dimorpha</i> (P1), <i>Allocasuarina tessellata</i> (P3), <i>Cyanicula fragrans</i> (P3), <i>Grevillea scabrida</i> (P3), <i>Persoonia pentasticha</i> (P3), <i>Rhodanthe collina</i> (P3) Indicator Taxa: <i>Acacia kochii</i>, <i>Cyanicula fragrans</i>, <i>Enchylaena tomentosa</i> var. <i>tomentosa</i>, <i>Grevillea scabrida</i>, <i>Hemigenia macphersonii</i>, <i>Leptosema aphyllum</i>, <i>Pimelea avonensis</i>, <i>Senna artemisioides</i> subsp. <i>filifolia</i>, <i>Sida calyxhymenia</i>, <i>Wurmbea densiflora</i>
FCT 31 (Karara)	AdAa/AdAt	2306	Description: Tall shrubland to tall open shrubland of mixed species including <i>Acacia burkittii</i>, <i>A. karinae</i>, <i>A. tetragonophylla</i>, <i>Allocasuarina tessellata</i> and <i>A. dielsiana</i> over low sparse shrubland of species including <i>Ptilotus obovatus</i> over low sparse forbland of <i>Borya sphaerocephala</i> on red clay loams on hillslopes with granite and/or ironstone outcropping Significant Taxa: <i>Acacia diallaga</i> (P1), <i>Chamelaucium</i> sp. Warriedar (A.P. Brown & S. Patrick APB 1100) (P1), <i>Lepidosperma</i> sp. Blue Hills (A. Markey & S. Dillon 3468) (P1), <i>Millotia dimorpha</i> (P1), <i>Acacia karinae</i> (P3), <i>Allocasuarina tessellata</i> (P3), <i>Grevillea scabrida</i> (P3), <i>Grevillea subtiliflora</i> (P3), <i>Persoonia pentasticha</i> (P3), <i>Rhodanthe collina</i> (P3) Indicator Taxa: <i>Acacia diallaga</i> (P1), <i>Acacia karinae</i> (P3), <i>Allocasuarina tessellata</i> (P3), <i>Borya sphaerocephala</i>
FCT 32 (Karara)	AdAa	4218	Description: Tall shrubland to tall open shrubland of <i>Acacia</i> species including <i>Acacia umbraculiformis</i>, <i>A. tetragonophylla</i>, <i>A. ramulosa</i> var. <i>ramulosa</i> and <i>A. kochii</i> over mid sparse shrubland of species including <i>Solanum lasiophyllum</i>, <i>Dodonaea inaequifolia</i> and <i>Thryptomene costata</i> over low isolated clumps of ferns of <i>Cheilanthes sieberi</i> over low sparse forbland of <i>Borya sphaerocephala</i> on red-brown clay loam on slopes with granite or ironstone outcropping Significant Taxa: <i>Stylidium scintillans</i> (T), <i>Chamelaucium</i> sp. Warriedar (A.P. Brown & S. Patrick APB 1100) (P1), <i>Eremophila grandiflora</i> (P1), <i>Acacia karinae</i> (P3), <i>Acacia subsessilis</i> (P3), <i>Cyanicula fragrans</i> (P3), <i>Grevillea scabrida</i> (P3), <i>Grevillea subtiliflora</i> (P3), <i>Persoonia pentasticha</i> (P3), <i>Rhodanthe collina</i> (P3) Indicator Taxa: <i>Acacia umbraculiformis</i>, <i>Thryptomene costata</i>
VT4 (Rothsay)	AdAa/AdAt	369	Description: Low open woodland to woodland dominated by <i>Allocasuarina dielsiana</i> and <i>Melaleuca hamata</i> over tall shrubland to open shrubland dominated by <i>Acacia acuminata</i> and <i>Allocasuarina tessellata</i> (P3) over mid sparse shrubland dominated by <i>Acacia karinae</i> (P3) and occasionally <i>Melaleuca radula</i> over low open to sparse forbland and tussock grassland of mixed species including <i>Waitzia nitida</i>, <i>Lobelia rhytidosperra</i>, <i>Goodenia berardiana</i>, <i>Ptilotus helipteroides</i> and <i>Austrostipa blackii</i> on red clay-loam soils with basalt stones on the slopes and crests of low hills Significant Taxa: <i>Hemigenia tichbonii</i> (P1), <i>Millotia dimorpha</i> (P1), <i>Acacia karinae</i> (P3), <i>Allocasuarina tessellata</i> (P3), <i>Grevillea scabrida</i> (P3), <i>Cyanicula fragrans</i> (P3), <i>Grevillea subtiliflora</i> (P3), <i>Micromyrtus trudgenii</i> (P3), <i>Persoonia pentasticha</i> (P3), <i>Rhodanthe collina</i> (P3) Indicator Taxa: <i>Acacia acuminata</i>, <i>Acacia karinae</i> (P3), <i>Allocasuarina dielsiana</i>, <i>Allocasuarina tessellata</i> (P3), <i>Hemigenia tichbonii</i> (P1), <i>Melaleuca radula</i>, <i>Solanum lasiophyllum</i>, <i>Tricoryne tuberosa</i>
VT5 (Rothsay)	AdAa	157	Description: Low open woodland dominated by <i>Melaleuca hamata</i> over tall shrubland to open shrubland of mixed species dominated by <i>Acacia ramulosa</i> var. <i>ramulosa</i> and <i>Acacia tetragonophylla</i> and <i>Acacia sibina</i> over low sparse shrubland dominated by <i>Eremophila eriocalyx</i> and <i>Ptilotus obovatus</i> over low sparse forbland of mixed species including <i>Waitzia acuminata</i> var. <i>acuminata</i>, <i>Calocephalus multiflorus</i>, <i>Velleia rosea</i>, <i>Ptilotus gaudichaudii</i> subsp. <i>eremita</i> and <i>Cephalopterum drummondii</i> on red or red brown clay loam soils with quartz and ironstone gravel on lower slopes, undulating plains and in minor drainage lines Significant Taxa: <i>Lepidosperma</i> sp. Blue Hills (A. Markey & S. Dillon 3468) (P1), <i>Allocasuarina tessellata</i> (P3), <i>Grevillea scabrida</i> (P3), <i>Persoonia pentasticha</i> (P3), <i>Rhodanthe collina</i> (P3), <i>Stenanthemum poicilum</i> (P3) Indicator Taxa: <i>Acacia tetragonophylla</i>, <i>Eremophila eriocalyx</i>



Site (Area)	Vegetation Unit	Area (ha)	Description
VA1 (Karara)	AdAt	-	Description: <i>Allocasuarina dielsiana</i> emergent low trees (6 – 8m) over <i>Allocasuarina tessellata</i> (P3), <i>Melaleuca hamata</i>, <i>Acacia burkittii</i> tall shrubland (5 – 6m) over <i>Chamelaucium</i> sp. Warriedar (P1), <i>Melaleuca radula</i> sparse shrubland (0.9 – 1.6m) over <i>Tricoryne tuberosa</i>, <i>Erodium cygnorum</i>, <i>Sida calyxhymenia</i>, <i>Asteraceae</i> sp. (germinating), <i>Acacia</i> sp. low sparse forbland (2 – 5%) Significant Taxa: <i>Chamelaucium</i> sp. Warriedar (P1), <i>Acacia karinae</i> (P3), <i>Allocasuarina tessellata</i> (P3), <i>Grevillea scabrida</i> (P3), <i>Grevillea subtiliflora</i> (P3)
VA2 (Karara)	AdAa	-	Description: <i>Allocasuarina dielsiana</i>, <i>Melaleuca hamata</i>, <i>Acacia burkittii</i> low open woodland over <i>Allocasuarina tessellata</i> (P3), <i>Dodonaea inaequifolia</i>, <i>Acacia burkittii</i> tall sparse shrubland over <i>Melaleuca radula</i>, <i>Allocasuarina tessellata</i>, <i>Dodonaea inaequifolia</i> open shrubland over <i>Lepidosperma</i> sp. Blue Hills (P1), <i>Melaleuca radula</i>, <i>Solanum lasiophyllum</i> sedgeland to open sedgeland Significant Taxa: <i>Lepidosperma</i> sp. Blue Hills (P1), <i>Allocasuarina tessellata</i> (P3), <i>Grevillea scabrida</i> (P3)
VA3 (Karara)	AdAa	-	Description: <i>Allocasuarina dielsiana</i> isolated low trees over <i>Allocasuarina tessellata</i> (P3), <i>Acacia karinae</i> (P3), <i>Allocasuarina dielsiana</i>, <i>Acacia burkittii</i> open to sparse shrubland over <i>Acacia karinae</i> (P3), <i>Grevillea subtiliflora</i> (P3), <i>Chamelaucium</i> sp. Warriedar (P1), <i>Ptilotus obovatus</i> low sparse shrubland over isolated patches of germinating grasses Significant Taxa: <i>Chamelaucium</i> sp. Warriedar (P1), <i>Acacia karinae</i> (P3), <i>Allocasuarina tessellata</i> (P3), <i>Grevillea subtiliflora</i> (P3)

* (Woodman Environmental, 2012; JBBC, 2021)

** (Woodman Environmental, 2017)



In 2022, Green Values (2023) conducted a reconnaissance survey for Accent Resources near the Mt Gibson area, approximately 40km to the southeast of the survey area. Two of the Vegetation Communities (VCs) described during the Green Values survey share similarities to vegetation units AdAa and AdAt (Table 1.3). VC12 was characterised as an *Allocasuarina tessellata* (P3) dominated tall shrubland, which is similar to AdAt, and although only a small area was surveyed, it is likely to be extensive in the broader area, especially west of the site. *Acacia umbraculiformis* dominated VC21, however, no *Acacia acuminata* were recorded, instead *Acacia burkittii* was present but not dominant. VC21 therefore has low similarity to vegetation unit AdAa.

Table 1.3 Results from Surveys in the Broader Area (JBBC, 2013; Green Values, 2023)

Site	Description
Road Verges along Warriedar Coppermine Road Shire of Perenjori	Targeted survey for Conservation Significant Flora (CSF), which identified <i>Acacia karinae</i> (P3) and <i>Allocasuarina tessellata</i> (P3) along with the indicator species <i>Acacia acuminata</i> and <i>Allocasuarina dielsiana</i> . Other CSF species identified were <i>Acacia diallaga</i> (P1), <i>Grevillea scabrida</i> (P3) and <i>Grevillea subtiliflora</i> (P3).
Gravel Pit within Survey Area Shire of Perenjori	<i>Melaleuca hamata</i> isolated tall shrubs with <i>Eucalyptus ewartiana</i> low mallee over <i>Melaleuca nematophylla</i> , <i>Malleostemon tuberculatus</i> , <i>M. roseus</i> , <i>Brachychiton gregorii</i> , <i>Gastrolobium laytonii</i> and <i>Acacia ramulosa</i> var. <i>ramulosa</i> open shrubland over <i>Neurachne alopecuroidea</i> , <i>Monachather paradoxus</i> , <i>Erodium cygnorum</i> , <i>Goodenia berardiana</i> , <i>Waitzia acuminata</i> and <i>Lawrencella rosea</i> isolated grasses and forbs.
Mt Gibson area Accent 40 km south-east VC12 AdAt	<i>Allocasuarina dielsiana</i> low isolated trees (8m) over <i>Allocasuarina tessellata</i> , <i>Acacia acuminata</i> , <i>Allocasuarina dielsiana</i> , <i>Calothamnus gilesii</i> tall shrubland over <i>Grevillea scabrida</i> , <i>G. subtiliflora</i> , <i>Melaleuca radula</i> , <i>Scaevola spinescens</i> sparse shrubland over <i>Waitzia acuminata</i> low forbland (Gabanintha/Moriarty Land System)
Mt Gibson area Accent 47 km south-east VC21 ?AdAa (lacks <i>A. acuminata</i> ; <i>A. burkittii</i> present)	<i>Acacia umbraculiformis</i> , <i>A. ramulosa</i> var. <i>ramulosa</i> , <i>Melaleuca nematophylla</i> , <i>A. tetragonophylla</i> , <i>Calycopeplus paucifolius</i> tall open shrubland over <i>Philotheca sericea</i> , <i>Eremophila latrobei</i> , <i>Calycopeplus paucifolius</i> , <i>Acacia umbraculiformis</i> , <i>A. kochii</i> , <i>Dodonaea amplisemina</i> open shrubland over <i>Dodonaea amplisemina</i> , <i>Philotheca sericea</i> , <i>Philotheca sericea</i> , <i>Eremophila latrobei</i> , <i>Hibbertia cockertoniana</i> , <i>Dodonaea petiolaris</i> low open shrubland over <i>Rhodanthe spicata</i> , <i>Helipterum craspedioides</i> , <i>Waitzia acuminata</i> , <i>Stenopetalum filifolium</i> , <i>Schoenia cassiniana</i> , <i>Ptilotus obovatus</i> low forbland (Watson Land System) + <i>Acacia burkittii</i> , <i>Melaleuca hamata</i>

1.4 Constraints & Limitations

During the survey, above average temperatures for spring were experienced, which constrained and limited aspects of the survey as discussed in Table 1.4.

Table 1.4 Constraints and Limitations

Constraint	Limitation	Comment
Effort and Extent	No	- Survey Area is considerable in size, which required targeting known locations of indicator species for the locally significant vegetation units to determine whether they were present. - The Survey Area was divided into three zones – east, north and west. The southern area wasn't surveyed as the geology appeared incorrect for the presence of <i>Acacia sulcaticaulis</i> (EN), there were also few known records of the indicator species. - Each zone was surveyed on a different day to provide adequate time to cover enough of the Survey Area.
Competency and Experience	No	Jenny Borger has over 20 years of experience completing flora and vegetation surveys in the Yalgoo region and at the Project.
Flora Identified	Partial	- Very few species were in flower or fruiting, which added difficulty in accurately identifying some species. Where possible, a genus was listed. - Identification of <i>Acacia ramulosa</i> var. <i>ramulosa</i> was via old pods present under the shrubs to verify it was not <i>Acacia duriuscula</i>.



Constraint	Limitation	Comment
Information Sources	No	- Spectrum Ecology's (2021) Flora and Vegetation Assessment provided the basis for the locally significant vegetation units. - Multiple flora and vegetation surveys have been undertaken within and surrounding the Project area since 2011, with Spectrum Ecology consolidating the findings during their Flora and Vegetation Assessment (Spectrum Ecology, 2021). - Additional records of the indicator species <i>Acacia sulcatacaulis</i> (EN), <i>Acacia karinae</i> (P3) and <i>Allocasuarina tessellata</i> (P3), were received from DBCA Flora Data.
Timing and Weather	Partial	- Single survey occurred (27 November - 1 December 2023) - Survey timing aligned with the Environmental Protection Authority's (EPA's) recommended timing for the Southern Region. - Rainfall was well below the mean with average temperatures higher, especially for spring. This resulted in: - Many species senescing; some with poor foliage health and in some cases, major loss of foliage. - Very few species were in flower or fruiting, with poor evidence that fruit had been set during springs. - Annuals and grasses were mostly absent, very sparse or isolated.
Disturbance	No	- Disturbance within the Survey Area predominately related to historically cleared roads and tracks. - Mining activities are present in the Survey Area from TGN and other companies, although, the survey focused on undisturbed areas.
Remoteness and Access	No	Access across the Survey Area was via existing roads and tracks.

2 Existing Environment

2.1 Climate

The Survey Area is located within the Yalgoo Bioregion which is characterised by hot dry summers and cool moist winters. The closest weather monitoring stations are located at Paynes Find (~ 60 – 80km east; Bureau of Meteorology (BoM) Station 7139, 1919-) (BoM, 2024a) and Karara Station (~ 5 – 20km west; BoM Station 10195, 1928-2024) (BoM, 2024b).

Annual rainfall was higher at Karara compared to Paynes Find (Table 2.1). Both long-term rainfall patterns show the maximum rainfall is received from May to August, with a slight increase in March. Higher March falls are often the result of Tropical lows (including ex-tropical cyclones) trending south east over WA or summer thunderstorms. Rainfall is often of short duration and intense. Rainfall was lower than average for April-July, September-October and December, with significant falls recorded in March for both stations in 2023. Karara recorded 44mm in a three-hour period in November 2023 (pers comm KML Environment team); this event was also quite localised.

Table 2.1 Monthly Rainfall (mm) Recorded at Paynes Find (PF) and Karara in 2023 and Average for all Years

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean PF	20.6	24.1	27.7	24.2	34.4	40.4	34.7	28.3	13.9	10.6	13.8	12.1	283.7
2023 PF	19.8	7.8	48.9	6.8	3.2	16.0	10.0	32.4	5.4	1.0	19.6	1.0	171.9
Mean Karara	21.2	24.0	26.7	21.4	35.3	41.4	42.9	38.6	19.5	9.5	12.9	12.1	305.1
2023 Karara	44.0	2.0	30.5	19.3	5.2	34.3	20.5	24.2	6.5	1.0	45.5	0.0	233.0

Temperature data for Paynes Find is presented in Table 2.2. The 2023 maximum temperature was above average in February – March and close to average during autumn with a slightly cooler June. Maximum temperatures were 3 – 4°C above average and minimum temperatures 2 – 4°C above average during spring. Minimum temperatures were roughly 2 – 4°C below average for April to July.

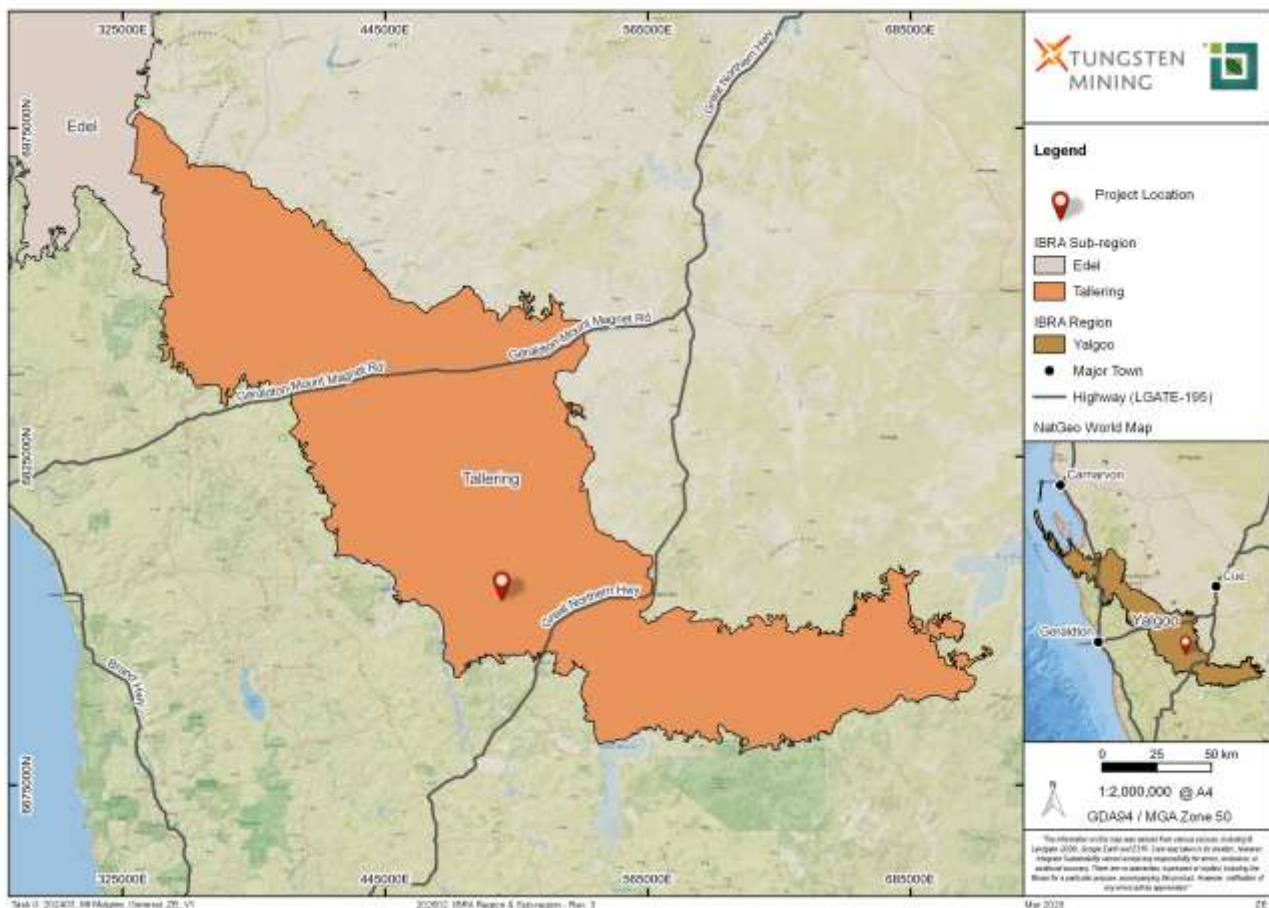
**Table 2.2 Monthly Temperature for Paynes Find in 2023**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean Max	37.4	36.5	33.1	28.5	23.2	19.4	18.7	20.3	24.0	28.0	31.9	35.2	28.0
2023 Max	38.1	38.9	34.4	26.1	25.1	17.3	19.6	24.9	28.1	32.2	35.4	37.7	29.8
Mean Min	21.1	21.2	18.3	14.2	9.4	6.6	5.5	6.1	8.2	11.6	15.5	18.6	13.0
2023 Min	21.5	22.0	19.3	10.8	7.6	3.7	3.9	8.1	11.3	14.4	19.5	20.4	13.5

2.2 Bioregion

The Interim Biogeographic Regionalisation for Australia (IBRA) is a biogeographic regionalisation of Australia developed by the Australian Government's Department of Sustainability, Environment, Water, Population and Communities (currently Department of Climate Change, Energy, the Environment and Water) (Thackway & Cresswell, 2017). It is a landscape-based approach to classify the land surface, including attributes of climate, geomorphology, landform, lithology and characteristics of fauna and flora.

The Survey Area is located within the Yalgoo IBRA region and Talling IBRA subregion (Figure 2.1). The Yalgoo IBRA region is the interzone between the cooler moister Avon Wheatbelt region and the semi-arid to arid Murchison and Coolgardie regions. It is characterised by Callitris/Gimlet, Mulga and Bowgada open woodlands and scrubs on earth to sandy-earth plains in the Western Yilgarn Craton and the Southern Carnarvon Basin.

**Figure 2.1 IBRA Region and Subregion of the Project**

The Talling IBRA sub-region is underlain by the north end of the Phanerozoic Perth Basin with parts of the Western Terraines and the southern end of the Narryer Terraine of the Yilgarn Craton (McKenzie, Keighery, & Gibson, 2001). The sub-region is characterised by low to open woodlands of Eucalyptus, Acacia and Callitris on red sandy plains.

2.3 Geology

The Survey Area is within the Yalgoo-Singleton greenstone belt which comprises a typical Archaean supracrustal greenstone sequence of mafic and felsic volcanic rocks with associated sediments, and intrusive mafic and ultramafic rocks. The greenstone belt is bounded by intrusive granitoid batholiths and is



characterised by heterogeneous deformation with narrow zones of high strain separating more weakly deformed zones.

Mapping by the Geological Survey of WA at a scale of 1:500,000 (Watkins & Hickman, 1990), identified two major stratigraphic successions; Luke Creek Group and Mount Farmer Group. Mafic and felsic volcanic rocks within each of these stratigraphic successions are only distinguishable based on structural criteria.

There are six geological sub-units present in the Survey Area (Figure 2.2; Table 2.3). All of the sub-units are present across Western Australia, with none restricted to the Survey Area. The sub-unit A-g-Y has the largest extent across Western Australia and is associated with hills and ridges present in the Survey Area.

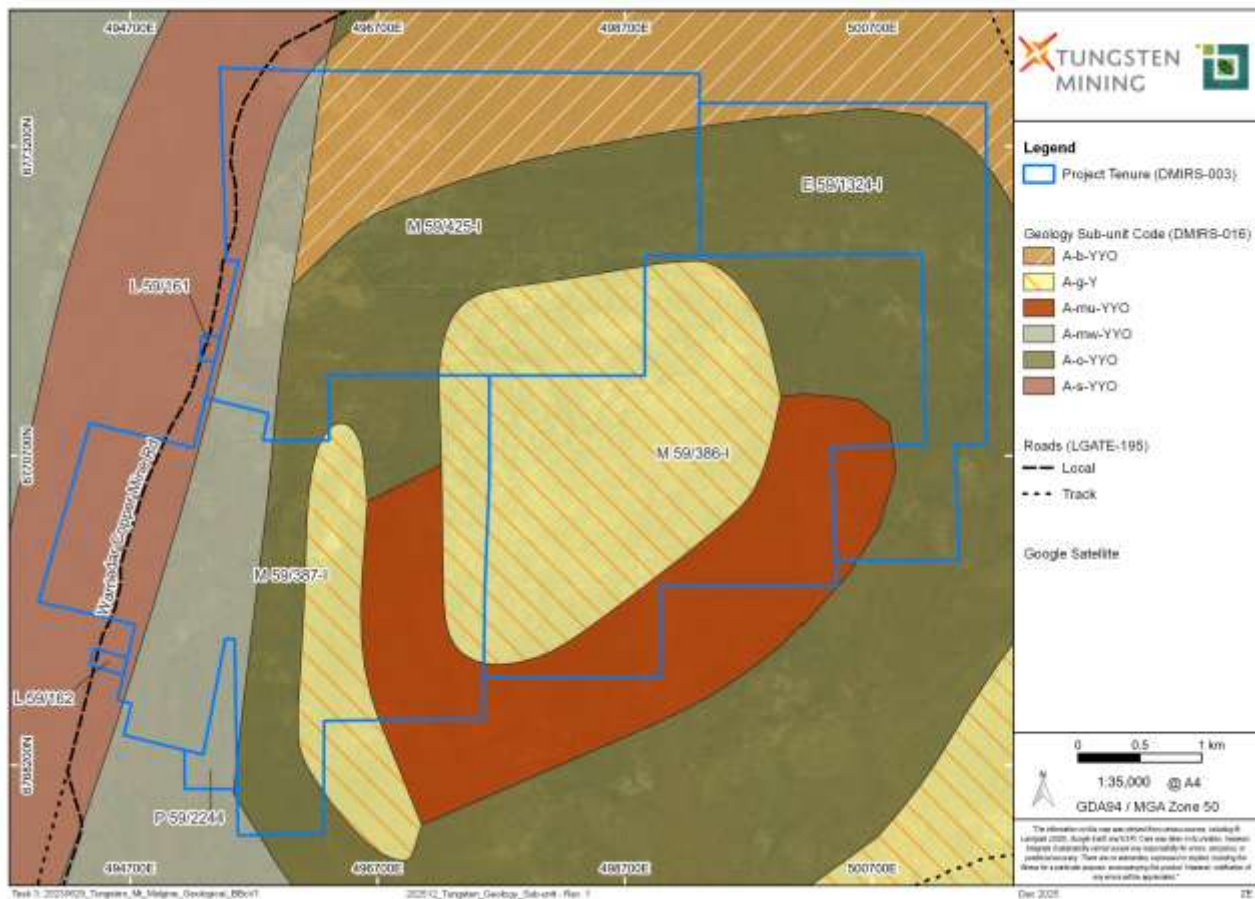


Figure 2.2 Geology Sub-units

Table 2.3 Geology Sub-unit Code Description

Geology Sub-unit Code	Sub-	Total Extent (ha)	Description
A-b-YYO		977,038	Mafic volcanic rock with minor mafic and ultramafic intrusive rocks; subordinate felsic rocks; metamorphosed
A-g-Y		237,777,563	Granitic rock, undivided; metamorphosed
A-mu-YYO		105,936	Metamorphosed ultramafic rock, undivided; typically deeply weathered
A-mw-YYO		164,979	Metamorphosed mafic igneous rock, undivided
A-o-YYO		156,564	Mafic intrusive rock dominant; metamorphosed
A-s-YYO		294,673	Clastic sedimentary rock dominant; metamorphosed

2.4 Soil

Soil landscape surveys and mapping completed over Western Australia (Tille, 2006) shows the Survey Area is within the Murchison Province, which is characterised by hardpan wash plains and sand plains (with some stony plains, hills, mesas and salt lakes) on granitic rocks and greenstone of the central north-western portion of the Yilgarn Craton. The Murchison Province is divided into seven soil-landscapes, with the Survey Area located within the Karara Hills, Plains and Lakes Zone (270). The Karara Hills, Plains and Lakes Zone is characterised by hills and ranges, sandy plains, hardpan wash plains, stony plains and salt lakes (with some mesas and plains) on greenstone and granitic rocks of the Yilgarn Craton (Tille, 2006). Soils include red



shallow loams, red loamy earths, red deep sands and salt lake soils with some red shallow sands, stony soils and red shallow sandy duplexes.

2.5 Land Systems

Payne *et al.* (1998) completed a survey from 1992 to 1993 that characterised the Sandstone-Yalgoo-Paynes Find area. Characterisation included geology, landforms, vegetation and soils to determine land systems.

A search of land systems over the Project area and Survey Area identified 14 land systems are present (Table 2.4). The Norie land system was only found within the Project area during the search, however, all the identified land systems are widespread across Western Australia, with none restricted to the Project.

Table 2.4 Land Systems within the Survey Area

Land System	Land Type	Description
Campsite	Alluvial plains with saline soils and predominantly helophytic shrublands	Alluvial plains supporting eucalypt woodlands with saltbush understoreys and eucalypt-acacia shrublands
Gabanintha	Hills with acacia shrublands	Greenstone ridges and hills supporting sparse acacia shrublands
Graves	Lows hills with eucalypt-halophyte woodlands and acacia shrublands	Basalt and greenstone rise and low hills, supporting eucalypt woodlands with prominent saltbush and bluebush understoreys
Kalli	Sandplains with grassy acacia shrublands	Red sandplains supporting bowgada shrublands with wanderrie grasses
Moriarty	Stony plains and lower alluvial plains with predominantly saline soils and halophytic shrublands	Low greenstone rises and stony plains supporting halophytic and acacia shrublands with patchy eucalypt overstoreys
Nerramyne	Irregular plains and low rises supporting mulga, bowgada and some halophytic shrublands	Undulating sandy and gravelly plains with low plateaux and breakaways supporting acacia shrublands
Norie	Hills with acacia shrublands	Granite hills with exfoliating domes and extensive tor fields supporting acacia shrublands
Olympic	Breakaways, stony plains and sandy surfaced plains on granite with mulga shrublands and minor halophytic shrublands	Irregular plains with occasional low breakaways and tor fields on granite supporting acacia shrublands
Pindar A	Plains with minor calcrete inclusions with casuarina-acacia shrublands or eucalypt woodlands	Loamy plains surrounded by sandplain supporting York gum woodlands and acacia shrublands
Singleton	Hills with mixed shrublands	Rugged greenstone ranges with dense casuarina and acacia shrublands
Tallering	Hills with mixed shrublands	Prominent ridges and hills of banded ironstone, dolerite and sedimentary rocks supporting bowgada and other acacia shrublands
Tealtoo	Plains with deep sandy soils supporting Acacia shrublands and occasionally with wanderrie grasses	Level to gently undulating loamy plains with fine ironstone lag gravel supporting dense Acacia shrublands
Yalluwin	Wash plains on hardpan with mulga shrublands	Hardpan plains and drainage tracts carrying concentrated flow supporting mulga, curare and other acacias
Yowie	Plains with deep sandy soils supporting acacia shrublands and occasionally with wanderrie grasses	Loamy plains supporting shrublands of mulga and bowgada with patchy wanderrie grasses

2.6 Environmentally Sensitive Areas

Environmentally Sensitive Areas are areas of native vegetation that are specially protected due to their biological value. The list of Environmentally Sensitive Areas is provided in the *Environmental Protection (Environmentally Sensitive Area) Notice 2005* (WA), and includes:

- Declared World Heritage properties;
- Areas on the Register of the National Estate due to their natural heritage value;
- Defined wetlands and surrounding 50m area;



- Vegetation within 50m of Threatened flora, to the extent to which the vegetation is continuous;
- Area for Threatened Ecological Communities;
- Bush Forever sites, except to the extent to which the site is approved for development; and
- Areas covered by the *Environmental Protection (Western Swamp Tortoise) Policy 2002*.

Acacia sulcatcaulis is a Threatened flora species found within the Survey Area, which is currently listed as Endangered under the BC Act. The Threatened Species Scientific Committee (TSSC) is considering listing the species as Critically Endangered under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth), with the assessment expected to finish by the end of April 2026 (TSSC, 2024). No other Threatened flora species have been identified in the Survey Area.

Using the publicly available layer Environmentally Sensitive Areas (DWER-046) no other Environmentally Sensitive Areas were determined to occur within the Survey Area. A search of the DBCA Threatened and Priority Communities spatial layer (DBCA-038) and the DBCA Conservation-significant ecological communities database determined that no Threatened Ecological Communities occur within 6km of the Survey Area. Two Priority Ecological Communities associated Banded Ironstone Formations were found within the Survey Area.

3 Methodology

3.1 Pre-field Trip Review & Desktop Assessment

Survey context was established through a comprehensive review of available literature, spatial data, and known locations of indicator species. Information was synthesized from the following sources:

- Atlas of Living Australia;
- Index of Biodiversity Surveys for Assessment (IBSA);
- Dandjoo biodiversity data platform (Dandjoo);
- Department of Biodiversity, Conservation and Attractions' database search for threatened and priority flora;
- Indicator species' association with land systems;
- Mt Mulgine (Tungsten) Spectrum Ecology (2021) report;
- Woodman Environmental (2012) report;
- Woodman Environmental (2017) report;
- Jenny Borger Botanical Consulting (2021) report;
- Shire of Perenjori, Jenny Borger (2013) report; and
- Accent Resources NL, Green Values (2023) report.

Prior to analysis, taxon nomenclature and conservation statuses were updated to reflect current records. For instance, *Acacia karina* was corrected to *Acacia karinae* (updated from P1 to P3), and the status of *Allocasuarina tessellata* was revised from P1 to P3. Notably, *Acacia sulcatcaulis* was updated from P1 to Endangered (EN).

The consolidated data was mapped using QGIS to predict the occurrence of locally significant vegetation units within the Survey Area. Predictive mapping focused on the eastern (Figure 3.1), northern (Figure 3.2), and western (Figure 3.3) sectors. The southern sector was excluded from the predictive model due to land use constraints (Wanarra pastoral station) and geological conditions deemed unsuitable for *A. sulcatcaulis* (EN).

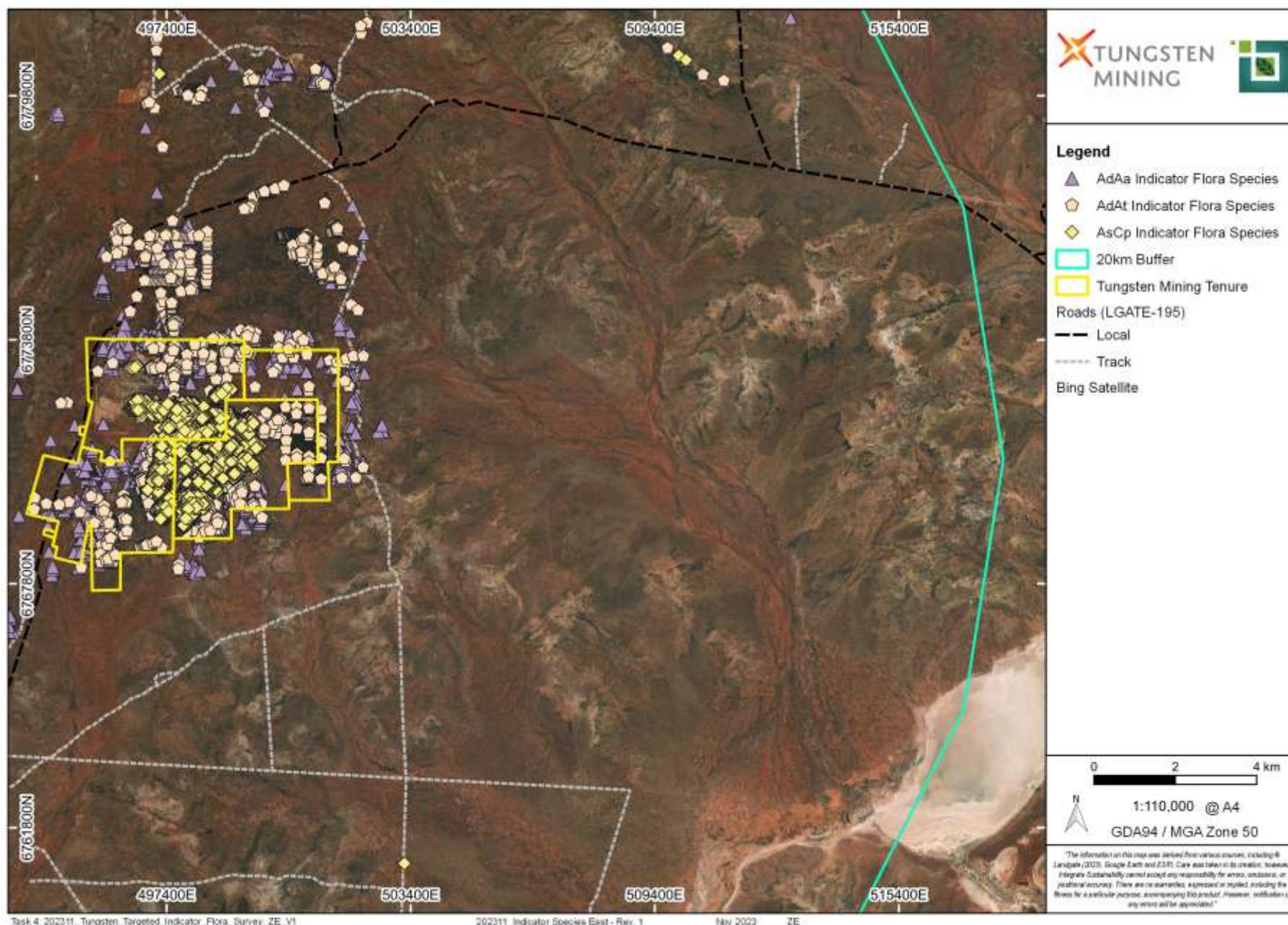


Figure 3.1 Indicator Species for Targeted Veg Units East of the Project

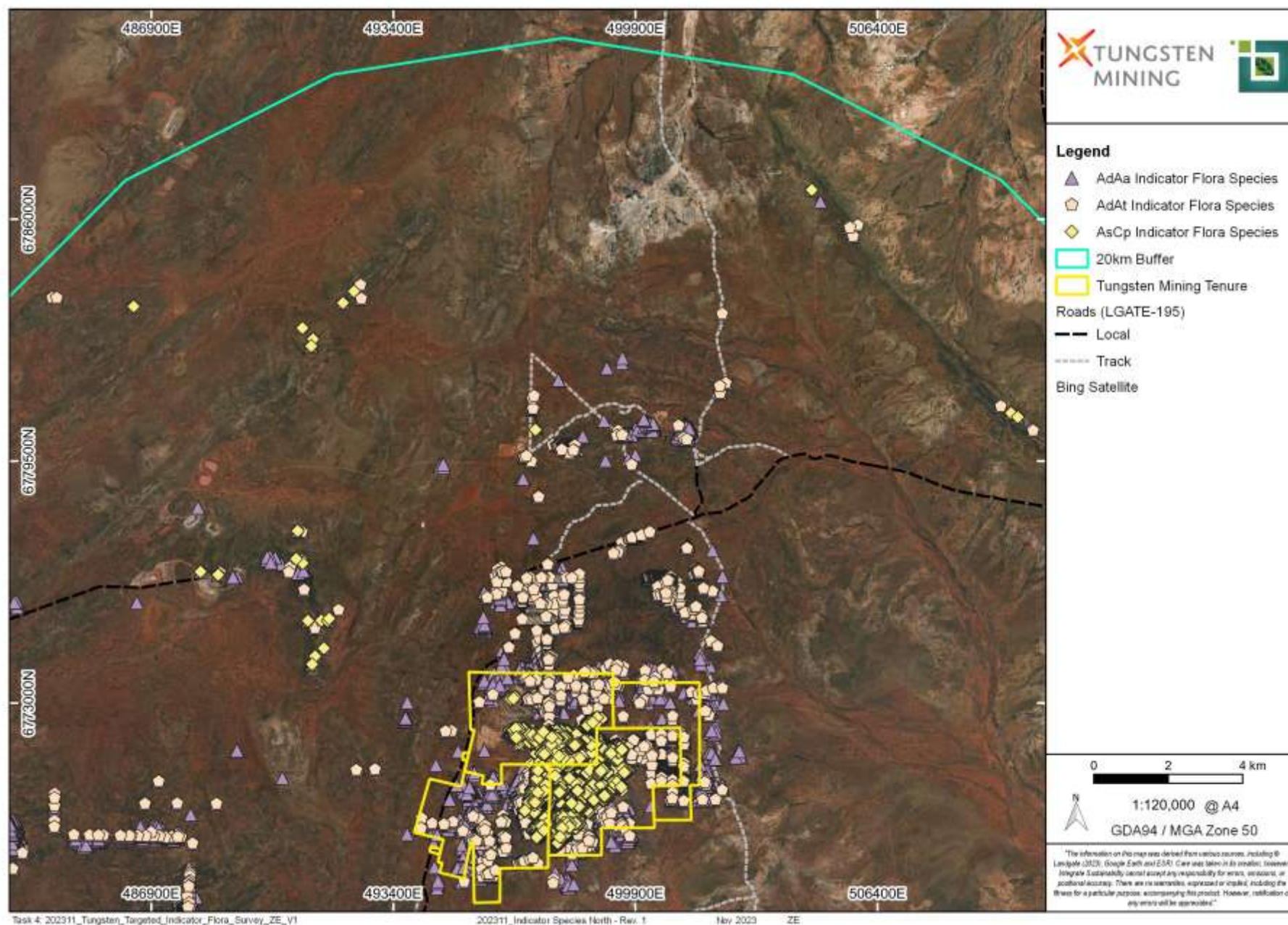


Figure 3.2 Indicator Species for Targeted Veg Units North of the Project

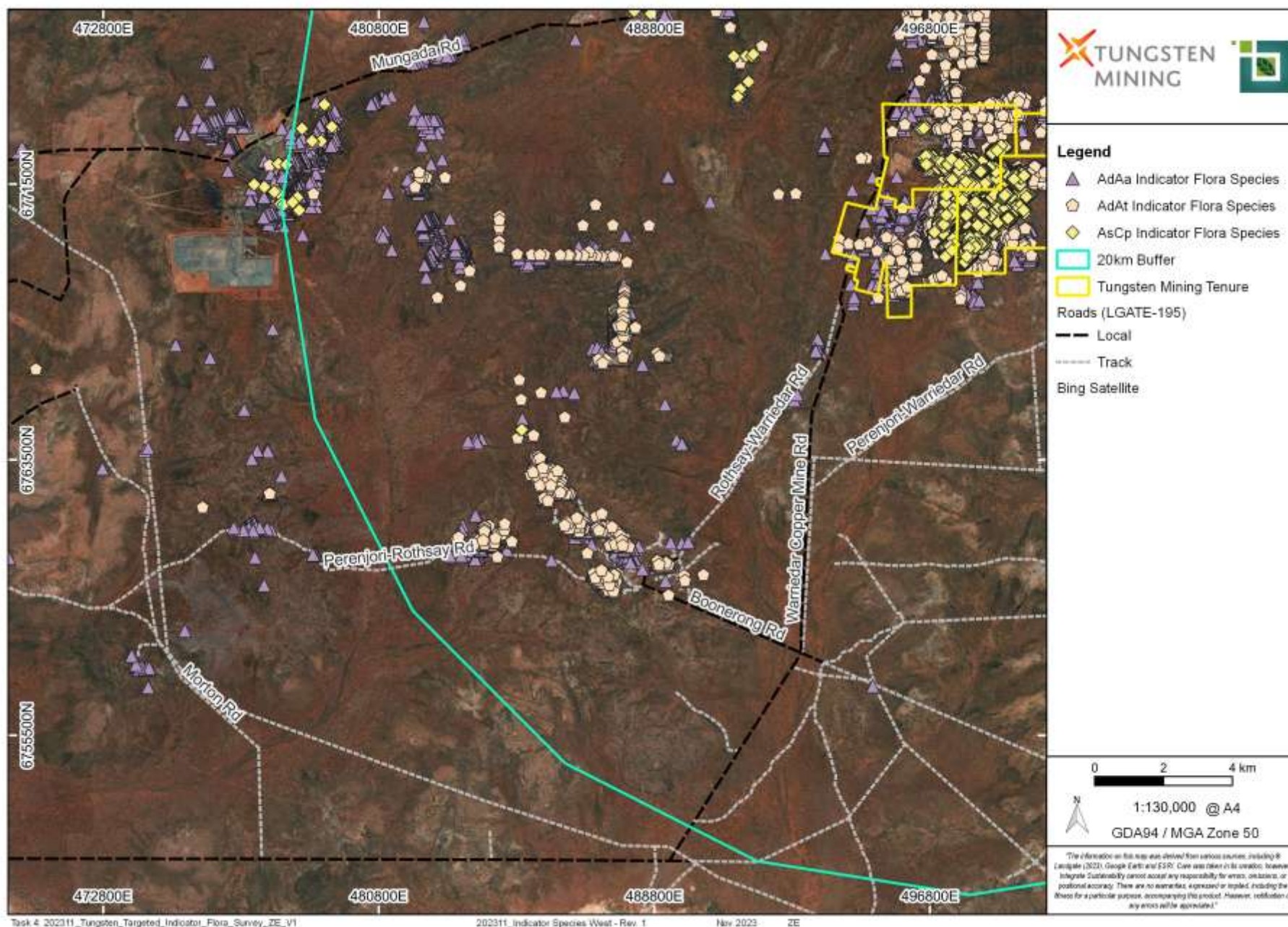


Figure 3.3 Indicator Species for Targeted Veg Units West of the Project



3.2 Field Survey Timing & Personnel

Field survey timing for the targeted search of locally significant vegetation communities was selected to align with the EPA's technical guidance (EPA, 2016). The EPA recommends sampling in spring (September to November) for the Southern Region to ensure adequate identification of flora species in a survey area.

The targeted vegetation communities survey was conducted by a botanist and environmental scientist graduate from 27 November to 1 December 2023 (Table 3.1). Jenny Borger has over 20 years of experience as a botanist completing flora and vegetation surveys for the Yalgoo region. She has undertaken surveys for the Project area since 2018.

Table 3.1 Project Personnel

Name	Experience	Role
Jenny Borger	20 years +	Botanist
Zerianna Edwards	1 year	Environmental Scientist Graduate

3.3 Field Survey

The survey was completed across the three zones; north, east and west. Each zone was sampled on a different day to ensure sufficient survey effort across the Survey Area. In total, 80 sites were visited 23 in the north zone, 30 in the east zone and 27 in the west zone (Figure 3.4).

Field personnel visited six sites from the Spectrum Ecology (2021) survey to facilitate ground-truthing and familiarization with the primary indicator species for the targeted vegetation units. Additional survey locations were identified based on indicator species clusters, using georeferenced PDFs (Figure 3.1Figure 3.2Figure 3.3

Six survey sites from the Spectrum Ecology's survey were visited to familiarise field personnel with the main indicator species for the targeted vegetation units. Further survey sites were selected based on clustered locations of indicator species identified through the use of georeferenced PDFs (Figures 3.1, 3.2 and 3.3) within the Avenza Maps application for navigation. Opportunistic observations were also recorded when *Acacia karinae* (P3; indicator for AdAa) and *Allocasuarina tessellata* (P3; indicator for AdAa and AdAt) were encountered during traverses across the Survey Area.

Survey sites were classified according to their alignment with the targeted vegetation unit descriptions (Table 3.2). While some sites directly matched the criteria established by Spectrum Ecology (2021), others exhibited slight floristic or structural variations.

Table 3.2 Sites' Vegetation Units

Site	Report Veg Unit	Site	Report Veg Unit	Site	Report Veg Unit	Site	Report Veg Unit
1	AdAa	42	Not Rep	22	AdAa	61a	AdAt
2	AdAa	43	Not Rep	23	AdAa	61b	AdAt
3	Not Rep	44	AdAa	24	AdAa	62	AdAa
4	AdAt	45	AdAa	25	AdAa	63	AdAa
5	AdAa	46	AdAa	26a	AdAt	64	AdAa
6	AsCp	47	AdAa	26b	AdAa	65	AdAt
7	AdAt	48	AdAa	27	AdAa	66	Not Rep
8	AdAa	49	Not Rep	28	AdAa	67	AdAt
9	AdAa	50	Not Rep	29	AdAa	68	AdAa
10	AdAt	51	AdAa	30	AdAt	69	AdAt
11	AdAt	52	AdAa	31	AdAa	70	AdAa
12	AdAt	53	Not Rep	32	AdAa	71	AdAt
13	AdAa	54	AdAt	33	AdAa	72	Not Rep
14	AdAa	55	Not Rep	34	AdAa	73	Not Rep
15	AdAa	56	AdAa	35	AdAa	74	AdAa
16	AdAa	57	AdAa	36	AdAa	75	AdAa
17	AdAa	58	AdAa	37	AdAa	76	AdAa
18	AdAa	59a	AdAa	38	AdAa	77	AdAa
19	AdAa	59b	AdAa	39	AdAa	78	AdAa
20	AdAa	60a	AdAa	40	AdAt	79	AdAa
21	AdAa	60b	AdAa	41	AdAa	80	AdAa

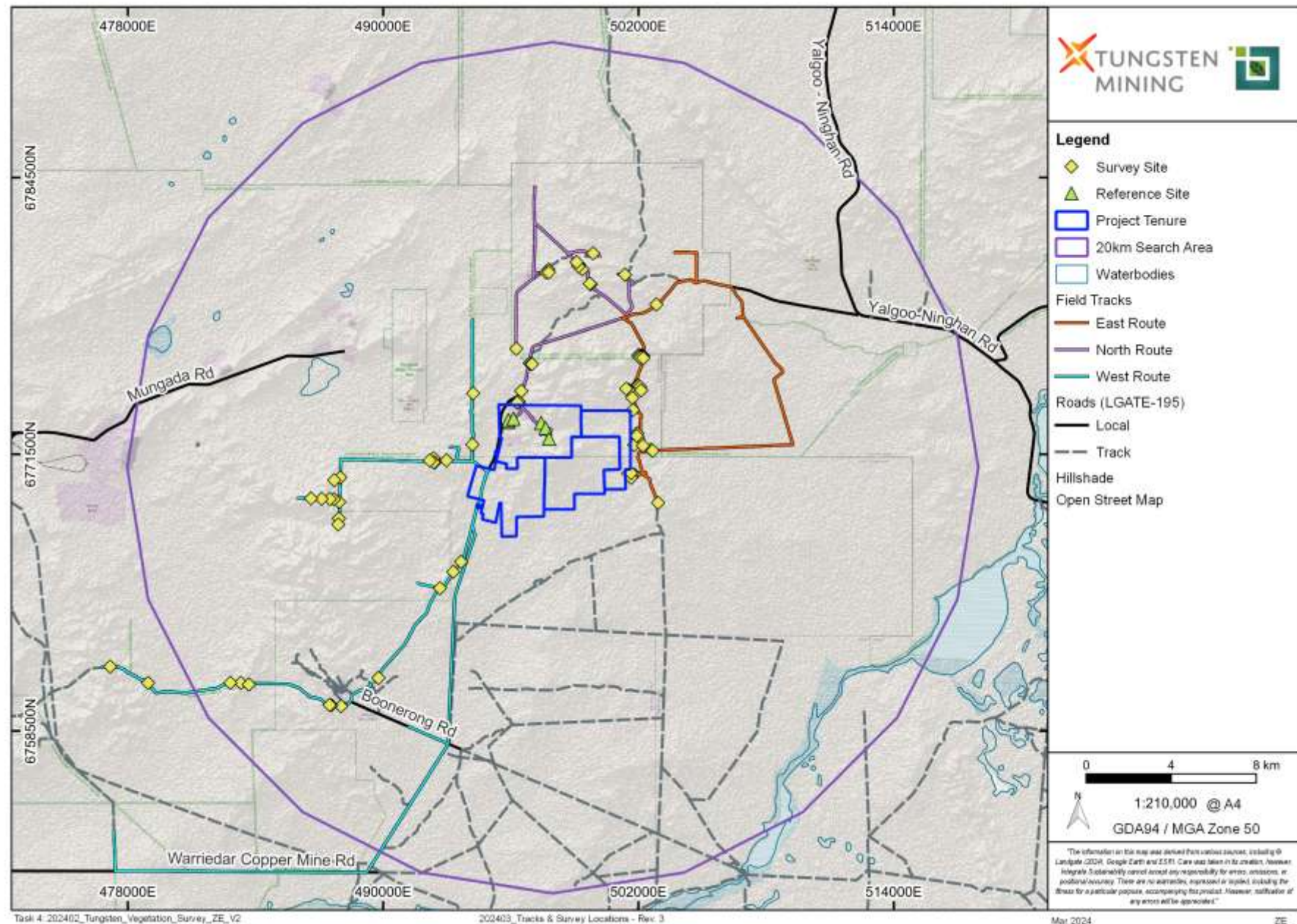


Figure 3.4 Tracks and Survey Sites from Field Survey



4 Results

4.1 Desktop Assessment

4.1.1 Spectrum Ecology's (2021) Survey Report

Spectrum Ecology (2021) report map seven vegetation units across the TGN tenure. After comparing these units to Beard's pre-European vegetation map, the presence of priorities species, the mapped extent of the vegetation unit and if landforms/habitat were restricted Spectrum Ecology determined three were considered locally and regionally significant; these being AdAa, AdAt and AsCp. While the vegetation unit was defined in the report, Spectrum Ecology did not identify any specific indicator species for any of the vegetation units. As a result, it was assumed that all species used to define the vegetation unit were considered indicators. Despite this, not all the quadrats Spectrum Ecology classified into one of the vegetation units had all these indicator species.

The vegetation unit AdAa is defined by its presence of *Allocasuarina dielsiana* +/- *Acacia umbraculiformis* over *Acacia acuminata*, *Allocasuarina tessellata* (P3) and *Acacia karinae* (P3). Using this criteria, Spectrum Ecology identified 16 quadrats which belong to this vegetation unit (Table 4.1). However, when considering *Allocasuarina dielsiana* and *Acacia umbraculiformis* as the dominant species, five identified quadrats were found to not match. Quadrats Q217 and Q222 contained neither of these species, while in M006, M007 and M020 they covered less than 2% of the quadrat. *Acacia acuminata* was also found in all the quadrats except M007, while only nine quadrats contained *Allocasuarina tessellata* (P3) and/or *Acacia karinae* (P3) (Table 4.1).

Spectrum Ecology (2021) reported that 76.5% of *Acacia diallaga* (P1) populations occurred within vegetation unit AdAa, despite the species being present in only five of the 16 quadrats surveyed (Table 4.1). Furthermore, *A. diallaga* was not a dominant component of these quadrats; foliar cover was recorded at or below 1% in quadrats M003, M017, M024, and Q219, with a peak of 6% in Q229. These discrepancies between individual quadrat data and the broader unit description highlight the inherent floristic variability within vegetation unit AdAa.

Table 4.1 AdAa Sites with Indicator/Defining and Other Species

Quadrat	<i>Acacia acuminata</i>	<i>Acacia diallaga</i> (P1)	<i>Acacia karinae</i> (P3)	<i>Acacia ramulosa</i> var. <i>ramulosa</i>	<i>Acacia tetragonophylla</i>	<i>Acacia umbraculiformis</i>
M003	Y	Y (0.1%)			Y	
M006	Y				Y	
M007					Y	Y (1%)
M012	Y		Y	Y		
M013	Y		Y		Y	
M014	Y				Y	Y (10%)
M017	Y	Y (1%)		Y		
M020	Y			Y	Y	
M022	Y		Y		Y	Y (2%)
M024	Y	Y (1%)	Y	Y	Y	
M027	Y			Y	Y	
Q217	Y		Y		Y	
Q219	Y	Y (1%)	Y		Y	Y (62%)
Q222	Y		Y		Y	
Q229	Y	Y (6%)	Y		Y	Y (8%)
Q230	Y		Y		Y	Y (15%)

Quadrat	<i>Allocasuarina dielsiana</i>	<i>Allocasuarina tessellata</i> (P3)	<i>Borya sphaerocephala</i>	<i>Grevillea scabrida</i> (P3)	<i>Melaleuca hamata/ scalena</i>
M003	Y (15%)				
M006	Y (1%)	Y			Y
M007	Y (0.5%)	Y			
M012	Y (12%)			Y	
M013	Y (2%)				
M014	Y (2%)				Y
M017	Y (2%)	Y		Y	



Quadrat	<i>Allocasuarina dielsiana</i>	<i>Allocasuarina tessellata</i> (P3)	<i>Borya sphaerocephala</i>	<i>Grevillea scabrida</i> (P3)	<i>Melaleuca hamata/ scalena</i>
M020	Y (1.5%)	Y			Y
M022	Y (12%)	Y			
M024	Y (2%)	Y			
M027	Y (2%)			Y	
Q217		Y		Y	
Q219		Y		Y	
Q222		Y		Y	Y
Q229	Y (2%)			Y	
Q230				Y	

Y represents the presence of the species in the quadrat

Percentage refers to cover for the species in each quadrat

Vegetation unit AdAt is characterized by the presence of *Acacia duriuscula* and/or *Allocasuarina tessellata* (P3). While Spectrum Ecology (2021) identified five quadrats as matching this criterion (Table 4.2), a detailed review reveals that none of these contained both species. Quadrat M015 recorded *A. duriuscula* alongside an unidentified *Allocasuarina* species, while M009 and Q223 contained only one of the two diagnostic taxa, respectively. Notably, quadrats Q202 and Q211 contained neither species. These discrepancies indicate low floristic similarity between the sampled quadrats and the unit description. While Q223 is the most representative of the AdAt description, the remaining four quadrats lacked key indicators, highlighting significant internal variability within this locally significant unit.

Furthermore, while the TGN tenure contains suitable habitat (sandy soils near granite outcrops) for *A. duriuscula*, the nearest confirmed record is 40km away. Given that *Acacia ramulosa* var. *ramulosa* was also recorded during the survey, it is possible that *A. duriuscula* was misidentified.

Unit AsCp is defined by the presence of *Acacia sulcatacaulis* (EN) and/or *Allocasuarina acutivalvis* subsp. *prinsepiana* over *Calycopseplus paucifolius* and *Philotheca deserti* subsp. *deserti*. Spectrum Ecology (2021) assigned seven quadrats to this unit. Only Q209 contained the full suite of diagnostic species. *A. acutivalvis* subsp. *prinsepiana* was absent from Q203 and Q213, while Q231 lacked *P. deserti* subsp. *deserti*. Quadrat Q212 contained only *A. sulcatacaulis* and *C. paucifolius*, while M004 and Q214 were restricted to a single indicator each. This distribution further confirms high variability within the AsCp unit.

Although the Spectrum Ecology report provides height and percentage cover for species within each quadrat, these data points represent maximum values and do not detail vertical structure or stratal distribution. Consequently, it is difficult to determine species dominance within specific strata.

In addition to the potential misidentification of *A. duriuscula*, other taxa appear to have been misapplied; for example, *Grevillea paniculata* is likely *Grevillea subtiliflora* (P3). Where a high likelihood of correction exists, these names have been revised in the current report.



Table 4.2 Variability within Vegetation Unit AdAt

Veg Unit Site	Description	Image
AdAt	Floristic Group 5B – Community description <i>Acacia duriuscula</i> or <i>Allocasuarina tessellata</i> tall open shrubland Associated species: <i>Acacia acuminata</i>, <i>Allocasuarina campestris</i>, <i>Eremophila clarkei</i>, <i>Malleostemon tuberculatus</i>, <i>Solanum lasiophyllum</i> Dominant Significant Flora: <i>Allocasuarina tessellata</i> (P3)	
Q223	<i>Allocasuarina campestris</i> (6m) tall sparse shrubs – <i>A. dielsiana</i> (assumed from image) <i>Allocasuarina dielsiana</i> low isolated trees over <i>Allocasuarina tessellata</i>, <i>Acacia acuminata</i> tall closed shrubland/ closed shrubland over <i>Borya sphaerocephala</i> low isolated forbs <i>Acacia acuminata</i> <i>Allocasuarina dielsiana</i> <i>Allocasuarina tessellata</i> (P3) <i>Borya sphaerocephala</i> <i>Erodium cygnorum</i>	
Q211	<i>Calycopeplus paucifolius</i>, <i>Acacia umbraculiformis</i>, <i>Acacia ramulosa</i> var. <i>ramulosa</i>, <i>Brachychiton gregorii</i> tall shrubland over <i>Eremophila latrobei</i> subsp. <i>latrobei</i>, <i>Acacia tetragonophylla</i>, <i>Philotheca deserti</i> subsp. <i>deserti</i>, <i>Eremophila clarkei</i>, <i>Eremophila latrobei</i> subsp. <i>latrobei</i> low open shrubland <i>Acacia ramulosa</i> var. <i>ramulosa</i> <i>Acacia tetragonophylla</i> <i>Acacia umbraculiformis</i> <i>Brachychiton gregorii</i> <i>Calycopeplus paucifolius</i> <i>Convolvulus remotus</i> <i>Eremophila clarkei</i> <i>Eremophila latrobei</i> subsp. <i>latrobei</i> <i>Euphorbia tannensis</i> subsp. <i>eremophila</i> <i>Erodium cygnorum</i> <i>Philotheca deserti</i> subsp. <i>deserti</i> <i>Ptilotus obovatus</i> <i>Sida</i> sp. Dark Green Fruits <i>Solanum lasiophyllum</i>	



Veg Unit Site	Description		Image
Q202	<i>Acacia umbraculiformis</i>, <i>Calycopeplus paucifolius</i>, <i>Malleostemon tuberculatus</i> tall sparse shrubland over <i>Thryptomene costata</i>, <i>Malleostemon tuberculatus</i>, <i>Acacia karinae</i> (P3) open shrubland over <i>Eremophila latrobei</i> subsp. <i>latrobei</i>, <i>Prostanthera althoferi</i> subsp. <i>althoferi</i>, <i>Dianella revoluta</i> var. <i>divaricata</i>, <i>Philotheca deserti</i> subsp. <i>deserti</i> low sparse shrubland over <i>Borya sphaerocephala</i> low open forbland		
	<i>Acacia karinae</i> (P3) <i>Acacia umbraculiformis</i> <i>Borya sphaerocephala</i> <i>Calycopeplus paucifolius</i> <i>Dianella revoluta</i> var. <i>divaricata</i> <i>Eremophila latrobei</i> subsp. <i>latrobei</i>	<i>Malleostemon tuberculatus</i> <i>Philotheca deserti</i> subsp. <i>deserti</i> <i>Prostanthera althoferi</i> subsp. <i>althoferi</i> <i>Thryptomene costata</i>	
M015	<i>Melaleuca hamata</i>, <i>Acacia duriuscula</i>, <i>Acacia acuminata</i>, <i>Brachychiton gregorii</i> tall open shrubland over <i>Acacia duriuscula</i>, <i>Hemigenia tichbonii</i> (P1), <i>Allocasuarina</i> sp. sparse shrubland over <i>Borya sphaerocephala</i>, <i>Solanum lasiophyllum</i> low open forbland		
	<i>Acacia acuminata</i> <i>Acacia duriuscula</i> <i>Allocasuarina</i> sp. <i>Borya sphaerocephala</i> <i>Brachychiton gregorii</i> <i>Hemigenia tichbonii</i> (P1)	<i>Melaleuca hamata</i> <i>Solanum lasiophyllum</i>	
M009	<i>Acacia duriuscula</i>, <i>Eremophila clarkei</i> open shrubland over <i>Eremophila latrobei</i> subsp. <i>latrobei</i>, <i>Olearia pimeleoides</i>, <i>Scaevola spinescens</i>, <i>Ptilotus obovatus</i> low shrubland		
	<i>Acacia duriuscula</i> <i>Alyxia buxifolia</i> <i>Calandrinia</i> sp. <i>Eremophila clarkei</i> <i>Eremophila latrobei</i> subsp. <i>latrobei</i> <i>Erodium cygnorum</i> <i>Goodenia mimuloides</i> <i>Lepidium</i> sp.	<i>Olearia humilis</i> <i>Olearia pimeleoides</i> <i>Ptilotus obovatus</i> <i>Scaevola spinescens</i> <i>Solanum lasiophyllum</i>	



4.1.2 Similar Vegetation Types in Karara Communications Tower Survey

A previous targeted flora and vegetation survey was completed by JBBC within the Survey Area in 2021 (JBBC, 2021). The targeted flora and vegetation survey covered a 6ha area for the new communication tower for the Karara Iron Ore Project and described three VAs. VA1 has similarities to Spectrum Ecology's (2021) vegetation unit AdAt while VA3 is similar to vegetation AdAa. VA2, on the other hand, is considered a low representative of AdAa due to the sparse presence of *Allocasuarina tessellata* (P3) in its composition.

Table 4.3 Vegetation Descriptions for VA1, VA2 and VA3

Site (Veg Unit)	Description	Image
VA1 (AdAt)	Landform: Hill, mid to upper slopes, gentle slope Land surface: Reddish brown (5YR 4/4) clay loam; surface rock (dolerite, metabasalt (isolated outcrops on western side)) 10 – 20/40%; litter 60 – >90%; fallen timber 10 – 20/40% <i>Allocasuarina dielsiana</i> emergent low trees (6 – 8m) over <i>Allocasuarina tessellata</i> (P3), <i>Melaleuca hamata</i>, <i>Acacia burkittii</i> tall shrubland (5 – 6m) over <i>Chamelaucium</i> sp. Warriedar (P1), <i>Melaleuca radula</i> sparse shrubland (0.9 – 1.6m) over <i>Tricoryne tuberosa</i>, <i>Erodium cygnorum</i>, <i>Sida calyxhymenia</i>, Asteraceae sp. (germinating), <i>Acacia</i> sp. (seedlings) low sparse forbland 2 – 5% Other species: <i>Acacia karinae</i> (P3), <i>A. kochii</i>, <i>Austrostipa elegantissima</i>, <i>Borya sphaerocephala</i>, <i>Dianella revoluta</i> var. <i>divaricata</i>, <i>Dodonaea inaequifolia</i>, <i>Euphorbia drummondii</i>, <i>E. tannensis</i> subsp. <i>eremophila</i>, <i>Grevillea subtiliflora</i> (P3), <i>G. scabrada</i> (P3), <i>Cryptandra micrantha</i>, <i>Leptosema aphyllum</i>	
VA2 (AdAa) (Low Rep)	Landform: Hill, rocky ridge with rocky scree slope, south aspect; moderate to steep slope Land surface: Reddish brown (5YR 4/4) clay loam skeletal soils; surface rock (dolerite) >90%, outcropping rock, boulders; litter 20 – 30%, fallen timber 2 – 5% <i>Allocasuarina dielsiana</i>, <i>Melaleuca hamata</i>, <i>Acacia burkittii</i> low open woodland over <i>Allocasuarina tessellata</i> (P3), <i>Dodonaea inaequifolia</i>, <i>Acacia burkittii</i> tall sparse shrubland over <i>Melaleuca radula</i>, <i>Allocasuarina tessellata</i> (P3), <i>Dodonaea inaequifolia</i> open shrubland over <i>Lepidosperma</i> sp. Blue Hills (P1), <i>Melaleuca radula</i>, <i>Solanum lasiophyllum</i> sedgeland to open sedgeland Other species: <i>Grevillea scabrada</i> (P3)	



Site (Veg Unit)	Description	Image
VA3 (AdAa)	Landform: Hill; midslopes; northerly aspect; moderate slope Land surface: Reddish brown clay loam; surface rock (dolerite) 60 – 80%; litter 5 – 10%; fallen timber <2%; cryptogams (lichen) <5% Other species: <i>Borya sphaerocephala</i>, <i>Euphorbia tannensis</i> subsp. <i>eremophila</i>, <i>Melaleuca hamata</i>	

Soil colour assessed using Soil Colour Charts (Munsell Color Company, 1992)



4.1.3 Associated Land Systems

Using the publicly available DPIRD land systems layer (DPIRD-064) 14 land systems are present within the Survey Area, with six present in the Project area. All the identified land systems were associated with at least one indicator species for the targeted vegetation units, with the Gabanintha, Graves, Moriarty, Singleton, Tallering and Tealtoo land systems supporting at least six indicator species (Table 4.4). As a result, these land systems are considered highly important for the vegetation units. The Norie land system is also considered important as it supports the locally restricted *Acacia sulcaticaulis* (EN) species endemic to the Mt Mulgine area.

Table 4.4 Indicator Species and Associated Land Systems

Species	Campsite	Gabanintha	Graves	Kalli	Moriarty	Nerramyne	Norie	Olympic	Pindar A	Singleton	Tallering	Tealtoo	Yalluwin	Yowie
<i>Acacia acuminata</i>										Y				
<i>Acacia duriuscula</i>			Y				Y			Y				
<i>Acacia karinae</i> (P3)	Y	Y	Y		Y		Y	Y	Y	Y	Y	Y	Y	Y
<i>Acacia sulcaticaulis</i> (EN)			Y		Y		Y							
<i>Acacia umbraculiformis</i>		Y	Y		Y	Y				Y	Y			
<i>Allocasuarina acutivalvis</i> subsp. <i>prinsepiana</i>		Y	Y	Y	Y						Y	Y		
<i>Allocasuarina dielsiana</i>		Y	Y	Y	Y					Y	Y	Y		Y
<i>Allocasuarina tessellata</i> (P3)		Y	Y		Y		Y			Y		Y	Y	Y
<i>Borya sphaerocephala</i>		Y	Y			Y				Y	Y			
<i>Calycopeplus paucifolius</i>			Y		Y					Y	Y	Y		Y
<i>Philotheca deserti</i> subsp. <i>deserti</i>											Y	Y		

Y represents land systems the indicator species are associated with

Indicator species for the vegetation unit AdAa were found to associate with all 14 land systems located within the Survey Area (Figure 4.1). All of the indicator species were associated with the Singleton land system, with all species except *Acacia acuminata* also associated with the Gabanintha and Graves land systems.

The two indicator species for the vegetation unit AdAt were found to associate with eight of the land systems located in the Survey Area (Figure 4.2). Both indicator species were supported by the Graves, Norie and Singleton systems, while the remaining systems only supported one of the species.

Indicator species for the vegetation unit AsCp were found to associate with nine land systems in the Survey Area (Figure 4.3). No land system was associated with all the indicator species, however, the Graves, Moriarty, Tallering and Tealtoo land systems were associated with three of the species.

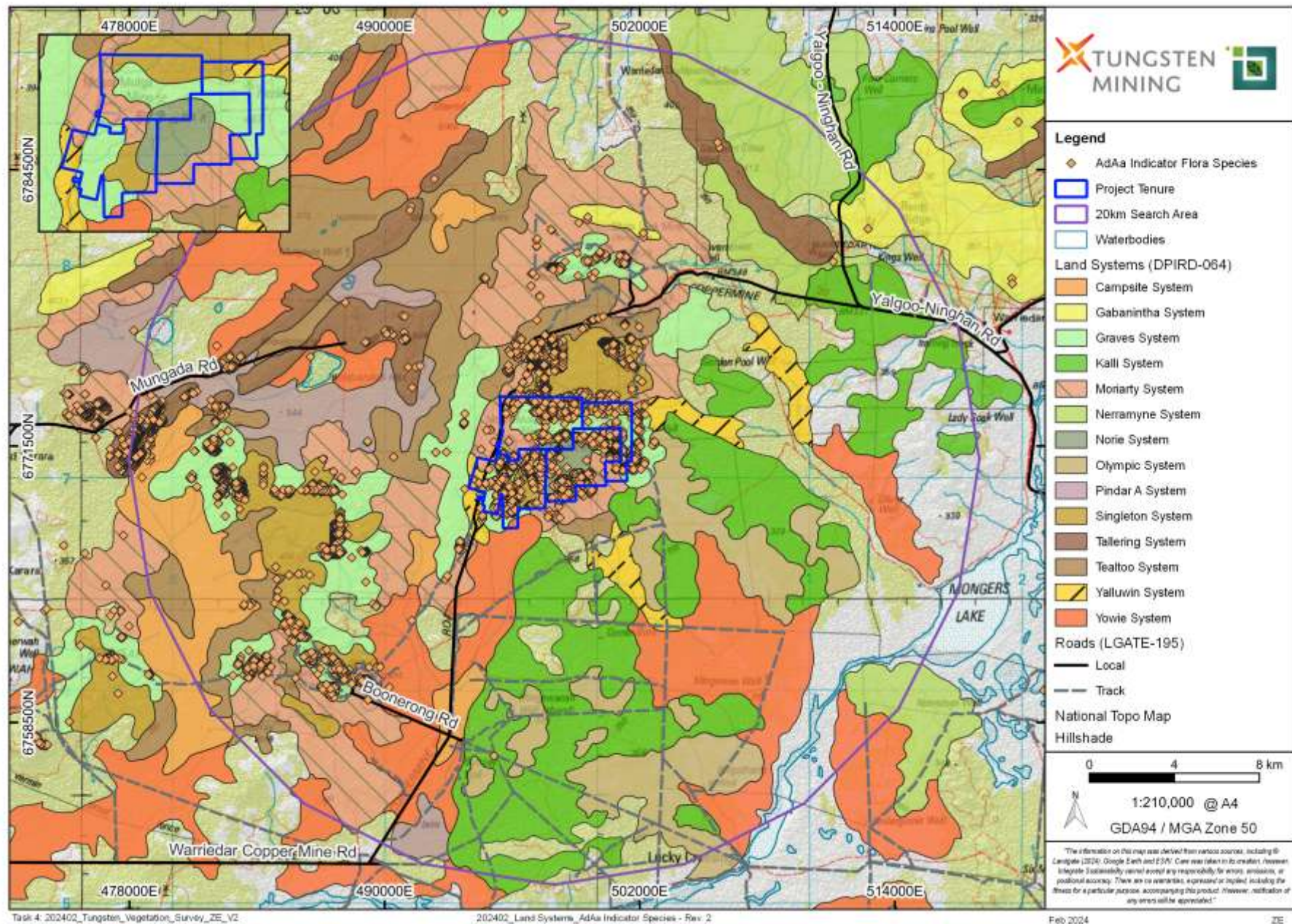


Figure 4.1 Land Systems Associated with Vegetation Unit AdAa

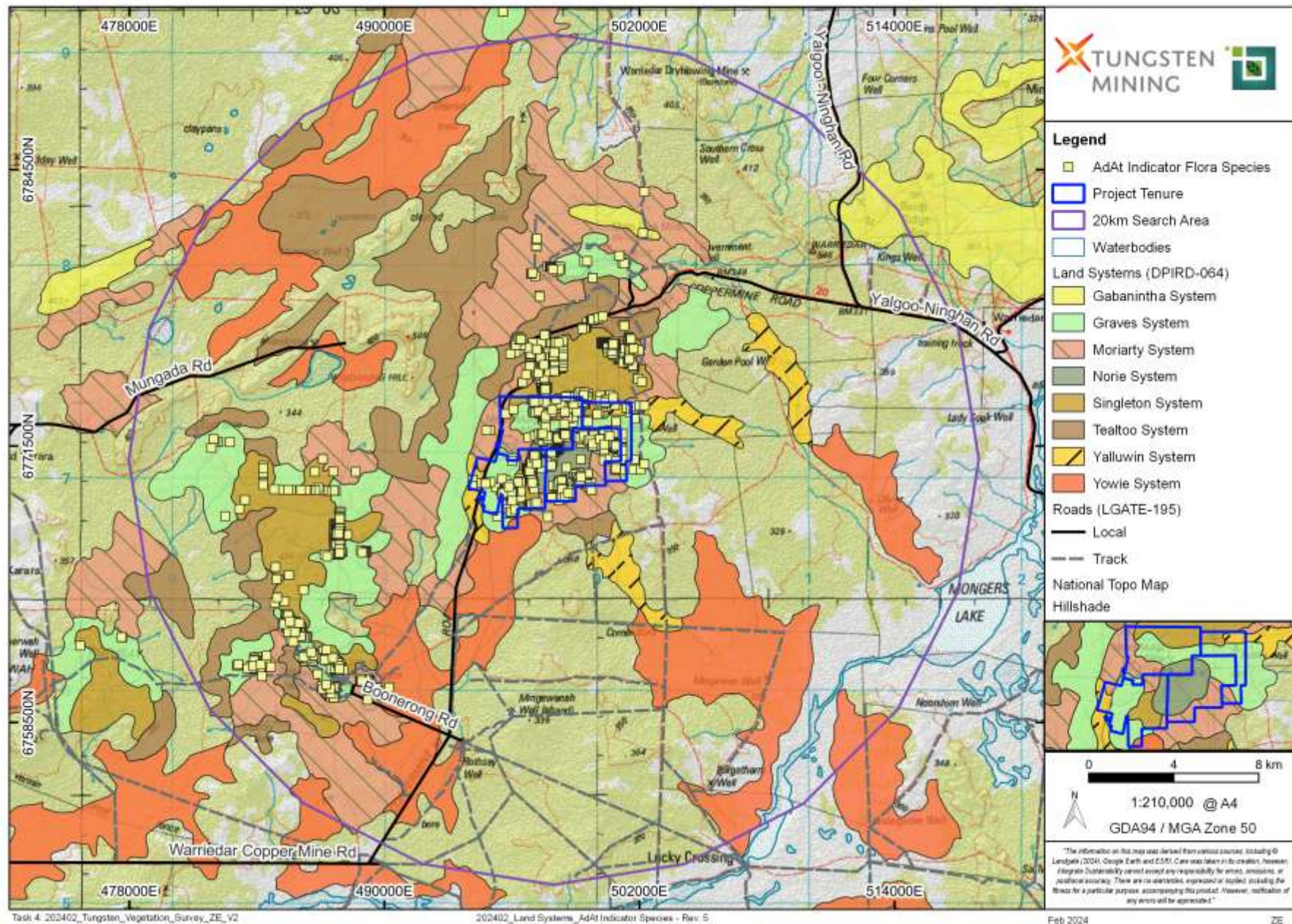


Figure 4.2 Land Systems Associated with Vegetation Unit AdAt

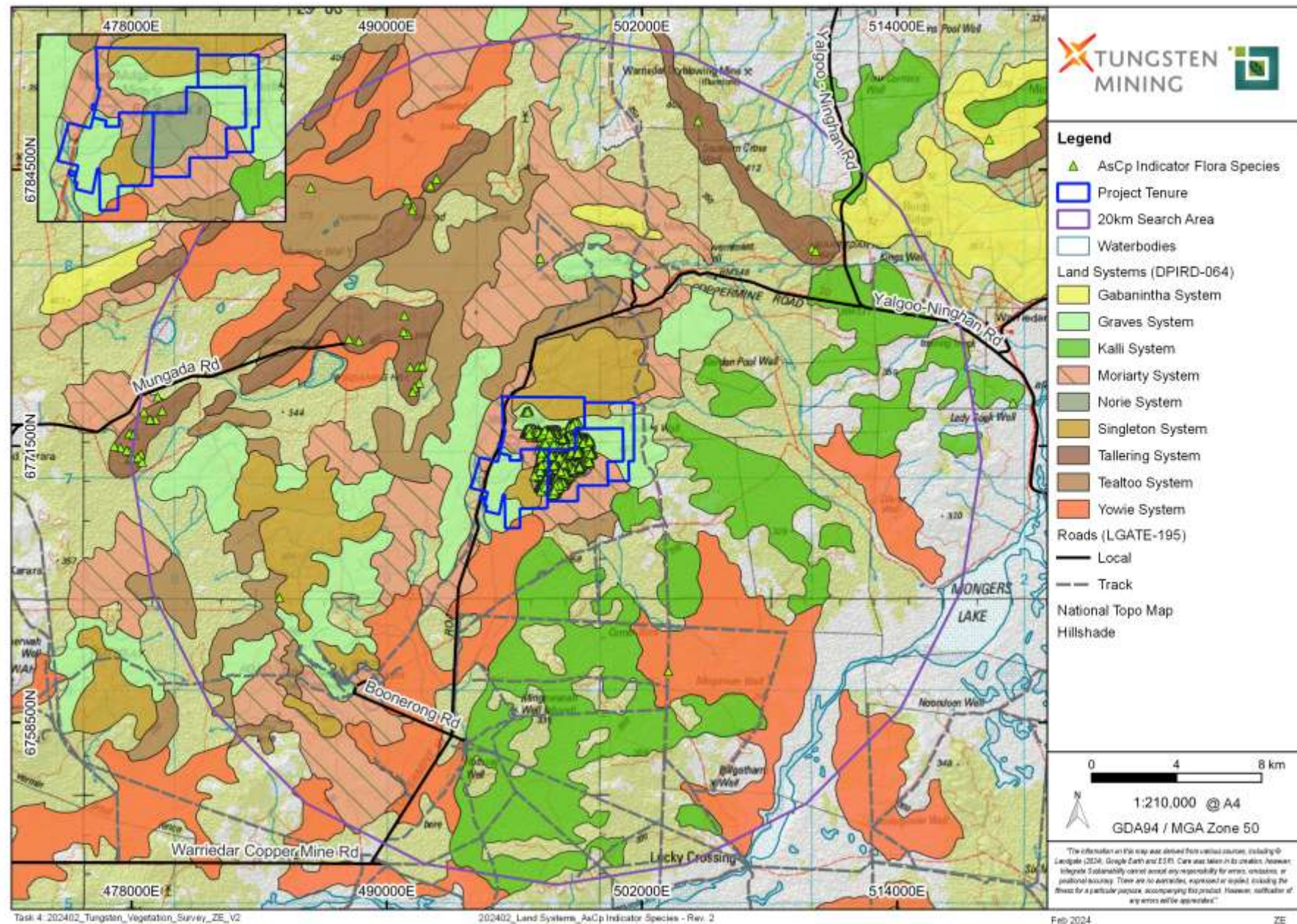


Figure 4.3 Land Systems Associated with Vegetation Unit AsCp



4.2 Targeted Vegetation Units

Eighty sites were sampled targeting three locally significant vegetation units as described by Spectrum Ecology (2021) within the Survey Area. However, while assessing Spectrum Ecology's (2021) quadrats, variability between the quadrats and the vegetation unit descriptions was noted. This variability was utilised when determining whether a surveyed site matched or was not representative of a targeted vegetation unit. In particular, three varieties of vegetation unit AdAa and two varieties of vegetation unit AdAt were noted in the field, while a single site matching vegetation unit AsCp was identified (Table 4.5). Site 26 was identified as a mosaic between vegetation unit AdAa and AdAt. Sites 46 and 47 contained similarities to two varieties of vegetation unit AdAa.

Table 4.5 Vegetation Units Recorded in the Field

Veg Unit	Description	Image
AdAa	<i>Allocasuarina dielsiana</i> , <i>Melaleuca hamata</i> low open woodland over <i>Acacia acuminata</i> , <i>Allocasuarina tessellata</i> (P3), <i>Acacia karinae</i> (P3) tall open shrubland over <i>Borya sphaerocephala</i> low sparse shrubland Sites: 1 (SE), 2 (SE), 8, 9, 13, 14, 15, 16, 21, 22, 23, 24, 25, 28, 29, 31, 32, 33, 37, 38, 39, 51, 52, 56, 57, 58, 60a, 60b, 62, 63, 64, 68, 74, 75*, 77, 78, 79, 80	
	<i>Allocasuarina dielsiana</i> and/or <i>Melaleuca hamata</i> isolated trees over <i>Acacia umbraculiformis</i> low open woodland to open woodland over <i>Acacia</i> spp. (<i>A. ramulosa</i> var. <i>ramulosa</i> , <i>Allocasuarina dielsiana</i> , <i>Acacia acuminata</i> , <i>Acacia tetragonophylla</i> , <i>A. diallaga</i> (P1), <i>A. karinae</i> (P3)) tall open shrubland to open shrubland over <i>Grevillea scabrida</i> (P3), <i>Ptilotus obovatus</i> , <i>Solanum lasiophyllum</i> low sparse shrubland Sites: 5 (SE), 26b, 41, 44, 45, 46**, 47**, 59a, 59b, 70, 76	
	<i>Allocasuarina dielsiana</i> , <i>Acacia acuminata</i> , <i>Acacia umbraculiformis</i> or <i>Melaleuca hamata</i> , <i>Brachychiton gregorii</i> low open woodland over <i>Acacia acuminata</i> , <i>Allocasuarina tessellata</i> (P3), <i>Acacia tetragonophylla</i> , <i>Acacia karinae</i> (P3) tall sparse shrubland over <i>Acacia diallaga</i> (P1), <i>A. karinae</i> (P3), <i>A. tetragonophylla</i> , <i>Allocasuarina tessellata</i> (P3), <i>Melaleuca radula</i> shrubland to open shrubland over <i>Grevillea scabrida</i> (P3), <i>Ptilotus obovatus</i> , <i>Acacia diallaga</i> (P1) low sparse shrubland over <i>Borya sphaerocephala</i> , <i>Ptilotus drummondii</i> low open forbland Sites: 17, 18, 19, 20, 27, 34, 35, 36, 46**, 47**, 48	



Veg Unit	Description	Image
AdAt	<i>Allocasuarina dielsiana</i> and/or <i>Melaleuca hamata</i> isolated trees to low open woodland (2 – 10%) over <i>Allocasuarina tessellata</i> (P3) tall shrubland or shrubland over <i>Borya sphaerocephala</i> low open to sparse forbland Sites: 4 (SE), 7, 10, 11, 12, 26a, 30, 61a, 61b, 65, 67, 69, 71	
	Hill, summit; granite, laterite; aspect east/west <i>Acacia umbraculiformis</i>, <i>A. ramulosa</i> var. <i>ramulosa</i>, <i>Calycopeplus paucifolius</i>, <i>Allocasuarina acutivalvis</i> subsp. <i>prinsepiana</i>, <i>Brachychiton gregorii</i>, <i>Melaleuca nematophylla</i> tall open shrubland over <i>Acacia ramulosa</i> var. <i>ramulosa</i>, <i>Allocasuarina acutivalvis</i> subsp. <i>prinsepiana</i>, <i>Philotheca sericea</i>, <i>Acacia tetragonophylla</i>, <i>Micromyrtus trudgenii</i> (P3) open shrubland over <i>Aluta aspera</i> subsp. <i>hesperia</i>, <i>Eremophila latrobei</i> subsp. warty leaves, <i>Acacia ramulosa</i> var. <i>ramulosa</i> low open shrubland Sites: 40, 54	
AsCp	<i>Melaleuca nematophylla</i> tall shrubland over <i>Calycopeplus paucifolius</i>, <i>Philotheca brucei</i> subsp. <i>brucei</i>, <i>Eremophila clarkei</i>, <i>Acacia assimilis</i> subsp. <i>assimilis</i> sparse shrubland Sites: 6 (SE)	
	Not Representative Sites: 3 (SE), 42, 43, 49, 50, 53, 55, 66, 72, 73	

SE refers to sites surveyed within Spectrum Ecology's (2021) survey area

* Site 75 is slightly different to the initial description for AdAa; has *Grevillea hakeoides* subsp. *stenophylla* in understorey as well as *Acacia ramulosa* but lacks *Acacia acuminata*. It has similarities to SE AdAa sites M012 and M020 (both with *Grevillea* and *Acacia ramulosa*) but *A. acuminata* is present. *Grevillea hakeoides* was also present in SE ElAt (Q204, Q206); however, this unit has *Eucalyptus loxophleba* which was not present in Site 75.

** Sites have similarities with multiple AdAa varieties

4.2.1 Vegetation Unit AdAa

Vegetation unit AdAa was the most frequently recorded vegetation unit during the survey with 55 surveyed sites either matching the initial description or a variation (Figure 4.4). Two main variations were identified in the field alongside the initial description, one dominated by *Acacia umbraculiformis* with *Allocasuarina dielsiana* and *Acacia acuminata* present, while the other is dominated by *Acacia diallaga* (P1). There is potential for the *Acacia diallaga* (P1) dominant variant to be restricted to the Mt Mulgine - Karara area as the species is endemic to this area.

Three of the surveyed sites categorised as vegetation unit AdAa were within Spectrum Ecology's (2021) mapped boundary (Figure 4.4). These included sites 1 and 2 which matched the initial description and site 5



which matched the *Acacia umbraculiformis* dominant variant. The remaining 52 sites were located across the Survey Area, primarily on the eastern side with 24 sites identified followed by the western side at 17 sites.

Sites 46 and 47 were found to not match the initial description for the vegetation unit or completely match a variation noted, instead containing elements from both variations. For example, the sites both contained *Acacia umbraculiformis* as the dominant species in the upper strata and *Acacia diallaga* (P1) as the dominant species in the understory. Both sites also contained *Acacia tetragonophylla*, *Ptilotus obovatus* and *Solanum lasiophyllum* which differentiate the variants from the initial description.

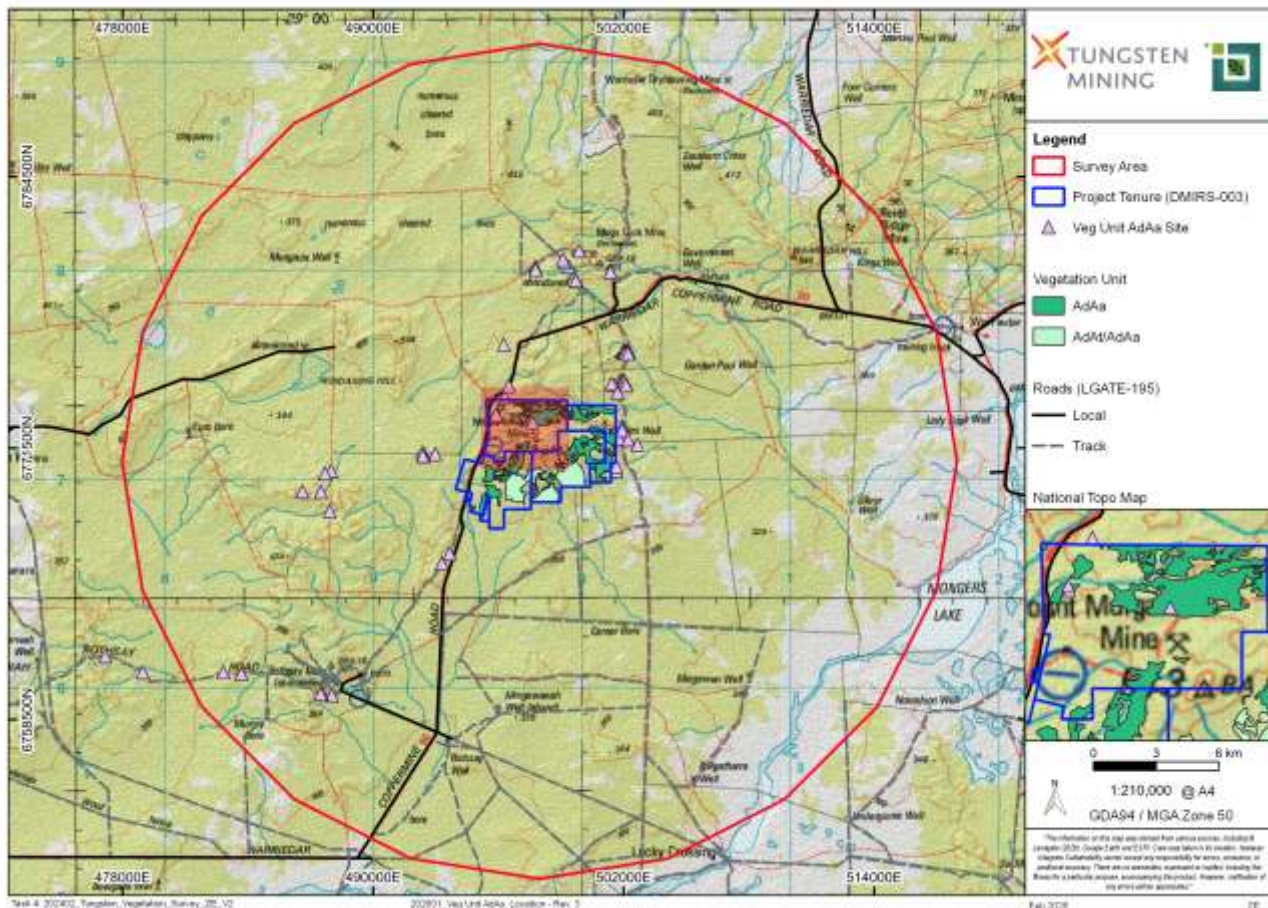


Figure 4.4 Vegetation Unit AdAa Identified Sites

4.2.2 Vegetation Unit AdAt

During the survey, no occurrences of *Acacia duriuscula* were identified and as such, no sites matching the initial description for vegetation unit AdAt were recorded (Appendix A). Despite this, 13 surveyed sites were found to match a variation for the vegetation unit (Figure 4.5). The most common variation was dominated by tall *Allocasuarina tessellata* (P3) shrubland and considered species poor. However, the upper stratum was not dominant, instead consisting of sparse or isolated low trees. This variation was identified more north-west of the Survey Area with six sites recorded north and five sites west.

The secondary variation was recorded at two sites, sites 40 and 54 located east and south-west of the Project, respectively on a hill or summit (Figure 4.5). *Allocasuarina tessellata* (P3) was not identified at the sites, however, the vegetation description did match Spectrum Ecology's (2021) description for quadrat Q211, which was categorised as vegetation unit AdAt. Both the sites and quadrat contained the species *Acacia ramulosa* var. *ramulosa*, *Acacia umbraculiformis* and *Calycopeplus paucifolius*.

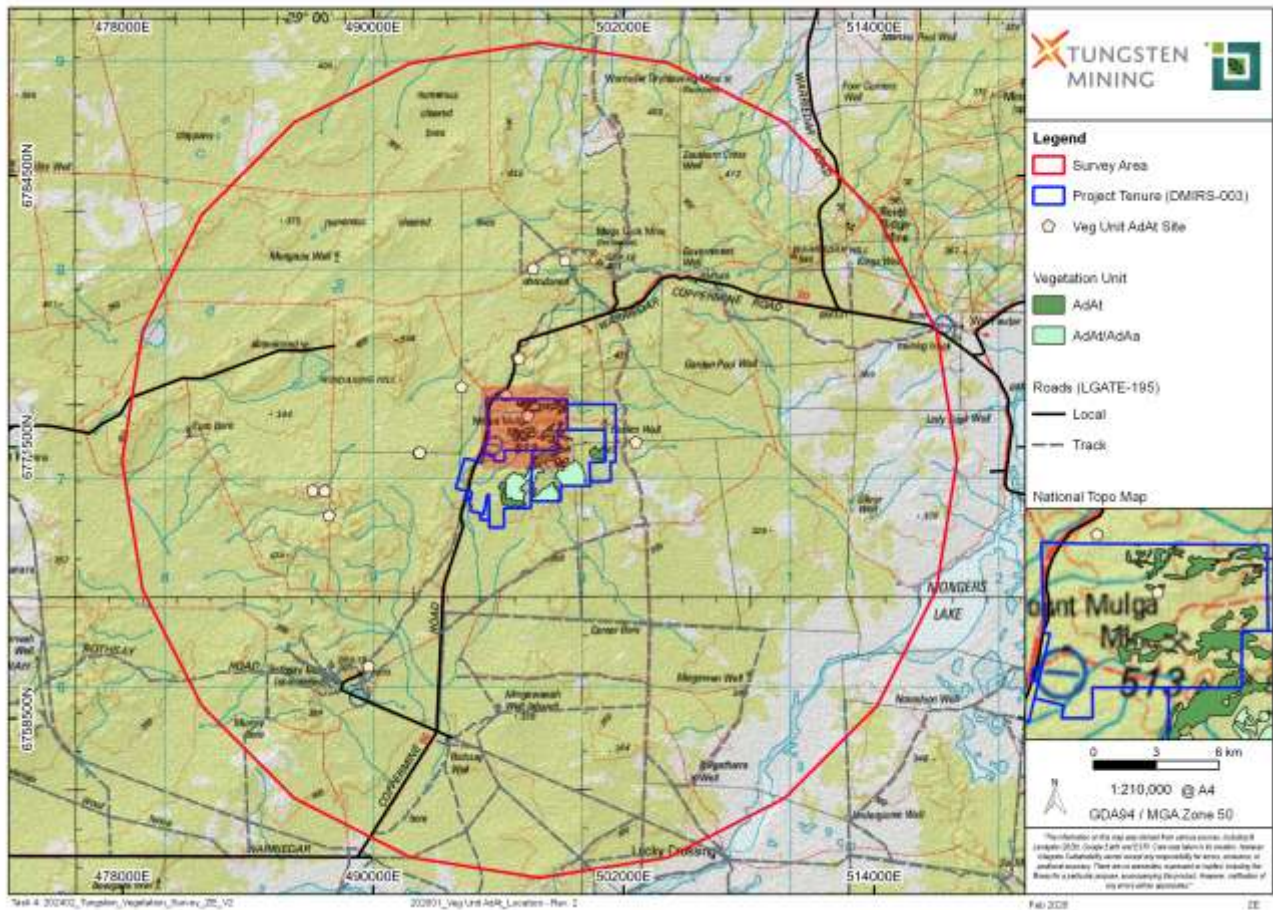


Figure 4.5 Vegetation Unit AdAt Identified Sites

4.2.3 Vegetation Unit AsCp

No occurrences of *Acacia sulcaticaulis* (EN) or *Philotheca deserti* subsp. *deserti* were identified during the survey (Appendix A). Despite this, Site 6 was recorded within Spectrum Ecology's (2021) mapped area for the vegetation unit AsCp and contained the indicator species *Calycopeplus paucifolius* alongside *Philotheca brucei* subsp. *brucei* (Figure 4.6). The site also contained *Acacia assimilis* subsp. *assimilis*, *Eremophila clarkei* and *Melaleuca nematophylla* which were recorded in quadrats Spectrum Ecology (2021) categorised as AsCp.

An additional four sites recorded in the Survey Area contained the indicator species *Calycopeplus paucifolius* with a *Philotheca* species; *P. brucei* in two sites and *P. sericea* in two sites. Despite this, one of the sites (site 41) better aligned with locally significant vegetation unit AdAa while sites 40 and 54 aligned with Spectrum Ecology's (2021) quadrat Q211, and therefore, were categorised as AdAt. Site 55, on the other hand, was Not Representative of the locally significant vegetation units, instead containing *Allocasuarina acutivalvis* and *Acacia ramulosa* var. *ramulosa*, defining species for vegetation unit AaAr; the site also matched Spectrum Ecology's (2021) description for quadrat Q218 which was categorised as AaAr.

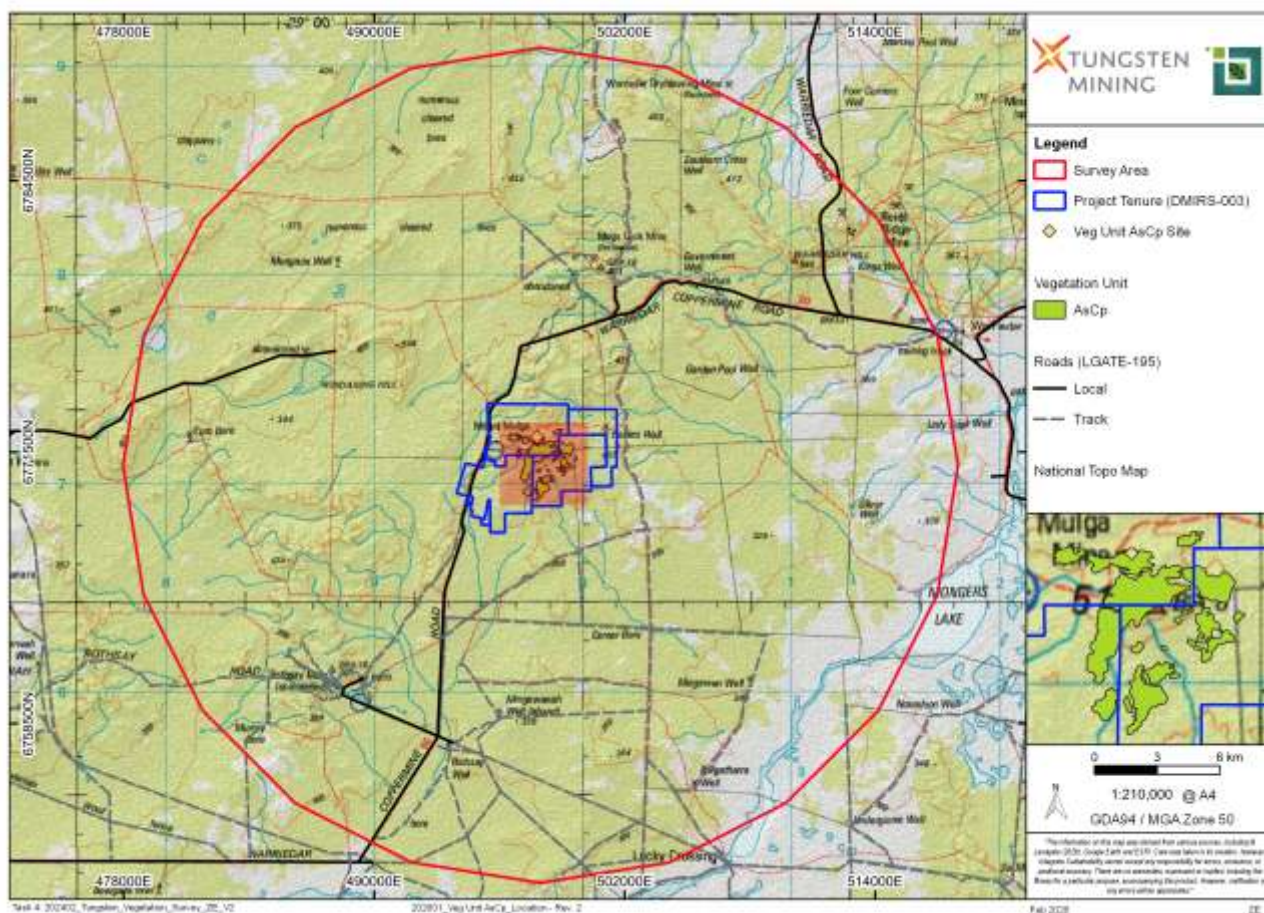


Figure 4.6 Vegetation Unit AsCp Identified Site

5 Survey Outcomes

Vegetation representative of units AdAa and AdAt has been consistently recorded within the Survey Area across multiple assessments. For example, units described by Woodman Environmental (2012; 2017) at Rothsay and Karara exhibit moderate to high similarity to these units. The current survey identified an additional 52 sites categorized as AdAa and 12 sites as AdAt outside the immediate Project area.

However, *Acacia duriuscula* was not recorded during this assessment. Given the potential for misidentification with the similar *Acacia ramulosa* var. *ramulosa*, it is recommended that Spectrum Ecology (2021) quadrats M004, M009, M010, and M015 be revisited for taxonomic verification (Appendix B).

Conversely, vegetation unit AsCp appears to be locally restricted, as it was identified exclusively within the TGN tenure. This restricted distribution is associated with the presence of *Acacia sulcatacaulis* (EN), which currently is only known from the TGN tenure. Consequently, it is recommended that the known extent of unit AsCp be avoided where practicable. Protecting this vegetation unit will also serve as a primary strategy for the conservation of *A. sulcatacaulis* (EN).

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Appendices

Appendix A – Site Descriptions

Site	Description	Image
1 – AdAa 28/11/23 7:03 am GPS: 495909 E/ 6773028 N SE Mapped Site Plain	U1: <i>Allocasuarina dielsiana</i> isolated low trees M1: <i>Acacia ramulosa</i> var. <i>ramulosa</i> tall shrubland M2: <i>Senna artemisioides</i> subsp. <i>filifolia</i> , <i>Scaevola spinescens</i> , <i>Eremophila clarkei</i> sparse shrubland M3: <i>Acacia ramulosa</i> var. <i>ramulosa</i> , <i>Ptilotus obovatus</i> low sparse shrubland No <i>A. acuminata</i> , <i>Allocasuarina tessellata</i> (P3) or <i>Acacia karinae</i> (P3) <u>Low association</u>	
2 – AdAa 28/11/23 7:09 am GPS: 495888 E/ 6773104 N SE Mapped Site Plain Reddish brown clay loam	U1: <i>Melaleuca hamata</i> , <i>Allocasuarina dielsiana</i> low open woodland M1: <i>Acacia ramulosa</i> var. <i>ramulosa</i> , <i>Persoonia manotricha</i> open shrubland M2: <i>Dianella revoluta</i> var. <i>divaricata</i> , <i>Ptilotus drummondii</i> low sparse shrubland Other species: <i>Allocasuarina acutivalvis</i> subsp. <i>prinsepiana</i> , <i>Acacia tetragonophylla</i> , <i>Eremophila forrestii</i> subsp. <i>forrestii</i> No <i>Acacia acuminata</i> , <i>Allocasuarina tessellata</i> (P3) or <i>Acacia karinae</i> (P3)	
3 - Not Rep 28/11/23 GPS: 496124 E/ 6773171 N SE Mapped Site Not mapped as AdAa or AdAt Plain Drainage line area	<i>Allocasuarina dielsiana</i> isolated trees over <i>Acacia acuminata</i> , <i>A. tetragonophylla</i> tall shrubland over <i>Acacia ramulosa</i> var. <i>ramulosa</i> , <i>Grevillea subtiliflora</i> , <i>Dodonaea inaequifolia</i> open shrubland over <i>Lepidosperma</i> sp. Blue Hills open sedgeland CSF: <i>Lepidosperma</i> sp. Blue Hills (P1), <i>Grevillea subtiliflora</i> (P3)	



Site	Description	Image
4 – AdAt	28/11/23 7:52 am GPS: 497422 E/ 6772973 N SE Mapped Site Hill; lower slope; aspect south U1: <i>Allocasuarina dielsiana</i> low isolated trees M1: <i>Allocasuarina tessellata</i> tall open shrubland M2: <i>Allocasuarina tessellata</i> shrubland CSF: <i>Allocasuarina tessellata</i> (P3)	
5 – AdAa	28/11/23 8:06 am GPS: 497634 E/ 6772733 N SE Mapped Site Hill; upper slope and ridge Dolerite U1: <i>Acacia umbraculiformis</i>, <i>A. ramulosa</i> var. <i>ramulosa</i>, <i>Allocasuarina dielsiana</i> low woodland M1: <i>Acacia ramulosa</i> var. <i>ramulosa</i>, <i>Grevillea subtiliflora</i> sparse shrubland G1: <i>Ptilotus obovatus</i>, <i>Solanum lasiophyllum</i>, <i>Grevillea scabrida</i>, <i>Austrostipa</i> sp. low sparse shrubland CSF: <i>Grevillea scabrida</i> (P3), <i>Grevillea subtiliflora</i> (P3)	
6 - AsCp	28/11/23 8:21 am GPS: 497798 E/ 6772233 N SE Mapped Site Hill; lower midslope; aspect north U1: <i>Melaleuca nematophylla</i> tall shrubland M1: <i>Calycophyllum paucifolium</i>, <i>Philotheca brucei</i> subsp. <i>brucei</i>, <i>Eremophila clarkei</i>, <i>Acacia assimilis</i> subsp. <i>assimilis</i> sparse shrubland	



Site	Description	Image
7 - AdAt	28/11/23 8:44 am GPS: 496382 E/ 6773965 N 416m Hill; lower slope; aspect south; surface rock >80% scree, dolerite, metabasalt U1: <i>Melaleuca hamata</i>, <i>Allocasuarina dielsiana</i>, <i>Acacia acuminata</i> low open woodland to isolated low trees M1: <i>Allocasuarina tessellata</i> shrubland G1: <i>Borya sphaerocephala</i> low open forbland CSF: <i>Allocasuarina tessellata</i> (P3); dominant	
8 – AdAa	28/11/23 8:48 am GPS: 496302 E/ 6773930 N 414m Hill; midslope; aspect NW Surface rock: >70%, dolerite, quartz U1: <i>Melaleuca hamata</i>, <i>Acacia acuminata</i> low open woodland (8m) M1: <i>Allocasuarina tessellata</i>, <i>Acacia acuminata</i> tall open shrubland (4m) M2: <i>Allocasuarina tessellata</i>, <i>Senna artemisioides</i> subsp. <i>filifolia</i>, <i>Acacia tetragonophylla</i>, <i>Allocasuarina dielsiana</i> open shrubland G1: <i>Ptilotus obovatus</i>, <i>Solanum lasiophyllum</i>, <i>Acacia tetragonophylla</i> low isolated shrubs CSF: <i>Allocasuarina tessellata</i> (P3)	
9 – AdAa	28/11/23 9:07 am Warriedar Coppermine Road – north side GPS: 496497 E/ 6774472 N 409m Hill; lower slope; aspect north; gentle to moderate; adjacent to drainage line U1: <i>Allocasuarina dielsiana</i>, <i>Melaleuca hamata</i> low open woodland M1: <i>Acacia acuminata</i>, <i>Melaleuca hamata</i>, <i>Allocasuarina dielsiana</i>, <i>A. tessellata</i> tall open shrubland M2: <i>Grevillea scabrida</i>, <i>Persoonia pentasticha</i>, <i>Micromyrtus trudgenii</i> low sparse shrubland <i>Hemigenia tichbonii</i> common in drainage line CSF: <i>Hemigenia tichbonii</i> (P1), <i>Allocasuarina tessellata</i> (P3), <i>Grevillea scabrida</i> (P3), <i>Micromyrtus trudgenii</i> (P3), <i>Persoonia pentasticha</i> (P3)	



Site	Description		Image
10 - AdAt	28/11/23 9:30 am GPS: 496894 E/ 6775777 N Fire regrowth ~ 10 years Hill; lower slope; aspect north, gentle slope; surface rock <1%	M1: <i>Allocasuarina dielsiana</i> low isolated emergent trees M2: <i>Allocasuarina tessellata</i> , <i>Acacia acuminata</i> . <i>Grevillea subtiliflora</i> shrubland (40 – 50%) CSF: <i>Allocasuarina tessellata</i> (P3), <i>Grevillea subtiliflora</i> (P3)	
11 - AdAt	28/11/23 GPS: 496958 E/ 6775737 N	<i>Allocasuarina tessellata</i> , <i>Acacia acuminata</i> shrubland over <i>Dianella revoluta</i> var. <i>divaricata</i> low isolated shrubs CSF: <i>Allocasuarina tessellata</i> (P3)	Upslope from Site 10
12 - AdAt	28/11/23 GPS: 496995 E/ 6775734 N 425m	<i>Acacia acuminata</i> , <i>Allocasuarina tessellata</i> , <i>Grevillea subtiliflora</i> shrubland CSF: <i>Allocasuarina tessellata</i> (P3), <i>Grevillea subtiliflora</i> (P3)	Upslope from Sites 10, 11
Malleefowl Mound AdAt	28/11/23 9:40 am GPS: 496975 E/ 6775772 N Old; Long unused; extinct Profile 1, 8m x 9m; height 0.6 m	<i>Allocasuarina tessellata</i> tall shrubland CSF: <i>Allocasuarina tessellata</i> (P3)	
13 – AdAa	28/11/23 10:04 am GPS: 502218 E/ 6776127 N 373m Hill; gentle to moderate slope; aspect east	U1: <i>Melaleuca hamata</i> , <i>Allocasuarina dielsiana</i> low woodland (30% Projective Foliage Cover, 6 – 10m) M1: <i>Acacia acuminata</i> , <i>A. ramulosa</i> var. <i>ramulosa</i> , <i>A. tetragonophylla</i> , <i>Allocasuarina tessellata</i> open shrubland M2: <i>Grevillea scabrida</i> , <i>Ptilotus obovatus</i> , <i>Senna artemisioides</i> subsp. <i>xpetiolaris</i> , <i>Teucrium disjunctum</i> low sparse shrubland CSF: <i>Allocasuarina tessellata</i> (P3), <i>Grevillea scabrida</i> (P3) Vegetation continues west upslope – Sites 14, 15	



Site	Description		Image
14 – AdAa	28/11/23 GPS: 502192 E/ 6776132 N	As above	As above
15 – AdAa	28/11/23 GPS: 502142 E/ 6776113 N	As above	As above
16 – AdAa	28/11/23 10:15 am GPS: 502095 E/ 6776125 N Hill; upper midslope; moderate slope; aspect east	U1: <i>Allocasuarina dielsiana</i> , <i>Melaleuca hamata</i> low emergent trees M1: <i>Acacia acuminata</i> , <i>Allocasuarina tessellata</i> tall shrubland M2: <i>Allocasuarina tessellata</i> , <i>Acacia diallaga</i> , <i>Acacia tetragonophylla</i> sparse shrubland G1: <i>Borya sphaerocephala</i> low isolated forbs CSF: <i>Acacia diallaga</i> (P1), <i>Allocasuarina tessellata</i> (P3) <i>Acacia diallaga</i> (P1) comes in; increases upslope	
17 – AdAa	28/11/23 10:20 am GPS: 502047 E/ 6776151 N Rocky hillslope; gentle; aspect east Similar SE sites: Q229	U1: <i>Allocasuarina dielsiana</i> isolated emergent tree (12m) U2: <i>Melaleuca hamata</i> , <i>Acacia acuminata</i> low open woodland (4/6 – 7m) M1: <i>Allocasuarina tessellata</i> , <i>Acacia diallaga</i> , <i>Acacia acuminata</i> shrubland (1.5 – 3m) CSF: <i>Acacia diallaga</i> (P1), <i>Allocasuarina tessellata</i> (P3)	
18 – AdAa	28/11/23 10:25 am GPS: 502006 E/ 6776159 N 389m Rocky hillslope; dolerite >70%	U1: <i>Melaleuca hamata</i> low open woodland M1: <i>Allocasuarina tessellata</i> , <i>Acacia diallaga</i> , <i>Allocasuarina dielsiana</i> , <i>Acacia acuminata</i> , <i>Hemigenia</i> sp. shrubland (30 – 40%) G1: <i>Borya sphaerocephala</i> low forbland 20 – 30/40% CSF: <i>Acacia diallaga</i> (P1) (200 +), <i>Allocasuarina tessellata</i> (P3)	



Site	Description		Image
19 – AdAa	28/11/23 10:34 am GPS: 502027 E/ 6776078 N 390m Hill; midslope; moderate slope; aspect east Surface rock dolerite, quartz >70%	U1: <i>Melaleuca hamata</i> , <i>Allocasuarina dielsiana</i> , <i>Brachychiton gregorii</i> low open woodland M1: <i>Allocasuarina tessellata</i> , <i>Acacia acuminata</i> open shrubland (1 – 2.5m; 25 – 30/40%) M2: <i>Acacia diallaga</i> , <i>Grevillea scabrida</i> , <i>Acacia tetragonophylla</i> , <i>Melaleuca radula</i> open shrubland G1: <i>Borya sphaerocephala</i> low forbland CSF: <i>Acacia diallaga</i> (P1), <i>Allocasuarina tessellata</i> (P3), <i>Grevillea scabrida</i> (P3)	
20 – AdAa	28/11/23 10:42 am GPS: 502084 E/ 6776030 N 381m Midslope; aspect east	U1: <i>Melaleuca hamata</i> , <i>Acacia acuminata</i> isolated low trees M1: <i>Allocasuarina tessellata</i> , <i>Acacia diallaga</i> , <i>Dodonaea amplisemina</i> shrubland G1: <i>Borya sphaerocephala</i> low forbland CSF: <i>Acacia diallaga</i> (P1), <i>Allocasuarina tessellata</i> (P3), <i>Dodonaea</i> <i>amplisemina</i> (P4)	
21 – AdAa	28/11/23 10:48 am GPS: 502221 E/ 6776024 N 379m Hill, lower slope; east aspect	U1: <i>Melaleuca hamata</i> , <i>Acacia acuminata</i> tall shrubland M1: <i>Allocasuarina tessellata</i> , <i>Acacia acuminata</i> , <i>Comesperma</i> <i>integerimum</i> open shrubland M2: <i>Acacia tetragonophylla</i> , <i>Grevillea scabrida</i> , <i>Micromyrtus trudgenii</i> , <i>Acacia ramulosa</i> var. <i>ramulosa</i> low sparse shrubland G1: <i>Borya sphaerocephala</i> low forbland CSF: <i>Allocasuarina tessellata</i> (P3), <i>Grevillea scabrida</i> (P3), <i>Micromyrtus</i> <i>trudgenii</i> (P3)	



Site	Description		Image
22 – AdAa	28/11/23 11:34 am GPS: 501366 E/ 6779936 N 384m North of Warriedar Coppermine Road Surface rock: granite, ironstone gravel, siltstone Similar SE sites: Q219/ 229	U1: <i>Melaleuca hamata</i> isolated low trees U2: <i>Acacia acuminata</i> tall shrubland M1: <i>Styphelia serratifolia</i> low isolated shrubs Other species: <i>Allocasuarina dielsiana</i>, <i>Acacia umbraculiformis</i>, <i>Acacia diallaga</i>, <i>Allocasuarina ?campestris</i> (sterile), <i>Persoonia pentasticha</i>, <i>Grevillea scabrida</i>, <i>Senna</i> sp. Austin CSF: <i>Acacia diallaga</i> (P1), <i>Grevillea scabrida</i> (P3), <i>Persoonia pentasticha</i> (P3)	
23 – AdAa	28/11/23 12:07 pm GPS: 499755 E/ 6779483 N 403m Low hill; surface rock (ironstone, quartz, granite) >50%	U1: <i>Melaleuca hamata</i> low open woodland M1: <i>Allocasuarina tessellata</i>, <i>Acacia acuminata</i> tall shrubland M2: <i>Xanthosia kochii</i>, <i>Micromyrtus trudgenii</i>, <i>Acacia tetragonophylla</i>, <i>Styphelia serratifolia</i> low sparse shrubland G1: <i>Borya sphaerocephala</i> low isolated forbs CSF: <i>Acacia karinae</i> (P3) – GPS: 499714 E/ 6779522 (x11)	
24 – AdAa	28/11/23 12:17 pm GPS: 499744 E/ 6779521 N 408m	U1: <i>Melaleuca hamata</i> low open woodland M1: <i>Allocasuarina tessellata</i>, <i>Acacia karinae</i> tall shrubland (1.7 – 3m) G1: <i>Xanthosia kochii</i>, <i>Acacia karinae</i> low sparse shrubland G2: <i>Borya sphaerocephala</i> low sparse forbland Other species: <i>Hemigenia</i> sp., <i>Mirbelia</i> sp. Bursarioides, <i>Melaleuca radula</i>, <i>Acacia acuminata</i>, <i>Grevillea scabrida</i> CSF: <i>Acacia karinae</i> (P3), <i>Allocasuarina tessellata</i> (P3), <i>Grevillea scabrida</i> (P3)	



Site	Description	Image
25 – AdAa	28/11/23 12:32 pm GPS: 499369 E/ 6780196 N Valley; mid catchment M1: <i>Acacia acuminata</i>, <i>Allocasuarina tessellata</i>, <i>Allocasuarina dielsiana</i> tall shrubland M2: <i>Acacia acuminata</i>, <i>Allocasuarina tessellata</i>, <i>A. dielsiana</i> open shrubland G1: <i>Grevillea scabrida</i>, <i>Acacia acuminata</i>, <i>Styphelia serratifolia</i> low sparse shrubland CSF: <i>Allocasuarina tessellata</i> (P3), <i>Grevillea scabrida</i> (P3)	
26a – AdAt	28/11/23 12:42 pm GPS: 499197 E/ 6780414 N Hill crest; gentle slope; aspect NE Surface rock (quartz, granite) >50% U1 <i>Melaleuca hamata</i>, <i>Allocasuarina tessellata</i> tall shrubland M1 <i>Allocasuarina tessellata</i> isolated shrubs G1 <i>Borya sphaerocephala</i> low forbland (>50%) Tall shrubland with open forbland patches Other species: <i>Exocarpos aphyllus</i>, <i>Persoonia pentasticha</i> CSF: <i>Allocasuarina tessellata</i> (P3), <i>Persoonia pentasticha</i> (P3)	
26b – AdAa	28/11/23 12:47 pm GPS: 499186 E/ 6780372 N Hill; ridge, broad, gentle slope U1: <i>Acacia umbraculiformis</i>, <i>Melaleuca hamata</i>, <i>Allocasuarina tessellata</i>, <i>Santalum spicatum</i> low open woodland M1: <i>Acacia tetragonophylla</i>, <i>Allocasuarina tessellata</i>, <i>Alyxia buxifolia</i>, <i>Acacia umbraculiformis</i> open shrubland M2: <i>Solanum lasiophyllum</i>, <i>Styphelia serratifolia</i>, <i>Grevillea scabrida</i> low isolated shrubs CSF: <i>Allocasuarina tessellata</i> (P3), <i>Grevillea scabrida</i> (P3)	



Site	Description	Image
27 – AdAa	28/11/23 1:04 pm GPS: 499095 E/ 6780531 N 418m Hill; upper slope; gentle, aspect north; surface rock (granite, quartz, greenstone, dolerite) 40 – 50% U1: <i>Melaleuca hamata</i>, <i>Acacia acuminata</i> low open woodland (4 – 6m) M1: <i>Allocasuarina tessellata</i>, <i>Acacia diallaga</i> shrubland M2: <i>Dodonaea amplisemina</i> low isolated shrubs G2: <i>Borya sphaerocephala</i> low open forbland CSF: <i>Acacia diallaga</i> (P1), <i>Allocasuarina tessellata</i> (P3), <i>Dodonaea amplisemina</i> (P4)	
28 – AdAa	28/11/23 GPS: 499869 E/ 6780941 N Near Warriedar Mine Hill; lower slope grading to plain <i>Allocasuarina tessellata</i> (>5) in <i>Acacia ramulosa</i> var. <i>ramulosa</i>, <i>A. acuminata</i>, <i>A. tetragonophylla</i> tall shrubland over <i>Eremophila clarkei</i>, <i>Hibbertia arcuata</i>, <i>Persoonia pentasticha</i> low sparse shrubland Small patch (<10m²) <i>Allocasuarina dielsiana</i> isolated low trees over <i>Acacia acuminata</i>, <i>Allocasuarina tessellata</i>, <i>Philotheca sericea</i>, <i>Aluta aspera</i> subsp. <i>hesperia</i> open shrubland CSF: <i>Allocasuarina tessellata</i> (P3), <i>Persoonia pentasticha</i> (P3)	
29 – AdAa	28/11/23 2:10 pm GPS: 497773 E/ 6780175 N 411m Hill; lower slope; aspect north U1: <i>Melaleuca hamata</i> low isolated trees M1: <i>Acacia acuminata</i>, <i>Allocasuarina tessellata</i> tall shrubland M2: <i>Grevillea scabrida</i>, <i>Melaleuca radula</i>, <i>Styphelia serratifolia</i>, <i>Acacia tetragonophylla</i>, <i>Dianella revoluta</i> var. <i>divaricata</i> isolated shrubs G1: <i>Borya sphaerocephala</i> low open forbland CSF: <i>Allocasuarina tessellata</i> (P3), <i>Grevillea scabrida</i> (P3)	
30 – AdAt	28/11/23 2:30 pm GPS: 497664 E/ 6780037 N 411m Hill; lower slope; aspect north Minjar Haul Road U1: <i>Melaleuca hamata</i> low open woodland to low isolated trees M1: <i>Allocasuarina tessellata</i>, <i>Acacia acuminata</i>, <i>Persoonia manotricha</i>, <i>Acacia tetragonophylla</i> tall shrubland M2: <i>Grevillea scabrida</i> low isolated shrubs G1: <i>Borya sphaerocephala</i> low sparse forbland CSF: <i>Allocasuarina tessellata</i> (P3), <i>Grevillea scabrida</i> (P3)	



Site	Description	Image
31 – AdAa	28/11/23 2:35 pm GPS: 497785 E/ 6780045 N Hill; lower midslope; aspect north; surface rock (granite) >50%, outcrops U1: <i>Melaleuca hamata</i> low open woodland M1: <i>Allocasuarina tessellata</i>, <i>Acacia acuminata</i> open shrubland G1: <i>Borya sphaerocephala</i> low open forbland CSF: <i>Allocasuarina tessellata</i> (P3)	
32 – AdAa	28/11/23 3:00 pm GPS: 496260 E/ 6776461 N 412m Minjar Haul Road Edge; changing to <i>Eucalyptus kochii</i> and <i>E. loxophleba</i> subsp. <i>supralaevis</i> woodland GPS: 496296 E/ 6776471 N U1: <i>Melaleuca hamata</i>, <i>Acacia acuminata</i> low woodland (4 – 5m) M1: <i>Allocasuarina tessellata</i>, <i>Acacia ramulosa</i> var. <i>ramulosa</i>, <i>A. acuminata</i>, <i>Allocasuarina acutivalvis</i> subsp. <i>prinsepiana</i> tall shrubland M2: <i>Philotheca brucei</i> subsp. <i>brucei</i> sparse shrubland G1: <i>Dianella revoluta</i> var. <i>divaricata</i> low isolated shrubs CSF: <i>Allocasuarina tessellata</i> (P3)	
33 – AdAa	29/11/23 7:22 am GPS: 501935 E/ 6774725 N 376m Hill; lower mid slope; moderate slope; aspect west Surface rock 20 – 25% Condition excellent; pastoral impacts on lower slopes Lot of fallen timber U1: <i>Allocasuarina dielsiana</i> open woodland to isolated trees (8 – 12m) M1: <i>Allocasuarina tessellata</i>, <i>Acacia acuminata</i>, <i>Allocasuarina dielsiana</i>, <i>Brachychiton gregorii</i> tall open shrubland (3 – 5m) M2: <i>Allocasuarina tessellata</i>, <i>Acacia acuminata</i>, <i>Grevillea subtiliflora</i> sparse shrubland (1 – 2m) G1: <i>Grevillea scabrida</i>, <i>Ptilotus drummondii</i>, <i>Solanum cleistogamum</i>, <i>Acacia tetragonophylla</i>, <i>Solanum nummularium</i> low sparse shrubland <i>Eucalyptus loxophleba</i> subsp. <i>supralaevis</i> at change of vegetation lower slope CSF: <i>Allocasuarina tessellata</i> (P3), <i>Grevillea scabrida</i> (P3), <i>Grevillea subtiliflora</i> (P3)	



Site	Description	Image
34 – AdAa	29/11/23 7:29 am GPS: 502001 E/ 6774731 N 385m Midslope; moderate; rocky; aspect west to north west U1: <i>Allocasuarina dielsiana</i>, <i>Acacia acuminata</i> low open woodland (3 – 5m, 5 – 10%) M1: <i>Acacia acuminata</i>, <i>Allocasuarina tessellata</i>, <i>Acacia tetragonophylla</i>, <i>Acacia karinae</i> sparse shrubland (1.2 – 2m) M2: <i>Acacia diallaga</i>, <i>A. karinae</i>, <i>A. tetragonophylla</i> shrubland G1: <i>Grevillea scabrida</i>, <i>Ptilotus obovatus</i>, <i>Acacia diallaga</i> low sparse shrubland G2: <i>Borya sphaerocephala</i>, <i>Ptilotus drummondii</i> low open forbland CSF: <i>Acacia diallaga</i> (P1), <i>Acacia karinae</i> (P3), <i>Allocasuarina tessellata</i> (P3), <i>Grevillea scabrida</i> (P3)	
35 – AdAa	29/11/23 7:41 am GPS: 502073 E/ 6774662 N 394m Hill; upper slope; gentle slope; aspect north Surface rock (dolerite, quartz) >90% Water stressed; some crown death U1: <i>Allocasuarina dielsiana</i>, <i>Brachychiton gregorii</i> low open woodland (3 – 7m; 2 – 10%) M1: <i>Allocasuarina tessellata</i>, <i>Acacia karinae</i>, <i>Allocasuarina dielsiana</i>, <i>Micromyrtus trudgenii</i>, <i>Acacia diallaga</i>, <i>Grevillea subtiliflora</i> open shrubland M2: <i>Hemigenia</i> sp., <i>Acacia karinae</i>, <i>A. diallaga</i> isolated low shrubs G1: <i>Borya sphaerocephala</i> low open forbland CSF: <i>Acacia diallaga</i> (P1), <i>Acacia karinae</i> (P3), <i>Allocasuarina tessellata</i> (P3), <i>Grevillea subtiliflora</i> (P3), <i>Micromyrtus trudgenii</i> (P3)	
36 – AdAa	29/11/23 7:53 am GPS: 502122 E/ 6774504 N 403m Hill crest; gentle slope; aspect all directions Surface rock (dolerite) >90% Moderate crown deaths, water stressed DEC survey point MULG 15 U1: <i>Allocasuarina dielsiana</i>, <i>Brachychiton gregorii</i>, <i>Acacia acuminata</i> low open woodland (4 – 6m; 2 – 10%) M1: <i>Allocasuarina tessellata</i>, <i>Acacia acuminata</i>, <i>A. karinae</i>, <i>Micromyrtus trudgenii</i>, <i>Hemigenia</i> sp., <i>Acacia diallaga</i>, <i>Allocasuarina dielsiana</i> open shrubland (1 – 2.5m) M2: <i>Acacia diallaga</i>, <i>Allocasuarina tessellata</i>, <i>Acacia karinae</i>, <i>A. acuminata</i>, <i>Dodonaea amplisemina</i>, <i>Grevillea scabrida</i>, <i>Ptilotus obovatus</i>, <i>Micromyrtus trudgenii</i>, <i>Hemigenia</i> sp. low sparse shrubland G1: <i>Borya sphaerocephala</i> low open forbland CSF: <i>Acacia diallaga</i> (P1), <i>Acacia karinae</i> (P3), <i>Allocasuarina tessellata</i> (P3), <i>Grevillea scabrida</i> (P3), <i>Micromyrtus trudgenii</i> (P3), <i>Dodonaea amplisemina</i> (P4)	



Site	Description	Image
37 – AdAa	29/11/23 8:26 am GPS: 501554 E/ 6774523 N 382m Hill; lower slope; gentle to moderate; aspect east Surface rock (dolerite) 40 – 50% U1: <i>Allocasuarina dielsiana</i>, <i>Acacia acuminata</i> low isolated trees M1: <i>Allocasuarina tessellata</i>, <i>Acacia acuminata</i>, <i>Grevillea subtiliflora</i>, <i>Brachychiton gregorii</i>, <i>Allocasuarina dielsiana</i> tall sparse shrubland (1.5 – 3m) M2: <i>Acacia diallaga</i>, <i>Allocasuarina tessellata</i> isolated shrubs (0.5 – 1.2m) G1: <i>Borya sphaerocephala</i> low open forbland (< 0.2m) CSF: <i>Acacia diallaga</i> (P1), <i>Allocasuarina tessellata</i> (P3), <i>Grevillea subtiliflora</i> (P3)	
38 – AdAa	29/11/23 8:35 am GPS: 501421 E/ 6774584 N 397m Hill; midslope; moderate slope; aspect east Surface rock (dolerite, metabasalt) >80% U1: <i>Allocasuarina dielsiana</i>, <i>Melaleuca hamata</i> low open woodland (5 – 9m) M1: <i>Brachychiton gregorii</i>, <i>Allocasuarina tessellata</i>, <i>Acacia acuminata</i>, <i>Allocasuarina dielsiana</i> tall sparse shrubland/ low open woodland (2 – 4m) (trees, shrubs) M2: <i>Allocasuarina tessellata</i>, <i>Acacia acuminata</i>, <i>Acacia diallaga</i>, <i>A. tetragonophylla</i>, <i>Grevillea subtiliflora</i> open shrubland (1 – 2m) G1: <i>Grevillea scabrida</i>, <i>Styphelia serratifolia</i>, <i>Acacia diallaga</i> low isolated shrubs (0.2 – 0.6m) G2: <i>Borya sphaerocephala</i> low forbland (<0.2m) CSF: <i>Acacia diallaga</i> (P1), <i>Allocasuarina tessellata</i> (P3), <i>Grevillea scabrida</i> (P3), <i>Grevillea subtiliflora</i> (P3)	
39 – AdAa	29/11/23 8:54 am GPS: 501714 E/ 6774150 N 377 m U1: <i>Allocasuarina dielsiana</i>, <i>Melaleuca hamata</i>, <i>Acacia acuminata</i>, <i>A. ramulosa</i> var. <i>ramulosa</i> low woodland M1: <i>Allocasuarina tessellata</i>, <i>Acacia acuminata</i> open shrubland (1 – 2.5m) M2: <i>Acacia diallaga</i>, <i>Allocasuarina tessellata</i>, <i>Grevillea scabrida</i>, <i>Acacia karinae</i> low open shrubland CSF: <i>Acacia diallaga</i> (P1), <i>Acacia karinae</i> (P3), <i>Allocasuarina tessellata</i> (P3), <i>Grevillea scabrida</i> (P3)	



Site	Description	Image
40 - AdAt	29/11/23 9:14 am GPS: 502591 E/ 6771720 N Hill, summit; granite, laterite; aspect east/ west Surface rock (mostly lateritic gravel) >90% U1: <i>Acacia umbraculiformis</i>, <i>A. ramulosa</i> var. <i>ramulosa</i>, <i>Calycopeplus paucifolius</i>, <i>Allocasuarina acutivalvis</i> subsp. <i>prinsepiana</i>, <i>Brachychiton gregorii</i>, <i>Melaleuca nematophylla</i> (<i>Santalum spicatum</i> – dead) tall open shrubland M1: <i>Acacia ramulosa</i> var. <i>ramulosa</i>, <i>Allocasuarina acutivalvis</i> subsp. <i>prinsepiana</i>, <i>Philotheca sericea</i>, <i>Acacia tetragonophylla</i>, <i>Micromyrtus trudgenii</i> open shrubland (1 – 2m) M2: <i>Aluta aspera</i> subsp. <i>hesperia</i>, <i>Eremophila latrobei</i> subsp. <i>warty leaves</i>, <i>Acacia ramulosa</i> var. <i>ramulosa</i> low open shrubland CSF: <i>Micromyrtus trudgenii</i> (P3)	
41 – AdAa	29/11/23 9:28 am GPS: 502664 E/ 6771665 N Hill; upper slope; south aspect Surface rock (Metabasalt, loose rock and outcrops) >70% U1: <i>Acacia umbraculiformis</i>, <i>Melaleuca hamata</i> low open woodland (4 – 6m, 10 – 15%) M1: <i>Acacia karinae</i>, <i>Melaleuca hamata</i>, <i>Acacia diallaga</i>, <i>Calycopeplus paucifolius</i>, <i>Acacia umbraculiformis</i> tall open shrubland (1.5 – 3m) M2: <i>Acacia diallaga</i>, <i>A. karinae</i>, <i>A. tetragonophylla</i>, <i>Philotheca brucei</i> subsp. <i>brucei</i> sparse shrubland (0.6 – 1.5m, 2 – 10%) G1: <i>Ptilotus obovatus</i>, <i>Brachychiton gregorii</i>, <i>Solanum lasiophyllum</i> low isolated shrubs (0.2 – 0.5m) G2: <i>Borya sphaerocephala</i> low sparse forbland CSF: <i>Acacia diallaga</i> (P1), <i>Acacia karinae</i> (P3)	
42 - Not Rep BIF outcrop	29/11/23 11:30 am GPS: 502841 E/ 6778537 N 382m U1: <i>Acacia acuminata</i>, <i>A. ramulosa</i> var. <i>ramulosa</i>, <i>Allocasuarina dielsiana</i> low open woodland M1: <i>Philotheca brucei</i> subsp. <i>brucei</i>, <i>Eremophila clarkei</i>, <i>Mirbelia</i> sp., <i>Grevillea</i> sp., <i>Eremophila oldfieldii</i>, <i>Acacia tetragonophylla</i>, <i>Eremophila latrobei</i> subsp. <i>warty leaves</i> sparse shrubland	



Site	Description	Image
43 - Not Rep	29/11/23 11:55 am GPS: 501743 E/ 6773580 N 369 m Low rise; gentle; aspect south Surface rock (fine ironstone gravel) 40 – 50% U1: <i>Eucalyptus ewartiana</i>, <i>Acacia ramulosa</i> var. <i>ramulosa</i>, <i>Brachychiton gregorii</i>, <i>Acacia tetragonophylla</i> mallee woodland M1: <i>Acacia tetragonophylla</i>, <i>Grevillea scabrida</i>, <i>Acacia ramulosa</i> var. <i>ramulosa</i> low isolated shrubs Other species: <i>Ptilotus obovatus</i>, <i>Acacia andrewsii</i>, <i>Austrostipa</i> sp. <i>E. ewartiana</i> not included in any Spectrum Ecology (2021) vegetation descriptions CSF: <i>Grevillea scabrida</i> (P3)	
44 – AdAa	29/11/23 12:11 pm GPS: 501997 E/ 6772213 N 375m Hill; upper slope; rocky, moderate slope; aspect east Surface rock (dolerite, quartz) > 60% U1: <i>Allocasuarina dielsiana</i>, <i>Acacia umbraculiformis</i> low isolated trees U2: <i>Allocasuarina dielsiana</i>, <i>Acacia acuminata</i>, <i>A. ramulosa</i> var. <i>ramulosa</i> tall isolated shrubs M1: <i>Acacia karinae</i>, <i>A. diallaga</i>, <i>A. acuminata</i> open shrubland M2: <i>Acacia diallaga</i>, <i>Ptilotus obovatus</i>, <i>Acacia karinae</i>, <i>A. tetragonophylla</i>, <i>A. umbraculiformis</i> low sparse shrubland G1: <i>Borya sphaerocephala</i> low sparse forbland CSF: <i>Acacia diallaga</i> (P1), <i>Acacia karinae</i> (P3)	
45 – AdAa	29/11/23 12:30 pm GPS: 501794 E/ 6771938 N 392 m Hill; granitic, quartz with outcrops; aspect east to south east Surface rock >70% U1: <i>Acacia ramulosa</i> var. <i>ramulosa</i>, <i>A. umbraculiformis</i>, <i>Eremophila oldfieldii</i>, <i>Acacia tetragonophylla</i>, <i>Brachychiton gregorii</i> tall shrubland (30 – 40%) M1: <i>Scaevola spinescens</i>, <i>Acacia ramulosa</i> var. <i>ramulosa</i>, <i>Senna</i> sp. Austin sparse shrubland (1 – 1.5m) M2: <i>Ptilotus obovatus</i>, <i>Acacia ramulosa</i> var. <i>ramulosa</i>, <i>A. umbraculiformis</i>, <i>Maireana triptera</i>, <i>Maireana</i> sp. low isolated shrubs	



Site	Description	Image
46 – AdAa	29/11/23 12:46 pm GPS: 501944 E/ 6772488 N 380m Hill; upper slope; gentle; aspect north; elevated stony plain Surface rock (quartz, dolerite) >60% U1: <i>Allocasuarina dielsiana</i>, <i>Acacia umbraculiformis</i> low isolated trees M1: <i>Acacia diallaga</i>, <i>Acacia umbraculiformis</i>, <i>Acacia tetragonophylla</i>, <i>Hakea recurva</i> subsp. <i>arida</i> isolated shrubs M2: <i>Ptilotus obovatus</i>, <i>Allocasuarina dielsiana</i>, <i>Solanum lasiophyllum</i> low isolated shrubs G1: <i>Borya sphaerocephala</i> low open forbland CSF: <i>Acacia diallaga</i> (P1)	
47 – AdAa	29/11/23 12:52 pm GPS: 501921 E/ 6772366 N 386m Hill; ridge; aspect NE Rocky (quartz, dolerite) >60% U1: <i>Allocasuarina dielsiana</i>, <i>Acacia umbraculiformis</i> low isolated trees to low open woodland M1: <i>Acacia tetragonophylla</i>, <i>Allocasuarina dielsiana</i> tall sparse shrubland (2 – 3 m; < 2%) M2: <i>Acacia diallaga</i>, <i>Melaleuca radula</i>, <i>Acacia tetragonophylla</i>, <i>Eremophila clarkei</i> shrubland (0.9 – 1.5 m; 30 – 40%) G1: <i>Ptilotus obovatus</i>, <i>Solanum lasiophyllum</i> low isolated shrubs (0.2 – 0.5 m; <2%) G2: <i>Borya sphaerocephala</i> low sparse forbland CSF: <i>Acacia diallaga</i> (P1)	
48 – AdAa	29/11/23 1:20 pm GPS: 502215 E/ 6771901 N 382m Hill; dolerite ridge (north – south); surface rock (dolerite; loose, outcrop) >90% Disturbance: access track for drill lines U1: <i>Allocasuarina dielsiana</i>, <i>Acacia umbraculiformis</i>, <i>Brachychiton gregorii</i> low isolated trees (<1%) M1: <i>Acacia diallaga</i>, <i>Melaleuca radula</i>, <i>Hemigenia</i> sp., <i>Thryptomene costata</i>, <i>Acacia acuminata</i> shrubland (50 – 70%) CSF: <i>Acacia diallaga</i> (P1)	



Site	Description	Image
49 - Not Rep	29/11/23 GPS: 501796 E/ 6770544 N 371m Rehabilitation <i>Acacia karinae</i> closed shrubland (> 70%) CSF: <i>Acacia karinae</i> (P3)	
50 - Not Rep	29/11/23 1:48 pm GPS: 501667 E/ 6770485 N 379m Low hill; aspect north; gentle slope Surface rock (Metabasalt, siltstone, quartz, granite) 15 – 20% Lot of disturbance; historic mining and pastoral activities; erosion active U1: <i>Acacia umbraculiformis</i>, <i>Eremophila oldfieldii</i> low open woodland M1: <i>Acacia ramulosa</i> var. <i>ramulosa</i>, <i>A. karinae</i>, <i>Senna</i> sp. Austin sparse shrubland G1: <i>Ptilotus obovatus</i>, <i>Solanum lasiophyllum</i> low sparse shrubland Other species: <i>Eucalyptus loxophleba</i> subsp. <i>supralaavis</i>, <i>Brachychiton gregorii</i> CSF: <i>Acacia karinae</i> (P3)	
51 – AdAa	29/11/23 1:54 pm GPS: 501651 E/ 6770398 N 381 m Hill; rocky ridge (east – west) Surface rock (dolerite, granite) >90% on ridge; 80 – 90% on slopes Granite outcrops below ridge, long narrow (dyke) U1: <i>Brachychiton gregorii</i>, <i>Melaleuca hamata</i>, <i>Acacia ramulosa</i> var. <i>ramulosa</i>, <i>A. acuminata</i> low open woodland M1: <i>Acacia karinae</i>, <i>Hemigenia</i> sp. open shrubland M2: <i>Ptilotus obovatus</i>, <i>Acacia ramulosa</i> var. <i>ramulosa</i>, <i>Austrostipa</i> sp., <i>Solanum lasiophyllum</i>, <i>Sida</i> sp. (?calyxhymenia) Other species: <i>Allocasuarina dielsiana</i>, <i>Acacia umbraculiformis</i> CSF: <i>Acacia karinae</i> (P3)	



Site	Description	Image
52 – AdAa	29/11/23 2:17 pm GPS: 501649 E/ 6770613 N Low hill; aspect south; gentle becoming steeper upslope Surface rock (metabasalt, granitic rock) 10 – 20% U1: <i>Melaleuca hamata</i>, <i>Acacia acuminata</i>, <i>A. ramulosa</i> var. <i>ramulosa</i>, <i>Allocasuarina dielsiana</i>, <i>Brachychiton gregorii</i> low isolated trees (6 – 10m) M1: <i>Acacia ramulosa</i> var. <i>ramulosa</i>, <i>A. acuminata</i>, <i>Brachychiton gregorii</i>, <i>Acacia karinae</i>, <i>Acacia diallaga</i> tall open shrubland (2 – 4m) M2: <i>Acacia karinae</i>, <i>A. acuminata</i>, <i>Eremophila clarkei</i>, <i>Acacia tetragonophylla</i>, <i>Hemigenia</i> sp. sparse shrubland (1 – 2m) G1: <i>Ptilotus obovatus</i>, <i>Solanum lasiophyllum</i>, <i>Leptosema aphyllum</i>, <i>Mirbelia</i> sp. low sparse shrubland G2: <i>Borya sphaerocephala</i> low sparse forbland CSF: <i>Acacia diallaga</i> (P1), <i>Acacia karinae</i> (P3)	
53 - Not Rep	29/11/23 2:55 pm GPS: 502919 E/ 6769220 N Breakaway system; sheet granite to west with breakaway; description site just uphill Low hill; gentle slope; aspect NW U1: <i>Acacia ramulosa</i> var. <i>ramulosa</i>, <i>A. umbraculiformis</i> low woodland M1: <i>Eremophila forrestii</i> subsp. <i>forrestii</i>, <i>E. latrobei</i> subsp. <i>warty leaves</i>, <i>Philotheca brucei</i> subsp. <i>brucei</i>, <i>Hakea recurva</i> subsp. <i>recurva</i> sparse shrubland G1: <i>Ptilotus obovatus</i>, <i>Solanum lasiophyllum</i> low sparse shrubland	
54 - AdAt	30/11/23 6:25 am GPS: 489783 E/ 6760990 N 341 m Low hill; upper slope; gentle slope; aspect east Rothsay area U1: <i>Allocasuarina dielsiana</i>, <i>Acacia umbraculiformis</i>, <i>A. ramulosa</i> var. <i>ramulosa</i> low woodland M1: <i>Acacia tetragonophylla</i>, <i>A. ramulosa</i> var. <i>ramulosa</i>, <i>Calycopeplus paucifolius</i>, <i>Acacia assimilis</i> subsp. <i>assimilis</i> tall open shrubland M2: <i>Acacia exocarpoides</i>, <i>Philotheca brucei</i> subsp. <i>brucei</i>, <i>Thryptomene decussata</i> sparse shrubland	



Site	Description		Image
55 - Not Rep AaAr (Similar to Q218)	30/11/23 6:50 am GPS: 492673 E/ 6765211 N 366 m Hill; upper slope; aspect south; gentle slope becoming moderate; laterite, ironstone	U1: <i>Acacia caesaneura</i> , <i>Melaleuca nematophylla</i> low isolated trees M1: <i>Acacia ramulosa</i> var. <i>ramulosa</i> , <i>A. assimilis</i> subsp. <i>assimilis</i> , <i>Grevillea obliquistigma</i> subsp. <i>obliquistigma</i> , <i>Acacia caesaneura</i> , <i>Allocasuarina acutivalvis</i> , <i>Calycopeplus paucifolius</i> , <i>Melaleuca nematophylla</i> tall shrubland M2: <i>Philotheca sericea</i> , <i>Eremophila clarkei</i> , <i>E. latrobei</i> , <i>Aluta aspera</i> subsp. <i>hesperia</i> shrubland	
56 – AdAa	30/11/23 7:07 am GPS: 493295 E/ 6765979 N 355m Hill; lower slope; gentle slope; aspect east Surface rock (dolerite, granite, quartz) <20%, minor outcrops Old Rothsay Road	U1: <i>Allocasuarina dielsiana</i> , <i>Acacia acuminata</i> low open woodland (5 – 8m) M1: <i>Acacia ramulosa</i> var. <i>ramulosa</i> , <i>A. acuminata</i> , <i>A. tetragonophylla</i> , <i>Santalum spicatum</i> tall open shrubland (2 – 4m) M2: <i>Acacia ramulosa</i> var. <i>ramulosa</i> , <i>A. tetragonophylla</i> , <i>A. exocarpoides</i> , <i>Melaleuca hamata</i> open shrubland (1 – 2m) G1: <i>Borya sphaerocephala</i> low isolated forbs Other species: <i>Eucalyptus loxophleba</i> subsp. <i>supralaevis</i> (at edge); <i>Eremophila oldfieldii</i> subsp. <i>oldfieldii</i>	
57 – AdAa	30/11/23 7:22 am GPS: 493662 E/ 6766447 N 348m Hill; lower slope; aspect east Old Rothsay Road	U1: <i>Allocasuarina dielsiana</i> low open woodland M1: <i>Acacia ramulosa</i> var. <i>ramulosa</i> , <i>A. tetragonophylla</i> , <i>Brachychiton gregorii</i> tall sparse shrubland M2: <i>Solanum lasiophyllum</i> , <i>Ptilotus obovatus</i> , <i>Hemigenia</i> sp. low isolated shrubs G1: <i>Borya sphaerocephala</i> low forbland	



Site	Description	Image
58 – AdAa	30/11/23 7:58 am GPS: 492978 E/ 6771209 N Low hill; gentle slope; east aspect Surface rock (quartz, siltstone, chert) 20 – 40% Mulga Track Mallee fowl mound GPS: 493036 E/ 6771211 N – monitored – crossed sticks in place U1: <i>Allocasuarina dielsiana</i> patches of low woodland M1: <i>Acacia ramulosa</i> var. <i>ramulosa</i>, <i>A. acuminata</i>, <i>A. tetragonophylla</i> tall open shrubland G1: <i>Ptilotus obovatus</i>, <i>Solanum lasiophyllum</i>, <i>Micromyrtus trudgenii</i> low isolated shrubs Other species: <i>Acacia umbraculiformis</i>, <i>Santalum spicatum</i> CSF: <i>Micromyrtus trudgenii</i> (P3)	
59a – AdAa	30/11/23 8:13 am GPS: 492395 E/ 6771258 N 397 m Mulga Track Hill; crest; gentle slope; aspect south/ east Surface rock (granitic, dolerite, quartz, siltstone) 10% DEC Rothsay description site ROTH02 27/11/2011 U1: <i>Allocasuarina dielsiana</i>, <i>Melaleuca hamata</i>, <i>Acacia umbraculiformis</i> low open woodland M1: <i>Acacia ramulosa</i> var. <i>ramulosa</i>, <i>A. umbraculiformis</i>, <i>A. acuminata</i>, <i>Allocasuarina</i> sp. tall open shrubland M2: <i>Acacia ramulosa</i> var. <i>ramulosa</i>, <i>Grevillea scabrida</i> isolated shrubs G1: <i>Grevillea scabrida</i>, <i>Acacia umbraculiformis</i>, <i>Ptilotus obovatus</i> low sparse shrubland G2: <i>Borya sphaerocephala</i> low open forbland Other species: <i>Senna artemisioides</i> subsp. <i>filifolia</i>, <i>Dodonaea inaequifolia</i>, <i>Senna</i> sp. Austin CSF: <i>Grevillea scabrida</i> (P3)	
59b – AdAa	30/11/23 8:21 am GPS: 492368 E/ 6771314 N 395m Hill; ridge, broad gentle slope (east – west) Mulga Track Rabbits U1: <i>Acacia umbraculiformis</i>, <i>Eremophila oldfieldii</i> subsp. <i>oldfieldii</i>, <i>Allocasuarina dielsiana</i> tall shrubland M1: <i>Acacia tetragonophylla</i>, <i>Alyxia buxifolia</i>, <i>Senna artemisioides</i> subsp. <i>filifolia</i> open shrubland M2: <i>Ptilotus obovatus</i>, <i>Grevillea scabrida</i> low isolated shrubs Other species: <i>Allocasuarina tessellata</i> – isolated CSF: <i>Allocasuarina tessellata</i> (P3), <i>Grevillea scabrida</i> (P3)	



Site	Description	Image
60a – AdAa	30/11/23 8:33 am GPS: 492409 E/ 6771110 N 393m Hill; ridge; gentle slope; aspect south Mulga Track U1: <i>Melaleuca hamata</i> low open woodland (6 – 9m) M1: <i>Allocasuarina tessellata</i>, <i>Acacia acuminata</i>, <i>Allocasuarina dielsiana</i> tall open shrubland (2 – 4m) M2: <i>Allocasuarina tessellata</i>, <i>Hemigenia yalgensis</i>, <i>Acacia acuminata</i>, <i>Grevillea scabrida</i>, <i>Micromyrtus trudgenii</i> sparse shrubland (1 – 2m) G1: <i>Grevillea scabrida</i>, <i>Styphelia serratifolia</i>, <i>Acacia acuminata</i> low sparse shrubland (0.2 – 0.6m) G2: <i>Borya sphaerocephala</i> low isolated forbs CSF: <i>Allocasuarina tessellata</i> (P3), <i>Grevillea scabrida</i> (P3), <i>Micromyrtus trudgenii</i> (P3)	
60b – AdAa	30/11/23 8:39 am GPS: 492381 E/ 6771121 N Surface rock (granitic, quartz, dolerite) 30 – 40% U1: <i>Melaleuca hamata</i>, <i>Acacia acuminata</i> low open woodland M1: <i>Allocasuarina tessellata</i> sparse shrubland M2: <i>Melaleuca radula</i>, <i>Grevillea scabrida</i> low sparse shrubland G1: <i>Borya sphaerocephala</i> low forbland CSF: <i>Allocasuarina tessellata</i> (P3), <i>Grevillea scabrida</i> (P3)	
61a - AdAt	30/11/23 9:07 am GPS: 492193 E/ 6771206 N 387m Valley; gentle slope; aspect west Surface rock (siltstone, ironstone, quartz) 20 – 40% Mulga Track U1: <i>Melaleuca hamata</i>, <i>Allocasuarina tessellata</i>, <i>Amyema</i> sp. low open woodland (6 – 8m) M1: <i>Allocasuarina tessellata</i> tall closed shrubland (2.3 – 3m) G1: <i>Borya sphaerocephala</i> low isolated forbs Other species: <i>Acacia acuminata</i>, <i>A. tetragonophylla</i>, <i>Allocasuarina dielsiana</i>, <i>Grevillea scabrida</i>, <i>Melaleuca radula</i>, <i>Styphelia serratifolia</i> CSF: <i>Allocasuarina tessellata</i> (P3), <i>Grevillea scabrida</i> (P3)	



Site	Description	Image
61b - AdAt	30/11/23 GPS: 492228 E/ 6771220 N Surface rock (quartz, ironstone) 40 – 50% More open areas - <i>Melaleuca hamata</i> low isolated trees to open woodland over <i>Allocasuarina tessellata</i> shrubland to open shrubland over <i>Borya sphaerocephala</i> low open forbland CSF: <i>Allocasuarina tessellata</i> (P3)	
62 – AdAa	30/11/23 9:36 am GPS: 487985 E/ 6770410 N 389m Mulga Track South Low hill; aspect north; gentle slope Surface rock (granite, quartz) 30 – 40% U1: <i>Allocasuarina dielsiana</i>, <i>Melaleuca hamata</i> low open woodland M1: <i>Acacia acuminata</i>, <i>Melaleuca hamata</i>, <i>Acacia tetragonophylla</i> tall sparse shrubland M2: <i>Acacia ramulosa</i> var. <i>ramulosa</i>, <i>A. acuminata</i>, <i>Grevillea scabrida</i> sparse shrubland G1: <i>Borya sphaerocephala</i> low sparse forbland CSF: <i>Grevillea scabrida</i> (P3)	
63 – AdAa	30/11/23 9:44 am GPS: 487699 E/ 6770285 N 387m Mulga Track South U1: <i>Acacia acuminata</i>, <i>Allocasuarina tessellata</i>, <i>A. dielsiana</i> tall shrubland M1: <i>Allocasuarina tessellata</i>, <i>Acacia acuminata</i> open to sparse shrubland G1: <i>Borya sphaerocephala</i> low sparse forbland CSF: <i>Allocasuarina tessellata</i> (P3)	



Site	Description	Image
64 – AdAa	30/11/23 10:02 am GPS: 487919 E/ 6768479 N Hill; upper slope; gentle slope along ridge, with moderate slope to south Thick litter cover and fallen timber; surface rock > 60% with some large boulders (?granite) Lower shrubs very water stressed Mulga Track South	U1: <i>Melaleuca hamata</i>, <i>Acacia acuminata</i>, <i>Allocasuarina acutivalvis</i> subsp. <i>prinsepiana</i> woodland/ tall shrubland M1: <i>Allocasuarina tessellata</i>, <i>Exocarpos aphyllus</i> shrubland M2: <i>Cryptandra</i> sp., <i>Melaleuca radula</i>, <i>Solanum lasiophyllum</i>, <i>Acacia acanthoclada</i> subsp. <i>glaucescens</i>, <i>Dodonaea amplisemina</i> open shrubland CSF: <i>Allocasuarina tessellata</i> (P3), <i>Dodonaea amplisemina</i> (P4) 
65 - AdAt	30/11/23 10:34 am GPS: 487890 E/ 6768203 N 392 m Valley; gentle slope; drainage to west Surface rock >60% Rabbits Mulga Track South; just north of Tower	U1: <i>Melaleuca hamata</i>, <i>Acacia acuminata</i> low open woodland to low isolated trees M1: <i>Allocasuarina tessellata</i> tall shrubland G1: <i>Borya sphaerocephala</i> low open forbland Other species: <i>Dodonaea amplisemina</i>, <i>Grevillea scabrida</i> CSF: <i>Allocasuarina tessellata</i> (P3), <i>Grevillea scabrida</i> (P3), <i>Dodonaea amplisemina</i> (P4) 
66 - Not Rep	30/11/23 10:49 am GPS: 487936 E/ 6769259 N 405 m Low rocky hill; gentle to moderate slope; aspect west Surface rock (dolerite, granite) 40 – 50%	U1: <i>Allocasuarina dielsiana</i>, <i>Acacia acuminata</i>, <i>Eucalyptus loxophleba</i> subsp. <i>supralaevis</i> open woodland M1: <i>Acacia tetragonophylla</i>, <i>Eremophila oldfieldii</i> subsp. <i>oldfieldii</i>, <i>Acacia acuminata</i>, <i>Dodonaea inaequifolia</i>, <i>Exocarpos aphyllus</i> mixed open shrubland G1: <i>Ptilotus obovatus</i>, <i>Styphelia serratifolia</i> low sparse shrubland Surrounded by <i>Eucalyptus salubris</i> woodland to south, east, north 



Site	Description	Image
67 - AdAt	30/11/23 11:00 am GPS: 487686 E/ 6769387 N 395m Broad valley to lower slope of hill; aspect east Unnamed track M1: <i>Allocasuarina tessellata</i> tall shrubland M2: <i>Acacia acuminata</i>, <i>Allocasuarina tessellata</i> isolated shrubs G1: Grasses (dried off), <i>Allocasuarina tessellata</i>, <i>Sida calyxhymenia</i> low isolated shrubs in open tussock grassland G2: <i>Borya sphaerocephala</i> low isolated forbs CSF: <i>Allocasuarina tessellata</i> (P3)	
68 – AdAa	30/11/23 11:07 am GPS: 487498 E/ 6769398 N 402m Hill; ridge Surface rock (dolerite) >60% Unnamed track U1: <i>Allocasuarina dielsiana</i>, <i>Melaleuca hamata</i> low isolated trees M1: <i>Acacia acuminata</i>, <i>Allocasuarina tessellata</i> tall sparse shrubland M2: <i>Allocasuarina tessellata</i>, <i>Acacia diallaga</i> open shrubland G1: <i>Borya sphaerocephala</i> low forbland CSF: <i>Acacia diallaga</i> (P1), <i>Allocasuarina tessellata</i> (P3)	
69 - AdAt	30/11/23 11:19 am GPS: 487107 E/ 6769407 N 408m Hill, upper slope, moderate slope, aspect west Surface rock (granite, dolerite) >60%; lot of litter and fallen timber U1: <i>Allocasuarina dielsiana</i>, <i>Melaleuca hamata</i> low open woodland M1: <i>Allocasuarina tessellata</i>, <i>Acacia karinae</i>, <i>Grevillea subtiliflora</i>, <i>Acacia acuminata</i>, <i>Melaleuca radula</i> shrubland G1: <i>Borya sphaerocephala</i> low isolated forbs Seedlings of <i>Acacia karinae</i>, <i>Grevillea subtiliflora</i> quite common along edges of track CSF: <i>Acacia karinae</i> (P3), <i>Allocasuarina tessellata</i> (P3), <i>Grevillea subtiliflora</i> (P3)	



Site	Description	Image
70 – AdAa	30/11/23 11:33 am GPS: 486609 E/ 6769419 N 406m Hill, lower slope, moderate slope changing to gentle; aspect west Surface rock (granite/ gneiss) >60% U1: <i>Melaleuca hamata</i>, <i>Acacia umbraculiformis</i>, <i>Allocasuarina dielsiana</i> low isolated trees (6 – 9m) M1: <i>Allocasuarina tessellata</i>, <i>Acacia karinae</i>, <i>Acacia acuminata</i>, <i>Allocasuarina dielsiana</i> tall open shrubland M2: <i>Allocasuarina tessellata</i>, <i>Acacia karinae</i>, <i>A. umbraculiformis</i>, <i>Grevillea subtiliflora</i> sparse shrubland G1: <i>Dodonaea amplisemina</i> low isolated shrubs CSF: <i>Acacia karinae</i> (P3), <i>Allocasuarina tessellata</i> (P3), <i>Grevillea subtiliflora</i> (P3), <i>Dodonaea amplisemina</i> (P4)	
71 - AdAt	30/11/23 12:33 pm GPS: 494230 E/ 6774364 N 399m Lower slope/ valley; gentle slope; aspect west Surface rock (siltstone, ironstone, BIF) >80% P Track U1: <i>Allocasuarina dielsiana</i>, <i>Melaleuca hamata</i> low isolated trees M1: <i>Allocasuarina tessellata</i>, <i>Acacia acuminata</i> tall shrubland G1: <i>Borya sphaerocephala</i> low sparse forbland Other species (at edges): <i>Acacia tetragonophylla</i>, <i>Santalum spicatum</i> CSF: <i>Allocasuarina tessellata</i> (P3)	
72 - Not Rep	30/11/23 1:07 pm GPS: 494194 E/ 6771956 N 390m Hill; upper midslope; gentle slope; aspect east Surface rock 20 – 30% P Track U1: <i>Eucalyptus loxophleba</i> subsp. <i>supralaevis</i>, <i>Allocasuarina dielsiana</i> isolated trees M1: <i>Acacia ramulosa</i> var. <i>ramulosa</i> tall open shrubland M2: <i>Acacia karinae</i>, <i>A. ramulosa</i> var. <i>ramulosa</i>, <i>A. tetragonophylla</i>, <i>A. exocarpoides</i> sparse shrubland M3: <i>Solanum lasiophyllum</i>, <i>Acacia karinae</i>, <i>A. ramulosa</i> var. <i>ramulosa</i>, <i>Ptilotus obovatus</i> low isolated shrubs CSF: <i>Acacia karinae</i> (P1) x6	



Site	Description	Image
73 - Not Rep	30/11/23 2:27 pm GPS: 483306 E/ 6760762 N Hill; upper slope – crest; gentle slope; aspect NW Surface rock (dolerite) > 50% Perenjori Rothsay Rd U1: <i>Acacia umbraculiformis</i>, <i>Brachychiton gregorii</i>, <i>Allocasuarina dielsiana</i> low open woodland to low woodland M1: <i>Eremophila forrestii</i> subsp. <i>forrestii</i>, <i>Scaevola spinescens</i>, <i>Solanum lasiophyllum</i>, <i>Eremophila granitica</i>, <i>Sida</i> sp., <i>Acacia umbraculiformis</i>, <i>Ptilotus obovatus</i>, <i>Persoonia pentasticha</i> low open shrubland CSF: <i>Persoonia pentasticha</i> (P3)	
74 – AdAa	30/11/23 2:37 pm GPS: 482816 E/ 6760763 N 330m Hill; lower slope, rocky 30% Disturbances – road, historic mining, pastoral Perenjori Rothsay Rd U1: <i>Allocasuarina dielsiana</i>, <i>Melaleuca hamata</i>, <i>Acacia ramulosa</i> var. <i>ramulosa</i> low open woodland M1: <i>Acacia ramulosa</i> var. <i>ramulosa</i>, <i>A. acuminata</i>, <i>A. tetragonophylla</i> tall sparse shrubland M2: <i>Grevillea scabrida</i>, <i>Acacia kochii</i>, <i>A. acuminata</i>, <i>Solanum lasiophyllum</i> sparse shrubland CSF: <i>Grevillea scabrida</i> (P3)	
75 – AdAa Medium rep.	30/11/23 2:53 pm GPS: 478955 E/ 6760756 N 333m Hill, midslope; north west aspect Surface rock (ironstone gravel with scattered rocks) 30 – 40% Perenjori Rothsay Rd U1: <i>Allocasuarina dielsiana</i> open woodland (9 – 12 m) M1: <i>Acacia ramulosa</i> var. <i>ramulosa</i> tall open shrubland M2: <i>Acacia ramulosa</i> var. <i>ramulosa</i>, <i>A. karinae</i>, <i>A. obtecta</i>, <i>Grevillea hakeoides</i> subsp. <i>stenophylla</i>, <i>Acacia tetragonophylla</i>, <i>Eremophila eriocalyx</i> sparse shrubland G1: <i>Ptilotus obovatus</i>, <i>Acacia ramulosa</i> var. <i>ramulosa</i>, <i>Styphelia serratifolia</i>, <i>Acacia exocarpoides</i> low isolated shrubs CSF: <i>Acacia karinae</i> (P3)	



Site	Description	Image
76 – AdAa	30/11/23 3:11 pm GPS: 477166 E/ 6761526 N Hill; midslope; gentle to moderate; north aspect Surface rock (dolerite) >70% Perenjori Rothsay Rd U1: <i>Allocasuarina dielsiana</i> isolated trees U2: <i>Acacia umbraculiformis</i>, <i>Allocasuarina dielsiana</i>, <i>Acacia acuminata</i> tall open shrubland M1: <i>Acacia umbraculiformis</i>, <i>A. karinae</i>, <i>A. kochii</i>, <i>Dodonaea inaequifolia</i>, <i>Grevillea scabrida</i>, <i>Austrostipa elegantissima</i> open shrubland G1: <i>Borya sphaerocephala</i>, <i>Solanum lasiophyllum</i>, <i>S. cleistogamum</i> low sparse forbland CSF: <i>Acacia karinae</i> (P3), <i>Grevillea scabrida</i> (P3)	
77 – AdAa	27/11/23 15:54 pm GPS: 488019 E/ 6759661 N Low rise Perenjori Rothsay Rd U1: <i>Allocasuarina dielsiana</i>, <i>Melaleuca hamata</i> low open woodland M1: <i>Acacia ramulosa</i> var. <i>ramulosa</i>, <i>A. acuminata</i>, <i>Allocasuarina acutivalvis</i> subsp. <i>prinsepiana</i>, <i>Dodonaea inaequifolia</i> tall open shrubland M2: <i>Acacia acuminata</i>, <i>Senna artemisioides</i> subsp. <i>filifolia</i>, <i>Solanum lasiophyllum</i> low sparse shrubland	
78 – AdAa	27/11/23 4:05 pm GPS: 487565 E/ 6759707 N Low hill; gentle slope; aspect south to SW Dense litter and fallen timber cover; surface rock (granite/ gneiss, ?dolerite, laterite) 20 – 25% Perenjori Rothsay Rd U1: <i>Melaleuca hamata</i>, <i>Allocasuarina dielsiana</i>, <i>Acacia acuminata</i> low woodland (5 – 8 m) M1: <i>Allocasuarina tessellata</i>, <i>Acacia acuminata</i>, <i>Persoonia manotricha</i>, <i>Exocarpos aphyllus</i> tall shrubland (1.7 – 3 m) M2: <i>Solanum lasiophyllum</i>, <i>Allocasuarina tessellata</i>, <i>Halgania anagalloides</i>, <i>Leptosema aphyllum</i> low sparse shrubland G1: <i>Borya sphaerocephala</i> low isolated forbs CSF: <i>Allocasuarina tessellata</i> (P3)	



Site	Description	Image
79 – AdAa	27/11/23 4:11 pm GPS: 487483 E/ 6759716 N Low hill; gentle slope; aspect SW Surface rock (quartz, siltstone) 20 – 25% Perenjori Rothsay Rd U1: <i>Allocasuarina dielsiana</i>, <i>Melaleuca hamata</i>, <i>Acacia acuminata</i> low woodland M1: <i>Allocasuarina tessellata</i>, <i>Acacia tetragonophylla</i>, <i>Dodonaea inaequifolia</i> open shrubland M2: <i>Grevillea scabrida</i>, <i>Styphelia serratifolia</i>, <i>Solanum lasiophyllum</i>, <i>Persoonia pentasticha</i>, <i>Halgania anagalloides</i> low sparse shrubland CSF: <i>Allocasuarina tessellata</i> (P3), <i>Grevillea scabrida</i> (P3), <i>Persoonia pentasticha</i> (P3)	
80 – AdAa	27/11/23 GPS: 483688 E/ 6760684 N Low rocky ridge/outcrop, trending SE – NW Surface rock varies 20/40 – 60% Perenjori Rothsay Rd U1: <i>Allocasuarina dielsiana</i>, <i>Acacia acuminata</i> low isolated trees M1: <i>Allocasuarina tessellata</i>, <i>Acacia acuminata</i>, <i>Micromyrtus trudgenii</i>, <i>Acacia umbraculiformis</i>, <i>Acacia kochii</i>, <i>Mirbelia</i> sp. <i>Bursarioides</i> shrubland G1: <i>Borya sphaerocephala</i> low isolated forbs CSF: <i>Allocasuarina tessellata</i> (P3), <i>Micromyrtus trudgenii</i> (P3)	

SE refers to Spectrum Ecology (2021) sites

Appendix B – Resurveying Spectrum Ecology’s (2021) *Acacia duriuscula* Quadrats

In 2025, JBBC with the support of ISPL undertook a targeted flora survey for TGN over proposed operational areas and potential *Acacia sulcaticaulis* (EN) areas (JBBC & ISPL, 2026). During the targeted survey, the Spectrum Ecology (2021) quadrats M004 and M010 were revisited to verify the presence of *Acacia duriuscula* (Figure B.1). An area of approximately 30m x 30m was searched for the species; any species with similarities to *Acacia duriuscula* were recorded.

It was noted that Spectrum Ecology (2021) recorded the height of *Acacia duriuscula* as 4m in quadrat M004; as such, tall *Acacia* species were targeted during the 2025 targeted survey. A tall *Acacia* sp. shrub with smoothish bark and pods with seed was located in the quadrat (Figure B.2) with a specimen collected for identification. The seeds of the specimen were dark brown, not mottled and 4-5mm long. The pods were also fairly uniform in diameter along the length of the pod with no obvious areas raised above the seed. In comparison, *A. duriuscula* seeds are longitudinal, 3.0-3.5mm long, glossy, black-brown and mottled with the pod slightly raised over the seeds (Figure B.3). Images of *A. duriuscula* bark shows it as quite rough, although, Maslin (2018) does not describe it as such.

After studying the specimen, it was determined that it most likely belongs to the *Acacia coolgardiensis* group and particularly, the species *Acacia latior*. *A. latior* is most closely related to *Acacia sulcaticaulis* (EN) and is very variable in its phyllode shape and size. For example, a variant with narrower than normal phyllodes (2-4mm) is common within the Blue Hills area. The species may also hybridise with other members of the *A. coolgardiensis* group (e.g. *A. effusifolia*). Pods of *A. latior* are similar in appearance to *A. sulcaticaulis* (EN) but are slightly larger along with their seeds. Comparing the specimen to specimens lodged at the Western Australian Herbarium has confirmed it is *Acacia latior*.

The survey at quadrat M010 did not identify *Acacia duriuscula*; however, *Acacia ramulosa* var. *ramulosa* and *Senna* sp. Austin were present which have similarities to the species. In Spectrum Ecology’s (2021) species list for the quadrat, *Senna* sp. Austin was recorded but not *Acacia ramulosa* var. *ramulosa*, indicating it was most likely mistaken for *A. duriuscula*. The phyllodes for *Acacia ramulosa* var. *ramulosa* are 7-15cm long and 1.4-3.5mm wide which is similar to the phyllodes of *Acacia duriuscula* at 2-7cm long and 2-4mm wide (Figure B.4). No other species resembling *Acacia duriuscula* were found in the area.

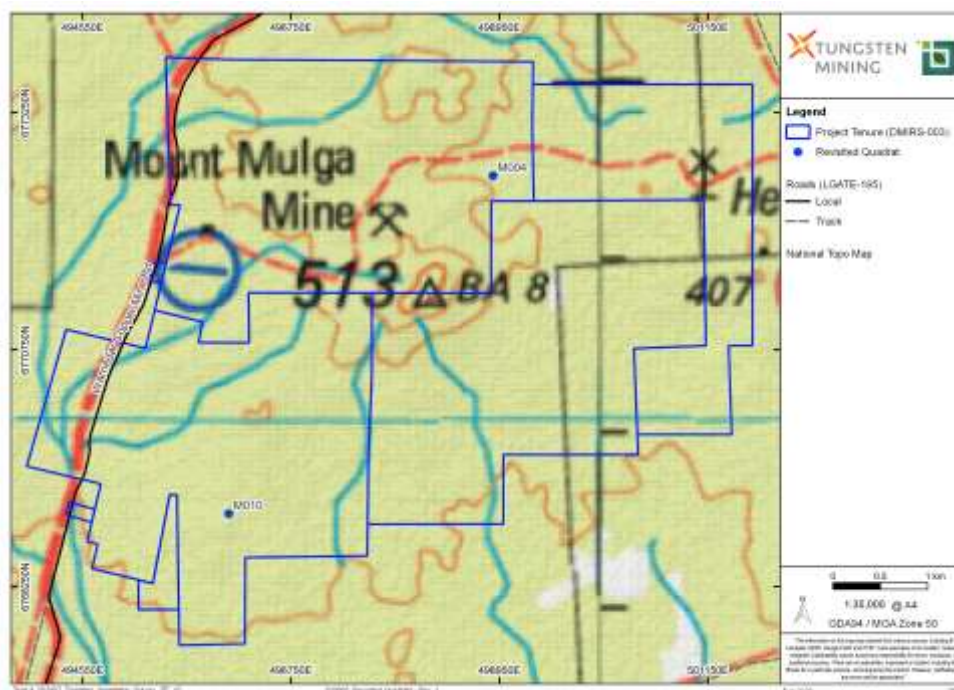


Figure B.1 Revisited Spectrum Ecology (2021) Quadrats’ Location



Figure B.2 *Acacia latior* Identified in Quadrat M004



Figure B.3 *Acacia duriuscula* (Maslin, 1994)



Figure B.4 *Acacia ramulosa* var. *ramulosa* (Alford, 1998)

Appendix C 2025 Targeted Conservation Significant Flora Survey

Trench Operation

Targeted Conservation Significant Flora Survey
over the Trench Open Pit, TSF and Camp Areas

3 April 2026

Prepared for



Prepared by

Jenny Borger Botanical Consulting

and



Trench Operation: Targeted Conservation Significant Flora Survey

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This document has been prepared based on assumptions as reported throughout, and upon information and data supplied by others or generated by JBBC and ISPL. This document has been subject to review and changes from the Client and the Client's representative.



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Executive Summary

Tungsten Mining NL (TGN) through its wholly owned subsidiary, Mid-West Tungsten Pty Ltd (Mid-West Tungsten), proposes to develop the Trench Operation (the Trench; the operation) which is located approximately 330km northeast of Perth and 15km northeast of Rothsay, in the Shire of Perenjori in Western Australia. TGN plans to mine and produce a tungsten-molybdenum concentrate from the Trench Open Pit. Jenny Borger Botanical Consulting (JBBC), with the support of Integrate Sustainability Pty Ltd (ISPL), was commissioned to identify conservation-significant flora species within the Survey Area, comprised of the proposed mining area, TSF and potential camp locations and potential areas where *Acacia sulcaticaulis* (EN) may occur. The Survey Area also included two previously surveyed quadrats, which were revisited to confirm species identification for *Acacia duriuscula*, as there was some question about historic identifications. A targeted regional review was also undertaken on tenure adjacent to the operation area (referred to as the Regional Review Area).

Since 2011, numerous flora and vegetation surveys have been conducted across the Survey and Regional Review Areas. Data from these previous studies were collated during the desktop assessment to identify priority search locations. Satellite imagery from March 2024 was used to evaluate track accessibility throughout both areas.

Botanist Jenny Borger and Environmental Specialist Zerianna Edwards conducted two field trips in October and November/December 2025, in accordance with EPA technical guidance (EPA, 2016). The Survey Areas were accessed via existing tracks where possible, followed by foot traverses. Areas 2 through 5 were surveyed using 20–30m spaced transects, whereas Area 1 surveys focused on locations with minimal historical records. For Areas 6 and 7, effort was prioritised toward identifying the endangered *Acacia sulcaticaulis*. For the Regional Review Area, surveying was conducted from existing tracks; the portion that coincided with Area 6 was traversed on foot. For each conservation-significant species identified, the scientific name, abundance, and GPS coordinates (GDA94z50) were recorded; abundance was estimated in areas of dense vegetation.

Previously established quadrats were relocated in the field using georeferenced PDFs. Upon reaching each site, a 30m x 30m area was surveyed specifically for *Acacia duriuscula*. To ensure comprehensive data collection, any specimens exhibiting morphological characteristics similar to those of *A. duriuscula* were also recorded.

A total of 15 conservation-significant flora species were recorded across the Survey Area, comprising one Endangered, four Priority 1, and ten Priority 3 species. While all species had previously been identified in the region, several new populations were documented within the survey areas. New populations of *Acacia diallaga* (P1), *Lepidosperma* sp. Blue Hills (P1) and *Micromyrtus acuta* (P3) were newly recorded in Areas 2 and 3, while in Area 4, new records of *A. diallaga* (P1), *Acacia karinae* (P3), and *Grevillea scabrida* (P3) were recorded. *G. scabrida* was also identified in Area 5. In Areas 6 and 7, *Acacia sulcaticaulis* (EN) was recorded for the first time.

Several previously recorded species were not relocated during this survey, primarily due to constraints in survey extent. In Area 1, *Chamelaucium* sp. Yalgoo (P1) and *A. karinae* (P3) occur within the northern open pit, which was outside the current survey footprint. Furthermore, field verification suggests that previous records of *Acacia subsessilis* (P3) in Area 1 may be misidentifications of *A. tetragonophylla*. In Area 3, *Chamelaucium* sp. Warriedar (P1) and *Micromyrtus trudgenii* (P3) were not recorded as their known locations sit outside the traversed area.

Two previously established quadrats were revisited (Site 1 and Site 2). At Site 1, tall *Acacia* specimens were targeted to relocate *Acacia duriuscula* population. A specimen featuring smoothish bark and mature pods was collected for verification. Taxonomic analysis revealed seeds measuring 4–5mm (not mottled) and pods of uniform diameter. These features distinguish the specimen from *A. duriuscula*, which typically possesses mottled seeds (3.0–3.5mm) and pods raised over the seeds. The specimen was identified as *Acacia latior* and subsequently confirmed through comparison with Western Australian Herbarium records.

Two species with similarities to *Acacia duriuscula* were identified at Site 2 *Acacia ramulosa* var. *ramulosa* and *Senna* sp. Austin. However, when compared to the species list previously recorded for the quadrat, *Senna* sp. Austin was listed but not *Acacia ramulosa* var. *ramulosa*, suggesting that the previously recorded *Acacia duriuscula* has been misidentified. No other species resembling *Acacia duriuscula* were identified in the area.



Field Trip 1 visited three of the eight Regional Review Area zones and collated data from previous surveys across all eight zones. Following this field trip, new occurrences of *Acacia sulcatacaulis* (EN) were located in Zones 6 and 7. Additional records of eight other conservation-significant taxa were also recorded in Zone 8.

A comparison of conservation-significant species recorded across the Regional Review Area zones indicates that Zone 4 remains the most diverse (12 species). Zones 1, 2, 8, and now Zone 7 each support nine species. Diversity was notably lower in the remaining areas: Zone 6 (4 species), Zone 5 (2 species), and Zone 3 (1 species).

A review of the vegetation mapping previously conducted by Spectrum Ecology (2021) confirmed that most areas remain consistent with historical data. However, in the southern portions of Area 2 and Area 3, the vegetation composition diverged from previous records, showing only a broad alignment with existing units. Consequently, the following three new vegetation units were identified:

- AtAk: *Allocasuarina dielsiana* emergent trees over *Allocasuarina tessellata* (P3), *Acacia karinae* (P3) shrubland on dolerite/greenstone hills;
- AssMa: *Acacia assimilis* isolated tall shrubs over *Micromyrtus acuta* (P3), *Alyxia buxifolia*, *Eremophila clarkei* low open shrubland on rocky outcrops; and
- EeAr: *Eucalyptus ewartiana*, *Acacia ramulosa* mallee woodland over *Acacia ramulosa* var. *ramulosa*, *Acacia tetragonophylla* sparse shrubland on hardpan plains.

Area 7 was also remapped as a vegetation unit “AsCp”, due to the presence of *Acacia sulcatacaulis* (EN). Area 6 is also likely representative of the vegetation unit AsCp, with the new vegetation unit AssMa noted on the ridge top in the field, although the vegetation wasn’t mapped.

The targeted survey identified *Acacia sulcatacaulis* (EN) regrowing within disturbed portions of Area 1, as well as several conservation-significant species in a drainage line west of the proposed Area 5 camp location. It is recommended that these *A. sulcatacaulis* regrowth areas be avoided. For the Area 5 drainage line, a pre-clearance survey is required to delineate and protect significant flora, and to implement erosion controls to prevent downstream sedimentation.

In Area 3 (the proposed Tailings Storage Facility), numerous priority species were recorded, including *Allocasuarina tessellata* (P3) and *Acacia karinae* (P3). While the endangered *A. sulcatacaulis* can likely be avoided, the final TSF design must account for indirect impacts such as dust deposition and altered surface hydrology. Additionally, the TSF footprint should avoid the ephemeral drainage line along the western boundary to mitigate risks of high-volume flow during significant rainfall events.

The newly defined vegetation unit 'AtAk' replaces the previously mapped mosaic 'AdAt/AdAa' in Area 2 and 3. Given that the Spectrum Ecology (2021) unit 'AdAt' is poorly defined—and *Acacia duriuscula* is unlikely to occur in the region—a re-analysis of these vegetation units is recommended.



1 Introduction

1.1 Operation Overview

The Trench operation (Trench; operation) is situated approximately 330km northeast of and 15km northeast of Rothsay, in the Shire of Perenjori in Western Australia. (Figure 1.1). Tungsten Mining NL (TGN) plans to mine and produce a tungsten-molybdenum concentrate. The proposed operation is partially on the Wanarra Pastoral station and Department of Biodiversity, Conservation and Attractions (DBCA) lands of interest, on the former Karara Pastoral station. Access to the operation is via the Warriedar Copper Mine Road and the Minjar Haul Road.

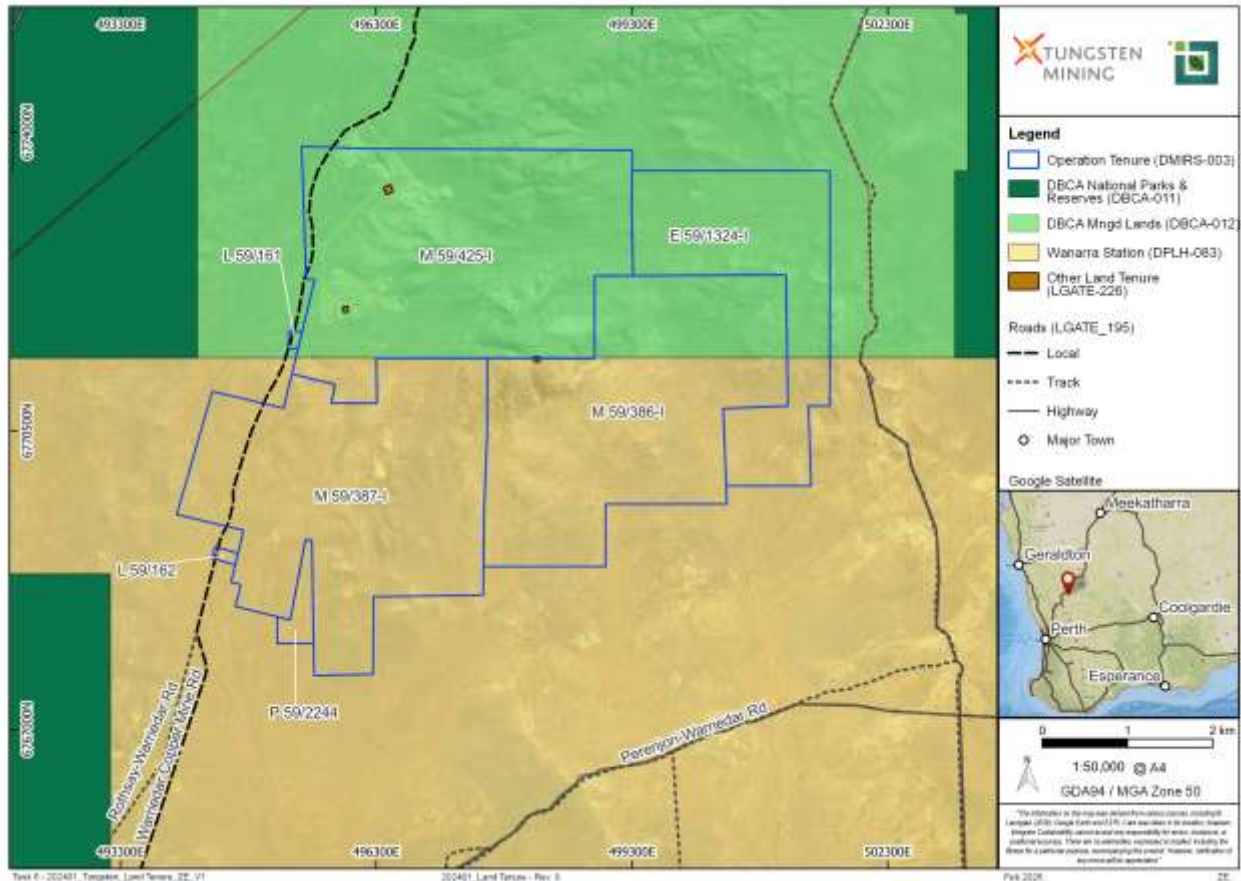


Figure 1.1 Trench Operation and Underlying Land Tenure

Jenny Borger Botanical Consulting (JBBC), with the support of Integrate Sustainability Pty Ltd (ISPL), was commissioned by TGN to conduct a targeted survey for conservation-significant flora species listed under the *Biodiversity Conservation Act 2016* (WA) (BC Act) within the area proposed to be used for the Trench Operation. Two field trips were undertaken to survey the proposed open pit, tailings storage facility and accommodation camps, and potential areas for *Acacia sulcatacaulis* (EN)(Figure 1.2); collectively, these are referred to as the Survey Area. The survey area also included two previously established quadrats, which were revisited to confirm the identification of *Acacia duriuscula*. A targeted regional review was also undertaken on tenure adjacent to the operation area (referred to as the Regional Review Area)(Figure 1.3).

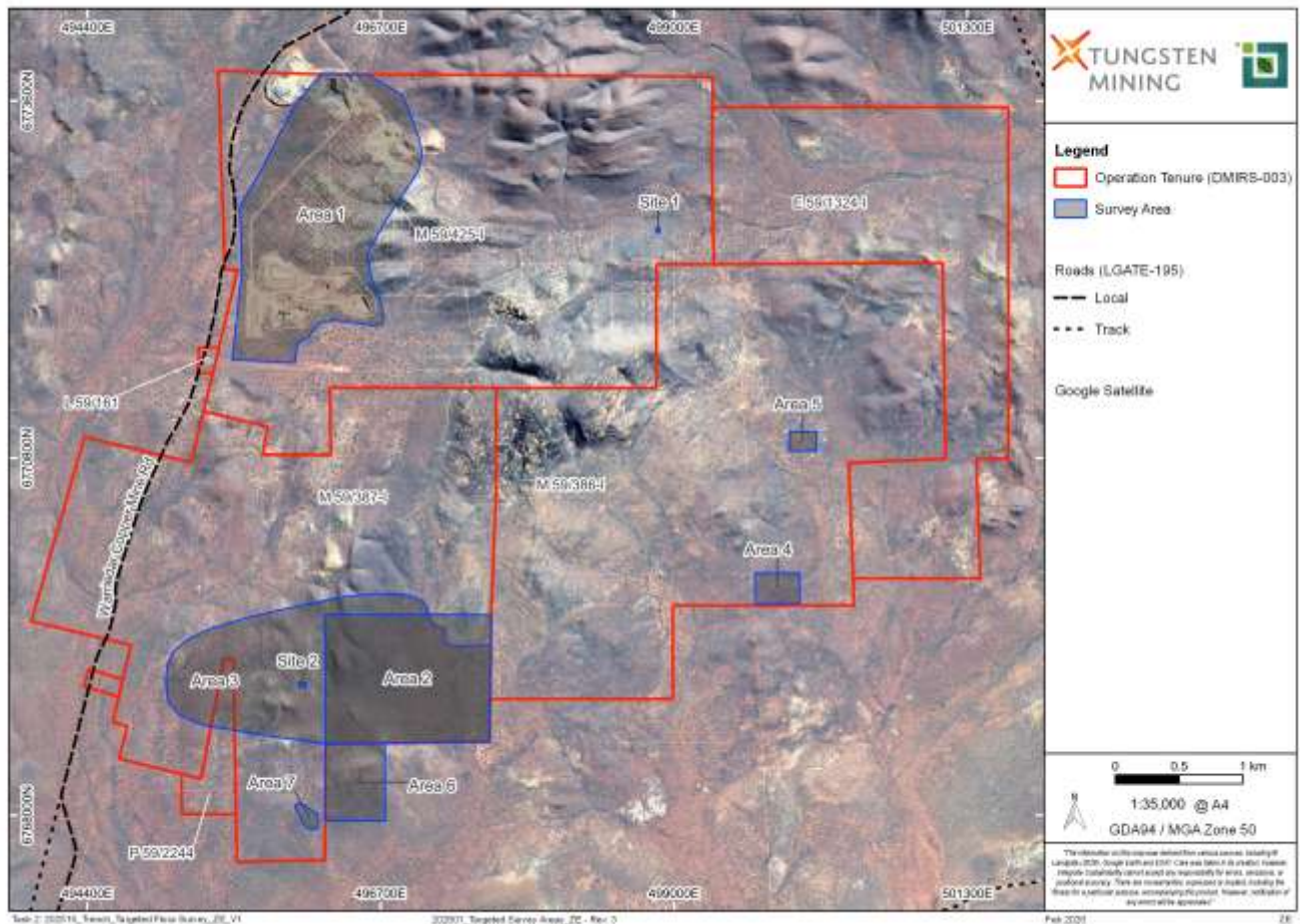


Figure 1.2 Survey Area

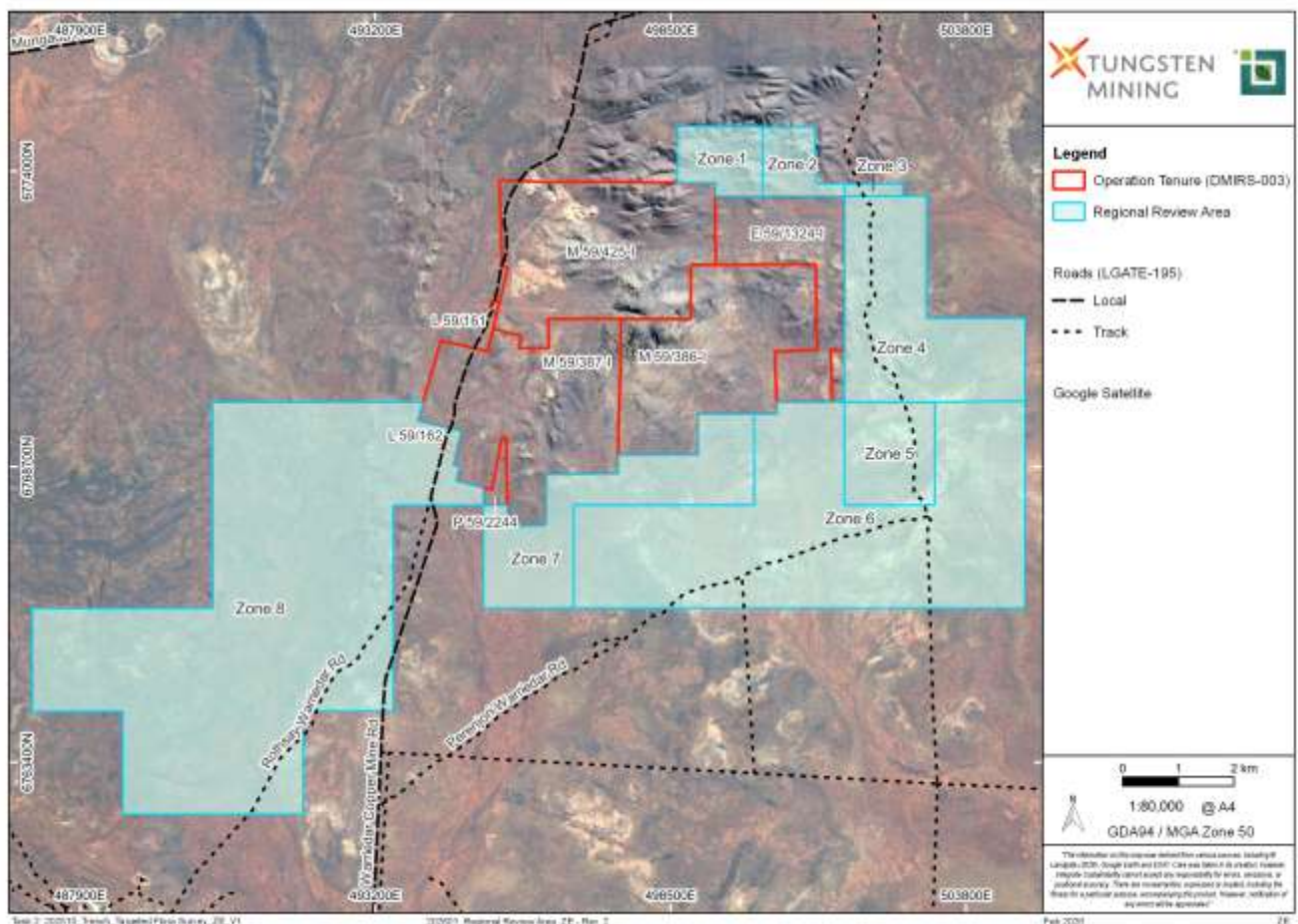


Figure 1.3 Regional Review Area



1.2 Scope of Work

The objectives of the Targeted Conservation Significant Flora Survey were to:

- Undertake a desktop review of known locations of conservation-significant flora species to determine priority survey locations in the Survey Area and the Regional Review Area.
- Undertake a desktop review of previously used and visible tracks from imagery within the Survey Area and the Regional Review Area, which could be utilised.
- Investigate and report on additional populations of conservation-significant flora species within the Survey Area and the Regional Review Area, which include:
 - *Acacia sulcaticaulis* (EN);
 - *Acacia diallaga* (P1);
 - *Chamelaucium* sp. Warriedar (P1);
 - *Chamelaucium* sp. Yalgoo (P1);
 - *Hydrocotyle dimorphocarpa* (P1);
 - *Lepidosperma* sp. Blue Hills (P1);
 - *Acacia karinae* (P3);
 - *Acacia subsessilis* (P3);
 - *Allocasuarina tessellata* (P3);
 - *Dicrastylis linearifolia* (P3);
 - *Drummondita fulva* (P3);
 - *Grevillea globosa* (P3);
 - *Grevillea scabrada* (P3);
 - *Grevillea subtiliflora* (P3);
 - *Micromyrtus acuta* (P3);
 - *Micromyrtus trudgenii* (P3);
 - *Persoonia pentasticha* (P3);
 - *Rhodanthe collina* (P3);
 - *Stenanthemum poicilum* (P3); and
 - *Dodonaea amplussemina* (P4).
- While undertaking the above work, look out for opportunistic sightings of previously unrecorded conservation-significant flora species.
- Investigate and report on the potential misidentification of *Acacia duriuscula* at previously surveyed quadrats.

1.3 Constraints & Limitations

During the surveys, track access was constrained, which limited the extent of the Survey Area and the Regional Review Area surveyed. Similarly, towards the end of the second field trip, temperatures close to 40°C were experienced, which limited the time in the field. No other constraints or limitations were experienced during the survey, as discussed in Table 1.1.

Table 1.1 Constraints and Limitations

Constraint	Limitation	Comment
Effort and Extent	Partial	• Survey Trip 1 covered Area 1, Area 2, Area 4 and Area 6 along with the Regional Review Area, while Survey Trip 2 covered Area 3, Area 5, Area 6, Area 7, Site 1 and Site 2. • The Survey Area for Survey Trip 1 was manageable, but the Regional Review Area was considerable in size for a single targeted survey. As a result, a strategic approach was utilised to prioritise areas in the Survey Area with no or minimal records of conservation-significant flora, while available tracks were utilised to survey accessible areas of the Regional Review Area. • Significant time was allocated to trying to access parts of the Regional Review Area, which limited survey effort over the Survey Area. • The majority of the Regional Review Area was not surveyed due to time constraints and limited track access. • The Survey Area for Survey Trip 2 was more manageable; however, originally, four previously surveyed quadrats were to be revisited to confirm the species identification.
Competency and Experience	No	• Jenny Borger has extensive knowledge of the Yalgoo region and the operation.
Flora Identified	No	• Survey Trip 1 occurred at the end of the season for the annual species <i>Rhodanthe collina</i> (P3), which resulted in observing many individuals dying off. No individuals were observed during Survey Trip 2. • Many species were in flower or producing seed, aiding in identification.
Information Sources	No	• Multiple surveys have been completed over areas of the operation area, with Spectrum Ecology consolidating findings from the surveys during their Flora and Vegetation Assessment (Spectrum Ecology, 2021).
Timing and Weather	Partial	• Two field trips occurred: Survey Trip 1 (13-17 October) and Survey Trip 2 (28 November – 1 December).



Constraint	Limitation	Comment
		- Survey timing aligned with the Environmental Protection Authority's (EPA's) recommended timing for the Southern Region. - Weather conditions during Survey Trip 1 were warm (28-36°C) but acceptable for surveying. Survey Trip 2, on the other hand, was warmer (31-39°C), which limited time in the field towards the end of the survey.
Disturbance	No	- Most disturbance in the Survey Area and Regional Review Area related to historically cleared roads, with the largest disturbance noted in Area 1, which related to historic open pits and waste landforms. <i>Acacia sulcatacaulis</i> (EN) was found to thrive in Area 1, where disturbance occurred with other conservation-significant flora species identified along track edges in the Regional Review Area.
Remoteness and Access	Yes	- Tracks were visible on imagery during pre-trip planning, but were often found inaccessible when in the field, leading to most of the Regional Review Area not being visited. - Area 1 and Area 6 contained existing tracks throughout which aided in accessibility. - Track access for Area 2 and Area 3 was only present along the bottom edge while the imagery showed tracks moving towards the top edge. Area 4, Area 5 and Area 7 were not located near an existing track, as such, survey effort was supplemented by strategic planning for walking access. - Originally, four previously surveyed quadrats were to be revisited. The two quadrats revisited were either close to an existing road (Site 1) or within an area for surveying (Site 2), while the other two sites were in remote locations.

2 Existing Environment

2.1 Climate

The climate for the region is characterised by hot, dry summers and cool, moist winters. A monitoring station was established by TGN in September 2019 within the operational area, with the closest Bureau of Meteorology (BoM) monitoring station with long-term data located at Paynes Find (~60-80km east; BoM Station 7139, 1919-) (BoM, 2025). Average rainfall was lower in the operational area compared to Paynes Find for most months of the year (Table 2.1). Both rainfall patterns show a slight increase in rainfall during March, with the maximum recorded at Trench in July and August, compared with May to August at Paynes Find. Higher March rainfall is often the result of Tropical lows (including ex-tropical cyclones) tracking southeast over WA, or summer thunderstorms. Rainfall was below average in May, with above-average rainfall in August at both stations; significant rainfall was also recorded in November at Paynes Find.

Table 2.1 Monthly Rainfall (mm) for Trench and Paynes Find

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Trench Monitoring Station													
Mean	0.8	19.5	26.0	9.9	17.2	14.5	24.7	27.4	8.1	6.5	15.5	5.6	14.6
2025	1.8	0.8	5.0	16.0	12.0	27.6	36.4	62.2	11.6	4.8	17.4	9.6	205.2
Paynes Find BoM Station													
Mean	20.6	24.1	27.7	24.2	34.4	40.4	34.7	28.3	13.9	10.6	13.8	12.1	283.7
2025	6.2	3.4	66.6	22.4	30.6	26.2	26.4	80.2	13.2	14.2	51.6	9.2	350.2

Temperature data from the operation (Figure 2.1; Table 2.2) recorded an average maximum temperature which exceeded 40°C from November to March, while the maximum temperature at Paynes Find ranged from 32.0 to 37.4°C over the same period (Figure 2.1). Average minimum temperatures at both stations were below 10.0°C from May to September, with the operation recording 7.8°C in November, compared with 15.6°C at Paynes Find.

The 2025 maximum temperature for Paynes Find was above average in January to June by approximately 2-3°C (Table 2.2). The maximum temperature recorded in July 2025 was slightly cooler compared to the average. The 2025 minimum temperature, on the other hand, was approximately 1-2°C below average in July and October.

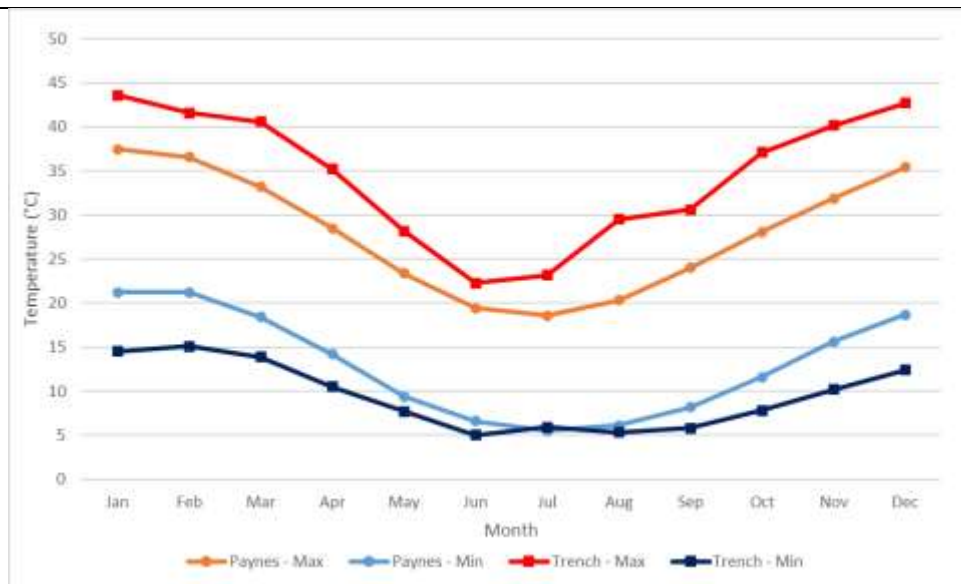


Figure 2.1 Average Monthly Temperature (°C) for Paynes Find and Trench

Table 2.2 Monthly Temperature (°C) Recorded at Paynes Find in 2025 and Average for all Years

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean Max	37.5	36.6	33.2	28.5	23.4	19.4	18.6	20.3	24.0	28.1	31.9	35.4	28.1
2025 Max	40.5	38.5	35.7	29.8	26.3	20.9	17.7	20.4	23.9	28.8	31.3	37.8	29.3
Mean Min	21.2	21.2	18.4	14.2	9.4	6.6	5.5	6.1	8.2	11.6	15.6	18.7	13.0
2025 Min	23.8	21.0	20.1	15.9	9.3	7.6	4.4	6.7	7.5	10.9	15.7	20.3	13.6

2.2 Bioregion

The operation is located within the Yalgoo IBRA region and Talling IBRA sub-region (Figure 2.2). The Yalgoo IBRA region is the interzone between the cooler moister Avon Wheatbelt region and the semi-arid to arid Murchison and Coolgardie regions. It is characterised by Callitris/Gimlet, Mulga and Bowgada open woodlands and scrubs on earth to sandy-earth plains in the Western Yilgarn Craton and the Southern Carnarvon Basin.

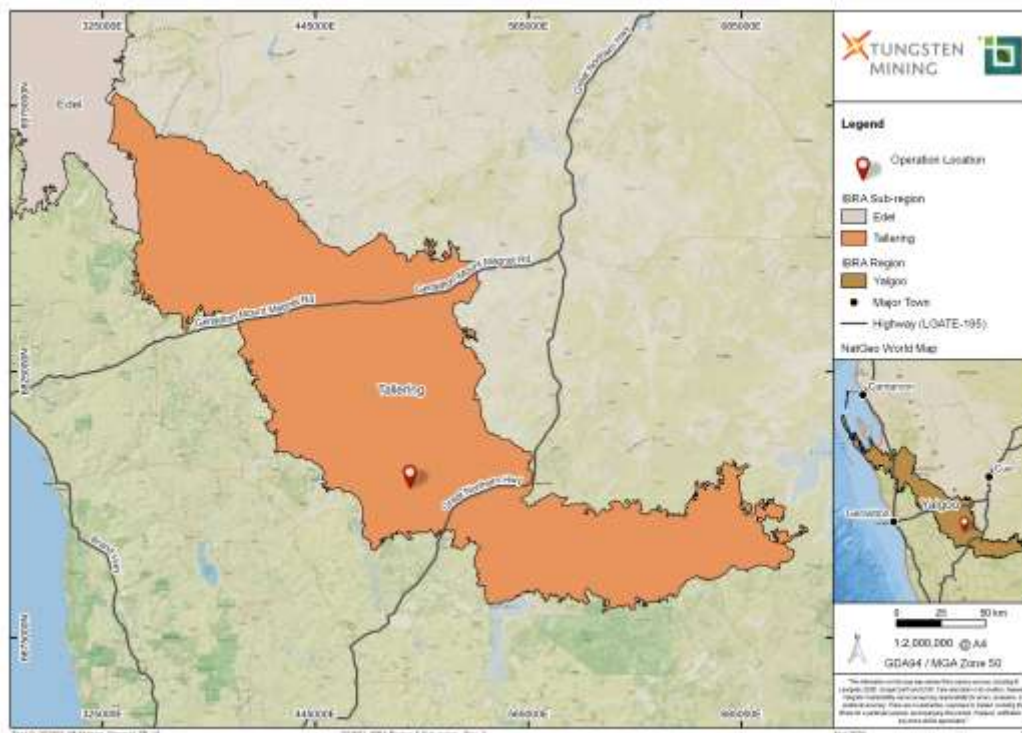


Figure 2.2 IBRA Region and IBRA Sub-Region

The Talling IBRA sub-region is underlain by the north end of the Phanerozoic Perth Basin with parts of the Western Terranes and the southern end of the Narryer Terrane of the Yilgarn Craton (McKenzie, Keighery, & Gibson, 2001). The sub-region is characterised by low to open woodlands of Eucalyptus, Acacia and Callitris on red sandy plains.



2.3 Geology

The operation is located within the Yalgoo-Singleton greenstone belt, which comprises a typical Archaean supracrustal greenstone sequence of mafic and felsic volcanic rocks, associated sediments, and intrusive mafic and ultramafic rocks. The greenstone belt is bounded by intrusive granitoid batholiths and is characterised by heterogeneous deformation with narrow zones of high strain separating more weakly deformed zones.

Mapping by the Geological Survey of WA at a scale of 1:500,000 (Watkins & Hickman, 1990), identified two major stratigraphic successions; Luke Creek Group and Mount Farmer Group. Mafic and felsic volcanic rocks within each of these stratigraphic successions are only distinguishable based on structural criteria.

There are six geological sub-units present in the Survey Area (Figure 2.3; Table 2.3). All of the sub-units are present across Western Australia, with none restricted to the Survey Area. The sub-unit A-g-Y has the largest extent across Western Australia and is associated with hills and ridges present in the Survey Area.

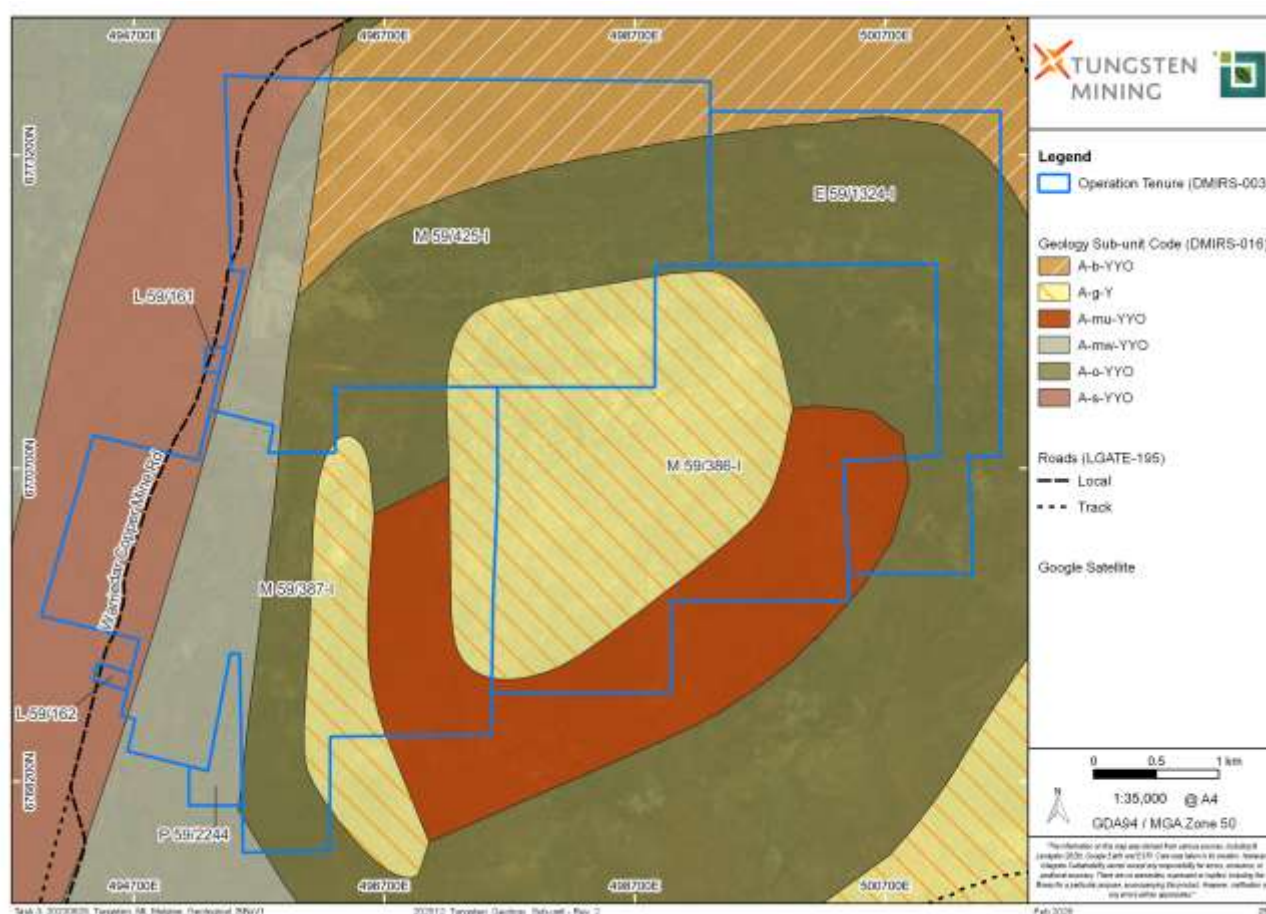


Figure 2.3 Geology Sub-units

Table 2.3 Geology Sub-unit Code Descriptions

Geology Sub-unit Code	Total Extent (ha)	Description
A-b-YYO	977,038	Mafic volcanic rock with minor mafic and ultramafic intrusive rocks; subordinate felsic rocks; metamorphosed.
A-g-Y	237,777,563	Granitic rock, undivided; metamorphosed.
A-mu-YYO	105,936	Metamorphosed ultramafic rock, undivided; typically, deeply weathered.
A-mw-YYO	164,979	Metamorphosed mafic igneous rock, undivided.
A-o-YYO	156,564	Mafic intrusive rock dominant; metamorphosed.
A-s-YYO	294,673	Clastic sedimentary rock dominant; metamorphosed.

2.4 Soil

Soil landscape surveys and mapping were completed over Western Australia (Tille, 2006) shows the operation and Regional Review Area are within the Murchison Province, which is characterised by hardpan wash plains and sandplains (with some stony plains, hills, mesas and salt lakes) on granitic rocks and greenstone of the central north-western portion of the Yilgarn Craton. The Murchison Province is divided into seven soil-landscapes, with the Survey Area and Regional Review Area located within the Karara Hills, Plains and Lakes



Zone (270). The Karara Hills, Plains and Lakes Zone is characterised by hills and ranges, sandy plains, hardpan wash plains, stony plains and salt lakes (with some mesas and plains) on greenstone and granitic rocks of the Yilgarn Craton (Tille, 2006). Soils include red shallow loams, red loamy earths, red deep sands, salt lake soils, some red shallow sands, stony soils, and red shallow sandy duplexes.

2.5 Land Systems

Payne *et al.* (1998) completed a survey from 1992 to 1993 that characterised the Sandstone-Yalgoo-Paynes Find area. Geology, landforms, vegetation and soils were described to characterise different land systems.

The operation includes six land systems (Figure 2.4; Table 2.4), which are well represented in the wider region. The Singleton land system covers the smallest area and is associated with rugged greenstone hills present within and around the operation.

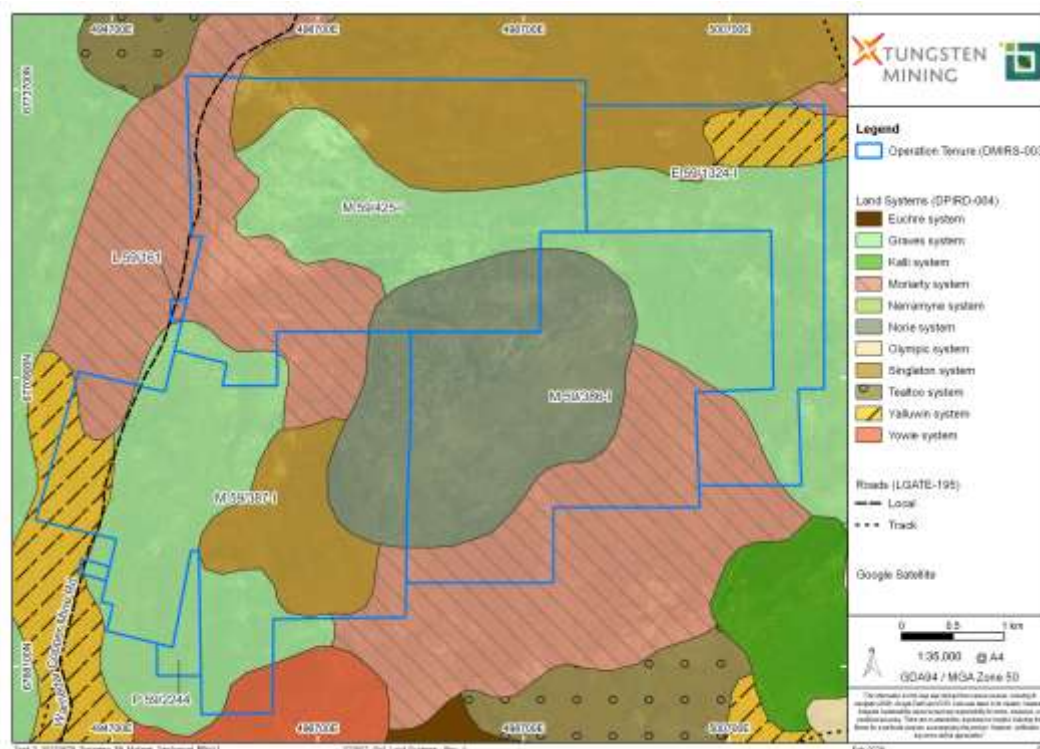


Figure 2.4 Land Systems Associated with the Operational Area

Table 2.4 Land System Descriptions

Land System	Total Extent (ha)	Land Type	Description
Graves	129,528	Low hills with Eucalypt-halophyte woodlands and Acacia shrublands	Basalt and greenstone rises and low hills, supporting Eucalypt woodlands with prominent saltbush and bluebush understorey
Moriarty	219,719	Stony plains and lower alluvial plains with predominantly saline soils and halophytic shrublands	Low greenstone rises and stony plains supporting halophytic and Acacia shrublands with patchy Eucalypt overstoreys
Norie	218,337	Hills with Acacia shrublands	Granite hills with exfoliating domes and extensive tor fields supporting Acacia shrublands
Singleton	23,834	Hills with mixed shrublands	Rugged greenstone ranges with dense Casuarina and Acacia shrublands
Yalluwin	26,278	Wash plains on hardpan with Mulga shrublands	Hardpan plains and drainage tracts carrying concentrated flow supporting Mulga, Curare and other Acacia
Yowie	1,605,576	Plains with deep sandy soils supporting Acacia shrublands and occasionally with wanderrie grasses	Loamy plains supporting shrublands of Mulga and Bowgada with patchy wanderrie grasses



2.6 Surface Water

The Survey Area and Regional Review Area are within the Mongers Lake catchment system, which comprises a long chain of salt lakes and low-lying areas extending along the east and south of the operation. Drainage in the operation is typically from small rocky creeks in steeper areas where there is sufficient water contributing to the catchment; where no creek has formed, flow is effectively overland in topographic valleys (Hydrologia, 2024). These creeks and flow paths typically dissipate quickly onto wash plains below the steeper hillslopes, although some larger streamlines to the west and south persist over a longer distance but dissipate before reaching Mongers Lake, 22km south of the operation.

2.7 Previous Studies

Flora and vegetation surveys have been undertaken in and around the Survey Area since 2011, with surveys commissioned by TGN occurring since 2017.

Between 2019 and 2021, Spectrum Ecology (2021) conducted four field assessments to characterise flora and vegetation present and consolidate flora results from previous surveys undertaken in the operation area. During the assessments, 281 native plant species were recorded, with 17 conservation-significant flora listed under the BC Act identified, which included:

- *Acacia sulcataulis* (EN);
- *Acacia diallaga* (P1);
- *Chamelaucium* sp. Warriedar (P1);
- *Hemigenia tichbonii* (P1);
- *Hydrocotyle dimorphocarpa* (P1);
- *Lepidosperma* sp. Blue Hills (P1);
- *Acacia karinae* (P3);
- *Allocasuarina tessellata* (P3);
- *Grevillea globosa* (P3);
- *Grevillea scabrada* (P3);
- *Grevillea subtiliflora* (P3);
- *Micromyrtus acuta* (P3);
- *Micromyrtus trudgenii* (P3);
- *Persoonia pentasticha* (P3);
- *Rhodanthe collina* (P3);
- *Stenanthemum poicilum* (P3); and
- *Dodonaea amplisemina* (P4)

Spectrum Ecology's assessments identified the species *Hemigenia tichbonii* (P1) and *Grevillea globosa* (P3) which had not previously been recorded at the operation. In comparison, no additional records of *Chamelaucium* sp. Yalgoo (P1), *Acacia subsessilis* (P3) and *Drummondita fulva* (P3) were identified by Spectrum Ecology, despite their occurrence during previous flora surveys (Figure 2.5; Figure 2.6).

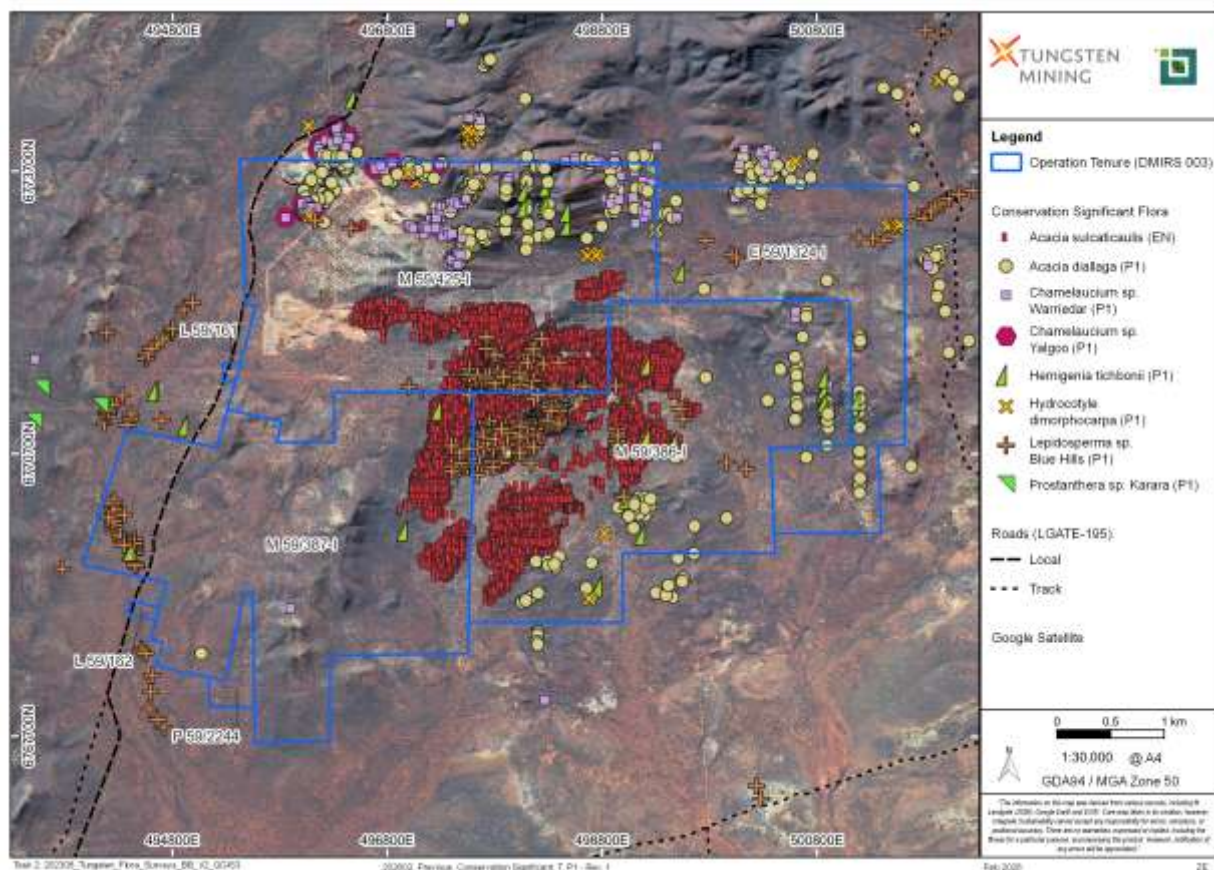


Figure 2.5 Previously Recorded Threatened and Priority 1 Flora

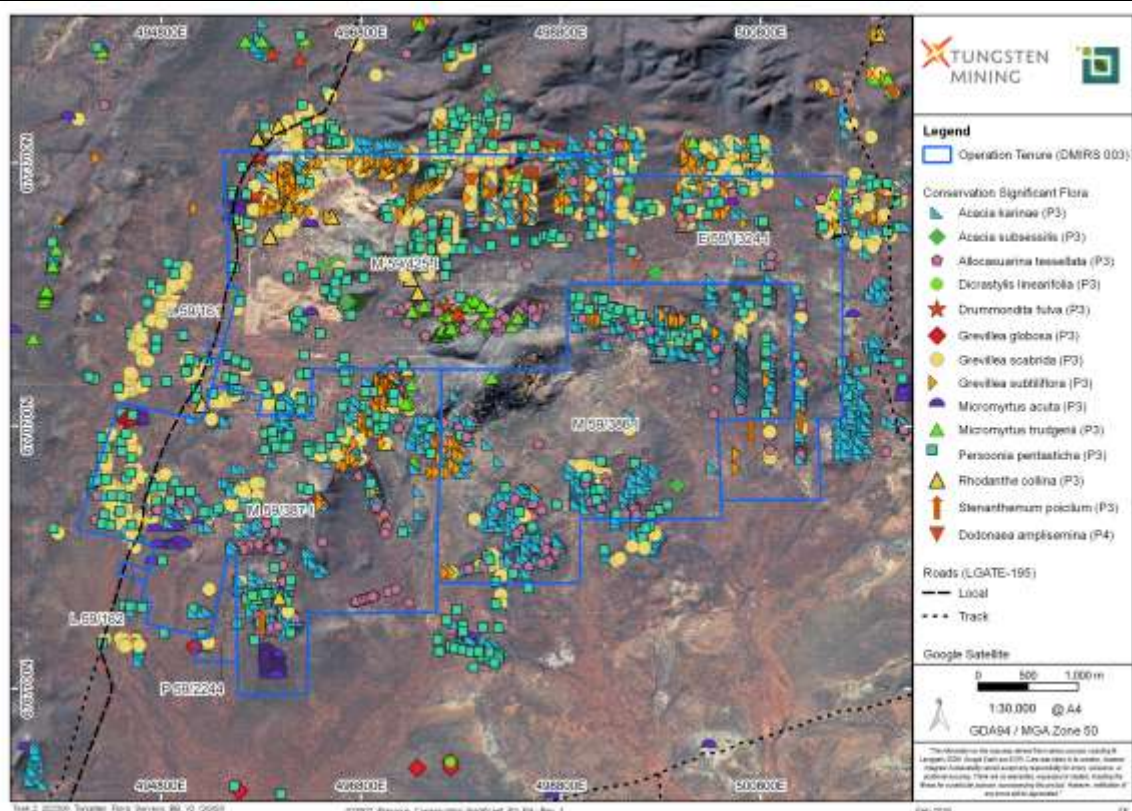


Figure 2.6 Previously Recorded Priority 3 and 4 Flora

As part of their Flora and Vegetation Assessment, Spectrum Ecology (2021) also characterised the vegetation present in the operation area. During the assessment, Spectrum Ecology identified and mapped seven vegetation units (Figure 2.7). A mosaic of AdAt/AdAa was also mapped due to similarities in topography, substrate, structure, colour characteristics, and fine-scale vegetation interactions.

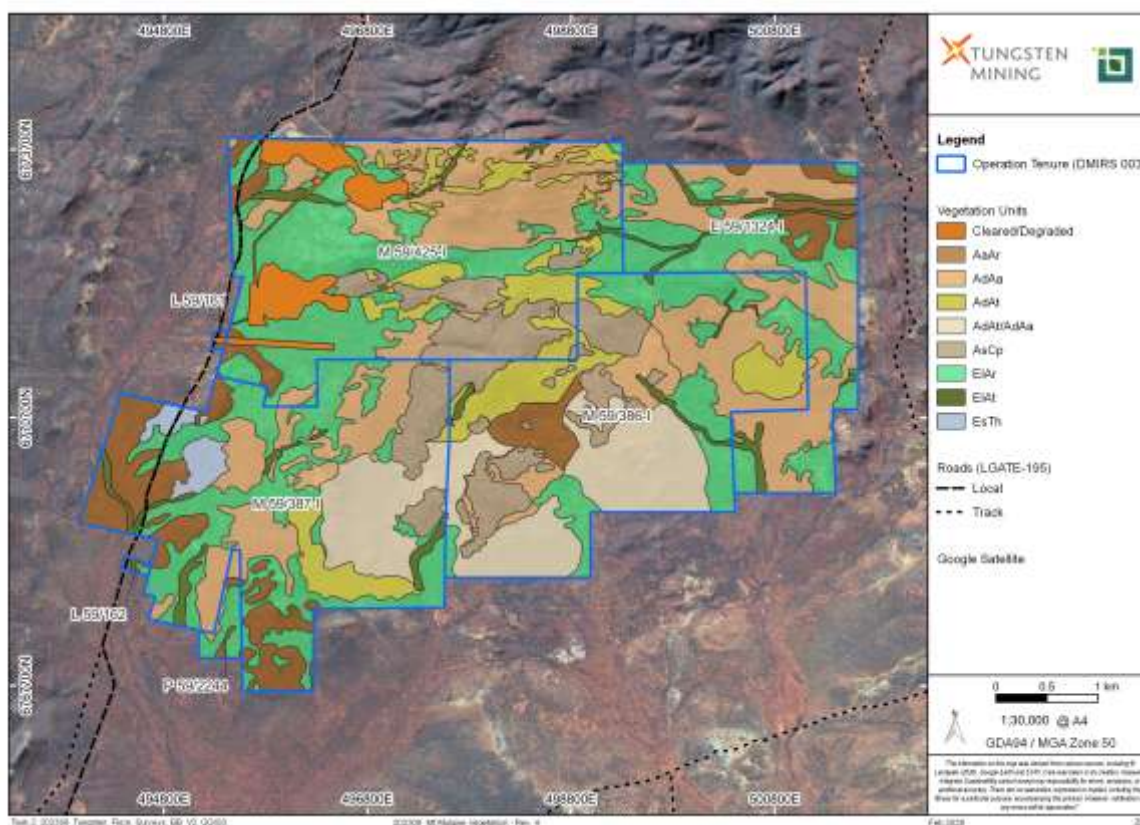


Figure 2.7 Vegetation Units in the Operation Area

A significance assessment on the vegetation units found that AdAa, AdAt and AsCp are regionally and locally significant. Regional significance was determined by comparing the vegetation unit descriptions to Beard's pre-European vegetation association map. Local significance, on the other hand, considered whether habitat



for locally significant flora was provided by the vegetation unit and whether the mapped extent or landforms/habitat present in the vegetation unit were restricted.

In 2023, JBBC, with support from ISPL, undertook a targeted survey for the locally significant vegetation units AdAa, AdAt and AsCp identified by Spectrum Ecology (2021) over a 20km area around the operation (JBBC & ISPL, 2026). During the survey, the vegetation units AdAa and AdAt were positively identified outside the operation area, while no additional occurrences of the vegetation unit AsCp were found.

2.8 Environmentally Sensitive Areas

Environmentally Sensitive Areas are areas of native vegetation that are specially protected due to their biological value. The list of Environmentally Sensitive Areas is provided in the *Environmental Protection (Environmentally Sensitive Area) Notice 2005*, and includes:

- Declared World Heritage properties;
- Areas on the Register of the National Estate due to their natural heritage value;
- Defined wetlands and the surrounding 50m area;
- Vegetation within 50m of Threatened flora, to the extent to which the vegetation is continuous;
- Area for Threatened Ecological Communities;
- Bush Forever sites, except to the extent to which the site is approved for development; and
- Areas covered by the *Environmental Protection (Western Swamp Tortoise) Policy 2002*.

Acacia sulcatacaulis (EN) is found within the operational area and the Regional Review Area, and is listed as Endangered under the BC Act. The Threatened Species Scientific Committee (TSSC) is considering listing the species as Critically Endangered under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth), with the assessment expected to finish by the end of April 2026 (TSSC, 2024). No other Threatened flora species have been identified.

Checking the publicly available dataset Environmentally Sensitive Areas (DWER-046) identified no other Environmentally Sensitive Areas present in the operational area or Regional Review Area. The next closest is a wetland listed in the Directory of Important Wetlands, which is approximately 27km northeast of the Survey Area. No Threatened or Priority Ecological Communities were identified, although two Priority Ecological Communities were found within 15km, which related to Banded Ironstone Formations and are therefore unlikely to occur in the Survey Area or Regional Review Area.

3 Methodology

3.1 Pre-field Trip Review & Desktop Assessment

The desktop assessment involved reviewing data from previous flora and vegetation reports conducted within and surrounding the proposed activity areas and collating them to produce a spatially explicit presentation in QGIS.

Priority survey locations for the targeted survey were then determined based on areas with minimal records of conservation-significant flora or areas with known locations of *Acacia sulcatacaulis* (EN).

Google Satellite imagery (dated March 2024) and contractor track logs from work in the area were utilised to determine access across the operational area and the Regional Review Area.

3.2 Field Timing & Personnel

Two field trips were undertaken, with the timing selected to align with the EPA's technical guidance (EPA, 2016). The EPA recommends spring (September to November) when sampling in the Southern Region to ensure adequate identification of plant species within a survey area.

The targeted conservation significant flora survey trips were conducted by a botanist and environmental specialist from 13-17 October 2025 and 28 November to 1 December 2025 (Table 3.1). Jenny Borger has over 20 years of experience as a botanist, completing flora and vegetation surveys for the Yalgoo region. She has also undertaken surveys for the operational area since 2018.

Table 3.1 Survey Personnel

Name	Experience	Role
Jenny Borger	20+ years	Botanist
Zerianna Edwards	3 years	Environmental Specialist



3.3 Field Survey

Available tracks were utilised, to access the Survey Area before the individual areas were traversed on foot. Priority areas for Area 1 were selected based on locations with minimal records, identified using georeferenced PDFs in the Avenza Maps app. For Area 2, Area 3, Area 4 and Area 5, transects spaced 20-30m apart were walked, while potential *Acacia sulcaticaulis* (EN) individuals noted by TGN personnel were prioritised for Area 6. The potential boundary for the new location of *Acacia sulcaticaulis* (EN) was walked in Area 7. Where a conservation-significant flora species was identified, its scientific name, abundance and GPS location (GDA94z50) were recorded. In areas with dense vegetation, abundance was estimated.

Previously established quadrats were relocated in the field using georeferenced PDFs. Upon reaching each site, a 30m x 30m area was surveyed specifically for *Acacia duriuscula*. To ensure comprehensive data collection, any specimens exhibiting morphological characteristics similar to those of *A. duriuscula* were also recorded.

The Regional Review Area was primarily surveyed utilising existing tracks, although part of the survey coincided with Area 6, were transversed on foot. When a conservation-significant flora species was identified along the track, with scientific name, abundance and GPS coordinates (GDA94z50) were recorded.

4 Results & Discussion

4.1 Targeted Conservation Significant Flora

Over two field trips, 704 locations were surveyed; 372 locations during Field Trip 1 and 332 locations during Field Trip 2 (Figure 4.1). In total, 101 flora species were recorded, including 15 conservation-significant species and three weed species (Appendix A). The conservation-significant species included one Endangered, four Priority 1, and 10 Priority 3 species, all of which have previously been identified in the Survey Area.

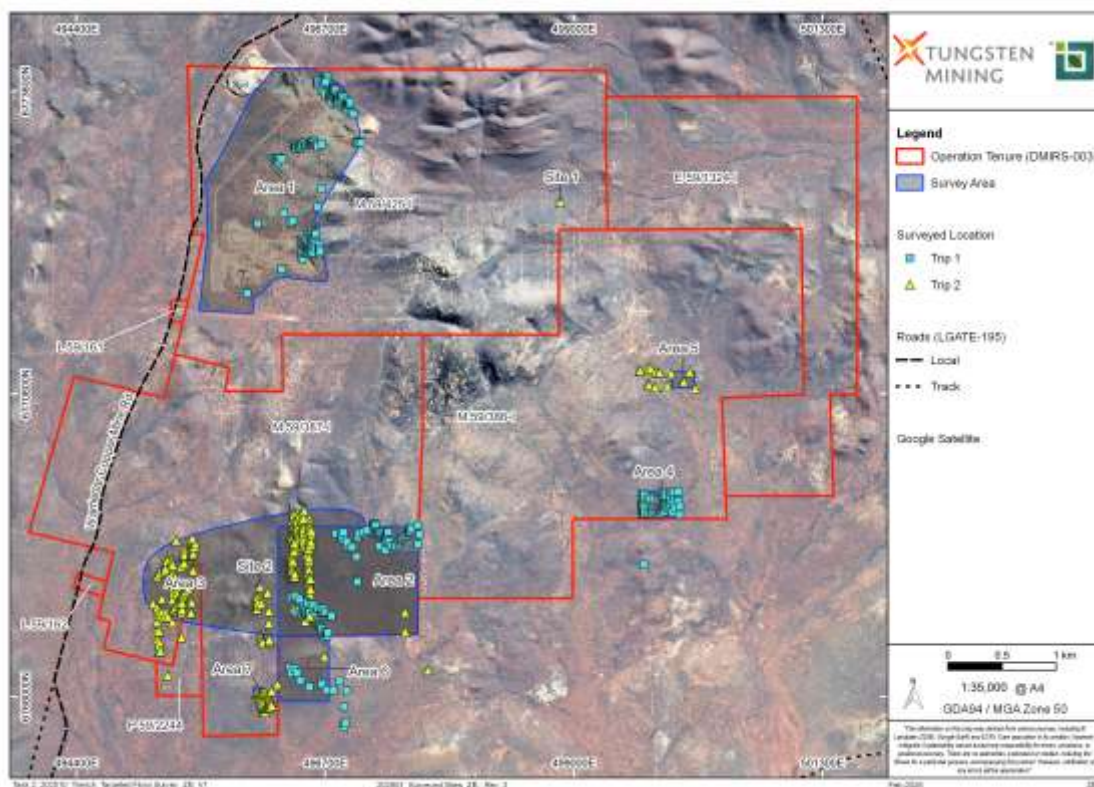


Figure 4.1 Areas Surveyed During the 2025 survey

4.1.1 Open Pit

The proposed open pit mining area (Area 1) was surveyed during Trip 1, with 11 conservation-significant flora species identified (Figure 4.2). New populations of *Chamelaucium* sp. Warriedar (P1), *Hydrocotyle dimorphocarpa* (P1), *Allocasuarina tessellata* (P3) and *Grevillea scabrida* (P3) were recorded south of the existing northern open pit. *Acacia sulcaticaulis* (EN) and *Lepidosperma* sp. Blue Hills (P1) were previously recorded at this location; however, their population has increased to approximately 430 and 100 individuals, respectively. The known populations for *Grevillea subtiliflora* (P3) and *Rhodanthe collina* (P3) remained roughly the same.



Acacia sulcataulis (EN) was also recorded along the eastern edge of the existing southern open pit (Figure 4.2). The population has increased compared to previous records, with new plants found along the edge of the cleared areas within the open pit. A similar pattern was noted for *Persoonia pentasticha* (P3), while a new occurrence of *Rhodanthe collina* (P3) recorded.

Previous flora records north of the existing northern open pit were primarily located close to the tenement border for the operation (Figure 2.5; Figure 2.6). During the targeted flora survey, new occurrences of *Allocasuarina tessellata* (P3) and *Rhodanthe collina* (P3) were identified, with approximately 60 and 850 individuals recorded, respectively. Two new individuals of *Persoonia pentasticha* (P3) were also recorded, with additional individuals of *Acacia diallaga* (P1) and *Grevillea scabrida* (P3) identified.

Two previous occurrences of *Acacia subsessilis* (P3) and *Micromyrtus acuta* (P3) were attempted to be verified in the field, although neither was found. It is possible that the *Acacia* was a misidentification of *Acacia tetragonophylla*. The *Micromyrtus acuta* (P3), on the other hand, may either be an incorrect GPS location or incorrect identification, given it was within York gum woodland on a plain south of the existing southern open pit, which is not the correct habitat for the species. A new occurrence of *Persoonia pentasticha* (P3) shrub was recorded at the location.

Previous surveys also indicated *Chamelaucium* sp. Yalgoo (P1) and *Acacia karinae* (P3) were present in Area 1; however, no new occurrences were identified. The previous records were located around the northern open pit, which wasn't surveyed during the trips.

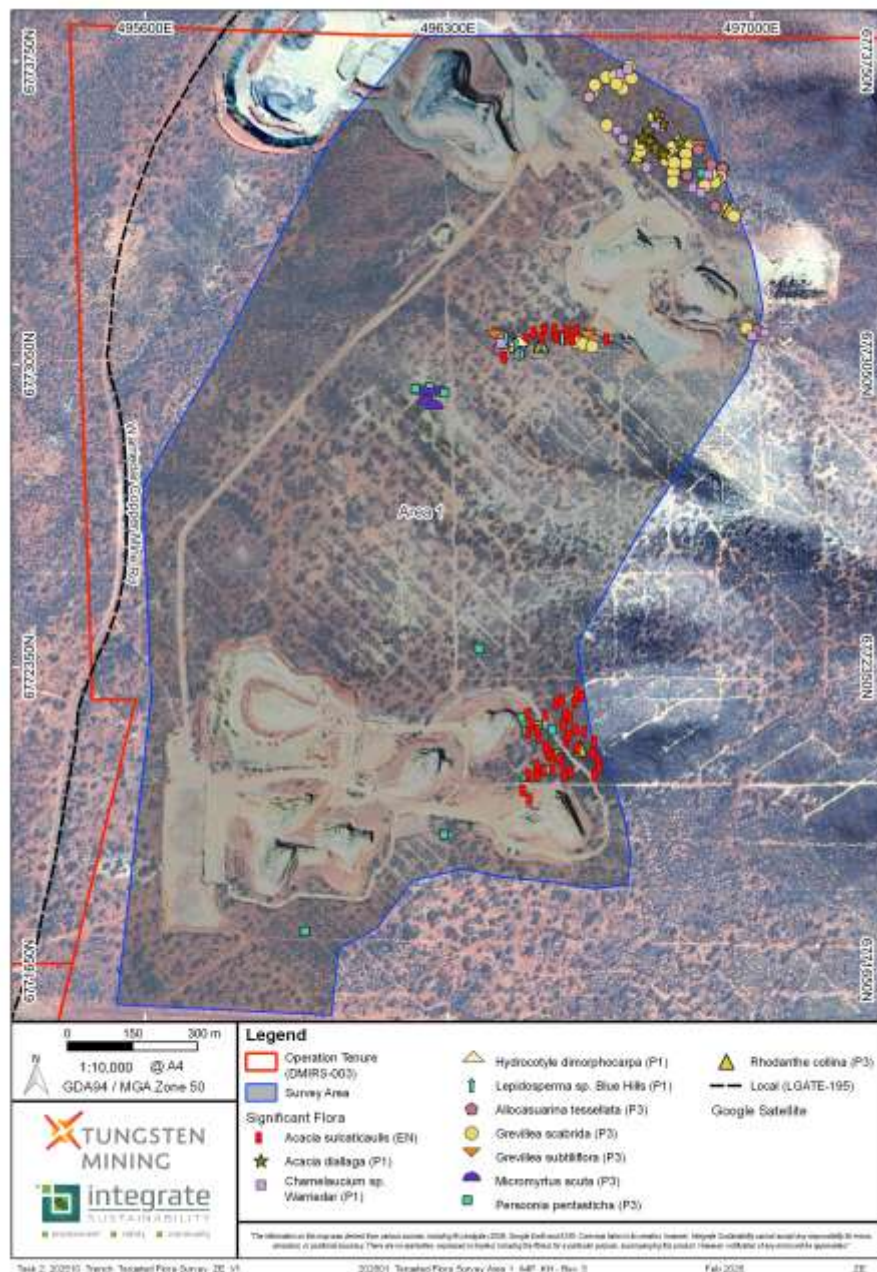


Figure 4.2 Conservation-Significant Flora in Area 1



4.1.2 Tailings Storage Facility

The proposed Tailings Storage Facility changed design between the two field trips; as a result, it was surveyed as Area 2 during Trip 1 and Area 3 during Trip 2 (Figure 4.3). A total of 10 conservation-significant flora species were identified across both trips. Three new flora species: *Acacia diallaga* (P1) and *Lepidosperma* sp. Blue Hills (P1) and *Micromyrtus acuta* (P3) were recorded during the survey. A single occurrence of *Acacia diallaga* (P1) was recorded on the western edge of Area 2 and the middle of Area 3 alongside *Allocasuarina tessellata* (P3). While the new occurrence of *Lepidosperma* sp. Blue Hills (P1) was located on the edge of *Acacia sulcataculis* (EN) within a drainage line. Approximately 1000 individuals of *Micromyrtus acuta* (P3) were recorded in a cluster at the southern edge of Area 2 and Area 3, and within Area 6.

Acacia sulcataculis (EN) was only identified in the top north east corner of Area 2, with some death and damage noted (mainly at the edges) for the population, including fallen and dead shrubs or low trees (Figure 4.3). The damage may be attributed to Tropical Cyclone Seroja, which passed over the Shire of Perenjori in April 2021 as a Category 1 system. Despite the damage, the distribution for the population has remained the same when compared to previous records (Figure 2.5).

Allocasuarina tessellata (P3) was the most abundantly species with over 15,000 individuals identified throughout Area 2 and Area 3 (Figure 4.3). Most of these records were located along the western edge of Area 2 and the middle of Area 3, indicating it is common along the ridges. A few individuals were also recorded toward the western edge of Area 3, although this area was dominated primarily by *Acacia karinae* (P3) and *Grevillea scabrida* (P3), with over 200 of each species recorded; *Persoonia pentasticha* (P3) was also recorded on the western side.

Dead *Allocasuarina tessellata* (P3) shrubs were noted throughout Area 2 and Area 3, which may be attributed to dry conditions in 2023. Annual rainfall recorded at Paynes Find (BoM Station 7139) in 2023 was 171.9 mm (mean 290.6), and Mount Gibson (BoM Station 10075) had 147 mm in 2023 (lowest on record) against the mean of 341.2 mm. Despite this, thousands of juveniles (mostly < 20 cm) were recorded during the surveys. The overall size of the population of *A. tessellata* (P3) is expected to exceed 50,000 individuals, based on the surveyed area and the extent of the vegetation community.

Nine individuals of *Grevillea subtiliflora* (P3) were recorded along the northern edge of Area 2, with none identified only within Area 3 (Figure 4.3). Area 2 also contained a single clump of at least 40 *Rhodanthe collina* (P3) individuals near *Grevillea scabrida* (P3). It is noted that *Rhodanthe collina* (P3) is an annual species and would have died off by the second survey in late November.

Neither survey recorded *Chamelaucium* sp. Warriear (P1) or *Micromyrtus trudgenii* (P3), which were previously recorded only within Area 3. However, these previous records were in an area not covered by either survey.

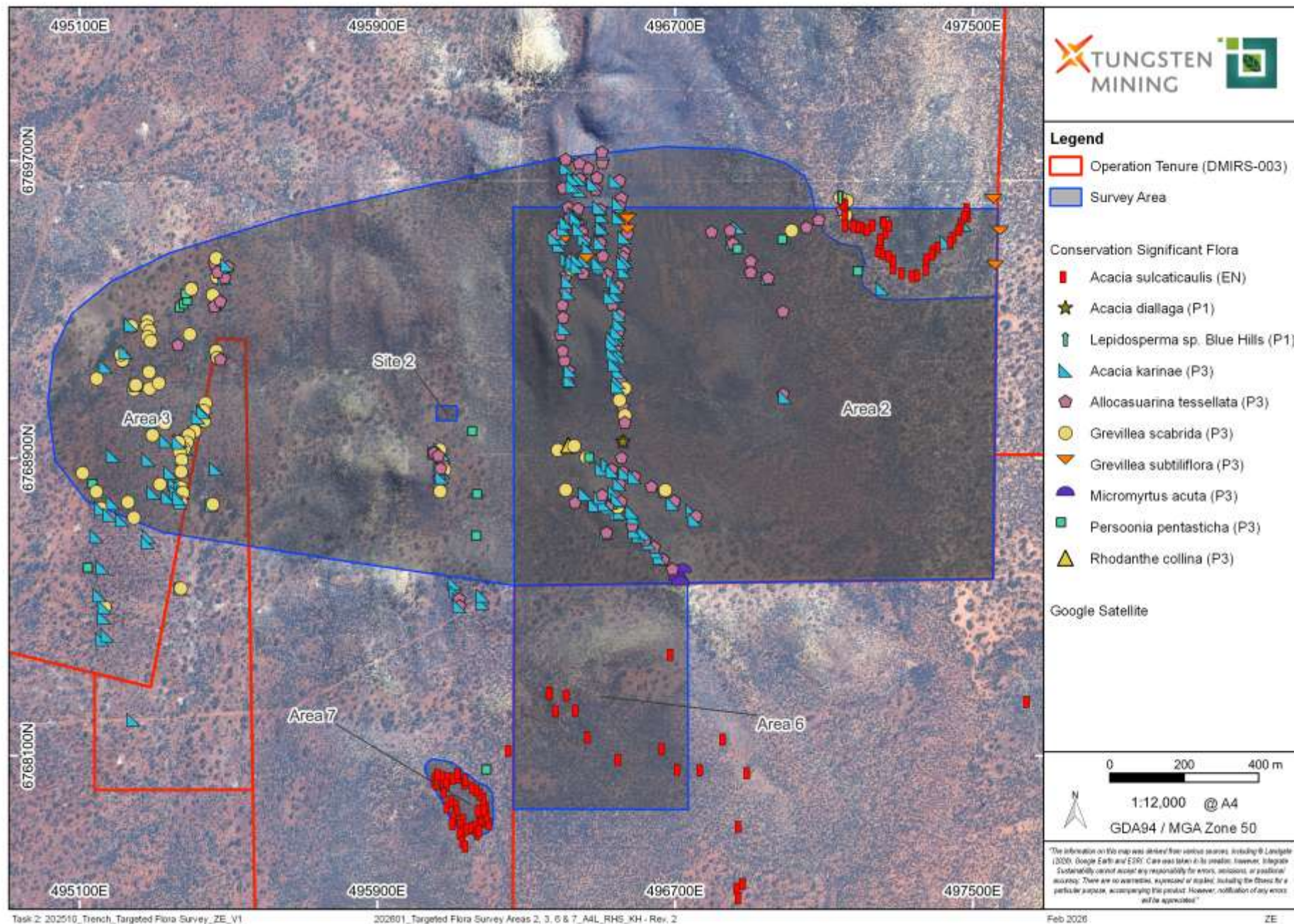


Figure 4.3 Conservation-Significant Flora in Area 2, 3, 6 and 7



4.1.3 Accommodation Camp

Two potential accommodation camp locations were surveyed – Area 4 and Area 5 (Figure 4.4). A total of five conservation-significant flora species were recorded in Area 4, including the previously unrecorded occurrences of *Acacia diallaga* (P1), *Acacia karinae* (P3) and *Grevillea scabrada* (P3). Over 200 individuals of *Acacia karinae* (P3) and *Allocasuarina tessellata* (P3) were identified, which indicates they are common in the area. Seven occurrences of *Acacia diallaga* (P1) and four of *Grevillea scabrada* (P3) were identified, and one *Persoonia pentasticha* (P3) was recorded.

Due to the abundance of conservation-significant flora species in Area 4, Area 5 was surveyed with historic records showing a single occurrence of *Grevillea scabrada* (P3) (Figure 4.4). Five conservation-significant flora species were recorded west of Area 5, with 90 *Lepidosperma* sp. Blue Hills individuals are identified along a drainage line. *Acacia karinae* (P3) and *Allocasuarina tessellata* (P3) were also noted, with 30 and 60 individuals identified, respectively.

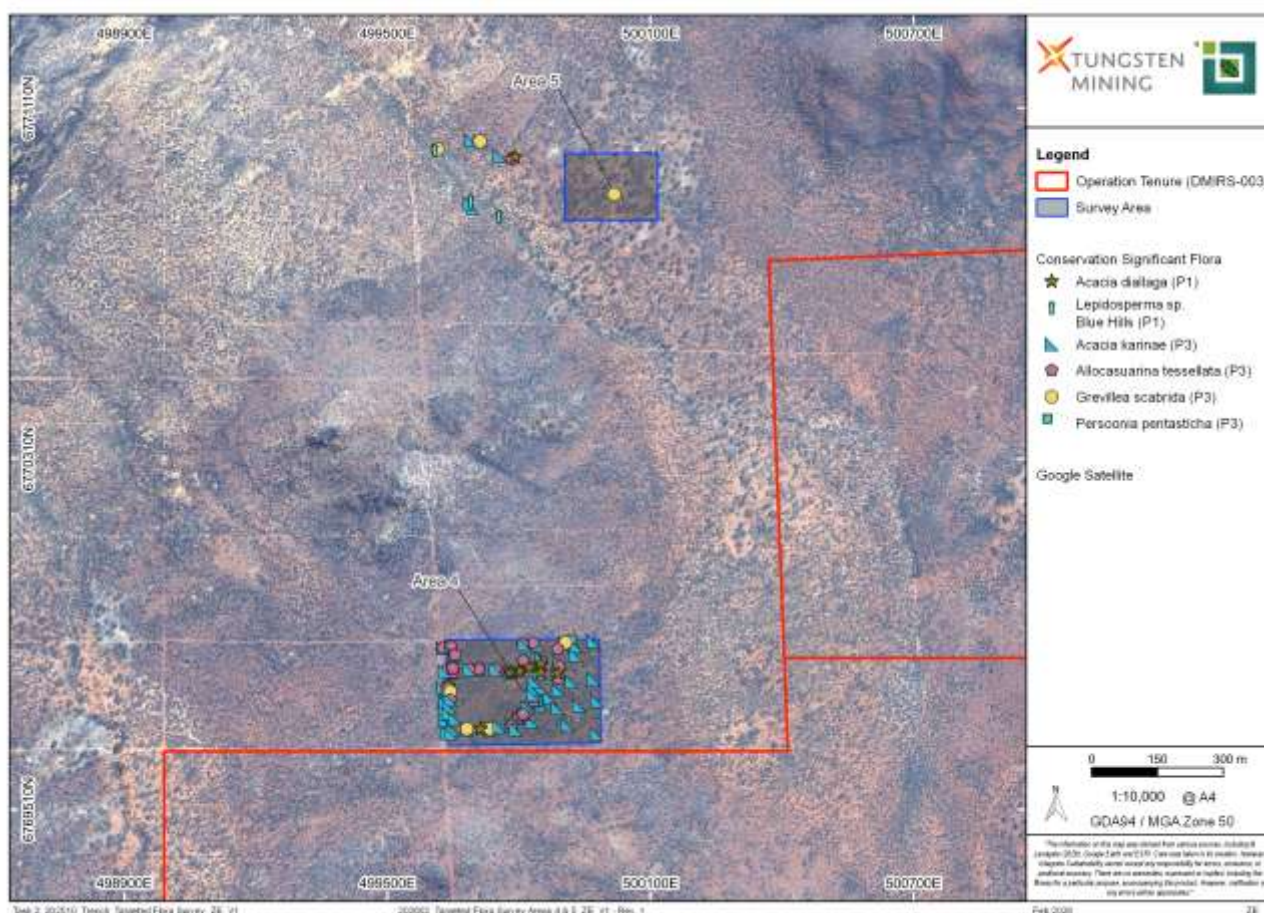


Figure 4.4 Conservation Significant Flora in Areas 4 and 5

4.1.4 Potential *Acacia sulcatcaulis* (EN)

Two new potential areas with *Acacia sulcatcaulis* (EN) were investigated as Area 6 and Area 7 (Figure 4.5). Area 6 is located directly south of the operation, with previous flora and vegetation surveys indicating the species was only present within the TGN tenure (Figure 2.5). Although occurring within the operational area, the closest previous records of *Acacia sulcatcaulis* (EN) to Area 7 were approximately 1.7km north-east, at the corner of Area 2. Specimens from the locations were collected and lodged at the Western Australian Herbarium to confirm their identification as *Acacia sulcatcaulis* (EN).

The population observed in Area 6 was distributed over approximately 440m within the area and continued for another 300m in a south-easterly direction (Figure 4.5). Individuals in this population were primarily mature with seeds present. A potential secondary population was identified approximately 250m to the north, consisting mostly of juveniles. Given the limited survey effort in this area, there is potential for the *Acacia sulcatcaulis* (EN) populations to cover a larger area than was recorded during this survey and actually be part of the same population.

The survey boundary for Area 7 was the recorded extent of the identified *Acacia sulcaticaulis* (EN) population (Figure 4.5). In particular, approximately 210 individuals, consisting mostly of mature plants, were recorded over a 200m area.

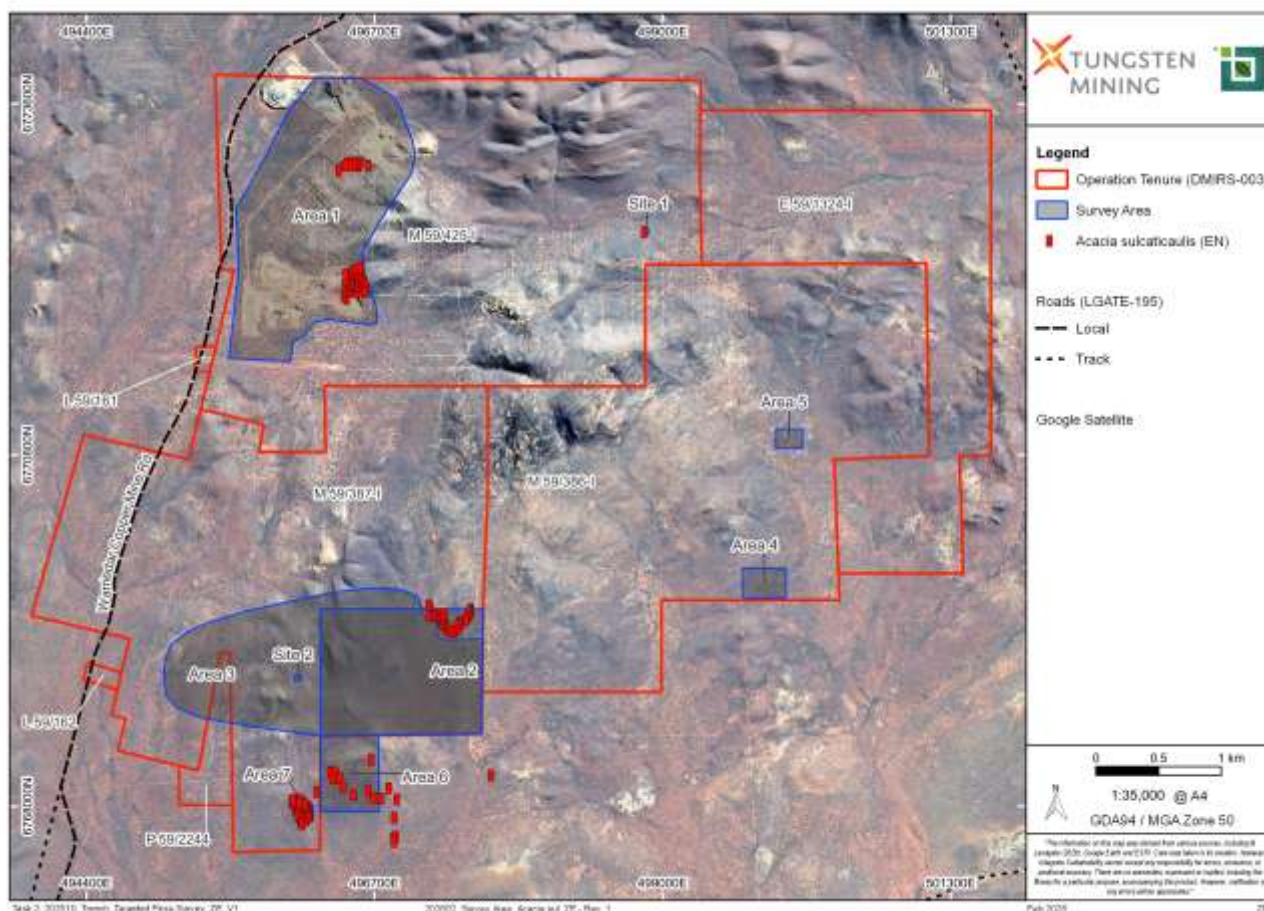


Figure 4.5 *Acacia sulcaticaulis* (EN) Identified in the Survey Area

4.2 Revisited Quadrats

Spectrum Ecology (2021) identified *Acacia duriuscula* at four quadrats with two of the quadrats revisited during this targeted survey – M004 as Site 1 and M010 as Site 2 (Figure 4.6). Spectrum Ecology (2021) recorded the height of *Acacia duriuscula* as 4m in quadrat M004; as such, tall *Acacia* species were targeted during this survey.

A tall *Acacia* sp. shrub with smoothish bark and pods with seed was located at Site 1 (Figure 4.7) with a specimen collected for identification. The seeds of the specimen were dark brown, not mottled and 4-5mm long. The pods were also fairly uniform in diameter along their length, with no obvious areas raised above the seed. In comparison, *Acacia duriuscula* seeds are longitudinal, 3.0-3.5mm long, glossy, brown-black and mottled with the pod slightly raised over the seeds (Figure 4.8). Images of *Acacia duriuscula* bark shows it as quite rough, although Maslin (2018) does not describe it as such.

After studying the specimen, it was determined that it most likely belongs to the *Acacia coolgardiensis* group and particularly the species *Acacia latior*. *A. latior* is most closely related to *A. sulcaticaulis* (EN) and is very variable in its phyllode shape and size. For example, a variant with narrower than normal phyllodes (2-4mm) is common within the Blue Hills area. The species may also hybridise with other members of the *A. coolgardiensis* group (e.g. *A. effusifolia*). Pods of *A. latior* are similar in appearance to *A. sulcaticaulis* (EN) but are slightly larger along with their seeds. Comparing the specimen to specimens lodged at the Western Australian Herbarium has confirmed it is *Acacia latior*.

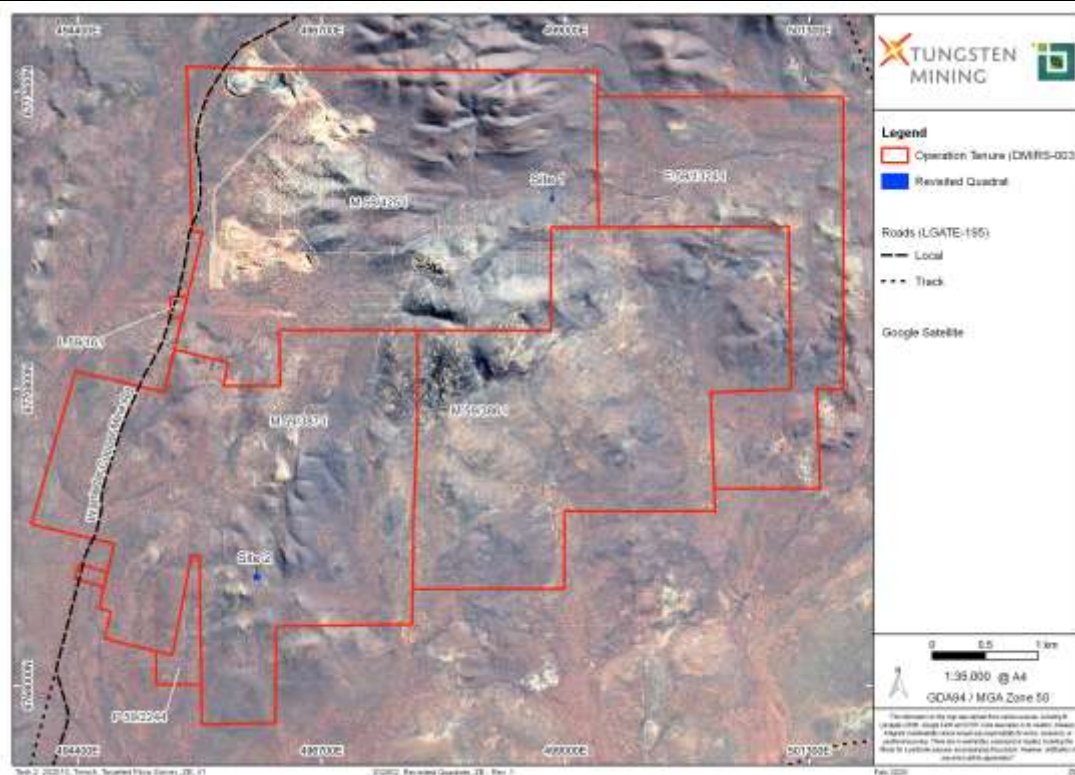


Figure 4.6 Site 1 and Site 2



Figure 4.7 *Acacia latior* Identified in Site 1



Figure 4.8 *Acacia duriuscula* (Maslin, 1994)



At Site 2 no *Acacia duriuscula* were observed; however, *Acacia ramulosa* var. *ramulosa* and *Senna* sp. Austin was observed, and both have features similar to *A. duriuscula*. The Spectrum Ecology's (2021) species list for the quadrat noted *Senna* sp. Austin but not *Acacia ramulosa* var. *ramulosa*, indicating it was most likely mistaken for *A. duriuscula*. The phyllodes for *Acacia ramulosa* var. *ramulosa* are 7-15cm long and 1.4-3.5mm wide which is similar to the phyllodes of *Acacia duriuscula* at 2-7cm long and 2-4mm wide (Figure 4.9). No other species resembling *Acacia duriuscula* were observed in the area.



Figure 4.9 *Acacia ramulosa* var. *ramulosa* (Alford, 1998)

Vegetation descriptions for the sites also appeared incorrect based on species height and foliage cover recorded by Spectrum Ecology and vegetation noted in the field (Table 4.1). Spectrum Ecology (2021) described *Allocasuarina campestris* as 5m tall, however, the species is rarely above 3m. The *Allocasuarina* sp. identified in the field contained old fruit that was representative of *A. acutivalvis* rather than *A. campestris*. The habitat noted for Site 2 is also unlikely to support *Acacia duriuscula*, as the species prefers sandy soils adjacent to or on granite outcrops.

Table 4.1 Vegetation Descriptions for Revisited Quadrats

Site	Description	Image
1	GPS: 498881 E / 6772585 N Landform: Hill; lower midslope; north aspect	SE: <i>Allocasuarina campestris</i> , <i>Acacia sulcatacaulis</i> (EN), <i>A. duriuscula</i> tall open shrubland over <i>Malleostemon tuberculatus</i> , <i>Gastrolobium laytonii</i> , <i>Eremophila latrobei</i> subsp. <i>latrobei</i> open shrubland over low sparse forbland
		JB: <i>Acacia latior</i> , <i>A. sulcatacaulis</i> (EN), <i>Allocasuarina acutivalvis</i> tall shrubland over <i>Gastrolobium laytonii</i> sparse shrubland
2	GPS: 496092 E / 6768018 N Landform: Hill; upper slope; gentle slope; aspect east Land surface: Reddish brown clay loam; surface rock (ironstone gravel, quartz) <10%	SE: <i>Eucalyptus loxophleba</i> subsp. <i>supraeae</i> woodland over <i>Eremophila oldfieldii</i> subsp. <i>oldfieldii</i> , <i>E. oppositifolia</i> subsp. <i>angustifolia</i> , <i>Exocarpos aphyllus</i> , <i>Acacia duriuscula</i> tall sparse shrubland over <i>Senna</i> sp. Austin isolated shrubs over <i>Dodonaea inaequifolia</i> , <i>Ptilotus obovatus</i> var. <i>obovatus</i> , <i>Maireana georgei</i> low sparse shrubland



Site	Description	Image
	JB: <i>Eucalyptus loxophleba</i> subsp. <i>supralaevis</i> woodland over <i>Eremophila oldfieldii</i> subsp. <i>oldfieldii</i> , <i>E. oppositifolia</i> subsp. <i>angustifolia</i> tall isolated shrubs over <i>Acacia tetragonophylla</i> , <i>Dodonaea inaequifolia</i> , <i>Acacia acuminata</i> isolated shrubs over <i>Ptilotus obovatus</i> var. <i>obovatus</i> , <i>Senna artemisioides</i> subsp. <i>filifolia</i> , <i>Maireana georgei</i> , <i>Austrostipa elegantissima</i> low open shrubland	

SE – Spectrum Ecology vegetation description

JB – Jenny Borger vegetation description

4.3 Targeted Regional Review

During the two trips, 37 locations were surveyed across Zones 6, 7 and 8 (Figure 4.10). Part of Zone 7 overlaps Area 6, where the new populations of *Acacia sulcatacaulis* (EN) were identified (Figure 4.5; Figure 4.11). *Acacia diallagia* (P1), *Acacia karinae* (P3) and *Micromyrtus acuta* (P3) were recorded within Zone 7. No other conservation-significant species were recorded for Zone 6 (Figure 4.11). A total of eight conservation-significant flora species were identified in Zone 8, which included one Priority 1 and seven Priority 3 species. These species were all recorded in the southern part of Zone 8, with *Stenanthemum poicilum* (P3) identified at five locations, compared with four for *Grevillea scabrida* (P3) and *Micromyrtus acuta* (P3). A significant number of *Micromyrtus acuta* (P3) individuals were observed in Zone 8, unfortunately no population count was completed. It was estimated that around 100 *Stenanthemum poicilum* (P3) plants were also located in Zone 8.

Despite the limited survey effort within the Regional Review Area during the 2025 survey trips, previous flora and vegetation surveys have been undertaken over much of this area. Sixteen conservation significant flora species have been identified, including one Endangered, four Priority 1, 10 Priority 3 and one Priority 4 species (Figure 4.12).

Zone 4 contained the highest diversity of flora species compared to the other zones, with 12 species identified (Figure 4.12). These species were recorded primarily within 500m of the operation area. Similarly, Zone 1 and Zone 2 recorded nine conservation-significant flora species, with most within 400m of the operation area. Nine species were also recorded in Zone 7 and Zone 8, although they were identified throughout the zone. The targeted survey did identify *Acacia sulcatacaulis* (EN) on Zone 7, which hadn't been recorded previously, while additional records for eight species were identified on Zone 8. There were no additional records for *Grevillea subtiliflora* (P3) on Zone 8, which was previously recorded in the north-eastern area.

Four conservation-significant flora species were recorded on Zone 6, with most identified along the Perenjori-Warriedar Road (Figure 4.12). The *Acacia sulcatacaulis* (EN) population, which continued from Zone 7, was the first occurrence of the species in Zone 6. Only two species were recorded around a single location on a track passing through Zone 5, with a single *Grevillea scabrida* (P3) noted on Zone 3.

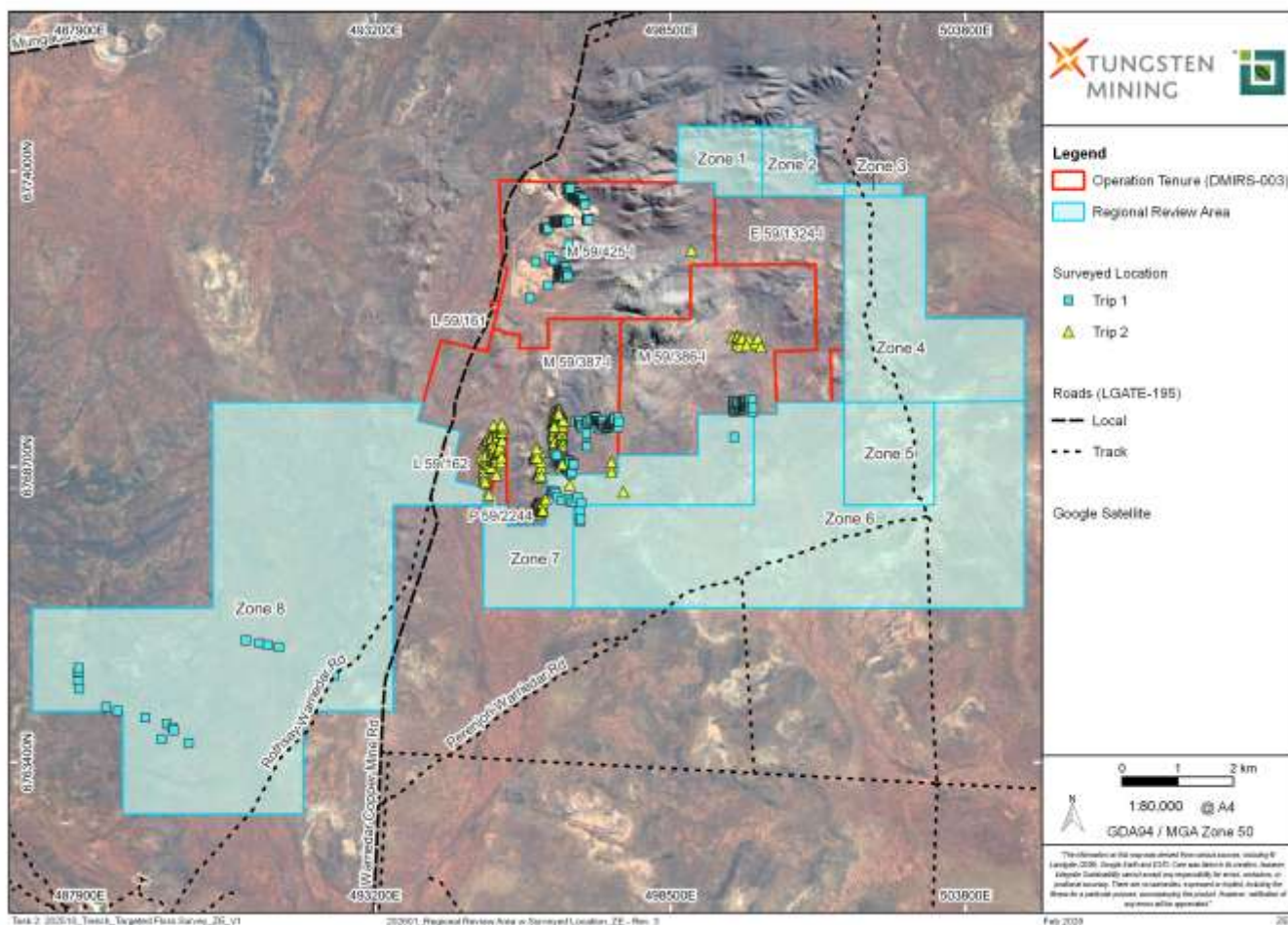


Figure 4.10 Surveyed Sites in the Regional Review Area

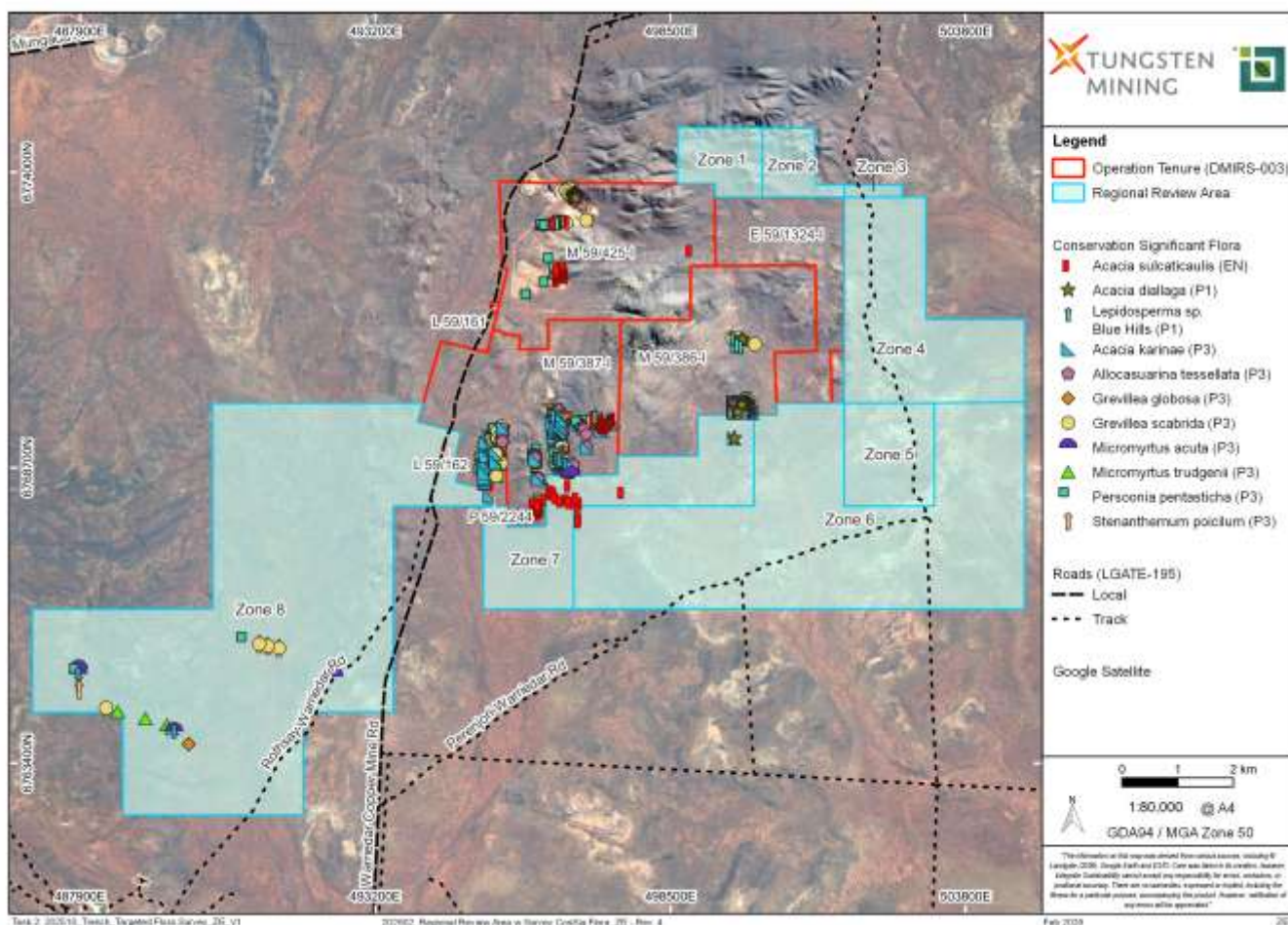


Figure 4.11 Surveyed Conservation Significant Flora in Regional Review Area

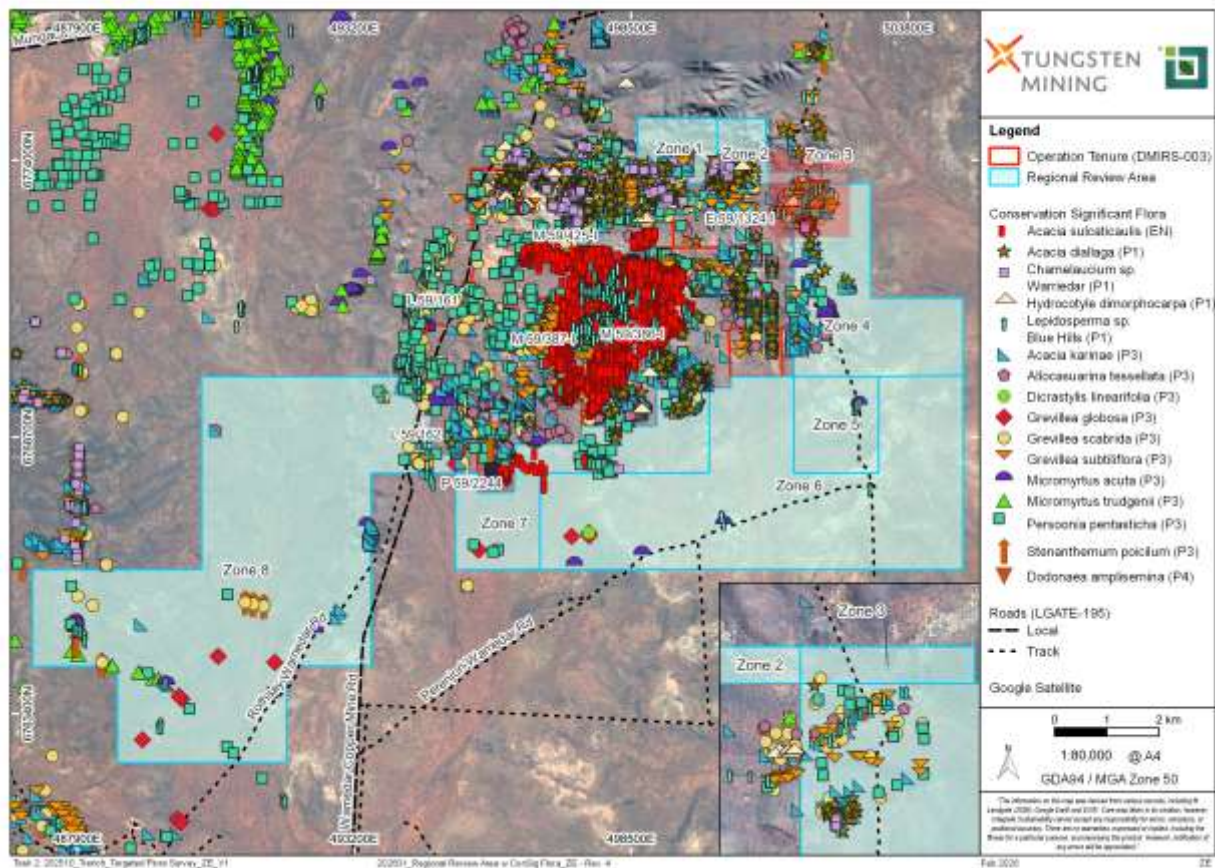


Figure 4.12 Conservation Significant Flora in Regional Review Area

4.4 Predicted Conservation Significant Flora Locations

It is expected that additional conservation-significant flora species will be present along drainage lines through the TGN tenure. These conservation-significant flora species include *Lepidosperma* sp. Blue Hills (P1) and *Grevillea scabrata* (P3), as both species are commonly found in drainage lines (Figure 4.13).

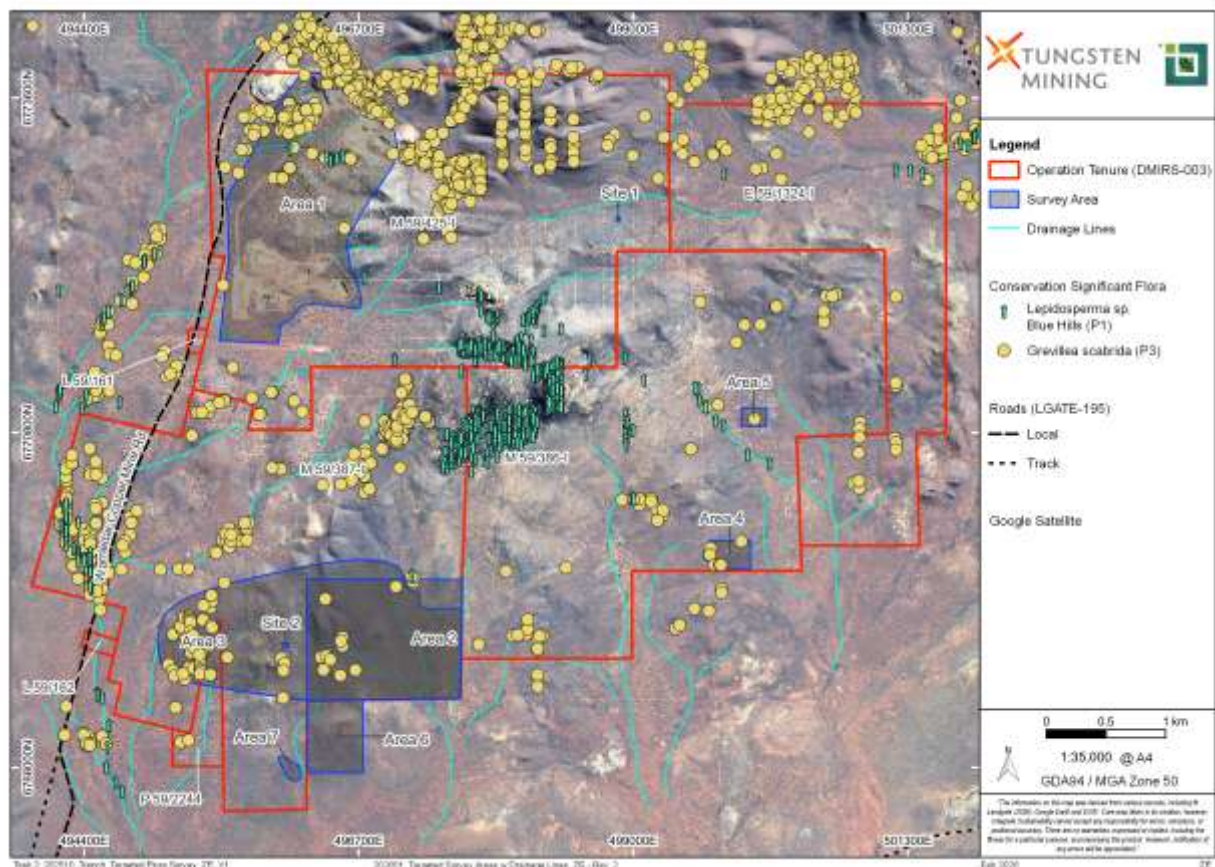


Figure 4.13 Drainage Lines Through the Survey Area



4.5 Vegetation Units

Vegetation was described at 35 sites within the Survey Area, two of which were within the Regional Review Area; one of the vegetation description sites was within Area 6 (Zone 7) (Figure 4.14). Based on the vegetation descriptions, the vegetation at Area 1, Area 4, Area 5, Site 1 and Site 2 aligned with vegetation units mapped by Spectrum Ecology (2021) for Trench ([Appendix B](#)).

Vegetation units observed in Area 2 and Area 3 only broadly aligned with the Spectrum Ecology (2021) vegetation units. Vegetation in this area was noted as starting to change when compared to vegetation in the northern area of the operation, with three new vegetation units identified: AtAk, AssMa and EeAr (Table 4.2). The previously mapped vegetation unit AdAt/AdAa was split into the vegetation units AdAa and AtAk, with the boundary for ElAr on the eastern side revised for the vegetation unit EeAr and an extended boundary for ElAt (Figure 4.15). The vegetation unit AssMa was identified along the southern edge of Area 2 and Area 3, with an additional occurrence noted further west within Area 3, although it was not covered during this survey, and *Micromyrtus acuta* (P3) has not been recorded in the area.

Area 7 was previously mapped as vegetation units AaAr and ElAr, however, due to the presence of *Acacia sulcaticaulis* (EN), it has been remapped as vegetation unit AsCp (Figure 4.15). The area also contains the species *Acacia assimilis* subsp. *assimilis* and *Melaleuca nematophylla*, which were recorded in quadrats, Spectrum Ecology (2021) categorised as AsCp.

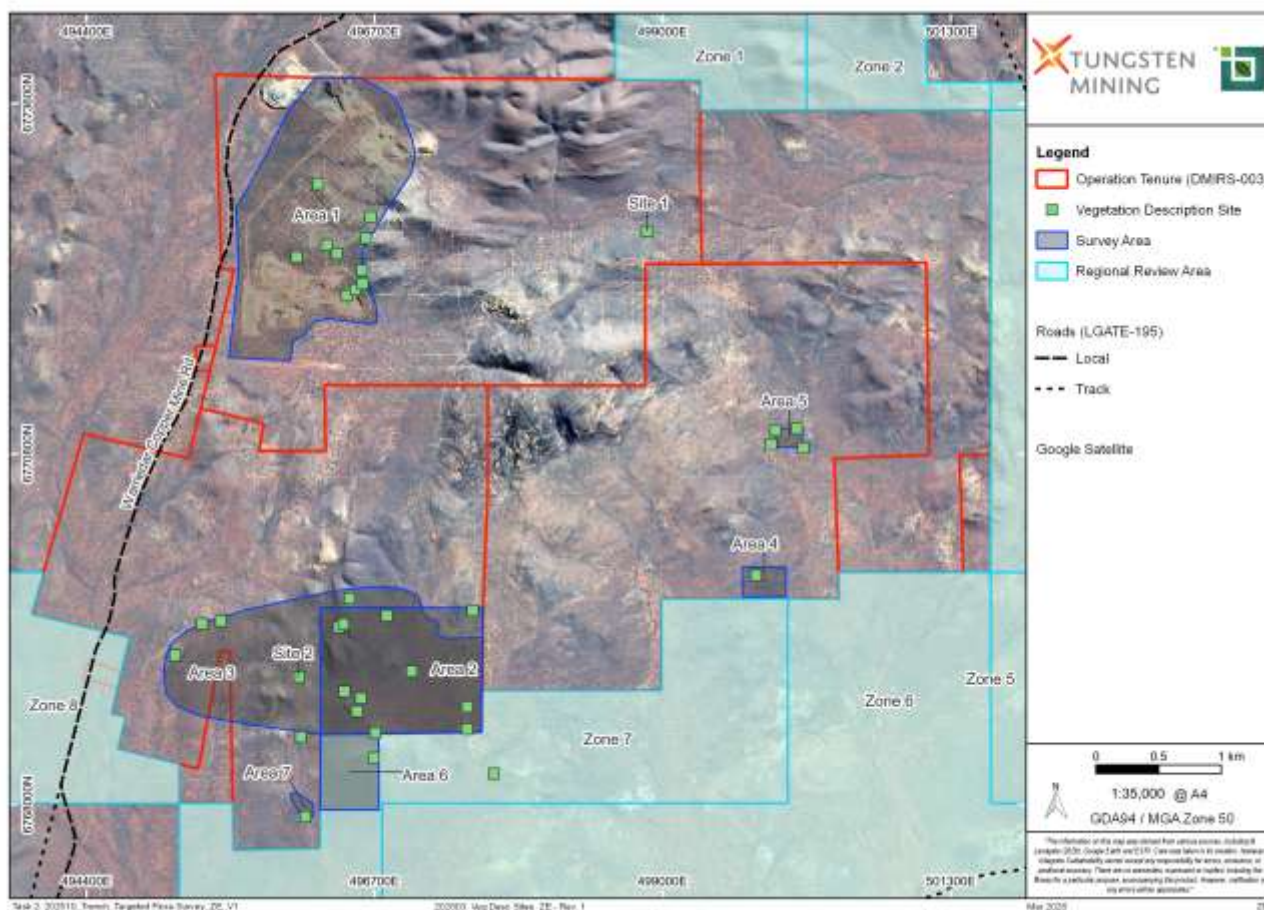


Figure 4.14 Vegetation Description Sites



Table 4.2 Description of New Vegetation Units

Veg Unit	Description	Image
AtAk	<i>Allocasuarina dielsiana</i> emergent trees over <i>Allocasuarina tessellata</i> (P3), <i>Acacia karinae</i> (P3) shrubland on dolerite/greenstone hills.	
AssMa	<i>Acacia assimilis</i> isolated tall shrubs over <i>Micromyrtus acuta</i> (P3), <i>Alyxia buxifolia</i> , <i>Eremophila clarkei</i> low open shrubland on rocky outcrops.	
EeAr	<i>Eucalyptus ewartiana</i> , <i>Acacia ramulosa</i> mallee woodland over <i>Acacia ramulosa</i> var. <i>ramulosa</i> , <i>Acacia tetragonophylla</i> sparse shrubland on hardpan plains.	

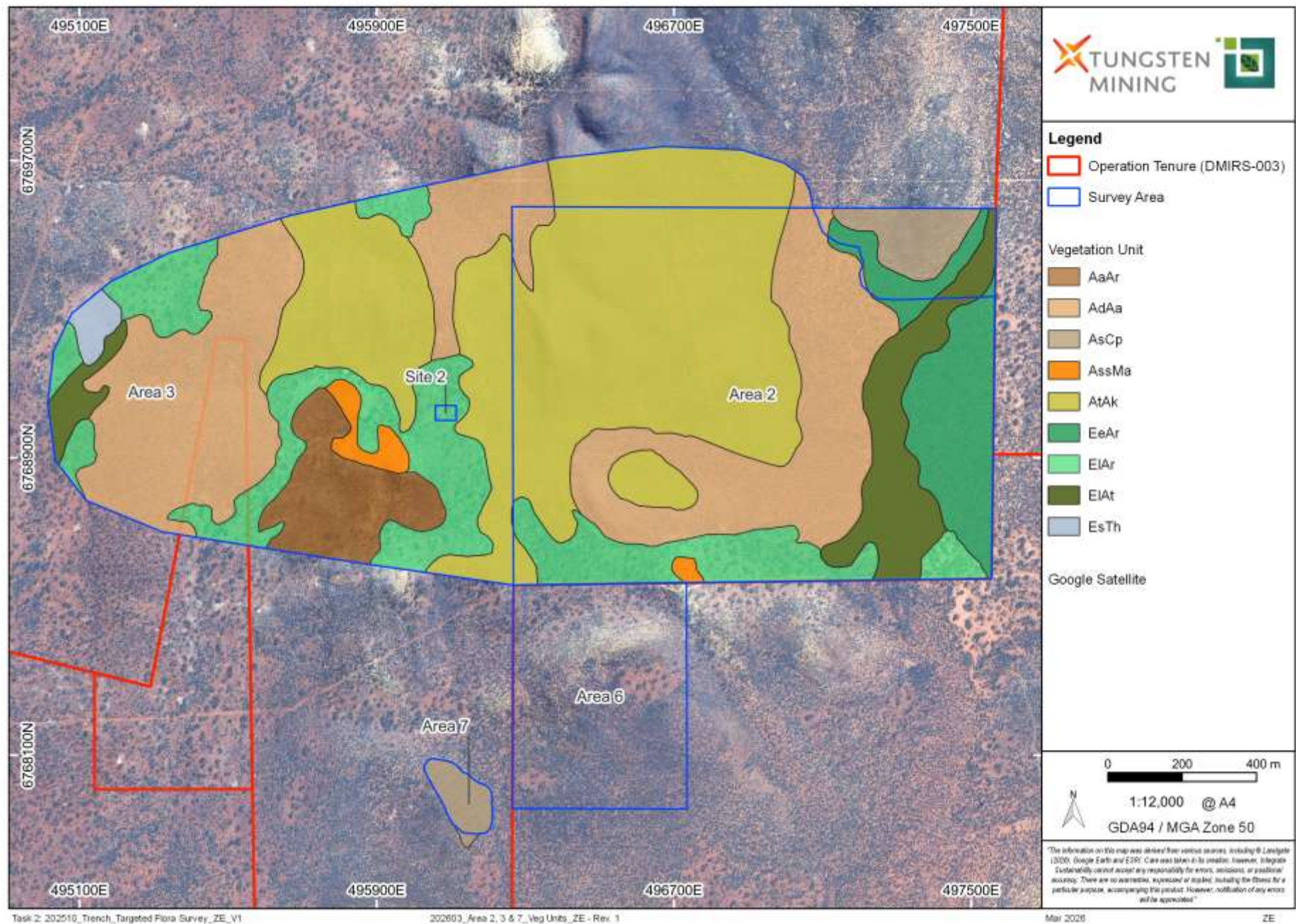


Figure 4.15 Vegetation Units in Area 2, 3 and 7



5 Outcomes

Much of the open-pit area already shows high levels of disturbance, with this survey identifying *Acacia sulcatacaulis* (EN) regrowing there. It is therefore likely that disturbed areas (with the appropriate substrate) contain good prospects for regenerating the species. As a result, it is recommended that either the areas with *Acacia sulcatacaulis* (EN) regrowth be avoided or the substrate be stockpiled separately for future rehabilitation use.

During Trip 1, it was noted that *Micromyrtus acuta* (P3) occurs in the low shrubland areas in the central area of the open pit. *Micromyrtus acuta* (P3) is known to occur with *Stylidium scintillans*, listed as VU under the BC Act. In spring 2019 and 2020, Spectrum Ecology searched 20 potentially suitable habitats across the site, with no plants identified (Spectrum Ecology, 2020). It is therefore unlikely that *Stylidium scintillans* (VU) occurs at Trench.

The proposed Area 5 camp location, which was found to contain no conservation-significant species, makes it the most logical option; however, depending on the size of the camp, some may be affected during the clearing of an access track on the western side near the drainage line. It is recommended that a pre-clearance survey be undertaken over the area, with conservation-significant plants avoided where possible. Erosion controls will also need to be implemented to prevent sedimentation in downstream areas.

Depending on the final design and location of the Tailings Storage Facility, it is likely that a large number of priority flora, particularly *Allocasuarina tessellata* (P3) and *Acacia karinae* (P3) will be cleared. It is noted that these species are likely in unsurveyed areas outside the proposed disturbance areas, reducing the size of the impact. *Acacia sulcatacaulis* (EN) was identified in the northeastern corner of Area 2, which may be indirectly impacted by dust, alterations to drainage lines or other indirect disturbance activities. *Acacia sulcatacaulis* (EN) and *Micromyrtus acuta* (P3) occurring in Area 7 should be avoided.

The Tailings Storage Facility design needs to account for an ephemeral drainage line on the western side of the area, which should be avoided where possible, as substantial volumes of water are likely to flow through the area following significant rainfall events.

The vegetation unit AsCp is larger than previously mapped, with much of Area 6 and Area 7, located on TGN tenure, remapped as belonging to the vegetation unit. Field observations also noted an occurrence of the new vegetation unit AssMa on the ridge top of Area 6. The new vegetation unit, AtAk, also likely covers additional parts of the previously mapped mosaic AdAt/AdAa through the operation area. It is acknowledged that the Spectrum Ecology (2021) The vegetation unit AdAt is poorly defined, with *Acacia duriuscula* unlikely to be present within Trench and would therefore benefit from re-analysis.



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Appendices

Appendix A – Flora Species List

Family	Taxa	Status
Aizoaceae	<i>*Mesembryanthemum nodiflorum</i>	Weed
Amaranthaceae	<i>Ptilotus divaricatus</i>	
Amaranthaceae	<i>Ptilotus exaltatus</i>	
Amaranthaceae	<i>Ptilotus obovatus</i> var. <i>obovatus</i>	
Apocynaceae	<i>Alyxia buxifolia</i>	
Araliaceae	<i>Hydrocotyle dimorphocarpa</i>	P1
Araliaceae	<i>Trachymene ornata</i>	
Asteraceae	<i>Bellida graminea</i>	
Asteraceae	<i>Calocephalus multiflorus</i>	
Asteraceae	<i>Gilberta tenuifolia</i>	
Asteraceae	<i>Gilruthia osbornei</i>	
Asteraceae	<i>Olearia muelleri</i>	
Asteraceae	<i>Rhodanthe citrina</i>	
Asteraceae	<i>Rhodanthe collina</i>	P3
Asteraceae	<i>Waitzia acuminata</i> var. <i>acuminata</i>	
Boryaceae	<i>Borya sphaerocephala</i>	
Casuarinaceae	<i>Allocasuarina acutivalvis</i>	
Casuarinaceae	<i>Allocasuarina acutivalvis</i> subsp. <i>acutivalvis</i>	
Casuarinaceae	<i>Allocasuarina acutivalvis</i> subsp. <i>prinsepiana</i>	
Casuarinaceae	<i>Allocasuarina dielsiana</i>	
Casuarinaceae	<i>Allocasuarina tessellata</i>	P3
Chenopodiaceae	<i>Atriplex vesicaria</i>	
Chenopodiaceae	<i>Maireana carnosia</i>	
Chenopodiaceae	<i>Maireana georgei</i>	
Chenopodiaceae	<i>Maireana tomentosa</i>	
Chenopodiaceae	<i>Maireana triptera</i>	
Chenopodiaceae	<i>Rhagodia drummondii</i>	
Chenopodiaceae	<i>Sclerolaena</i> sp.	
Cyperaceae	<i>Lepidosperma</i> sp. Blue Hills	P1
Dilleniaceae	<i>Hibbertia arcuata</i>	
Euphorbiaceae	<i>Calycoplepus paucifolius</i>	
Euphorbiaceae	<i>Euphorbia tannensis</i> subsp. <i>eremophila</i>	
Fabaceae	<i>Acacia acanthoclada</i> subsp. <i>glaucescens</i>	
Fabaceae	<i>Acacia acuminata</i>	
Fabaceae	<i>Acacia andrewsii</i>	
Fabaceae	<i>Acacia aneura</i>	
Fabaceae	<i>Acacia assimilis</i> subsp. <i>assimilis</i>	
Fabaceae	<i>Acacia aulacophylla</i>	
Fabaceae	<i>Acacia burkittii</i>	
Fabaceae	<i>Acacia diallaga</i>	P1
Fabaceae	<i>Acacia erinacea</i>	
Fabaceae	<i>Acacia karinae</i>	P3
Fabaceae	<i>Acacia latior</i>	
Fabaceae	<i>Acacia ramulosa</i> var. <i>ramulosa</i>	
Fabaceae	<i>Acacia sulcatacaulis</i>	EN
Fabaceae	<i>Acacia tetragonophylla</i>	
Fabaceae	<i>Acacia umbraculiformis</i>	
Fabaceae	<i>Daviesia</i> sp.	
Fabaceae	<i>Gastrolobium laytonii</i>	
Fabaceae	<i>Mirbelia</i> sp. <i>Bursarioides</i>	
Fabaceae	<i>Senna artemisioides</i> subsp. <i>filifolia</i>	
Fabaceae	<i>Senna</i> sp.	
Fabaceae	<i>Senna</i> sp. Austin	



Family	Taxa	Status
Frankeniaceae	<i>Frankenia setosa</i>	
Goodeniaceae	<i>Goodenia</i> sp.	
Goodeniaceae	<i>Scaevola spinescens</i>	
Lamiaceae	<i>Hemigenia ciliata</i>	
Lamiaceae	<i>Prostanthera althoferi</i> subsp. <i>althoferi</i>	
Lamiaceae	<i>Prostanthera patens</i>	
Malvaceae	<i>Brachychiton gregorii</i>	
Malvaceae	<i>Seringia velutina</i>	
Malvaceae	<i>Sida calyxhymenia</i>	
Myrtaceae	<i>Aluta aspera</i> subsp. <i>hesperia</i>	
Myrtaceae	<i>Chamelaucium</i> sp. Warriedar	P1
Myrtaceae	<i>Eucalyptus clelandiorum</i>	
Myrtaceae	<i>Eucalyptus ewartiana</i>	
Myrtaceae	<i>Eucalyptus kochii</i> subsp. <i>amaryssia</i>	
Myrtaceae	<i>Eucalyptus loxophleba</i> subsp. <i>supralaevis</i>	
Myrtaceae	<i>Eucalyptus salubris</i>	
Myrtaceae	<i>Melaleuca nematophylla</i>	
Myrtaceae	<i>Micromyrtus acuta</i>	P3
Myrtaceae	<i>Micromyrtus trudgenii</i>	P3
Myrtaceae	<i>Thryptomene costata</i>	
Poaceae	* <i>Pentameris airoides</i>	Weed
Poaceae	<i>Amphipogon caricinus</i> var. <i>caricinus</i>	
Poaceae	<i>Austrostipa elegantissima</i>	
Poaceae	<i>Monachather paradoxus</i>	
Polygonaceae	* <i>Rumex vesicarius</i>	Weed
Proteaceae	<i>Grevillea acacioides</i>	
Proteaceae	<i>Grevillea globosa</i>	P3
Proteaceae	<i>Grevillea scabrida</i>	P3
Proteaceae	<i>Grevillea subtiliflora</i>	P3
Proteaceae	<i>Hakea recurva</i> subsp. <i>recurva</i>	
Proteaceae	<i>Persoonia pentasticha</i>	P3
Rhamnaceae	<i>Stenanthemum poicilum</i>	P3
Rutaceae	<i>Philotheca brucei</i>	
Rutaceae	<i>Philotheca brucei</i> subsp. <i>brucei</i>	
Rutaceae	<i>Philotheca sericea</i>	
Santalaceae	<i>Exocarpos aphyllus</i>	
Santalaceae	<i>Santalum spicatum</i>	
Sapindaceae	<i>Dodonaea inaequifolia</i>	
Scrophulariaceae	<i>Eremophila clarkei</i>	
Scrophulariaceae	<i>Eremophila forrestii</i> subsp. <i>forrestii</i>	
Scrophulariaceae	<i>Eremophila granitica</i>	
Scrophulariaceae	<i>Eremophila latrobei</i> subsp. warty leaves	
Scrophulariaceae	<i>Eremophila oldfieldii</i> subsp. <i>angustifolia</i>	
Scrophulariaceae	<i>Eremophila oldfieldii</i> subsp. <i>oldfieldii</i>	
Scrophulariaceae	<i>Eremophila oppositifolia</i> subsp. <i>angustifolia</i>	
Solanaceae	<i>Solanum cleistogamum</i>	
Solanaceae	<i>Solanum lasiophyllum</i>	
Violaceae	<i>Pigea curvifolia</i>	



Appendix B – Vegetation Site Descriptions

Site (Veg Unit)		Description	Image
A1-1 (ElAr)	14/10/2025 GPS: 496320 E/ 6772470 N Elevation: 419m Low hill	<i>Eucalyptus loxophleba</i> subsp. <i>supralaevis</i> low open woodland over <i>Eremophila oppositifolia</i> subsp. <i>angustifolia</i> sparse shrubland over <i>Atriplex vesicaria</i> , <i>Ptilotus obovatus</i> var. <i>obovatus</i> , <i>P. divaricatus</i> , <i>P. exaltatus</i> , <i>Austrostipa elegantissima</i> low open shrubland Other species: <i>Acacia erinacea</i> , <i>Olearia muelleri</i> , <i>Maireana tomentosa</i> , <i>Frankenia setosa</i> , <i>Scaevola spinescens</i> , <i>Rhagodia drummondii</i>	
A1-2 (ElAr)	14/10/2025 GPS: 496400 E/ 6772401 N Elevation: 410m Vegetation change; lower slope	<i>Acacia ramulosa</i> var. <i>ramulosa</i> , <i>Eremophila oppositifolia</i> subsp. <i>angustifolia</i> , <i>Exocarpos aphyllus</i> , <i>Eremophila oldfieldii</i> subsp. <i>angustifolia</i> tall shrubland over <i>Acacia tetragonophylla</i> sparse shrubland	
A1-7 (AsCp)	14/10/2025 496604 E/ 6772162 N Elevation: 415m Hill; lower slope	<i>Allocasuarina acutivalvis</i> subsp. <i>prinsepiana</i> , <i>Melaleuca nematophylla</i> , <i>Acacia sulcatacaulis</i> tall open shrubland over <i>Allocasuarina acutivalvis</i> subsp. <i>prinsepiana</i> , <i>A. assimilis</i> subsp. <i>assimilis</i> , <i>Acacia sulcatacaulis</i> , <i>Gastrolobium laytonii</i> , <i>Philotheca brucei</i> subsp. <i>brucei</i> , <i>Melaleuca nematophylla</i> shrubland over <i>Rhodanthe citrina</i> , <i>Waitzia acuminata</i> var. <i>acuminata</i> , <i>Acacia sulcatacaulis</i> low open forbland CSF: <i>Allocasuarina sulcatacaulis</i> (EN)	



Site (Veg Unit)		Description	Image
A1-21 (AsCp)	14/10/2025 496598 E/ 6772269 N Elevation: 407m Hill; lower slope High levels of fallen timber	<i>Acacia sulcatiaulis</i> , <i>Allocasuarina acutivalvis</i> subsp. <i>prinsepiana</i> , <i>Melaleuca nematophylla</i> tall shrubland over <i>Allocasuarina acutivalvis</i> subsp. <i>prinsepiana</i> sparse shrubland over <i>Amphipogon caricinus</i> var. <i>caricinus</i> , <i>Solanum lasiophyllum</i> , <i>Waitzia acuminata</i> var. <i>acuminata</i> , <i>Solanum cleistogamum</i> , <i>Acacia sulcatiaulis</i> (seedlings) low open tussock grassland CSF: <i>Acacia sulcatiaulis</i> (EN)	
A1-25 (AsCp)	14/10/2025 GPS: 496478 E/ 6772065 N Rehabilitation next to pit	<i>Acacia sulcatiaulis</i> , <i>A. assimilis</i> subsp. <i>assimilis</i> , <i>Seringia velutina</i> , <i>Gastrolobium laytonii</i> open shrubland Other species: <i>Eucalyptus loxophleba</i> subsp. <i>supralaevis</i> , <i>Melaleuca nematophylla</i> CSF: <i>Acacia sulcatiaulis</i> (EN)	
A1-32 (AsCp)	14/10/2025 496547 E/ 6772114 N Rehabilitation	<i>Acacia sulcatiaulis</i> tall open shrubland (2 – 3 m) over <i>Acacia sulcatiaulis</i> , <i>Seringia velutina</i> , <i>Melaleuca nematophylla</i> , <i>Gastrolobium laytonii</i> , <i>Allocasuarina acutivalvis</i> subsp. <i>prinsepiana</i> shrubland over <i>Acacia sulcatiaulis</i> , <i>Solanum lasiophyllum</i> , <i>Melaleuca nematophylla</i> low sparse shrubland Other species: <i>Bellida graminea</i> , <i>Gilruthia osbornei</i> , <i>Rhodanthe citrina</i> CSF: <i>Allocasuarina sulcatiaulis</i> (EN)	



Site (Veg Unit)		Description	Image
A1-53 (ElAr)	14/10/2025 GPS: 496078 E/ 6772374 N Elevation: 406m Low hill; old drill lines; isolated shrub regrowth; adjacent vegetation in very good condition	<i>Acacia ramulosa</i> var. <i>ramulosa</i> , <i>Melaleuca nematophylla</i> tall shrubland over <i>Philotheca brucei</i> subsp. <i>brucei</i> , <i>Eremophila latrobei</i> subsp. <i>warty leaves</i> , <i>Mirbelia</i> sp. <i>Bursarioides</i> , <i>Eremophila clarkei</i> open shrubland over <i>Prostanthera patens</i> , <i>Ptilotus obovatus</i> var. <i>obovatus</i> , <i>Hibbertia arcuata</i> low open shrubland Other species: <i>*Rumex vesicarius</i> (Ruby Dock), <i>*Mesembryanthemum nodiflorum</i> (Ice Plant) and <i>Waitzia acuminata</i> var. <i>acuminata</i> – within disturbance areas; <i>Scaevola spinescens</i>	
A1-54 (ElAr)	14/10/2025 496631 E/ 6772526 N Elevation: 426m Rocky quartz hill	<i>Eucalyptus loxophleba</i> subsp. <i>supralaevis</i> open woodland over <i>Acacia ramulosa</i> var. <i>ramulosa</i> , <i>A. assimilis</i> subsp. <i>assimilis</i> , <i>Eremophila oppositifolia</i> subsp. <i>angustifolia</i> tall shrubland over <i>Acacia andrewsii</i> , <i>Eremophila oppositifolia</i> subsp. <i>angustifolia</i> , <i>Olearia muelleri</i> , <i>Rhagodia drummondii</i> low open shrubland	
A1-55 (ElAr)	14/10/2025 GPS: 496669 E/ 6772694 N Elevation: 431m Hill; quartz	<i>Exocarpos aphyllus</i> , <i>Acacia aulacophylla</i> , <i>A. assimilis</i> subsp. <i>assimilis</i> , <i>Eremophila oppositifolia</i> subsp. <i>angustifolia</i> , <i>Senna</i> sp. Austin tall sparse shrubland over open shrubland over <i>Acacia erinacea</i> , <i>Scaevola spinescens</i> , <i>Alyxia buxifolia</i> , <i>Acacia aulacophylla</i> , <i>Senna</i> sp. Austin open shrubland over <i>Frankenia setosa</i> , <i>Maireana triptera</i> , <i>Rhagodia drummondii</i> , <i>Ptilotus obovatus</i> var. <i>obovatus</i> low shrubland Other species: <i>Maireana carnosa</i> , <i>*Mesembryanthemum nodiflorum</i> , <i>Austrostipa elegantissima</i> , <i>Olearia muelleri</i> Summit of hill: <i>Eucalyptus loxophleba</i> subsp. <i>supralaevis</i> open woodland patch	



Site (Veg Unit)		Description	Image
A1-93 (ElAr)	15/10/2025 GPS: 496248 E/ 6772958 N Low hill; crest; laterised granite outcrop Surface rock > 90 %	<i>Melaleuca nematophylla</i> , <i>Acacia assimilis</i> subsp. <i>assimilis</i> , <i>A. aulacophylla</i> tall sparse shrubland over <i>Acacia assimilis</i> subsp. <i>assimilis</i> , <i>Micromyrtus acuta</i> , <i>Melaleuca nematophylla</i> , <i>Philotheca sericea</i> open shrubland over <i>Micromyrtus acuta</i> , <i>Philotheca sericea</i> , <i>Melaleuca nematophylla</i> low open shrubland over <i>Calocephalus multiflorus</i> , <i>Waitzia acuminata</i> var. <i>acuminata</i> , <i>Trachymene ornata</i> low open forbland CSF: <i>Micromyrtus acuta</i> (P3)	
A2-4 (AssMa)	15/10/2025 GPS: 496706 E/ 6768573 N Low hill; laterised granite; quartz boulders	<i>Micromyrtus acuta</i> low open shrubland <i>Acacia assimilis</i> subsp. <i>assimilis</i> isolated tall shrubs over <i>Micromyrtus acuta</i> , <i>Alyxia buxifolia</i> , <i>Eremophila clarkei</i> , <i>Acacia assimilis</i> subsp. <i>assimilis</i> , <i>Philotheca brucei</i> sparse shrubland over <i>Micromyrtus acuta</i> , <i>Prostanthera patens</i> , <i>Philotheca brucei</i> subsp. <i>brucei</i> low open shrubland over <i>Borya sphaerocephala</i> , <i>Waitzia acuminata</i> var. <i>acuminata</i> , <i>Calocephalus multiflorus</i> , <i>Trachymene ornata</i> , * <i>Pentameris airoides</i> low sparse forbland Other species: <i>Santalum spicatum</i> CSF: <i>Micromyrtus acuta</i> (P3)	
A2-35 (AdAa)	15/10/2025 GPS: 496459 E/ 6768902 N Valley; old track – overgrown	<i>Acacia ramulosa</i> var. <i>ramulosa</i> , <i>A. umbraculiformis</i> , <i>Allocasuarina tessellata</i> tall open shrubland over <i>Grevillea scabrida</i> , <i>Persoonia pentasticha</i> low sparse shrubland CSF: <i>Allocasuarina tessellata</i> (P3), <i>Grevillea scabrida</i> (P3), <i>Persoonia pentasticha</i> (P3)	



Site (Veg Unit)		Description	Image
A2-43 (AtAk)	15/10/2025 GPS: 496591 E/ 6768849 N Low hill; dolerite/ greenstone; rocky Many drought deaths	<i>Allocasuarina dielsiana</i> low emergent trees over <i>Allocasuarina tessellata</i> , <i>Acacia karinae</i> shrubland with sparse understorey CSF: <i>Allocasuarina tessellata</i> (P3) and <i>Acacia karinae</i> (P3)	
A2-58 (AsCp)	16/10/2025 GPS: 497484 E/ 6769549 N Low hill; greisen/ granite; rocky	Edge of <i>Acacia sulcatacaulis</i> tall shrubland; much fallen timber at edges – maybe impacts from Cyclone Seroja in 2021 CSF: <i>Acacia sulcatacaulis</i> (EN)	
A2-108 (AtAk)	16/10/2025 GPS: 496798 E/ 6769508 N Low hill; midslope; aspect east; reddish brown clay loam; surface rock (metamorphosed dolerite?) > 50 %; drought impacts	<i>Allocasuarina dielsiana</i> low isolated emergent trees over <i>Allocasuarina</i> <i>tessellata</i> , <i>Acacia acuminata</i> , <i>A. karinae</i> , <i>A. tetragonophylla</i> tall shrubland CSF: <i>Allocasuarina tessellata</i> (P3), <i>Acacia karinae</i> (P3)	



Site (Veg Unit)		Description	Image
A2-116 (AtAk)	16/10/2025 GPS: 496996 E/ 6769065 N Low hill; lower slope	<i>Acacia acuminata</i> tall open shrubland over <i>Acacia acuminata</i> , <i>Allocasuarina tessellata</i> , <i>Acacia karinae</i> open shrubland over <i>Pigea curvifolia</i> , <i>Eremophila granitica</i> , <i>Hemigenia ciliata</i> , <i>Persoonia pentasticha</i> low sparse shrubland over low forbland CSF: <i>Allocasuarina tessellata</i> (P3), <i>Acacia karinae</i> (P3), <i>Persoonia pentasticha</i> (P3)	
A3-9 (EsTh)	29/11/2025 GPS: 495106 E/ 6769191 N Elevation: 366m Low rise; valley	<i>Eucalyptus salubris</i> , <i>E. clelandiorum</i> woodland over <i>Ptilotus exaltatus</i> , <i>Sclerolaena</i> sp., <i>Monachather paradoxus</i> low open forbland	
A3-53 (ElAr)	29/11/2025 GPS: 495322 E/ 6769444 N Elevation: 372m Valley; lower slope of hill; looking towards <i>York gum</i> woodland/ <i>Acacia acuminata</i> tall shrubland strip along drainage line	<i>Acacia erinacea</i> , <i>Scaevola spinescens</i> sparse shrubland on lower slopes	



Site (Veg Unit)		Description	Image
A3-76 (AdAa)	29/11/2025 GPS: 492472 E/ 6769465 N Hill slope; midslope; aspect west Calcrete mounds on lower slopes	<i>Allocasuarina dielsiana</i> low open woodland over <i>Acacia ramulosa</i> var. <i>ramulosa</i> , <i>A. acuminata</i> tall open shrubland over <i>Acacia ramulosa</i> var. <i>ramulosa</i> , <i>A. karinae</i> , <i>Grevillea scabrida</i> , <i>Senna</i> sp. sparse shrubland CSF: <i>Acacia karinae</i> (P3), <i>Grevillea scabrida</i> (P3)	
A3-126 (AtAk)	29/11/2025 GPS: 496112 E/ 6768539 N Hill; dolerite/ greenstone; calcrete mounds	<i>Allocasuarina tessellata</i> , <i>Acacia karinae</i> shrubland over <i>Grevillea scabrida</i> low sparse shrubland CSF: <i>Acacia karinae</i> (P3), <i>Allocasuarina tessellata</i> (P3), <i>Grevillea scabrida</i> (P3)	
A3-145 (AtAk)	30/11/2025 GPS: 496415 E/ 6769417 N Hill; midslope; valley Many hundreds of <i>Allocasuarina tessellata</i> seedlings present > image	<i>Allocasuarina tessellata</i> , <i>Acacia karinae</i> , <i>Grevillea subtiliflora</i> shrubland to closed shrubland over <i>Allocasuarina tessellata</i> , <i>Euphorbia tannensis</i> subsp. <i>eremophila</i> low open shrubland CSF: <i>Acacia karinae</i> (P3), <i>Allocasuarina tessellata</i> (P3), <i>Grevillea subtiliflora</i> (P3)	



Site (Veg Unit)		Description	Image
A3-184 (AtAk)	30/11/2025 GPS: 498451 E/ 6769441 N Rounded dolerite hills; occasional bare patches within shrubland	<i>Allocasuarina dielsiana</i> low emergent trees over <i>Allocasuarina tessellata</i> , <i>Acacia karinae</i> shrubland over <i>Allocasuarina tessellata</i> low sparse to open shrubland (seedlings) Isolated <i>Grevillea subtiliflora</i> CSF: <i>Acacia karinae</i> (P3), <i>Allocasuarina tessellata</i> (P3), <i>Grevillea subtiliflora</i> (P3)	
A3-207 (AtAk)	30/11/2025 GPS: 496500 E/ 6769646 N Hill/ ridge Image to east along old track Large sections of this track are still bare; however, there are overgrown patches which block vehicle access in the west	<i>Allocasuarina tessellata</i> , <i>Acacia karinae</i> shrubland with isolated <i>Grevillea subtiliflora</i> CSF: <i>Acacia karinae</i> (P3), <i>Allocasuarina tessellata</i> (P3), <i>Grevillea subtiliflora</i> (P3)	
A3-264 (AdAa)	30/11/2025 GPS: 496560 E/ 6768744 N Valley; gentle slope	<i>Allocasuarina dielsiana</i> emergent trees over <i>Acacia acuminata</i> , <i>Allocasuarina tessellata</i> tall open shrubland over <i>Acacia acuminata</i> sparse shrubland over <i>Grevillea scabrida</i> low isolated shrubs CSF: <i>Allocasuarina tessellata</i> (P3), <i>Grevillea scabrida</i> (P3)	



Site (Veg Unit)		Description	Image
A3-265 (EeAr)	30/11/2025 GPS: 497440 E/ 6768602 N Hardpan plain; lower catchment	<i>Eucalyptus ewartiana</i> , <i>Acacia ramulosa</i> var. <i>ramulosa</i> mallee woodland over <i>Acacia ramulosa</i> var. <i>ramulosa</i> , <i>A. tetragonophylla</i> , <i>Eremophila clarkei</i> sparse shrubland over <i>Waitzia acuminata</i> var. <i>acuminata</i> , <i>Monachather paradoxus</i> low forbland	
A3-266 (ElAr)	30/11/2025 GPS: 497440 E/ 6768780 N Hardpan plain; lower catchment – Patch of York gum at edge of <i>Eucalyptus ewartiana</i> mallee woodland	<i>Eucalyptus loxophleba</i> subsp. <i>supralaevis</i> open woodland over <i>Acacia acuminata</i> , <i>A. ramulosa</i> var. <i>ramulosa</i> tall open shrubland over <i>Acacia ramulosa</i> var. <i>ramulosa</i> , <i>Eremophila forrestii</i> subsp. <i>forrestii</i> , <i>Acacia tetragonophylla</i> sparse shrubland over <i>Ptilotus obovatus</i> var. <i>obovatus</i> low sparse shrubland	
A4-39 (AdAt/ AdAa)	16/10/2025 GPS: 499747 E/ 6769830 N Low rise; upper slope; greenstone	<i>Allocasuarina tessellata</i> , <i>Acacia karinae</i> shrubland (to open shrubland) – many deaths of <i>Allocasuarina</i> Occurred mostly in NW area of site; more open <i>Acacia</i> tall shrubland with <i>Acacia karinae</i> , <i>A. diallaga</i> in remaining area CSF: <i>Acacia diallaga</i> (P1), <i>Acacia karinae</i> (P3), <i>Allocasuarina tessellata</i> (P3)	



Site (Veg Unit)		Description	Image
A5-8 (ElAr)	28/11/2025 GPS: 499901 E/ 6770990 N Elevation 366m Undulating plain/ gentle hills; valley; gentle slope; aspect west Reddish brown clay loam; surface rock dolerite/ schist Many drought related deaths of taller shrubland	<i>Eucalyptus loxophleba</i> subsp. <i>supralaevis</i> open woodland over <i>Acacia ramulosa</i> var. <i>ramulosa</i> , <i>Brachychiton gregorii</i> tall sparse shrubland over <i>Ptilotus obovatus</i> var. <i>obovatus</i> low open shrubland, dried off grasses and herbs	
A5-9 (ElAr)	28/11/2025 GPS: 500071 E/ 6771004 N Elevation: 365m Plain; very gentle slope; aspect south Reddish brown clay loam; surface rock (?micaceous dolerite, quartz) 30 – 40 %; cryptogams 40 – 50 %	<i>Eucalyptus loxophleba</i> subsp. <i>supralaevis</i> open woodland over <i>Exocarpos aphyllus</i> , <i>Acacia tetragonophylla</i> , <i>A. acuminata</i> tall open shrubland over <i>Senna artemisioides</i> subsp. <i>filifolia</i> , <i>Acacia acanthoclada</i> subsp. <i>glaucescens</i> , <i>Scaevola spinescens</i> open shrubland over <i>Ptilotus obovatus</i> var. <i>obovatus</i> low open shrubland	
A5-10 (ElAr)	28/11/2025 GPS: 500123 E/ 6770848 N Undulating plain; gentle sloping valley; aspect south Reddish brown sandy clay loam Old overgrown tracks through area	<i>Eucalyptus loxophleba</i> subsp. <i>supralaevis</i> woodland over <i>Acacia ramulosa</i> var. <i>ramulosa</i> , <i>Senna artemisioides</i> subsp. <i>filifolia</i> , <i>Grevillea acacioides</i> open shrubland	



Site (Veg Unit)	Description	Image
A5-12 (ElAr)	28/11/2025 GPS: 499867 E/ 6770876 N Elevation: 368m Low rise on undulating plain; gentle slope; aspect west to south west Old overgrown track to south	Patch of <i>Eucalyptus kochii</i> subsp. <i>amaryssia</i> woodland over <i>Acacia ramulosa</i> var. <i>ramulosa</i> tall open shrubland over <i>Senna</i> spp., <i>Acacia ramulosa</i> var. <i>ramulosa</i> open shrubland over <i>Ptilotus obovatus</i> var. <i>obovatus</i> low open shrubland 
A7-27 (AsCp)	29/11/2025 GPS: 496148 E/ 6767902 N Low gravelly hill; rock outcrop on summit Red (2.5YR4/6) fine sandy clay loam; surface rock (fine ironstone gravel) 20-40%; cryptogams (lichen) 30-40%	<i>Acacia sulcatacaulis</i>, <i>A. assimilis</i> subsp. <i>assimilis</i>, <i>Melaleuca nematophylla</i>, <i>Acacia ramulosa</i> var. <i>ramulosa</i> tall shrubland to tall open shrubland over <i>Aluta aspera</i> subsp. <i>hesperia</i>, <i>Philotheca brucei</i> subsp. <i>brucei</i>, <i>Thryptomene costata</i>, <i>Melaleuca nematophylla</i>, <i>Acacia burkittii</i> open shrubland CSF: <i>Acacia sulcatacaulis</i> (EN) 
Z7-8 (AsCp)	1/12/2025 GPS: 497652 E/ 6768245 N Elevation: 353m New Population of <i>Acacia sulcatacaulis</i>; south east of Area 2/3; historic and recent exploration disturbances Low rise; Dark red (5YR3/4) fine sandy clay loam; surface rock (fine ironstone gravel and few larger quartz and ironstone rocks 5-8 cm) 10-20%; litter 40-60%; fallen timber 10-15%	<i>Acacia sulcatacaulis</i>, <i>Allocasuarina acutivalvis</i> subsp. <i>acutivalvis</i>, <i>Acacia ramulosa</i> var. <i>ramulosa</i> tall shrubland over <i>Allocasuarina acutivalvis</i>, <i>Acacia sulcatacaulis</i>, <i>Hakea recurva</i> subsp. <i>recurva</i> sparse shrubland over <i>Prostanthera althoferi</i> subsp. <i>althoferi</i> low open shrubland over <i>Amphipogon caricinus</i> var. <i>caricinus</i>, <i>Waitzia acuminata</i> var. <i>acuminata</i>, <i>Monachather paradoxus</i>, <i>Aluta aspera</i> subsp. <i>hesperia</i> low open tussock grassland Other species: <i>Sida calyxhymenia</i>, <i>Seringia velutina</i> CSF: <i>Acacia sulcatacaulis</i> (EN) 



Site (Veg Unit)	Description		Image
Z7-9 (AsCp)	1/12/2025 GPS: 496694 E/ 6768371 N Elevation: 366m Hill; moderate slope; aspect east to north east; recent exploration clearing to north Red (2.5YR4/6) fine sandy clay loam; surface rock (ironstone gravel) > 70 %	<i>Acacia aneura</i> , <i>A. sulcatacaulis</i> , <i>A. ramulosa</i> var. <i>ramulosa</i> tall open shrubland (5 – 9 m) over <i>Acacia sulcatacaulis</i> , <i>Acacia ramulosa</i> var. <i>ramulosa</i> , <i>Calycopeplus paucifolius</i> tall sparse shrubland (2 – 4 m) over <i>Aluta aspera</i> subsp. <i>hesperia</i> , <i>Acacia assimilis</i> subsp. <i>assimilis</i> , <i>Melaleuca nematophylla</i> , <i>Acacia ramulosa</i> var. <i>ramulosa</i> , <i>Calycopeplus paucifolius</i> open shrubland over <i>Philotheca brucei</i> subsp. <i>brucei</i> , <i>Aluta aspera</i> subsp. <i>hesperia</i> low open shrubland Other species: <i>Eremophila clarkei</i> , <i>E. latrobei</i> subsp. warty leaves, <i>Goodenia</i> sp., <i>Gilberta tenuifolia</i> , <i>Waitzia acuminata</i> var. <i>acuminata</i> , <i>Daviesia</i> sp. CSF: <i>Acacia sulcatacaulis</i> (EN)	
Site 1 (AsCp)	28/11/2025 GPS: 498881 E / 6772585 N Landform: Hill; lower midslope; north aspect	<i>Acacia latior</i> , <i>A. sulcatacaulis</i> , <i>Allocasuarina acutivalvis</i> tall shrubland over <i>Gastrolobium laytonii</i> sparse shrubland CSF: <i>Acacia sulcatacaulis</i> (EN)	
Site 2 (ElAr)	29/11/2025 GPS: 496092 E/ 6768018 N Elevation: 383m Hill; upper slope; gentle slope; aspect east Reddish brown clay loam; surface rock (ironstone gravel, quartz) < 10 %	<i>Eucalyptus loxophleba</i> subsp. <i>supralaevis</i> woodland over <i>Eremophila oldfieldii</i> subsp. <i>oldfieldii</i> , <i>E. oppositifolia</i> subsp. <i>angustifolia</i> tall isolated shrubs over <i>Acacia tetragonophylla</i> , <i>Dodonaea inaequifolia</i> , <i>Acacia acuminata</i> isolated shrubs over <i>Ptilotus obovatus</i> var. <i>obovatus</i> , <i>Senna artemisioides</i> subsp. <i>filifolia</i> , <i>Maireana georgei</i> , <i>Austrostipa elegantissima</i> low open shrubland Other species: <i>Acacia ramulosa</i> var. <i>ramulosa</i> , <i>Senna</i> sp. Austin, <i>Ptilotus exaltatus</i> , <i>Exocarpos aphyllus</i> , <i>Acacia erinacea</i>	

Appendix D 2020-2022 Terrestrial Fauna Assessment

MT MULGINE

TERRESTRIAL FAUNA ASSESSMENT

PREPARED FOR: TUNGSTEN MINING NL





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EXECUTIVE SUMMARY

The Mt Mulgine Project (the Project) is situated approximately 330 kilometres (km) north east of Perth and 15 km north east of Rothsay. The Project is located within contiguous Mining Leases M59/386, M59/387, M59/425 and E59/1324 which are held by Minjar Gold Pty Ltd (Minjar). Minor activities (construction and operation of roads) will be undertaken within the Miscellaneous Leases L59/161 and L59/162. M59/386, M59/387, M59/425, L59/161 and L59/162 constitute the Project area referred to throughout this document. Prospecting Lease P59/2244 was approved in June 2020, which is also owned by Mid West Tungsten. An extension (tenement M59/460 owned by Minjar Gold Pty Ltd) adjoining the west of the Mulgine Project (the Extension Area) covers 127 ha and was included in the desktop assessment.

The Mt Mulgine area and surrounding region has been well surveyed during the assessment of surrounding projects such as Karara and Mungada Ridge (Blue Hills). Some sections of the Project area appear to contain restricted habitat types (e.g. Granite Outcropping) which have only previously been surveyed at a low intensity with several Level 1 fauna surveys being completed in conjunction with detailed flora and vegetation assessments. Regional survey information is considered sufficient to determine the vertebrate fauna assemblage and the associated vertebrate conservation significant fauna species. Sampling of Short Range Endemic (SRE) taxa has been extensive in the neighbouring Blue Hills (Karara and Mungada Ridge) area.

Tungsten Mining NL (Tungsten Mining) commissioned Spectrum Ecology (Spectrum) to undertake a Level 1 fauna assessment, a comprehensive SRE fauna survey and targeted conservation significant fauna searches for the Mt Mulgine Tungsten Project (Mt Mulgine). In addition, three pre-clearance surveys were completed within the Project, and one regional survey was conducted in the surrounding area. The surveys were undertaken between September 2019 and August 2021, totalling 60 person days in the field.

The desktop assessment identified 29 mammal, 148 bird, 55 reptile and five amphibian species that have been recorded from the local region surrounding the Project. The Department of Biodiversity, Conservation and Attractions (DBCA) Threatened Fauna Database search identified seven conservation significant fauna species (Western Brush Wallaby, Malleefowl, Night Parrot, Peregrine Falcon, Gilled Slender Blue-tongue, Western Spiny-tailed Skink and Northern Shield-backed Trapdoor Spider) that may be found within 40 km of the Project. The Northern Shield-backed Trapdoor Spider *Idiosoma nigrum* was split up into multiple species in Western Australia in 2018 of which *Idiosoma clypeatum* remained with the same common name (Michael G Rix *et al.*, 2018).

Seven major fauna habitat types were recorded from the Project; Mixed Shrubland, Open Eucalypt Woodland, Granite Outcropping, Granitic Flats, Basalt Hills, Eucalypt Woodland on Quartz, and Stony Hillslope Shrubland. The most widespread habitat type was the Mixed Shrubland. The most restricted habitat type was the Eucalypt Woodland on Quartz, followed by Granitic Flats and Stony Hillslope Shrubland.

During the fauna field survey, five native mammals, three introduced mammals, 42 birds, and 17 reptiles and one amphibian were recorded from within the Project area. A total of seven conservation significant fauna species were recorded:

- Malleefowl (*Leipoa ocellata*; EPBC / BC Act Vulnerable),
- Gilled Slender Blue-tongue (*Cyclodomorphus branchialis*; BC Act Vulnerable),
- Peregrine Falcon (*Falco peregrinus*; BC Act OS),
- Northern Shield-backed Trapdoor Spider (*Idiosoma clypeatum*; DBCA Priority 3),
- Coolgardie Shield-backed Trapdoor Spider (*I. intermedium*; DBCA Priority 3), and

- Gutha Pintharuka Shield-backed Trapdoor Spider (*I. gutharuka*; DBCA Priority 1).

Secondary evidence (scats) from the Western Spiny-tailed Skink (*Egernia stokesii badia*; EPBC Act Endangered/BC Act Vulnerable) was recorded from Eucalypt Woodland, 200 m outside the Project. Six species identified in the desktop assessment are considered to have a low to medium likelihood of occurring in the Project. The fauna assemblage recorded from the more restricted habitat types was found to differ from those of the more widespread habitats in the region, including species with a limited range (e.g. *Idiosoma gutharuka*).

During the comprehensive SRE invertebrate survey at the Project, a total of 30 taxa belonging to SRE target groups were collected. Of these, 19 taxa are considered potential SRE's (four Mygalomorphae, six pseudoscorpiones, six isopods, two diplopods, one geophilomorph) of which 14 taxa have previously not been recorded (represented in the Western Australian Museum (WAM) collection). Four of these new SRE taxa were found only inside the Project area and are currently not known to occur elsewhere:

- Three mygalomorph spider: *Aname* 'BMYG177', *Idiommatia* sp. MH3, and *Bungulla* 'BMYG176'; and
- One isopod: *Acanthodillo* sp. 5B

1. INTRODUCTION

1.1. Project Background

The Mt Mulgine Project (the Project) is situated approximately 330 kilometres (km) north east of Perth and 15 km north east of Rothsay. the Project is located within contiguous Mining Leases M59/386, M59/387, M59/425, and E59/1324 which are held by Minjar Gold Pty Ltd (Minjar). Minor activities (construction and operation of roads) will be undertaken within the Miscellaneous Leases L59/161 and L59/162. Prospecting Lease P59/2244 was approved in June 2020, which is also owned by Mid West Tungsten Pty Ltd (Mid West Tungsten). The Project is within the Shire of Perenjori and can be accessed from the Warriendar Copper Mine Road and the Minjar Haul Road. Tenements M59/425 and M59/386 are partially located within the former Warriendar pastoral lease, which is now managed by the Department of Biodiversity, Conservation and Attractions (DBCA). Tenements M59/387 and a portion of M59/425 are partly within the Wanarra pastoral lease. An extension (tenement M59/460 owned by Minjar Gold Pty Ltd) adjoining the west of the Mulgine Project (the Extension Area) covers 127 ha and was included in the desktop assessment.

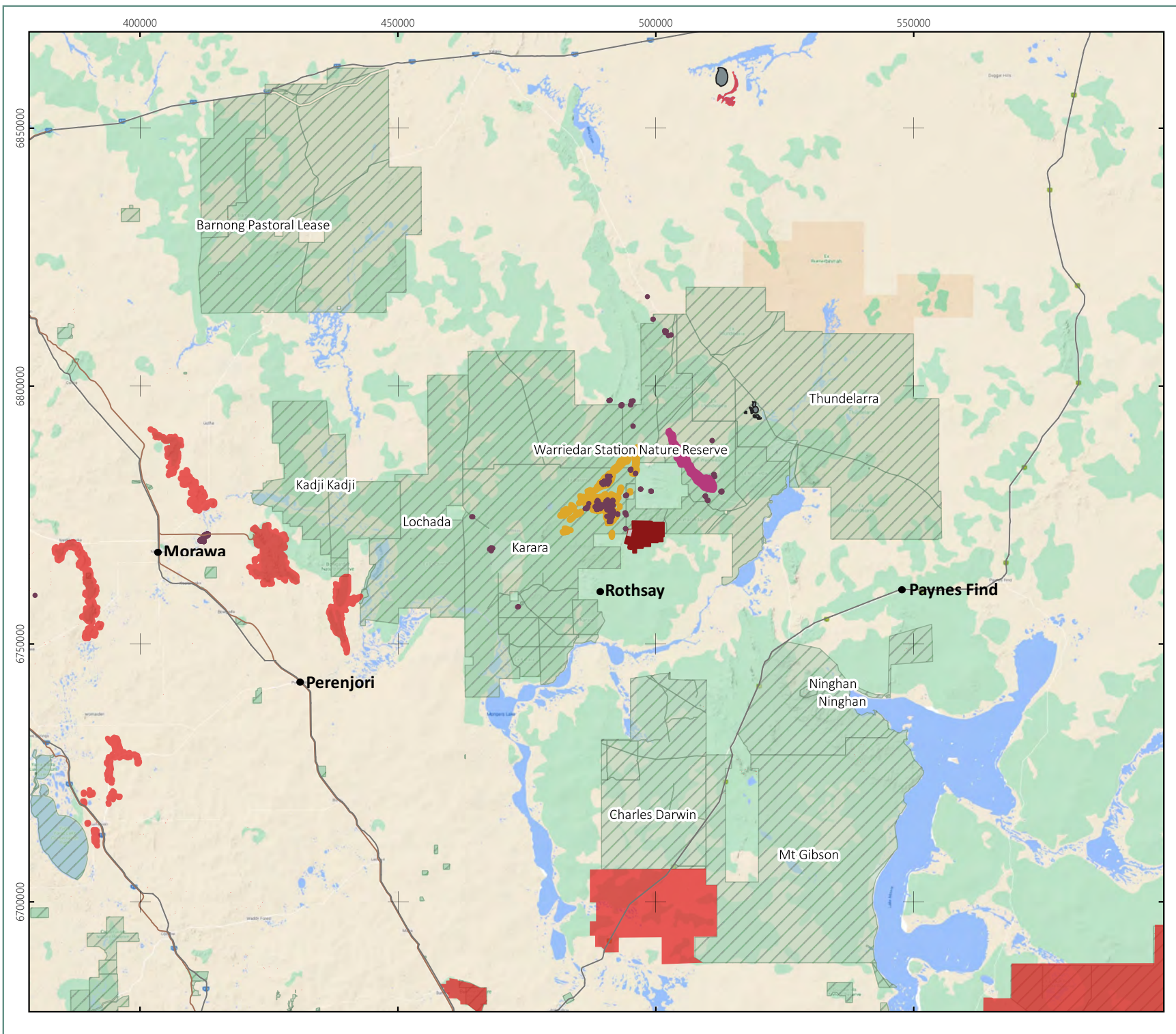
Tungsten Mining NL (Tungsten Mining) is developing the Mt Mulgine Tungsten Project. Tungsten Mining holds the tungsten and molybdenum rights to the Mt Mulgine Project and also has the rights to all by-products from the mining of tungsten and molybdenum. M The Mt Mulgine Project consists of two main areas; the Mulgine Hill and the Mulgine Trench deposits. Both are within tenement M59/425. Additional site infrastructure including the Processing Plant and ROM Pad, Waste Rock Landforms, Stockpiles, Tailings Storage Facilities (TSF) and camp facilities will be located within the M59/386 and M59/387 tenements.

A Pre-Feasibility Study (PFS) for a proposed large-scale project for the Mt Mulgine Trench deposit was completed in December 2020 with the aim of detailing a single option to move forward into a Definitive Feasibility Study in the near future.

1.2. Objectives

Tungsten Mining commissioned Spectrum Ecology (Spectrum) to undertake a Level 1 vertebrate fauna assessment (including targeted conservation significant fauna surveys) and a comprehensive Short Range Endemic (SRE) invertebrate survey for the Mt Mulgine Project. The assessment is required as the Project supports a high diversity of biological significance. Local and regional context will be provided by the comprehensive desktop component. The desktop assessment included conducting database searches and undertaking a literature review of all available information to determine flora and fauna species, vegetation communities and areas of conservation significance that have been recorded within or may occur within the Project.

• .



Legend

- Mt Mulgine Project
- Extension Tenement M59/460
- Significant Lands**
- Conservation Estate
- Environmentally Sensitive Areas - DWER 2019
- Environmentally Sensitive Areas - Threatened Flora
- Directory of Important Wetlands
- PECs**
- Blue Hills BIF
- Warriedar/Pinyalling/Walagnumming Hills BIF



0 10 20 30 40 km

Scale: 1:1000000

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter



Author: CS

Date: 18-03-2021

Location of the Mt Mulgine Project & Significant Lands

Mt Mulgine Project

Prepared for
Tungsten Mining NL

Figure
1.1

1.3. Short Range Endemism

Endemism is the term used to describe when taxa are distributed across a particular defined area (Morrone, 2008) and endemic species can also be considered threatened due to this restricted distribution. Short range endemism describes endemic taxa that are naturally restricted to particularly small areas due to ecological, morphological and life history characteristics that affect their range (Ponder, 1999; M. S. Harvey, 2002). Short Range Endemic Invertebrate (SRE) taxa are defined as terrestrial and freshwater invertebrates that have naturally small distributions of less than 10,000 km² (M. S. Harvey, 2002; Environmental Protection Authority, 2016b).

1.3.1. Taxonomic Groups Associated With SRE Invertebrate Fauna

Short-range endemic invertebrate species are defined as species with naturally small distributions (<10,000 km²) that possess ecological, morphological and life history characteristics that affect their range. Poor powers of dispersal, confinement to discontinuous habitats, slow growth rates and low levels of fecundity often result in fragmented or severely restricted distributions. Many species appear to be Gondwanan relicts now isolated in pockets of mesic habitat that was once more widespread and contiguous prior to the aridification of the Australian landscape. A low level of taxonomic resolution, lack of detailed ecological information and difficulties identifying many taxa via morphological means further complicates the assessment of potential SRE species. In many taxa, such as *Antichiropus* sp. millipedes, male only characters (e.g. gonopod morphology) are the primary diagnostic features used when identifying species (Wojcieszek, Harvey and Rix, 2010). If female or juvenile specimens are collected, identification to species level or alignment with known undescribed morphospecies using morphological characters is not possible. The use of DNA barcoding is gradually addressing this issue though the database of known sequences is still limited for many taxa (Western Australian Museum, 2014).

The combination of these factors make SRE species particularly vulnerable to threatening processes such as habitat loss, degradation and climate change (Harvey *et al.*, 2011). The taxa detailed in Table 1.1 have been identified as displaying one or more of the characteristics known to cause short-range endemism (M. Harvey, 2002) and as such are targeted during field assessments.

Table 1.1: SRE Target Groups

Phylum or Subphylum	Class	Order	Details
Annelida	Oligochaeta	Haplotaxida	Earthworms.
Chelicerata	Arachnida	Araneae	Spiders, particularly those belonging to the infraorder Mygalomorphae (trapdoor spider).
		Opiliones	Harvestmen.
		Pseudoscorpiones	False scorpion or book scorpion.
		Schizomida	Micro whip scorpions, mostly known from troglobitic species.
		Scorpiones	Scorpions.
Crustacea	Malacostraca	Isopoda	Terrestrial Isopods, also known as slaters or woodlice.
Mollusca	Gastropoda	Stylommatophora	Land snails.
Myriapoda	Chilopoda	Geophilomorpha	Elongate soil centipedes.
		Scolopendromorpha	Centipedes from the family Cryptopidae.
	Diplopoda	Not specified	Millipedes
Onychophora	Udeonychophora	Euonychophora	Velvet worms, family Peripatopsidae.

1.4. Bioregion & Climate

The Interim Biogeographic Regionalisation for Australia (IBRA) classifies Australia into regions based on dominant landscape, climate, lithology, geology, landform and vegetation (Thackway and Cresswell, 1995).

The Project is located within the Yalgoo IBRA region (Figure 1.2) a large region which forms an interzone between the south western bioregions and the Murchison. The Yalgoo bioregion is characterised by Callitris/Gimlet, Mulga and Bowgada open woodlands and scrubs on earth to sandy-earth plains in the western Yilgarn Craton and the southern Carnarvon Basin. The Yalgoo region is divided into two sub-regions: Edel and Tallering and the Project is located within the Tallering sub-region (Figure 1.2).

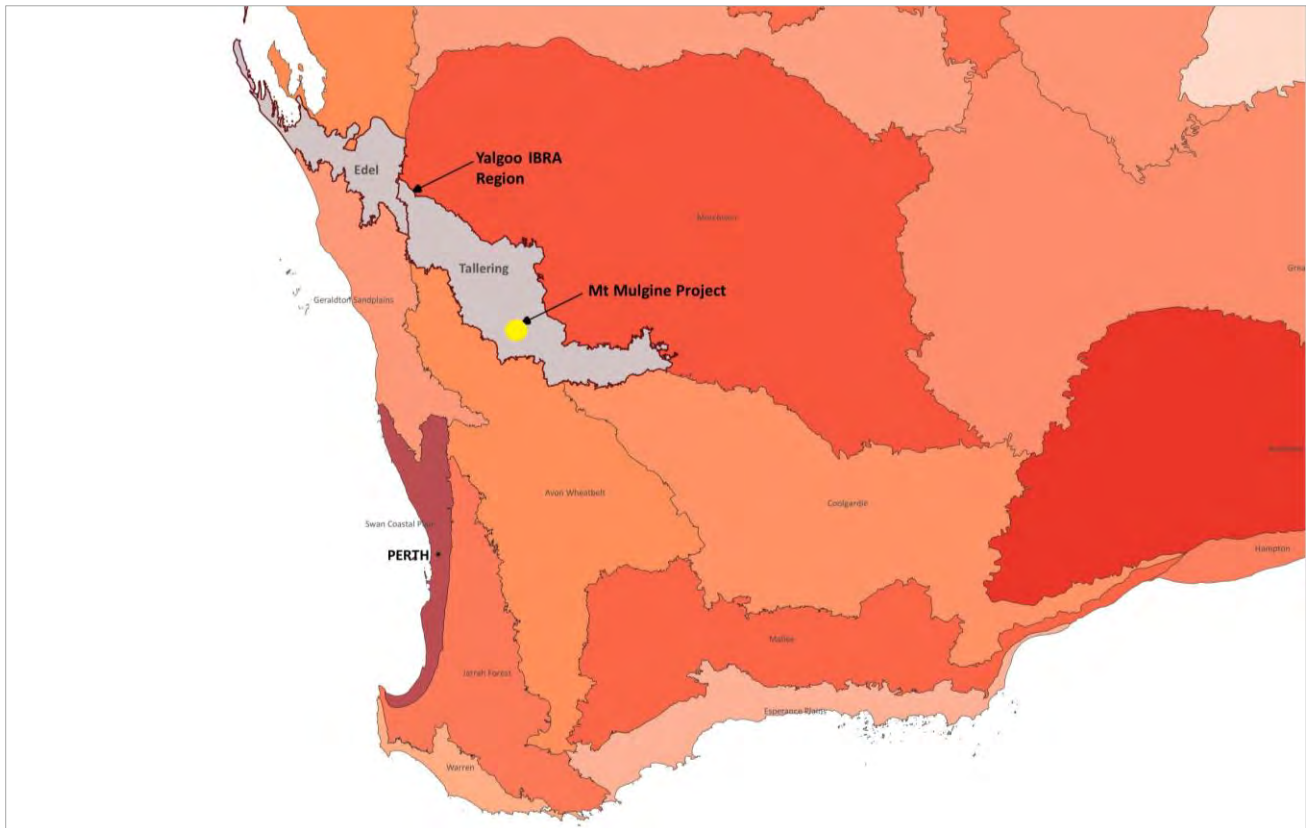


Figure 1.2: IBRA Classification

The climate of the Yalgoo bioregion is classified as Mediterranean, arid to semi-arid and warm, with 200 mm to 300 mm of rainfall annually (Desmond and Chant, 2001; McKenzie, May and McKenna, 2003). Rainfall for the region is highest in the Winter months (June-August).

1.5. Disturbance History

The dominant current and historical land use across the Yalgoo region is grazing of native pastures (77%) (Desmond and Chant, 2001) however since 2015 nine pastoral stations or sections of (Barnong, Burnerbinmah, Kadji, Karara, Lochada, Thundelarra, Woolgorong, Warriedar, and Yuin) have been returned as conservation estates. Mining interest in the region is considerable however most mining leases are still required to be stocked (Desmond and Chant, 2001).

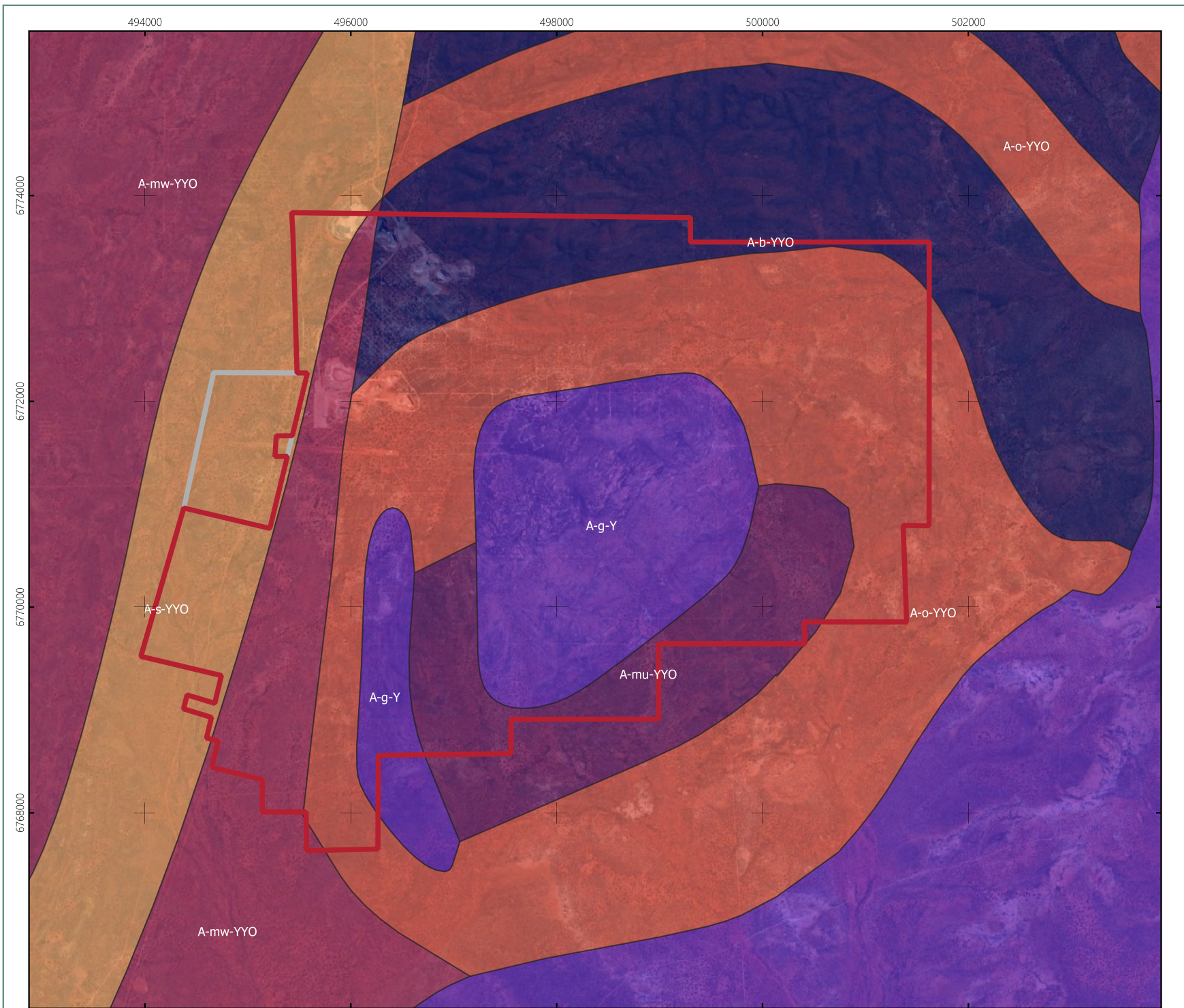
1.6. Geology

The geology of Western Australia has been mapped at a scale of 1:500,000 (Geological Survey of Western Australia, 2016). No finer mapping is available digitally for the area. Two units and five sub-units have been mapped within the Project and these are listed in Table 1.2 and mapped on Figure 1.3.

None of the sub-units are restricted to the Yalgoo bioregion and all extend into other areas within Western Australia. All units have less than 1.0% of their total occurrence within the Project.

Table 1.2: Geological Units (1:500,000)

Unit	Sub-unit Code	Description	Area in Project (ha)	% of State Total in Project	Total Extent (ha)	Location & Description of Occurrence
Yilgarn Craton Granites	A-g-Y	Granitic rock, undivided; metamorphosed.	804	<0.0%	23,777,563	Mapped as a very large area covering much of the Yilgarn Craton over many IBRA regions.
Youanmi Terrane Greenstones	A-b-YYO	Mafic volcanic rock with minor mafic and ultramafic intrusive rocks; subordinate felsic rocks; metamorphosed.	298	<0.0%	977,038	Widespread across large areas of the Yilgarn Craton.
	A-mu-YYO	Metamorphosed ultramafic rock, undivided; typically deeply weathered.	364	0.3%	105,936	Widespread across the Yilgarn Craton but with small occurrences and a low total area.
	A-mw-YYO	Metamorphosed mafic igneous rock, undivided.	331	0.2%	164,979	Widespread across the Yilgarn Craton but with small occurrences.
	A-o-YYO	Mafic intrusive rock dominant; metamorphosed.	1,147	0.7%	156,564	Widespread across the Yilgarn Craton but with small occurrences.
	A-s-YYO	Clastic sedimentary rock dominant; metamorphosed.	218	0.7%	294,673	Widespread across the Yilgarn Craton but with small occurrences.



Legend

- Mt Mulgine Project
- Extension Tenement M59/460
- Geology Units (1:500,000)**
 - A-b-YYO
 - A-g-Y
 - A-mu-YYO
 - A-mw-YYO
 - A-o-YYO
 - A-s-YYO



0 0.5 1 1.5 2 km

Scale: 1:500,000

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter



Author: AH

Date: 09-02-2022

Geological Units (1:500,000)

Mt Mulgine Project

Prepared for
Tungsten Mining NL

Figure
1.3

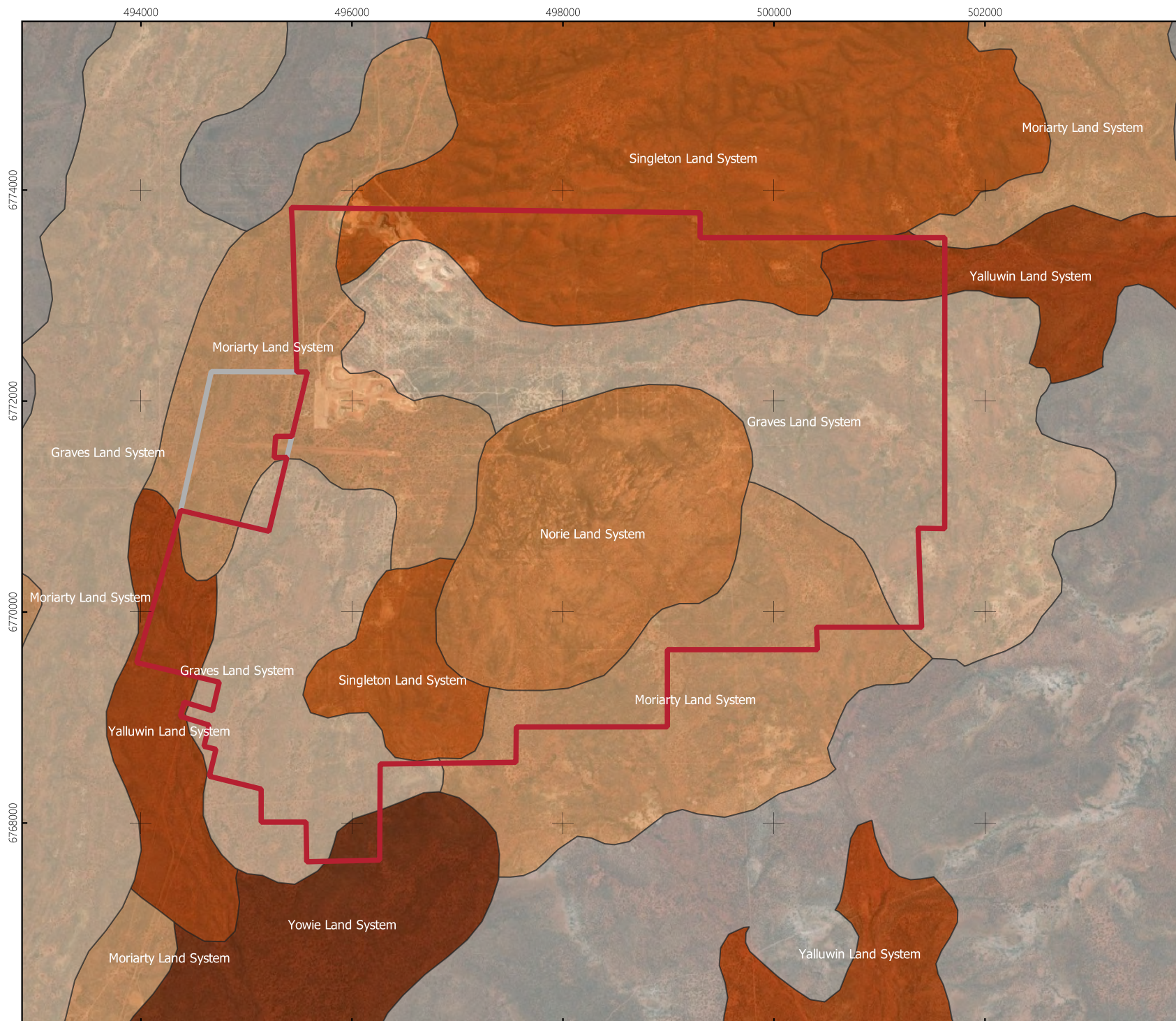
1.7. Land Systems

Payne *et al* (1998) completed an inventory of the Sandstone-Yalgoo-Paynes Find area to document the land systems including the condition of each. Land systems were described using the biophysical characteristics of geology, landforms, vegetation, and soils.

The Project includes six land systems as described in Table 1.3 and mapped in Figure 1.4. Most of the land systems that occur are well represented in the wider region. The Singleton land system covers the smallest area and has the most restricted distribution. This land system is associated with rugged Greenstone Hills in areas within and close to the Project.

Table 1.3: Land Systems

Land System	Description	Area in Project (ha)	% of Total Extent in Project	Total Extent (ha)	Location & Description of Occurrence
Graves	Basalt and Greenstone rises and low hills supporting Eucalypt woodlands with prominent Saltbush and Bluebush understoreys.	1,220	1.1%	111,245	Widespread over the Yalgoo, Southern Murchison and Coolgardie IBRA regions.
Moriarty	Low Greenstone rises and stony plains supporting Chenopod shrublands with patchy Eucalypt overstoreys.	626	0.2%	264,921	Widespread over the Yalgoo, Southern Murchison and Coolgardie IBRA regions, and small occurrences in the Avon Wheatbelt.
Norie	Granite hills with exfoliating domes and extensive tor fields, supporting Acacia shrublands.	632	0.3%	211,312	Widespread across the Murchison, Yalgoo and some small occurrences in the Coolgardie region.
Singleton	Rugged Greenstone ranges with dense Casuarina and Acacia shrublands.	543	2.3%	23,834	Restricted land system to the Yalgoo region and local area surrounding the Project.
Yalluwin	Hardpan plains and drainage tracts carrying concentrated flow, supporting Mulga, Curara and other Acacia shrublands.	122	0.5%	26,278	Small occurrences but recorded in the Yalgoo and Murchison regions.
Yowie	Sandy plains supporting tall shrublands of Mulga and Bowgada with patchy Wanderrie grasses.	17	<0.0%	1,614,487	Very widespread across the Yalgoo and Southern Murchison, extending into the Avon Wheatbelt and Coolgardie regions.



Legend

- Mt Mulgine Project
- Extension Tenement M59/460
- Land Systems**
 - Graves Land System
 - Moriarty Land System
 - Norie Land System
 - Singleton Land System
 - Yalluwin Land System
 - Yowie Land System



0 0.5 1 1.5 2 km

Scale: 1:50,000

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter



Author: AH

Date: 09-02-2022

Land Systems

Mt Mulgine Project

Prepared for
Tungsten Mining NL

Figure
2.3

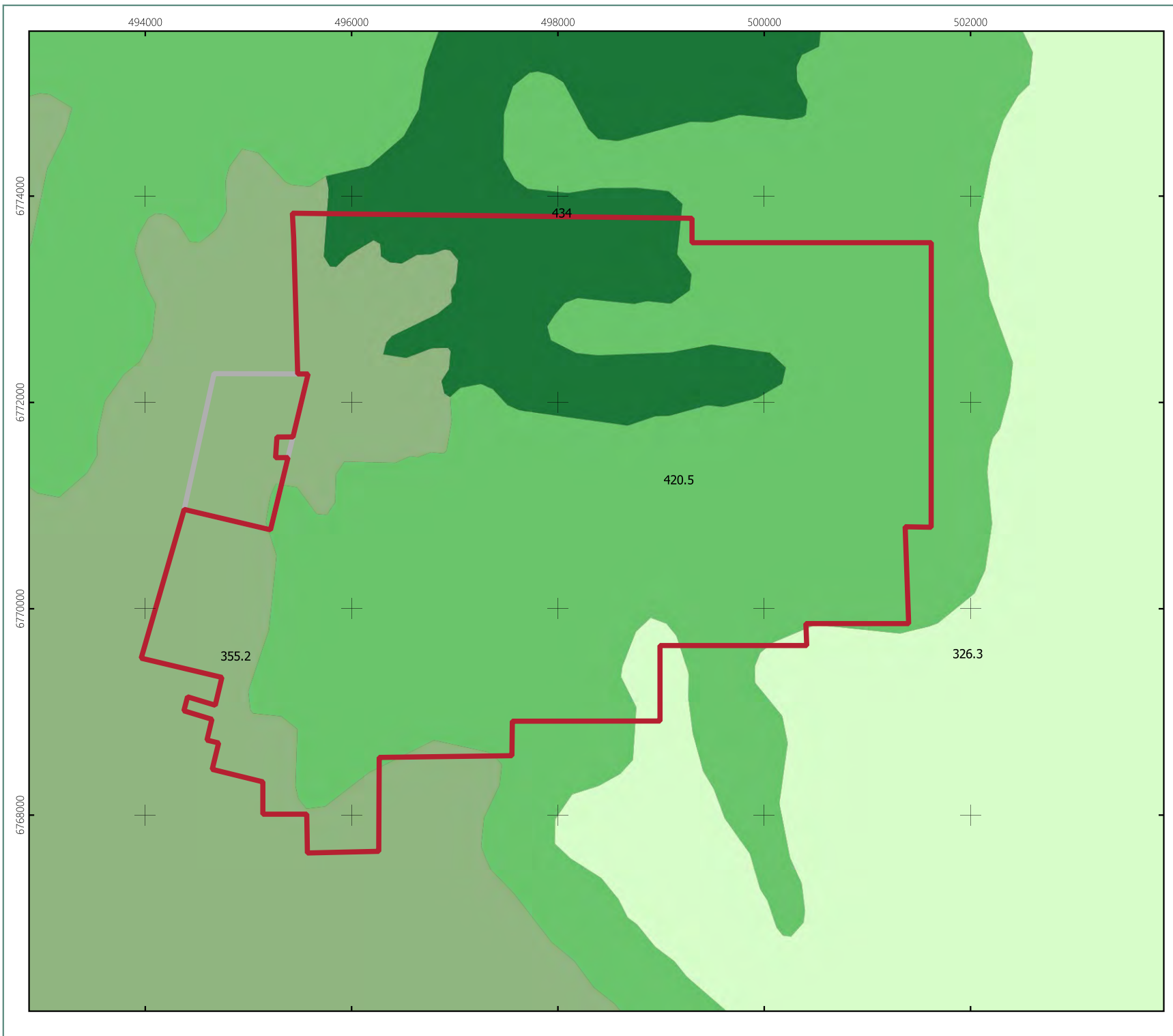
1.8. Beard Vegetation

Pre-European vegetation mapping was originally undertaken by Beard at various scales across the State and has since been updated to be consistent with Native Vegetation Information System (NVIS) descriptions at a scale of 1:250,000 (Department of Primary Industry and Regional Development, 2019). State-wide vegetation statistics are available for these associations which lists pre-European extent, current extent, area in DBCA managed lands and is a useful tool to determine if a vegetation association is rare or otherwise significant (Government of Western Australia, 2019).

Four vegetation sub-associations, including one mosaic, have been mapped within the Project and these are listed in Table 1.4 and mapped in Figure 1.5. All the sub-associations are restricted to the Yalgoo IBRA region with associations 326.3, 355.2, and 420.5 very widespread across it. Association 434.0 is very restricted with a total extent of 1,387 ha mapped in the state, of which 34% is within the Project. All four vegetation associations have more than 97% of their pre-European extent remaining and have not been extensively cleared and all have good representation within DBCA-managed lands (Table 1.4).

Table 1.4: Beard Vegetation

Sub-Association	NVIS Vegetation Description	Area in Project (ha)	Pre-European Extent State (ha)	Current Extent State (ha)	% Remaining	% of Current Extent in DBCA Managed Land
326.3	<i>Acacia ramulosa</i> , <i>Acacia acuminata</i> , <i>Acacia grasbyi</i> , <i>Acacia tetragonophylla</i> , <i>Acacia aneura</i> tall open shrubland, over <i>Senna artemisioides</i> subsp. x <i>artemisioides</i> , <i>Chorizema genistoides</i> , <i>Dodonaea inaequifolia</i> , <i>Eremophila forrestii</i> , <i>Eremophila viscida</i> mid sparse shrubland, over <i>Chamaexeros fimbriata</i> , <i>Dichopogon capillipes</i> , <i>Wurmbea densiflora</i> , <i>Cephalopterum drummondii</i> , <i>Helipterum craspedioides</i> low open forbland.	34	542,040	542,013	100	44
	<i>Acacia sclerosperma</i> , <i>Acacia eremaea</i> , <i>Grevillea obliquistigma</i> , <i>Hakea preissii</i> , <i>Acacia aneura</i> tall open shrubland.					
355.2	<i>Eucalyptus loxophleba</i> , <i>Eucalyptus oleosa</i> low isolated trees, over <i>Acacia aneura</i> , <i>Acacia ramulosa</i> tall open shrubland.	721	56,303	54,965	97.6	43
420.5	<i>Acacia ramulosa</i> , <i>Acacia acuminata</i> , <i>Acacia quadrimarginea</i> , <i>Acacia stereophylla</i> tall open shrubland, over <i>Allocasuarina campestris</i> , <i>Melaleuca uncinata</i> , <i>Thryptomene australis</i> mid sparse shrubland.	2,053	457,736	456,619	99.8	21
434.0	<i>Eucalyptus loxophleba</i> , <i>Allocasuarina huegeliana</i> isolated low trees, over <i>Acacia quadrimarginea</i> , <i>Acacia acuminata</i> tall open shrubland.	478	1,387	1,387	100	85



Legend

-  Mt Mulgine Project
-  Extension Tenement M59/460

Beard Vegetation Units

-  326.3
-  355.2
-  420.5
-  434



Scale: 1:50,000

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter



Author: Evan Hamilton

Date: 09-02-2022

Beard Vegetation

Mt Mulgine Project

Prepared for
Tungsten Mining NL

Figure
1.5

1.9. Significant Lands

1.9.1. Environmentally Sensitive Areas

Environmentally Sensitive Areas (ESA) that are associated with flora and vegetation are areas that are defined by the Department of Water and Environmental Regulation (DWER) (2019) as:

- A defined wetland and the area within 50 m of a wetland;
- The area covered by vegetation within 50 m of Threatened flora, to the extent to which the vegetation is continuous with the vegetation in which the Threatened flora is located;
- The area covered by a TEC;
- A Bush Forever site;
- Areas covered by the Gngangara Mound Crown Land Policy and Western Swamp Tortoise Policy; and
- Areas covered by lakes, wetlands and fringing vegetation of the Swan Coastal Plain Lakes Policy, including South West Agricultural Zone Wetlands Policy and Swan and Canning Rivers Policy.

No ESAs are located within the Project. The closest known ESA to the Project area are the known locations of the Threatened Flora species 1.5 km to the west of the Project (Figure 1.1).

1.9.2. Australian Wetlands Database

The Australian Wetlands Database includes nationally significant wetlands (as listed in the directory of important wetlands), wetlands listed under the Ramsar convention, wetlands that are representative, rare or unique, or wetlands that are considered of international importance (DoEE 2019).

No nationally significant wetlands, including Ramsar wetlands, are located within the Project. The closest is the Thundelarra Lignum Swamp, located 27 km to the northeast (Figure 1.1).

1.9.3. Conservation Estate

The Western Australian Conservation Estate includes land and waters vested in the Conservation and Parks Commission under the *Conservation and Land Management Act* (1984). The Conservation Estate is generally managed by the Parks and Wildlife Service of DBCA to protect Western Australia's biodiversity, and includes National Parks, Nature Reserves, Conservation Reserves and other areas managed primarily for biodiversity conservation (DoEE 2016).

The northern half of the Project is included in the Warriedar Station Nature Reserve, an ex-pastoral station that has been incorporated into the National Reserve System (Figure 1.1).

2. METHODS

2.1. Legislation & Guidelines

2.1.1. Threatened Fauna (EPBC Act)

Nationally threatened species (flora and fauna) and ecological communities are protected under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The EPBC Act provides for the identification and listing of species and ecological communities as threatened, development of conservation advice and recovery plans, development of a register of critical habitat, recognition of key threatening processes and the development of threat abatement plans. Listed threatened species and ecological communities are recognised under the EPBC Act as a matter of national environmental significance and must be referred to the Minister and undergo an environmental assessment and approval process if they are likely to be significantly impacted. The categories for listing under the EPBC Act are outlined in Appendix A.

2.1.2. Threatened Fauna (BC Act)

The Western Australian *Biodiversity Conservation Act 2016* (BC Act) provides for the conservation, protection and ecologically sustainable use of biodiversity and biodiversity components in Western Australia. Threatened species (both flora and fauna) and ecological communities that meet the conservation categories listed within the BC Act are protected and require authorisation by the Minister to take or disturb. Species listed as Threatened under the BC Act are publicly listed in the WA Government Gazette with the current list published and correct as of 11 September 2018.

Fauna species may also be listed as being of special conservation interest if they have a naturally low population, restricted natural range, are subject to or recovering from a significant population decline or reduction of range or are of special interest, and the Minister considers that taking may result in depletion of the species. These are known as Specially Protected Species in the BC Act. The conservation categories covering State-listed threatened fauna species are aligned with those listed under the EPBC Act and are outlined in Appendix A.

2.1.3. Priority Fauna (DBCA)

Conservation significant species are listed by the Department of Biodiversity, Conservation and Attractions (DBCA) as Priority species where populations are geographically restricted or threatened by local processes, or where there is insufficient information to formally assign them to threatened fauna categories. Whilst Priority species are not specifically listed in the BC Act, they have a greater level of significance than other native species. The categories covering Priority Fauna species are outlined in Appendix A.

2.1.4. Assessment Guidance

The terrestrial fauna assessment was conducted in accordance with the following Commonwealth and State legislation, as well as the Environmental Protection Authority (EPA) requirements for environmental surveys as outlined below.

- *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act);
- *Biodiversity Conservation Act 2016* (BC Act);
- EPA Technical Guidance: Sampling Methods for Short Range Endemic Invertebrate Fauna (Environmental Protection Authority, 2016b);
- EPA Technical Guidance: Sampling Methods for Terrestrial Vertebrate Fauna (Environmental Protection Authority, 2016c); and

- EPA Technical Guidance: Terrestrial Fauna Surveys (Environmental Protection Authority, 2016d).

Relevant species-specific survey guidelines that were considered during the development of survey methods include:

- Survey guidelines for Australia's threatened reptiles (Department of Sustainability Environment Water Population and Communities, 2011);
- Survey guidelines for Australia's threatened birds (Department of the Environment Water Heritage and the Arts, 2010);
- Interim guideline for preliminary surveys of night parrot (*Pezoporus occidentalis*) in Western Australia (Department of Parks and Wildlife, 2017); and
- Revised draft referral guideline for three threatened black cockatoo species: Carnaby's Cockatoo, Baudin's Cockatoo and the Forest Red-tailed Black Cockatoo (Commonwealth of Australia, 2017)

2.2. Literature Review

The following databases were searched and reviewed for significant terrestrial fauna and incorporated into the desktop assessment (Table 2.1).

Table 2.1: Database Searches

Data Source	Custodian	Target Fauna	Details
Commonwealth Protected Matter Search Tool (PMST)	Department of the Environment and Energy (DoEE)	Vertebrate Fauna	Date: 21/8/19 Buffer: 40 km
NatureMap	Department of Parks and Wildlife (DPaW) / Western Australian Museum (WAM)	Vertebrate and Invertebrate Fauna	Date: 24/7/19 Buffer: 40 km, Centre Point: 116°58'54"E 29°11'09"S
DBCA Threatened Database Search	Department of Biodiversity, Conservation and Attraction (DBCA)	Vertebrate and Invertebrate Fauna	Date: 19/08/19 Details: Polygon plus 40 km
Western Australian Museum	Arachnida & Myriapoda, Crustacea, Mollusca Database	SRE Invertebrate Fauna	Date: 15/8/19 Search Area: NW corner -28.82° 116.52° SE corner -29.58° 117.39°
TEC & PEC database	DBCA	Vertebrate and (SRE) Invertebrate Fauna	Date: 03/09/2019, Buffer: 15 km, Reference: 02 - 0919EC
Index of Biodiversity Surveys of Assessments (IBSA) database.	Department of Water and Environmental Regulation (DWER)	Vertebrate and (SRE) Invertebrate Fauna	Date: 30/11/2019, Buffer: 100 km

Thirty-seven previously conducted biological assessments within the vicinity of the Project were reviewed to provide information on the terrestrial fauna and associated habitats associated with the Project. Reports were incorporated if they were provided by Tungsten Mining, or if they were publicly available. The reports incorporated into the desktop assessment are listed in Table 2.2 and the approximate location of the survey is shown in Figure 2.1.

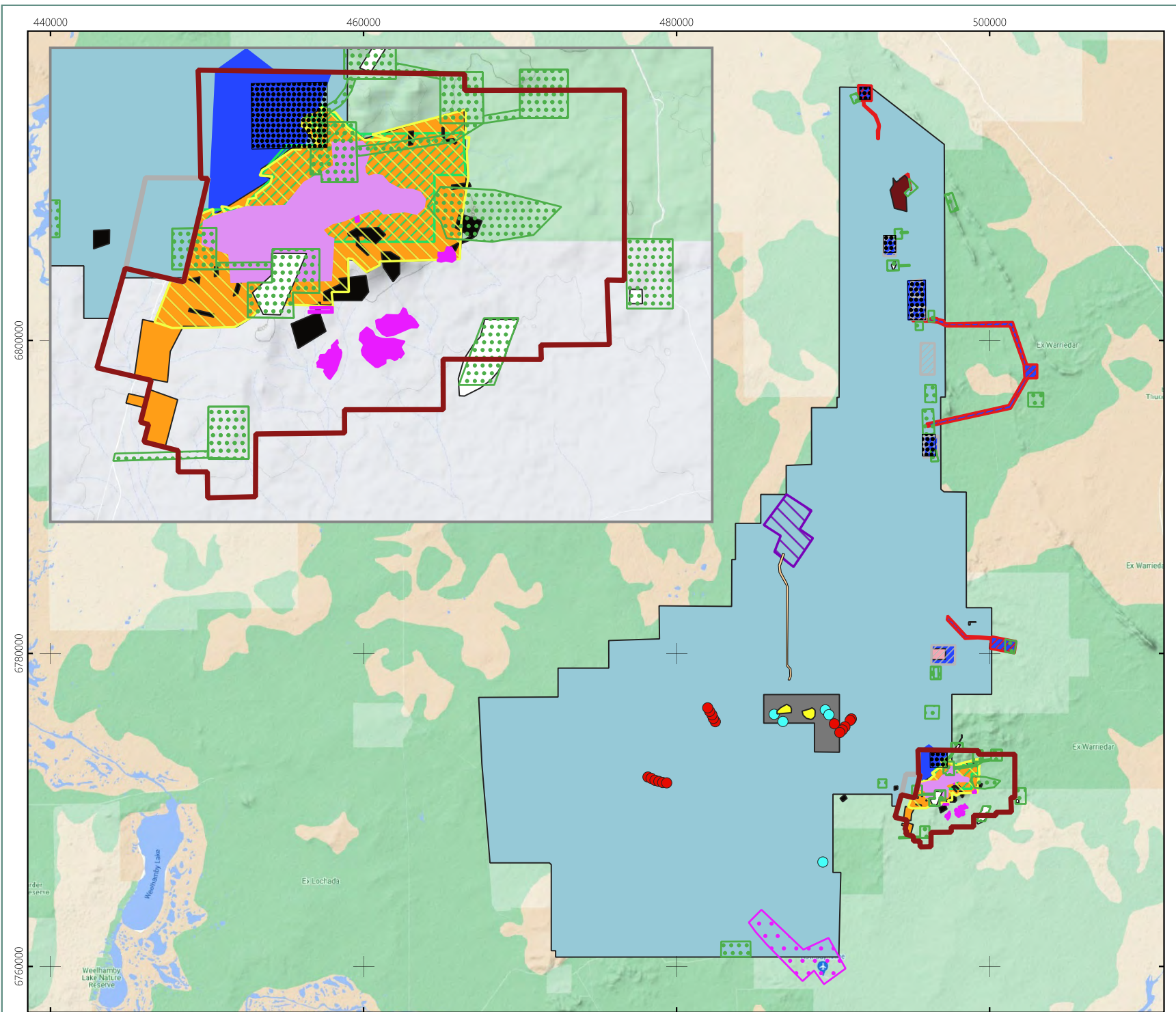
Table 2.2: Previously Conducted Biological Assessments

Reference	Survey Type	Title	Prepared For	Location of Study from Project
(Animal Plant Mineral, 2011)	Detailed flora & vegetation	Minjar Gold biological survey. Minjar Gold Mine expansion. Flora & vegetation assessment	Minjar Gold Pty Ltd	Within
(Animal Plant Mineral, 2012a)	Level 1 terrestrial fauna. Targeted Malleefowl & <i>Egernia stokesii badia</i> surveys	Fauna Assessment. Austin, Blackdog, Bobby McGee, Bugeye, Camp, Highland Chief, Keronima, M1, Monaco, Mugs Luck, Riley, Silverstone, Trench and Windinne Well Projects. South Murchison, WA	Minjar Gold Pty Ltd	Area between Project and 45 km north
(Animal Plant Mineral, 2012b)	Flora - Level 1 & targeted	Minjar Gold Mine expansion. Level 1 flora & vegetation assessment & targeted search for flora of conservation significance. Austin, Blackdog Camp, Highland Chief, Keronima, Mugs Luck, Riley & Trench. Mid-West, WA	Minjar Gold Pty Ltd	6.5 km north
(Animal Plant Mineral, 2012c)	Flora - targeted	<i>Stylidium scintillans</i> (WEGE) assessment. Keronima & surrounding tenements. Mid-West, WA	Minjar Gold Pty Ltd	6 km north
(APM, 2017a)	Flora & fauna - targeted	Mt Mulgine project - Mulgine Hill M59/425 - M59/387. Targeted survey for Threatened and Priority flora, and conservation significant fauna habitat. Murchison, WA. October 2017	Mid-West Tungsten Pty Ltd, Tungsten Mining NL	Within
(APM, 2017b)	Flora - detailed, Fauna - Level 1	Mt Mulgine project biological survey. Rothsay, WA. February 2017	Tungsten Mining NL	Within
(APM, 2018a)	Flora & fauna - targeted	Mt Mulgine project - Mulgine Hill M59/425 - M59/387. Targeted survey for Threatened and Priority flora, and conservation significant fauna habitat. Murchison, WA. July 2018	Mid-West Tungsten Pty Ltd, Tungsten Mining NL	Within
(APM, 2018b)	Flora - detailed, Fauna - Level 1	Mt Mulgine project biological survey. Rothsay, WA. July 2018	Tungsten Mining NL	Within
(Animal Plant Mineral, 2018c)	Flora - targeted	Tungsten Mining NL. <i>Acacia sulcataculis</i> (P1) targeted search population extension & management. Mount Mulgine, WA	Tungsten Mining NL	Within & 1 km east
(Bamford & Wilcox, 2004)	Level 2 (single phase), opportunistic SRE	Blue Hills fauna assessment	ATA Environmental	6 km west
(BCE, 2006)	Level 2 (two phase), opportunistic SRE	Fauna values of Gindalbie Metals Karara & Mungada Haematite/Magnetite Project	Gindalbie Metals Ltd	5 km west
(BCE, 2013a)	Level 1 & targeted vertebrate and SRE invertebrate survey	Hinge Project Area fauna assessment	Karara Mining Limited	14 km north west

Reference	Survey Type	Title	Prepared For	Location of Study from Project
(Bamford Consulting Ecologists, 2013b)^	Targeted vertebrate and SRE invertebrate survey	Significant fauna survey of the Hinge Haul Road: November 2012	Karara Mining Limited	14 km north west
(Bamford Consulting Ecologists, 2017)	Level 1 fauna assessment	Rothsay Project Area fauna assessment	Egan Street Resources	7 km west
(ecologia Environment, 2007)	Level 2 SRE assessment	Koolanooka/Blue Hills DSO mining project Short Range Endemic biological assessment	Midwest Corporation Limited	7 km west
(ecologia Environment, 2010b)	Level 2 SRE assessment	Blue Hills Short Range Endemic invertebrate survey	Sinosteel Midwest Corporation	7 km west
(ecologia Environment, 2011a)^	Level 2 SRE assessment	Blue Hills Additional Short-range Endemic invertebrate survey	Sinosteel Midwest Corporation	7 km west
(ecologia Environment, 2011b)	Level 1 vertebrate fauna	Blue Hills Project Level 1 fauna assessment	Sinosteel Midwest Corporation	7 km west
(ecologia Environment, 2012)^	Targeted invertebrate fauna survey	Blue Hills <i>Idiosoma nigrum</i> targeted survey	Sinosteel Midwest Corporation	7 km west
(Ecoscape (Australia), 2016b)	Consolidation of terrestrial fauna data, targeted terrestrial fauna survey	Blue Hills - Mungada East terrestrial fauna assessment	Sinosteel Midwest Corporation	5 km west
(Jenny Borger Botanical, 2018)	Flora - targeted	Targeted flora survey for new populations of <i>Acacia sulcata</i> to support the application for a clearing permit for the Mount Mulgine Project CPS 8141/1 for Mid-West Tungsten Pty Ltd Tenements M59/386, M59/387, M59/425	Tungsten Mining NL	Within

Reference	Survey Type	Title	Prepared For	Location of Study from Project
(Mattiske Consulting, 2009a)	Detailed flora & vegetation	Flora and vegetation survey of the Austin Project Area within tenement M59/420, Minjar Project Area	Golden Stallion Resources	5 – 30 km north
(Mattiske, 2009b)	Detailed flora & vegetation	Flora and vegetation survey of the Bugeye Project Area within tenement M59/420, Minjar Project Area	Golden Stallion Resources	5 – 30 km north
(Mattiske, 2009c)	Detailed flora & vegetation	Flora and vegetation survey of the Eastern Creek Project Area within tenements M59/421 and M59/458, Minjar Project Area	Golden Stallion Resources	5 – 30 km north
(Mattiske, 2009d)	Detailed flora & vegetation	Flora and vegetation survey of the Keronima Project Area within tenement M59/420, Minjar Project Area	Golden Stallion Resources	5 – 30 km north
(Mattiske, 2009e)	Detailed flora & vegetation	Flora and vegetation survey of the Monaco Project Area within tenements M59/420 and M59/458, Minjar Project Area	Golden Stallion Resources	5 – 30 km north
(Mattiske Consulting, 2009f)	Detailed flora & vegetation	Flora and vegetation survey of the Silverstone Project Area within tenement M59/420, Minjar Project Area	Golden Stallion Resources	5 – 30 km north
(Mattiske, 2009g)	Detailed flora & vegetation	Flora and vegetation survey of the Windinnie Well Project Area within tenement M59/420, Minjar Project Area	Golden Stallion Resources	5 – 30 km north
(Outback Ecology, 2013)	Detailed flora & vegetation	Karara Mining Limited. Targeted flora & vegetation assessment - Hinge Haul Road	Karara Mining Limited	9.6 km north west
(Terratree, 2013)	Detailed flora & vegetation, & targeted flora	Level 1 and 2 Flora and Vegetation Survey and Mapping Potential Habitat for the Threatened (Declared Rare) species <i>Stylidium scintillans</i>	Minjar Gold	Within & north
(Terratree Ecological Assessment & Management, 2014)	Detailed flora & vegetation, & targeted flora	Level 1 and 2 Flora and Vegetation Survey and Mapping Potential Habitat for the Threatened (Declared Rare) species <i>Stylidium scintillans</i>	Minjar Gold	Within & north
(Terratree Ecological Assessment & Management, 2015)	Level 1 flora & vegetation, & targeted flora & fauna	Level 1 Flora and Vegetation and Targeted Threatened Flora and Fauna Assessment	Minjar Gold	35 km north

Reference	Survey Type	Title	Prepared For	Location of Study from Project
(Terrestrial Ecosystems, 2019)	Targeted fauna - preclearance	Pre-clearance fauna assessment - Mt Mulgine Trench Deposit area	Tungsten Mining NL	Within
(Woodman, 2012)	Detailed flora & vegetation	Karara Mining Limited. Regional flora & vegetation survey of the Karara to Minjar Block	Karara Mining Limited	Within, 40 km north & 30 km west
(Woodman, 2017)	Detailed flora & vegetation	Rothsay Gold Project - Flora and vegetation assessment	Egan Street Resources	8 km south west
(Woodman 2018)	Flora - targeted	Rothsay Gold Project - Targeted survey for <i>Stylidium scintillans</i> (Threatened)	Egan Street Resources	8 km south west
Woodman (2019)	Flora - targeted	Rothsay Gold Project - <i>Hemigenia tichbonii</i> survey, May 2019	Egan Street Resources	8 km south west



Legend

- Mt Mulgine Project
- Extension Tenement M59/460

Previous Flora & Fauna Assessments

- APM (2011)
- APM (2012a)
- APM (2012b)
- APM (2012c)
- APM (2017a)
- APM (2017b)
- APM (2018a)
- APM (2018b)
- APM (2018c)
- Bamford & Wilcox (2004)
- BCE (2006)
- BCE (2013a)
- BCE (2017)
- Ecologia (2007;2010;2011a)
- Ecoscape (2016)
- Jenny Borger (2018)
- Mattiske (2009a-g)
- Outback Ecology (2013)
- Terratree (2013)
- Terratree (2014)
- Terratree (2015)
- Woodman (2012)
- Woodman (2017;2018;2019)



0 4 8 12 km

Scale: 1:330,000

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter



Author: AH

Date: 27-05-2020

Previously Conducted Flora & Fauna Assessments

Mt Mulgine Project

Prepared for
Tungsten Mining NL

Figure
2.1

2.3. Conservation Significant Fauna

Terrestrial fauna can be considered significant for a range of reasons including (Environmental Protection Authority, 2016a):

- Being identified as a Threatened or Priority species;
- Species with restricted distribution;
- Degree of historical impact from threatening processes; or
- Providing an important function required to maintain the ecological integrity of a significant ecosystem.

Fauna habitats can be considered significant if they provide habitat important to the life history of a significant species, or where they are unique or isolated habitats in the landscape or region (Environmental Protection Authority, 2016a).

The results of the fauna species that are listed under current legislative frameworks. Three conservation lists have been developed at national (EPBC Act) and State level (BC Act and DBCA Priority list) (Appendix A). The likelihood of a conservation significant fauna species, identified during the literature review, being present within the Project was determined by examining the following:

- Suitability of fauna habitats known to exist within the Project;
- Distribution of previously recorded conservation significant species;
- Frequency of occurrence of conservation significant species records in the region;
- Detectability of conservation significant species based on specific behavioural and ecological characteristics; and
- Temporal distribution of conservation significant species records, taking previous survey effort into consideration.

Each conservation significant species potentially occurring in the Project, was assigned a likelihood of occurrence based on the below categories (Table 2.3). In accordance with the precautionary principal, the level of available information for each species was also taken into consideration so that species are not allocated a low likelihood of occurrence because of insufficient survey information.

Table 2.3: Criteria to Assess Likelihood of Occurrence

Likelihood	Criteria
Recorded	Species recorded within the Study Area within the previous ten years.
High	Species recorded within or in proximity to the Study Area within the previous 20 years. Suitable habitat occurs in the Study Area.
Medium	Species recorded within or in proximity to the Study Area more than 20 years ago. Species recorded outside the Study Area but within 40 km. Suitable habitat occurs in the Study Area.
Low	Species rarely or not recorded within 40 km of the Study Area. Suitable habitat does not occur within or in proximity to the Study Area.
Very Low	Species not recorded within 40 km despite multiple recent surveys. Suitable habitat does not occur within the Study Area. Species considered locally extinct.

2.4. Determination of Survey Design

The level of existing fauna and fauna habitat knowledge was assessed for the region within which the Project was located. A total of two Level 2 vertebrate fauna surveys (Bamford & Wilcox, 2004; Bamford Consulting Ecologists, 2006), five Level 1 vertebrate fauna surveys (Ecologia 2011b; APM 2012a; BCE 2013a, 2017; Animal Plant Mineral, 2018b), five targeted vertebrate fauna surveys (Animal Plant Mineral, 2012a; Bamford

Consulting Ecologists, 2013a, 2013b; Ecoscape (Australia), 2016b; Terrestrial Ecosystems, 2019) and nine SRE invertebrate surveys (Bamford & Wilcox, 2004; BCE 2006; Ecologia 2007, 2010b, 2011a, 2012; Bamford Consulting Ecologists, 2013a, 2013b; Ecoscape 2016b) have previously been completed in the local region (Table 2.1).

Due to the high number of previous fauna surveys completed across the local region, it was determined that a Level 1 fauna (habitat assessment) and targeted conservation significant fauna survey was appropriate. Additional SRE invertebrate survey methods were also employed due to the complexity of the habitats that occur within the Project. The factors that may influence survey design are detailed in Table 2.4. Previous terrestrial fauna survey completed in the region have been mapped in Figure 2.1.

Table 2.4: Factors that may influence Survey Design

Factor	Relevance
Bioregion – level of existing survey knowledge of the region and associated ability to predict accurately.	The Yalgoo bioregion has been relatively intensively surveyed over the past decade with a general expansion in the detailed knowledge of the terrestrial faunal assemblages that occur in the region. The Talling sub-region has been the focus of several mining proposals which provide regional information particularly relating to the vertebrate fauna assemblage. Regional SRE invertebrate fauna assessments indicate some complexity which is thought to be related to the variable geology in the local region.
Landform special characteristics / specific fauna / specific context of the landform characteristics and their distribution and rarity in the region.	The geology and other landforms within the Project are considered to be complex and the potential for SRE invertebrate fauna taxa is considered high. As such additional survey methods were employed to provide additional information to supplement the limited previous survey effort completed to date.
Lifeforms, life cycles, types of assemblages and seasonality (e.g. migration) of species likely to be present.	The vertebrate fauna assemblage associated with the Project is not considered unique and is well understood. The complexity of the habitat and the potential for unique SRE invertebrate taxa within the Project was considered to be high and additional survey methods were added.
Level of existing knowledge and results of previous regional sampling (e.g. species accumulation curves, species/area curves).	A total of two Level 2 vertebrate fauna surveys, five Level 1 vertebrate fauna surveys, five targeted vertebrate fauna surveys and nine SRE invertebrate surveys have previously been completed within 40 km of the Project. Sufficient regional knowledge is available including information to allow assessment of the likelihood of occurrence for conservation significant fauna species.
Number of different habitat or degree of similarity between habitats within a survey area.	Seven fauna habitat types (excluding cleared areas) were identified based on previous habitat mapping, staff experience with the region, land systems and vegetation units. Habitat complexity is a consideration as habitats appear to be distinct with relation to SRE invertebrate fauna.
Climatic restrictions (e.g. temperature or rainfall that preclude certain sampling methods).	Field surveys are generally conducted in Autumn and Spring to avoid climatic conditions that may preclude sampling (Extreme heat, flooding, or cold conditions). No climatic constraints were expected to influence the field surveys and extensive data from previous surveys provides information to cover any sampling limitations caused by weather.
Sensitivity of the environment to the proposed activities.	The Project contains habitat types which are represented in the surrounding region, however some habitats are expected to be unique and potentially restricted. Highest impacts are associated with the areas of mining and associated infrastructure; however, this information is not currently available.

Factor	Relevance
Size, shape, and location of the proposed activities.	The exact impact areas are not currently known. The Project as surveyed is based on relevant tenements. The survey was designed to ensure adequate coverage to allow the assessment of several proposed impact layout options.
Scale and impact of the proposal.	The proposed development will include mine pits, waste rock landforms and associated infrastructure. The entire (Mt Mulgine) tenement was surveyed to allow the design of the project to include environmental considerations.

2.5. Field Surveys

The current assessment was completed over several stages with information collected during each survey informing the design of subsequent field events. Three preclearance targeted fauna surveys for exploration related activities including proposed drill pads and access tracks, one Level 1/targeted fauna survey and one comprehensive SRE invertebrate survey were completed. The Level 1/targeted fauna survey and preclearance surveys comprised of habitat assessments, opportunistic searches, and targeted searches for Malleefowl (*Leipoa ocellata*), Western Spiny-scaled Skink (*Egernia stokesii badia*), Gilled Slender Blue-tongue (*Cyclodomorphus branchialis*) and Shield-backed Trapdoor Spider species (*Idiosoma* spp.). Due to the range of SRE invertebrate fauna taxa recorded from the region a comprehensive SRE invertebrate fauna survey that included the use of a range of survey techniques was completed following the Level 1 habitat assessment. Detailed descriptions of the methods completed are presented below.

2.5.1. Survey Timing

Climatic conditions are considered to be key factors for certain fauna groups when planning terrestrial fauna surveys. The climatic conditions leading up to the fauna field surveys are illustrated below (Figure 2.2) The data displayed below was derived from weather stations located at Karara (#10195) and Paynes Find (#7139), located 30 km west and 70 km east of the Project (Bureau of Meteorology, 2020). The overall rainfall pattern that was recorded appears to be typical for the region, with limited rainfall occurring across most months and significant rainfall events occurring sporadically across the year due to either tropical low systems from the north or large cold front systems from the southwest. Two widespread significant rainfall events occurred in June 2019 and February 2020 with above average rainfall recorded at both stations (Figure 2.2) providing suitable conditions for the targeted surveys completed in late Spring 2019 and the comprehensive SRE invertebrate survey that was completed over Winter in 2020.

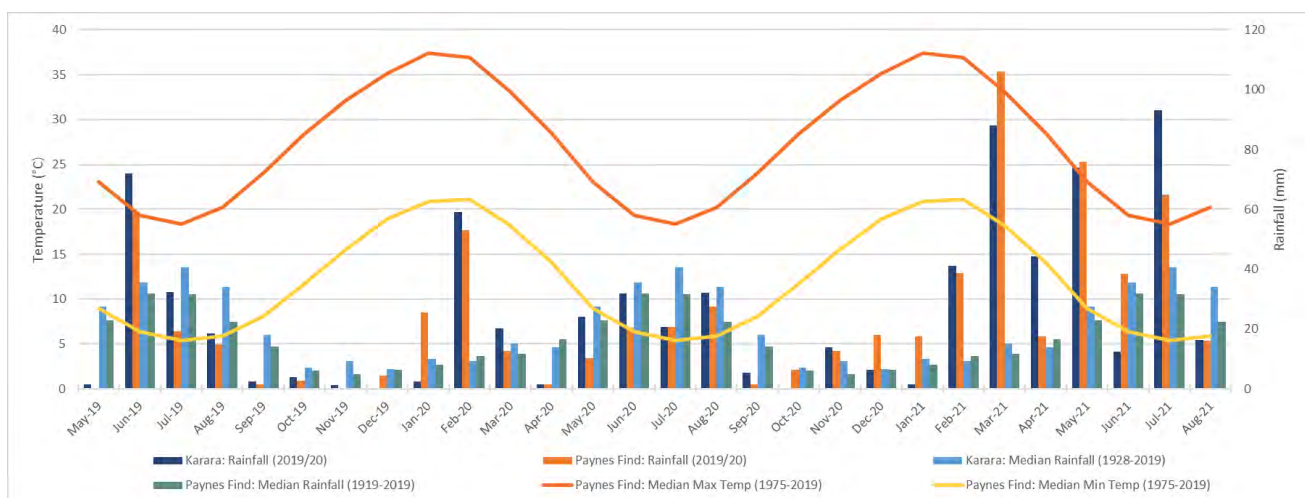


Figure 2.2: Climate Data for Karara (#10195) & Paynes Find (#7139)

The three preclearance targeted surveys for exploration drilling were completed in September, October and December 2019. Survey timing was not considered a significant factor as active searches of the small target areas for evidence of the conservation significant fauna species listed above are not seasonally dependant, although the warm temperatures in late Spring and early Summer were conducive for increased reptile activity.

The Level 1/targeted fauna survey was completed in Spring (October 2019) to coincide with the target species peak period of activity. The warmer months following the cooler, higher rainfall period over Winter are known to trigger an increase in activity and therefore detectability in many fauna species, including those targeted by the survey. Although rainfall across the site was lower than average in 2019 the above average rainfall recorded in July 2019 is thought to have provided sufficient moisture to maintain suitable fauna activity.

The comprehensive SRE invertebrate fauna survey was completed during the wet Winter period (rainfall recorded from Karara was close to average across the Winter period) when many target SRE taxa are active (EPA 2016b). Field survey timing for the fauna field assessments are listed in Table 2.5.

The targeted regional assessment for SREs was completed during Winter 2021 (June – August 2021) when conditions for SRE activity were optimal with above rainfall recorded prior to surveying (Figure 2.2).

Table 2.5: Field Survey Timing – Fauna

Field Survey	Date	Person Days
Preclearance targeted fauna survey (68 drill pads)	5 – 8 Sept 2019	4
Level 1 and targeted fauna survey	8 – 14 Oct 2019	14
Preclearance targeted fauna survey (123 drill pads)	15-16 Oct 2019	4
Preclearance targeted fauna survey (25 drill pads)	12 – 13 Dec 2019	2
SRE survey (incl. wet pitfall installation)	18-24 June 2020	12
SRE wet pitfall (wet pitfall collection)	11-12 August 2020	4
Regional SRE survey incl. wet pitfall installation)	24-29 June 2021	12
SRE wet pitfall (wet pitfall collection)	23-26 August 2021	8
Total		60

2.5.2. Sites Selection

Prior to the current surveys (excluding preclearance surveys), information was considered from previous surveys and available public information. Survey site locations and survey effort completed during the survey were influenced by the following factors:

- Previous survey effort within the Project area (as per Figure 2.3) – a focus on areas previously not surveyed;
- Areas of proposed impact – a focus on areas inside the proposed impact footprint;
- Planned Exclusion Zones – survey effort was focused on areas outside the Planned Exclusion Zones;
- Habitat types – all habitat types were sampled in proportion to their extent;
- Conservation significant fauna habitats – habitats that are favoured by conservation significant fauna were targeted during opportunistic searches;
- Restricted habitat types – habitats that are likely restricted in the wider region, in particular habitats that are associated with restricted geological units or vegetation types that fall outside the Planned Exclusion Zone and may potentially be impacted.

Regional SRE sites were selected based on the following criteria:

- Access permission (tenements and pastoral);
- Habitats similar to those that recorded potential SREs from within the Project area; and
- Access tracks.

All survey sites are listed in Appendix D and their locations displayed in Figure 2.4.

2.5.3. Project Team

Spectrum Ecology staff involved in the assessment are listed in Table 2.6, along with their role and years of experience. The field survey was conducted under Regulation 27 licence BA27000272, and authorisation to take or disturb threatened species licence TFA 2020-0078.

Table 2.6: Project Team

Staff	Role & Project Tasks	Years of Experience
Fauna		
Damien Cancilla	Principal Zoologist – field survey and reporting	14
Astrid Heidrich	Senior Zoologist – field survey and reporting	12
Jordan Vos	Zoologist – field survey and reporting	10
Melinda Henderson	Zoologist – field survey	2
Lachlan Peterson	Zoologist – field survey	3
Gabrielle Beca	Zoologist – field survey	1

2.5.4. Level 1 Terrestrial Fauna Assessment

The Level 1 terrestrial vertebrate fauna survey was carried out in accordance with Technical Guidance: Terrestrial Fauna Surveys (EPA, 2016g), Technical Guidance: Sampling of short range endemic invertebrate fauna (EPA, 2016e) and Technical Guidance: Sampling Methods for Terrestrial Vertebrate Fauna (EPA, 2016f). The guidance suggests selective low-intensity sampling of fauna and fauna habitats to verify the accuracy of the desktop assessment. The approach of a Level 1 fauna survey was used to describe and map the fauna habitats that occur across the Project and complete active searches to describe the fauna assemblages that occur within the Project, particularly any conservation significant fauna identified as likely to be present. A variety of survey techniques were used for fauna as outlined in Table 2.7.

Table 2.7: Fauna Survey Techniques

Fauna	Survey Technique
Mammals	Direct sightings and indirect evidence such as tracks, scats and diggings were recorded across the Project.
Birds	Direct sightings and calls, as well as indirect evidence such as feathers, pellets and nests were recorded across the Project. Search effort was focused to Malleefowl in areas of potential habitat.
Reptiles & Amphibians	Direct sightings and indirect evidence such as calls, tracks, diggings, skins and latrines were recorded across the Project and targeted searches were undertaken in areas with suitable habitat. Hollow logs and timber piles were inspected for Western Spiny-tailed Skink occupation and foraging included the turning of surface debris and the raking of spoil heaps in an effort to detect the Gilled Slender Blue-tongue Skink.
SRE Invertebrate Fauna	Foraging methods were tailored to target Shield-backed Trapdoor Spiders (<i>Idiosoma</i> spp.). Litter beds and areas between litter beds were surveyed for the leaf arrangement burrow lids characteristic of <i>Idiosoma</i> spp. in the region.

2.5.4.1. Fauna Habitat Mapping

Fauna habitat mapping identifies areas of vegetation and land features that are distinguishable from other areas. Typically, each fauna habitat supports a characteristic fauna assemblage that is adapted to the features of the fauna habitat. Fauna habitat types are identified and mapped based on the following information:

- General vegetation type (Shepherd, Beeston and Hopkins, 2001);
- Vegetation units mapped within the Project;
- Vegetation structure;
- Landforms;
- Geological units;
- Soil substrate;
- Aerial imagery;
- Fauna assemblage; and
- Field observations.

The fauna habitat was recorded at each survey site, opportunistically while traversing the Project on foot, and when travelling between sites.

2.5.4.2. Nomenclature

Nomenclature for mammals, birds, reptiles and amphibians followed the Western Australian Museum Checklist of the Vertebrates of Western Australia (April 2020). Fauna species identifications were completed based on information provided in references listed in Table 2.8. Nomenclature for SRE invertebrates is based on data provided by WA Museum and relevant experts.

Table 2.8: References Used for Identification of Fauna Species

Fauna	Reference
Mammals	Churchill (Churchill, 2009), Menkhorst and Knight (Menkhorst and Knight, 2001), Van Dyck and Strahan (Van Dyck and Strahan, 2008)
Birds	Menkhorst, Clarke and Rogers (Menkhorst <i>et al.</i> , 2019)
Reptiles & Amphibians	Wilson and Swan (Wilson and Swan, 2017), Cogger (Cogger, 2014), Tyler and Doughty (Tyler and Doughty, 2009)

2.5.5. Targeted Conservation Significant Fauna Surveys

During the field survey, the preliminary assessment of the likelihood of conservation significant fauna species occurring within the Project was reviewed and amended (see Section 3.1). The assessment included the following:

- Suitable fauna habitats recorded from the Project;
- Distribution of previously recorded conservation significant species;
- Frequency of occurrence of conservation significant species in the region;
- Temporal distribution of conservation significant species; and
- Accuracy of record locations, date and source of record (level of reliability).

The likelihood of occurrence of each conservation significant species listed by the database searches was determined based on the criteria outlined in Table 2.3.

2.5.5.1. *Idiosoma* Spider Survey

The field survey methods for *Idiosoma* replicated the targeted survey methodology conducted by ecologia Environment (2012) and Ecoscape (2016b) at Blue Hills Mungada Ridge. Spider survey quadrats were

established across various habitats within the Project. These were randomly selected by placing a 100m x 100m grid over the development envelope and using an online random number generator to select each grid coordinate. Each quadrat was searched by two zoologists who walked evenly spaced transects (12.5 - 20 m apart, depending on density of vegetation) across the quadrat. Habitat data (landform, substrate, vegetation, aspect, leaf litter coverage) was recorded for each quadrat and burrow morphometrics (width of burrow, distance to nearest shrub) were collected for each spider burrow located. The dominant vegetation was also determined based on recent flora and vegetation assessments. The *Idiosoma* spiders were identified (where possible) using an inspection camera that was inserted into the burrow to determine the following characteristics:

- Orientation of spider inside the burrow (upright or upside down);
- Colour of abdomen;
- Level of corrugation of the abdomen; and
- Appearance of the spiders' abdomen.

Where this method did not allow clear identification of the spider to a species level, representative individuals were collected and submitted for taxonomic and genetic analysis by subject matter experts.

A total of 34 survey sites were established at the Project (see Figure 2.4):

- Eight opportunistic survey sites (all species recorded across various habitat types);
- Twenty *Idiosoma* survey sites (randomly selected 100 m x 100 m quadrats, other fauna also recorded); and
- Two targeted *Idiosoma gutharuka* survey site (100 m x 100 m quadrat to further define the species population).

In addition, three preclearance surveys were completed at 216 quadrats (20m x 20m) and associated access tracks. The area was searched using walking transects, which were 5-10 m spaced depending on vegetation density. The coordinates of the north-west corner of each quadrat and drill pad are listed in Appendix D and shown in Figure 2.4.

Tungsten have also identified Planned Exclusion Zones (Zones 1-3, see Figure 2.4) around areas of cultural and environmental significance. These areas will be protected from development to mitigate potential impacts.

2.5.5.2. Western Spiny-tailed Skink

Database search results show the Western Spiny-tailed Skink, *Egernia stokesii badia*, has been recorded in close proximity (8.5 km north-west) to the Project. Loss of habitat due to agriculture, grazing and crop production has resulted in the species being listed as Endangered under the EPBC Act.

Potential habitat for the Western Spiny-tailed Skink is characterised by eucalypt woodlands (typically York Gum, Gimlet and Salmon Gum) hosting fallen timber and hollow logs that are used as refuge sites. The species creates distinctive 'latrine' sites, depositing scats in piles or clusters outside of refuges (Department of the Environment, 2019). This behaviour is particularly useful as a way to identify log piles and hollows that may be occupied by individual animals or family groups.

Areas of eucalypt woodland habitat containing fallen timber were searched for secondary signs (latrine sites) and hollows were inspected with handheld torches and an inspection camera when found. Potential habitat was surveyed both within the quadrats assigned for spider surveys as well as opportunistically when suitable habitat was encountered.

2.5.5.3. Gilled Slender Blue-tongue

The Gilled Slender Blue-tongue, *Cyclodomorphus branchialis*, was recorded during previous surveys of the Blue Hills Mungada Ridge area approximately 6 km north west of the Project (BCE, 2006). It is currently listed as Vulnerable under the BC Act.

Little is known about the habitat preferences of the Gilled Slender Blue-tongue with individuals recorded from Acacia shrubland on hard red clay soils, under a laterite boulder on a limestone ridge (Shea and Miller, 1995) and from an ironstone ridge (BCE 2006).

Due to the lack of specific information related to the species habitat preferences, opportunistic searches were conducted across all habitat types within the Project. Suitable microhabitats such as spoil heaps (piles of soil, tree branches and other vegetation pushed up by machinery) and leaf litter beds beneath trees and shrubs were raked through with three-pronged cultivator rakes. Searches under surface debris such as rocks and logs were also completed with all habitat features returned to their original position.

2.5.5.4. Night Parrot

Recent records of Night Parrot in the central desert region have identified suitable habitat as including long-unburnt areas of ring forming spinifex hummocks, and grasslands of inland lakes (Department of Parks and Wildlife, 2017; Greatwich, 2017; Jackett *et al.*, 2017; Murphy *et al.*, 2017). Habitat assessments within the Project looked to determine if any habitat was considered suitable for Night Parrot. Due to a lack of suitable habitat recorded within the Project, additional survey techniques such as the use of acoustic recorders or nocturnal listening surveys were considered not to be required.

2.5.5.5. Malleefowl

Database searches show that the Malleefowl (*Leipoa ocellata*) is well known from the region surrounding Mt Mulgine with one record from 2012 from 2 km north of the Project (DBCA Threatened Fauna Database). During previous fauna surveys, Malleefowl were recorded from the Project area on seven occasions (four active mounds, two inactive mounds and tracks). The species is listed as Vulnerable under the EPBC Act due to population decline as a result of habitat loss (effects of fire, grazing, clearing for agriculture) and predation by introduced predators (Benshemesh, 2007).

Potential habitat for the Malleefowl in Western Australia is described as semi-arid to arid shrublands and woodlands. Preference is often shown for areas of dense shrubland (often dominated by *Acacia* spp.) with abundant leaf litter available for nesting. Malleefowl build conspicuous nest mounds than can remain detectable in the landscape for up to 100 years following active use (Benshemesh, 2007).

Walking transects were completed within areas of potential habitat at 20-50 m intervals dependant on vegetation density. Previously recorded mounds (Figure 3.4) were revisited in June 2020 and assessed for activity level. All observations of birds and secondary evidence was recorded using standardised Malleefowl data sheets (National Malleefowl Recovery Team, 2016) to ensure all relevant information was collected by the field team. The activity of mounds was determined using the categories endorsed by the Malleefowl Preservation Group (Malleefowl Preservation Group Inc., 2011) displayed in Table 2.9. Spectrum Ecology botanists operating within the Mt Mulgine Project also recorded any Malleefowl or secondary evidence they observed while completing the flora and vegetation survey.

Active Malleefowl mounds recorded from the Project were confirmed as active via the use of motion sensing cameras (Reconyx HF2X Hyperfire). Cameras were left in place for 6 weeks and collected during a separate field event.

Table 2.9: Malleefowl Mound Activity Levels

Level of Activity	Description
Active	Fresh scratching, loose soil and mound dug out in preparation for the breeding season or mounded for breeding. Mounds containing abundant but weathered plant material and shell fragments have been used regularly over at least the previous few years.
Recently used (1-5 years)	No signs of very recent activity, such as scratching. Soil surface compacted and little plant material present. However, mound slopes still steep and no plants growing in mound.
Moderately old (5-25 years)	No recent activity, soil compacted and no plant material. Surface of mound showing some weathering, such as loose soil and debris accumulating in central depression, and some plant colonisation possibly present.
Old (26-100 years)	Mound moderately to very weathered, often with a veneer of gravel on the slopes because of removal of fine materials from the surface. Some bushes growing on mound.
Very old (100+ years)	Mound very weathered. Profile low and central depression poorly defined. Bushes and even small trees growing on mound.

2.5.6. SRE Invertebrate Fauna Survey

SRE invertebrate sampling was completed using a variety of survey techniques due to the complexity of the habitats within the Project. A total of 12 SRE wet pitfall sites were installed in addition to 12 leaf litter sites being sampled inside the Project area. The sites were spread across the different habitat types, with half the sites installed inside the proposed footprint and the other half installed outside (Appendix D) (Figure 2.4). Additional foraging was also completed to supplement the trapping and leaf litter sampling. A separate survey was completed in the surrounding region to target SRE taxa recorded from within the Project area, in particular taxa that were assessed as formerly undescribed (representing 'new' potential SRE taxa). A total of 16 SRE wet pitfall sites and 12 leaf litter samples were sampled as part of the regional survey (Figure 2.5).

Details of the methods used during the SRE invertebrate fauna surveys are described below.

- **Wet pitfall trapping:** Wet pitfall traps consisted of a 1 L plastic jar containing 500–700 ml of preserving solution (active ingredient Propylene-Glycol). All wet pitfall traps were covered with a bucket lid, situated approximately 2–3 cm above the surface of the ground to limit vertebrate by-catch (Plate 2.1). Each wet pitfall site comprised four wet pitfalls which were established in suitable microhabitats and left in-situ for 6 weeks. During the regional targeted survey, smaller vials (120ml) were used to reduce by-catch as per the fauna licence requirements. Each vial was filled with Propylene-Glycol and left in the field for eight weeks. The smaller vials are a preferred method in areas where Threatened skink species (such as the Gilled Slender Blue-tongue) occur. Each wet pitfall trap site was also searched opportunistically for 1 person-hour.
- **Leaf litter collection:** Three 1 m² quadrats were collected from each site containing suitable leaf litter or soil. The samples were initially processed using a leaf litter reducer, with the smaller leaf litter components placed into plastic zip-lock bags and transported back to Perth where they were placed in Tullgren funnels in order to extract the invertebrates.
- **Foraging:** Suitable microhabitats were foraged for invertebrates that potentially represent SRE species. Leaf litter and the underside of rocks and logs were closely searched for molluscs, millipedes, isopods, pseudoscorpions and arachnids. If encountered, live snails were also collected from vegetation and trapdoor spider burrows were excavated.



Plate 2.1: 1L Wet Pitfall Traps in the Field

2.5.7. SRE Invertebrate Fauna Identification

Invertebrate fauna specimens collected during the 2020 surveys were provided to Bennelongia Environmental Consultants (Bennelongia), where they were identified to the lowest possible taxonomic level. Leaf litter samples were processed immediately following the field survey to ensure maximum survivorship before the samples were placed in Tullgren funnels (Plate 2.2). Invertebrate specimens from the wet pitfall traps were initially sorted by Spectrum Ecology staff before being passed on to Bennelongia for identification. DNA analysis was completed for selected specimens and analysed by Bennelongia staff (Appendix F).

Identification of SRE samples collected during the regional survey were completed by Erich Volschenk (Alacran Environmental Science (Alacran)) who works in collaboration with WA Museum which results in the taxa identification to be aligned with the WA Museum collection. Specimens collected during the initial SRE survey in 2020 were provided for identification and comparison to Alacran to determine the regional distribution.



Plate 2.2: Tullgren Funnel set-up

2.5.8. Determination of SRE Status

The SRE status of invertebrates is based on categories which were developed by the Western Australian Museum (WAM). For consistency purpose, identifications completed by Alacran Environmental Science (Alacran) followed the WAM categories (Table 2.10). Following the precautionary principle, all data deficient species from known SRE target groups are regarded as potential short-range endemics.

Table 2.10: SRE Categories

Categories	Defining Characteristics
Confirmed SRE	• Known distribution of <10,000 km². • Taxonomy is well understood. • Species is well represented in collections. • Region of occurrence has been comprehensively sampled.
Potential SRE	• Limited sampling has resulted in incomplete knowledge of the species distribution. • Poor or limited taxonomic resolution. • Species not well represented in collections.
Not SRE	• Known distribution of >10,000 km². • Taxonomy is well understood. • Species is well represented in collections. • Region of occurrence has been comprehensively sampled.

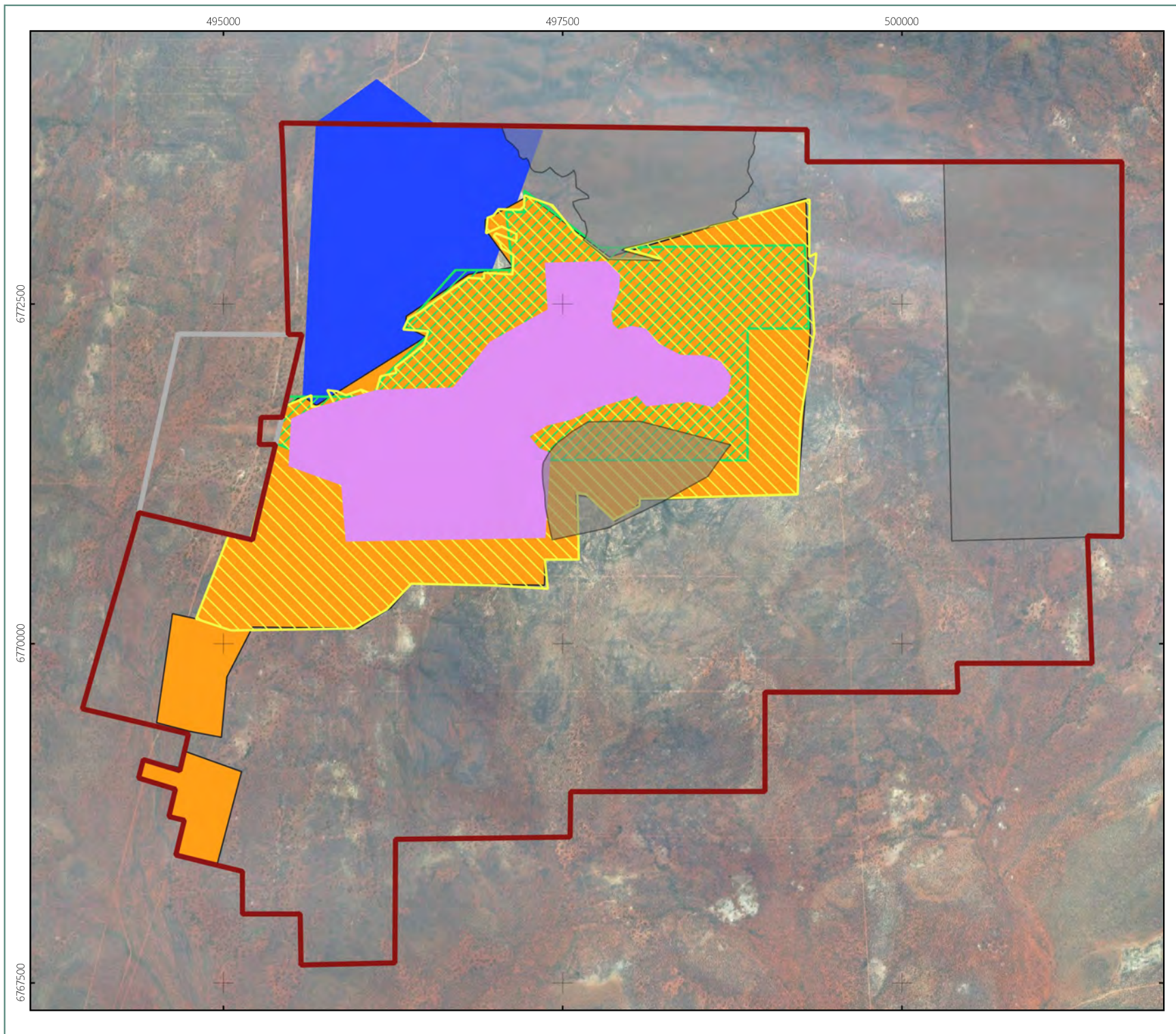
In order to align with sub-categories used by the WAM, the following sub-categories will also be included to further clarify a species' ranking as a potential SRE (Table 2.11).

Table 2.11: WAM Sub-Categories Used to Justify Potential SRE Status

Sub-Category	Description
A: Data Deficient (DD)	• There is insufficient data available to determine SRE status. • Factors that fall under this category include: - Lack of geographic information (DDG) - Lack of taxonomic information (DDT) - The group may be poorly represented in collections; and - The individuals sampled (e.g., juveniles) may prevent identification to species level.
B: Habitat Indicators (H)	• It is becoming increasingly clear that habitat data can elucidate SRE status; and • Where habitat is known to be associated with SRE taxa and vice versa, it will be noted here.
C: Morphology Indicators (M)	• A suite of morphological characters are characteristic of SRE taxa; and • Where morphological characters are known to be associated with SRE taxa and vice-versa, it will be noted here.
D: Molecular Evidence (M)	• If molecular work has been done on this taxon (or a close relative), it may reveal patterns congruent or incongruent with SRE status.
E: Unpublished Research & Expertise (U)	• Previous research and/ or WAM expertise elucidates taxon SRE status; and • This category takes into account the expert knowledge held within the WAM.

2.6. Data for the Index of Biodiversity Surveys for Assessment (IBSA)

The Environmental Protection Authority (EPA) has given instruction that all biological surveys collecting data on biodiversity submit the report and associated raw data to IBSA as an IBSA data package. All survey data collected at the Project was provided electronically following the completion of the surveys to comply with IBSA data standards.



Legend

-  Mt Mulgine Project
-  Extension Tenement M59/460
-  Planned Exclusion Zones
-  APM (2012a) - Level 1/targeted
-  APM (2017a) - Targeted
-  APM (2017b) - Level 1
-  APM (2018a) - Targeted



0 0.5 1 1.5 km

Scale: 1:38000

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter



Author: Astrid Heidrich

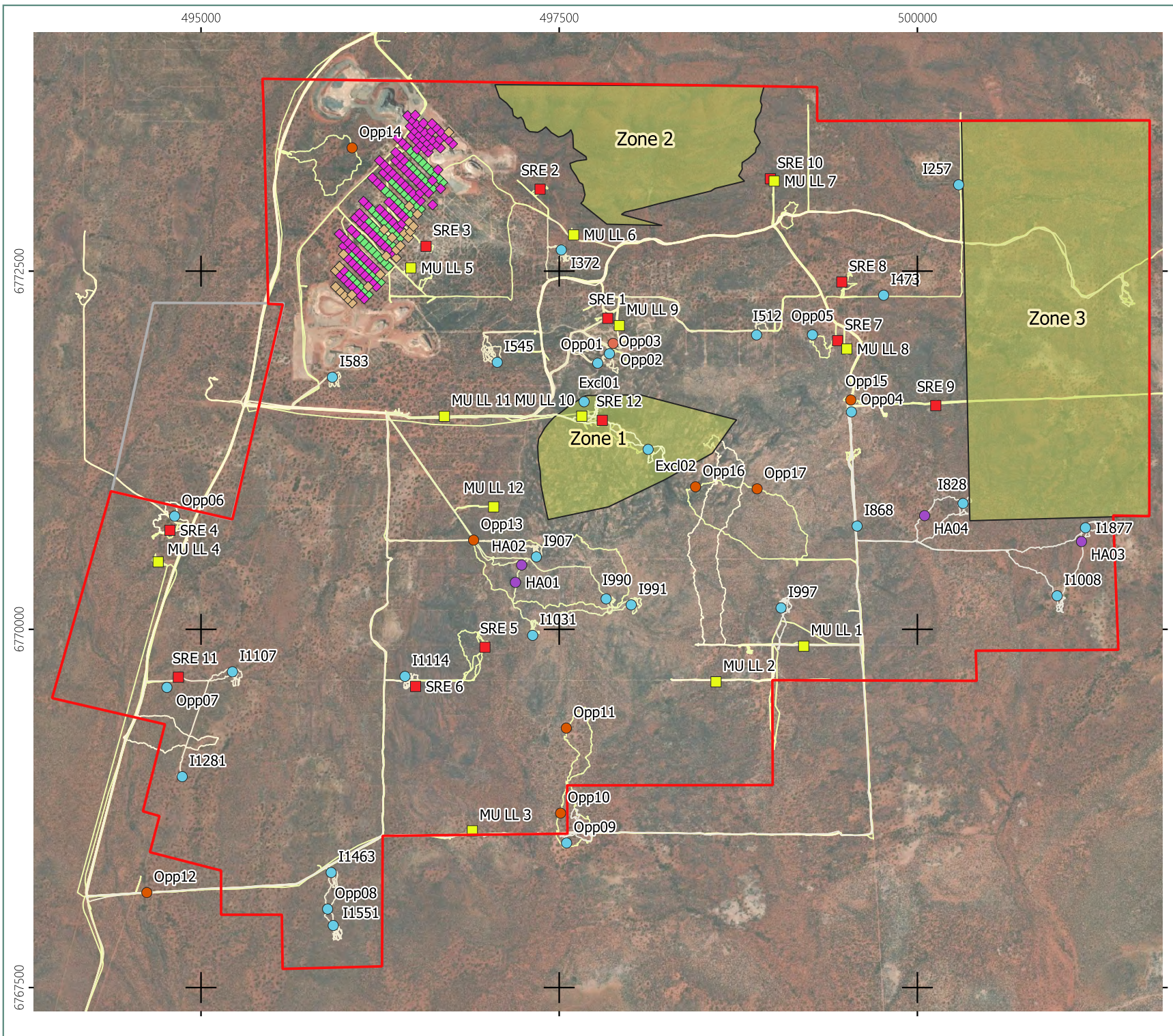
Date: 27-05-2020

Previously Surveyed Areas
Within The Project

Mt Mulgine Project

Prepared for
Tungsten Mining NL

Figure
2.3



Legend

- Mt Mulgine Project
- Extension Tenement M59/460
- Fauna Sites**
 - Active Search
 - Habitat Assessment
 - Spider Quadrat
- SRE Fauna Sites**
 - SRE Wet Pitfall
 - Leaf Litter Collection
- Pre-clearance Drillpads**
 - ◆ Phase 1
 - ◆ Phase 2
 - ◆ Phase 3
- Planned Exclusion Zones



1:36,000

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Projection: Transverse Mercator
Units: Meter



Author: Astrid Heidrich

Date: 10-02-2022

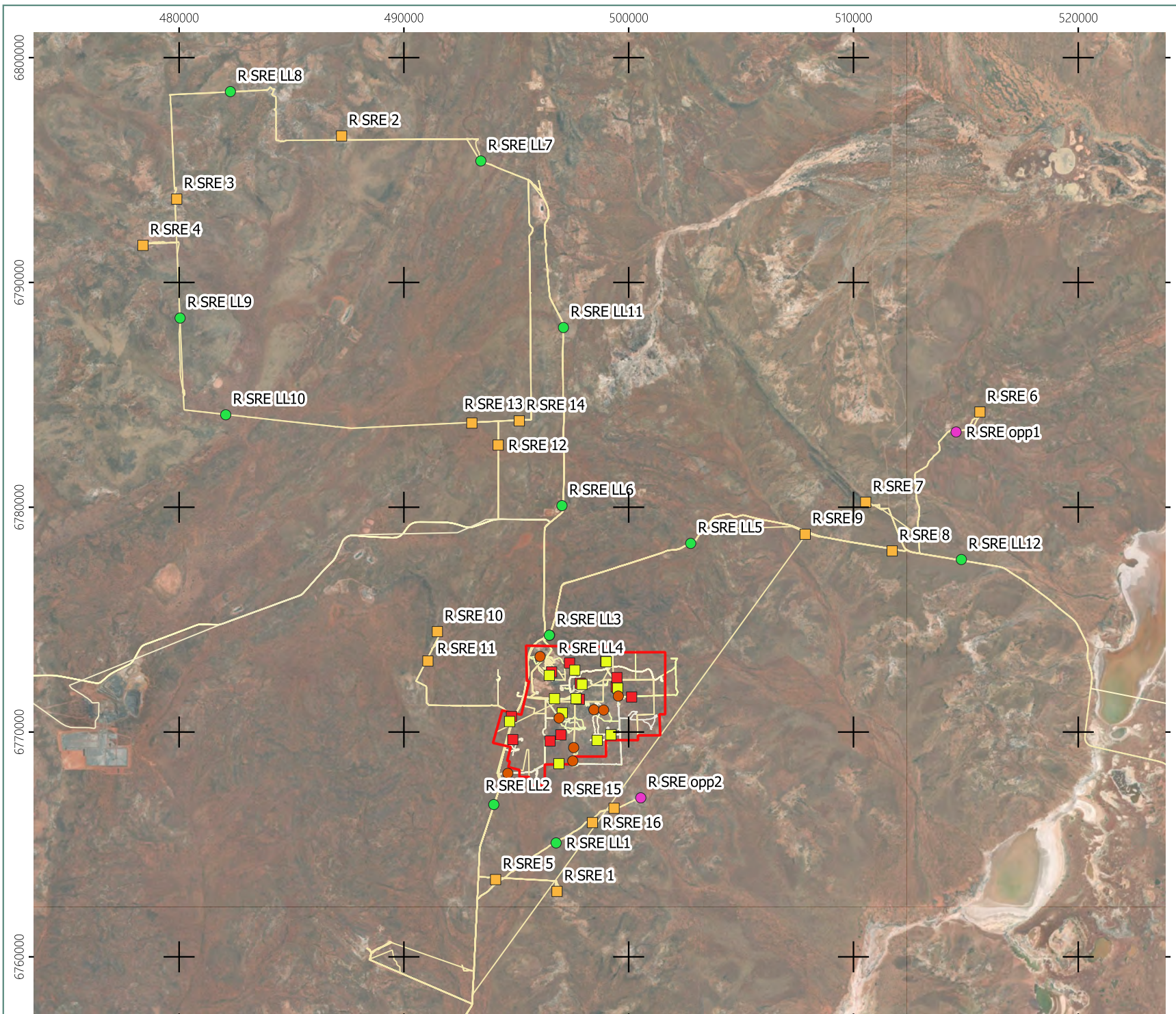
Terrestrial Fauna Sampling Effort

Mt Mulgine Project

Figure

2.4

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Legend

 Mt Mulgine Project

Regional SRE Sites

■ SRE Wet Pitfall

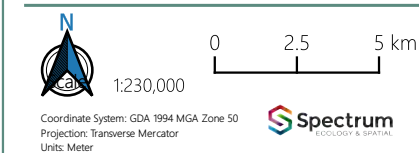
● SRE Leaf Litter

● Opportunistic Search Site

SRE Fauna Sites (Inside Project)

■ SRE Wet Pitfall

■ Leaf Litter Collection



Author: Astrid Heidrich

Date: 13-01-2022

Regional SRE Sampling Effort

Mt Mulgine

Figure
2.5

Prepared for
Tungsten Mining NL

3. RESULTS

3.1. Desktop Assessment

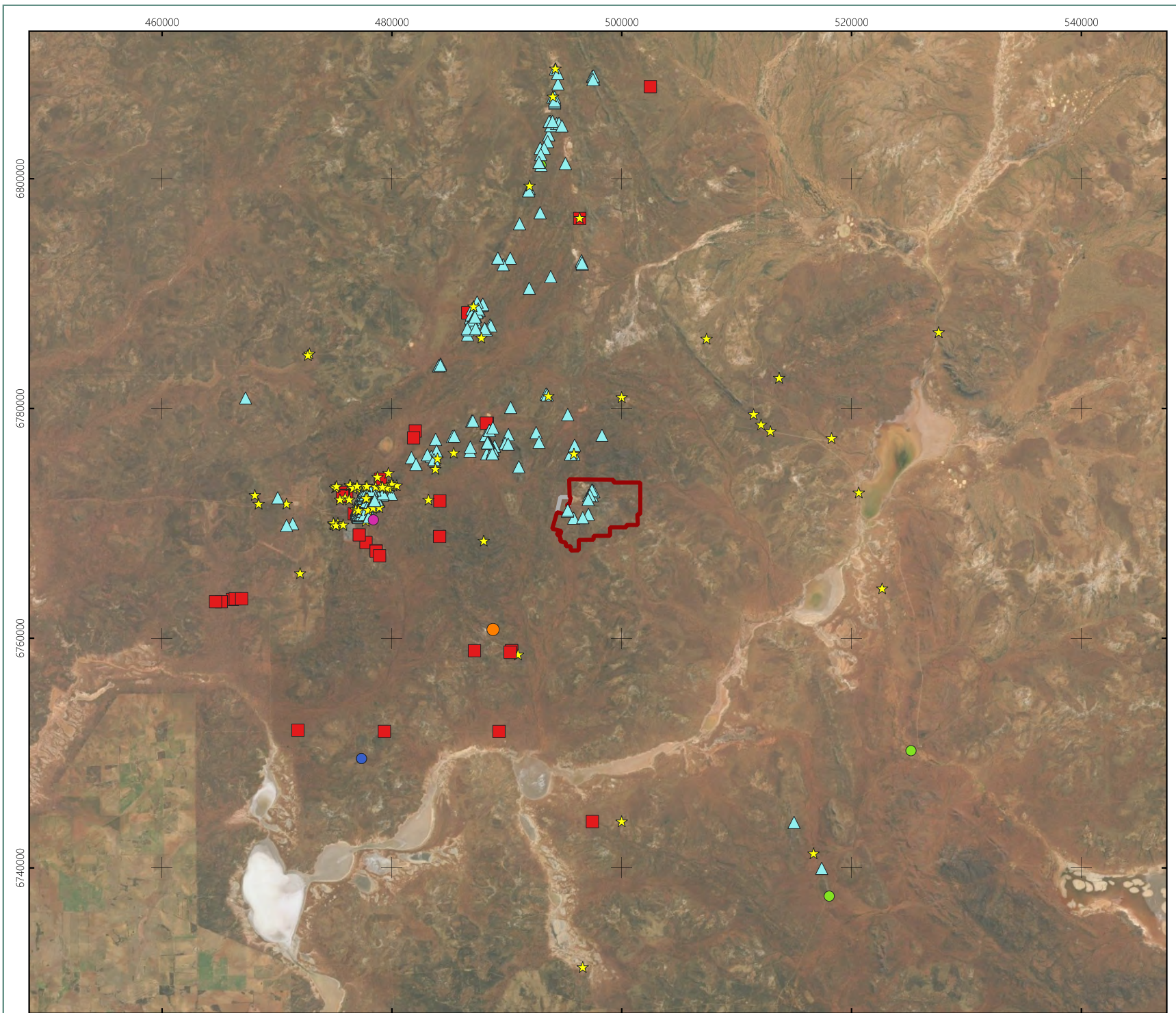
The literature review and database search identified 29 mammal, 148 bird, 55 reptile and 5 amphibian species that may potentially utilise habitats within the local region surrounding the Project. The DBCA Threatened Fauna Database search identified seven conservation significant fauna species (Western Brush Wallaby, Malleefowl, Night Parrot, Peregrine Falcon, Gilled Slender Blue-tongue, Western Spiny-tailed Skink and Northern Shield-backed Trapdoor Spider) from within 40 km of the Project (Figure 3.1). The Northern Shield-backed Trapdoor Spider *Idiosoma nigrum* was undergoing taxonomic revision in 2018 and has since been split up into several species, four of which are known from the region (*I. clypeatum*, *I. gutharuka*, *I. formosum* and *I. intermedium*) (Michael G Rix *et al.*, 2018). *Idiosoma clypeatum* remained with the same common name of Northern Shield-backed Trapdoor Spider due to it being the most northern species of the *Idiosoma* complex (Michael G Rix *et al.*, 2018). It is unknown which species the DBCA records displayed on Figure 3.1 refer to, therefore they are listed under the original species name *I. nigrum*.

The WAM SRE Invertebrate Fauna Database search identified 53 taxa (50 Arachnida, two Crustacea and one Mollusca) from the surrounding region. The full list is provided in Appendix C. The majority of the Arachnids identified from the database search were recorded from Charles Darwin Reserve and Mt Gibson which are located 30-45 km to the south of the Project area. Ten Arachnid, two Crustacean and one Mollusc taxa were recorded from within 25 km of the Project area and have therefore a medium to high likelihood to occur at the Project area (Table 3.1, Figure 3.2). None of the SRE taxa have been recorded from within the Project area, except the snail *Bothriembryon* sp., which was recorded from just inside the Project area (Figure 3.2).

Table 3.1: SRE Taxa from Within 25 km of the Project.

Family and Species	Previous records	Additional Information	Likelihood to Occur
ARACHNIDS			
Lamponidae			
<i>Notsodipus</i> 'sp. nov.'	One record from Lochada Nature Reserve (5 km north west).	Undescribed species of white-tailed spider. Genus not typically considered an SRE.	Medium Habitat may differ to that present within the Project area.
Prodidomidae			
<i>Wesmaladra baynesi</i>	One record from Warriedar Station (11 km north).	Only known record of this ground spider species. Genus not typically considered an SRE.	Medium Habitat may differ to that present within the Project area.
Urodacidae			
<i>Urodacus</i> sp.	One record from Mungada Ridge (7 km west). Record not mapped on Figure 3.2.	Unreported specimen from the Blue Hills SRE survey (ecologia Environment, 2007). Expected to be one of the <i>Urodacus</i> taxa listed below.	High Some suitable habitat present and species recorded nearby.
<i>Urodacus</i> 'blue hills'	Four records from Mungada Ridge (7 km west).	Potential SRE. Specimen from the Blue Hills SRE survey (ecologia Environment, 2007).	High Some suitable habitat present and species recorded nearby.

Family and Species	Previous records	Additional Information	Likelihood to Occur
<i>Urodacus</i> 'karara'	One record from Karara Station (10 km north west).	Potential SRE. Specimen from Blue Hills SRE survey (Bamford Consulting Ecologists, 2006).	High Some suitable habitat present and species recorded nearby.
<i>Urodacus</i> 'koolanooka'	Two records from Mungada Ridge (7 km west).	Potential SRE. Specimen from the Blue Hills SRE survey (ecologia Environment, 2007).	High Some suitable habitat present and species recorded nearby.
Chthoniidae			
<i>Tyrannochthonius</i> 'sp.nov.Blue Hills'	One record from Mungada Ridge (7 km west).	Potential SRE. Specimen from the Blue Hills SRE survey (ecologia Environment, 2010b).	High Some suitable habitat present and species recorded nearby.
Olpiidae			
<i>Austrohorus</i> 'similis'	One record from Blue Hills (11 km west).	Potential SRE. Specimen from the Blue Hills SRE survey (ecologia Environment, 2011a).	Medium Some suitable habitat present and species recorded from 15 km to the west.
MYRIAPODA			
Paradoxosomatidae			
<i>Antichiropus</i> 'DIP146, karara'	One record from Mt Karara (15 km west).	Potential SRE. Specimen from the Karara SRE survey.	Medium Some suitable habitat present and species recorded from 15 km to the west.
<i>Antichiropus</i> 'karara'	Three records from Blue Hills (1-15 km north & west).	Potential SRE. Specimen from the Karara SRE survey (Bamford Consulting Ecologists, 2006).	High Some suitable habitat present and species recorded nearby.
CRUSTACEANS			
Cypridopsidae			
<i>Sarscypridopsis ochracea</i>	Four records from Karara (15-30 km west) and Bogada Well (250 km north).	Aquatic freshwater Ostracod recorded from two projects located 250 km apart.	Very Low No suitable habitat present within the Project.
MOLLUSCS			
Bulimulidae			
<i>Bothriembryon</i> sp.	One record from adjacent to the Project area and four records from surrounding region south east to Mt Gibson.	Potential SRE. Undescribed species from several regional projects. Specimen located adjacent to Project area collected in 1967. Location accuracy thought to be 2km.	High Some suitable habitat present and species recorded nearby.



Legend

-  Mt Mulgine Project
-  Extension Tenement M59/460
- Conservation Significant Fauna Species
 -  Night Parrot
 -  Western Spiny-tailed Skink
 -  Malleefowl
 -  Gilled Slender Blue-tongue
 -  Peregrine Falcon
 -  Northern Shield-backed Trapdoor Spider
former *Idiosoma nigrum*
 -  Western Brush Wallaby



Scale 1:450,000

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter



Author: Jordan Vos

Date: 10-02-2022

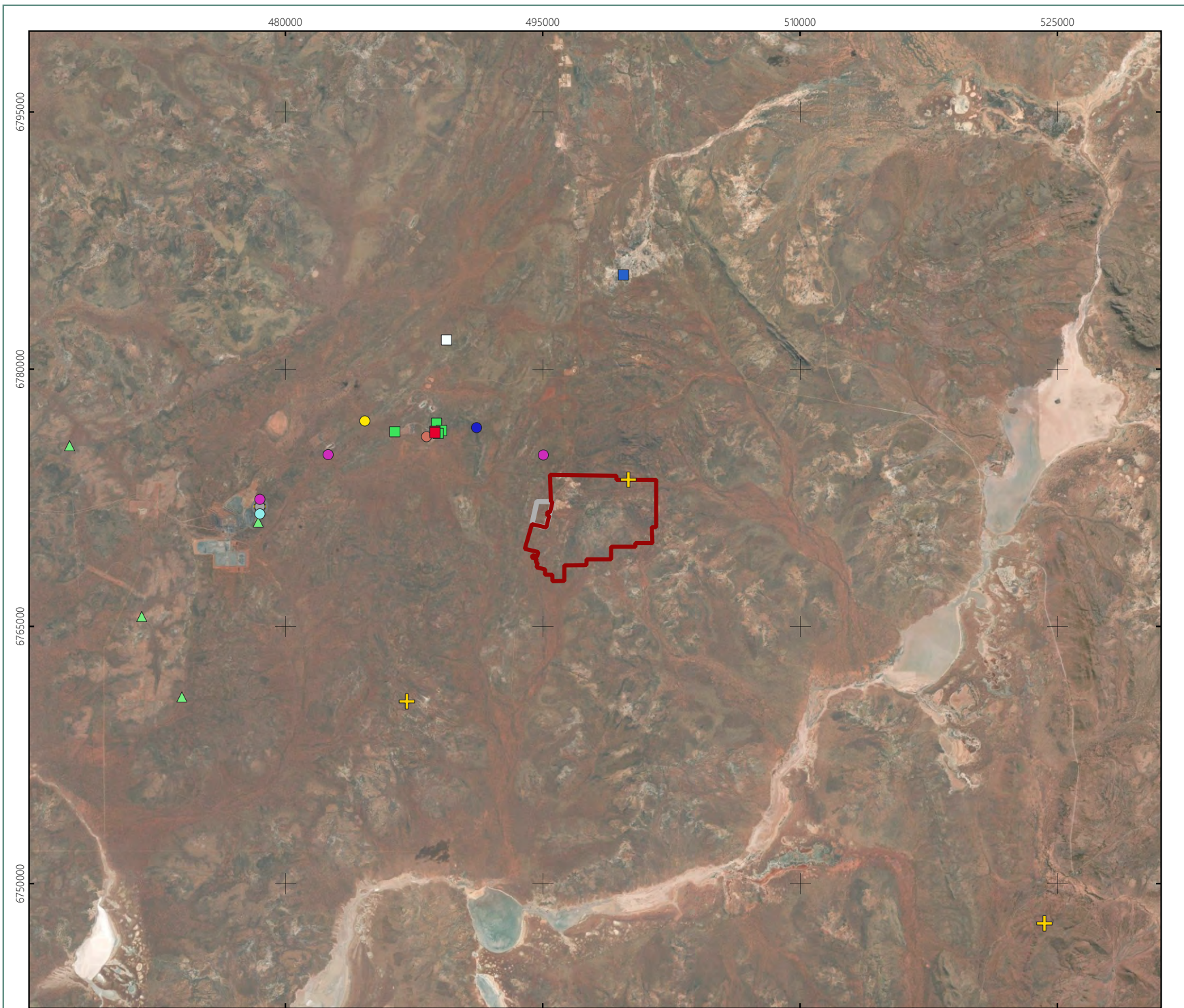
DBCA Threatened Fauna Database Search Results

Mt Mulgine Project

Figure

3.1

Prepared for
Tungsten Mining NL



Legend

- Mt Mulgine Project
- Extension Tenement M59/460

Arachnids

- Antichiropus* 'DIP146, karara'
- Antichiropus* 'karara'
- Austrohorus* 'similis'
- Notsodipus* 'sp. nov.'
- Tyrannochthonius* 'sp. nov. Blue Hill'
- Urodacus* 'blue hills'
- Urodacus* 'karara'
- Urodacus* 'koolanooka'
- Wesmaldra baynesi*

Crustaceans

- Sarscypridopsis ochracea*

Molluscs

- Bothriembryon* sp.



0 2.5 5 7.5 10 km

Scale 1:300000

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Units: Meter



Author: Jordan Vos

Date: 18-03-2021

SRE Invertebrate Database Search Results (WAM)

Mt Mulgine Project

Figure

3.2

Prepared for
Tungsten Mining NL

3.2. Field Survey

3.2.1. Fauna Habitats

Seven major fauna habitat types were recorded from the Project. Their extents are listed in Table 3.2 and shown in Figure 3.3. Detailed habitat descriptions can be found in the sections below.

Table 3.2: Fauna Habitat Extents

Habitat Type	Extent Project (ha)	% of Project
Mixed Shrubland	1,905.3	58.0
Open Eucalypt Woodland	543.1	16.5
Granite Outcropping	384.3	11.7
Granitic Flats	86.5	2.6
Basalt Hills	162.8	5.0
Eucalypt Woodland on Quartz	15.7	0.5
Stony Hillslope Shrubland	92.9	2.8
Cleared	93.8	2.9

3.2.1.1. Mixed Shrubland

The Mixed Shrubland habitat was the most common habitat type covering 1,905.3 ha, which represents 58% of the Project area. It was intersected by the remaining six habitat types (Figure 3.3). The Mixed Shrubland habitat was dominated by a mixture of tall sparse *Acacia* shrubs, in particular *Acacia ramulosa* over isolated *Eremophila* sp., *Hakea* sp. and *Sida* sp. shrubs. Ground cover was generally very sparse with some fallen timber. Leaf litter was minimal and restricted to beneath vegetation. The substrate consisted of loam clay to sandy clay soils with some pebbles and rocks present in areas. (Plate 3.1).



Plate 3.1: Mixed Shrubland Recorded from the Project

3.2.1.2. Open Eucalypt Woodland

The Open Eucalypt Woodland habitat type covered 543.1 ha, representing 16.5% of the Project. It was recorded from patches across the Project area, which are intersected by Mixed Shrubland (Figure 3.3). The vegetation was characterised by a very tall open Eucalypt woodland (*Eucalyptus salubris*) over sparse lower mixed shrubs of *Eremophila oldfieldii*, *Senna artemisioides*, *Maireana tomentosa* and *Frankenia setosa*. The substrate consisted of clay soils with leaf litter restricted to under large trees (Plate 3.2). Wood litter was sometimes present and consisted of dead trees and large branches which provided shelter for fauna species.



Plate 3.2: Eucalypt Woodland Recorded from the Project

3.2.1.3. Granite Outcropping

The Granite Outcropping habitat type was primarily associated with Mt Mulgine, with a smaller area located to the south-west (Figure 3.3). It was the most elevated and steep habitat type covering 384.3 ha, which represents only 11.7 % of the Project. The vegetation of the Granite Outcropping habitat type was dominated by low to moderately tall dense shrubs of *Allocasuarina acutivalvis*, *Allocasuarina campestris*, *Acacia assimilis* or *Acacia sulcataulis* over *Phebalium tuberosum*, *Micromyrtus trudgenii* and *Philotheca deserti*. The characteristic feature of this habitat type was the emergent granites which was interspersed with quartz, supporting a unique vegetation composition. The substrate consisted of loam clay soils with exposed quartz and granite pebbles forming a sparse mantle and small pockets between the larger rocks and boulders (Plate 3.3).



Plate 3.3: Granite Outcropping Recorded from the Project

3.2.1.4. Granitic Flats

The Granitic Flats were recorded from two locations south of the Granite Outcropping in association with Mt Mulgine (Figure 3.3). This habitat type covered 86.5 ha which represents 2.6 % of the Project. The vegetation of the Granitic Flats was dominated by mixed open tall shrubs of *Melaleuca hamata*, *M. stereophloia*, *Acacia acuminata*, *A. umbraculiformis*, *A. tetragonophylla*, and *Allocasuarina tessellata* over *Thryptomene costata*, *Borya sphaerocephala*, *Dodonaea adenophora* and *Grevillea scabrada* lower shrubs. The vegetation layer was open to moderately open, with very sparse ground cover on yellow sandy clay with undulating granitic rocks (Plate 3.4). Wood and leaf litter was limited to that found beneath vegetation.



Plate 3.4: Granitic Flats Recorded from the Project

3.2.1.5. Eucalypt Woodland on Quartz

The Eucalypt Woodland on Quartz was recorded from three small areas within the Project (Figure 3.3). It covered only 15.7 ha which represents 0.5 % of the Project. The Eucalypt Woodland on Quartz habitat type was associated with hillslopes and was characterised by open woodland of *Eucalyptus loxophleba* over isolated *Acacia acanthoclada*, *A. andrewsii*, *Olearia muelleri*, *Frankenia setosa* and *Exocarpos aphyllus*. The soil was a light brown clay beneath a contiguous layer of quartz (Plate 3.5). Woodlitter was present and consisted of hollow trees and branches. Leaf litter was only present beneath large trees.



Plate 3.5: Eucalypt Woodland on Quartz Recorded from the Project

3.2.1.6. Basalt Hills

The Basalt Hills habitat type covered 162.8 ha which represents 5 % of the Project. It was recorded from four areas, in the north, south and east of the Project area (Figure 3.3). It was the second most elevated habitat type, not quite reaching the height of the Granite Outcropping habitat. The vegetation was characterised by a relatively homogenous shrub layer of mid-size *Acacia umbraculiformis* over a moderately dense layer of *Thryptomene costata*. Leaf litter was sparse and woody debris were minimal. The substrate was skeletal coarse loamy soils with abundant pebbles, stones, rocks and boulders (Plate 3.6).



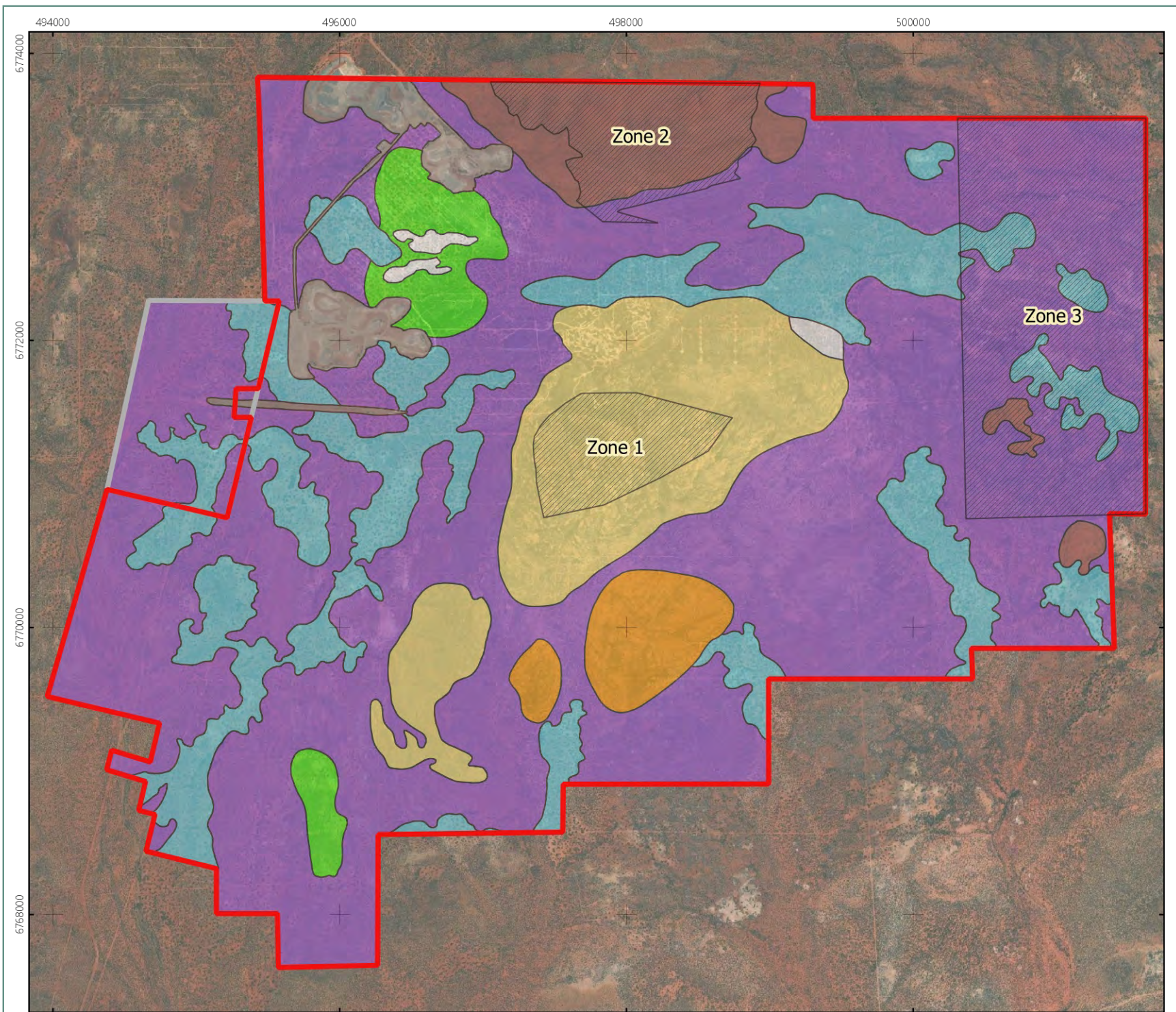
Plate 3.6: Basalt Hill Recorded from the Project

3.2.1.7. Stony Hillslope Shrubland

The Stony Hillslope Shrubland habitat type was recorded from two areas within the Project area covering 92.9 ha, representing 2.8 % of the Project. The Stony Hillslope Shrubland habitat is vegetated by scattered *Allocasuarina dielsiana* and *Acacia umbraculiformis* over a low, moderately dense, and relatively homogenous shrubland of *Acacia ramulosa* and *A. acuminata* over scattered *Acacia karina*, *A. tetragonophylla* and patches of *Thryptomene costata* (Plate 3.7). The substrate consisted of loam clay soils with exposed pebbles and rocks forming a mantle. Fallen timber and leaf litter was almost absent with small amounts remaining under denser isolated shrubs.

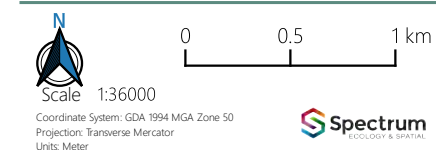


Plate 3.7: Stony Hillslope Shrubland Recorded from the Project



Legend

- Mt Mulgine Project
- Extension Tenement M59/460
- Proposed Exclusion Zones
- Fauna Habitat Types**
- Basalt Hills
- Cleared
- Granite Outcropping
- Granitic Flats
- Mixed Shrubland
- Open Eucalypt Woodland
- Stony Hillslope Shrubland
- Eucalypt Woodland on Quartz



Author: Astrid Heidrich

Date: 18-03-2021

Fauna Habitats Recorded

Mt Mulgine Project

Figure

3.3

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3.2.2. Terrestrial Fauna

During the fauna field surveys, four mammals, three introduced mammals, 42 birds, and 17 reptiles and one amphibian were recorded from within the Project (Appendix B). One additional reptile species was recorded from just outside the Project area. A total of seven conservation significant fauna species were recorded: Malleefowl (*Leipoa ocellata*; EPBC / BC Act Vulnerable), Gilled Slender Blue-tongue (*Cyclodomorphus branchialis*; BC Act Vulnerable), Peregrine Falcon (*Falco peregrinus*; BC Act OS), Northern Shield-backed Trapdoor Spider (*Idiosoma clypeatum* (former *I. nigrum*) DBCA Priority 3), Coolgardie Shield-backed Trapdoor Spider (*I. intermedium*; DBCA Priority 3), and Gutha Pintharuka Shield-backed Trapdoor Spider (*I. gutharuka*; DBCA Priority 1). Secondary evidence (scats) from the Western Spiny-tailed Skink (*Egernia stokesii badia*; EPBC Act Endangered/BC Act Vulnerable) was recorded from Open Eucalypt Woodland, 200 m outside the Project area. Conservation significant fauna records are discussed in further detail in the sections below.

3.2.2.1. Malleefowl (*Leipoa ocellata*; EPBC and BC Act Vulnerable)

During previous fauna surveys, Malleefowl have been recorded from the Project area on seven occasions (two active mounds, four inactive mounds and tracks) (APM, 2018a). During the current targeted fauna survey, the mounds were revisited and assessed for activity. Two of the mounds were assessed as currently active which was confirmed by video recordings of Malleefowl individuals visiting the mounds, with an additional mound assessed as recently active (1-3 years) (Figure 3.4, Plate 3.9). The three mounds were located within the Granite Outcropping and Mixed Shrubland habitat types (Figure 3.4). The mounds were assessed in June 2020 which is outside the breeding season for Malleefowl (Spring to late Summer) therefore the motion camera recordings indicate adult individuals visiting the mound for maintenance rather than breeding. An additional five mounds were assessed that were determined to be of old to very old age.



Plate 3.8: Malleefowl on Two Active Mounds Within the Project Area



Plate 3.9: Recently Active Malleefowl Mounds Within the Project Area

3.2.2.2. Western Spiny-tailed Skink (*Egernia stokesii badia*; EPBC Act Endangered / BC Act Vulnerable)

During the targeted survey, hollow logs and tree crevices were inspected for the presence of Western Spiny-tailed Skink and/ or the distinctive latrine sites they create. A single latrine site was recorded 200 m outside the southern boundary of the Project area in Open Eucalypt Woodland habitat (Plate 3.10). The latrine contained fresh scats when first recorded (October 2019) though when revisited in June 2020 no fresh scats or other secondary evidence was present at the site. This indicates that the species may no longer be present at this location. No other evidence of the species was recorded from the Project. Overall, the Open Eucalypt Woodland present within the Project area represents marginal habitat (very few log piles with suitable hollows), with large areas of more suitable Open Eucalypt Woodland present in the wider region, in particular to the south and west of the Project.



Plate 3.10: Western Spiny-tailed Skink Latrine Site

3.2.2.3. Peregrine Falcon (*Falco peregrinus*; BC Act Other Specially Protected Species)

During the survey, one individual Peregrine Falcon was recorded overflying the site office (50K 496316mE, 6771502mN) (Figure 3.4). It was recorded from the Mixed Shrubland habitat type that it may be using for foraging purposes. The remaining six habitat types within the Project area are also likely to be utilised for foraging though breeding habitat (elevated ledges associated with cliffs) is limited and may only occur within the Granite Outcropping habitat type.

3.2.2.4. Gilled Slender Blue-tongue Skink (*Cyclodomorphus branchialis*; BC Act Vulnerable)

A single animal was recorded from the Project during the current targeted survey (Plate 3.11). The individual was recorded moving from a spoil heap (a heap of soil, vegetation, and rocks often created by track clearing and maintenance) and across a small vehicle track in Mixed Shrubland habitat. Spoil heaps are often used as refuges by a variety of fauna species including the Gilled Slender Blue-tongue. The Mixed Shrubland within the Project area hosts suitable spoil heaps and is likely to harbour a small population of the species.



Plate 3.11 Gilled Slender Blue-tongue from the Project Area

3.2.2.5. Northern Shield-backed Trapdoor Spider (*Idiosoma clypeatum*; DBCA Priority 3)

The Northern Shield-backed Trapdoor Spider was recorded from two of the 20 pre-selected spider quadrats, totalling 18 burrows (individuals) (see Table 3.3). An additional five burrows were recorded from two opportunistic sites within the Project and 52 burrows were recorded during the preclearance surveys (see Table 3.3). A further seven burrows were recorded during the SRE survey which were attributed to *Idiosoma clypeatum* based on visual assessment and habitat types (Table 3.3).

Individuals of this species are characterised by the heavily sclerotised 'shield-like' corrugations found on the spiders abdomen (hence the common name) (Plate 3.12). The burrows have a distinct 'moustache-like' arrangement of twigs and leaves, and a thin flap-like door or lid (Plate 3.13). The burrow is typically 'wine glass' shaped with a wider entrance chamber that narrows as the burrow deepens. The spiders were often observed positioned head down at the point where the burrow narrows with their heavily corrugated abdomens facing the entry of the burrow (Plate 3.14). This is believed to deny potential predators (eg. parasitic wasps and scorpions) access to the burrow.

Information on the microhabitat indicates that *I. clypeatum* is associated with Mixed Shrubland, Eucalypt Woodland on Quartz, Granitic Flats and Granite Outcropping with a variety of vegetation used for their burrows. In particular, leaves of *Acacia ramulosa* were favoured for constructing the moustache-like leaf arrangement at the burrow entrance (Plate 3.13).



Plate 3.12: A Northern Shield-back Trapdoor Spider from the Project Area



Plate 3.13: Northern Shield-backed Trapdoor Spider Burrow

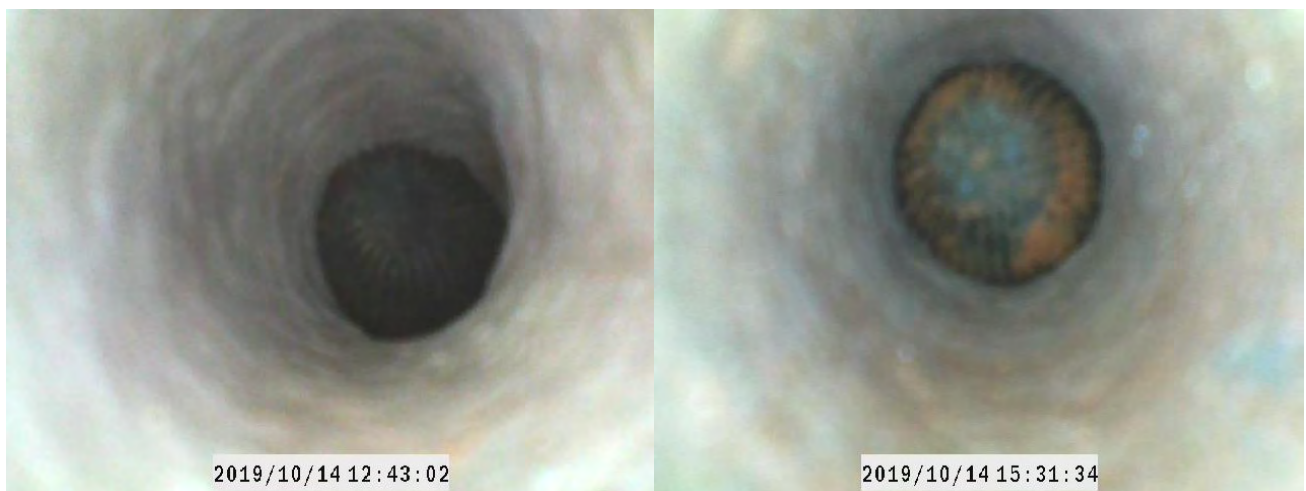


Plate 3.14: Northern Shield-backed Trapdoor Spider Inside Burrow

Table 3.3: Northern Shield-backed Trapdoor Spiders Recorded from the Project

Species	Site ID	No. of burrows	Individuals	Easting	Northing	Habitat	Vegetation at burrow	WAM Collection No./Comments
Pre-selected sites								
<i>I. clypeatum</i>	I1551	3	1 adult, 2 juveniles	495930	6767929	Mixed Shrubland	<i>Acacia</i> sp. shrubs	Visual confirmation
<i>I. clypeatum</i>		7	1 adult, 6 juveniles	495984	6767901		<i>Acacia</i> sp. shrubs	Visual confirmation
<i>I. clypeatum</i>		3	1 adult, 2 subadults	495984	6767893		<i>Acacia</i> sp. shrubs	N/A
<i>I. clypeatum</i>	I990	5	1 adult, 4 juveniles	497864	6770187	Granitic Outcropping	Tall mixed shrubs	WAM147954
Opportunistic records								
<i>I. clypeatum</i>	Opp2	1	1 adult	497875	6771998	Granite Outcropping	Mixed shrubs on hillslope	WAM147953
<i>I. clypeatum</i>	Opp8	1	1 adult	495891	6768049	Mixed Shrubland	<i>A. ramulosa</i>	WAM147955
<i>I. clypeatum</i>		3	1 adult, 2 juveniles	495887	6768048		<i>A. ramulosa</i>	N/A
Preclearance survey records								
<i>I. clypeatum</i>	MRT041	1	1 adult	496132	6772364	Granite Outcropping	Mixed shrubs on hillslope	N/A
<i>I. clypeatum</i>	MRT044	2	1 adult, 1 juvenile	496057	6772447	Mixed Shrubland	Mixed Acacia woodland	N/A
		1	1 adult	496057	6772443	Mixed Shrubland	Mixed Acacia woodland	N/A
		1	1 adult	496054	6772439	Mixed Shrubland	Mixed Acacia woodland	N/A
		3	1 adult, 1 subadult, 1 juvenile	496051	6772454	Mixed Shrubland	Mixed Acacia woodland	N/A
<i>I. clypeatum</i>	MRT045	1	1 adult	496031	6772469	Mixed Shrubland	Mixed Acacia woodland	N/A
<i>I. clypeatum</i>	MRT155	1	1 adult	496287	6772851	Granitic Outcropping	Tall mixed <i>A. ramulosa</i> shrubs	N/A
<i>I. clypeatum</i>	MRT032	3	1 adult, 2 juveniles	496086	6772372	Mixed Shrubland	Mixed Acacia woodland	N/A
<i>I. clypeatum</i>	MRT034	10	4 adults, 6 juveniles	496024	6772424	Mixed Shrubland	Mixed Acacia woodland	N/A
<i>I. clypeatum</i>		3	1 adult, 2 juveniles	496028	6772427	Mixed Shrubland	Mixed Acacia woodland	N/A
<i>I. clypeatum</i>		1	1 adult	496018	6772423	Mixed Shrubland	Mixed Acacia woodland	N/A
<i>I. clypeatum</i>		2	2 adults	496029	6772426	Mixed Shrubland	Mixed Acacia woodland	N/A
<i>I. clypeatum</i>		1	1 subadult	496027	6772433	Mixed Shrubland	Mixed Acacia woodland	N/A
<i>I. clypeatum</i>	MRT034	1	1 x adult	496023	6772424	Mixed Shrubland	Mixed Acacia woodland	Visual confirmation

Species	Site ID	No. of burrows	Individuals	Easting	Northing	Habitat	Vegetation at burrow	WAM Collection No./Comments
<i>I. clypeatum</i>		3	1 x adult, 2 juveniles	496017	6772430	Mixed Shrubland	Mixed Acacia woodland	N/A
<i>I. clypeatum</i>		6	1 adult, 5 juveniles	496015	6772428	Mixed Shrubland	Mixed Acacia woodland	Visual confirmation
<i>I. clypeatum</i>		1	1 juvenile	496021	6772445	Mixed Shrubland	Mixed Acacia woodland	N/A
<i>I. clypeatum</i>	MRT059	1	1 adult	496163	6772444	Mixed Shrubland	Mixed Acacia woodland	Unsure of ID
<i>I. clypeatum</i>	MRT063	2	1 adult, 1 subadult	496043	6772561	Mixed Shrubland	Mixed Acacia woodland	Visual confirmation
<i>I. clypeatum</i>	MRT123	1	1 subadult	496267	6772685	Mixed Shrubland	Mixed Acacia woodland	Unsure of ID
<i>I. clypeatum</i>	MRT016	6	1 adult, 5 subadults	495979	6772377	Mixed Shrubland	Mixed Acacia woodland	Unsure of ID
<i>I. clypeatum</i>	MRT367	1	1 adult	495979	6772377	Mixed Shrubland	Mixed Acacia woodland	Unsure of ID
SRE survey								
<i>I. clypeatum</i>	MM LL1	1	1 adult	499213	6769869	Mixed Shrubland	<i>Acacia ramulosa</i> woodland	Presumably <i>I. clypeatum</i> based on habitat
<i>I. clypeatum</i>	SRE 5	1	1 adult	496981	6769911	Granite Outcropping	Mixed Shrubland	Visual confirmation
<i>I. clypeatum</i>	MM LL2	1	1 subadult	498590	6769604	Mixed Shrubland	<i>Acacia ramulosa</i> woodland	Presumably <i>I. clypeatum</i> based on habitat
<i>I. clypeatum</i>	MFM4	2	2 adults	496611	6772471	Stony Hillslope Shrubland	<i>Acacia ramulosa</i> woodland	Likely ID (visual)
<i>I. clypeatum</i>	SRE Opp2	2	2 adults	496541	6772377	Stony Hillslope Shrubland	<i>Acacia ramulosa</i> woodland	Likely ID (visual)

3.2.2.6. Coolgardie Shield-backed Trapdoor Spider (*Idiosoma intermedium*; DBCA Priority 3)

A total of four *Idiosoma intermedium* were recorded from four of the 20 pre-selected spider quadrats (Table 3.4). An additional three burrows were recorded from two additional sites within the Project area. The species was also recorded during pre-clearance surveys at the Trench area (Spectrum Ecology, 2019).

During the regional survey, one individual was recorded from a granite hillslope 16 km northeast of the Project area (Table 3.4).

Idiosoma intermedium can be easily distinguished from *I. clypeatum* by its lack of a heavily sclerotised and corrugated abdominal shield (Plate 3.15). The characteristics of the burrow constructed by the species are like that of *I. clypeatum* with a slightly more cone shaped entrance (vs. the 'wine glass' like shape). The collected individuals were observed to be sitting upright within the burrow, with the abdomen facing downwards (Plate 3.16). They displayed more pro-active, and sometimes defensive behaviour, with some individuals inspecting disturbances at their burrow entrance.

The species was recorded from the Granite Outcropping, Mixed Shrubland and Eucalypt Woodland on Quartz habitat types.



Plate 3.15: A Coolgardie Shield-backed Trapdoor Spider from the Project Area



Plate 3.16: A Coolgardie Shield-backed Trapdoor Spider Recorded Inside Burrow

Table 3.4: Coolgardie Shield-backed Trapdoor Spiders Recorded from the Project

Species	Site ID	No. burrows	Individuals	Easting	Northing	Habitat	Vegetation at burrow	WAM Collection No.
Pre-selected sites								
<i>I. intermedium</i>	I512	1	1 adult	498914	6772048	Granite Outcropping	<i>Allocasuarina</i> and <i>Acacia</i>	WAM147957
<i>I. intermedium</i>	I1114	1	1 adult	496457	6769616	Basalt Hills	<i>Allocasuarina</i>	WAM147960
<i>I. intermedium</i>		1	1 adult	496472	6769662			N/A
<i>I. intermedium</i>	I997	1	1 adult	499076	6770201	Mixed Shrubland	Mixed shrubs	WAM147961
Opportunistic records								
<i>I. intermedium</i>	Opp1	2	1 adult, 1 subadult	497769	6771858	Granite Outcropping	<i>Allocasuarina</i> sp.	WAM147958
Preclearance survey records								
<i>I. intermedium</i>	MRT211	2	1 adult, 1 juvenile	496501	6773017	Stony Hillslope Shrubland	<i>A. ramulosa</i>	WAM147959 (adult)
<i>I. intermedium</i>	MRT243	2	1 adult, 1 juvenile	496612	6773081	Stony Hillslope Shrubland	<i>A. ramulosa</i>	Unsure of ID
<i>I. intermedium</i>	MRT183	1	1 subadult	496465	6772881	Stony Hillslope Shrubland	Tall mixed <i>A. ramulosa</i> shrubs	-
<i>I. intermedium</i>	MRT184	1	1 juvenile	496416	6772912	Stony Hillslope Shrubland	Tall mixed <i>A. ramulosa</i> shrubs	-
Regional survey								
<i>I. intermedium</i>	Opp1	1	1 adult	514579	6783390	Granite Outcropping	<i>Allocasuarina</i> and <i>Acacia</i>	WAMT155373

3.2.2.7. Gutha Pintharuka Shield-backed Trapdoor Spider (*Idiosoma gutharuka*; DBCA Priority 1)

The Gutha Pintharuka Shield-backed Trapdoor Spider was recorded from two locations within Planned Exclusion Zone 1 and from one location south of Planned Exclusion Zone 1 (Figure 3.4, Table 3.5). DNA analysis has shown that it is conspecific with the previously recorded *Idiosoma* MYG641 which was also recorded from the (same) Planned Exclusion Zone (Animal Plant Mineral, 2018a) (Appendix E). The species was previously known from only one location at Gutha (near Pintharuka) approximately 100 km west of the Project area (Rix *et al.*, 2018). *Idiosoma gutharuka* was recorded in high density from one location (site Excl01) within Planned Exclusion Zone 1 (Figure 3.4) with over 90 burrows recorded in a single one hectare search site. The burrows were in very close proximity to each other and it is assumed that they belonged to the same species; however, only four representatives from this site were collected, all of which were identified as *I. gutharuka*. The high density was only recorded from one quadrat and is unlikely to be a representation of its population density across its range. An additional 22 burrows were recorded at two locations within the Granite Outcropping habitat type at Mt Mulgine, one of which was located within Planned Exclusion Zone 1 (Figure 3.4).

The regional SRE survey recorded the species from an additional two location: one individual was recorded from 4 km northeast of the Project area, two individuals were collected from 12 km northwest of the Project area (Figure 3.7, Table 3.5). These additional records represent are significant, indicating a known range extension outside the two locations previously known from Mt Mulgine and Gutha location (Figure 3.5).

The habitat at the known locations was dominated by dense *Allocasuarina* dominated shrubland (sometimes mixed with *Acacias* and other shrubs) on granitic or greenstone metamorphic rock, sometimes with quartz pebbles or stones (Plate 3.18). Within the Mt Mulgine Project area the species was only recorded from the Granite Outcropping habitat type which was relatively restricted within the Project (12.3 %) and is largely covered by Planned Exclusion Zone 1 (Figure 3.4).

Similar to *Idiosoma intermedium*, *I. gutharuka* can be easily distinguished from *I. clypeatum* by the lack of the highly sclerotised and corrugated abdominal shield (Plate 3.17).



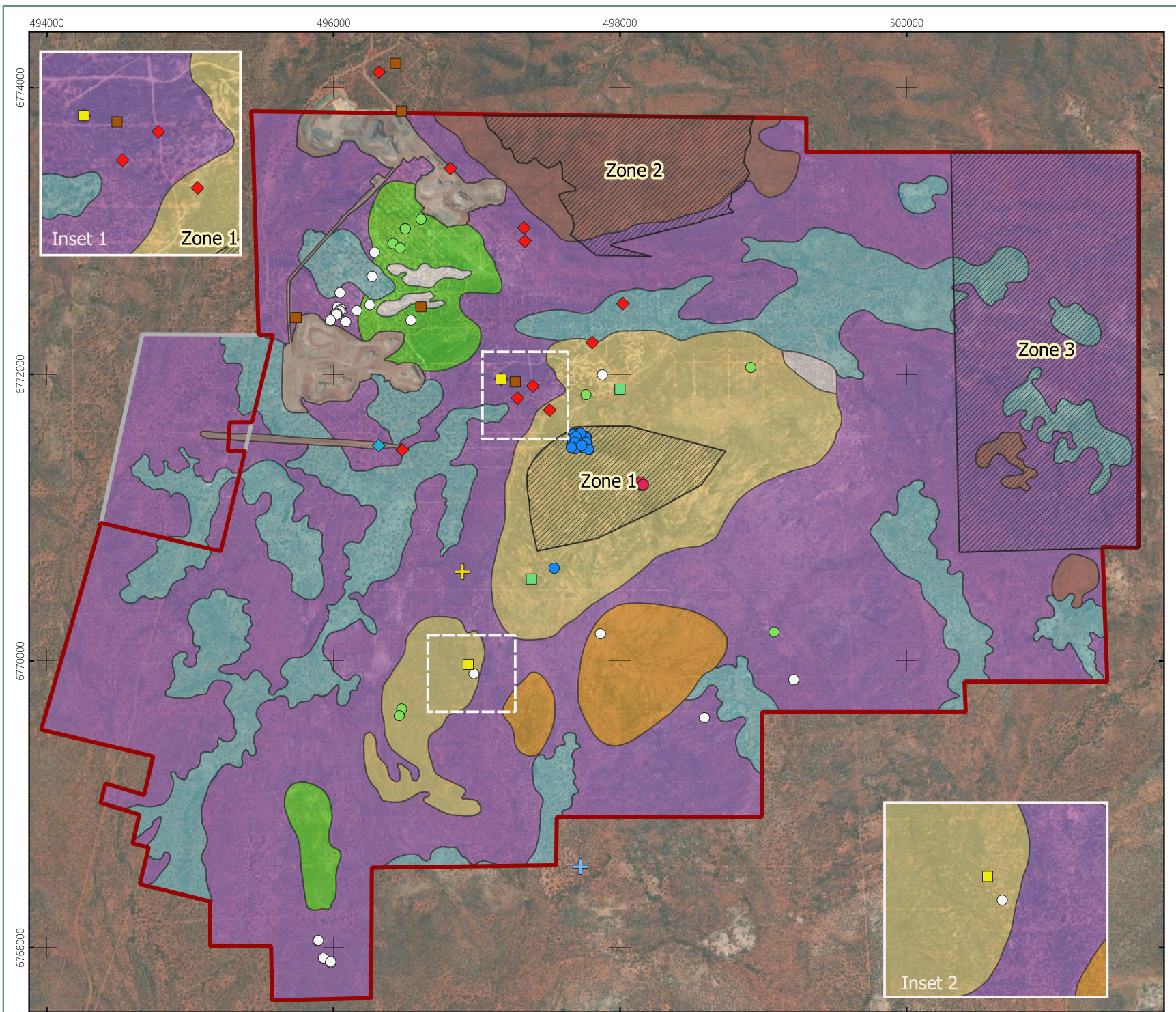
Plate 3.17: A Gutha Pintharuka Shield-backed Trapdoor Spider from the Project Area



Plate 3.18: Gutha Pintharuka Shield-backed Trapdoor Spider Habitat

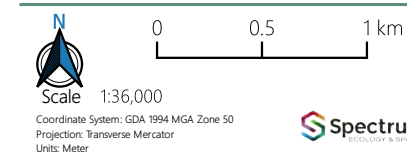
Table 3.5: Gutha Pintharuka Shield-backed Trapdoor Spiders Recorded from the Project

Species	Site ID	No. burrows	Details Individuals	Easting	Northing	Habitat	Vegetation at burrow	WAM Collection No.
Opportunistic records								
<i>I. gutharuka</i>	EXCL1	Approx. 90	Approx. 90 individuals within 1 ha	497686	6771531	Granite Outcropping	<i>Allocasuarina</i> shrubland	WAMTS147956
<i>I. gutharuka</i>	EXCL2	5	1 adult, 4 juveniles	498158	6771226	Granite Outcropping	<i>Allocasuarina</i> shrubland	-
<i>I. gutharuka</i>		2	2 individuals	498158	6771225			-
<i>I. gutharuka</i>		1	1 individual	498140	6771225			
<i>I. gutharuka</i>		1	1 individual	498135	6771232			
<i>I. gutharuka</i>		1	1 individual	498158	6771236			
<i>I. gutharuka</i>		1	1 individual	498145	6771248			
<i>I. gutharuka</i>		2	2 individuals	498161	6771232			
<i>I. gutharuka</i>		1	1 individual	498164	6771232			
<i>I. gutharuka</i>		5	5 adults/subadults	498162	6771230			WAMTS150971
<i>I. gutharuka</i>	SRE Opp1	3	1 adult, 2 juveniles	497541	6770647	Granite Outcropping	Mixed <i>Allocasuarina</i> shrubland	WAMTS150972
Regional SRE survey								
<i>I. gutharuka</i>	R SRE 10	1	1 adult	491502	6774468	Rocky hillslope	Mixed shrubland	WAMT155372
<i>I. gutharuka</i>	R SRE 7	8	6 adults, 2 juveniles	510479	6780223	Rocky hillslope	<i>Allocasuarina</i> shrubland	WAMT155370 & WAMT155371



Legend

- Mt Mulgine Project
- Extension Tenement M59/460
- Planned Exclusion Zones
- ◆ Previous Malleefowl Records (APM 2017)
- Conservation Significant Fauna Recorded
- + Western Spiny-tailed Skink (scats)
- Malleefowl (active)
- Malleefowl (recently active)
- Malleefowl (old)
- + Gilled Slender Blue-tongue
- ◆ Peregrine Falcon
- Idiosoma gutharuka
- Idiosoma clypeatum
- Idiosoma intermedium
- Idiosoma sp. (unidentified)
- Fauna Habitats
- Mixed Shrubland
- Open Eucalypt Woodland
- Granite Outcropping
- Granitic Flats
- Basalt Hills
- Eucalypt Woodland on Quartz
- Stony Hillslope Shrubland
- Cleared



Author: Astrid Heidrich

Date: 10-02-2022

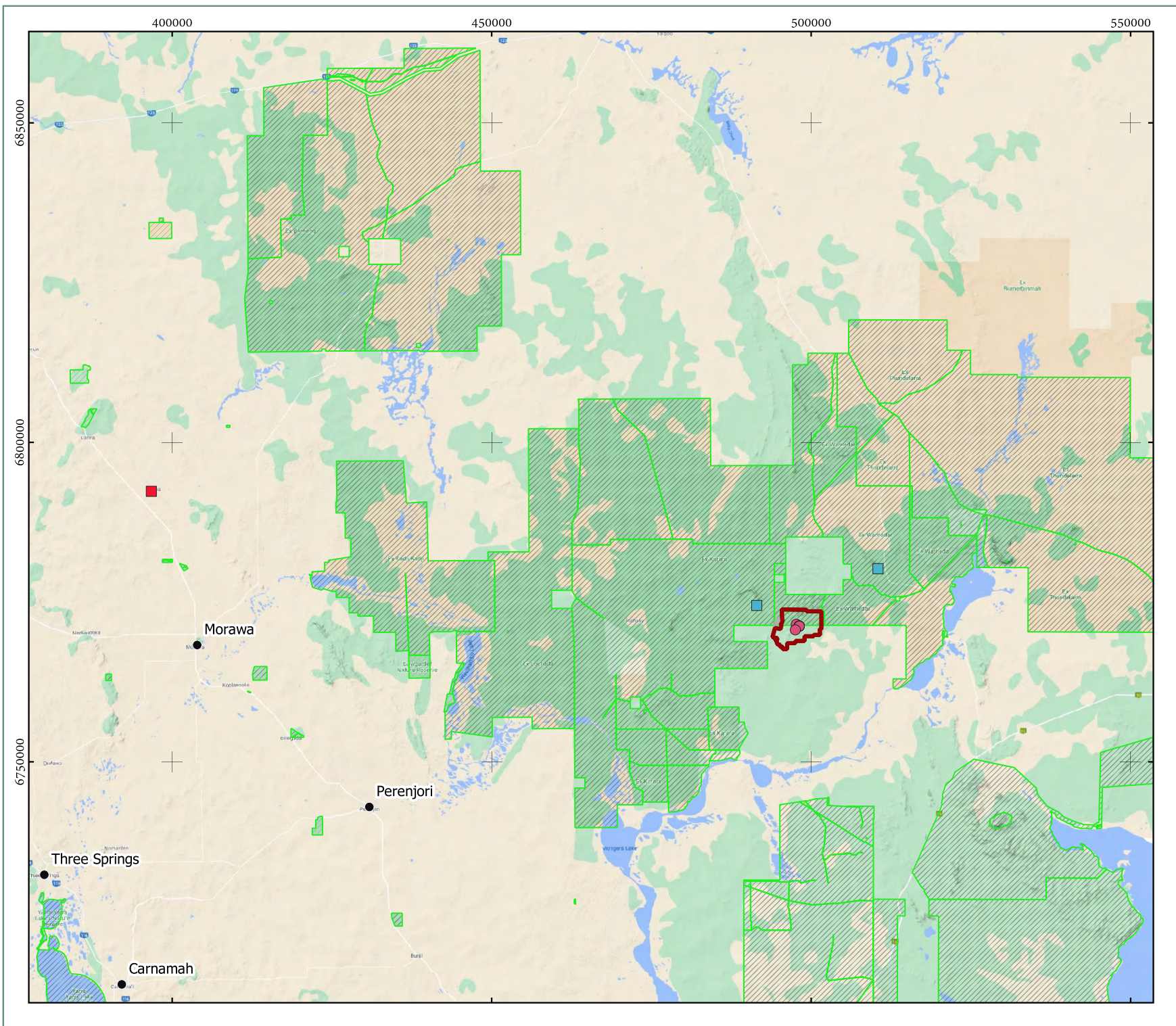
Conservation Significant Fauna Recorded

Mt Mulgine Project

Figure

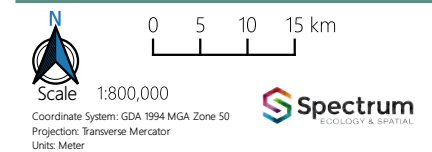
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Legend

- Mt Mulgine Project
- Extension Tenement M59/460
- Conservation Estates
- Project and Regional SRE Specimens Locations
- Holotype
- Mt Mulgine survey
- Regional Survey



Author: AH Date: 10-02-2022

Gutha Pintharuka Shield-backed Trapdoor Spider Records

Mt Mulgine Project

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Figure
3.5

3.2.2.8. SRE Invertebrate Fauna Survey

During the comprehensive SRE invertebrate survey at the Project, a total of 30 taxa belonging to SRE target groups were collected (Table 3.6). Of these, 19 taxa are considered potential SRE's (four Mygalomorphae, six pseudoscorpiones, six isopods, two diplopods, one geophilomorph) of which 14 taxa have previously not been recorded (represented in the WAM collection). Four of these SRE taxa were found only inside the Project area (highlighted in blue in Table 3.6, and detailed in section 3.2.2.9):

- Three mygalomorph spider: *Aname* 'BMYG177', *Idiommatata* sp. MH3, and *Bungulla* 'BMYG176'; and
- One isopod: *Acanthodillo* sp. 5B

One additional taxa, a single specimen of an isopod (*Spherillo* sp.), was recorded from inside and potentially outside the Project area. The specimen collected during the comprehensive SRE survey in 2020 was slightly damaged in the process of collection and identification so that subsequent comparison with regional records in 2021 was not possible. It is therefore not entirely clear if this specimen belongs to one of the two taxa found outside the Project area. DNA sequencing would be required to achieve a better understanding about its taxonomy and regional distribution.

During the regional SRE survey an additional four potential SRE taxa were collected from outside the Project area: one mygalomorph spider (Anamididae sp. MH2), and three isopods (*Buddelundia* '87' (very likely conspecific with *Buddelundia* sp. B30 found within the Project), *Spherillo* 2a and *Spherillo* 2c (potentially conspecific with *Sperillio* sp. found from within the Project)).

Details of each taxa are provided in Table 3.6. The DNA sequencing report is presented in Appendix F, and SRE Identification report completed by Alacran Environmental Science is provided in Appendix G.

Due to the change in taxonomists and reference collections between the initial SRE survey (Bennelongia) and the regional survey (Alacran), undescribed SRE taxa are sometimes given different phrase names (*Idiommatata* 'BMYG175' and *Idiommatata* sp. MH3) (Table 3.6). Where possible specimens were compared to WAM's reference collection, with additional private collections accessed where required. Overall, more credence has been given to Alacran's identification and phrase names due to the collaboration with the WA Museum unless previous work completed by Bennelongia provided more detail or context (such as DNA sequencing). The phrase names for each taxa are listed in Table 3.6.

Table 3.6: SRE Invertebrate Fauna Recorded

Order/ Family	Bennelongia ID (2020)	Alacran ID (2021)	Project Site	No. of Individuals	Habitat type	SRE Status	DNA sequenced (Yes/No)	Details/Comments	Area collected (SRE only)
Araneae									
Mygalomorphae									
Nemesiidae	<i>Aname</i> 'BMYG177'	(Anamidae sp. MH1)	SRE 4	1	Eucalypt Woodland	Potential SRE (DDT)	Yes	Best match (13.2% divergence in COI) is MW039189 (<i>Aname</i> 'MYG700').	Project only
Barychelidae	<i>Idiommatia</i> 'BMYG175'	(<i>Idiommatia</i> sp. MH3)	SRE 5	1	Granite Outcropping	Potential SRE (DDT)	Yes	Most likely new species. Closest to <i>Idiommatia</i> MYG254 (KJ745103.1, T123636), but still 10.7% divergent.	Project only
Actinopodidae	<i>Missulena insignis</i>	-	SRE 3	1	Eucalypt on Quartz	Not SRE	No	According to Miglio et al 2014, it is <i>M. insignis</i> in WA and <i>M. occatoria</i> in the east coast (indistinguishable from original descriptions)	N/A
Idiopidae	<i>Bungulla</i> 'BMYG176'	(tentatively <i>Bungulla bringo</i>)	SRE 7	1	Eucalypt on Quartz	Potential SRE (DDG)	No	New species. Michael Rix ID, confirmed this is similar to <i>Bungulla biota</i> (Bennelongia) and <i>B. bringo</i> (Alacran) (but different species)	Project only

Order/ Family	Bennelongia ID (2020)	Alacran ID (2021)	Project Site	No. of Individuals	Habitat type	SRE Status	DNA sequenced (Yes/No)	Details/Comments	Area collected (SRE only)
Dipluridae	<i>Cethegus</i> 'BMYG174'	-	SRE 1	1	Granite Outcropping	Potential SRE (DDT)	Yes	Match with BMYG174 from Mt Gibson 67 km SSE. Conspecifics (2.1% COI divergence) but > 13.8% divergent to other <i>Cethegus</i> clades (intra divergences are max of 9%)	Project and Regional (Mount Gibson Mining, 2015)
Pseudoscorpiones									
Chthoniidae	<i>Austrochthonius</i> 'BPS295', 'BPS296', 'BPS308'	<i>Austrochthonius</i> MH1	SRE 1 & SRE 5-8, SRE 10-12, MU LL 1 2, MU LL 6, MU LL 9	25	Mixed Shrubland, Eucalypt on Quartz & Granite Outcropping	Potential SRE (DDT)	No	New species, locally abundant	Project and Regional
		<i>Austrochthonius</i> MH2							Project and Regional
		<i>Austrochthonius</i> MH3							Project and Regional
Olpiidae	<i>Beierolpium</i> 8/4 'BPS303'	<i>Beierolpium</i> sp. 8/4 MH3	MU LL 2	1	Mixed Shrubland	Potential SRE (DDT)	No	New species. Possible species complex.	Project and Regional
	<i>Beierolpium</i> 8/4 'BPS304'		MU LL 11	1	Eucalypt Woodland		No		
	<i>Beierolpium</i> 8/2 'BPS305'	<i>Beierolpium</i> sp. 8/2 MH2	MU LL 1, MU LL 4, MU LL 7, SRE 3	7	Mixed Shrubland & Eucalypt on Quartz	Potential SRE (DDT)	No	New species, locally widespread	Project and Regional
	<i>Indolpium</i> 'BPS302'	<i>Indolpium</i> sp.	MU LL 9	3	Granite Outcropping	Potential SRE (DDT)	No	New species, all juveniles	Project and Regional

Order/ Family	Bennelongia ID (2020)	Alacran ID (2021)	Project Site	No. of Individuals	Habitat type	SRE Status	DNA sequenced (Yes/No)	Details/Comments	Area collected (SRE only)
	<i>Indolpium</i> sp.		MU LL 1, MU LL 7	2	Mixed Shrubland	Potential SRE (DDT)	No	Dueteronymph, very juvenile to compare but probably <i>Indolpium</i> BPS302. Similar specimens found regionally.	Project and Regional
Isopoda									
Armadillidae	<i>Acanthodillo</i> 'BIS412'	<i>Acanthodillo</i> sp. 5B	SRE 8	1	Eucalypt Woodland	Potential SRE (DDT)	No	New species	Project only
	<i>Acanthodillo</i> sp. B05	-	SRE 3	1	Eucalypt on Quartz	Potential SRE (DDG)	No	Same as animals collected 55 km SSE	Project and Regional (previous survey)
	<i>Buddelundia</i> sp. B30	-	MU LL 10, SRE 1, SRE 6, SRE 7, SRE 9, SRE 12	10	Eucalypt on Quartz, Mixed Shrubland & Granite Outcropping	Potential SRE (DDG)	No	Same species as animals collected 55 km SSE, locally widespread	Project and Regional (previous survey)
	<i>Spherillo</i> 'BIS411'	<i>Spherillo</i> sp.	MU LL 4	1	Eucalypt Woodland	Potential SRE (DDT)	No	New species. Single specimen is damaged. Similar to regional specimens (<i>Spherillo</i> 2a & <i>Spherillo</i> 2c)	Project and likely Regional

Order/ Family	Bennelongia ID (2020)	Alacran ID (2021)	Project Site	No. of Individuals	Habitat type	SRE Status	DNA sequenced (Yes/No)	Details/Comments	Area collected (SRE only)
Philosciidae	<i>Laevophiloscia</i> `BIS409`	<i>Laevophiloscia</i> sp.	SRE 7, SRE 4	2	Eucalypt on Quartz, Eucalypt Woodland	Potential SRE (DDT)	No	Same species as animals collected 50 km SSE of Mt Mulgine	Project and Regional (previous survey)
	<i>Laevophiloscia</i> sp. B18		SRE 3	1	Eucalypt on Quartz		No	Same species as animals collected 90 km NE of Mt Mulgine	
Platyarthridae	<i>Paraplatyarthus</i> `BIS410`	<i>Paraplatyarthus</i> sp. MH1	MU LL 10	1	Granite Outcropping	Potential SRE (DDT)	Yes	New species. 18% divergent to each other - > separate species. Not aligned with anything else in database. Regional records require DNA sequencing due to morphological similarities.	Project and Regional
	<i>Paraplatyarthus</i> `BIS420`		SRE 2	1	Mixed Shrubland	Potential SRE (DDT)	Yes		
Chilopoda									
Lithobiomorpha									
Henicopidae	<i>Lamyctes</i> nr <i>africanus</i>	-	SRE 2	1	Mixed Shrubland	Not SRE	No	Keys to <i>Lamyctes africanus</i> . Called nr because maxillipede coxosternites slightly different	N/A
Scolopendrida									
Scolopendridae	<i>Scolopendra laeta</i>	-	MU LL 1	1	Eucalypt Woodland	Not SRE	No	-	N/A

Order/ Family	Bennelongia ID (2020)	Alacran ID (2021)	Project Site	No. of Individuals	Habitat type	SRE Status	DNA sequenced (Yes/No)	Details/Comments	Area collected (SRE only)
	<i>Scolopendra morsitans</i>	-	SRE 8	1	Eucalypt Woodland	Not SRE	No	-	N/A
Diplopoda									
Polyxenida									
Polyxenidae	Unixenus sp.	-	MU LL 2, SRE 9	3	Mixed Shrubland	Not SRE	No	-	N/A
Synxenidae	<i>Phryssonotus novaehollandiae</i>	-	MU LL 1, MU LL 1 2, SRE 1, SRE 2, SRE 5, SRE 9, SRE 12	18	Mixed Shrubland & Granite Outcropping	Not SRE	No	Widespread	N/A
Polyzoniida									
Siphonotidae	Siphonotidae sp.	<i>Siphonotidae</i> sp. MH1	MU LL 8	3	Eucalypt on Quartz	Potential SRE (DDT)	No	-	Project and Regional

Order/ Family	Bennelongia ID (2020)	Alacran ID (2021)	Project Site	No. of Individuals	Habitat type	SRE Status	DNA sequenced (Yes/No)	Details/Comments	Area collected (SRE only)
Polydesmida									
Paradoxosomatidae	<i>Antichiropus</i> 'BDI070'	<i>Antichiropus</i> sp.	MU LL 10, MU LL 12	14	Mixed Shrubland & Granite Outcropping	Potential SRE (DDT)	Yes	Possibly new species. At least 8.6% divergent with <i>A. pendiculus</i> . Morphology very similar to <i>A. sagittulus</i> (also geographically consistent with that, but no sequences to compare). Gonopods have slight differences though.	Project and Regional
Geophilida									
Mecistocephalidae	Mecistocephalidae sp.	-	MU LL 11, MU LL 6, MU LL 1, SRE 3, SRE 12	6	Mixed Shrubland, Eucalyptus on Quartz, Eucalypt Woodland & Granite Outcropping	Not SRE	No	Locally widespread	N/A
Schendylidae	<i>Australoschendyla</i> 'BGE049' (capensis?)	-	MU LL 1.2	2	Granite Outcropping	Not SRE	No	Keys to <i>Australoschendyla capensis</i> from centipedes of australia as has 1 pair of coxal pores	N/A
Chilenophilidae	<i>Ribautia</i> 'BGE050'	<i>Geophilidae</i> sp. MH1 (<i>ribautia</i>)	MU LL 1, SRE 2	2	Mixed Shrubland	Potential SRE (DDT)	No	New species	Project and Regional

Order/ Family	Bennelongia ID (2020)	Alacran ID (2021)	Project Site	No. of Individuals	Habitat type	SRE Status	DNA sequenced (Yes/No)	Details/Comments	Area collected (SRE only)
Molluscs									
Camaenidae	<i>Sinumelon</i> 'BGA048'	<i>Sinumelon vagente</i>	Egernia site, SRE Op 5, SRE Op 2, SRE Op 4, SRE 1, SRE 2, SRE 3, SRE 7, SRE 9, SRE 8	40	Mixed Shrubland, Granite Outcropping, Eucalypt Woodland & Eucalypt on Quartz	Not SRE	No	Locally widespread	N/A
Punctidae	<i>Westralaoma aprica</i>	-	MU LL 11	1	Eucalypt Woodland	Not SRE	No	Widespread	N/A
Bothriembryontidae	<i>Bothriembryon sedgwicki</i>	<i>Bothriembryon</i> sp.	Egernia site, MU LL 11, SRE Op 4, SRE 10	6	Eucalypt Woodland, Mixed Shrubland	Not SRE	No	Locally widespread	N/A

3.2.2.9. Restricted SRE Species

Taxa that represent potential SREs and have only been recorded from within the Project area are discussed in detail below.

Class Arachnida | Order Araneae | Family Anamidae | Taxa Anamidae 'BMYG177'

One female specimen originally named *Aname* 'BMYG177' (new phrase name Anamidae sp. 'MH1') was recorded from Eucalypt Woodland during the SRE survey at the project in 2020. DNA sequencing found the specimen to be a new species (13.2 % divergence to *Aname* 'MYG700') (Appendix F). Identification of species or genera in the family Anamidae requires examination of adult male specimens. Subsequent sampling regionally collected one adult female (Anamidae sp. 'MH2') from outside the Project area and comparison of the spermathecae indicates they are different species; however, broader comparisons between the species were not possible using female morphology alone. DNA sequencing of the regionally collected Anamidae sp. 'MH2' and comparison with W.A. Museums private collection (e.g. research sequences) is required to determine if *Aname* 'BMYG177' is represented in the region (Appendix G). Eucalypt Woodland was recorded from outside the Project area and is widespread in the region. In the absence of regional data, this species is a potential SRE (Appendix G).

Family Anamidae | Taxa *Idiommata* 'MH3'

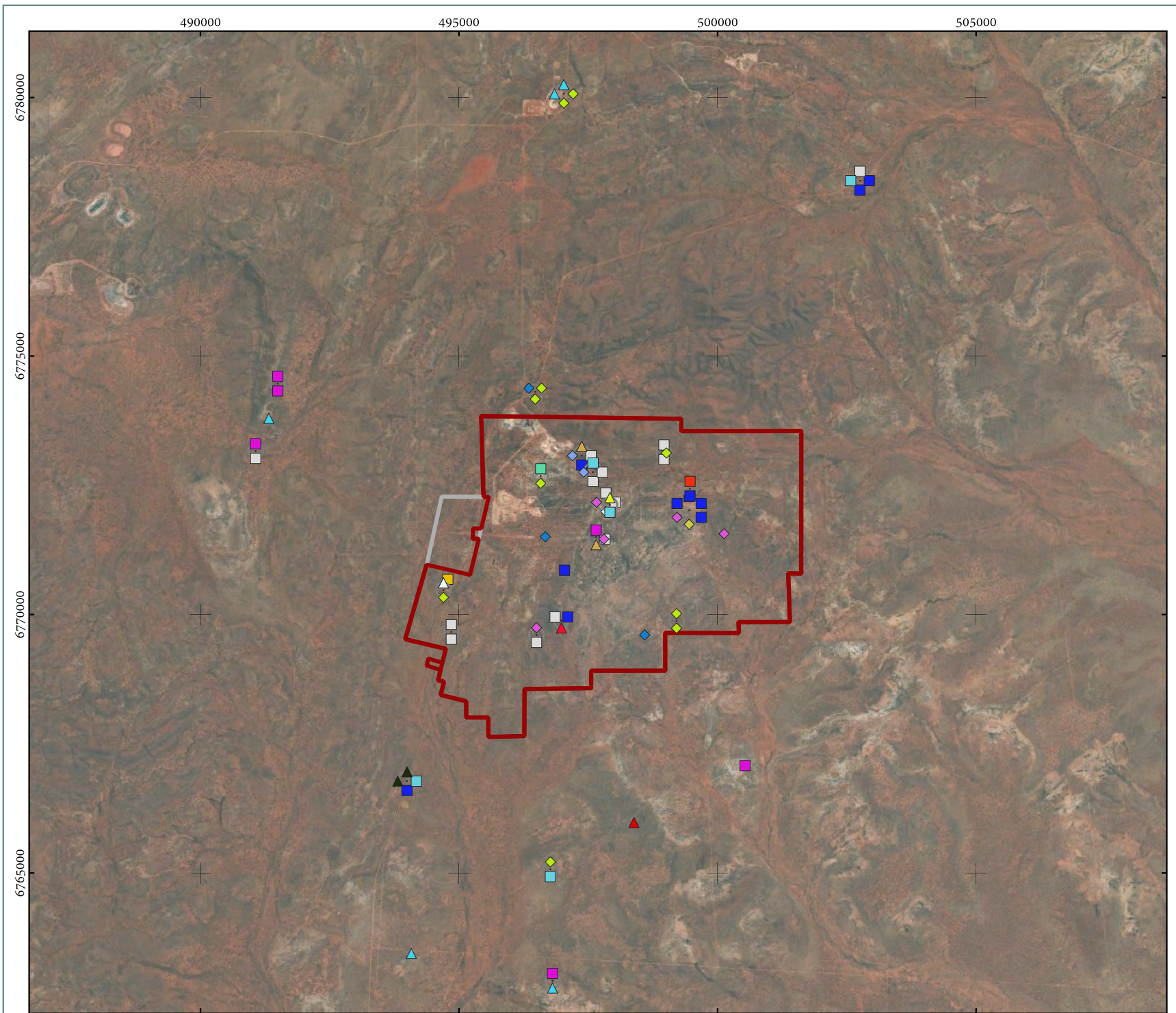
A single individual of *Idiommata* 'MH3' was collected from Granite Outcropping during the SRE survey at the Project in 2020. This specimen could not be matched with any specimens present in the W.A. Museum collection. DNA sequencing indicates that the species is 10.7 % divergent to *Idiommata* MYG254 which is the closest match in Genbank (Appendix F). In the absence of a clear identification, this species is a potential SRE owing to geographical data deficiency. Granite Outcropping is limited within the Project area and is restricted within the surrounded region.

Family Idiopidae | Taxa *Bungulla* 'BMYG176'

The single specimen was confirmed as *Bungulla* 'BMYG176' by Michael Rix. The specimen has similarities with *Bungulla biota* and *B. bringo* based on the species identification key (M.G. Rix *et al.*, 2018); however, its identity should be confirmed using DNA sequences (Appendix G). The single specimen was recorded from the Eucalypt on Quartz habitat type which has a limited extent within the Project area and may be limited in the region. *Bungulla* 'BMYG176' is currently not known from outside the Project area, therefore should be considered a potential SRE owing to geographical data deficiencies.

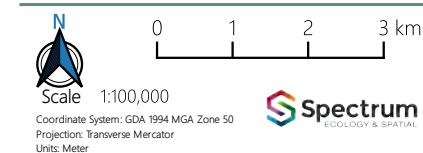
Class Malacostraca | Order Isopoda | Family Armadillidae | Taxa *Acanthodillo* '5B'

A single specimen of *Acanthodillo* '5B' was collected from the Eucalypt Woodland within the Project. The morphospecies belong to the *Acanthodillo* 5 species complex found in the central and southern jarrah forest. Sequencing should be undertaken if greater resolution between the specimen and other species of this complex is required. The morphospecies *Acanthodillo* '5B' is a potential SRE owing to taxonomic data deficiencies (Appendix G). Eucalypt Woodland was recorded from outside the Project area and is widespread in the region.



Legend

- Mt Mulgine Project
- Extension Tenement M59/460
- Project and Regional SRE Specimens Locations
- Acanthodillo sp. 5B
- Acanthodillo sp. B05
- Anamidae sp. MH1
- Antichiropus sp.
- Austrochthonius sp. MH1
- Austrochthonius sp. MH2
- Austrochthonius sp. MH3
- Beierolpium sp. 8/2 MH2
- Beierolpium sp. 8/4 MH3
- Buddelundia sp. B30/Buddelundia '87'
- Bungulla 'BMYG176'
- Cethegus 'BMYG174'
- Geophilidae sp. MH1 (Ribautia)
- Idiommatia sp. MH3
- Indolpium sp.
- Laevophiloscia sp.
- Paraplatyarthus sp. MH1
- Siphonotidae sp. MH1
- Spherillo sp.
- Spherillo sp. 2A
- Spherillo sp. 2C



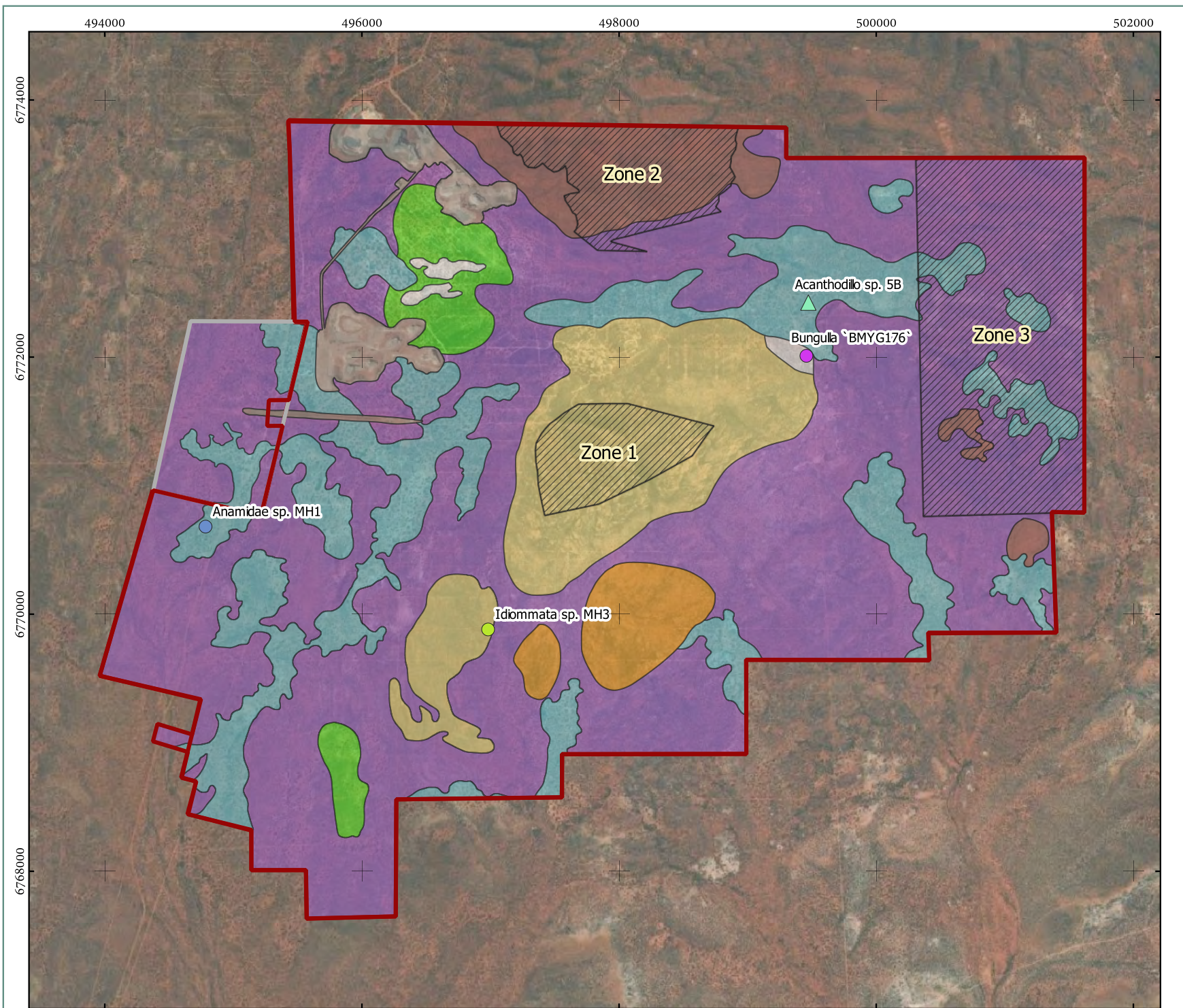
Author: AH

Date: 09-02-2022

Potential SRE Species Recorded (including Regional Records) Mt Mulgine

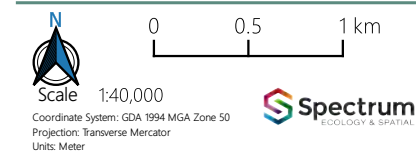
Prepared for
Tungsten Mining NL

Figure
3.6



Legend

- Mt Mulgine Project
- Extension Tenement M59/460
- ▨ Planned Exclusion Zones
- Proposed Footprint
- SREs Recorded
- Anamidae sp. MH1
- Idiommatata sp. MH3
- Bungulla 'BMYG176'
- ▲ Acanthodillo sp. 5B



Author: AH

Date: 09-02-2022

SRE Taxa Only Recorded from the Project

Mt Mulgine

Figure

3.7

Prepared for
Tungsten Mining NL

3.3. Limitations & Constraints

Survey specific limitations and constraints for the Level 1 fauna assessment conducted at the Project are discussed in Table 3.7.

Table 3.7: Limitations & Constraints

Limitation	Constraint	Comment
Competency/experience of the consultant carrying out the survey.	No	Zoologists had relevant experience surveying within the greater Yalgoo region and areas immediately adjacent to the Project.
Scope (what faunal groups were sampled and were some sampling methods not able to be employed because of constraints such as weather conditions).	No	Sampling techniques were adequate for a Level 1 and targeted fauna survey, and an SRE fauna survey. All fauna groups were sampled, and no survey constraints were experienced.
Proportion of fauna identified, recorded and/or collected.	No	All vertebrate fauna species encountered were identified in the field. Level 1 survey methods do not require the identification of all fauna species present within the Project. Invertebrate fauna was submitted to Bennelongia for identification.
Sources of information.	No	Database searches and previous survey reports provided a significant level of information, adequate to guide field survey design and effort.
The proportion of the task achieved and further work which might be needed.	No	All components of a Level 1, targeted and SRE invertebrate fauna assessment were completed.
Timing/weather/season/cycle.	No	All dominant fauna groups, assemblages and major fauna habitat types were recorded.
Disturbances (e.g. fire, flood, accidental human intervention) which affected results of survey.	No	No disturbances were recorded during the survey.
Intensity (in retrospect, was the intensity adequate).	No	A multi-phased Level 1 assessment was adequate to identify faunal assemblages and fauna habitat present within the Project. Targeted searches for significant fauna species were completed within areas of suitable habitat. The SRE invertebrate fauna survey included all major sampling types and regional sampling, and was adequate for the Project area.
Completeness (was the relevant area fully surveyed).	No	All major fauna habitat types were sampled and defined. Habitat types that may host significant fauna species were surveyed.
Resources (degree of expertise available in animal identification to taxon level).	Partially	Resources in the field were adequate and did not compromise the outcome of the survey. Poor SRE taxonomic resolution continues to limit the ability to properly determine specific invertebrate fauna taxa, however multiple reference collections have been accessed, as well as DNA sequencing has been completed as part of the identification process and to give regional context.
Remoteness and/or access problems.	No	No access restrictions were experienced within the Project.
Availability of contextual (e.g. biogeographic) information on the region.	No	Background information about the region was available and sufficient.

4. DISCUSSION

4.1. Conservation Significant Fauna

The desktop assessment and targeted survey identified six conservation significant fauna species from the Project area, whilst an additional two conservation significant fauna species are considered to have a medium to high likelihood of occurrence based on the relevant species distributions and habitats occurring within the Project. Five species identified in the desktop assessment are considered to have a low likelihood of occurring in the Project.

Conservation significant fauna species recorded within the Project or with a medium to high likelihood of occurrence are discussed below with additional information on the likelihood of occurrence. Definitions of the relevant conservation status codes are also shown in Appendix A.

Table 4.1: Summary of Conservation Significant Fauna Species Identified in the Desktop Assessment.

Species	Conservation Status			Preferred Habitats	Previous Records	Likelihood of Occurrence
	EPBC Act	BC Act	DBCA			
Mammals						
Chuditch, Western Quoll <i>Dasyurus geoffroii</i>	VU	VU	-	Sclerophyll forest, riparian forest, dry woodland, heath and mallee shrubland.	No records from the surrounding region. Potential occurrence identified in PMST. Nearest record located near Dongara in 2012 (NatureMap).	Low Although suitable habitat exists within to the Project and a population has been reintroduced to Kalbarri NP, Chuditch have not been recorded from the local region.
Western Brush Wallaby <i>Notamacropus irma</i>			P4	Open forest or woodland. Open, seasonally wet flats with low grasses and scrubby thickets. Mallee and heathland occasionally utilised.	One record in 2002 from approx. 20 km west of the Project, near Rothsay (DBCA), and 40 km north (NatureMap).	Low The Project is located on the northern edge of its current distribution. Suitable habitat is located within the Project; however local populations are expected to be at very low densities.
Birds						
Night Parrot <i>Pezoporus occidentalis</i>	EN	CR	-	Most records from long unburnt <i>Triodia</i> grasslands and/or Chenopod shrublands featuring large dense clumps of vegetation.	No confirmed records in the area. PMST lists habitat to potentially be present within the Project. Project located just outside of priority area (DPaW 2017).	Low Suitable habitat could occur in the regional area, however livestock grazing has removed all areas of dense grass tussocks and hummocks in the Project.
Australian Painted Snipe <i>Rostratula benghalensis australis</i>	EN	EN		Inhabits a range of permanent wetlands habitats and ephemeral wetland habitat when present.	No confirmed records within 40 km. PMST lists habitat to potentially be present within the Project.	Low No suitable habitat occurs within the Project.

Species	Conservation Status			Preferred Habitats	Previous Records	Likelihood of Occurrence
	EPBC Act	BC Act	DBCA			
Malleefowl <i>Leipoa ocellata</i>	VU	VU	-	Semi-arid and arid mallee, mulga and other habitats with dense litter forming vegetation. Variety of dry forest, woodlands and shrublands dominated by eucalypts and acacias.	Several historic and recent records in the surrounding and regional area (TFDS, NatureMap).	Recorded Suitable habitat recorded from the Project. Multiple records of inactive mounds from within the Project and the surrounding region. Tracks were recorded during previous surveys (APM, 2018a).
Common Greenshank <i>Tringa nebularia</i>	IA	IA	-	Migratory/waterbird species are typically associated with coastal habitats. These species also inhabit inland ephemeral wetland habitat types when present.	Two records from Mongers Lake (40 km south west of the Project (NatureMap). Potential occurrence identified in PMST.	Low No suitable habitat occurs within the Project.
Fork-tailed Swift <i>Apus pacificus</i>	IA	IA	-	Nomadic, almost entirely aerial lifestyle over a variety of habitats; associated with storm fronts.	No confirmed records within 40 km. PMST lists habitat to potentially be present within the Project.	Low The Fork-tailed Swift is highly nomadic and can occur across Australia. Records typically associated with suitable climatic conditions instead of habitat types.

Species	Conservation Status			Preferred Habitats	Previous Records	Likelihood of Occurrence
	EPBC Act	BC Act	DBCA			
Peregrine Falcon <i>Falco peregrinus</i>	-	OS	-	Widespread but uncommon; variety of habitats ranging from urban areas, coastal cliffs, riverine gorges, wooded watercourses or margins of cleared lands.	Several historical and recent records from the surrounding region. Two individuals recorded from Blue Hills (Ecoscape 2016a). One female and nest recorded on eastern edge of Mungada Ridge (Bamford 2006).	Recorded Recently recorded from the region surrounding the Project. Also recorded during the Level 1 survey. Foraging habitat is present, breeding habitat was not recorded.
Reptiles						
Western Spiny-tailed Skink <i>Egernia stokesii badia</i>	EN	VU		Typically found in York Gum (<i>Eucalyptus loxophleba</i>) woodland, also Gimlet (<i>E. salubris</i>) and Salmon Gum (<i>E. salmonophloia</i>). Structural properties of available crevices very important, also will utilise tin sheets, woodpiles, and abandoned buildings.	Many records in the surrounding region (DBCA).	Medium Fresh latrine site was located just outside of the Project (<200 m) in October 2019. No fresh evidence was found when site was re-visited in June 2020. Habitat within the Project is marginal, since there is suitable habitat present in the surrounding areas, the species has potentially to move through the Survey Area on an infrequent basis.
Gilled Slender Blue-tongue Skink <i>Cyclodomorphus branchialis</i>		VU		Poorly understood. Recorded from both heavy red soils and on rocky habitats including banded ironstone ranges (Ecologia 2010a; Ecoscape 2016a)	Two records from Mungada Ridge area (Bamford & Wilcox, 2004).	Recorded Recorded during the targeted survey within the Project. Suitable habitat is present.
Invertebrates						
Gutha Pintharuka shield-backed trapdoor spider <i>Idiosoma gutharuka</i>			P1	Unknown.	One specimen recorded in 1996 from Gutha (Michael G Rix <i>et al.</i> , 2018).	Recorded DNA analysis confirmed 6 individuals from the Project. Only recorded from Granite Outcropping habitat type associated with Mt Mulgine.

Species	Conservation Status			Preferred Habitats	Previous Records	Likelihood of Occurrence
	EPBC Act	BC Act	DBCA			
Northern Shield-backed Trapdoor Spider <i>Idiosoma clypeatum</i>			P3	Little information is available however it is associated with Iron stone ranges in the Murchison region; Blue Hills, Jack Hills, Weld Range.	PMST lists habitat (<i>Idiosoma nigrum</i>) to potentially be present within the Project. Commonly reported as <i>Idiosoma nigrum</i> across the northern wheatbelt and Murchison region.	Recorded Recent taxonomic information (Michael G Rix <i>et al.</i> , 2018) identifies this as 'MYG018' which has been recorded from Blue Hills, Weld Range and Jack Hills. Suitable habitat is common within the Project and surrounding.
Coolgardie Shield-backed Trapdoor Spider <i>Idiosoma intermedium</i>			P3	Unknown.	Only records are identified in recent taxonomy paper (Michael G Rix <i>et al.</i> , 2018).	Recorded DNA analysis confirmed 5 individuals from the Project. Recorded from across the Project.

4.1.1. Malleefowl (*Leipoa ocellata*)

Conservation Status: EPBC Act: Vulnerable, BC Act: Vulnerable

Distribution and Habitat: Malleefowl are a large ground-dwelling bird that inhabit semi-arid to arid mallee, mulga or other dense litter-forming shrublands as well as dry forest dominated by other eucalypts, mulga and other *Acacia* species. In Western Australia they occur in woodland habitats that are dominated by Mallee, Wandoo, Marri, Mallet, Broombush and/or Wattle species that form thick dense structure. The species is most abundant in areas with dense shrubs and trees that have a sandy substrate and an abundance of leaf litter (Benshemesh, 2007; Parsons, 2008). Population densities are generally greater in areas of higher rainfall and high shrub species diversity (Benshemesh, 2007; Parsons, 2008). The species has declined in range and occupancy due to clearing, altered fire regimes, introduced predators, and other local causes (Parsons, 2008; Australian Government, 2018).

Ecology: Malleefowl pairs occupy permanent territories, cooperating to construct nesting mounds of sand and leaf litter (typically 3-5 m in diameter and 1 m high). After egg-laying, the male predominantly maintains the mound during incubation, attending it for 9-11 months each year. Malleefowl rarely breed in vegetation that has been burnt within the last 15 years thus they require abundant litter, with the highest breeding densities occur in vegetation that is at least 40 years post fire (Woinarski, 1989; Parsons, 2008). Active mounds are continually modified in shape according to weather conditions and stage of incubation (Benshemesh, 2007).

Occurrence and Regional Context: The Malleefowl have been recorded from the Project during previous and the current surveys (APM, 2018a). The recordings made during the current survey, despite being made outside the breeding season, indicate that the local population at the Project has been breeding over consecutive years (Plate 3.8).

They are regularly recorded in the surrounding region with over 70 locations reported within 40 km of the Project (DBCA and NatureMap). The species is commonly seen in patches of moderately dense to very dense *Acacia* shrubland habitats in the local region as the vegetation structure provides shelter and cover from predation. Suitable conditions are provided within the Granitic Outcropping habitat of the Project, but also within denser vegetation patches of the Granitic Flats and Basalt Hill habitat. Active and inactive mounds have been recorded in the surrounding area (Bamford 2006, 2013a, 2013b; Ecologia 2011c; Ecoscape 2016b), indicating that significant populations occur in the surrounding region.

4.1.2. Western Spiny-tailed Skink (*Egernia stokesii badia*)

Conservation Status: EPBC Act: Endangered, BC Act: Vulnerable

Distribution and Habitat: *Egernia stokesii badia* is a subspecies of the large, stout, herbivorous Gidgee skink that occurs across southern Australia. This Western Australian subspecies currently includes two geographically and morphologically non-overlapping forms that are likely to be distinct taxa (currently under investigation by WAM). The reddish-brown form that is found in the northern and central wheatbelt (south from Mullewa, with an isolated area of distribution around Shark Bay including Dirk Hartog Island and Peron Peninsula) is the form that is associated with the *badia* sub species nomenclature and the form that is discussed in this report. The distinct 'black form' is associated with emergent granite formations in the Murchison district, ranging from hills to low rises, but only where boulder piles or crevices provide adequate shelter granite outcrops. The black form is thought to be a distinct taxon which will be potentially given a separate sub species name.

Egernia stokesii badia is most commonly recorded from York Gum (*Eucalyptus loxophleba*) woodland, however it is also associated with Gimlet (*E. salubris*) and Salmon Gum (*E. salmonophloia*) where it occupies tree hollows and log piles (How, Dell and Robinson, 2003). However, its distribution does not seem to be determined by particular species of trees but the structural properties of available crevices, as demonstrated by the use of tin, woodpiles, and abandoned buildings in the Wheatbelt and Shark Bay populations, and the use of limestone and granite outcrop by closely related populations in WA (Hamilton, 2003; How, Dell and Robinson, 2003).

Ecology: Like other members of the *Egernia* genus of 'social skinks', populations of *E. stokesii* occur in small colonies or family groups that show long-term site fidelity, and dispersal between suitable home-sites or colonies is relatively infrequent (Duffield and Bull, 2002). Preferences and usage of refuge sites has been investigated in a captive colony; skinks prefer relatively deep refugia with multiple entrances that are relatively narrow, approximately 5 cm (Duffield and Bull, 2002). This species feeds mainly on fibrous plant material, and scats are deposited in discrete 'latrine' sites outside occupied crevices (Arida and Bull, 2008; Mensforth and Bull, 2008).

Occurrence and Regional Context: *Egernia stokesii badia* was recorded from 37 locations in the region surrounding the Project area (DBCA). During the targeted survey hollow logs and tree crevices were checked for *Egernia stokesii badia* with only one latrine site recorded from Eucalypt Woodland habitat in October 2019 approximately 200 m south of the Project area (Plate 3.10). Overall, the Eucalypt Woodland present within the Project represents marginal habitat, with large areas of more suitable Eucalypt Woodland present in the wider region, in particular to the south and west of the Project. The species is more likely to occur outside the Project and may utilise some areas within the Eucalypt Woodland on an infrequent basis.

4.1.3. Peregrine Falcon (*Falco peregrinus*)

Conservation Status: BC Act: Other specially protected species (Schedule 7)

Distribution and Habitat: The Peregrine Falcon occurs across the world including most of Australia but they are an uncommon species and are rare across all states and territories (Bird Life Australia, 2012). Peregrine Falcons utilise a range of habitats however they tend to prefer areas with rocky ledges, cliffs, watercourses, open woodland or margins with cleared land (White, Pruett-Jones and Emison, 1980; Olsen *et al.*, 2006; Ratcliffe, 2010). Ledges, cliff faces, large tree hollows and spouts, electricity pylons and similar structures, or abandoned nests of other raptors are used for nesting (Olsen *et al.*, 2006; Ratcliffe, 2010).

Ecology: Peregrine Falcon feed almost exclusively on birds (including pigeons, parrots and passerines) which are captured in flight (Ratcliffe, 2010). Pairs mate for life and return to the same nesting spot annually (Ratcliffe, 2010).

Occurrence and Regional Context: The DBCA database search identified three records from the surrounding region. During the survey, one individual Peregrine Falcon was recorded overflying the site office where potential foraging habitat is present. Two Peregrine Falcons were observed from the Mungada Ridge in 2015 circling above a small clifftop on a hill before flying out of the Project (Ecoscape 2016b). Fauna surveys associated with Mungada Ridge in 2006 observed a potentially breeding female and nest from the eastern edge of the Mungada Ridge (Bamford 2006). Mungada Ridge is located approximately 4 km to the west of the Project area. The species may utilise the Project area as part of its larger foraging range and they are also known to use artificial structures such as communication towers (Ratcliffe, 2010).

4.1.4. Gilled Slender Blue-tongue Skink (*Cyclodomorphus branchialis*)

Conservation Status: BC Act: Vulnerable

Distribution and Habitat: The Gilled Slender Blue-tongue Skink was originally recorded from semi-arid shrublands on heavy red soils from Irwin River to Murchison River, and inland to Yalgoo (Storr, Smith and Johnstone, 1981), with additional populations recorded further east associated with ironstone ranges near the Project (Bamford 2006). *C. branchialis* has been suggested to be dependent on (or restricted to) rocky habitats including banded ironstone ranges (Bamford 2006) however records from the Greenough River region are from Mulga woodland and shrubland habitats (Ecologia 2010a; Ecoscape 2016a). *Cyclodomorphus* species generally inhabit dense low vegetation (Wilson and Swan, 2017).

Ecology: Little is known about *Cyclodomorphus branchialis* however they are largely crepuscular/nocturnal ground-dwelling skinks which shelters in grass hummocks, leaf litter and fallen timber (Cogger, 2014). The diet of *C. branchialis* is composed mainly of arthropods, but also includes land snails and occasionally smaller skinks (Shea and Miller, 1995).

Occurrence and Regional Context: A single individual was recorded from the Project during the current targeted survey. The individual was recorded moving crossing a track in the vicinity to spoil heap located in mixed shrubland habitat. *C. branchialis* was recorded at two locations during the baseline assessment of Blue Hills (Bamford & Wilcox, 2004) with one individual was recorded from Mungada Ridge and the second recorded 9 km to the south. A third individual was caught by hand on the 'Karara Ridge' in 2006 (Bamford 2006) however location data was not provided. The species is known to be recorded on an infrequent basis and is possibly more common throughout its range than recordings indicate. The Project contains areas of suitable habitat which is also present outside.

4.1.5. Northern Shield-backed Trapdoor Spider (*Idiosoma clypeatum*)

Conservation Status: DBCA Priority 3

Distribution and Habitat: *Idiosoma clypeatum* has a widespread distribution across the Yalgoo and Murchison bioregions that seems to be strongly correlated with annual rainfall of less than 250mm. It has been recorded from near Paynes Find, Blue Hills and Karara in the south, north and north east to Jack Hills and Yeelirrie (Michael G Rix *et al.*, 2018). *I. clypeatum* has been recorded in association with a variety of habitats within the Project area. During fauna surveys at Weld Range, *I. clypeatum* was recorded from rocky hillslopes dominated by *A. ramulosa* shrubland.

Ecology: Currently no information available.

Occurrence and Regional Context: *Idiosoma clypeatum* has been recorded from across the Project area (Figure 3.4) and also the surrounding region (ecologia, 2010b; ecologia 2011a; Ecologia Environment, 2012; BCE, 2013b; Ecoscape, 2016a). Within the Project it was recorded across a range of habitat types which were not restricted. The species is considered to be widespread with a known occurrence of over 120,000 km² (Michael G Rix *et al.*, 2018).

4.1.6. Coolgardie Shield-backed Trapdoor Spider (*Idiosoma intermedium*)

Conservation Status: DBCA Priority 3

Distribution and Habitat: Although poorly defined, Coolgardie Shield-backed trapdoor Spider is relatively widespread across the eastern Wheatbelt and north western Coolgardie bioregions of south western Western Australia (Michael G Rix *et al.*, 2018). Its known range extends from Bodallin north to Billiburning Rock in the eastern Wheatbelt, and east to near the Helena-Aurora Range, Mount Manning, and Koolyanobbing in the Coolgardie bioregion (Michael G Rix *et al.*, 2018).

Ecology: Currently no information available.

Occurrence and Regional Context: The Coolgardie Shield-backed Trapdoor Spider (*Idiosoma intermedium*) was recorded from across the Project, in particular from Stony Hillslope Shrubland and Granitic Outcropping (Figure 3.4). The current records represent a northerly range extension, along the western edge of its current distribution, of approximately 100 km. The species is likely to occur across the region, with some restriction to rocky habitat types.

4.1.7. Gutha Pintharuka Shield-backed Trapdoor Spider (*Idiosoma gutharuka*)

Conservation Status: DBCA Priority 1

Distribution and Habitat: Gutha Pintharuka Shield-backed Trapdoor Spider (*Idiosoma gutharuka*) has only been recorded from one specimen located approximately 100 km to the west of the Project area. Recent DNA analysis identified this species from the Planned Exclusion Zone 1 associated with Mt Mulgine (Figure 3.4). The habitat was characterised by dense to moderately dense *Allocasuarina* shrubland on a south west facing steep hillslope on quartzitic-granitic substrate.

Ecology: Currently no information available.

Occurrence and Regional Context: To date, this species has only been recorded from a few locations within and surrounding the Project area (Figure 3.4, Figure 3.5). It appears, the species has a preference for granitic outcrops and rocky ridges with a dense shrubland. Sampling of other habitat types across the Project has not recorded the species. Based on the currently known very restricted range, the species is likely to have a very low dispersal rate. At this stage the Granitic Outcropping habitat at Mt Mulgine from which the species has been recorded in high density, is mostly located within the Planned Exclusion Zone 1. This habitat type has not been recorded from the region. The habitat type of the holotype location was dominated by open eucalypt woodland on clay which is widespread in the region. Two regional records were made from rocky ridges with *Allocasuarina* dominated shrubland. It is currently unknown how restricted *Idiosoma gutharuka* is and if it can be found in other habitat types in the region. Regional surveys may detect additional records of the species, however it is likely that the species has a high endemism.

4.2. SRE Invertebrate Fauna

A total of 19 potential SRE invertebrate fauna taxa were identified from within the Project area. These taxa include mygalomorph spiders (four taxa), pseudoscorpions (six taxa), isopods (six taxa), millipedes (two taxa), and geophilomorphs (one taxa). Of the total of 19 potential SREs, 14 taxa have not been recorded previously, representing a new species. This assessment is comparable with detailed SRE surveys completed in similar habitat in the region (e.g. Blue Hills). When comparing the number of recorded taxa to the results of the desktop assessment (section 3.1), a considerably higher number of potential SREs have been recorded in the region (n=53), in particular when considering records from Mt Gibson and Charles Darwin Reserve. This is largely due to the fact that SREs are often taxonomically unresolved, and some species identified in the desktop review are actually duplicates. For example individuals of the mygalomorph genus *Aname* collected at Mt Gibson are currently identified as five different taxa. One of these could be conspecific with the individual of *Aname* sp. MH1 collected during the current survey. The lack of taxonomic resolution around species groups is exacerbated by the fact DNA analysis of SRE invertebrates has not always been completed as part SRE fauna assessment in the past, therefore reducing the amount of comparable data to assess regional presence or a species and its distributions. In addition, the WAM collection is not easily accessed, leading to greater inconsistency between reference collections and the small number of taxonomists able to identify SRE invertebrate species based on morphology alone.

In addition, a number of the species show similarities to described species collected from the region, but have slight differences in morphology (e.g. *Bungulla* 'BMYG176') or there is a lack of males collected on site to confirm species identification (e.g. *Austrochthonius* MH1).

At least five of the seven habitat types recorded from the Project area are likely to support SRE invertebrate fauna. In particular stony and elevated habitats that have the ability to provide adequate moisture levels for longer than the surrounding habitats are likely to harbour restricted species. These habitat types include the Granitic Outcropping, Basalt Hills, Eucalypt Woodland on Quartz and Stony Hillslope Shrubland habitats, in particular along small drainage lines (which have not been mapped as a separate habitat type due to their small extent in the Project area). This is shown with most of the potential spider (Araneae), isopod (Isopoda), millipede & centipede (Antichiropus, Polydesmida and Geophilida) SRE taxa being recorded from elevated habitats/sites. In comparison most of the Pseudoscorpion and Mollusc potential SRE invertebrate fauna taxa recorded during the survey were recorded from a wide range of habitat types across the project area indicating a lower likelihood that these taxa represent actual SRE invertebrate taxa.

5. CONCLUSIONS

5.1. Fauna Habitats

Some sections of the Project area appear to contain restricted habitat types (e.g. Granite Outcropping) which have only been surveyed at a low level previously. The fauna assemblage recorded during the current survey from these rather restricted habitat types have been found to differ from those of the more widespread habitats in the region, including species with a limited range (e.g. *Idiosoma gutharuka*).

5.2. Threatened Vertebrate Fauna

Regional survey information was considered sufficient to determine the vertebrate fauna assemblage and the associated vertebrate conservation significant fauna species associated with the Mt Mulgine Project. No significant populations of threatened vertebrate fauna were recorded from the Project area.

5.3. SRE Invertebrates

Sampling of SRE taxa has been extensive in the neighbouring Blue Hills (Mungada Ridge and Karara) area, and has also been undertaken sufficiently within the Project area and surrounding. Records of new invertebrate species without information about their distribution is a common occurrence in Western Australia (Ecologia 2009; 2011a, 2013; Subterranean Ecology 2012; Phoenix 2013) and contributes to the lack of taxonomic knowledge of SRE species in general (see Table 2.10).

Four taxa of potential SRE are currently known to only occur at the Project area: Anamidae 'BMYG177', *Idiommatia* 'MH3', *Bungulla* 'BMYG176', and *Acanthodillo* '5B'. Of these two taxa were recorded from Eucalypt Woodland (Anamidae 'BMYG177' & *Acanthodillo* '5B') which is a widespread and common habitat types that does not typically provide niches for SRE species (e.g. isolated rocky gorges). The remaining two taxa (*Idiommatia* 'MH3' & *Bungulla* 'BMYG176') were recorded from Granitic Outcropping and Eucalypt on Quartz, both of which are considered to provide adequate conditions for SREs, and are uncommon in the region. The two taxa are therefore likely to be restricted and may be limited in their distribution.

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Appendix A: Conservation Codes



Appendix A1: Definitions of Conservation Categories under the EPBC Act

Category	Definition
Extinct	A native species is eligible to be included in the extinct category at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.
Extinct in the Wild	A native species is eligible to be included in the extinct in the wild category at a particular time if, at that time: (a) it is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or (b) it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
Critically Endangered	A native species is eligible to be included in the critically endangered category at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
Endangered	A native species is eligible to be included in the endangered category at a particular time if, at that time: (a) it is not critically endangered; and (b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
Vulnerable	A native species is eligible to be included in the vulnerable category at a particular time if, at that time: (a) it is not critically endangered or endangered; and (b) it is facing a high risk of extinction in the wild in the medium term future, as determined in accordance with the prescribed criteria.
Conservation Dependent	A native species is eligible to be included in the conservation dependent category at a particular time if, at that time: (a) the species is the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered; or (b) the following subparagraphs are satisfied: (i) the species is a species of fish; (ii) the species is the focus of a plan of management that provides for management actions necessary to stop the decline of, and support the recovery of, the species so that its chances of long term survival in nature are maximised; (iii) the plan of management is in force under a law of the Commonwealth or of a State or Territory; (iv) cessation of the plan of management would adversely affect the conservation status of the species.

Appendix A2: Definitions of Conservation Categories under the BC Act (DBCA 2019)

Threatened Species: Listed by order of the Minister as Threatened in the category of critically endangered, endangered or vulnerable under section 19(1), or is a rediscovered species to be regarded as Threatened species under section 26(2) of the Biodiversity Conservation Act 2016 (BC Act).

Threatened fauna is that subset of 'Specially Protected Fauna' listed under schedules 1 to 3 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for Threatened Fauna.

Threatened flora is that subset of 'Rare Flora' listed under schedules 1 to 3 of the Wildlife Conservation (Rare Flora) Notice 2018 for Threatened Flora.

The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria as detailed below.

Category	Definition
CR	Critically endangered species Threatened species considered to be "facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as critically endangered under section 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines. Published under schedule 1 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for critically endangered fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for critically endangered flora.
EN	Endangered species Threatened species considered to be "facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as endangered under section 19(1)(b) of the BC Act in accordance with the criteria set out in section 21 and the ministerial guidelines. Published under schedule 2 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for endangered fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for endangered flora.
VU	Vulnerable species Threatened species considered to be "facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as vulnerable under section 19(1)(c) of the BC Act in accordance with the criteria set out in section 22 and the ministerial guidelines. Published under schedule 3 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for vulnerable fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for vulnerable flora.

Extinct species: Listed by order of the Minister as extinct under section 23(1) of the BC Act as extinct or extinct in the wild.

Category	Definition
EX	Extinct species Species where "there is no reasonable doubt that the last member of the species has died", and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act). Published as presumed extinct under schedule 4 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for extinct fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for extinct flora.
EW	Extinct in the wild species Species that "is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form", and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act). Currently there are no Threatened fauna or Threatened flora species listed as extinct in the wild. If listing of a species as extinct in the wild occurs, then a schedule will be added to the applicable notice.

Specially protected species: Listed by order of the Minister as specially protected under section 13(1) of the BC Act. Meeting one or more of the following categories: species of special conservation interest; migratory species; cetaceans; species subject to international agreement; or species otherwise in need of special protection.

Species that are listed as Threatened species (critically endangered, endangered or vulnerable) or extinct species under the BC Act cannot also be listed as Specially Protected species.

MI	Migratory species Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines (section 15 of the BC Act). Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and fauna subject to the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention), an environmental treaty under the United Nations Environment Program. Migratory species listed under the BC Act are a subset of the migratory animals, that are known to visit Western Australia, protected under the international agreements or treaties, excluding species that are listed as Threatened species. Published as migratory birds protected under an international agreement under schedule 5 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.
CD	Species of special conservation interest (Conservation dependant fauna) Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as Threatened, and listing is otherwise in accordance with the ministerial guidelines (section 14 of the BC Act). Published as conservation dependent fauna under schedule 6 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.
OS	Other specially protected species Fauna otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines (section 18 of the BC Act). Published as other specially protected fauna under schedule 7 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.
¹ The definition of flora includes algae, fungi and lichens. ² Species includes all taxa (plural of taxon - a classificatory group of any taxonomic rank, e.g. a family, genus, species or any infraspecific category i.e. subspecies or variety, or a distinct population).	

Appendix A3: Definitions of Priority Species Classification (DBCA 2019)

Priority species: Possibly Threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna or Priority flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as Threatened fauna or flora.

Species that are adequately known, are rare but not Threatened, or meet criteria for near Threatened, or that have been recently removed from the Threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring.

Assessment of Priority codes is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.

Category	Definition
P1	Priority 1: Poorly-known species Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.
P2	Priority 2: Poorly-known species Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.
P3	Priority 3: Poorly-known species Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.
P4	Priority 4: Rare, Near Threatened and other species in need of monitoring (a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently Threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands. (b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent. (c) Species that have been removed from the list of Threatened species during the past five years for reasons other than taxonomy

Appendix B: Potential Species List – Fauna



Mammals

Family and Species	Common name	EPBC Act	BC Act	DBCA	DBCA Fauna Database 2019	NatureMap 2019	PMST 2019	Well Projects (APM 2012a)	Mt Mulgine (APM 2018b)	Blue Hills (BCE 2004)	Karara & Mungada (BCE 2006)	Hinge (BCE 2013a)	Rothsay (BCE 2017)	Blue Hills (ecologia 2011b)	Koolanooka (ATA 2004)	Current Survey
Tachyglossidae																
Tachyglossus aculeatus	Echidna, Short-beaked Echidna					•		•		•	•	•	•	•	•	•
Dasyuridae																
Dasyurus geoffroii	Chiditch, Western Quoll	VU	VU				•									
Pseudantechinus woolleyae	Woolley's Pseudantechinus					•					•					
Sminthopsis crassicaudata	Fat-tailed Dunnart					•										
Sminthopsis dolichura	Little Long-tailed Dunnart					•				•	•				•	
Macropodidae																
Macropus fuliginosus	Western Grey Kangaroo					•									•	
Notamacropus irma	Western Brush Wallaby			P4	•	•										
Osphranter robustus erubescens	Euro, Biggada (mainland)					•		•		•	•		•		•	MC
Osphranter rufus	Red Kangaroo, Marlu					•		•		•	•	•		•	•	•
Phalangeridae																
Trichosurus vulpecula	Brush-tailed Possum										•					
Molossidae																
Austronomus australis	White-striped Freetail-bat								•	•	•					
Ozimops petersi	Inland Free-tailed Bat								•							
Vespertilionidae																
Chalinolobus gouldii	Gould's Wattled Bat					•			•	•	•					•
Chalinolobus morio	Chocolate Wattled Bat					•										
Nyctophilus geoffroyi	Lesser Long-eared Bat					•			•		•					
Scotorepens greyii	Little Broad-nosed Bat										•					
Vespadelus baverstocki	Inland Forest Bat										•					
Vespadelus finlaysoni	Finlayson's Cave Bat					•			•						•	
Vespadelus regulus	Southern Forest Bat									•?						
Muridae																
Notomys alexis	Spinifex Hopping-mouse					•										
Notomys mitchelli	Mitchell's Hopping-mouse					•		•		•?	•					
Pseudomys hermannsburgensis	Sandy Inland Mouse										•					
*Rattus rattus	Black Rat														•	
*Mus musculus	House Mouse					•		•			•				•	
Leporidae																
*Oryctolagus cuniculus	Rabbit					•		•		•	•	•		•	•	•
Bovidae																
*Capra hircus	Goat					•		•		•	•	•	•	•	•	•
Canidae																

Family and Species	Common name	EPBC Act	BC Act	DBCA	DBCA Fauna Database 2019	NatureMap 2019	PMST 2019	Well Projects (APM 2012a)	Mt Mulgine (APM 2018b)	Blue Hills (BCE 2004)	Karara & Mungada (BCE 2006)	Hinge (BCE 2013a)	Rothsay (BCE 2017)	Blue Hills (ecologia 2011b)	Koolanooka (ATA 2004)	Current Survey
<i>Canis lupus dingo</i>	Dingo										•					
* <i>Vulpes vulpes</i>	Red Fox					•				•	•				•	
Felidae																
* <i>Felis catus</i>	Domestic Cat					•				•		•		•	•	•

S = Secondary evidence was recorded

Birds

Family and Species	Common name	EPBC Act	BC Act	DBCA	DBCA Fauna Database 2019	NatureMap 2019	PMST 2019	Well Projects (APM 2012a)	Mt Mulgine (APM 2018b)	Blue Hills (BCE 2004)	Karara & Mungada (BCE 2006)	Hinge (BCE 2013)	Rothsay (BCE 2017)	Blue Hills (ecologia 2011b)	Koolanooka (ATA 2004)	Current Survey
Casuariidae																
<i>Dromaius novaehollandiae</i>	Emu					•		•		•	•	•	•	•	•	•
Megapodiidae																
<i>Leipoa ocellata</i>	Malleefowl	VU	VU		•	•	•	•	•	•	•	•		•		•
Phasianidae																
* <i>Gallus gallus</i>	Red Junglefowl (Domestic Chicken)					•										
Anatidae																
<i>Biziura lobata</i>	Musk Duck					•										
<i>Stictonetta naevosa</i>	Freckled Duck					•										
<i>Cygnus atratus</i>	Black Swan					•										
<i>Tadorna tadornoides</i>	Australian Shelduck					•				•					•	
<i>Chenonetta jubata</i>	Australian Wood Duck					•										
<i>Malacorhynchus membranaceus</i>	Pink-eared Duck					•										
<i>Anas gracilis</i>	Grey Teal					•		•			•			•		
<i>Anas superciliosus</i>	Pacific Black Duck					•		•								
<i>Oxyura australis</i>	Blue-billed Duck															
Podicipedidae																
<i>Tachybaptus novaehollandiae</i>	Australasian Grebe							•							•	
Columbidae																
<i>Phaps chalcoptera</i>	Common Bronzewing					•		•		•	•	•		•	•	•
<i>Ocyphaps lophotes</i>	Crested Pigeon					•		•		•		•			•	
<i>Geopelia cuneata</i>	Diamond Dove					•										
Podargidae																
<i>Podargus strigoides</i>	Tawny Frogmouth					•		•		•					•	
Eurostopodidae																
<i>Eurostopodus argus</i>	Spotted Nightjar					•		•		•		•			•	
Aegothelidae																
<i>Aegotheles cristatus</i>	Australian Owlet Nightjar					•		•		•						

Family and Species	Common name	EPBC Act	BC Act	DBCA	DBCA Fauna Database 2019	NatureMap 2019	PMST 2019	Well Projects (APM 2012a)	Mt Mulgine (APM 2018b)	Blue Hills (BCE 2004)	Karara & Mungada (BCE 2006)	Hinge (BCE 2013)	Rothsay (BCE 2017)	Blue Hills (ecologia 2011b)	Koolanooka (ATA 2004)	Current Survey
Apodidae																
<i>Apus pacificus</i>	Fork-tailed Swift	IA	IA				•									
Ardeidae																
<i>Ardea pacifica</i>	White-necked Heron					•										
<i>Egretta novaehollandiae</i>	White-faced Heron					•										
Threskiornithidae																
<i>Threskiornis molucca</i>	Australian White Ibis					•										
<i>Threskiornis spinicollis</i>	Straw-necked Ibis					•										
Accipitridae																
<i>Lophoictinia isura</i>	Square-tailed Kite							•								
<i>Haliastur sphenurus</i>	Whistling Kite							•								
<i>Accipiter fasciatus</i>	Brown Goshawk					•		•		•		•			•	•
<i>Accipiter cirrocephalus</i>	Collared Sparrowhawk					•		•		•						
<i>Circus assimilis</i>	Spotted Harrier														•	
<i>Aquila audax</i>	Wedge-tailed Eagle					•		•		•	•			•	•	
<i>Hieraeetus morphnoides</i>	Little Eagle					•										•
Falconidae																
<i>Falco cenchroides</i>	Nankeen Kestrel					•		•		•					•	
<i>Falco berigora</i>	Brown Falcon					•		•		•	•	•	•	•	•	•
<i>Falco longipennis</i>	Australian Hobby					•		•								
<i>Falco subniger</i>	Black Falcon							•								
<i>Falco peregrinus</i>	Peregrine Falcon		OS		•	•		•		•						
Rallidae																
<i>Fulica atra</i>	Eurasian Coot					•									•	
Otididae																
<i>Ardeotis australis</i>	Australian Bustard					•		•								
Burhinidae																
<i>Burhinus grallarius</i>	Bush Stone-curlew					•										
Recurvirostridae																
<i>Himantopus himantopus</i>	Black-winged Stilt					•										
<i>Recurvirostra novaehollandiae</i>	Red-necked Avocet					•										
<i>Cladorhynchus leucocephalus</i>	Banded Stilt					•										
Charadriidae																
<i>Charadrius ruficapillus</i>	Red-capped Plover					•										
<i>Elsayornis melanops</i>	Black-fronted Dotterel					•										
<i>Thinornis rubricollis [ex Charadrius]</i>	Hooded Plover			P4		•										
<i>Erythrogonyys cinctus</i>	Red-kneed Dotterel					•										
<i>Vanellus tricolor</i>	Banded Lapwing					•										

Family and Species	Common name	EPBC Act	BC Act	DBCA	DBCA Fauna Database 2019	NatureMap 2019	PMST 2019	Well Projects (APM 2012a)	Mt Mulgine (APM 2018b)	Blue Hills (BCE 2004)	Karara & Mungada (BCE 2006)	Hinge (BCE 2013)	Rothsay (BCE 2017)	Blue Hills (ecologia 2011b)	Koolanooka (ATA 2004)	Current Survey
Scolopacidae																
<i>Rostratula benghalensis australis</i>	Australian Painted Snipe	EN	EN				•									
Scolopacidae																
<i>Tringa nebularia</i>	Common Greenshank	IA	IA			•	•									
Turnicidae																
<i>Turnix varius varius</i>	Painted Button-quail (mainland)									•						
<i>Turnix velox</i>	Little Button-quail					•										
Cacatuidae																
<i>Calyptorhynchus banksii</i>	Red-tailed Black Cockatoo					•		•		•					•	•
<i>Lophochroa leadbeateri (ex Cacatua)</i>	Major Mitchell's Cockatoo					•		•		•		•	•			○
<i>Eolophus roseicapillus</i>	Galah					•		•		•	•	•		•	•	•
<i>Cacatua pastinator butleri</i>	Western Corella					•										
<i>Cacatua sanguinea westralensis</i>	Little Corella (Pilbara-Murchison-Wheatbelt)														•	
<i>Nymphicus hollandicus</i>	Cockatiel					•		•				•				
Psittaculidae																
<i>Glossopsitta porphyrocephala</i>	Purple-crowned Lorikeet					•				•						
<i>Polytelis anthopeplus</i>	Regent Parrot					•		•		•						
<i>Barnardius zonarius</i>	Australian Ringneck					•		•		•	•	•	•	•	•	•
<i>Psephotus varius</i>	Mulga Parrot					•		•		•	•	•	•	•	•	
<i>Melopsittacus undulatus</i>	Budgerigar					•		•		•		•				
<i>Neopsephotus bourkii</i>	Bourke's Parrot					•		•								
<i>Pezoporus occidentalis</i>	Night Parrot	EN	CR		•	•	•									
Cuculidae																
<i>Chalcites basalus</i>	Horsfield's Bronze-Cuckoo							•		•						
<i>Chalcites osculans (=Chrysococcyx)</i>	Black-eared Cuckoo					•		•		•						
<i>Chalcites lucidus</i>	Shining Bronze-Cuckoo									•						
<i>Cacomantis pallidus</i>	Pallid Cuckoo					•		•								
Strigidae																
<i>Ninox novaeseelandiae</i>	Southern Boobook					•				•						
Halcyonidae																
<i>Todiramphus pyrrhopygia</i>	Red-backed Kingfisher					•		•								•
<i>Todiramphus sanctus</i>	Sacred Kingfisher					•										
Meropidae																
<i>Merops ornatus</i>	Rainbow Bee-eater					•		•		•					•	•
Climacteridae																
<i>Climacteris rufa</i>	Rufous Treecreeper					•							•			
Ptilonorhynchidae																

Family and Species	Common name	EPBC Act	BC Act	DBCA	DBCA Fauna Database 2019	NatureMap 2019	PMST 2019	Well Projects (APM 2012a)	Mt Mulgine (APM 2018b)	Blue Hills (BCE 2004)	Karara & Mungada (BCE 2006)	Hinge (BCE 2013)	Rothsay (BCE 2017)	Blue Hills (ecologia 2011b)	Koolanooka (ATA 2004)	Current Survey
<i>Ptilonorhynchus guttatus</i>	Western Bowerbird										•			•		
Maluridae																
<i>Malurus splendens</i>	Splendid Fairy-wren					•		•		•	•	•		•	•	•
<i>Malurus leucopterus leuconotus</i>	White-winged Fairy-wren (mainland)					•		•					•		•	
<i>Malurus lamberti</i>	Variegated Fairy-wren					•		•		•			•		•	
Acanthizidae																
<i>Sericornis frontalis</i>	White-browed Scrubwren					•						•				
<i>Pyrrholaemus brunneus</i>	Redthroat					•		•		•	•	•	•	•	•	•
<i>Smicronis brevirostris</i>	Weebill					•		•		•	•	•	•	•	•	•
<i>Gerygone fusca fusca</i>	Western Gerygone					•		•		•	•			•		
<i>Acanthiza robustirostris</i>	Slaty-backed Thornbill					•		•		•		•				
<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill					•		•		•			•		•	
<i>Acanthiza uropygialis</i>	Chestnut-rumped Thornbill					•		•		•	•	•	•	•	•	•
<i>Acanthiza iredalei iredalei</i>	Slender-billed Thornbill (western)					•										
<i>Acanthiza apicalis</i>	Broad-tailed (Inland) Thornbill					•		•		•	•	•		•	•	•
<i>Aphelocephala leucopsis</i>	Southern Whiteface					•		•		•					•	•
Pardalotidae																
<i>Pardalotus striatus</i>	Striated Pardalote					•		•		•					•	•
Meliphagidae																
<i>Certhionyx variegatus</i>	Pied Honeyeater					•		•			•			•	•	
<i>Gavicalis virescens</i>	Singing Honeyeater							•		•	•	•	•	•	•	
<i>Nesoptilotis leucotis</i>	White-eared Honeyeater														•	
<i>Ptilotula plumulus</i>	Grey-fronted Honeyeater					•										
<i>Purnella albifrons</i>	White-fronted Honeyeater					•		•		•	•	•		•	•	•
<i>Manorina flavigula</i>	Yellow-throated Miner					•		•		•	•	•	•	•	•	
<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater					•		•		•	•	•		•		•
<i>Anthochaera carunculata</i>	Red Wattlebird					•		•		•					•	
<i>Conopophila whitei</i>	Grey Honeyeater					•										
<i>Epthianura tricolor</i>	Crimson Chat					•		•			•			•	•	•
<i>Epthianura aurifrons</i>	Orange Chat														•	
<i>Epthianura albifrons</i>	White-fronted Chat					•										
<i>Sugomel niger</i>	Black Honeyeater					•										
<i>Lichmera indistincta</i>	Brown Honeyeater					•		•		•	•			•		
<i>Melithreptus brevirostris</i>	Brown-headed Honeyeater					•		•		•						
Pomatostomidae																
<i>Pomatostomus temporalis</i>	Grey-crowned Babbler					•		•								•
<i>Pomatostomus superciliosus</i>	White-browed Babbler					•		•		•	•	•		•	•	

Family and Species	Common name	EPBC Act	BC Act	DBCA	DBCA Fauna Database 2019	NatureMap 2019	PMST 2019	Well Projects (APM 2012a)	Mt Mulgine (APM 2018b)	Blue Hills (BCE 2004)	Karara & Mungada (BCE 2006)	Hinge (BCE 2013)	Rothsay (BCE 2017)	Blue Hills (ecologia 2011b)	Koolanooka (ATA 2004)	Current Survey
Cinclosomatidae																
<i>Cinclosoma clarum</i>	Western Chestnut Quail-thrush					•		•		•		•	•	•		•
<i>Cinclosoma marginatum</i>	Western Quail-thrush					•		•			•					
Psophodidae																
<i>Psophodes occidentalis</i>	Chiming Wedgebill					•										
Neosittidae																
<i>Daphoenositta chrysoptera</i>	Varied Sittella					•		•		•						
Campephagidae																
<i>Coracina maxima</i>	Ground Cuckoo-shrike					•										
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike					•		•		•					•	
<i>Lalage sueurii</i>	White-winged Triller					•		•				•				
Pachycephalidae																
<i>Pachycephala inornata</i>	Gilbert's Whistler							•		•						
<i>Pachycephala pectoralis</i>	Golden Whistler					•				•		•				
<i>Pachycephala rufiventris</i>	Rufous Whistler					•		•		•	•	•	•	•	•	•
<i>Colluricincla harmonica</i>	Grey Shrike-thrush					•		•		•	•	•		•	•	•
<i>Oreoica gutturalis</i>	Crested Bellbird					•?		•		•	•	•		•	•	•
Artamidae																
<i>Artamus personatus</i>	Masked Woodswallow					•		•				•				
<i>Artamus superciliosus</i>	White-browed Woodswallow					•										
<i>Artamus cinereus</i>	Black-faced Woodswallow					•		•		•		•			•	•
<i>Artamus cyanopterus</i>	Dusky Woodswallow					•										
<i>Artamus minor</i>	Little Woodswallow					•		•		•			•		•	•
Cracticidae																
<i>Cracticus torquatus</i>	Grey Butcherbird					•		•		•		•				•
<i>Cracticus nigrogularis</i>	Pied Butcherbird					•		•		•					•	•
<i>Cracticus tibicen</i>	Australian Magpie					•		•		•		•			•	
<i>Strepera versicolor</i>	Grey Currawong					•		•		•						•
Rhipiduridae																
<i>Rhipidura albiscapa</i>	Grey Fantail					•		•		•	•			•		•
<i>Rhipidura leucophrys</i>	Willie Wagtail					•		•		•		•	•		•	•
Corvidae																
<i>Corvus coronoides</i>	Australian Raven					•				•	•	•	•	•	•	
<i>Corvus bennetti</i>	Little Crow					•				•		•			•	•
<i>Corvus orru</i>	Torresian Crow					•		•		•	•			•		•
Monarchidae																
<i>Grallina cyanoleuca</i>	Magpie-Lark					•		•							•	
Petroicidae																

Family and Species	Common name	EPBC Act	BC Act	DBCA	DBCA Fauna Database 2019	NatureMap 2019	PMST 2019	Well Projects (APM 2012a)	Mt Mulgine (APM 2018b)	Blue Hills (BCE 2004)	Karara & Mungada (BCE 2006)	Hinge (BCE 2013)	Rothsay (BCE 2017)	Blue Hills (ecologia 2011b)	Koolanooka (ATA 2004)	Current Survey
<i>Microeca fascinans</i>	Jacky Winter					•										•
<i>Petroica boodang (ex multicolor)</i>	Scarlet Robin									•						
<i>Petroica goodenovii</i>	Red-capped Robin					•		•		•	•	•	•	•	•	•
<i>Melanodryas cucullata</i>	Hooded Robin							•								
<i>Eopsaltria griseogularis</i>	Western Yellow Robin					•		•		•		•			•	•
<i>Drymodes brunneopygia</i>	Southern Scrub-robin					•										
Megaluridae																
<i>Megalurus gramineus</i>	Little Grassbird					•										
<i>Cincloramphus mathewsi</i>	Rufous Songlark					•									•	
Timaliidae																
<i>Zosterops lateralis</i>	Silvereye					•										
Hirundinidae																
<i>Cheramoeca leucosterna</i>	White-backed Swallow					•		•								
<i>Hirundo neoxena</i>	Welcome Swallow					•		•		•	•			•	•	•
<i>Petrochelidon ariel</i>	Fairy Martin					•		•								
<i>Petrochelidon nigricans</i>	Tree Martin					•		•		•	•	•		•	•	
Nectariniidae																
<i>Dicaeum hirundinaceum</i>	Mistletoebird									•						•
Estrildidae																
<i>Taeniopygia guttata</i>	Zebra Finch					•		•				•	•		•	•
Motacillidae																
<i>Anthus novaeseelandiae</i>	Australasian Pipit							•		•					•	•

O=Recorded Outside the Project area, S=Secondary evidence recorded,

Reptiles

Family and Species	Common name	EPBC Act	BC Act	DBCA	DBCA Fauna Database 2019	NatureMap 2019	PMST 2019	Well Projects (APM 2012a)	Mt Mulgine (APM 2018b)	Blue Hills (BCE 2004)	Karara & Mungada (BCE 2006)	Hinge (BCE 2013)	Rothsay (BCE 2017)	Blue Hills (ecologia 2011b)	Koolanooka (ATA 2004)	Current Survey
Carphodactylidae																
<i>Underwoodisaurus milii</i>	Barking Gecko									•					•	•
Diplodactylidae																
<i>Diplodactylus granariensis</i>	Western Stone Gecko							•		•						
<i>Diplodactylus pulcher</i>	Fine-faced Gecko					•		•		•					•	
<i>Hesperoedura reticulata</i>	Reticulated Velvet Gecko									•						
<i>Lucasium squarrosum</i>	Spotted Ground Gecko					•				•					•	
<i>Rhynchoedura ornata</i>	Western Beaked Gecko					•				•		•				
<i>Strophurus strophurus</i>	Western Spiny-tail Gecko					•					•			•	•	

Family and Species	Common name	EPBC Act	BC Act	DBCA	DBCA Fauna Database 2019	NatureMap 2019	PMST 2019	Well Projects (APM 2012a)	Mt Mulgine (APM 2018b)	Blue Hills (BCE 2004)	Karara & Mungada (BCE 2006)	Hinge (BCE 2013)	Rothsay (BCE 2017)	Blue Hills (ecologia 2011b)	Koolanooka (ATA 2004)	Current Survey
Gekkonidae																
<i>Gehyra variegata</i>	Common Dtella					•		•		•	•			•	•	•
<i>Heteronotia binoei</i>	Bynoe's Prickly Gecko					•		•		•	•			•	•	•
Pygopodidae																
<i>Delma australis</i>	Southern (Marble-faced) Delma					•				•	•			•	•	
<i>Lialis burtonis</i>	Burton's Legless lizard							•		•						
Agamidae																
<i>Ctenophorus maculatus</i>	Spotted Military Dragon							•								
<i>Ctenophorus nuchalis</i>	Central Netted Dragon					•									•	
<i>Ctenophorus ornatus</i>	Ornate Crevice Dragon					•										
<i>Ctenophorus reticulatus</i>	Western Netted Dragon					•				•					•	•
<i>Ctenophorus scutulatus</i>	Lozenge-marked Dragon					•		•		•		•			•	•
<i>Diporiphora amphiboluroides</i> (ex <i>Caimanops</i>)	Mulga Dragon									•						
<i>Moloch horridus</i>	Thorny Devil					•						•				
<i>Pogona minor (minor)</i>	Western Bearded Dragon					•		•		•					•	•
Scincidae																
<i>Cryptoblepharus buchanani</i>	Buchanan's Snake-eyed Skink					•				•		•				
<i>Cryptoblepharus plagiocephalus</i>	Péron's Snake-eyed Skink							•							•	
<i>Ctenotus mimetes</i>	Checker-sided Ctenotus					•				•					•	
<i>Ctenotus schomburgkii</i>	Barred Wedge-snout Ctenotus					•				•						•
<i>Ctenotus inornatus</i> (incl. <i>C. severus</i>)	Stern Ctenotus					•										•
<i>Ctenotus uber uber</i>	Spotted Ctenotus					•		•		•						•
<i>Cyclodomorphus branchialis</i>	Gilled Slender Bluetongue		VU		•	•				•					•	•
<i>Egernia depressa</i>	Southern Pygmy Spiny-tailed Skink					•		•		•		•			•	
<i>Egernia stokesii badia</i>	Western Spiny-tail Skink	EN	VU		•	•	•		•			•			•	○
<i>Eremiascincus richardsonii</i>	Broad-banded Sandswimmer					•		•		•						
<i>Lerista gerrardii</i>	Bold-striped Robust Slider					•				•	•			•	•	•
<i>Lerista kingi</i> (ex <i>muelleri</i>)	King's Lerista					•				•	•			•	•	•
<i>Lerista nicholli</i>	Inland Broad-blazed Slider					•					•			•		
<i>Liopholis inornata</i>	Desert Skink					•										
<i>Menetia greyii</i> (incl. <i>M. amaura</i>)	Common Dwarf Skink					•		•		•			•		•	•
<i>Morethia butleri</i>	Woodland Morethia Skink					•				•					•	•
<i>Morethia obscura</i>	Shrubland Morethia Skink					•										
<i>Tiliqua occipitalis</i>	Western Bluetongue							•		•						
<i>Tiliqua rugosa rugosa</i>	Bobtail					•									•	
Varanidae																
<i>Varanus caudolineatus</i>	Stripe-tailed Monitor					•		•		•					•	

Family and Species	Common name	EPBC Act	BC Act	DBCA	DBCA Fauna Database 2019	NatureMap 2019	PMST 2019	Well Projects (APM 2012a)	Mt Mulgine (APM 2018b)	Blue Hills (BCE 2004)	Karara & Mungada (BCE 2006)	Hinge (BCE 2013)	Rothsay (BCE 2017)	Blue Hills (ecologia 2011b)	Koolanooka (ATA 2004)	Current Survey
<i>Varanus giganteus</i>	Perentie					•				•						•
<i>Varanus gouldii</i>	Gould's Sand Monitor					•		•		•		•			•	
<i>Varanus panoptes</i>	Yellow-spotted Monitor					•		•		•			•			•
<i>Varanus tristis</i>	Black-tailed Monitor					•		•		•			•			
Typhlopidae																
<i>Anilius hamatus</i>	Pale-headed Blindsnake									•						
Pythonidae																
<i>Antaresia stimsoni</i>	Stimson's Python									•					•	
Elapidae																
<i>Demansia psammophis reticulata</i>	Yellow-faced Whipsnake (SW)														•	
<i>Furina ornata</i>	Moon Snake							•								
<i>Neelaps bimaculatus</i>	Black-naped Snake										•			•		
<i>Parasuta monachus</i>	Monk Snake					•		•		•						
<i>Pseudechis australis</i>	Mulga Snake, King Brown									•						
<i>Pseudechis butleri</i>	Spotted Mulga Snake					•				•						
<i>Pseudonaja mengdeni (ex nuchalis)</i>	Gwardar, Western Brown Snake					•		•							•	
<i>Pseudonaja modesta</i>	Ringed Brown Snake					•				•						
<i>Simoselaps bertholdi</i>	Jan's Banded Snake					•				•	•			•		•
<i>Suta fasciata</i>	Rosen's Snake					•										

Amphibians

Family and Species	Common name	EPBC Act	BC Act	DBCA	NatureMap 2019	PMST 2019	Well Projects (APM 2012a)	Mt Mulgine (APM 2018b)	Blue Hills (BCE 2004)	Karara & Mungada (BCE 2006)	Hinge (BCE 2013)	Rothsay (BCE 2017)	Blue Hills (ecologia 2011b)	Koolanooka (ATA 2004)	Current Survey
Hylidae															
<i>Cyclorana platycephala</i>	Water-holding Frog				●										
Limnodynastidae															
<i>Neobatrachus sudellae</i>	Desert Trilling Frog								●						
<i>Neobatrachus sutor</i>	Shoemaker Ftrog				●										
<i>Neobatrachus wilsmorei</i>	Plonking Frog				●										
Myobatrachidae															
<i>Pseudophryne occidentalis</i>	Western Toadlet				●					●			●		●

Appendix C: SRE Database Search Results



Family and Species	Previous records
ARACHNIDS	
Araneidae	
<i>Phonognatha pallida</i>	One record from Charles Darwin reserve (30 km south).
Corinnidae	
<i>Battalus helenstarkae</i>	Two records from Mt Gibson (45 km south east).
<i>Battalus</i> 'boolathana? (female)'	One record from Lochada Station (40 km west).
Gnaphosidae	
'CDR gen. 1' 'CDR sp. 1'	One record from Charles Darwin reserve (30 km south).
<i>Encoptarthria</i> 'CDR sp. 1'	One record from Charles Darwin reserve (30 km south).
<i>Encoptarthria</i> 'group'	One record from Mt Gibson (45 km south east).
Hersiliidae	
<i>Tamopsis</i> 'CDR sp. 1'	Two records from Charles Darwin reserve (30-40 km south).
Lamponidae	
<i>Lampona</i> 'folifera?'	One record from Charles Darwin reserve (30 km south).
<i>Lampona</i> 'CDR sp. 1'	One record from Charles Darwin reserve (30 km south).
<i>Notsodipus</i> 'sp. nov.'	One record from Lochada Nature Reserve (5 km north west).
Prodidomidae	
<i>Wesmaladra baynesi</i>	One record from Warriadar Station (11 km north).
Salticidae	
<i>Adoxotoma</i> 'CDR sp. 1'	19 records from Charles Darwin reserve and Mt Gibson (30-50 km south).
<i>Adoxotoma</i> 'sp.'	Two records from Mt Gibson (45 km south east).
<i>Damoetas</i> 'CDR sp. 1'	One record from Charles Darwin reserve (40 km south).
Sparassidae	
<i>Delena</i> 'sp. 6'	One record from Mt Gibson (42 km south).
Theridiidae	
<i>Episinus</i> 'sp. indet. (juvenile)'	One record from Lochada Station (40 km west).
<i>Latrodectus</i> 'hasseltii'	One record from Lochada Station (40 km west) and two records from the northern Jarrah forest (230-300 km south).
Thomisidae	
<i>Tharpyna</i> 'sp. indet. (juvenile)'	One record from Lochada Station (40 km west).
Zodariidae	
<i>Australutica</i> 'CDR sp. 1'	Three records from Charles Darwin reserve (30-40 km south).
<i>Habronestes</i> 'CDR sp. 1'	One record from Charles Darwin reserve (30 km south).
<i>Habronestes</i> 'CDR sp. 2'	One record from Charles Darwin reserve (30 km south).
<i>Habronestes</i> 'CDR sp. 3'	One record from Charles Darwin reserve (30 km south).
'Habronestes?' 'CDR sp. 4'	Two records from Charles Darwin reserve (30-40 km south).
Dipluridae	
<i>Cethegus</i> 'sp. nov. (cf. ischnotheloides)'	One record from Mt Gibson (45 km south).
Halonoproctidae	

Family and Species	Previous records
<i>Conothele</i> `MYG550`	Four records from Mummaloo, Charles Darwin Reserve & Mt Gibson (40-45 km south).
Idiopidae	
<i>Eucyrtops</i> `MYG148`	One record from Mt Gibson (45 km south).
<i>Idiosoma</i> `Mt Gibson sp. 1`	One record from Mt Gibson (45 km south).
<i>Idiosoma kopejtkai</i>	21 records from the region south of the Project (38-110 km).
Nemesiidae	
<i>Aname</i> `Mt Gibson sp. 2`	One record from Mt Gibson (45 km south).
<i>Aname</i> `MYG001 group, Mt Gibson 1`	Four records from Mt Gibson (45 km south).
<i>Aname</i> `MYG001 group, Mt Gibson 2`	Three records from Mt Gibson (45 km south).
<i>Aname</i> `MYG332`	Four records from Mt Gibson (45 km south).
<i>Aname</i> `MYG363`	Three records from Mt Gibson (45 km south).
<i>Kwonkan</i> `MYG058`	One record from Mt Gibson (45 km south).
<i>Teyl</i> `MYG022`	One record from Mt Gibson (45 km south).
<i>Teyl</i> `MYG345`	One record from Lochada Station (40 km west).
Buthidae	
<i>Isometroides</i> `laverton3`	One record from Mt Gibson (45 km south).
Urodacidae	
<i>Urodacus</i> `blue hills`	Four records from Mungada Ridge (7 km west).
<i>Urodacus</i> `gibson4`	18 records from Mt Gibson (45 km south east).
<i>Urodacus</i> `karara`	One record from Karara Station (10 km north west).
<i>Urodacus</i> `koolanooka`	Two records from Mungada Ridge (7 km west).
<i>Urodacus</i> `sp. indet. (laverton2 or laverton3?)`	One record from Charles Darwin reserve (35 km south west).
Chthoniidae	
<i>Tyrannochthonius</i> sp.nov.Blue Hills	One record from Mungada Ridge (7 km west).
Garypidae	
<i>Synsphyronus</i> `PSE071`	One record from Lochada Station (40 km west).
<i>Synsphyronus christopherdarwini</i>	16 records from Charles Darwin reserve (30-40 km south).
Olpiidae	
<i>Austrohorus</i> `similis`	One record from Blue Hills (11 km west).
MYRIAPODA	
Paradoxosomatidae	
<i>Antichiropus</i> `DIP146, karara`	One record from Mt Karara (15 km west).
<i>Antichiropus</i> `karara`	Three records from Blue Hills (1-15 km north & west).
<i>Antichiropus alatus</i>	14 records from Mt Gibson and surrounds (30-70 km south east).
<i>Antichiropus westi</i>	48 records from Mt Gibson and Helena-Aurora Range (45-300 km south east).
Scolopendridae	
<i>Cormocephalus westanglasensis</i>	One record from Charles Darwin reserve (30 km south).
CRUSTACEANS	
Cyprididae	

Family and Species	Previous records
<i>Ilyodromus hiatus</i>	35 records from Wannara Rock (37 km south west).
Cypridopsidae	
<i>Sarscypridopsis ochracea</i>	Four records from Karara (15-30 km west) and Bogoda Well (250 km north).
MOLLUSCS	
Bulimulidae	
<i>Bothriembryon</i> sp.	One record from adjacent to the Project area and four records from surrounding region south east to Mt Gibson.

Appendix D: Site Locations



Level 1/Targeted Fauna Search Sites

Site Name	Easting	Northing	Site Type	Site Name	Easting	Northing	Site Type
I1008	500976	6770234	Quadrat	Excl01	497674	6771589	Quadrat
I1031	497315	6769958	Quadrat	Excl02	498121	6771256	Quadrat
I1107	495219	6769703	Quadrat	Opp01	497769	6771858	Quadrat
I1114	496424	6769672	Quadrat	Opp02	497877	6771996	Active Search
I1281	494869	6768972	Quadrat	Opp03	497851	6771924	Quadrat
I1463	495909	6768303	Quadrat	Opp04	499540	6771518	Quadrat
I1551	495923	6767933	Quadrat	Opp05	499268	6772056	Quadrat
I1877	501174	6770709	Quadrat	Opp06	494816	6770790	Quadrat
I257	500289	6773103	Quadrat	Opp07	494762	6769595	Quadrat
I372	497515	6772648	Quadrat	Opp08	495884	6768048	Quadrat
I473	499765	6772332	Quadrat	Opp09	497552	6768509	Quadrat
I512	498878	6772055	Quadrat	I1008	500976	6770234	Quadrat
I545	497068	6771864	Quadrat	HA01	497195	6770328	Habitat Assessment
I583	495917	6771760	Quadrat	HA02	497238	6770449	Habitat Assessment
I828	500319	6770879	Quadrat	HA03	501146	6770613	Habitat Assessment
I868	499580	6770721	Quadrat	HA04	500051	6770794	Habitat Assessment
I907	497341	6770506	Quadrat				
I990	497828	6770213	Quadrat				
I991	498003	6770171	Quadrat				
I997	499049	6770150	Quadrat				

Preclearance drillpad sites

Site Name	Easting	Northing	Site Type	Site Name	Easting	Northing	Site Type
Preclearance Ph 1							
MRT040	496167	6772336	20m x 20m	MRT156	496249	6772875	20m x 20m
MRT041	496139	6772364	20m x 20m	MRT157	496220	6772903	20m x 20m
MRT042	496110	6772392	20m x 20m	MRT158	496192	6772931	20m x 20m
MRT043	496082	6772420	20m x 20m	MRT183	496454	6772898	20m x 20m
MRT044	496053	6772449	20m x 20m	MRT184	496426	6772926	20m x 20m
MRT045	496025	6772477	20m x 20m	MRT185	496397	6772954	20m x 20m
MRT071	496252	6772422	20m x 20m	MRT186	496369	6772982	20m x 20m
MRT072	496223	6772450	20m x 20m	MRT187	496340	6773010	20m x 20m
MRT073	496195	6772478	20m x 20m	MRT188	496311	6773039	20m x 20m
MRT074	496166	6772506	20m x 20m	MRT189	496283	6773067	20m x 20m
MRT075	496138	6772534	20m x 20m	MRT200	496532	6772934	20m x 20m
MRT076	496109	6772562	20m x 20m	MRT201	496503	6772962	20m x 20m
MRT077	496081	6772591	20m x 20m	MRT202	496475	6772990	20m x 20m
MRT078	496052	6772619	20m x 20m	MRT203	496446	6773018	20m x 20m
MRT099	496308	6772535	20m x 20m	MRT204	496418	6773046	20m x 20m

MRT100	496279	6772563	20m x 20m	MRT205	496389	6773075	20m x 20m
MRT101	496251	6772592	20m x 20m	MRT206	496361	6773103	20m x 20m
MRT102	496222	6772620	20m x 20m	MRT207	496332	6773131	20m x 20m
MRT103	496194	6772648	20m x 20m	MRT243	496616	6773076	20m x 20m
MRT104	496165	6772676	20m x 20m	MRT244	496587	6773104	20m x 20m
MRT105	496136	6772704	20m x 20m	MRT245	496559	6773132	20m x 20m
MRT106	496108	6772732	20m x 20m	MRT246	496530	6773161	20m x 20m
MRT131	496335	6772677	20m x 20m	MRT247	496502	6773189	20m x 20m
MRT132	496307	6772705	20m x 20m	MRT248	496473	6773217	20m x 20m
MRT133	496278	6772734	20m x 20m	MRT249	496445	6773245	20m x 20m
MRT134	496249	6772762	20m x 20m	MRT260	496687	6773119	20m x 20m
MRT135	496221	6772790	20m x 20m	MRT261	496658	6773147	20m x 20m
MRT136	496192	6772818	20m x 20m	MRT262	496630	6773175	20m x 20m
MRT137	496164	6772846	20m x 20m	MRT263	496601	6773203	20m x 20m
MRT151	496391	6772734	20m x 20m	MRT264	496572	6773232	20m x 20m
MRT152	496363	6772762	20m x 20m	MRT265	496544	6773260	20m x 20m
MRT153	496334	6772791	20m x 20m	MRT266	496515	6773288	20m x 20m
MRT154	496306	6772819	20m x 20m	MRT267	496487	6773316	20m x 20m
MRT155	496277	6772847	20m x 20m	MRT268	496458	6773344	20m x 20m
Preclearance Ph 2							
MRT030	496139	6772307	20m x 20m	MRT216	496360	6773159	20m x 20m
MRT031	496111	6772336	20m x 20m	MRT217	496332	6773188	20m x 20m
MRT032	496082	6772364	20m x 20m	MRT218	496303	6773216	20m x 20m
MRT033	496053	6772392	20m x 20m	MRT219	496275	6773244	20m x 20m
MRT034	496025	6772420	20m x 20m	MRT220	496246	6773272	20m x 20m
MRT035	495996	6772448	20m x 20m	MRT227	496617	6772963	20m x 20m
MRT036	495968	6772476	20m x 20m	MRT230	496531	6773047	20m x 20m
MRT046	495996	6772505	20m x 20m	MRT234	496588	6773047	20m x 20m
MRT057	496224	6772393	20m x 20m	MRT235	496559	6773076	20m x 20m
MRT058	496195	6772421	20m x 20m	MRT236	496531	6773104	20m x 20m
MRT059	496166	6772449	20m x 20m	MRT237	496502	6773132	20m x 20m
MRT060	496138	6772477	20m x 20m	MRT238	496474	6773160	20m x 20m
MRT061	496109	6772506	20m x 20m	MRT239	496445	6773188	20m x 20m
MRT062	496081	6772534	20m x 20m	MRT240	496417	6773216	20m x 20m
MRT063	496052	6772562	20m x 20m	MRT241	496388	6773245	20m x 20m
MRT064	496024	6772590	20m x 20m	MRT242	496360	6773273	20m x 20m
MRT079	496023	6772647	20m x 20m	MRT250	496416	6773273	20m x 20m
MRT080	495995	6772675	20m x 20m	MRT251	496388	6773301	20m x 20m
MRT083	496223	6772506	20m x 20m	MRT252	496359	6773329	20m x 20m
MRT084	496194	6772535	20m x 20m	MRT253	496673	6773076	20m x 20m

MRT085	496166	6772563	20m x 20m	MRT255	496616	6773133	20m x 20m
MRT086	496137	6772591	20m x 20m	MRT269	496430	6773372	20m x 20m
MRT087	496109	6772619	20m x 20m	MRT270	496401	6773401	20m x 20m
MRT088	496080	6772647	20m x 20m	MRT271	496373	6773429	20m x 20m
MRT089	496052	6772675	20m x 20m	MRT272a	496654	6773207	20m x 20m
MRT090	496023	6772704	20m x 20m	MRT275	496508	6773352	20m x 20m
MRT091	495995	6772732	20m x 20m	MRT285	496586	6773331	20m x 20m
MRT092	495966	6772760	20m x 20m	MRT286	496557	6773359	20m x 20m
MRT107	496079	6772761	20m x 20m	MRT287	496529	6773387	20m x 20m
MRT108	496051	6772789	20m x 20m	MRT288	496500	6773415	20m x 20m
MRT121	496335	6772621	20m x 20m	MRT289	496472	6773444	20m x 20m
MRT122	496307	6772649	20m x 20m	MRT291	496603	6773370	20m x 20m
MRT123	496278	6772677	20m x 20m	MRT292	496575	6773398	20m x 20m
MRT124	496250	6772705	20m x 20m	MRT293	496546	6773426	20m x 20m
MRT125	496221	6772733	20m x 20m	MRT294	496518	6773455	20m x 20m
MRT126	496193	6772761	20m x 20m	MRT295	496489	6773483	20m x 20m
MRT127	496164	6772790	20m x 20m	MRT296	496461	6773511	20m x 20m
MRT128	496136	6772818	20m x 20m	MRT297	496671	6773360	20m x 20m
MRT129	496107	6772846	20m x 20m	MRT298	496642	6773388	20m x 20m
MRT130	496079	6772874	20m x 20m	MRT299	496614	6773416	20m x 20m
MRT138	496135	6772874	20m x 20m	MRT300	496585	6773444	20m x 20m
MRT139	496107	6772903	20m x 20m	MRT301	496557	6773473	20m x 20m
MRT159	496163	6772960	20m x 20m	MRT302	496528	6773501	20m x 20m
MRT160	496135	6772988	20m x 20m	MRT303	496500	6773529	20m x 20m
MRT161	496391	6772791	20m x 20m	MRT304	496471	6773557	20m x 20m
MRT162	496363	6772819	20m x 20m	MRT305	496443	6773585	20m x 20m
MRT163	496334	6772847	20m x 20m	MRT308	496667	6773420	20m x 20m
MRT164	496305	6772876	20m x 20m	MRT310	496610	6773476	20m x 20m
MRT165	496277	6772904	20m x 20m	MRT312	496553	6773533	20m x 20m
MRT166	496248	6772932	20m x 20m	MRT314	496496	6773589	20m x 20m
MRT168	496405	6772834	20m x 20m	MRT315	496756	6773389	20m x 20m
MRT171	496426	6772869	20m x 20m	MRT316	496727	6773417	20m x 20m
MRT172	496397	6772897	20m x 20m	MRT317	496699	6773445	20m x 20m
MRT173	496369	6772926	20m x 20m	MRT318	496670	6773473	20m x 20m
MRT174	496340	6772954	20m x 20m	MRT319	496642	6773501	20m x 20m
MRT175	496312	6772982	20m x 20m	MRT320	496613	6773530	20m x 20m
MRT190	496254	6773095	20m x 20m	MRT211	496503	6773019	20m x 20m
MRT191	496226	6773123	20m x 20m	MRT212	496474	6773047	20m x 20m
MRT192	496197	6773151	20m x 20m	MRT213	496446	6773075	20m x 20m
MRT208	496304	6773159	20m x 20m	MRT214	496417	6773103	20m x 20m

MRT209	496275	6773187	20m x 20m	MRT215	496389	6773131	20m x 20m
MRT210	496532	6772990	20m x 20m				
Preclearance Ph 3							
MRT013	496054	6772278		MRT193	496511	6772898	
MRT014	496026	6772307		MRT195	496454	6772954	
MRT015	495997	6772335		MRT367	496251	6772478	
MRT016	495969	6772363		MRT373	496364	6772592	
MRT017	495940	6772391		MRT375	496364	6772649	
MRT025	496054	6772335		MRT378	496392	6772678	
MRT037	495939	6772505		MRT383	496420	6772763	
MRT047	495967	6772533		MRT384	496448	6772735	
MRT051	496167	6772393		MRT386	496462	6772777	
MRT065	495995	6772618		MRT387	496455	6772841	
MRT116	496293	6772606		MRT388	496483	6772813	
MRT141	496335	6772734		MRT400	496730	6773470	
MRT143	496278	6772790					

SRE Invertebrate Fauna survey

Site Name	Easting	Northing	Site Type	Site Name	Easting	Northing	Site Type
SRE fauna sites							
SRE 1	497839	6772171	SRE Wet pitfall	MU LL 5	496465	6772523	Leaf litter collection
SRE 2	497367	6773072	SRE Wet pitfall	MU LL 6	497601	6772753	Leaf litter collection
SRE 3	496571	6772674	SRE Wet pitfall	MU LL 7	499001	6773129	Leaf litter collection
SRE 4	494783	6770692	SRE Wet pitfall	MU LL 8	499508	6771957	Leaf litter collection
SRE 5	496982	6769875	SRE Wet pitfall	MU LL 9	497920	6772120	Leaf litter collection
SRE 6	496498	6769602	SRE Wet pitfall	MU LL 10	497658	6771488	Leaf litter collection
SRE 7	499444	6772015	SRE Wet pitfall	MU LL 11	496699	6771487	Leaf litter collection
SRE 8	499473	6772424	SRE Wet pitfall	MU LL 12	497043	6770855	Leaf litter collection
SRE 9	500129	6771562	SRE Wet pitfall	Opp10	497510	6768717	Opportunistic
SRE 10	498974	6773145	SRE Wet pitfall	Opp11	497550	6769311	Opportunistic
SRE 11	494842	6769666	SRE Wet pitfall	Opp12	494622	6768163	Opportunistic

SRE 12	497801	6771459	SRE Wet pitfall
MU LL 1	499207	6769883	Leaf litter collection
MU LL 2	498595	6769634	Leaf litter collection
MU LL 3	496894	6768594	Leaf litter collection
MU LL 4	494701	6770471	Leaf litter collection

Opp13	496903	6770623	Opportunistic
Opp14	496055	6773361	Opportunistic
Opp15	499536	6771601	Opportunistic
Opp16	498452	6770995	Opportunistic
Opp17	498882	6770981	Opportunistic

Regional Invertebrate Fauna survey

Site Name	Easting	Northing	Site Type	Site Name	Easting	Northing	Site Type
Regional SRE fauna sites							
R SRE 1	496810	6762915	SRE Wet pitfall	R SRE 16	498384	6765975	SRE Wet pitfall
R SRE 2	487226	6796517	SRE Wet pitfall	R SRE LL1	496769	6765071	Leaf litter collection
R SRE 3	479893	6793710	SRE Wet pitfall	R SRE LL2	493997	6766776	Leaf litter collection
R SRE 4	478389	6791650	SRE Wet pitfall	R SRE LL3	496479	6774307	Leaf litter collection
R SRE 5	494079	6763440	SRE Wet pitfall	R SRE LL4	496467	6774309	Leaf litter collection
R SRE 6	515622	6784236	SRE Wet pitfall	R SRE LL5	502756	6778393	Leaf litter collection
R SRE 7	510541	6780224	SRE Wet pitfall	R SRE LL6	497029	6780072	Leaf litter collection
R SRE 8	511718	6778058	SRE Wet pitfall	R SRE LL7	493421	6795404	Leaf litter collection
R SRE 9	507849	6778801	SRE Wet pitfall	R SRE LL8	482280	6798489	Leaf litter collection
R SRE 10	491488	6774470	SRE Wet pitfall	R SRE LL9	480043	6788418	Leaf litter collection
R SRE 11	491066	6773160	SRE Wet pitfall	R SRE LL10	482073	6784114	Leaf litter collection
R SRE 12	494191	6782768	SRE Wet pitfall	R SRE LL11	497095	6787995	Leaf litter collection
R SRE 13	493021	6783746	SRE Wet pitfall	R SRE LL12	514795	6777676	Leaf litter collection
R SRE 14	495131	6783842	SRE Wet pitfall	R SRE opp1	514562	6783349	Opportunistic
R SRE 15	499347	6766612	SRE Wet pitfall	R SRE opp2	500535	6767075	Opportunistic

SRE Wet Pitfall Site Details

Site name	Habitat Type	Proposed Footprint	Photo
SRE 1	Granitic Outcropping	Inside	
SRE 2	Basalt Hill	Inside	
SRE 3	Eucalypt Woodland on Quartz	Inside	
SRE 4	Eucalypt Woodland	Inside	

SRE 5	Granitic Outcropping	Inside	
SRE 6	Granitic Outcropping	Outside	
SRE 7	Eucalypt Woodland on Quartz	Outside	
SRE 8	Eucalypt Woodland	Outside	

SRE 9	Mixed Shrubland	Outside	
SRE 10	Mixed Shrubland	Outside	
SRE 11	Mixed Shrubland	Inside	
SRE 12	Granitic Outcropping	Outside	

Appendix E: WAM Molecular Identification Reports



Molecular identification of mygalomorph spiders (Idiopidae) from Mount Mulgine, Western Australia

Report to *Spectrum Ecology*

06 August 2020

Nerida Wilson and Mark Harvey

Molecular Systematics Unit & Department of Terrestrial Zoology,
Western Australian Museum,
Locked Bag 49, Welshpool DC, Western Australia 6986, Australia



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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

Spectrum Ecology requested the sequencing and identification of mitochondrial COI sequences from two specimens of *Idiosoma* spiders from Mount Mulgine. The main objectives of the WA Museum's Molecular Systematics Unit (MSU) were to use COI barcoding to determine the taxonomic identity of the specimens.

DNA was extracted and DNA barcoding sequences (COI) were amplified by PCR in the MSU and sequenced at the Australian Genomic Research Facility (AGRF) Perth node, using *Idiosoma*-specific primers (Rix et al. 2017). DNA sequences were BLASTED against publicly accessible sequences in GenBank and with data sets derived from current research projects in collaboration with the WA Museum. The top 10 blast hits for each major taxon were gathered, duplicates removed, and analysed with a Maximum Likelihood phylogenetic analysis using a GTR+G model of evolution and 100 bootstraps (RAxML). Distances were calculated via tree-based estimates of identical bases in Geneious v11.1.5. A summary of specimen identifications is in Table 1.

Table 1.

Table 1. Summary of queried sequences generated by the WA Museum.

INFRAORDER	GENUS	SPECIES	# OF SPECIMENS	# OF SEQUENCES
Mygalomorphae	<i>Idiosoma</i>	<i>gutharuka</i>	2	2

Results

COI DNA barcodes were amplified and successfully sequenced from both specimens. The two COI sequences were compared to existing data held by the WA Museum and its collaborators, and the publicly accessible GenBank database. A summary of the comparison is provided in Table 2. The resulting Maximum Likelihood tree is provided in Appendix 2 for visualisation of genetic relationships. The new DNA sequences have GenBank accession numbers available in Appendix 1, as well as with the raw data in Appendix 3.

Both specimens (WAMT150971, WAMT150972) represent newly sequenced specimens of *Idiosoma gutharuka* (formerly known by MYG157, MYG641 & MYG675). The species was initially only known only from Gutha, near Pintharuka in the northern Wheatbelt bioregion of south-western Western Australia (Rix et al. 2018), but subsequently reported from Mount Mulgine (Wilson et al. 2019). Rix et al. (2018) suggested that this species is Critically Endangered, but an application to the WA Threatened Species Scientific Committee rejected this nomination and added it to the Priority List as P1 due to inadequate survey data.

Table 2. Summary of results.

REGNO	SPECIES	SUMMARY OF RESULTS
WAMT150971 WAMT150972	<i>Idiosoma gutharuka</i>	These sequences fall into a clade known as <i>Idiosoma gutharuka</i> , which is 11.4% divergent from its nearest congener (<i>Idiosoma schoknechtorum</i> , WAMT140765).

Conclusions

The main objectives were to compare successful COI sequences from the queried specimens to DNA barcoding sequences held with WAM and collaborators, and those publicly accessible in GenBank. All species recovered in this data set were identified as *Idiosoma gutharuka*.

References

- Rix, M. G., Cooper, S. J., Meusemann, K., Klopstein, S., Harrison, S. E., Harvey, M. S., & Austin, A. D. (2017). Post-Eocene climate change across continental Australia and the diversification of Australasian spiny trapdoor spiders (Idiopidae: Arbanitinae). *Molecular Phylogenetics and Evolution*, 109, 302-320.
- Rix, M. G., Huey, J. A., Cooper, S. J., Austin, A. D., & Harvey, M. S. (2018). Conservation systematics of the shield-backed trapdoor spiders of the *nigrum*-group (Mygalomorphae, Idiopidae, *Idiosoma*): integrative taxonomy reveals a diverse and threatened fauna from south-western Australia. *ZooKeys*, (756), 1.
- Wilson, N. G., Huey, J. A. and Harvey, M. S. (2019) MSU-480: Molecular identification of mygalomorph spiders (Idiopidae) from Rothsay, near Mount Mulgine, Western Australia – Report to Spectrum Ecology.

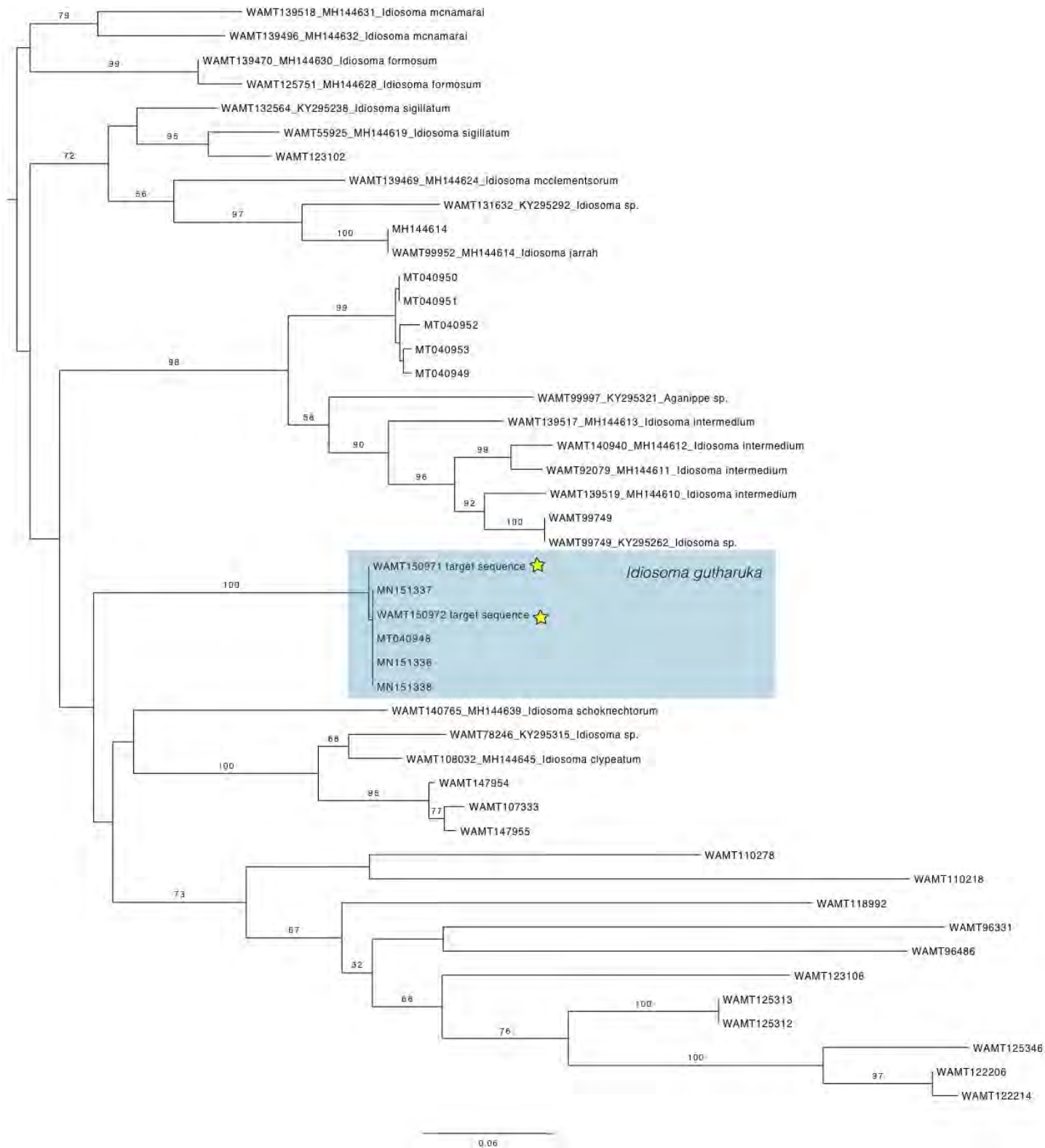
WAM-MSU-483
Report by Western Australian Museum

Appendix 1. Specimen data for all specimens.

REGNO	FIELD NO	GB NO	FAMILY	GENUS	SPECIES	SITE	LATITUDE	LONGITUDE
T150971	EXCL2	MT835389	Idiopidae	<i>Idiosoma</i>	<i>gutharuka</i>	Mount Mulgine	29°11'15.47"S	116°58'51.79"E
T150972	Sre Opp1 S1	MT835390	Idiopidae	<i>Idiosoma</i>	<i>gutharuka</i>	Mount Mulgine	29°11'34.28"S	116°58'28.91"E

WAM-MSU-483
Report by Western Australian Museum

Appendix 2. Excerpt from Maximum Likelihood tree of *Idiosoma* COI, to be used *ONLY* for visualisation of genetic relationships. Bootstrap values less than 50 have been removed.



Appendix 3. COI DNA sequence data generated in this report

>WAMT150971 = MT835389

AATCATAAGGATATTGGAACCTTTATATATTATTTTAGGAGTGTGGTCTGCTATGTTTGGGACTGCGATAAGA
GTGATTGTACGGACAGAGCTGGGGCAGGTTGGTAGATTATTATTAGATGATCATTTATATAATGTGGTAGTG
ACTGTTACAGCCTTAGTGATGATTTTTTTTTATAGTGATGCCGATTATAAATTGGAGGGTTTGGGAATTGGTTA
GTCCCTTTGATATTGGGAGCGCCTGATATGGCTTTTCCTCGGATAAATAAATTTGAGATTTTGGTTGTTGCCC
TCTTCTTTGTTTTTTTTGATGATGTCTTCTTTGATAGGTGTTGGTGTGGAGCTGGGTGGACTATTTATCCT
CCTTTGTCTTCTGGTGTGGGCATAGAGGGGGTGAATGGATTTTGTATTTTTCTTTGCATTTGGCTGGT
GCATCTTCTATTATGGGGGCTATTAATTTTATTTCTACAATTATTAATATACGATCTGAAGGAATAGTGTTT
GAGCGTGTCTCTTTGTTTGTGTGGTCTGTAATAGTGACTGCAATTTTATTATTGTTATCTCTTCCTGTTTTA
GCTGGGGCTATTACTATGTTGTTAACTGATCGCAATTTTAATACTTCTTTTTTTGATCCAGCTGGGGGAGGT
GACCCTGTGTTGTTTCAGCATTTGTTTTGGTTTTTTGGTCATCCTGAG

>WAMT150972 = MT835390

AATCATAAGGATATTGGAACCTTTATATATTATTTTAGGAGTGTGGTCTGCTATGTTTGGGACTGCGATAAGA
GTGATTGTACGGACAGAGCTGGGGCAGGTTGGTAGATTATTATTAGATGATCATTTATATAATGTGGTAGTG
ACTGTTACAGCCTTAGTGATGATTTTTTTTTATAGTGATGCCGATTATAAATTGGAGGGTTTGGGAATTGGTTA
GTCCCTTTGATATTGGGAGCGCCTGATATGGCTTTTCCTCGGATAAATAAATTTGAGATTTTGGTTGTTGCCC
TCTTCTTTGTTTTTTTTGATGATGTCTTCTTTGATAGGTGTTGGTGTGGAGCTGGGTGGACTATTTATCCT
CCTTTGTCTTCTGGTGTGGGCATAGAGGGGGTGAATGGATTTTGTATTTTTCTTTGCATTTGGCTGGT
GCATCTTCTATTATGGGGGCTATTAATTTTATTTCTACAATTATTAATATACGATCTGAGGGAATAGTGTTT
GAGCGTGTCTCTTTGTTTGTGTGGTCTGTAATAGTGACTGCAATTTTATTATTGTTATCTCTTCCTGTTTTA
GCTGGGGCTATTACTATGTTGTTAACTGATCGCAATTTTAATACTTCTTTTTTTGATCCAGCTGGGGGAGGT
GACCCTGTGTTGTTTCAGCATTTGTTTTGGTTTTTTGGTCATCCTGAG

Molecular identification of mygalomorph spiders (*Idiosoma* sp.) from Mt Mulgine, Western Australia

Report to *Spectrum Ecology*

5 Oct 2021

Nerida Wilson and Mark Harvey

Molecular Systematics Unit & Department of Terrestrial Zoology,
Western Australian Museum,
Locked Bag 49, Welshpool DC, Western Australia 6986, Australia



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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

Spectrum Ecology requested the sequencing and identification of mitochondrial COI sequences from four specimens of *Idiosoma* from Mt Mulgine. The main objectives of the WA Museum's Molecular Systematics Unit (MSU) were to use COI barcoding to determine the taxonomic identity of the specimens.

DNA was extracted and DNA barcoding sequences (COI) were amplified by PCR in the MSU and sequenced at the Australian Genomic Research Facility (AGRF) Perth node, using *Idiosoma*-specific primers (Rix et al. 2017). DNA sequences were BLASTED against publicly accessible sequences in GenBank and with data sets derived from current research projects in collaboration with the WA Museum. The top 10 blast hits for each major taxon were gathered, duplicates removed, and analysed with a Maximum Likelihood phylogenetic analysis using a GTR+G model of evolution and 100 bootstraps (RAxML). Distances were calculated via tree-based estimates of identical bases in Geneious Prime 2020 2.5. A summary of specimen identifications is in Table 1.

Table 1.

Table 1. Summary of queried sequences generated by the WA Museum.

ORDER	GENUS	SPECIES	# OF SPECIMENS	# OF SEQUENCES
Mygalomorphae	<i>Idiosoma</i>	<i>intermedium</i>	1	1
Mygalomorphae	<i>Idiosoma</i>	<i>gutharuka</i>	3	3

Results

COI DNA barcodes were amplified and successfully sequenced from all 4 specimens. The COI sequences were compared to existing data held by the WA Museum and its collaborators, and the publicly accessible GenBank database. A summary of the comparison is provided in Table 2. The resulting Maximum Likelihood tree is provided in Appendix 2 for visualisation of genetic relationships. The new DNA sequences have GenBank accession numbers available in Appendix 1, as well as with the raw data in Appendix 3.

Three specimens (WAMT155370, WAMT155371, WAMT155372) represent newly sequenced specimens of *Idiosoma gutharuka* (formerly known by MYG157, MYG641 & MYG675). The species was initially only known only from Gutha, near Pintharuka in the northern Wheatbelt bioregion of south-western Western Australia (Rix et al. 2018), but subsequently reported from Mount Mulgine (Wilson et al. 2019). Rix et al. (2018) suggested that this species is Critically Endangered, but an application to the WA Threatened Species Scientific Committee rejected this nomination and added it to the Priority List as P1 due to inadequate survey data. One specimen (WAMT155373) represents the relatively widespread *Idiosoma intermedium* (formerly known as MYG475). This species is currently listed as a Priority Species by DBCA, category P3.

Table 2. Summary of results.

REGNO	SPECIES	SUMMARY OF RESULTS
WAMT155370 WAMT155371 WAMT155372	<i>Idiosoma gutharuka</i>	These sequences fall into a clade known as <i>Idiosoma gutharuka</i> , which is 11.85% divergent from its nearest congener (<i>Idiosoma schoknechtorum</i> , WAMT140765).
WAMT155373	<i>Idiosoma intermedium</i>	This sequence falls into a clade known as <i>Idiosoma intermedium</i> I, and is 6.08% divergent from the nearest cluster of other <i>I. intermedium</i> I sequences. With COI data, <i>I. intermedium</i> is rendered paraphyletic, as <i>I. incomptum</i> (WAMT99997) is most closely related to <i>I. intermedium</i> I, rather than the conspecific <i>I. intermedium</i> II.

Conclusions

The main objectives were to compare successful COI sequences from the queried specimens to DNA barcoding sequences held with WAM and collaborators, and those publicly accessible in GenBank. Of the two species recovered in this data set one was identified as *Idiosoma gutharuka*, and the other as *Idiosoma intermedium*.

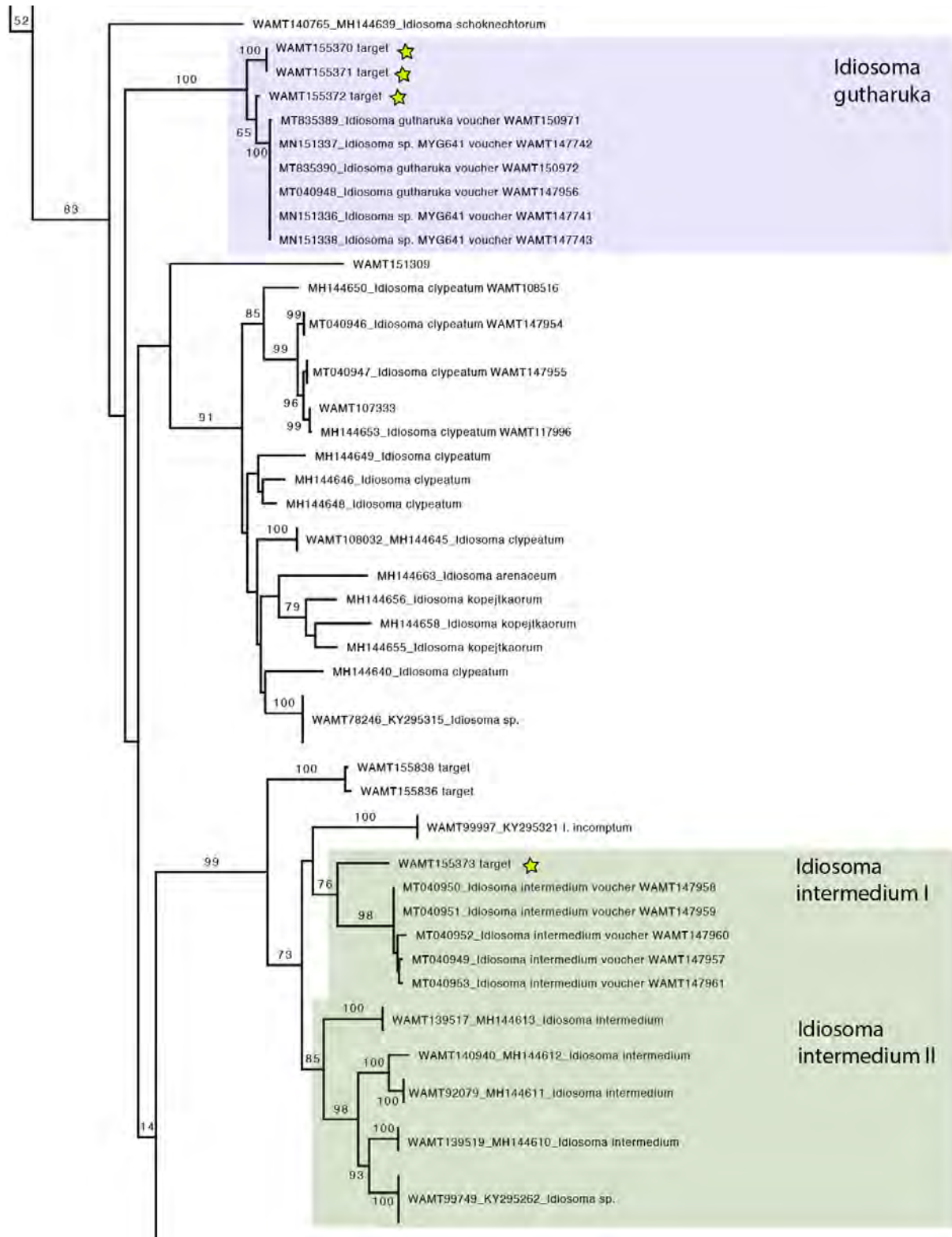
References

- Rix, M. G., Cooper, S. J., Meusemann, K., Klopstein, S., Harrison, S. E., Harvey, M. S., & Austin, A. D. (2017). Post-Eocene climate change across continental Australia and the diversification of Australasian spiny trapdoor spiders (Idiopidae: Arbanitinae). *Molecular Phylogenetics and Evolution*, 109, 302-320.
- Rix, M. G., Huey, J. A., Cooper, S. J., Austin, A. D., & Harvey, M. S. (2018). Conservation systematics of the shield-backed trapdoor spiders of the *nigrum*-group (Mygalomorphae, Idiopidae, *Idiosoma*): integrative taxonomy reveals a diverse and threatened fauna from south-western Australia. *ZooKeys*, (756), 1.
- Wilson, N. G., Huey, J. A. and Harvey, M. S. (2019) MSU-480: Molecular identification of mygalomorph spiders (Idiopidae) from Rothsay, near Mount Mulgine, Western Australia – Report to Spectrum Ecology.

Appendix 1. Specimen data for all specimens.

REGNO	FIELD NO	GenBank NO	FAMILY	GENUS	SPECIES	SITE	LATITUDE	LONGITUDE
WAMT155370	TUNRSRE7IDIO1	OK342108	Idiopidae	<i>Idiosoma</i>	<i>gutharuka</i>	Mt Mulgine, 30 km NE. of Rothsay	29°06`23.39"S	117°06`27.92"E
WAMT155371	TUNRSRE7IDIO1	OK342108	Idiopidae	<i>Idiosoma</i>	<i>gutharuka</i>	Mt Mulgine, 30 km NE. of Rothsay	29°06`23.39"S	117°06`27.92"E
WAMT155372	TUNRSRE10IDIO1	OK342108	Idiopidae	<i>Idiosoma</i>	<i>gutharuka</i>	Mt Mulgine, 15 km N. of Rothsay	29°09`30.06"S	116°54`45.41"E
WAMT155373	TUNRSREOPP1	OK342108	Idiopidae	<i>Idiosoma</i>	<i>intermedium</i>	Mt Mulgine, 35 km NE. of Rothsay	29°04`39.94"S	117°08`59.26"E

Appendix 2a. Excerpt from Maximum Likelihood tree of *Idiosoma* COI, to be used *ONLY* for visualisation of genetic relationships. Bootstrap values less than 50 have been removed.



Appendix 3. COI DNA sequence data generated in this report

>WAMT155370 = OK342108

AATCATAGGGATATTGGAACCTTTATATATTATTTTAGGGGTGTGGTCTGCTATGTTTGGGACTGCAATGAGAG
TGATTGTACGGACAGAGTTGGGGCAGGTTGGCAGATTATTATTAGATGATCATTTATATAATGTGGTAGTGAC
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CTTTGTTTTTTTTGATGATATCTTCTTTGATAGGTGTAGGTGTTGGAGCTGGGTGAACATTTATCCTCCTTT
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TATTACTATGTTGTTGACTGATCGCAATTTTAATACTTCTTTTTTTGATCCAGCTGGGGGAGGTGATCCTGTG
TTGTTTCAGCATTTGTTTTGGTTTTTTGGTCAT

>WAMT155371 = OK342109

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TGTTTCATGCCTTAGTGATGATTTTTTTTTATAGTGATGCCGATTATAAATTGGAGGGTTTGGTAATTGGTTAGTC
CCTATGATATTGGGAGCGCCTGATATGGCTTTTCCTCGGATAAATAAATTGAGATTTTGGTTGTTGCCCTCTT
CTTTGTTTTTTTTGATGATATCTTCTTTGATAGGTGTAGGTGTTGGAGCTGGGTGAACATTTATCCTCCTTT
GTCTTCTGGTGTGGGCATAGAGGGGGTGAATGGATTTTGTTATTTTTCTTTGCATTTGGCTGGTGCATCT
TCTATTATGGGGGCTATTAATTTTATTTCTACAATTATTAATATACGATCTGAGGGAATAGTGTGTTGAATGTA
TTTCTTTGTTTGTGTGGTCTGTAATAGTGACTGCGGTTTTATTATTGTTATCTCTTCTGTTTTAGCTGGGGC
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>WAMT155372 = OK342110

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CTTTGTTTTTTTTGATGATATCTTCTTTGATAGGTGTTGGTGTGGAGCTGGGTGAACATTTATCCTCCTTT
GTCTTCTGGTGTGGGCATAGAGGGGGTGAATGGATTTTGTTATTTTTCTTTGCATTTGGCTGGTGCATCT
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>WAMT155373 = OK342111

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TGTTTCATGCTTTGGTGATGATTTTTTTTTATAGTTATACCGATTATGATTGGAGGGTTTGGTAAGTGGTTAGTA
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ATCATCAGGTGTGGGACATAGAGGGGGTGAATGGATTTTGTTATTTTTCTTTACATTTAGCTGGAGCTTCT
TCGATTATGGGTGCTATTAATTTTATTTCTACGATTGTTAATATGCGAGCTGAAGGAATGGTGTGTTGAGCGTG
TTCCTTTGTTTGTGTGGTCTGTTATGGTTACTGCGGATTGTTATTATTATCTCTTCTGTTTGGCTGGGGC
TATTACTATATTGTTGACTGATCGAAATTTCAATACTTCTTTTTTTGATCCTGCGGGAGGGGGTATCCTGTG
TTGTTTCAGCATTTATTTTGGTTTTTTGGTCAT

Appendix F: DNA Identification Report (Bennelongia)





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Review: Huon Clark
11th December 2020

Mt Mulgine Short-range Endemic Genetics Results

This memo presents data from genetics work carried out on SRE species collected from Mt Mulgine, in the Midwest region of WA. Bennelongia Environmental Consultants (BEC) were commissioned to identify SRE specimens collected during surveys. Morphological identifications were conducted, and molecular barcoding analyses were performed to support and confirm the morphological identifications in 47 specimens belonging to SRE Groups.

Depending on the size of the specimens, legs or whole animals were used for DNA extractions using a Qiagen DNeasy Blood & Tissue kit (Qiagen 2006). Elute volumes varied from 40 µL to 200 µL depending on the quantity of material.

Primers combinations used for PCR amplifications were: (1) LCO1490:HCO2198 and LCO1490:HCOoutout for the MT-CO1 gene (Folmer *et al.* 1994; Schwendinger and Giribet 2005); (2) 12Sai:12RJ and 12Sai:12Sbi for the 12S gene (Kambhampati and Smith 1995; Simon *et al.* 1994); and (3) Cybj10612: Cybj_id_rl for the MT-CYB gene (Rix *et al.* 2017). Next, dual-direction, sanger sequencing was undertaken for PCR products by the Australian Genome Research Facility (AGRF). Sequences returned were aligned in Geneious (Kearse *et al.* 2012) and neighbour-joining phylogenetic trees were estimated using 1000 bootstraps. Genetic distances (using the Tamura-Nei method) between sequences were measured as uncorrected p-distances (total percentage of nucleotide differences between sequences). Sequences on GenBank and in the grey literature were included in phylogenetic analysis to provide a framework for assessing intra- and interspecific variation, as well as to document the levels of intra-specific differentiation in described species across their geographic ranges.

The results of the genetical analysis are presented below.



Trapdoor Spiders

Anamidae: *Aname* (2 species)

Two of the trapdoor spiders collected were initially identified as members of the family Anamidae, most likely in the genus *Aname*, which has recently been transferred out of the family Nemesiidae and elevated to the family Anamidae (Opatova *et al.* 2020). This family has been relatively well studied through recent phylogenetic work, along with the description of a new genus and 15 new species of *Aname* (Castalanelli *et al.* 2020; Castalanelli *et al.* 2017; Harvey *et al.* 2012), providing a good taxonomic framework, but also showing large cryptic genetic diversity in species complexes, such as *Aname mainae* and *Aname mellosa*. The genus *Aname* is endemic to Australia, currently with 42 valid species (World Spider Catalog 2020). These spiders inhabit inland dry open country, and at least 15 of them have been recorded in the Pilbara before. Since the specimens collected by Spectrum consisted of a female and a spiderling, genetic analyses were required for a full identification.

The female collected at Mt Mulgine (site SRE 4.2, wet pitfall, 19/06/20) was initially identified to the *Aname mellosa* species complex. A GenBank BLAST returned 60 sequences of the genus, but the most similar reference sequences were at least 13.2% (*Aname* MYG700, GenBank accession number MW039189) divergent in COI to the new specimen, which is higher divergence than the commonly used threshold of 9.5% suggested by Castalanelli *et al.* 2014. The new specimen was also compared to all COI sequences for the genus *Aname* in the Bennelongia Database (418 sequences, including the ones reported in Castalanelli *et al.* 2014), and once again the closest match was still 14.2% divergent. Finally, one representative sequence from each of the new species described in Castalanelli *et al.* 2020 were retrieved and compared to the new specimen, but the closest match was still 15.6% divergent in COI. In conclusion, the new specimen is an undescribed species of the genus *Aname*. The lack of matches is not completely unexpected, given that the vast majority of molecular work conducted on this genus has been in the Pilbara. Given that these studies have consistently revealed cryptic genetic variation indicative of species complexes, it is not surprising that the specimen from Mt Mulgine, an area from which these spiders have not been studied genetically yet, represents a new and still undescribed species.



Euagridae: Cethegus 'BMYG174'

A male from the curtain web genus *Cethegus* was collected in Mt Mulgine (site SRE 1.2, wet pitfall, 19/06/20). Similarly to the genus *Aname*, the genus *Cethegus* has also been recently moved to a different family, from Dipluridae to Euagridae (Opatova *et al.* 2020). The new specimen is morphologically consistent with the *Cethegus fugax* group, which Raven 1983 suggests represents a species complex. Bennelongia has a record of a male *Cethegus* from the Mt Gibson area (*Cethegus* 'BMYG1774'), which was morphologically very similar to the new specimen, so this male was also sequenced along the new specimen from Mt Mulgine.

A BLAST of the new specimen returned four sequences of the genus *Cethegus*, and a manual search for this genus on GenBank returned four additional sequences. The Bennelongia database also contained three additional sequences, resulting in a total of 11 reference sequences for comparison with the new ones.

The new specimen genetically aligned with the male previously collected at Mt Gibson (Figure 1), and is only 2.1% divergent in COI to that record. This level of genetic divergence is consistent with intra-specific divergences in the other species included in the analyses (Table 1).

In conclusion, the new specimen was considered conspecific with *Cethegus* 'BMYG174' from Mt Gibson Iron project, 67 km SSE from Mt Mulgine.

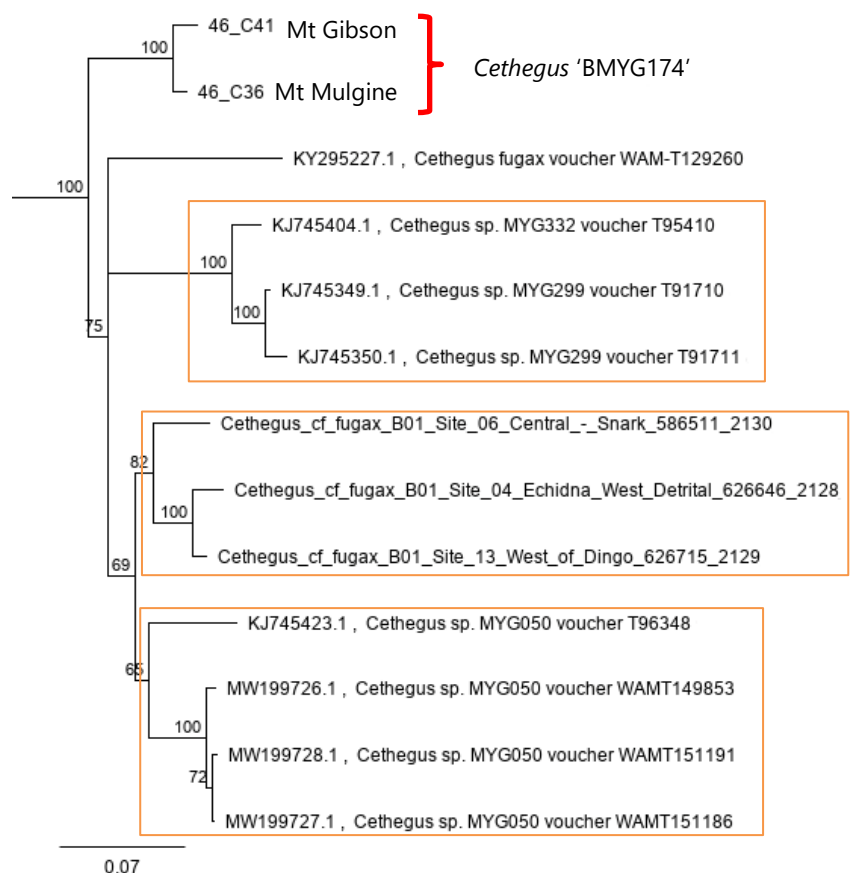


Figure 1: Neighbour-joining tree of species of *Cethegus* included in the analysis.



Table 1: Intra (bold) and interspecific genetic divergences (% different base pairs) in sequences of mt-CO1 from species of *Cethegus* included in the analysis presented above.

	<i>C. fugax</i> WAM T129260	<i>C. MYG332</i> and <i>MYG299</i>	<i>C. 'BMYG174'</i>	<i>C. MYG050</i>	<i>C. cf. fugax</i> B01
<i>C. fugax</i> WAM T129260	-				
<i>C. MYG332</i> and <i>MYG299</i>	15.2 - 16.4	1.4 - 4.4			
<i>C. 'BMYG174'</i>	14.1 - 14.2	13.8 - 15.2	2.1		
<i>C. MYG050</i>	13.1 - 13.8	12.3 - 14.3	10.2 - 12.8	0.5 - 9	
<i>C. cf. fugax</i> B01	13.4 - 14.6	11.6 - 14.4	8.8 - 11.5	7.4 - 10.2	2.4 - 7

Barychelidae

Idiommata 'BMYG175'

A male of the brush-footed trapdoor spider genus *Idiommata* was collected from a wet pitfall trap in Mt Mulgine (site SRE 5.2, 19/6/20). The taxonomic framework for this genus is weak, and taxonomists agree that the only species recorded in Western Australia, *Idiommata blackwallii*, represents a species complex. A genetic analysis was performed with nine reference sequences obtained from GenBank and from the Bennelongia database. The new specimen was not genetically aligned with *Idiommata* MYG320 (13.5% distance in Mt-COI), as initially suspected based on location. Instead, the new specimen was genetically closet to *Idiommata* MYG254 (GenBank accession KJ745103), presenting a divergence of 10.7% in Mt-COI to that species, which is borderline between intra and interspecific divergence (Table 2).



However, the phylogenetic analysis (Figure 3) did not provide support for the conspecificity of the new specimen and *Idiommata* MYG254. Moreover, given that the record of the latter is from a location 380 km NNE from Mt Mulgine (coordinates: -25.8027, 117.338), we conclude that the new specimen represents a new and undescribed species, which received the species code name *Idiommata* 'BMYG175'.

Table 2: Intra (bold) and interspecific genetic divergences (% different base pairs) in sequences of mt-CO1 from species of *Idiommata* included in the analysis presented here.

	<i>I.</i> MYG247	<i>I.</i> blackwallii	<i>I.</i> MYG320	<i>I.</i> 'BMYG175'
<i>I.</i> MYG247	0 - 10.2			
<i>I.</i> <i>blackwallii</i>	14.8 - 15.1	-		
<i>I.</i> MYG320	12.8 - 14.8	12.5 - 13.6	5.2 - 7	
<i>I.</i> 'BMYG175'	12.5 - 14.4	12.5 - 12.5	13.5 - 14.5	-
<i>I.</i> MYG254	12.5 - 13.3	13.8	11.5 - 11.6	10.7

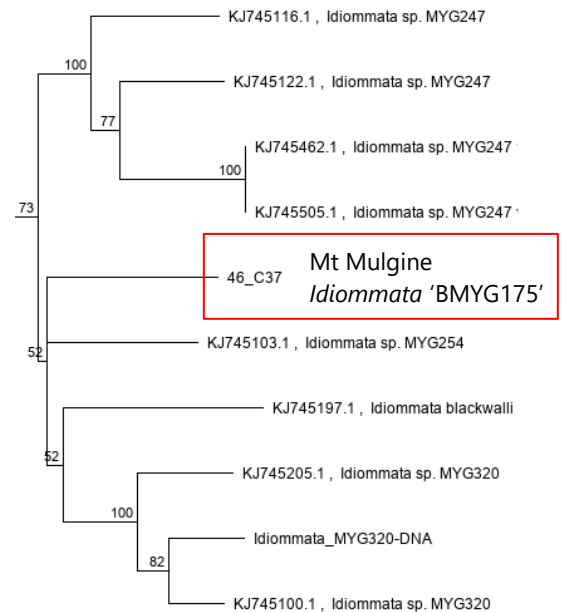


Figure 3: Neighbour-joining tree of species of *Idiommata* included in the analysis.



Pseudoscorpions

Olpiidae

Austrochthonius 'BPS308'

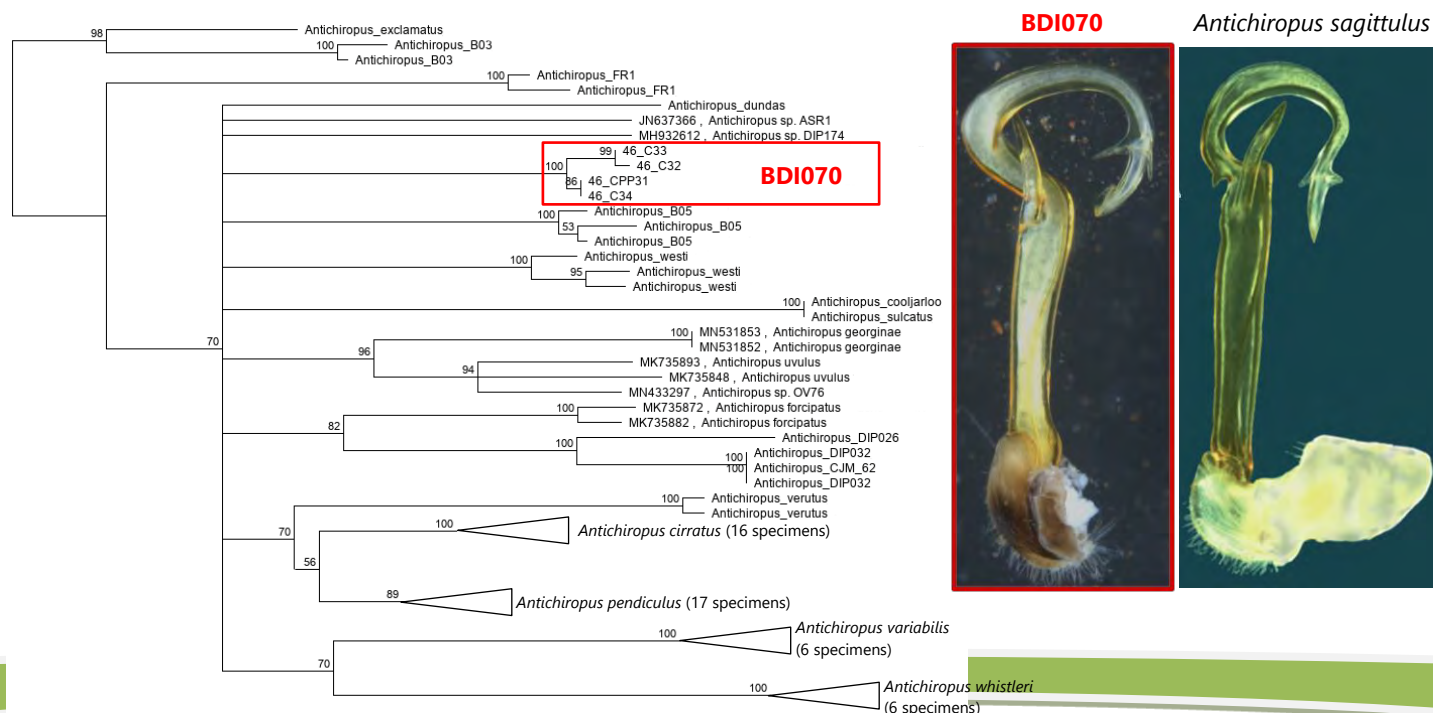
A specimen of the genus *Austrochthonius* (collected in Mt Mulgine), along with a previously collected specimen from Mt Gibson, were sequenced for comparison purposes. The Mt Mulgine specimen failed to return a sequence, and the comparison with the reference animal from Mt Gibson was not possible.

Millipedes

Paradoxosomatidae: Antichiropus 'BDI070'

One adult male and three juveniles of the millipede genus *Antichiropus* were sequenced. The juveniles lack gonopods, and therefore could not be initially morphologically identified to species level. The adult male is very similar morphologically to *Antichiropus sagittulus*, which also occurs in the area, but the gonopods present some slight differences (Figure 7). The genetics aligned the adult with all of the juveniles, and their maximum divergence between these individuals was 0.9% in Mt-COI. The specimens did not align with any other species for which there are available sequences, and the closest genetic match was *Antichiropus pendiculus*, at 8.6% Mt-COI distance. However, there were no sequences of *A. sagittulus* for comparison, and the gonopod morphology of *A. pendiculus* is completely different to the gonopod of the new specimen. Moreover, *A. pendiculus* is from the Pilbara, so the new specimen is certainly more closely related to *A. sagittulus*, but until sequences of that species are available for comparison, under a precautionary approach we are calling these new specimens a new species code, *A.* 'BDI070'.

Figure 7: Neighbour-joining tree of species of *Antichiropus* included in the analysis.





Isopods

Paraplatyarthus

Two individuals of *Paraplatyarthus* 'BIS410' were sent for sequencing. Minor differences in morphology were noted at the time of identification prompting the use of genetics to confirm that they are members of the same species. A BLAST returned 57 sequences of *Paraplatyarthus* and there were a further four sequences within the Bennelongia database. One sequence could not be aligned with the full set and as a result 60 sequences were available to compare against the target individuals. The results identified that the two individuals collected at Mt Mulgine were from different species and diverged in 17.7% in Mt-COI. Neither of these individuals aligned with any of the other sequences collected from GenBank or the Bennelongia database. As a result, the individual collected at site MU LL 10.2 retains the species identification of *P.* 'BIS410', while the specimen collected at site SRE 2.1 has been updated to *P.* 'BIS420'.



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Appendix G: SRE Identification Report (Alacran)



Identification and Short-range endemic assessment of Invertebrates from Mulgine Hill

Prepared for
Spectrum Ecology



Acanthodillo '5B'

Identification and Short-range endemic assessment of Invertebrates from Mulgine Hill

Report No. 2123 | DRAFT | Prepared by Erich Volschenk | Submitted to Lachlan Petersen (Spectrum Ecology) | 17 Dec 2021

EXECUTIVE SUMMARY

During 2021 Spectrum Ecology provided several collections of invertebrates from Mulgine hill for taxonomic identification and conservation assessment. In total, the collection contained 175 samples, representing 42 different taxa.

Of these 42 taxa, 35 belonged to SRE categories and seven were widespread. Seven species were described with formally names species and 35 were represented by morphospecies or ambiguous (sp.) identifications.

The identity of most of the SRE category taxa was unresolved. Morphospecies were assigned however that is largely within the context of this collection. Broader regional context and species relationships will require a review of these morphospecies using DNA sequencing.

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Limitation: This report was prepared for Spectrum Ecology to provide identifications and SRE determinations for a collection of invertebrates from Mulgine Hill, Western Australia. *Alacran Environmental Science* accepts no liability or responsibility for any use or reliance on this report for anything other than its purpose. The accuracy and completeness of the information supplied by Spectrum Ecology or other data sources including (but not limited to) W.A. Museum, Bureau of Meteorology and Department of Minerals and Petroleum, has not been reviewed or verified.

SCOPE

In December (2020), Spectrum Ecology (Spectrum) requested identification and SRE assessment of multiple collections of invertebrate samples from Mulgine Hill, Western Australia. Spectrum requested taxonomic identifications and assessment of SRE and other conservation categories for these invertebrate species.

BACKGROUND

SHORT-RANGE ENDEMISM

Short-range endemics (SREs) are organisms with small geographic distributions (Harvey 2002; Ponder *et al.* 2002), nominally less than 10,000 km²(Harvey 2002). These organisms are typically characterised by one or more of the following features:

- limited dispersal capabilities,
- seasonal activity (cooler or wetter periods),
- slow growth, and
- low levels of fecundity.

Their limited dispersal capabilities result in small populations being isolated from each other by inhospitable geographic features such as rivers, rocky ridges or plains. Prolonged isolation between populations eventually results in speciation, with each population becoming genetically and, or morphologically distinct over time. Two types of short-range endemism have been recognised: Relictual Endemism and Habitat Specialist Endemism (Harvey 2002; Ponder *et al.* 2002).

Relictual SREs result when speciation occurs following the fragmentation of continuous habitat into two or more refugia. In Australia, the primary driver of this over the last 65 million years has been aridification, which acted to isolate formerly widespread species living in mesic forests to small patches of mesic refugia. Relictual SREs include scorpions in the genus *Aops* (Volschenk *et al.* 2008), pseudoscorpions in the genera *Tyrannochthonius* (Harvey 1991; Edward *et al.* 2008), *Indohya* (Harvey 1993b; Harvey *et al.* 2007) and *Idioblothrus* (Muchmore 1982; Harvey 1993a; Harvey *et al.* 2008) and millipedes in the genus *Antichiropus* (Car *et al.* 2013; Car *et al.* 2014).

Habitat specialist SREs are species that have adapted to very specific environment types, including those found in arid environments (*e.g.* rocky outcrops, isolated dune systems and salt lakes). These habitats are often relatively young (<10 million years) and therefore are not refugial. Examples of habitat specialist SREs include spiders in the family Selenopidae, pseudoscorpions in the genus *Synsphyronus* (Harvey 2011, 2012), scorpions in the genera *Lychas* and *Urodacus* and tiger beetles in the genus *Pseudotetracha* (Lopez-Lopez *et al.* 2016)

METHODS

ASSESSMENT OF SHORT-RANGE ENDEMISM

Assessment of short-range endemism can be challenging when data for evaluation are absent or limited. Limitations may include any of the following:

- **Poor survey coverage**, e.g. the fauna of an area has not been sampled extensively enough to enable assessment of species distributions. The absence of a species from survey records may not mean that it is absent from the area.
- **Poor taxonomic resolution**, e.g. a species has not been subject to systematic investigation, and/or the identity is either difficult or impossible to determine. Good taxonomic resolution does not necessarily need to be in the form of published revisions, as it can be facilitated by any of the following:
 - a researcher actively working on the group who can authorise identifications,
 - a publicly accessible reference collection, and/or;
 - assessment of species boundaries using genomic methods such as DNA barcoding (Hebert et al. 2003a; Hebert et al. 2003b).
- **Identification issues**, e.g. surveys sampled life stages of SREs that are impossible to identify based on morphological characters. Examples of relevant taxa include juvenile or female millipedes, mygalomorph spiders and *Urodacus* scorpions.

There are no published systems for assessing the SRE potential for a species. The W.A. Museum previously employed the following system to assess SRE-status of invertebrates:

- **Confirmed SRE**: This category applies when the identity of the taxon is unambiguous and its distribution is less than 10 000 km² based on publicly available vouchered records. Supporting data can be either genomic (from DNA sequences) or morphological, ideally both.
- **Potential SRE**: This category applies to situations where there are knowledge gaps for the taxon. The following sub-categories further elucidate this status:
 - **Data Deficiency (DD)**: This category covers taxa for which there is insufficient data available to determine SRE status. Factors that fall under this category include:
 - insufficient geographic information (DDG),
 - insufficient taxonomic information (DDT), and/or
 - inappropriate life stages prevent identification to species level.
 - **Habitat Indicators (H)**: This category employs habitat characteristics to evaluate SRE status when habitats are known to support SRE taxa. For example, many species sampled from subterranean habitats are known to be range restricted; a new species discovered from such habitat therefore has greater potential to be range restricted (i.e. a SRE) than widespread.
 - **Morphological Evidence (M)**: This category uses one or more morphological characters that are characteristic of SRE taxa inhabiting restricted environments,

e.g. the specialised morphological features of animals adapted to subterranean habitats, including body markings that are absent or significantly paler than surface dwelling relatives, eyes that are absent or significantly reduced, and/or longer appendages (legs and antennae) than surface relatives.

- **Unpublished Research & Expertise (U):** This category relies on unpublished research or expertise to develop SRE status. **Widespread (not an SRE):** This category applies when vouchered evidence demonstrates a distribution greater than 10,000 km².

TAXONOMY

The taxonomic nomenclature of invertebrates follows the references detailed in Table 2.2. Morphospecies designations follow the parataxonomy of the scientist(s) working on the group; these informal names are written between single quotation marks rather than being italicised as they are not valid under the International Code of Zoological Nomenclature (1999).

In defining morphospecies, Alacran follows the “Phylogenetic Species Concept” (Cracraft 1983):

“A species is the smallest **diagnosable** cluster of individual organisms within which there is a parental pattern of ancestry and descent.”

Morphological Identification (Traditional Taxonomy)

For this report, Isopod identifications were carried out by Dr Simon Judd and all remaining identifications were carried out by the Dr Erich Volschenk. The references used for species determination are summarised in Table 2.2.

Table 2.1. The following references and collections were used to assist with morphospecies designations.

Order	Taxonomic reference	Morphospecies and reference
Pseudoscorpiones	(Harvey 1992; Muriene <i>et al.</i> 2008; Harvey 2012, 2013)	W.A. Museum reference collection.
Araneae (Mygalomorphae)	(Castalanelli <i>et al.</i> 2014; Rix <i>et al.</i> 2017; Harvey <i>et al.</i> 2018; Rix <i>et al.</i> 2018a; Rix <i>et al.</i> 2018b; Rix <i>et al.</i> 2018c)	WA Museum reference collection
Scorpiones	(Glauert 1925b, a; Acosta 1990; Kovařík 1997; Fet <i>et al.</i> 2000; Volschenk <i>et al.</i> 2000; Volschenk <i>et al.</i> 2008; Volschenk <i>et al.</i> 2010)	Morphospecies designation by Dr Erich S Volschenk, W.A. Museum reference collection.
Chilopoda	(Koch 1983b, a, c, 1984; Koch <i>et al.</i> 1984; Koch 1985; Colloff <i>et al.</i> 2005; Bonato <i>et al.</i> 2014)	W.A. Museum reference collection.
Eupulmonata	(Solem 1985, 1988, 1997; Whisson <i>et al.</i> 2012; Whisson <i>et al.</i> 2014; Stanasic <i>et al.</i> 2017)	W.A. Museum reference collection.
Isopoda	(Judd <i>et al.</i> 2003; Judd <i>et al.</i> 2013; Javidkar <i>et al.</i> 2015; Javidkar <i>et al.</i> 2016; Javidkar <i>et al.</i> 2017a; Javidkar <i>et al.</i> 2017b)	Dr Simon Judd Reference Collection

RESULTS

The collection contained 175 samples, representing 42 different taxa. Of these taxa 35 belonged to SRE categories and seven are widespread. Seven species were described with formal names and 35 were represented by morphospecies or ambiguous (sp.) identifications. A taxonomic summary of the SRE species (with corresponding SRE categories) are summarised in Table 1. The list of representative samples for these taxa are provided in Appendix 1.

Table 2. List of species present in this collection with assigned SRE categories.

CLASS	ORDER	FAMILY	SPECIES/morphospecies	SRE
Arachnida	Araneae	Anamidae	Anamidae 'MH1'	Potential SRE: DDT
Arachnida	Araneae	Anamidae	Anamidae 'MH2'	Potential SRE: DDT
Arachnida	Araneae	Barychelidae	Barychelidae 'MH1'	Potential SRE: DDT
Arachnida	Araneae	Barychelidae	Barychelidae 'MH2'	Potential SRE: DDT
Arachnida	Araneae	Barychelidae	<i>Idiommatia</i> 'MH3'	Potential SRE: DDT
Arachnida	Araneae	Idiopidae	<i>Bungulla bringo</i>	Potential SRE: DDG
Arachnida	Pseudoscorpiones	Cheiridiidae	Cheiridiidae sp.	Potential SRE: DDT
Arachnida	Pseudoscorpiones	Chthoniidae	<i>Austrochthonius</i> sp.	Potential SRE: DDT
Arachnida	Pseudoscorpiones	Chthoniidae	<i>Austrochthonius</i> 'MH1'	Potential SRE: DDT
Arachnida	Pseudoscorpiones	Chthoniidae	<i>Austrochthonius</i> 'MH2'	Potential SRE: DDT
Arachnida	Pseudoscorpiones	Chthoniidae	<i>Austrochthonius</i> 'MH3'	Potential SRE: DDT
Arachnida	Pseudoscorpiones	Olpidae	<i>Austrochthonius</i> sp.	Potential SRE: DDT
Arachnida	Pseudoscorpiones	Olpidae	<i>Beierolpium</i> '8/2 MH2'	Potential SRE: DDT
Arachnida	Pseudoscorpiones	Olpidae	<i>Beierolpium</i> '8/4'	Potential SRE: DDT
Arachnida	Pseudoscorpiones	Olpidae	<i>Beierolpium</i> '8/4 MH3'	Potential SRE: DDT
Arachnida	Pseudoscorpiones	Olpidae	<i>Indolpium</i> sp.	Potential SRE: DDT
Arachnida	Scorpiones	Bothriuridae	<i>Cercophonium michaelsoni</i>	Widespread
Chilopoda	Geophilomorpha	Geophilidae	Geophilidae 'MH1' (<i>Ribautia</i>)	Potential SRE: DDT
Chilopoda	Geophilomorpha		Geophilomorpha sp.	Potential SRE: DDT
Chilopoda	Geophilomorpha	Mecistocephalidae	Mecistocephalidae sp.	Potential SRE: DDT
Chilopoda	Geophilomorpha	Mecistocephalidae	Mecistocephalidae 'MH1'	Potential SRE: DDT
Chilopoda	Geophilomorpha	Oryidae	<i>Orphnaeus</i> 'MH1'	Potential SRE: DDT
Chilopoda	Geophilomorpha	Oryidae	<i>Orphnaeus</i> 'MH2'	Potential SRE: DDT
Chilopoda	Lithobiomorpha		Lithobiomorpha sp.	Potential SRE: DDT
Chilopoda	Scolopendromorpha	Scolopendridae	Scolopendridae sp.	Widespread
Diplopoda	Polydesmida	Paradoxosomatidae	<i>Antichiropus</i> sp.	Potential SRE: DDT
Diplopoda	Polyzoniida	Siphonotidae	Siphonotidae 'MH1'	Potential SRE: DDT
Gastropoda	Eupulmonata	Bothriembryontidae	<i>Bothriembryon</i> sp.	Potential SRE: DDT
Gastropoda	Eupulmonata	Camaenidae	<i>Sinumelon vagante</i>	Widespread
Gastropoda	Eupulmonata	Punctidae	<i>Westralaoma expicta</i>	Widespread
Gastropoda	Eupulmonata	Pupillidae	<i>Gastrocopta larapinta</i>	Widespread
Gastropoda	Eupulmonata	Pupillidae	<i>Pupoides contrarius</i>	Widespread
Gastropoda	Eupulmonata	Pupillidae	<i>Pupoides pacificus</i>	Widespread
Malacostraca	Isopoda	Armadillidae	<i>Acanthodillo</i> '5A'	Potential SRE: DDT
Malacostraca	Isopoda	Armadillidae	<i>Acanthodillo</i> '5B'	Potential SRE: DDT
Malacostraca	Isopoda	Armadillidae	<i>Buddelundia</i> '87'	Potential SRE: DDG
Malacostraca	Isopoda	Armadillidae	<i>Spherillo</i> sp.	Potential SRE: DDT

Malacostraca	Isopoda	Armadillidae	<i>Spherillo</i> '2A'	Potential SRE: DDT
Malacostraca	Isopoda	Armadillidae	<i>Spherillo</i> '2C'	Potential SRE: DDT
Malacostraca	Isopoda		Isopoda 'MH1'	Potential SRE: DDT
Malacostraca	Isopoda	Paraplatyarthridae	<i>Paraplatyarthrus</i> 'MH1'	Potential SRE: DDT
Malacostraca	Isopoda	Philosciidae	<i>Laevophiloscia</i> sp.	Potential SRE: DDT

DISCUSSION

Species identifications and SRE justification for each taxon are discussed below.

ARACHNIDA

Araneae (Mygalomorphae)

Family Anamididae

Anamididae 'MH1' and Anamididae 'MH2'

Identification of species or genera in this family requires examination of adult male specimens. These specimens were adult females and comparison of the spermathecae indicates they are different species; however, broader comparisons between species were not possible using female morphology alone.

Greater taxonomic resolution may be possibly by comparing the DNA sequences of these specimens with those on Genbank or in the W.A. Museums private collection of research sequences. Anamididae contains both widespread and SRE species and in the absence of species level identifications these specimens are potential SRE owing to taxonomic data deficiency.

Family Barychelidae

Barychelidae 'MH1' and Barychelidae 'MH2'

Identification of species or genera in this family requires examination of adult male specimens. These specimens were adult females and comparison of the spermathecae indicates they are different species; however, broader comparisons between species were not possible using morphology alone.

Greater taxonomic resolution may be possibly by comparing the DNA sequences of these specimens with those on Genbank or in the W.A. Museums private collection of research sequences. Barychelidae contains both widespread and SRE species and in the absence of species level identifications these specimens are potential SRE owing to taxonomic data deficiency.

***Idiommatata* 'MH3'**

This specimen could not be matched with any in the W.A. Museum. In the absence of a clear identification, this species is a potential SRE owing to geographical data deficiency.

Family Idiopidae

Bungulla bringo

This species is tentatively identified as *Bungulla bringo* (Rix *et al.* 2018b); however, its identity should be confirmed using DNA sequences. *Bungulla bringo* is a rare species known from few specimens. The species is a potential SRE owing to geographical data deficiencies.

Pseudoscorpiones

Family Cheiridiidae

Cheiridiidae sp.

A single juvenile specimen was present in this collection. Species identification was impossible since the specimen is juvenile. Little is known about Western Australian cheiridiids. Several undescribed morphospecies are known from the Kimberley and Pilbara and a few rarer records are known from the Goldfields. No records are known from the study region. This is a potential SRE owing to taxonomic data deficiency. The identity of this species may be revealed following assessment of its DNA sequences by the W.A. Museum.

Family Chthoniidae

Austrochthonius 'MH1', *Austrochthonius* 'MH2' and *Austrochthonius* 'MH3' and *Austrochthonius* sp.

In Western Australia *Austrochthonius* is represented by four described species; however, none of these are known from the region sampled. Many undescribed *Austrochthonius* species are also known from W.A. The taxonomy of *Austrochthonius* is challenging and relies on both discrete morphological characters and meristic characters.

The present collection appears to contain at least three morphospecies that were diagnosed on the basis of chela morphometrics, trichobothrial patterns and cheliceral morphology. There is potential for these morphospecies to contain more than one species and an assessment of the DNA sequences from targeted specimens is strongly recommended.

Two morphospecies were previously recognised for a part of this collection however they did not conform with the identifications made here. *Austrochthonius* 'MH1' and *Austrochthonius* 'MH2' both contained representatives that were previously identified as BPS306 and BPS307. This taxonomic inconsistency further justifies the need to resolve this group using DNA sequences.

Most *Austrochthonius* species appear to be relatively widespread and multiple species are also known to occur in sympatry; however, in the absence of more detailed taxonomic information about these species, they are potential SREs owing to taxonomic data deficiency.

Family Olpiidae

Austrohorus sp.

The taxonomy of this genus is very poorly resolved in Australia and numerous undescribed species are known. Currently there is no reliable character system for diagnosing *Austrohorus* species.

Three samples were identified from *Austrohorus* and their morphological characteristics suggest that they are likely to represent a single species. The only way to unambiguously identify species within these groups at this is with an assessment of their DNA sequences. Assessment of the species boundaries of these specimens is necessary to determine if they are conspecific and if they correspond with previously samples morphospecies. In the absence of unambiguous species identity this taxon is a potential SRE owing to taxonomic data deficiency and more than one species may be present.

Beierolpium '8/2 MH1', *Beierolpium* '8/4 MH2' and *Beierolpium* '8/4 MH3'

Three putative species groups of *Beierolpium* were identified from this collection. Species groups of *Beierolpium* are generally diagnosable based on trichobothrial patterns and this has led to the W.A. Museum morphospecies notation of "8/4", "8/2" etc. Assessment of the DNA sequences from specimens within these groups has revealed the presence of numerous undescribed species therefore what was thought to represent species is in fact indicative of species complexes or species groups. Unambiguous species delimitation of the specimens in this collection therefore requires an assessment of their DNA sequences as the most unambiguous means of assessing species boundaries in *Beierolpium*.

I am reasonably confident that *Beierolpium* '8/2 MH1' and *Beierolpium* '8/4 MH3' are each single species, but *Beierolpium* '8/4 group' may be a species complex and represent more than one species. All three of these taxa are potential SREs owing to taxonomic data deficiency.

Indolpium sp.

The taxonomy of this genus is very poorly resolved in Australia and numerous undescribed species are known from W.A. Currently there is no reliable character system for diagnosing *Indolpium* species and species delimitation relies on DNA sequences.

Three samples were identified from this genus. These specimens appear similar and may represent one species; however, the only way to unambiguously verify if they are conspecific is with an assessment of their DNA sequences. In the absence of unambiguous species identity this taxon is a potential SRE owing to taxonomic data deficiency and more than one species may be present.

Scorpiones

Family Bothriuridae

Cercophonius michaelsoni

A single juvenile specimen of this species was collected. This species is widespread in Western Australia and is the most arid adapted member of the genus.

CHILOPODA

Geophilomorpha

Geophilomorpha sp.

A single specimen could not be identified beyond Order owing to its tiny size. It is almost certainly a juvenile and its identity should be established using DNA sequencing methods. In the absence of unambiguous species identity this taxon is a potential SRE owing to taxonomic data deficiency and more than one species may be present.

Family Geophilidae

Four taxa were identified to Geophilidae. Most W.A. representatives of this family were previously placed in the family Chilenophilidae; however, that family is now a synonym of Geophilidae (Bonato *et al.* 2014).

Very little is known about the taxonomy of Western Australian Geophilidae and species delimitation relies on assessment of DNA sequence data.

Geophilidae 'MH1' (*Ribautia*),

Three specimens were tentatively identified to this species. Two specimens (AES211008 and AES211009) were previously identified as unresolved species of *Ribautia*. I am cautious to support this genus assignment; however, they do appear to be conspecific and may be the same species as specimen AES210817. Despite their similar appearance, the relationships of these specimens to one another should be verified using DNA sequences. This species is potential SRE owing to taxonomic data deficiency and there is potential for multiple species to be present.

Family Mecistocephalidae

Mecistocephalidae 'MH1'

This morphospecies was represented by four specimens. Assignment to this morphospecies was tentative and the veracity of these should be verified with DNA sequences. This is a potential SRE species owing to taxonomic data deficiency and there is potential for more than one species to be involved.

Mecistocephalidae sp.

Thirteen specimens could not be clearly assigned to morphospecies, mainly because their size suggest they are juveniles. The identity of these specimens will need to be determined using DNA sequence. This taxon is a potential SRE owing to taxonomic data deficiency and more than one species may be present.

Family Oryidae

Orphnaeus 'MH1' and *Orphnaeus* 'MH2'

Two morphospecies of *Orphnaeus* were identified in this collection. A single species (*Orphnaeus brevilabiatus*) is known in W.A.; however, it appears to be a cosmopolitan species and some of those identifications may also be erroneous. As with all geophilids in W.A., species delimitation is heavily dependent on assessment of

DNA sequence data. These two morphospecies should be verified using DNA sequence data and both species are potential SRE owing to taxonomic data deficiency.

Lithobiomorpha

Lithobiomorpha sp.

Seven samples of this order were present in the collection. No Lithobiomorpha are currently flagged as SRE so no further taxonomic resolution was sought for these samples.

Scolopendromorpha

Family Scolopendridae

Scolopendridae sp.

One sample of this family was present in the collection. No Scolopendridae are currently flagged as SRE so no further taxonomic resolution was sought for this sample.

DIPLOPODA

Polydesmida

Family Paradoxosomatidae

Antichiropus sp.

Nine samples contained representatives of *Antichiropus*. Adult male specimens are required to identify *Antichiropus* specimens but only one of these samples contained an adult male. Further complicating identification of *Antichiropus* is the regular occurrence of two or more species in sympatry. Most *Antichiropus* species appear to be SREs (Car *et al.* 2013; Car *et al.* 2014; Car *et al.* 2019). The only way to obtain identifications of the unresolved specimens is with the use of DNA sequences. This taxon is a potential SRE owing to taxonomic data deficiency and more than one species may be represented.

Polyzoniida

Family Siphonotidae

Siphonotidae 'MH1'

This order of millipedes is very poorly known in W.A. Representatives are known mostly from mesic forests in the southwest of the state; however, they have also (rarely) been collected from arid regions of W.A. Currently the only way to assess species in this group is with the use of DNA sequences. A single specimen of this morphospecies was represented from the Mulgine Hill area. The morphology of this specimen is consistent with specimens from more arid localities. This species is a potential SRE owing to taxonomic data deficiency.

GASTROPODA

Eupulmonata

Family Bothriembryontidae

The taxonomy of *Bothriembryon* is challenging and largely informed by DNA sequence data. Shell morphology alone is often insufficient to obtain identifications so live specimens are required for assessment their DNA.

***Bothriembryon* sp.**

This taxon was represented by eight samples. These were all dead shells of the 'typical' *Bothriembryon* form, so more resolved species delimitation was not possible. The shells also appear to be quite old and several are fragmented. These are potential SREs owing to taxonomic data deficiency and it is unlikely that the samples present will have any suitable tissue from which to extract DNA. The identity of this species will require collection of live specimens from which DNA sequences can be generated.

Family Camaenidae

Sinumelon vagente

The genus *Sinumelon* is largely represented by widespread species from the southern and central parts of WA. *Sinumelon vagente* is the only *Sinumelon* known from the region in which this survey was undertaken (Stanisic *et al.* 2010). This species is widespread with most records from inland of Geraldton to North of Lake Moor.

Family Punctidae

Westralaoma expicta

Two samples were identified to *Westralaoma expicta*. This is a widespread species found in the southern Murchison and through the W.A. Goldfields.

Family Pupillidae

Gastrocopta larapinta*, *Pupoides contrarius* and *Pupoides pacificus

Three species of pupillid snails were present in these samples. They are all widespread species.

MALACOSTRACA

Isopoda

Isopoda 'MH1'

One male and one female specimen of an unusual isopod were collected from site LL3. They look to be a primitive form of Oniscidea. They superficially resemble Paraplatyarthridae but have a different form of scale-setae. There are also Philosciidae of this type, but these specimens clearly have a 2-segmented flagellum. Philosciidae have a 3-segmented flagellum. This is a potential SRE (likely) owing to taxonomic data deficiency. Assessment of the DNA sequences of this species will be necessary to obtain more resolved identification and potential regional context.

Family Armadillidae

Acanthodillo '5A' and *Acanthodillo* '5B'

Two morphospecies of *Acanthodillo* were present in this collection, both represented by single specimens and belonging to the *Acanthodillo* 5 species complex found in the central and southern jarrah forest. Sequencing should be undertaken if greater resolution between the two specimens is required. Both of these morphospecies are potential SREs owing to taxonomic data deficiencies.

Buddelundia '87'

This morphospecies was represented by 10 samples from the Mulgine Hill area. It is a known morphospecies and had been previously collected from the area. It is a potential SRE owing to geographical data deficiency.

Spherillo '2A' and *Spherillo* '2C'

Spherillo 2 is a morphospecies complex and occurs in the northern jarrah forest region. These are four similar looking morphospecies. There is very limited material, and probably no adult males, but each are significantly different enough to consider them distinct morphospecies. Assessment of the DNA sequencing from these morphospecies may yield more information about their relationships to other *Spherillo* in W.A. Both morphospecies are potential SREs owing to taxonomic data deficiencies.

Spherillo sp.

This specimen (AES211003) was originally determined by Bennelongia. It is a very small female specimen that was damaged, and in two halves. Unfortunately, the posterior half is now lost. It is very pale and so is possibly a small juvenile or a partially subterranean species. This is a potential (likely) SRE species owing to taxonomic data deficiency.

Family Philosciidae

Laevophiloscia sp.

This is a typical form of *Laevophiloscia* found in drier regions. The taxonomy of this genus in WA and the distribution of this species are unknown. *Laevophiloscia yalagoonensis* Wahrberg, 1922 was described from this area. This species is very similar to one from approximately 20 km E of Ledge Point. This relationship should be verified using DNA sequences since most Philosciidae appear to be SREs. This is a **potential SRE** owing to taxonomic data deficiency.

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Appendix 1 (attached file): 2123-Spectrum-Mulgine-SRE-Data.xlsx

Appendix E 2023-2024 Detailed Terrestrial Fauna Survey



Detailed Terrestrial Fauna Survey – Mt Mulgine Project

March 2026

Prepared for Tungsten Mining NL





Limitations

Scope of services

This report ("the report") has been prepared by Western Ecological Pty Ltd (WE) in accordance with the scope of services set out in the contract, or as otherwise agreed, between the Client and WE. In some circumstances, a range of factors such as time, budget, access and/or site disturbance constraints may have limited the scope of services. This report is strictly limited to the matters stated in it and is not to be read as extending, by implication, to any other matter in connection with the matters addressed in it.

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Report Version	Revision No.	Purpose	Author/reviewer	Submitted to Client	
				Form	Date
Draft Report	1	For client review	Western Ecological / ISPL	Electronic	31/05/2024
Final Report	2	Client submission	Western Ecological / ISPL	Electronic	23/03/2026

Executive Summary

Western Ecological was commissioned by Tungsten Mining NL to undertake a two-season detailed terrestrial vertebrate survey and a targeted threatened species survey at the Trench Tungsten Operation located at Mount Mulgine. The Trench Tungsten Operation (the operation) is situated approximately 330 km northeast of Perth and 15 km northeast of Rothsay, in the Shire of Perenjori.

It is understood that the operation is located within contiguous Mining Leases M59/386, M59/387, M59/425, and L59/161 and L59/162. TM located three tungsten and molybdenum deposits referred to as Mulgine Hill, Mulgine Hill East and Trench, with the focus initially on the Trench deposit; all the deposits are within tenement M59/425. Additional site infrastructure including the Processing Plant and ROM Pad, Waste Rock Landforms (WRL), Stockpiles, Tailings Storage Facilities (TSF) and Camp Facilities will be located within the M59/387 and M59/386 tenements. Minor activities (construction and operation of roads) will be undertaken within the Miscellaneous Leases L59/161 and L59/162.

The detailed field survey was undertaken over two seasons. The primary season trapping programme was undertaken for a total of eleven days from 17th – 27th November 2023 and the secondary season was undertaken for a total of ten days from the 16th – 25th March 2024 (excluding travel days), by two qualified Zoologists, Dr Ron Firth and Laura Stevens from Western Ecological.

The field survey included undertaking a trapping programme that included eight dedicated trap sites with pitfall traps, funnel traps, Elliott and cage traps, as well as long-term camera traps. Acoustic recording units (Song Meter 4 units) were also used to record the calls of micro bat species.

Targeted searches for the threatened Malleefowl (*Leipoa ocellata*), Western Spiny-tailed Skink (*Egernia stokesii badia*) and Gilled Slender Bluetongue (*Cyclodomorphus branchialis*) were also undertaken. This included some systematic searches in suitable habitat for the three species and deploying 15 long-term camera traps.

During the field survey, a total of 94 species were recorded; 25 reptile species, 55 bird species and 14 mammal species were recorded. Of these 14 mammal species, eight were micro bat species that were recorded on the Song Meter 4 units. A total of 23 species across the eight trap sites were captured during the entire trapping programme. The most frequently captured species was the Bynoe's Gecko (*Heteronotia binoei*) with 15 captures in total, followed by the Western Spotted Ctenotus (*Ctenotus uber*) and Variegated Gehyra (*Gehyra variegata*) both with 12 captures.

Camera traps recorded the images of 14 species. Of the 14 species captured on the camera traps, one species was not recorded by any other means: the Echidna, which was recorded on two cameras. Of the 14 species recorded, two are introduced – the Feral Cat and Rabbit. The Feral Cat was recorded on cameras at seven locations, and the Rabbit was recorded on cameras at four locations. The Malleefowl was recorded on two cameras.

Four broad fauna habitat types were identified in the survey area:

- Mixed Shrubland
- Open Eucalyptus Woodland
- Rocky Hill
- Cleared

During the survey, no Western Spiny-tailed Skinks, or Gilled Slender Bluetongues, were recorded. The Malleefowl, however, was recorded through a single sighting during the second-season survey, images from two of the long-term camera traps, five Disused mounds and 13 re-assessed Disused mounds.



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1. Introduction

1.1 Background

Western Ecological (WE) was commissioned by Tungsten Mining NL (TM) to undertake a two-season detailed terrestrial vertebrate survey and a targeted threatened species survey at the Trench Tungsten Operation (the operation) located at Mount Mulgine (Figure 1). The operation is situated approximately 330 km northeast of Perth and 15 km northeast of Rothsay, in the Shire of Perenjori.

It is understood that the operation is located within contiguous Mining Leases M59/386, M59/387, M59/425, and L59/161 and L59/162. TM located three tungsten and molybdenum deposits referred to as Mulgine Hill, Mulgine Hill East and Trench, with the focus initially on the Trench deposit; all the deposits are within tenement M59/425. Additional site infrastructure, including the Processing Plant and ROM Pad, Waste Rock Landforms (WRL), Stockpiles, Tailings Storage Facilities (TSF) and Camp Facilities, will be located within the M59/387 and M59/386 tenements. Minor activities (construction and operation of roads) will be undertaken within the Miscellaneous Leases L59/161 and L59/162.

The detailed terrestrial vertebrate and targeted threatened species survey will help support the environmental approvals process.

1.2 Scope and Objectives

The scope of work (SoW) to be undertaken and broad objectives were as follows:

- Detailed terrestrial vertebrate fauna survey,
- Targeted threatened species survey (in conjunction with the detailed fauna survey) where suitable habitat is present:
 - *Leipoa ocellata* (Malleefowl) – listed as Vulnerable (Vu) under the EPBC Act and BC Act
 - Western Spiny-tailed Skink (*Egernia stokesii badia*) Endangered (En) under the EPBC Act and Vu under the BC Act
 - Gilled Slender Bluetongue (*Cyclodomorphus branchialis*) Vu under the BC Act
- Document the above in a technical report.

2. Legislative context

Fauna in Western Australia is protected formally and informally by various legislative and non-legislative measures, which are as follows:

- *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)* – Commonwealth Government
- *Biodiversity Conservation Act 2016 (BC Act)* – WA State Government.

Non-legislative measures:

- WA Department of Biodiversity, Conservation and Attractions (DBCA) Priority lists for flora, ecological communities and fauna.

A short description of each is given below. Other definitions, including species conservation categories, are provided in Appendix 1.

EPBC Act

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) aims to protect matters of national environmental significance, which are detailed in Appendix 1. Under the EPBC Act, the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) lists protected species and Threatened Ecological Communities (TECs) by criteria set out in the Act. Species are considered conservation significant if they are listed as Threatened (i.e., Critically Endangered [CrEn], Endangered [En] and Vulnerable [Vu]) or Migratory.

Bird species protected as Migratory under the EPBC Act include those listed under international migratory bird agreements relating to the protection of birds, which migrate between Australia and other countries, for which Australia has agreed. This includes the Japan-Australia Migratory Bird Agreement (JAMBA), the China-Australia Migratory Bird Agreement (CAMBA), the Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA) and the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention).

Some marine fauna or terrestrial fauna that use marine habitats are listed as Marine under the EPBC Act. These species are only considered conservation significant when a proposed development occurs in a Commonwealth marine area (i.e., any Commonwealth Waters or Commonwealth Marine Protected Area). Outside of such areas, the EPBC Act does not consider these species to be matters of national environmental significance, so are not protected under the EPBC Act.

BC Act

The *Biodiversity Conservation Act 2016* (BC Act) replaced both the *Wildlife Conservation Act 1950* and the *Sandalwood Act 1929* and came into effect on 1 January 2019. The aim of the new BC Act is to conserve and protect biodiversity and to promote the ecologically sustainable use of biodiversity components in the State and will bring more activities within the scope of biodiversity laws.

Taxa listed as Threatened in the category of Critically Endangered, Endangered or Vulnerable under section 19(1a, 1b, and 1c), or is a rediscovered species to be regarded as threatened species under section 26(2) of the BC Act. Other categories include Extinct or Extinct in the Wild and they are listed under section 23 (1) of the BC Act (Appendix 1).

If a species meets one or more of the following categories: species of special conservation interest; migratory species; cetaceans; species subject to international agreement; or species otherwise in need of special protection, they are covered under section 13(1) of the BC Act and are called specially protected species. Species that are listed as threatened species (Critically Endangered, Endangered or Vulnerable) or extinct species under the BC Act can't also be listed as Specially Protected species (see Appendix 1 for a more detailed description of each threat category).

Threatened Ecological Communities (TECs) are also covered under the BC Act and are placed into three categories of Critically Endangered, Endangered or Vulnerable under section 27(1a, 1b, and 1c) of the BC Act depending on their threat status.

DBCA Priority Species and Communities

DBCA lists species that are possibly threatened but do not meet criteria for listing under the BC Act, or are otherwise data deficient, and adds them to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are

ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened fauna or flora. Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring. Consideration of Priority codes is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations (see Appendix 1 for more detail of the priority codes).

DBCA also has a list of Priority Ecological Communities (PECs) that have scant information available to be considered a TEC, or which are rare but not currently threatened. Ecological communities that do not meet survey criteria or that are not sufficiently defined are added to the PEC list under Priorities 1, 2 and 3. These three categories are ranked in order of priority for survey and/or definition of the community, and evaluation of conservation status, so that consideration can be given to their declaration as a TEC. Ecological communities that are adequately known, and are rare but not threatened or meet criteria for near threatened, or that have been recently removed from the threatened list, are placed in Priority 4. These ecological communities require regular monitoring. Conservation dependent ecological communities are placed in Priority 5.

Informal Recognition of Threatened Fauna

Certain populations or communities of fauna may be of local significance or interest because of their patterns of distribution and abundance. For example, fauna may be locally significant because they are range extensions to the previously known distribution or are newly discovered species (and have the potential to be of conservation significance). In addition, many species are in decline as a result of threatening processes (land clearing, grazing and changed fire regimes) and relict populations of such species assume local importance for DBCA. It is not uncommon for DBCA to make comment on these species of interest.

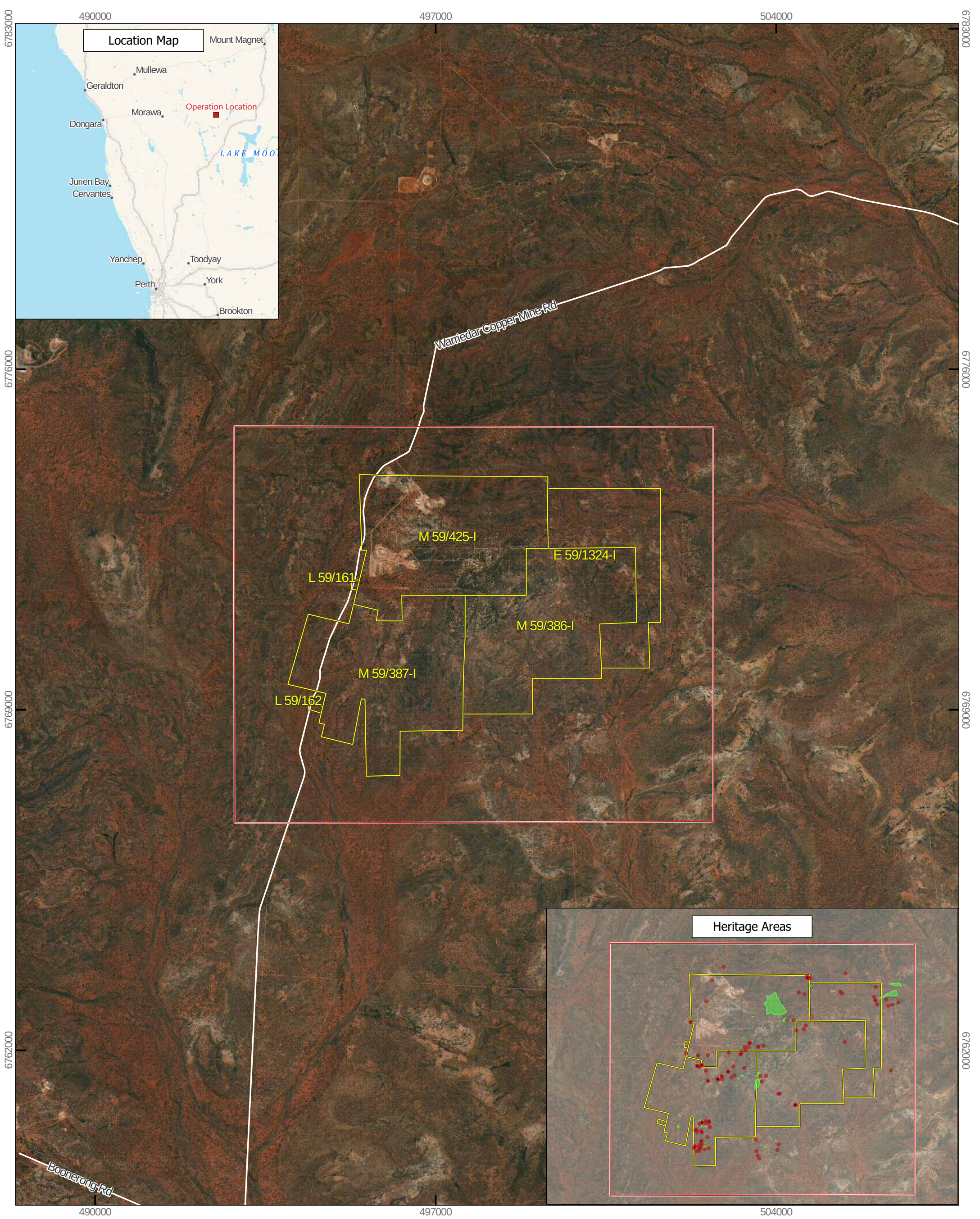


Figure 1: Operation Location



GDA2020 - MGA Zone 50

Legend

- Artifacts or Sites
- Heritage Sites (2023)
- Tenement Boundary
- Survey Area



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3. Existing Environment

3.1 Climate

The nearest Bureau of Meteorology (BoM) weather station with long-term rainfall records is Ningham Station (Station No. 007068) which is approximately 40 km south-west of the survey area. The annual long-term average (1905 – 2023) rainfall is 294.4 mm, with the lowest average monthly rainfall being 9.9 mm in December, while the highest average monthly rainfall is 45.4 mm in June (BoM 2024) (Figure 2).

Temperature data for Ningham Station has never been recorded. Consequently, temperature records have been obtained from Paynes Find (Station No. 007139) weather station which is the closest station with long-term temperature data (1975 – 2024). Paynes Find is approximately 70 km east of the survey area. The mean annual maximum temperature recorded at the Paynes Find weather station is 28.0°C and minimum is 13.0°C. On average the warmest month of the year is January with a mean maximum temperature of 37.5°C. July is the coolest month with a mean minimum temperature of 5.5°C.

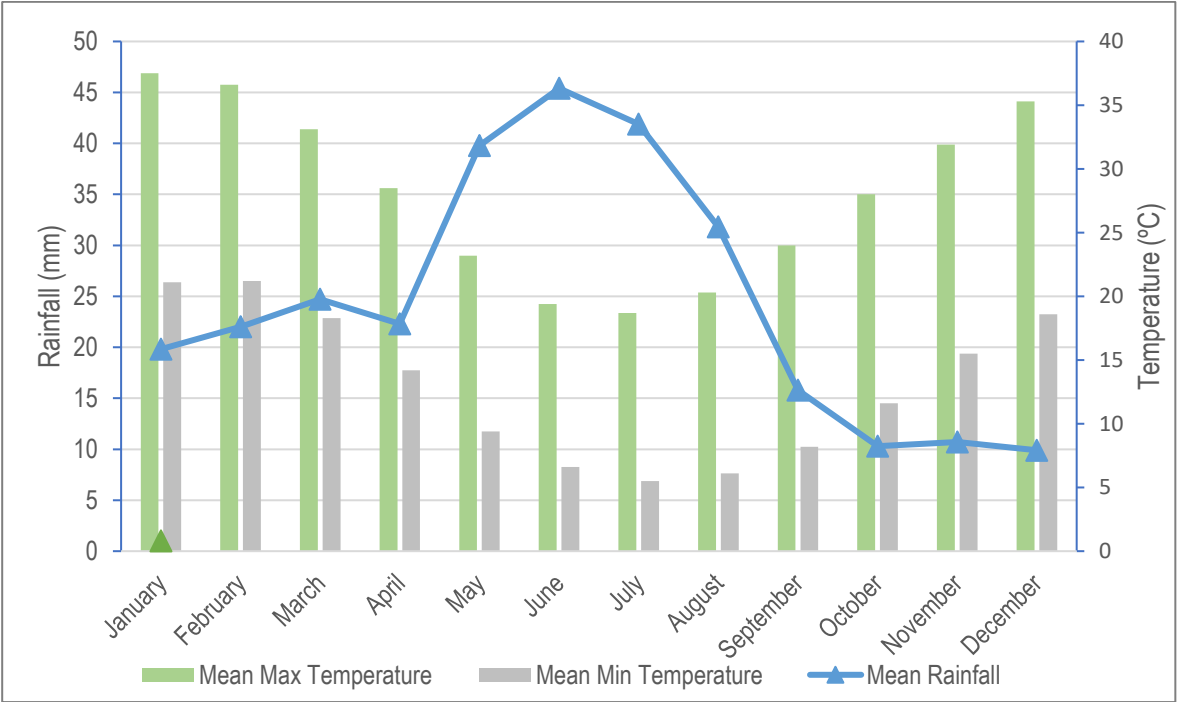


Figure 2. Climate Graph. Monthly mean temperatures (from 1975 – 2023) from Paynes Find and rainfall (1905 – 2023) data from Ningham Station (BoM 2024).

Climate data is also recorded in the survey area by TM, providing more local temperature and rainfall information. Temperature and rainfall recorded during the two field surveys can be seen in Table 1 and Figures 3 and 4.

During both seasons of the survey (days traps were open) daily minimum and maximum temperatures recorded by TM at the Mount Mulgine weather station were variable and considerably different to the long-term average maximum and minimum temperatures recorded at Paynes Find weather station (refer to Table 1 below).

This was particularly apparent for the November season. In November 2023, two trapping days experienced temperatures which approximately aligned with the long-term maximum average of 31.9°C, (from Paynes Find station) (30.8°C on the 17th and 31.1°C on the 23rd). The remaining eight days were all significantly higher than the long-term average (Table 1). Minimum temperatures were higher than the long-term average (from Paynes Find station) on every day of the November season. A total of 1 mm of rain was recorded during the November season field survey. This was across two days and is below the long-term average of 10.7 mm (recorded at Ningham Station) (Table 1, Figure 3).

In March 2024, five of the ten trapping days experienced a maximum temperature above the long-term average (from Paynes Find station) of 33.1°C (Table 1, Figure 4). Minimum temperatures were higher than the long-term average (from Paynes Find station) of 18.3°C, on four days. In March 2024, no rainfall was recorded in the survey area.



Table 1. Maximum and minimum temperatures and rainfall for Mt Mulgine in November 2023 and March 2024 on the days traps were being setup/open. Those temperatures in bold are above the long-term November or March long-term averages recorded at Paynes Find weather station (Station No. 007139 BoM 2024).

Date (November 2023)	Mt. Mulgine Max Temp (°C)	Mt. Mulgine Min temp (°C)	Mt. Mulgine Rainfall (mm)
17	30.8	17.0	0
18	33.8	17.5	0
19	37.9	20.0	0
20	41.0	22.2	0
21	41.2	23.9	0
22	38.8	25.5	0
23	31.1	24.2	0
24	39.4	20.3	0.8
25	40.9	25.0	0
26	41.0	23.1	0
27	33.7	17.9	0.2
Date (March 2024)	Mt. Mulgine Max temp (°C)	Mt. Mulgine Min temp (°C)	Mt. Mulgine Rainfall (mm)
16	38.1	22.8	0
17	38.5	23.3	0
18	31.6	18.8	0
19	27.2	17.8	0
20	27.5	17.1	0
21	31.4	16.0	0
22	30.2	18.0	0
23	28.9	16.5	0
24	27.5	14.4	0
25	30.9	14.2	0

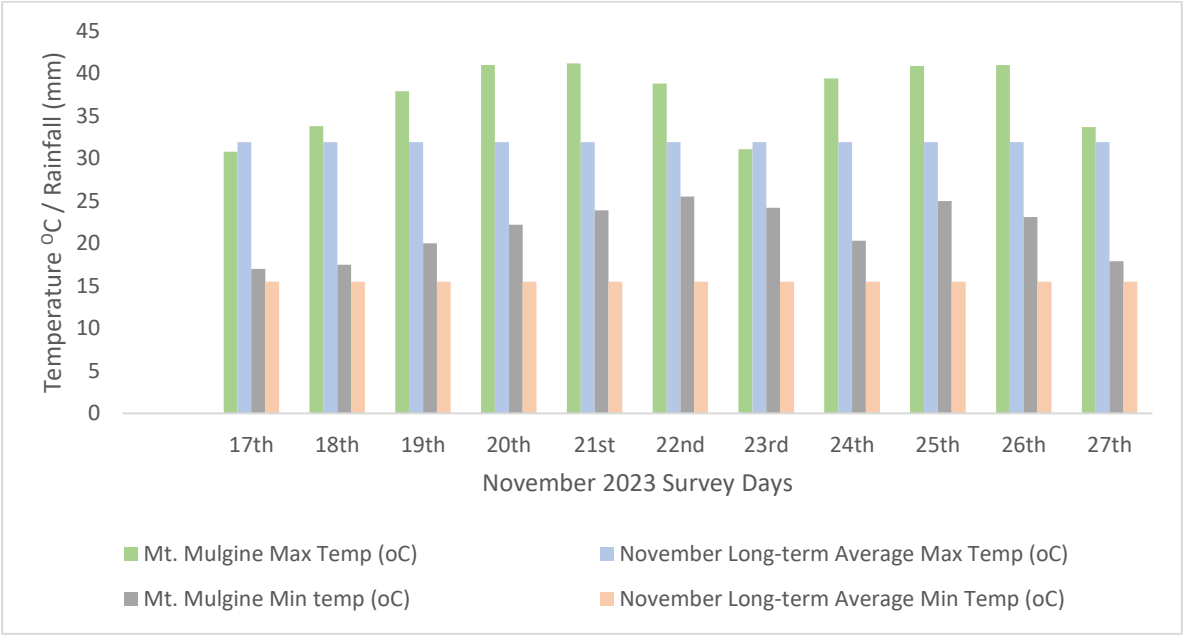


Figure 3: Mount Mulgine temperatures and rainfall, compared to long-term temperature averages at Paynes Find weather station (Station No. 007139 BoM 2024) (November 2023 survey days).

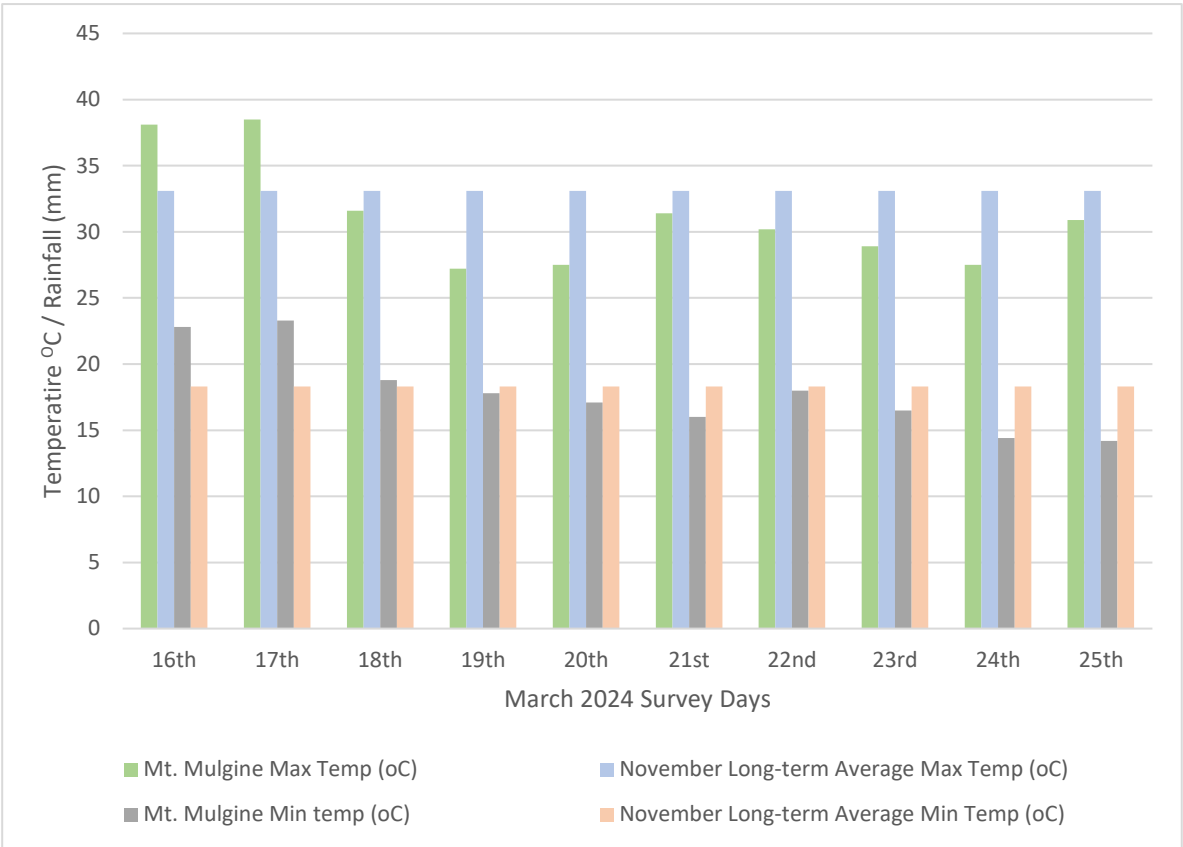


Figure 4: Mount Mulgine temperatures and rainfall, compared to long-term temperature averages at Paynes Find weather station (Station No. 007139 BoM 2024) (March 2024 survey days).

3.2 Bioregions

The Biogeographic Regionalisation of Australia (IBRA7) divides Australia into 89 bioregions based on major biological, geographical and geological attributes. These bioregions are subdivided into 419 subregions as part of a refinement of the IBRA framework (DCCEEW 2016). The survey area sits within the Tallering (YAL02) subregion of the Yalgoo bioregion which extends south-eastwards from the southern end of Shark Bay nearly to Lake Barlee in the interior of Western Australia, forming an interzone between the south-west and Murchison bioregions.

The climate of this subregion ranges from semi-arid to Mediterranean, with 200 – 300 mm of rainfall annually. The Yalgoo bioregion is characterised by sand and alluvial plains, low ranges and lakes. Mulga or bowgada shrublands dominate in the east. Western parts include sand plains, heathlands and some eucalypt shrublands. Tenure is pastoral leasehold and sheep grazing is the main enterprise type. Mining is also important in the bioregion (Desmond & Chant 2001) (Figure 5).

3.3 Previous Fauna Surveys

A number of fauna surveys have previously been undertaken, either in the current survey area or in the vicinity of the survey area (Table 2). A summary of these surveys is outlined below, with particular reference to any threatened fauna that may have been recorded, in order to provide some context for this current assessment. There were other reports in the local region but most of these were either further away from the survey area or more than twelve years old.

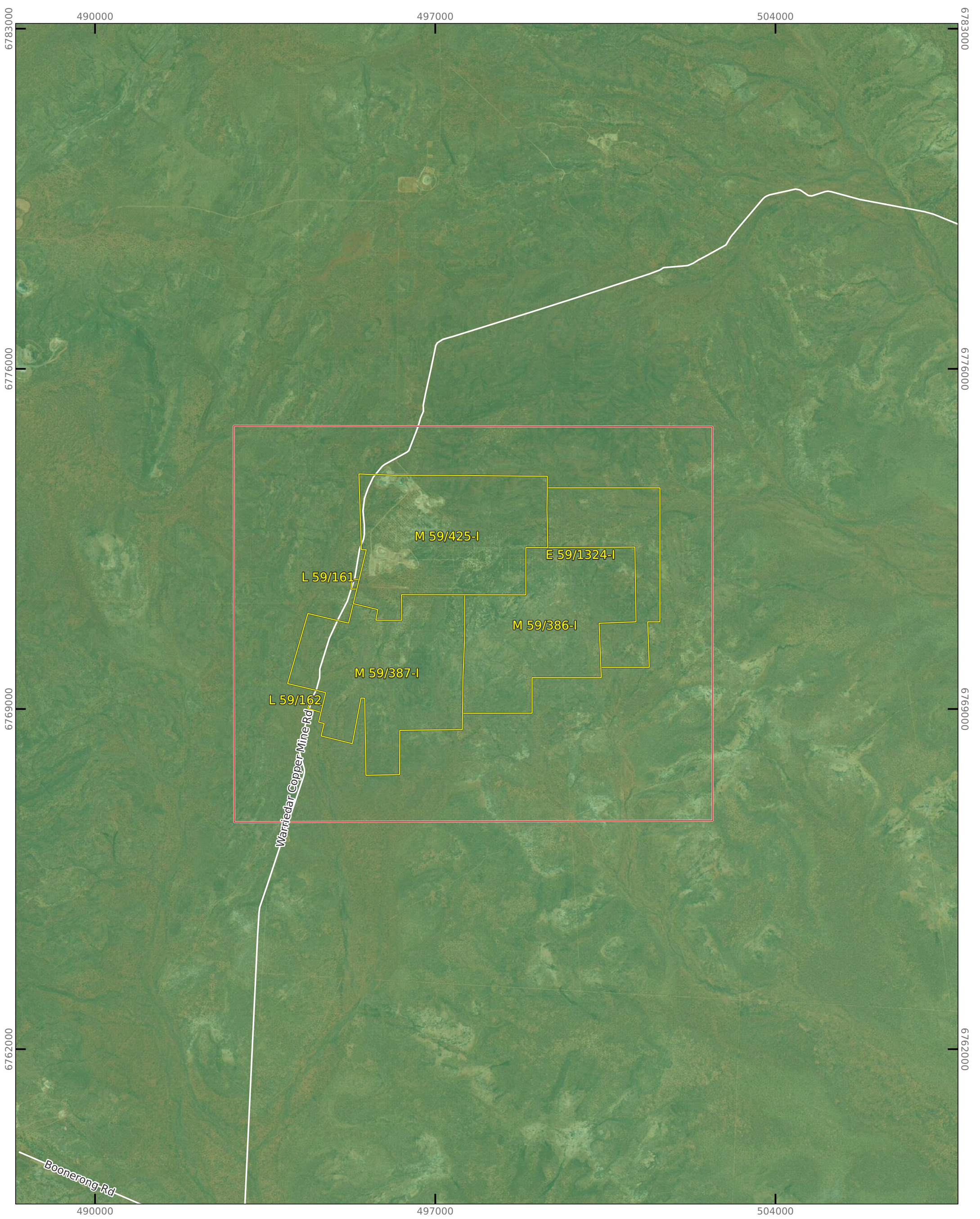
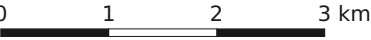


Figure 5: IBRA Region



GDA2020 - MGA Zone 50

Legend

-  Tenement Boundary
-  Survey Area
- IBRA Region - Sub-region
 -  Yalgoo - Talling



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Table 2: Previous Fauna Surveys

Reference	Prepared For	Field Survey Date	Fauna Survey Type	Proximity to survey area	Broad Fauna Habitat Described	Threatened Vertebrate Fauna Recorded
Mt Mulgine Terrestrial Fauna Assessment (Spectrum Ecology, 2022)	Tungsten Mining NL	June 2020. (Utilised 2019 Spectrum survey data)	Level 1 fauna, targeted conservation significant fauna survey (and SRE assessment)	In survey area	- Mixed Shrubland - Open Eucalypt Woodland - Granite Outcropping - Granitic Flats - Basalt Hills - Eucalypt Woodland on Quartz - Stony Hillslope Shrubland	- Malleefowl (two active mounds and individuals recorded on camera traps). - Peregrine Falcon - Gilled Slender Bluetongue Skink - Western Spiny-tailed Skink (recorded outside the survey area)
Mt Mulgine Clearance Survey (Phase 1) (Spectrum Ecology, 2019)	Tungsten Mining NL	Sept 2019	Targeted preclearance fauna survey	In survey area	- Mixed Shrubland - Open Eucalypt Woodland	None
Mt Mulgine Clearance Survey (Phase 2) (Spectrum Ecology, 2019)	Tungsten Mining NL	Oct 2019	Targeted preclearance fauna survey	In survey area	- Mixed Shrubland - Open Eucalypt Woodland	None
Mt Mulgine Clearance Survey (Phase 3) (Spectrum Ecology, 2019)	Tungsten Mining NL	Dec 2019	Targeted preclearance fauna survey	In survey area	- Mixed Shrubland - Open Eucalypt Woodland	None
Pre-clearance fauna assessment - Mt Mulgine Trench Deposit area (Terrestrial Ecosystems, 2019)	Tungsten Mining NL	June 2019	Targeted preclearance fauna survey	In survey area	None stated	None
Mt Mulgine project - Mulgine Hill M59/425 - M59/387. Targeted survey for Threatened and Priority flora, and conservation significant fauna habitat. (Animal Plant Mineral, 2018)	Mid-West Tungsten Pty Ltd, Tungsten Mining NL	Sept 2017	Targeted Fauna Survey	In survey area	None stated	Two active Malleefowl mounds. Three inactive mounds
Mt Mulgine project biological survey (Animal Plant Mineral, 2017)	Tungsten Mining NL	Nov 2016	Level 1 Fauna Survey	In survey area	- Eucalyptus Open Woodland - Mixed shrubland - Allocasuarina Open Woodland	Malleefowl (tracks)
Rothsay Project Area Fauna Assessment (Bamford Consulting Ecologists, 2017)	Egan Street Resources	Jan 2017	Level 1 Fauna Survey	7 km west of the survey area	- Open woodland and Shrubland on Gravelly Loam - Low Woodland to Tall Shrubland and Thickets - Open Eucalypt Woodlands	None

Reference	Prepared For	Field Survey Date	Fauna Survey Type	Proximity to survey area	Broad Fauna Habitat Described	Threatened Vertebrate Fauna Recorded
Blue Hills - Mungada East terrestrial fauna assessment (Ecoscape (Australia), 2016b)	Sinosteel Midwest Corporation Limited	Aug 2015	Consolidation of terrestrial fauna data, targeted terrestrial fauna survey	30 km west of the survey area	- Rocky ridge with steep slopes - Low slopes with dense Acacia shrubs - Eucalypt woodland - Acacia Shrubland	None
Hinge Project Area fauna assessment (Bamford Consulting Ecologists, 2013a)	Karara Mining Limited	Dec 2011 July 2012 Sept 2012	Level 1 & targeted vertebrate and SRE invertebrate survey	20 km west of the survey area	- banded ironstone ridge - foothills and slopes - drainage lines - Eucalypt woodlands	- Western Spiny-tailed Skink - Malleefowl
Significant fauna survey of the Hinge Haul Road: November 2012. (Bamford Consulting Ecologists, 2013b)	Karara Mining Limited	Sept 2012 Nov 2012	Targeted vertebrate and SRE invertebrate survey	20 km west of the survey area	Mixed Acacia Shrubland	Old/degraded Malleefowl mounds

4. Methods

4.1 Survey Guidance

The fauna survey was completed in accordance with the following EPA and DCCEEW requirements (and other institutions) for the environmental surveying and reporting of fauna surveys in WA, where relevant and practical, and as documented in:

- EPA Technical Guidance: Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (EPA 2020)
- EPA Statement of Environmental Principles, Factors and Objectives (EPA 2018)
- Survey Guidelines for Australia's Threatened Bats. EPBC Act survey guidelines 6.1 (2010) (DEWHA)
- Survey Guidelines for Australia's Threatened Birds. EPBC Act survey guidelines 6.2 (2010) (DSEWPaC)
- Survey Guidelines for Australia's Threatened Frogs. EPBC Act survey guidelines 6.3 (2010) (DSEWPaC)
- Survey Guidelines for Australia's Threatened Mammals. EPBC Act survey guidelines 6.5 (2011) (DSEWPaC)
- Survey Guidelines for Australia's Threatened Reptiles. EPBC Act survey guidelines 6.6 (2011) (DSEWPaC)
- Threatened Species Scientific Committee. Conservation Advice were provided for species listed under the EPBC Act (DCCEEW)
- National Recovery Plan for Malleefowl (*Leipoa ocellata*), Department for Environment and Heritage (Benshemesh 2007)
- Western Spiny-tailed Skink (*Egernia stokesii*) National Recovery Plan (Department of Environment and Conservation [DEC] 2012)
- DBCA/ DPaW standard fauna operating procedures (where relevant).

4.2 Database Searches

Searches of the following databases were undertaken, each with a 50 km buffer applied:

- Atlas of Living Australia (ALA)
- BirdLife Australia Birddata Search
- DBCA Dandjoo
- DBCA Threatened Fauna Database
- EPBC Protected Matters Search Tool (PMST)

The database searches were undertaken to identify threatened fauna species potentially occurring in and near the survey area (ALA 2024, BirdLife 2024, DBCA 2024a, DBCA 2024b, DCCEEW 2024) (Appendix 2).

It is important to note that databases such as the ALA get many of their records from the various state museums and government departments such as DBCA, hence the records are very similar. And finally for assessments such as this we are primarily interested in significant species records, not common and widespread species that form the majority of records in the above database searches. The DBCA threatened fauna database is typically the most relevant and best resource for records of threatened species.

4.3 Detailed Field Survey

The detailed field survey was undertaken over two seasons. The primary season trapping programme was undertaken for a total of eleven days from 17th – 27th November 2023 and the secondary season was undertaken for a total of ten days from the 16th – 25th March 2024, by two qualified Zoologists, Dr Ron Firth and Laura Stevens from Western Ecological.

4.3.1 Trapping Programme

The trapping programme for both seasons (2023 and 2024) consisted of eight trap sites (systematic sampling sites) situated across the survey area, placed in the main broad habitat types identified (see Table 3 below). Each trap site was open for seven nights with the same survey effort (time, number of traps and search effort [defined as person hours]). Traps were not placed in areas mapped as existing disturbance because these areas were highly degraded and as a result, the reward for the expended effort for establishing the trap sites would be inefficient in terms of trap captures.

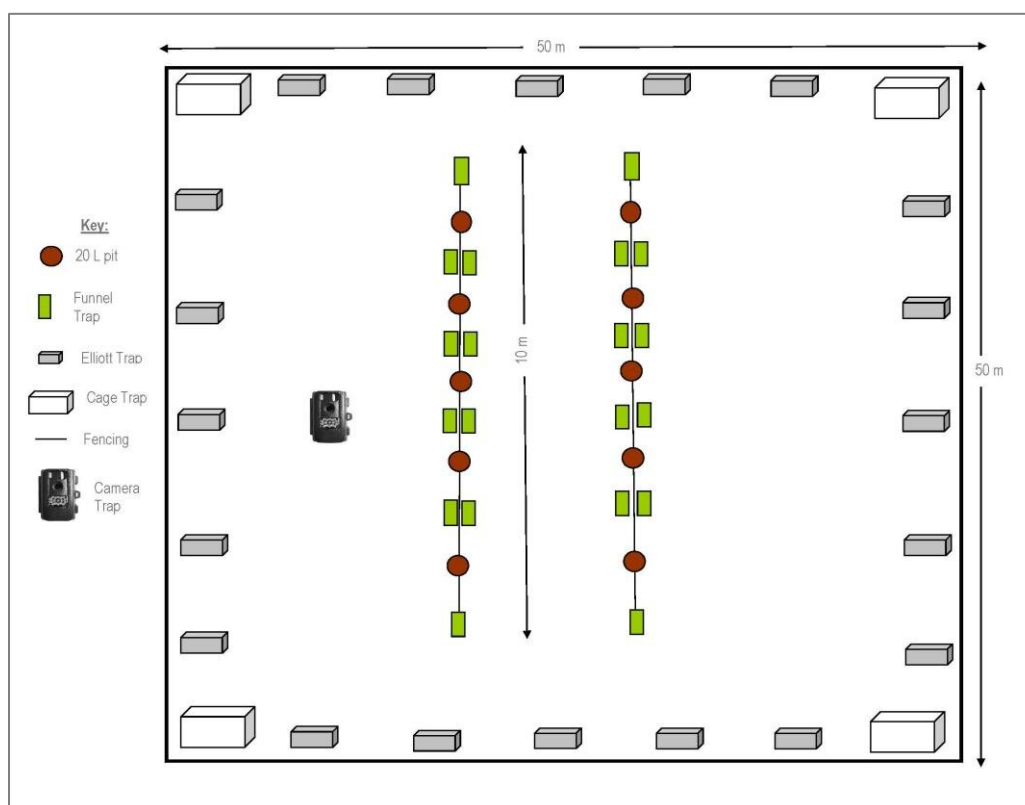
Table 3. The habitat type that each trap site was located in (including co-ordinates in UTMs [GDA 94]).

Trap Site Number	Habitat Type	Northing	Easting
1	Open Eucalyptus Woodland	6772504	497841
2	Mixed Shrubland	6771059	497221
3	Open Eucalyptus Woodland	6772255	499368
4	Mixed Shrubland	6769890	499379
5	Rocky Hill	6771609	497681
6	Rocky Hill	6772159	498318
7	Open Eucalyptus Woodland	6768610	497500
8	Mixed Shrubland	6769910	494643

Trap sites consisted of a 50 x 50 m quadrat. In each quadrat, 10 pitfall traps (20 L buckets) were set with drift fence (trap sites 5 and 6 did not have pitfall buckets as they were located on Rocky Hill habitat, which consisted of solid rock). Quadrats consisted of two lines of five pitfall traps at about 2 – 3 m intervals each with an approximate 10 m section of drift fence. A total of 10 funnel traps were set along the sides of the drift fence, and four cage traps and 20 Elliott traps were spaced equidistantly around the perimeter of the quadrat (Figure 6 – trap site layout below [not to scale]).

One camera trap was also set in each of the trap sites during the first season and ran until the end of the second season (approximately four months) (see Plate 1 for example of setup). Trap effort across all sites can be seen below in Table 4 and the locations of survey sites can be seen on Figure 6. We also placed out an additional seven camera traps in areas deemed more likely to capture images of threatened species such as a mixed shrubland on lower hillslopes, where Malleefowl were being targeted (Figure 7).

Cage, Elliott and funnel traps were covered with cloth to reduce sun exposure during the day and cloth was added inside the traps for warmth at night. Pitfall buckets had wet sponge (for frogs) and cloth/egg cartons added for shade and cover during the day and night. Traps were checked within the first three hours of sunrise each day and then again in the afternoon (animal ethics is of paramount importance). Cage and Elliott traps were baited with universal bait and fresh bait was added every second day (the old bait was also retained in the traps until trapping was complete).

**Figure 6. Trap Site Layout.**

Data collected systematically (i.e., where methods and effort are the same per sample unit) can be analysed to determine patterns in the richness, abundance and composition of the fauna (should the data collected be adequate to do so). Sites

were selected to obtain a broad coverage of the survey area and to be readily accessible to check traps in a timely manner to reduce stress on captured animals (for animal ethics purposes).

Table 4. Trap site effort undertaken in the survey area (14 nights in total at each trap site).

Trap Site Number	Pitfall Buckets – No. of nights	Funnel traps – No. of nights	Elliott traps – No. of nights	Cage traps – No. of nights
1	140	140	280	56
2	140	140	280	56
3	140	140	280	56
4	140	140	280	56
5	0	140	280	56
6	0	140	280	56
7	140	140	280	56
8	140	140	280	56
Total effort	840	1,120	2,240	448

4.3.2 Fauna Habitat Assessment

During the detailed survey, habitat assessments were undertaken systematically throughout the survey area to define and delineate the main habitats present (see examples from each fauna habitat type in Appendix 3). A summary of habitat assessments can be seen in Appendix 4, with a focus on the three target threatened fauna species (Malleefowl, Western Spiny-tailed Skink and Gilled Slender Bluetongue). A description and map of the broad main habitat type was developed for the survey area with this based on broad vegetation types, usually the dominant species in the canopy, vegetation structure and cover and position in the landscape (and some input from previous surveys).

The habitat assessment included an evaluation (likelihood assessment) of the potential for habitats to support the threatened fauna species being targeted during this survey (with this based on the database results, previous surveys, habitats present, known distributions and ecology of species from the literature and survey personnel's extensive experience).

Each habitat description included the following information where relevant:

- GPS co-ordinate will be recorded
- habitat condition will be assessed as 'completely degraded through to pristine, based on the scale given in Keighery (1994)
- landscape position
- dominant vegetation and structure e.g., number of vegetation strata
- hollow-bearing trees and dead stags (e.g., average size and abundance of hollows – should they be present)
- description of any rock and rocky outcrops
- logs (e.g., abundance and size)
- substrate (e.g., leaf litter)
- wetlands, creeks, rivers, dams and other water bodies
- description of any observed nests and roosts
- associated fauna species observed using the habitat
- disturbance e.g., cattle grazing, fire
- photo showing a typical example of the broad habitat type.

4.3.3 Targeted Threatened Species Surveys

The following targeted threatened species surveys were undertaken.

Malleefowl Survey

The targeted Malleefowl survey was undertaken in habitat considered to be potential Malleefowl habitat, with this based on vegetation cover and structure. In addition, a number of camera traps and habitat assessments were taken in these areas to illustrate habitat suitability.

The methods undertaken in the survey area were consistent with relevant guidelines, conservation advice and current practices where relevant and practical and were as follows:

- The survey area was assessed for habitat deemed suitable for potential Malleefowl breeding, with this based mostly on the density of vegetation in the midstorey and groundstorey i.e., not being too dense in order for birds to construct mounds or too open i.e., not enough cover from the sun and or potential predators.
- Camera traps were also used as a potential method to record Malleefowl
- Recording evidence of Malleefowl activity while walking the transects such as:
 - Malleefowl tracks
 - Malleefowl nesting mounds including status (inactive/ active) and activity according to the following criteria:
 - Nest in preparation – eggs not laid (evidence of litter trail)
 - Mound is in progress/ maintenance – eggs assumed to be laid
 - Evidence of chicks leaving nest – chicks fledging site / shell fragments
 - Decommissioned – spreading and returning of mound soil
- Malleefowl individual sightings and assessment of age (chick/ adult)
- Opportunistic observations of Malleefowl evidence (tracks, mounds, feathers and or individual sightings) in the survey area while not assessing the systematic transects.

Various fauna surveys have previously been undertaken in the survey area, a number of which recorded Malleefowl mounds. These previously recorded mounds were visited on foot to assess accuracy, presence/absence, age and habitat in which they were found. A total of 13 previously surveyed mounds were assessed. These mounds were classed as Active, if a mound was found closed over with signs of incubating. Recently Active, if there was evidence of use since they were last surveyed by Spectrum Ecology in 2020. For example, Malleefowl feathers (particularly down feathers), evidence of eggshell or if the mound shows evidence of recent workings. Or they were classed as Disused, if there were no signs of activity, if the mound was weathered or eroded.

In addition, Malleefowl evidence (mounds and or individual sightings) in the survey area was also looked for when driving tracks between trap sites (and other survey activities), as this was mostly undertaken at about 20-30 km/h.

Western Spiny-tailed Skink Survey

The targeted Western Spiny-tailed Skink survey involved looking for individuals in suitable habitat in the survey area. Typical Western Spiny-tailed Skink habitat includes isolated stands of granite boulders or more extensive clusters of rock that have crevices and cracks present. Latrine sites, which are piles of faecal droppings that are placed outside of refuges, were also searched for in suitable habitat. Camera traps and bait stations were also placed in potentially suitable habitat.

Gilled Slender Bluetongue Survey

The targeted Gilled Slender Bluetongue survey involved looking for animals in suitable habitat in the survey area. Typical Gilled Slender Bluetongue habitat includes hummock grass, leaf-litter including Acacia and under fallen logs and stumps. Camera traps and bait stations were also placed in potentially suitable habitat.

4.3.4 Long-term Camera Traps

Long-term camera traps were first placed out at 15 different locations (including the eight trap sites) across the survey area during season one of the survey in November 2023. The primary objective of the camera traps was to attempt to record threatened fauna species being targeted during this survey i.e., the Malleefowl, Western Spiny-tailed Skink and Gilled Slender Bluetongue and any others that may occur in the survey area.

Each camera trap was tethered to a star picket and pointed at a bait station (1.5 m apart) that was also tied to a star picket (see Plate 1 below). Bait consisted of oats, peanut butter, sardines and water (universal bait) and was placed into each of the 15 bait stations. New batteries were placed in the camera traps and new bait was placed into the bait station in November 2023 when the first season of trapping programme was being undertaken. Camera traps were retrieved in March 2024 when undertaking the second season of the trapping programme. Camera trap effort for each long-term camera is outlined below in Table 5 as are the location coordinates.

Table 5. Long-term camera trap effort expressed as number of nights in the survey area (location coordinates also included [UTMs]).

Long-term camera trap number	Northing (GDA 94)	Easting (GDA 94)	Camera trap effort (number of nights)
1	Placed in trap site 1		128
2	Placed in trap site 2		128
3	Placed in trap site 3		128
4	Placed in trap site 4		128
5	Placed in trap site 5		128
6	Placed in trap site 6		128
7	Placed in trap site 7		128
8	Placed in trap site 8		128
9	6770326	496463	126
10	6772061	498220	126
11	6772124	497904	126
12	6772295	498397	126
13	6771606	500678	126
14	6773563	495556	126
15	6768551	499499	126
Total camera trap nights: 1,906			



Plate 1. An example of a camera trap setup in the survey area with the camera in the foreground and the bait station in the background (this camera was placed in Mixed Shrubland habitat).

4.3.5 Bird Surveys

Systematic bird surveys were undertaken in all habitats in the study area for 20 minutes in a 1-ha quadrat during the survey. They were also undertaken in the same locations as the trap sites on four occasions, but again in a 1-ha quadrat during the morning (twice) and afternoons (twice) (the centre of the trap site was the basis of the 1-ha quadrat).

Bird surveys were carried out during typical peak periods of activity when birds are calling and moving about, which is typically in the 3-4 hours of sunrise, particularly during warmer periods and again in the late afternoon. However, this is dependent on season and local weather. We also used call playback to help identify some species and to try and locate cryptic and or threatened fauna species where possible and relevant.

4.3.6 Acoustic Bat Survey

Two Song Meter (SM4) acoustic recording units were placed at five separate locations for three nights each (Table 6 and Plate 2 below). The units were set up in perceived flyways, beside an old mine shaft and in different habitats. Bat specialist Bob Bullen (Bat Call WA) identified the calls recorded on the SM4 units.

Table 6. Micro bat SM4 unit, Coordinates in UTMs and habitat type it was placed in.

Bat Unit Location	SM4 Unit Number	Northing (GDA94)	Easting (GDA94)	Habitat type
1	S4U14094	6772506	497827	Open Eucalyptus Woodland
2	S4U16597	6772011	497833	Rocky Hill (beside old shaft)
3	S4U16597	6768159	494597	Open Eucalyptus Woodland (in creekline)
4	S4U14094	6768583	497945	Open Eucalyptus Woodland
5	S4U16597	6771987	497567	Rocky Hill



Plate 2. Example of a SM4 unit setup for micro bats in a perceived flyway in Open Eucalyptus Woodland (unit is in the centre-front of the image on the ground in front of the tree).

4.3.7 Nocturnal Spotlighting

Spotlighting at each of the systematic trap sites was undertaken once per season, by two people with head torches for five minutes each (20 minutes of effort per trap site over the two seasons). Spotlighting was also done by car along vehicle tracks while travelling between sites for a total period of 160 minutes per person. Total spotlighting effort for the survey area was 480 person minutes or eight person hours.

4.3.8 Reptile Search Sites

We undertook a number of specific reptile searches for 20 person minutes in ten locations during the survey. The focus was on the Western Spiny-tailed Skink and the Gilled Slender Bluetongue however, all reptiles were searched for. We specifically looked for relatively large piles of dead trees and wood that had fallen over and that had bark peeling off where these reptiles could shelter, plus rocky boulders with cracks and crevices. We also looked under bark on live and dead

trees, and trees that were on the ground, including in litter. In these ten locations, we also looked for the latrines of the Western Spiny-tailed Skink (Table 7 and Figure 6).

Table 7. Reptile search site, its location (coordinates in UTM's) and habitat type it was placed in.

Reptile Search Site Number	Habitat Type	Northing (GDA 94)	Easting (GDA 94)
1	Open Eucalyptus Woodland (with rocky areas)	6771481	496870
2	Rocky Hill	6772275	497542
3	Open Eucalyptus Woodland (with rocky areas)	6772078	499610
4	Open Eucalyptus Woodland (with rocky areas)	6772640	499618
5	Open Eucalyptus Woodland	6770896	495128
6	Open Eucalyptus Woodland	6768663	497058
7	Open Eucalyptus Woodland	6768818	497521
8	Rocky Hill	6768619	499180
9	Open Eucalyptus Woodland	6768123	495532
10	Open Eucalyptus Woodland	6771481	496870

4.3.9 Opportunistic Searches

Fauna was opportunistically observed and recorded during the survey. The opportunistic data supplements the systematic data collected at trap sites. During the opportunistic searches, the following techniques were used: raking through leaf litter, overturning rocks, looking under decorticating bark, investigating burrows, tracks and scats were observed.

In addition, opportunistic records of fauna species encountered while travelling between trap sites were also documented. Opportunistic data comprises records of fauna species by location and coordinates are taken with a GPS in the case of any threatened fauna. Noting that many of the bird species recorded during the survey come from opportunistic observations.

4.3.10 Taxonomy

For species identified in the desktop assessment, where there is doubt to their true taxonomy (through subsequent name changes or taxonomic reviews), an effort was made to determine the current scientific name for each taxon. In some cases, old scientific names were presented where correct nomenclature could not be determined due to name changes. Some taxon names may be followed by 'sp.', meaning that the species name was not given in the data source or the identification is in doubt. Where there are previously recorded taxa such as this that have the potential to be a threatened fauna species, they are discussed specifically in the results and discussion sections.

Taxonomy and nomenclature in this report follows the accepted listing of published terrestrial vertebrate species, primarily the WA Museum (2023). In addition, the following are also considered where relevant; the listing for amphibians and reptiles is consistent with Wilson & Swan (2023) and Chapple (2019) and to a lesser extent Cogger (2018); bird listings are consistent with Christidis & Boles (2008), and mammal listings are consistent with Baker & Gynther (2023) and to a lesser extent Woinarski *et al.* (2014).

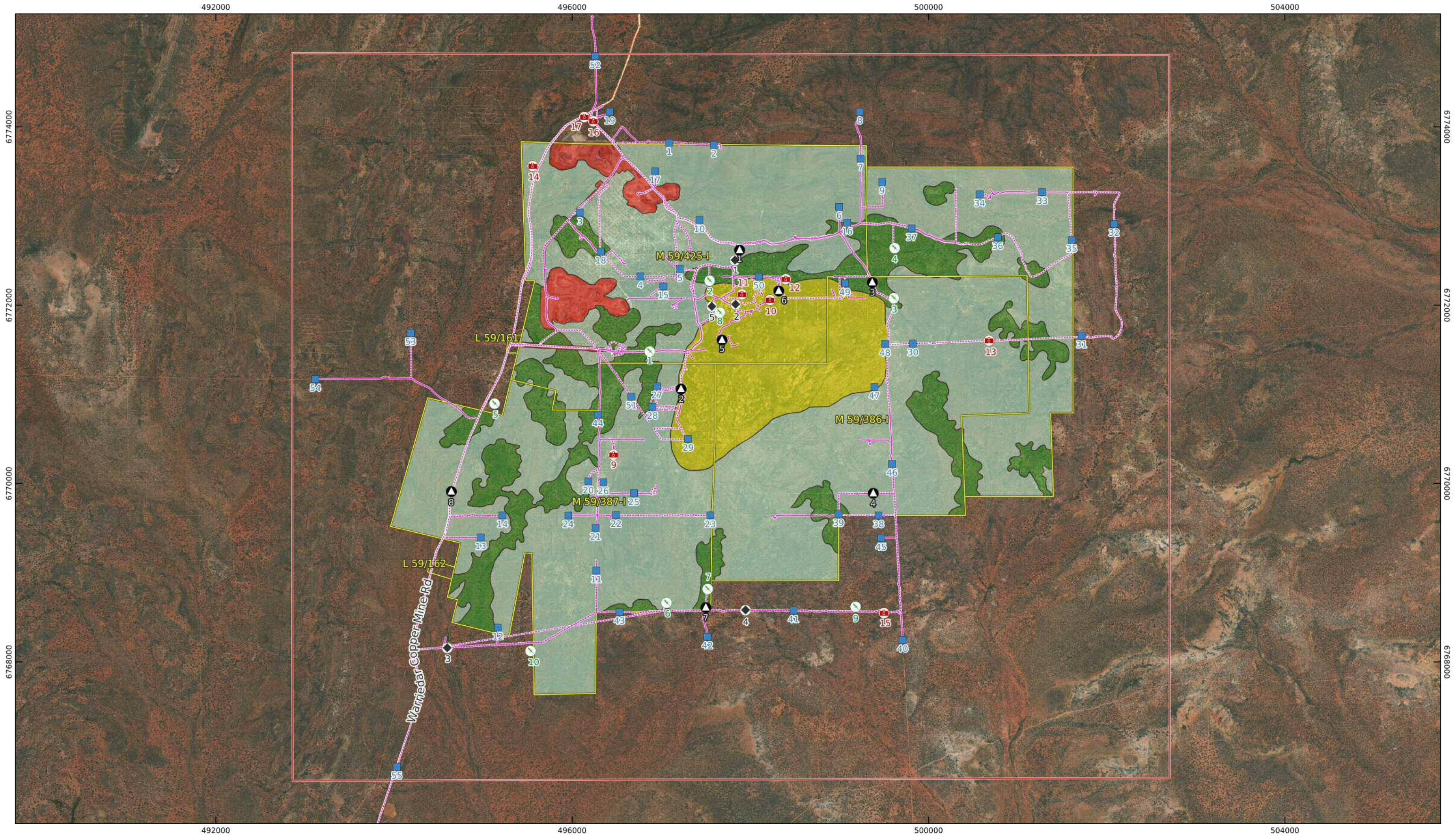


Figure 7: Fauna Habitat and Fauna Habitat Assessment Locations

Scale 1:40,000
GDA94 / MGA zone 50

Legend

- Survey Area
- Tenement Boundary
- Survey Track

Fauna Habitat

- Mixed Shrubland
- Open Eucalyptus Woodland
- Rocky Hill

- Cleared
- Bat Unit
- Camera
- Habitat Assessment
- Reptile Search Site
- Trapsite

WESTERN
ECOLOGICAL

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5. Results

5.1 Fauna Survey Limitations

Survey limitations are sometimes difficult to predict prior to undertaking the assessment, as is the extent to which they influence survey effort. The limitations of the fauna survey are outlined below in Table 8.

Table 8. Limitations associated with the survey.

Potential Limitation or Constraint	Impact on Survey	Comment
Qualifications and survey experience	None	The Zoologists that undertook the survey are qualified and experienced. Dr Ron Firth has 25 years of experience designing, managing and undertaking biodiversity and ecological surveys throughout Western Australia, the Northern Territory, Queensland, New South Wales and Victoria. He has written over 120 consultant reports and has authored or co-authored 15 papers that have been published in peer reviewed scientific journals and has made other contributions to published Books. Laura Stevens has ten years of experience undertaking fauna surveys in WA and has written more than 35 consultant reports. Therefore, there were no perceived limitations associated with qualifications and experience.
Access	Moderate Impact	Access within the survey area was difficult in places. Exploration and old tracks were used as much as possible, but in many places, these were overgrown/impassable. A large part of the centre of the survey was not accessible. Access was particularly important to consider when choosing trap sites, so twice daily checks could occur in a timely manner and adhere to guidelines and animal ethics project approval. Focus was therefore given to the areas of main interest/priority provided by TM.
Timing - weather, season	Little impact	The two-season detailed fauna assessment was undertaken from 17th – 27th November 2023 and 16th – 25th March 2024. This is the recommended time to survey for species that are much more temperature dependent i.e., reptiles. Survey timing according to guidance for this group is September-April. The nearest Bureau of Meteorology (BoM) weather station with long-term rainfall records is Ningham Station (Station No. 007068) (see section 2.2 above). The annual long-term average (1905 – 2023) rainfall at Ningham Station is 294.4 mm (BoM 2024) (Figure 2). During both seasons of the survey (days traps were open) daily minimum and maximum temperatures recorded by TM at the Mount Mulgine weather station were variable and considerably different to the long-term average maximum and minimum temperatures recorded at Paynes Find weather station (refer to Table 1). This was particularly apparent for the November season. In November 2023, two trapping days experienced temperatures which approximately aligned with the long-term maximum average of 31.9°C, (from Paynes Find station) (30.8°C on the 17th and 31.1°C on the 23rd). The remaining eight days were all significantly higher than the long-term average (Table 1). Minimum temperatures were higher than the long-term average (from Paynes Find station) on every day of the November season. A total of 1 mm of rain was recorded during the November season field survey. This was across two days and is below the long-term average of 10.7 mm (recorded at Ningham Station) (Table 1, Figure 3). In March 2024, five of the ten trapping days experienced a maximum temperature above the long-term average (from Paynes Find station) of 33.1°C (Table 1, Figure 4). Minimum temperatures were higher than the long-term average (from Paynes Find station) of 18.3°C, on four days. In March 2024, no rainfall was recorded in the survey area. It is difficult to determine what the impacts of the higher temperatures and below average rainfall are on the fauna in the survey area and their detectability.
Scope - Life forms sampled	None	The primary objective of the survey was to sample terrestrial vertebrates by undertaking a detailed fauna assessment (baseline trapping) and an assessment of habitat and targeted searches for the Malleefowl, Western Spiny-tailed Skink and Gilled Slender Bluetongue. This was achieved.
Sources of information	None	Sources of information included the ALA database, BirdLife, DBCA Dandjoo databases, DBCA threatened fauna database and EPBC PMST. Other sources of information include a number of past reports, and the scientific literature (peer reviewed scientific papers and books).

Potential Limitation or Constraint	Impact on Survey	Comment
Completeness	None	The main objective of the survey was to undertake a detailed fauna assessment (baseline trapping), an assessment of habitat and targeted searches for the Malleefowl, Western Spiny-tailed Skink and Gilled Slender Bluetongue, and this was achieved. Then based on the current survey, previous surveys and database search results we assessed the likelihood of several threatened species occurring in the survey area.
Disturbance	Moderate Impact	The survey area has been disturbed as a result of historic grazing, as well as mining that has occurred (mine pits, tailings dams and associated infrastructure etc) and more recent mining activity (exploration associated activities). Cats and rabbits (and their signs) were recorded on camera traps during the survey. The extent to which these disturbances might have impacted the results is difficult to quantify based on the work undertaken in the survey area thus far, as this work represents baseline information, however, habitat clearing and degradation as a result of previous farming and mining as well as predation by Cats is likely to have negatively impact fauna.

5.2 Database Results

A total of 31 listed threatened vertebrate species (including Priority species) from 20 families, were identified during the desktop review of the database searches (Appendix 2). Of the 31 species, two were reptiles, 21 were bird species and eight were mammals (Appendix 2, Appendix 5 and Figure 7).

Some marine fauna or terrestrial fauna that use marine habitats or have been recorded in marine reserves are listed as Marine under the EPBC Act. Several species of bird in the PMST database search are listed as Marine under the EPBC Act. For example the Rainbow Bee-eater (*Merops ornatus*) and the Black-eared Cuckoo (*Chalcites osculans*); however, these species are only considered threatened when a proposed development occurs in a Commonwealth marine area (i.e., any Commonwealth Waters or Commonwealth Marine Protected Area). Outside of such areas, the EPBC Act does not consider these species to be matters of national environmental significance (unless they are listed under another category such as migratory), so are not protected under the Act. These species are therefore excluded from any further discussion.

Shorebirds and Waterbirds

Several shorebird and waterbird species were returned in the database searches. These were a combination of waders/shorebirds and waterbirds (Appendix 2 and Appendix 5). These wetland avifauna such as wading birds, including Sandpipers, Plovers and Greenshanks for example inhabit marshes, estuaries, mudflats, saltmarshes, sandflats and beaches, with shallow water edges, where they feed on invertebrates such as worms, molluscs, insects and crustaceans (Garnett *et al.* 2011, Garnett & Baker 2021). Suitable habitat for these shorebird and waterbird species is not present in the survey area, with the majority of these records coming from a waterbird survey undertaken in 1999 at Mongers Lake, which is 40 km to the south-west of the survey area. Therefore, these species have also been omitted from any further discussion.

Now Regionally Extinct

A number of threatened species in the database searches were also known to be historical records of species now regionally extinct, for example the Masked Owl (*Tyto novaehollandiae*), had a single record from 1964. Or the Western Barred Bandicoot (*Perameles bougainville*) and the Chuditch (*Dasyurus geoffroii*), or Extinct, such as the Lesser Stick-nest Rat (*Leporillus apicalis*) (Appendix 2). In addition, those species with few records (two or fewer), for example the Western Brush Wallaby (*Notamacropus irma*), which had one record from 2002 (14.5 km from the survey area) and one record from 2006 (40 km from the survey area). These species have been excluded from any further discussion.

Unsuitable Habitat

Some species present in the database searches simply won't be in the survey area because suitable habitat is not available e.g., the Australian Painted Snipe (*Rostratula australis*) as it requires swamp and wetland habitat (Garnett *et al.* 2011, Knuckey *et al.* 2013), which is not present in the survey area.

In addition, fauna are not distributed evenly across the landscape; they are more abundant in some places than others, and consequently, more detectable (Currie 2007). Furthermore, some small, common ground-dwelling reptile and mammal species tend to be habitat-specific, and many bird species can occur as regular migrants, occasional visitors, or vagrants. Therefore, all these species have been excluded from any further discussion.

Database Errors and Anomalies

Occasionally there are errors and/or anomalies in the database searches that are sourced from the various government departments, for example, the Grey Wagtail (*Motacilla cinerea*) which is a rare visitor with very few records were present in the EPBC PMST (Johnstone & Storr 1998). These species have been omitted from any further discussion.

It is important to note that the EPBC PMST is not entirely based on point records but also on broader information (e.g., bioclimatic distribution models), whereas the DBCA threatened fauna database is solely based on point records. Consequently, the results of the EPBC PMST are in some cases less accurate, particularly at a local scale. As a result, the EPBC PMST can include species that do not occur in the study area because, for example, there is no habitat available or they are now known to be locally extinct (for example the Greater Bilby (*Macrotis lagotis*) and the Greater Stick-nest Rat (*Leporillus conditor*)).

With the above-mentioned species removed, a total of five threatened species retrieved from the database searches are considered as either Recorded, Likely, Possible or Unlikely to occur in the survey area, with this based on location of the database record, habitats present in the survey area, and importantly the species ecology. Of these five threatened species, three were Recorded in the survey area, one is considered Likely to occur in the survey area, one is considered as Possible and no species are considered Unlikely to occur (Table 9).

A summary of the five threatened species records is outlined below and all five species will be considered further below in the discussion (Section 6).

The Likelihood of each species is based on the following criteria:

- Recorded: Recorded during the field survey or from database records in the survey area
- Likely: Suitable habitat is present in the study area and the study area is in the species' known distribution
- Possible: Limited or no suitable habitat is present in study area but is present nearby. The species has good dispersal abilities and is known from the general area
- Unlikely: No suitable habitat is present in study area but is nearby, the species has poor dispersal abilities, but is known from the general area; or suitable habitat is present, however, the study area is outside of the species' known distribution.

Table 9. Listed threatened fauna potentially occurring in the survey area.

CrE = Listed as Critically Endangered under the EPBC Act and BC Act, En = Listed as Endangered under the EPBC Act and BC Act, Vu = Listed as Vulnerable under the EPBC Act and BC Act, Mi = Listed as Migratory under the EPBC Act and BC Act, OS = Other specially protected species under the BC Act. Both the EPBC Act and BC Act use IUCN threat categories to determine the threat status and category of species. P4 and P3 = Priority listed under the BC Act.

Common name	Species name	EPBC Act	BC Act	Likelihood
Reptiles				
Western Spiny-tailed Skink	<i>Egernia stokesii badia</i>	En	Vu	Likely
Gilled Slender Blue-tongue	<i>Cyclodomorphus branchialis</i>		Vu	**Recorded
Birds				
Malleefowl	<i>Leipoa ocellata</i>	Vu	Vu	*Recorded
Peregrine Falcon	<i>Falco peregrinus</i>		OS	**Recorded
Mammals				
Central Long-eared Bat	<i>Nyctophilus major tor</i>		P3	Possible

* Recorded during this current survey.

** Recorded during a previous survey.

Western Spiny-tailed Skink

As per the database searches outlines in Section 4.2, this species was present in the ALA and DBCA threatened fauna databases and the EPBC PMST but absent from the DBCA Dandjoo database. There were a total of 86 records in the DBCA threatened fauna database, the closest being 6 km from the survey area and the most recent record from 2018 (Figure 7 and Appendix 2).

Gilled Slender Bluetongue

This species was present in the ALA and DBCA threatened fauna databases but absent from the DBCA Dandjoo database and EPBC PMST search results. There were three records of the Gilled Slender Bluetongue in the DBCA threatened fauna database, the closest being 23 km from the survey area in 2003. The remaining two records were 45 km from the survey area and were from 1965 (Figure 7 and Appendix 2).

Malleefowl

The Malleefowl was present in all database search results. There were a total of 249 records of the Malleefowl in the DBCA threatened fauna database. These records were from between 1958 and 2019. The closest of these records was approximately 1 km north of the survey area (Figure 7 and Appendix 2).

Peregrine Falcon

The Peregrine Falcon was present in all database search results, with the exception of the EPBC PMST (this database only includes species listed under the EPBC Act). There were 20 records of this species in the DBCA threatened fauna database from between 1999 and 2017. The closest of these records was in 2012, approximately 26 km to the north of the survey area (Figure 7 and Appendix 2).

Central Long-eared Bat

The Central Long-eared Bat was present in the DBCA threatened fauna database only. There were a total of three records (2015 – 2017), all from Charles Darwin Reserve, which is approximately 40 km to the south of the survey area (Figure 7 and Appendix 2).

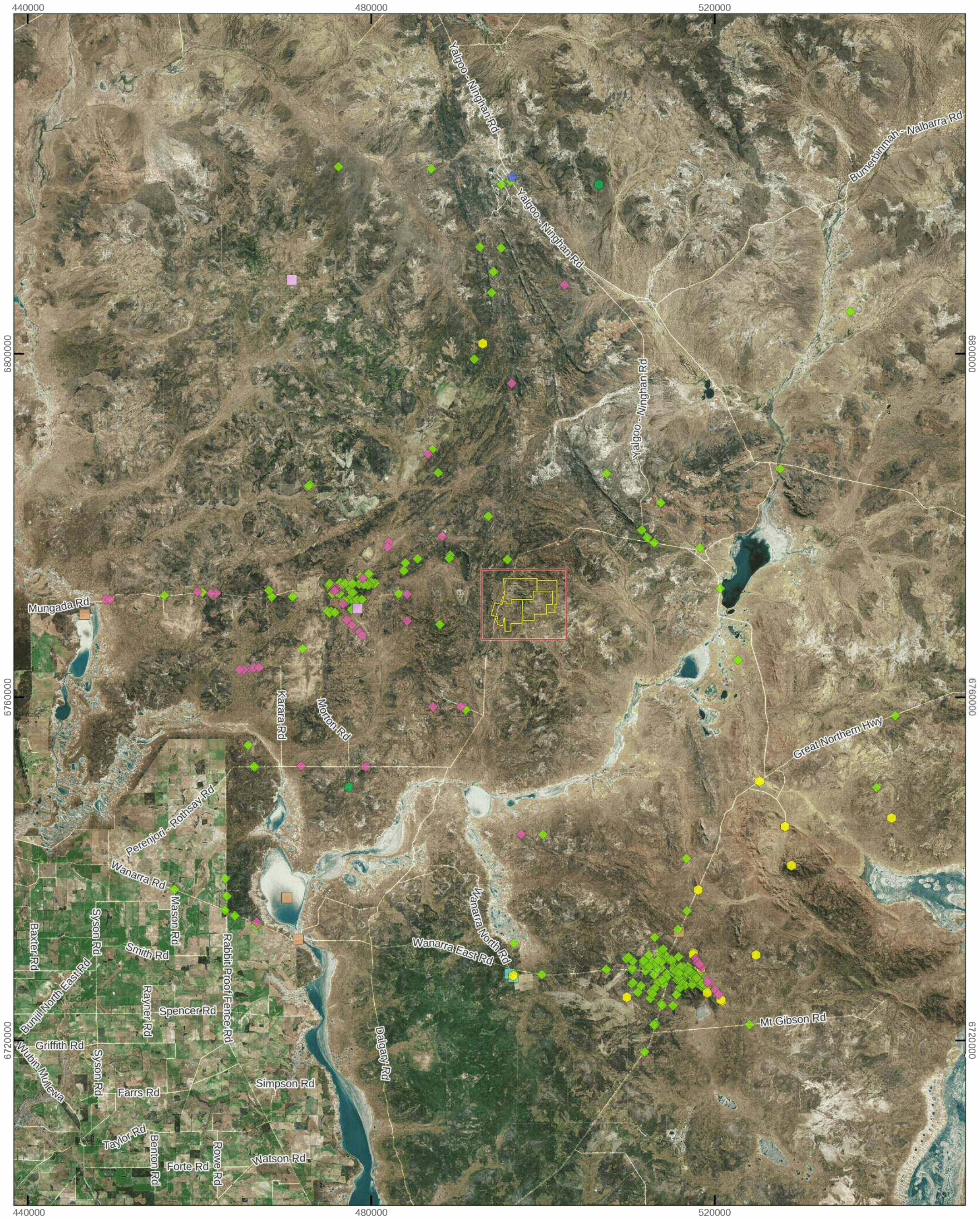


Figure 8: Threatened Fauna Records (DBCA)

0 5 10 15 km
GDA2020 - MGA Zone 50

Legend

Tenement Boundary

Survey Area

Threatened Fauna (DBCA)

Central Long-eared Bat

Common Greenshank

Common Sandpiper

Gilled Slender Blue-tongue

Gull-billed Tern

Hooded Plover, Hooded Dotterel

Malleefowl

Masked Owl (southwest)

Peregrine Falcon

Western Brush Wallaby

Western Spiny-tailed Skink

● 2024. Whilst every care has been taken to prepare this map, GIS Pro and Western Ecological make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason. Date printed: 2024-04-18.
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5.3 Field Survey Results

The following species were recorded during the field assessment in the survey area through various methods, including at a trap site, on a camera trap, recorded on the SM4 units, during spotlighting and opportunistically. For scientific names of each species mentioned below see Appendix 5 and for some images of species captured see Appendix 6.

Amphibians

No amphibian species were recorded (seen or heard calling) during either season of the survey. There were five species of frog in the ALA database search results (one species was also present in the DBCA Dandjoo database), none of which are threatened. The absence of frogs is not surprising given no water was present in the survey area.

Reptiles

In total across both seasons, 25 reptile species were recorded from eight families. A total of seven of the 25 reptile species were Geckos (Diplodactylidae and Gekkonidae family), one species was a Legless Lizard (Pygopodidae family), seven species were skinks (Scincidae family), four species were dragons (Agamidae family), two species were Goannas (Varanidae family), one species was a Blind Snake (Typhlopidae family) and three were Snake species from the Elapidae family. None of the reptiles recorded are considered threatened.

Birds

During both seasons of the field survey 55 bird species were recorded from 28 families. The family with the most species recorded was the Artamidae with seven species and this included Butcherbirds (two species), Woodswallows (three species), Magpie and Currawong. One threatened bird species was recorded during the survey, the Malleefowl.

Mammals

During both seasons of the field survey 14 mammal species from seven families were recorded. Two of the species were introduced i.e., Feral Cat and Rabbit. The family with the most species was the Vespertilionidae (Wattled Bats, Long-eared Bats and Forest Bats) with five species, two Bat species from the Molossidae family and one from the Emballonuridae family were also recorded on the SM4 units. Family Macropodidae (Western Grey Kangaroo and Euro) were represented by two species each respectively. The Dasyuridae (Carnivorous Marsupials) family was represented by a single Dunnart species. A small mammal was also recorded on the camera traps but was not possible to identify due to the small size and it was at night (black and white image). None of the mammals recorded are considered threatened.

5.3.1 Trapping Programme Results

During the first season of the trapping programme in November 2023 a total of 18 species were captured across the eight trap sites in all the trap types. The most frequently captured species was Bynoe's Gecko (*Heteronotia binoei*) with 14 captures, followed by the Variegated Gehyra (*Gehyra variegata*) with ten captures and the third most frequently captured species was the Pretty Gecko (*Diplodactylus pulcher*) with nine captures (Figure 9). No Frog or Mammal species were recorded in the trap sites during the first season of the trapping programme. One unusual capture was the Little Crow (*Corvus bennetti*) in a cage trap. No threatened species were recorded in the eight trap sites during the first season.

In the second season of trapping carried out in March 2024 a total of 15 species across the eight trap sites were captured (three species less than the first season). The most frequently captured species was the Western Spotted Ctenotus (*Ctenotus uber*) with eight captures, followed by the Barred Wedge-snouted Ctenotus (*Ctenotus schomburgkii*) with four captures – slightly more than the first season of the survey (Figure 10). The third most frequently captured species was the Broad-banded Sand Swimmer (*Eremiascincus richardsoni*) with four captures, slightly less than during the first season of the survey in November 2023. During this second season a single mammal species was captured in traps across the eight trap sites – the Fat-tailed Dunnart (*Sminthopsis crassicaudata*). As with the first season, no Frog species were captured. (Figure 10).

Total trap captures were significantly different between the two survey seasons when all species and their captures frequencies are combined. In November 2023 there were a total of 77 trap captures, but in March 2024 this was notably less at 33 captures (Figures 9 and 10). The most frequently captured species in November 2023 (Bynoe's Gecko) accounted for 18% of all captures during this season, while in March 2024, the most captured species was the Western Spotted Ctenotus which accounted for 24% of all captures.

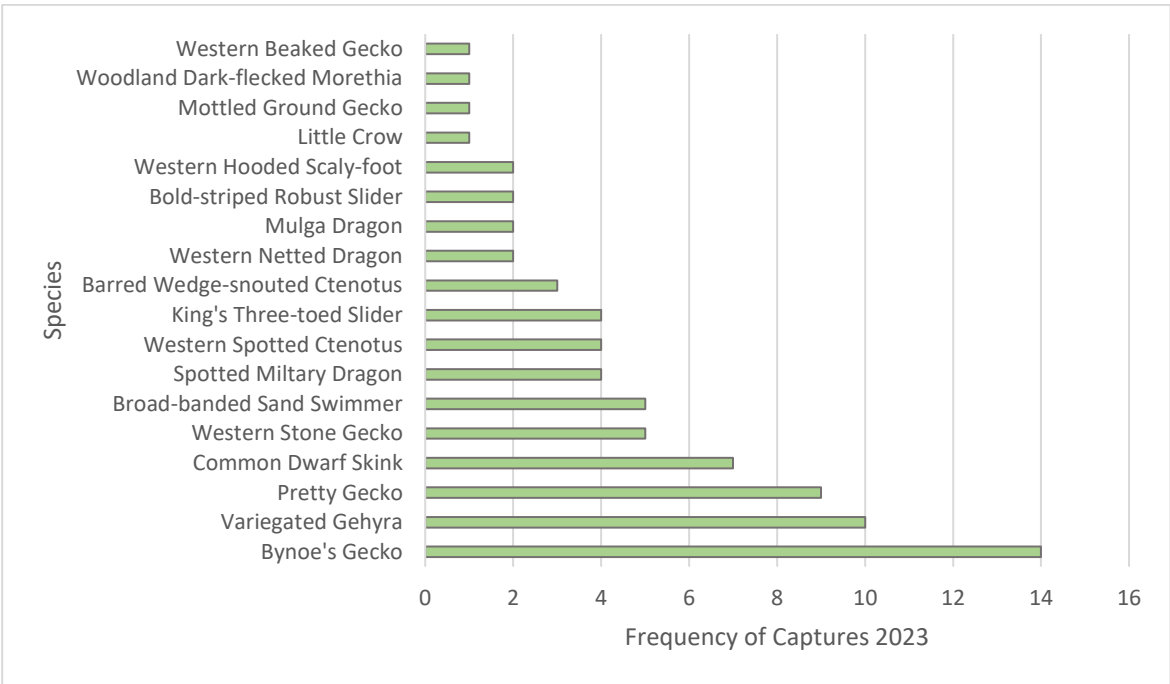


Figure 9. Frequency of species captured at trap sites during the first season (November 2023) of the field survey.

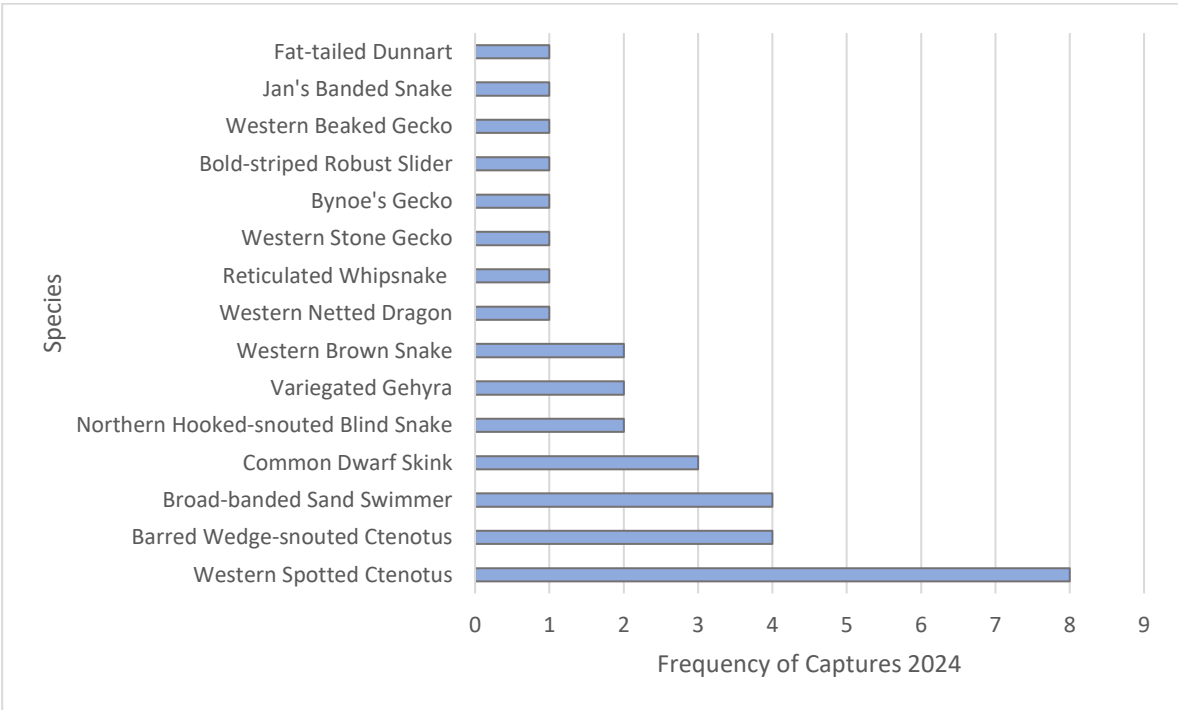


Figure 10. Frequency of species captured at trap sites during the second season (March 2024) of the field survey

Species accumulation curves were generated based only on the systematic capture data collected from the trap sites. Therefore, reptiles only were used to generate the curves. Two types of curves are presented:

- Number of species and number of captures
- Number of species and number of survey nights.

The accumulation curve (logarithmic function has been applied and the goodness of fit of the line is strong at $R^2 = 0.937$) for the number of species versus the number of captures does not reach an asymptote after a total of 110 (see Figure 11 below). However, the slope of the curve is reducing and at 59 captures (just over half of the total captures) 18 species or almost 82% of the species have been captured.

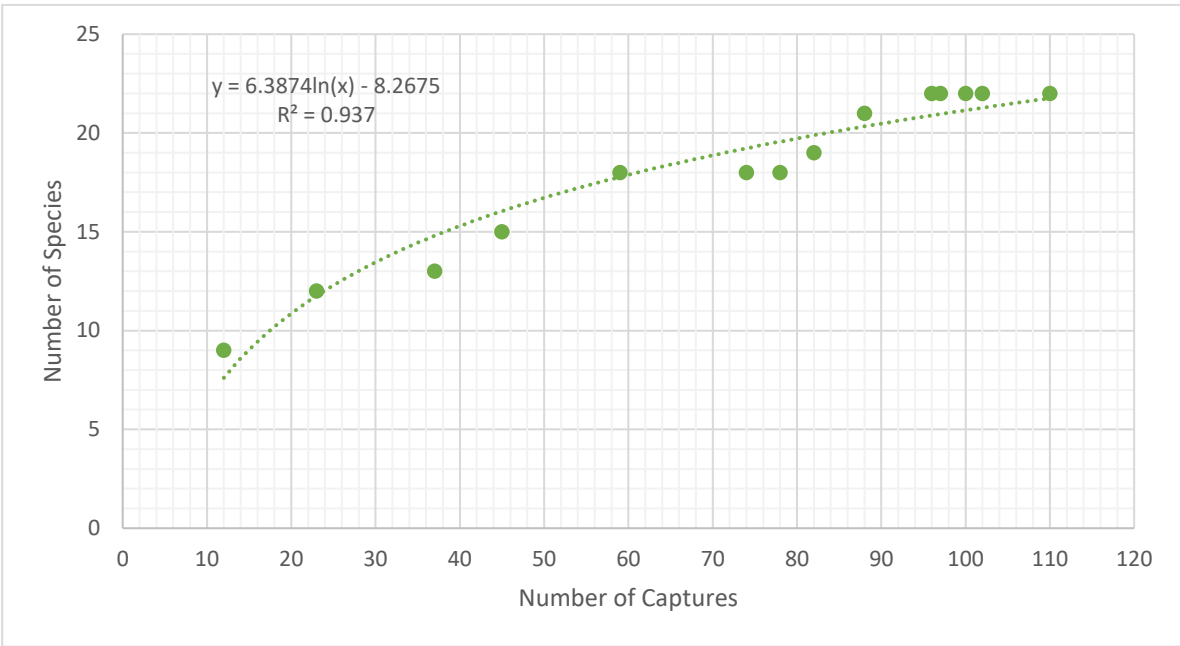


Figure 11: Species accumulation curve for the number of captures at trap sites.

The accumulation curve (logarithmic function has been applied and the goodness of fit of the line is strong at $R^2 = 0.9615$) for the number of species versus the number of trap nights does not reach an asymptote after a total of 14 nights (see Figure 12 below). However, the slope of the curve is reducing and at 5 nights, 18 species or almost 82% of the species have been captured.

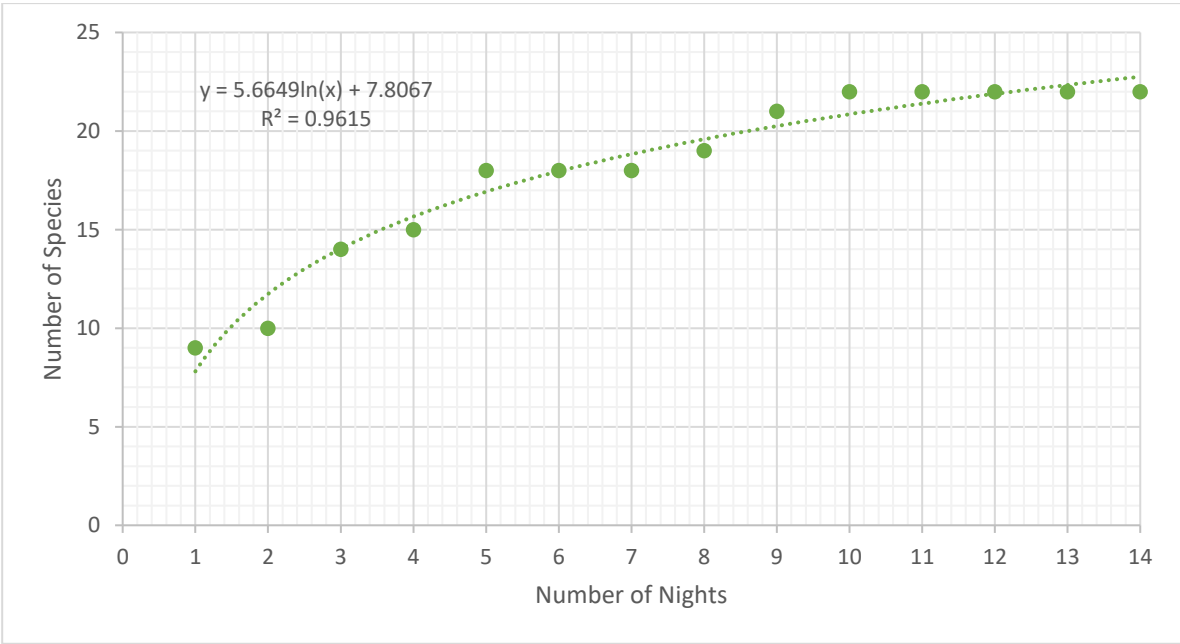


Figure 12: Species accumulation curve for the number of trap nights at sites.

5.3.2 Bird Survey Results

When combined across both seasons of the survey, a total of 55 bird species across 28 families were detected either by their calls or they were observed across the survey area. During the first season, temperatures were significantly higher than the long-term average (Table 1) and this likely had a negative impact on bird activity. The number of Bird species, however, were higher during the first season (48) than the second season (38).

One threatened bird species was recorded, the Malleefowl, which was recorded through sightings once, mounds (old) and on two camera traps (More detail is provided below and in Section 6).

5.3.3 Targeted Threatened Species Surveys

Western Spiny-tailed Skink

During the two seasons of the survey, no Western Spiny-tailed Skink were captured in traps, no images of them were recorded on camera traps, and none were seen while undertaking searches. When undertaking the searches for the Western Spiny-tailed Skink, effort was focused on Open Eucalyptus Woodland as this is considered likely suitable habitat. This habitat contained large piles of dead trees and wood that had fallen over, which may contain hollows and crevices where these reptiles could shelter. Searches were also undertaken for signs of the Western Spiny-tailed Skink, such as latrines, with old or fresh scats, however none were recorded during either season of the survey.

Gilled Slender Bluetongue

During the two seasons of the survey no Gilled Slender Bluetongues were captured in traps, no images of them were recorded on camera traps, and none were seen while undertaking searches. During the searches for the Gilled Slender Bluetongue, effort was focused on suitable habitat considered likely to be Mixed Shrubland, particularly in areas with heavy red soils and in areas where the species could shelter in rocky boulders, cracks and crevices. We also looked under bark on live and dead trees, and trees that were on the ground, including in litter and no individuals were recorded.

Malleefowl

During previous fauna surveys undertaken in the survey area (Table 1), a total of 27 Malleefowl mounds have been recorded (Table 10). To reassess the mounds for any signs of activity and the habitat in which they were located, a total of 13 were revisited. The majority of the revisited mounds were located in Mixed Shrubland on rocky/stony/calcrete hills, usually on a slope, or a flat area on a rocky hill. In general, the mounds that were more recently constructed, were built with small rocks and pebbles, with a layer of earth. These 13 mounds were of various ages, and sizes with some having weathered to a stage that made them almost unrecognisable. All of these mounds are considered to be Disused.

During the survey a series of tracks were traversed in suitable habitat, which was considered to be Mixed Shrubland and some areas of Rocky Hill. While traversing these areas a total of five previously unrecorded Malleefowl mounds were found (Table 10 and Figure 13). No Malleefowl or their tracks and feathers were recorded in any of these mounds, and they are also considered to be disused. An example of the mounds can be seen below in Plate 3.

A single Malleefowl was observed on the 19th of March crossing a track in the northern part of the survey area (6774078 / 496225) (Figure 13). In addition, Malleefowl were also recorded on two of the long-term cameras.

Table 10. Malleefowl mounds recorded during the assessment in the survey area, their status and location.

Malleefowl Mound	Northing	Easting	Habitat Type	Status
WE 1	6774078	496225	Mixed Shrubland	Disused
WE 2	6771027	497192	Mixed Shrubland	Disused
WE 3	6769656	497363	Mixed Shrubland	Disused
WE 4	6770788	497199	Mixed Shrubland	Disused
WE 5	6771280	497288	Mixed Shrubland	Disused
Reassessed Mound 1	6774108	496318	Mixed Shrubland	Disused
Reassessed Mound 2	6772249	496846	Mixed Shrubland	Disused
Reassessed Mound 3	6772055	496635	Mixed Shrubland	Disused
Reassessed Mound 4	6772737	496093	Mixed Shrubland	Disused
Reassessed Mound 5	6773846	496470	Mixed Shrubland	Disused
Reassessed Mound 6	6774175	496435	Mixed Shrubland	Disused
Reassessed Mound 7	6772395	495740	Mixed Shrubland	Disused
Reassessed Mound 8	6772471	496611	Mixed Shrubland	Disused
Reassessed Mound 9	6771966	497171	Mixed Shrubland	Disused
Reassessed Mound 10	6771895	498000	Mixed Shrubland	Disused
Reassessed Mound 11	6770572	497382	Mixed Shrubland	Disused
Reassessed Mound 12	6769976	496941	Mixed Shrubland	Disused
Reassessed Mound 13	6772904	499082	Mixed Shrubland	Disused



Plate 3. A previously unrecorded disused Malleefowl mound, recorded during the November survey (WE Mound 4)

5.3.4 Long-term Camera Traps

There were thousands of images taken by the 15 long-term camera traps over the period they were deployed. A total of 14 species were able to be identified from images taken by the cameras (Table 11). One species could only be identified as a small mammal (possibly a Rodent or a Dasyurid).

The Australian Raven was recorded on the greatest number of different camera traps (12), followed by the Feral Cat (7) and the Western Grey Kangaroo (5). Camera trap 11 recorded the greatest number of species with eight species, followed by camera traps 2 and 14 with six species each, and camera traps 1, 3 and 10, with four species (Table 11). See Plates 4 to 12 below, which illustrate some of the species captured on camera traps.

Of the 14 species captured on the camera traps, one species was not recorded by any other means, the Echidna, which was recorded on two cameras. Of the 14 species recorded, two are introduced – the Feral Cat and Rabbit.

One threatened species was recorded on camera traps 2 and 11 - the Malleefowl (Figure 10). These cameras were both placed in Mixed Shrubland, located at the bottom of a rocky slope. Camera 2 recorded the Malleefowl in December 2023, January and March 2024 and camera 11 recorded the Malleefowl in February 2024.

Following the sighting of a Malleefowl during the second season survey (March 2024), two extra cameras were subsequently placed in that location for five nights (until the end of the survey), however they did not record any Malleefowl.

Table 11. Species recorded on cameras at trap sites (1 – 8) and at an additional seven camera trap sites (9 – 15).

Species Recoded	Camera Trap Number														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Perentie (<i>Varanus giganteus</i>)											✓				
Sand Monitor (<i>Varanus gouldii</i>)			✓		✓	✓	✓							✓	
Malleefowl (<i>Leipoa ocellata</i>)		✓									✓				
Common Bronzewing (<i>Phaps chalcoptera</i>)											✓				
Splendid Fairy-wren (<i>Malurus splendens</i>)														✓	
Chestnut Quail-thrush (<i>Cinclosoma castanotum</i>)	✓	✓								✓	✓				
Grey Shrike-thrush (<i>Colluricincla harmonica</i>)											✓				
Australian Raven (<i>Corvus coronoides</i>)	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		
Grey Currawong (<i>Strepera versicolor</i>)														✓	
Short-beaked Echidna (<i>Tachyglossus aculeatus</i>)										✓				✓	
Western Grey Kangaroo (<i>Macropus fuliginosus</i>)	✓	✓	✓								✓	✓			
Euro (<i>Osphranter robustus</i>)			✓	✓											
Rabbit (* <i>Oryctolagus cuniculus</i>)		✓									✓			✓	✓
Feral Cat (* <i>Felis catus</i>)	✓	✓						✓		✓		✓		✓	✓

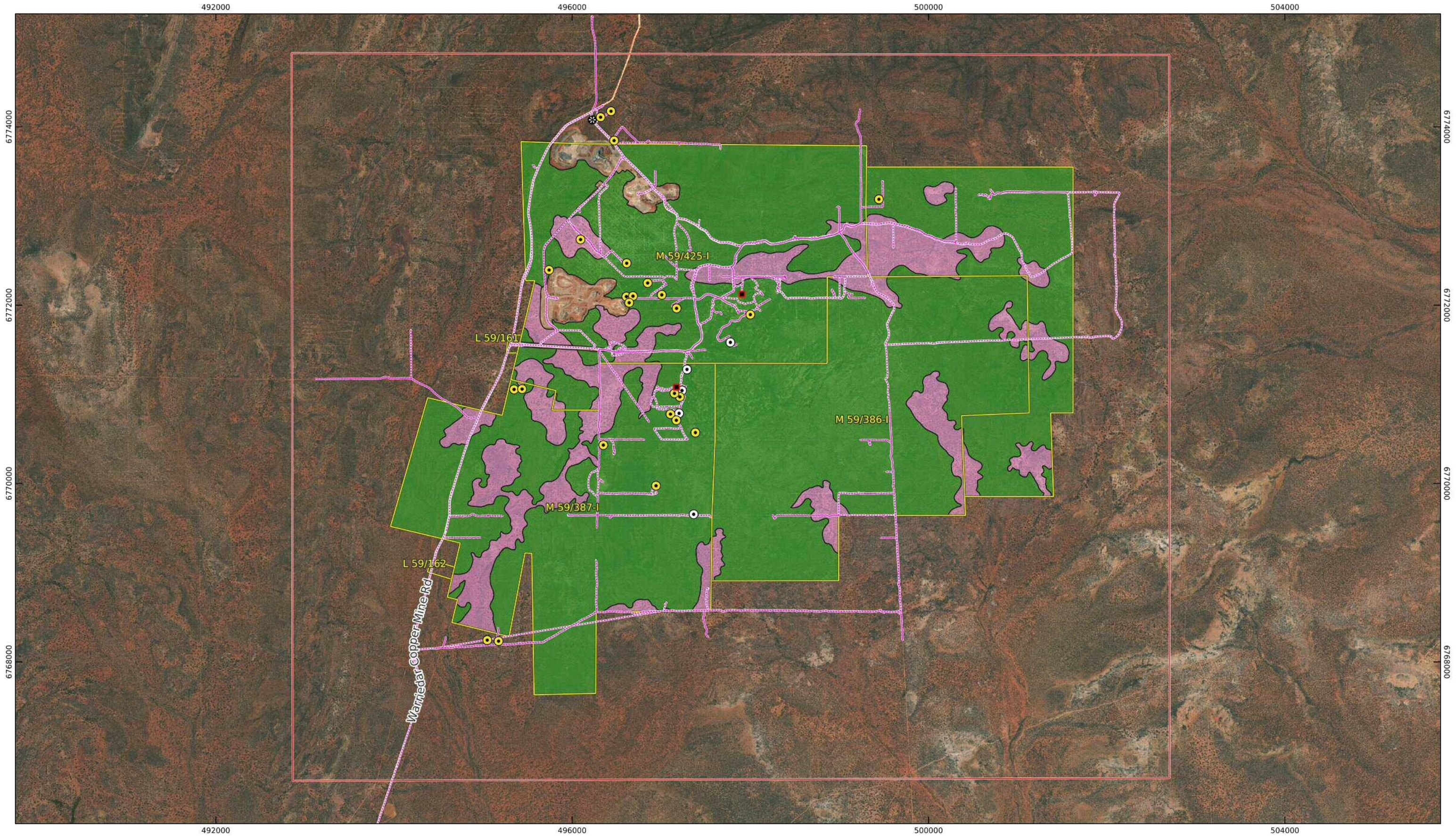


Figure 13: Malleefowl Site Records and Potential Habitat




Scale 1:40,000
GDA94 / MGA zone 50

Legend

- Survey Area
- Tenement Boundary
- Potential Nesting Habitat
- Foraging Habitat
- Survey Track

Malleefowl Record

- Previously Surveyed Mounds
- WE Mound
- WE Malleefowl Sighting
- Malleefowl Recorded on Camera Traps



WESTERN
ECOLOGICAL



Plate 4. Perentie recorded on a camera trap in the survey area.



Plate 5. Sand Goanna recorded on a camera trap in the survey area.



Plate 6. Malleefowl recorded on a camera trap in the survey area.



Plate 7. Malleefowl pair recorded on a camera trap in the survey area.



Plate 8. Common Bronzewing recorded on a camera trap in the survey area.



Plate 9. Australian Ravens recorded on a camera trap in the survey area.



Plate 10. Grey Currawong recorded on a camera trap in the survey area.



Plate 11. Echidna recorded on a camera trap in the survey area.



Plate 12. Euro recorded on a camera trap in the survey area.

5.3.5 Fauna Habitat

Four broad fauna habitat types were identified in the survey area and included:

- Mixed Shrubland
- Open Eucalyptus Woodland
- Rocky Hill
- Cleared.

These broad habitats are generally widespread and common in areas adjacent to the survey area and, more broadly, across the region. The fauna habitat types are mapped in Figure 7 and an example of the habitat assessments undertaken in each of the habitat types is detailed in Appendix 3. The extent of each habitat in the survey area is presented below in Table 12 (note that there has been some very minor rounding of the figures). The broad habitat types were for the most part differentiated by the dominant plant species, vegetation cover and density, and where they were in the landscape.

Table 12. Broad fauna habitat types and extent in the survey area (includes areas cleared of vegetation).

Habitat Type	Extent (ha)	Extent (%)
Mixed Shrubland	2,171.2	69.4
Open Eucalyptus Woodland	515.0	16.5
Rocky Hill	350.3	11.2
Cleared	92.7	2.9
Total	3,129.2	100

Mixed Shrubland

This broad habitat type is relatively widespread in the survey area, primarily on the hill slopes. Mixed Shrubland habitat was dominated by a canopy of mixed Acacia (including *Acacia ramulosa* and *A. acuminata*) and Allocasuarina shrubs, over a mid-story of Eremophila and Hakea (Plate 13). Ground cover was generally sparse with limited mixed herbs and grasses. On the upper slopes surface rock (mostly larger stones) was present and on the lower slopes, soils were generally sandy-loam (although heavily compacted) with smaller rocks, stones and calcrete in some areas. Litter was present, particularly under Acacia and woody debris from fallen Acacia and Allocasuarina was evident. Mixed Shrubland habitat lacked any hollow logs. There was a significant amount of dying/dead Acacia shrubs in the survey area, considered likely to be as a result of high temperatures and low rainfall.

Mixed Shrubland provides habitat for numerous bird species, such as Thornbills and Fairy-wrens which were recorded in this habitat. The Mixed Shrubland habitat also provides suitable foraging and breeding habitat for Malleefowl, as was evidenced from the presence of mounds and camera trap images in this habitat type. It is important to note that not all of the Mixed Shrubland habitat is suitable for Malleefowl to breed in. Within this habitat, breeding habitat are most likely the areas where there is thick enough vegetation to provide adequate shelter, but with enough space, substrate and litter to build mounds.



Plate 13. Example of Mixed Shrubland habitat in the survey area.

Open Eucalyptus Woodland Habitat

This broad habitat type was primarily in the lower, flatter parts of the survey area. Open Eucalypt Woodland habitat was dominated by a canopy of *Eucalyptus salubris*, over a mid-story of Eremophila and Senna (Plate 14). Ground cover was sparse with limited mixed herbs and grasses. Soils were generally sandy-loam (although heavily compacted at deeper levels) and generally lacked rocks or stones. There were large open areas lacking any vegetation and piles of large logs and fallen trees throughout, with plentiful litter under the *E. salubris*.

Open Eucalyptus Woodland habitat provides habitat for larger birds such as Australian Ringnecks and Spiny-cheeked Honeyeaters, as well as slightly sandy soils for burrowing reptiles such as Blind Snakes. Open Eucalyptus Woodland also provides large log piles and fallen trees and is potential Western Spiny-tailed Skink habitat.



Plate 15. Example of Open Woodland habitat in the survey area.

Rocky Hill Habitat

This broad habitat type is relatively uncommon in the general vicinity of the survey area and is restricted to higher elevation areas of the survey area. The Rocky Hill habitat is approximately 100 m higher (approximately 450 m) than the lower parts of the survey area and the surrounding general area.

Rocky Hill habitat also contains a canopy of mixed shrubs, however they are very sparse and ground cover is virtually absent (Plate 15). The substrate across this habitat type consisted of granite, basalt and areas of calcrete. It was stony and rocky with some outcropping on ridges. There was relatively little leaf litter or woody debris and varied with respect to the amount of rock cover and outcropping and the amount of vegetation present.

Rocky Hill habitat provides suitable habitat for saxicoline reptiles including various *Ctenotus* species and potentially the Gilled Slender Bluetongue.

A small number of Malleefowl mounds were also found in Rocky Hill habitat. These mounds were restricted to areas where there were small, flat areas, with some soil etc, in order for Malleefowl to construct a mound.



Plate 14. Example of Rocky Hill habitat in the survey area.

5.3.6 Acoustic Bat Survey Results

The SM4 units recorded calls from eight microbat species across two survey seasons (see Table 13 and Appendix 5). Of the eight species recorded during the survey, three species were recorded during the first season only, Hill's Sheathtail-bat, the Western Free-tailed Bat and Finlayson's Cave Bat. None of the species recorded are threatened.

Table 13. Micro bat species recorded during both seasons of the survey (November 2023 and March 2024).

Bat Species	November Survey	March Survey
Hill's Sheathtail-bat (<i>Taphozous hilli</i>)	✓	
White-striped Freetail Bat (<i>Austronomus australis</i>)	✓	✓
Western Free-tailed Bat (<i>Ozimops kitcheneri</i>)	✓	
Gould's Wattled Bat (<i>Chalinolobus gouldii</i>)	✓	✓
Chocolate Wattled Bat (<i>Chalinolobus morio</i>)	✓	✓
Lesser Long-eared Bat (<i>Nyctophilus geoffroyi</i>)	✓	✓
Inland Broad-nosed Bat (<i>Scotorepens balstoni</i>)	✓	✓
Finlayson's Cave Bat (<i>Vespadelus finlaysoni</i>)	✓	

5.3.7 Nocturnal Spotlighting

While spotlighting across both seasons, we recorded the following four species (noting that none are threatened):

- Tree Dtella (*Gehyra variegata*)
- Tawny Frogmouth (*Podargus strigoides*)
- Southern Boobook (*Ninox boobook*)
- Western Grey Kangaroo (*Macropus fuliginosus*)

5.3.8 Reptile Search Sites

During the reptile searches we captured and observed five reptile species:

- Variegated Gehyra (*Gehyra variegata*)
- Spotted Military Dragon (*Ctenophorus maculatus*)
- Lozenge-marked Dragon (*Ctenophorus scutulatus*)
- Sand Monitor (*Varanus gouldii*)
- Perentie (*Varanus giganteus*)

These five reptiles are relatively common and widespread.

6. Discussion

6.1 Threatened Fauna

A total of five threatened fauna species retrieved from the database searches are considered as either Recorded, Likely, Possible or Unlikely to occur in the survey area, with this based on location of the database record, habitats present in the survey area and survey results, and importantly the species ecology. Of these five threatened species, three were Recorded in the survey area, one is considered Likely to occur in the survey area, one is considered as Possible and no species are considered Unlikely to occur (Table 8). All five threatened species will be discussed below, and their likelihood of occurrence will be outlined.

6.1.1 Threatened Fauna Recorded

Gilled Slender Bluetongue (*Cyclodomorphus branchialis*)

The Gilled Slender Bluetongue has a somewhat restricted distribution, in the central northern west coast and inland, and its population is considered extremely fragmented. There is a continuing decline in the extent and quality of its habitat by grazing activities (Chapple *et al.* 2019). The species was originally recorded from semi-arid shrublands on heavy red soils from Irwin River to Murchison River, and inland to Yalgoo. It is also known to inhabit dense low vegetation (Wilson & Swan, 2023).

Little is known about the Gilled Slender Bluetongue, however as with all *Cyclodomorphus* species, it is mainly crepuscular to nocturnal. The species is ground dwelling, sheltering by day in hummock grass, leaf litter, including *Acacia* and under fallen timber, logs and stumps (Cogger 2018, Chapple *et al.* 2019). It is an omnivorous species, feeding on invertebrates (particularly snails), flowers and fruits (Wilson & Swan 2023).

There were three records of the Gilled Slender Bluetongue in the DBCA threatened fauna database. Two of these records were from 1965. The remaining record was from 2002, from approximately 23 km to the west of the survey area.

While conducting the survey, no Gilled Slender Bluetongues were caught at any of the traps sites, and none were recorded on camera traps. Spectrum Ecology however recorded the species in their 2020 survey. One individual was recorded crossing a track to a spoil heap located in Mixed Shrubland habitat.

Low, dense vegetation, or hummock grass is not present in the survey area, however leaf litter, fallen timber, logs and stumps are present to provide shelter and suitable habitat for the Gilled Slender Bluetongue.

Malleefowl (*Leipoa ocellata*)

In the past century, the range of the Malleefowl has contracted, particularly in arid areas and at the periphery of its former range (Benshemesh 2007). In Australia, clearing for agriculture has eliminated and fragmented much of the Malleefowl habitat, resulting in localised extinctions and fragmented populations (Garnett *et al.* 2011). In WA since 1981, the range of the Malleefowl has been estimated to have contracted by between 28 and 30% (Benshemesh 2007, Parsons *et al.* 2008).

Historically, the species was originally common and widespread in semiarid zones, mainly in scrubs of mallee and other low Eucalypts on sandy and lateritic soils; also, *Acacia* scrubs on heavy red soils, especially north and east of the Mulga-Eucalypt line. The Malleefowl is now generally rare to uncommon and patchily distributed due to habitat loss.

Studies have shown that a wide range of food shrubs, rather than an abundance of any one species is probably important for birds during, for example, droughts (Harlen & Priddel 1996). This is supported by other studies showing that Malleefowl are more abundant in areas where shrubs are more diverse (Woinarski 1989). As shown in section 3.1, there was below average rainfall for both seasons of the survey, and the survey area does appear to be relatively species poor with respect to shrub diversity.

Malleefowl have a relatively large home range that can be up to 4 km² in low rainfall areas (Booth 1987). Predation by the introduced Fox is also thought to be limiting the abundance of Malleefowl and in many areas and may be a major cause of decline (Benshemesh 2007). No Foxes or their tracks were recorded during the survey, and none were captured on the camera traps that were placed in the survey area. However, Feral Cats were recorded across the survey area and there is no reason why Feral Cats couldn't predate Malleefowl.

Malleefowl prefer habitat with a dense canopy and an open ground layer in which they can construct their mounds (Benshemesh 2007). Benshemesh (1992) also found that dense canopy cover was the most important feature associated

with high breeding densities at sites in Victoria. Fire history is also important with Malleefowl birds preferring old growth (i.e., long unburnt) mallee. Fire has a major influence on the structure and floristic composition of habitats that Malleefowl occupy. Much of the survey area has an absence of dense canopy and this may contribute to a lack of active or recently active mounds recorded during the survey.

Habitat in the way of Mixed Shrubland is present in the survey area which provides foraging and breeding habitat for Malleefowl (Figure 13). During the survey, Malleefowl mounds were recorded, one individual was observed and Malleefowl were recorded on two of the long-term camera traps. Five previously unknown mounds were recorded giving a total of 32 known mounds in the survey area. It is important to note, that the mounds are all Disused and the majority are all very old. One mound was active in a more recent survey in 2018 (APM 2018), and an individual was recorded visiting this mound in 2020 (Spectrum 2020).

We have not attempted to assign broad categories of age to old mounds as the rate of mound weathering is not known for this area and would change, with this being dependent to some extent on the material from which the mound is constructed, its location in the landscape (surrounding vegetation) and weather (i.e., rainfall quantities and how much occurs during a particular rainfall event, wind and extreme storm events).

In addition to these recent Malleefowl records in the survey area, there were a total of 249 Malleefowl records in the DBCA threatened fauna database in the vicinity of the survey area. These records were from within 50km of the survey area, the closest being approximately 1 km to the north of the survey area. The most recent record is from 2019, approximately 4 km from the survey area.

Peregrine Falcon (*Falco peregrinus*)

The Peregrine Falcon (*Falco peregrinus*) is listed as other specially protected species (OS) under the BC Act. It is an uncommon but wide-ranging bird across Australia (Barrett *et al.* 2003). It occurs mainly along rivers and ranges as well as wooded watercourses and lakes and nests primarily on cliffs, granite outcrops and quarries. The diet of the Peregrine Falcon has been well studied and primarily includes flocking species such as parrots, pigeons and on the east coast European Starlings (*Sturnus vulgaris*) (Olsen & Fuentes 2008).

There were 20 records of the Peregrine Falcon in the DBCA threatened fauna database, the most recent of which was from 2017. The record comes from 34 km away at the Ningham Station. The closest record of the Peregrine Falcon is approximately 26 km away, from 2012. In addition, Spectrum Ecology recorded the species. One individual was seen flying overhead in Mixed Shrubland habitat (Spectrum 2020).

The Peregrine Falcon was not recorded during either season of the current survey and there is a lack of suitable habitat in the way of wooded watercourses and rivers results in the survey area. The species, however, may utilise the survey area for foraging and might possibly use the granite outcrops or old mining pits in the north-west of the survey area for nesting.

6.1.2 Threatened Fauna Considered Likely to Occur

Western Spiny-tailed Skink (*Egernia stokesii badia*)

The species (*Egernia stokesii*) has a wide but patchy distribution, occurring in the southern Northern Territory, eastern South Australia, south-west and central Queensland and Western Australia. At present, four subspecies are generally recognised. This subspecies (*E. stokesii badia*), occurs in several forms, including a black form that occurs in the upper Murchison (DEC 2012).

The Western Spiny-tailed Skink has suffered significant historical declines from land clearing, and it currently occurs in small, isolated populations. Typically, habitat for Western Spiny-tailed Skinks includes rocky outcrops, hills, isolated stands of granite boulders or more extensive clusters of rock that have crevices and cracks present, including lateritic breakaways (DEC 2012, Chapple *et al.* 2019). The species is most commonly recorded from York Gum (*Eucalyptus loxophleba*) woodland; however it is also associated with Gimlet (*E. salubris*) and Salmon Gum (*E. salmonophloia*) where it occupies tree hollows and log piles (How *et al.* 2003). It adapts well to human disturbances, in log piles and under rubbish (Cogger 2018). Therefore, suitable habitat for the Western Spiny-tailed Skink is found throughout the survey area.

While conducting the survey, no Western Spiny-tailed Skinks were caught at any of the traps sites, none were recorded on camera traps, and no scats or latrine sites were recorded.

There were a total of 86 records of the Western Spiny-tailed Skink in the DBCA threatened fauna database. All of these were from fauna surveys undertaken for the Mount Gibson Mine and Karara Mine, carried out mainly between 2007 and

2018. The closest record is 6 km from the survey area. In addition, the Western Spiny-tailed Skink was also recorded just outside the survey area by Spectrum Ecology (Spectrum 2020).

The survey area has suitable habitat for the Western Spiny-tailed Skink in terms of rocky areas with crevices and woodland with log piles, where the species can shelter. There are also numerous records from nearby, therefore, the Western Spiny-tailed Skink is considered Likely to occur in the survey area.

6.1.3 Threatened Fauna Considered as Possibly Occurring

Central Long-eared Bat (*Nyctophilus major tor*)

In WA, the Central Long-eared Bat (*Nyctophilus major tor*) is known to be widespread in the arid Coolgardie, Gawler and semi-arid Avon regions. It is common but patchy in mixed Eucalypt woodlands with prominent shrub strata, and around wattle thickets that surround granite outcrops and old dams in these woodlands (Baker & Gynther 2023). In this typical habitat, the woodland trees include species such as Salmon Gum (*E. salmonophloia*) and Gimlet (*E. salubris*), with shrub strata usually including dense thickets of Melaleuca and Eremophila. In these habitats, the Central Long-eared Bat roosts in tree crevices, amongst foliage or under loose bark (Baker & Gynther 2023).

There were three records of the Central Long-eared Bat in the DBCA threatened fauna database. All the records were from a survey undertaken at Charles Dawin Reserve (2015 and 2017), which is approximately 40 km to the south of the survey area.

No Central Long-eared Bats were recorded on the SM4 units however, suitable habitat in the way of Gimlet is present in the Open Eucalyptus Woodland. The species is considered to be cryptic and probably more common than records suggest (Baker & Gynther 2023), which results in the species being considered as Possibly occurring in the survey area.

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APPENDICES



Appendix 1: Conservation Categories



Categories of Threatened Fauna Species under the EPBC Act

Conservation Code	Description
Ex	Extinct Taxa which at a particular time if, at the time, there is no reasonable doubt that the last member of the species has died.
ExW	Extinct in the Wild Taxa which are known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
CE	Critically Endangered Taxa which at a particular time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
En	Endangered Taxa which is not critically endangered and it is facing a very high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
Vu	Vulnerable Taxa which is not critically endangered or endangered and is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.

Source: Environment Protection and Biodiversity Conservation Act 1999.

Categories of Threatened Flora and Fauna Species under the BC Act



Department of Biodiversity,
Conservation and Attractions

CONSERVATION CODES

For Western Australian Flora and Fauna

Threatened, Extinct and Specially Protected fauna or flora¹ are species² which have been adequately searched for and are deemed to be, in the wild, threatened, extinct or in need of special protection, and have been gazetted as such.

The *Wildlife Conservation (Specially Protected Fauna) Notice 2018* and the *Wildlife Conservation (Rare Flora) Notice 2018* have been transitioned under regulations 170, 171 and 172 of the *Biodiversity Conservation Regulations 2018* to be the lists of Threatened, Extinct and Specially Protected species under Part 2 of the *Biodiversity Conservation Act 2016*.

Categories of Threatened, Extinct and Specially Protected fauna and flora are:

T **Threatened species**

Listed by order of the Minister as Threatened in the category of critically endangered, endangered or vulnerable under section 19(1), or is a rediscovered species to be regarded as threatened species under section 26(2) of the *Biodiversity Conservation Act 2016* (BC Act).

Threatened fauna is that subset of 'Specially Protected Fauna' listed under schedules 1 to 3 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for Threatened Fauna.

Threatened flora is that subset of 'Rare Flora' listed under schedules 1 to 3 of the *Wildlife Conservation (Rare Flora) Notice 2018* for Threatened Flora.

The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria as detailed below.

CR **Critically endangered species**

Threatened species considered to be "facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines".

Listed as critically endangered under section 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines. Published under schedule 1 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for critically endangered fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for critically endangered flora.

EN **Endangered species**

Threatened species considered to be "facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines".

Listed as endangered under section 19(1)(b) of the BC Act in accordance with the criteria set out in section 21 and the ministerial guidelines. Published under schedule 2 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for endangered fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for endangered flora.

VU **Vulnerable species**

Threatened species considered to be "facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines".

Listed as vulnerable under section 19(1)(c) of the BC Act in accordance with the criteria set out in section 22 and the ministerial guidelines. Published under schedule 3 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for vulnerable fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for vulnerable flora.

**Extinct species**

Listed by order of the Minister as extinct under section 23(1) of the BC Act as extinct or extinct in the wild.

EX Extinct species

Species where *"there is no reasonable doubt that the last member of the species has died"*, and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act).

Published as presumed extinct under schedule 4 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for extinct fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for extinct flora.

EW Extinct in the wild species

Species that *"is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form"*, and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act).

Currently there are no threatened fauna or threatened flora species listed as extinct in the wild. If listing of a species as extinct in the wild occurs, then a schedule will be added to the applicable notice.

Specially protected species

Listed by order of the Minister as specially protected under section 13(1) of the BC Act. Meeting one or more of the following categories: species of special conservation interest; migratory species; cetaceans; species subject to international agreement; or species otherwise in need of special protection.

Species that are listed as threatened species (critically endangered, endangered or vulnerable) or extinct species under the BC Act cannot also be listed as Specially Protected species.

MI Migratory species

Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines (section 15 of the BC Act).

Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and fauna subject to the *Convention on the Conservation of Migratory Species of Wild Animals* (Bonn Convention), an environmental treaty under the United Nations Environment Program. Migratory species listed under the BC Act are a subset of the migratory animals, that are known to visit Western Australia, protected under the international agreements or treaties, excluding species that are listed as Threatened species.

Published as migratory birds protected under an international agreement under schedule 5 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.

CD Species of special conservation interest (conservation dependent fauna)

Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened, and listing is otherwise in accordance with the ministerial guidelines (section 14 of the BC Act).

Published as conservation dependent fauna under schedule 6 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.

OS Other specially protected species

Fauna otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines (section 18 of the BC Act).

Published as other specially protected fauna under schedule 7 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.



Conservation codes for Western Australian flora and fauna

P Priority species

Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened fauna or flora.

Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring.

Assessment of Priority codes is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.

1 Priority 1: Poorly-known species

Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.

2 Priority 2: Poorly-known species

Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.

3 Priority 3: Poorly-known species

Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.

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

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

(b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent.

(c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

¹The definition of flora includes algae, fungi and lichens

²Species includes all taxa (plural of taxon - a classificatory group of any taxonomic rank, e.g. a family, genus, species or any infraspecific category i.e. subspecies or variety, or a distinct population).

Appendix 2: Database Searches

Atlas of Living Australia Database - Amphibians

Phylum	Class	Order	Family	Genus	Species Name	Common Name	No. of Records	No. of Families	No. of Species
Chordata	Amphibia	Anura	Limnodynastidae	Neobatrachus	<i>Neobatrachus kunapalari</i>	Wheatbelt Frog	18	3	5
Chordata	Amphibia	Anura	Limnodynastidae	Neobatrachus	<i>Neobatrachus sutor</i>	Shoemaker Frog	19		
Chordata	Amphibia	Anura	Limnodynastidae	Neobatrachus	<i>Neobatrachus wilsmorei</i>	Goldfields Bullfrog	14		
Chordata	Amphibia	Anura	Myobatrachidae	Pseudophryne	<i>Pseudophryne occidentalis</i>	Orange-crowned Toadlet	47		
Chordata	Amphibia	Anura	Pelodyadidae	Cyclorana	<i>Cyclorana occidentalis</i>	Western Water-holding Frog	12		

Atlas of Living Australia Database - Reptiles

Phylum	Class	Order	Family	Genus	Species Name	Common Name	No. of Records	No of Families	No. of Species
Chordata	Reptilia	Squamata	Agamidae	Ctenophorus	<i>Ctenophorus cristatus</i>	Bicycle Lizard	1	10	58
Chordata	Reptilia	Squamata	Agamidae	Ctenophorus	<i>Ctenophorus maculatus</i>	Spotted Military Dragon	1		
Chordata	Reptilia	Squamata	Agamidae	Ctenophorus	<i>Ctenophorus nuchalis</i>	Central Netted Dragon	1		
Chordata	Reptilia	Squamata	Agamidae	Ctenophorus	<i>Ctenophorus ornatus</i>	Ornate Dragon	4		
Chordata	Reptilia	Squamata	Agamidae	Ctenophorus	<i>Ctenophorus reticulatus</i>	Western Netted Dragon	33		
Chordata	Reptilia	Squamata	Agamidae	Ctenophorus	<i>Ctenophorus salinarum</i>	Claypan Dragon	2		
Chordata	Reptilia	Squamata	Agamidae	Ctenophorus	<i>Ctenophorus scutulatus</i>	Lozenge-marked Dragon	9		
Chordata	Reptilia	Squamata	Agamidae	Diporiphora	<i>Diporiphora amphiboluroides</i>	Mulga Dragon	1		
Chordata	Reptilia	Squamata	Agamidae	Moloch	<i>Moloch horridus</i>	Thorny Devil	4		
Chordata	Reptilia	Squamata	Agamidae	Pogona	<i>Pogona minor</i>	Dwarf Bearded Dragon	4		
Chordata	Reptilia	Squamata	Carphodactylidae	Underwoodisaurus	<i>Underwoodisaurus millii</i>	Barking Gecko	3		
Chordata	Reptilia	Squamata	Diplodactylidae	Diplodactylus	<i>Diplodactylus granariensis</i>	Wheat-belt Stone Gecko	1		
Chordata	Reptilia	Squamata	Diplodactylidae	Diplodactylus	<i>Diplodactylus granariensis granariensis</i>	Western Stone Gecko	1		
Chordata	Reptilia	Squamata	Diplodactylidae	Diplodactylus	<i>Diplodactylus granariensis rex</i>	Giant Stone Gecko	1		
Chordata	Reptilia	Squamata	Diplodactylidae	Diplodactylus	<i>Diplodactylus pulcher</i>	Fine-faced Gecko	5		
Chordata	Reptilia	Squamata	Diplodactylidae	Hesperoedura	<i>Hesperoedura reticulata</i>	Reticulated Velvet Gecko	1		
Chordata	Reptilia	Squamata	Diplodactylidae	Lucasium	<i>Lucasium maini</i>	Main's Ground Gecko	2		
Chordata	Reptilia	Squamata	Diplodactylidae	Lucasium	<i>Lucasium squarrosum</i>	Mottled Ground Gecko	5		
Chordata	Reptilia	Squamata	Diplodactylidae	Rhynchoedura	<i>Rhynchoedura ornata</i>	Western Beaked Gecko	4		
Chordata	Reptilia	Squamata	Diplodactylidae	Strophurus	<i>Strophurus assimilis</i>	Goldfields Spiny-tailed Gecko	3		
Chordata	Reptilia	Squamata	Diplodactylidae	Strophurus	<i>Strophurus strophurus</i>	Western Spiny-tailed Gecko	1		
Chordata	Reptilia	Squamata	Elapidae	Furina	<i>Furina ornata</i>	Moon Snake	1		
Chordata	Reptilia	Squamata	Elapidae	Pseudechis	<i>Pseudechis australis</i>	Mulga Snake	1		
Chordata	Reptilia	Squamata	Elapidae	Pseudechis	<i>Pseudechis butleri</i>	Spotted Mulga Snake	9		
Chordata	Reptilia	Squamata	Elapidae	Pseudonaja	<i>Pseudonaja mengdeni</i>	Western Brown Snake	1		
Chordata	Reptilia	Squamata	Elapidae	Pseudonaja	<i>Pseudonaja modesta</i>	Ringed Brown Snake	7		
Chordata	Reptilia	Squamata	Elapidae	Simoselaps	<i>Simoselaps bertholdi</i>	Jan's Banded Snake	4		
Chordata	Reptilia	Squamata	Elapidae	Suta	<i>Suta fasciata</i>	Rosen's Snake	6		
Chordata	Reptilia	Squamata	Elapidae	Suta	<i>Suta monachus</i>	Monk Snake	2		
Chordata	Reptilia	Squamata	Gekkonidae	Gehyra	<i>Gehyra variegata</i>	Tree Dtella	27		
Chordata	Reptilia	Squamata	Gekkonidae	Heteronotia	<i>Heteronotia binoei</i>	Bynoe's Gecko	107		
Chordata	Reptilia	Squamata	Pygopodidae	Delma	<i>Delma australis</i>	Marble-faced Delma	2		

Chordata	Reptilia	Squamata	Pygopodidae	Pygopus	<i>Pygopus nigriceps</i>	Western Hooded Scaly-foot	5		
Chordata	Reptilia	Squamata	Scincidae	Cryptoblepharus	<i>Cryptoblepharus buchanani</i>	Buchanan's Snake-eyed Skink	1		
Chordata	Reptilia	Squamata	Scincidae	Ctenotus	<i>Ctenotus inornatus</i>	Bar-shouldered Ctenotus	17		
Chordata	Reptilia	Squamata	Scincidae	Ctenotus	<i>Ctenotus mimetes</i>	Checker-sided Ctenotus	3		
Chordata	Reptilia	Squamata	Scincidae	Ctenotus	<i>Ctenotus schomburgkii</i>	Schomburgk's Ctenotus	1		
Chordata	Reptilia	Squamata	Scincidae	Ctenotus	<i>Ctenotus severus</i>	Stern Ctenotus	11		
Chordata	Reptilia	Squamata	Scincidae	Ctenotus	<i>Ctenotus uber uber</i>	Rich Ctenotus	1		
Chordata	Reptilia	Squamata	Scincidae	Cyclodomorphus	<i>Cyclodomorphus branchialis</i>	Gilled Slender Blue-tongue	2		
Chordata	Reptilia	Squamata	Scincidae	Egernia	<i>Egernia depressa</i>	Pygmy Spiny-tailed Skink	8		
Chordata	Reptilia	Squamata	Scincidae	Egernia	<i>Egernia stokesii badia</i>	Western Spiny-tailed Skink	3		
Chordata	Reptilia	Squamata	Scincidae	Eremiascincus	<i>Eremiascincus richardsonii</i>	Broad-banded Sand-swimmer	10		
Chordata	Reptilia	Squamata	Scincidae	Lerista	<i>Lerista gerrardii</i>	Bold-striped Robust Slider	6		
Chordata	Reptilia	Squamata	Scincidae	Lerista	<i>Lerista nicholli</i>	Inland Broad-blazed Slider	4		
Chordata	Reptilia	Squamata	Scincidae	Lerista	<i>Lerista timida</i>	Timid Slider	2		
Chordata	Reptilia	Squamata	Scincidae	Liopholis	<i>Liopholis inornata</i>	Desert Skink	2		
Chordata	Reptilia	Squamata	Scincidae	Menetia	<i>Menetia greyii</i>	Grey's Menetia	27		
Chordata	Reptilia	Squamata	Scincidae	Morethia	<i>Morethia butleri</i>	Woodland Morethia Skink	5		
Chordata	Reptilia	Squamata	Scincidae	Tiliqua	<i>Tiliqua rugosa rugosa</i>	Shingleback	1		
Chordata	Reptilia	Squamata	Typhlopidae	Anilius	<i>Anilius waitii</i>	Beaked Blind Snake	1		
Chordata	Reptilia	Squamata	Varanidae	Varanus	<i>Varanus</i>	Mangrove Monitor	1		
Chordata	Reptilia	Squamata	Varanidae	Varanus	<i>Varanus caudolineatus</i>	Stripe-tailed Monitor	4		
Chordata	Reptilia	Squamata	Varanidae	Varanus	<i>Varanus giganteus</i>	Perentie	3		
Chordata	Reptilia	Squamata	Varanidae	Varanus	<i>Varanus gouldii</i>	Gould's Goanna	3		
Chordata	Reptilia	Squamata	Varanidae	Varanus	<i>Varanus panoptes rubidus</i>	Yellow Spotted Monitor	5		
Chordata	Reptilia	Squamata	Varanidae	Varanus	<i>Varanus tristis</i>	Black-headed Monitor	1		
Chordata	Reptilia	Testudines	Chelidae	Chelodina	<i>Chelodina (Macrochelodina) oblonga</i>	Northern Snake-necked Turtle	3		

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Phylum	Class	Order	Family	Genus	Species Name	Common Name	No. of Records	No of Families	No. of Species
Chordata	Aves	Accipitriformes	Accipitridae	Accipiter	<i>Accipiter (Leucospiza) fasciatus</i>	Brown Goshawk	45	55	190
Chordata	Aves	Accipitriformes	Accipitridae	Accipiter	<i>Accipiter (Paraspizias) cirrocephalus</i>	Collared Sparrowhawk	17		
Chordata	Aves	Accipitriformes	Accipitridae	Aquila	<i>Aquila (Uroaetus) audax</i>	Wedge-tailed Eagle	97		
Chordata	Aves	Accipitriformes	Accipitridae	Circus	<i>Circus assimilis</i>	Spotted Harrier	14		
Chordata	Aves	Accipitriformes	Accipitridae	Elanus	<i>Elanus axillaris</i>	Black-shouldered Kite	3		
Chordata	Aves	Accipitriformes	Accipitridae	Haliastur	<i>Haliastur spheurnus</i>	Whistling Kite	26		
Chordata	Aves	Accipitriformes	Accipitridae	Hamirostra	<i>Hamirostra melanosternon</i>	Black-breasted Buzzard	10		
Chordata	Aves	Accipitriformes	Accipitridae	Hieraaetus	<i>Hieraaetus (Hieraaetus) morphnoides</i>	Little Eagle	11		
Chordata	Aves	Accipitriformes	Accipitridae	Lophoictinia	<i>Lophoictinia isura</i>	Square-tailed Kite	8		
Chordata	Aves	Accipitriformes	Accipitridae	Milvus	<i>Milvus migrans</i>	Black Kite	3		
Chordata	Aves	Anseriformes	Anatidae	Anas	<i>Anas (Anas) superciliosa</i>	Pacific Black Duck	19		
Chordata	Aves	Anseriformes	Anatidae	Anas	<i>Anas gracilis</i>	Grey Teal	44		
Chordata	Aves	Anseriformes	Anatidae	Aythya	<i>Aythya (Nyroca) australis</i>	Hardhead	3		
Chordata	Aves	Anseriformes	Anatidae	Biziura	<i>Biziura lobata</i>	Musk Duck	2		
Chordata	Aves	Anseriformes	Anatidae	Chenonetta	<i>Chenonetta jubata</i>	Australian Wood Duck	32		
Chordata	Aves	Anseriformes	Anatidae	Cygnus	<i>Cygnus atratus</i>	Black Swan	14		
Chordata	Aves	Anseriformes	Anatidae	Malacorhynchus	<i>Malacorhynchus membranaceus</i>	Pink-eared Duck	12		
Chordata	Aves	Anseriformes	Anatidae	Spatula	<i>Spatula rhynchotis</i>	Australasian Shoveler	1		
Chordata	Aves	Anseriformes	Anatidae	Tadorna	<i>Tadorna (Casarca) tadornoides</i>	Australian Shelduck	40		
Chordata	Aves	Apodiformes	Aegothelidae	Aegotheles	<i>Aegotheles (Aegotheles) cristatus</i>	Australian Owlet-nightjar	35		
Chordata	Aves	Caprimulgiformes	Caprimulgidae	Eurostopodus	<i>Eurostopodus (Eurostopodus) argus</i>	Spotted Nightjar	15		
Chordata	Aves	Caprimulgiformes	Podargidae	Podargus	<i>Podargus strigoides</i>	Tawny Frogmouth	14		
Chordata	Aves	Charadriiformes	Burhinidae	Burhinus	<i>Burhinus (Burhinus) grallarius</i>	Bush Stone-curlew	1		
Chordata	Aves	Charadriiformes	Charadriidae	Charadrius	<i>Charadrius (Charadrius) ruficapillus</i>	Red-capped Plover	22		
Chordata	Aves	Charadriiformes	Charadriidae	Elseyonis	<i>Elseyonis melanops</i>	Black-fronted Dotterel	33		
Chordata	Aves	Charadriiformes	Charadriidae	Erythronys	<i>Erythronys cinctus</i>	Red-kneed Dotterel	11		
Chordata	Aves	Charadriiformes	Charadriidae	Thinornis	<i>Thinornis cucullatus</i>	Hooded Plover	1		
Chordata	Aves	Charadriiformes	Charadriidae	Vanellus	<i>Vanellus (Lobivanellus) tricolor</i>	Banded Lapwing	46		
Chordata	Aves	Charadriiformes	Laridae	Chroicocephalus	<i>Chroicocephalus novaehollandiae</i>	Silver Gull	1		
Chordata	Aves	Charadriiformes	Laridae	Gelochelidon	<i>Gelochelidon nilotica</i>	Gull-billed Tern	1		
Chordata	Aves	Charadriiformes	Recurvirostridae	Cladorhynchus	<i>Cladorhynchus leucocephalus</i>	Banded Stilt	9		
Chordata	Aves	Charadriiformes	Recurvirostridae	Himantopus	<i>Himantopus himantopus</i>	Black-winged Stilt	7		
Chordata	Aves	Charadriiformes	Recurvirostridae	Himantopus	<i>Himantopus himantopus leucocephalus</i>	Pied Stilt	11		
Chordata	Aves	Charadriiformes	Recurvirostridae	Recurvirostra	<i>Recurvirostra novaehollandiae</i>	Red-necked Avocet	22		

Chordata	Aves	Charadriiformes	Rostratulidae	Rostratula	<i>Rostratula australis</i>	Australian Painted Snipe	2		
Chordata	Aves	Charadriiformes	Scolopacidae	Actitis	<i>Actitis hypoleucos</i>	Common Sandpiper	1		
Chordata	Aves	Charadriiformes	Scolopacidae	Tringa	<i>Tringa (Glottis) nebularia</i>	Common Greenshank	1		
Chordata	Aves	Ciconiiformes	Ardeidae	Ardea	<i>Ardea pacifica</i>	White-necked Heron	10		
Chordata	Aves	Ciconiiformes	Ardeidae	Egretta	<i>Egretta garzetta</i>	Little Egret	1		
Chordata	Aves	Ciconiiformes	Ardeidae	Egretta	<i>Egretta novaehollandiae</i>	White-faced Heron	24		
Chordata	Aves	Ciconiiformes	Ardeidae	Ixobrychus	<i>Ixobrychus dubius</i>	Minute Bittern	4		
Chordata	Aves	Ciconiiformes	Threskiornithidae	Threskiornis	<i>Threskiornis moluccus</i>	Australian White Ibis	1		
Chordata	Aves	Ciconiiformes	Threskiornithidae	Threskiornis	<i>Threskiornis spinicollis</i>	Straw-necked Ibis	5		
Chordata	Aves	Columbiformes	Columbidae	Ocyphaps	<i>Ocyphaps lophotes</i>	Crested Pigeon	193		
Chordata	Aves	Columbiformes	Columbidae	Phaps	<i>Phaps (Phaps) chalcoptera</i>	Common Bronzewing	150		
Chordata	Aves	Coraciiformes	Alcedinidae	Todiramphus	<i>Todiramphus (Cyanalcyon) pyrrhopygius</i>	Red-backed Kingfisher	50		
Chordata	Aves	Coraciiformes	Alcedinidae	Todiramphus	<i>Todiramphus (Todiramphus) sanctus</i>	Sacred Kingfisher	5		
Chordata	Aves	Coraciiformes	Meropidae	Merops	<i>Merops (Merops) ornatus</i>	Rainbow Bee-eater	52		
Chordata	Aves	Cuculiformes	Cuculidae	Cacomantis	<i>Cacomantis (Vidgenia) flabelliformis</i>	Fan-tailed Cuckoo	1		
Chordata	Aves	Cuculiformes	Cuculidae	Chalcites	<i>Chalcites basalis</i>	Horsfield's Bronze-cuckoo	32		
Chordata	Aves	Cuculiformes	Cuculidae	Chalcites	<i>Chalcites lucidus</i>	Shining Bronze-cuckoo	1		
Chordata	Aves	Cuculiformes	Cuculidae	Chalcites	<i>Chalcites osculans</i>	Black-eared Cuckoo	72		
Chordata	Aves	Cuculiformes	Cuculidae	Heteroscenes	<i>Heteroscenes pallidus</i>	Pallid Cuckoo	104		
Chordata	Aves	Falconiformes	Falconidae	Falco	<i>Falco (Falco) longipennis</i>	Australian Hobby	39		
Chordata	Aves	Falconiformes	Falconidae	Falco	<i>Falco (Hierofalco) peregrinus</i>	Peregrine Falcon	17		
Chordata	Aves	Falconiformes	Falconidae	Falco	<i>Falco (Hierofalco) subniger</i>	Black Falcon	1		
Chordata	Aves	Falconiformes	Falconidae	Falco	<i>Falco (Ieracidea) berigora</i>	Brown Falcon	140		
Chordata	Aves	Falconiformes	Falconidae	Falco	<i>Falco (Ieracidea) berigora berigora</i>	Eastern Brown Falcon	1		
Chordata	Aves	Falconiformes	Falconidae	Falco	<i>Falco (Tinnunculus) cenchroides</i>	Nankeen Kestrel	107		
Chordata	Aves	Galliformes	Megapodiidae	Leipoa	<i>Leipoa ocellata</i>	Malleefowl	35		
Chordata	Aves	Galliformes	Phasianidae	Coturnix	<i>Coturnix (Coturnix) pectoralis</i>	Stubble Quail	2		
Chordata	Aves	Galliformes	Phasianidae	Gallus	<i>Gallus gallus</i>	Red Junglefowl	2		
Chordata	Aves	Gruiformes	Otididae	Ardeotis	<i>Ardeotis australis</i>	Australian Bustard	16		
Chordata	Aves	Gruiformes	Rallidae	Fulica	<i>Fulica atra</i>	Eurasian Coot	7		
Chordata	Aves	Gruiformes	Rallidae	Porphyrio	<i>Porphyrio (Porphyrio) porphyrio</i>	Purple Swamphen	1		
Chordata	Aves	Gruiformes	Rallidae	Tribonyx	<i>Tribonyx ventralis</i>	Black-tailed Native-hen	15		
Chordata	Aves	Passeriformes	Acanthizidae	Acanthiza	<i>Acanthiza (Acanthiza) apicalis</i>	Red-rumped Tit	218		
Chordata	Aves	Passeriformes	Acanthizidae	Acanthiza	<i>Acanthiza (Geobasileus) chrysorrhoa</i>	Yellow-rumped Thornbill	203		
Chordata	Aves	Passeriformes	Acanthizidae	Acanthiza	<i>Acanthiza (Geobasileus) iredalei</i>	Slender-billed Thornbill	4		
Chordata	Aves	Passeriformes	Acanthizidae	Acanthiza	<i>Acanthiza (Geobasileus) uropygialis</i>	Chestnut-rumped Thornbill	439		
Chordata	Aves	Passeriformes	Acanthizidae	Acanthiza	<i>Acanthiza (Milligania) robustirostris</i>	Slaty-backed Thornbill	74		
Chordata	Aves	Passeriformes	Acanthizidae	Aphelocephala	<i>Aphelocephala leucopsis</i>	Southern Whiteface	343		
Chordata	Aves	Passeriformes	Acanthizidae	Aphelocephala	<i>Aphelocephala leucopsis castaneiventris</i>	South-west Southern Whitef	1		

Chordata	Aves	Passeriformes	Acanthizidae	Calamanthus	<i>Calamanthus montanellus</i>	Western Fieldwren	5		
Chordata	Aves	Passeriformes	Acanthizidae	Gerygone	<i>Gerygone fusca</i>	Western Gerygone	143		
Chordata	Aves	Passeriformes	Acanthizidae	Hylacola	<i>Hylacola cauta</i>	Shy Heathwren	9		
Chordata	Aves	Passeriformes	Acanthizidae	Pyrrholaemus	<i>Pyrrholaemus brunneus</i>	Redthroat	203		
Chordata	Aves	Passeriformes	Acanthizidae	Sericornis	<i>Sericornis (Sericornis) frontalis</i>	White-browed Scrubwren	1		
Chordata	Aves	Passeriformes	Acanthizidae	Sericornis	<i>Sericornis (Sericornis) frontalis maculatus</i>	South-western Spotted Scru	2		
Chordata	Aves	Passeriformes	Acanthizidae	Smicrornis	<i>Smicrornis brevirostris</i>	Weebill	317		
Chordata	Aves	Passeriformes	Artamidae	Artamus	<i>Artamus (Angroyan) cinereus</i>	Black-faced Woodswallow	98		
Chordata	Aves	Passeriformes	Artamidae	Artamus	<i>Artamus (Angroyan) cyanopterus</i>	Dusky Woodswallow	25		
Chordata	Aves	Passeriformes	Artamidae	Artamus	<i>Artamus (Angroyan) minor</i>	Little Woodswallow	24		
Chordata	Aves	Passeriformes	Artamidae	Artamus	<i>Artamus (Campbellornis) personatus</i>	Masked Woodswallow	36		
Chordata	Aves	Passeriformes	Artamidae	Artamus	<i>Artamus (Campbellornis) superciliosus</i>	White-browed Woodswallow	5		
Chordata	Aves	Passeriformes	Artamidae	Cracticus	<i>Cracticus nigrogularis</i>	Pied Butcherbird	237		
Chordata	Aves	Passeriformes	Artamidae	Cracticus	<i>Cracticus torquatus</i>	Grey Butcherbird	231		
Chordata	Aves	Passeriformes	Artamidae	Gymnorhina	<i>Gymnorhina tibicen</i>	Australian Magpie	201		
Chordata	Aves	Passeriformes	Artamidae	Gymnorhina	<i>Gymnorhina tibicen dorsalis</i>	South-western Australian Ma	2		
Chordata	Aves	Passeriformes	Artamidae	Strepera	<i>Strepera (Neostrepera) versicolor</i>	Grey Currawong	61		
Chordata	Aves	Passeriformes	Campephagidae	Coracina	<i>Coracina (Coracina) novaehollandiae</i>	Black-faced Cuckoo-shrike	191		
Chordata	Aves	Passeriformes	Campephagidae	Coracina	<i>Coracina (Pteropodocys) maxima</i>	Ground Cuckoo-shrike	9		
Chordata	Aves	Passeriformes	Campephagidae	Lalage	<i>Lalage (Lalage) tricolor</i>	White-winged Triller	58		
Chordata	Aves	Passeriformes	Cinclosomatidae	Cinclosoma	<i>Cinclosoma (Malleeavis) castanotum</i>	Chestnut Quail-thrush	16		
Chordata	Aves	Passeriformes	Cinclosomatidae	Cinclosoma	<i>Cinclosoma (Malleeavis) clarum</i>	Inland Chestnut Quail-thrush	8		
Chordata	Aves	Passeriformes	Cinclosomatidae	Cinclosoma	<i>Cinclosoma (Samuela) castaneothorax</i>	Chestnut-breasted Quail-thr	11		
Chordata	Aves	Passeriformes	Cinclosomatidae	Cinclosoma	<i>Cinclosoma (Samuela) marginatum</i>	Western Quail-thrush	9		
Chordata	Aves	Passeriformes	Climacteridae	Climacteris	<i>Climacteris (Climacteris) rufus</i>	Rufous Treecreeper	53		
Chordata	Aves	Passeriformes	Climacteridae	Climacteris	<i>Climacteris (Climacterobates) affinis</i>	White-browed Treecreeper	7		
Chordata	Aves	Passeriformes	Corvidae	Corvus	<i>Corvus bennetti</i>	Little Crow	117		
Chordata	Aves	Passeriformes	Corvidae	Corvus	<i>Corvus coronoides</i>	Australian Raven	240		
Chordata	Aves	Passeriformes	Corvidae	Corvus	<i>Corvus coronoides perplexus</i>	Western Australian Raven	1		
Chordata	Aves	Passeriformes	Corvidae	Corvus	<i>Corvus orru</i>	Torresian Crow	45		
Chordata	Aves	Passeriformes	Corvidae	Corvus	<i>Corvus orru ceciliae</i>	Australian Torresian Crow	3		
Chordata	Aves	Passeriformes	Dicaeidae	Dicaeum	<i>Dicaeum (Dicaeum) hirundinaceum</i>	Mistletoebird	21		
Chordata	Aves	Passeriformes	Estrildidae	Taeniopygia	<i>Taeniopygia guttata</i>	Zebra Finch	122		
Chordata	Aves	Passeriformes	Hirundinidae	Cheramoeca	<i>Cheramoeca leucosterna</i>	White-backed Swallow	22		
Chordata	Aves	Passeriformes	Hirundinidae	Hirundo	<i>Hirundo (Hirundo) neoxena</i>	Welcome Swallow	207		
Chordata	Aves	Passeriformes	Hirundinidae	Petrochelidon	<i>Petrochelidon (Hylochelidon) nigricans</i>	Tree Martin	163		
Chordata	Aves	Passeriformes	Hirundinidae	Petrochelidon	<i>Petrochelidon (Petrochelidon) ariel</i>	Fairy Martin	20		
Chordata	Aves	Passeriformes	Locustellidae	Cincloramphus	<i>Cincloramphus (Cincloramphus) cruralis</i>	Brown Songlark	16		
Chordata	Aves	Passeriformes	Locustellidae	Cincloramphus	<i>Cincloramphus (Maclennania) mathewsi</i>	Rufous Songlark	84		

Chordata	Aves	Passeriformes	Locustellidae	Poodytes	<i>Poodytes gramineus</i>	Little Grassbird	2		
Chordata	Aves	Passeriformes	Maluridae	Malurus	<i>Malurus (Leggeornis) assimilis</i>	Purple-backed Fairy-wren	4		
Chordata	Aves	Passeriformes	Maluridae	Malurus	<i>Malurus (Leggeornis) lamberti</i>	Variegated Fairy-wren	21		
Chordata	Aves	Passeriformes	Maluridae	Malurus	<i>Malurus (Leggeornis) pulcherrimus</i>	Blue-breasted Fairy-wren	6		
Chordata	Aves	Passeriformes	Maluridae	Malurus	<i>Malurus (Malurus) splendens</i>	Splendid Fairy-wren	268		
Chordata	Aves	Passeriformes	Maluridae	Malurus	<i>Malurus (Musciparus) leucopterus</i>	White-winged Fairy-wren	65		
Chordata	Aves	Passeriformes	Meliphagidae	Anthochaera	<i>Anthochaera (Anthochaera) carunculata</i>	Red Wattlebird	59		
Chordata	Aves	Passeriformes	Meliphagidae	Certhionyx	<i>Certhionyx (Certhionyx) variegatus</i>	Pied Honeyeater	89		
Chordata	Aves	Passeriformes	Meliphagidae	Conopophila	<i>Conopophila (Lacustroica) whitei</i>	Grey Honeyeater	2		
Chordata	Aves	Passeriformes	Meliphagidae	Epthianura	<i>Epthianura (Aurepthianura) aurifrons</i>	Orange Chat	3		
Chordata	Aves	Passeriformes	Meliphagidae	Epthianura	<i>Epthianura (Epthianura) albifrons</i>	White-fronted Chat	41		
Chordata	Aves	Passeriformes	Meliphagidae	Epthianura	<i>Epthianura (Parepthianura) tricolor</i>	Crimson Chat	55		
Chordata	Aves	Passeriformes	Meliphagidae	Gavicalis	<i>Gavicalis virescens</i>	Singing Honeyeater	455		
Chordata	Aves	Passeriformes	Meliphagidae	Gliciphila	<i>Gliciphila melanops</i>	Tawny-crowned Honeyeater	2		
Chordata	Aves	Passeriformes	Meliphagidae	Lichmera	<i>Lichmera (Lichmera) indistincta</i>	Brown Honeyeater	80		
Chordata	Aves	Passeriformes	Meliphagidae	Manorina	<i>Manorina (Myzantha) flavigula</i>	Yellow-throated Miner	263		
Chordata	Aves	Passeriformes	Meliphagidae	Melithreptus	<i>Melithreptus (Eidopsarus) brevirostris</i>	Brown-headed Honeyeater	20		
Chordata	Aves	Passeriformes	Meliphagidae	Nesoptilotis	<i>Nesoptilotis leucotis</i>	White-eared Honeyeater	20		
Chordata	Aves	Passeriformes	Meliphagidae	Ptilotula	<i>Ptilotula ornata</i>	Yellow-plumed Honeyeater	4		
Chordata	Aves	Passeriformes	Meliphagidae	Ptilotula	<i>Ptilotula penicillata</i>	White-plumed Honeyeater	2		
Chordata	Aves	Passeriformes	Meliphagidae	Ptilotula	<i>Ptilotula plumula</i>	Grey-fronted Honeyeater	12		
Chordata	Aves	Passeriformes	Meliphagidae	Purnella	<i>Purnella albifrons</i>	White-fronted Honeyeater	242		
Chordata	Aves	Passeriformes	Meliphagidae	Sugomel	<i>Sugomel niger</i>	Black Honeyeater	33		
Chordata	Aves	Passeriformes	Monarchidae	Grallina	<i>Grallina cyanoleuca</i>	Magpie-lark	153		
Chordata	Aves	Passeriformes	Motacillidae	Anthus	<i>Anthus (Anthus) novaeseelandiae</i>	Australian Pipit	91		
Chordata	Aves	Passeriformes	Neosittidae	Daphoenositta	<i>Daphoenositta (Neositta) chrysoptera</i>	Varied Sittella	9		
Chordata	Aves	Passeriformes	Oreoicidae	Oreoica	<i>Oreoica gutturalis</i>	Crested Bellbird	515		
Chordata	Aves	Passeriformes	Pachycephalidae	Colluricincla	<i>Colluricincla (Colluricincla) harmonica</i>	Grey Shrike-thrush	312		
Chordata	Aves	Passeriformes	Pachycephalidae	Pachycephala	<i>Pachycephala (Alisterornis) rufiventris</i>	Rufous Whistler	335		
Chordata	Aves	Passeriformes	Pachycephalidae	Pachycephala	<i>Pachycephala (Alisterornis) rufiventris rufi</i>	Southern Rufous Whistler	1		
Chordata	Aves	Passeriformes	Pachycephalidae	Pachycephala	<i>Pachycephala (Pachycephala) pectoralis</i>	Golden Whistler	30		
Chordata	Aves	Passeriformes	Pachycephalidae	Pachycephala	<i>Pachycephala (Pachycephala) pectoralis f</i>	South Australian Golden Wh	19		
Chordata	Aves	Passeriformes	Pachycephalidae	Pachycephala	<i>Pachycephala (Timixos) inornata</i>	Gilbert's Whistler	6		
Chordata	Aves	Passeriformes	Pardalotidae	Pardalotus	<i>Pardalotus (Pardalotinus) striatus</i>	Striated Pardalote	236		
Chordata	Aves	Passeriformes	Pardalotidae	Pardalotus	<i>Pardalotus (Pardalotinus) striatus substri</i>	Western Striated Pardalote	1		
Chordata	Aves	Passeriformes	Pardalotidae	Pardalotus	<i>Pardalotus (Pardalotus) punctatus</i>	Spotted Pardalote	1		
Chordata	Aves	Passeriformes	Petroicidae	Drymodes	<i>Drymodes brunneopygia</i>	Southern Scrub-robin	24		
Chordata	Aves	Passeriformes	Petroicidae	Eopsaltria	<i>Eopsaltria (Eopsaltria) griseogularis</i>	Western Yellow Robin	26		
Chordata	Aves	Passeriformes	Petroicidae	Melanodryas	<i>Melanodryas (Melanodryas) cucullata</i>	Hooded Robin	26		

Chordata	Aves	Passeriformes	Petroicidae	Microeca	<i>Microeca (Microeca) fascinans</i>	Jacky Winter	37		
Chordata	Aves	Passeriformes	Petroicidae	Petroica	<i>Petroica (Petroica) goodenovii</i>	Red-capped Robin	567		
Chordata	Aves	Passeriformes	Pomatostomidae	Pomatostomus	<i>Pomatostomus (Morganornis) superciliosus</i>	White-browed Babbler	191		
Chordata	Aves	Passeriformes	Pomatostomidae	Pomatostomus	<i>Pomatostomus (Pomatostomus) temporalis</i>	Grey-crowned Babbler	38		
Chordata	Aves	Passeriformes	Psophodidae	Psophodes	<i>Psophodes (Sphenostoma) cristatus</i>	Chirruping Wedgebill	1		
Chordata	Aves	Passeriformes	Psophodidae	Psophodes	<i>Psophodes (Sphenostoma) occidentalis</i>	Chiming Wedgebill	7		
Chordata	Aves	Passeriformes	Ptilonorhynchidae	Chlamydera	<i>Chlamydera guttata</i>	Western Bowerbird	20		
Chordata	Aves	Passeriformes	Rhipiduridae	Rhipidura	<i>Rhipidura (Rhipidura) albiscapa</i>	Grey Fantail	136		
Chordata	Aves	Passeriformes	Rhipiduridae	Rhipidura	<i>Rhipidura (Rhipidura) albiscapa preissi</i>	South-western Grey Fantail	4		
Chordata	Aves	Passeriformes	Rhipiduridae	Rhipidura	<i>Rhipidura (Sauloprocta) leucophrys</i>	Willie Wagtail	294		
Chordata	Aves	Passeriformes	Zosteropidae	Zosterops	<i>Zosterops lateralis</i>	Silvereye	6		
Chordata	Aves	Passeriformes	Zosteropidae	Zosterops	<i>Zosterops lateralis chloronotus</i>	Western Silvereye	1		
Chordata	Aves	Pelecaniformes	Pelecanidae	Pelecanus	<i>Pelecanus conspicillatus</i>	Australian Pelican	2		
Chordata	Aves	Pelecaniformes	Phalacrocoracidae	Microcarbo	<i>Microcarbo melanoleucos</i>	Little Pied Cormorant	1		
Chordata	Aves	Podicipediformes	Podicipedidae	Poliiocephalus	<i>Poliiocephalus poliiocephalus</i>	Hoary-headed Grebe	19		
Chordata	Aves	Podicipediformes	Podicipedidae	Tachybaptus	<i>Tachybaptus novaehollandiae</i>	Australasian Grebe	20		
Chordata	Aves	Psittaciformes	Cacatuidae	Cacatua	<i>Cacatua (Licmetis) pastinator</i>	Western Corella	18		
Chordata	Aves	Psittaciformes	Cacatuidae	Cacatua	<i>Cacatua (Licmetis) sanguinea</i>	Little Corella	27		
Chordata	Aves	Psittaciformes	Cacatuidae	Calyptorhynchus	<i>Calyptorhynchus (Calyptorhynchus) banksii</i>	Red-tailed Black Cockatoo	155		
Chordata	Aves	Psittaciformes	Cacatuidae	Eolophus	<i>Eolophus roseicapilla</i>	Galah	387		
Chordata	Aves	Psittaciformes	Cacatuidae	Eolophus	<i>Eolophus roseicapilla roseicapilla</i>	Western Galah	7		
Chordata	Aves	Psittaciformes	Cacatuidae	Lophochroa	<i>Lophochroa leadbeateri</i>	Major Mitchell's Cockatoo	122		
Chordata	Aves	Psittaciformes	Cacatuidae	Lophochroa	<i>Lophochroa leadbeateri mollis</i>	Western Major Mitchell's Cockatoo	2		
Chordata	Aves	Psittaciformes	Cacatuidae	Nymphicus	<i>Nymphicus hollandicus</i>	Cockatiel	65		
Chordata	Aves	Psittaciformes	Psittacidae	Barnardius	<i>Barnardius zonarius</i>	Australian Ringneck	425		
Chordata	Aves	Psittaciformes	Psittacidae	Melopsittacus	<i>Melopsittacus undulatus</i>	Budgerigar	73		
Chordata	Aves	Psittaciformes	Psittacidae	Neophema	<i>Neophema (Neonanolis) elegans</i>	Elegant Parrot	5		
Chordata	Aves	Psittaciformes	Psittacidae	Neophema	<i>Neophema (Neophema) splendida</i>	Scarlet-chested Parrot	7		
Chordata	Aves	Psittaciformes	Psittacidae	Neopsephotus	<i>Neopsephotus bourkii</i>	Bourke's Parrot	38		
Chordata	Aves	Psittaciformes	Psittacidae	Parvipsitta	<i>Parvipsitta porphyrocephala</i>	Purple-crowned Lorikeet	7		
Chordata	Aves	Psittaciformes	Psittacidae	Polytelis	<i>Polytelis anthopeplus</i>	Regent Parrot	74		
Chordata	Aves	Psittaciformes	Psittacidae	Psephotellus	<i>Psephotellus varius</i>	Mulga Parrot	185		
Chordata	Aves	Strigiformes	Strigidae	Ninox	<i>Ninox (Ninox) boobook</i>	Southern Boobook	11		
Chordata	Aves	Strigiformes	Strigidae	Ninox	<i>Ninox (Ninox) novaeseelandiae</i>	Southern Boobook	20		
Chordata	Aves	Strigiformes	Tytonidae	Tyto	<i>Tyto</i>	Barn Owl	3		
Chordata	Aves	Strigiformes	Tytonidae	Tyto	<i>Tyto javanica</i>	Eastern Barn Owl	4		
Chordata	Aves	Strigiformes	Tytonidae	Tyto	<i>Tyto novaehollandiae</i>	Masked Owl	1		
Chordata	Aves	Struthioniformes	Casuariidae	Dromaius	<i>Dromaius novaehollandiae</i>	Emu	86		
Chordata	Aves	Turniciformes	Turnicidae	Turnix	<i>Turnix (Alphaturnia) velox</i>	Little Button-quail	18		

Atlas of Living Australia Database - Mammals

Phylum	Class	Order	Family	Genus	Species Name	Common Name	No. of Records	No of Families	No. of Species
Chordata	Mammalia	Artiodactyla	Bovidae	Capra	<i>Capra hircus</i>	Goat	2	9	16
Chordata	Mammalia	Carnivora	Canidae	Vulpes	<i>Vulpes vulpes</i>	Fox	6		
Chordata	Mammalia	Carnivora	Felidae	Felis	<i>Felis catus</i>	Cat	1		
Chordata	Mammalia	Chiroptera	Molossidae	Austronomus	<i>Austronomus australis</i>	White-striped Freetail-bat	1		
Chordata	Mammalia	Chiroptera	Vespertilionidae	Chalinolobus	<i>Chalinolobus gouldii</i>	Gould's Wattled Bat	15		
Chordata	Mammalia	Chiroptera	Vespertilionidae	Vespadelus	<i>Vespadelus baverstocki</i>	Inland Forest Bat	2		
Chordata	Mammalia	Chiroptera	Vespertilionidae	Vespadelus	<i>Vespadelus finlaysoni</i>	Finlayson's Cave Bat	5		
Chordata	Mammalia	Dasyuromorphia	Dasyuridae	Antechinomys	<i>Antechinomys laniger</i>	Kultarr	1		
Chordata	Mammalia	Dasyuromorphia	Dasyuridae	Sminthopsis	<i>Sminthopsis crassicaudata</i>	Fat-tailed Dunnart	3		
Chordata	Mammalia	Dasyuromorphia	Dasyuridae	Sminthopsis	<i>Sminthopsis dolichura</i>	Little Long-tailed Dunnart	5		
Chordata	Mammalia	Diprotodontia	Macropodidae	Osphranter	<i>Osphranter rufus</i>	Red Kangaroo	3		
Chordata	Mammalia	Monotremata	Tachyglossidae	Tachyglossus	<i>Tachyglossus aculeatus</i>	Short-beaked Echidna	2		
Chordata	Mammalia	Rodentia	Muridae	Mus	<i>Mus musculus</i>	House Mouse	2		
Chordata	Mammalia	Rodentia	Muridae	Notomys	<i>Notomys alexis</i>	Spinifex Hopping-mouse	1		
Chordata	Mammalia	Rodentia	Muridae	Notomys	<i>Notomys mitchellii</i>	Mitchell's Hopping-mouse	1		
Chordata	Mammalia	Rodentia	Muridae	Pseudomys	<i>Pseudomys hermannsburgensis</i>	Sandy Inland Mouse	4		

BirdLife Australia Database

Scientific Name	Common Name	Count
Australasian Grebe	<i>Tachybaptus novaehollandiae</i>	20
Australasian Pipit	<i>Anthus novaeseelandiae</i>	136
Australasian Shoveler	<i>Spatula rhynchotis</i>	1
Australian Bustard	<i>Ardeotis australis</i>	11
Australian Hobby	<i>Falco longipennis</i>	41
Australian Magpie	<i>Gymnorhina tibicen</i>	156
Australian Owlet-nightjar	<i>Aegotheles cristatus</i>	32
Australian Raven	<i>Corvus coronoides</i>	206
Australian Reed-Warbler	<i>Acrocephalus australis</i>	1
Australian Ringneck	<i>Barnardius zonarius</i>	352
Australian Shelduck	<i>Tadorna tadornoides</i>	34
Australian White Ibis	<i>Threskiornis moluccus</i>	1
Australian Wood Duck	<i>Chenonetta jubata</i>	45
Banded Lapwing	<i>Vanellus tricolor</i>	49
Banded Stilt	<i>Cladorhynchus leucocephalus</i>	3
Barn Owl	<i>Tyto alba</i>	5
Black Honeyeater	<i>Sugomel nigrum</i>	27
Black Kite	<i>Milvus migrans</i>	1
Black Swan	<i>Cygnus atratus</i>	7
Black-breasted Buzzard	<i>Hamirostra melanosternon</i>	3
Black-eared Cuckoo	<i>Chalcites osculans</i>	65
Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>	175
Black-faced Woodswallow	<i>Artamus cinereus</i>	81
Black-fronted Dotterel	<i>Elseyornis melanops</i>	44
Black-shouldered Kite	<i>Elanus axillaris</i>	3
Black-tailed Native-hen	<i>Tribonyx ventralis</i>	17
Blue-breasted Fairy-wren	<i>Malurus pulcherrimus</i>	1
Bourke's Parrot	<i>Neopsephotus bourkii</i>	40
Brown Falcon	<i>Falco berigora</i>	112
Brown Goshawk	<i>Accipiter fasciatus</i>	30
Brown Honeyeater	<i>Lichmera indistincta</i>	80
Brown Songlark	<i>Cincloramphus cruralis</i>	5
Brown-headed Honeyeater	<i>Melithreptus brevirostris</i>	24
Budgerigar	<i>Melopsittacus undulatus</i>	19
Buff-banded Rail	<i>Hypotaenidia philippensis</i>	1
Chestnut Quail-thrush	<i>Cinclosoma castanotum</i>	23
Chestnut-breasted Quail-thrush	<i>Cinclosoma castaneothorax</i>	5
Chestnut-rumped Thornbill	<i>Acanthiza uropygialis</i>	362
Chiming Wedgebill	<i>Psophodes occidentalis</i>	4

Cockatiel	<i>Nymphicus hollandicus</i>	36
Collared Sparrowhawk	<i>Accipiter cirrocephalus</i>	17
Common Bronzewing	<i>Phaps chalcoptera</i>	138
Common Greenshank	<i>Tringa nebularia</i>	2
Common Sandpiper	<i>Actitis hypoleucos</i>	1
Corella spp		7
Crested Bellbird	<i>Oreoica gutturalis</i>	381
Crested Pigeon	<i>Ocyphaps lophotes</i>	178
Crimson Chat	<i>Epthianura tricolor</i>	36
Crow & Raven spp		41
Dusky Woodswallow	<i>Artamus cyanopterus</i>	13
Emu	<i>Dromaius novaehollandiae</i>	88
Eurasian Coot	<i>Fulica atra</i>	6
Fairy Martin	<i>Petrochelidon ariel</i>	24
Fan-tailed Cuckoo	<i>Cacomantis flabelliformis</i>	7
Gilbert's Whistler	<i>Pachycephala inornata</i>	4
Glossy Ibis	<i>Plegadis falcinellus</i>	1
Golden Whistler	<i>Pachycephala pectoralis</i>	50
Grey Butcherbird	<i>Cracticus torquatus</i>	179
Grey Currawong	<i>Strepera versicolor</i>	65
Grey Fantail	<i>Rhipidura albiscapa</i>	117
Grey Plover	<i>Pluvialis squatarola</i>	1
Grey Shrike-thrush	<i>Colluricincla harmonica</i>	256
Grey Teal	<i>Anas gracilis</i>	46
Grey-crowned Babbler	<i>Pomatostomus temporalis</i>	40
Grey-fronted Honeyeater	<i>Ptilotula plumula</i>	1
Ground Cuckoo-shrike	<i>Coracina maxima</i>	9
Hardhead	<i>Aythya australis</i>	1
Hoary-headed Grebe	<i>Poliiocephalus poliocephalus</i>	18
Hooded Plover	<i>Thinornis cucullatus</i>	2
Hooded Robin	<i>Melanodryas cucullata</i>	21
Horsfield's Bronze-Cuckoo	<i>Chalcites basalis</i>	52
Inland Dotterel	<i>Peltohyas australis</i>	3
Inland Thornbill	<i>Acanthiza apicalis</i>	177
Jacky Winter	<i>Microeca fascinans</i>	35
Little Button-quail	<i>Turnix velox</i>	7
Little Corella	<i>Cacatua sanguinea</i>	34
Little Crow	<i>Corvus bennetti</i>	102
Little Eagle	<i>Hieraaetus morphnoides</i>	22
Little Grassbird	<i>Poodytes gramineus</i>	1
Little Woodswallow	<i>Artamus minor</i>	22
Magpie-lark	<i>Grallina cyanoleuca</i>	147

Major Mitchell's Cockatoo	<i>Cacatua leadbeateri</i>	83
Malleefowl	<i>Leipoa ocellata</i>	30
Masked Woodswallow	<i>Artamus personatus</i>	14
Mistletoebird	<i>Dicaeum hirundinaceum</i>	20
Musk Duck	<i>Biziura lobata</i>	2
Nankeen Kestrel	<i>Falco cenchroides</i>	92
Pacific Black Duck	<i>Anas superciliosa</i>	35
Pallid Cuckoo	<i>Heteroscenes pallidus</i>	86
Peregrine Falcon	<i>Falco peregrinus</i>	13
Pied Butcherbird	<i>Cracticus nigrogularis</i>	212
Pied Honeyeater	<i>Certhionyx variegatus</i>	34
Pied Stilt	<i>Himantopus leucocephalus</i>	10
Pink-eared Duck	<i>Malacorhynchus membranaceus</i>	8
Purple-crowned Lorikeet	<i>Glossopsitta porphyrocephala</i>	6
Rainbow Bee-eater	<i>Merops ornatus</i>	38
Red Wattlebird	<i>Anthochaera carunculata</i>	77
Red-backed Kingfisher	<i>Todiramphus pyrrhopygius</i>	40
Red-capped Plover	<i>Charadrius ruficapillus</i>	12
Red-capped Robin	<i>Petroica goodenovii</i>	431
Red-kneed Dotterel	<i>Erythronyx cinctus</i>	11
Red-necked Avocet	<i>Recurvirostra novaehollandiae</i>	7
Red-tailed Black-Cockatoo	<i>Calyptorhynchus banksii</i>	125
Redthroat	<i>Pyrrholaemus brunneus</i>	148
Regent Parrot	<i>Polytelis anthopeplus</i>	58
Rock Dove	<i>Columba livia</i>	2
Rufous Fieldwren	<i>Calamanthus campestris</i>	4
Rufous Songlark	<i>Cincloramphus mathewsi</i>	47
Rufous Treecreeper	<i>Climacteris rufus</i>	45
Rufous Whistler	<i>Pachycephala rufiventris</i>	277
Sacred Kingfisher	<i>Todiramphus sanctus</i>	8
Scarlet-chested Parrot	<i>Neophema splendida</i>	3
Shining Bronze-Cuckoo	<i>Chalcites lucidus</i>	8
Shy Heathwren	<i>Calamanthus cautus</i>	8
Silver Gull	<i>Larus novaehollandiae</i>	1
Silveryeye	<i>Zosterops lateralis</i>	7
Singing Honeyeater	<i>Gavicalis virescens</i>	342
Slaty-backed Thornbill	<i>Acanthiza robustirostris</i>	64
Slender-billed Thornbill	<i>Acanthiza iredalei</i>	5
Southern Boobook	<i>Ninox boobook</i>	23
Southern Scrub-robin	<i>Drymodes brunneopygia</i>	19
Southern Whiteface	<i>Aphelocephala leucopsis</i>	259
Spiny-cheeked Honeyeater	<i>Acanthagenys rufogularis</i>	445

Splendid Fairy-wren	<i>Malurus splendens</i>	221
Spotted Harrier	<i>Circus assimilis</i>	6
Spotted Nightjar	<i>Eurostopodus argus</i>	20
Square-tailed Kite	<i>Lophoictinia isura</i>	10
Straw-necked Ibis	<i>Threskiornis spinicollis</i>	12
Striated Pardalote	<i>Pardalotus striatus</i>	218
Stubble Quail	<i>Coturnix pectoralis</i>	5
Tawny Frogmouth	<i>Podargus strigoides</i>	21
Tawny-crowned Honeyeater	<i>Gliciphila melanops</i>	7
Torresian Crow	<i>Corvus orru</i>	36
Tree Martin	<i>Petrochelidon nigricans</i>	139
Varied Sittella	<i>Daphoenositta chrysoptera</i>	16
Variegated Fairy-wren	<i>Malurus lamberti</i>	35
Wedge-tailed Eagle	<i>Aquila audax</i>	100
Weebill	<i>Smicromis brevirostris</i>	250
Welcome Swallow	<i>Hirundo neoxena</i>	204
Western Bowerbird	<i>Chlamydera guttata</i>	22
Western Corella	<i>Cacatua pastinator</i>	13
Western Gerygone	<i>Gerygone fusca</i>	127
Western Wattlebird	<i>Anthochaera lunulata</i>	1
Western Yellow Robin	<i>Eopsaltria griseogularis</i>	25
Whistling Kite	<i>Haliastur sphenurus</i>	17
White-backed Swallow	<i>Cheramoeca leucosterna</i>	13
White-browed Babbler	<i>Pomatostomus superciliosus</i>	163
White-browed Scrubwren	<i>Sericornis frontalis</i>	1
White-browed Treecreeper	<i>Climacteris affinis</i>	9
White-eared Honeyeater	<i>Nesoptilotis leucotis</i>	24
White-faced Heron	<i>Egretta novaehollandiae</i>	25
White-fronted Chat	<i>Epthianura albifrons</i>	46
White-fronted Honeyeater	<i>Purnella albifrons</i>	138
White-necked Heron	<i>Ardea pacifica</i>	11
White-winged Fairy-wren	<i>Malurus leucopterus</i>	34
White-winged Triller	<i>Lalage tricolor</i>	75
Willie Wagtail	<i>Rhipidura leucophrys</i>	264
Yellow-plumed Honeyeater	<i>Ptilotula ornata</i>	1
Yellow-rumped Thornbill	<i>Acanthiza chrysorrhoa</i>	208
Yellow-throated Miner	<i>Manorina flavigula</i>	231
Zebra Finch	<i>Taeniopygia castanotis</i>	77

DBCA Dandjoo Database

Kingdom	Phylum	Class	Order	Family	Species Name
Animalia	Chordata	Amphibia	Anura	Myobatrachidae	<i>Pseudophryne occidentalis</i>
Animalia	Chordata	Aves	Accipitriformes	Accipitridae	<i>Accipiter fasciatus</i>
Animalia	Chordata	Aves	Caprimulgiformes	Caprimulgidae	<i>Eurostopus argus</i>
Animalia	Chordata	Aves	Casuariiformes	Casuariidae	<i>Dromaius novaehollandiae</i>
Animalia	Chordata	Aves	Columbiformes	Columbidae	<i>Ocyphaps lophotes</i>
Animalia	Chordata	Aves	Columbiformes	Columbidae	<i>Phaps chalcoptera</i>
Animalia	Chordata	Aves	Coraciiformes	Meropidae	<i>Merops ornatus</i>
Animalia	Chordata	Aves	Falconiformes	Falconidae	<i>Falco berigora</i>
Animalia	Chordata	Aves	Falconiformes	Falconidae	<i>Falco cenchroides</i>
Animalia	Chordata	Aves	Falconiformes	Falconidae	<i>Falco peregrinus</i>
Animalia	Chordata	Aves	Galliformes	Megapodiidae	<i>Leipoa ocellata</i>
Animalia	Chordata	Aves	Passeriformes	Acanthizidae	<i>Acanthiza apicalis</i>
Animalia	Chordata	Aves	Passeriformes	Acanthizidae	<i>Acanthiza robustirostris</i>
Animalia	Chordata	Aves	Passeriformes	Acanthizidae	<i>Acanthiza uropygialis</i>
Animalia	Chordata	Aves	Passeriformes	Acanthizidae	<i>Pyrrholaemus brunneus</i>
Animalia	Chordata	Aves	Passeriformes	Acanthizidae	<i>Sericornis frontalis</i>
Animalia	Chordata	Aves	Passeriformes	Acanthizidae	<i>Smicronis brevirostris</i>
Animalia	Chordata	Aves	Passeriformes	Artamidae	<i>Artamus cinereus</i>
Animalia	Chordata	Aves	Passeriformes	Artamidae	<i>Artamus personatus</i>
Animalia	Chordata	Aves	Passeriformes	Artamidae	<i>Cracticus nigrogularis</i>
Animalia	Chordata	Aves	Passeriformes	Artamidae	<i>Cracticus torquatus</i>
Animalia	Chordata	Aves	Passeriformes	Artamidae	<i>Gymnorhina tibicen</i>
Animalia	Chordata	Aves	Passeriformes	Campephagidae	<i>Lalage tricolor</i>
Animalia	Chordata	Aves	Passeriformes	Cracticidae	<i>Strepera versicolor</i>
Animalia	Chordata	Aves	Passeriformes	Estrildidae	<i>Taeniopygia guttata</i>
Animalia	Chordata	Aves	Passeriformes	Hirundinidae	<i>Petrochelidon nigricans</i>
Animalia	Chordata	Aves	Passeriformes	Maluridae	<i>Malurus lamberti</i>
Animalia	Chordata	Aves	Passeriformes	Maluridae	<i>Malurus splendens</i>
Animalia	Chordata	Aves	Passeriformes	Meliphagidae	<i>Acanthagenys rufogularis</i>
Animalia	Chordata	Aves	Passeriformes	Meliphagidae	<i>Certhionyx variegatus</i>
Animalia	Chordata	Aves	Passeriformes	Meliphagidae	<i>Gavicalis virescens</i>
Animalia	Chordata	Aves	Passeriformes	Meliphagidae	<i>Manorina flavigula</i>
Animalia	Chordata	Aves	Passeriformes	Meliphagidae	<i>Ptilotula plumula</i>
Animalia	Chordata	Aves	Passeriformes	Meliphagidae	<i>Purnella albifrons</i>
Animalia	Chordata	Aves	Passeriformes	Oreoicidae	<i>Oreoica gutturalis</i>
Animalia	Chordata	Aves	Passeriformes	Pachycephalidae	<i>Colluricincla harmonica</i>
Animalia	Chordata	Aves	Passeriformes	Pachycephalidae	<i>Pachycephala occidentalis</i>
Animalia	Chordata	Aves	Passeriformes	Pachycephalidae	<i>Pachycephala rufiventris</i>
Animalia	Chordata	Aves	Passeriformes	Pardalotidae	<i>Pardalotus striatus</i>
Animalia	Chordata	Aves	Passeriformes	Petroicidae	<i>Eopsaltria griseogularis</i>
Animalia	Chordata	Aves	Passeriformes	Petroicidae	<i>Petroica goodenovii</i>

Animalia	Chordata	Aves	Passeriformes	Pomatostomidae	<i>Pomatostomus superciliosus</i>
Animalia	Chordata	Aves	Passeriformes	Rhipiduridae	<i>Rhipidura leucophrys</i>
Animalia	Chordata	Aves	Psittaciformes	Cacatuidae	<i>Cacatua roseicapilla</i>
Animalia	Chordata	Aves	Psittaciformes	Cacatuidae	<i>Eolophus roseicapilla roseicapilla</i>
Animalia	Chordata	Aves	Psittaciformes	Cacatuidae	<i>Lophochroa leadbeateri</i>
Animalia	Chordata	Aves	Psittaciformes	Psittacidae	<i>Nymphicus hollandicus</i>
Animalia	Chordata	Aves	Psittaciformes	Psittaculidae	<i>Barnardius zonarius</i>
Animalia	Chordata	Aves	Psittaciformes	Psittaculidae	<i>Melopsittacus undulatus</i>
Animalia	Chordata	Aves	Psittaciformes	Psittaculidae	<i>Psephotellus varius</i>
Animalia	Chordata	Mammalia	Artiodactyla	Bovidae	<i>Capra aegagrus hircus</i>
Animalia	Chordata	Mammalia	Carnivora	Canidae	<i>Vulpes vulpes</i>
Animalia	Chordata	Mammalia	Chiroptera	Vespertilionidae	<i>Vespadelus finlaysoni</i>
Animalia	Chordata	Mammalia	Chiroptera	Vespertilionidae	<i>Vespadelus regulus</i>
Animalia	Chordata	Mammalia	Dasyuromorphia	Dasyuridae	<i>Pseudantechinus woolleyae</i>
Animalia	Chordata	Mammalia	Diprotodontia	Macropodidae	<i>Notamacropus irma</i>
Animalia	Chordata	Mammalia	Diprotodontia	Macropodidae	<i>Osphranter robustus</i>
Animalia	Chordata	Mammalia	Diprotodontia	Macropodidae	<i>Osphranter rufus</i>
Animalia	Chordata	Mammalia	Lagomorpha	Leporidae	<i>Oryctolagus cuniculus</i>
Animalia	Chordata	Mammalia	Monotremata	Tachyglossidae	<i>Tachyglossus aculeatus</i>
Animalia	Chordata	Reptilia	Squamata	Agamidae	<i>Ctenophorus reticulatus</i>
Animalia	Chordata	Reptilia	Squamata	Agamidae	<i>Ctenophorus scutulatus</i>
Animalia	Chordata	Reptilia	Squamata	Agamidae	<i>Diporiphora amphiboluroides</i>
Animalia	Chordata	Reptilia	Squamata	Agamidae	<i>Moloch horridus</i>
Animalia	Chordata	Reptilia	Squamata	Agamidae	<i>Pogona minor minor</i>
Animalia	Chordata	Reptilia	Squamata	Elapidae	<i>Brachyuropsis semifasciatus</i>
Animalia	Chordata	Reptilia	Squamata	Elapidae	<i>Pseudechis butleri</i>
Animalia	Chordata	Reptilia	Squamata	Elapidae	<i>Pseudonaja mengdeni</i>
Animalia	Chordata	Reptilia	Squamata	Elapidae	<i>Pseudonaja modesta</i>
Animalia	Chordata	Reptilia	Squamata	Elapidae	<i>Simoselaps bertholdi</i>
Animalia	Chordata	Reptilia	Squamata	Elapidae	<i>Suta fasciata</i>
Animalia	Chordata	Reptilia	Squamata	Gekkonidae	<i>Gehyra variegata</i>
Animalia	Chordata	Reptilia	Squamata	Gekkonidae	<i>Heteronotia binoei</i>
Animalia	Chordata	Reptilia	Squamata	Scincidae	<i>Ctenotus severus</i>
Animalia	Chordata	Reptilia	Squamata	Scincidae	<i>Ctenotus uber</i>
Animalia	Chordata	Reptilia	Squamata	Scincidae	<i>Ctenotus uber uber</i>
Animalia	Chordata	Reptilia	Squamata	Scincidae	<i>Egernia depressa</i>
Animalia	Chordata	Reptilia	Squamata	Scincidae	<i>Egernia stokesii</i>
Animalia	Chordata	Reptilia	Squamata	Scincidae	<i>Egernia stokesii badia</i>
Animalia	Chordata	Reptilia	Squamata	Scincidae	<i>Lerista gerrardii</i>
Animalia	Chordata	Reptilia	Squamata	Scincidae	<i>Lerista kingi</i>
Animalia	Chordata	Reptilia	Squamata	Scincidae	<i>Menetia greyii</i>
Animalia	Chordata	Reptilia	Squamata	Scincidae	<i>Morethia butleri</i>
Animalia	Chordata	Reptilia	Squamata	Typhlopidae	<i>Anilius hamatus</i>
Animalia	Chordata	Reptilia	Squamata	Typhlopidae	<i>Anilius waitii</i>

DBCA Threatened Fauna Database

SCI NAME	COM NAME	CLASS	STATUS	WA STATUS	EPBC STATUS	YEAR	CERTAINTY	OBS METHOD	OBS TYPE	SEC SIGN	COUNT	SITE	ACCURACY M	LAT	LONG
<i>Nyctophilus major tor</i>	Central Long-eared Bat	MAMMAL	Priority	P3		2015	Certain	Survey	Caught or trapped		1	Charles Darwin Reserve, Quandong	25000	-29.583400000000	116.964300000000
<i>Nyctophilus major tor</i>	Central Long-eared Bat	MAMMAL	Priority	P3		2015	Certain	Survey	Caught or trapped		1	Charles Darwin Reserve, Unnamed dam	25000	-29.583400000000	116.964300000000
<i>Nyctophilus major tor</i>	Central Long-eared Bat	MAMMAL	Priority	P3		2017	Certain	Survey			1	Charles Darwin Reserve, White Wells Station	3000	-29.580000000000	116.960000000000
<i>Tringa nebularia</i>	Common Greenshank	BIRD	Specially Protected - Migratory	MI	MI	1999					0	SPS166/A	30	-29.543100000000	116.705800000000
<i>Tringa nebularia</i>	Common Greenshank	BIRD	Specially Protected - Migratory	MI	MI	1999	Moderately Certain	Survey	Unknown		1	SPS166	0	-29.543100000000	116.705800000000
<i>Actitis hypoleucos</i>	Common Greenshank	BIRD	Specially Protected - Migratory	MI	MI	2017					0	Ninghan Hsd	0	-29.424700000000	117.290300000000
<i>Cyclodomorphus branchialis</i>	Gilled Slender Blue-tongue	REPTILE	Threatened - Vulnerable	VU		1965	Certain	Survey	Caught or trapped		2	36 miles S of Yalgoo	1000	-28.749999040000	117.066667500000
<i>Cyclodomorphus branchialis</i>	Gilled Slender Blue-tongue	REPTILE	Threatened - Vulnerable	VU		2003	Certain	Survey	Caught or trapped		1	Karara Station	1000	-29.383335520000	116.766670900000
<i>Cyclodomorphus branchialis</i>	Gilled Slender Blue-tongue	REPTILE	Threatened - Vulnerable	VU		1965	WAM Vouchered	Collection	Specimen		1	YALGOO	50000	-28.750000000000	117.066700000000
<i>Gelochelidon nilotica</i>	Gull-billed Tern	BIRD	Specially Protected - Migratory	MI	MI	1999					0	SPS166/A	30	-29.543100000000	116.705800000000
<i>Thinornis cucullatus</i>	Hooded Plover	BIRD	Priority	P4		1999					0	SPS166/A	30	-29.543100000000	116.705800000000
<i>Thinornis cucullatus</i>	Hooded Plover	BIRD	Priority	P4		1999					0	SPS169/A	30	-29.201100000000	116.450600000000
<i>Thinornis cucullatus</i>	Hooded Plover	BIRD	Priority	P4		1999	Moderately Certain	Survey	Unknown		1	SPS166	0	-29.543100000000	116.705800000000
<i>Thinornis cucullatus</i>	Hooded Plover	BIRD	Priority	P4		1999	Moderately Certain	Survey	Unknown		1	SPS169	0	-29.201100000000	116.450600000000
<i>Thinornis cucullatus</i>	Hooded Plover	BIRD	Priority	P4		1999	Certain	Survey	Day sighting		3	"30.6km (?) from Wubin on Wubin-Paynes Find Rd"	1000	-29.535678300000	117.163384900000
<i>Thinornis cucullatus</i>	Hooded Plover	BIRD	Priority	P4		1995	Certain	Targeted survey	Day sighting		4	Mongers Lake, ~40km East of Perenjori	1000	-29.499609340000	116.691731400000
<i>Thinornis cucullatus</i>	Hooded Plover	BIRD	Priority	P4		1995	Certain	Targeted survey	Day sighting		2	Mongers Lake, ~40km East of Perenjori	1000	-29.499610610000	116.692278200000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2011					0	Great Northern Hwy (29 39S 117 07E)	100	-29.661900000000	117.122200000000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2011					0	Dirt Track to Yalgoo (29 10 29S 117 12 44E)	100	-29.174700000000	117.212200000000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2013					0	Mt Gibson--State Barrier Fence	0	-29.558300000000	117.181100000000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2000					0	Mt Gibson	100	-29.577900000000	117.164800000000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2001					0	Great Northern Hwy	500	-29.632100000000	117.134800000000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2001					0	Midday Well, Lochada Station	500	-29.065400000000	116.720900000000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2001					0	Perenjori - White Wells Road	100	-29.526800000000	116.656400000000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	1998					0	White Wells Station	100	-29.580700000000	116.965900000000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2002					0	Great Northern Hwy	100	-29.611200000000	117.142300000000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004					0	Karara Stn	100	-29.361700000000	116.654400000000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004					0	Karara Stn	100	-29.183300000000	116.675000000000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004					0	Karara Stn	100	-29.173300000000	116.766700000000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004					0	Karara Stn	100	-29.183300000000	116.700000000000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2005					0	Warriedar Ninghan Rd	100	-29.126700000000	117.133100000000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2010					0	Charles Darwin Reserve	100	-29.547800000000	116.965000000000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2010	Certain	Survey	Unknown		4	Karara Station, Karara	100	-29.185200000000	116.768500000000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2011	Certain	Survey	Unknown		2	Badja Station, Yalgoo	100	-28.731100000000	116.756000000000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2012	Certain	Survey	Unknown		1	Karara, Karara	10000	-28.841700000000	116.940900000000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2012	Certain	Survey	Unknown		1	Greater Karara Iron Ore Project Area, Hinge	100	-29.053200000000	116.874600000000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2012	Certain	Survey	Unknown		1	Greater Karara Iron Ore Project Area, Skeksi	100	-29.028600000000	116.867600000000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2012	Certain	Survey	Unknown		1	Greater Karara Iron Ore Project Area, Windanning A	100	-29.144400000000	116.957300000000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2012	Certain	Survey	Unknown		1	Greater Karara Iron Ore Project Area, The Gap	100	-28.863700000000	116.938600000000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2013	Certain	Survey	Unknown		1	Mt Gibson Range, Ext Hill	100	-29.557200000000	117.180000000000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2013	Certain	Survey	Unknown		1	Mt Gibson Range, Ext Hill	100	-29.573300000000	117.187000000000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2013	Certain	Survey	Unknown		1	Mt Gibson Range, Ext Hill	100	-29.633800000000	117.134500000000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2013	Certain	Survey	Unknown		1	Mt Gibson Range, Ext Hill	100	-29.579000000000	117.187600000000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2013	Certain	Survey	Unknown		1	Murchison, Minjar Gold	100	-28.959100000000	116.962500000000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2014	Certain	Survey	Unknown		1	Murchison, Karara	100	-28.933700000000	116.917800000000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2014	Certain	Survey	Unknown		1	Murchison, Karara	100	-29.099000000000	116.934500000000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2014	Certain	Survey	Unknown		1	Mid West, G59/38	10000	-29.196900000000	116.770900000000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2014	Certain	Survey	Unknown		1	Mid West, G59/38	10000	-29.156200000000	116.833300000000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2015	Certain	Survey	Unknown		0	Mt. Gibson, 9	50000	-29.587400000000	117.180700000000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2015	Certain	Survey	Unknown		1	Mt. Gibson, 20	50000	-29.579600000000	117.187200000000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2015	Certain	Survey	Unknown		0	Mt. Gibson, 15	50000	-29.582400000000	117.183400000000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2015	Certain	Survey	Unknown		1	Mt. Gibson, 16	50000	-29.583900000000	117.183000000000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2015	Certain	Survey	Unknown		0	Mt. Gibson, 18	50000	-29.575400000000	117.107100000000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2017	Moderately Certain		Secondary sign		1	EH PC S12	30	-29.590000000000	117.191500000000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2017	Moderately Certain		Secondary sign		1	EH PC S12	30	-29.590300000000	117.191600000000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2017	Moderately Certain		Secondary sign		1	NA	30	-29.572400000000	117.127800000000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2017	Moderately Certain		Secondary sign		1	EH PC S07	30	-29.584100000000	117.184700000000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2001	Certain	Community survey	Sighting		1	Great Northern Hwy, 86km N of Wubin.	10000	-29.458329820000	117.172222500000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2001	Certain	Community survey	Sighting		1	Thundelarra Rd, between Warriedar and Paynes Find.	50000	-29.250002230000	117.233334700000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Certain	Survey	Secondary sign	Mound	0	Mount Gibson area	1000	-29.581776320000	117.172504000000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Certain	Survey	Secondary sign	Mound	0	Mount Gibson area	1000	-29.573863850000	117.170508200000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Certain	Survey	Secondary sign	Mound	0	Mount Gibson area	1000	-29.576103340000	117.176459000000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Certain	Survey	Secondary sign	Mound	0	Mount Gibson area	1000	-29.576077700000	117.175374800000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Certain	Survey	Secondary sign	Mound	0	Mount Gibson area	1000	-29.577023500000	117.176760000000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Certain	Survey	Secondary sign	Mound	0	Mount Gibson area	1000	-29.577159100000	117.176595000000

Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Certain	Survey	Secondary sign	Mound	0	Mount Gibson area	1000	-29.58083542000	117.17425760000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Certain	Survey	Secondary sign	Mound	0	Mount Gibson area	1000	-29.58087227000	117.17367950000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Certain	Survey	Secondary sign	Mound	0	Mount Gibson area	1000	-29.58047586000	117.17315220000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Certain	Survey	Secondary sign	Mound	0	Mount Gibson area	1000	-29.58152254000	117.17332950000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Certain	Survey	Secondary sign	Mound	0	Mount Gibson area	1000	-29.58157016000	117.17140910000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Certain	Survey	Secondary sign	Mound	0	Mount Gibson area	1000	-29.57842846000	117.17214720000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Certain	Survey	Secondary sign	Mound	0	Mount Gibson area	1000	-29.57844627000	117.17233310000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Certain	Survey	Secondary sign	Mound	0	Mount Gibson area	1000	-29.57367190000	117.17238690000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Certain	Survey	Secondary sign	Mound	0	Mount Gibson area	1000	-29.57860012000	117.17200300000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Certain	Survey	Secondary sign	Mound	0	Mount Gibson area	1000	-29.57369888000	117.17245920000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Certain	sighting	Day sighting		1	Mount Gibson area	1000	-29.59238325000	117.19054140000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Certain	sighting	Dead		1	Mount Gibson area	1000	-29.57223476000	117.17402600000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Certain	sighting	Day sighting		1	On Ninghan to Yalgoo Rd, 45 km NW of Gt Northern Hwy	10000	-29.04863283000	117.28341670000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	1984	Certain	sighting	Sighting		1	Karara Stn	1000	-29.23799980000	116.71199840000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2005	Certain	sighting	Day sighting	Mound	2		10000	-29.05400105000	117.07590170000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2007	Certain	sighting	Day sighting		1	Hwy	1000	-29.30779905000	117.42200250000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Certain	Targeted survey	Secondary sign	Mound	0	proposed Mount Gibson mine development	100000	-29.57374413000	117.14184740000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Certain	Targeted survey	Secondary sign	Mound	0	proposed Mount Gibson mine development	100000	-29.56200530000	117.16292140000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Certain	Targeted survey	Secondary sign	Mound	0	proposed Mount Gibson mine development	100000	-29.57463793000	117.16501690000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Certain	Targeted survey	Secondary sign	Mound	0	proposed Mount Gibson mine development	100000	-29.57484493000	117.16548180000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Certain	Targeted survey	Secondary sign	Mound	0	proposed Mount Gibson mine development	100000	-29.57333771000	117.16550000000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Certain	Targeted survey	Secondary sign	Mound	0	proposed Mount Gibson mine development	100000	-29.57770374000	117.16720040000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Certain	Targeted survey	Secondary sign	Mound	0	proposed Mount Gibson mine development	100000	-29.57308204000	117.16786390000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Certain	Targeted survey	Secondary sign	Mound	0	proposed Mount Gibson mine development	100000	-29.57245814000	117.16878170000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Certain	Targeted survey	Secondary sign	Mound	0	proposed Mount Gibson mine development	100000	-29.57307099000	117.16945380000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Certain	Targeted survey	Secondary sign	Mound	0	proposed Mount Gibson mine development	100000	-29.57286310000	117.16970120000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Certain	Targeted survey	Secondary sign	Mound	0	proposed Mount Gibson mine development	100000	-29.58088621000	117.16987990000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Certain	Targeted survey	Secondary sign	Mound	0	proposed Mount Gibson mine development	100000	-29.57383678000	117.17050820000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Certain	Targeted survey	Secondary sign	Mound	0	proposed Mount Gibson mine development	100000	-29.59210313000	117.17090030000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Certain	Targeted survey	Secondary sign	Mound	0	proposed Mount Gibson mine development	100000	-29.59170550000	117.17131270000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Certain	Targeted survey	Secondary sign	Mound	0	proposed Mount Gibson mine development	100000	-29.58215634000	117.17176120000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Certain	Targeted survey	Secondary sign	Mound	0	proposed Mount Gibson mine development	100000	-29.58079250000	117.17256420000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Certain	Targeted survey	Secondary sign	Mound	0	proposed Mount Gibson mine development	100000	-29.58079250000	117.17256420000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Certain	Targeted survey	Secondary sign	Mound	0	proposed Mount Gibson mine development	100000	-29.58079250000	117.17256420000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Certain	Targeted survey	Secondary sign	Mound	0	proposed Mount Gibson mine development	100000	-29.57932857000	117.17398660000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Certain	Targeted survey	Secondary sign	Mound	0	proposed Mount Gibson mine development	100000	-29.58073634000	117.17410260000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Certain	Targeted survey	Secondary sign	Mound	0	proposed Mount Gibson mine development	100000	-29.57966208000	117.17430720000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Certain	Targeted survey	Secondary sign	Mound	0	proposed Mount Gibson mine development	100000	-29.57605966000	117.17536450000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Certain	Targeted survey	Secondary sign	Mound	0	proposed Mount Gibson mine development	100000	-29.57744744000	117.17694660000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Certain	Targeted survey	Secondary sign	Mound	0	proposed Mount Gibson mine development	100000	-29.58379772000	117.17948740000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Certain	Targeted survey	Secondary sign	Mound	0	proposed Mount Gibson mine development	100000	-29.59114402000	117.17959330000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Certain	Targeted survey	Secondary sign	Mound	0	proposed Mount Gibson mine development	100000	-29.58381461000	117.18034440000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Certain	Targeted survey	Secondary sign	Mound	0	proposed Mount Gibson mine development	100000	-29.58051922000	117.18123690000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Certain	Targeted survey	Secondary sign	Mound	0	proposed Mount Gibson mine development	100000	-29.58182532000	117.18308740000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Certain	Targeted survey	Secondary sign	Mound	0	proposed Mount Gibson mine development	100000	-29.58229424000	117.18336700000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Certain	Targeted survey	Secondary sign	Mound	0	proposed Mount Gibson mine development	100000	-29.58943339000	117.18959620000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Certain	Targeted survey	Secondary sign	Mound	0	proposed Mount Gibson mine development	100000	-29.58948751000	117.18961700000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Certain	Targeted survey	Secondary sign	Mound	0	proposed Mount Gibson mine development	100000	-29.58964047000	117.18994770000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Certain	Targeted survey	Secondary sign	Mound	0	proposed Mount Gibson mine development	100000	-29.59009791000	117.19192080000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Certain	Targeted survey	Secondary sign	Mound	0	proposed Mount Gibson mine development	100000	-29.59037727000	117.19221050000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Certain	Targeted survey	Secondary sign	Mound	0	proposed Mount Gibson mine development	100000	-29.59068355000	117.19260340000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Certain	Targeted survey	Secondary sign	Mound	0	proposed Mount Gibson mine development	100000	-29.59132406000	117.19279050000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Certain	Targeted survey	Secondary sign	Mound	0	proposed Mount Gibson mine development	100000	-29.59116119000	117.19307940000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Certain	Targeted survey	Secondary sign	Mound	0	proposed Mount Gibson mine development	100000	-29.59383974000	117.19438560000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Certain	Targeted survey	Secondary sign	Mound	0	proposed Mount Gibson mine development	100000	-29.59269285000	117.19486870000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Certain	Targeted survey	Secondary sign	Mound	0	proposed Mount Gibson mine development	100000	-29.59273657000	117.19581880000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Certain	Targeted survey	Secondary sign	Mound	0	proposed Mount Gibson mine development	100000	-29.59386363000	117.19655420000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2005	Certain	Targeted survey	Secondary sign	Mound	0	proposed Mount Gibson mine development	100000	-29.58002674000	117.14907340000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2005	Certain	Targeted survey	Secondary sign	Mound	0	proposed Mount Gibson mine development	100000	-29.56424499000	117.14615970000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2005	Certain	Targeted survey	Secondary sign	Mound	0	proposed Mount Gibson mine development	100000	-29.58072015000	117.13354540000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2005	Certain	Targeted survey	Secondary sign	Mound	0	proposed Mount Gibson mine development	100000	-29.55916413000	117.14588400000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2005	Certain	Targeted survey	Secondary sign	Mound	0	proposed Mount Gibson mine development	100000	-29.55941374000	117.14038220000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2005	Certain	Targeted survey	Secondary sign	Mound	0	proposed Mount Gibson mine development	100000	-29.55525168000	117.14174930000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2005	Certain	Targeted survey	Secondary sign	Mound	0	proposed Mount Gibson mine development	100000	-29.57665977000	117.12324630000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2005	Certain	Targeted survey	Secondary sign	Mound	0	proposed Mount Gibson mine development	100000	-29.59243160000	117.11783390000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2005	Certain	Targeted survey	Secondary sign	Mound	0	proposed Mount Gibson mine development	100000	-29.59055455000	117.10695820000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2005	Certain	Targeted survey	Secondary sign	Mound	0	proposed Mount Gibson mine development	100000	-29.58347498000	117.14850030000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2005	Certain	Targeted survey	Secondary sign	Mound	0	proposed Mount Gibson mine development	1000	-29.56733560000	117.14247850000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2005	Certain	Targeted survey	Secondary sign	Mound	0	proposed Mount Gibson mine development	100000	-29.56690682000	117.15465990000
Leipoa ocellata	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2005	Certain	Targeted survey	Secondary sign	Mound	0	proposed Mount Gibson mine development	100000	-29.56458166000	117.15176580000

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<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2008	Certain	Survey	Secondary sign	Mound	0	Karara/Blue Hills/Mungarda area, Karara Station for Gundalbie Metals/Karara Mining Ltd	1000	-29.19957591000	116.74190630000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2008	Certain	Survey	Secondary sign	Mound	0	Karara/Blue Hills/Mungarda area, Karara Station for Gundalbie Metals/Karara Mining Ltd	1000	-29.18864214000	116.76435630000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2008	Certain	Survey	Secondary sign	Mound	0	Karara/Blue Hills/Mungarda area, Karara Station for Gundalbie Metals/Karara Mining Ltd	1000	-29.19956868000	116.74284240000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2008	Certain	Survey	Secondary sign	Mound	0	Karara/Blue Hills/Mungarda area, Karara Station for Gundalbie Metals/Karara Mining Ltd	1000	-29.18846753000	116.77299660000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2008	Certain	Survey	Secondary sign	Mound	0	Karara/Blue Hills/Mungarda area, Karara Station for Gundalbie Metals/Karara Mining Ltd	1000	-29.19871848000	116.74190850000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2008	Certain	Survey	Secondary sign	Mound	0	Karara/Blue Hills/Mungarda area, Karara Station for Gundalbie Metals/Karara Mining Ltd	1000	-29.16902945000	116.79162190000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2008	Certain	Survey	Secondary sign	Mound	0	Karara/Blue Hills/Mungarda area, Karara Station for Gundalbie Metals/Karara Mining Ltd	1000	-29.20044688000	116.74425980000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2008	Certain	Survey	Secondary sign	Mound	0	Karara/Blue Hills/Mungarda area, Karara Station for Gundalbie Metals/Karara Mining Ltd	1000	-29.16919820000	116.79570420000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2008	Certain	Survey	Secondary sign	Mound	0	Karara/Blue Hills/Mungarda area, Karara Station for Gundalbie Metals/Karara Mining Ltd	1000	-29.19998058000	116.75064900000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2008	Certain	Survey	Secondary sign	Mound	0	Karara/Blue Hills/Mungarda area, Karara Station for Gundalbie Metals/Karara Mining Ltd	1000	-29.16913952000	116.79867630000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2008	Certain	Survey	Secondary sign	Mound	0	Karara/Blue Hills/Mungarda area, Karara Station for Gundalbie Metals/Karara Mining Ltd	1000	-29.18675089000	116.77732020000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2008	Certain	Survey	Secondary sign	Mound	0	Karara/Blue Hills/Mungarda area, Karara Station for Gundalbie Metals/Karara Mining Ltd	1000	-29.16815799000	116.79422540000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2008	Certain	Survey	Secondary sign	Mound	0	Karara/Blue Hills/Mungarda area, Karara Station for Gundalbie Metals/Karara Mining Ltd	1000	-29.18639932000	116.78308080000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2008	Certain	Survey	Secondary sign	Mound	0	Karara/Blue Hills/Mungarda area, Karara Station for Gundalbie Metals/Karara Mining Ltd	1000	-29.16950596000	116.76334080000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2008	Certain	Survey	Secondary sign	Mound	0	Karara/Blue Hills/Mungarda area, Karara Station for Gundalbie Metals/Karara Mining Ltd	1000	-29.18038910000	116.82708150000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2008	Certain	Survey	Secondary sign	Mound	0	Karara/Blue Hills/Mungarda area, Karara Station for Gundalbie Metals/Karara Mining Ltd	1000	-29.16902439000	116.75651360000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2008	Certain	Survey	Secondary sign	Mound	0	Karara/Blue Hills/Mungarda area, Karara Station for Gundalbie Metals/Karara Mining Ltd	1000	-29.16856497000	116.75700830000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2008	Certain	Survey	Secondary sign	Mound	0	Karara/Blue Hills/Mungarda area, Karara Station for Gundalbie Metals/Karara Mining Ltd	1000	-29.17085960000	116.74361330000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2008	Certain	Survey	Secondary sign	Mound	0	Karara/Blue Hills/Mungarda area, Karara Station for Gundalbie Metals/Karara Mining Ltd	1000	-29.17114201000	116.75962460000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2008	Certain	Survey	Secondary sign	Mound	0	Karara/Blue Hills/Mungarda area, Karara Station for Gundalbie Metals/Karara Mining Ltd	1000	-29.16996989000	116.77061030000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2008	Certain	Survey	Secondary sign	Mound	0	Karara/Blue Hills/Mungarda area, Karara Station for Gundalbie Metals/Karara Mining Ltd	1000	-29.17039024000	116.78459540000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2008	Certain	Survey	Secondary sign	Mound	0	Karara/Blue Hills/Mungarda area, Karara Station for Gundalbie Metals/Karara Mining Ltd	1000	-29.17106917000	116.79156640000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2008	Certain	Survey	Secondary sign	Mound	0	Karara/Blue Hills/Mungarda area, Karara Station for Gundalbie Metals/Karara Mining Ltd	1000	-29.17106634000	116.78975640000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2008	Certain	Survey	Secondary sign	Mound	0	Karara/Blue Hills/Mungarda area, Karara Station for Gundalbie Metals/Karara Mining Ltd	1000	-29.17030216000	116.78595300000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2008	Certain	Survey	Secondary sign	Mound	0	Karara/Blue Hills/Mungarda area, Karara Station for Gundalbie Metals/Karara Mining Ltd	1000	-29.16971557000	116.74477820000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2008	Certain	Survey	Secondary sign	Mound	0	Karara/Blue Hills/Mungarda area, Karara Station for Gundalbie Metals/Karara Mining Ltd	1000	-29.16947857000	116.76316600000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2008	Certain	Survey	Secondary sign	Mound	0	Karara/Blue Hills/Mungarda area, Karara Station for Gundalbie Metals/Karara Mining Ltd	1000	-29.16962008000	116.77189660000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2013	Certain	sighting	Dead		1	Mungada road, near Blue Hills north mine	1000	-29.15930821000	116.79125080000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2013	Certain	Opportunistic sighting	Dead		1	Mungada Road between Blue Hills north mine site and Terapod mine site.	1000	-29.14798815000	116.83526850000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	1996	Moderately Certain	sighting	Day sighting		2	off.	1000	-29.54149612000	117.13419570000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2014	Certain	sighting	Dead		1	Wanarra Road - Shire of Perenjori	1000	-29.49040293000	116.55719920000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2014	Certain	sighting	Dead		1	Wanarra Rd, Perenjori	1000	-29.51262110000	116.61775230000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2014	Certain	Opportunistic sighting	Dead		1	Wanarra Road approximately 13km west of Great Northern Highway intersection	1000	-29.58078730000	116.99861640000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2017	Very Certain	Opportunistic sighting	Secondary sign	Mound	0	Karara Rangeland Park, ex Karara pastoral lease, 70km E of N-S running track, 3.4km S of Mulga bore	1000	-29.21270000000	116.87650000000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2002	Moderately Certain	sighting	Sighting	No other s	1	rd	100000	-29.49766667000	116.62016670000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	1975	Moderately Certain	sighting	Secondary sign	Mound	0	13 miles South West of Ninghan South T/O	1000	-29.51364400000	117.17302200000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	1975	Moderately Certain	sighting	Secondary sign	Mound	0	14 miles South West of Ninghan turn off	1000	-29.53294700000	117.16237200000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Moderately Certain	Opportunistic sighting	Sighting	Mound	1	300 m nth of Kurara Station sthn boundary, 10 m in on west side of Rabbit Proof Fence rd	100000	-29.47916667000	116.61833330000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	1958	Moderately Certain	sighting	Secondary sign	Mound	0	33 miles South East of Yalgoo	1000	-28.74537500000	116.96197500000

<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	1958	Moderately Certain	sighting	Secondary sign	Mound	0	33 miles South East of Yalgoo	10000	-28.74120000000	116.96394200000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	1958	Moderately Certain	sighting	Secondary sign	Mound	0	33 miles South East of Yalgoo	10000	-28.74320800000	116.96146900000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	1958	Moderately Certain	sighting	Secondary sign	Mound	0	33 miles South East of Yalgoo	1000	-28.74650300000	116.96129400000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2001	Moderately Certain	sighting	Sighting	No other s	3	35 kms ESE Perenjori	1000	-29.51828611000	116.62956940000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	0	Moderately Certain	sighting	Secondary sign	Mound	0	40 miles East of Perenjori	10000	-29.43330000000	117.00000000000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	1966	Moderately Certain	Historical (written)	Secondary sign	Mound	1	5 miles West of Golden Grove	1000	-28.73330000000	116.86670000000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2005	Moderately Certain	Opportunistic sighting	Secondary sign	Mound	0	6 km NNW of Warriedar Homestead on Yalgoo Ninghan Rd approx 0.6 km nth of copper mine/Warriedar Rd junctn	1000	-29.12138889000	117.12472220000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2005	Moderately Certain	Opportunistic sighting	Secondary sign	Mound	0	6 km WNW of Warriedar Homestead on Ninghan Yalgoo Rd 1 km Nth of Copper Mine Yalgoo Rd junctn	1000	-29.11333333000	117.11805560000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2005	Moderately Certain	Opportunistic sighting	Secondary sign	Mound	0	7 km NW of Warriedar Station approx 100m west of track to Reid's Ridg	1000	-29.08472222000	117.14083330000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2001	Moderately Certain	sighting	Sighting	No other s	1	approx 60 km south of Yalgoo	1000	-28.81562222000	116.92476390000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2001	Moderately Certain	Opportunistic sighting	Sighting	Mound	2	approx 60 km south of Yalgoo and 10 km west of Yalgoo-paines Find Rd, about 2 km south of Minjar Hill	0	-28.81666667000	116.95000000000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Moderately Certain	Opportunistic sighting	Sighting	No other s	1	Approx halfway along rd into Rothsay mine (abandoned) off Warriedar/Copper Mine Rd east of Paynes Find	0	-29.30216667000	116.90716670000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	1998	Moderately Certain	Opportunistic sighting	Sighting	No other s	1	B/n Paynes Find t/off on Warradah Rd (to Golden Grove Mine)	0	-28.88333333000	117.36666670000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	1964	Moderately Certain	Historical (written)	Secondary sign	Mound	0	Golden Grove	10000	-28.75000000000	116.95000000000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	1964	Moderately Certain	Historical (written)	Secondary sign	Mound	0	Golden Grove area	50000	-28.75000000000	116.95000000000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2001	Moderately Certain	sighting	Sighting	No other s	1	Great Northern Hwy	100000	-29.63333000000	117.13333000000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Moderately Certain	Opportunistic sighting	Sighting	No other s	1	Kurara Homestead, on Mungada 4 km east on nthn entrance to old Kurara Homestead	100000	-29.17866667000	116.75250000000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2001	Moderately Certain	sighting	Sighting	No other s	1	Midday Well, Lochada Station	100000	-29.06666800000	116.71944400000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2001	Moderately Certain	sighting	Sighting	No other s	1	Mt Gibson	100000	-29.57917000000	117.16334000000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Moderately Certain	Opportunistic sighting	Sighting	No other s	1	on Mungada Rd 1km east of Emu Proof Fence Rd on Kurara Station 3 km west of Nthn entrance to station	100000	-29.17650000000	116.67166670000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	1996	Moderately Certain	Opportunistic sighting	Sighting	No other s	1	On Warrdagga Rd halfway between Ningham Stn and Warrdagga Rock	0	-29.38333333000	117.40000000000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2001	Moderately Certain	sighting	Sighting	No other s	1	Perenjori - White Wells Road	100000	-29.52805500000	116.65499900000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2003	Moderately Certain	Opportunistic sighting	Sighting	No other s	1	Rd into Mt Gibson Station off Gt Nthn Hwy approx 1 km past vermin proof fence	0	-29.63316667000	117.24816670000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2004	Moderately Certain	Opportunistic sighting	Sighting	No other s	1	Warriedar Copper Mine rd 3 km west of Kurara rd on Kurara Station	100000	-29.36145278000	116.65290000000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2005	Moderately Certain	sighting	Sighting	Mound	2	Warriedar Station	1000	-29.13199432000	117.18779250000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2001	Moderately Certain	sighting	Sighting	No other s	1	White Wells Station	100000	-29.58194000000	116.96445000000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2018	Very Certain	Opportunistic sighting	Dead	No other s	1	Mungada Road, near SMC Blue Hills turnoff (tenement M59/721), Rothsay	100000	-29.14360060000	116.84974100000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2007	Certain	sighting		No other s	2	Perenjori-Rothsay Rd, 14km from Rothsay	1000	-29.33900000000	116.64630000000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2010	Certain	sighting	Dead		4	Adjacent Karara mine acces tracks on Mungada Road	10000	-29.18138889000	116.54638890000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2019	Certain	Survey	Sighting		1	Blue Hills	10000	-29.13997584000	116.88879230000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2019	Certain	Survey	Sighting		1	Blue Hills	10000	-29.14303455000	116.88756560000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2017		Survey			0	Leipoa ocellata 07/11/2017	30	-29.58400000000	117.18470000000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2017		Survey			0	Leipoa ocellata 08/11/2017	30	-29.57230000000	117.12780000000
<i>Leipoa ocellata</i>	Malleefowl	BIRD	Threatened - Vulnerable	VU	VU	2017		Survey			0	Leipoa ocellata 10/11/2017.1	30	-29.58990000000	117.19150000000
<i>Tyto novaehollandiae novaeholland</i>	Masked Owl (southwest)	BIRD	Priority	P3		1964	Certain	Historical (written)	Sighting		1	Golden Grove Mine, 30 miles SE of Yalgoo on Paynes Find-Yalgoo Rd	1000	-28.74206732000	116.96309960000
<i>Falco peregrinus</i>	Peregrine Falcon	BIRD	Specially Protected - Other Specially	OS		2013					0	Mt Gibson area 5	0	-29.57420000000	117.19000000000
<i>Falco peregrinus</i>	Peregrine Falcon	BIRD	Specially Protected - Other Specially	OS		2014					0	Mt Gibson--State Barrier Fence	0	-29.55830000000	117.18110000000
<i>Falco peregrinus</i>	Peregrine Falcon	BIRD	Specially Protected - Other Specially	OS		2017					0	Ninghan Hsd	0	-29.42470000000	117.29030000000
<i>Falco peregrinus</i>	Peregrine Falcon	BIRD	Specially Protected - Other Specially	OS		2017					0	Ninghan Hsd	0	-29.42470000000	117.29030000000
<i>Falco peregrinus</i>	Peregrine Falcon	BIRD	Specially Protected - Other Specially	OS		2017					0	Ninghan Hsd	0	-29.42470000000	117.29030000000
<i>Falco peregrinus</i>	Peregrine Falcon	BIRD	Specially Protected - Other Specially	OS		2017					0	Ninghan Salmon Gums	0	-29.55990000000	117.25580000000
<i>Falco peregrinus</i>	Peregrine Falcon	BIRD	Specially Protected - Other Specially	OS		2017					0	Ninghan Salmon Gums	0	-29.55990000000	117.25580000000
<i>Falco peregrinus</i>	Peregrine Falcon	BIRD	Specially Protected - Other Specially	OS		2003					0	Ninghan Station	5000	-29.41540000000	117.41810000000
<i>Falco peregrinus</i>	Peregrine Falcon	BIRD	Specially Protected - Other Specially	OS		1999					0	Wubin - Paynes Find Road	100	-29.49150000000	117.18640000000
<i>Falco peregrinus</i>	Peregrine Falcon	BIRD	Specially Protected - Other Specially	OS		1999					0	White Wells Station	100	-29.58180000000	116.96420000000
<i>Falco peregrinus</i>	Peregrine Falcon	BIRD	Specially Protected - Other Specially	OS		1999					0	Mt Singleton	100	-29.46570000000	117.29810000000
<i>Falco peregrinus</i>	Peregrine Falcon	BIRD	Specially Protected - Other Specially	OS		2004					0	Great Northern Hwy	100	-29.37710000000	117.25950000000
<i>Falco peregrinus</i>	Peregrine Falcon	BIRD	Specially Protected - Other Specially	OS		2012	Certain	Survey	Unknown		1	Greater Karara Iron Ore Project Area, Gobo	100	-28.91730000000	116.92800000000
<i>Falco peregrinus</i>	Peregrine Falcon	BIRD	Specially Protected - Other Specially	OS		2013	Certain	Survey	Unknown		1	Mt Gibson Range, Ext Hill	100	-29.57410000000	117.19000000000
<i>Falco peregrinus</i>	Peregrine Falcon	BIRD	Specially Protected - Other Specially	OS		2013	Certain	Survey	Unknown		1	Mt Gibson Range, Ext Hill	100	-29.55970000000	117.18080000000
<i>Falco peregrinus</i>	Peregrine Falcon	BIRD	Specially Protected - Other Specially	OS		2013	Certain	Survey	Unknown		1	Mt Gibson Range, Ext Hill	100	-29.60820000000	117.21490000000
<i>Falco peregrinus</i>	Peregrine Falcon	BIRD	Specially Protected - Other Specially	OS		2015	Certain	Survey	Unknown		0	Mt. Gibson, 12	50000	-29.60450000000	117.10070000000
<i>Falco peregrinus</i>	Peregrine Falcon	BIRD	Specially Protected - Other Specially	OS		2015	Certain	Survey	Unknown		0	Mt. Gibson, 17	50000	-29.59970000000	117.19760000000
<i>Falco peregrinus</i>	Peregrine Falcon	BIRD	Specially Protected - Other Specially	OS		2015	Certain	Survey	Unknown		1	Mt. Gibson, 25	50000	-29.60720000000	117.21340000000
<i>Falco peregrinus</i>	Peregrine Falcon	BIRD	Specially Protected - Other Specially	OS		2015	Certain	Survey	Unknown		0	Mt. Gibson, 26	50000	-29.60700000000	117.21380000000
<i>Notamacropus irma</i>	Western Brush Wallaby	MAMMAL	Priority	P4		2006	Certain	sighting	Day sighting		1	Lochada and Badja Stations boundary fence line	1000	-28.84999908000	116.70000250000

Notamacropus irma	Western Brush Wallaby	MAMMAL	Priority	P4		2002	Certain	Survey	Day sighting		1	ex Karara Station	10000	-29.19580424000	116.77770190000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2010	Certain	Survey	Unknown		1	Karara Station, Karara	100	-29.25810000000	116.65130000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2010	Certain	Survey	Unknown		1	Karara Station, Karara	100	-29.25760000000	116.65390000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2010	Certain	Survey	Unknown		5	Karara Station, Karara	100	-29.25750000000	116.65960000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2010	Certain	Survey	Unknown		4	Karara Station, Karara	100	-29.25980000000	116.64130000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2010	Certain	Survey	Unknown		1	Murchison, Karara	100	-29.18540000000	116.47630000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2010	Certain	Survey	Unknown		1	Murchison, Karara	100	-29.17780000000	116.58610000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2010	Certain	Survey	Unknown		5	Murchison, Karara	100	-29.17950000000	116.60870000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2011	Certain	Survey	Unknown		1	Karara Station, SKM-06	100	-29.25980000000	116.63620000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2011	Certain	Survey	Unknown		1	MIDWEST, Bowgada	100	-29.18580000000	116.48110000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2012	Certain	Survey	Unknown		1	Greater Karara Iron Ore Project Area, Hinge	100	-29.03310000000	116.86260000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2012	Certain	Survey	Unknown		1	Greater Karara Iron Ore Project Area, Hinge	100	-29.03330000000	116.86240000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2013	Certain	Survey	Unknown		1	Karara, Syncline Track - Clearance area	100	-29.12000000000	116.87990000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2013	Certain	Survey	Unknown		1	Karara, Syncline Track - Release Area	100	-29.12000000000	116.87900000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2013	Certain	Survey	Unknown		1	Mt Gibson Range, Ext Hill	100	-29.56400000000	117.18380000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2013	Certain	Survey	Unknown		1	Mt Gibson Range, Ext Hill	100	-29.56700000000	117.18580000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2013	Certain	Survey	Unknown		1	Mt Gibson Range, Ext Hill	100	-29.56780000000	117.18590000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2013	Certain	Survey	Unknown		1	Mt Gibson Range, Ext Hill	100	-29.56690000000	117.18600000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2013	Certain	Survey	Unknown		1	Mt Gibson Range, Ext Hill	100	-29.56810000000	117.18660000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2013	Certain	Survey	Unknown		1	Mt Gibson Range, Ext Hill	100	-29.56960000000	117.18740000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2013	Certain	Survey	Unknown		1	Mt Gibson Range, Ext Hill	100	-29.56940000000	117.18790000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2013	Certain	Survey	Unknown		1	Mt Gibson Range, Ext Hill	100	-29.57040000000	117.18840000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2013	Certain	Survey	Unknown		1	Mt Gibson Range, Ext Hill	100	-29.57070000000	117.18880000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2013	Certain	Survey	Unknown		1	Mt Gibson Range, Ext Hill	100	-29.57190000000	117.18970000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2013	Certain	Survey	Unknown		1	Mt Gibson Range, Ext Hill	100	-29.58850000000	117.20040000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2013	Certain	Survey	Unknown		1	Murchison, Minjar Gold	10000	-28.95910000000	116.96250000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2015	Certain	Survey	Unknown		0	Mt. Gibson, 29	50000	-29.59990000000	117.20950000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2015	Certain	Survey	Unknown		1	Mt. Gibson, ECO-ESB01	50000	-29.56820000000	117.18540000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2015	Certain	Survey	Unknown		0	Mt. Gibson, PES-ESB03	50000	-29.57060000000	117.18860000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2015	Certain	Survey	Unknown		1	Mt. Gibson, 1	50000	-29.56780000000	117.18720000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2015	Certain	Survey	Unknown		0	Mt. Gibson, 28	50000	-29.59910000000	117.20890000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2015	Certain	Survey	Unknown		0	Mt. Gibson, PES-ESB01	50000	-29.56450000000	117.18400000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2015	Certain	Survey	Unknown		0	Mt. Gibson, 2	50000	-29.56790000000	117.18710000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2015	Certain	Survey	Unknown		1	Mt. Gibson, ECO-ESB01	50000	-29.56820000000	117.18540000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2015	Certain	Survey	Unknown		0	Mt. Gibson, 3	50000	-29.59660000000	117.20700000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2015	Certain	Survey	Unknown		1	Mt. Gibson, PES-ESB03	50000	-29.57060000000	117.18860000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2015	Certain	Survey	Unknown		1	Mt. Gibson, 4	50000	-29.59670000000	117.20700000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2015	Certain	Survey	Unknown		1	Mt. Gibson, PES-ESB03	50000	-29.57060000000	117.18860000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2015	Certain	Survey	Unknown		0	Mt. Gibson, PES-ESB03	50000	-29.57060000000	117.18860000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2015	Certain	Survey	Unknown		0	Mt. Gibson, PES-ESB03	50000	-29.57060000000	117.18860000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2015	Certain	Survey	Unknown		0	Mt. Gibson, PES-ESB03	50000	-29.57060000000	117.18860000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2015	Certain	Survey	Unknown		0	Mt. Gibson, PES-ESB03	50000	-29.57060000000	117.18860000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2015	Certain	Survey	Unknown		0	Mt. Gibson, PES-ESB03	50000	-29.57060000000	117.18860000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2015	Certain	Survey	Unknown		0	Mt. Gibson, PES-ESB03	50000	-29.57060000000	117.18860000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2015	Certain	Survey	Unknown		0	Mt. Gibson, PES-ESB03	50000	-29.57060000000	117.18860000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2015	Certain	Survey	Unknown		0	Mt. Gibson, PES-ESB03	50000	-29.57060000000	117.18860000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2015	Certain	Survey	Unknown		0	Mt. Gibson, PES-ESB03	50000	-29.57060000000	117.18860000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2015	Certain	Survey	Unknown		0	Mt. Gibson, PES-ESB03	50000	-29.57060000000	117.18860000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2015	Certain	Survey	Unknown		0	Mt. Gibson, PES-ESB03	50000	-29.57060000000	117.18860000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2015	Certain	Survey	Unknown		0	Mt. Gibson, PES-ESB03	50000	-29.57060000000	117.18860000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2015	Certain	Survey	Unknown		0	Mt. Gibson, PES-ESB03	50000	-29.57060000000	117.18860000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2015	Certain	Survey	Unknown		0	Mt. Gibson, PES-ESB03	50000	-29.57060000000	117.18860000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2015	Certain	Survey	Unknown		0	Mt. Gibson, PES-ESB03	50000	-29.57060000000	117.18860000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2015	Certain	Survey	Unknown		0	Mt. Gibson, PES-ESB03	50000	-29.57060000000	117.18860000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2015	Certain	Survey	Unknown		0	Mt. Gibson, PES-ESB03	50000	-29.57060000000	117.18860000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2015	Certain	Survey	Unknown		0	Mt. Gibson, PES-ESB03	50000	-29.57060000000	117.18860000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2015	Certain	Survey	Unknown		0	Mt. Gibson, PES-ESB03	50000	-29.57060000000	117.18860000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2015	Certain	Survey	Unknown		0	Mt. Gibson, PES-ESB03	50000	-29.57060000000	117.18860000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2015	Certain	Survey	Unknown		0	Mt. Gibson, PES-ESB03	50000	-29.57060000000	117.18860000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2015	Certain	Survey	Unknown		0	Mt. Gibson, PES-ESB03	50000	-29.57060000000	117.18860000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2015	Certain	Survey	Unknown		0	Mt. Gibson, PES-ESB03	50000	-29.57060000000	117.18860000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2015	Certain	Survey	Unknown		0	Mt. Gibson, PES-ESB03	50000	-29.57060000000	117.18860000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2015	Certain	Survey	Unknown		0	Mt. Gibson, PES-ESB03	50000	-29.57060000000	117.18860000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2015	Certain	Survey	Unknown		0	Mt. Gibson, PES-ESB03	50000	-29.57060000000	117.18860000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2015	Certain	Survey	Unknown		0	Mt. Gibson, PES-ESB03	50000	-29.57060000000	117.18860000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2015	Certain	Survey	Unknown		0	Mt. Gibson, PES-ESB03	50000	-29.57060000000	117.18860000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2015	Certain	Survey	Unknown		0	Mt. Gibson, PES-ESB03	50000	-29.57060000000	117.18860000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2015	Certain	Survey	Unknown		0	Mt. Gibson, PES-ESB03	50000	-29.57060000000	117.18860000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2015	Certain	Survey	Unknown		0	Mt. Gibson, PES-ESB03	50000	-29.57060000000	117.18860000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2015	Certain	Survey	Unknown		0	Mt. Gibson, PES-ESB03	50000	-29.57060000000	117.18860000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2015	Certain	Survey	Unknown		0	Mt. Gibson, PES-ESB03	50000	-29.57060000000	117.18860000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2015	Certain	Survey	Unknown		0	Mt. Gibson, PES-ESB03	50000	-29.57060000000	117.18860000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2015	Certain	Survey	Unknown		0	Mt. Gibson, PES-ESB03	50000	-29.57060000000	117.18860000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2015	Certain	Survey	Unknown		0	Mt. Gibson, PES-ESB03	50000	-29.57060000000	117.18860000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2015	Certain	Survey	Unknown		0	Mt. Gibson, PES-ESB03	50000	-29.57060000000	117.18860000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2015	Certain	Survey	Unknown		0	Mt. Gibson, PES-ESB03	50000	-29.57060000000	117.18860000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2015	Certain	Survey	Unknown		0	Mt. Gibson, PES-ESB03	50000	-29.57060000000	117.18860000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2015	Certain	Survey	Unknown		0	Mt. Gibson, PES-ESB03	50000	-29.57060000000	117.18860000000
Egernia stokesii badia	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2015	Certain	Survey</							

<i>Egernia stokesii badia</i>	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2007	Certain	Survey	Day sighting		1	Golden Grove- 50km south of Yalgoo	1000	-28.85561058000	117.02563170000
<i>Egernia stokesii badia</i>	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2009	Certain	Survey	Caught or trapped		0	Karara/Blue Hills/Mungarda area, Karara Station for Gundalbie Metals/Karara Mining Ltd	1000	-29.17550377000	116.75103730000
<i>Egernia stokesii badia</i>	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2009	Certain	Survey	Caught or trapped		0	Karara/Blue Hills/Mungarda area, Karara Station for Gundalbie Metals/Karara Mining Ltd	1000	-29.17432902000	116.75027910000
<i>Egernia stokesii badia</i>	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2009	Certain	Survey	Caught or trapped		0	Karara/Blue Hills/Mungarda area, Karara Station for Gundalbie Metals/Karara Mining Ltd	1000	-29.17651376000	116.75056180000
<i>Egernia stokesii badia</i>	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2009	Certain	Survey	Caught or trapped		0	Karara/Blue Hills/Mungarda area, Karara Station for Gundalbie Metals/Karara Mining Ltd	1000	-29.17681170000	116.75061250000
<i>Egernia stokesii badia</i>	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2009	Certain	Survey	Caught or trapped		0	Karara/Blue Hills/Mungarda area, Karara Station for Gundalbie Metals/Karara Mining Ltd	1000	-29.17718083000	116.75011800000
<i>Egernia stokesii badia</i>	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2009	Certain	Survey	Caught or trapped		0	Karara/Blue Hills/Mungarda area, Karara Station for Gundalbie Metals/Karara Mining Ltd	1000	-29.21356454000	116.77107920000
<i>Egernia stokesii badia</i>	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2009	Certain	Survey	Caught or trapped		0	Karara/Blue Hills/Mungarda area, Karara Station for Gundalbie Metals/Karara Mining Ltd	1000	-29.21995157000	116.77999560000
<i>Egernia stokesii badia</i>	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2009	Certain	Survey	Caught or trapped		0	Karara/Blue Hills/Mungarda area, Karara Station for Gundalbie Metals/Karara Mining Ltd	1000	-29.22051146000	116.78017960000
<i>Egernia stokesii badia</i>	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2009	Certain	Survey	Caught or trapped		0	Karara/Blue Hills/Mungarda area, Karara Station for Gundalbie Metals/Karara Mining Ltd	1000	-29.20896777000	116.83702280000
<i>Egernia stokesii badia</i>	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2009	Certain	Survey	Caught or trapped		0	Karara/Blue Hills/Mungarda area, Karara Station for Gundalbie Metals/Karara Mining Ltd	1000	-29.22408158000	116.78324840000
<i>Egernia stokesii badia</i>	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2009	Certain	Survey	Caught or trapped		0	Karara/Blue Hills/Mungarda area, Karara Station for Gundalbie Metals/Karara Mining Ltd	1000	-29.16393616000	116.78414610000
<i>Egernia stokesii badia</i>	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2009	Certain	Survey	Caught or trapped		0	Karara/Blue Hills/Mungarda area, Karara Station for Gundalbie Metals/Karara Mining Ltd	1000	-29.18099756000	116.83726250000
<i>Egernia stokesii badia</i>	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2009	Certain	Survey	Caught or trapped		0	Karara/Blue Hills/Mungarda area, Karara Station for Gundalbie Metals/Karara Mining Ltd	1000	-29.12600260000	116.81536160000
<i>Egernia stokesii badia</i>	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2009	Certain	Survey	Caught or trapped		0	Karara/Blue Hills/Mungarda area, Karara Station for Gundalbie Metals/Karara Mining Ltd	1000	-29.13139787000	116.81383050000
<i>Egernia stokesii badia</i>	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2009	Certain	Survey	Caught or trapped		0	Karara/Blue Hills/Mungarda area, Karara Station for Gundalbie Metals/Karara Mining Ltd	1000	-29.17946732000	116.60209590000
<i>Egernia stokesii badia</i>	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2012	Certain	sighting	Day sighting		1	State Barrier Fence track on Ninghan Station	1000	-29.56952621000	117.18801040000
<i>Egernia stokesii badia</i>	Western Spiny-tailed Skink	REPTILE	Threatened - Vulnerable	VU	EN	2018	Very Certain	sighting	Dead	Burrow	1	Access track for Karara Minesite	10000	-29.20760000000	116.76500000000



Australian Government

Department of Climate Change, Energy,
the Environment and Water

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. Please see the caveat for interpretation of information provided here.

Report created: 16-Apr-2024

[Summary](#)

[Details](#)

[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

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[Acknowledgements](#)

Summary

Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the [Administrative Guidelines on Significance](#).

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	1
Listed Threatened Species:	33
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 <https://www.dcceew.gov.au/parks-heritage/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 Lands:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	12
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have

State and Territory Reserves:	13
Regional Forest Agreements:	None
Nationally Important Wetlands:	1
EPBC Act Referrals:	19
Key Ecological Features (Marine):	None
Biologically Important Areas:	None
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Listed Threatened Ecological Communities

[Resource Information]

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.

Status of Vulnerable, Disallowed and Ineligible are not MNES under the EPBC Act.

Community Name	Threatened Category	Presence Text	Buffer Status
Eucalypt Woodlands of the Western Australian Wheatbelt	Critically Endangered	Community likely to occur within area	In buffer area only

Listed Threatened Species

[Resource Information]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.

Number is the current name ID.

Scientific Name	Threatened Category	Presence Text	Buffer Status
BIRD			
Aphelocephala leucopsis Southern Whiteface [529]	Vulnerable	Species or species habitat known to occur within area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area	In feature area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat may occur within area	In feature area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat known to occur within area	In feature area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area	In feature area
Tringa nebularia Common Greenshank, Greenshank [832]	Endangered	Species or species habitat may occur within area	In buffer area only
Zanda latirostris listed as Calyptorhynchus latirostris Carnaby's Black Cockatoo, Short-billed Black-cockatoo [87737]	Endangered	Species or species habitat likely to occur within area	In buffer area only
MAMMAL			
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Lagostrophus fasciatus fasciatus Banded Hare-wallaby, Merrnine, Marnine, Munning [66664]	Vulnerable	Translocated population known to occur within area	In buffer area only
Leporillus conditor Wopilkara, Greater Stick-nest Rat [137]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Macrotis lagotis Greater Bilby [282]	Vulnerable	Translocated population known to occur within area	In buffer area only
Perameles bougainville Shark Bay Bandicoot [278]	Endangered	Translocated population known to occur within area	In buffer area only
PLANT			
Acacia imitans Gibson Wattle [65211]	Endangered	Species or species habitat known to occur within area	In buffer area only
Acacia unguicula a shrub [55592]	Critically Endangered	Species or species habitat likely to occur within area	In buffer area only
Acacia woodmaniorum Woodman's Wattle [85026]	Endangered	Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Darwinia masonii Mason's Darwinia [18538]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
Dasymalla axillaris Native Foxglove [38829]	Critically Endangered	Species or species habitat likely to occur within area	In buffer area only
Eremophila nivea Silky Eremophila [14431]	Endangered	Species or species habitat may occur within area	In buffer area only
Eremophila rostrata Beaked Eremophila [65124]	Critically Endangered	Species or species habitat may occur within area	In buffer area only
Eremophila viscida Varnish Bush [2394]	Endangered	Species or species habitat likely to occur within area	In feature area
Eucalyptus beardiana Beard's Mallee [18933]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Eucalyptus crucis subsp. praecipua Paynes Find Mallee [64650]	Endangered	Species or species habitat known to occur within area	In buffer area only
Eucalyptus synandra Jingymia Mallee [3753]	Vulnerable	Species or species habitat known to occur within area	In feature area
Frankenia conferta Silky Frankenia [6074]	Endangered	Species or species habitat may occur within area	In buffer area only
Gyrostemon reticulatus Net-veined Gyrostemon [8491]	Critically Endangered	Species or species habitat likely to occur within area	In buffer area only
Hybanthus cymulosus Ninghan Violet [2803]	Critically Endangered	Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Ricinocarpos brevis [82879]	Endangered	Species or species habitat may occur within area	In buffer area only
Roycea pycnophylloides Saltmat [21161]	Endangered	Species or species habitat likely to occur within area	In buffer area only
Tecticornia bulbosa Large-articled Samphire [82741]	Vulnerable	Species or species habitat may occur within area	In buffer area only

REPTILE

Egernia stokesii badia Western Spiny-tailed Skink, Baudin Island Spiny-tailed Skink [64483]	Endangered	Species or species habitat known to occur within area	In feature area
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SPIDER

Idiosoma nigrum Shield-backed Trapdoor Spider, Black Rugose Trapdoor Spider [66798]	Vulnerable	Species or species habitat known to occur within area	In feature area
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Listed Migratory Species [\[Resource Information \]](#)

Scientific Name	Threatened Category	Presence Text	Buffer Status
Migratory Marine Birds			
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area	In feature area

Migratory Terrestrial Species

Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area	In feature area
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Migratory Wetlands Species

Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat likely to occur within area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area	In feature area
Tringa nebularia Common Greenshank, Greenshank [832]	Endangered	Species or species habitat may occur within area	In buffer area only

Other Matters Protected by the EPBC Act

Listed Marine Species	[Resource Information]		
Scientific Name	Threatened Category	Presence Text	Buffer Status
Bird			
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat likely to occur within area	In feature area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area	In feature area
Bubulcus ibis as Ardea ibis Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area overfly marine area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Chalcites osculans as Chrysococcyx osculans Black-eared Cuckoo [83425]		Species or species habitat known to occur within area overfly marine area	In feature area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area	In feature area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area overfly marine area	In feature area
Rostratula australis as Rostratula benghalensis (sensu lato) Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area overfly marine area	In feature area
Thinornis cucullatus as Thinornis rubricollis Hooded Plover, Hooded Dotterel [87735]		Species or species habitat known to occur within area overfly marine area	In buffer area only
Tringa nebularia Common Greenshank, Greenshank [832]	Endangered	Species or species habitat may occur within area overfly marine area	In buffer area only

Extra Information

State and Territory Reserves			[Resource Information]
Protected Area Name	Reserve Type	State	Buffer Status
Barnabinmah	Conservation Park	WA	In buffer area only
Charles Darwin	Conservation Reserve	WA	In buffer area only
Kadji Kadji	NRS Addition - Gazettal in Progress	WA	In buffer area only
Karara	NRS Addition - Gazettal in Progress	WA	In feature area
Lochada	NRS Addition - Gazettal in Progress	WA	In buffer area only
Mt Gibson	Private Nature Reserve	WA	In buffer area only

Protected Area Name	Reserve Type	State	Buffer Status
Mungada Ridge	National Park	WA	In buffer area only
Ninghan	Indigenous Protected Area	WA	In buffer area only
Thundelarra	NRS Addition - Gazettal in Progress	WA	In buffer area only
Unnamed WA28755	Nature Reserve	WA	In buffer area only
Unnamed WA53971	Conservation Park	WA	In feature area
Warriedar Station Nature Reserve	NRS Addition - Gazettal in Progress	WA	In feature area
Weelhamby Lake	Nature Reserve	WA	In buffer area only

Nationally Important Wetlands		[Resource Information]	
Wetland Name		State	Buffer Status
Thundelarra Lignum Swamp		WA	In buffer area only

EPBC Act Referrals					[Resource Information]
Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status	
Karara Iron Ore Project - Mine Life Extension	2023/09566		Assessment	In feature area	
Mount Gibson Gold Project	2023/09745		Referral Decision	In buffer area only	

Controlled action				
Construct and operate 79km rail spur	2009/5040	Controlled Action	Post-Approval	In buffer area only
Hematite (iron ore) Mine and Beneficiation Plant	2001/542	Controlled Action	Completed	In buffer area only
Iron Hill Deposit mining project, mt Gibson Ranges, Shire of Yalgoo, WA	2015/7514	Controlled Action	Post-Approval	In buffer area only
Karara Magnetite Project	2006/3017	Controlled Action	Post-Approval	In buffer area only
Koolanooka/Blue Hills Iron Ore Mining Project	2007/3809	Controlled Action	Post-Approval	In buffer area only
Mount Gibson Iron Ore Pellet Project	2000/95	Controlled Action	Completed	In buffer area only
Mt Gibson Iron Ore Project	2004/1874	Controlled Action	Completed	In buffer area only

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Controlled action				
open cut mine & assoc infrastructure	2005/2381	Controlled Action	Post-Approval	In buffer area only
Not controlled action				
Blue Hills Iron Ore Project, near Rothsay, WA	2019/8591	Not Controlled Action	Completed	In buffer area only
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed	In feature area
Mt Mulgine Mining Project, 330km northeast Perth, WA	2017/7913	Not Controlled Action	Completed	In feature area
Mungada Ridge Hematite Project	2006/2797	Not Controlled Action	Completed	In feature area
Mungada Ridge Rehabilitation, Mid-West Region, WA	2019/8556	Not Controlled Action	Completed	In buffer area only
Shine Iron ore project WA	2012/6331	Not Controlled Action	Completed	In buffer area only
Not controlled action (particular manner)				
Karara Hinge Iron ore project, Perejori, Mid West, WA	2013/7090	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only
Minjar Gold Mining Project, WA	2012/6646	Not Controlled Action (Particular Manner)	Post-Approval	In feature area
Mummaloo Iron Ore Project	2012/6634	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only

Appendix 3: Habitat Assessment Examples

FAUNA HABITAT ASSESSMENT SHEET										
Location:		Mount Mulgine (HA13)								
Survey Dates:		November 2024 & March 2024								
Easting:		494973			Northing:		6769395			
Aspect		SW			Soil Texture		Sany-loam			
Fauna Habitat Type: MIXED SHRUBLAND					Average Height	Cover (tick)				
Stratum						Scattered Plants	Sparse	Moderate	Thick	
Overstorey		Acacia ramulosa and Acacia acuminata			2			✓		
Midstorey		Eremophila and Hakea			1			✓		
Ground Cover		Mixed hebs and grasses			0.5	✓				
CONDITION						LAST FIRE				
Excellent	Very Good	Good	Degraded	Completely Degraded		<1 year	1 -3 Yr	4-5 Yr	>5 Yr	
Notes:										
(general)			DISTURBANCE				(cattle)			
Heavy	Medium	Mild	None			Heavy	Medium	Mild	None	
Notes: Mining										
GROUND COVER										
Bare Ground (%)	<5	<20	20-60	60-100		Hummock Grass (%)	<5	<20	20-60	60-100
Rock (%)	<5	<20	20-60	60-100		Other Grass (%)	<5	<20	20-60	60-100
Leaf Litter (%)	<5	<20	20-60	60-100		Herbs (%)	<5	<20	20-60	60-100
Hollow logs (%)	<5	<20	20-60	60-100		Other:(%)	<5	<20	20-60	60-100
MICROHABITATS										
Burrowing Suitability (%)	Rock	Stoney	Sandy Loam	Sand	Peeling Bark	None	Rare	Moderate	Common	
Pebbles Stones (%)	<5	<20	20-60	60-100	Hollows	None	Rare	Moderate	Common	
Exfoliating Slabs (%)	<5	<20	20-60	60-100	Water Prescence	None	Rare	Moderate	Common	
Rock Crevices (%)	<5	<20	20-60	60-100	Distance to Water	>5km	2-5km	500m - 2km	<500m	
Boulders (%)	<5	<20	20-60	60-100	Termite Mounds	None	Rare	Moderate	Common	
Caves	Absent		Present		Woody Debris	None	Rare	Moderate	Common	
Fauna										
Species recorded	Spendid Fairy-wren, Chestnut-rumped Thornbill, Lozange-marked Dragon, Sand Goanna									
Potential threatened fauna species	Malleefowl, Western Spiny-tailed Skink, Gilled Slender Bluetongue									
Threatened fauna habitat	Suitable Malleefowl foraging habitat. Potential Malleefowl breeding habitat in areas with dense vegetation and suitable structure to provide adequate shelter and suitable substrate, to build mounds. Suitable habitat for the Western Spiny-tailed Skink, in areas where there are rock crevices, or log piles, to provide shelter. Suitable habitat for the Gilled Slender Bluetonge in areas with leaf litter and log piles to provide shelter.									
										

FAUNA HABITAT ASSESSMENT SHEET													
Location:		Mount Mulgine (HA36)											
Survey Dates:		November 2024 & March 2024											
Easting:		500775				Northing:		6772761					
Aspect		S				Soil Texture		Sany-loam					
Fauna Habitat Type: OPEN EUCALYPTUS WOODLAND						Average Height	Cover (tick)						
Stratum							Scattered Plants	Sparse	Moderate	Thick			
Overstorey		Eucalyptus salubris				12	✓						
Midstorey		Eremophila and Senna				3		✓					
Ground Cover		Mixed hebs and grasses				0.5		✓					
CONDITION						LAST FIRE							
Excellent		Very Good		Good		Degraded	Completely Degraded		<1 year	1 -3 Yr	4-5 Yr	>5 Yr	
Notes:													
(general)				DISTURBANCE				(cattle)					
Heavy		Medium				Mild				Heavy	Medium	Mild	None
Notes: Mining													
GROUND COVER													
Bare Ground (%)	<5	<20	20-60	60-100		Hummock Grass (%)	<5	<20	20-60	60-100			
Rock (%)	<5	<20	20-60	60-100		Other Grass (%)	<5	<20	20-60	60-100			
Leaf Litter (%)	<5	<20	20-60	60-100		Herbs (%)	<5	<20	20-60	60-100			
Hollow logs (%)	<5	<20	20-60	60-100		Other:(%)	<5	<20	20-60	60-100			
MICROHABITATS													
Burrowing Suitability (%)	Rock	Stoney	Sandy Loam	Sand	Peeling Bark	None	Rare	Moderate	Common				
Pebbles Stones (%)	<5	<20	20-60	60-100	Hollows	None	Rare	Moderate	Common				
Exfoliating Slabs (%)	<5	<20	20-60	60-100	Water Prescence	None	Rare	Moderate	Common				
Rock Crevices (%)	<5	<20	20-60	60-100	Distance to Water	>5km	2-5km	500m - 2km	<500m				
Boulders (%)	<5	<20	20-60	60-100	Termite Mounds	None	Rare	Moderate	Common				
Caves	Absent		Present		Woody Debris	None	Rare	Moderate	Common				
Fauna													
Species recorded	Grey Shrike-thrush, Crested Bellbird, Australian Ringneck, Little Crow, Perentie												
Potential threatened fauna species	Malleefowl, Western Spiny-tailed Skink												
Threatened fauna habitat	Suitable Malleefowl foraging habitat. Suitable habitat for the Western Spiny-tailed Skink, in areas where there are log piles, to provide shelter. Suitable habitat for the Gilled Slender Bluetongue in areas with leaf litter and log piles to provide shelter.												
													

FAUNA HABITAT ASSESSMENT SHEET										
Location:		Mount Mulgine (HA48)								
Survey Dates:		November 2024 & March 2024								
Easting:		499510				Northing:		6771565		
Aspect		S				Soil Texture		Rocky		
Fauna Habitat Type: ROCKY HILL						Average Height	Cover (tick)			
Stratum							Scattered Plants	Sparse	Moderate	Thick
Overstorey		Acacia ramulosa and A. acuminata					1	✓		
Midstorey		Eremophila and Hakea					0.5		✓	
Ground Cover		Mixed hebs and grasses					0.25		✓	
CONDITION						LAST FIRE				
Excellent	Very Good	Good	Degraded	Completely Degraded		<1 year	1 -3 Yr	4-5 Yr	>5 Yr	
Notes:										
(general)			DISTURBANCE				(cattle)			
Heavy	Medium		Mild			Heavy	Medium	Mild	None	
Notes: Mining										
GROUND COVER										
Bare Ground (%)	<5	<20	20-60	60-100		Hummock Grass (%)	<5	<20	20-60	60-100
Rock (%)	<5	<20	20-60	60-100		Other Grass (%)	<5	<20	20-60	60-100
Leaf Litter (%)	<5	<20	20-60	60-100		Herbs (%)	<5	<20	20-60	60-100
Hollow logs (%)	<5	<20	20-60	60-100		Other: (%)	<5	<20	20-60	60-100
MICROHABITATS										
Burrowing Suitability (%)	Rock	Stoney	Sandy Loam	Sand	Peeling Bark	None	Rare	Moderate	Common	
Pebbles Stones (%)	<5	<20	20-60	60-100	Hollows	None	Rare	Moderate	Common	
Exfoliating Slabs (%)	<5	<20	20-60	60-100	Water Prescence	None	Rare	Moderate	Common	
Rock Crevices (%)	<5	<20	20-60	60-100	Distance to Water	>5km	2-5km	500m - 2km	<500m	
Boulders (%)	<5	<20	20-60	60-100	Termite Mounds	None	Rare	Moderate	Common	
Caves	Absent		Present		Woody Debris	None	Rare	Moderate	Common	
Fauna										
Species recorded		Australian Raven								
Potential threatened fauna species		Malleefowl, Western Spiny-tailed Skink								
Threatened fauna habitat		Suitable Malleefowl foraging habitat. Potential Malleefowl breeding habitat in areas with dense vegetation and suitable structure to provide adequate shelter and suitable substrate on flat areas to build mounds. Suitable habitat for the Western Spiny-tailed Skink, in areas where there are rock crevices, to provide shelter.								
										



Appendix 4: Habitat Assessment Summary

Habitat Assessment	Northing	Easting	Fauna Habitat	Vegetation	Substrate	Suitable Habitat: Malleefowl	Suitable Habitat: WSTS	Suitable Habitat: GSB	Example Photograph
Habitat Assessment 1	6773821	497088	Mixed Shrubland	Mixed Acacia over Eremophila and Hakea	Rocky	✓	✓		
Habitat Assessment 2	6773798	497590	Mixed Shrubland	Mixed Acacia over Eremophila and Hakea	Rocky	✓	✓		
Habitat Assessment 26	6770016	496349	Mixed Shrubland	Mixed Acacia over Eremophila and Hakea	Rocky	✓	✓		
Habitat Assessment 30	6771569	499824	Mixed Shrubland	Mixed Acacia over Eremophila and Hakea	Rocky	✓	✓		
Habitat Assessment 52	6774793	496257	Mixed Shrubland	Mixed Acacia over Eremophila and Hakea	Rocky	✓	✓		
Habitat Assessment 46	6770221	499590	Mixed Shrubland	Mixed Acacia over Eremophila and Hakea	Rocky	✓	✓		
Habitat Assessment 4	6772324	496764	Mixed Shrubland	Mixed Acacia over Eremophila and Hakea	Stony	✓	✓		
Habitat Assessment 5	6772404	497210	Mixed Shrubland	Mixed Acacia over Eremophila and Hakea	Stony	✓	✓		
Habitat Assessment 6	6773102	498994	Mixed Shrubland	Mixed Acacia over Eremophila and Hakea	Stony	✓	✓		
Habitat Assessment 7	6773645	499237	Mixed Shrubland	Mixed Acacia over Eremophila and Hakea	Stony	✓	✓		
Habitat Assessment 9	6773381	499478	Mixed Shrubland	Mixed Acacia over Eremophila and Hakea	Stony	✓	✓		
Habitat Assessment 10	6772954	497428	Mixed Shrubland	Mixed Acacia over Eremophila and Hakea	Stony	✓	✓		
Habitat Assessment 11	6769026	496270	Mixed Shrubland	Mixed Acacia over Eremophila and Hakea	Stony	✓	✓		
Habitat Assessment 17	6773503	496931	Mixed Shrubland	Mixed Acacia over Eremophila and Hakea	Stony	✓	✓		
Habitat Assessment 20	6770025	496180	Mixed Shrubland	Mixed Acacia over Eremophila and Hakea	Stony	✓	✓		
Habitat Assessment 22	6769646	496493	Mixed Shrubland	Mixed Acacia over Eremophila and Hakea	Stony	✓	✓		
Habitat Assessment 24	6769643	495956	Mixed Shrubland	Mixed Acacia over Eremophila and Hakea	Stony	✓	✓		
Habitat Assessment 25	6769892	496692	Mixed Shrubland	Mixed Acacia over Eremophila and Hakea	Stony	✓	✓		
Habitat Assessment 35	6772731	501606	Mixed Shrubland	Mixed Acacia over Eremophila and Hakea	Stony	✓	✓		
Habitat Assessment 8	6774168	499227	Mixed Shrubland	Mixed Acacia over Eremophila and Hakea	Sandy-loam	✓	✓		
Habitat Assessment 13	6769396	494974	Mixed Shrubland	Mixed Acacia over Eremophila and Hakea	Sandy-loam	✓	✓		
Habitat Assessment 14	6769644	495217	Mixed Shrubland	Mixed Acacia over Eremophila and Hakea	Sandy-loam	✓	✓		
Habitat Assessment 15	6772211	497023	Mixed Shrubland	Mixed Acacia over Eremophila and Hakea	Sandy-loam	✓	✓		
Habitat Assessment 19	6774167	496421	Mixed Shrubland	Mixed Acacia over Eremophila and Hakea	Sandy-loam	✓	✓		
Habitat Assessment 21	6769503	496261	Mixed Shrubland	Mixed Acacia over Eremophila and Hakea	Sandy-loam	✓	✓		
Habitat Assessment 23	6769645	497550	Mixed Shrubland	Mixed Acacia over Eremophila and Hakea	Sandy-loam	✓	✓		
Habitat Assessment 32	6772910	502082	Mixed Shrubland	Mixed Acacia over Eremophila and Hakea	Sandy-loam	✓	✓		
Habitat Assessment 33	6773269	501275	Mixed Shrubland	Mixed Acacia over Eremophila and Hakea	Sandy-loam	✓	✓		
Habitat Assessment 34	6773242	500572	Mixed Shrubland	Mixed Acacia over Eremophila and Hakea	Sandy-loam	✓	✓		
Habitat Assessment 40	6768247	499708	Mixed Shrubland	Mixed Acacia over Eremophila and Hakea	Sandy-loam	✓	✓		
Habitat Assessment 41	6768576	498484	Mixed Shrubland	Mixed Acacia over Eremophila and Hakea	Sandy-loam	✓	✓		
Habitat Assessment 51	6770975	496664	Mixed Shrubland	Mixed Acacia over Eremophila and Hakea	Sandy-loam	✓	✓		
Habitat Assessment 53	6771689	494187	Mixed Shrubland	Mixed Acacia over Eremophila and Hakea	Sandy-loam	✓	✓		
Habitat Assessment 54	6771172	493118	Mixed Shrubland	Mixed Acacia over Eremophila and Hakea	Sandy-loam	✓	✓		
Habitat Assessment 55	6766823	494032	Mixed Shrubland	Mixed Acacia over Eremophila and Hakea	Sandy-loam	✓	✓		
Habitat Assessment 3	6773038	496087	Open Eucalyptus Woodland	Eucalyptus salubris over Eremophile and Senna	Sandy-loam	✓	✓	✓	
Habitat Assessment 12	6768386	495166	Open Eucalyptus Woodland	Eucalyptus salubris over Eremophile and Senna	Sandy-loam	✓	✓	✓	
Habitat Assessment 16	6772926	499086	Open Eucalyptus Woodland	Eucalyptus salubris over Eremophile and Senna	Sandy-loam	✓	✓	✓	
Habitat Assessment 18	6772601	496320	Open Eucalyptus Woodland	Eucalyptus salubris over Eremophile and Senna	Sandy-loam	✓	✓	✓	
Habitat Assessment 27	6771091	496951	Open Eucalyptus Woodland	Eucalyptus salubris over Eremophile and Senna	Sandy-loam	✓	✓	✓	
Habitat Assessment 28	6770861	496900	Open Eucalyptus Woodland	Eucalyptus salubris over Eremophile and Senna	Sandy-loam	✓	✓	✓	
Habitat Assessment 31	6771657	501717	Open Eucalyptus Woodland	Eucalyptus salubris over Eremophile and Senna	Sandy-loam	✓	✓	✓	
Habitat Assessment 36	6772761	500775	Open Eucalyptus Woodland	Eucalyptus salubris over Eremophile and Senna	Sandy-loam	✓	✓	✓	
Habitat Assessment 37	6772861	499809	Open Eucalyptus Woodland	Eucalyptus salubris over Eremophile and Senna	Sandy-loam	✓	✓	✓	
Habitat Assessment 38	6769644	499439	Open Eucalyptus Woodland	Eucalyptus salubris over Eremophile and Senna	Sandy-loam	✓	✓	✓	
Habitat Assessment 39	6769656	498989	Open Eucalyptus Woodland	Eucalyptus salubris over Eremophile and Senna	Sandy-loam	✓	✓	✓	
Habitat Assessment 42	6768283	497517	Open Eucalyptus Woodland	Eucalyptus salubris over Eremophile and Senna	Sandy-loam	✓	✓	✓	
Habitat Assessment 43	6768560	496531	Open Eucalyptus Woodland	Eucalyptus salubris over Eremophile and Senna	Sandy-loam	✓	✓	✓	
Habitat Assessment 44	6770774	496288	Open Eucalyptus Woodland	Eucalyptus salubris over Eremophile and Senna	Sandy-loam	✓	✓	✓	
Habitat Assessment 45	6769388	499467	Open Eucalyptus Woodland	Eucalyptus salubris over Eremophile and Senna	Sandy-loam	✓	✓	✓	
Habitat Assessment 29	6770501	497300	Rocky Hill	Mixed Acacia over Eremophila and Hakea	Rocky	✓	✓		
Habitat Assessment 47	6771083	499391	Rocky Hill	Mixed Acacia over Eremophila and Hakea	Rocky	✓	✓		
Habitat Assessment 48	6771565	499510	Rocky Hill	Mixed Acacia over Eremophila and Hakea	Rocky	✓	✓		
Habitat Assessment 49	6772245	499061	Rocky Hill	Mixed Acacia over Eremophila and Hakea	Rocky	✓	✓		
Habitat Assessment 50	6772319	498095	Rocky Hill	Mixed Acacia over Eremophila and Hakea	Rocky	✓	✓		



Appendix 5: Species List

AMPHIBIAN SPECIES RECORDED IN THE REGION

Key: EPBC Act = Environmental Protection and Biodiversity Conservation Act 1999, BC Act = Biodiversity Conservation Act 2016 (IUCN Threat categories), DBCA = Department of Biodiversity, Conservation and Attractions Priority Code, A = EPBC Protected Matters search, B = Listed in DBCA Dandjoo, C = DBCA Threatened Fauna Database, D = ALA, E = Current Field Survey.

Note: For Definitions of Conservation Codes see Appendix 1.

AMPHIBIANS		Conservation Codes			A	B	C	D	E
Family and Scientific Name	Common Name	EPBC Act	BC Act	DBCA					
LIMNODYNASTIDAE									
<i>Neobatrachus kunapalari</i>	Wheatbelt Frog							X	
<i>Neobatrachus sutor</i>	Shoemaker Frog							X	
<i>Neobatrachus wilsmorei</i>	Plonking Frog/Goldfields Bullfrog							X	
MYOBATRACHIDAE									
<i>Pseudophryne occidentalis</i>	Western Toadlet					X		X	
PELODRYADIDAE									
<i>Cyclorana occidentalis</i>	Western Water-holding Frog							X	

REPTILIAN SPECIES RECORDED IN THE REGION

Key: EPBC Act = Environmental Protection and Biodiversity Conservation Act 1999, BC Act = Biodiversity Conservation Act 2016 (IUCN Threat categories), DBCA = Department of Biodiversity, Conservation and Attractions Priority Code, A = EPBC Protected Matters search, B = Listed in DBCA Dandjoo, C = DBCA Threatened Fauna Database, D = ALA, E = Current Field Survey.

Note: For Definitions of Conservation Codes see Appendix 1.

REPTILES			Conservation Codes			A	B	C	D	E
Family and Scientific Name	Common Name	EPBC Act	BC Act	DBCA						
CHELIDAE										
<i>Chelodina oblonga</i>	Snake-necked Turtle								X	
UNDERWOODISAURUS										
<i>Underwoodisaurus milii</i>	Barking Gecko								X	
DIPLODACTYLIDAE										
<i>Diplodactylus granariensis</i>	Western Stone Gecko								X	X
<i>Diplodactylus pulcher</i>	Pretty Gecko								X	X
<i>Hesperoedura reticulata</i>	Reticulated Velvet Gecko								X	
<i>Lucasium maini</i>	Main's Ground Gecko								X	X
<i>Lucasium squarrosus</i>	Mottled Ground Gecko								X	X
<i>Rhynchoedura ornata</i>	Western Beaked Gecko								X	X
<i>Strophurus assimilis</i>	Goldfields Spiny-tailed Gecko								X	
<i>Strophurus strophurus</i>	Western Spiny-tailed Gecko								X	
GEKKONIDAE										
<i>Gehyra variegata</i>	Variegated Gehyra								X	X
<i>Heteronotia binoei</i>	Bynoe's Gecko						X		X	X
PYGOPODIDAE										
<i>Delma australis</i>	Marble-faced Delma								X	
<i>Pygopus nigriceps</i>	Western Hooded Scaly-foot								X	X
SCINCIDAE										
<i>Cryptoblepharus plagiocephalus</i>	Peron's Snake-eyed Skink								X	
<i>Ctenotus inornatus</i>	Bar-shouldered Ctenotus								X	
<i>Ctenotus mimetes</i>	Checker-sided Ctenotus								X	
<i>Ctenotus schomburgkii</i>	Barred Wedge-snouted Ctenotus								X	X
<i>Ctenotus severus</i>	Stern Rock Ctenotus						X		X	
<i>Ctenotus uber</i>	Spotted Ctenotus						X		X	X
<i>Cyclodomorphus branchialis</i>	Gilled Slender Blue-tongue		Vu					X	X	

REPTILES		Conservation Codes			A	B	C	D	E
Family and Scientific Name	Common Name	EPBC Act	BC Act	DBCA					
<i>Egernia depressa</i>	Pygmy Spiny-tailed Skink					X		X	
<i>Egernia stokesii badia</i>	Western Spiny-tailed Skink	En	Vu		X		X	X	
<i>Eremiascincus richardsonii</i>	Broad-banded Sand Swimmer							X	X
<i>Lerista gerrardii</i>	Bold-striped Robust Slider					X		X	X
<i>Lerista kingi</i>	King's Three-toed Slider					X			X
<i>Lerista nichollsi</i>	Inland Broad-blazed Slider							X	
<i>Lerista timida</i>	Dwarf Three-toed Slider							X	
<i>Liopholis inornata</i>	Desert Skink							X	
<i>Menetia greyii</i>	Common Dwarf Skink					X		X	X
<i>Morethia butleri</i>	Butlers Snake-eyed Skink					X			X
AGAMIDAE									
<i>Ctenophorus cristatus</i>	Bicycle Lizard							X	
<i>Ctenophorus maculatus</i>	Spotted Military Dragon							X	X
<i>Ctenophorus nuchalis</i>	Central Netted Dragon							X	
<i>Ctenophorus ornatus</i>	Central Netted Dragon							X	
<i>Ctenophorus reticulatus</i>	Western Netted Dragon					X		X	X
<i>Ctenophorus salinarum</i>	Claypan Dragon							X	
<i>Ctenophorus scutulatus</i>	Lozenge-marked Dragon					X		X	X
<i>Diporiphora amphiboluroides</i>	Mulga Dragon					X		X	X
<i>Pogona minor minor</i>	Dwarf Bearded Dragon					X		X	
<i>Moloch horridus</i>	Thorny Devil					X		X	
<i>Tiliqua rugosa</i>	Shingleback							X	
VARANIDAE									
<i>Varanus caudolineatus</i>	Stripe-tailed Monitor							X	
<i>Varanus giganteus</i>	Perentie							X	X
<i>Varanus gouldii</i>	Sand Monitor							X	X
<i>Varanus panoptes rubidus</i>	Yellow-spotted Monitor							X	
<i>Varanus tristis</i>	Black-headed Monitor							X	
TYPHLOPIDAE									
<i>Anilius hamatus</i>	Northern Hooked-snouted Blind Snake					X			X
<i>Anilius waitii</i>	Southern Beaked Blind Snake					X		X	
ELAPIDAE									
<i>Brachyuophis semifasciatus</i>	Southern Shovel-nosed Snake					X			
<i>Demansia reticulata</i>	Reticulated Whipsnake								X
<i>Furina ornata</i>	Moon Snake							X	
<i>Pseudechis australis</i>	Mulga Snake							X	

REPTILES		Conservation Codes			A	B	C	D	E
Family and Scientific Name	Common Name	EPBC Act	BC Act	DBCA					
<i>Pseudechis butleri</i>	Spotted Mulga Snake					X		X	
<i>Pseudonaja mengdeni</i>	Western Brown Snake					X		X	X
<i>Pseudonaja modesta</i>	Ringed Brown Snake					X		X	
<i>Simoselaps bertholdi</i>	Jan's Banded Snake					X		X	X
<i>Suta fasciata</i>	Rosen's Snake					X		X	

AVIAN SPECIES RECORDED IN THE REGION

Key: EPBC Act = Environmental Protection and Biodiversity Conservation Act 1999, BC Act = Biodiversity Conservation Act 2016 (IUCN Threat categories), DBCA = Department of Biodiversity, Conservation and Attractions Priority Code, A = EPBC Protected Matters search, B = Listed in DBCA Dandjoo, C = DBCA Threatened Fauna Database, D = ALA, E = BirdLife, F = Current Field Survey. * = Non endemic or introduced species/pest.

Note: For Definitions of Conservation Codes see Appendix 1.

BIRDS		Conservation Codes			A	B	C	D	E	F	
Family and Scientific Name	Common Name	EPBC Act	BC Act	DBCA							
CASUARIIDAE											
<i>Dromaius novaehollandiae</i>	Emu					X		X	X	X	
ANATIDAE											
<i>Anas superciliosa</i>	Pacific Black Duck							X	X		
<i>Anas gracilis</i>	Grey Teal							X	X		
<i>Aythya australis</i>	Hardhead							X	X		
<i>Biziura lobata</i>	Musk Duck							X	X		
<i>Chenonetta jubata</i>	Australian Wood Duck							X	X		
<i>Cygnus atratus</i>	Black Swan							X	X		
<i>Malacorhynchus membranaceus</i>	Pink-eared Duck							X	X		
<i>Spatula rhynchotis</i>	Australasian Shoveler							X	X		
<i>Tadorna tadornoides</i>	Australian Shelduck							X	x		
MEGAPODIIDAE											
<i>Leipoa ocellata</i>	Malleefowl	Vu	Vu		X	X	X	X	X	X	
COLUMBIDAE											
<i>Geopelia cuneata</i>	Diamond Dove									X	
<i>Ocyphaps lophotes</i>	Crested Pigeon					X		X	X	X	
<i>Phaps chalcoptera</i>	Common Bronzewing					X		X	X	X	
PODICIPEDIDAE											
<i>Poliiocephalus poliocephalus</i>	Hoary-headed Grebe							X	X		
<i>Tachybaptus novaehollandiae</i>	Australasian Grebe							X	X		
PODARGIDAE											
<i>Podargus strigoides</i>	Tawny Frogmouth							X	X	X	
CAPRIMULGIDAE											
<i>Eurostopodus argus</i>	Spotted Nightjar					X		X	X		
AEGOTHELIDAE											
<i>Aegotheles cristatus</i>	Australian Owlet-nightjar							X	X		
APODIDAE											
<i>Apus pacificus</i>	Fork-tailed Swift	MiMa	Mi		X						

BIRDS		Conservation Codes			A	B	C	D	E	F	
Family and Scientific Name	Common Name	EPBC Act	BC Act	DBCA							
CHARADRIIDAE											
Charadrius ruficapillus	Red-capped Plover	MiMa						X	X		
Elseyornis melanops	Black-fronted Dotterel							X	X		
Erythrogonys cinctus	Red-kneed Dotterel							X	X		
Thinornis cucullatus	Hooded Plover			P4	X		X	X	X		
Vanellus tricolor	Banded Lapwing							X	X		
RECURVIROSTRIDAE											
Cladorhynchus leucocephalus	Banded Stilt							X	X		
Himantopus himantopus	Black-winged Stilt							X			
Himantopus himantopus leucocephalus	Pied Stilt							X	X		
Recurvirostra novaehollandiae	Red-necked Avocet							X	X		
ROSTRATULIDAE											
Rostratula australis	Australian Painted Snipe	En			X			X			
PHASIANIDAE											
Coturnix pectoralis	Stubble Quail							X	X		
SCOLOPACIDAE											
Actitis hypoleucos	Common Sandpiper	MiMa			X			X	X		
Calidris acuminata	Sharp-tailed Sandpiper	MiMa	Mi		X						
Calidris ferruginea	Curlew Sandpiper	CRMi	CR		X						
Calidris melanotos	Pectoral Sandpiper	Mi	Mi		X						
Tringa nebularia	Common Greenshank	Mi	Mi		X		X	X	X		
LARIDAE											
Chroicocephalus novaehollandiae	Silver Gull							X	X		
Gelochelidon nilotica	Gull-billed Tern	MiMa	MiMa				X	X			
TURNICADAE											
Turnix velox	Little Button-quail							X	X		
BURHINIDAE											
Burhinus grallarius	Bush Stone-curlew							X			
CACATUIDAE											
Cacatua pastinator	Western Corella							X	X		
Cacatua sanguinea	Little Corella							X	X		
Calyptorhynchus banksii esconditus	Red-tailed Black Cockatoo							X	X	X	
Cacatua roseicapilla	Galah					X		X		X	
Lophochroa leadbeateri	Major Mitchell's cockatoo					X		X	X		
Nymphicus hollandicus	Cockatiel							X	X		
Zanda latirostris	Carnaby's Black Cockatoo	En	En		X						
PSITTACIDAE											
Barnardius zonarius	Australian Ringneck					X		X	X	X	

BIRDS		Conservation Codes			A	B	C	D	E	F
Family and Scientific Name	Common Name	EPBC Act	BC Act	DBCA						
<i>Gavialis virescens</i>	Singing Honeyeater					X		X	X	X
<i>Gliciphila melanops</i>	Tawny-crowned Honeyeater							X	X	
<i>Lichmera indistincta</i>	Brown Honeyeater							X	X	
<i>Manorina flavigula</i>	Yellow-throated Miner					X		X	X	X
<i>Melithreptus brevirostris</i>	Brown-headed Honeyeater							X		
<i>Nesoptilotis leucotis</i>	White-eared Honeyeater							X	X	
<i>Ptilotula ornata</i>	Yellow-plumed Honeyeater							X	X	
<i>Ptilotula penicillata</i>	White-plumed Honeyeater							X		
<i>Ptilotula plumula</i>	Grey-fronted Honeyeater					X		X	X	
<i>Purnella albifrons</i>	White-fronted Honeyeater					X		X	X	
<i>Sugomel niger</i>	Black Honeyeater							X	X	
PARDALOTIDAE										
<i>Pardalotus punctatus</i>	Spotted Pardalote							X		
<i>Pardalotus striatus</i>	Striated Pardalote					X		X	X	X
ACANTHIZIDAE										
<i>Acanthiza apicalis</i>	Inland Thornbill					X		X		
<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill							X	X	X
<i>Acanthiza iredalei</i>	Slender-billed Thornbill							X	X	
<i>Acanthiza robustirostris</i>	Slaty-backed Thornbill					X		X	X	
<i>Acanthiza uropygialis</i>	Chestnut-rumped Thornbill					X		X	X	X
<i>Aphelocephala leucopsis</i>	Southern Whiteface	Vu			X			X	X	
<i>Calamanthus montanellus</i>	Western Fieldwren							X	X	
<i>Gerygone fusca</i>	Western Gerygone							X	X	
<i>Hylacola cauta</i>	Shy Heathwren							X	X	
<i>Pyrrholaemus brunneus</i>	Redthroat					X		X	X	
<i>Sericornis frontalis</i>	White-browed Scrubwren					X		X		
<i>Sericornis maculatus</i>	South-western Spotted Scrubwren							X	X	
<i>Smicrornis brevirostris</i>	Weebill					X		X	X	X
POMATOSTOMIDAE										
<i>Pomatostomus superciliosus</i>	White-browed Babbler					X		X	X	X
<i>Pomatostomus temporalis</i>	Grey-crowned Babbler							X	X	
PAOPHODIDAE										
<i>Cinclosoma castanotum</i>	Chestnut Quail-thrush							X	X	X
<i>Cinclosoma clarum</i>	Inland Chestnut Quail-thrush							X		
<i>Cinclosoma castaneothorax</i>	Chestnut-breasted Quail-thrush							X	X	X
<i>Cinclosoma marginatum</i>	Western Quail-thrush							X		
<i>Psophodes occidentalis</i>	Chiming Wedgebill							X	X	X
CAMPEPHAGIDAE										

BIRDS		Conservation Codes			A	B	C	D	E	F
Family and Scientific Name	Common Name	EPBC Act	BC Act	DBCA						
<i>Hirundo neoxena</i>	Welcome Swallow							X	X	
<i>Petrochelidon nigricans</i>	Tree Martin					X		X	X	X
<i>Petrochelidon ariel</i>	Fairy Martin							X	X	
DICAEIDAE										
<i>Dicaeum hirundinaceum</i>	Mistletoebird							X	X	
LOCUSTELLIDAE										
<i>Cincloramphus cruralis</i>	Brown Songlark							X	X	
<i>Cincloramphus mathewsi</i>	Rufous Songlark							X	X	
<i>Poodytes gramineus</i>	Little Grassbird							X	X	
ZOSTEROPIDAE										
<i>Zosterops lateralis</i>	Silvereye							X	X	X
ESTRILDIDAE										
<i>Taeniopygia guttata</i>	Zebra Finch					X		X	X	X
MOTACILLIDAE										
<i>Motacilla cinerea</i>	Grey Wagtail	MiMa	Mi		X					

MAMMALIAN SPECIES RECORDED IN THE REGION

Key: EPBC = Environmental Protection and Biodiversity Conservation Act 1999, BC = Biodiversity Conservation Act 2016 (IUCN Threat categories), DBCA = Department of Biodiversity, Conservation and Attractions Priority Code, A = EPBC Protected Matters search, B = Listed in DBCA Dandjoo, C = DBCA Threatened Fauna Database, D = ALA, E = Current Field Survey.
 *=Non Endemic and or introduced/pest.

Note: For Definitions of Conservation Codes see Appendix 1.

MAMMALS		Conservation Codes					A	B	C	D	E
Family and Scientific Name	Common Name	EPBC	BC	DBCA							
TACHYGLOSSUS											
<i>Tachyglossus aculeatus</i>	Sort-beaked Echidna							X		X	X
DASYURIDAE											
<i>Antechinomys laniger</i>	Kultarr									X	
<i>Dasyurus geoffroi</i>	Chuditch (Western Quoll)	Vu	Vu			X					
<i>Pseudantechinus woolleyae</i>	Woolley's Pseudantechinus							X			
<i>Sminthopsis crassicaudata</i>	Fat-tailed Dunnart									X	X
<i>Sminthopsis dolichura</i>	Little Long-tailed Dunnart									X	
PERAMELINAE											
<i>Perameles bougainville</i>	Western Barred Bandicoot	Vu				X					
THYLACOMYIDAE											
<i>Macrotis lagotis</i>	Greater Bilby	Vu	Vu			X					
MACROPODIDAE											
<i>Notamacropus irma</i>	Western Brush Wallaby			P4				X	X		
<i>Macropus fuliginosus</i>	Western Grey Kangaroo										X
<i>Osphranter robustus</i>	Euro							X			X
<i>Osphranter rufus</i>	Red Kangaroo							X		X	
<i>Lagostrophus fasciatus</i>	Banded Hare-wallaby	Vu	Vu			X					
EMBALLONURIDAE											
<i>Taphozous hilli</i>	Hill's Sheathtail-bat										X
MOLOSSIDAE											
<i>Austronomus australis</i>	White-striped Freetail-bat									X	X
<i>Ozimops kitcheneri</i>	Western Free-tailed Bat										X
VESPERTILIONIDAE											
<i>Chalinolobus gouldii</i>	Gould's Wattled Bat									X	X
<i>Chalinolobus morio</i>	Chocolate Wattled Bat										X
<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat										X
<i>Nyctophilus major tor</i>	Central Long-eared Bat			P3					X		

MAMMALS		Conservation Codes			A	B	C	D	E
Family and Scientific Name	Common Name	EPBC	BC	DBCA					
<i>Scotorepens balstoni</i>	Inland Broad-nosed Bat								X
<i>Vespadelus baverstocki</i>	Inland Forest Bat							X	
<i>Vespadelus finlaysoni</i>	Finlayson's Cave Bat					X		X	X
<i>Vespadelus regulus</i>	Southern Forest Bat					X			
MURIDAE									
<i>Leporillus apicalis</i>	Lesser Stick-nest Rat	Ex			X				
<i>Leporillus conditor</i>	Greater Stick-nest Rat	Vu	CD		X				
<i>Notomys alexis</i>	Spinifex Hopping-mouse							X	
<i>Notomys mitchellii</i>	Mitchell's Hopping-mouse							X	
<i>Pseudomys hermannsburgensis</i>	Sandy Inland Mouse							X	
* <i>Mus musculus</i>	House Mouse							X	
CANIDAE									
* <i>Vulpes vulpes</i>	Red Fox					X		X	
FELIDAE									
* <i>Felis catus</i>	Feral Cat							X	X
LEPORIDAE									
* <i>Oryctolagus cuniculus</i>	European Rabbit					X			X
BOVIDAE									
* <i>Capra hircus</i>	Goat					X		X	



Appendix 6: Fauna Photographs



Plate 16. Western Stone Gecko



Plate 17. Bynoe's Gecko



Plate 18. Western Hooded Scaly-foot



Plate 19. Broad-banded Sand Swimmer



Plate 20. Lozange-marked Dragon



Plate 21. Mulga Dragon



Plate 22. Perentie



Plate 23. Australian Raven

Appendix F 2025 Targeted Vertebrate Fauna Survey for the Trench Mining Area

23 March 2026

Tungsten Mining NL
C/- Belinda Bastow
Integrate Sustainability
Lower Ground Floor,
3 Richardson St, West Perth 6005

Re: Targeted vertebrate fauna survey for the Tungsten Mining Trench Gold Mining Area

Dear Belinda

Terrestrial Ecosystems is pleased to provide a summary of recently completed field work searching for threatened vertebrate fauna in the Tungsten Mining NL Trench Gold Mining Area (Figure 1).

Several vertebrate fauna surveys have been conducted for the Tungsten Mining project and reviewed for contextual information to help determine which vertebrate fauna species of conservation significance could occur in the survey area. These surveys included:

- Animal Plant Mineral (2017a) Attachment 1 *Mt Mulgine Project EPA Referral Supporting Document V3 Rothsay, WA*. Unpublished report for Tungsten Mining NL, Perth.
- Animal Plant Mineral (2017b) *Mt Mulgine Project Biological Survey Rothsay, WA*. Unpublished report for Tungsten Mining NL, Perth.
- Animal Plant Mineral (2018a) *Mt Mulgine Project - Mulgine Hill M59/425-M59/387 Targeted Survey for Threatened and Priority Flora and Conservation Significant Fauna Habitat*. Unpublished report for Mid-West Tungsten Pty Ltd, Perth.
- Animal Plant Mineral (2018b) *Mt Mulgine Project Biological Survey Rothsay, WA*. Unpublished report for Tungsten Mining NL, Perth.
- Spectrum Ecology (2019a) *Mt Mulgine Fauna Clearance Survey (December)*. Unpublished letter report for Tungsten Mining NL, Perth.
- Spectrum Ecology (2019b) *Mt Mulgine Fauna Clearance Survey (September)*. Unpublished letter report for Tungsten Mining NL, Perth.
- Spectrum Ecology (2019c). *Mt Mulgine Fauna Clearance Survey Phase 2*. Unpublished letter report for Tungsten Mining NL, Perth.
- Spectrum Ecology (2022) *Mount Mulgine Terrestrial Fauna Assessment*. Unpublished report for Tungsten Mining NL, Perth.

The vertebrate fauna of conservation significance and interest in this assessment were:

- Western Spiny-tailed skink – *Egernia stokesii badia*;
- Gilled Slender Bluetongue - *Cyclodomorphus branchialis*; and
- Malleefowl – *Leipoa ocellata*.

Vertebrate fauna of conservation significance

The Western Spiny-tailed Skink (Plate 1) is listed as Vulnerable under the *Biodiversity Conservation Act (BC Act) 2016* and Endangered under the *Environment Protection and Biodiversity Conservation Act (EPBC Act) 1999*. It is a large, stout, live-bearing lizard that has several recognised subspecies in Western Australia. The biology of this species is well understood, as it is very similar to that of the *Egernia stokesii* in South Australia, which has been extensively studied (Duffield and Bull 1998; Gardner *et al.* 1999; Gardner *et al.* 2001; Gardner *et al.* 2002). In WA, it is typically found in places that provide shallow crevices or hollows, so it can be found in hollow logs, granite, particularly exfoliating granite, or some man-made structures that provide layered crevices (Bradley *et al.* 2022). The skink lives in small, fragmented groups that can be genetically isolated (Pearson *et al.* 2020).



Plate 1. Western Spiny-tailed Skink



Plate 2. Gilled Slender Bluetongue

How et al. (2003) examined old records and visited multiple known sites for this species to report that it is typically found in areas supported by York Gum, but also in Gimlet and Salmon Gum woodlands. It is relatively easy to detect by its scat piles for someone suitably experienced.

The Gilled Slender Bluetongue (Plate 2) is listed as Vulnerable under the *BC Act 2016*. Chapple et al. (2019) reported that there was little data on the population, and recent records are mostly from rocky outcrops. It is a ground dwelling crepuscular and nocturnal species that shelters in hummock grass, leaf litter, including *Acacia*, under logs and stumps (Chapple *et al.* 2019). It has a restricted distribution in the south-west Murchison, from the Murchison River in the north to the Irwin River in the south and inland to Yalgoo (Chapple *et al.* 2019).

The Malleefowl is listed as Vulnerable under the *EPBC Act 1999* and *BC Act 2016*, and government regulators typically wish to know whether Malleefowl are present, and if so, how abundant and where they are in a project area. Malleefowl are large, ground-dwelling birds that rarely fly unless alarmed or are perching for the night. Historically, Malleefowl have been found in mallee regions of southern Australia from approximately the 26th parallel of latitude southwards. Prior to vegetation clearing for agriculture, Malleefowl were abundant in the WA Wheatbelt. Vegetation clearing for agriculture also exposed adjacent bushland to predators, and in the south-west of WA, Malleefowl often persist only in isolated remnant patches of native vegetation. Sheep and other herbivores (e.g. goats, kangaroos) grazing in remnant vegetation remove or thin the undergrowth, and they also compete with Malleefowl for herbaceous foods and can cause changes to the structure and floristic diversity of foraging habitats (Benshemesh 2007).

Malleefowl and their eggs are vulnerable to predation by foxes, and newly hatched chicks are vulnerable to foxes, cats and raptors (Priddel and Wheeler 1990; Benshemesh and Burton 1999; Benshemesh 2007; Lewis and Hines 2014). Malleefowl build distinctive nests that comprise a large mound of soil/rock covering a central core of leaf litter. These nest mounds range in diameter but can span more than five metres and may be up to one metre high. Malleefowl are generally monogamous, and once breeding commences, they pair for life. The presence of nest mounds indicates the presence of Malleefowl in the area.

Malleefowl have been observed in the bioregion and elsewhere on site.

Methods

Dr Scott Thompson, Stelleena Wipp and Brody Altus (Terrestrial Ecosystems zoologists) searched the project area for signs of the three fauna species of conservation significance, using both direct observations and indirect evidence such as scats, burrows and mounds. The field surveys were undertaken on 3-4 and 15-19 September 2025. The entire project area was searched (Figures 2 and 3).

For Malleefowl, transect searches were based on vegetation density, so any Malleefowl mound present would have been recorded. The national Malleefowl monitoring program used the following Malleefowl mound profiles (National Malleefowl Recovery Team 2016) and in this report to classify mounds:

- Profile 1 (Typical crater with raised rim) – this is the typical mound shape of an inactive (dormant) mound and without any accumulated vegetation in the crater.
- Profile 2 (mound dug out) – this is a recently fully dug out mound with steep sides to the crater, with the base forming a box like structure with the sides normally 20-30cm deep. Sometimes litter has been raked into windrows in readiness to be placed in the mound.

- Profile 3 (mound filled with litter) – this mound contains litter in the crater and is the next construction stage after profile 2. Layers of litter are evident on the surface and there may or may not be sand mixed with the litter.
- Profile 4 (active mound with no crater) – this active mound is closed, and dome shaped. Note that some mounds have a dome and no crater but are not active.
- Profile 5 (mound with crater and often a peak at the centre) – this is an active mound that is being opened or closed by Malleefowl.
- Profile 6 (disused or extinct mound) – this mound has not been used for some time and weathering and erosion have ‘flattened’ the original mound.
- Profile 7 (very large flat mound) – this mound is very broad and flat and generally measures in excess of 10m in diameter. The mounds are thought to have been made by a species of mega-fauna (bird similar to a Malleefowl) or in Western Australia are likely to be extinct Burrowing Bettong or Boodie warrens.



For mounds that could potentially be used again, crossed sticks were placed at the centre of the mound, so if they were moved, then there was a method of indicating use.

Results

Although extensive searches were undertaken, no evidence of Malleefowl, Gilled Slender Bluetongue, or Western Spiny-tailed Skinks was found during the searches. Plates 3-5 show some of the fauna recorded during the searches and plates 6-10 show some of the available habitats in the project area. The habitats appeared suitable for the threatened species, however, none were recorded.

Discussion

The abundance and local geographical distribution of Western Spiny-tailed Skinks is typically low and fragmented almost anywhere in their extant geographical distribution (How *et al.* 2003). They are a sedentary species, with limited movement of individuals among colonies, so it is therefore important that a buffer is established if a colony is discovered. It is expected that Malleefowl will be seen infrequently in the project area, however, there was no evidence that they are breeding. If new Malleefowl mounds are discovered in the future, appropriate buffers should be established. Gilled Slender Bluetongues are infrequently recorded across their distribution; when found, and if they are likely to be impacted, they should be moved to adjacent alternative habitats.

Project staff should be made familiar with the threatened species in the area and encouraged to report suspected sightings.

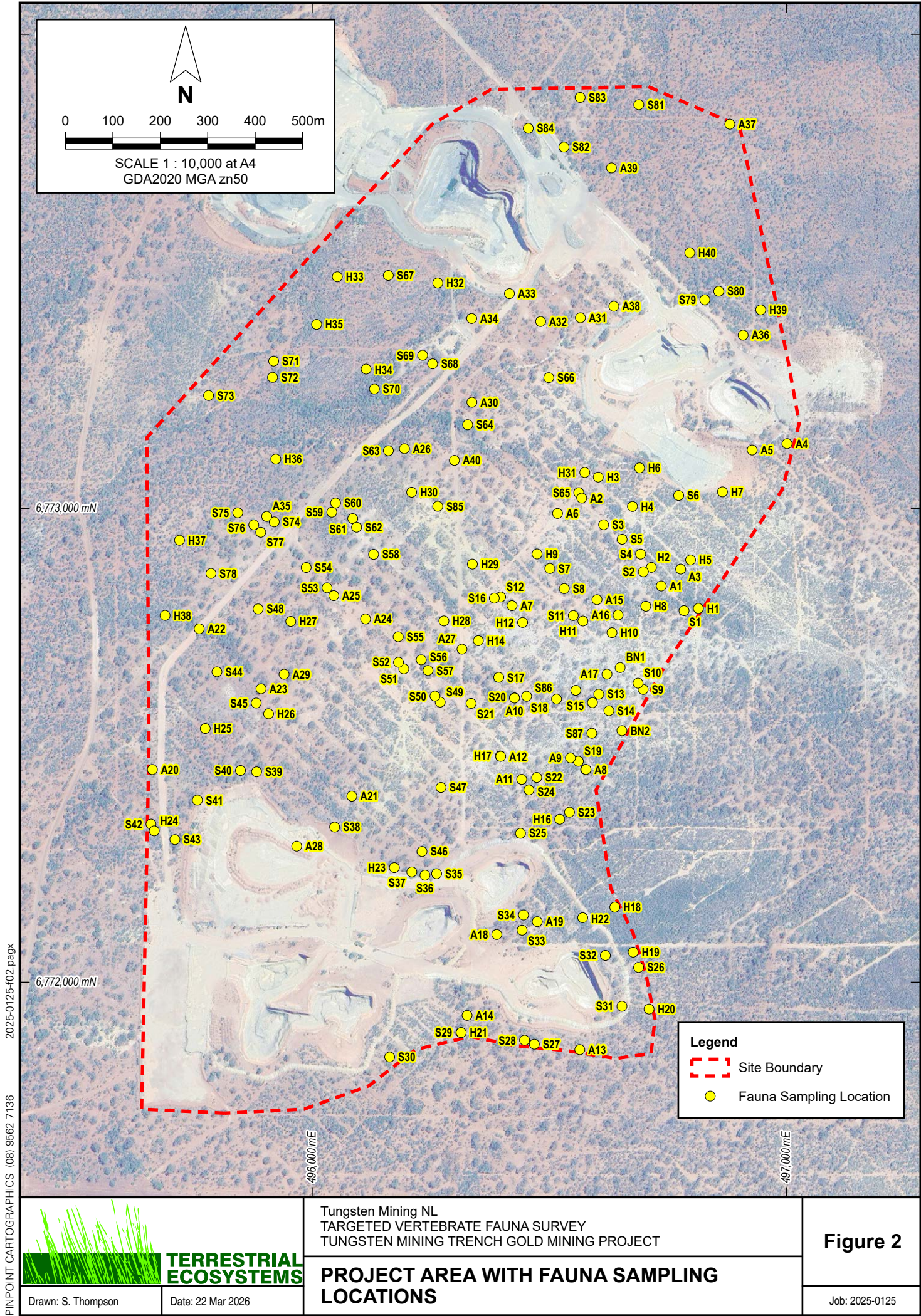
Yours sincerely

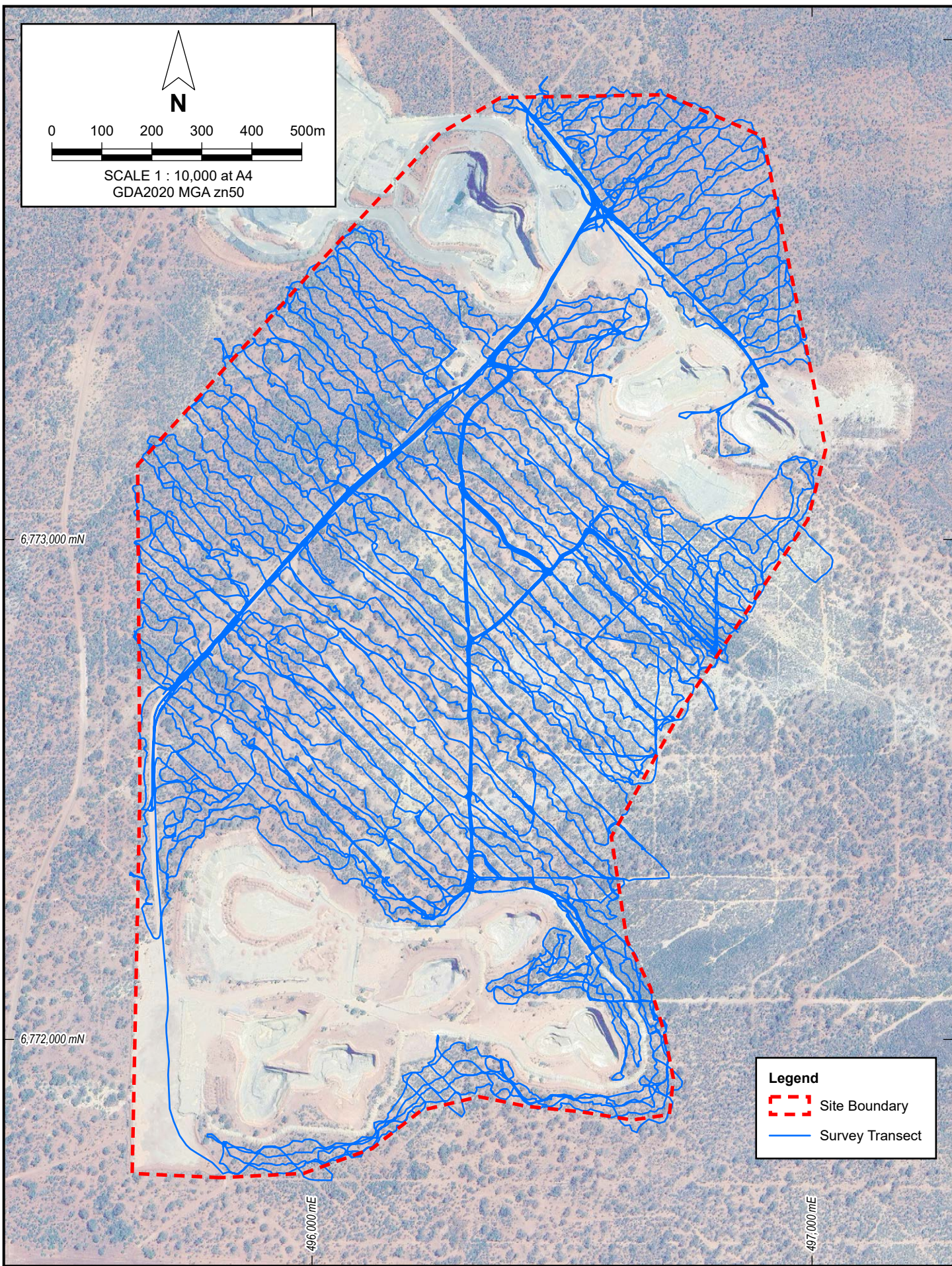
Dr Scott Thompson
Director and Principal Zoologist

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Drawn: S. Thompson

Date: 22 Oct 2025

Tungsten Mining NL
TARGETED VERTEBRATE FAUNA SURVEY
TUNGSTEN MINING TRENCH GOLD MINING PROJECT

PROJECT AREA WITH FAUNA SURVEY TRACK COVERAGE

Figure 3

Job: 2025-0125



Plate 3. Echidna



Plate 4. Western Bearded Dragon



Plate 5. Barking geckoes



Plate 6. Fauna habitat



Plate 7. Fauna habitat



Plate 8. Fauna habitat

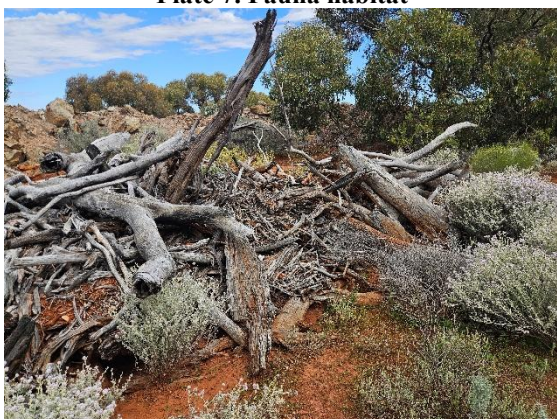


Plate 9. Log pile

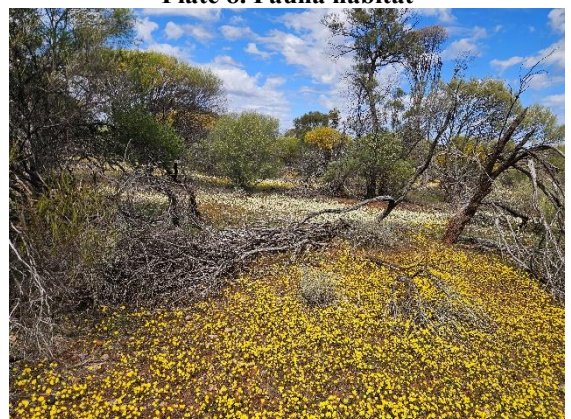


Plate 10. Fauna habitat

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Appendix G 2024 Targeted SRE Invertebrate Survey



Mulgine Targeted Short-Range Endemic (SRE) Invertebrate Fauna Survey and Species Consolidation Report

Prepared for:

Tungsten Mining NL (TGN)

March 2026
Final Report



Short-Range Endemics | Subterranean Fauna | Wetlands

Mulgine Targeted Short-Range Endemic (SRE) Invertebrate Fauna Survey and Species Consolidation Report

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Final	Kevin Sagastume-Espinoza		email	10 March 2026

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EXECUTIVE SUMMARY

Tungsten Mining NL (Tungsten) is developing the Trench Tungsten Operation (Trench or operation) located at Mulgine, which is situated approximately 330 km northeast of Perth and 230 km east-southeast of Geraldton in the Shire of Perenjori. Tungsten has located three deposits Mulgine Hill, Mulgine Hill East and Trench with the focus initially on the Trench deposit. Tungsten engaged Bennelongia Environmental Consultants (Bennelongia) to undertake additional Short-Range Endemic (SRE) invertebrate fauna surveys to expand the survey carried out in 2019-2021 (Spectrum Ecology 2021a). The 2024 /2025 work completed by Bennelongia involved targeted SRE field surveys, along with molecular analysis of samples collected.

Targeted field surveys were consistent with the Technical Guidance-Sampling for Short-Range Endemic Invertebrate Fauna but focused primarily on the following targeted SRE Groups: mygalomorph spiders, *Antichiropus* and Siphonotidae millipedes and isopods. However, members of non-targeted SRE Groups were also collected. Prior to the field survey, Bennelongia conducted a desktop review to collate a list of species belonging to SRE groups known to occur in or near the Operational Development Area (Development Area). Compilation of data from the Western Australia Museum, Bennelongia and Spectrum Ecology recognised 1,878 specimens from at least 143 species in the desktop search area. Among these species, SRE categorisation recognised six Confirmed SREs, five Likely Potential SREs, 13 Unlikely Potential SREs, 62 Data Deficient Potential SREs and 57 Widespread species. Six of the 143 species have been listed as Endangered or Priority. A two-round field survey was conducted after the desktop assessment from 15-17 July 2024 by Kevin Sagastume-Espinoza and Jaxon Haines and from 28-30 October 2024 by Jaxon Haines and Ethan Lamont. Originally a single round of the survey was planned, but rain events before the first round of the survey made it impossible to complete it as scheduled. The second round was scheduled to sample the remaining unsurveyed sites (n = 8). During the survey, a total of 25 sites were sampled via hand foraging techniques in the Survey Area: 12 sites in the Development Area were considered "impact sites", and 13 sites elsewhere in the Survey Area were considered "reference sites".

The survey collected 216 specimens from at least 40 species belonging to SRE Groups. No Confirmed SRE species were collected in the survey, but two Priority 3 species were: *Idiosoma clypeatum* and *I. intermedium*. Of the 40 identifiable species collected in the survey, 1 was categorised as Likely Potential SRE, 8 as Unlikely Potential SRE, 12 as Data Deficient Potential SRE and 17 are Widespread. Additionally, habitat mapping conducted by Bennelongia identified seven habitats prospective for SRE terrestrial invertebrate fauna and one habitat, Cleared areas, not prospective for SREs.

After both the desktop assessment and field survey, a consolidated list of targeted SRE Groups occurring across the Tungsten tenure was compiled; 15 species of mygalomorph spiders, 11 species of isopods, and 3 species of millipedes were recorded within the Survey Area. Of these, four species are conservation-significant: *Idiosoma gutharuka* (P1), *I. clypeatum* (P3), *I. intermedium* (P3) and *I. castellum* (P4). However, none of the conservation-significant species are confined to the Tungsten tenure and three have widespread distributions. The fourth species (*Idiosoma gutharuka* (P1)) is a Confirmed SRE with a high density of records from the Survey Area. Rather than reflecting a truly restricted distribution, however, this high density of records is probably due to survey efforts being concentrated in pockets of the species' range. This observation is supported by the presence of records from 100 km from the Tungsten tenure, at the type locality of Gutha, as well as 4-12 km outside of the Survey Area. None of the species from the targeted groups collected in the Survey Area are expected to be confined to it.

Overall, although some species in the survey records are known only from the Survey Area, all were collected from widespread and locally abundant habitats and microhabitats, so are not expected to be confined to the Survey Area. The other species recorded, including Confirmed SREs and conservation-listed species, are also expected to have distributions greater than the Survey Area. The Survey Area (~11,386 ha) is a small fraction of the broader landscape, and the development of the operation is not

expected to significantly reduce the broad-scale availability of habitat. If necessary, further targeted surveys outside of the Survey Area could be conducted to provide further characterisation of the distributions of conservation-significant species. Additionally, mitigation measures (such as translocation of specimens) could be considered for the Priority species, and to reduce any potential impacts that may result from the Trench development.

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1. INTRODUCTION

The Trench Tungsten Operation (Trench or operation) located at Mulgine, is situated approximately 330 km northeast of Perth and 230 km east-southeast of Geraldton in the Shire of Perenjori (Figure 1). Tungsten Mining NL (Tungsten) has located three tungsten and molybdenum deposits referred to as Mulgine Hill, Mulgine Hill East and Trench, with the focus initially on the Trench deposit. The proposed operation is located across M59/386, M59/387, M59/425, L59/161, and L59/162. Tenements M59/425 and L59/161 are partially and wholly located on the former pastoral Karara lease, which is now managed by the Department of Biodiversity Conservation and Attractions (DBCA). Tenements M59/387, M59/425, M59/386 and L59/162 are partly and wholly located within the Wanarra pastoral lease.

Tungsten is proposing to develop the operation focusing on the recovery of tungsten, molybdenum and other minerals. Tungsten engaged Bennelongia Environmental Consultants (Bennelongia) to assist with baseline studies required for regulatory approvals.

Bennelongia was engaged to add to the previous Short-Range Endemic (SRE) invertebrate fauna surveys carried out in 2019-2021 (Spectrum Ecology 2021a). Bennelongia was commissioned to conduct additional targeted SRE field surveys and to perform molecular analysis of samples across the Survey area. The focus area for the survey, as provided by the client, was expanded at the client's request to encompass additional reference sites; this expanded area is referred to in this report as the Survey Area (Figure 1, green boundary). Within the Survey Area are two regions: the Development Area (hatched red in Figure 1) and a Reference Area around it (hatched green in Figure 1). This Survey Area, capitalised, differs from other survey areas described by other agencies and reports. The SRE survey aims to:

- Undertake molecular analysis to verify the identity of trapdoor spider species from the Survey Area;
- Undertake additional leaf litter collections to determine the presence of additional isopod species in the Survey Area;
- Review and revise past identifications to conform to latest taxonomy;
- Compile a standalone SRE report that incorporates all previous work and the additional 2024 studies, including an updated list of conservation-significant SRE species potentially occurring in the Survey Area.

2. SRE FRAMEWORK

2.1. Short Range Endemics

In addition to having ranges notionally less than 10,000 km², SRE species usually have patchy distributions within their range, slow growth, low fecundity and poor dispersal capabilities. Guidelines for the consideration and assessment of SRE invertebrates in Western Australia are provided in the *Environmental Factor Guideline: Terrestrial Fauna* (EPA 2016a) and *Technical Guidance: Sampling of short-range endemic invertebrate fauna* (EPA 2016b). Assessment focuses on SRE Groups, which are higher-level taxonomic groupings known to contain moderate to high proportions of SRE species. SRE Groups include land snails (Gastropoda), millipedes (Diplopoda), centipedes (Chilopoda), pseudoscorpions (Pseudoscorpiones), scorpions (Scorpiones), spiders (Araneae; mainly trapdoor spiders, Mygalomorphae), slaters (Isopoda), and in mesic landscapes velvet worms (Onychophora) and earthworms (Oligochaeta).

Not all species in SRE Groups have restricted ranges; some or indeed many may be widespread. Determining whether a species belonging to an SRE Group is, in fact, often difficult. One approach is to assume that the distribution of a species reflects the extent of its preferred or obligate habitat(s), and that species found only in restricted or patchy habitats have smaller ranges than those collected from extensive or common habitats. However, in cases where short-range endemism is driven by life history characteristics, a species may be a true SRE but inhabit a widespread, apparently well-connected habitat

(Harvey 2002; Harvey *et al.* 2015b; Harvey *et al.* 2011; Rix *et al.* 2015). Therefore, several factors are considered in conjunction when evaluating the SRE status of a species and the likelihood of threat to that species. These factors include the known range of the species; habitat(s) at the collection site(s) and the spatial extent and connectivity of these habitats; and the distribution patterns of phylogenetically related surrogate species (ideally members of the same genus).

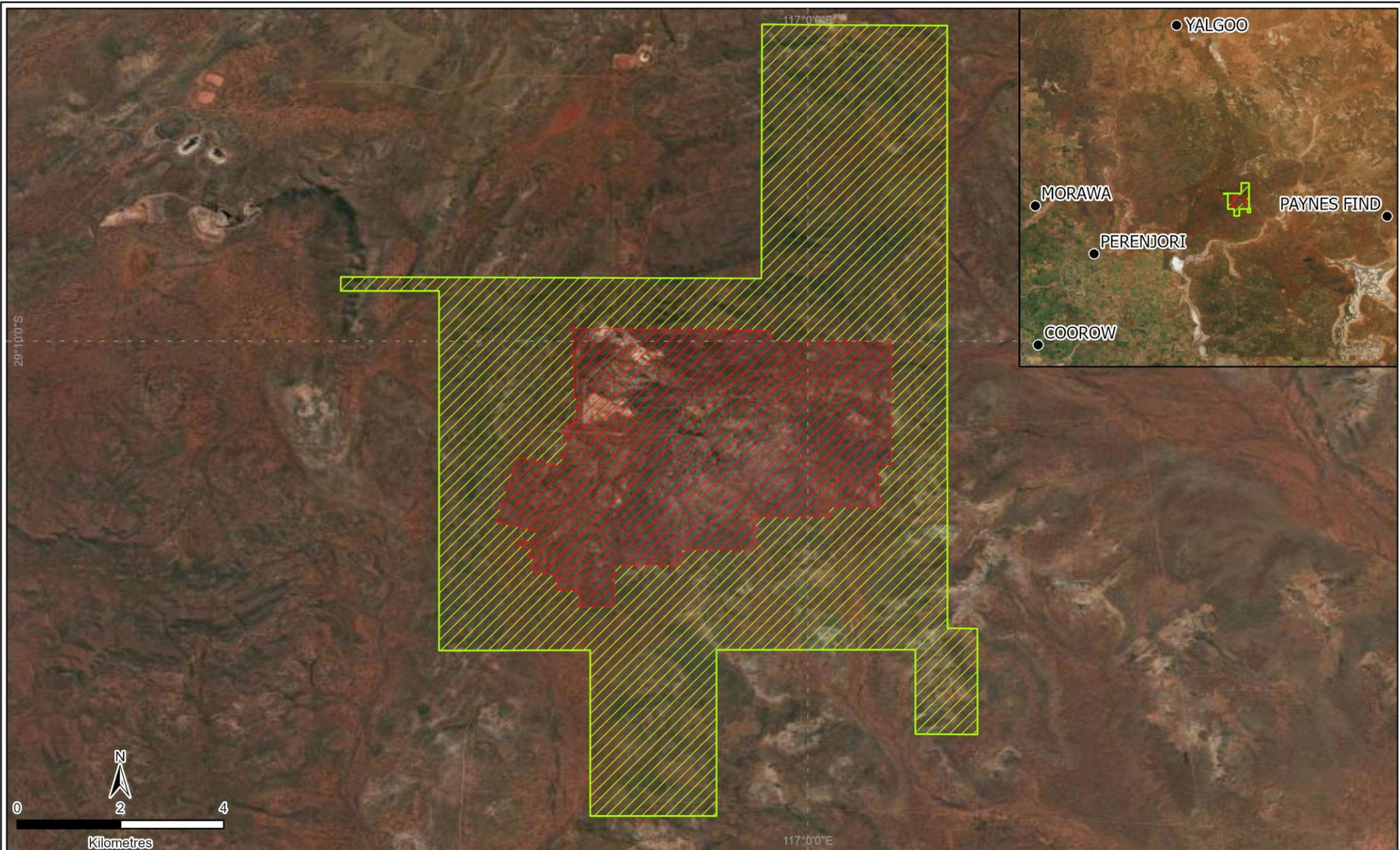
In order to synthesise investigations of these factors in the context of determining SRE status, this report follows the Western Australia Museum's (WAM) classification system for SREs in recognising three categories:

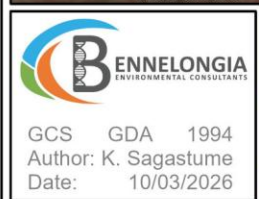
1. **Confirmed SRE** species have a known distribution range smaller than 10,000 km². The taxonomy is well known, and the group is well represented in collections and/or via comprehensive sampling.
2. **Potential SRE** species belong to a group with gaps in our knowledge of its distribution, either because the group is not well represented in collections, taxonomic knowledge is incomplete, or the distribution is poorly understood due to insufficient sampling.
3. **Widespread (not SRE)** species have a known distribution range larger than 10,000 km². The taxonomy is well known, and the group is well represented in collections via comprehensive sampling.

In many surveys, most species fit the **Potential SRE** category, but the likelihood of species within the category actually being SREs varies substantially. In an attempt to increase the accuracy of categorisation, for the purposes of this report, the Potential SRE category is further sub-divided into three categories:

- A. **Data Deficient Potential SRE** status indicates that insufficient data is available to determine SRE status. Insufficiency of data may be caused either by a lack of geographic or taxonomic information, or because the individuals sampled are not identifiable to species level (e.g. nondiagnostic sex, juvenile, damaged). This category is applied only to those species that belong to a known SRE Group, rather than being applied to any undescribed species in the records.
- B. **Unlikely Potential SRE** species status is applied in one of two cases. First, the species belongs to an SRE Group but has been collected from many sites and/or multiple habitats. Second, the species belongs to a smaller taxonomic group within the SRE Group that tends not to contain SREs.
- C. **Likely Potential SRE** species are from taxonomic groups in which SREs are likely, and when specimens have been collected, it has been from one or very few sites and/or habitats.

In the context of these categories, identifying a species as a Potential or Confirmed SRE is often only the first step in determining the impacts of mining activities on that species. Even a Confirmed SRE species may be locally widespread around the Development Area, and therefore at minimal risk of disturbance. The actual level of threat to an SRE species depends on its distribution relative to the development footprint, rather than its SRE status alone. Determining the likely level of threat to a species, therefore, requires further consideration of the extent of the species' preferred habitat, both within and beyond the area of activity.





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 Date: 10/03/2026



PAYNES FIND
 PERTH

Legend

-  Development Area
-  Targeted SRE Survey Area

Figure 1. Location of the Mt Mulgine Project Development Area and the Survey Area.

Inset shows location of the Project in relation to nearby towns.

3. CONSERVATION FRAMEWORK

The *Biodiversity Conservation Act 2016* (BC Act) in Western Australia deals with the protection, conservation and sustainable use of the state's biodiversity, and provides general protection for all native species (DBCA 2023). Some species are given special protection under the BC Act, primarily because they are rare, and are referred to as Threatened species. Species may also be recognised and protected as Threatened at the national level under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). There is a general concordance of species listed under the two acts, but the BC Act has greater invertebrate coverage.

Additionally, the DBCA lists some Priority species for conservation; species are typically listed as Priority primarily when they are considered potentially under threat, but there is insufficient evidence to support listing them as Threatened. Priority species listed by DBCA are still recognised, but do not receive full protection as those under either the BC Act or the EPBC Act (DBCA 2024).

Information available from the BC and EPBC Acts, as well as from the DBCA's list of Priority species, is often used to complement a species' SRE assessment. Additionally, when a taxon listed in these sources is found in a project area, the potential impact of development on that taxon requires additional consideration of that taxon's taxonomy, distribution, and habitat requirements.

4. LANDSCAPE SETTING

4.1. Project Location

The operation is located within the Talling sub-region (YAL02) of the Yalgoo Bioregion as recognised by the Interim Biogeographic Regionalisation of Australia (IBRA; Figure 2A). The Yalgoo Bioregion is an interzone between the south-western bioregions and the Murchison. It is characterised by open woodlands of Callitris, Mulga, and Bowgada with scrub on earthy to sandy-earth plains in the western Yilgarn craton and the southern Carnarvon Basin. The climate is Mediterranean, semi-arid to arid and warm. The Yalgoo Bioregion is rich and diverse in flora and fauna, although most species are wide-ranging and usually occur in at least one adjoining region (McKenzie *et al.* 2002).

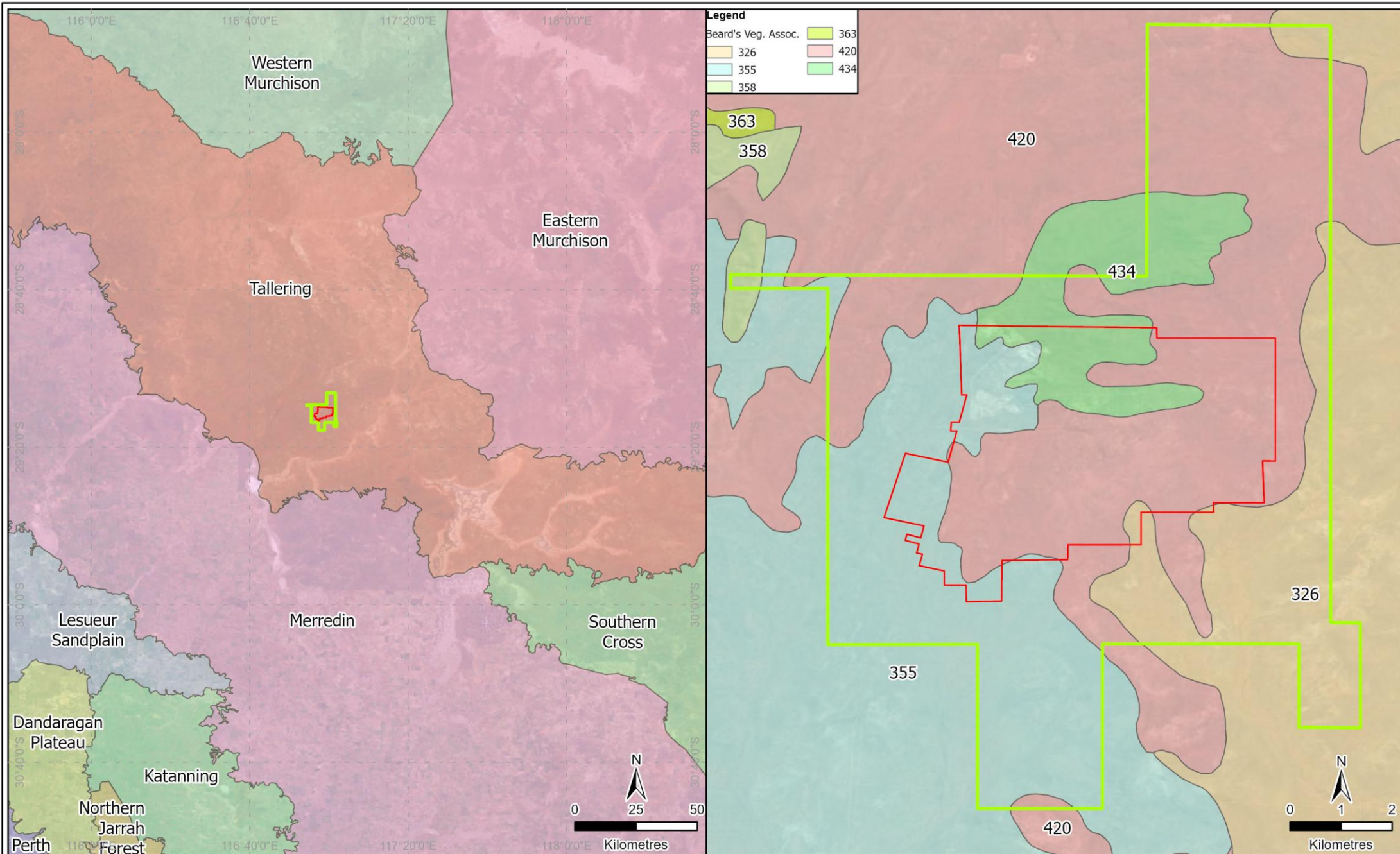
4.2. Vegetation

Pre-European vegetation mapping of the Survey Area by Spectrum Ecology (2021b) found four vegetation system associations (Figure 2B; Table 1), all of which are widespread in the Yalgoo Bioregion (McKenzie *et al.* 2002; Spectrum Ecology 2021b). The same survey (Spectrum Ecology 2021b) identified 296 vascular plant taxa, most of which belonged to the genera *Acacia*, *Rhodanthe* and *Eremophila*. These species were assigned to seven vegetation units (Table 1) in five broad floristic groups, most of which have been identified as in Excellent Condition and with a small proportion identified as Completely Degraded (see tables 3.6 and 3.7 in Spectrum Ecology 2021b).

Table 1: Vegetation system associations in Spectrum Ecology's (2021b) survey area.

Veg Assoc Code (Beard 2013)	Description	Common flora species
326	Low woodland over scrub; Mulga over Bowgada & Minni Ritchi scrub	<i>Acacia</i> spp., <i>Senna artemisioides</i> , <i>Chorizema genistoides</i> , <i>Eremophila</i> spp.
355	Shrublands; Bowgada & Jam scrub with scattered York Gum & Red Mallee	<i>Eucalyptus loxophleba</i> , <i>E. oleosa</i> , <i>Acacia aneura</i> , <i>A. ramulosa</i> .
358	Shrublands; Bowgada & <i>Acacia quadrimarginea</i> on stony ridges	<i>Acacia ramulosa</i> , <i>A. ramulosa</i> var. <i>linophylla</i> , <i>A. quadrimarginea</i> .
420	Shrublands; Bowgada & Jam scrub	<i>Acacia</i> spp., <i>Allocasuarina campestris</i> , <i>Melaleuca uncinata</i> , <i>Thryptomene australis</i> .
434	Shrublands; <i>Acacia quadrimarginea</i> & Jam scrub with scattered York Gum & <i>Allocasuarina huegeliana</i>	<i>Eucalyptus loxophleba</i> , <i>Allocasuarina huegeliana</i> , <i>Acacia quadrimarginea</i> , <i>A. acuminata</i> .
Veg Unit (Spectrum 2021*)	Description	Common flora species
Floristic Group 1: <i>Eucalyptus</i> low open woodland over <i>Acacia</i> tall open shrubland on flats & drainage lines		
EIAr	<i>Eucalyptus loxophleba</i> subsp. <i>supralaevis</i> or <i>E. loxophleba</i> subsp. <i>lissophloia</i> low open woodland over <i>Acacia ramulosa</i> var. <i>ramulosa</i> tall open shrubland over <i>Ptilotus obovatus</i> , <i>Scaevola spinescens</i> low isolated shrubs.	<i>Exocarpos aphyllus</i> , <i>Eremophila oldfieldii</i> subsp. <i>oldfieldii</i> , <i>Senna artemisioides</i> subsp. <i>filifolia</i> , <i>Acacia acuminata</i> , <i>Eucalyptus kochii</i> subsp. <i>plenissima</i> , <i>Melaleuca scalena</i> , <i>M. hamata</i> .
EIAt	<i>Eucalyptus loxophleba</i> subsp. <i>supralaevis</i> low woodland over <i>Acacia tetragonophylla</i> , <i>Allocasuarina dielsiana</i> , <i>Acacia ramulosa</i> var. <i>ramulosa</i> tall open shrubland over <i>Dodonaea inaequifolia</i> , <i>Acacia acanthoclada</i> subsp. <i>glaucescens</i> mid-low sparse shrubland.	<i>Austrostipa elegantissima</i> , <i>Ptilotus obovatus</i> , <i>Senna artemisioides</i> subsp. <i>filifolia</i> , <i>Sida</i> sp. Dark Green Fruits (S. van Leeuwen 2260), <i>Gastrolobium laytonii</i> .
Floristic Group 2: <i>Acacia</i> tall open woodland over <i>Micromyrtus</i> mid open shrubland on flats		
AaAr	<i>Allocasuarina acutivalvis</i> subsp. <i>prinsepiana</i> tall sparse shrubland over <i>Acacia ramulosa</i> var. <i>ramulosa</i> (+/- <i>Micromyrtus acuta</i>) mid open shrubland over <i>Austrostipa elegantissima</i> isolated tussock grasses.	<i>Acacia acuminata</i> , <i>A. burkittii</i> , <i>A. ramulosa</i> var. <i>linophylla</i> , <i>Eremophila latrobei</i> subsp. <i>latrobei</i> , <i>Melaleuca nematophylla</i> .
Floristic Group 3: <i>Eucalyptus</i> low open woodland over <i>Tecticornia</i> sparse low shrubland on flats		
EsTh	<i>Eucalyptus salubris</i> low open woodland over <i>Tecticornia halocnemoides</i> low sparse shrubland.	<i>Acacia acanthoclada</i> subsp. <i>glaucescens</i> , <i>Frankenia setosa</i> , <i>Maireana tomentosa</i> , <i>M. trichoptera</i> , <i>Sclerolaena diacantha</i> , <i>Senna</i> sp. Austin (A. Strid 20210).
Floristic Group 4: <i>Allocasuarina</i> low open woodland over <i>Acacia</i> tall open shrubland over <i>Borya</i> low sparse shrubland on slopes		
AdAa	<i>Allocasuarina dielsiana</i> (+/- <i>Acacia umbraculiformis</i>) low open woodland over <i>Acacia acuminata</i> , <i>Allocasuarina tessellata</i> , <i>Acacia karinae</i> tall open shrubland over <i>Borya sphaerocephala</i> low sparse shrubland.	<i>Dodonaea inaequifolia</i> , <i>Melaleuca scalena</i> , <i>Mirbelia microphylla</i> , <i>Brachychiton gregorii</i> , <i>Eucalyptus kochii</i> subsp. <i>plenissima</i> .
Floristic Group 5: <i>Acacia</i> tall open shrubland over <i>Calycopeplus</i> or <i>Allocasuarina</i> mid shrubland on slopes and crests		
AsCp	<i>Acacia sulcataulis</i> and/or <i>Allocasuarina acutivalvis</i> subsp. <i>prinsepiana</i> tall open to closed shrubland over <i>Calycopeplus paucifolius</i> mid sparse shrubland over <i>Philothea deserti</i> subsp. <i>deserti</i> low sparse shrubland.	<i>Allocasuarina acutivalvis</i> subsp. <i>prinsepiana</i> , <i>A. campestris</i> , <i>Eremophila clarkei</i> , <i>Sida</i> sp. Dark Green Fruits (S. van Leeuwen 2260).
AdAt	<i>Acacia duriuscula</i> or <i>Allocasuarina tessellata</i> tall open shrubland.	<i>Acacia acuminata</i> , <i>Allocasuarina campestris</i> , <i>Eremophila clarkei</i> , <i>Malleostemon tuberculatus</i> , <i>Solanum lasiophyllum</i> .

*Modified from Spectrum Ecology (2021b).



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Legend

- Development Area (Red outline)
- Targeted SRE Survey Area (Green outline)
- IBRA Sub-Region
 - AVW01
 - AVW02
 - COO02
 - GES02

- JAF01
- MUR01
- MUR02
- SWA01
- SWA02
- YAL02

Figure 2. IBRA sub-regions (A) and Beard's Vegetation Associations (B) within and around the Mt Mulgine Development Area and Survey Area.

4.3. Geology

Regolith in the Development Area is dominated by exposed rock (saprolite and saprock; Figure 3A; Table 2). Small sections of colluvium and alluvium also occur within the Survey Area, but these appear to be minor. Residual deposits, including ferruginous, siliceous and calcareous duricrust, also occur (Figure 3A). These same geologies extend throughout the Survey Area.

4.4. Land Systems

Landscape mapping by DPIRD (2022) suggests 13 Land Systems occur within the Survey Area (Figure 3B; Table 2). The predominant Land System is the Graves System, which is characterised by basalt and greenstone rises and low hills supporting *Eucalyptus* woodlands with saltbush and bluebush understory (Spectrum Ecology 2021b). All Land Systems in the Survey Area, including the Graves System, are widespread across the Yalgoo Bioregion; all but one (the Singleton System) extend into neighbouring bioregions.

Table 2: Explanatory notes for geology mapping of the Survey Area (see Figure 3).

Layer	Code	Description
Regolith	S	Sandplains of aeolian origins; some residual deposits.
	X	Exposed rock of saprolite and saprock.
	C	Colluvium in slope deposits.
	A	Alluvium in slope deposits
	R	Residual deposits including ferruginous, siliceous, and calcareous duricrust.
Layer	Name	Description
Land Systems	Euchre System	Low granite breakaways with alluvial plains and sandy tracts supporting Eucalypt woodlands and Acacia shrublands.
	Graves System	Basalt and greenstone rises, and low hills supporting Eucalypt woodlands with prominent saltbush and bluebush understoreys.
	Kalli System	Elevated gently undulating red sandplains edged by stripped surfaces on laterite and granite, supporting Acacia tall shrublands with wanderrie grass understoreys.
	Moriarty System	Low greenstone rises and stony plains supporting Chenopod shrublands with patchy eucalypt overstoreys.
	Norie System	Granite hills with exfoliating domes and extensive tor fields, supporting Acacia shrublands.
	Olympic System	Irregular plains with occasional low breakaways and tor fields on granite supporting Acacia shrublands.
	Singleton System	Rugged greenstone ranges with dense Casuarina and Acacia shrublands.
	Tealtoo System	Level to gently undulating loamy plains with fine ironstone gravel mantles supporting dense Acacia shrublands.
	Waguin System	Sandplains and stripped granite or laterite surfaces with low fringing breakaways and lower plains; supports Bowgada and Mulga shrublands with Wanderrie grasses and minor Halophytic shrublands.
	Yalluwin System	Hardpan plains and drainage tracts carrying concentrated flow, supporting Mulga, Curara and other Acacia shrublands.
	Yowie System	Sandy plains supporting tall shrublands of Mulga and Bowgada with patchy Wanderrie grasses.

4.5. TECs and PECs

According to Spectrum Ecology (2021b) two Priority 1 Priority Ecological Communities (PECs) have been recorded within 15 km from the Development Area: Blue Hills Banded Iron Formation (BIF) and Warriedar/Pinyalling/Walagnumming Hills BIF. Both PECs are restricted to BIFs and are listed due to their vegetation assemblages, none of which resemble the vegetation within the Development Area (Spectrum Ecology 2021b). No Threatened Ecological Communities (TECs) have been recorded within 15 km of the Development Area.

5. PREVIOUS SURVEYS IN THE OPERATION AREA

Fauna assessments, including SRE assessments, have been conducted previously within and around the operation (Table 3). While these surveys have collected a variety of species from SRE Groups (reported alongside other desktop search results in Appendix 1), the majority have been targeted towards listed species in the trapdoor spider genus *Idiosoma*, particularly *I. nigrum* (Vulnerable under the EPBC Act) and *I. clypeatum* (Priority 3 under DBCA). These species have previously been reported under various names and codes; this report uses the most up-to-date names for both species, under which *Idiosoma nigrum* is no longer recognised as occurring in or around the operation. This section of the report will synthesise all available information with the latest taxonomic frameworks.

The earliest fauna assessment near the operation was carried out by Bamford (2004) at Blue Hills, located approximately 6 km west. This survey did not specifically target SRE Groups, but opportunistic invertebrate sampling resulted in the collection of unidentified mygalomorph spiders, millipedes and scorpions. Bamford and Bancroft (2006) subsequently assessed fauna values at Gindalbie Metals' Karara and Mungada Projects 5 km west. Opportunistic sampling across this two-phase study collected several species from SRE Groups, including specimens identified as "*Idiosoma nigrum*", among other invertebrate species (Bamford and Bancroft 2006).

The first surveys specifically for SREs were conducted by ecologia (2010, 2011, 2012) at Blue Hills, 7 km to the west. Desktop assessments conducted prior to these surveys (ecologia and Midwest Corporation Limited 2008) recognised *Idiosoma [Aganippe] castellum* and *Idiosoma nigrum* as possibly occurring in the area; specimens identified as "*Idiosoma nigrum*" were subsequently collected in a targeted survey at Blue Hills (ecologia 2012), but have since been re-examined and classified as *Idiosoma clypeatum* following Rix *et al.* (2018a).

Bamford (2013a, 2013b) conducted a targeted vertebrate and SRE invertebrate survey at the Karara Mining Limited haul road, 14 km to the northwest. Their survey targeted Mallee fowl (*Leipoa ocellata*), the Western Spiny-tailed Skink (*Egernia stokesii badia*) and *Idiosoma nigrum*. Bamford (2013a) collected "*Idiosoma nigrum*" throughout the area and highlighted low hills with gravelly loam soils as the most suitable habitat for the species. This was followed by a Level 1 and targeted vertebrate and SRE invertebrate survey in the same area (Bamford 2013b) which identified extensive suitable habitat exists for *I. nigrum* in the area, and estimated a population >19,500 spiders across the Hinge ridge.

ecoscape (2016) conducted a terrestrial fauna assessment at Blue Hills-Mungada East, approximately 5 km to the west. Their report includes a detailed SRE literature review and targeted surveys concerning conservation-sensitive species including *Idiosoma clypeatum* (identified as *Idiosoma* 'MYG018' in the report). Their findings identified 10 potential SRE taxa from the general area within and around Blue Hills (see Table 14 in ecoscape 2016). Additionally, the combined results of ecologia (2012) and ecoscape (2016) suggested that the species' populations were stable, healthy and abundant, and highlighted the affinity of the species for two widespread *Acacia* species, namely *A. ramulosa* var. *ramulosa* and *A. caesaneura*.

APM (2018a, b) targeted and Level 1 survey targeted *Idiosoma* species within the Tungsten tenure and collected, in addition to *I. clypeatum*, two newly recognised species: *I. formosum* and *I. kopejtkorum*.

Their results suggested a density ranging from 6.25 – 14.3 northern shield-backed trapdoor spider burrows per hectare, depending on habitat suitability. The presence of *Idiosoma nigrum* within the Tungsten tenure was considered unlikely (APM 2018a, b); prior records of that species from the area are now considered to have used outdated taxonomy, and their identities have been revised.

The most recent fauna survey was undertaken between 2019-2021 (Spectrum Ecology 2021a) which included a comprehensive survey of SRE invertebrate fauna. They collected *Idiosoma clypeatum*, *I. intermedium*, and the Priority 1 *I. gutharuka* from within the Development Area, amongst other conservation-significant vertebrate fauna species. The comprehensive SRE invertebrate survey also recovered a total of 30 taxa belonging to SRE Groups, of which 19 were considered Potential SREs, and 4 have only been collected from within the Development Area (three undescribed mygalomorph spiders and one undescribed isopod).

Table 3. Previous fauna assessments conducted in or near the Project.

Reference	Title	Survey Type	Location from the Development Area
Bamford (2004)	Blue Hills Fauna Assessment	General fauna survey, with opportunistic SRE collection.	6 km west
Bamford and Bancroft (2006)	Fauna values of Gindalbie Metals' Karara & Mungada Haematite/Magnetite Project	General fauna survey, with opportunistic SRE collection.	5 km west
ecologia (2010)	Blue Hills Short-Range Endemic invertebrate survey	Level 2 SRE assessment	7 km west
ecologia (2011)	Blue Hills Additional Short-Range Endemic invertebrate survey	Level 2 SRE assessment	7 km west
ecologia (2012)	Blue Hills <i>Idiosoma nigrum</i> targeted survey	Targeted invertebrate fauna survey	7 km west
Bamford (2013a)	Hinge Project area fauna assessment	Level 1 & targeted vertebrate and SRE invertebrate survey	14 km north-west
Bamford (2013b)	Significant fauna survey of the Hinge Haul Road: November 2012	Targeted vertebrate and SRE invertebrate survey	14 km north-west
ecoscape (2016)	Blue Hills – Mungada East terrestrial fauna assessment	Consolidation and targeted terrestrial fauna survey	5 km west
APM (2018a)	Mt Mulgine project – Mulgine Hill M59/425 – M59/387. Targeted survey for Threatened and Priority flora, and conservation significant fauna habitat. Murchison, WA.	Targeted flora and fauna	Within the Development Area.
APM (2018b)	Mt Mulgine Project biological survey. Rothsay, WA.	Detailed flora; Level 1 fauna	Within the Development Area.
Spectrum Ecology 2021a	Mt Mulgine Terrestrial Fauna Assessment	Level 2 Terrestrial Fauna Assessment	Within the Development Area.

6. METHODS

6.1. Desktop Assessment

The desktop assessment combined three sources of information using GIS mapping: records of occurrence of species belonging to SRE Groups provided by the Western Australia Museum (WAM); records of occurrence of species from SRE Groups stored in Bennelongia's database; and any publicly available information such as published papers or scientific reports accessible via online portals (such as Atlas of Living Australia and the Australian Faunal Directory). Additionally, Spectrum Ecology (2021a) collection records were included as part of the desktop assessment. Specimens that are not identified to the species level were counted as distinct species only if their group was not represented elsewhere in the data. For example, an unidentified land snail in a dataset otherwise lacking snails would be counted as a distinct species, but an unidentified snail in a dataset with other snails would not, as it could belong to one of the other species found. Specimens that cannot be identified to the species level are considered "higher-order identifications" and are referred to as such in this report. Conversely, specimens may be identified to the species level but not to any species previously described in the taxonomic literature. These specimens carry identifying codes rather than full scientific names and are considered distinct species.

Database searches covered an area of 10,000 km² centred on the Development Area (28.7319314°S, 116.4468161°E to 29.6385369°S, 117.5009677°E; Figure 4). Database searches were combined and filtered to include species belonging to taxonomic groups known to contain SRE species ('SRE Groups') and to exclude other records. Where possible, each taxon was categorised according to the Western Australia Museum SRE classification scheme (Section 2.1). Categorisation was based on a combination of information regarding the taxon's known distribution, habitat preferences and extent and biology. Analysis and mapping were undertaken using ArcGIS Pro v2.9.5.

6.2. Field Survey

A two-round field survey in search for invertebrates belonging to SRE Groups was carried out from 15-17 July 2024 by Kevin Sagastume-Espinoza and Jaxon Haines, and from 28-30 October 2024 by Jaxon Haines and Ethan Lamont. Originally, a single round of the survey was planned, but rain events before the first round of the survey left the vehicle bogged, making it impossible to complete the survey as scheduled. The second round was scheduled to sample the remaining unsurveyed sites (n = 8).

During the survey, a total of 25 sites were sampled via hand foraging techniques in the Survey Area: 12 sites in the Development Area were considered "impact sites", and 13 sites elsewhere in the Survey Area were considered "reference sites" (Figure 5). Not all "impact sites" will be affected by proposed activities, but, on average, the distinction between impact and reference zones is helpful for understanding the potential impacts of the operation on SRE species. Site photographs are presented in Appendix 3.

The aim of the survey was to collect species from representative habitat types in the Survey Area, with the survey design and effort informed by the desktop assessment. Additionally, the survey targeted three specific SRE Groups: trapdoor spiders (particularly *Idiosoma*), millipedes (particularly *Antichiropus* and the family Siphonotidae) and isopods (slaters).

6.2.1. Sampling Techniques

Sampling techniques followed published guidelines (EPA 2016b). At least one hour was spent by two team-members hand foraging at each site. Hand foraging involved actively searching for taxa belonging to the SRE Groups in their preferred habitats. Techniques used at each site were selected based on observation of available habitats and basic assumptions about the target species' (or Group's) biology. The hand foraging techniques that were used are:

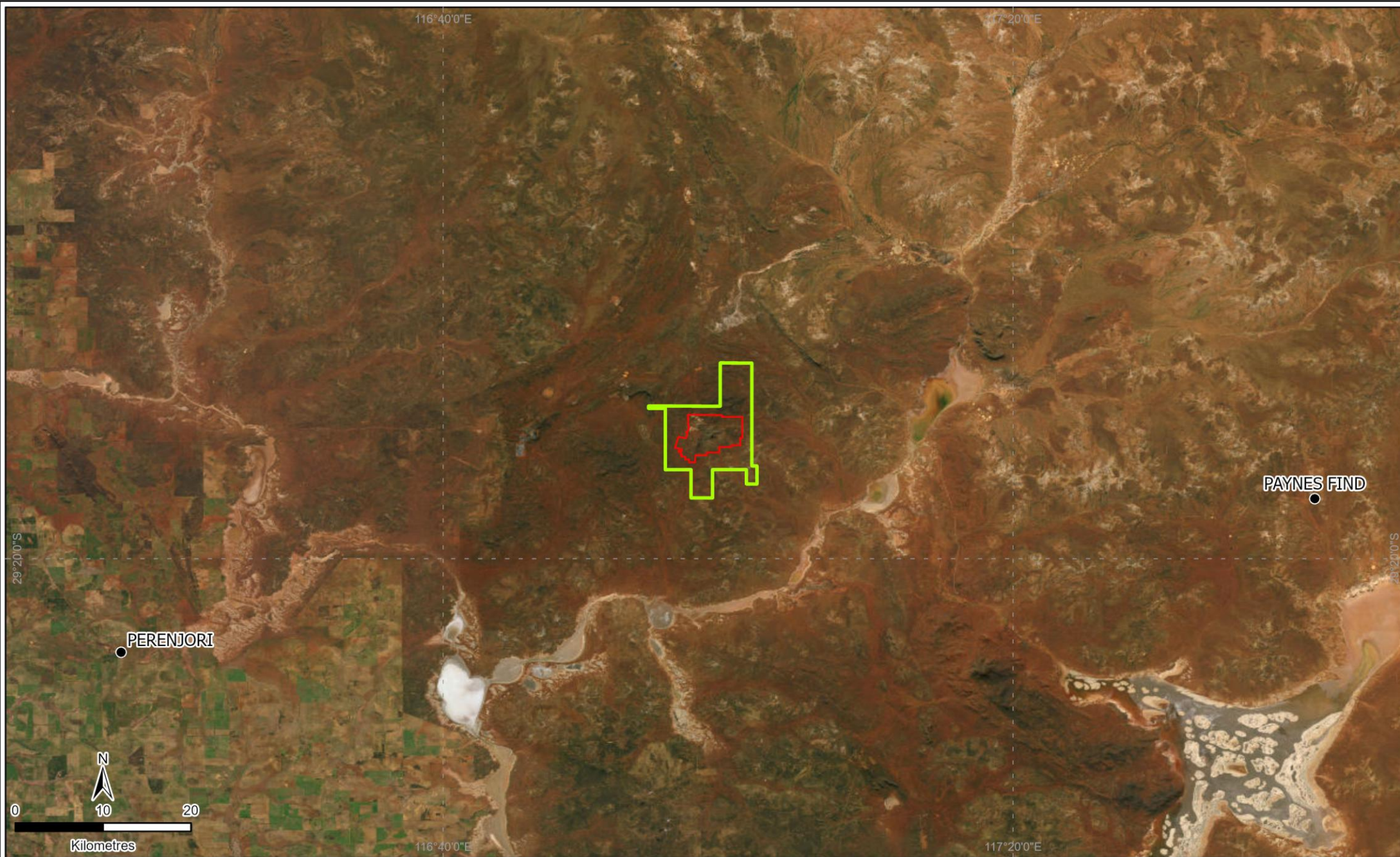
- *Log flipping and raking*: turning over and breaking apart logs and dead wood in search of isopods, myriapods and pseudoscorpions. Raking also helps to uncover camouflaged

mygalomorph spider burrows or to uncover buried land snails that may aestivate below the surface.

- *Rock flipping*: turning over rocks and other debris in search of harvestmen, centipedes and isopods. Rocks were returned to their natural position when possible.
- *Leaf litter sieving*: sieving leaf litter to target litter- and soil-dwelling species. Leaf litter sieving also uncovers small-bodied SRE species (such as pseudoscorpions, millipedes and land snails). Two leaf litter samples per site were collected and transported in cloth bags to the laboratory and placed in Tullgren funnels to collect litter-dwelling invertebrates.
- *Leaf blowing*: hand-held leaf blowers were used to remove leaf litter and reveal mygalomorph spider burrows covered by litter or otherwise difficult to identify unaided. If found, burrows were examined; burrows likely to house a mygalomorph spider were then excavated.
- *Bark peeling and tree digging*: removing pieces of bark from trees with smooth and exfoliating bark for inspection, and removing dirt from the bases of trees to search for SRE taxa. These techniques were only applied at sites containing trees (i.e. not only shrubs or spinifex).

6.2.2. SRE Targeted Groups Consolidated List

The additional targeted SRE survey presented in this report, in combination with results from the desktop assessment, lead to a consolidated list of species from targeted SRE Groups. The targeted Groups comprise mygalomorph (trapdoor) spiders, millipedes from the genus *Antichiropus* and isopods. However, the field survey also collected representatives from SRE Groups other than the targeted Groups. Targeted Groups were defined by the client as taxonomical groups of particular interest based on their conservation significance (trapdoor spiders and *Antichiropus* millipedes), or poor taxonomical knowledge (isopods).





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 Author: K. Sagastume
 Date: 10/03/2026

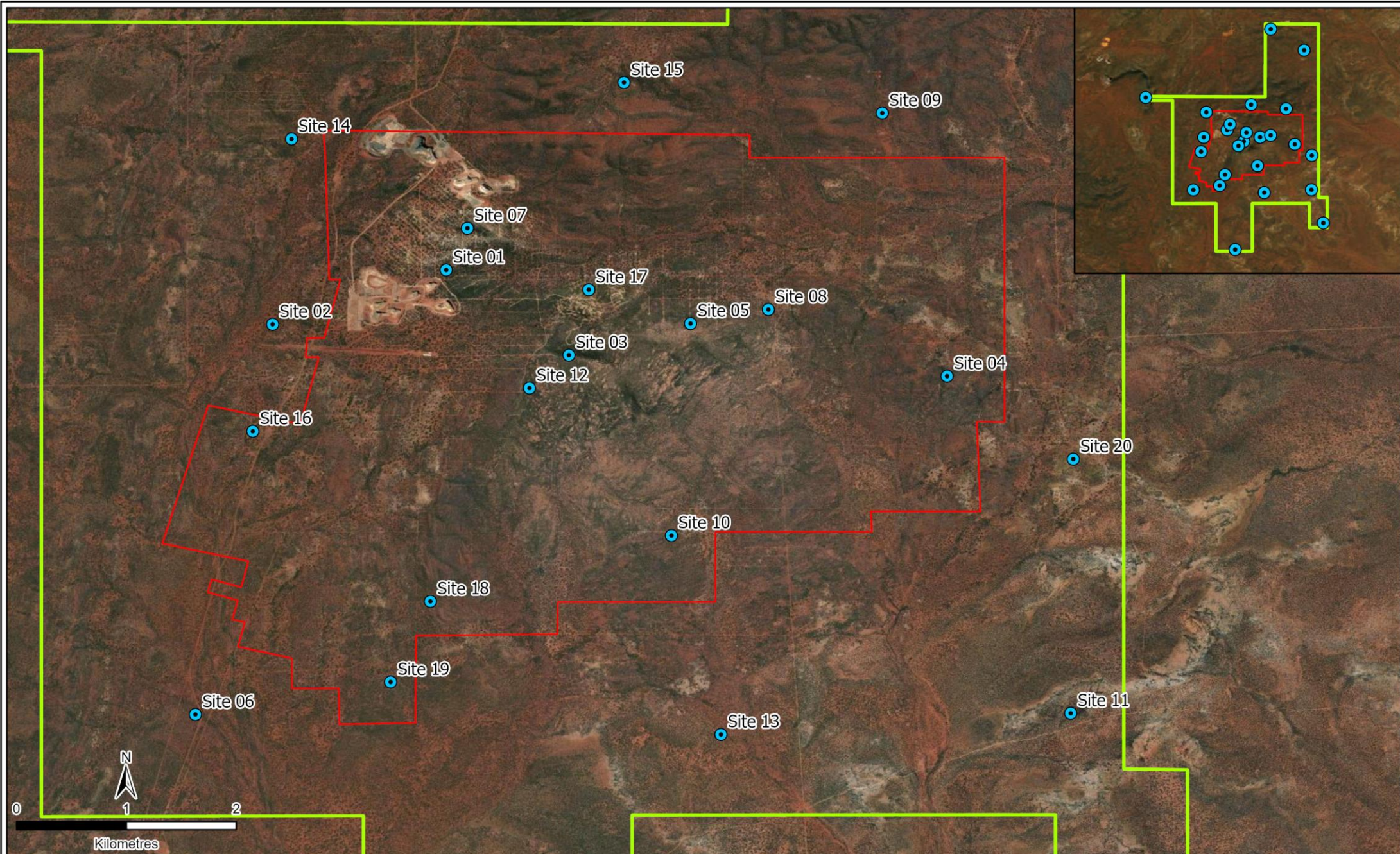


PAYNES FIND
 PERTH

Legend

- Development Area
- Targeted SRE Survey Area

Figure 4. Desktop search area around the Mt Mulgine Development Area and Survey Area.



GCS GDA 1994
 Author: K. Sagastume
 Date: 10/03/2026



Legend

- Development Area
- Targeted SRE Survey Area
- Mt Mulgine Project SRE Sites

Figure 5. Targeted SRE survey sites within the Mt Mulgine Survey Area.

Inset shows survey sites within the full extent of the Survey Area.

6.2.3. Preservation and Identification of Samples

Specimens collected in the field through hand foraging techniques were placed in 100% ethanol and transported to Bennelongia's laboratory for identification. Specimens were first sorted and separated from by-catch. When a specimen belonging to an SRE Group was found during this process, it was transferred to a labelled vial containing 100% ethanol for further identification.

The expertise of the team members involved in the field and identification is presented in Table 4. Morphological identifications were made using Leica stereomicroscopes. No animals have been lodged to the WAM at this stage.

Table 4. Details of Personnel Involved in the Survey.

Name	Contribution	Role	Taxonomic Group
Kevin Sagastume-Espinoza	Report writing, field survey, morphological IDs	Principal Biologist	Spiders and scorpions
Huon Clark	Morphological IDs	Principal Biologist	Isopods
Ana Vasconcelos	Morphological IDs	Senior Biologist	Pseudoscorpions
Ella Carstens	Morphological IDs	Biologist	Centipedes
Melita Pennifold	Morphological IDs	Senior Scientist	Millipedes and snails
Heather McLetchie	DNA extraction and sequencing	Biologist	
Veera Haslam	DNA extraction, sequencing and analysis	Biologist	Snails
Vitor Marques	GIS specialist	Senior Biologist	
Jaxon Haines	Field survey	Biologist	
Ethan Lamont	Field survey	Biologist	

6.2.4. Molecular Methods

During the identification process, specimens that were unidentifiable because of unclear characteristics (e.g. juvenile or damaged specimens) or unresolved taxonomy were flagged for molecular sequencing. Thirty-six specimens from the Survey Area and two additional reference animals from nearby localities were identified and subsequently sequenced using this method.

For all samples, mitochondrial DNA was extracted using a Qiagen DNeasy Blood & Tissue kit (Qiagen 2006). For smaller animals such as pseudoscorpions, legs and other body parts (e.g. sections of the abdomen) were used for DNA extraction. For larger animals, and where possible, muscle tissue was collected from the legs. Elute volumes varied from 50 µL to 100 µL, and were dependent on the age, condition and quantity of material available.

Primer combinations used for PCR amplifications were LCO1490:HCO2198, C1J1718:HCO2198, and LCO1490:HCOoutout, targeting the COI region of the mitochondrial genome and 16SAR-L:16SBR-H, C1N2191Nancy:LCO1490, and LRJ12887:16SRscorp targeting the 16S gene (Folmer *et al.* 1994; Schwendinger and Giribet 2005). PCR products were sequenced using dual-direction Sanger sequencing carried out by the Australian Genome Research Facility (AGRF). The returned sequences were edited and aligned manually in Geneious Prime v2022.2.2 (<https://www.geneious.com>).

Pairwise genetic distances to related sequences in the Bennelongia database were calculated as uncorrected p-distances (total percentage of nucleotide differences between sequences) in Geneious. Similarity to all sequences in the non-redundant nucleotide database at GenBank was determined using the Basic Local Alignment Search Tool nucleotide (BLAST) suite of applications (<https://blast.ncbi.nlm.nih.gov/Blast.cgi>) (Altschul *et al.* 1990). Publicly available sequences on GenBank were included in phylogenetic analysis to provide a framework for assessing intra- versus interspecific

variation, examine levels of differentiation among individuals within described species across their geographic ranges and determine species boundaries. To visualise genetic distances and phylogenetic relationships between taxa, distance-based phylogenetic trees using the Tamura-Nei genetic distance were generated, also in Geneious. These trees were used in analysis but are not replicated in this report.

6.2.5. SRE Habitat Mapping

Habitat maps made by Spectrum Ecology (2021a) were modified in combination with publicly available layers such as vegetation layers, geological layers (regolith) and landscape mapping layers to produce updated maps of SRE-suitable habitat types in the Survey Area. The focus of SRE habitat mapping is not to recognise either vegetation units or unique landforms, but to overlay both in efforts to identify distinct habitat categories exploitable by SREs. Synthesising both biotic and abiotic spatial data facilitates a finer delineation of habitats. This integrated approach enables assessment of potential impacts on SRE species through the lens of the habitats they use.

7. DESKTOP ASSESSMENT

7.1. Desktop Search Results

Compilation of data from WAM, Bennelongia and Spectrum Ecology (2021a) recognised 1,878 specimens from at least 142 species in the desktop search area (Figure 6; Appendix 1). The following SRE Groups were represented among the records: trapdoor spiders (Mygalomorphae), slaters (Isopoda), centipedes (Chilopoda), pseudoscorpions (Pseudoscorpiones), scorpions (Scorpiones) and land snails (Stylommatophora). Each of these SRE Groups is considered in turn in Section 7.2. Among these species, SRE categorisation recognised six Confirmed SREs, five Likely Potential SREs, 13 Unlikely Potential SREs, 62 Data Deficient Potential SREs and 57 Widespread species. Six of the 143 species have been listed as Endangered or Priority; these are discussed in detail in Section 7.3.

7.2. SRE Groups in the Search Area

Gastropoda (land snails)

Fourteen species of land snails were recovered from the search area (Appendix 1). Of these, only one, *Bothriembryon sedgwicki*, was categorised as a Likely Potential SRE; three were categorised as Data Deficient Potential SREs because they were higher-order identifications; and the remaining 10 species are Widespread.

Bothriembryon sedgwicki is represented in the search results by six specimens collected within the Development Area. Its classification may not be accurate; the species' known distribution is highly localised to the Merredin area, approximately 280 km southeast of the Survey Area (Atlas of Living Australia 2025; Stanicic *et al.* 2017). Molecular analysis has not been carried out to resolve the specimens' identity. Nevertheless, morphologically the specimens resemble *B. sedgwicki* and in any case the genus is rich in species with restricted distributions, so these specimens have been categorised as Likely Potential SRE.

Harvestmen

A single, undescribed species (*Megalopsalis* 'sp.') was recovered in the desktop search and categorised as a Data Deficient Potential SRE based on taxonomical uncertainty. It is not expected to represent a conservation-significant or restricted species.

Pseudoscorpions

Epigean pseudoscorpion species are generally considered widespread, and few are expected to be SREs (Harvey 2002). Notably, however, some species are restricted to specialist habitats, including granite outcrops and have limited distributions (Harvey 2010, 2012; Harvey 2018; Harvey *et al.* 2015a). Phoresy (dispersal by means of attachment to a host organism) has been documented for many families of

pseudoscorpion (Jhasser Martínez *et al.* 2018; Lira and Tizo-Pedroso 2017; Muchmore 1972), which might allow movement outside of restricted habitats. However, pseudoscorpion taxonomy is poorly resolved, largely due to high diversity, and thus accurate range determination can be difficult.

The desktop search detected at least 23 species of pseudoscorpions in the search area (Appendix 1). Of these, one species is a Confirmed SRE, *Synsphyronus christopherdarwini*, known only from the type locality of Charles Darwin Reserve, approximately 40 km southeast of the Survey Area. Given all efforts to locate the species from nearby areas have failed (Harvey 2012), it is not expected the species will be present at Mulgine.

Additionally, 19 Data Deficient Potential SRE species were identified in the desktop search area (Appendix 1). Among these are seven higher-order identifications, but also eight species with different codes assigned by different consultancies (Bennelongia and Alacran). Three *Austrochthonius* species, namely A. `BPS295`, A. `BPS296`, and A. `BPS308`, have been identified in Alacran (2021) as A. MH1, A. MH2, and A. MH3. Given the lack of genetic data on either end (Bennelongia and Alacran), it is hard to determine which B- code aligns with which MH- code. Therefore, we have retained Bennelongia codes in the species list (Appendix 1).

The same principle is followed by three other species, namely *Beierolpium* `sp. 8/4` `BPS303`, B. `sp. 8/4` `BPS304` (identified as B. 8/4 MH3 in Alacran 2021), and *Indolpium* `BPS302` (identified as *Indolpium* sp. in Alacran 2021). Neither of these species have been sequenced and aligning them taxonomically is a difficult task without access to the specimens. We retain Bennelongia species codes based on morphological characteristics (Bennelongia 2020). Finally, three species have Widespread distributions and are not of conservation concern.

Scorpions

The desktop search recovered at least 22 species of scorpions from three families (Appendix 1). Three species are categorised as Unlikely Potential SREs, five as Data Deficient Potential SREs based on poor taxonomical knowledge, and fourteen as Widespread.

The three Unlikely Potential SREs (*Urodacus* `gibson 2`, U. `gibson 4` and U. `gibson 5`) collected from the Mt. Gibson area approximately 45 km to the southeast are not expected to occur in the Survey Area or to have restricted distributions. The Data Deficient Potential SRE species collected at Mt. Gibson or at Blue Hills, less than 10 km from the Survey Area. The species collected from Blue Hills, *Urodacus* `blue hills`, U. `koolanooka` and U. `SCO015, karara`, may occur within the Development Area but have not been collected to date.

Mygalomorph (trapdoor) spiders

In total, 42 species from 7 families of mygalomorph (trapdoor) spiders were recovered from the search area (Appendix 1). Among these species, three are Confirmed SREs, one Likely Potential SRE, five Unlikely Potential SREs, seventeen Data Deficient Potential SREs, and sixteen Widespread species. Each of the three Confirmed SREs, *Idiosoma formosum*, *I. gutharuka* and *I. kopejtkorum*, has a distribution <5,000 km². Of the three species, only *I. gutharuka* has been recorded from the Development Area.

Another mygalomorph species, *Bungulla inermis*, has been categorised as a Likely Potential SRE as it is known to have a distribution restricted to the Avon Wheatbelt and Geraldton Sandplains Bioregions, with a linear range of approximately 480 km (Atlas of Living Australia 2025; Rix *et al.* 2018b). The records recovered for this species all come from near Mt. Gibson, over 40 km southeast of the operation. The species is not expected to occur within the Development Area.

Five undescribed species, *Missulena* sp. B05, *Aname* `Mt Gibson 1`, A. `MYG332`, A. `MYG363` and *Cethegus* cf. *fugax* sp. B02, have been categorised as Unlikely Potential SREs because they occupy widespread habitats or come from genera that are generally widespread. The closest record for either of these species is one of *Aname* `MYG332` which is found approximately 30 km to the southeast around

the junction of Wubin-Paynes Find Road with Yalgoo Road. None of these species are expected to occur within the Development Area.

A total of 17 mygalomorph species, all undescribed, have been categorised as Data Deficient Potential SREs based on incomplete taxonomical knowledge. Moreover, little is known about their distribution or habitat requirements. One species, *Aname* `BMYG177` (reported as *Aname* MH1 by Alacran, 2021), is currently known only from the Development Area, but it is expected that the species will also be found in the surrounding area.

The remaining 16 mygalomorph species are Widespread (Appendix 1).

Isopods (slaters)

In Australia, the order Isopoda contains a diverse and largely undescribed group of terrestrial epigean crustaceans (suborder Oniscidae) that, due to poor dispersal capabilities and specific habitat preferences, are often SREs (Judd 2004; Judd and Horwitz 2003; Judd and Tati 2011). The desktop search recorded 14 species of slaters in the search area (Appendix 1). Among these only one, the Unlikely Potential SRE species *Buddelundia* `sp. B30`, is known from the Development Area; this species it is also known from near Mummaloo and has a linear range of over 60 km, so it is not expected this species' distribution is restricted.

Nine undescribed isopod species have been categorised as Data Deficient Potential SREs based on poor taxonomical knowledge. Two of these species, *Paraplatyarthus* `BIS410` and *P.* `BIS420`, are known only from the Development Area. Reported as a single species (*Paraplatyarthus* sp. MH1) in Alacran (2021), molecular sequencing data differentiate these as separate species.

The remaining four species, including the only described species *Buddelundia sulcata*, are Widespread and are of no conservation concern.

Centipedes (Geophilida; Scolopendrida; Scutigera)

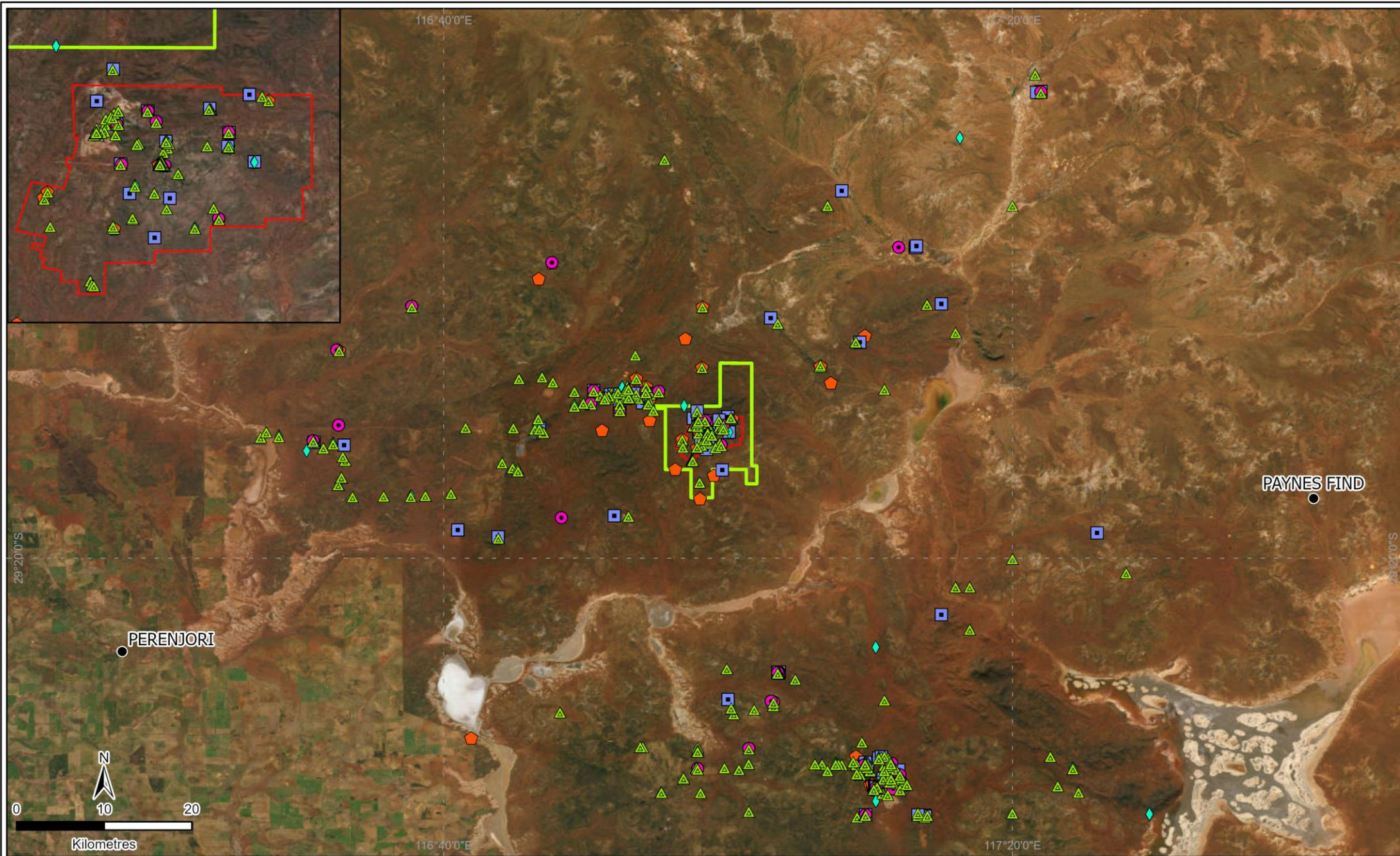
Thirteen species of centipedes were recovered in the search area including two Unlikely Potential SREs, *Sepenodophilus* `sp. B02` and *Mecistocephalus* `sp. B06`, both of which are known from near Mummaloo and have been collected from widespread habitats. Five species were categorised as Data Deficient Potential SREs, all but one based on poor taxonomical knowledge. The remaining species, *Australoschendyla* `BGE049` (capensis?), was categorised as a Data Deficient Potential SRE because it is known only from two localities within the Development Area, 2 km apart. The remaining six species are Widespread.

Millipedes (Polydesmida; Polyxenida; Polyzoniida; Spirostrepida)

At least 13 species of millipedes were recovered in the desktop assessment (Appendix 1). Two species are Confirmed SREs, *Antichiropus alatus* and *A. sagittulus*; both are known only from their respective type localities near Mt. Gibson Station (Car and Harvey 2014). The closest known occurrences of these localities are between 45-55 km from the Development Area, so *Antichiropus* are not expected to occur within development boundaries.

Additionally, three Likely Potential SRE and one Unlikely Potential SRE species have been recovered from the search area, all from the SRE-rich genus *Antichiropus*. One Likely Potential SRE species, *Antichiropus* `BDI070`, is currently known only from the Development Area, while the other three species have been recorded either from Karara Station, Blue Hills or Charles Darwin Reserve. Although the latter have not been recorded from the Development Area, the species from Karara Station and Blue Hills may occur there.

Finally, three undescribed Data Deficient Potential SRE species and four Widespread species were also recovered in the desktop search.



7.3. Threatened and Priority Species

Two of the 143 species recovered from the desktop assessment are Endangered under the BC Act (DBCA 2024): the trapdoor spiders *Idiosoma formosum* and *I. kopejtkorum*. An additional four species are recognised as Priority species by DBCA: *Idiosoma gutharuka* (Priority 1), *I. clypeatum* and *I. intermedium* (Priority 3) and *I. castellum* (Priority 4). Note that a species' distribution is only one criterion used when making listings of this kind; population size, population decline, habitat availability and threatening processes are also key criteria. Thus, it is possible for a Widespread species to be threatened and listed accordingly.

DBCA's Priority listings descend with perceived risk, i.e. a Priority 1 species is perceived to be at greater risk than a Priority 3 species (Appendix 2). Priority is assigned primarily based on the number of known locations (i.e. discontinuous populations) in combination with information about population size and decline, and any ongoing processes that may threaten species persistence. A lower Priority number indicates fewer known locations and/or more known threatening processes. DBCA recommends further survey for all Priority listed species; further information about species usually results in the species either being moved to the BC Act list (i.e. assigned a threatened status such as Vulnerable or Endangered) or being given a lower Priority.

Ornate shield-backed trapdoor spider (*Idiosoma formosum*), EN

Idiosoma formosum has an extent of occurrence less than 4,000 km² and an area of occupancy within it of less than 500 km²; the main threats to the species are clearing activities associated with mining and mineral resource development (Rix *et al.* 2018a). This species is restricted to the Lake Moore catchment from near Rothsay in the north to Mungari Nature Reserve and Dajoing Rock in the southeast, with the closest known record approximately 40 km from the Development Area. The distribution appears to correspond to red clay soils west and southeast of Lake Moore. Given the species has a well-defined and restricted distribution and since numerous SRE surveys have failed to record the species within the Development Area, it is not expected to occur and thus is not likely to be impacted.

Lake Goorly shield-backed trapdoor spider (*Idiosoma kopejtkorum*), EN

Idiosoma kopejtkorum has a restricted range to the north-eastern Wheatbelt bioregion of south-western Western Australia, in a relatively small area surrounding Lake Goorly (Rix *et al.* 2018a), where it has a distribution <5,000 km² (Bennelongia 2024) ranging from Charles Darwin Nature Reserve, Mt. Gibson and Mummaloo-Wye-bubba Hill in the north, southwest to Coorow, and south to Goodlands and the Maya, Buntine and Snake Gully Nature Reserves, all north of Dalwallinu (Rix *et al.* 2018a). As with *I. formosum*, the species has been listed as Endangered, given its populations are under multiple threats, particularly from mining and mineral resources around the Mt. Gibson area. *Idiosoma kopejtkorum* is restricted to the Lake Goorly area, where recent efforts to confirm its presence in areas as close as 20 linear km from Mt. Gibson failed (Bennelongia 2024), it is therefore not expected to occur within the Development Area and thus is not likely to be impacted.

Gutha-Pintharuka shield-backed trapdoor spider (*Idiosoma gutharuka*), P1

Idiosoma gutharuka has a distribution in the northern Wheatbelt Bioregion, where it was previously known only from a single specimen at the type locality of Gutha near Pintharuka, approximately 100 km west of the Development Area (Rix *et al.* 2018a). However, survey efforts have since identified a high density of the species occurring within the Development Area and from two additional localities approximately 4 and 12 km from the Development Area (Spectrum Ecology 2021a), indicating a linear range for the species >120 km. The high density of *Idiosoma gutharuka* records within the Development Area is a result of survey efforts and does not represent a hotspot for this species. Rather, it is expected that the species will be distributed along its 120 km linear range.

Spectrum Ecology (2021a) found that the habitats where *Idiosoma gutharuka* has been collected are primarily *Allocasuarina* shrublands on granitic or greenstone metamorphic rocks. Within the

Development Area, the species has been recorded from granite outcrops with mixed vegetation; this habitat type is relatively restricted within the Development Area, however does extend into areas outside development boundaries. Therefore, given its known linear range, any potential impacts on this species resulting from the operation are expected to be minor. Further mitigation of conservation concerns (such as translocation of specimens) could be considered to reduce the impact on this Priority species.

Northern shield-backed trapdoor spider (*Idiosoma clypeatum*), P3

Idiosoma clypeatum has a widespread distribution across 120,000 km² across Western Australia's inland arid zone, principally throughout the Yalgoo and Murchison Bioregions, extending from near Paynes Find, Blue Hills Range, Kadji Kadji Nature Reserve and Karara in the south, north and northeast to at least Coolcalalaya Homestead, Jack Hills, Albion Downs, Yakabindie and Yeelirrie (Rix *et al.* 2018a). Although it has a distribution >120,000 km², a recommendation for listing as Priority 3 was made by Rix *et al.* (2018a) in recognition of its occurrence in areas prospective for mining and mineral resources.

The high density of *Idiosoma clypeatum* across the Development Area (Spectrum Ecology 2021a) is a result of survey efforts and does not represent a hotspot for this species. Nevertheless, conservation efforts such as translocation of the species to undisturbed areas could help minimise the potential impact on this species.

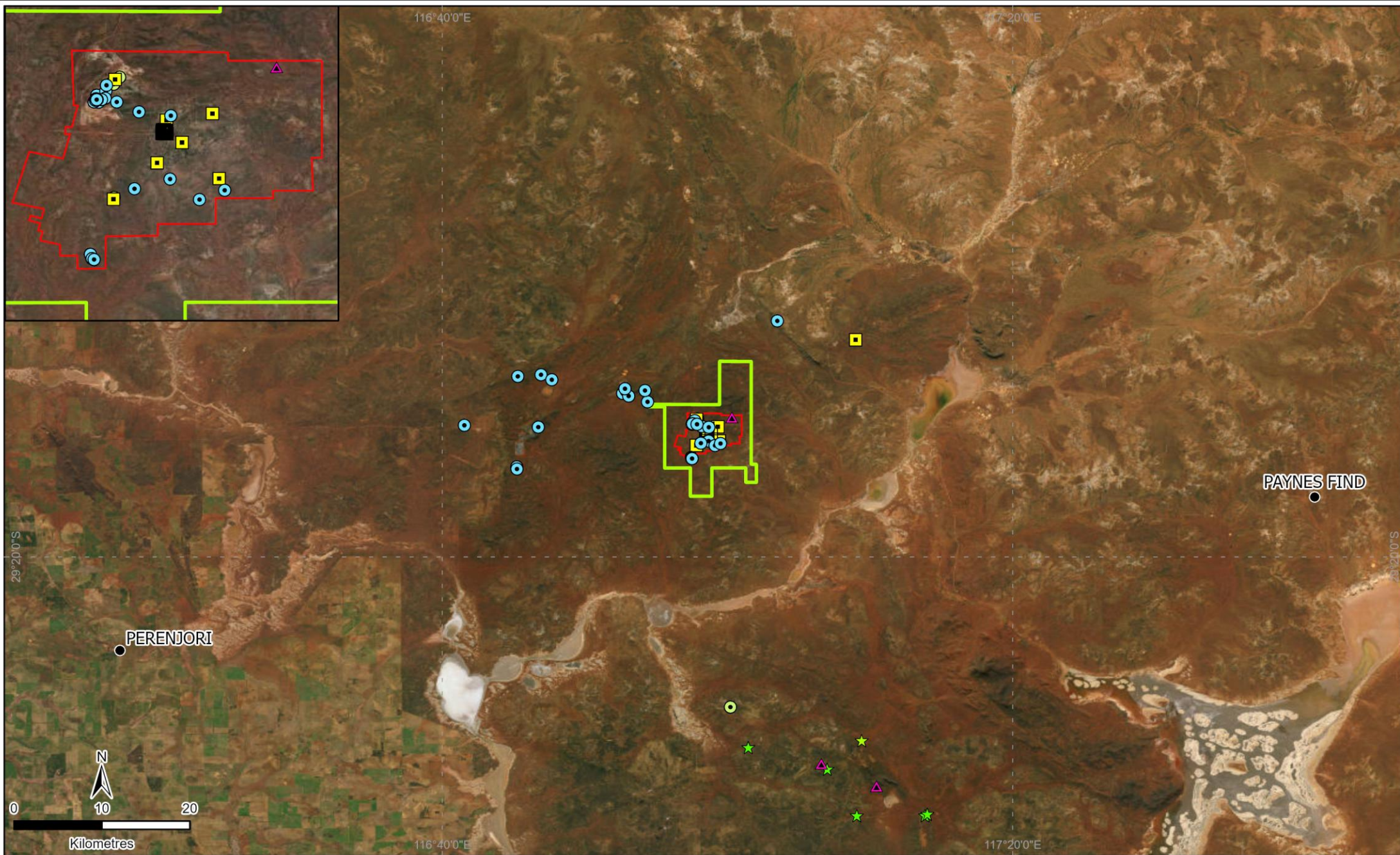
Coolgardie shield-backed trapdoor spider (*Idiosoma intermedium*), P3

Idiosoma intermedium has a widespread but poorly defined distribution in the eastern Wheatbelt and north-western Coolgardie Bioregions of Western Australia, of at least 14,500 km² (Rix *et al.* 2018a). Its known range extends from Bodallin north of Billiburning Rock in the eastern Wheatbelt, east to near the Helena-Aurora Range, Mount Manning and Koolyanobbing in the Coolgardie Bioregion. Rix *et al.* (2018a) recommended Priority 3 listing due to the occurrence of the species in areas prospective for mining and mineral resources.

Idiosoma intermedium has been collected from the Development Area and from surrounding areas by Spectrum Ecology (2021a). In the Development Area, the species has been recorded from granite outcrops, mixed shrublands and eucalypt woodland habitats. The widespread nature of these habitat types, in combination with the widespread distribution of the species, suggests that the proposed activities are unlikely to have significant impacts on the species' populations.

Tree-stem trapdoor spider (*Idiosoma castellum*), P4

Idiosoma castellum is a widespread species with a range of approximately 55,900 km² (Atlas of Living Australia 2025). The species was transferred to the genus *Idiosoma* (previously in *Aganippe*) by Rix *et al.* (2017). The lower Priority 4 category, compared to higher categories, indicates the species has been adequately surveyed and is known to be rare and near threatened, but is not listed as a conservation-dependent specially protected species (DBCA 2024). One record for this species has been collected from the Development Area by Bamford (2013) in a locality labelled "ca. 3 km SE of Mulgine Hill". Additional records have been identified over 40 km southeast of the Development Area. Accordingly, the species is likely to be found more abundantly throughout the desktop search area. Given the likely widespread distribution of the species and the habitats where it has been collected, it is not expected that the development of the proposed activities will affect the species.



8. FIELD SURVEY

8.1. Survey timing and limitations

Many SRE Groups require high humidity and therefore are most active and most likely to be collected during and immediately following substantial rainfall. A total of 24.6 mm of rain was recorded the week leading up to the first round of the field survey, which ran from 15-17 July 2024 (BOM 2025). No rain was recorded before the second round of the survey, but 2.0 mm of rain was recorded during the first day of the second round, which was carried out on 28-30 October 2024 (BOM 2025). This suggests adequate humidity to facilitate the activity of invertebrates belonging to SRE Groups in both rounds, in turn leading to a good representation of biodiversity within the Survey Area.

8.2. Habitat

Habitat mapping conducted by Bennelongia for the present report extends the area mapped to encompass the Survey Area (~11,386 ha). This process identified seven habitats prospective for SRE terrestrial invertebrate fauna and one habitat, Cleared Areas, not prospective for SREs (Table 5; Figure 8). The area occupied by each habitat type ranges from 3% ('Granite outcrops') to 40% ('Low hills with mixed shrublands; Table 5).

8.3. Survey Results

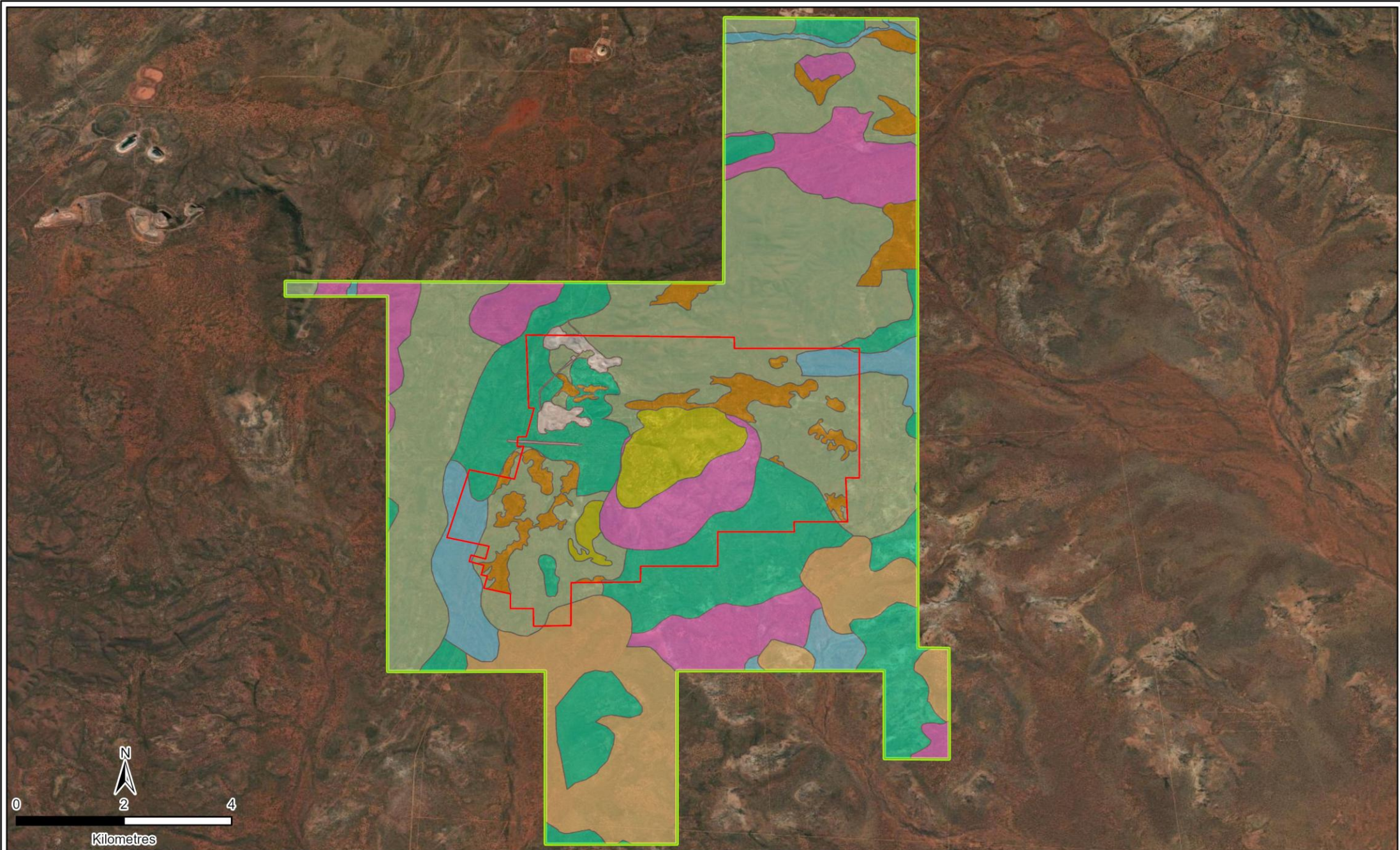
The survey collected 216 specimens from at least 40 species belonging to SRE Groups. Some specimens were immature or belonged to the nondiagnostic sex so could only be classified to levels higher than species; thus, they could not be aligned with other species collected and it is not possible to determine whether the higher-order specimens belong to other species in the collection or represent distinct species. Accordingly, higher-order specimens are not considered distinct species unless they are the only representative of their respective grouping.

Species collected comprise four species of land snail, five species of pseudoscorpion, two species of scorpion, nine species of mygalomorph spider, four species of isopod, twelve species of centipede and three species of millipede (Table 6). Millipedes and centipedes were the most abundant SRE Groups recorded from the survey, accounting for 50% of the samples collected. The least abundant SRE Groups were scorpions and slaters, accounting for 10% of the samples collected.

Table 5. SRE habitats identified within the Survey Area around the Development Area.

No.	SRE Habitat	Description	Area (Ha)	% of Area	SRE Prospectivity
1	Low hills with mixed shrublands	Low basalt and rugged greenstone ranges with dense Casuarina and Acacia shrublands.	4,523	40%	Moderate prospectivity for SRE species as the multiple vegetation types can provide refuge for different groups such as pseudoscorpions, centipedes, scorpions and mygalomorph spiders. However, these are rarely isolated habitats and are often exploited by generalist species.
2	Stony plains with mixed shrubland	Low rises and stony plains supporting Chenopod shrublands with patchy Eucalypt overstoreys.	2,359	21%	Ideal for generalist species within the different SRE Groups, such as mygalomorph spiders, slaters and centipedes. *
3	Mixed shrublands	Mixed shrublands of Acacia, Casuarina, Chenopod or Bowgada over low hills and plains.	1,470	13%	Moderate prospectivity for SRE species as the multiple vegetation types can provide refuge for different groups such as pseudoscorpions, centipedes, scorpions and mygalomorph spiders. However, these are rarely isolated habitats and are often exploited by generalist species.
4	Sandplains with mixed shrubland	Low plains supporting tall shrublands of Mulga and Bowgada with patchy Wanderrie grasses and minor Halophytic shrublands.	1,382	12%	Ideal for generalist species within the different SRE Groups, such as mygalomorph spiders, slaters and centipedes. *
5	Floodplains and drainage areas	Carrying concentrated flow, supporting Mulga, Curara and other Acacia shrublands.	588	5%	Ideal for generalist species within the different SRE Groups, such as mygalomorph spiders, slaters and centipedes. *
6	Open Eucalypt woodlands	Open Eucalypt woodlands over low hills with occasional saltbush and bluebush understoreys.	591	5%	Open Eucalypt woodland often provides shelter for multiple mygalomorph spider species, including from the genus <i>Idiosoma</i> .
7	Granite outcrops	Granite hills with exfoliating domes and tor fields, supporting Acacia shrublands.	373	3%	Granite outcrops have high prospectivity for SRE species as they often represent isolated habitats within the broader landscape, and specialist species (such as pseudoscorpions and millipedes) tend to be restricted to this habitat type.
8	Cleared	Disturbed and previously cleared areas.	100	1%	N/A

* Generalist species adapt better to numerous microhabitats the different vegetation types provide, which along with abiotic factors such as soil type, crevices and rocks, provide ideal refuges for species from SRE Groups. However, these microhabitats are rarely isolated and therefore, less likely to hold true SRE species.



Legend

- Development Area
- Targeted SRE Survey Area
- SRE Habitat**
- Cleared

- Floodplains and drainage areas
- Granite outcrop
- Low hills with mixed shrublands
- Mixed shrubland

- Open Eucalyptus woodlands
- Sandplains with mixed shrublands
- Stony plains with mixed shrublands

Figure 8. SRE Habitats identified within the Mt Mulgine Survey Area.

8.3.1. Species Accounts

No Confirmed SRE species were collected in the survey, but two Priority 3 species were: *Idiosoma clypeatum* and *I. intermedium* (discussed previously in Section 7.3). Of the 40 identifiable species collected in the survey, 1 was categorised as Likely Potential SRE, 8 as Unlikely Potential SREs, 12 as Data Deficient Potential SRE, and 17 are Widespread (Figure 9; Table 6). Two species, *Pupoides* sp. and *Scutigermorpha* sp., were only identified to levels higher than species but belong to groups not otherwise represented within the survey, resulting in their addition within the species numbers, however no SRE categorisation was assigned to them. Another seven specimens were also only identified to higher order levels, however other specimens from those groups were collected and identified, therefore the higher order specimens aren't included towards species counts (Table 6).

The sites that yielded the most samples were Site 4 and Site 20 (Figure 5) with 23 and 25 samples respectively. Both sites belong to the 'Low hills with mixed shrubland' habitat type. In contrast, Site 16 yielded the fewest specimens with just two. Site 16 belongs to the 'Stony plains with mixed shrubland' habitat type.

Conservation-significant species

Two Priority 3 species were collected during the survey: *Idiosoma clypeatum* and *I. intermedium*. Note, as in Section 7.3, that Priority listing is not necessarily linked with distribution. Both species are Widespread, but both species are at risk from threatening processes, hence the Priority listing (Rix *et al.* 2018a). As both species have been discussed in Section 7.3, they will not be discussed at length here. The single record of *Idiosoma clypeatum* in the survey was collected from a reference site (Site 22; see inset in Figure 9). *Idiosoma intermedium* was collected from six potential impact sites within the Development Area and one reference site (Site 22; Figure 9).

The field survey did not record any specimens of *Idiosoma gutharuka*, a Priority 1 and Confirmed SRE species previously collected from the Mulgine area (Spectrum Ecology 2021a). Additionally, no specimens of the Priority 4 *Idiosoma castellum* or the Endangered *Idiosoma formosum* or *Idiosoma kopejtkorum* were collected, despite appearing in the desktop search area (Section 7; Appendix 1).

Gastropoda (land snails)

Four species of land snail were collected in the survey. Of these, three are Widespread and of no conservation concern, and one singleton is considered a Data Deficient Potential SRE, namely *Bothriembryon* 'BGA054'. *Bothriembryon* 'BGA054' was identified through molecular sequencing which confirmed it as a distinct species different from any other sequenced species in Bennelongia's database or publicly available in GenBank. *Bothriembryon* 'BGE054' was collected from under a log on a granite outcrop, but given its singleton nature it is unknown if the species has an affinity for this habitat type. The species belongs to a genus rich in SREs, but given the lack of distribution data it is conservatively retained as a Data Deficient Potential SRE here.

Pseudoscorpiones (pseudoscorpions)

Of the five species of pseudoscorpions collected in the survey, three are categorised as Unlikely Potential SREs: *Austrohorus* 'BPS586', *Beierolpium* 8/2 'BPS589' and *Beierolpium* 8/4 'BPS600' (Table 6; Figure 9). These three species are currently known only from the Development Area, but they have been collected from widespread microhabitats such as Eucalyptus woodlands (leaf litter) and Acacia shrublands (bark and leaf litter), and from under rocks. Given the widespread and abundant nature of these collection microhabitats, the distributions of these species are not expected to be restricted.

The other two species, *Austrochthonius* 'BPS585' and *Indolpium* 'BPS586', have been categorised as Data Deficient Potential SREs. *Austrochthonius* 'BPS585' is known from a single specimen collected from under leaf litter inside the Development Area; as with most singletons, it is considered a Data Deficient Potential SRE until further records are collected. *Indolpium* 'BPS586' was collected from Acacia leaf litter in the

Survey Area and the Development Area, and matched genetically with a WAM record, 'Olpiidae sp. WAM T118387', known from approximately 20 km west of the Development Area. Although it appears to be known from two records and from widespread habitat types, it is conservatively retained as a Data Deficient Potential SRE until further records are collected. Nevertheless, its distribution is not expected to be restricted.

Scorpiones (scorpions)

Two Widespread species of scorpion were collected in the survey: *Isometroides* 'BSCO084' and *Lychas* 'BSCO092' 'splendens group' (Table 6). Both species were identified by molecular sequencing. *Isometroides* 'BSCO084' has also been collected from near Meekatharra and near Laverton, while *Lychas* 'BSCO092' 'splendens group' also occurs near Kalgoorlie, Lake Lefroy and the Helena Aurora ranges. These species are not expected to be significantly impacted by the development.

Mygalomorphae (mygalomorph spiders)

At least nine species of mygalomorph spiders were collected in the survey, including the Unlikely Potential SRE species *Aname* 'BMYG255' and *A.* 'BMYG256' and the Data Deficient Potential SREs *Synothele* 'BMYG254', *Eucyrtops* 'BMYG253' and *Idiosoma* 'BMYG252' (Table 6). The remaining four species are Widespread: *Idiommatia* 'MYG32-DNA', *Cethegus* 'BMYG174', and the Priority 3 species *Idiosoma clypeatum* and *Idiosoma intermedium*.

The two Unlikely Potential SRE species, *Aname* 'BMYG255' and *A.* 'BMYG256', are undescribed species currently known only from the Development Area and the Survey Area. Given morphological features were not enough to assign them to a species, and because there are multiple undescribed species only recognised by their molecular data, DNA sequencing was used to differentiate between these species. Molecular analysis of the specimens produced no match with any existing sequence, indicating that they have not previously been collected; new species codes were assigned accordingly. Despite being new and unknown, both species were collected from widespread open woodland habitats and are therefore not expected to be restricted to the Survey Area or affected by the development.

Two of the three Data Deficient Potential SRE species were all collected as singletons, *Synothele* 'BMYG254' and *Idiosoma* 'BMYG252', with *Eucyrtops* 'BMYG253' being collected at just two sites. All three species analysed for molecular similarity with existing species, however none were found, so all three species were assigned new species codes. Nothing is known about the actual distribution or habitat requirements for any of the species other than they have been collected from open woodland habitats, which are widespread.

Isopoda (slaters)

Four species of slaters were collected in the survey: the Unlikely Potential SRE *Buddelundia* sp. B30 and Data Deficient Potential SREs *Buddelundia* 'BIS597', *Paraplatyarthus* 'BIS420' and *Laevophiloscia* 'BIS592' (Table 6). *Buddelundia* sp. B30 has also been collected from near Mummaloo, approximately 60 km southeast of the Development Area, where it has been collected from widespread habitats; its distribution is not expected to be restricted.

The three Data Deficient Potential SRE species are known from either one or two localities within the Survey Area. Nothing is known about their actual distribution or habitat requirements other than they have been collected from under rocks or leaf litter.

Chilopoda (centipedes; includes Scolopendrida and Geophilida)

At least 12 species of centipedes have been collected from the Development Area (Table 6). Two species, both undescribed, are categorised as Unlikely Potential SREs, *Scolopendra* 'BSCOL118' and *Mecistocephalus* 'BGE087'. Both species are currently known only from the Development Area and the Survey Area but have been collected from multiple sites and in at least three widespread habitats. Therefore, their distributions are not expected to be restricted to the Survey Area.

Three Data Deficient Potential SRE species were also collected from the Survey Area: *Cormocephalus* `BSCOL123`, *Orphnaeus* `BGE086` and *Lamyctes* `BLITH005`. These species were collected from either one or two sites. One of the species, *Lamyctes* `BLITH005`, was differentiated from the morphologically similar and Widespread *L. africanus* through molecular sequencing.

Six of the remaining centipede species are Widespread with no conservation concern. One final species, a higher-order classification (*Scutigera* sp.), was not assigned an SRE category.

Diplopoda (millipedes; includes Polyxenida and Polydesmida)

Three species of millipedes were collected in the survey, the Likely Potential SRE *Antichiropus* `BDI070` and the Widespread *Phrysonotus novaehollandiae* and *Unixenus* sp. (Table 6). Even though records of *Unixenus* were not identified to species level, all the described species within the genus are known to have widespread distributions and the entire genus is considered as widespread (Short and Huynh 2011, 2013).

Antichiropus `BDI070` is currently known only from around the Mulgine area, where it has a linear range of ~10 km. Morphological inspections were not successful on matching the collected specimens to any of the described species. Therefore, this species was verified to be unique through molecular sequencing. It has been collected from under rocks and Acacia logs in granite outcrop and floodplain/drainage area habitats. Given the genus is known to contain many Confirmed SRE species, this new species is conservatively categorised as a Likely Potential SRE. The actual distribution of the species is expected to be larger than currently known, but may still be <10,000 km².

8.3.2. Consolidated Records for Targeted SRE Groups

After conducting both, a desktop assessment and field survey, a consolidated list of targeted SRE Groups occurring in the Development Area was compiled. These targeted groups comprise mygalomorph (trapdoor) spiders, millipedes from the genus *Antichiropus* and isopods (slaters). In total, 15 species of mygalomorph spiders, 11 species of isopods, and 3 species of millipedes have been recorded within the Survey Area (Table 7; Figure 10).

Table 6. Records of species from SRE Groups collected during the field survey within the Development Area.

Priority and Listed species are highlighted in green. Likely Potential SRE and Unlikely Potential SRE species are highlighted in blue. Data Deficient species are highlighted in orange. Higher-order identifications not considered as distinct species and are highlighted in grey.

No.	SRE Group	Lowest ID	Spec. count	SRE Status	Comments
	Gastropoda				
	Bothriembryontidae				
1		<i>Bothriembryon</i> `BGA054`	1	Data Deficient Potential SRE	Undescribed species known from singleton specimen.
2		<i>Bothriembryon sedgwicki</i>	3	Likely Potential SRE	These records are located approximately 280 km NW from the ALA (2024) record found near Merredin and are all found within the Development Area. Without genetic data, it is unclear if they represent the same species, however, given the genus is known to have species with restricted distributions it has been categorised as a Likely Potential SRE.
	Camaenidae				
3		<i>Sinumelon jimberlanensis</i>	13	Widespread	
		Camaenidae sp.	1		Damaged specimen, unable to be identified further.
	Gastrocoptidae				
4		<i>Gastrocopta bannertonensis</i>	2	Widespread	
	Pupillidae				
5		<i>Pupoides</i> sp.	1	NA	High order ID. Given it represents the only member of the family, it has been considered as a distinct species, but no SRE categorisation has been given.
	Pseudoscorpiones				
	Chthoniidae				
6		<i>Austrochthonius</i> `BPS585`	1	Data Deficient Potential SRE	Known from single specimen. Nothing is known about the species' actual distribution or habitat requirements other than it has been collected from leaf litter.
	Olpidae				
7		<i>Austrohorus</i> `BPS586`	7	Unlikely Potential SRE	Species only known from around the Survey Area. It has been collected from under rocks and leaf litter.

No.	SRE Group	Lowest ID	Spec. count	SRE Status	Comments
8		<i>Beierolpium</i> 8/2 `BPS589`	15	Unlikely Potential SRE	Species only known from around the Survey Area. It has been collected from under <i>Acacia</i> bark and leaf litter, and it is not expected to have a restricted distribution.
9		<i>Beierolpium</i> 8/4 `BPS600`	16	Unlikely Potential SRE	Species only known from around the Survey Area. It has been collected from under <i>Acacia</i> and <i>Eucalyptus</i> leaf litter, and it is not expected to have a restricted distribution.
10		<i>Indolpium</i> `BPS586`	5	Data Deficient Potential SRE	Undescribed species known from around the Survey Area. It has been collected from <i>Acacia</i> leaf litter. Matches genetically with WAM's record <i>Olpiidae</i> sp. WAM T118387 collected approximately 20 km from the Project area.
		<i>Olpiidae</i> sp.	1		Damaged specimen, unable to ID further
	Scorpiones				
	Buthidae				
11		<i>Isometroides</i> `BSCO084`	1	Widespread	Species identified by molecular characteristics. It is known from near Meekatharra and Laverton.
12		<i>Lychas</i> `BSCO092` `splendens group`	1	Widespread	Widespread species confirmed through genetic data to occur near Kalgoorlie, Lake Lefroy and Helena Aurora.
	Araneae				
	Anamidae				
13		<i>Aname</i> `BMYG255`	3	Unlikely Potential SRE	Species known only from around the Survey Area where it has been collected from open woodland habitats. It did not match any of the previously sequenced species from around the area.
14		<i>Aname</i> `BMYG256`	2	Unlikely Potential SRE	Species known only from around the Survey Area where it has been collected from open woodland habitats. It did not match any of the previously sequenced species from around the area.
	Barychelidae				
15		<i>Idiommatia</i> `MYG320-DNA`	1	Widespread	Species matched genetically with specimens collected near Mt. Forest and near Lake Ballard.
16		<i>Synothele</i> `BMYG254`	1	Data Deficient Potential SRE	Singleton for which nothing is known about its actual distribution or habitat requirement. Molecular sequence did not match any of the known species around the Development Area.
	Euagridae				
17		<i>Cethegus</i> `BMYG174`	3	Widespread	Species matched genetically with specimens collected south of Kalbarri and from near Mt. Gibson.

No.	SRE Group	Lowest ID	Spec. count	SRE Status	Comments
	Idiopidae				
18		<i>Eucyrtops</i> `BMYG253`	2	Data Deficient Potential SRE	Species is known only from two localities within the Development Area <4km apart. Molecular sequencing could not match it with any of the publicly available sequence data or sequenced specimens from the Survey Area. It has been collected from open woodlands next to access tracks.
19		<i>Idiosoma</i> `BMYG252`	1	Data Deficient Potential SRE	Damaged specimen (legs only) sequenced but could not be matched with any of the molecular species known from around the Development Area. Nothing is known about this undescribed species except it has been collected from open woodland areas.
20		<i>Idiosoma clypeatum</i>	1	Widespread	Priority 3 species (DBCA).
21		<i>Idiosoma intermedium</i>	7	Widespread	Priority 3 species (DBCA).
		Idiopidae sp.	1		Moult only; higher-order classification.
	Isopoda				
	Armadillidae				
22		<i>Buddelundia</i> sp. B30	11	Unlikely Potential SRE	Species is also known from near Mummaloo, approximately 60 km SE from the Development Area. It has been collected from widespread habitats (under rocks and logs), and it is not expected to be a restricted species.
23		<i>Buddelundia</i> `BIS597`	2	Data Deficient Potential SRE	Species only known from single locality. Little is known about the species' actual distribution or habitat requirements other than it has been collected from under rocks.
		Armadillidae sp.	1		Damaged specimen. Not counted as unique species.
	Paraplatyarthridae				
24		<i>Paraplatyarthrus</i> `BIS420`	1	Data Deficient Potential SRE	Species known only from two localities around the Survey Area. Little is known about the species habitat requirements other than it has been collected from under leaf litter.
	Philosciidae				
25		<i>Laevophiloscia</i> `BIS592`	4	Data Deficient Potential SRE	Known from a single locality. Nothing is known about the species' actual distribution or habitat requirements except it has been collected from under rocks.
	Scolopendromorpha				
	Cryptopidae				

No.	SRE Group	Lowest ID	Spec. count	SRE Status	Comments
26	Scolopendridae	<i>Cryptops australis</i>	3	Widespread	
27		<i>Asanada</i> `BSCOL101`	1	Widespread	Species also known from near Laverton and near Newman.
28		<i>Cormocephalus</i> `BSCOL117`	1	Widespread	Species also known from near Wiluna.
29		<i>Cormocephalus</i> `BSCOL123`	1	Data Deficient Potential SRE	Known from a single specimen. Nothing is known about the species' actual distribution or habitat requirements.
30		<i>Cormocephalus rubriceps</i>	3	Widespread	
31		<i>Scolopendra</i> `BSCOL118`	4	Unlikely Potential SRE	Currently known only from around the Survey Area, but it has been collected from multiple sites and at least two widespread habitats (under rocks, under logs). None of the described species in the genus have restricted distributions, so this species is not expected to have one either.
32		<i>Scolopendra laeta</i>	11	Widespread	
	Scutigeromorpha				
33		Scutigeromorpha sp.	1	NA	Higher-order classification
	Geophilomorpha				
	Mecistocephalidae				
34		<i>Mecistocephalus</i> `BGE087`	17	Unlikely Potential SRE	Currently only known from around the Survey Area, but it has been collected from multiple sites and at least three habitats (under rocks, leaf litter, under logs) and is not expected to be restricted to the area.
		Mecistocephalidae sp.	1		Damaged specimen
	Oryidae				
35		<i>Orphnaeus</i> `BGE086`	2	Data Deficient Potential SRE	Only known from two localities <5 km apart. Both records were collected from under rocks.
	Lithobiomorpha				
	Henicopidae				
36		<i>Lamyctes africanus</i>	2	Widespread	
37		<i>Lamyctes</i> `BLITH005`	3	Data Deficient Potential SRE	Species morphologically different from <i>Lamyctes africanus</i> ; sequence data did not find any matches. Known from single locality.

No.	SRE Group	Lowest ID	Spec. count	SRE Status	Comments
	Polyxenida				
	Polyxenidae				
38		<i>Unixenus sp.</i>	17	Widespread	All species within the genus are known to have widespread distributions (Short and Huynh 2011).
	Synxenidae				
39		<i>Phryssonotus novaehollandiae</i>	4	Widespread	
	Polydesmida				
	Paradoxosomatidae				
40		<i>Antichiropus</i> `BDI070`	14	Likely Potential SRE	Species only known from the area around Survey Area, with a linear range <10 km. Given the genus is known to have numerous Confirmed SREs, this species is conservatively categorised as a Likely Potential SRE.
		<i>Antichiropus sp.</i>	22		Juvenile or damaged specimens which cannot be identified further, but likely belong to the species above.

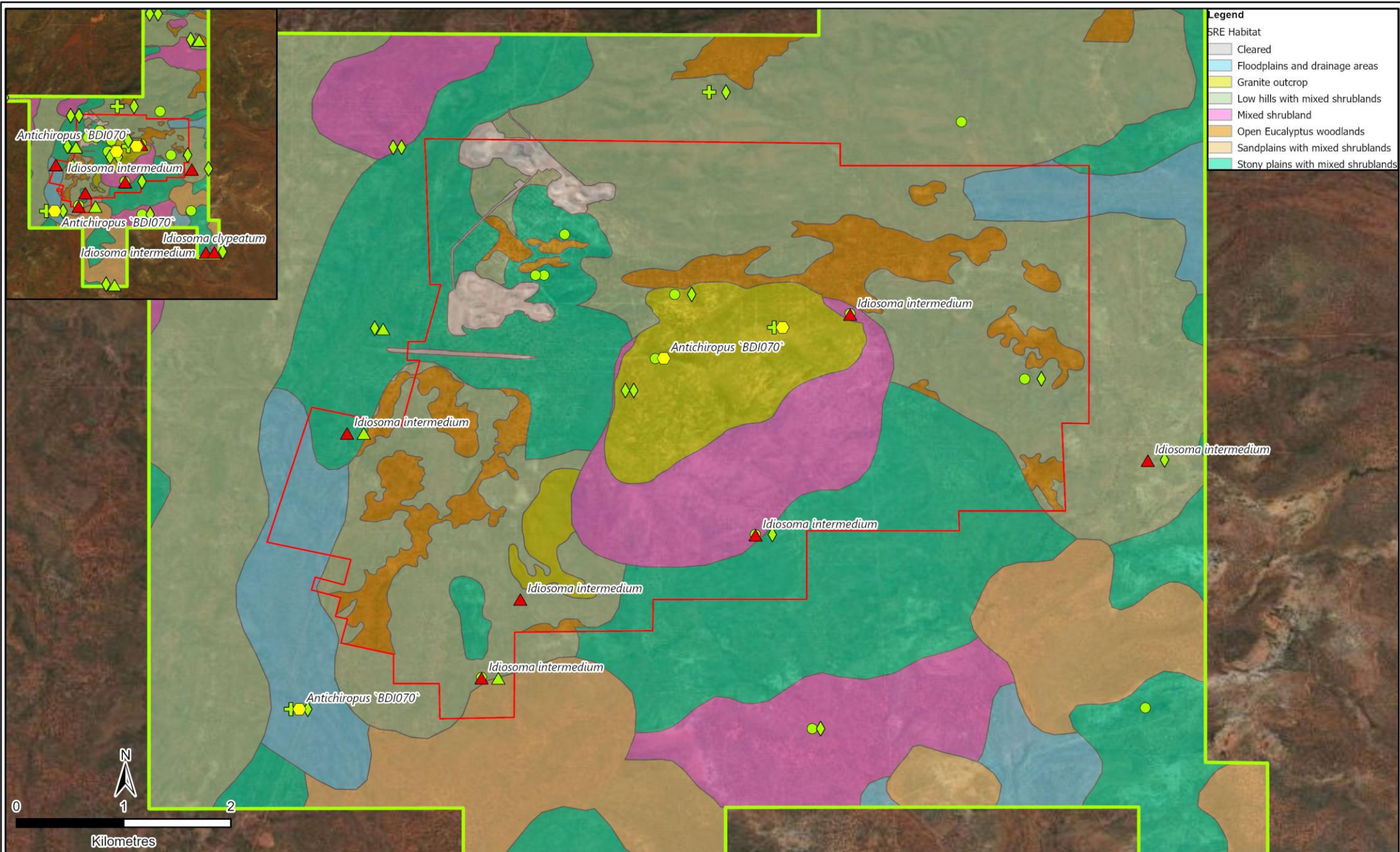


Table 7. Species from targeted SRE Groups known from the Survey Area (combined desktop assessment and survey results).

Newly collected species are highlighted in blue.

SRE Group	Lowest ID	Conservation/SRE Status	Source	Comments
Mygalomorphae (Araneae)				
Actinopodidae				
	<i>Missulena insignis</i>	Widespread	Spectrum Ecology (2021a)	Species is widespread in WA and is not conservation-significant (ALA 2025; Miglio et al 2014).
Anamidae				
	<i>Aname</i> `BMYG177`	Data Deficient Potential SRE	Spectrum Ecology (2021a)	Species known only from the Development Area and recognised as a distinct species by its molecular characteristics. Identified by Alacran (2021) as <i>Aname</i> MH1, but given associated molecular data, the species code `BMYG177` is preferred.
	<i>Aname</i> `BMYG255`	Unlikely Potential SRE	This survey.	New addition for the Development Area. Identified through morphological and molecular methods and recognised as a distinct species. Even though it has been collected in close vicinity to <i>A. `BMYG177`</i> , molecular data suggests molecular divergence >17.8%.
	<i>Aname</i> `BMYG256`	Unlikely Potential SRE	This survey.	New addition for the Development Area, identified through morphological and molecular data. Molecular analysis showed similarities with WAM's MYG364, MYG271 and MYG212. Due to taxonomic uncertainty, a new species code was assigned pending further revision.
Barychelidae				
	<i>Idiommata</i> `BMYG175`	Data Deficient Potential SRE	Spectrum Ecology (2021a)	Singleton. Identified by Alacran (2021) as <i>Idiommata</i> MH3, but given the molecular data associated to the species code `BMYG175`, the latter is preferred. Molecular data shows at least 12.8% divergence between this and any <i>Idiommata</i> species collected from the Development Area.

SRE Group	Lowest ID	Conservation/SRE Status	Source	Comments
	<i>Idiommatata</i> `MYG320-DNA`	Widespread	This survey.	Species matched genetically with specimens collected near Mt. Forest, Lake Ballard and Laverton. Linear range ~550 km.
	<i>Synothele</i> `BMYG254`	Data Deficient Potential SRE	This survey.	Singleton. Molecular data did not find any matches, indicating a distinct species.
Euagridae				
	<i>Cethegus</i> `BMYG174`	Widespread	Spectrum Ecology (2021a); this survey.	This species has been matched genetically with specimens collected near Mt. Gibson, but also near Kalbarri, ~300 km apart.
Idiopidae				
	<i>Bungulla</i> `BMYG176`	Data Deficient Potential SRE	Spectrum Ecology (2021a)	Singleton. Recognised as a distinct species based on morphological data and expert advice (M. Rix, pers comm).
	<i>Eucyrtops</i> `BMYG253`	Data Deficient Potential SRE	This survey.	Known only from two localities in the Development Area. Molecular sequencing could not match it with any of the sequenced specimens from the Development Area or nearby localities.
	<i>Idiosoma</i> `BMYG252`	Data Deficient Potential SRE	This survey.	Known only from a damaged specimen for which only legs were able to be recovered. Legs were sequenced but molecular data could not match it with any of the species known from around the Development Area.
	<i>Idiosoma castellum</i>	Priority 4/ Widespread	(Bamford 2013a,b)	Species occurs in the southwest, but extends north up to Pintharuka Nature Reserve, Karara, Lochada, and Warradier stations (Atlas of Living Australia 2025; Inglis 2008). Listed as Priority 4 by DBCA. The record known from the Tungsten tenure comes from a specimen collected by Bamford (2013) and deposited at WAM. No recent records of this species have been recovered from the Development Area (Spectrum Ecology, 2021a; this survey).

SRE Group	Lowest ID	Conservation/SRE Status	Source	Comments
	<i>Idiosoma clypeatum</i>	Priority 3/Widespread	Spectrum Ecology (2021a); this survey.	Priority 3 species according to DBCA based on taxonomic, geographic and genetic data provided by Rix et al. (2018a). The species has been recorded extensively around the Survey Area.
	<i>Idiosoma gutharuka</i>	Priority 1/Confirmed SRE	Spectrum Ecology (2021a)	Listed as Priority 1 species by DBCA as it shows a restricted distribution in the northern Wheatbelt bioregion, where it was previously known only from a single specimen at the type locality of Gutha near Pintharuka (Rix et al. 2018a). It has been recorded at a high density within the Development Area but also from two additional localities approximately 4 and 12 km from the Development Area (Spectrum Ecology 2021a).
	<i>Idiosoma intermedium</i>	Priority 3/Widespread	Spectrum Ecology (2021a); this survey.	Listed as Priority 3 by DBCA. Widespread distribution of at least 14,500 km ² (Rix et al. 2018a). Has been identified from the Development Area and from the regional area by Spectrum Ecology (2021a) where it was recorded from granite outcrops, mixed shrublands and eucalypt woodland habitats.
Isopoda (Crustacea)				
Armadillidae				
	<i>Acanthodillo</i> `BIS412`	Data Deficient Potential SRE	Spectrum Ecology (2021a)	Singleton. Also been identified under the code name A. sp 5B (Alacran 2021). Only identified based on morphological characteristics; no molecular data are known for this species.
	<i>Acanthodillo</i> sp. B05	Widespread	Spectrum Ecology (2021a)	Previously categorised as Data Deficient (Spectrum Ecology 2021a) but now known to have a linear range >300 km.
	<i>Buddelundia</i> `BIS597`	Data Deficient Potential SRE	This survey.	Known from a single locality within the Development Area. Identified through molecular data and recognised as a distinct species.

SRE Group	Lowest ID	Conservation/SRE Status	Source	Comments
	<i>Buddelundia</i> sp. B30	Unlikely Potential SRE	Spectrum Ecology (2021a); this survey.	Also known from near Mummaloo. Identified by both morphological and molecular data.
	<i>Buddelundia sulcata</i>	Widespread	(Bamford 2004)	Widespread species collected by Bamford (2004) from the Blue Hills Project.
	<i>Spherillo</i> `BIS411`	Data Deficient Potential SRE	Spectrum Ecology (2021a)	Singleton (damaged). No sequence data have been associated with this species; it may align with <i>Spherillo</i> sp. specimens identified by Alacran (2021).
Paraplatyarthridae				
	<i>Paraplatyarthrus</i> `BIS410`	Data Deficient Potential SRE	Spectrum Ecology (2021a)	Singleton. Molecularly distinct from <i>P.</i> `BIS420`
	<i>Paraplatyarthrus</i> `BIS420`	Data Deficient Potential SRE	Spectrum Ecology (2021a); this survey.	Species known only from two localities around the Mt. Mulgine area. Molecularly distinct from <i>P.</i> `BIS410`
Philosciidae				
	<i>Laevophiloscia</i> `BIS409`	Data Deficient Potential SRE	Spectrum Ecology (2021a)	Species known from the Development Area and from near Mt Gibson, with a linear range of 50 km. No molecular data have been associated with this species.
	<i>Laevophiloscia</i> `BIS592`	Data Deficient Potential SRE	This survey.	Known from a single locality in the Development Area. Considered different to any other <i>Laevophiloscia</i> species recorded during past survey. No molecular data have been associated with this species.
	<i>Laevophiloscia</i> sp. B18	Widespread	Spectrum Ecology (2021a)	Morphologically distinct from the other two <i>Laevophiloscia</i> species known from the Development Area. No molecular data have been associated with this species.
Diplopoda (Myriapoda)				
Paradoxosomatidae				
	<i>Antichiropus</i> `BDI070`	Likely Potential SRE	Spectrum Ecology (2021a); this survey.	Known from multiple localities within the Development Area. Identified through morphological and molecular data. Does not match any species known from nearby areas.

SRE Group	Lowest ID	Conservation/SRE Status	Source	Comments
Polyxenidae				
	<i>Unixenus</i> sp.	Widespread	Spectrum Ecology (2021a); this survey.	All known species are Widespread and of no conservation concern (Short and Huynh 2013).
Synxenidae				
	<i>Phryssonotus novaehollandiae</i>	Widespread	Spectrum Ecology (2021a); this survey.	Has the most widespread distribution of any Australian millipede species (Short and Huynh 2009).

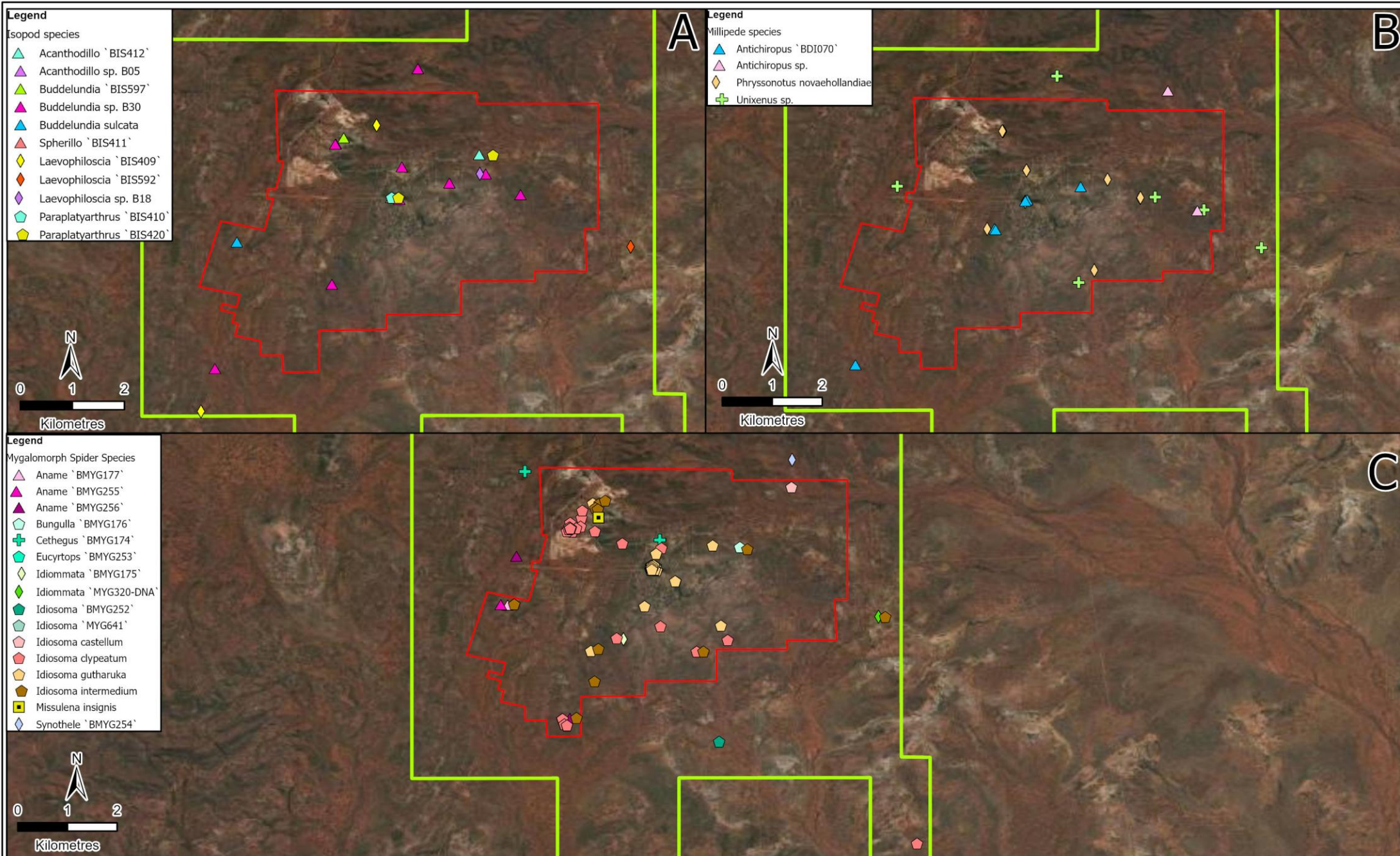


Figure 10. Records of Targeted SRE Groups collected within the Mt Mulgine Development Area

A) Isopod species
B) Millipede species
C) Mygalomorph spider species

Legend

- Development Area
- Targeted SRE Survey Area
- Spider Family
- Actinopodidae

- Anamidae
- Barychelidae
- Euagridae
- Idiopidae

Isopod Family

- Armadiillidae
- Paraplatyarthridae
- Philosciidae

Millipede Family

- Paradoxosomatidae
- Polyxenidae
- Synxenidae

9. DISCUSSION AND CONCLUSION

With 143 species from SRE Groups recovered from the search area, the desktop assessment suggests a moderately diverse community of SRE invertebrates in the region around Mulgine. The results include six Confirmed SREs also listed as Endangered or Priority, five Likely Potential SREs and thirteen Unlikely Potential SREs. A relatively high proportion of species were categorised as Data Deficient Potential SREs (62/143), but it is possible that some or even many of these specimens correspond with species found among the records, particularly in the genera *Beierolpium*, *Eucyrtops*, *Idiosoma*, *Buddelundia* and *Mecistocephalus* (Appendix 1). Further survey and taxonomic work is required to differentiate among these species further.

The desktop assessment also identified seven habitats prospective for SRE species and one habitat not prospective for SRE species ('Cleared,' 1%) in the Survey Area. All seven prospective habitats are locally widespread and abundant. The most abundant habitat (40%) was 'Low hills with mixed shrublands,' characterised by low ranges with dense casuarina and acacia. The least abundant SRE habitat (3%) was 'Granite outcrops,' characterised by granite hills with exfoliating domes usually supporting Acacia shrublands. Actual prospectivity varies among the seven habitat types considered prospective. Granite outcrops (3%) and open Eucalypt woodland (5%) are among the most prospective of the habitat types detected due to their isolated nature and complex structure, respectively. Approximately 60% of the Survey Area is moderately or highly prospective. Overall, habitat in the Survey Area is conducive to hosting species from various SRE Groups, including but not limited to mygalomorph spiders, isopods and millipedes.

Field survey targeting mygalomorph spiders, isopods and millipedes collected 216 specimens from at least 40 species belonging to SRE Groups. From these, 9 were mygalomorph spiders, 4 were isopods and 3 were millipedes. Of the 40 identifiable species collected from the Survey Area, 1 was categorised as Likely Potential SRE, 8 as Unlikely Potential SREs, 12 as Data Deficient Potential SREs and 17 as Widespread. There were no Confirmed SRE species in the survey results but two Priority 3 species were collected: *Idiosoma clypeatum* and *I. intermedium*. Both species are Widespread in distribution but potentially at risk from threatening processes associated with mining development (Rix *et al.* 2018a). Two species only identifiable to higher levels were not assigned an SRE category. Some species are known only from the Survey Area, but all were collected from habitats that are widespread, so are not expected to be confined to it.

The field survey did not record any specimens of *Idiosoma gutharuka*, a Priority 1 and Confirmed SRE species previously collected from the Mt. Mulgine area (Spectrum Ecology 2021a). Additionally, no specimens of the Priority 4 *Idiosoma castellum* or the Endangered *Idiosoma formosum* and *Idiosoma kopejtkorum* were recovered during the field survey, despite appearing in the desktop search results. Based on their current known distribution, neither *Idiosoma formosum* or *I. kopejtkorum* are expected to occur in the Development Area, which along with the cryptic nature of *I. castellum* burrows may explain why these species were not collected during the survey. The lack of *Idiosoma gutharuka* records is not fully understood but may be linked to environmental factors such as rain, which may have caused the spiders to seal shut their burrows, or similar defensive behaviours.

Combining results from the present survey with those of previous surveys, 15 mygalomorph spider species, 11 isopod species, and 3 millipede species have been collected from the Survey Area. Of these, four species are conservation-significant: *Idiosoma gutharuka* (P1), *I. clypeatum* (P3), *I. intermedium* (P3) and *I. castellum* (P4). However, none of the conservation-significant species are confined to the Development Area and three have widespread distributions. The fourth species (*Idiosoma gutharuka*) is a Confirmed SRE with a high density of records from the Survey Area. Rather than reflecting a truly restricted distribution, however, this high density of records is probably due to survey efforts being concentrated in pockets of the species' range. This notion is supported by the presence of records from 100 km from the Development Area, at the type locality of Gutha (Rix *et al.* 2018a), as well as 4-12 km

outside of the Survey Area. Although none of the species from the targeted groups collected in the Survey Area are expected to be confined to it, mitigation measures (such as translocation) for conservation significant species could be considered.

Overall, although some species in the survey records are known only from the Survey Area, all were collected from widespread and locally abundant habitats and microhabitats so are not expected to be confined to the Survey Area. The other species in the records, including Confirmed SREs and conservation-listed species, are also expected to have distributions greater than the Survey Area. The Survey Area (~11,386 ha) is a small fraction of the general landscape, and development is not expected to reduce the broad-scale availability of habitat significantly. If necessary, further targeted surveys outside of the Survey Area could be conducted to provide further characterisation of the distributions of conservation-significant species.

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Appendix 1 – Species belonging to SRE Groups recovered from the Desktop search area around the Operation.

Confirmed SREs are highlighted in red. Priority and Listed species that are not Confirmed SREs are highlighted in green. Likely Potential SRE and Unlikely Potential SRE species are highlighted in blue. Data Deficient species are highlighted in orange. High order identification records (not considered distinct species) are highlighted in grey. `(T)` in Data Deficient Potential SRE species stands for “taxonomical” reasons, `(G)` stands for “geographical” reasons.

No	High Order ID	Species	Spec. Count	SRE Status	Comments
	Gastropoda				
	Stylommatophora				
1	Bothriembryontidae	<i>Bothriembryon sedgwicki</i>	6	Likely Potential SRE	These records are located approximately 280 km NW from the ALA (2024) record found near Merredin and are all found within the Development Area. Without genetic data, it is unclear if they represent the same species, however, given the genus is known to have species with restricted distributions it has been categorised as a Likely Potential SRE.
		<i>Bothriembryon</i> `sp.`	14		
2	Camaenidae	<i>Sinumelon vagante</i>	240	Widespread	Bennelongia (2020) identified representatives of this species under the code `BGA048`. These have now been unified under the <i>S. vagante</i> species name as per Spectrum (2018) and Alacran (2021).
		<i>Sinumelon</i> `sp.`	38		
		Camaenidae `sp.`	1		

3	cf. Pupillidae	cf. Pupillidae `sp.`	1	Data Deficient (T) Potential SRE	Unidentified species within the family; as it is the sole member of the family it is considered a distinct species. Given the taxonomical uncertainty, a conservative approach was taken to categorise the species as best as possible within the available SRE categories.
4	Gastrocoptidae	<i>Gastrocopta cf. bannertonensis</i>	20	Widespread	
5		<i>Gastrocopta larapinta</i>	1	Widespread	
		<i>Gastrocopta</i> `sp.`	2		
6	Planorbidae	Planorbidae `sp.`	33	Data Deficient (T) Potential SRE	Unidentified species within the family; as it is the sole member of the family it is considered a distinct species. Given the taxonomical uncertainty, a conservative approach was taken to categorise the species as best as possible within the available SRE categories.
7	Punctidae	<i>Westralaoma aprica</i>	2	Widespread	
8		<i>Westralaoma cf. expicta</i>	5	Widespread	
9	Pupillidae	<i>Pupoides cf. myoporinae</i>	1	Widespread	
10		<i>Pupoides adelaidae</i>	11	Widespread	
11		<i>Pupoides cf. beltianus</i>	2	Widespread	
12		<i>Pupoides contrarius</i>	1	Widespread	
13		<i>Pupoides pacificus</i>	2	Widespread	

14	Succineidae	Succineidae `sp.`	3	Data Deficient (T) Potential SRE	Unidentified species within the family; as it is the sole member of the family it is considered an independent species. Given the taxonomical uncertainty, a conservative approach was taken to categorise the species as best as possible within the available SRE categories.
	Arachnida				
	Opiliones				
15	Neopilionidae	<i>Megalopsalis</i> `sp.`	1	Data Deficient (T) Potential SRE	Unidentified species; as it is the sole member of the genus it is considered an independent species. Given the taxonomical uncertainty, a conservative approach was taken to categorise the species as best as possible within the available SRE categories.
		Neopilionidae `sp.`	1		
		Opiliones `sp.`	1		
	Pseudoscorpiones				
16	Chernetidae	Chernetidae `sp.`	1	Data Deficient (T) Potential SRE	Unidentified species within the family; as it is the sole member of the family it is considered an independent species. Given the taxonomical uncertainty, a conservative approach was taken to categorise the species as best as possible within the available SRE categories.
17	Chthoniidae	<i>Austrochthonius</i> `BPS295`	12	Data Deficient (T) Potential SRE	These species (except for <i>A.</i> `BPS306`) are identified in Alacran

18		<i>Austrochthonius</i> `BPS296`	35	Data Deficient (T) Potential SRE	(2021) as <i>A. MH1-MH3</i> based on morphological characters. Given the uncertain taxonomy of the genus, sequence data will be necessary to consolidate the taxonomy of the species. Therefore, they have been categorised as Data Deficient species based on poor taxonomical knowledge.
19		<i>Austrochthonius</i> `BPS306`	4	Data Deficient (T) Potential SRE	
20		<i>Austrochthonius</i> `BPS308`	3	Data Deficient (T) Potential SRE	
21		<i>Austrochthonius</i> `PSE188, similis`	9	Widespread	Species also known to occur from outside of the desktop search area.
22		<i>Austrochthonius</i> `PSE190, duchaci`	2	Data Deficient (T) Potential SRE	Little is known about this undescribed species other than it has been collected from under rocks. An SRE categorisation conservative approach has been taken for this species.
23		<i>Austrochthonius</i> `PSE196, semotus`	5	Data Deficient (T) Potential SRE	Undescribed species which collected from Blue Hills (ecologia 2011). Nothing is known about its actual distribution or habitat requirements except it has been collected from leaf litter samples.
		<i>Austrochthonius</i> `sp.`	56		
24		<i>Tyrannochthonius</i> `sp. nov. Blue Hill`	1	Data Deficient (T) Potential SRE	Undescribed species collected from Blue Hills (ecologia 2010). Nothing is known about its actual distribution or habitat requirements except it has been collected from leaf litter samples.
		Chthoniidae `sp.`	6		

25	Garypidae	<i>Synsphyronus</i> `PSE071`	1	Data Deficient (T) Potential SRE	Undescribed species known Lochada Station (40 km west of the Development Area). Little is known about the species actual distribution and habitat requirements other than it has been collected from sandy gully.
26		<i>Synsphyronus christopherdarwini</i>	1	Confirmed SRE	The species is only known from the type locality of Charles Darwin Reserve (>40 km SE) where it has been collected from granite outcrops (Harvey 2012). Efforts to locate the species in nearby areas have failed but have found other members of the genus. It is not expected this species will occur within the Development Area.
27		<i>Synsphyronus mimulus</i>	77	Widespread	
		<i>Synsphyronus</i> `sp.`	7		
		Garypidae `sp.`	5		
28	Garypinidae	<i>Protogarypinus</i> `sp.`	1	Data Deficient (T) Potential SRE	These species are the only representatives of their respective genera and therefore are considered distinct species.
29		<i>Solinus</i> `sp.`	2	Data Deficient (T) Potential SRE	
30	Geogarypidae	<i>Geogarypus connatus</i>	2	Widespread	
31	Olpiidae	<i>Austrohorus</i> `similis`	2	Data Deficient (T) Potential SRE	Undescribed species recorded from Blue Hills. Given the taxonomical uncertainty, a conservative approach for the SRE category was taken.
		<i>Austrohorus</i> `sp.`	14		

32		<i>Beierolpium</i> `sp. 8/2` `BPS305`	22	Data Deficient (T) Potential SRE	This species has also been identified by Alacran (2021) as <i>B. 8/2</i> MH2. It is currently known from the Development Area and nearby localities (<15 km from Development Area).
		<i>Beierolpium</i> `sp. 8/2`	36		
33		<i>Beierolpium</i> `sp. 8/3`	1	Data Deficient (T) Potential SRE	Identified by morphological features. Given it is the sole representative of this morphotype it is considered a distinct species, and a conservative SRE categorisation is given.
34		<i>Beierolpium</i> `sp. 8/4` `BPS303`	1	Data Deficient (T) Potential SRE	Both species have been identified as <i>B. 8/4</i> MH3 by Alacran (2021). Given the lack of genetic data for these species, it is hard to determine if they belong to the same (MH3) or separate species.
35		<i>Beierolpium</i> `sp. 8/4` `BPS304`	1	Data Deficient (T) Potential SRE	
		<i>Beierolpium</i> `sp. 8/4`	30		
36		<i>Beierolpium</i> `sp. 8/4 lge`	1	Data Deficient (T) Potential SRE	Identified by morphological features. Given it is the sole representative of this morphotype it is considered a distinct species, and a conservative SRE categorisation is given.
		<i>Beierolpium</i> `sp.`	14		

37		<i>Indolpium</i> `BPS302`	3	Data Deficient (T) Potential SRE	Identified as <i>Indolpium</i> sp. by Alacran (2021). It is a singleton collected from the Development Area. Nothing is known about its habitat requirements or actual distribution.
		<i>Indolpium</i> `sp.`	19		
38		<i>Xenolpium</i> `sp.`	2	Data Deficient (T) Potential SRE	Given it is the sole representative of the genus it is considered a distinct species. A conservative SRE approach has been taken.
		Olpiidae `sp.`	27		
	Scorpiones				
39	Bothriuridae	<i>Cercophonius granulosus</i>	1	Widespread	
40		<i>Cercophonius michaelsoni</i>	2	Widespread	
		<i>Cercophonius</i> `sp.`	8		
41	Buthidae	<i>Isometroides</i> `laverton3`	1	Widespread	
42		<i>Isometroides</i> `SCO025`	1	Widespread	
43		<i>Isometroides</i> `vescus`	1	Widespread	Likely a species complex with many undescribed species.
		<i>Isometroides</i> `sp.`	5		
44		<i>Lychas</i> `adonis`	6	Widespread	Each "species" is probably a complex of undescribed species.
45		<i>Lychas</i> `annulatus?`	1	Widespread	
46		<i>Lychas</i> `subsplendens`	2	Widespread	
47		<i>Lychas jonesae</i>	3	Widespread	
48		<i>Lychas splendens</i>	3	Widespread	
		<i>Lychas</i> `sp.`	15		

49	Urodacidae	<i>Urodacus`armatus`</i>	2	Widespread	Likely a species complex with many undescribed species.
50		<i>Urodacus`blue hills`</i>	4	Data Deficient (T) Potential SRE	Undescribed species known from Blue Hills, <10 km from the Development Area.
51		<i>Urodacus`gibson 1`</i>	1	Data Deficient (T) Potential SRE	These species have been collected from near Mt Gibson, approximately 45 km SE of the Development Area. They are undescribed species separated based on morphological characters. Specialised taxonomical work is required to understand the true number and relationship of species.
52		<i>Urodacus`gibson 2`</i>	13	Unlikely Potential SRE	
53		<i>Urodacus`gibson 3`</i>	2	Data Deficient (T) Potential SRE	
54		<i>Urodacus`gibson 4`</i>	18	Unlikely Potential SRE	
55		<i>Urodacus`gibson 5`</i>	9	Unlikely Potential SRE	Undescribed species known from Blue Hills, <10 km from the Development Area.
56		<i>Urodacus`koolanooka`</i>	2	Data Deficient (T) Potential SRE	
57		<i>Urodacus`laverton 3`</i>	10	Widespread	Undescribed species from Laverton, approximately 550 km E-NE of the Development Area.
58		<i>Urodacus`laverton 5`</i>	28	Widespread	
59		<i>Urodacus`SCO015, karara`</i>	1	Data Deficient (T) Potential SRE	Recorded from Karara Station during the Blue Hills survey (BCE 2006).
60		<i>Urodacus`hoplurus`</i>	8	Widespread	
		<i>Urodacus`sp.`</i>	28		
		<i>Scorpiones`sp.`</i>	3		
	Araneae				
61	Actinopodidae	<i>Missulena`MYG043`</i>	1	Data Deficient (T) Potential SRE	Undescribed species. Nothing is known of this species except that it was collected from sandplains around Mt Gibson.

62		<i>Missulena davidi</i> (ex `MYG045`)	2	Widespread	The species was known initially under the WAM code `MYG045` and was later described as <i>M. davidi</i> by Greenberg et al. (2021). Widespread in the Pilbara, but also been recorded from Pintharuka, Mt Gibson, Mt Manning and Meka Station in the Avon Wheatbelt (ecologia 2010).
63		<i>Missulena</i> `MYG046`	2	Data Deficient (T) Potential SRE	Undescribed species. Nothing is known of this species except that it was collected from sandplains around Mt Gibson.
64		<i>Missulena</i> `MYG047`	3	Data Deficient (T) Potential SRE	Undescribed species. Nothing is known of this species except that it was collected from sandplains around Mt Gibson.
65		<i>Missulena insignis</i>	2	Widespread	
66		<i>Missulena rutraspina</i>	2	Widespread	
67		<i>Missulena</i> sp. B05	2	Unlikely Potential SRE	This species is known from numerous specimens and widespread habitats around Mummaloo (Bennelongia 2012). It is probably widespread.
		<i>Missulena</i> `sp.`	4		

68	Anamidae	<i>Aname</i> `BMYG177`	1	Data Deficient (T) Potential SRE	The species was identified as <i>Aname</i> MH1 by Alacran (2021). Currently known only from the Development Area. Identified here based on unique molecular sequence that did not match any publicly available.
69		<i>Aname</i> `Mt Gibson 1`	4	Unlikely Potential SRE	This species is known from the Mt Gibson area where it has been collected from widespread habitats. It is therefore not expected that its distribution is restricted.
70		<i>Aname</i> `MYG212`	9	Widespread	
71		<i>Aname</i> `MYG332`	8	Unlikely Potential SRE	This species has been collected from Mt Gibson, Charles Darwin Reserve and near Paynes Find Road. It is not expected it will have a restricted distribution.
72		<i>Aname</i> `MYG363`	6	Unlikely Potential SRE	This species is known from near Mt Gibson where it has been collected from Eucalyptus woodlands. It is not expected to be widespread.
73		<i>Aname</i> `MYG692`	2	Data Deficient (T) Potential SRE	Undescribed species. Nothing is known of this species except that it was collected from Eucalypt woodlands around Charles Darwin Reserve.
74		<i>Aname lillianae</i>	2	Widespread	
75		<i>Aname mellosa</i>	1	Widespread	
		<i>Aname</i> `sp.`	53		

76	<i>Kwonkan</i> `MYG058`	1	Data Deficient (T) Potential SRE	Undescribed species collected from near Mt Gibson. Nothing is known about its actual distribution or habitat requirements except was collected from <i>Acacia</i> thickets over sandplains.
77	<i>Kwonkan</i> `MYG439`	1	Data Deficient (T) Potential SRE	Undescribed species collected near Weelhamby Lake. Nothing is known about its actual distribution or habitat requirements.
	<i>Kwonkan</i> `sp.`	4		
78	<i>Proshermacha</i> `sp.`	7	Data Deficient (T) Potential SRE	High order ID. Given it represents the only member of the genus it is considered a distinct species.
79	<i>Teyl</i> `MYG022`	1	Data Deficient (T) Potential SRE	Undescribed species collected from near Mt Gibson. Nothing is known about its actual distribution or habitat requirements except that it was collected from sandplain habitat.
80	<i>Teyl</i> `MYG345`	1	Data Deficient (T) Potential SRE	Undescribed species known to occur along the Goldfields region. It was collected from York gum woodlands and is expected to have a larger distribution than the current records suggest.
	<i>Teyl</i> `sp.`	7		
	Anamidae `sp.`	6		

81	Barychelidae	<i>Idiommata</i> `BMYG175`	1	Data Deficient (T) Potential SRE	Singleton from the Development Area. Identified as <i>Idiommata</i> MH3 by Alacran (2021). Given the sequence data associated to the code name `BMYG175`, we prefer this name for this species.
82		<i>Idiommata blackwalli</i>	2	Widespread	
		<i>Idiommata</i> `sp.`	4		
83		<i>Synothele durokoppin</i>	1	Widespread	
		<i>Synothele</i> `sp.`	7		
		Barychelidae `sp.`	21		Includes specimens identified as Barychelidae sp. MH1 and sp. Barychelidae MH2 by Alacran (2021).
84	Euagridae	<i>Cethegus</i> `BMYG174`	2	Widespread	This species has also been collected from near Mt Gibson and near Kalbarri. It has a linear range >300 km.
		<i>Cethegus cf. fugax</i> sp. B02	14	Unlikely Potential SRE	Known from around the Mummaloo area, approximately 50 km SE of the Development Area. Probably widespread; not expected to occur in the Survey Area.
85		<i>Cethegus</i> `sp.`	16		

86	Halonoproctidae	<i>Conothele</i> `MYG550`	5	Data Deficient (T) Potential SRE	Part of the Southwest and Central <i>Conothele</i> clade (https://museum.wa.gov.au/online-collections/names/Conothele-MYG550), recognised by genetic sequences. This species was also known under the identification code `sp. B05` and has been collected from near Mummaloo. Little is known about its actual distribution or habitat requirements.
		<i>Conothele</i> `sp.`	2		
87	Idiopidae	<i>Blakistonia</i> `MYG148`	1	Data Deficient (T) Potential SRE	Little is known about this undescribed species other than it was collected from sandplains around Mt. Gibson. Many species within the genus are known to have restricted distributions (Harrison et al 2018).
88		<i>Bungulla</i> `BMYG176`	1	Data Deficient (T) Potential SRE	Undescribed species identified by its molecular characters. Recognised as different from both <i>B. biota</i> and <i>B. bringo</i> . Nothing is known about the species' actual distribution or habitat requirements.
89		<i>Bungulla bertmaini</i>	12	Widespread	
90		<i>Bungulla ferraria</i>	2	Widespread	The species has a disjunct distribution in the Avon Wheatbelt and Geraldton Sandplains bioregions (Rix et al 2018), with a linear range of approximately 480 km extending from near Geraldton

					to near Helena Aurora Ranges (ALA 2024).
91		<i>Bungulla inermis</i>	3	Likely Potential SRE	The species has a relatively restricted distribution in the Avon Wheatbelt bioregion, from Mt Gibson to Merredin (Rix et al 2018). It has a distribution area of 4,720 km ² along a linear range of just over 220 km (ALA 2024).
92		<i>Euoplos</i> `mt_gibson_hoggi_gp`	2	Data Deficient (T) Potential SRE	Undescribed species found near Mt Gibson. Nothing is known about its actual distribution or habitat requirements.
		<i>Euoplos</i> `sp.`	2		
93		<i>Gaius villosus</i>	14	Widespread	
		<i>Gaius</i> `sp.`	1		
94		<i>Idiosoma</i> `Mt Gibson sp. 1`	1	Data Deficient (T) Potential SRE	Undescribed species. Nothing is known of this species except that it has been collected from sandplains near Mt Gibson.
95		<i>Idiosoma</i> `sp. B09 plug`	1	Data Deficient (T) Potential SRE	Undescribed species known from near Mt Gibson.
96		<i>Idiosoma castellum</i>	4	Widespread	DBCA Priority 4 species.
97		<i>Idiosoma clypeatum</i>	60	Widespread	DBCA Priority 3 species.

98		<i>Idiosoma formosum</i>	4	Confirmed SRE	Endangered (EN) species with an extent of occurrence (=distribution) <4,000 km ² restricted to the Lake Moore catchment in a relatively small area near the junction of the Wheatbelt, Yalgoo and Coolgardie Bioregions (Rix et al 2018).
99		<i>Idiosoma gutharuka</i>	128	Confirmed SRE	DBCA Priority 1 species. Type locality ~100 km E-NE of the Development Area near Morawa. Previously collected from Mt. Mulgine by Spectrum Ecology (2021a).
100		<i>Idiosoma intermedium</i>	6	Widespread	DBCA Priority 3 species.
101		<i>Idiosoma kopeitkaorum</i>	9	Confirmed SRE	Endangered (EN) species with an extent of occurrence (=distribution) <4,000 km ² restricted to the north-eastern Wheatbelt Bioregion (Rix et al 2018). Recently, Bennelongia (2024) conducted a targeted study that increased the known distribution to 4,377 km ² .
		<i>Idiosoma</i> `sp.`	8		
		Idiopidae `sp.`	3		
102	Theraphosidae	<i>Selenotholus foelschei</i>	3	Widespread	
		Theraphosidae `sp.`	2		
	Malacostraca				
	Isopoda				
103	Armadillidae	<i>Acanthodillo</i> `BIS412`	1	Data Deficient (T) Potential SRE	Singleton. Referred to as A. sp. 5B by Alacran (2021).

104		<i>Acanthodillo</i> `sp. B05`	4	Widespread	Species has a linear range >300 km. Was previously considered a Data Deficient Potential SRE.
		<i>Acanthodillo</i> `sp.`	9		
105		<i>Buddelundia</i> `sp. 87`	35	Data Deficient (T) Potential SRE	Collected from Blue Hills. Nothing is known about its habitat requirements except that it has been collected from leaf litter.
106		<i>Buddelundia</i> `sp. B30`	11	Unlikely Potential SRE	Species is known from the Development Area but has also been collected from Mummaloo and has a linear range >60 km. Given it has been collected from multiple, widespread habitats, it is not expected to have a restricted distribution.
107		<i>Buddelundia sulcata</i>	5	Widespread	
		<i>Buddelundia</i> `sp.`	26		
108		<i>Spherillo</i> `BIS411`	1	Data Deficient (T) Potential SRE	Singleton, damaged. May be the same specimen reported by Alacran (2021) as <i>Spherillo</i> sp.
109		<i>Spherillo</i> `sp. 2A`	1	Data Deficient (T) Potential SRE	Undescribed species collected from within and outside the Development Area.
110		<i>Spherillo</i> `sp. 2C`	2	Data Deficient (T) Potential SRE	
111	Paraplatyarthridae	<i>Paraplatyarthus</i> `BIS410`	1	Data Deficient (T) Potential SRE	Singleton from the Development Area. Nothing is known about the species' habitat requirements except that it has been collected from leaf litter.

112		<i>Paraplatyarthus</i> `BIS420`	1	Data Deficient (T) Potential SRE	Singleton from the Development Area. Confirmed as distinct from <i>P.</i> `BIS410` by molecular data. Nothing is known about the species' habitat requirements.
113		<i>Paraplatyarthus</i> `sp. MH1`	3	Data Deficient (T) Potential SRE	Collected from the Development Area. Alacran (2021) suggested this species was the same as <i>P.</i> `BIS410` and <i>P.</i> `BIS420`, but molecular data indicates the latter are two distinct species.
		<i>Paraplatyarthus</i> `sp.`	2		
114	Philosciidae	<i>Laevophiloscia</i> `BIS409`	4	Data Deficient (G) Potential SRE	Species known from the Development Area and from near Mt Gibson, with a linear range of 50 km.
115		<i>Laevophiloscia</i> cf. <i>yalgooensis</i>	2	Widespread	Specimens attributed to <i>L. yalgooensis</i> , a widespread species.
116		<i>Laevophiloscia</i> sp. B18	3	Widespread	
		<i>Laevophiloscia</i> `sp.`	1		
		Philosciidae `sp.`	88		
		Isopoda `sp.`	20		
	Chilopoda				
	Geophilida				
117	Chilenophilidae	<i>Ribautia</i> `BGE050`	3	Data Deficient (G) Potential SRE	Known from two sites in the Development Area <1 km apart. Nothing is known about the species' actual distribution or habitat requirements.

118		<i>Sepedonophilus</i> `sp. B02`	1	Unlikely Potential SRE	Known from near Mummalo where it is found in multiple, widespread habitats. It is not expected to have a restricted distribution.
		Chilenophilidae `sp.`	2		
119	Geophilidae	Geophilidae `sp.`	5	Data Deficient (T) Potential SRE	Unidentified species. Given it is the only representative of the family, it is considered a distinct species.
120	Mecistocephalidae	<i>Mecistocephalus</i> `sp. B06`	1	Unlikely Potential SRE	Known from near Mummalo and Mt Gibson areas. It has been found at multiple, widespread habitats and its distribution is not expected to be restricted.
		Mecistocephalidae `sp.`	21		
121	Schendylidae	<i>Australoschendyla</i> `BGE049` (capensis?)	2	Data Deficient (G) Potential SRE	Known only from two sites in the Development Area 2 km apart.
	Lithobiida				
122	Lithobiidae	Lithobiidae `sp.`	6	Data Deficient (T) Potential SRE	Given it is the only representative of the family, it is considered a distinct species.
	Lithobiomorpha				
123	Henicopidae	<i>Lamyctes</i> nr <i>africanus</i>	1	Widespread	
		Lithobiomorpha `sp.`	1		
	Scolopendrida				
124	Cryptopidae	<i>Cryptops</i> `sp.`	1	Data Deficient (T) Potential SRE	Given it is the only representative of the family, it is considered a distinct species.
125	Scolopendridae	<i>Cormocephalus westanglasensis</i>	1	Widespread	
		<i>Cormocephalus</i> `sp.`	1		

126		<i>Ethmostigmus rubripes</i>	1	Widespread	
127		<i>Scolopendra laeta</i>	3	Widespread	
128		<i>Scolopendra morsitans</i>	10	Widespread	
	Scutigerida				
129	Scutigeridae	<i>Pilbarascutigera incola</i>	6	Widespread	
		<i>Pilbarascutigera</i> `sp.`	2		
		Scutigeridae `sp.`	2		
	Diplopoda				
	Polydesmida				
130	Paradoxosomatidae	<i>Antichiropus</i> `BDI070`	14	Likely Potential SRE	Currently known only from the Development Area. Little is known about the species' habitat requirements except that it was collected from leaf litter.
131		<i>Antichiropus</i> `DIP115, PM1`	14	Unlikely Potential SRE	Collected from Karara Station and near Mt Gibson. It is likely the species has a wider distribution than current collection records suggest.
132		<i>Antichiropus</i> `DIP115/DIP199 pintharuka`	1	Data Deficient (T) Potential SRE	Little is known about this undescribed species except that it was collected from rocky outcrops near Burnerbinmah Station.
133		<i>Antichiropus</i> `DIP131, charles darwin`	3	Likely Potential SRE	Known only from granite outcrops at Charles Darwin Reserve and from near Lochada.
134		<i>Antichiropus</i> `DIP146, karara`	11	Likely Potential SRE	Known only from Karara Station and Blue Hills.
135		<i>Antichiropus alatus</i>	14	Confirmed SRE	Known only from the type locality near Mt Gibson Station (Car and Harvey 2014).

136		<i>Antichiropus sagittulus</i>	11	Confirmed SRE	Known only from the type locality near Mt Gibson Station (Car and Harvey 2014).
137		<i>Antichiropus westi</i>	23	Widespread	
		<i>Antichiropus</i> `sp.`	32		
	Polyxenida				
138	Lophoproctidae	<i>Lophoturus madecassus</i>	1	Widespread	
139	Polyxenidae	<i>Unixenus</i> `sp.`	3	Widespread	All species in this genus are widespread (Short and Huynh 2011).
140	Synxenidae	<i>Phryssonotus novaehollandiae</i>	14	Widespread	
	Polyzoniida				
141	Siphonotidae	<i>Siphonotidae</i> `sp.`	3	Data Deficient (T) Potential SRE	Given it is the only representative of the family, it is considered a distinct species.
	Spirostreptida				
142		<i>Spirostreptida</i> `sp.`	3	Data Deficient (T) Potential SRE	Given it is the only representative of the family, it is considered a distinct species.

Appendix 2 – Conservation categories

Western Australia – Biodiversity Conservation Act (DBCA 2016)

Threatened species

Listed by order of the Minister as Threatened in the category of critically endangered, endangered or vulnerable under section 19(1), or is a rediscovered species to be regarded as threatened species under section 26(2) of the Biodiversity Conservation Act 2016 (BC Act). Threatened fauna is that subset of 'Specially Protected Fauna' listed under schedules 1 to 3 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for Threatened Fauna.

- CR, Critically Endangered: Threatened species considered to be "facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines".
- EN, Endangered: Threatened species considered to be "facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines".
- VU, Vulnerable: Threatened species considered to be "facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines".

Priority species

Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened fauna or flora. Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring.

- P1: Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.
- P2: Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.
- P3: Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.
- P4: (a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need

of special protection but could be if present circumstances change. These species are usually represented on conservation lands. (b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent. (c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

Appendix 3 – Photographs of SRE collection sites within the Survey Area

Site 1



Site 1



Site 2



Site 2



Site 3



Site 3



Site 4



Site 4



Site 5



Site 5



Site 6



Site 6



Site 7



Site 7



Site 8



Site 8



Site 9



Site 9



Site 10



Site 10



Site 11



Site 11



Site 12



Site 12



Site 13



Site 13



Site 14



Site 14



Site 15



Site 15



Site 16



Site 16



Site 17



Site 17



Site 18



Site 18



Site 19



Site 19



Site 20



Site 20



Site 21



Site 21



Site 22



Site 22



Site 23



Site 23



Site 24



Site 24



Site 25



Site 25



Appendix H 2025 Trench - Targeted Conservation Significant Mygalomorph Spider Survey and Assessment



Trench Mine – Targeted Conservation Significant Mygalomorph Spider Survey and Assessment

Prepared for:
Tungsten Mining

March 2026
Final Report



Short-Range Endemics | Subterranean Fauna | Wetlands

Trench Mine – Targeted Conservation Significant Mygalomorph Spider Survey and Assessment

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EXECUTIVE SUMMARY

Tungsten Mining NL (Tungsten) is proposing to establish the Trench open-pit and processing operation (the operation) at Mt Mulgine, located 330 km northeast of Perth, and 15 km northeast of Rothsay (Figure 1). The proposed open pit mine is located on M59/425 and is situated between the historic mining areas of Camp and Highland Chief / Bobby McGee mine, established by Minjar Gold. Previous surveys have identified three conservation-significant trapdoor spider species, namely *Idiosoma gutharuka* (P1), *Idiosoma clypeatum* (P3) and *Idiosoma intermedium* (P3), present within the development area. Therefore, Bennelongia Environmental Consultants (Bennelongia) was commissioned by Tungsten to undertake a single-round Targeted Mygalomorph Survey to determine the presence and local distribution of the three Priority Listed species and to assess the potential impacts on the species' populations as a result of the development.

A single round of the survey was completed between the 15th and 20th of September. This consisted of targeted inspection for *Idiosoma* burrows by walking 200 m linear transects and using leaf blowers to uncover spider burrows. A total of 119 transects were inspected across the Survey Area, with a minimum of 30 minutes at each transect, resulting in a total of approximately 60-man hours of survey. In total, 22 ha, or 14% of the undeveloped/surveyable habitat were surveyed for burrows of the targeted species.

A total of 23 mygalomorph spider burrows were mapped across the Survey Area, with two of these attributed to species other than *Idiosoma*, namely *Gaius* sp. (one record) and *Lycosidae* sp. (one record). The remaining 21 burrows included *Idiosoma clypeatum* (P3) (13 burrows), and *Idiosoma intermedium* (P3) (eight burrows). No *Idiosoma gutharuka* (P1) burrows or specimens were recorded during the targeted survey, despite the species being known to occur within the Tungsten tenement package. Nine specimens out of the 23 burrows were collected through burrow digs, three *I. clypeatum* specimens and six *I. intermedium* specimens. To confirm morphological IDs, five specimens were sequenced, one *I. clypeatum*, and four *I. intermedium* specimens, which aligned with morphological identifications.

Even though the targeted survey identified the presence of two of the three Priority species within the survey area, namely *I. clypeatum* and *I. intermedium*, our results suggest that impacts over these species populations are expected to be minor and to have no significant effects over the species populations. This is evidenced by the widespread nature of both species' distributions, and by the very low expected impacts over their current known AOOs, impacting only 0.3% of *I. intermedium*'s AOO, and just 0.002% of *I. clypeatum*'s AOO. Finally, no evidence of *I. gutharuka*, the sole targeted species with a restricted distribution, were found during the field survey despite records of the species occurring nearby. Therefore, it is deemed that mining operations will pose a negligible risk to the conservation values of these species.

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1. INTRODUCTION

Tungsten Mining NL (Tungsten) is proposing to establish the Trench open-pit and processing operation (the development area) at Mt Mulgine, located 330 km northeast of Perth, and 15 km northeast of Rothsay (Figure 1). The Project is located on M59/425 and is situated between the historic mining areas of Camp and Highland Chief / Bobby McGee mine, established by Minjar Gold. The proposed mining area is located on a former pastoral lease now managed by the Department of Biodiversity, Conservation and Attractions (DBCA). The proposed mining area covers a 219.44-hectare (ha) area split into two distinct zones: previously cleared areas (64.86 ha) and the Survey Area (154.58 ha), which includes all habitable, and therefore, surveyable areas.

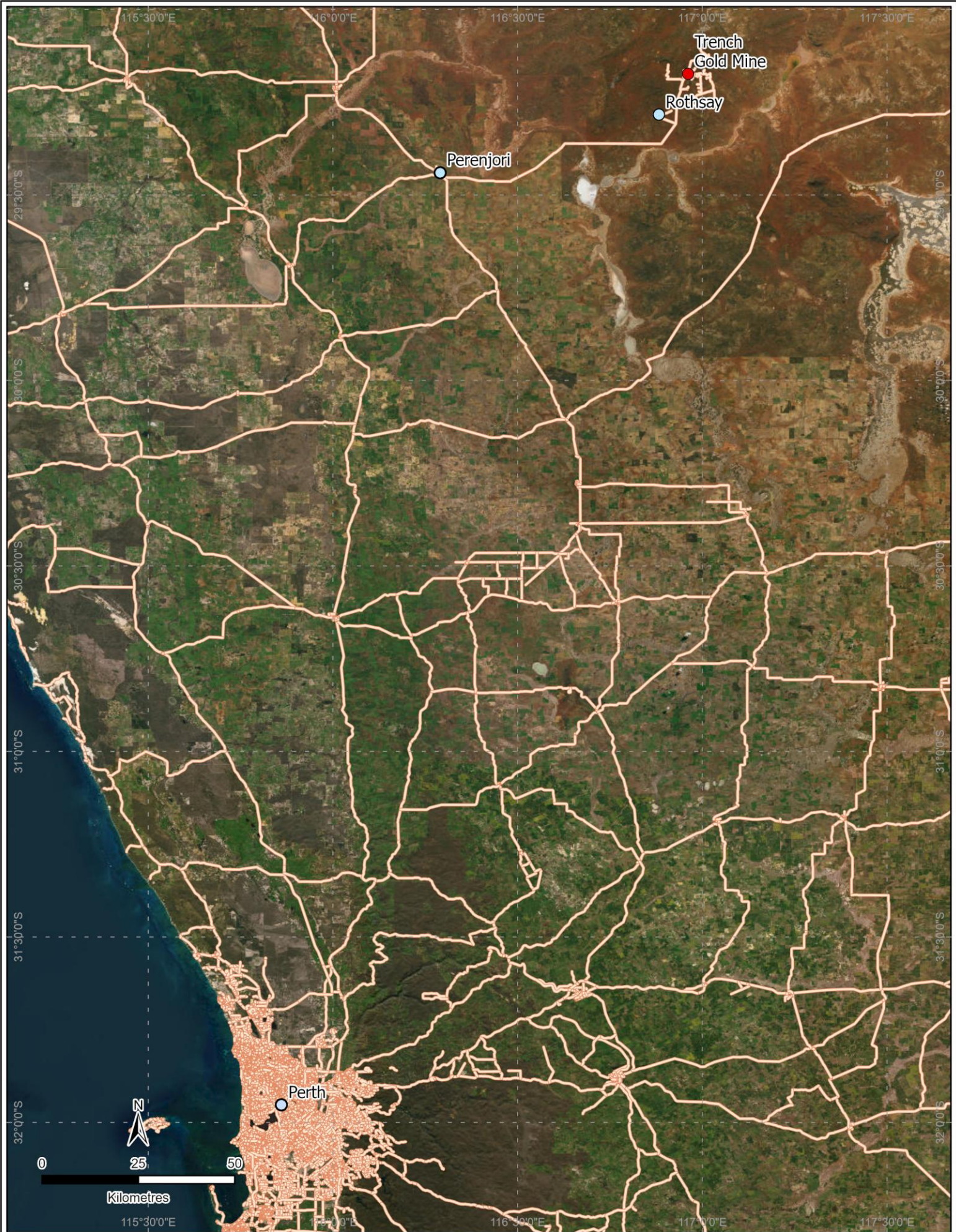
Previous surveys have identified three conservation-significant trapdoor spider species present within the development area, namely *Idiosoma gutharuka* (P1), *Idiosoma clypeatum* (P3) and *Idiosoma intermedium* (P3). Therefore, Bennelongia Environmental Consultants (Bennelongia) was commissioned by Tungsten to undertake a single-round Targeted Mygalomorph Survey to determine the presence and local distribution of the three Priority-listed species and to assess the potential impacts on the species' populations as a result of the development.

2. SRE FRAMEWORK

2.1. Short-Range Endemics

Endemism refers to the restriction of a species to a particular area, whether it is at the continental, national or local scale, the latter being commonly referred to as short-range endemism. Proposed by Harvey (2002), the concept of Short-Range Endemic (SRE) invertebrates aims to assist the conservation of species with naturally small distribution ranges due to various physical characteristics and specific life-history traits such as slow growth, low fecundity, specific habitat requirements and availability, and limited dispersal capabilities (Harvey, 2002; Durrant, 2011). Within the same publication, Harvey also proposed a threshold for the definition of an SRE species as an invertebrate species with distribution ranges less than 10,000 km². Guidelines for the consideration and assessment of SRE invertebrates in Western Australia are provided in the Environmental Factor Guideline: Terrestrial Fauna (EPA 2016a) and Technical Guidance: Sampling of short-range endemic invertebrate fauna (EPA 2016b). Several groups are found to consist principally of SREs: land snails (Gastropoda), millipedes (Diplopoda), centipedes (Chilopoda), pseudoscorpions (Pseudoscorpiones), scorpions (Scorpiones), some spider groups (Araneae: Mygalomorphae), slaters (Isopoda), and in mesic landscapes such as south-western Australia also velvet worms (Onychophora), earthworms (Oligochaeta), and harvestmen (Opiliones) (Bennelongia, 2024a; Harvey, 2002).

Not all species within SRE groups have limited distributions. Some species may have ranges that extend beyond the SRE threshold, while others may be highly range restricted. Additionally, the unresolved taxonomy of many SRE groups can complicate the process of determining whether a species truly qualifies as an SRE. One way to approach this issue is to assume that a species' distribution corresponds to the extent of its preferred or obligatory habitats. Species that are confined to specific, patchy habitats tend to have smaller ranges, while those found in more widespread or common habitats generally have larger ranges. For example, rock-dwelling pseudoscorpions from the genus *Synsphyronus* may be restricted to a single granite peak or scree slope (Cullen & Harvey 2021). However, in some cases, short-range endemism can be influenced by life history traits such as longevity, meaning a species could be a true SRE even if it inhabits a broad, seemingly connected habitat (Harvey 2002; Harvey *et al.* 2011; Harvey *et al.* 2015; Rix *et al.* 2015). Therefore, determining whether a species is an SRE requires considering multiple factors, such as the species' known range, the habitat(s) at the collection site(s), the spatial extent and connectivity of those habitats, and the distribution patterns of phylogenetically related species (preferably within the same genus). Additionally, insufficient survey efforts for SREs may result in underreporting of a species, which might be widespread but not adequately surveyed.



GDA2020
 Author: elamont
 Date: 24/11/2025

- Legend**
- Trench Gold Mine
 - Roads
 - Towns

Figure 1. Project Location

This report follows the Western Australia Museum (WAM) classification system for SREs in recognising three categories:

1. **Confirmed SRE species** have a known distribution range smaller than 10,000 km². The taxonomy is well known and the group well represented in collections and/or via comprehensive sampling.
2. **Potential SRE species** belong to a group with gaps in our knowledge of its distribution, either because the group is not well represented in collections, taxonomic knowledge is incomplete or the distribution is poorly understood due to insufficient sampling.
3. **Widespread (not SRE) species** have a known distribution range larger than 10,000 km². The taxonomy is well known, and the group is well represented in collections via comprehensive sampling.

When assessing survey results, it's typical for a large portion of species collected to fit within the "Potential SRE species" category, as assessment of true SRE status is particularly difficult if range sizes are unclear or the taxonomy is unresolved. In an attempt to increase accuracy of categorisation, for the purposes of this report, we will be splitting the Potential SRE category into three sub-categories:

- A. **Data Deficient:** This category indicates that insufficient Data is available to accurately determine SRE status. Data deficits could include a lack of geographical or taxonomic information, or because specimens are not identifiable to species level due to damage or life-cycle status (e.g. juvenile). This category is only applied to those species that already belong to a higher order SRE group, rather than to an undescribed species in the records.
- B. **Unlikely SRE:** This is applied to species that belong to an SRE group, but has been collected from many sites, especially if the sites feature various habitat types. A species will also be categorised this way if it belongs to a smaller taxonomic group within an SRE group that tends not to contain any SRE species.
- C. **Likely SRE:** Categorised this way when species are from taxonomic groups in which SREs are likely, and when specimens have been collected from singular or limited sites and/or habitats.

In the context of these categories, it is important to note that identifying a species as a Potential or Confirmed SRE is often only the first step in determining the impacts of land development activities on a particular SRE species. Even a Confirmed SRE species may be locally widespread around a development area, and therefore at minimum risk of impact. The actual level of threat to an SRE species depends on its distribution relative to the development footprint, rather than its SRE status alone. Determining the likely level of threat to a species therefore requires further consideration of the extent of the species' preferred habitat and microclimate, both within and beyond the area of activity.

2.2. Conservation significant *Idiosoma* Species within the Trench area

The Trench development is located in a sub-region rich in mygalomorph spiders, including three conservation-significant species belonging to the *Idiosoma* genus, namely Gutha Pintharuka Shield-Backed Trapdoor Spider (*Idiosoma gutharuka*) (P1), Northern Shield-Backed Trapdoor Spider (*Idiosoma clypeatum*) (P3), and Coolgardie Shield-Backed Trapdoor Spider (*Idiosoma intermedium*) (P3).

Idiosoma nigrum, also called Black Rugose Trapdoor Spider, is a mygalomorph species belonging to the family Idiopidae, endemic to dry woodlands east of the Darling Scarp and north to Moore River. This species, described in 1952 by Main, became the only spider in Australia to be afforded threatened species status under both State and Commonwealth legislation. In 2017 Rix *et al.* revised genera of the family Idiopidae, using morphological and molecular investigation to propose a division of the family into 10 genera, from four tribes. Rix *et al.* (2018a) then revised the *Idiosoma nigrum* group, which resulted in the splitting and description of 15 new species, including *I. clypeatum*, *I. intermedium* and *I. gutharuka*. This revision emphasised the conservation systematics of each species, with subsequent conservation classification based on the IUCN categorisation systems suggested for some species.

Idiosoma species have long been the topic of conservation discussions due to many factors. *Idiosoma* species, as most mygalomorph spiders, are known to have sedentary habits and live in permanent burrows for their whole life cycle, further limiting the dispersal ability of the species, and keeping species ranges short. Additionally, *Idiosoma* species are highly dependent on specific soil types and microhabitats to build their burrows (Rix *et al.* 2018a), meaning loss of this habitat could be seriously detrimental to population numbers. An important conservation factor affecting *Idiosoma* species is that populations appear to be restricted to areas that, in many cases, have already been highly disturbed by anthropogenic activities such as mining, agriculture and conversion of land for human habitation. Clearing of habitat also leads to fragmented habitats, which isolates individuals or small groups of spiders and creates fragmented populations with low to no connectivity between each other.

Species of *Idiosoma* are often identified in the field by their characteristic burrow type. Rix *et al.* (2018a) characterises burrows of the protected species by the “presence of a ‘moustache-like’ arrangement of twig-lines and thin flap-type or wafer-type doors which are adorned with leaf litter debris”. These structures around the doors act like a set of trip lines, alerting the spider to the presence of prey (or predators), making them lethal ambush predators, or allowing them to seal their burrows in an act of self-preservation. Areas with high amounts of leaf litter, are therefore ecologically necessary, serving as ideal microhabitats for species of this group, allowing for easier formation of burrows, and the adornments that accompany them. Each species is discussed in greater detail below.

Previous surveys in the area were undertaken by Spectrum Ecology (2019, 2021), which identified the conservation significant species *Idiosoma gutharuka* (Priority 1), *Idiosoma clypeatum* (Priority 3) and *Idiosoma intermedium* (Priority 3) (explanation of the conservation listing codes are found in Appendix 1). In 2019, a three round pre-clearance survey identified; 14 *Idiosoma* sp. burrows and three *Idiosoma clypeatum* specimens, in round one; in round two, 37 *Idiosoma* sp. burrows and one specimen of *Idiosoma* sp. of uncertain and unresolved taxonomy; and in round three, seven *Idiosoma* sp. burrows with no live specimens collected (Spectrum Ecology, 2019).

Following the pre-clearance survey, a complete terrestrial fauna assessment was completed between 2020 and 2021 (Spectrum Ecology, 2021). Data collected in the 2019 survey was included, resulting in 97 *Idiosoma clypeatum* specimens collected, 18 *Idiosoma intermedium* specimens collected, and 121 *Idiosoma gutharuka* burrows observed and 53 collected specimens (Figure 2).

Northern Shield-Backed Trapdoor Spider (*Idiosoma clypeatum*, DBCA Priority 3)

Idiosoma clypeatum is a member of the northern *clypeatum*-clade within the *nigrum*-group (Rix *et al.* 2018a). This species has a wide range across the arid interior of Western Australia, mainly in the Yalgoo and Murchison bioregions, extending between Geraldton, Meekatharra, Leinster and Perenjori. This species is listed as Priority 3 by DBCA as there are a number of records known from several different locations, and due to the widespread nature of the species (Extent of Occurrence [EOO] of 12,195,100 ha and Area of Occupancy [AOO] of 7,010,300 ha) (ALA, 2025), it does not appear to be under imminent threat. Individuals of this species are characterised by the heavily sclerotised ‘shield-like’ corrugations found on the spider’s abdomen (hence the common name). The burrows have a distinct ‘moustache-like’ arrangement of twigs and leaves, and a thin flap-like door or lid. The burrow is typically ‘wine glass’ shaped with a wider entrance chamber that narrows as the burrow deepens. The spiders were often observed positioned head down at the point where the burrow narrows with their heavily corrugated abdomens facing the entry of the burrow. This is believed to deny potential predators (e.g. parasitic wasps and scorpions) access to the burrow.

Information on the microhabitat indicates that *I. clypeatum* is associated with Mixed Shrubland, Eucalypt Woodland on Quartz, Granitic Flats and Granite Outcropping with a variety of vegetation used for their burrows. In particular, leaves of *Acacia ramulosa* were favoured for constructing the moustache-like leaf arrangement at the burrow entrance.

Coolgardie Shield-Backed Trapdoor Spider (*Idiosoma intermedium*; Priority 3)

Idiosoma Intermedium is one of nine south-western Australian species in the *intermedium*- and *sigillatum*-clades which does not belong to the distinctive 'sigillate complex'. This species is listed as Priority 3 by DBCA as there are a number of records known from several different locations, and due to the widespread EOO (1,756,500 ha) and AOO (50,700 ha) (ALA, 2025), it does not appear to be under imminent threat. *Idiosoma intermedium* can be easily distinguished from *I. clypeatum* by its lack of a heavily sclerotised and corrugated abdominal shield. The characteristics of the burrow constructed by the species are like that of *I. clypeatum* with a slightly more cone shaped entrance (vs. the 'wine glass' like shape). Previously collected individuals have been observed to be sitting upright within the burrow, with the abdomen facing downwards. They display more pro-active, and sometimes defensive behaviour, with some individuals inspecting disturbances at their burrow entrance.

Gutha Pintharuka Shield-Backed Trapdoor Spider (*Idiosoma gutharuka*; Priority 1)

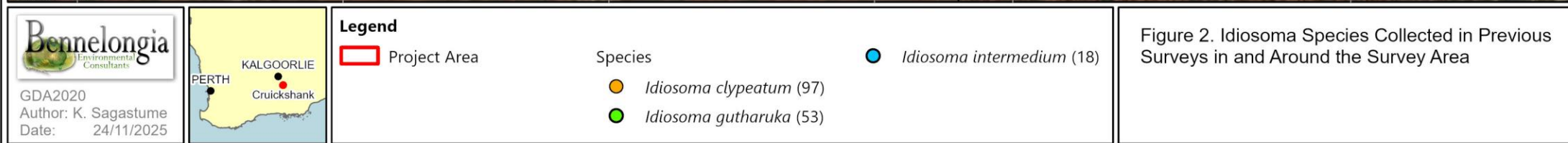
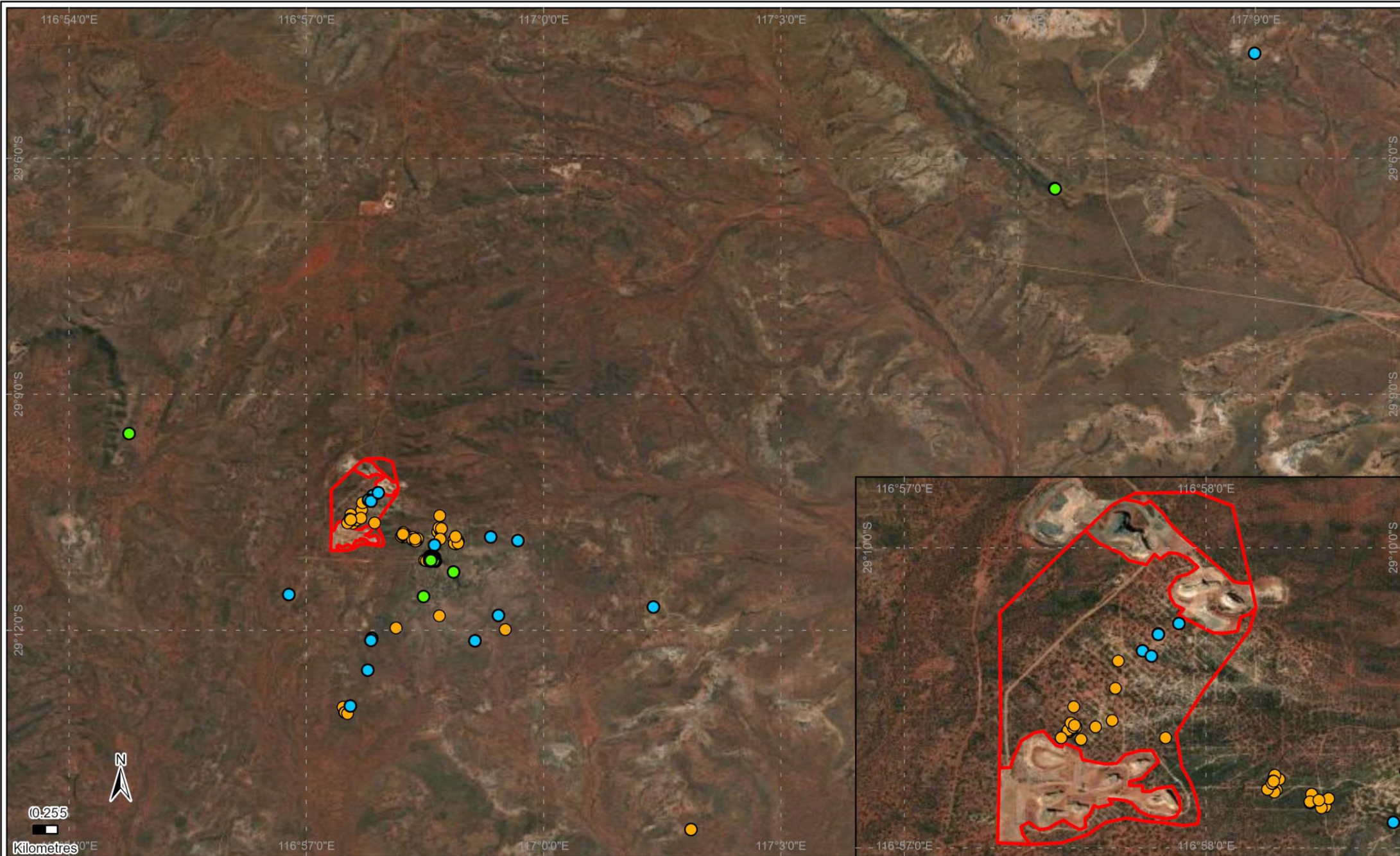
Idiosoma gutharuka is one of nine south-western Australian species in the *intermedium*- and *sigillatum*-clades which does not belong to the distinctive 'sigillate complex' (Rix *et al* 2018). This species is listed as Priority 1 by DBCA, as it represents a poorly known species, with only seven records from three localities representing a small EOO (80,700 ha) and AOO (1,300 ha) around the Rothsay, Perenjori region (ALA 2025). This species can be distinguished by the absence of well-defined lateral sclerotic strips on the male abdomen and by the significantly less sclerotised morphology of the female abdomen (which may be strongly corrugate but never leathery and 'shield-like').

The habitat at known locations is dominated by dense *Allocasuarina* shrubland (sometimes mixed with *Acacias* and other shrubs) on granitic or greenstone metamorphic rock, sometimes with quartz pebbles or stones. A large proportion of other records have been recorded from a Granite Outcropping habitat type, meaning some habitat specialisation may be present.

2.2.1. Burrow Recognition

Burrows of spider species in the *nigrum*-group are characterised by the presence of a 'moustache-like' arrangement of twig lines and thin flap-type or wafer-type doors which are adorned with leaf litter debris (Rix *et al*. 2018a). Adorned burrows are not exclusive to species of the *nigrum*-group and numerous species of *Idiosoma* outside of the *nigrum*-group, along with species of *Gaius* and *Blakistonia*, often adorn their burrows with twig lines (Rix *et al*. 2017). However, burrows of *Gaius* differ from species in the *nigrum*-group by having burrow entrances adorned by radial 'fan' twig lines which can or cannot have flappy doors and a much larger size of the door (Rix *et al*. 2018b; Rix *et al*. 2017).

The current report collates density, distribution, habitat preference and molecular data generated by Bennelongia (2024b, 2024c), Biota (2022, 2023), and Rix *et al*. (2018a) to assess the impacts of the development on populations of the conservation-significant trapdoor spider species that occur within the development area.



3. METHODS

3.1. Survey Techniques

During the field survey, the Survey Area was split into smaller sections which were surveyed via 200 m linear transects. One observer per transect would walk the entire length of it using a leaf-blower to remove excess leaf litter and to make spider burrows easier to identify. An endoscope inspection camera (Protech-QC8718) was used to inspect trapdoor spider burrows and to record presence/absence of *Idiosoma* and its habitat characteristics. Species determination was based on the burrow characteristics and the morphological features observed with the aid of the endoscope. When species determination was not guaranteed, the spider was dug out of the burrow and collected as a reference specimen for morphological and molecular identifications.

In addition, a subset of the target and non-target species observed during the survey were collected as whole specimens for further species determination via morphological and molecular methods, and to provide a better understanding of the *Idiosoma* species diversity within the development area.

3.2. Survey Personnel

The field survey was conducted by Kevin Sagastume and Kiara Harris. Laboratory DNA work was conducted by Leila McCaughan, and Dr Veera Haslam. Morphological species identifications were completed by Kevin Sagastume and molecular laboratory analyses were undertaken by Dr Veera Haslam and Dr Daniel White. GIS mapping and report writing were completed by Vitor Marques and Ethan Lamont (Table 1).

Table 1. Qualifications and Roles of Key Personnel Involved within the Survey

Name	Qualification	Role
Ethan Lamont	BSc (Zoology)	Reporting
Dr Stuart Halse	BSc (Hons), PhD (Zoology)	Project supervision
Kevin Sagastume-Espinoza	BSc, MSc (Biological Sciences/Zoology)	Field data collection, Species Identification
Kiara Harris	BSc (Biological Sciences)	Field data collection
Vitor Marques	BSc (Biological Sciences)	GIS support
Leila McCaughan	BSc (Environmental Restoration)	DNA extraction, sequences
Dr Veera Haslam	BSc (Hons.), PhD (Genetics)	DNA extraction, sequences and haplotype analysis
Dr Dan White	BSc, MSc, PhD (Genetics)	Sequence analysis and DNA supervision



Legend

Project Area



Previously Cleared



Survey Area

Tracks



Survey Effort



**Figure 3. Survey Effort
Across the Survey Area**

3.3. Burrow categorisations

Across all areas, each burrow was mapped and assigned to one of three categories based on the likelihood of them belonging to *Idiosoma* species and given an activity status as previously defined by Bennelongia (2024c). Appendix 2 shows examples of *Idiosoma* burrow likelihood and activity categorisations. The categories used during this survey were:

Idiosoma likelihood burrow categorisation:

- Unlikely: no visible twig pattern around burrow lid.
- Probable: twig pattern visible, not in “moustache” formation or damaged, precautionary principle applied as it is probable this burrow type belongs to species part of the *nigrum*-group
- Likely: twig pattern clearly in “moustache” formation as typical from species within the *nigrum*-group.

Idiosoma burrow activity categorisation:

- Active: burrow appears to be maintained/structurally sound.
- Inactive: burrow appears to be old, damaged or occupied by another animal.
- Unknown: burrow status is unable to be determined.

3.4. Habitat mapping

Habitat mapping was developed through integration of recognised vegetation units after detailed vegetation assessments was completed by Spectrum Ecology (2021), and considering recognised vegetation system associations (Beard *et al.* 2013) alongside publicly available soil and landscape layers.

Habitat categories need to represent habitat characteristics that are exploitable by SRE species, rather than solely emphasising the unique attributes of individual vegetation units. Consequently, the characteristics of these vegetation units were cross-referenced with landform and soil conditions to discern distinct SRE habitats. Notably, only landforms exhibiting significant differences, such as clay-loam floodplains versus hillslopes or ridges, were considered distinct habitats.

Synthesising both biotic and abiotic spatial data facilitated a finer delineation of habitats, enabling more accurate assessments of habitat suitability and distribution. Importantly, the grouping of vegetation units was not solely based on their rarity within the development area, but rather on their overall structural attributes and their relationship with abiotic factors.

In essence, this integrated approach to habitat mapping offers a comprehensive framework for conservation and management strategies, allowing us to identify habitats that may be crucial for SRE species, and the likelihood of potential impacts over populations of SRE species as a result of habitat clearing or other development activities

3.5. Survey effort and Population Estimates

Survey consisted of targeted inspection for *Idiosoma* burrows by walking 200 m linear transects and using leaf blowers to uncover spider burrows, with a minimum of 30 minutes at each transect. To calculate the survey effort (ha), a 3 m buffer around the recorded transects was estimated which is the average effective search size when leaf-blowing across transects.

Considering all *Idiosoma* burrows (Table 3), the burrow density (per ha) of each *Idiosoma* sp. was estimated as follows:

$$(1) \text{Idiosoma sp. burrow density} = (\# \text{ of Idiosoma sp. burrows} / \text{area (ha)})$$

Density was used to extrapolate to the surveyable habitat, i.e., excluding the already cleared/disturbed portions of the Survey Area, and generate an approximate population estimate within the Survey Area.

(2) *Idiosoma* sp. population estimate within Survey Area = total surveyable habitat x density.

It should be noted that the previously cleared areas are now uninhabitable, therefore, the population estimates consider only the habitable Survey Area, rather than the whole development area.

3.6. Molecular Methods

Nine specimens from the Survey Area were taken and subsequently five specimens were sequenced. For all spiders, muscle tissue was collected from the legs. DNA was extracted using a Qiagen DNeasy Blood & Tissue kit (Qiagen 2006) using manufacturer's protocols, except for the incubation period in Lysis Buffer ATL and Proteinase K, which was increased to 24 h. Elute volumes were set to 2 x 100 µL.

Primer combinations used for PCR amplifications were jgLCO1490:jgHCO2198 (Geller *et al.* 2013), C1J1718:HCO2198 (Simon *et al.* 1994), targeting the mitochondrial Cytochrome Oxidase I (COI) partial gene. PCR products were sequenced using dual-direction Sanger sequencing carried out by the Australian Genome Research Facility (AGRF). The returned sequences were edited and aligned in Geneious Prime v2024.0.7 (<https://www.geneious.com>), using MAFFT alignment (Katoh and Standley 2013) and verified in GenBank using the Basic Local Alignment Search Tool nucleotide (BLAST) suite of applications (<https://blast.ncbi.nlm.nih.gov/Blast.cgi>) (Altschul *et al.* 1990). Pairwise genetic distances to related sequences in the Bennelongia database and in GenBank were calculated as uncorrected p-distances (total percentage of nucleotide differences between sequences) in Geneious. To visualise and analyse phylogenetic relationships between taxa (using novel sequences generated here, and sequences from Bennelongia database and GenBank) maximum likelihood (ML) phylogenetic tree (Appendix 5) was drawn using IQ-tree (Nguyen *et al.* 2015) with TIM2+F+I+G4 as the best fitting model (Kalyaanamoorthy *et al.* 2017) and with 1000 ultrafast bootstrap replicates Hoang *et al.* (2018).

4. RESULTS

4.1. Survey effort

A single round of survey was completed between the 15th and 20th of September. A total of 119 transects were inspected across the Survey Area, resulting in a total of approximately 60-man hours of survey. In total, 22 ha or 14% of the undeveloped/surveyable habitat were surveyed across the development area (Figure 3). Unsurveyed localities could not be inspected due to difficulty of access such as dense vegetation limiting walkability and survey accuracy.

4.2. Habitat Assessment

Seven Vegetation and Substrate Associations (VSAs) have been identified as occurring within the Disturbance Footprint (Spectrum Ecology, 2021), corresponding to four SRE habitat units (Table 2, Figure 4). A large proportion of the habitat within the development area belonged to areas of "degradation", otherwise described as "cleared" area throughout the figures, e.g. areas of active mining, or areas that have been previously cleared of vegetation for development purposes, accounting for 33.3% of the Survey Area. The most abundant SRE habitat within the Survey Area was Stony plains with mixed shrubland (36.1%), followed by Low hills with mixed shrublands (Table 2; Figure 4). The remaining code covers an area of 7.8%, being Open Eucalyptus woodlands. Prospectivity is moderate for multiple groups of SREs, with pseudoscorpions, centipedes, scorpions and mygalomorph spiders being expected in Stony plains with mixed shrubland. Open Eucalypt Woodlands provides the most prospective habitat for *Idiosoma* species.

Table 2. SRE Habitat Units Presented in Figure 4

SRE Habitat	Description	Area (ha)	Area (%)	SRE Prospectivity
Stony plains with mixed shrubland	Low rises and stony plains supporting Chenopod shrublands with patchy Eucalypt overstoreys.	79	36.1	Ideal for generalist species within the different SRE Groups, such as mygalomorph spiders, slaters and centipedes. *
Open Eucalyptus woodlands	Open Eucalypt woodlands over low hills with occasional saltbush and bluebush understoreys.	17	7.8	Open Eucalypt woodland often provides shelter for multiple mygalomorph spider species, including from the genus <i>Idiosoma</i> .
Cleared	Active mining/cleared areas	73	33.3	N/A
Low hills with mixed shrublands	Low basalt and rugged greenstone ranges with dense Casuarina and Acacia shrublands.	50	22.8	Moderate prospectivity for SRE species as the multiple vegetation types can provide refuge for different groups such as pseudoscorpions, centipedes, scorpions and mygalomorph spiders. However, these are rarely isolated habitats and are often exploited by generalist species.

* Generalist species adapt better to numerous microhabitats the different vegetation types provide, which along with abiotic factors such as soil type, crevices and rocks, provide ideal refuges for species from SRE Groups. However, these microhabitats are rarely isolated and therefore, less likely to hold true SRE species.



Legend

Survey Area

- Previously Cleared
- Survey Area
- Drainage Lines

SRE_Hab

- Cleared
- Low hills with mixed shrublands
- Open Eucalyptus woodlands
- Stony plains with mixed shrubland

**Figure 4. SRE Habitat Units
Occurring Within the Survey Area**

4.3. Survey outcomes-*Idiosoma* burrows in the Survey Area

A total of 23 active burrows have been mapped across the Survey Area (Table 3, Figure 5), of which two belonged to species other than *Idiosoma*, namely *Gaius* sp. (one record) and *Lycosidae* sp. (one record). Of the remaining 21 burrows, three were initially categorised as Probable, while the remaining 18 were categorised as Likely. However, inspection via endoscope or burrow dig confirmed the species identity to either of the targeted species. No burrows were categorised as Unlikely.

Of the 21 burrows, 13 were assigned to *Idiosoma clypeatum* (see [section 4.5.1](#)) and eight to *Idiosoma intermedium* (see [section 4.5.2](#)), with no *Idiosoma gutharuka* burrows or specimens recorded from the targeted survey. Categorisations of both burrow status and *Idiosoma* species likelihood was supported by 12 of the 23 burrows being inspected using an endoscope and nine additional burrows being inspected via burrow dig, all of which resulted in successful collection of a specimen.

4.4. *Idiosoma* molecular analysis

Molecular sequencing (as described in [section 3.6](#)) was conducted on five specimens (Appendix 3). Sequencing analysis confirmed the targeted species aligned with the morphological identifications resulting in four *Idiosoma intermedium* specimens and one *Idiosoma clypeatum* specimen being sequenced.

4.5. *Idiosoma* species in the Survey Area

4.5.1. *Idiosoma clypeatum*

The field survey recovered 13 *I. clypeatum* confirmed and active burrows across the Survey Area. Of these, three specimens were collected via burrow digs, one of which was sequenced as a reference specimen and matched to *Idiosoma clypeatum* type specimen sequence.

Following the formulas detailed in [section 3.5](#), the *I. clypeatum* burrow density (burrow/ha) was estimated as follows:

- (1) *Idiosoma clypeatum* burrow density = (13 active and confirmed burrows / 22 ha survey effort within the Survey Area)

Resulting in a burrow density of 0.59 burrows per ha. This density was extrapolated to the total Survey Area to generate an approximate population estimate as follows:

- (2) *Idiosoma clypeatum* population estimate within Survey Area = 154.58 ha x 0.59 burrows per ha.

Resulting in an estimated *Idiosoma clypeatum* population of 91 spiders around the Survey Area. Even though the cleared areas within the development area are not expected to have spider presence given the heavy disturbance, if we consider the entire Survey Area (219.44 ha), a maximum of 130 *I. clypeatum* burrows could be found within the development area.

This species has a widespread distribution, with an EOO of over 12,195,100 ha and an AOO of 7,010,300 ha (ALA, 2025). Therefore, native vegetation clearing of the Survey Area as a result of the development will impact 0.001% of the species' known EOO and 0.002% of the species' AOO.

4.5.2. *Idiosoma intermedium*

Eight *I. intermedium* burrows were identified as occurring within the Survey Area, with five of these specimens collected after successful burrow digs. Four of these five specimens were sequenced, with all morphological identifications being maintained.

Following the formulas detailed in [section 3.5](#), the Burrow density (burrow/ha) for *I. intermedium* was estimated as follows:

- (1) *Idiosoma intermedium* burrow density = (8 active confirmed burrows / 22 ha survey effort within the Survey Area)

Resulting in a burrow density of 0.36 burrows per ha. This density was extrapolated to the total Survey Area to generate an approximate population estimate as follows:

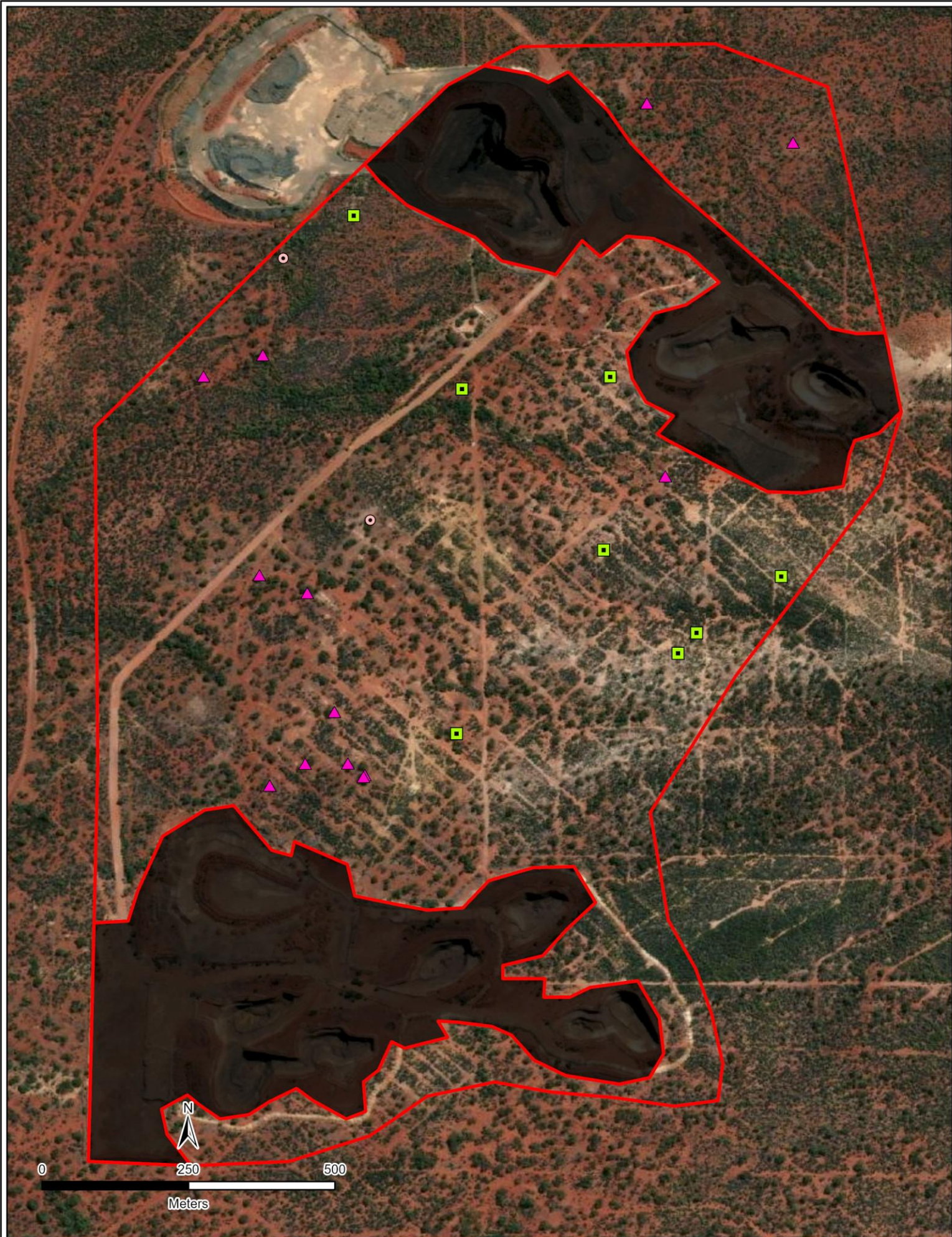
- (2) *Idiosoma intermedium* population estimate within Survey Area = 154.58 ha x 0.36 burrows per ha.

Resulting in an estimated *Idiosoma intermedium* population of 56 spiders around the Survey Area. Just as with *I. clypeatum*, the previous cleared areas on site are not expected to have any spider presence, however, if a maximum population estimate was to consider the entire Project area, up to 80 *I. intermedium* burrows could be found within the Project area.

This species is known from an EOO of over 1,756,500 ha and an AOO of 50,700 ha (ALA, 2025). Therefore, clearing of the Survey Area as a result of the Project development will impact 0.009% of the species' known EOO, and 0.3% of the species' AOO.

4.5.3. *Idiosoma gutharuka*

No burrows or specimens of *Idiosoma gutharuka* were recorded during the targeted survey. The closest records for this species are located approximately 1 km East from the Project boundary and come from Spectrum Ecology's (2021) survey.



Legend

Project Area

- █ Previously Cleared
- ▭ Survey Area

Potential species

- ▲ *Idiosoma clypeatum* (13)
- *Idiosoma intermedium* (8)
- Other (2)

Figure 5. Burrows Identified as Occurring Within the Survey Area During Field Survey

Table 3. Details of Spider Burrows Identified as Occurring at the Survey Area

Records highlighted BLUE represent burrows in which the spider was collected from the burrow via a successful burrow dig.

*** Collected species genetically investigated

Burrow ID	Date	Burrow Type	Burrow Status	Inspected	Likelihood	Potential spp.	Burrow Dig	Habitat	Comments
KH001	16 Sep 2025	Moustache	Active	Burrow dig	Probable	<i>Idiosoma intermedium</i>	Yes	Hills and ranges; Acacia shrublands	Accidentally removed one of her legs. Concave lid. Angled burrow.
KH002	16 Sep 2025	Moustache	Active	Burrow dig	Likely	<i>Idiosoma clypeatum</i> ***	Yes	Low hills; Acacia or Eucalypt woodlands with halophytic understorey	Hard rocky ground with many tall Acacia shrubs. Burrow at base of thin leafed Acacia. Flatter lid, not concave. Lid was flush with ground (not angled up). Adornments of lid on entirety rather than only half of lid.
KH003	17 Sep 2025	Moustache	Active	Endoscope	Probable	<i>Idiosoma clypeatum</i>	No	Low hills; Acacia or Eucalypt woodlands with halophytic understorey	Burrow looks similar to other <i>I. clypeatum</i> .
KH004	17 Sep 2025	Twigline	Active	Endoscope	Likely	Other (<i>Gaius</i> sp.)	Yes	Low hills; Acacia or Eucalypt woodlands with halophytic understorey	Burrow at base of Acacia
KH005	18 Sep 2025	Simple Lid	Active	Endoscope	Probable	Other (<i>Lycosidae</i> sp.)	No	Low hills; Acacia or Eucalypt woodlands with halophytic understorey	Slight adornments to lid.
KH006	18/09/2025	Moustache	Active	Endoscope	Likely	<i>Idiosoma clypeatum</i>	No	Low hills; Acacia or Eucalypt woodlands with halophytic understorey	Burrow at base of thin leafed Acacia. Very adorned lid. Twigs around entirety of burrow lip.
KSE001	15 Sep 2025	Moustache	Active	Burrow dig	Likely	<i>Idiosoma intermedium</i> ***	Yes	Hills and ranges; Acacia shrublands	
KSE002	16 Sep 2025	Moustache	Active	Burrow dig	Likely	<i>Idiosoma intermedium</i>	Yes	Hills and ranges; Acacia shrublands	Base of Acacia

Burrow ID	Date	Burrow Type	Burrow Status	Inspected	Likelihood	Potential spp.	Burrow Dig	Habitat	Comments
KSE003	16 Sep 2025	Moustache	Active	Burrow dig	Likely	<i>Idiosoma intermedium</i> ***	Yes	Hills and ranges; Acacia shrublands	Juvenile, more twigline than others, lid less concave
KSE004	16 Sep 2025	Moustache	Active	Endoscope	Likely	<i>Idiosoma intermedium</i>	No	Low hills; Acacia or Eucalypt Woodlands with halophytic understorey	
KSE005	17 Sep 2025	Moustache	Active	Endoscope	Likely	<i>Idiosoma clypeatum</i>	No	Low hills; Acacia or Eucalypt woodlands with halophytic understorey	Flat lid, adornment all across lid
KSE006	17 Sep 2025	Moustache	Active	Burrow dig	Likely	<i>Idiosoma clypeatum</i>	Yes	Low hills; Acacia or Eucalypt woodlands with halophytic understorey	Juvenile, burrow lid less covered but still flat
KSE007	17 Sep 2025	Moustache	Active	No	Likely	<i>Idiosoma clypeatum</i>	No	Low hills; Acacia or Eucalypt woodlands with halophytic understorey	Juvenile, looks like <i>I. clypeatum</i> burrow
KSE008	17 Sep 2025	Moustache	Active	Endoscope	Likely	<i>Idiosoma clypeatum</i>	No	Low hills; Acacia or Eucalypt woodlands with halophytic understorey	Twigline broken with blowing, flat lid
KSE009	17 Sep 2025	Moustache	Active	Endoscope Burrow dig	Likely	<i>Idiosoma clypeatum</i>	Yes	Low hills; Acacia or Eucalypt woodlands with halophytic understorey	Cluster of 5: 1 adult and 4 juvs. Larger female adult collected.
KSE010	17 Sep 2025	Moustache	Active	No	Likely	<i>Idiosoma clypeatum</i>	No	Low hills; Acacia or Eucalypt woodlands with halophytic understorey	Juvenile <i>I. clypeatum</i> burrow
KSE011	17 Sep 2025	Moustache	Active	No	Likely	<i>Idiosoma clypeatum</i>	No	Low hills; Acacia or Eucalypt woodlands with halophytic understorey	Juvenile <i>I. clypeatum</i> , flat lid, lots of adornments
KSE012	17 Sep 2025	Moustache	Active	Endoscope	Likely	<i>Idiosoma clypeatum</i>	No	Low hills; Acacia or Eucalypt woodlands with halophytic understorey	Likely <i>I. clypeatum</i> , lid heavily adorned, flat lid

Burrow ID	Date	Burrow Type	Burrow Status	Inspected	Likelihood	Potential spp.	Burrow Dig	Habitat	Comments
KSE013	17 Sep 2025	Moustache	Active	Burrow dig	Likely	<i>Idiosoma intermedium</i> ***	Yes	Low hills; Acacia or Eucalypt Woodlands with halophytic understorey	
KSE014A	17 Sep 2025	Moustache	Active	No	Likely	<i>Idiosoma clypeatum</i>	No	Hills and ranges; Acacia shrublands	Concave lid, less adornments
KSE014B	18 Sep 2025	Moustache	Active	Endoscope	Likely	<i>Idiosoma intermedium</i>	No	Low hills; Acacia or Eucalypt woodlands with halophytic understorey	Less adornments on lid
KSE015	18 Sep 2025	Moustache	Active	Burrow dig	Likely	<i>Idiosoma intermedium</i> ***	Yes	Hills and ranges; Acacia shrublands	Decent size, endoscope not conclusive, burrow dig assumed <i>Gaius</i> sp., but morphological ID suggested <i>I. intermedium</i>
KSE016	18 Sep 2025	Moustache	Active	Endoscope	Likely	<i>Idiosoma clypeatum</i>	No	Low hills; Acacia or Eucalypt woodlands with halophytic understorey	Burrow with twig all around, flat lid with adornments all around, 2 burrows

5. DISCUSSION AND CONCLUSIONS

Population estimates for *Idiosoma clypeatum* (P3) suggest there are approximately 91 spiders within the Survey Area, and that the development has the potential to impact approximately 0.001% of the species known EOO, and 0.002% to the species known AOO, both considered to be minor impacts.

A similar scenario can be observed for *Idiosoma intermedium* (P3), with population estimates suggesting there are approximately 56 spiders within the Survey Area. The development could potentially impact 0.009% of the species EOO, and 0.3% to the species AOO, both also considered to be minor impacts as a result of habitat clearing. *Idiosoma intermedium* has been collected from the TGN tenement and from the surrounding areas by Spectrum Ecology (2021), and Bennelongia (2024c, 2025) on multiple occasions. The species has been recorded from granite outcrops, mixed shrublands and Eucalypt woodland habitats. The widespread nature of these habitat types, in combination with the widespread distribution of the species, suggest that the development is unlikely to have significant impacts over the species populations.

Given that no records of *I. gutharuka* (P1) were identified during the targeted survey, no impacts are expected to occur over the species populations as a result of the development, although specimens have been recorded in the immediate surroundings.

Even though the targeted survey identified the presence of two of the three Priority species within the survey area, namely *I. clypeatum* and *I. intermedium*, our results suggest that impacts on these species populations are expected to be minor and to have no significant effects on the species' populations. This is evidenced by the widespread nature of both species' distributions, and by the very low expected impacts over their current known AOOs. Finally, no evidence of *I. gutharuka*, the sole targeted species with a restricted distribution, were found during the field survey despite records of the species occurring nearby. Therefore, it is deemed that mining operations will pose a negligible risk to the conservation values of these species.

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7. APPENDICES

Appendix 1 - Threatened and Priority species categorisation

Western Australia – Biodiversity Conservation Act (2016)

The following is reproduced from:

Department of Biodiversity, Conservation and Attractions. *Conservation Codes for Western Australian Flora and Fauna*. Available at: <https://www.dpaw.wa.gov.au/images/documents/plants-animals/threatened-species/Listings/Conservation%20code%20definitions.pdf> (Accessed 24 July 2025).

Threatened species

Listed by order of the Minister as Threatened in the category of critically endangered, endangered or vulnerable under section 19(1), or is a rediscovered species to be regarded as a threatened species under section 26(2) of the *Biodiversity Conservation Act 2016* (BC Act). Threatened fauna is a subset of 'Specially Protected Fauna' listed under schedules 1 to 3 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for Threatened Fauna. The categories are defined as:

- CR, Critically Endangered: Threatened species considered to be "facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines".
- EN, Endangered: Threatened species considered to be "facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines".
- VU, Vulnerable: Threatened species considered to be "facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines".

Priority species

Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened fauna or flora. Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for reasons other than taxonomy, are placed in Priority 4. These species require regular monitoring.

- P1: Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.
- P2: Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.
- P3: Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.

- **P4:** (a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands. (b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent. (c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

Australia – Environment Protection and Biodiversity Conservation Act 1999

Listing of species under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is based on the IUCN Red List categories and criteria for threatened species listing. In addition to the categories Extinct (EX) and Extinct in the Wild (EW), the EPBC Act includes:

- **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.

These considerations are based on the criteria set out in:

IUCN (2000) *IUCN Red List and Criteria*, V 3.1. Available at http://s3.amazonaws.com/iucnredlist-newcms/staging/public/attachments/3097/redlist_cats_crit_en.pdf (Accessed 24 July 2025).

Additionally, under the EPBC Act species in Australia can be listed under the category Conservation Dependent, if:

- (a) the species is the focus of a specific conservation program the cessation of which would result in the species becoming Vulnerable, Endangered or Critically Endangered; or
- (b) the following subparagraphs are satisfied: (i) the species is a species of fish; (ii) the species is the focus of a management plan that provides for management actions necessary to stop the decline of, and support the recovery of, the species so that its chances of long term survival in nature are maximised; (iii) the management plan is in force under a law of the Commonwealth or of a State or Territory; (iv) cessation of the management plan would adversely affect the conservation status of the species.

For more information, see:

Threatened Species Scientific Committee (2014) *Guidelines for assessing the conservation status of a native species*. Available at <https://www.environment.gov.au/system/files/pages/d72dfd1a-f0d8-4699-8d43-5d95bbb02428/files/tssc-guidelines-assessing-species-2020.pdf> (Accessed 27 July 2025)

Appendix 2 - *Idiosoma* burrows and activity categorisation examples

Burrow ID	Classification	Closed Burrow	Open Burrow	Status	Species
KH001	Probable			Active	<i>Idiosoma intermedium</i>
KH002	Likely			Active	<i>Idiosoma clypeatum</i>

Burrow ID	Classification	Closed Burrow	Open Burrow	Status	Species
KH003	Probable			Active	<i>Idiosoma clypeatum</i>
KH004	Likely			Active	Other (<i>Gaius</i> sp.)

Burrow ID	Classification	Closed Burrow	Open Burrow	Status	Species
KH005	Probable			Active	Other (<i>Lycosidae</i> sp.)
KH006	Likely			Active	<i>Idiosoma clypeatum</i>

Burrow ID	Classification	Closed Burrow	Open Burrow	Status	Species
KSE001	Likely		N/A	Active	<i>Idiosoma intermedium</i>
KSE002	Likely			Active	<i>Idiosoma intermedium</i>
KSE003	Likely			Active	<i>Idiosoma intermedium</i>

Burrow ID	Classification	Closed Burrow	Open Burrow	Status	Species
KSE004	Likely			Active	<i>Idiosoma intermedium</i>
KSE005	Likely			Active	<i>Idiosoma clypeatum</i>
KSE006	Likely			Active	<i>Idiosoma clypeatum</i>

Burrow ID	Classification	Closed Burrow	Open Burrow	Status	Species
KSE007	Likely			Active	<i>Idiosoma clypeatum</i>
KSE008	Likely			Active	<i>Idiosoma clypeatum</i>
KSE009	Likely			Active	<i>Idiosoma clypeatum</i>

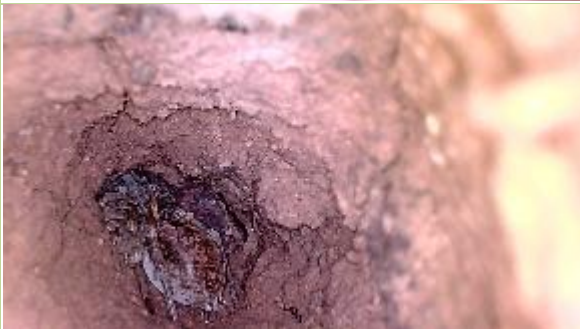
Burrow ID	Classification	Closed Burrow	Open Burrow	Status	Species
KSE010	Likely			Active	<i>Idiosoma clypeatum</i>
KSE011	Likely			Active	<i>Idiosoma clypeatum</i>
KSE012	Likely			Active	<i>Idiosoma clypeatum</i>

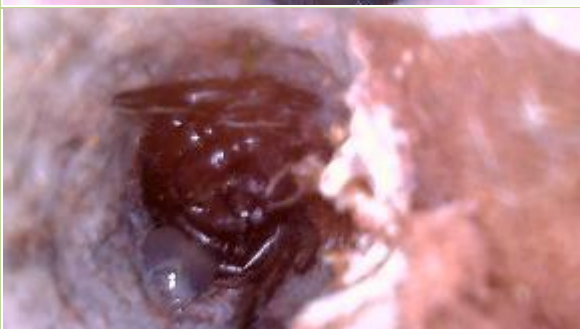
Burrow ID	Classification	Closed Burrow	Open Burrow	Status	Species
KSE013	Likely			Active	<i>Idiosoma intermedium</i>
KSE014A	Likely			Active	<i>Idiosoma clypeatum</i>
KSE014B	Likely			Active	<i>Idiosoma intermedium</i>

Burrow ID	Classification	Closed Burrow	Open Burrow	Status	Species
KSE015	Likely			Active	<i>Idiosoma intermedium</i>
KSE016	Likely			Active	<i>Idiosoma intermedium</i>
Previous Survey***	Unlikely			Active	<i>Idiosoma clypeatum</i>

*** Example of unlikely burrow only, not from this survey

Appendix 3 – Endoscope Photos Taken Inside Burrow

Burrow ID	Potential spp.	Burrow Photo	Specimen Collected
KH003	<i>Idiosoma clypeatum</i>		No
KH004	Other (Gaius sp.)		No
KH005	Other (Lycosidae sp.)		No
KH006	<i>Idiosoma clypeatum</i>		No
KSE004	<i>Idiosoma intermedium</i>		No

Burrow ID	Potential spp.	Burrow Photo	Specimen Collected
KSE005	<i>Idiosoma clypeatum</i>		No
KSE008	<i>Idiosoma clypeatum</i>		No
KSE009	<i>Idiosoma clypeatum</i>		Yes
KSE012	<i>Idiosoma clypeatum</i>		No
KSE014B	<i>Idiosoma intermedium</i>		No

Burrow ID	Potential spp.	Burrow Photo	Specimen Collected
KSE016	<i>Idiosoma clypeatum</i>		No

Appendix 4 – Interpretation of DNA Sequencing Results

Collection Date	Burrow ID	Identification Before DNA	Final Identification	Comments
16 Sep 2025	KH002	<i>Idiosoma clypeatum</i>	<i>Idiosoma clypeatum</i>	This sequence is 0.87% distant from <i>Idiosoma clypeatum</i> in the GenBank database
15 Sep 2025	KSE001	<i>Idiosoma intermedium</i>	<i>Idiosoma intermedium</i>	This sequence was the same as the other <i>I. intermedium</i> species sequenced, shown to be 0% distant from <i>Idiosoma intermedium</i> in the GenBank database
16 Sep 2025	KSE003	<i>Idiosoma intermedium</i>	<i>Idiosoma intermedium</i>	This sequence was the same as the other <i>I. intermedium</i> species sequenced, shown to be 0% distant from <i>Idiosoma intermedium</i> in the GenBank database
17 Sep 2025	KSE013	<i>Idiosoma intermedium</i>	<i>Idiosoma intermedium</i>	This sequence was the same as the other <i>I. intermedium</i> species sequenced, shown to be 0% distant from <i>Idiosoma intermedium</i> in the GenBank database
18 Sep 2025	KSE015	<i>Idiosoma intermedium</i>	<i>Idiosoma intermedium</i>	This sequence was the same as the other <i>I. intermedium</i> species sequenced, shown to be 0% distant from <i>Idiosoma intermedium</i> in the GenBank database

Appendix I Land Tenure & Proof of Access

Some documents
from this section are
confidential and have been provide
separately



ASIC

Australian Securities & Investments Commission

Australian Company

MID-WEST TUNGSTEN PTY LTD
ACN 609 574 503

Extracted from ASIC's database at AEST 14:05:03 on 09/04/2026

Company Summary

Name: MID-WEST TUNGSTEN PTY LTD

ACN: 609 574 503

ABN: 68 609 574 503

Registration Date: 30/11/2015

Next Review Date: 30/11/2026

Status: Registered

Type: Australian Proprietary Company, Limited By Shares

Locality of Registered Office: WEST PERTH WA 6005

Regulator: Australian Securities & Investments Commission

Further information relating to this organisation may be purchased from ASIC.